OMRON

High-function General-purpose Inverter

RX2 Series

User’s Manual

3G3RX2-□□□□□

I620-E1-04

Introduction

Thank you for purchasing the High-function General-purpose Inverter (Model: 3G3RX2).
This manual describes the installation and wiring methods of the 3G3RX2 Series Inverter, and parameter setting methods which are required for the operation, as well as troubleshooting and inspection methods.

Intended Readers

This manual is intended for the following individuals.
Those who have electrical knowledge (certified electricians or individuals who have equivalent knowledge) and also are qualified for one of the following:

- Introducing control equipment
- Designing control system
- Installing and connecting control systems
- Managing control systems and facilities

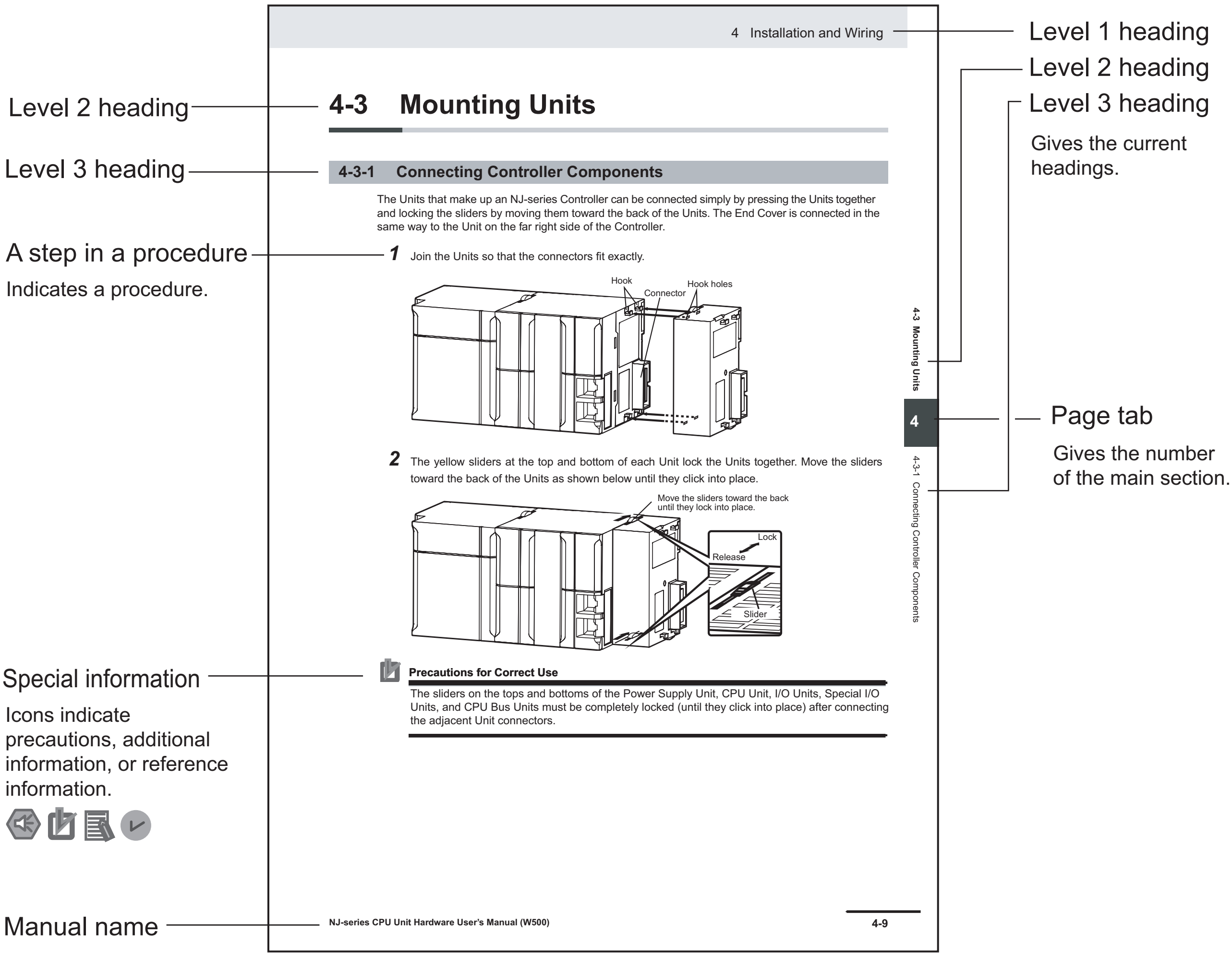
Notice

This manual contains information you need to know to correctly use the High-function General-purpose Inverter (Model: 3G3RX2).
Before using the inverter, read this manual and gain a full understanding of the information provided herein.
After you finished reading this manual, keep it in a convenient place so that it can be referenced at any time.
Make sure this manual is delivered to the end user.

Manual Structure

Page Structure

The following page structure is used in this manual.



Note This illustration is provided only as a sample. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:

Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

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Terms and Conditions Agreement

Warranty, Limitations of Liability

Warranties

- **Exclusive Warranty**

Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

- **Limitations**

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE.

Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right.

- **Buyer Remedy**

Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.

See http://www.omron.com/global/ or contact your Omron representative for published information.

Limitation on Liability; Etc

OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY

WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

Application Considerations

Suitability of Use

Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Programmable Products

Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

Disclaimers

Performance Data

Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.

Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Statement of security responsibilities for assumed use cases and against threats

OMRON SHALL NOT BE RESPONSIBLE AND/OR LIABLE FOR ANY LOSS, DAMAGE, OR EXPENSES DIRECTLY OR INDIRECTLY RESULTING FROM THE INFECTION OF OMRON PRODUCTS, ANY SOFTWARE INSTALLED THEREON OR ANY COMPUTER EQUIPMENT, COMPUTER PROGRAMS, NETWORKS, DATABASES OR OTHER PROPRIETARY MATERIAL CONNECTED THERETO BY DISTRIBUTED DENIAL OF SERVICE ATTACK, COMPUTER VIRUSES, OTHER TECHNOLOGICALLY HARMFUL MATERIAL AND/OR UNAUTHORIZED ACCESS.

It shall be the users sole responsibility to determine and use adequate measures and checkpoints to satisfy the users particular requirements for (i) antivirus protection, (ii) data input and output, (iii) maintaining a means for reconstruction of lost data, (iv) preventing Omron Products and/or software installed thereon from being infected with computer viruses and (v) protecting Omron Products from unauthorized access.

Safety Precautions

To ensure that the High-function General-purpose Inverter (Model: 3G3RX2) is used safely and correctly, be sure to read this Safety Precautions section and the main text before using the product.
Learn all items you should know before use, regarding the equipment as well as required safety information and precautions.
Make an arrangement so that this manual also gets to the end user of this product.
After reading this manual, keep it in a convenient place so that it can be referenced at any time.

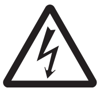
Indications and Meanings of Safety Information

In this user's manual, the following precautions and signal words are used to provide information to ensure the safe use of the High-function General-purpose Inverter (Model: 3G3RX2).
The information provided here is vital to safety. Strictly observe the precautions provided.

Meanings of Signal Words

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally there may be severe property damage.
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Explanation of Symbols

	⊘ This symbol indicates a prohibited item (an item you must not do). The specific instruction is indicated using an illustration or text inside or near⊘. The symbol shown to the left indicates “disassembly prohibited.”
	△ This symbol indicates danger and caution (including warning). The specific instruction is indicated using an illustration or text inside or near△. The symbol shown to the left indicates “beware of electric shock.”
	△ This symbol indicates danger and caution (including warning). The specific instruction is indicated using an illustration or text inside or near△. The symbol shown to the left indicates “non-specific general danger.”
	△ This symbol indicates caution (including warning). The specific instruction is indicated using an illustration or text inside or near△. The symbol shown to the left indicates “risk of hot surface.”
	The filled circle symbol (●) indicates operations that you must do. The specific operation is shown in the circle (●) and explained in text. This example shows a general precaution for something that you must do.
	● This symbol indicates a compulsory item (an item that must be done). The specific instruction is indicated using an illustration or text inside or near●. The symbol shown to the left indicates “grounding required.”

Precautionary Information

⚠ WARNING

Turn off the power supply and implement wiring correctly. Not doing so may result in a serious injury due to an electric shock.	
Wiring work must be carried out only by qualified personnel. Not doing so may result in a serious injury due to an electric shock.	
Do not change wiring and slide switches (SW1 to SW6), put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.	
Be sure to ground the unit. Not doing so may result in a serious injury due to an electric shock or fire. (200-V class: type-D grounding, 400-V class: type-C grounding)	
Do not remove the terminal cover during the power supply and 15 minutes*1 *2 after the power shut off. Doing so may result in a serious injury due to an electric shock.	
Do not operate the Operator or switches with wet hands. Doing so may result in a serious injury due to an electric shock.	
Inspection of the inverter must be conducted after the power supply was turned off. Not doing so may result in a serious injury due to an electric shock. The main power supply is not necessarily shut off even if the emergency shut off function is activated.	
Do not touch the inverter fins, braking resistors and the motor, which become too hot during the power supply and for some time after the power shut off. Doing so may result in a burn.	

*1. 10 minutes: For models 3G3RX2-A2004 to A2220 and 3G3RX2-A4007 to A4220

*2. 15 minutes: For models 3G3RX2-A2300 to A2550 and 3G3RX2-A4300 to A4550, B4750, B4900, B411K, B413K

Security Measures

⚠ WARNING

Anti-virus protection Install the latest commercial-quality antivirus software on the computer connected to the control system and maintain to keep the software up-to-date.	

Security measures to prevent unauthorized access Take the following measures to prevent unauthorized access to our products. • Install physical controls so that only authorized personnel can access control systems and equipment. • Reduce connections to control systems and equipment via networks to prevent access from untrusted devices. • Install firewalls to shut down unused communications ports and limit communications hosts and isolate control systems and equipment from the IT network. • Use a virtual private network (VPN) for remote access to control systems and equipment. • Adopt multifactor authentication to devices with remote access to control systems and equipment. • Set strong passwords and change them frequently. • Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.	
Data input and output protection Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment. • Checking the scope of data • Checking validity of backups and preparing data for restore in case of falsification and abnormalities • Safety design, such as emergency shutdown and fail-soft operation in case of data tampering and abnormalities	
Data recovery Backup data and keep the data up-to-date periodically to prepare for data loss.	
When using an intranet environment through a global address, connecting to an unauthorized terminal such as a SCADA, HMI or to an unauthorized server may result in network security issues such as spoofing and tampering. You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.	
When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment. Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.	
When using a device equipped with the SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media. Please take sufficient measures, such as restricting physical access to the Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.	

Caution

Be sure to confirm safety before conducting maintenance, inspection or parts replacement.	
Do not connect resistors to the terminals (PD/+1, P/+, N/-) directly. Doing so might result in a small-scale fire, heat generation, or damage to the unit.	

Install a stop motion device to ensure safety. Not doing so might result in a minor injury.
(A holding brake is not a stop motion device designed to ensure safety.)

Be sure to use a specified type of braking resistor/regenerative braking unit. In case of a braking resistor, install a thermal relay that monitors the temperature of the resistor.
Not doing so might result in a moderate burn due to the heat generated in the braking resistor/regenerative braking unit.
Configure a sequence that enables the inverter power to turn off when unusual over eating is detected in the braking resistor/regenerative braking unit.

The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property. Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring.

Take safety precautions such as setting up a molded-case circuit breaker (MCCB) that matches the inverter capacity on the power supply side.
Not doing so might result in damage to property due to the short circuit of the load.

Do not dismantle, repair or modify the product.
Doing so may result in an injury.

If a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur.

If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.

Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing the PG Unit and wiring.

Precautions for Safe Use

Installation and Storage

Do not store or use the product in the following places.

- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

Transportation, Installation, and Wiring

- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- Do not hold by the front cover and terminal cover, but hold by the fins during transportation.
- Confirm that the rated input voltage of the inverter is the same as AC power supply voltage.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product.
- Be sure to tighten the screws on the terminal block securely. Wiring work must be done after installing the unit body.
- Do not connect any load other than a three-phase inductive motor to the U, V, and W output terminals.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.
  - Locations subject to static electricity or other forms of noise.
  - Locations subject to strong magnetic fields.
  - Locations close to power lines.
- When using DriveProgramming, confirm that the program data is downloaded normally before starting operation.
- Connect the PG Unit to the Inverter tightly with fixing screws. In addition, be sure to connect terminal wires on the PG Unit securely.

Operation and Adjustment

- Be sure to confirm the permissible range of motors and machines before operation because the inverter speed can be changed easily from low to high.
- Provide a separate holding brake if necessary.
- If the clock command is used in DriveProgramming, an unexpected operation may occur due to weak battery. Take measures such as detecting a weak battery by [E042] RTC Error and stopping the inverter or programs. When the LCD Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock command.
- (bA-30), (bb-20), or The number of retries after under voltage
- Take careful note that if you set **Deceleration-stop at power failure** (bA-30), 、**The number of retries after instantaneous power failure**(bb-20), or **The number of retries after under voltage** (bb-21), to restart after a momentary power failure, under-voltage deceleration stop or reset, the power will restart suddenly after the power is restored.
- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- Be sure to confirm the RUN signal is turned off before resetting the alarm because the machine may abruptly start.
- If checking a signal while the power supply and the voltage is erroneously applied to the control input terminals, the motor may start abruptly. Be sure to confirm safety before checking a signal.
- Check whether the motor rotation direction is correct and whether any unusual sound or vibration occurs during operation.

Maintenance and Inspection

- The capacitor service life is affected by the ambient temperature. Refer to “Smoothing Capacitor Life Curve” described in the manual. When a capacitor reaches the end of its service life and does not work in the product, you need to replace the capacitor.
- When disposing of LCD operators and depleted batteries, follow the applicable ordinances of your local government. When disposing of the battery, insulate it using tape.

廢電池請回收

The following display must be indicated when products using lithium primary batteries (with more than 6 ppb of perchlorate) are transport to or through the State of California, USA.

Perchlorate Material - special handling may apply.
See https://dtsc.ca.gov/perchlorate/

When exporting your product containing a lithium primary battery to California, USA, please indicate the above labeling on the packing box or shipping box of your product.

- Do not short + and –, charge, disassemble, heat, put into the fire, or apply strong impact on the battery. The battery may leak, explode, produce heat or fire. Never use the battery which was applied strong impact due to such as fall on the floor, it may leak.
- UL standards establish that the battery shall be replaced by an expert engineer. The expert engineer must be in charge of the replacement and also replace the battery according to the method described in this manual.
- When the display of LCD Operator can not be recognized due to the service life, replace the LCD Operator.

Precautions for Correct Use

Installation

Mount the product vertically on a wall with the product’s longer sides upright.
The material of the wall must be noninflammable such as a metal plate.

Installation and Wiring

Confirm that the power voltage for the encoder is the same as the rated voltage (+12 VDC or +5 VDC) of the product.

Restart Selection Function

Do not come close to the machine when using **Instantaneous power failure/under-voltage trip** (bb-24) or **over-current** (bb-28) because the machine may abruptly start after the alarm is cleared.

Maintenance and Parts Replacement

- Generally speaking, inverters contain components and will operate properly only when each component operates normally.
  Some of the electrical components require maintenance depending on application conditions.
  Periodic inspection and replacement are necessary to ensure proper long-term operation of Inverters.

- When a cooling fan reaches the end of its service life, replace it.

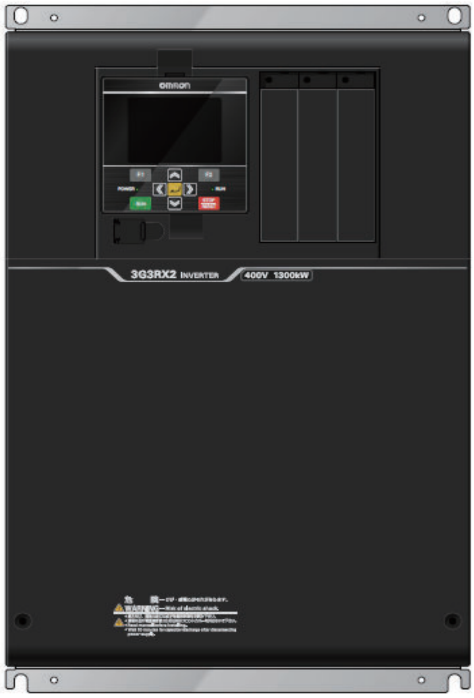
Product Disposal

Comply with the local ordinance and regulations when disposing of the product.

Dispose of in accordance with WEEE Directive

Warning Label

- This product bears a warning label at the following location to provide handling warnings.
- Be sure to follow the instructions.
  The appearance differs depending on the capacity of the inverter.



Warning Description

危　　険 ─ けが・感電のおそれがあります。

WARNING ─ Risk of electric shock.

- 据え付け、運転の前には必ず取扱説明書をお読み下さい。
- 通電中及び電源遮断後10分以内はフロントカバーを外さないで下さい。
- Read manual before installing.
- Wait 10 minutes for capacitor discharge after disconnecting power supply.

Regulations and Standards

To export (or provide to nonresident aliens) any part of this product that falls under the category of goods (or technologies) for which an export certificate or license is mandatory according to the Foreign Exchange and Foreign Trade Control Law of Japan, an export certificate or license (or service transaction approval) according to this law is required.

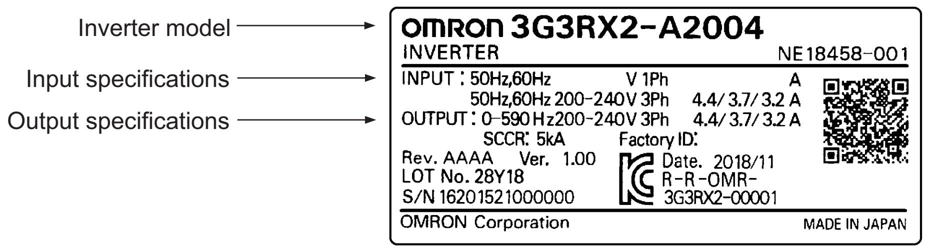
<table>
<tr><th colspan="2"></th><th>Standards</th></tr>
<tr><td rowspan="2">CE</td><td>EMC</td><td>EN 61800-3:2004/A1:2012</td></tr>
<tr><td>Machinery</td><td>EN 61800-5-2:2007 STO SIL3
EN ISO13849-1: 2015 Cat.4 PLe
EN 61800-5-1:2007/A1:2017</td></tr>
<tr><td rowspan="3">UL</td><td>US</td><td>UL61800-5-1</td></tr>
<tr><td>CA</td><td>CSA C22.2 No. 274</td></tr>
<tr><td>FS</td><td>IEC61800-5-2:2016 STO SIL3
ISO13849-1:2015 Cat.4 PLe</td></tr>
<tr><td colspan="2">KC</td><td>KN61800-3</td></tr>
<tr><td colspan="2">EAC</td><td>-</td></tr>
<tr><td colspan="2">RCM</td><td>EN 61800-3:2004/A1:2012</td></tr>
</table>

Items to Check after Unpacking

After unpacking, check the following items.
- Is this the model you ordered?
- Was there any damage sustained during shipment?

Checking the Nameplate

The nameplate is affixed to the product.



Checking the Model

3G3RX2 − A 2 055

Max. Applicable Motor Capacity Standard Rating (normal duty rating [ND])

004	0.4kW
007	0.75kW
015	1.5kW
022	2.2kW
037	3.7kW
055	5.5kW
075	7.5kW
110	11kW
150	15kW
185	18.5kW
220	22kW
300	30kW
370	37kW
450	45kW
550	55kW
750	75kW
900	90kW
11K	110kW
13K	132kW

Voltage class

2	3-phase 200 VAC (200-V class)
4	3-phase 400 VAC (400-V class)

Enclosure rating

A	IP20/UL open type
B	IP00/UL open type

Checking the Accessories

The instruction manual is the only accessory included in the High-function General-purpose Inverter (Model: 3G3RX2).
Mounting screws and other necessary parts must be provided by the user.
LCD operator does not come with battery. When you desire to display time and date in LCD operator, prepare the optional battery (CR2032, 3V). As for the method for setting the battery and for its use, refer to *3-1-5 How to Set Battery and Make Clock Settings* on page 3-13.

Accessory	3G3RX2-A2004/ -A2007/ -A2015/ -A2022/ -A2037/ -A2055/ -A2075/ -A2110/ -A2150/ -A2185/ -A2300/ -A4007/ -A4015/ -A4022/ -A4037/ -A4055/ -A4075/ -A4110/ -A4150/ -A4185/ -A4220/ -A4300	3G3RX2-A2220	3G3RX2-A2370/ -A2450/ -A2550/ -A4370/ -A4450/ -A4550/ -B4750/ -B4900/ -B411K/ -B413K
LCD Operator	1 (equipped with this inverter)		
User's Manual	1		
Sheet supporting 25 foreign languages	1		
Warning Label Sheet	1		
Spacer, Screw (M3×8)	-	4 each	-
Eye-bolts (M8 CB08EY 2M)	-	-	2

Related Manuals

Please see the manuals below for related product information.

Name	Catalog No.
Regenerative Braking Unit 3G3AX-RBU User’s Manual	I563
CX-Drive Operation Manual	W453
DriveProgramming User’s Manual	I622
Inverter RX2 Series EtherCAT® Communication Unit User’s Manual	I663

For the PG option, refer to *2-3-6 Wiring for PG Option Unit* on page 2-68in this manual.

Revision History

The manual revision code is a number appended to the end of the catalog number found in the bottom right-hand corner of the front and back covers.

Cat.No. I620-E1-04

Revision code

Revision code	Revision date	Revised Content
01	March 2019	Original production
--	N/A	N/A
02	November 2021	• Modification due to new EtherCAT Communication Unit 3G3AX-RX2-ECT • Improved descriptions, etc
03	July 2022	• Added descriptions
04	September 2022	Revisions for adding safety precautions regarding security.

1

Overview

This section provides an overview of the 3G3RX2 Series features, standard specifications, and external dimensions by inverter model

1-1 Overview of Functions

The high-function general-purpose inverter 3G3RX2 series is a human- and environmental-friendly inverter suitable for a wide variety of applications. It provides various features, convenient functions intended for ease of use and a variety of possible I/O configurations.
In addition, the 3G3RX2 Series complies with safety standards for many nation, such as the IEC Standard. You can use this product as a world standard inverter.

1-1-1 Features of 3G3RX2 Series Inverter

The 3G3RX2 Series Inverter has the following features.

Enhanced Application Support

The 3G3RX2 Series provides high performance and high functionality, which are the requirements of a general-purpose inverter.
It enhances the capability to support applications and addresses diverse needs with optimal performance.

● Adoption of the Triple Rating Function (Normal Duty, Low Duty and Very Low Duty)

The previously named Heavy and Light modes on the 3G3RX2 have been changed to Normal Duty (ND), Low Duty (LD) and Very Low Duty (VLD) to provide the triple rating function.
The Low Duty selection is available for a fan, pump, or other device that operates at the rated motor torque or less in its normal state. Setting the Low Duty causes the rated current of the inverter to increase, enabling the inverter to drive a motor that is one size larger in capacity.
However, take care in selecting an inverter because the overload capacity decreases to 1 minute, 120% of the rated current.

Precautions for Correct Use

Switching the Normal, Low and Very Low Duty changes the setting ranges and default data of the related parameters. Refer to *6-1-1 Inverter Load Rating Settings* on page 6-3.

● Addition of the Programming Function

The 3G3RX2 Series has the built-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control. You can create programs easily in flowchart or text language method by using the CX-Drive.
For details, refer to the *DriveProgramming User's Manual (Cat. No. I622)*.

● Addition of Vector Control Functions

With sensor-less vector control, the inverter realizes a high starting torque at 200% of the motor rating at 0.3 Hz. With 0-Hz sensor-less vector control, the inverter can also output a high starting torque at 150% of the motor rating at even lower frequencies.

The inverter has various vector control functions as listed below, in addition to V/f control.

- Sensor-less vector control
- 0-Hz sensor-less vector control
- Sensor vector control

● Position Control by Feedback

The inverter can realize accurate position control by feeding back the load-side position information, just as with a servo system. It is effective in cost-savings for the whole system because the position control system with a motor over 15 kW is available, and other position controllers are unnecessary if the inverter's internal position control function is used.

This inverter has the following position control functions.
- Absolute position control mode and high-resolution absolute position control mode that can control up to 8 points
- Pulse train position control mode that can control via pulse input from the host controller
- Orientation function that controls a rotating shaft to stop at a fixed position

● PID Control Function

The inverter provides PID control that adjusts the feedback value to match the target value.
This is available to process controls such as temperature, pressure, flow rate without temperature controller or external controller.

● Power Interruption Restart Function

If a momentary power interruption occurs during operation, the inverter automatically recognizes the rotation speed of the motor at power recovery, without detecting undervoltage, to enable a smooth restart.

● Stall Prevention Function

Induction motors may stall (or step out) if a large load is applied due to rapid acceleration or load fluctuation. This inverter has the overload limit function that prevents such a stall condition and ensures a persistent operation.

Environmental Considerations

OMRON gives consideration to not only the inverter, but also the service life and energy efficiency of the connected motor.
This inverter complies with the RoHS directive and international standards to realize an environmental-friendly inverter.

● Measures against Noise and Harmonic Interference for Peripheral Equipment Protection

The inverter comes standard with a built-in EMC noise filter as a measure against noise for compliance with the EMC directive.
To comply with the Japanese National Standard established by the Ministry of Land, Infrastructure, Transport and Tourism, an optional radio noise filter and DC reactor which comply with that specification can be connected.

● Long Life Design

The inverter has a design life of 10 years, achieved through the use of long-life parts for its capacitors, fan, and other consumables. Using an inverter for a longer period than ever before has an advantage in extending the life of your facility.

● Automatic Energy-saving Function

The automatic energy-saving function automatically adjusts the output power of the inverter operating at a constant speed to the minimum. It has an energy-saving effect in applications such as a fan or a pump.

● Compliance with Safety Standards

The inverter complies with international safety standards adopted by many nations such as the IEC Standard.

● Complies with RoHS Directive

This inverter complies with the RoHS Directive that restricts the use of 10 hazardous substances.

Ease of Use

The 3G3R2 Series Inverter has features to help reduce the man-hours needed in all phases of inverter-related work: from wiring, parameter setting, operation to maintenance.

● Removable Color LCD Operator Panel

This inverter comes standard with a removable LCD operator panel.
The Color LCD Display is to provide easier viewing when monitoring or setting parameters.
You can save inverter data to the LCD operator panel and it can be used as a copy unit.
By connecting the optional cable (3G3AX-OPCN□), it is possible to operate the operator panel while holding it, or install it to the front face of the control panel. This is convenient during setup or maintenance operations.
When the optional battery (CR2032, 3V) is installed in the LCD operator panel, date and time can be displayed in the error history. This display is useful in troubleshooting when an error occurs.

● Safe Torque OFF (STO) Function

Safe Torque OFF (STO) function complying with IEC61800-5-2 is equipped. With the use of a signal from a safety devices such as an emergency shutoff button, the motor current can be shutoff to stop the motor safely.

● Modbus Communication Function as Standard

The inverter is equipped standard with an RS485 communications circuit and the Modbus communication protocol.
You can use Modbus communications to control and monitor the inverter status, or read and write various parameter settings.

● Simplified Parameter Setting by User Parameters

This inverter provides User Selection (UA-31 to UA-62) as user parameters.

You can register parameters that are frequently used to simplify parameter setting and adjustment. It is also possible to automatically register parameters that have been changed as user parameters.

1-1-2 Classes of 3G3RX2 Series Inverter

There are two voltage classes for 3G3RX2 Series Inverters: 3-phase 200 VAC and 3-phase 400 VAC. The applicable motor capacities are 0.4 to 132 kW. All models comply as standard with the EC Directives

Rated voltage	Enclosure rating	Max. applicable motor capacity	Model
3-phase 200 VAC	IP20	0.4kW	3G3RX2-A2004
		0.75kW	3G3RX2-A2007
		1.5kW	3G3RX2-A2015
		2.2kW	3G3RX2-A2022
		3.7kW	3G3RX2-A2037
		5.5kW	3G3RX2-A2055
		7.5kW	3G3RX2-A2075
		11kW	3G3RX2-A2110
		15kW	3G3RX2-A2150
		18.5kW	3G3RX2-A2185
		22kW	3G3RX2-A2220
		30kW	3G3RX2-A2300
		37kW	3G3RX2-A2370
		45kW	3G3RX2-A2450
		55kW	3G3RX2-A2550
3-phase 400 VAC	IP20	0.75kW	3G3RX2-A4007
		1.5kW	3G3RX2-A4015
		2.2kW	3G3RX2-A4022
		3.7kW	3G3RX2-A4037
		5.5kW	3G3RX2-A4055
		7.5kW	3G3RX2-A4075
		11kW	3G3RX2-A4110
		15kW	3G3RX2-A4150
		18.5kW	3G3RX2-A4185
		22kW	3G3RX2-A4220
		30kW	3G3RX2-A4300
		37kW	3G3RX2-A4370
		45kW	3G3RX2-A4450
		55kW	3G3RX2-A4550
	IP00	75kW	3G3RX2-B4750
		90kW	3G3RX2-B4900
		110kW	3G3RX2-B411K
		132kW	3G3RX2-B413K

Nomenclature

3G3RX2 — A 2 0 5 5

Max. Applicable Motor Capacity Standard Rating (normal duty rating [ND])

004	0.4kW
007	0.75kW
015	1.5kW
022	2.2kW
037	3.7kW
055	5.5kW
075	7.5kW
110	11kW
150	15kW
185	18.5kW
220	22kW
300	30kW
370	37kW
450	45kW
550	55kW
750	75kW
900	90kW
11K	110kW
13K	132kW

Voltage class

2	3-phase 200 VAC (200-V class)
4	3-phase 400 VAC (400-V class)

Enclosure rating

A	IP20/UL open type
B	IP00/UL open type

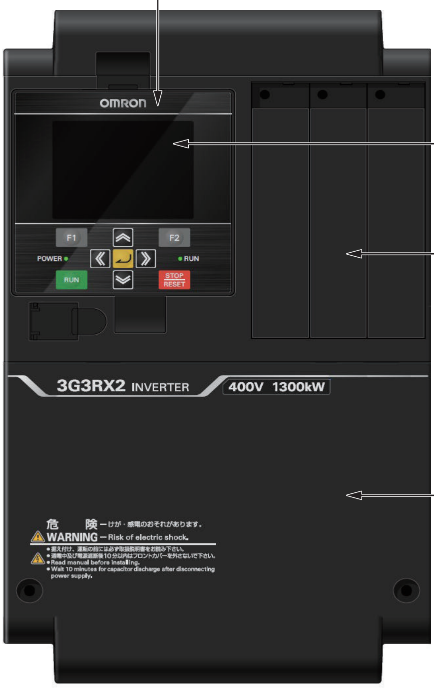
1-1-3 Compliance with International Standards

Because the 3G3RX2 Series complies as standard with the international IEC standard, the series conforms to various national standards including those for European nations.

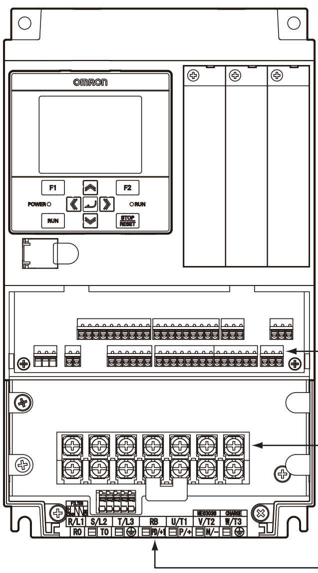
		Applicable standards
CE	**EMC**	EN 61800-3:2004/A1:2012
	Machinery	EN 61800-5-2:2007 STO SIL3 EN ISO13849-1: 2015 Cat.4 PLe EN 61800-5-1:2007/A1:2017
UL	**US**	UL61800-5-1
	CA	CSA C22.2 No. 274
	FS	IEC 61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe
KC		KN61800-3
EAC		-
RCM		EN 61800-3:2004/A1:2012

1-2 Appearance and Part Names

The following shows the front view when the product is unpacked
(an example of 3G3RX2-A2055/A2075/A2110/A4055/A4075/A4110).



Open the terminal block cover to wire the main circuit terminal block and the control circuit terminal block.
Moreover, you can open the Option Unit Connection Cover to mount option boards.



1-3 Specifications

1-3-1 Standard Specifications

Please refer to *Derating of Rated Output Current* on page 2-7 for details.

Common Specifications

<table>
<tr><td>Control mode (output to the motor)</td><td colspan="2">Sine wave PWM control voltage output (line sine wave modulation)</td></tr>
<tr><td>Output frequency range*1</td><td colspan="2">0.00 to 590.00Hz</td></tr>
<tr><td>Frequency accuracy</td><td colspan="2">Digital command ±0.01% and analog command ±0.2% (25°C±10°C) against the maximum frequency</td></tr>
<tr><td>Frequency resolution</td><td colspan="2">Digital setting: 0.01Hz
Analog setting: maximum frequency/4000
(Ai1 terminal/Ai2 terminal: 12bit/0 to +10V or 0 to +20mA, Ai3 terminal 12bit/-10 to +10V)</td></tr>
<tr><td rowspan="2">Control mode (frequency/ voltage calculation) *2</td><td>IM</td><td>V/f control (fixed torque/reduced torque/free), automatic boost control, cascade model sensorless vector control, 0 Hz range sensorless vector control, vector control with sensor.</td></tr>
<tr><td>SM/PMM</td><td>Synchronous starting sensorless vector control, IVMS starting smart sensorless vector control</td></tr>
<tr><td>Speed fluctuation*3</td><td colspan="2">±0.5% (during sensor-less vector control)</td></tr>
<tr><td>Acceleration or deceleration time</td><td colspan="2">0.00 to 3600.00sec (linear, S-shaped, U-shaped, reverse U-shaped, EL-S shaped)</td></tr>
<tr><td>Display monitor</td><td colspan="2">Output frequency, output current, output torque, trip history, I/O terminal status, I/O power *4, P-N voltage.</td></tr>
<tr><td>Starting functions</td><td colspan="2">Start after DC braking, frequency collection start, frequency entrainment start, reduced voltage start, retry start</td></tr>
<tr><td>Stopping functions</td><td colspan="2">Free-run stop, DC braking after deceleration stop or terminal DC braking (braking power, operating speed adjustment)</td></tr>
<tr><td>Stall prevention functions</td><td colspan="2">Overload restraining function, overcurrent suppression function, overvoltage suppression function</td></tr>
<tr><td>Protective functions*5</td><td colspan="2">Overcurrent error, Motor overload error, Braking resister Overload error, Overvoltage error, Memory error, Undervoltage error, Current detector error, CPU error, External trip error, USP error, Ground fault error, Incoming over voltage error, Instantaneous power failure error, Temperature detector error, Cooling fan rotation speed reduction temperature error, Temperature error, Input open-phase error, IGBT error, Output open-phase error, Thermistor error, Brake error, Low-speed range overload error, Controller overload error, RS485 communication error, Operator keypad disconnection error</td></tr>
</table>

Other functions	V/f free settings (7 points), Upper/lower limit frequency limiter, Frequency jump, Curve acceleration/deceleration, Manual torque boost, Energy-saving operation, Analog output adjustment function, Minimum frequency, Carrier frequency adjustment, Motor electronic thermal function (free setting is also possible), Inverter electronic thermal function, External start/end (volume/ratio), Frequency input selection, Trip retry, Restart after instantaneous stop, Output of signals, Initialization settings, PID control, Automatic deceleration at power shut-off, Brake control function, and Auto-tuning for commercial switching function (online/offline).

Input	**Frequency settings**	**LCD Operator**	Parameter setting using arrow keys	
		External signals*6	Ai1/Ai2 terminal (when changing voltage)	Setting through input of 0 to 10VDC voltage (input impedance: 10kΩ)
			Ai1/Ai2 terminal (when changing current)	Setting through input of 0 to 20mA current (input impedance: 100Ω)
			Ai3 terminal	Setting through input of -10 to +10V voltage (input impedance: 10kΩ)
			Multistage speed terminal (use of input terminal function)	15 speed
			Pulse string input (A/B terminal, use of input terminal function)	Maximum 32kHz×2
		External port	Setting via RS485 serial communication (protocol: Modbus-RTU)	
	Normal rotation/ reverse rotation Run/Stop	**LCD Operator**	Execution with the RUN /STOP key (normal rotation/reverse rotation can be switched by setting parameters)	
		External signals	Normal rotation operation (FW)/reverse rotation (RV) (when an input terminal function is assigned) 3-wire input available (when an input terminal function is assigned)	
		External port	Setting via RS485 serial communication (protocol: Modbus-RTU (maximum: 115.2kbps)	
	Input terminal functions		11 terminals (input of pulse string is available on terminal A and B)	
			FW (Normal rotation)/RV (Reverse rotation), CF1-4 (Multistage speed 1-4), SF1-7 (Multistage speed bit 1-7), ADD (Addition of frequency), SCHG (Switching of frequency command), STA (3-wire start)/STP (3-wire stop)/F_R (3-wire normal/reverse), AHD (Retention of analog command), FUP (Increase of speed via remote operation/FDN (Deceleration via remote operation), UDC (Deletion of data via remote operation), F-OP (Forced command switching), SET (Second control), RS (Reset), JG (Jogging), DB (External current braking), 2CH (2-stage acceleration/deceleration), FRS (Free-run stop), EXT (External abnormality), USP (Prevention of restart after restoration of power), CS (Commercial switching), SFT (Soft-lock), BOK (Brake check), OLR (Overload restriction switching), KHC (Clearance of integrated input power), OKHC (Clearance of integrated output power), PID (PID1 disabled), PIDC (PID1 integration reset), PID2 (PID2 disabled), PIDC2 (PID2 integration reset), SVC1-4 (PID1 multistage target values 1-4), PRO (PID gain switching), PIO (PID output switching), SLEP (SLEEP condition satisfied)/WAKE (WAKE condition satisfied), TL (Torque restriction enabled), TRQ1, 2 (Switching of torque limit 1,2), PPI (Switching of P/PI control), CAS (Switching of control gain), FOC (Preparatory excitation), ATR (Torque control enabled), TBS (Torque bias enabled), LAC (Cancellation of acceleration/deceleration), Mi1-11 (General-purpose input 1-11), PCC (Clearance of pulse counter), ECOM (Start of EzCOM), PRG (Program run), HLD (Acceleration/deceleration stop), REN (Operation permission signal), PLA (Pulse string input A), and PLB (Pulse string input B)	
	Backup power supply terminal		P+/P-: DC24V input (allowable input voltage: 24V±10%)	
	STO input terminal		2 terminals (simultaneous input)	
	Thermistor input terminal		1 terminal (possible to switch between positive temperature coefficient/negative temperature coefficient resistance element)	

Output	**Output terminal function**	Transistor output 5 terminal, 1a contact relay 1 point, 1c contact relay 1 point	
	Transistor output **Relay and alarm relay (16, AL)**	RUN (During operation), FA1-5 (Reached signal), IRDY (Operation ready completion), FWR (During normal rotation operation), RVR (During reverse rotation operation), FREF (Frequency command operator keypad), REF (Operation command operator keypad), SETM (Second control under selection), AL (Alarm signal), MJA (Severe failure signal), OTQ (Over torque) [*7], IP (During instantaneous power failure), UV (Under insufficient voltage), TRQ (During torque limitation), IPS (During power failure deceleration), RNT (RUN time over), ONT (Power on time over), THM (Electronic thermal warning), THC (Electronic thermal warning), WAC (Capacitor life advance notice), WAF (Fan life advance notice), FR (Operation command signal), OHF (Cooling fin heating advance notice), LOC/LOC2 (Low-current signal), OL/OL2 (Overload advance notice), BRK (Brake release), BER (Brake abnormality), ZS (Zero-speed detection signal), OD/OD2 (PID deviation excessive), FBV/FBV2 (PID feedback comparison), NDc (Communication disconnection), Ai1Dc/Ai2Dc/Ai3Dc (Analog disconnection Ai1/Ai2/Ai3), WCAi1/WCAi2/WCAi3 (Window comparator Ai1/Ai2/Ai3), LOG1-7 (Logical operation result 1-7), MO1-7 (General output 1-7), and OVS (Receiving overvoltage).	
	EDM output terminal	Output for STO diagnosis	
	Monitor output terminal[*8]	Possible to output through selection from monitor data of parameters	
EMC filter switching[*9]		Possible to enable the EMC noise filter (switching method is different depending on the model)	
External access to PC		USB Micro-B	
Use environment	**Ambient temperature[*10]**	ND (normal duty)	-10 to 50℃
		LD (low duty)	-10 to 45℃
		VLD (very low duty)	-10 to 40℃
	Storage temperature[*11]	-20 to 65℃	
	Humidity	20-90%RH (with no condensation)	
	Vibration[*12]	5.9m/s2 (0.6G) 10 to 55Hz: 3G3RX2-A2004 to A2220/3G3RX2-A4007 to A4220 2.94m/s2 (0.3G) 10 to 55Hz: 3G3RX2-A2300 to A2550/3G3RX2-A4300 to A413K	
	Use location[*13]	1000 m altitude or lower (location free from corrosive gas, oil mist, and dust)	
Expected service life		Smoothing capacitor 10 years	
		Designed life of cooling fan 10 years (models equipped with a cooling fan) free from dust	
		Memory element on the control circuit board	
Applicable standards[*14]		Compliance with UL/cUL/CE standards, RCM, Functional Safety SIL3/PLe	
Color		Black	
Operation, display		LCD Operator[*15]	
Number of option slots		3 ports	
Other options		Braking resistor, AC reactor, DC reactor, noise filter	

*1. The output frequency range depend on the control and motor used. When running the inverter exceeding 60Hz, check the maximum allowable frequency with the manufacturer of the motor.

*2. When the control mode is changed, unless the motor constant is appropriately configured, you cannot obtain the desired starting torque or the inverter may trip.

*3. The variable range of motor speed may vary depending on your system or the environment where the motor is used. Please contact us for details.

*4. Both the input power and output power are reference values, which are not appropriate for use in calculation of efficiency values, etc. To obtain an accurate value, use an external device.
*5. The IGBT error [E030] is generated by the protective function not only for short circuit protection but also when IGBT is damaged. Depending on the operating conditions of the inverter, the overcurrent error [E001] may occur, instead of the IGBT error.
*6. At the factory default setting, when voltage and current on Ai1/Ai2 terminal is changed using a switch, with input of voltage at 9.8V and current at 19.8mA, the command is recognized as being *100%*. To change characteristics, make adjustments using the analog start/end function.
*7. The threshold for signal output varies depending on the motor to be combined with the inverter, parameter adjustment, etc.
*8. The output data of analog voltage monitor and analog current monitor are reference values for connecting an analog meter. Due to the meter to be connected and variation in analog output circuit, the maximum output value may slightly vary from 10V or 20mA. To change characteristics, make adjustments using the Ao1 adjustment and Ao2 adjustment functions. Some monitor data cannot be output.
*9. To enable the EMC filter, connect with a power supply grounded at a neutral point. Otherwise, the leakage current may increase.
*10. Use the 400V class inverter at an input voltage of 500VAC or below. If input voltage exceeds 500VAC due to fluctuation of power, use the inverter at 40°C or lower ambient temperature.
*11. The storage temperature is the temperature during transport.
*12. To be in accordance with the testing method specified in JIS C 60068-2-6: 2010 (IEC 60068-2-6:2007)
*13. When the inverter is used in a location at 1000m or higher altitude, air pressure reduces approximately 1% every 100m elevation. Perform 1% current derating and conduct evaluation for every 100m elevation.
*14. For insulation distance, comply with UL and CE standards
*15. When a clock function is used, the optional battery (CR2032, 3V) is required. When you purchase, this LCD operator does not come with the battery.

1-3-2 200V Class Specifications

Model 3G3RX2-				A2004	A2007	A2015	A2022	A2037	A2055	A2075	A2110
Applicable motor capacity (kW) (4 pole)			VLD	0.75	1.5	2.2	3.7	5.5	7.5	11	15
			LD	0.75	1.5	2.2	3.7	5.5	7.5	11	15
			ND	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
Output	Rated output Current(A)		VLD	4.4	8.0	10.4	15.6	22.8	33.0	46.0	60.0
			LD	3.7	6.3	9.4	12.0	19.6	30.0	40.0	56.0
			ND	3.2	5.0	8.0	11.0	17.5	25.0	32.0	46.0
	Overload Current rating		VLD	110% 60sec/ 120% 3sec							
			LD	120% 60sec/ 150% 3sec							
			ND	150% 60sec/ 200% 3sec							
	Rated output voltage			3-phase (3-wire) 200 to 240V (depending on receiving voltage)							
	Rated capacity (kVA)	200V	VLD	1.5	2.8	3.6	5.4	7.9	11.4	15.9	20.8
			LD	1.3	2.2	3.3	4.2	6.8	10.4	13.9	19.4
			ND	1.1	1.7	2.8	3.8	6.1	8.7	11.1	15.9
		240V	VLD	1.8	3.3	4.3	6.5	9.5	13.7	19.1	24.9
			LD	1.5	2.6	3.9	5.0	8.1	12.5	16.6	23.3
			ND	1.3	2.1	3.3	4.6	7.3	10.4	13.3	19.1
Input	Rated input Current(A)*1		VLD	5.2	9.5	12.4	18.6	27.1	39.3	54.8	71.4
			LD	4.4	7.5	11.2	14.3	23.3	35.7	47.6	66.7
			ND	3.8	6.0	9.5	13.1	20.8	29.8	38.1	54.8
	Rated input AC voltage			Control power supply: Power supply single phase 200 to 240V/allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)							
				Main circuit power supply: 3-phase (3-wire) 200 to 240V/allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)							
	Power supply equipment capacity (kVA) *2		VLD	2.0	3.6	4.7	7.1	10.3	15.0	20.9	27.2
			LD	1.7	2.9	4.3	5.4	8.9	13.6	18.1	25.4
			ND	1.5	2.3	3.6	5.0	7.9	11.3	14.5	20.9
Carrier frequency operating range *3			VLD	0.5 to 10.0kHz							
			LD	0.5 to 12.0kHz							
			ND	0.5 to 16.0kHz							
Motor start torque *4				200%/ 0.3Hz							
Braking	Regenerative braking			Equipped with BRD circuit (with a discharging resistor separately installed)							
	Minimum resistance that can be connected (Ω) *5			50	50	35	35	35	16	10	10
Dimensions	Height (mm)			255	255	255	255	255	260	260	260
	Width (mm)			150	150	150	150	150	210	210	210
	Depth (mm)			140	140	140	140	140	170	170	170
Enclosure rating				IP20*6/UL open type							

Model 3G3RX2-	A2004	A2007	A2015	A2022	A2037	A2055	A2075	A2110
Approximate mass (kg)	3	3	3	3	3	6	6	6

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*3. The setting of rated values for **carrier frequencies** [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above **maximum output frequency for driving ×10**Hz for the setting of *carrier frequencies* [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

*5. The minimum resistance value of a discharge resistor that can be connected to the regenerative braking circuit built into the inverter.

*6. Based on self declaration.

Model 3G3RX2-				A2150	A2185	A2220	A2300	A2370	A2450	A2550
Applicable motor capacity (kW) (4 pole)			**VLD**	18.5	22	30	37	45	55	75
			LD	18.5	22	30	37	45	55	75
			ND	15	18.5	22	30	37	45	55
Output	**Rated output Current(A)**		**VLD**	80.0	93.0	124	153	185	229	295
			LD	73.0	85.0	113	140	169	210	270
			ND	64.0	76.0	95.0	122	146	182	220
	Overload Current rating		**VLD**	110% 60sec/ 120% 3sec						
			LD	120% 60sec/ 150% 3sec						
			ND	150% 60sec/ 200% 3sec						
	Rated output voltage			3-phase (3-wire) 200 to 240V (depending on receiving voltage)						
	Rated capacity (kVA)	**200V**	**VLD**	27.7	32.2	43.0	53.0	64.1	79.3	102.2
			LD	25.3	29.4	39.1	48.5	58.5	72.7	93.5
			ND	22.2	26.3	32.9	42.3	50.6	63.0	76.2
		240V	**VLD**	33.3	38.7	51.5	63.6	76.9	95.2	122.6
			LD	30.3	35.3	47.0	58.2	70.3	87.3	112.2
			ND	26.6	31.6	39.5	50.7	60.7	75.7	91.5
Input	**Rated input Current(A)*1**		**VLD**	95.2	110.7	147.6	182.1	220.2	272.6	351.2
			LD	86.9	101.2	134.5	166.7	201.2	250.0	321.4
			ND	76.2	90.5	113.1	145.2	173.8	216.7	261.9
	Rated input AC voltage			Control power supply: Power supply single phase 200 to 240V / allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz) / 60Hz (allowable variation range: 57 to 63Hz)						
				Main circuit power supply: 3-phase (3-wire) 200 to 240V / allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz) / 60Hz (allowable variation range: 57 to 63Hz)						
	Power supply equipment capacity (kVA) *2		**VLD**	36.3	42.2	56.3	69.4	83.9	103.9	133.8
			LD	33.1	38.6	51.3	63.5	76.7	95.3	122.5
			ND	29.0	34.5	43.1	55.3	66.2	82.6	99.8

Model 3G3RX2-		A2150	A2185	A2220	A2300	A2370	A2450	A2550
Carrier frequency operating range *3	**VLD**	0.5 to 10.0kHz						
	LD	0.5 to 12.0kHz						
	ND	0.5 to 16.0kHz						
Motor start torque *4		200%/ 0.3Hz						
Braking	**Regenerative braking**	Equipped with BRD circuit (with a discharging resistor separately installed)			Regenerative braking unit separately installed			
	Minimum resistance that can be connected (Ω) *5	7.5	7.5	5	-	-	-	-
Dimensions	**Height (mm)**	390	390	390	540	550	550	700
	Width (mm)	245	245	245	300	390	390	480
	Depth (mm)	190	190	190	195	250	250	250
Enclosure rating		IP20*6/ UL open typeIP20						
Approximate mass (kg)		10	10	10	22	33	33	47

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*3. The setting of rated values for **carrier frequencies** [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above **maximum output frequency for driving ×10**Hz for the setting of *carrier frequencies* [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

*5. The minimum resistance value of a discharge resistor that can be connected to the regenerative braking circuit built into the inverter.

*6. Based on self declaration.

1-3-3 400V Class Specifications

Model 3G3RX2-				A4007	A4015	A4022	A4037	A4055	A4075
Applicable motor capacity (kW) (4 pole)			VLD	1.5	2.2	3.7	5.5	7.5	11
			LD	1.5	2.2	3.7	5.5	7.5	11
			ND	0.75	1.5	2.2	3.7	5.5	7.5
Output	Rated output Current(A)		VLD	4.1	5.4	8.3	12.6	17.5	25.0
			LD	3.1	4.8	6.7	11.1	16.0	22.0
			ND	2.5	4.0	5.5	9.2	14.8	19.0
	Overload Current rating		VLD	110% 60sec/ 120% 3sec					
			LD	120% 60sec/ 150% 3sec					
			ND	150% 60sec/ 200% 3sec					
	Rated output voltage			3-phase (3-wire) 380 to 500V (depending on receiving voltage)					
	Rated capacity (kVA)	400V	VLD	2.8	3.7	5.8	8.7	12.1	17.3
			LD	2.1	3.3	4.6	7.7	11.1	15.2
			ND	1.7	2.8	3.8	6.4	10.3	13.2
		500V	VLD	3.6	4.7	7.2	10.9	15.2	21.7
			LD	2.7	4.2	5.8	9.6	13.9	19.1
			ND	2.2	3.5	4.8	8.0	12.8	16.5
Input	Rated input Current(A)*1		VLD	4.9	6.4	9.9	15.0	20.8	29.8
			LD	3.7	5.7	8.0	13.2	19.0	26.2
			ND	3.0	4.8	6.5	11.0	17.6	22.6
	Rated input AC voltage			Control power supply: Power supply single phase 380 to 500V (allowable variation range 323 to 550V, 50Hz (allowable variation range: 47.5 to 52.5Hz) / 60Hz (allowable variation range: 57 to 63Hz)					
				Main circuit power supply: 3-phase (3-wire) 380 to 500V (allowable variation range 323 to 550V, 50Hz (allowable variation range: 47.5 to 52.5Hz) / 60Hz (allowable variation range: 57 to 63Hz)					
	Power supply equipment capacity (kVA) *2		VLD	3.7	4.9	7.5	11.4	15.9	22.7
			LD	2.8	4.4	6.1	10.1	14.5	20.0
			ND	2.3	3.6	5.0	8.3	13.4	17.2
Carrier frequency operating range *3			VLD	0.5 to 10.0kHz					
			LD	0.5 to 12.0kHz					
			ND	0.5 to 16.0kHz					
Motor start torque *4				200%/ 0.3Hz					
Braking	Regenerative braking			Equipped with braking resistance circuit (with a discharging resistor separately installed)					
	Minimum resistance that can be connected (Ω) *5			100	100	100	70	70	35
Dimensions	Height (mm)			255	255	255	255	260	260
	Width (mm)			150	150	150	150	210	210
	Depth (mm)			140	140	140	140	170	170
Enclosure rating				IP20*6/ UL open type					
Approximate mass (kg)				3	3	3	3	6	6

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*3. The setting of rated values for **carrier frequencies** [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above **maximum output frequency for driving ×10**Hz for the setting of *carrier frequencies* [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

*5. The minimum resistance value of a discharge resistor that can be connected to the regenerative braking circuit built into the inverter.

*6. Based on self declaration.

Model 3G3RX2-				A4110	A4150	A4185	A4220	A4300	A4370
Applicable motor capacity (kW) (4 pole)			**VLD**	15	18.5	22	30	37	45
			LD	15	18.5	22	30	37	45
			ND	11	15	18.5	22	30	37
Output	**Rated output Current(A)**		**VLD**	31.0	40.0	47.0	62.0	77.0	93.0
			LD	29.0	37.0	43.0	57.0	70.0	85.0
			ND	25.0	32.0	39.0	48.0	61.0	75.0
	Overload Current rating		**VLD**	110% 60sec/ 120% 3sec					
			LD	120% 60sec/ 150% 3sec					
			ND	150% 60sec / 200% 3sec					
	Rated output voltage			3-phase (3-wire) 380 to 500V (depending on receiving voltage)					
	Rated capacity (kVA)	**400V**	**VLD**	21.5	27.7	32.6	43.0	53.3	64.4
			LD	20.1	25.6	29.8	39.5	48.5	58.9
			ND	17.3	22.2	27.0	33.3	42.3	52.0
		500V	**VLD**	26.8	34.6	40.7	53.7	66.7	80.5
			LD	25.1	32.0	37.2	49.4	60.6	73.6
			ND	21.7	27.7	33.8	41.6	52.8	65.0
Input	**Rated input Current(A)*1**		**VLD**	36.9	47.6	56.0	73.8	91.7	110.7
			LD	34.5	44.0	51.2	67.9	83.3	101.2
			ND	29.8	38.1	46.4	57.1	72.6	89.3
	Rated input AC voltage			Control power supply: Power supply single phase 380 to 500V (allowable variation range 323 to 550V), 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)					
				Main circuit power supply: 3-phase (3-wire) 380 to 500V (allowable variation range) 323 to 550V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)					
	Power supply equipment capacity (kVA) *2		**VLD**	28.1	36.3	42.6	56.3	69.9	84.4
			LD	26.3	33.6	39.0	51.7	63.5	77.1
			ND	22.7	29.0	35.4	43.5	55.3	68.0
Carrier frequency operating range *3			**VLD**	0.5 to 10.0kHz					
			LD	0.5 to 12.0kHz					
			ND	0.5 to 16.0kHz					
Motor start torque *4				200%/ 0.3Hz					

Model 3G3RX2-		A4110	A4150	A4185	A4220	A4300	A4370
Braking	Regenerative braking	Equipped with braking resistance circuit (with a discharging resistor separately installed)					
	Minimum resistance that can be connected (Ω) *5	35	24	24	20	15	15
Dimensions	Height (mm)	260	390	390	390	540	550
	Width (mm)	210	245	245	245	300	390
	Depth (mm)	170	190	190	190	195	250
Enclosure rating		IP20*6/ UL open type					
Approximate mass (kg)		6	8.5	8.5	8.5	22	31

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*3. The setting of rated values for **carrier frequencies** [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above **maximum output frequency for driving ×10**Hz for the setting of *carrier frequencies* [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

*5. The minimum resistance value of a discharge resistor that can be connected to the regenerative braking circuit built into the inverter.

*6. Based on self declaration.

Model 3G3RX2-				A4450	A4550	A4750	B4900	B411K	B413K
Applicable motor capacity (kW) (4 pole)			VLD	55	75	90	110	132	160
			LD	55	75	90	110	132	160
			ND	45	55	75	90	110	132
Output	Rated output Current(A)		VLD	116	147	176	213	252	316
			LD	105	135	160	195	230	290
			ND	91.0	112	150	180	217	260
	Overload Current rating		VLD	110% 60sec/ 120% 3sec					
			LD	120% 60sec/ 150% 3sec					
			ND	150% 60sec / 200% 3sec					
	Rated output voltage			3-phase (3-wire) 380 to 500V (depending on receiving voltage)					
	Rated capacity (kVA)	400V	VLD	80.4	101.8	121.9	147.6	174.6	218.9
			LD	72.7	93.5	110.9	135.1	159.3	200.9
			ND	63.0	77.6	103.9	124.7	150.3	180.1
		500V	VLD	100.5	127.3	152.4	184.5	218.2	273.7
			LD	90.9	116.9	138.6	168.9	199.2	251.1
			ND	78.8	97.0	129.9	155.9	187.9	225.2

Model 3G3RX2-			A4450	A4550	A4750	B4900	B411K	B413K
Input	Rated input Current(A)*1	VLD	138.1	175.0	209.5	253.6	300.0	376.2
		LD	125.0	160.7	190.5	232.1	273.8	345.2
		ND	108.3	133.3	178.6	214.3	258.3	309.5
	Rated input AC voltage		Control power supply: Power supply single phase 380 to 500V (allowable variation range 323 to 550V, 50Hz (allowable variation range: 47.5 to 52.5Hz) / 60Hz (allowable variation range: 57 to 63Hz)					
			Main circuit power supply: 3-phase (3-wire) 380 to 500V (allowable variation range) 323 to 550V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)					
	Power supply equipment capacity (kVA) *2	VLD	105.2	133.4	159.7	193.2	228.6	286.7
		LD	95.3	122.5	145.2	176.9	208.7	263.1
		ND	82.6	101.6	136.1	163.3	196.9	235.9
Carrier frequency operating range *3		VLD	0.5 to 10.0kHz		0.5 to 8.0kHz			
		LD	0.5 to 12.0kHz		0.5 to 8.0kHz			
		ND	0.5 to 16.0kHz		0.5 to 10.0kHz			
Motor start torque *4			200%/ 0.3Hz		180%/ 0.3Hz			
Braking	Regenerative braking		Regenerative braking unit separately installed					
	Minimum resistance that can be connected (Ω) *5		-	-	-	-	-	-
Dimensions	Height (mm)		550	550	700	700	740	740
	Width (mm)		390	390	390	390	480	480
	Depth (mm)		250	250	270	270	270	270
Enclosure rating			IP20*6/ UL open type		IP00/ UL open type			
Approximate mass (kg)			31	31	41	41	53	53

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance of the power supply (wiring, breaker, input reactor option, etc.)

*3. The setting of rated values for **carrier frequencies** [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above **maximum output frequency for driving ×10**Hz for the setting of **carrier frequencies** [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

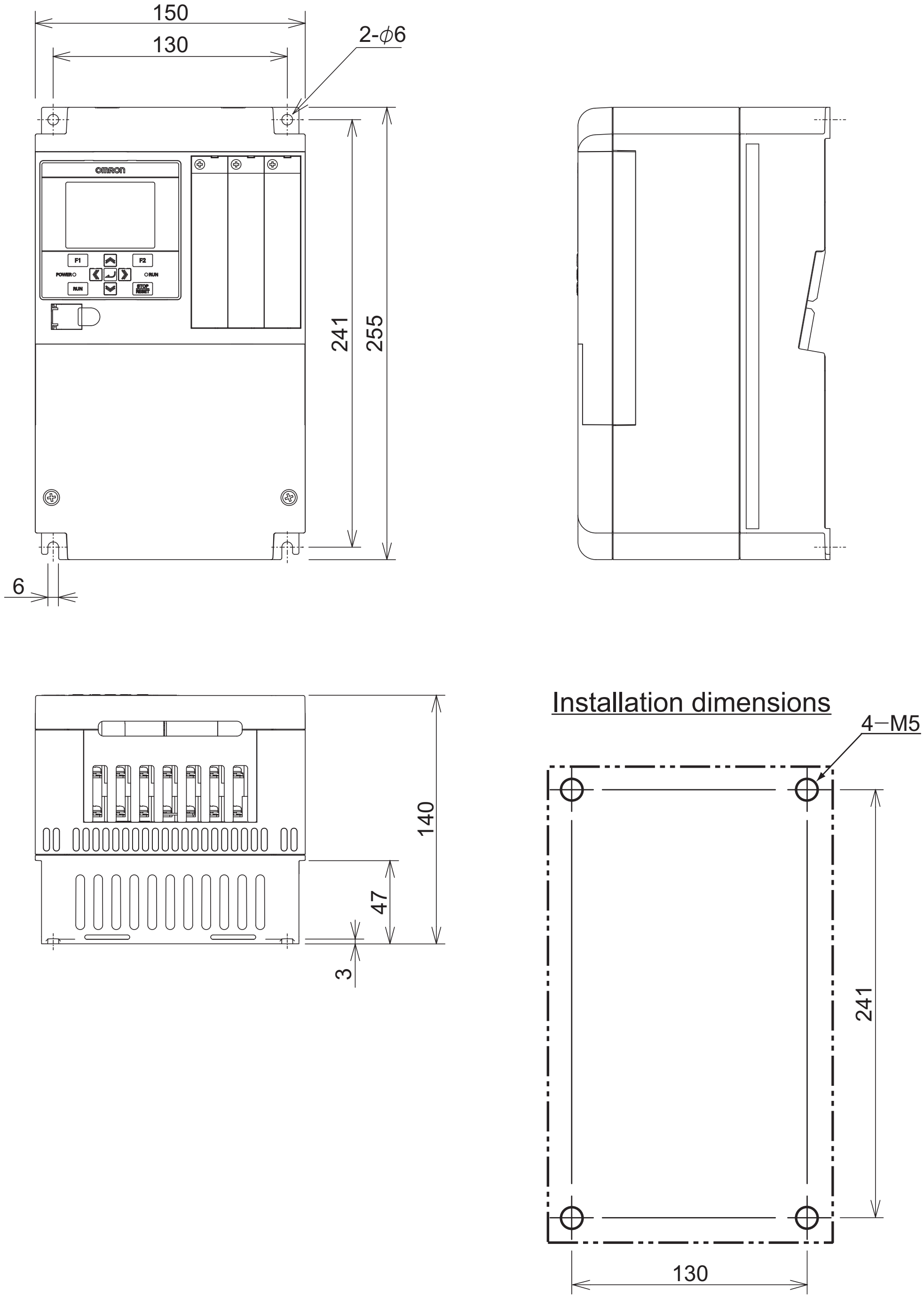
*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

*5. The minimum resistance value of a discharge resistor that can be connected to the regenerative braking circuit built into the inverter.

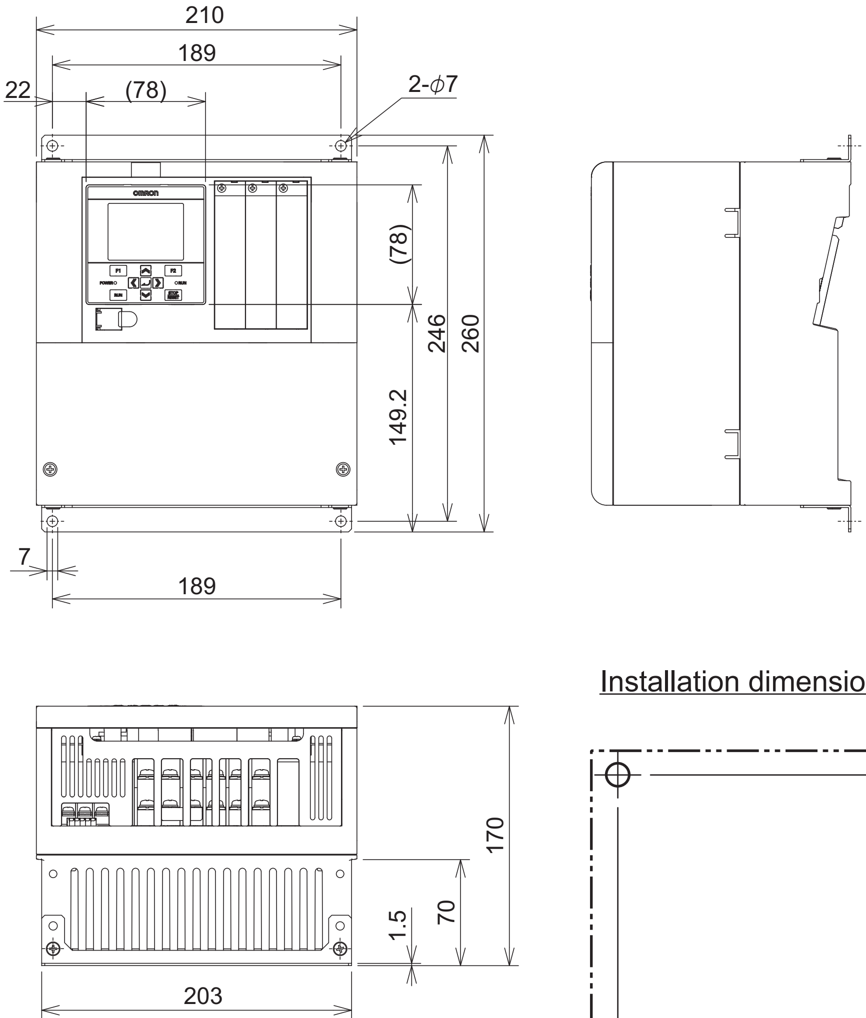
*6. Based on self declaration.

1-3-4 External dimensions

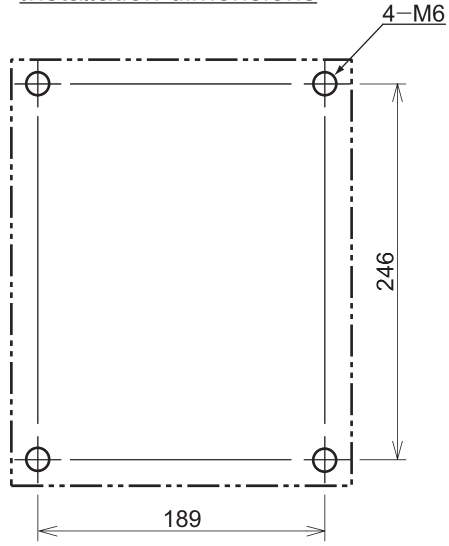
- **3G3RX2-A2004/ A2007/ A2015/ A2022/ A2037/ A4007/ A4015/ A4022/ A4037**


150
130
2-ϕ6
241
255
6
140
47
3
Installation dimensions
4−M5
241
130

- **3G3RX2-A2055/ A2075/ A2110/ A4055/ A4075/ A4110**



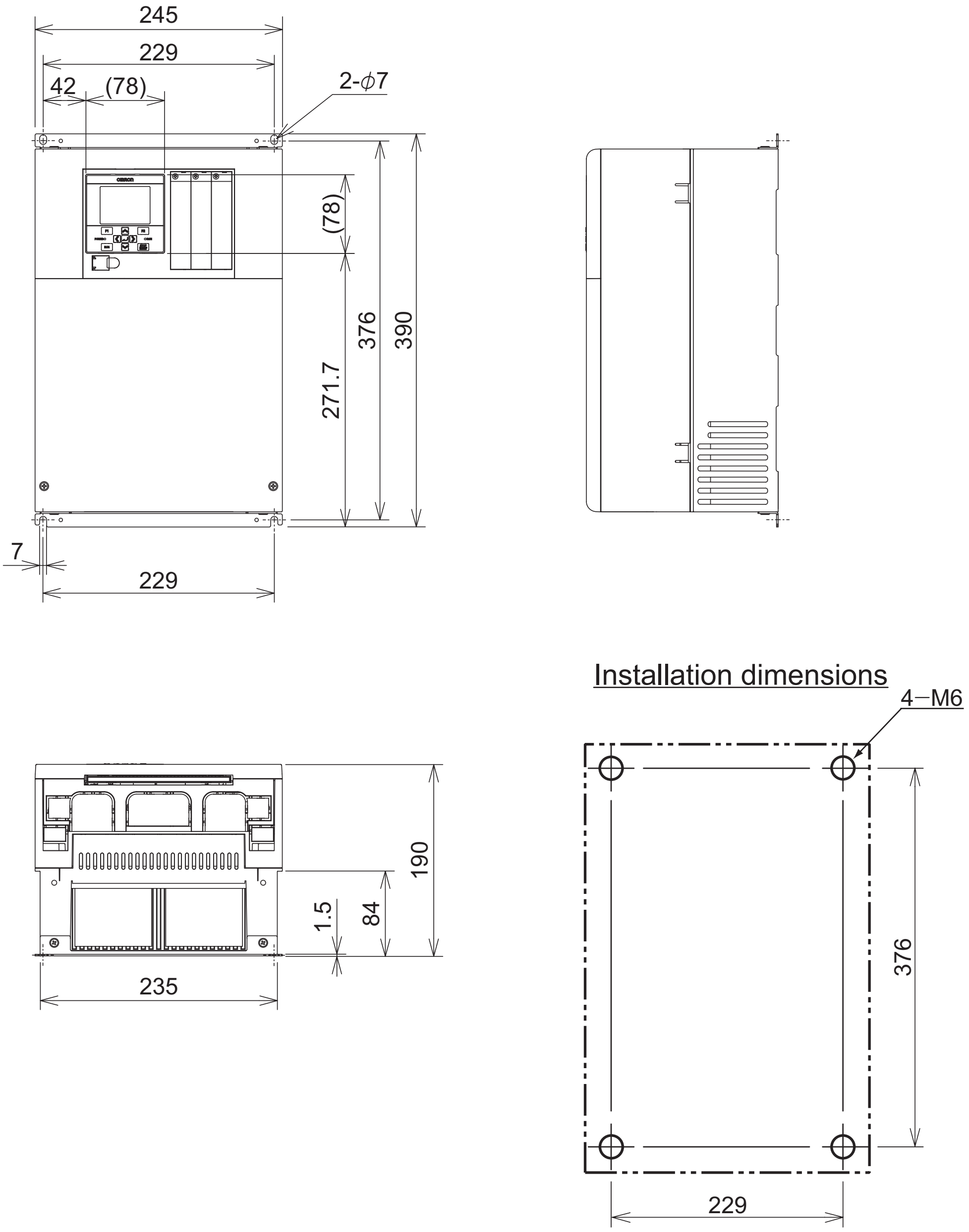
Installation dimensions



Precautions for Correct Use

If you operate 3G3RX2-A2110 at Low Duty (LD) or Very Low Duty (VLD), the inverter is subject to restrictions according to the installation method. Please refer to *Procedure for Mounting 3G3RX2-A2110* on page 2-2 for details.

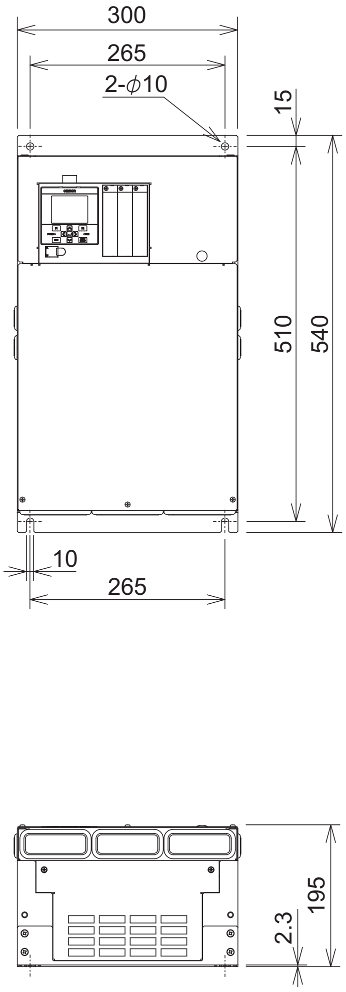
- **3G3RX2-A2150/ A2185/ A2220/ A4150/ A4185/ A4220**

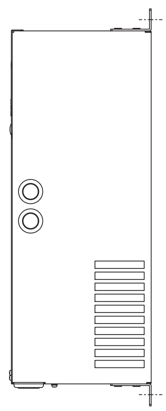


Precautions for Correct Use

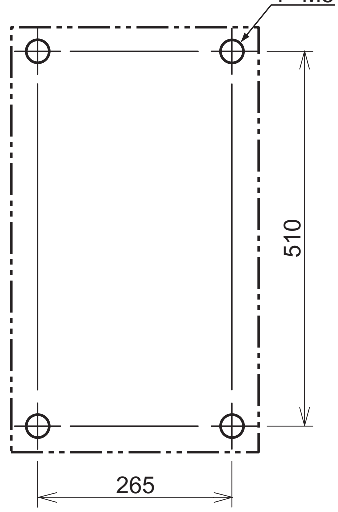
If you operate 3G3RX2-A2220 at Very Low Duty (VLD), the inverter is subject to restrictions according to the installation method. Please refer to *Procedure for Mounting 3G3RX2-A2220* on page 2-3 for details.

- **3G3RX2-A2300/ A4300**

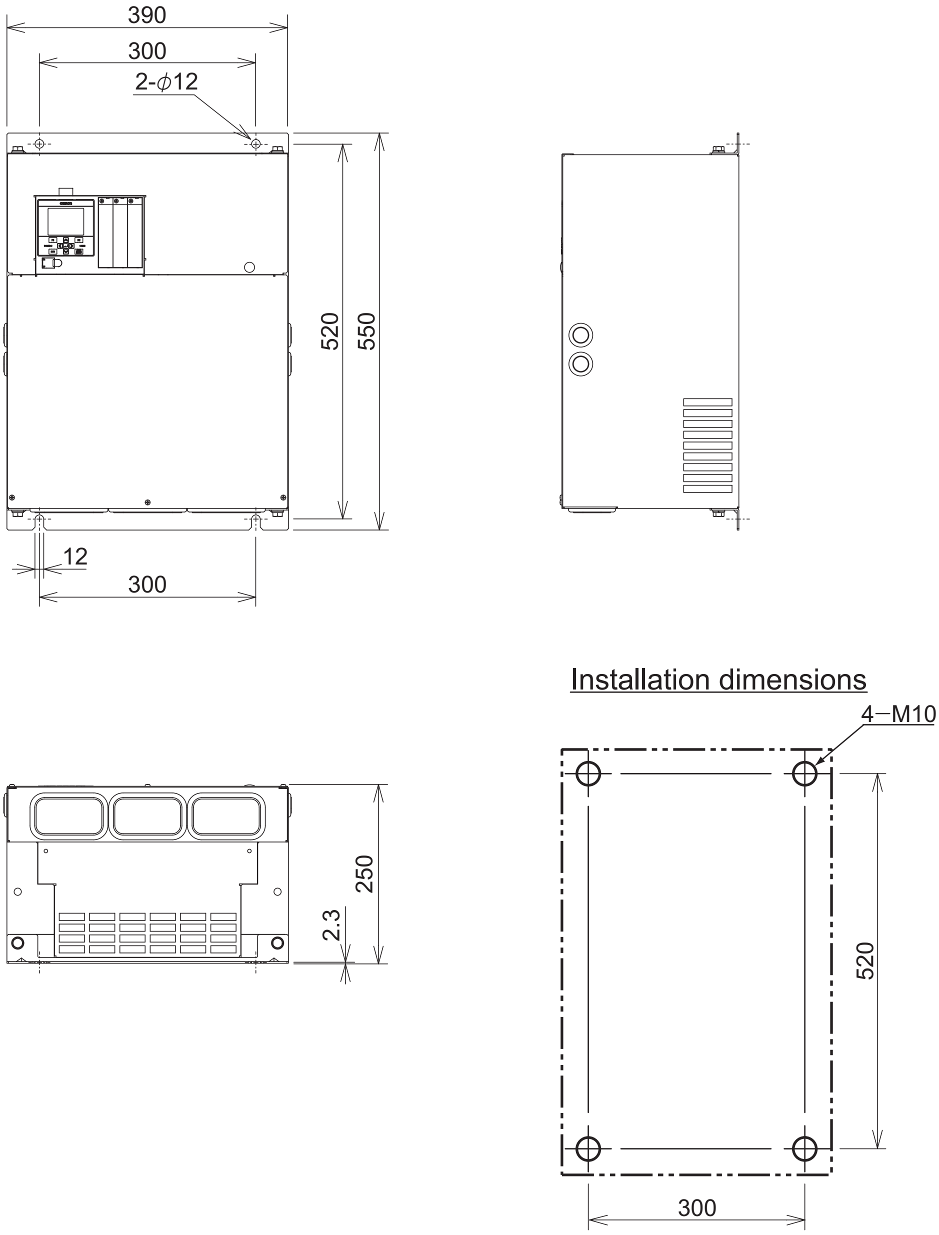




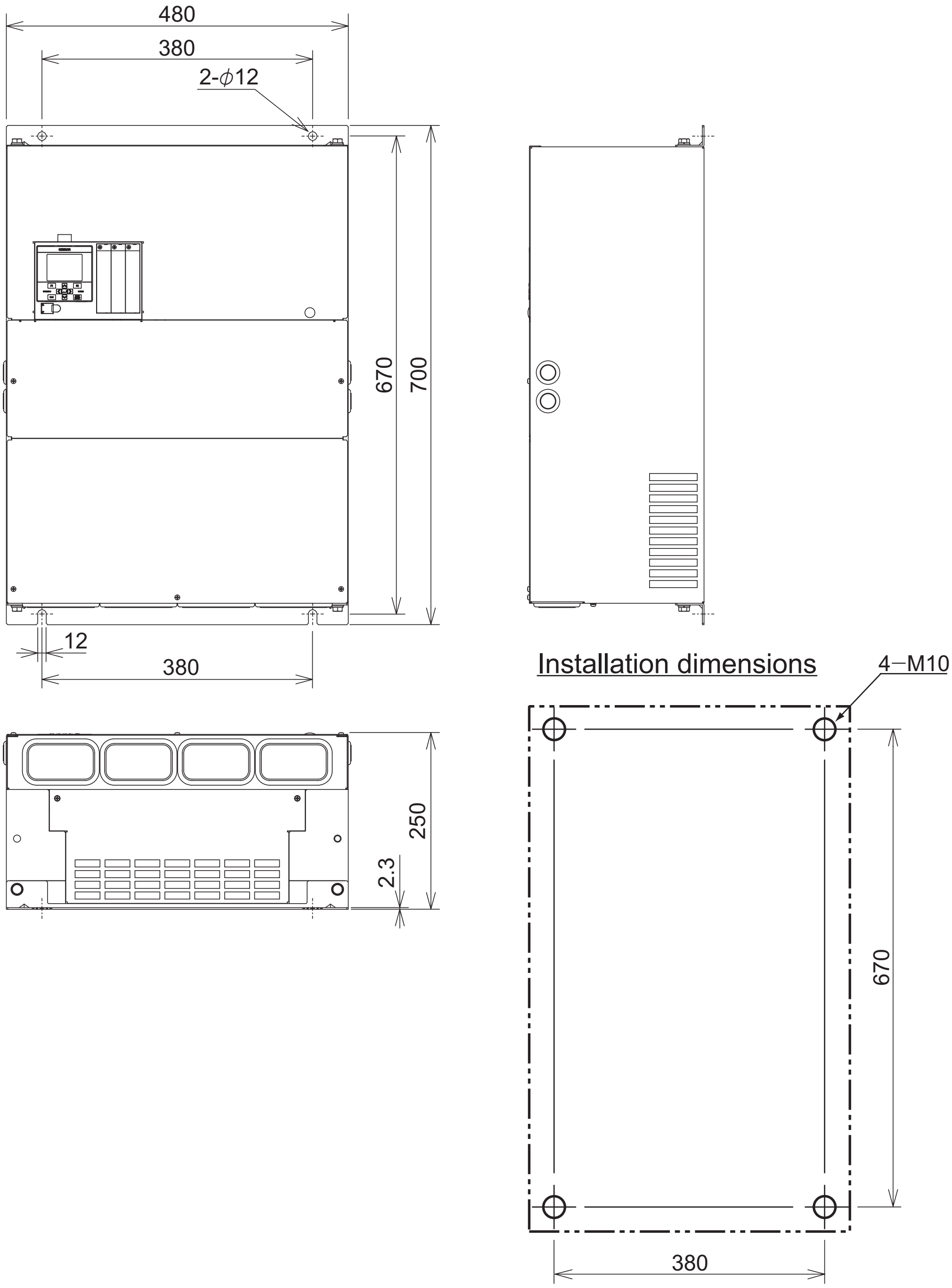
Installation dimensions



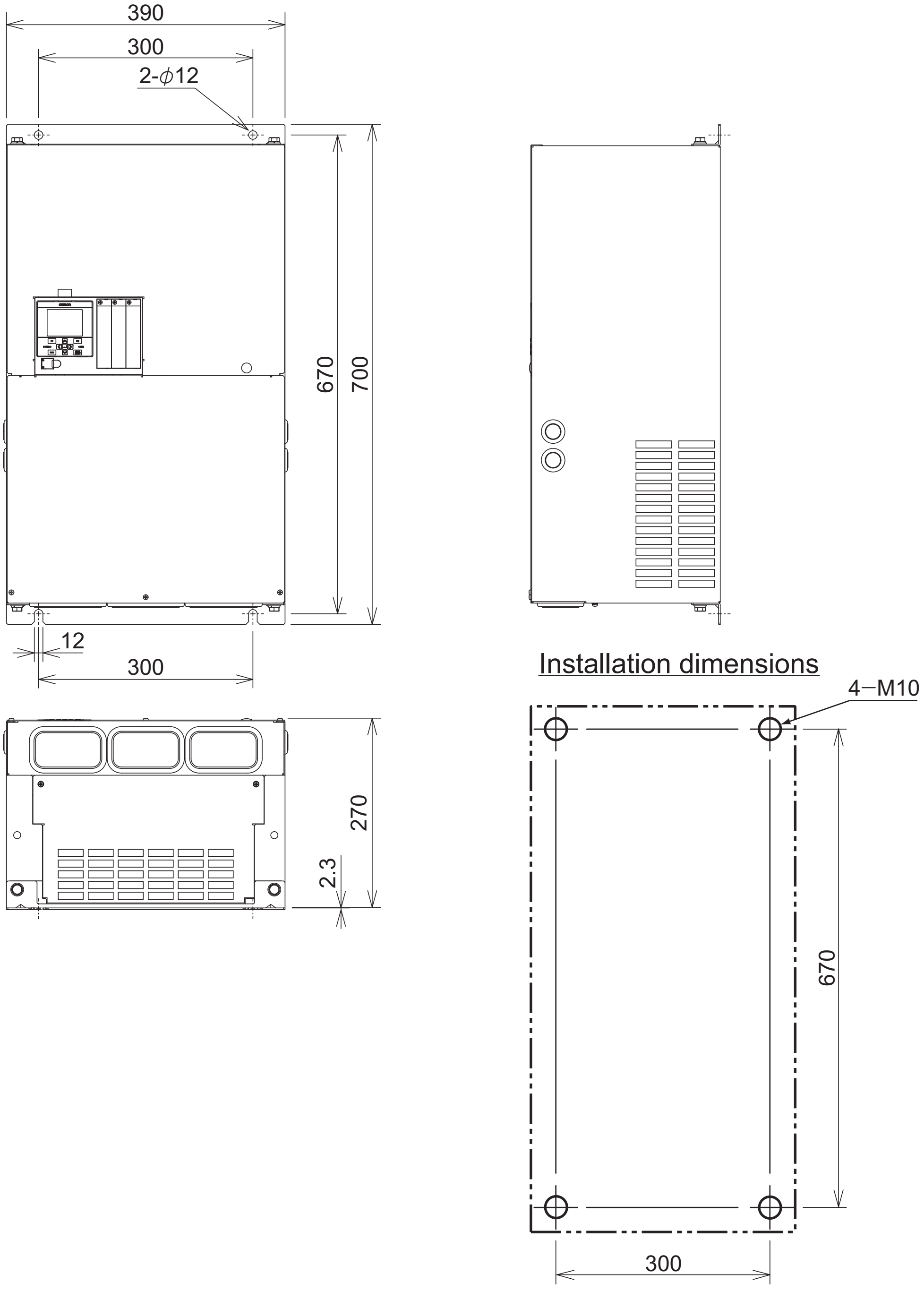
- **3G3RX2-A2370/ A2450/ A4370/ A4450/ A4550**



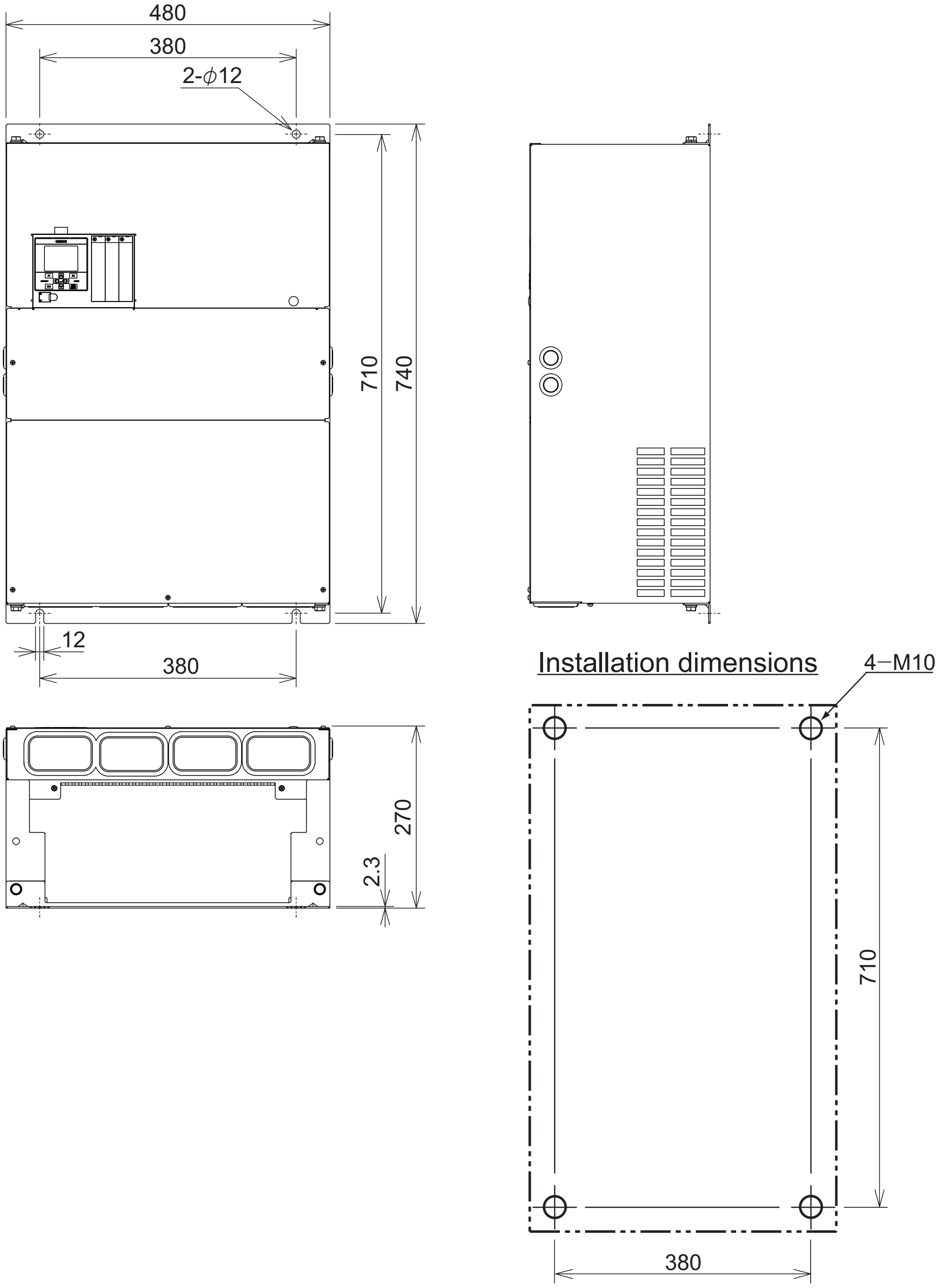
- **3G3RX2-A2550**



- **3G3RX2-B4750/ B4900**



- **3G3RX2-B411K/ B413K**



1-4 Restrictions

Limitation on 0-Hz Sensor-less Vector Control

When 0-Hz sensor-less vector control is used, a large current flows at low frequencies.
To protect the inverter against overload, select and use an inverter whose rated capacity is one size larger than the rated capacity of the motor.

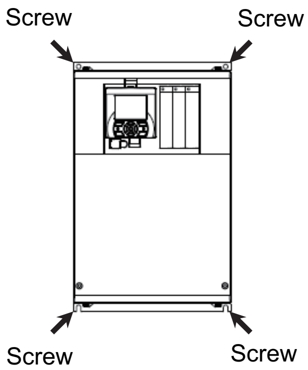
2

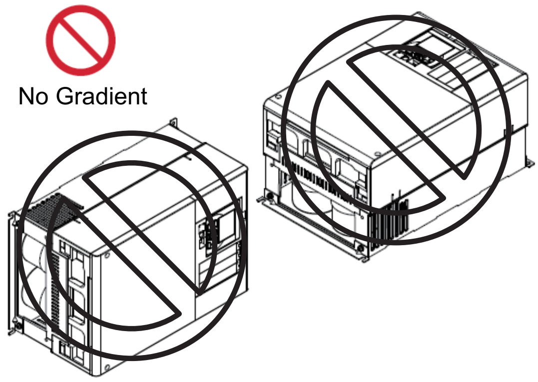
Design

2-1 Installation

Inverter Installation

Mount the 3G3RX2 Series Inverter firmly and vertically with screws or bolts on a mounting surface that can withstand the weight and that is not subject to vibration to prevent rattling.
Not installing the inverter vertically to the ground may reduce the cooling capacity and cause a trip to or damage on the inverter.





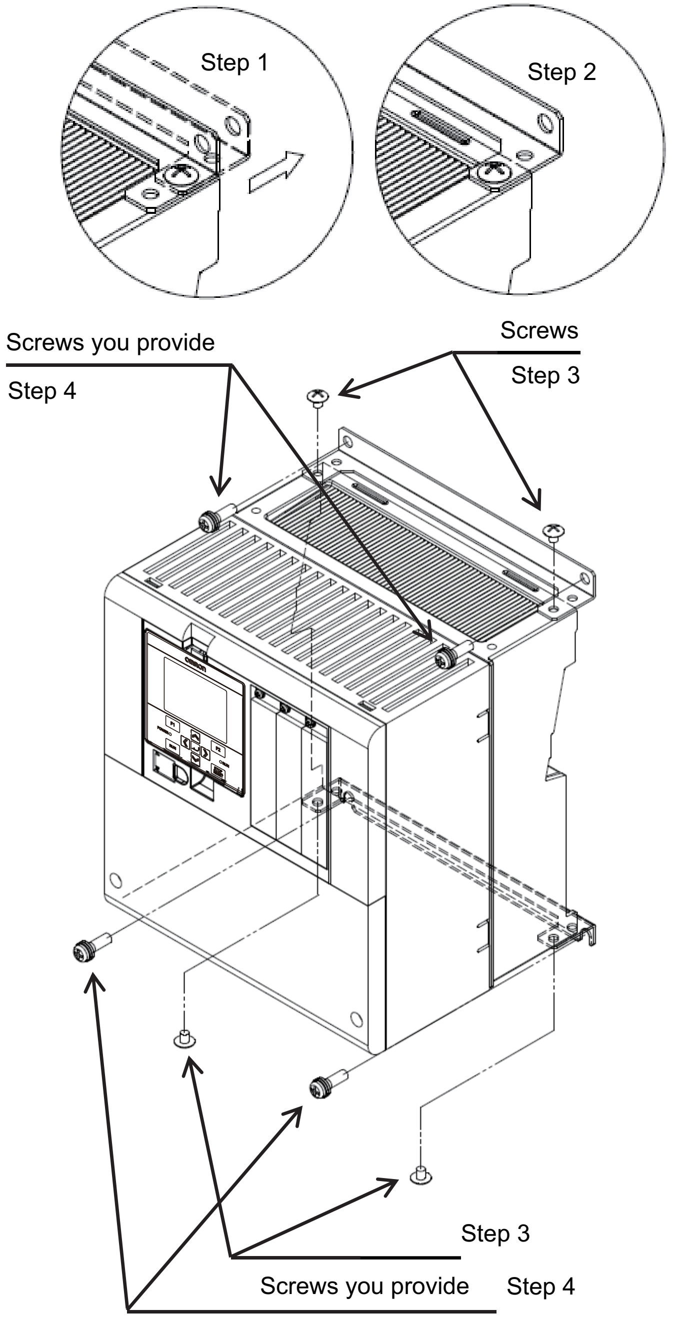
For the mounting dimensions, refer to *1-3-4 External dimensions* on page 1-19.

2-1-1 Precaution for Installation

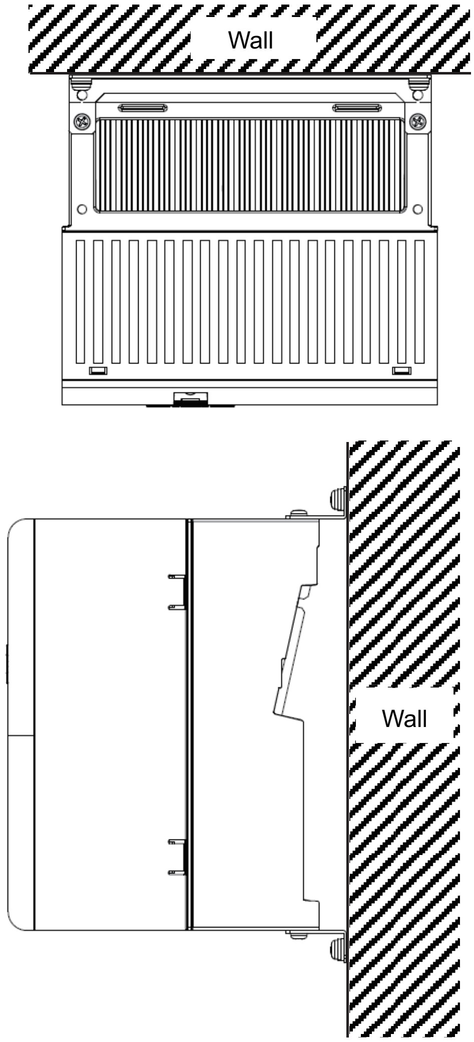
When you use 3G3RX2-A2110 at Low Duty (LD) or Very Low Duty (VLD), or 3G3RX2-A2220 at Very Low Duty (VLD), you must install the main body according to the instruction shown in the figure below. Please make sure to follow the procedure below.

● Procedure for Mounting 3G3RX2-A2110

1. Unscrew the four screws temporarily fixing the mounting fittings both on the top and bottom as factory shipping.
2. Pull and slide the fittings both on the top and bottom to match the next hole on the fittings to the screw holes on the main body.
3. Fix the fittings on the main body by the four screws that you removed at Step 1. (Torque: 2.2 to 2.5 N·m)
4. Fix the main body on the wall with four other screws you provide.



Mounting method



Top and right side view

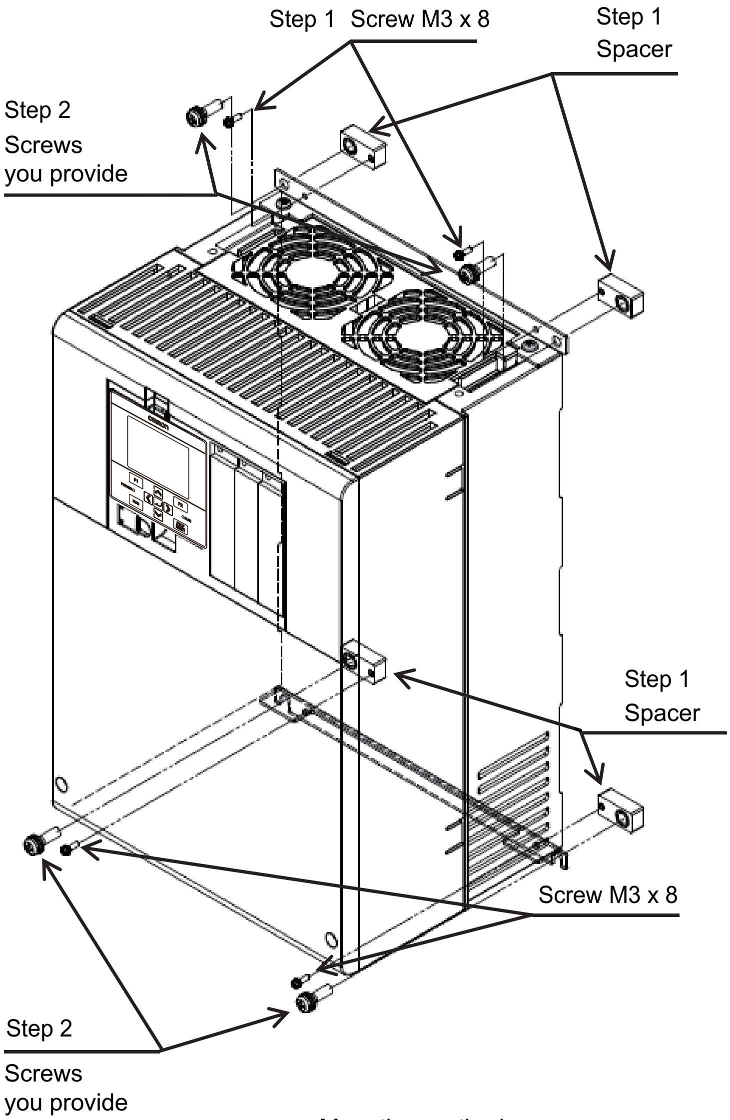
Additional Information

Change **Load type selection** (Ub-03) to *00: VLD* or *01: LD* to set for Low Duty (LD) or Very Low Duty (VLD).

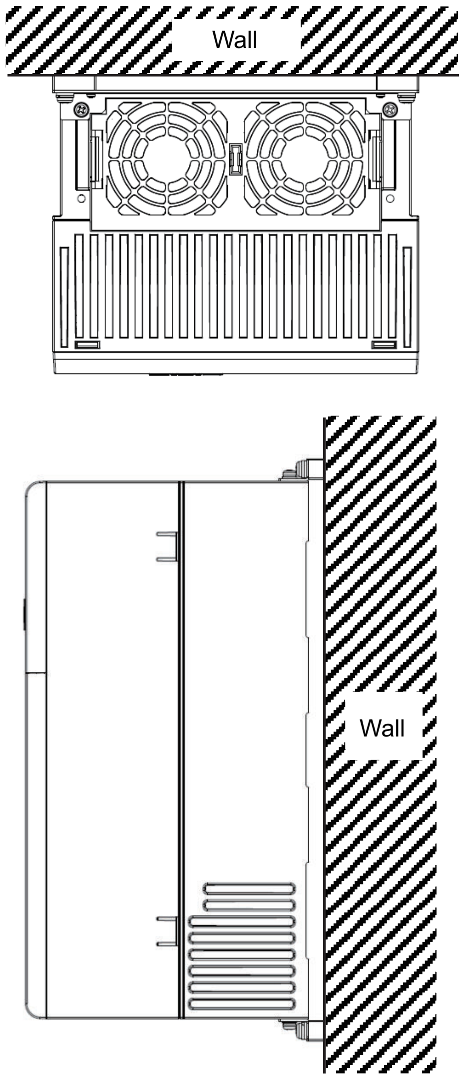
● Procedure for Mounting 3G3RX2-A2220

1. Fix the four spacers to the main body at the fittings both on the top and bottom using four M3×8 screws included in the pack. (Torque: 0.6 to 0.8 N·m)

2. Fix the main body on the wall with four other screws you provide.



Mounting method



Top and right side view

Additional Information

Change **Load type selection** (Ub-03) to *00: VLD* to set for Very Low Duty (VLD).

2-1-2 Installation Environment

Operating Environment Conditions

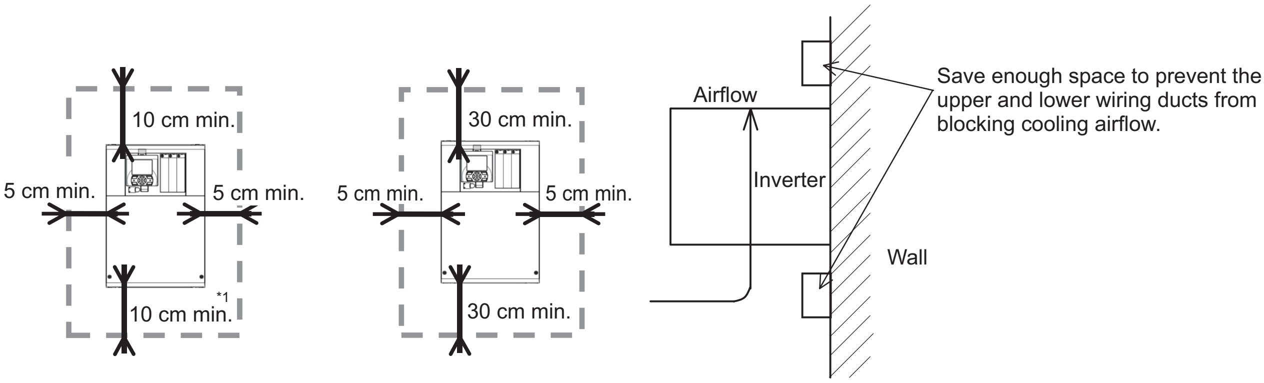
Install the inverter in a location that meets the following conditions.

Rating	Operating ambient temperature*1	Operating ambient humidity
Normal Duty (ND)	-10 to 50℃	20 to 90%RH (with no condensation)
Low Duty (LD)	-10 to 45℃	20 to 90%RH (with no condensation)
Very Low Duty (VLD)	-10 to 40℃	20 to 90%RH (with no condensation)

*1. Use the 400V class inverter at an input voltage of 500VAC or below. If input voltage exceeds 500VAC due to fluctuation of power, use the inverter at 40°C or lower ambient temperature.

Dimensional Conditions Around the Device

The inverter can be heated up to 150°C. Since the inverter might cause a fire accident, install the inverter on the non-flammable vertical wall (made of metals etc.).
Keep the inverter clear of heating elements such as a braking resistor or reactor so that the heat emitted does not affect the operation.
If the inverter is installed in a control panel, take into consideration dimensions and ventilation to keep the ambient temperature within the range of the specifications.
To allow heat radiation from inside the inverter, provide the clearance specified in the figure below.
Do not install more than one inverter side by side without clearance.



*1. Leave the space for maintenance and repair at least 22 cm under the inverter.

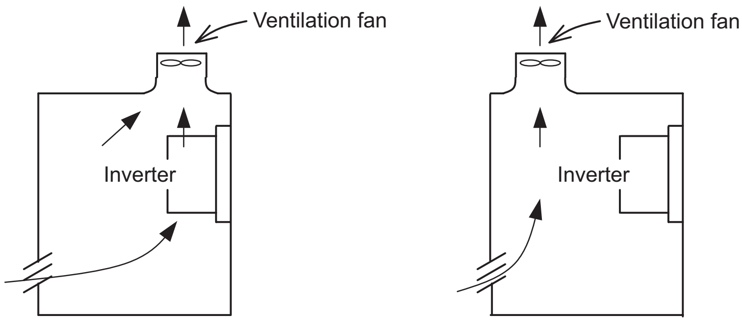
- 3G3RX2-A2150 to 3G3RX2-A2220
- 3G3RX2-A4150 to 3G3RX2-A4220

The inverter body must be removed when the consumable components are replaced on the following inverter models.

- 3G3RX2-A2055 to 3G3RX2-A2110
- 3G3RX2-A4055 to 3G3RX2-A4110

Ambient Temperature Control

To ensure reliable operation, use the inverter in an environment subject to minimal temperature rise as much as possible.
When mounting multiple inverters in an control panel with a ventilation fan, carefully design the layout of the inverters and the air intake port of the control panel. An inappropriate layout will reduce the inverter-cooling effect and raise the ambient temperature. Make sure that the inverter ambient temperature will remain within the allowable range.
A ventilation fan located directly above the inverter could drop dust on it. To prevent this, move the inverter horizontally to a suitable position.



(Correct example) (Incorrect example)

Position of ventilation fan

Entry of Foreign Objects During Installation

Place a cover over the inverter or take other preventative measures to prevent foreign objects, such as drill filings, from entering the inverter during installation.
Be sure to remove the cover after installation is completed. Using the inverter with the cover placed results in poor ventilation, which causes the inverter to overheat.

Amount of Heat Generation (Loss) According to the Inverter Capacity

The following table shows the amount of heat generation (loss) according to the inverter capacity.

Voltage	Loss at 100% load (W)					
	200V			400V		
	ND	LD	VLD	ND	LD	VLD
0.4	50	53	65			
0.75	65	80	105	62	67	76
1.5	93	118	135	94	98	104
2.2	142	162	197	96	107	134
3.7	225	253	314	145	163	189
5.5	348	365	420	235	260	290
7.5	376	400	520	240	280	306
11	498	625	754	260	306	380
15	742	922	1059	361	444	482
18.5	964	1167	1332	495	601	633
22	1163	1263	1377	687	805	860
30	1317	1536	1698	783	854	920
37	1534	1801	2092	812	880	971
45	1625	1940	2300	1047	1218	1300
55	1878	2669	3046	1130	1488	1592
75				1570	1811	2020
90				2034	2150	2359
110				2219	2397	2557
132				3872	4352	4598

Derating of Rated Output Current

Use the inverter within the current range in accordance with the derating graphs of respective models. If you use the inverter exceeding the derating range, the inverter may be damaged or its service life may be shortened.

The meaning of each line in the graphs is as follows.

50℃: Normal Duty (ND)

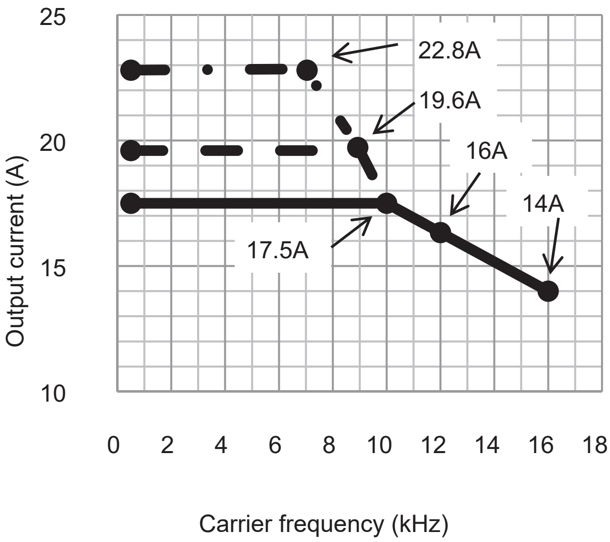
45℃: Low Duty (LD)

40℃: Very Low Duty (VLD)

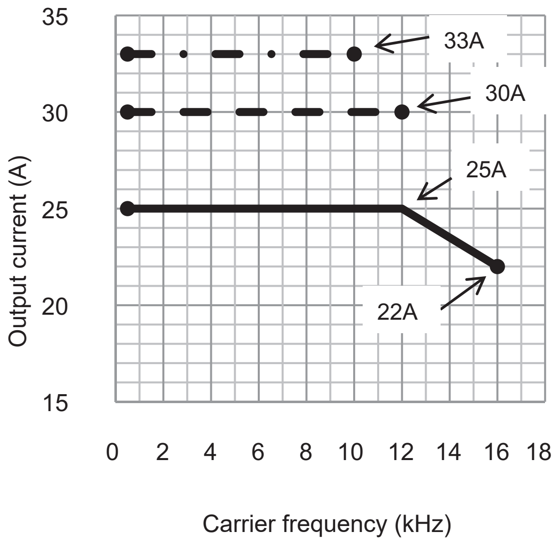
- **200V class**

Derating is not required for 3G3RX2-A2004/A2007/A2015/A2022.

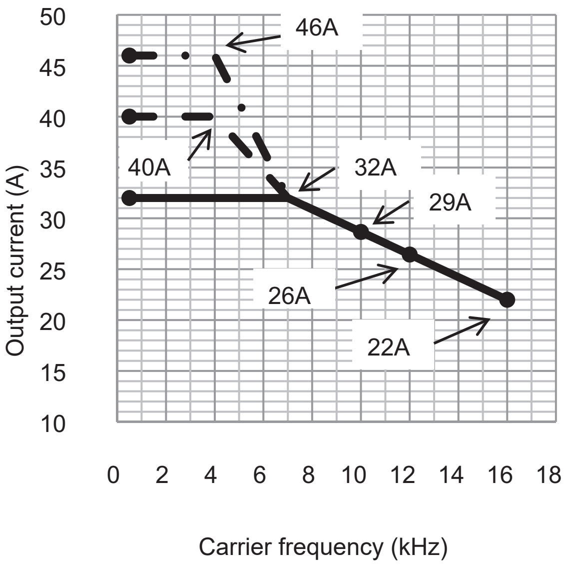
3G3RX2-A2037



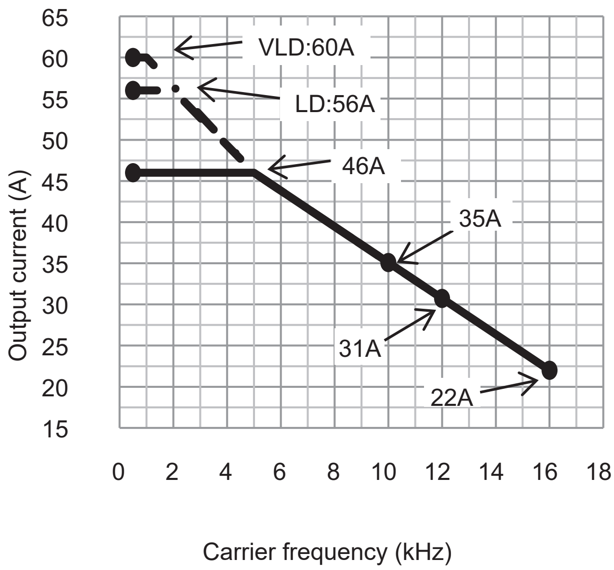
3G3RX2-A2055



3G3RX2-A2075

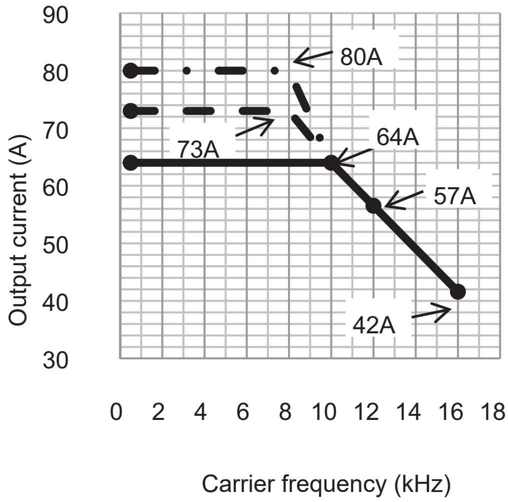


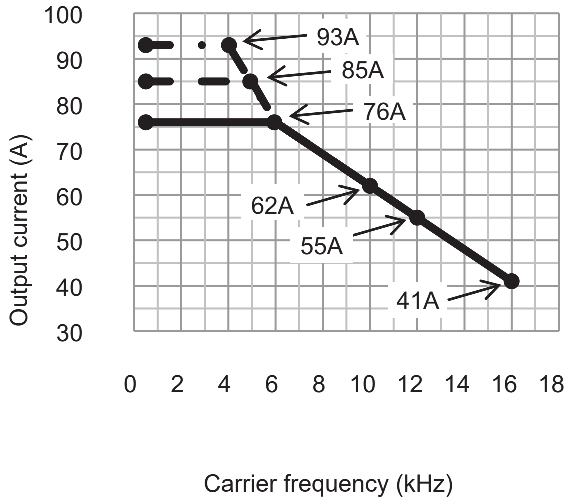
3G3RX2-A2110



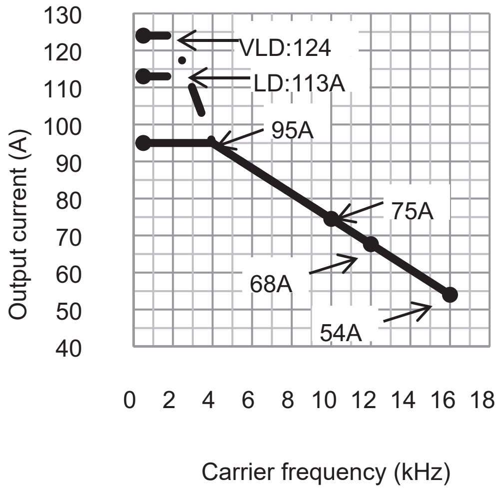
3G3RX2-A2150

3G3RX2-A2185

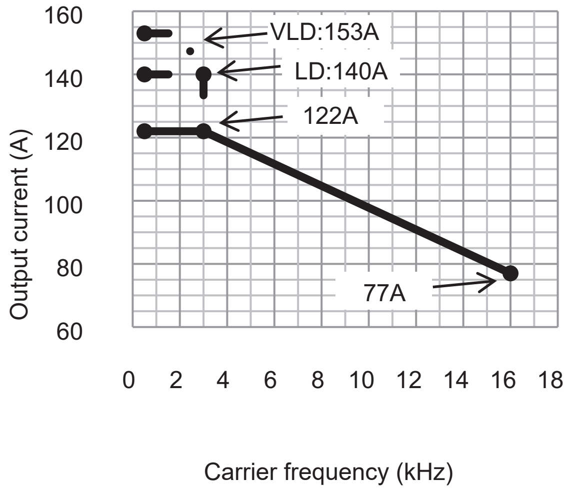




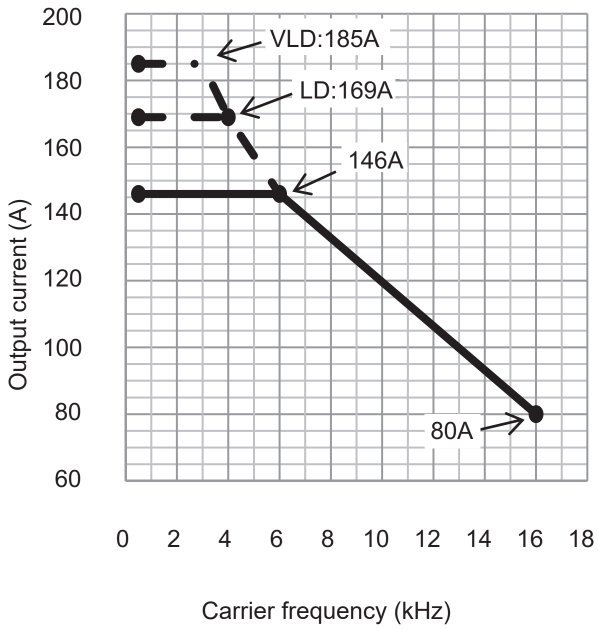
3G3RX2-A2220



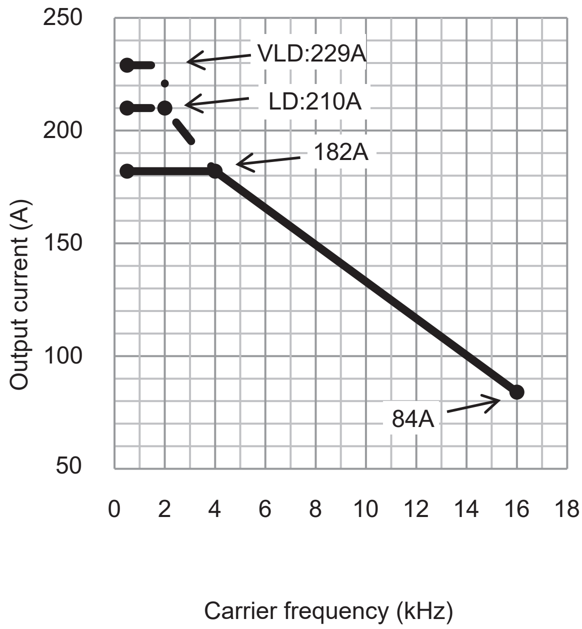
3G3RX2-A2300



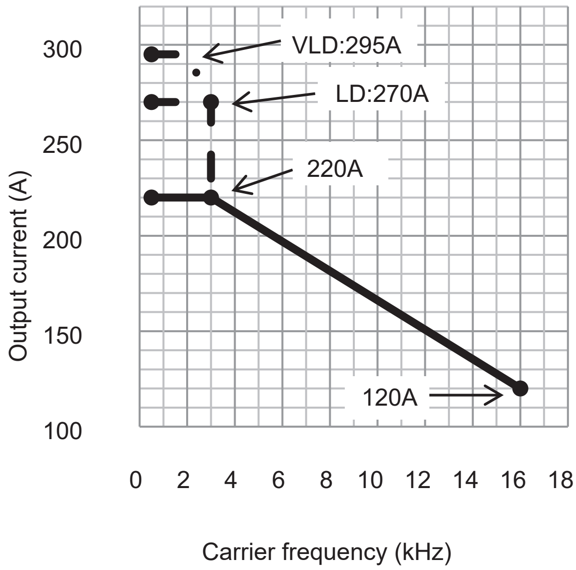
3G3RX2-A2370



3G3RX2-A2450

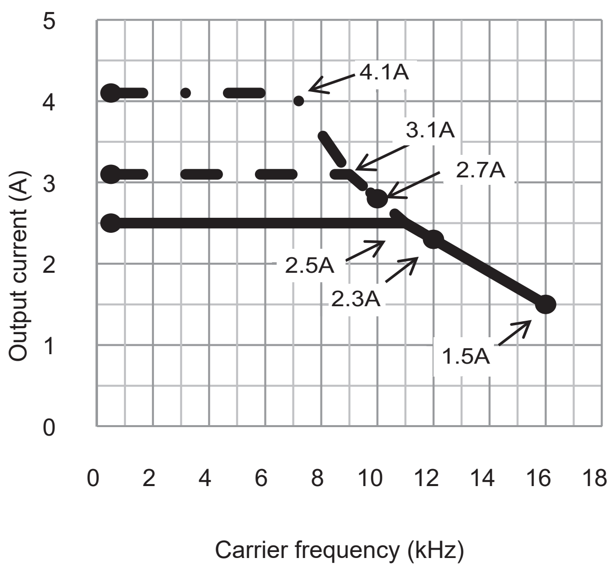


3G3RX2-A2550

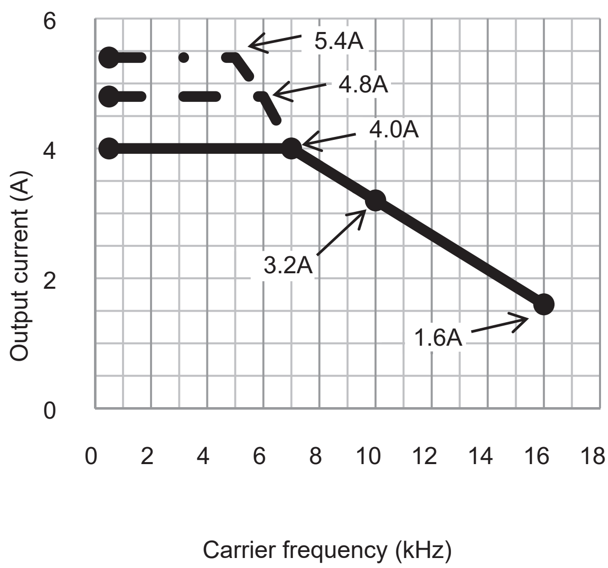


• **400V class**

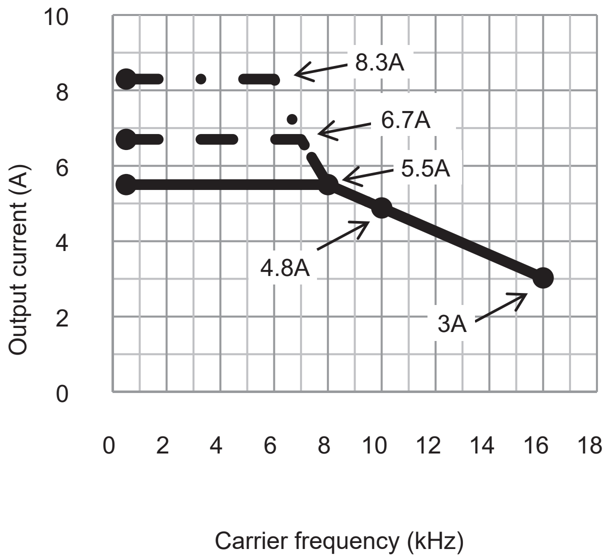
3G3RX2-A4007



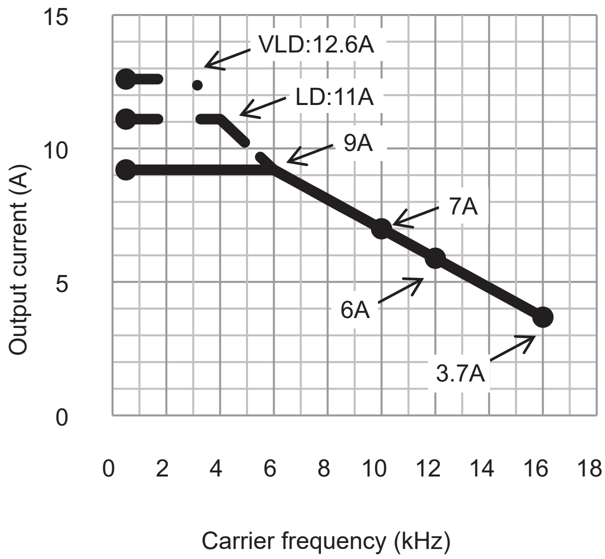
3G3RX2-A4015



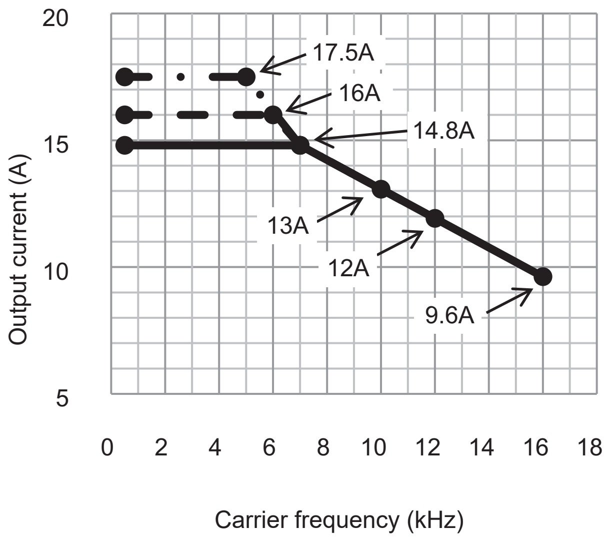
3G3RX2-A4022



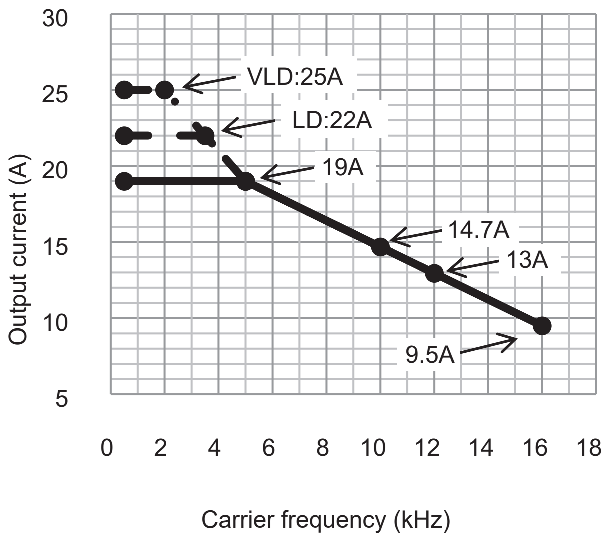
3G3RX2-A4037



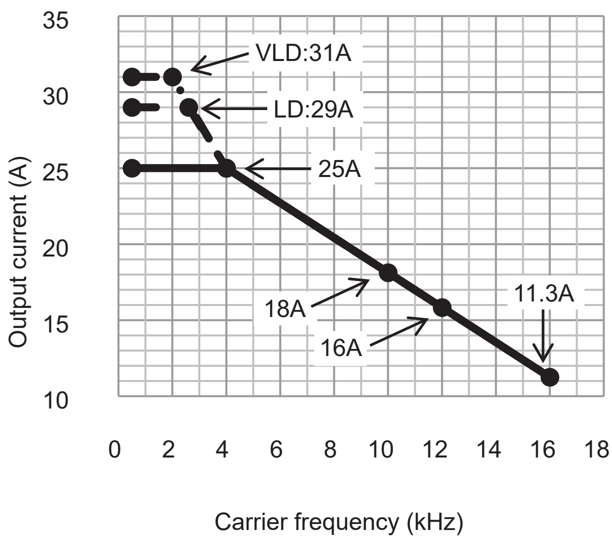
3G3RX2-A4055



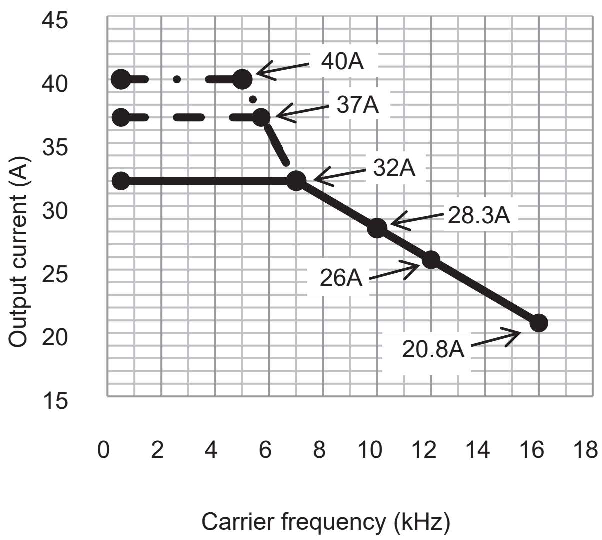
3G3RX2-A4075



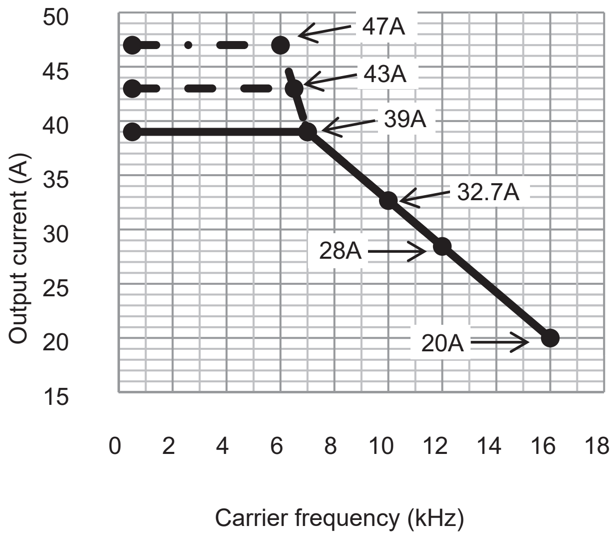
3G3RX2-A4110



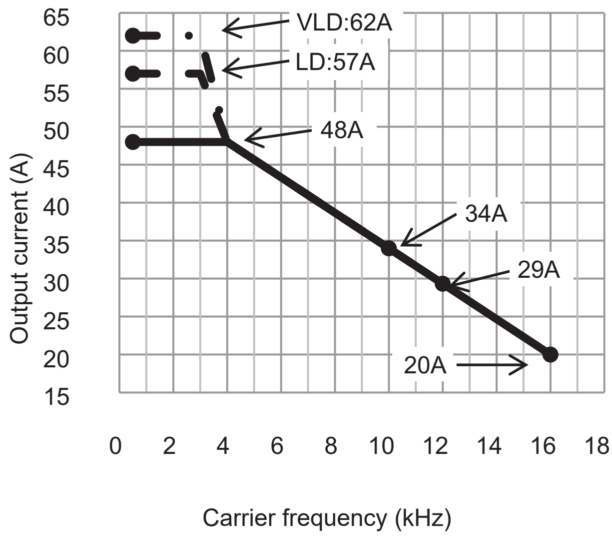
3G3RX2-A4150



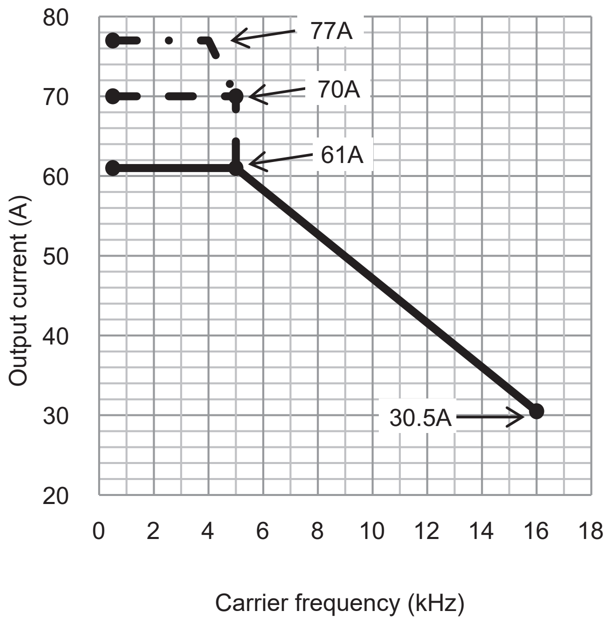
3G3RX2-A4185



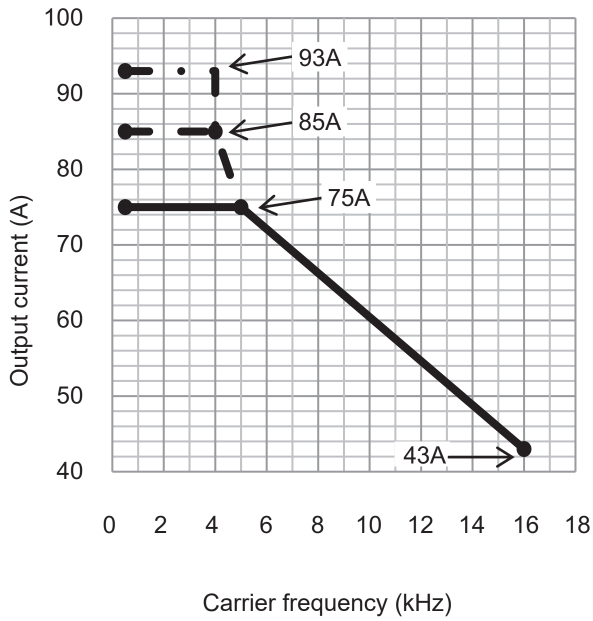
3G3RX2-A4220



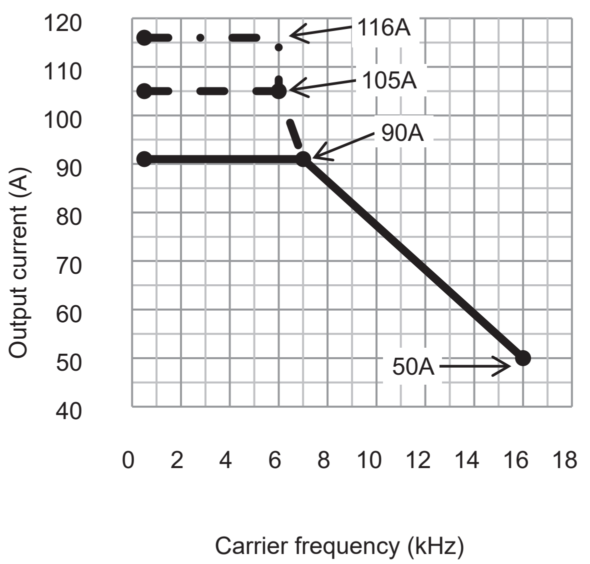
3G3RX2-A4300



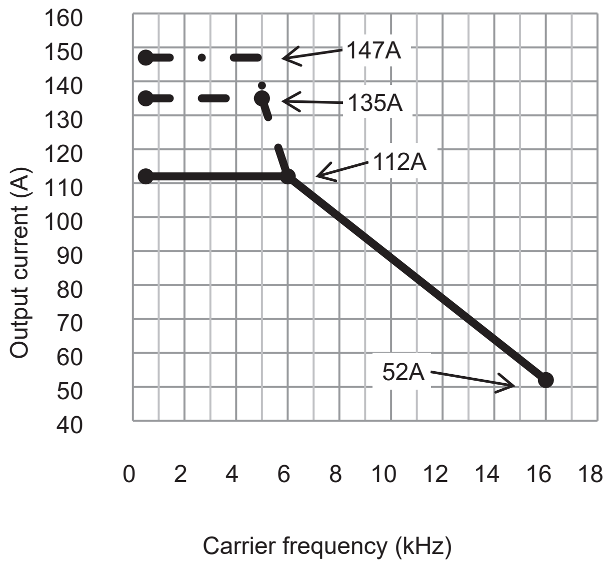
3G3RX2-A4370



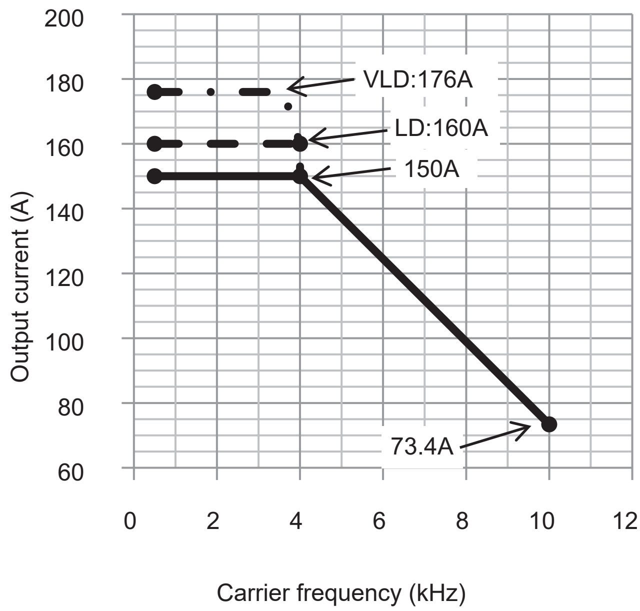
3G3RX2-A4450



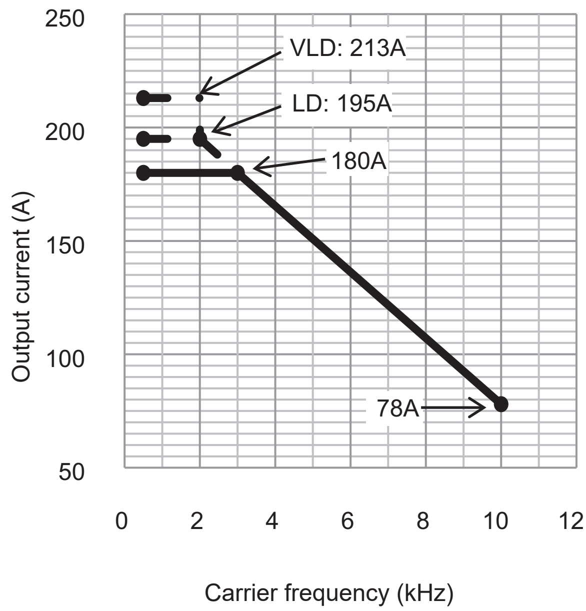
3G3RX2-A4550



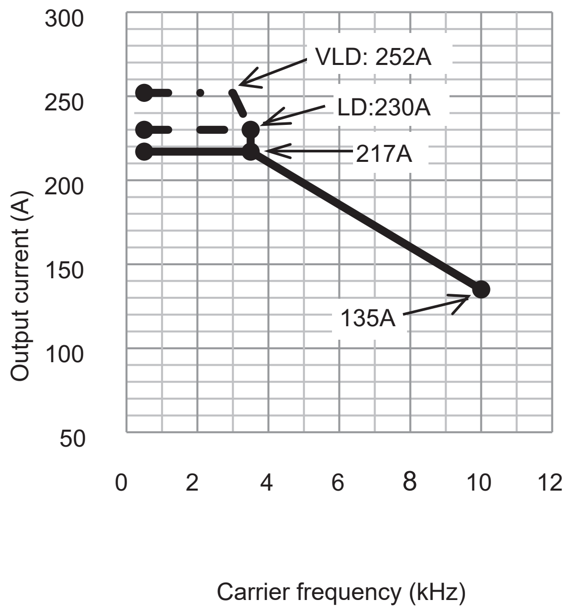
3G3RX2-B4750



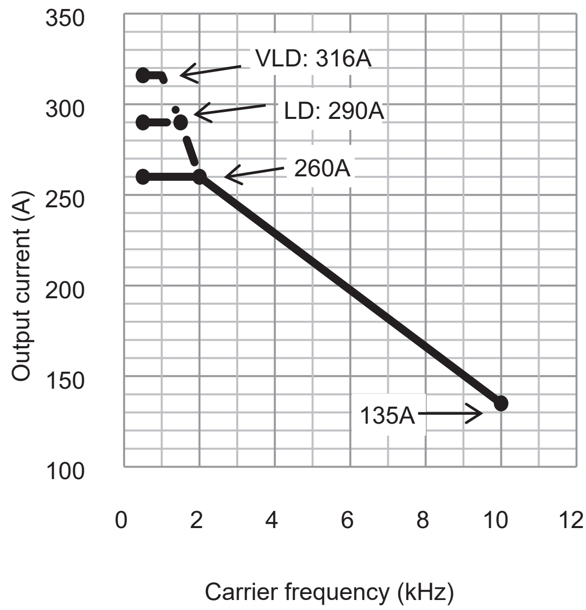
3G3RX2-B4900



3G3RX2-B411K



3G3RX2-B413K



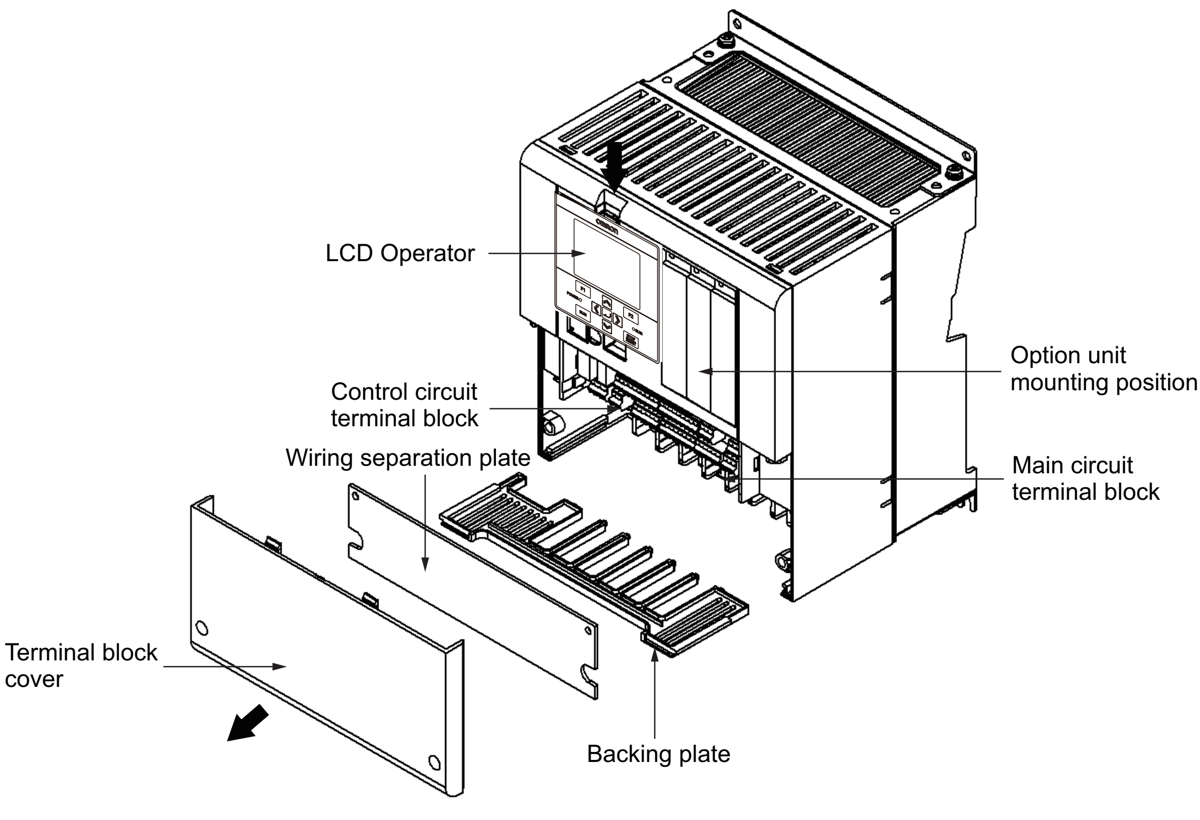
2-2 Removal of Each Part

2-2-1 Removal of Cover

Before wiring each terminal block, you need to remove the terminal block cover and the backing plate. In addition, to install a PG Option Unit, you must remove the option unit cover beforehand. This section describes how to remove them. To reinstall them, reverse the removal procedure.

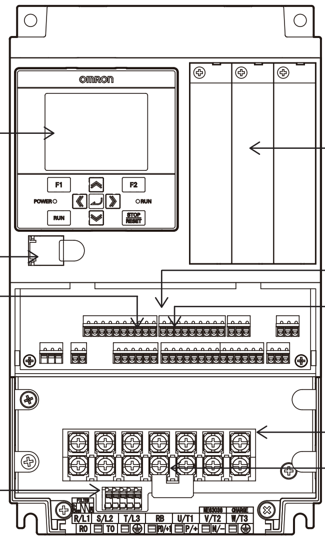
Removal of Terminal Block Cover, LCD Operator, Backing Plate and Option Unit Cover

1. Remove the terminal bock cover to check the control circuit terminal block. Remove the wiring separation plate and backing plate to check the main circuit terminal block.
2. Push the upper lip part to the direction of arrow and remove the LCD operator.
3. After removing the terminal block cover, take out the terminal blocks into the arrow direction.
4. Unscrew and remove the option unit cover where you want to connect option units.
   Do not lose the screws as you will need them to install the option units. Keep the removed option unit cover properly as you will need it when you remove the option unit and return it to its original state.



2-2-2 Terminal Blocks

Before wiring to terminal blocks, remove the terminal block cover and the backing plate.
The position and setting method of various terminal blocks differ depending on the inverter model.
Here, the example of 3G3RX2-A2004 is explained. For details, see *2-3-4 Wiring for Main Circuit Terminals* on page 2-31.



Positions of the main circuit terminal block, EMC filter function setting, charge LED, arrangement of terminals, and setting method vary depending on the inverter model.

Name	Description
LCD Operator	For data display and input operation.
Control circuit terminal block	The terminal block for connecting various digital or analog I/O devices used for inverter control.
Main circuit terminal block	The terminal block for connecting the main power supply for the inverter, outputs to the motor, braking resistor, etc.
Option unit mounting position	The position where the option unit is mounted.
EMC filter function setting	For switching filter function in order to conform the inverter to EMC Directives in EC Directives.
RS485-communication terminal block	The communications terminal for RS485 communication between the inverter and external control device.
Charge LED	Lights up even after the power supply is shut off if the main circuit DC voltage (between the P/+ and N/- terminals) is approximately 45 V or higher. Make sure that the charge LED is off before performing wiring etc.
Slide switch	Enables or disables the emergency shutoff function.
USB (micro-B)	The USB connector of micro-B for connecting PC.

2-2-3 Preparing Backing Plate

In Case of Backing Plate 1 and 2

When the AL terminal is wired with high voltage, pull and separate the backing plate from control circuit wiring.

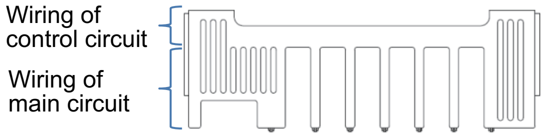
- Backing Plate 1

3G3RX2-A2055 to 3G3RX2-A2110
3G3RX2-A4055 to 3G3RX2-A4110

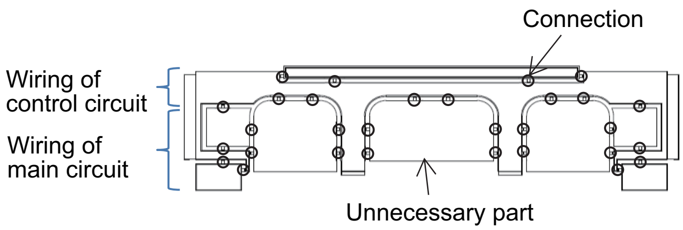
- Backing Plate 2
  3G3RX2-A2150 to 3G3RX2-A2220
  3G3RX2-A4150 to 3G3RX2-A4220

When wiring cables, cut the points between the backing plate and unnecessary portions with nippers or wire cutter, and remove.

- Backing plate 1



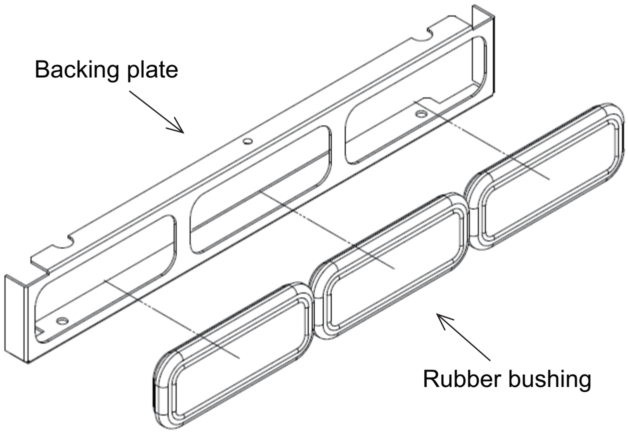
- Backing plate 2



In Case of Backing Plate 3

- Backing Plate 3
  3G3RX2-A2300 to 3G3RX2-A2550
  3G3RX2-A4300 to 3G3RX2-B413K

- **When Not Connecting a Conduit Tube**
  Cut the rubber bushing to create a notch using nippers or a cutter for wiring.
- **When Connecting a Conduit Tube**
  Remove the rubber bushing in the portion where a conduit tube is to be connected, and then connect the conduit tube.
- Backing plate 3



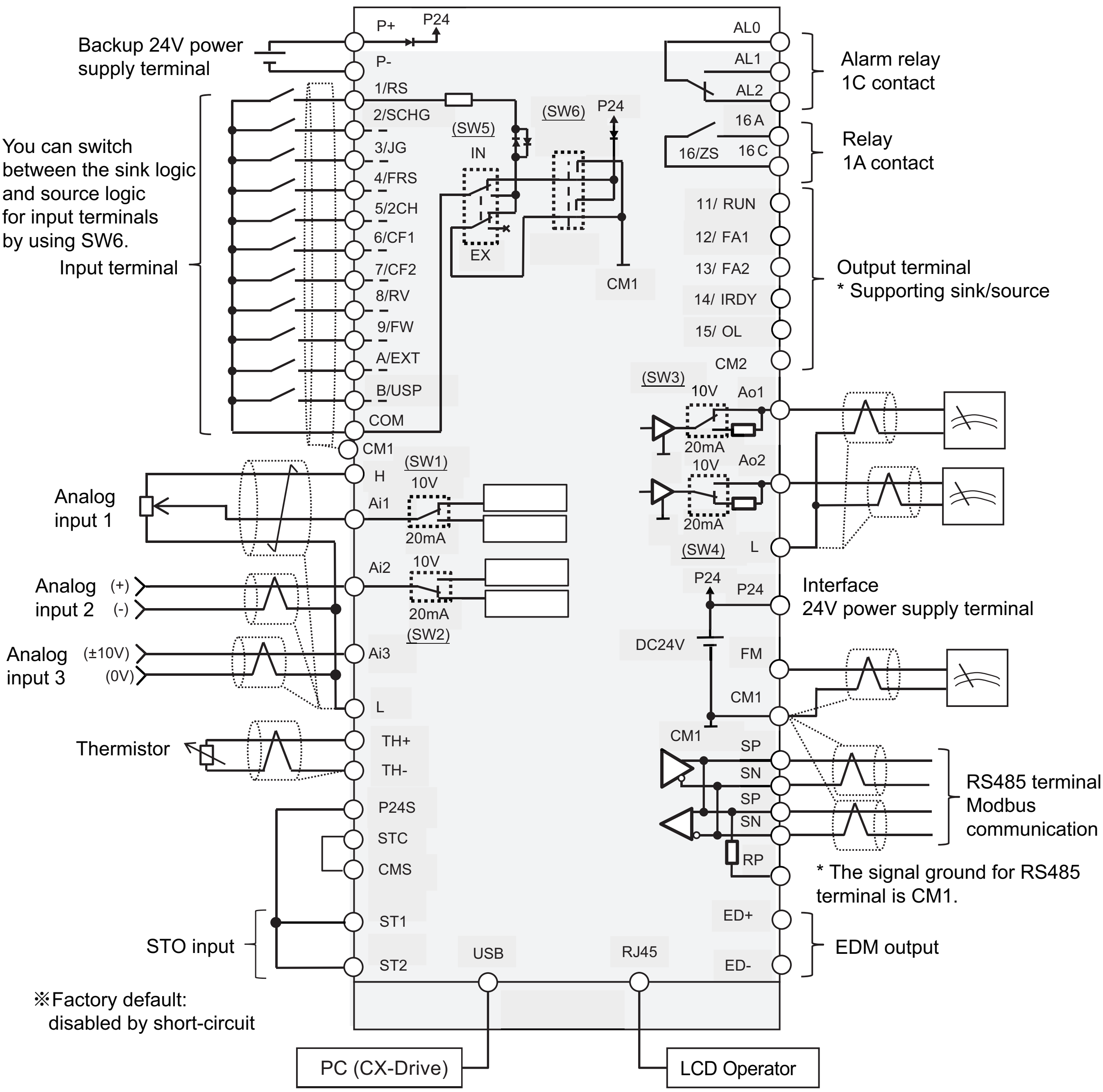
Precautions for Safe Use

Do not remove the rubber bushing unless you connect a conduit tube. Doing so may cause damage to the cable sheath by the inner edge of the backing plate, resulting in a short-circuit or ground fault.

2-3 Wiring

2-3-1 Standard Connection Diagram

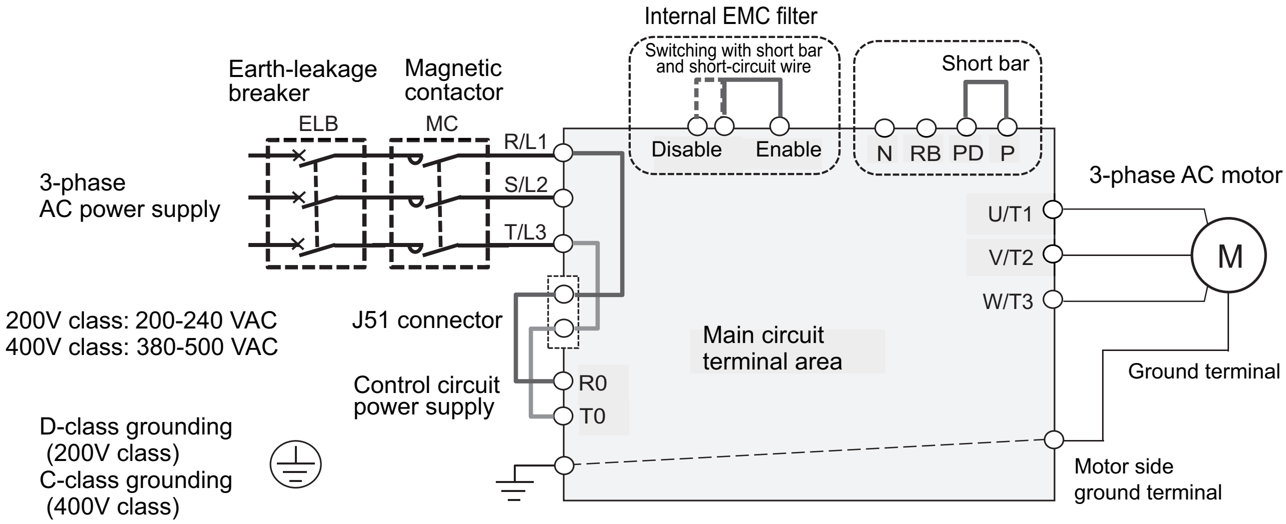
Outline of control circuit



2-3-2 Arrangement and Function of Main Circuit Terminal Block

The arrangement of the main circuit terminal block and description of each terminal are provided below.

Main Circuit Terminal Block



Precautions for Correct Use

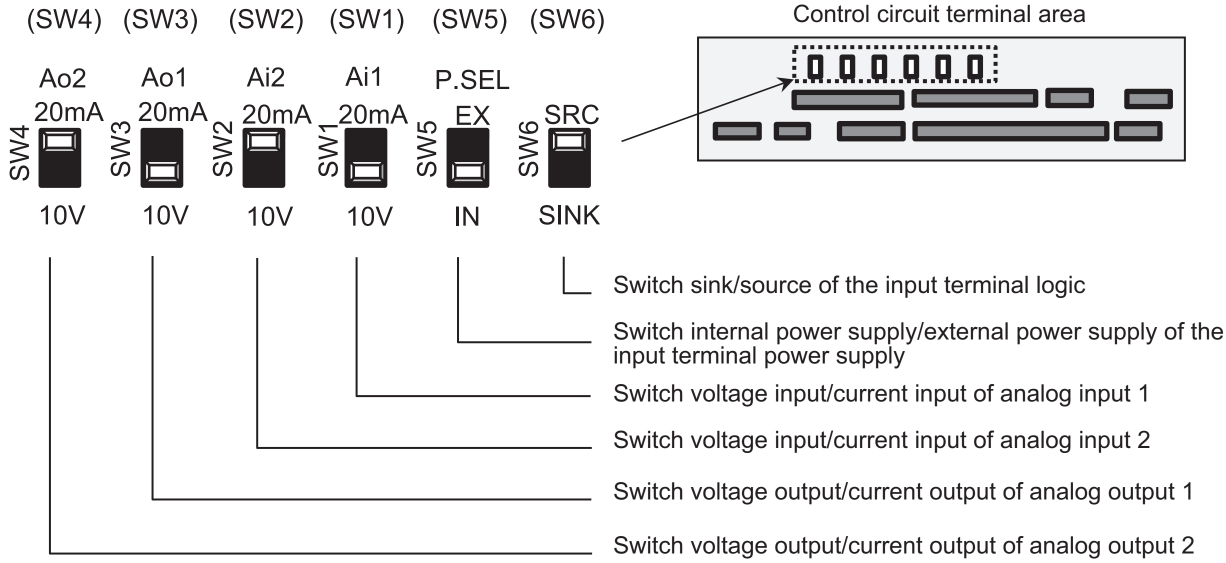
- EMC filter is enabled at factory default setting.
- The P and PD terminals are short-circuited with a shorting bar when shipped from the factory. If the shorting bar between the P and PD terminals is disconnected, power is not supplied to the main circuit, which disables operation.

Terminal symbol	Terminal name	Description
R, S, T (L1, L2, L3)	Input terminal for main power supply	Connect to the AC power supply.
U, V, W (T1, T2, T3)	Inverter output terminal	Connect the 3-phase motor.
PD, P (+1, +)	DC Reactor connection terminal	Remove the shorting bar between PD and P terminals, and connect the optional reactor for improving power factor.
P, RB (+, RB)	Connection terminal for external braking resistor	Connect the optional external braking resistor. For models equipped with the braking resistor circuit, see *1-3-3 400V Class Specifications* on page 1-16. Models not equipped with the braking resistor circuit do not have the RB terminal.
P, N (+, -)	Connection terminal for regenerative braking unit	Connect the optional regenerative braking unit.
⏚	Ground terminal	The earth terminal for the Inverter case. Connect this terminal to the ground. Conduct class-D ground work for 200V class, and class-C ground work for 400V class.

2-3-3 Arrangement and Function of Control Circuit Terminal Block

This section describes arrangement and function of control circuit terminal block and switch settings.

Switch Configurations

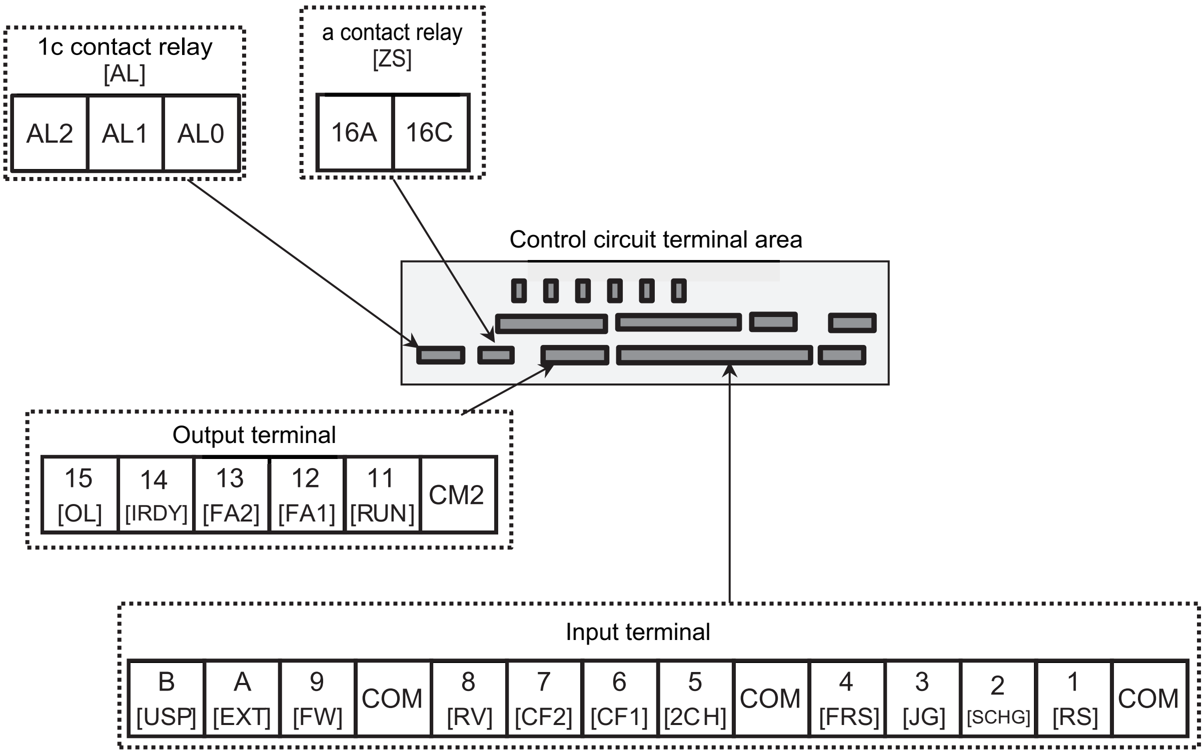


Indication	SW name	Description
Ai1 (SW1)	Analog input 1 switch	Switches input specification of analog input 1 (Ai1 terminal). 10 V: Voltage input is available. 20 mA: Current input is available.
Ai2 (SW2)	Analog input 2 switch	Switches input specification of analog input 2 (Ai2 terminal). 10 V: Voltage input is available. 20 mA: Current input is available.
Ao1 (SW3)	Analog output 1 switch	Switches output specification of analog output 1 (Ao1 terminal). 10 V: Sets to voltage output. 20 mA: Sets to current output.
Ao2 (SW4)	Analog output 2 switch	Switches output specification of analog output 2 (Ao2 terminal). 10 V: Sets to voltage output. 20 mA: Sets to current output.
P.SEL (SW5)	Switching the method of power supply to the input terminals	Switches the method of power supply to the input terminals. IN: Uses the internal power supply. EX: Uses the external power supply. (In the case of EX, a power supply is required between the input terminals and COM.)
SRC/SINK (SW6)	Switch of sink/source for the input terminals	Switches the sink/source logic for input terminals. This switch is enabled when SW5 is IN. SINK: Enables sink logic. SRC: Enables source logic.

Precautions for Correct Use

- Using a switch under power-on condition may cause failure. Use the switch only after turning off the power and confirming that the POWER lamp on the operator keypad is off.
- The factory default setting is shown below. If the switch setting does not match the actual input and output specifications, it may cause failure. Make sure that the input and output to be used and the switch setting are corresponding.
  - Analog terminal input settings:
    Ai1 (SW1) = Voltage input (10 V)
    Ai2 (SW2) = Currernt input (20 mA)
  - Analog terminal output settings:
    Ao1 (SW3) = Voltage output (10 V)
    Ao2 (SW4) = Current output (20mA)
  - Switching power supply method to I/O terminal: P.SEL (SW5) = External power supply (EX)
  - Switching sink/source for input terminal: SRC/SINK (SW6) = Source (SRC)

Wiring of Lower Part of Control Circuit Terminal



[ ] indicates the factory default setting.
You can assign the output terminal and relay output signals to **Output terminal function** (CC-01) to (CC-07). For details, refer to *List of Output Terminal Functions* on page 15-83.
You can assign the input terminal signal to **Input terminal function** (CC-01) to (CC-11). For details, refer to *List of Input Terminal Functions* on page 15-81.

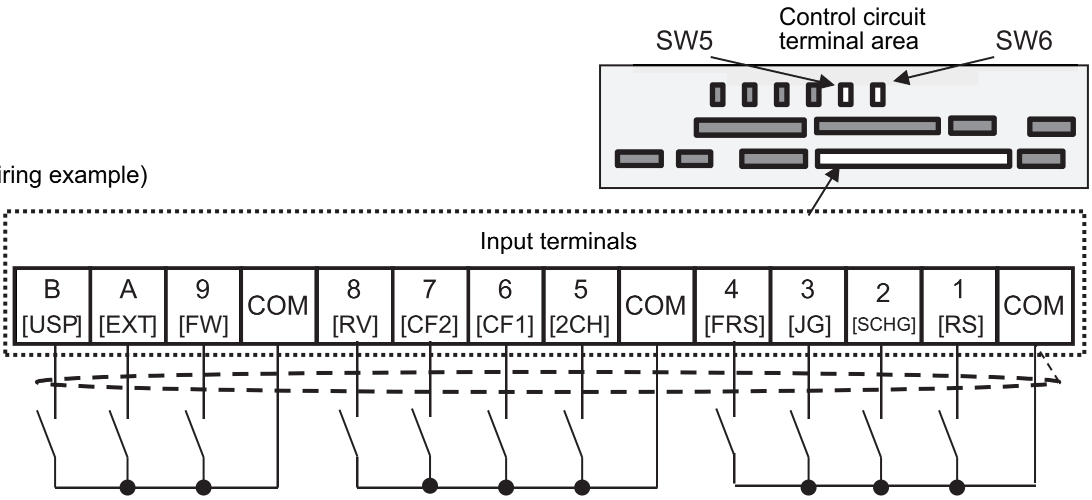
Precautions for Correct Use

- You can switch between the sink/source logic of input terminal by SW6.
- When connecting contacts to control circuit terminals, use a relay that does not generate contact failure even at weak current or voltage emitted from cross-bar twin contacts.
- When connecting a relay with output terminals, connect a diode for absorbing surge in parallel with the coil. Otherwise, internal elements may be damaged.

● Input Terminals

- All COM terminals are at the same potential.
- When connecting a power supply between 1 to 9, A, B, and COM, switch SW5 to the external power supply (EX).
- You can switch between the sink/source logic of input terminals by SW6.

(Wiring example)

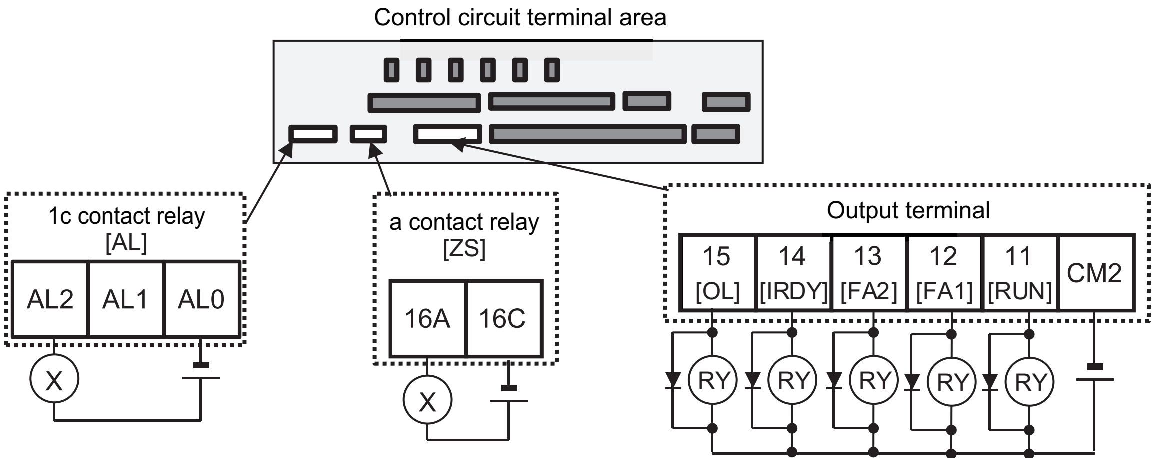


[ ] indicates the factory default setting.

			Terminal symbol	Terminal name	Description	Electrical characteristics
Input terminal	Digital input	Contact	9, 8, 7, 6, 5, 4, 3, 2, 1	Input terminal	You can select terminal functions using the parameter settings corresponding to each terminal. You can switch between the sink logic and source logic by switching SINK/SRC of SW6.	Voltage between each input/COM • ON when voltage is 18 VDC or higher • OFF when voltage is 3 VDC or lower • Maximum allowable voltage: 27 VDC • Load current: 5.6mA (at 27 VDC)
		Contact/ pulse	A	Pulse input-A	When (CA-90) is set to *00*, A and B terminals can be used as input terminals. You can select terminal functions using the parameter settings corresponding to each terminal. When (CA-90) is not set to *00*, they are used as terminals for pulse train input. The maximum input pulse is 32 kpps.	Voltage between each input/COM • ON when voltage is 18 VDC or higher • OFF when voltage is 3 VDC or lower • Maximum allowable voltage: 27 VDC • Load current: 5.6mA (at 27 VDC) • Maximum pulse input: 32 kpps
			B	Pulse input-B		
		Common	COM	Common for input terminal	Common terminals for digital input terminals (1, 2, 3, 4, 5, 6, 7, 8, 9, A, and B). There are three COM terminals.	

● Output Terminals

(Wiring example)



Ⓧ: Devices such as lamp, relay, and PLC
ⓇⓎ: Relay

[ ] indicates the factory default setting.

Precautions for Correct Use

When connecting a relay with output terminals, connect a diode for absorbing surge in parallel with the coil. Otherwise, internal elements may be damaged.

			Terminal symbol	Terminal name	Description	Electrical characteristics
Output terminal	Digital output	Open collector	15, 14, 13, 12, 11	Output terminal	You can select terminal functions using the parameter settings corresponding to each terminal. These terminals can be used both in sink logic or source logic.	Open collector output • Between each terminal and CM2 • Voltage drop at ON: 4V or below • Maximum allowable voltage: 27V • Maximum allowable current: 50mA
			CM2	Common for output terminal	Common terminals for output terminals 11 to 15	
		Relay	16A 16C	1a relay terminal	A relay for contact A output.	Maximum capacity of contact AC250V, 2A(resistance) AC250V, 1A(induction) Minimum capacity of contact • 1VDC, 1mA
			AL0 AL1 AL2	1c relay terminal	A relay for contact C output.	Maximum capacity of contact AL1/AL0: 250VAC, 2A (resistance)/ 250VAC, 0.2A (induction) AL2/AL0: 250VAC, 1A (resistance)/ AC250V, 0.2A (induction) Minimum capacity of contact (common) 100VAC, 10mA/ 5VDC, 100mA

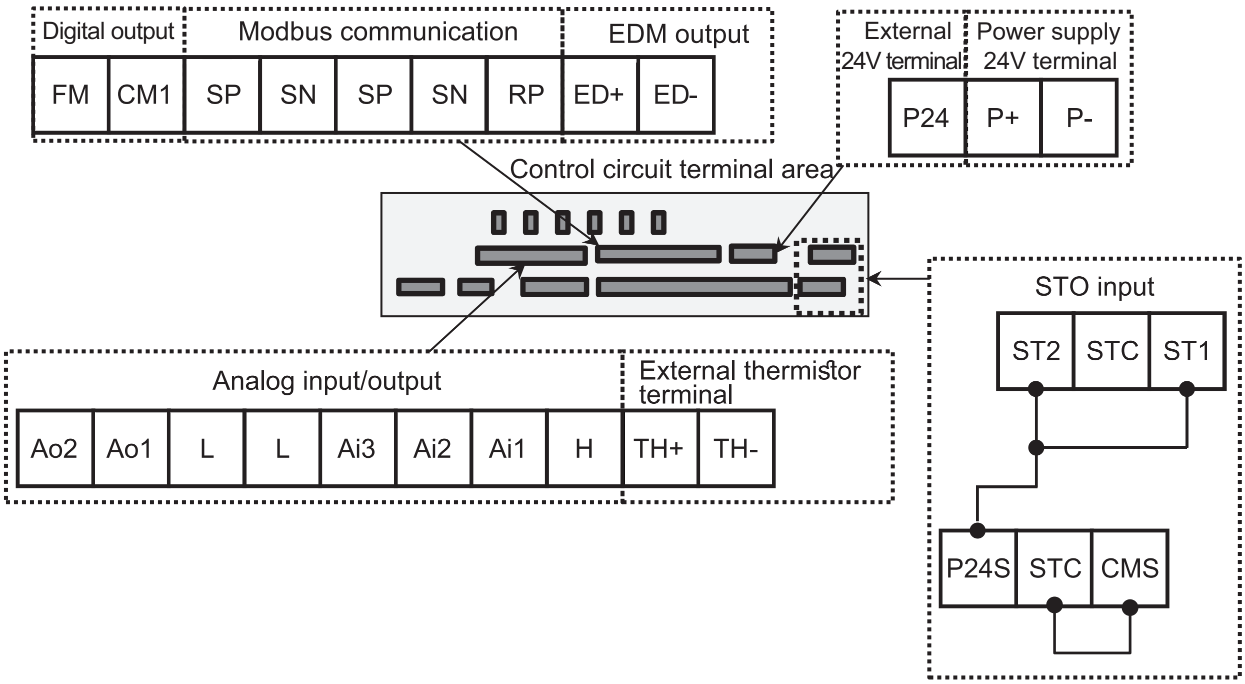
Additional Information

- The C contact relay AL1-AL0 and AL2-AL0 are set to [AL] by the default setting. When the output terminal [17: AL] is assigned to **Relay output terminal [AL] function** (CC-07), the behavior will be as follows.

CC-17	Control circuit power	Inverter error output	Output terminal settings	
			AL1-AL0	AL2-AL0
00	ON	Normal	Open	Close
		Alarm output	Close	Open
	OFF	-	Open	Close
01	ON	Normal	Close	Open
		Alarm output	Open	Close
	OFF	-	Open	Close

- You can set the alarm signal [17: AL] to any of (CC-01) to (CC-07) corresponding to the output terminal.

Wiring of Upper Part of Control Circuit Terminal



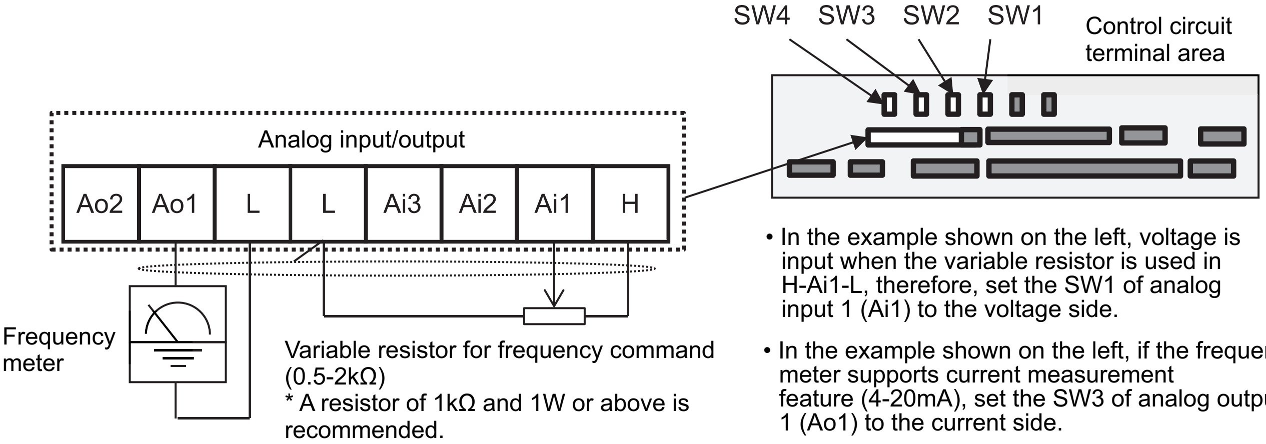
(At the factory default setting, the STO function is disabled.)

Precautions for Correct Use

- Factory default settings are shown below. You can change the setting for your needs.
  Analog input terminal setting switch: Ai1 (SW1) = Voltage input, Ai2 (SW2) = Current input
  Analog output terminal setting switch: Ao1 (SW3) = Voltage output, Ao2 (SW4) = Current output
- The factory default wiring is such that the STO input is disabled.
- Do not short between the analog power supply H and L terminals, power supply P+ and P- terminals, P24 and P- terminals, P+ and CM1 terminals, and P24 and CM1 terminals. Otherwise, the inverter may be damaged.

● Analog Input/Output

(Wiring example)



- In the example shown on the left, voltage is input when the variable resistor is used in H-Ai1-L, therefore, set the SW1 of analog input 1 (Ai1) to the voltage side.
- In the example shown on the left, if the frequency meter supports current measurement feature (4-20mA), set the SW3 of analog output 1 (Ao1) to the current side.

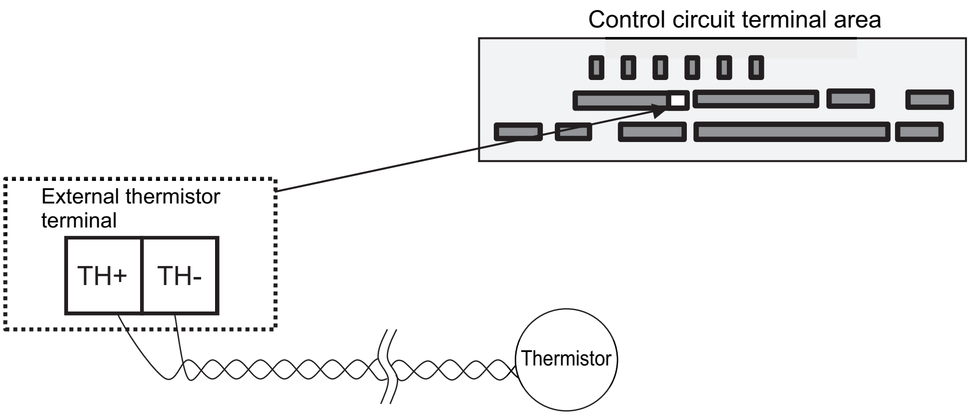
		Terminal symbol	Terminal name	Description	Electrical characteristics
Analog input terminal with voltage or current selection	Power supply	L	Analog power common	Common terminals for analog input terminals (Ai1, Ai2, Ai3) and analog output terminals (Ao1, Ao2). There are two L terminals.	
		H	Power supply forsetting speed	This is a 10 VDC power supply. It is used when using analog input terminals (Ai1, Ai2, Ai3) and variable resistor for inputting voltage.	Maximum allowable input current: 20mA

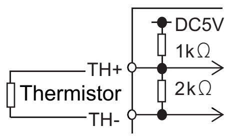
<table>
<tr><th></th><th></th><th>Terminal symbol</th><th>Terminal name</th><th>Description</th><th>Electrical characteristics</th></tr>
<tr><td rowspan="5">Analog input terminal with voltage or current selection</td><td rowspan="3">Analog input</td><td>Ai1</td><td>Analog input terminal 1 (Voltage/current switching SW1)</td><td>For Ai1 and Ai2, 0-10 VDC voltage input and 0-20 mA current input can be switched using a switch for use. It can be used for frequency command input or feedback input.</td><td>In the case of voltage input:
• Input impedance: about 10kΩ
• Allowable input voltage: -0.3 to 12 VDC
In the case of current input:
• Input impedance: about 100Ω
• Maximum allowable input current: 24 mA</td></tr>
<tr><td>Ai2</td><td>Analog input terminal 2 (Voltage/current switching SW2)</td><td>For Ai1 and Ai2, 0-10 VDC voltage input and 0-20 mA current input can be switched using a switch for use. It can be used for frequency command input or feedback input.</td><td>In the case of voltage input:
• Input impedance: about 10kΩ
• Allowable input voltage: -0.3 to 12 VDC
In the case of current input:
• Input impedance: about 100Ω
• Maximum allowable input current: 24 mA</td></tr>
<tr><td>Ai3</td><td>Analog input terminal 3</td><td>-10 to 10 VDC voltage input is available. It can be used for frequency command or feedback input.</td><td>Only voltage input:
• Input impedance: about 10kΩ
• Allowable voltage input: -12 to 12 VDC</td></tr>
<tr><td rowspan="2">Analog output</td><td>Ao1</td><td>Analog output terminal 1 (Voltage/current switching SW3)</td><td rowspan="2">For Ao1 and Ao2, 0-10 VDC voltage output and 0-20 mA current output can be switched using a switch as output of information monitor data of the inverter.</td><td rowspan="2">In the case of voltage output:
• Maximum allowable output current: 2 mA
• Output voltage accuracy: ±10%
(Ambient temperature: 25±10°C)
In the case of current output:
• Allowable load impedance: 250Ω or below
• Output current accuracy: ±20%
(Ambient temperature: 25±10°C)</td></tr>
<tr><td>Ao2</td><td>Analog output terminal 2 (Voltage/current switching SW4)</td></tr>
</table>

For analog input, refer to *8-12 Analog Input Terminal Function* on page 8-176.
For analog output, refer to *8-13 Analog Output Terminal Function* on page 8-185.

● External Thermistor

(Wiring example)



		Terminal symbol	Terminal name	Description	Electrical characteristics
Thermistor terminal	Analog input	TH+	External thermistor + terminal	When an external thermistor is connected, and resistance abnormality occurs due to abnormal temperature, etc., it trips the inverter. Connect the thermistor with TH+ and TH-. The level of detecting resistance abnormality can be adjusted from 0 to 10000Ω. [Recommended thermistor characteristics] Recommended product: SHIBAURA ELECTRONICS Co., Ltd. PB-41E (NTC characteristics) Allowable rated power: 100mW or more Impedance at abnormal temperature: 3kΩ	0 to 5 VDC [Input circuit] 
		TH-	External thermistor - terminal.		

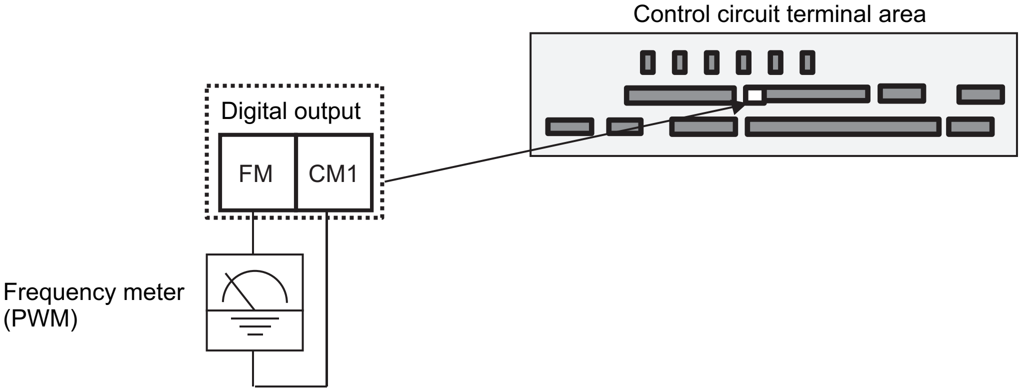
Precautions for Correct Use

To prevent malfunctioning, note the following when wiring.

- For connection to the TH terminal, twist only wires connecting to TH+ and TH-, and separate them from other wires.
- Since the current flowing in the thermistor is very weak, separate the wires from main circuit line (power line).
- The length of wiring to the thermistor shall be 20m or less.

● FM Output Terminal

(Wiring example)

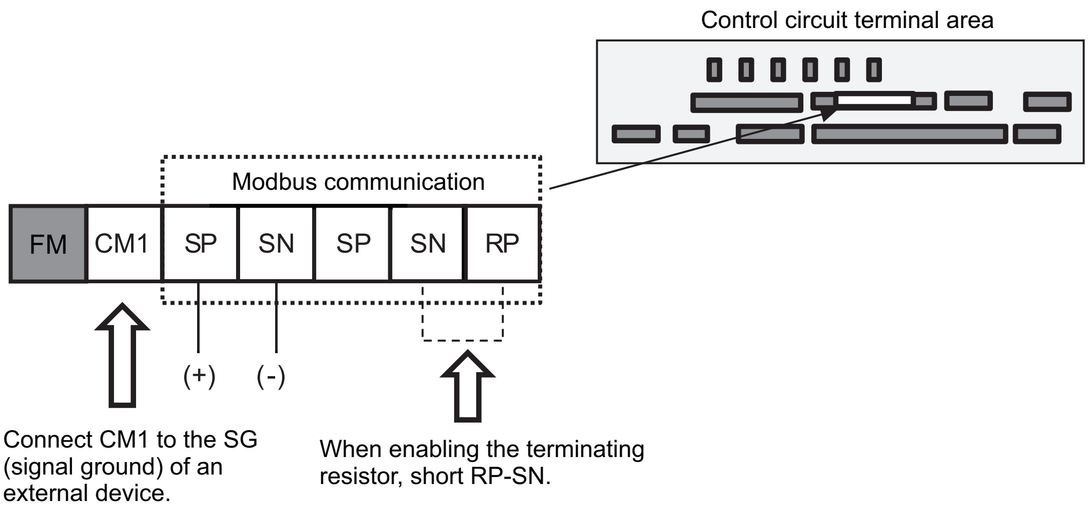


For FM output, you can choose the PWM output method at 6.4 ms fixed interval or pulse output method in which pulse frequency varies.
You can control FM output by setting parameters.

			Terminal symbol	Terminal name	Description	Electrical characteristics
Pulse output	Output	Monitor output	FM	Digital monitor (voltage)	For digital monitor output, you can choose the PWM output method at 6.4ms interval or pulse output method with about 50% duty in which frequency varies.	Pulse train output: 0-10 VDC • Maximum allowable current: 1.2 mA • Maximum frequency: 3.60 kHz
			CM1	Common terminal	The common terminal for digital monitor.	

● RS485 Communication Terminal Block

The arrangement and configuration of RS485 communication terminal block are described below.
(Wiring example)



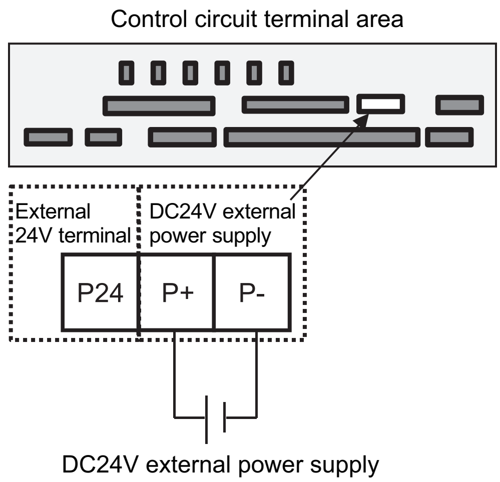
SP and SN terminals with the same names are internally connected respectively, so they can be used for wiring multiple terminals.

	Terminal symbol	Terminal name	Description	Electrical characteristics
RS485 serial communication	SP[*1] SN[*1]	RS-485 terminal for Modbus communication	SP terminal: RS-485 differential (+) signal SN terminal: RS-485 differential (-) signal	RS-485 compliant. Maximum baud rate is 115.2 kbps.
	RP	Enable terminating resistor terminal	Enabled when connected to SN. Enable: Short RP-SN Disable: Open RP-SN	Equipped with terminating resistor (120Ω)
	CM1[*2]	Signal ground	Connect with the signal ground of an external communication device. (Also used by FM terminal)	

*1. There are two terminals, which are connected internally.
*2. The CM1 terminal is internally connected to the negative side of the internal 24V.

● Power Input/Output

The arrangement and specifications of the external 24V power input terminals are described below.
(Wiring example)

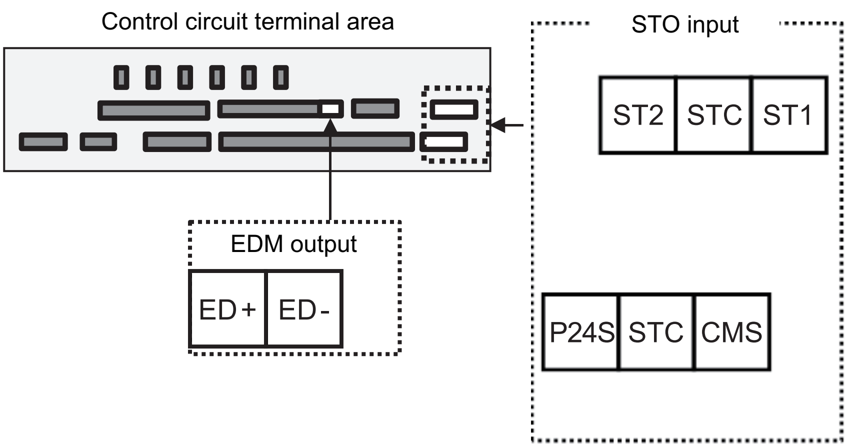


You can use an external 24V power supply when you want to change parameters or use communication of optional devices without main power supply. Also, for the purpose of maintaining input and output to the control circuit, power is also supplied to the internal P24 terminal, so P- and CM1 terminals are at the same potential.

		Terminal symbol	Terminal name	Description	Electrical characteristics
24V Power supply	Power input	P24	24V output power terminal	24 VDC power supply for contact signal. Note that the common is the CM1 terminal, but it is also connected to the P- terminal.	100mA output at maximum
		P+	External 24V input terminal (24V)	The terminal that inputs an external 24 VDC power to the inverter. It is connected to P24V via a diode and is used when the control power supply R0-R0 is OFF. It is used when changing the parameter settings of the inverter from the optional communication unit or USB while the control power is OFF because the main circuit is OFF.	Allowable input voltage: 24VDC±10% Maximum current consumption: 1A
		P-	Terminal for P24/P+ (0 (zero) V)		

● STO Terminal

Terminal symbol	Terminal name
P24S	24V output power terminal (dedicated for STO input)
CMS	Common terminal for 24V output (dedicated for STO input)
STC	Common terminal for inputs
ST1	STO input 1
ST2	STO input 2
ED+	EDM signal output terminal (+)
ED-	EDM signal output terminal (-)



For details, refer to *2-4-2 Wiring for STO Function* on page 2-83.

2-3-4 Wiring for Main Circuit Terminals

Applicable Peripheral Devices

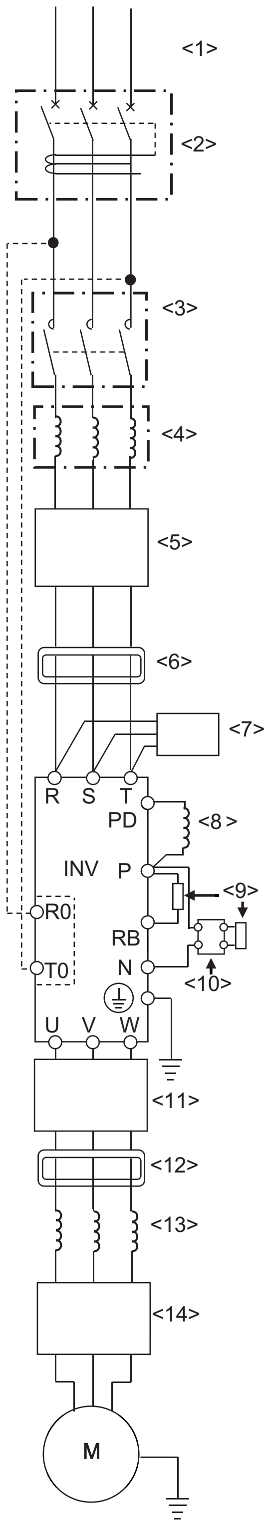
The configuration diagram and functions of the inverter and main circuit peripheral are described below. Those devices are only applicable in case of the standard 3-phase induction motor with four poles. Select appropriate sensitive currents for earth-leakage breaker (ELB) depending on the total wire length between the inverter and power supply and between the inverter and motor based on the table below.

Precautions for Correct Use

- Breakers must be selected in consideration of break capacity. (Use a inverter compatible type.)
- Use an earth-leakage breaker (ELB) for your safety.
- Use a 75°C heatproof copper wire (HIV wire).
- If the wiring length exceeds 20 m, heavier power lines need to be applied.
- Select for alarm output contact of 0.75 mm^2.
- Tighten the terminal screws at a specified torque. Loose tightening may cause short circuit or fire. Overtightening may damage the terminal block or the inverter.
- Select a time-delay type earth-leakage breaker (ELB). Otherwise, a high-speed type earth-leakage breaker (ELB) may malfunction.

Total wiring length	Sensitive current (mA)
100 m or shorter	50
300 m or shorter	100

- When selecting an earth leakage breaker (ELB) for use with IV/HIV wires, use one with 8 times the sensitivity current. Also, if the total wiring length of the cable between the power supply and inverter and between the inverter and power supply exceeds 100 m, use the CV line.

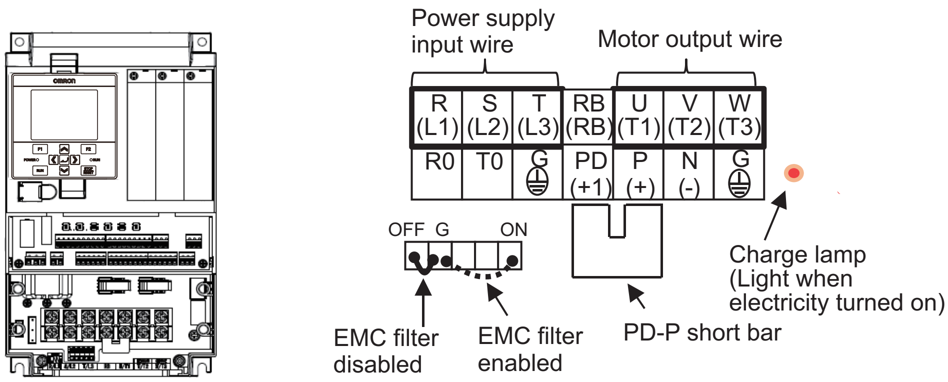


No.	Name	Function
<1>	Wire	Refer to *Recommended Wire Diameter, Wiring Tools, and Crimp Terminals* on page 2-41.
<2>	Earth-leakage breaker (ELB)	
<3>	Magnetic contactor (MC)	
<4>	Input side reactor	This is applied as a countermeasure against power supply harmonic suppression, or when imbalance of power supply voltage is 3% or above, or when power supply capacity is 500kVA or above, or when a rapid change is made to power supply voltage. It is also effective in improving power factor.
<5>	Inverter noise filter	This reduces the conductive noise that is generated from the inverter and transferred to the wire. Connect to the primary side (input side) of inverter.
<6>	Radio noise filter (zero-phase reactor)	When the inverter is used, noise may be generated on an adjacent radio or other devices through wiring on the power supply side. This is used for reducing the noise (reducing radiation noise).
<7>	Input-side radio noise filter (capacitor filter)	This reduces the radiation noise that is emitted from the wire on the input side.
<8>	DC reactor	This suppresses harmonics generated from the inverter.
<9>	Braking resistor	This is used for increasing the braking torque of the inverter, repeating power on and off at high interval, or reducing the speed of high load caused by moment of inertia.
<10>	Regenerative braking unit	
<11>	Output-side noise filter	This is installed between the inverter and motor to reduce the radiation noise that is emitted from the wire. It is used to reduce radio interference on radios or televisions or to prevent malfunctioning of measurement instruments and sensors.
<12>	Radio noise filter (zero-phase reactor)	This is applied for reducing noise generated on the output side of inverter. (It can be used on both the input side and output side.)
<13>	Output-side AC reactor	When a general-use motor is driven by the inverter, compared with when it is run by commercial power supply, larger vibration may be generated. By connecting this device between the inverter and motor, you can reduce the vibration of motor. Also, if the wiring length between the inverter and motor is long (10m or longer), by inserting a reactor, you can prevent malfunctioning of the thermal relay caused by harmonic attributable to switching of inverter. You can also use a current sensor instead of the thermal relay.
<14>	LCR filter	This is a filter installed between the inverter and motor. It improves output current and voltage waveform to reduce motor vibration, noise, and radiation noise emitted from the wire to convert output-side waveform to sine wave. It is also effective in suppressing surge voltage.

Arrangement of Main Circuit Terminals

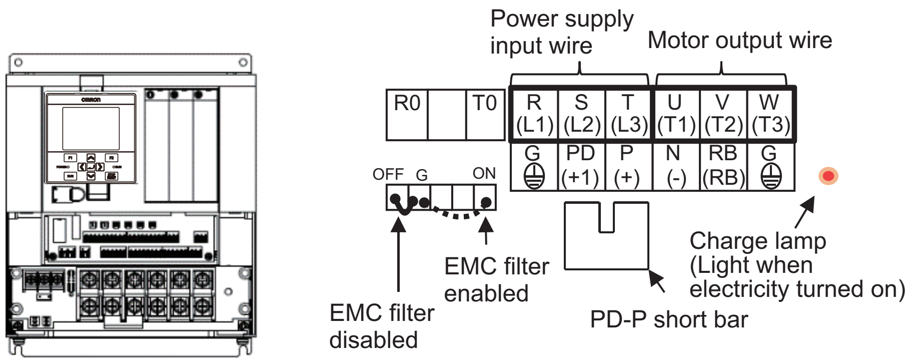
The arrangement of inverters' main circuit terminals are shown in the following diagrams.
For information on setting EMC filters, refer to *Built-in EMC Filter Settings* on page 2-48.

<table>
<tr><th>Arrangement of terminals</th><th>Model</th></tr>
<tr><td>



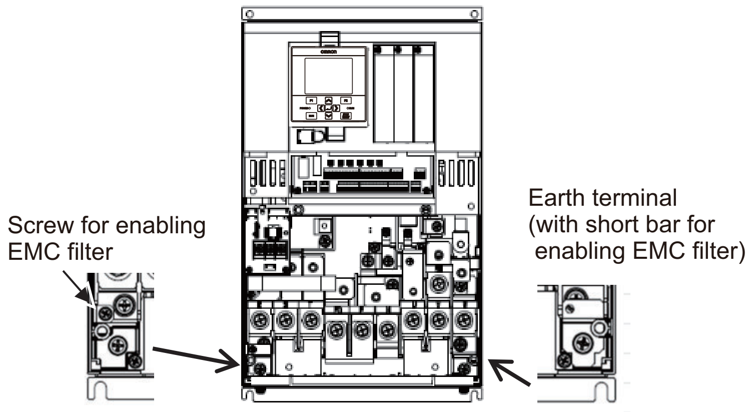
* The EMC filter is enabled/disabled by switching the short-circuit wire. Refer to *Type in Which Short-circuit Wire with Ferrule Is Used* on page 2-49 .

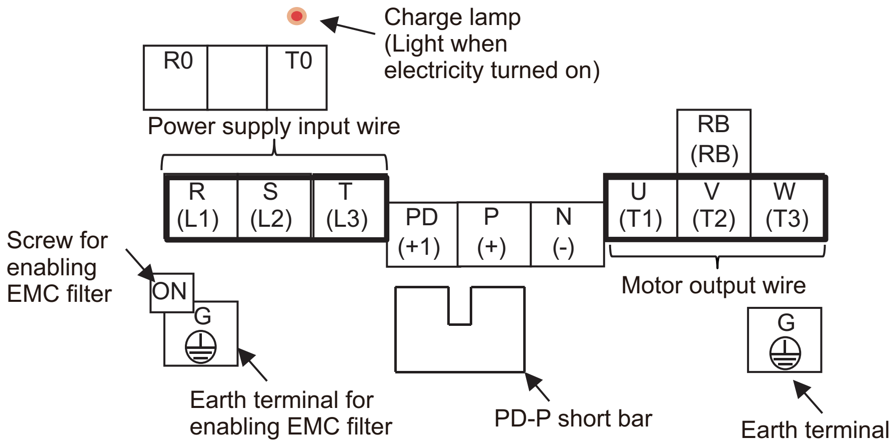
</td><td>3G3RX2-A2004
3G3RX2-A2007
3G3RX2-A2015
3G3RX2-A2022
3G3RX2-A2037
3G3RX2-A4007
3G3RX2-A4015
3G3RX2-A4022
3G3RX2-A4037
R0, T0: M4
Earth terminal: M4
Others: M4</td></tr>
<tr><td>



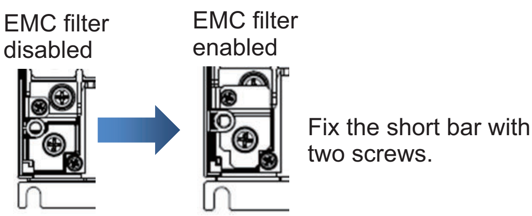
* The EMC filter is enabled/disabled by switching the short-circuit wire. Refer to *Type in Which Short-circuit Wire with Ferrule Is Used* on page 2-49 .

</td><td>3G3RX2-A2055
3G3RX2-A2075
3G3RX2-A4055
3G3RX2-A4075
R0, T0: M4
Earth terminal: M5
Others: M5
3G3RX2-A2110
3G3RX2-A4110
R0, T0: M4
Earth terminal: M6
Others: M6</td></tr>
</table>

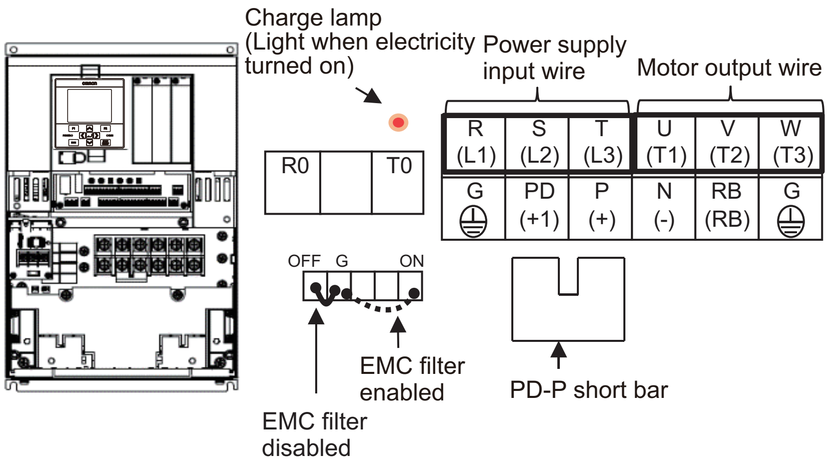
<table>
<tr><th>Arrangement of terminals</th><th>Model</th></tr>
<tr><td>


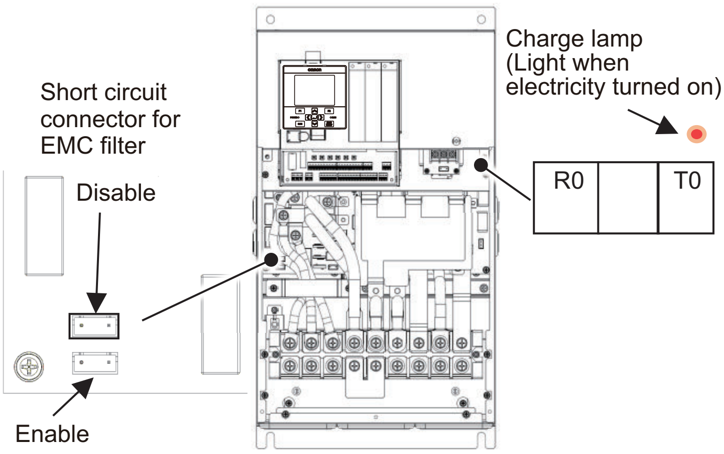


* The EMC filter is enabled at the position of the earth terminal on the power supply side by using the shorting bar, the earth terminal screw, and the EMC filter enable screw. The EMC filter is set to the enabled position at factory default setting.

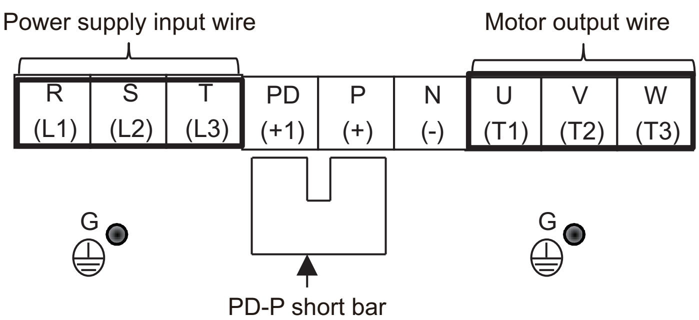


For information on setting EMC filters, refer to Type in which Ground Terminal Shorting Bar Is Tightened Together on page 2-50.
</td><td>3G3RX2-A2150
3G3RX2-A2185
R0, T0: M4
Earth terminal: M6
Others: M6
3G3RX2-A2220
R0, T0: M4
Earth terminal: M6
Others: M8</td></tr>
</table>

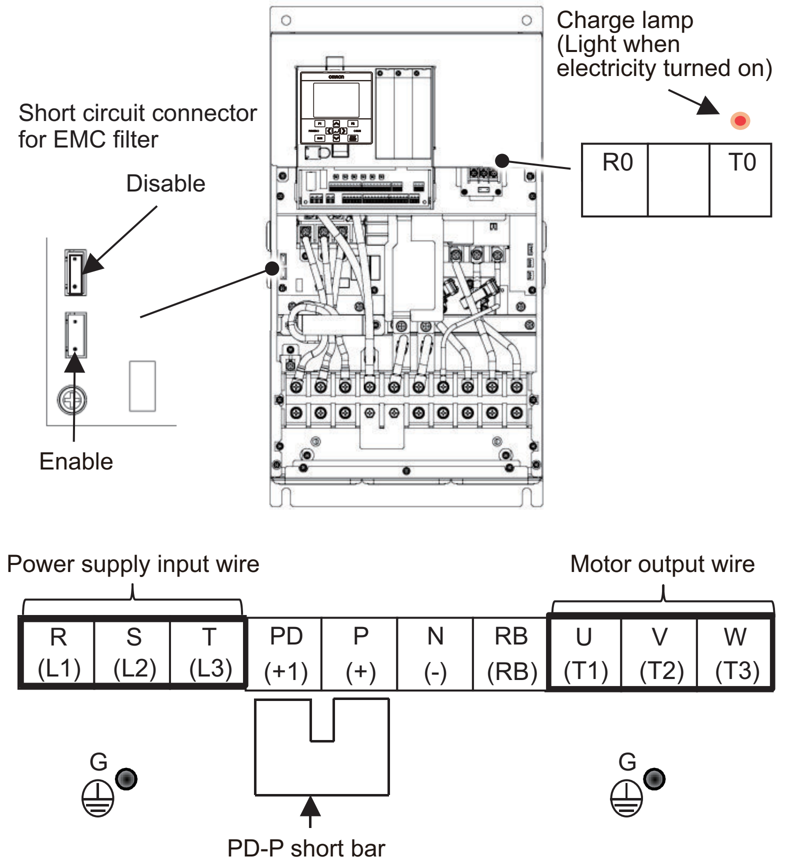
<table>
<tr><th>Arrangement of terminals</th><th>Model</th></tr>
<tr><td>


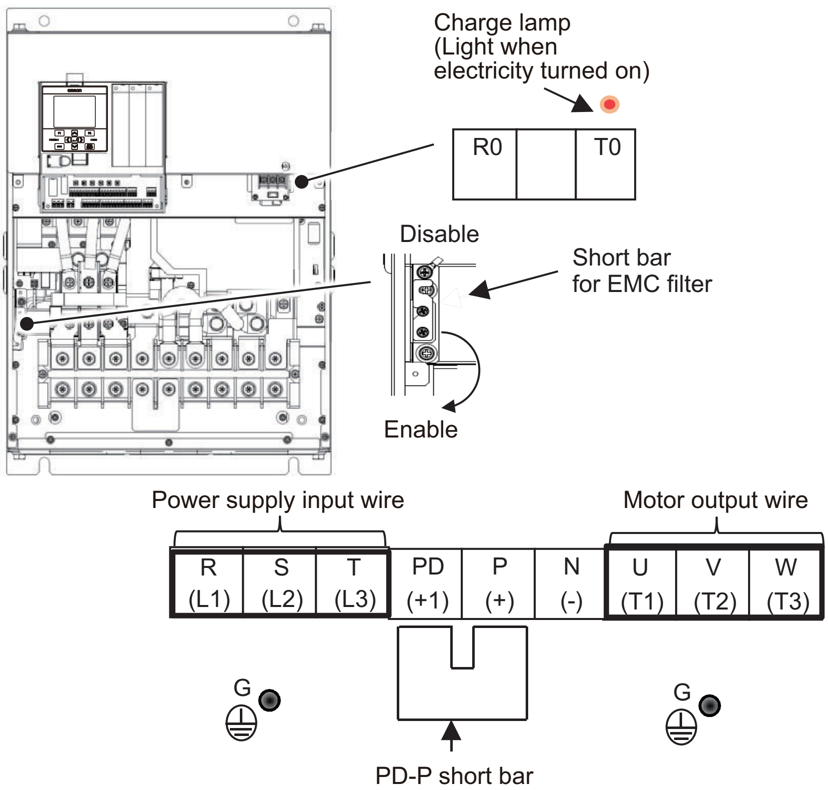
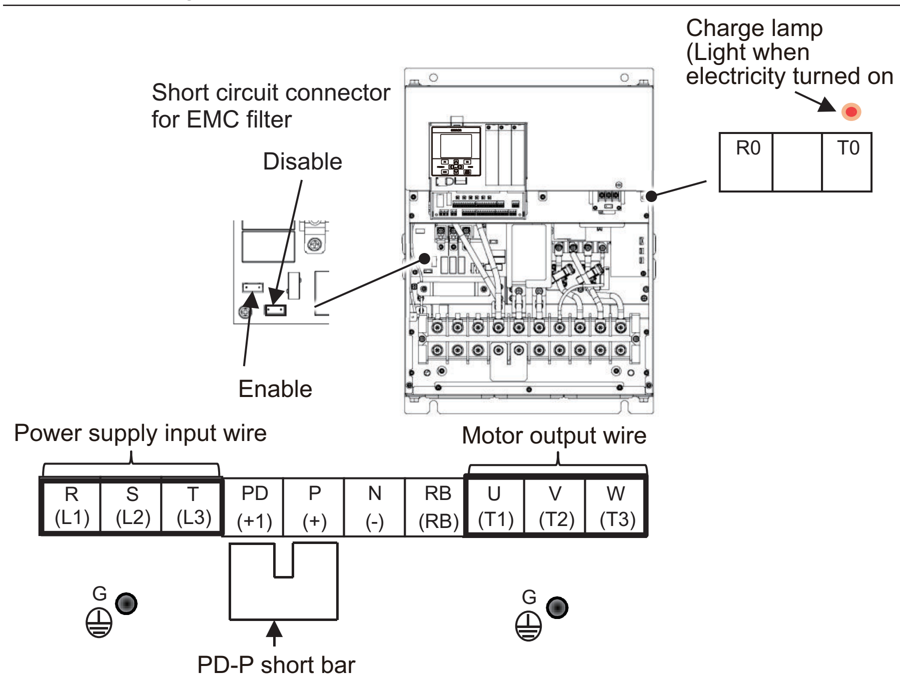
* The EMC filter is enabled/disabled by switching the short-circuit wire. Refer to *Type in Which Short-circuit Wire with Ferrule Is Used* on page 2-49 .
</td><td>3G3RX2-A4150
3G3RX2-A4180
3G3RX2-A4220
R0, T0: M4
Earth terminal: M6
Others: M6</td></tr>
<tr><td>


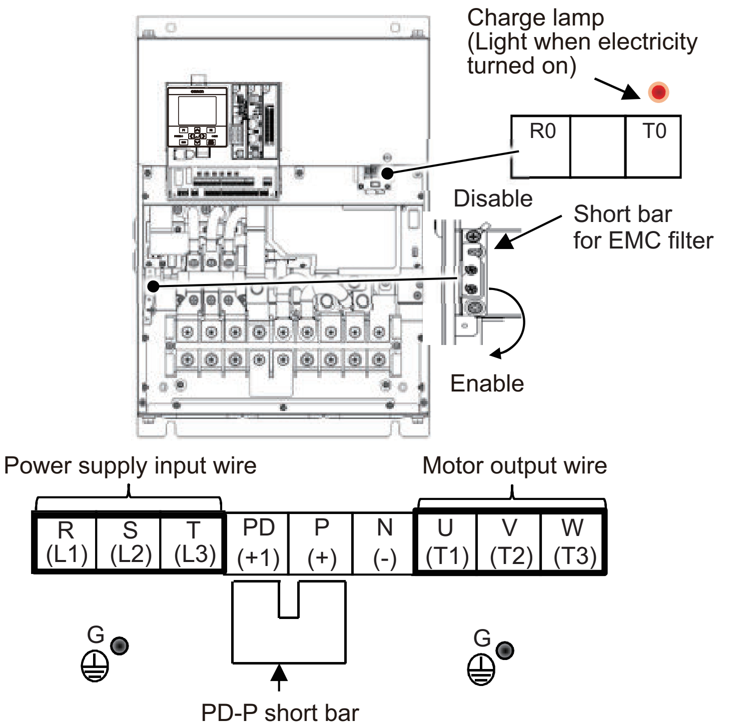
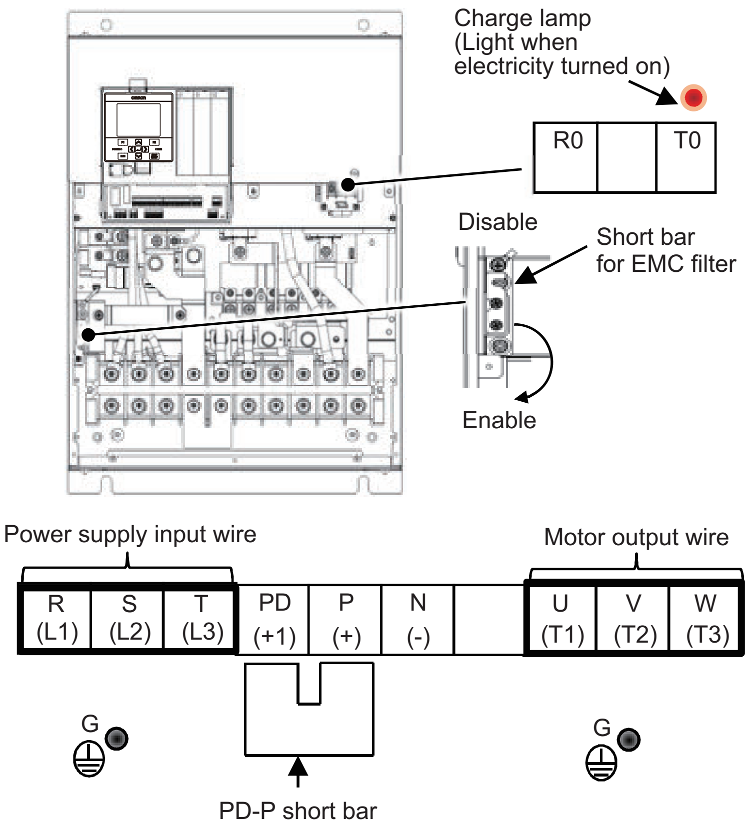
* The EMC filter is enabled/disabled by switching the short circuit connector. Refer to *Type to Connect Short-circuit Pins with Short-circuit Connector - 1* on page 2-49 .

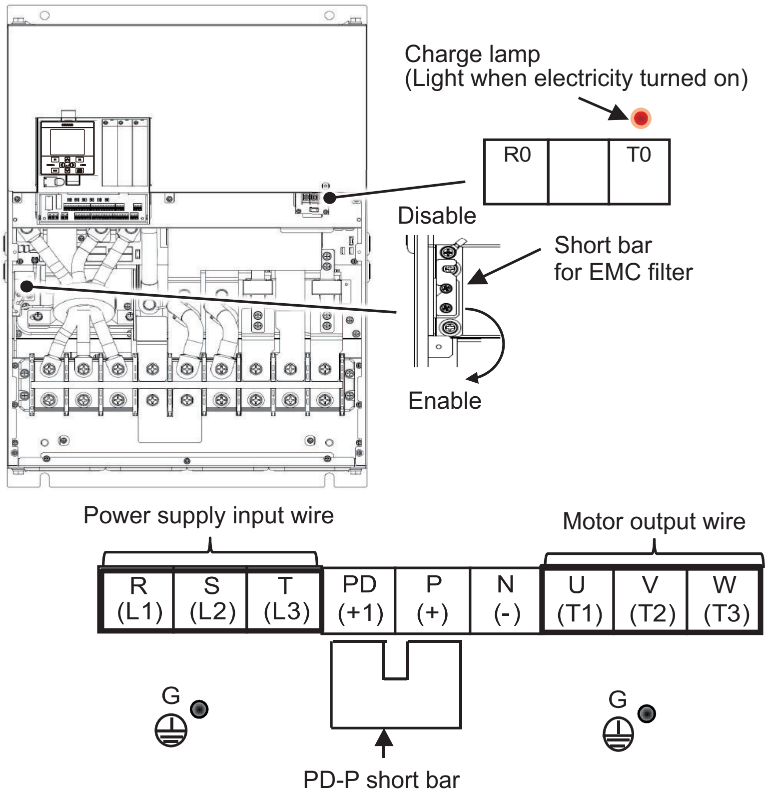


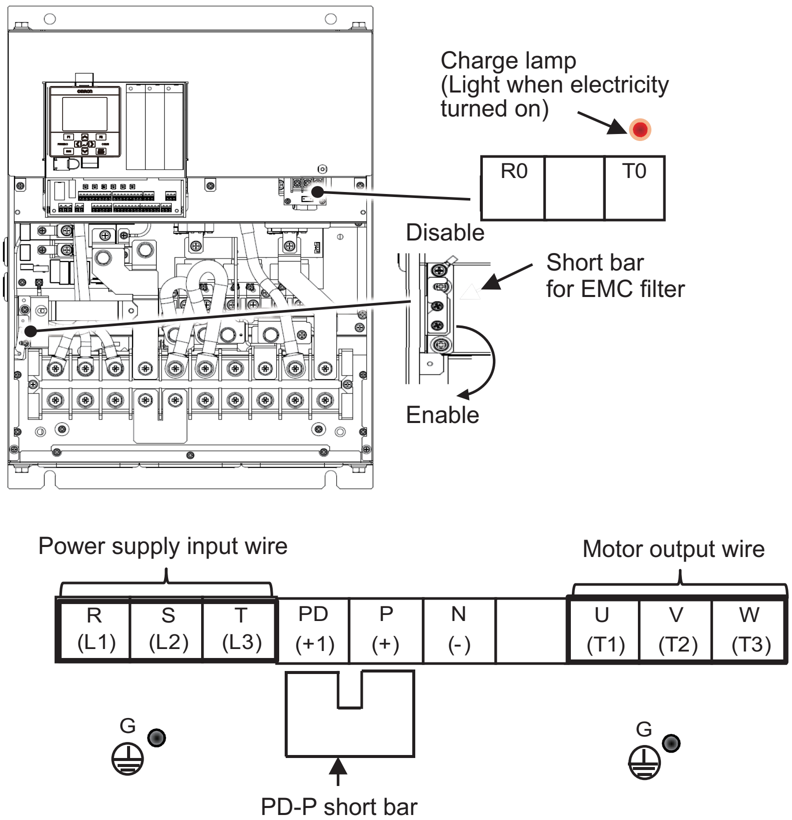
</td><td>3G3RX2-A2300
R0, T0: M4
Earth terminal: M6
Others: M8</td></tr>
</table>

Arrangement of terminals	Model
 * The EMC filter is enabled/disabled by switching the short-circuit connector. Refer to *Type to Connect Short-circuit Pins with Short-circuit Connector - 2* on page 2-49 .	3G3RX2-A4300 R0, T0: M4 Earth terminal: M6 Others: M8

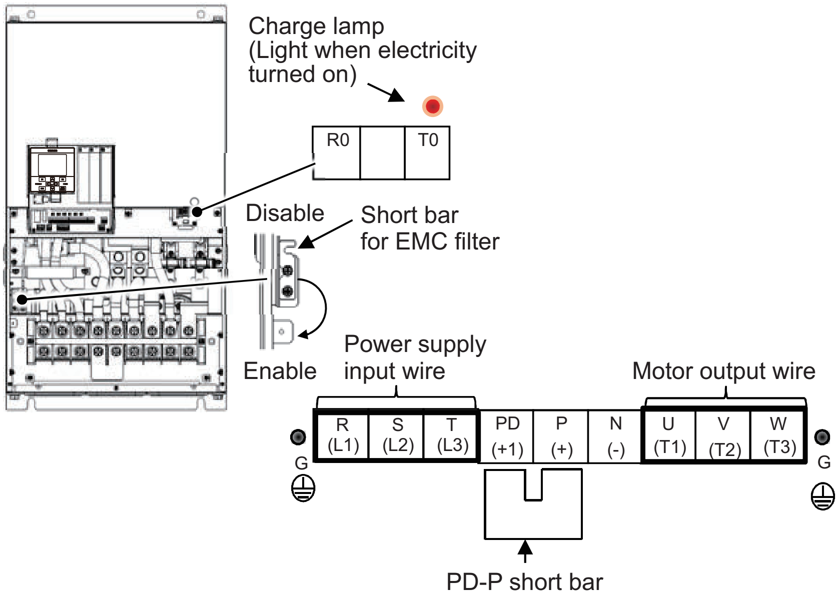
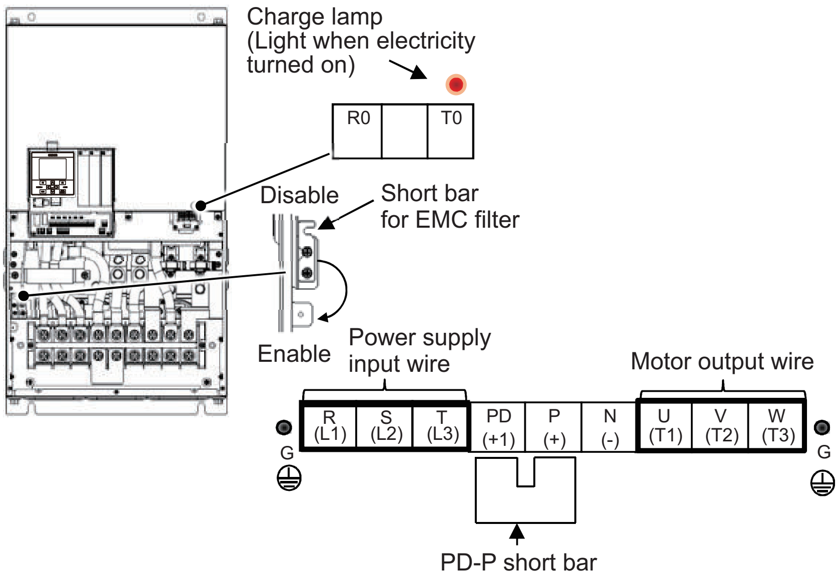
Arrangement of terminals	Model
 For information on setting EMC filters, refer to *Type in Which Rotary Shorting Bar Is Used for Switching* on page 2-49.	3G3RX2- A2370 R0, T0: M4 Earth termi- nal: M8 Others: M8
 * The EMC filter is enabled/disabled by switching the short-circuit connector. Refer to *Type to Connect Short-circuit Pins with Short-circuit Connector - 1* on page 2-49 .	3G3RX2- A4370 R0, T0: M4 Earth termi- nal: M8 Others: M8

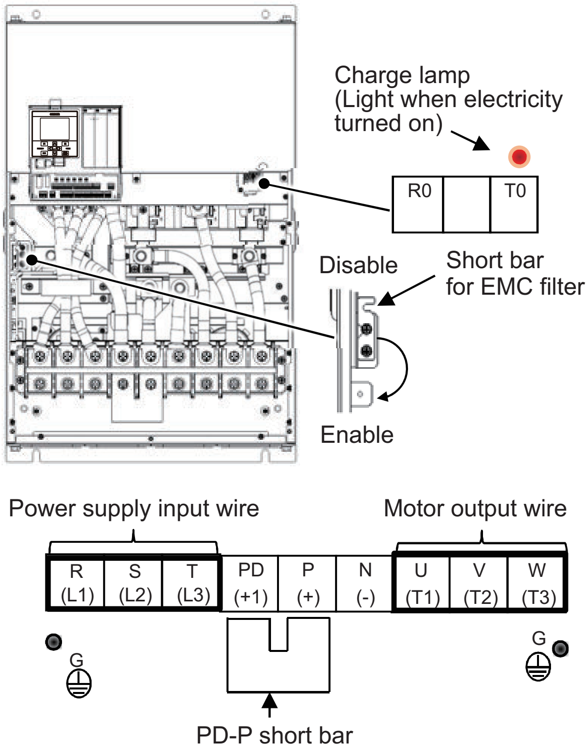
Arrangement of terminals	Model
 For information on setting EMC filters, refer to *Type in Which Rotary Shorting Bar Is Used for Switching* on page 2-49.	3G3RX2-A2450 R0, T0: M4 Earth terminal: M8 Others: M8
 For information on setting EMC filters, refer to *Type in Which Rotary Shorting Bar Is Used for Switching* on page 2-49.	3G3RX2-A4450 R0, T0: M4 Earth terminal: M8 Others: M8

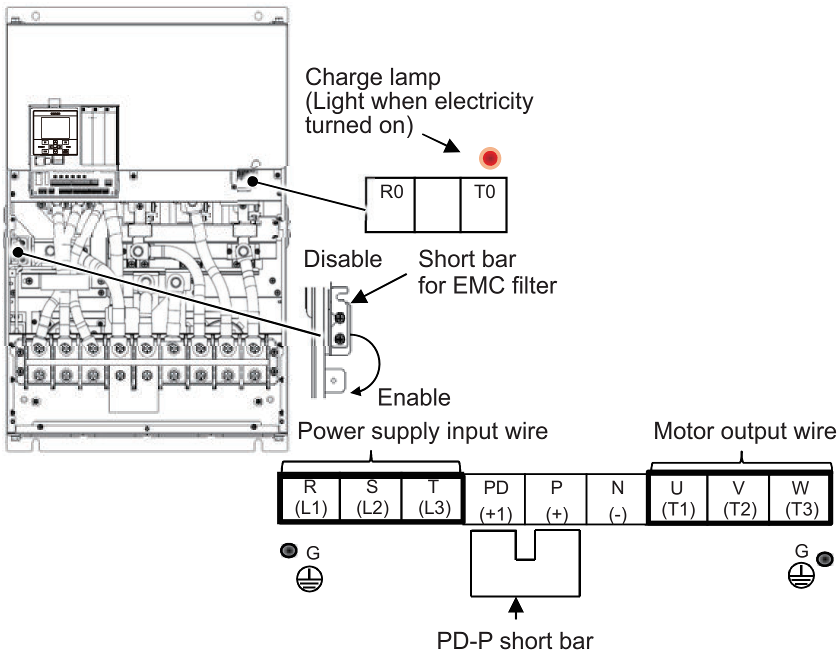
<table>
<tr><th>Arrangement of terminals</th><th>Model</th></tr>
<tr><td>


For information on setting EMC filters, refer to Type in Which Rotary Shorting Bar Is Used for Switching on page 2-49.
</td><td>3G3RX2-
A2550
Ro, To: M4
Earth termi-
nal: M8
Others:
M10</td></tr>
<tr><td>


For information on setting EMC filters, refer to Type in Which Rotary Shorting Bar Is Used for Switching on page 2-49.
</td><td>3G3RX2-
A4550
R0, T0: M4
Earth termi-
nal: M8
Others: M8</td></tr>
</table>

Arrangement of terminals	Model
 For information on setting EMC filters, refer to *Type in Which Rotary Shorting Bar Is Used for Switching* on page 2-49.	3G3RX2-B4750 R0, T0: M4 Earth terminal: M8 Others: M10
 For information on setting EMC filters, refer to *Type in Which Rotary Shorting Bar Is Used for Switching* on page 2-49.	3G3RX2-B4900 R0, T0: M4 Earth terminal: M8 Others: M10

<table>
<tr><th>Arrangement of terminals</th><th>Model</th></tr>
<tr><td>

For information on setting EMC filters, refer to Type in Which Rotary Shorting Bar Is Used for Switching on page 2-49.</td><td>3G3RX2-B411K
R0, T0: M4
Earth terminal: M8
Others: M10</td></tr>
<tr><td>

For information on setting EMC filters, refer to Type in Which Rotary Shorting Bar Is Used for Switching on page 2-49.</td><td>3G3RX2-B413K
R0, T0: M4
Earth terminal: M8
Others: M10</td></tr>
</table>

Recommended Wire Diameter, Wiring Tools, and Crimp Terminals

Refer to the following table for the wiring to the inverter, the crimp terminal, and the tightening torque of the terminal screw.

● 200V Class

Model 3G3RX2-****	Rated settings page 2-43	Power line AWG (mm^2) R, S, T,U, V, W, P, PD, N	Ground line AWG (mm^2)	Braking resistor AWG between P and RB (mm^2)	Terminal screw size	Crimp terminal power line/ ground line	Tightening torque N·m
A2004	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A2007	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A2015	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A2022	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD	10 (5.3)	10 (5.3)	10 (5.3)		5.5-4/5.5-4	
A2037	ND	10 (5.3)	10 (5.3)	10 (5.3)	M4	5.5-4/5.5-4	1.4
	LD						
	VLD						
A2055	ND	8 (8.4)	8 (8.4)	8 (8.4)	M5	8-5/8-5	3.0
	LD						
	VLD						
A2075	ND	8 (8.4)	6 (13.3)	8 (8.4)	M5	8-5/8-5	3.0
	LD						
	VLD	6 (13.3)		6 (13.3)		14-5/8-5	
A2110	ND	6 (13.3)	6 (13.3)	6 (13.3)	M6	14-6/14-6	4.0
	LD	4 (21.2)		4 (21.2)		22-6/14-6	
	VLD						
A2150	ND	4 (21.2)	6 (13.3)	4 (21.2)	M6	22-6/14-6	2.5 to 3.0
	LD	3 (26.7)		3 (26.7)		38-6/14-6	
	VLD						
A2185	ND	3 (26.7)	6 (13.3)	3 (26.7)	M6	38-6/14-6	2.5 to 3.0
	LD	2 (33.6)		2 (33.6)			
	VLD	1 (42.4)		1 (42.4)		60-6/14-6	
A2220	ND	1 (42.4)	6 (13.3)	1 (42.4)	M8	60-8/14-6	5.5 to 6.6
	LD	1/0 (53.5)		1/0 (53.5)			
	VLD	2/0 (67.4)		2/0 (67.4)		70-8/14-6	
A2300	ND	2/0 (67.4)	4 (21.2)	-	M8	70-8/22-6	6.0
	LD	1/0×2 (53.5×2)				60-8/22-6	
	VLD						
A2370	ND	4/0 (107.2)	4 (21.2)	-	M8	100-8/22-8	15.0
	LD	1/0×2 (53.5×2)				60-8/22-8	
	VLD						

Model 3G3RX2-****	Rated settings page 2-43	Power line AWG (mm^2) R, S, T,U, V, W, P, PD, N	Ground line AWG (mm^2)	Braking resistor AWG between P and RB (mm^2)	Terminal screw size	Crimp terminal power line/ ground line	Tightening torque N·m
A2450	ND	1/0×2 (53.5×2)	4 (21.2)	-	M8	60-8/22-8	6.0 to 10.0
	LD						
	VLD	2/0×2 (67.4×2)				70-8/22-8	
A2550	ND	350kc (177)	3 (26.7)	-	M10	180-10/38-8	19.6
	LD	3/0×2 (85.0×2)				80-10/38-8	
	VLD						

Rated settings: ND: Normal Duty, LD: Low Duty, and VLD: Very Low Duty

● 400V Class

Model 3G3RX2-****	Rated settings page 2-44	Power line AWG (mm^2) R, S, T, U, V, W,P, PD, N	Ground line AWG (mm^2)	Braking resistor AWG between P and RB (mm^2)	Screw size of power line terminal	Crimp terminal power line/ ground line	Tightening torque N·m
A4007	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A4015	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A4022	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A4037	ND	14 (2.1)	14 (2.1)	14 (2.1)	M4	2-4/2-4	1.4
	LD						
	VLD	12 (3.3)	12 (3.3)	12 (3.3)		5.5-4/5.5-4	
A4055	ND	12 (3.3)	12 (3.3)	12 (3.3)	M5	5.5-5/5.5-5	3.0
	LD						
	VLD	10 (5.3)	10 (5.3)	10 (5.3)			
A4075	ND	10 (5.3)	10 (5.3)	10 (5.3)	M5	5.5-5/5.5-5	3.0
	LD						
	VLD	8 (8.4)	8 (8.4)	8 (8.4)		8-5/8-5	
A4110	ND	8 (8.4)	8 (8.4)	8 (8.4)	M6	8-6/8-6	4.0
	LD						
	VLD						
A4150	ND	8 (8.4)	8 (8.4)	8 (8.4)	M6	8-6/8-6	4.0
	LD						
	VLD						

Model 3G3RX2-****	Rated settings page 2-44	Power line AWG (mm^2) R, S, T, U, V, W,P, PD, N	Ground line AWG (mm^2)	Braking resistor AWG between P and RB (mm^2)	Screw size of power line terminal	Crimp terminal power line/ ground line	Tightening torque N·m
A4185	ND	8 (8.4)	8 (8.4)	8 (8.4)	M6	8-6/8-6	4.0
	LD	6 (13.3)		6 (13.3)		14-6/8-6	
	VLD						
A4220	ND	6 (13.3)	8 (8.4)	6 (13.3)	M6	14-6/8-6	4.0
	LD	4 (21.2)		4 (21.2)		22-6/8-6	
	VLD						
A4300	ND	3 (26.7)	6 (13.3)	-	M8	38-8/14-6	6.0
	LD	2 (33.6)					
	VLD	1 (42.4)				60-8/14-6	
A4370	ND	1 (42.4)	6 (13.3)	-	M8	60-8/14-8	15.0
	LD						
	VLD						
A4450	ND	1 (42.4)	6 (13.3)	-	M8	60-8/14-8	6.0 to 10.0
	LD	1/0 (53.5)					
	VLD	2/0 (67.4)				70-8/14-8	
A4550	ND	2/0 (67.4)	4 (21.2)	-	M8	70-8/22-8	6.0 to 10.0
	LD	1/0×2 (53.5×2)				60-8/22-8	
	VLD						
B4750	ND	1/0×2 (53.5×2)	4 (21.2)	-	M10	60-10/22-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD						
	VLD						
B4900	ND	1/0×2 (53.5×2)	3 (26.7)	-	M10	60-10/38-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD						
	VLD	2/0×2 (67.4×2)				70-10/38-8	
B411K	ND	2/0×2 (67.4×2)	1 (42.4)	-	M10	70-10/60-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD						
	VLD	3/0×2 (85.0×2)				80-10/60-8	
B413K	ND	3/0×2 (85.0×2)	1 (42.4)	-	M10	80-10/60-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD	4/0×2 (107×2)				100-10/60-8	
	VLD	250kcmil×2 (127×2)				150-10/60-8	

Rated settings: ND: Normal Duty, LD: Low Duty, and VLD: Very Low Duty

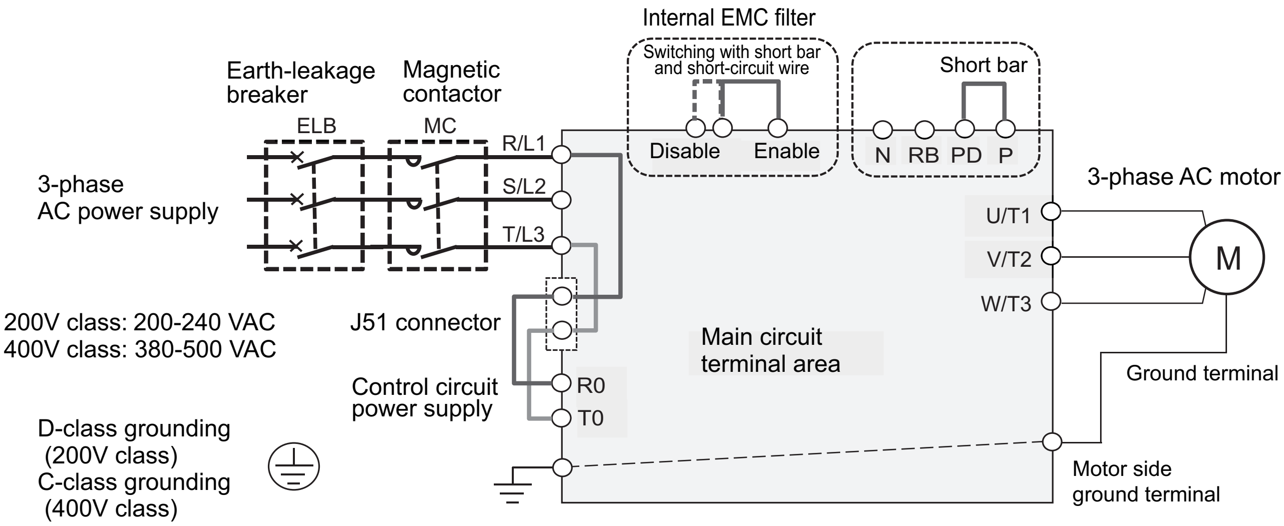
Wiring of Main Power Supply Input Terminal (R/L1, S/L2, T/L3)

Wiring of main power supply input terminals and peripheral devices are described below.

● Establishing Molded Case Circuit Breaker

Connect R, S, T (L1, L2, L3) to the AC power supply.
Connect U, V, W (T1, T2, T3) to the motor.
Driving a 200V motor by a 400V class inverter may result in burn out.
The input power supply must be in the range shown below:

Voltage class	Input range
200V class	200 to 240 VAC (allowable variation range: +10%/-15%) Power supply frequency 50 Hz/60 Hz (variation range ±5%)
400V class	380 to 500 VAC (allowable variation range: +10%/-15%) Power supply frequency 50 Hz/60 Hz (variation range ±5%)



● Installing Earth Leakage Breaker

Select the earth leakage breaker for circuit (wiring) protection to use between the power supply and the main power supply input terminals (R, S, T) in consideration of the following two points.

[High-frequency leakage current from inverter]
The inverter produces a high-frequency leakage current due to its high-speed output switching.
In general, a leakage current of approximately 100 mA will flow for the power cable length of 1 m per inverter. Moreover, an additional leakage current of approximately 5 mA will flow with the increasing length by 1 m.
Therefore, earth leakage breaker to be used at the power supply input shall have the following features: (1) It must remove a leakage current with high frequency, (2) It must detect only leakage current in a frequency band that is hazardous to human beings, and (3) It should be specialized for an inverter.

- Use an earth leakage breaker that is dedicated for an inverter, and select a breaker with a sensitivity current of 10 mA or more for each inverter.
- When the general earth leakage breaker that detects a high frequency leakage current is used, select a breaker with a sensitivity current of 200 mA or more and the operation time of 0.1 sec. or more per an inverter. Note that such breaker has a high sensitivity current at low frequencies, which reduces the effectiveness of electric shock prevention. These selection criteria is applicable when using such breaker for protecting equipment in places where there is no risk of human contact.

[Leakage current of EMC noise filter]

The EMC noise filter is designed in conformity with CE standard in Europe.

Since the noise filter is designed according to neutral ground based on the Europe power supply specification, if it is used under the rule of S-phase ground in Japan, a leakage current increase.

- When using the inverter in Japan where a leakage current is strictly regulated and when EMC regulations are not specifically imposed at the installation site, disable built-in EMC noise filter and consider use of 3G3AX-ZCL and a ferrite core as a measure against a noise.
- EMC noise filter for 3G3RX2 is enabled at factory default setting. If unnecessary, change from enable to disable. For how to change the settings, refer to the figure of applicable inverter shown in *2-3-2 Arrangement and Function of Main Circuit Terminal Block* on page 2-17.
- Use of the input side noise filter (3G3AX-NFI) of the external option has a noise reduction effect; however, note that leakage current is also generated.

● External Filter

It has a noise reduction effect that meets the requirements of EMC standards. Refer to the following table.

The table shows a selection for the Normal Duty (ND). When setting to the Light Duty (LD) or Very Low Duty (VLD), since the applicable motor runs at a duty ratio that uses the rating one class higher for a short time, you need to select peripheral devices according to the applicable motor capacity.

For the applicable motor capacity of the inverter, refer to *1-3-2 200V Class Specifications* on page 1-13.

Power supply	Model	Maximum applicable motor capacity (kW)		Input current	Leakage current (mA max.) with 60Hz
		3-phase 200 VAC	3-phase 400 VAC		
3-phase 200 VAC/400 VAC	3G3AX-EFI41	0.4, 0.75	0.4 to 2.2	7A	150
	3G3AX-EFI42	1.5	3.7	10A	150
	3G3AX-EFI43	2.2, 3.7	5.5, 7.5	20A	170
	3G3AX-EFI44	5.5	11	30A	170
	3G3AX-EFI45	7.5	15	40A	170
	3G3AX-EFI46	-	18.5	50A	250
	3G3AX-EFI47	11	22	60A	250
	3G3AX-EFI48	15	30	80A	250
	3G3AX-EFI49	18.5	37	100A	250
	3G3AX-EFI4A	22, 30	45, 55	150A	250
	3G3AX-EFI4B	37	75, 90	200A	250

● Installing Magnetic Contactor

To shut off the main circuit power supply with a sequence, you can use a magnetic contactor (MC) on the inverter side closer than a molded case circuit-breaker (MCCB).

However, do not run or stop the inverter by turning ON/OFF a magnetic contactor established at the input and output side of power supply of inverter. Otherwise, it may cause damage on the inverter.

Use the operation command signal (FW/RV) via the control circuit terminal of the inverter.

- Construct a sequence that turns *OFF* the power supply via the alarm output signal of the inverter.

- To use one or more braking resistors/regenerative braking units, construct a sequence that turns *OFF* a magnetic contactor via a thermal relay contact in each unit.

Precautions for Correct Use

Do not shut off the power supply more than once in 3 minutes. Otherwise, it may cause damage on the inverter.

● Inrush Current Flow When the Inverter Power Supply Is Turned ON

When the inverter power supply is turned ON, the charging current, which is called inrush current, flows in the main circuit board capacitor.
The table below shows the reference values at a power supply voltage of 240 V or 480 V when the power supply impedance is low. Take this into consideration when selecting the inverter power supply.

- With a low-speed no-fuse breaker, an inrush current 10 times the rated current can flow for 20 ms.
- To turn ON the power supply for multiple inverters simultaneously, select a no-fuse breaker with a 20-ms allowable current greater than the total inrush current shown in the following table.

Three-phase 200 V class		Three-phase 400 V class	
3G3RX2-	**Inrush current (Ao-P)**	**3G3RX2-**	**Inrush current (Ao-P)**
A2004-A2007	24	A4007-A4037	23
A2015-A2037	17	A4055-A4110	34
A2055-A2110	45	A4150-A4220	68
A2150-A2220	89	A4300-A4370	39
A2300	54	A4450-A4550	65
A2370-A2550	96	A4750-A4950	130
		A411K-A413K	260

● Main Power Supply Phase Loss and Single-phase Input

This inverter is designed for 3-phase power supply input. It cannot be used with a single-phase power supply.
Similarly, do not use the inverter in an input phase lost state of the 3-phase power supply. Doing so may result in inverter damage.
As shown in the table below, especially when the Phase S is lost, it cannot be detected even if the input phase loss detection function of the inverter is used. Check the power supply wiring before using the inverter.
Even if the R0-T0 terminal is separated from the main circuit and wired separately, the input phase loss detection function can detect only the Phase R and Phase T disconnection, and does not detect the S phase loss.

Phase loss	State
Phase R	The inverter does not operate.
Phase T	
Phase S	The inverter operates in a single-phase. Under voltage or over current may occur, which may damage the inverter.

Precautions for Safe Use

Even when the inverter is in an input phase lost state, built-in capacitors are charged. This may cause an electric shock or injury.

● Power Supply Environment

In the following cases, the internal converter module (rectifier) may be damaged.

Take countermeasures such as installing an AC reactor on the main circuit input side of the inverter.

- The power supply voltage unbalance factor is 3% or more.
- The power supply capacity is at least 10 times larger than the maximum applicable motor capacity (rated value in the Normal Duty (ND)), and 500 kVA or more.
- Rapid change in the power supply voltage occurs.

(Example) When the phase advance capacitor is wired to the contactor and can be turned on/off, or when multiple phase advance capacitors are installed side by side with a short wire or a bus.

● Installing Input Surge Absorber

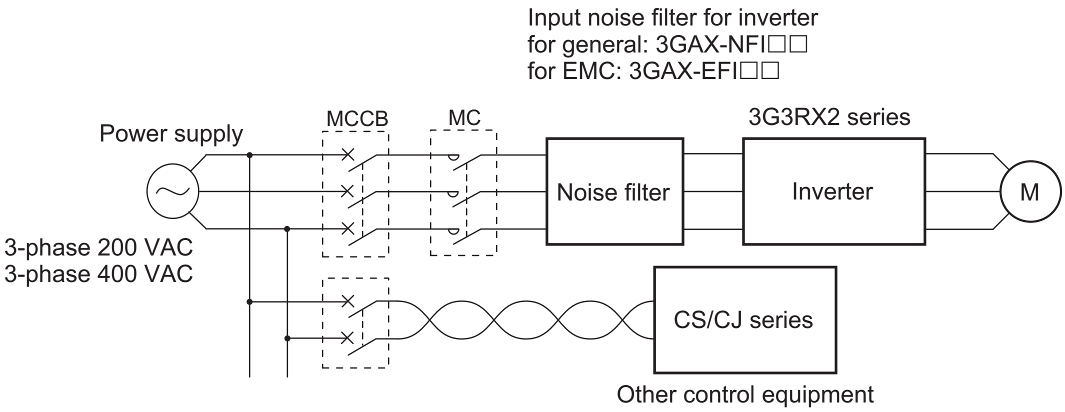
When using an inductive load (such as a magnetic contactor, magnetic relay, magnetic valve, solenoid, or electromagnetic brake), make sure to use a surge absorber or diode together.

● Installing Input Noise Filter

The inverter performs high-speed output switching, which may cause the noise flow from the inverter to power supply lines that negatively affects on peripheral equipment.

Therefore, it is recommended to use an input noise filter to reduce noise flowing out to power supply lines.

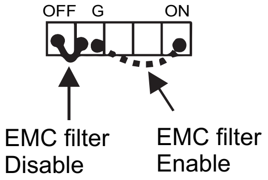
This also helps to reduce noise that enters the inverter from power supply lines.



Built-in EMC Filter Settings

This section shows how to set the EMC filter built into this inverter. There are 5 types of setting methods depending on the model.

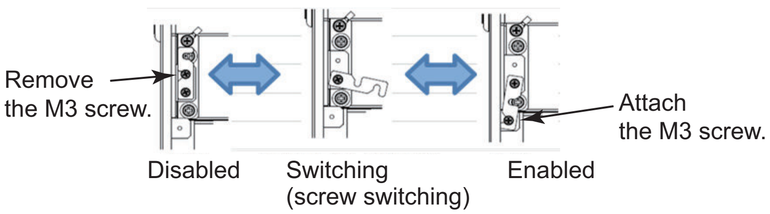
● Type in Which Short-circuit Wire with Ferrule Is Used



* Short-circuit wires with ferrules are attached to both ends.
To enable the EMC filter, short-circuit between the ON terminal and the G terminal.
To disable the EMC filter, open the ON terminal. Install the removed short-circuit wire between the OFF terminal and the G terminal.

● Type in Which Rotary Shorting Bar Is Used for Switching

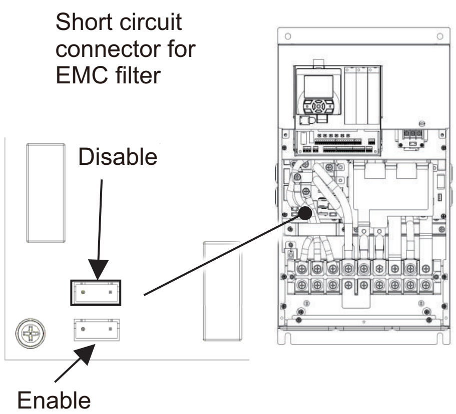
Switching method of EMC filters
- The EMC filter is enabled or disabled as follows.



● Type to Connect Short-circuit Pins with Short-circuit Connector - 1

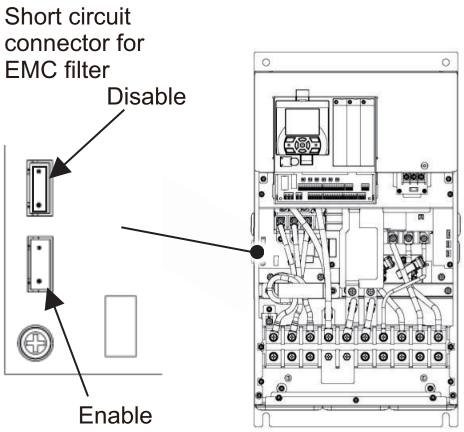
This is a type in which switching is performed by replacing the short-circuit connector attached to the switching connector.

* The EMC filter can be enabled/disabled by replacing the short-circuit connector.



● Type to Connect Short-circuit Pins with Short-circuit Connector - 2

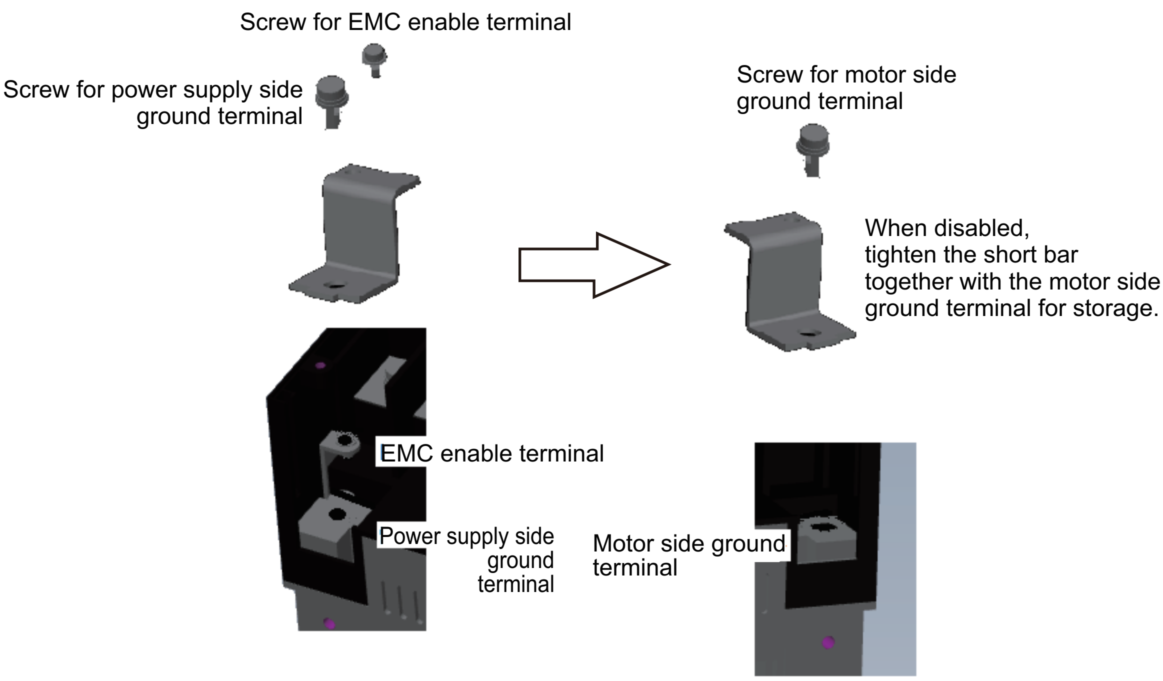
This is another type in which switching is performed by replacing the short-circuit connector attached to the switching connector.

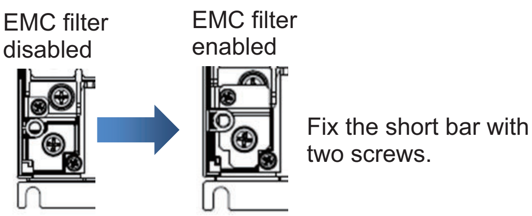


* The EMC filter can be enabled/disabled by replacing the short-circuit connector.

● Type in which Ground Terminal Shorting Bar Is Tightened Together

The EMC filter is enabled at the position of the ground terminal on the power supply side by using the shorting bar, the ground terminal screw, and the EMC filter enable screw. The EMC filter is set to the enabled position at factory default setting.

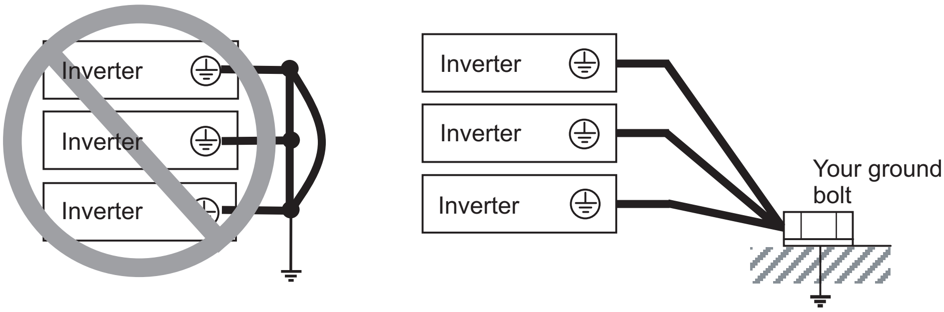




To disable the EMC filter, loosen and unscrew the EMC filter enable terminal (screw) and the left (power supply side) ground terminal, and remove the shorting bar from the left (power supply side) ground terminal. Tighten the removed shorting bar together with the right (motor side) ground terminal so that it will not be lost.

Wiring for Ground Terminal (G⏚)

To prevent electric shock, be sure to ground the inverter and the motor before using them.
The 200-V class should be connected to the ground terminal under type-D grounding conditions (conventional Class 3 grounding conditions: 100 Ω or less ground resistance). The 400-V class should be connected to the ground terminal under type-C grounding conditions (conventional special Class 3 grounding conditions: 10 Ω or less ground resistance).
For the ground cable, use the applicable cable or a cable with a larger diameter. Make the cable length as short as possible.
When multiple inverters are connected, the ground cable must not be connected across the multiple inverters or looped. Otherwise, the inverters and peripheral control equipment may malfunction.

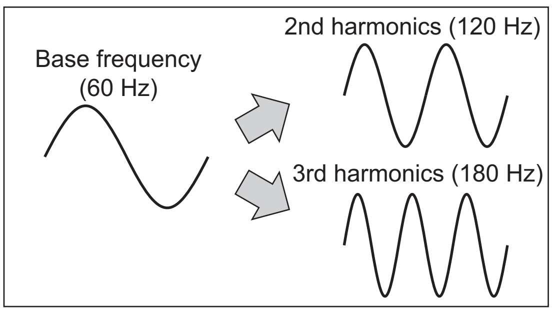


Harmonic Current Measures and DC/AC Reactor Wiring (PD, P)

In accordance with *Guideline to reduce harmonic emissions caused by electrical and electronic equipment for household and general use*, measures to suppress the amount of harmonic current outflow to the power supply line are required.
The following provides an overview of harmonics and measures against harmonics implemented in this inverter.

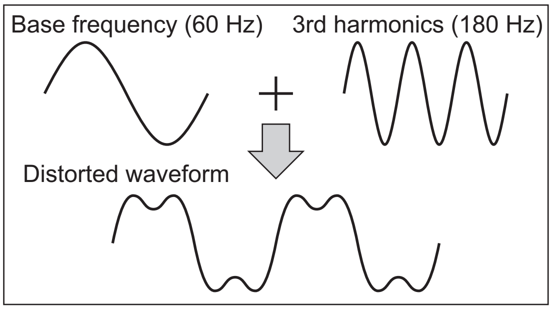
● Harmonics

A harmonic refers to the voltage or current whose frequency is an integral multiple of certain standard frequency (base frequency).
If a commercial power supply frequency of 60 Hz (50 Hz) is the standard frequency, the harmonics of that signal are as follows:
x2 = 120 Hz (100 Hz),
x3 = 180 Hz (150 Hz),
and so on.



● Reason Why Harmonics Cause Problems

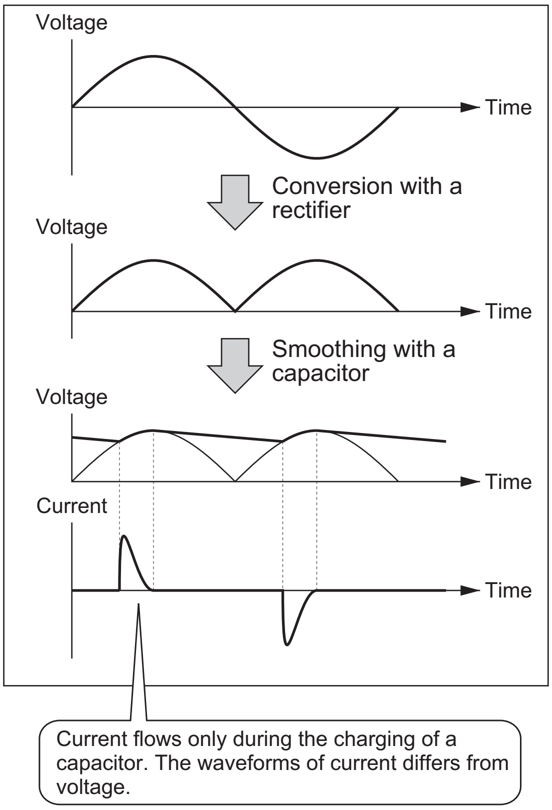
As the number of harmonics increases, the waveform of the commercial power supply has more distortion. This distortion causes the malfunction of the connected equipment or abnormal heat generation.



● Causes of Harmonics

General electrical equipment internally converts AC input power (commercial power) into DC power. At this time, harmonic currents occur because of the difference in the current flow direction between AC power and DC power.

- In an AC-to-DC power conversion, the rectifier converts the input power into a unidirectional voltage, which is then smoothened by the capacitor. As a result, the current charged into the capacitor has a waveform that contains harmonic components.
- The inverter also performs an AC-to-DC conversion, as with other electrical equipment, which allows current with harmonic components to flow. In particular, the inverter has more current than other equipment, so the number of harmonic components in current is larger.



DC/AC Reactor

To suppress harmonic currents, use the DC (direct current) and AC (alternating current) reactors. The DC/AC reactor functions to suppress a steep change in the current. The DC reactor has higher harmonics suppression ability, so even higher suppression ability can be expected when used in conjunction with the AC reactor.

Suppressing harmonic currents also leads to the improvement in the power factor on the input side of the inverter.

Before Wiring

The DC reactor is connected to the DC power supply located inside the inverter. Before wiring, be sure to turn off the power supply and make sure that the charge indicator is not lit.

Wire the inverter so that the heat from the optional DC reactor does not give any influences on the inverter.

Before connecting the DC reactor, remove the shorting bar between the PD and P terminals.

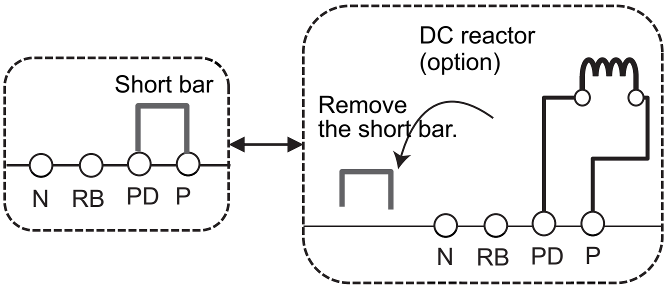
Note that the length of the DC reactor connection cable must be 5 m or shorter. Otherwise, you may not have desired performance of the inverter.

In case you do not use an optional DC reactor, do NOT remove the shorting bar between the PD and P terminals.

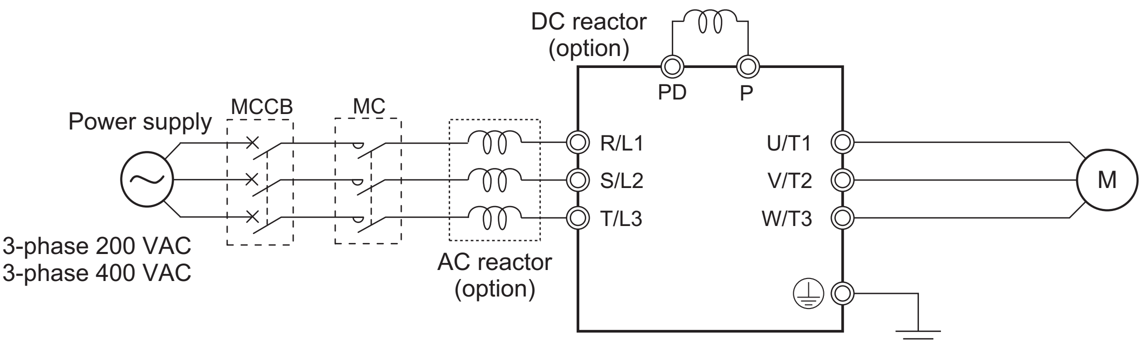
If you remove the shorting bar between the PD and P terminals with the optional DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

Wiring Method

<With optional DC reactor>



<With optional DC reactor and AC reactor>



Effect of Reactors

Through the use of DC and AC reactors, the harmonic current occurrence rate can be reduced as shown in the typical examples in the table of below.

Measures against harmonics	Harmonic current occurrence rate [%]							
	5th	7th	11th	13th	17th	19th	23th	25th
None (Inverter only)	65	41	8.5	7.7	4.3	3.1	2.6	1.8
With AC reactor	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
With DC reactor	30	13	8.4	5	4.7	3.2	3.0	2.2
With DC and AC Reactors	28	9.1	7.2	4.1	3.2	2.4	1.6	1.4

● Guideline for Reactor Selection

When implementing measures against harmonics, first install an optional DC reactor and evaluate its effect. Then, if further reduction is required, add an AC reactor.
To implement measures against harmonics in consideration of the power supply environment, first install an AC reactor and evaluate its effect. Then, if further reduction is required, add a DC reactor.
If you use multiple inverters and AC reactors, use one AC reactor for each inverter. Using only one AC reactor for more than one inverter does not provide sufficient reduction.

Wiring for Inverter Output Terminals (U/T1, V/T2, W/T3)

The following describes the wiring for the inverter output terminals (U/T1, V/T2, W/T3).

● Never Connect Power Supply to Output Terminals

Never connect the power supply to the output terminals U/T1, V/T2, W/T3.
The inverter is damaged internally if power supply voltage is applied to the output terminals.

● Never Short or Ground Output Terminals

Do not touch the output terminals with bare hand or contact the output wires with the inverter's case. Doing so may result in electric shock or ground fault.
Be careful not to short the output wires.

● Do Not Use Phase Advance Capacitors and Noise Filters

Never connect a phase advance capacitor or LC/RC noise filter for general-purpose power supplies to the output circuit.
Doing so may result in damage to the inverter or burnout of these parts.

● Do Not Use Magnetic Switches

Do not connect any magnetic switches or magnet contactor to the output circuit.
If a load is connected to the inverter in operation, the inverter's overcurrent protection circuit is activated due to the inrush current.

● Precautions for Connecting More Than One Motor to Inverter's Output Terminals

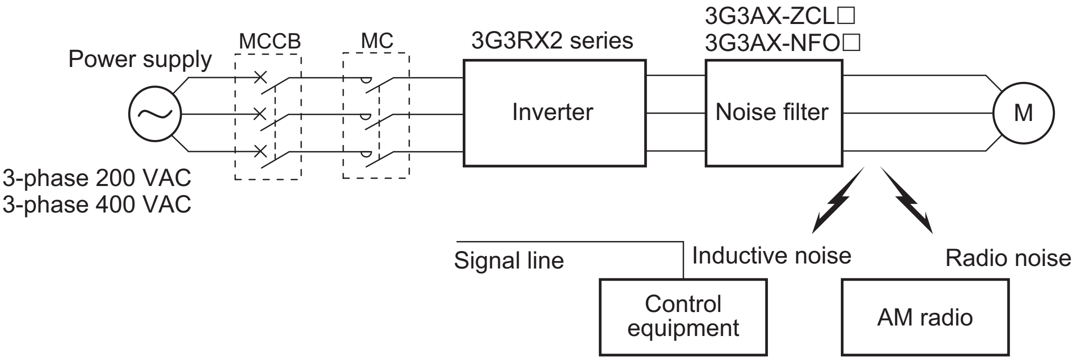
If connecting more than one motor to the output terminals of the inverter, note the following three points.

- Make sure that the Normal Duty (ND) rated current of the inverter is higher than the sum of the rated current values of the connected motors.
  Select an inverter with a sufficient capacity, taking emergency situations into consideration.

- The inverter cannot provide overload protection for individual motors, because it only detects a sum of the current values for all the connected motors.
  Install a thermal relay for each motor. The RC value of each thermal relay must be 1.1 times larger than the rated current of the motor.
- Set the inverter to detect only overloading that occurred in it by setting the inverter's rated output current to the electronic thermal level of the inverter.

● Installing Output Noise Filter

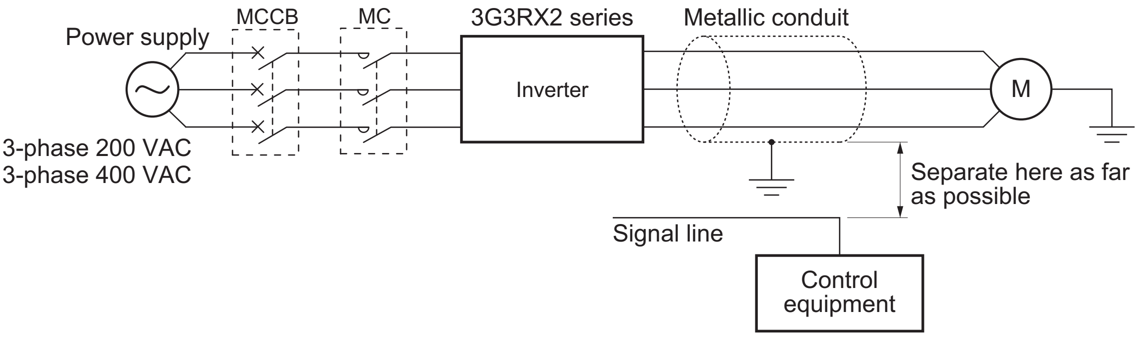
Connecting a noise filter to the output side of the inverter enables the reduction of radio noise and inductive noise.



Noise type	Description
Inductive noise	Produced by electromagnetic induction, this noise causes malfunction of control equipment due to noise in signal lines.
Radio noise	The electromagnetic waves emitted from the inverter body or cables cause noise in radio receivers.

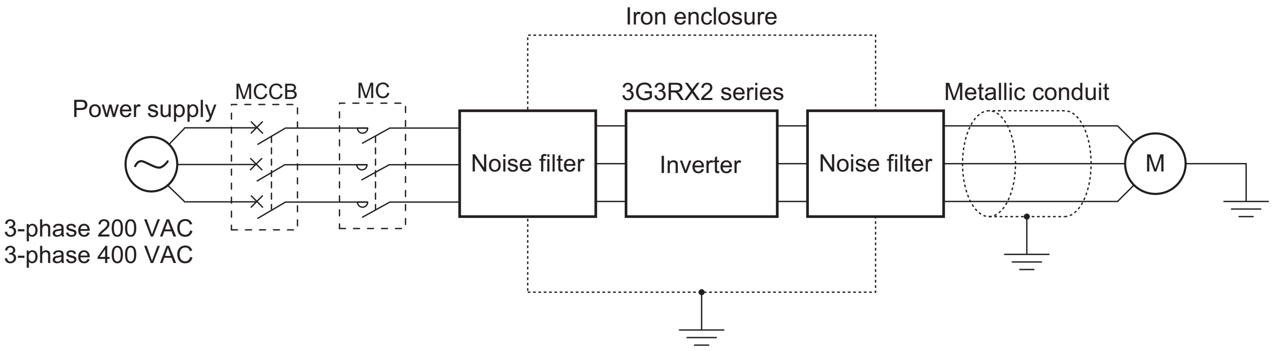
● Measures Against Inductive Noise

In order to suppress the inductive noise generated from the output side, in addition to installing the noise filter described above, you can connect a bundle of wires through a grounded metal conduit. Separate the metal conduit as far as possible from the signal line of the control equipment in order to suppress the influence of inductive noise.



● Measures Against Radio Noise

Radio noise is radiated from the inverter itself, besides the I/O wires.
This radio noise can be reduced by installing noise filters on both the input and output sides of the inverter and by installing and shielding the inverter body in a grounded iron enclosure etc.
Keep the cables between the inverter and the motor as short as possible.



● Cable Length Between Inverter and Motor

If the length of the cables between the inverter and the motor is long, consider how to address the following problems.

- Voltage drop in output cables.
  As the cable length between the inverter and the motor increases, the resistance in the cables becomes higher and accordingly the amount of voltage drop in the inverter output voltage becomes larger. This causes a decrease in the voltage that is applied to the motor, which results in a low output torque.
  If the cable is long, take measures to reduce the resistance, for example, by selecting cables whose wire diameter is larger than specified.
- Surge in long cables
  If the cable length exceeds 20 m, a surge voltage (approximately 1200 V maximum for 400-V class) may be generated at the motor terminal depending on the stray capacitance or inductance of the cable, which may result in motor burnout.
  In particular, when using a 400-V class inverter with a cable length of over 20 m, it is recommended to use a dedicated motor for the inverter. Dedicated motors for the inverter are designed to support the above surge voltage level.
- Leakage current from output cables
  As the cable length between the inverter and the motor increases, stray capacitance increases between the inverter output and the ground proportionally. The increase in the stray capacitance on the output side of the inverter causes an increase of the high-frequency leakage current.
  This high-frequency leakage current may negatively affect the current detector in the inverter output section or peripheral equipment.
  It is recommended to keep the wiring distance between the inverter and the motor at 100 m or shorter. If your system configuration requires the wiring distance of over 100 m, take measures to decrease the stray capacitance. The applicable measures include not wiring in a metal duct and using a separate cable for each phase.
  In addition, set a carrier frequency appropriate for the wiring distance between the inverter and the motor according to the table below.

Wiring distance between inverter and motor	50 m or less	100 m or less	Over 100 m
Carrier frequency	10 kHz or less	5 kHz or less	2.5 kHz

External Braking Resistor Connection Terminal (P, RB) and Regenerative Braking Unit Connection Terminal (P, N)

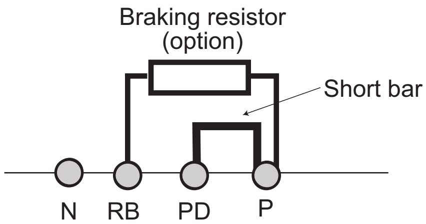
When driving a load with a large inertia or a vertical shaft, regenerated energy is fed back to the inverter when it is decelerating or generating downward movement.
If the amount of regenerative energy exceeds the allowable amount for the inverter, an overvoltage is detected. Use braking resistors or regenerative braking units to prevent this.

● 200 V Class Models with 22 kW and Lower and 400 V Class Models with 37 kW or Lower

These models have a built-in regenerative braking circuit.
To improve the braking capacity, connect the optional external braking resistor to these terminals (P, RB).

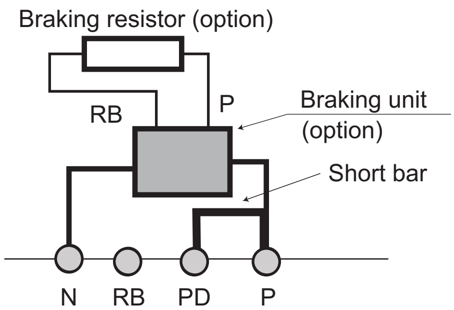
Precautions for Safe Use

- Be sure to install a circuit that detects overheating of the braking resistor via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the specified minimum connection resistance value. Doing so may result in damage to the regenerative braking circuit (e.g. built-in inverter, option 3G3AX-RBU).
- When using the braking resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class inverter, be sure to connect two braking resistors of the same model in series. Using the inverter with only one braking resistor connected may cause damage to the braking resistor.



● 200 V Class Models with 30 kW and Higher and 400 V Class Models with 45 kW or Higher

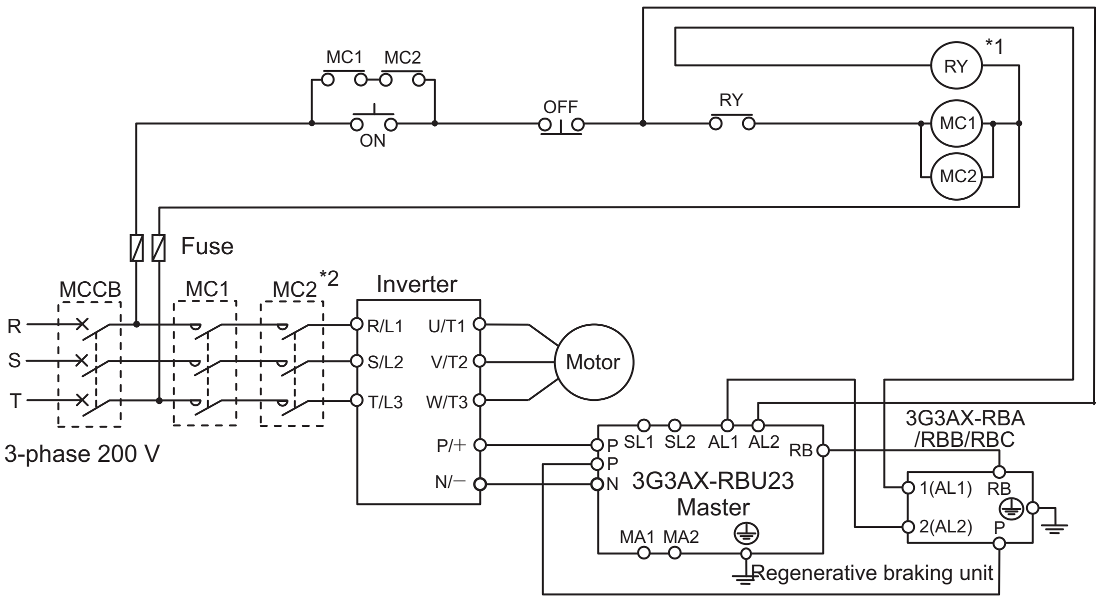
These models have no built-in regenerative braking circuit.
To improve the braking capacity, use the optional external braking resistor(s) and regenerative braking unit(s).
In this case, connect the terminals (P, N) of the regenerative braking unit to the inverter's terminals (P, N).



Precautions for Safe Use

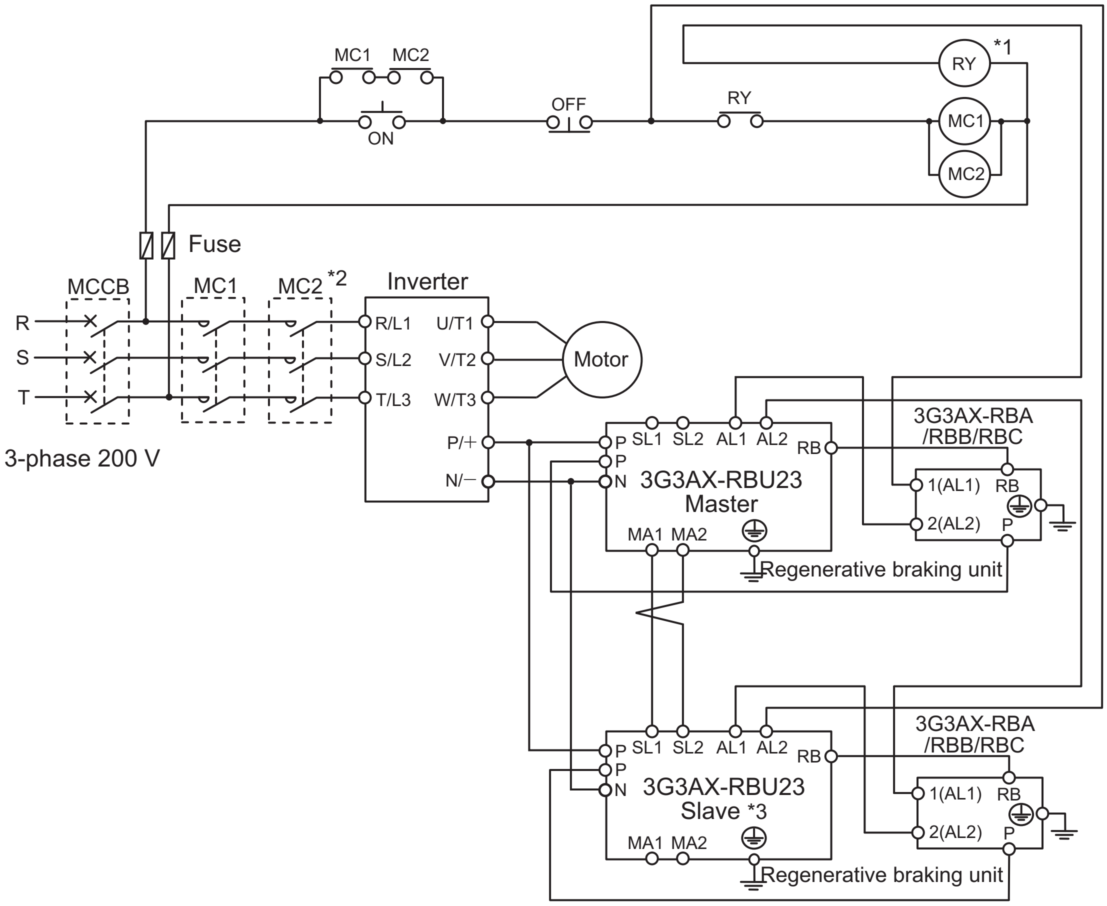
- Be sure to install a circuit that detects overheating of the regenerative braking unit(s) and braking resistor(s) via alarm contacts (thermal relay output terminals) and that shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the connection resistance value specified in the specifications table for that regenerative braking unit. Doing so may result in damage to the regenerative braking unit.
- When using the braking resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class regenerative braking unit (Model: 3G3AX-RBU41/RBU42/RBU43), be sure to connect two braking resistors of the same model in series. Using the regenerative braking unit with only one braking resistor connected may cause damage to the braking resistor.
- When using the regenerative braking unit (Model: 3G3AX-RBU21/RBU22/RBU41) with a built-in braking resistor with the braking resistor (Model: 3G3AX-RBA/RBB/RBC), remove the built-in resistor according to the manual for the regenerative braking unit. Using the regenerative braking unit with the built-in resistor connected may cause burnout of the built-in resistor.

● Wiring diagram for connecting one regenerative braking unit (Model: 3G3AX-RBU23)



*1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.
*2. MC1 and MC2 are used not only to provide redundancy, but also to meet safety standards.

●Wiring diagram for connecting two regenerative braking units (Model: 3G3AX-RBU23)



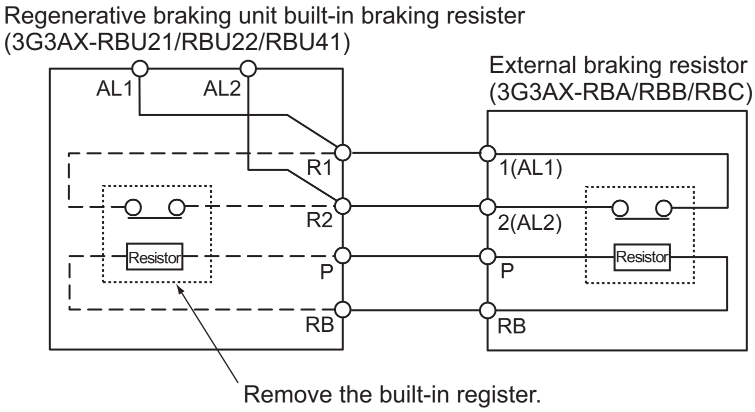
*1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.
*2. MC1 and MC2 are used not only to provide redundancy, but also to meet safety standards.
*3. You need to set DIP switch to regenerative braking unit as a slave, and wire terminal SL1 and SL2.

Precautions for Correct Use

Each braking resistor has alarm contact (thermal relay output) terminals as shown below. Be sure to perform wiring for these terminals.

Model	Alarm contact terminals
3G3AX-RBA□/ RBB□	Between terminal 1 and terminal 2
3G3AX-RBC□	Between terminal AL1 and terminal AL2

To remove the built-in register from the regenerative braking unit with a built-in braking resister (Model: 3G3AX-RBU21/RBU22/RBU41) in order to use the braking resistor (Model: 3G3AX-RBA/RBB/RBC), remove the wiring of thermal relay for the built-in resistor and connect the alarm contact (thermal relay output) terminals of the braking resistor with the terminals R1 and R2.



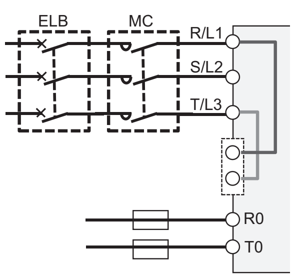
Connection for Separating Inverter Control Circuit Power Supply from Main Power Supply

If the inverter protection circuit is activated to shut off the magnetic contactor of the input power supply, the power to the inverter control circuit is also turned off, and the output terminal function [AL] alarm signal cannot be retained.
If the alarm signal must be retained, use control circuit power supply terminals R0 and T0.

(Connection method)

Receiving electricity specifications
200V class:
- 200 to 240VAC (+10%, -15%)
- (50/60 Hz ±5%)
- (Or, 282 to 339VDC)

400V class:
- 380 to 500VAC (+10%, -15%)
- (50/60 Hz ±5%)
- (Or, 537 to 707VDC)



By factory setting, the control circuit power supply (R0, T0) is supplied by connecting an electric wire to the R0 and T0 terminals via the J51 connector from the main power supply. Connect control circuit power supply terminals R0 and T0 with the primary circuit of the magnetic contactor according to the following procedure.

1. Remove the J51 connector.
2. Loosen the screw and disconnect the wire connected to the R0 and T0 terminals.
3. Connect the control circuit power cable to the R0 and T0 terminals.

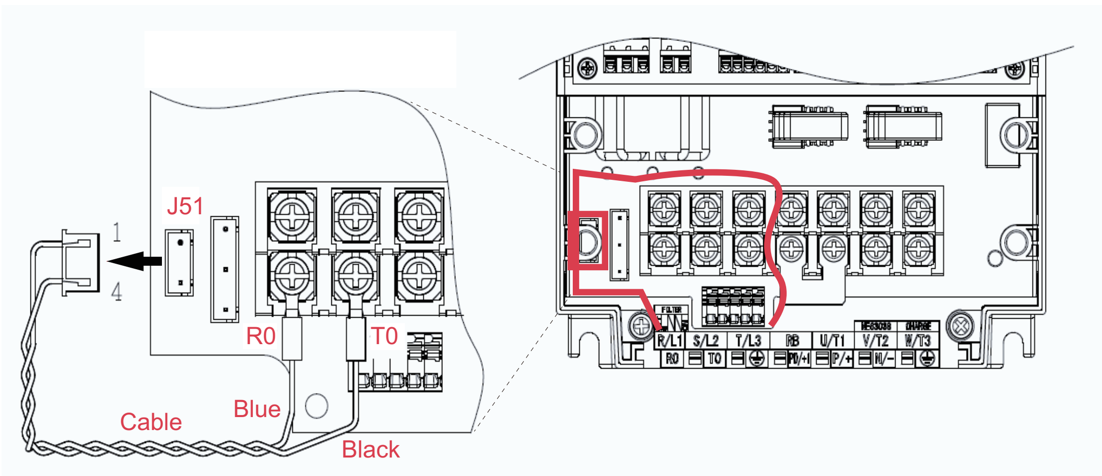
Precautions for Correct Use

To separate the control circuit power supply (R0, T0) from the main circuit power supply (R, S, T), observe the following instructions:

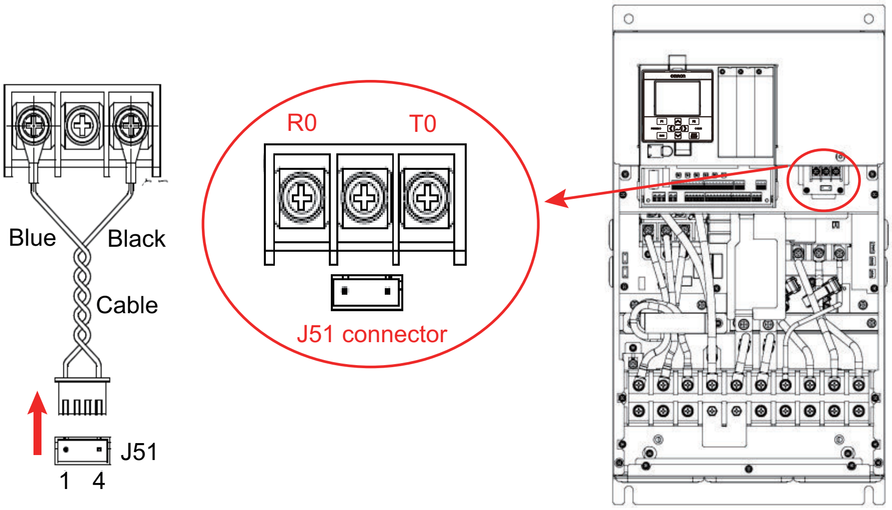
- For wiring between the R0 and T0 terminals (terminal screw size: M4), use a cable of 1.25 mm^2 or heavier.
- Connect a 3 A fuse to the control circuit power supply cable.
- If the control circuit power supply (R0, T0) is turned on before the main circuit power supply (R, S, T), ground fault detection is enabled at the main circuit power supply power-on. If the control circuit power supply (R0, T0) is turned on after or at the same time as the main circuit power supply (R, S, T), ground fault detection is enabled at the control circuit power supply power-on.
- If you supply direct current power supply to the control circuit power supply (R0, T0), set **Output terminal active state** (CC-11) to (CC-17) to *00: Normally open*. If it is set to *01: Normally closed*, output signal may chatter when the direct current is shut off.
- The tightening torque for the terminals R0 and T0 should be as follows.
  M4: 1.2 N·m (1.4 N·m max.)
- If you remove the J51 connector, keep the removed connector in case you need to use it again.

<Location of J51 connector>

1. A2004, A2007, A4007, A4015, A4022, and A4037



2. Models other than the above: Near the R0 and T0 terminals



2-3-5 Wiring for Control Circuit Terminals

Wiring for Control Circuit Terminals

The L, COM and CM2 terminals are insulated from each other via the input and output signal common terminals. Do NOT short-circuit or ground these common terminals. Do NOT ground the terminals via external equipment, either. When finished wiring, check the external equipment ground conditions.

For wiring to the control circuit terminals, use twisted-pair shielded wires. Connect the shielded wire to each common terminal.
Twist a cable connected to the TH+ (thermistor input) terminal with a cable of the TH- (thermistor common) terminal individually, and separate them from other CM1 common or L terminal cables. Since the current flowing through the thermistor is weak, separate the thermistor cable from main circuit wiring (power lines). The thermistor connection cable should be 20 m or shorter.
Connect diodes to output terminals and relay output terminals for the countermeasure of reverse electric power.
The control circuit terminal block has two rows of terminals. Start wiring from the lower terminals. Wiring from the upper terminals makes it difficult to wire the lower terminals.

Precautions for Correct Use

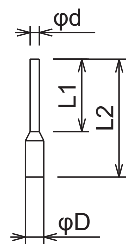
- Wiring the I/O signal lines for more than one inverter results in creating a sneak path in the circuit. Connect a diode for sneak current prevention.
- The control circuit connection cables should be 20 m or shorter. Otherwise, the inverter may not achieve specified characteristics due to voltage reduction or other reasons. When it is inevitable to use a connecting wire longer than 20 meters, apply analog insulating signal converter and confirm that the inverter operates correctly.
- Separate the cables for control circuit terminal connection from the main circuit cable (power lines) and the relay control circuit cable. If you cannot avoid crossing cables each other, try to keep them at right angles to each other. Not doing so may result in the inverter malfunction. Separate signal lines from power supply lines when wiring.
- Do not short-circuit between the analog power supply H and L terminals, the interface power supply P24 terminal and CM1 terminal, and the common terminals. Doing so may result in failure of the inverter.
- After wiring, pull the wire slightly to confirm that it is connected properly.

● Recommended ferrules

Spring-clamp types of terminals are used for the control circuit terminal blocks. We recommend to use ferrules in the following specifications for signal lines in order to improve wiring and reliability of connecting.

Ferrules with sleeves

Wire size mm^2 (AWG)	L1 [mm]	L2 [mm]	φd [mm]	φD [mm]
0.25 (24)	8	12.5	0.8	2.0
0.34 (22)	8	12.5	0.8	2.0
0.5 (20)	8	14	1.1	2.5
0.75 (18)	8	14	1.3	2.8

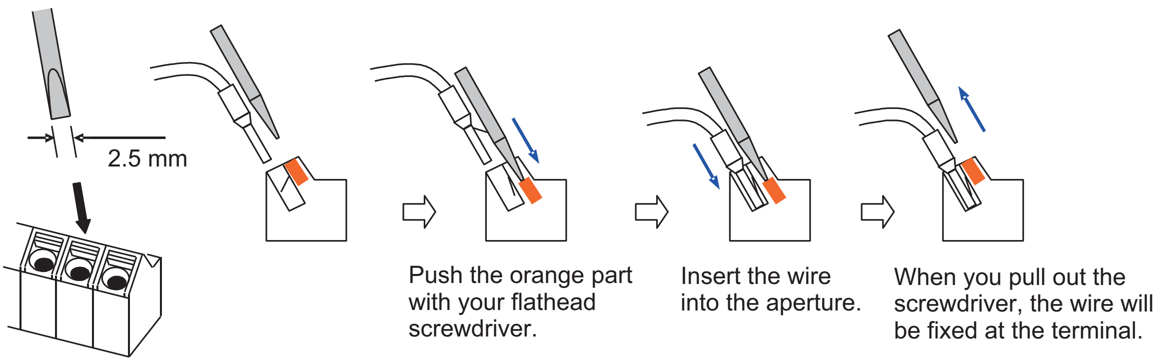


● Wiring Method

1 Push the orange colored part on the control circuit terminal block with a flathead screwdriver (2.5 mm widths or narrower). (The wire-inserting aperture (the circular hole) will open.)

2 While you are holding the screwdriver in the hole, insert the wire or ferrule into the wire-inserting aperture.

3 When you pull out the screwdriver, the wire will be fixed at the terminal.



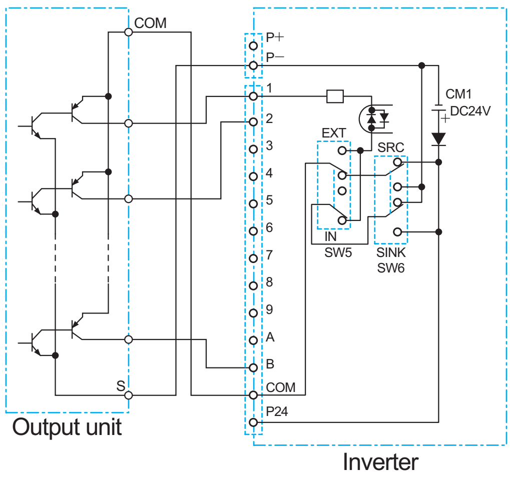
Precaution for Pulling Out the Wire

Pull the wire out of the terminal block, while you keep opening the wire-inserting aperture by pushing the orange part with your screwdriver.

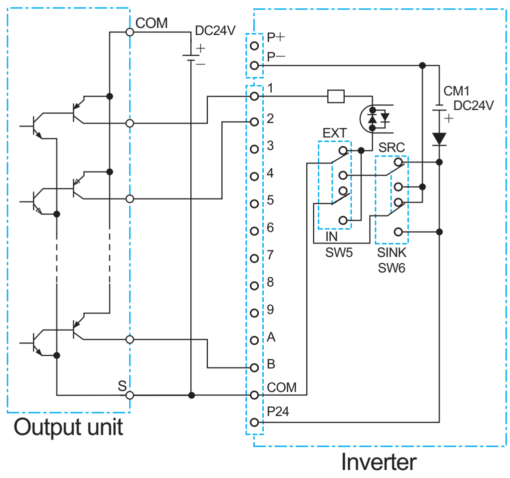
Input Terminals and Programmable Controller Connection

● Source Logic

When inverter's internal power supply is applied



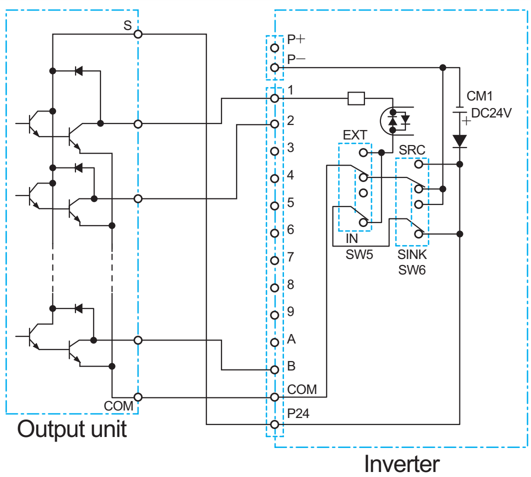
When external power supply is applied



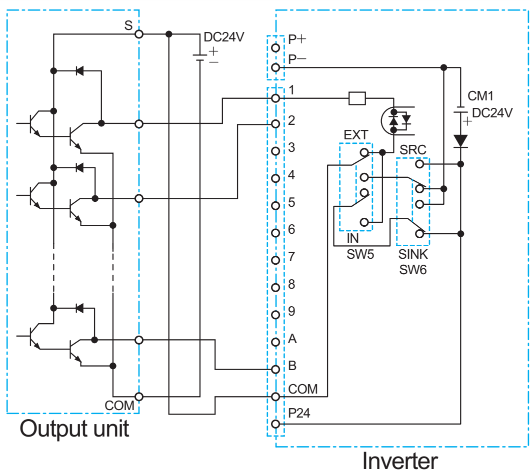
- If you apply the inverter's internal power supply, set SW5 to *IN*.
- If you apply the external power supply, set SW5 to *EXT*.
- If you connect a source type output unit, set SW6 to *SRC*.

● Sink Logic

When inverter's internal power supply is applied



When external power supply is applied



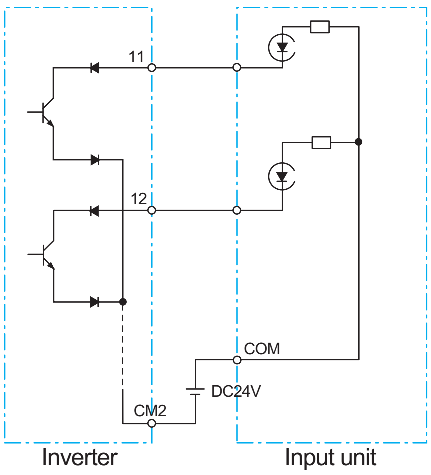
- If you apply the inverter's internal power supply, set SW5 to *IN*.
- If you apply the external power supply, set SW5 to *EXT*.
- If you connect output unit of sink type, set SW6 to *SINK*.

Precautions for Correct Use

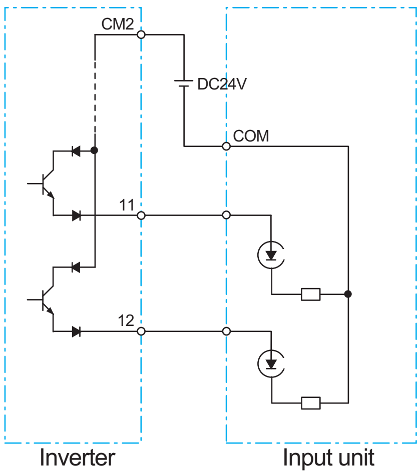
- Confirm the SW6-position for switching the sink/source logic, before turning on the main power supply. Not doing so may result in damage of the inverter or its peripheral unit.
- Make sure you must turn on the programmable controller and its external power supply at first before you turn on the inverter's power supply. Otherwise, the data in the inverter may be altered.

Output Terminals and Programmable Controller Connection

● Sink Logic



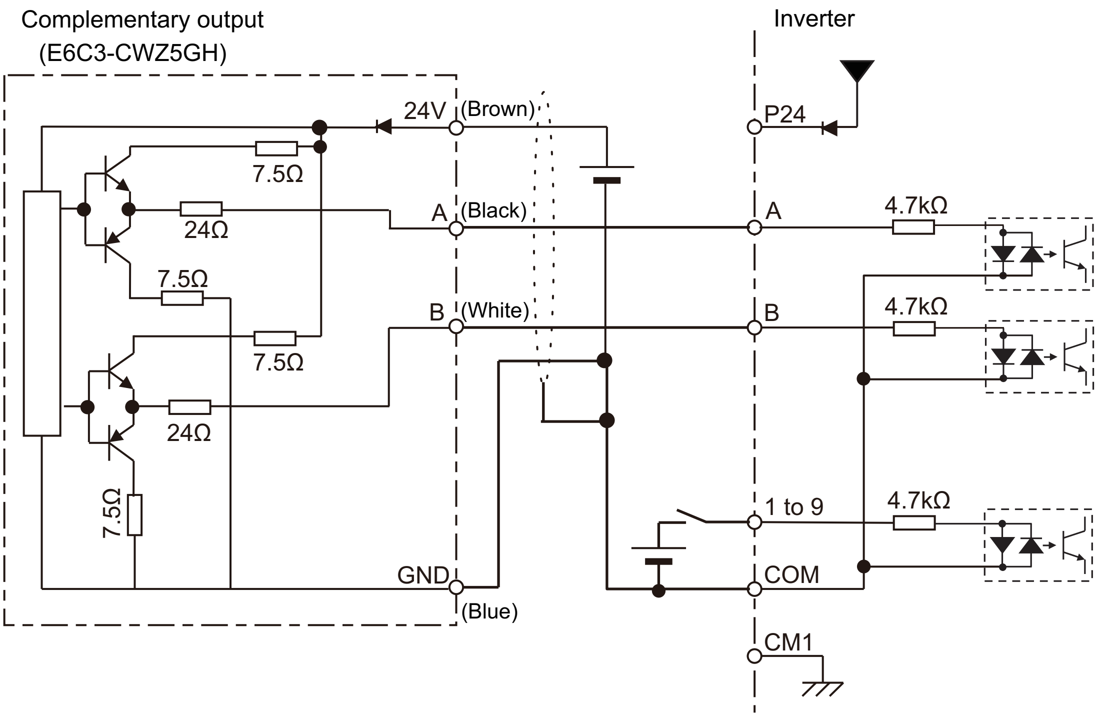
● Source Logic



Encoder Connection to Input Terminal

When connecting the encoder directly to the control circuit of the inverter, use a complementary type encoder. In order to separate the encoder power supply from other circuits, we recommend the following: to set the SW5 switch on the control terminal block to the EXT external power supply; and to wire the 24V power supply for the encoder separately from the power supply for non-encoder.

(Wiring example)



- Assign pulse input terminals 103 (PLA) and 104 (PLB) to the A and B terminals, respectively.
- The above figure shows the wiring when the SW5 switch of the control terminal block is set to the EXT external power supply. When using a complementary type encoder, make the settings as shown in the figure.
- Inputs other than pulses also apply circuits that use an external power supply as shown in the figure. (For the transistor circuit, apply a source type circuit in which a negative power supply is wired on the COM side.)

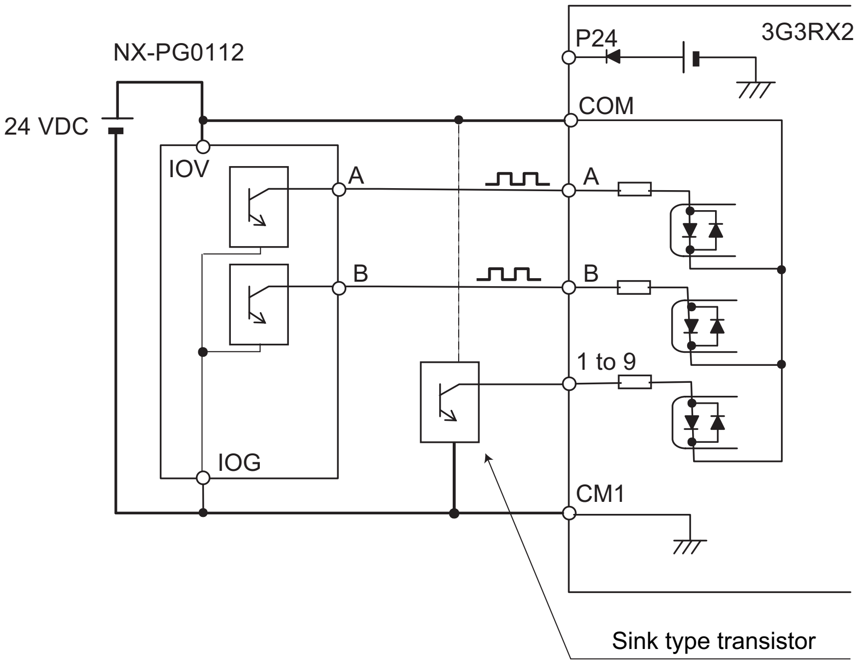
Pulse Command Connection to Input Terminal

This is the wiring when the high-speed pulse output from the programmable controller or the monitor pulse output from another inverter is used as a command.

Additional Information

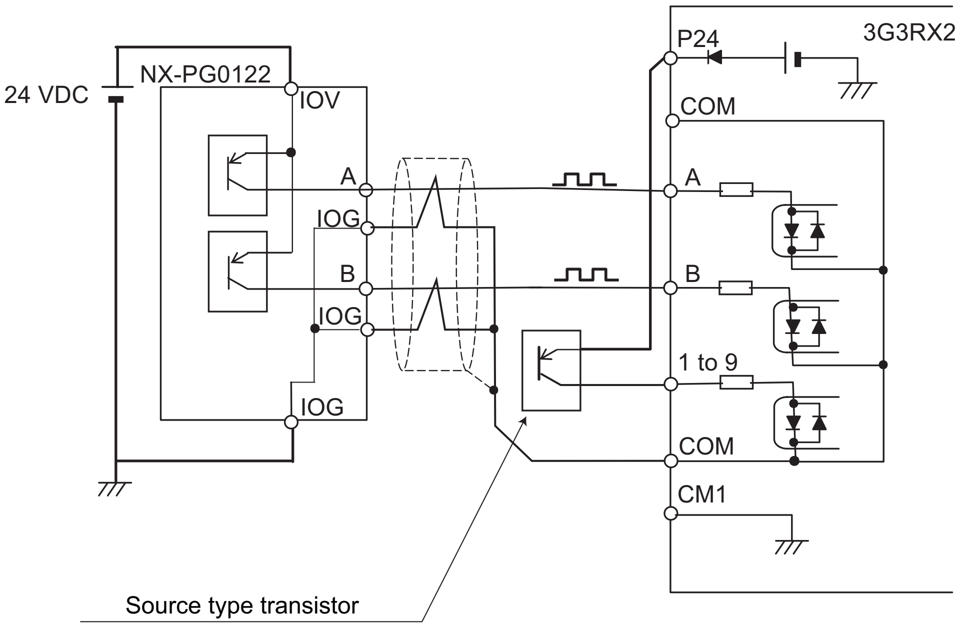
For the pulse input method, use the programmable controller settings and inverter settings. For pulse input settings, refer to *8-14 Pulse String Input Terminal Function* on page 8-195 and *Safety Precautions* on page 19.

● Connection Example of Sink Logic



- The above figure shows the wiring when the SW5 switch of the control terminal block is set to the EXT external power supply.
- Inputs other than pulses also apply sink type circuits as shown in the figure. (For the transistor circuit, apply a sink type circuit in which the positive voltage of the power supply is wired to the COM side.)

● Connection Example of Source Logic



- The above figure shows the wiring when the SW5 switch of the control terminal block is set to the EXT external power supply.
- Inputs other than pulses also apply source type circuits as shown in the figure. (For the transistor circuit, apply a source type circuit in which the negative voltage of the power supply is wired to the COM side.)

2-3-6 Wiring for PG Option Unit

To use PG vector control with this inverter, you need to mount and wire the PG Option Unit 3G3AX-RX2-PG01.
Then, install a detector (encoder) to the motor rotating shaft and wire it to the PG Option Unit.
For the detector (encoder), use a line-driver output type encoder. This is required for PG vector control, position control, or torque control operation.

Terminal Functions

Terminal name		Terminal symbol	Functions	Common terminal	Electric specifications
Input terminal	Pulse train position command input	SAP SAN SBP SBN RSA RSB	Pulse train input mode MD0: 90° phase difference pulse MD1: Forward/Reverse rotation signal + Pulse train MD2: Forward rotation pulse/Reverse rotation pulse according to Mode selection of pulse train input (ob-11). • RSA: Termination resistor ON/OFF terminal between SAP and SAN • RSB: Termination resistor ON/OFF terminal between SBP and SBN Termination resistor setting Built-in termination resistor: 150 Ω, switch between enabled and disabled with the wiring RSA, RSB terminals released: Built-in termination resistor disabled RSA-SAN short-circuit, RSB-SBN short-circuit: Built-in termination resistor enabled		5 VDC receiver input (RS-422 compliance)
	Encoder signal input	EAP EAN EBP EBN EZP EZN	A, B, Z: Rotary encoder signal input		Photo coupler input (Supports the 5 VDC line driver output type rotary encoder)
Output terminal	Encoder signal output	AP AN BP BN ZP ZN	Signal output according to the encoder input at pulse ratio (1:1)		5V DC line driver output (RS-422 compliance)
	Power supply for encoder	EP5	+5 VDC power supply	EG	Total supply capacity of EP5 and EP12 250 mA max.
		EP12	+12 VDC power supply		
Functional earth terminal		FG	It is a M3 screw terminal for providing a reference potential for signal stabilization. Connecting to a PLC or encoder, use the EG terminal to connect to the signal common (SC) of other devices (screw size M3). The FG terminal is provided for an additional purpose. If it is difficult to avoid multi-point grounding, you may use the EG terminal only without wiring the FG terminal.		

Specifications

Item		Specifications	
Model		3G3AX-RX2-PG01	
Dimensions (width × height × depth)		20.5 × 98.0 × 70.0 mm	
Weight		170 g	
Environment	Operating ambient temperature	-10 to 50℃	With no icing or condensation
	Operating ambient humidity	20 to 90%RH	
	Storage temperature*1	-20 to 65℃	
	Vibration resistance	5.9 m/s^2 (0.6G), 10 to 55 Hz	
	Protective structure	IP00	
Encoder Feedback		• Standard encoder pulse: 1024 pulse/r • Max. input pulse: 200k pulse/s	
Position command		Max. input pulse: 200k pulse/s	
Protective function		• Encoder cable breakage protection • RX2-PG connection error	

*1. The storage temperature is the temperature during transport.

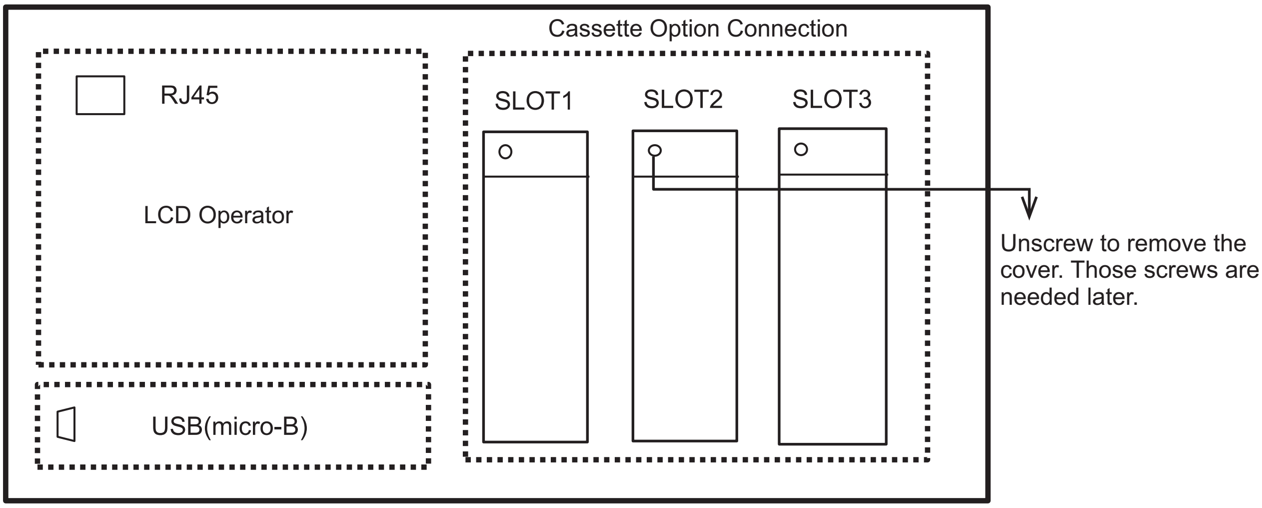
PG Option Unit Mounting

Install the PG Option Unit to the inverter's Cassette Option Connection. Install the PG Option Unit to SLOT2.

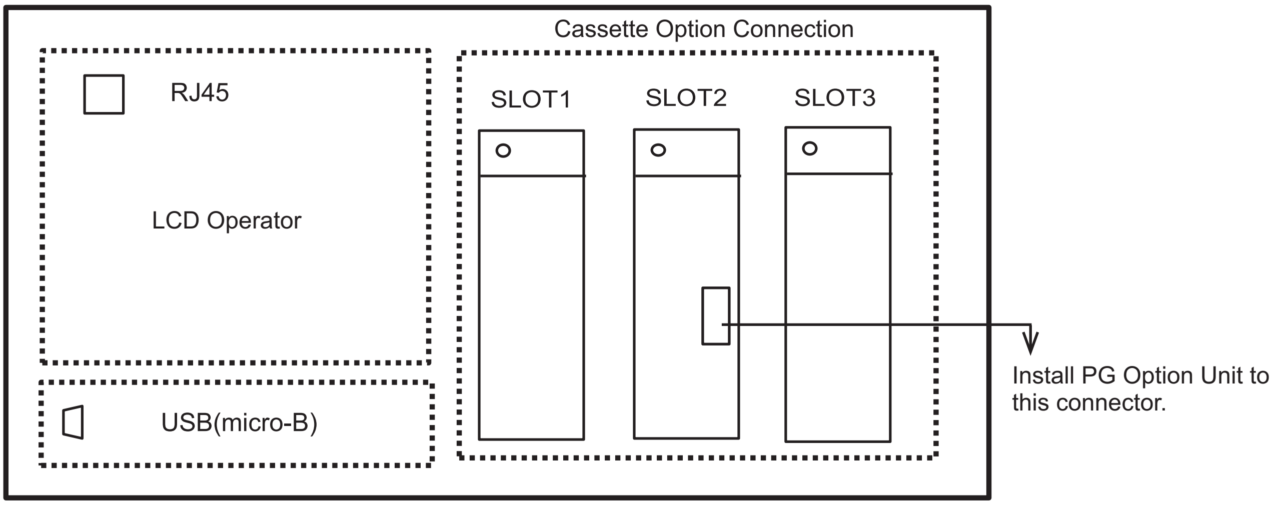
Precautions for Correct Use

If you install the PG Option Unit to SLOT1, the inverter cannot be operated due to the power disconnection.
If you install the PG Option Unit to SLOT3, the inverter and PG Option Unit may result in damage due to connector's interference.

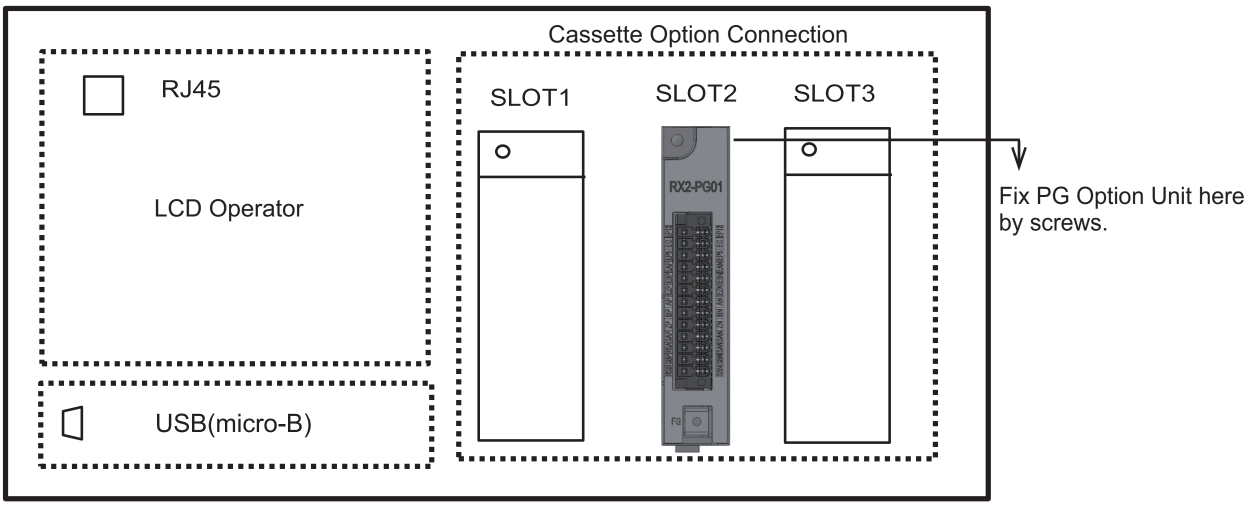
a. Remove the cover on the Cassette Option Connection of the main body. The removed cover is not needed any more but it must be kept properly. It may be needed in case you operate the inverter temporarily when the Option Unit fails. The screws which had fixed the cover are needed for fixing the PG Option Unit.



b. Install PG Option Unit to the connector in SLOT2. Do NOT use the other connector located above for PG Option Unit.



c. Fix the PG Option Unit to SLOT2 using the screws which you unscrewed at Step 1. Then, connect the FG terminal to the functional grounding.

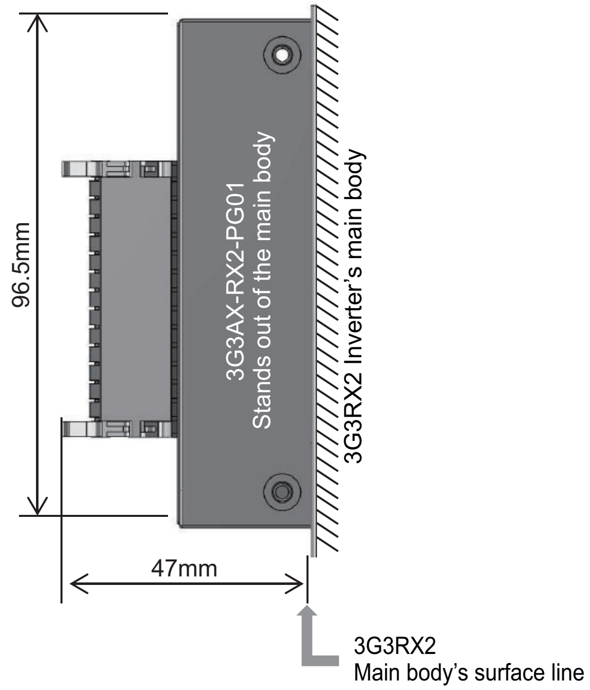


Precautions for Correct Use

- To mount the PG Option Unit, connect the connector and be sure to tightly fix it with the screw. Otherwise, the inverter cannot operate properly.
- When removing the PG Option Unit from the inverter, be sure to back the cover of the inverter to the original position.

Installation Dimension of PG Option Unit

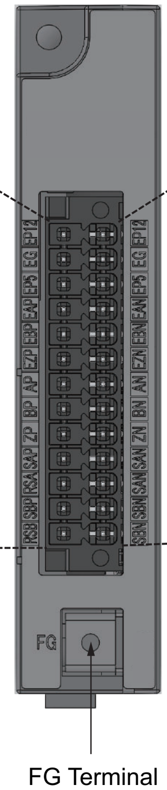
When you install PG Option Unit 3G3AX-RX2-PG01 to the inverter, it will stand out of the inverter's front surface as following dimension. When you install the unit, take a special care for it.



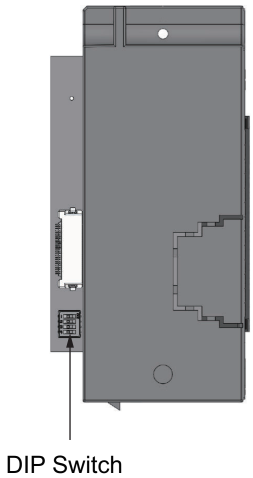
Terminal Arrangement on PG Option Unit

The arrangement of the terminals on the PG Option Unit 3G3AX-RX2-PG01 is shown below.

EP12	1
EG	3
EP5	5
EAP	7
EBP	9
EZP	11
AP	13
BP	15
ZP	17
SAP	19
RSA	21
SBP	23
RSB	25



2	EP12
4	EG
6	EP5
8	EAN
10	EBN
12	EZN
14	AN
16	BN
18	ZN
20	SAN
22	SAN
24	SBN
26	SBN



Put the attached terminal name label on the side of the terminal block. The signal name on the label is printed larger than the print on the front of the product, which helps to identify it during wiring work.

● Input Terminals

Terminal symbol	Terminal name	Functions	Electric specifications
SAP SAN SBP SBN RSA RSB	Pulse train position command input	• **Mode selection of pulse train input** (ob-11)*1 MD0: 90° phase difference pulse MD1: Forward/Reverse rotation signal + Pulse train MD2: Forward rotation pulse/Reverse rotation pulse • RSA: Termination resistor ON/OFF terminal between SAP and SAN • RSB: Termination resistor ON/OFF terminal between SBP and SBN • Built-in terminating resistor value: 150Ω	Line driver input 5 VDC receiver input (RS-422 compliance)
EAP EAN EBP EBN EZP EZN	Encoder signal input	A, B, Z: Encoder signal input	Photocoupler (5 VDC line driver output type rotary encoders supported)

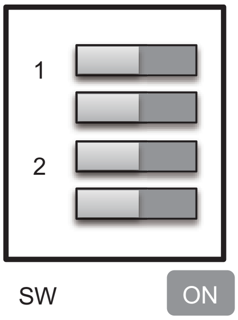
*1. You can select the pulse train mode in the parameters of the inverter body.

● Output Terminals

Terminal symbol	Terminal name	Functions	Electric specifications
AP AN BP BN ZP ZN	Encoder signal output	Output encoder input pulses in a ratio 1 to 1.	5 VDC line driver output (RS-422 compliance)
EP5 EP12 EG (Common)	Encoder power supply	EP5: 5 VDC power supply EP12: 12 VDC power supply	Total power supply capacity of EP5 and EP12: 250 mA max.

● DIP Switch

Slide the DIP switch to the left to turn it OFF, and slide it to the right to turn it ON.
All the dip switches are turned OFF at the factory default setting.
Set the switches before installing the device.

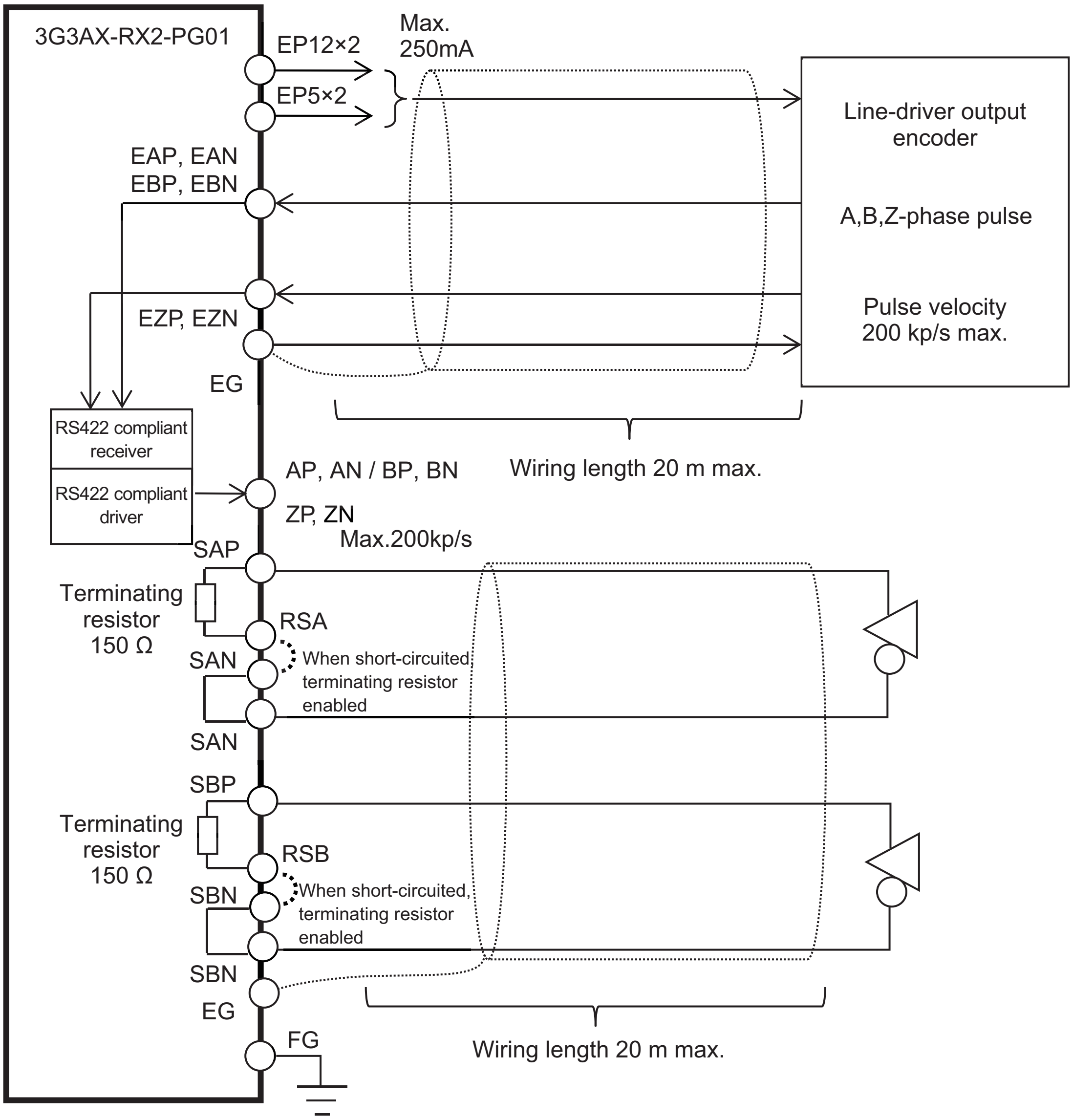


The switches are located behind the unit. You must set the terminal before installation.

Switch No.	Setting description	
1	ON	Encoder A and B phase disconnecting detection enabled
	OFF	Encoder A and B phase disconnecting detection disabled
2	ON	Encoder Z phase disconnecting detection enabled
	OFF	Encoder Z phase disconnecting detection disabled
3	ON	Do not change the setting.
	OFF	
4	ON	Do not change the setting.
	OFF	

Wiring of PG Option Unit

The following describes the wiring of PG Option Unit 3G3AX-RX2-PG01.



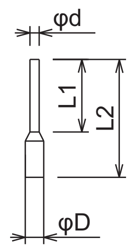
The wire length between devices, such as between the encoder and PG Option Unit, must be 20 m or shorter.
Use twisted pair shielded cable for the signal line.
When you connect cables, we recommend you to connect an encoder's shielded wire to the *EG* terminal on the PG Option Unit. If the cable is not shielded properly, the inverter may malfunction due to the influences of external noises. Generally, shielded wires are connected to the common signal terminal or chassis earth terminal. However, do not connect at multiple points.
Connect the *FG* terminal of PG Option Unit to functional grounding.
If you link-up the encoder power supply terminal of PG Option Unit by relay amplifier, distance between the relay amplifier and PG Option Unit must be 20 m or shorter.
When you connect a cable between the relay amplifier and PG Option Unit, we recommend you to connect the shielded wire to the *EG* terminal of PG Option Unit.
As for the connection between relay amplifier and encoder, such as the connecting method and cable length, ask and confirm the input specifications of the relay amplifier to the manufacturer before connecting.
If the wiring to PG Option Unit exceeds 20 m, the inverter may malfunction due to the influences of external noises. Take a special care for the wiring of relay amplifier for it.

When you supply the power to the encoder from devices other than PG Option Unit, connect the common of encoder power supply (basic potential) to the *EG* terminal of PG Option Unit.

● Recommended Ferrules

We recommend to use ferrules in the following specifications for signal lines in order to improve wiring and reliability of connecting.

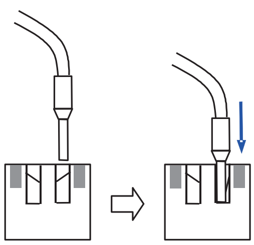
Wire size mm^2 (AWG)	L1 [mm]	L2 [mm]	φd [mm]	φD [mm]
0.25 (24)	10.0	14.5	0.8	2.0
0.34 (22)	10.0	14.5	0.8	2.0
0.5 (20)	10.0	16.0	1.1	2.5
0.75 (18)	10.0	16.0	1.3	3.4



Note that those specifications above are different from the recommended ferrules for the inverter's main body.
Up to one ferrule can be used per terminal. Wiring methods for terminals where two or more wires are inserted, such as the EG terminal, include wiring without ferrules, or connecting externally crimped terminals using ferrules, such as two insertion type ferrules.

● Insertion Method

Insert a ferrule to the terminal block of PG Option Unit. A recommended ferrule can be inserted without tools.

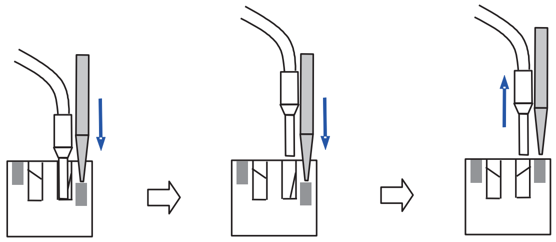


Insert the wire here.

If you do not use a recommended ferrule, insert the cable with a flathead screwdriver referring to Step 3 of the pull-out method shown below.

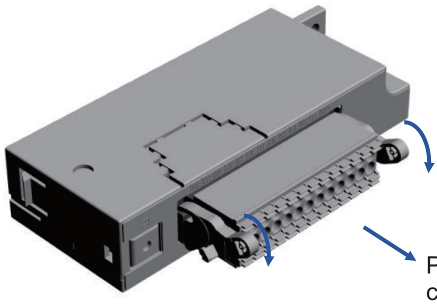
● Pull-out Method

1. Push the gray colored part on the PG Option Unit terminal block with a flathead screwdriver (2.5 mm widths or narrower). The wire-inserting aperture will open.
2. While you are holding the screwdriver, pull out the wire or ferrule.
3. Pull out the screwdriver.



● Connector Removing Method

1. Pull down the lock lever to the direction indicated by the arrow to release the lock.
2. Pull out the connector.



PG Option Unit Disconnection Detection

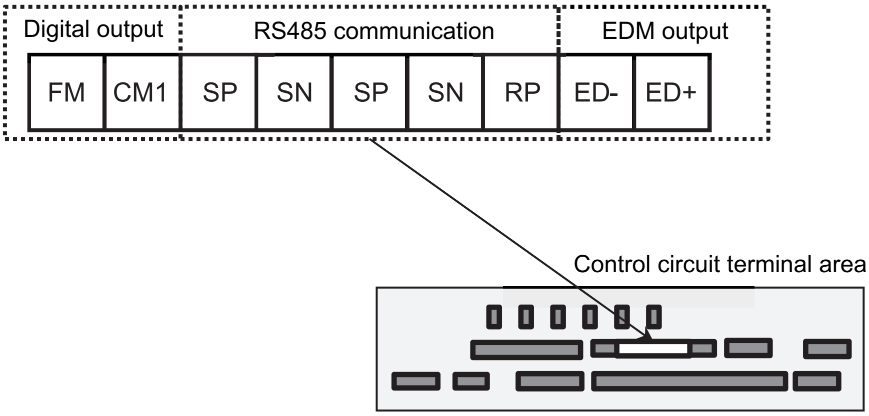
The encoder input terminals (EAP, EAN, EBP, EBN, EZP, and EZN) have a function to detect disconnection when the terminals are closed.
When you do not connect any encoders (when EAP, EAN, EBP, EBN, EZP, and EZN are closed), turn the DIP switch 1 and 2 to OFF in order to disable the detection of disconnection.
As for the encoder without Z-phase, turn the DIP switch 2 to OFF to disable the detection of Z-phase disconnection.

2-3-7 Wiring for RS485 Communication Terminals

The 3G3RX2 Series Inverter has an RS485 communications capability that enables the inverter to communicate with an external controller from its RS485 communications terminal block on the control terminal block PCB. For the communications protocol, the inverter supports the Modbus communication.

This section describes the wiring procedure for the RS485 communications terminal block and the installation of the terminating resistor. For details on communication functions, refer to *Section 9 Communication function* on page 9-1.

Wiring for RS485 Communication Terminal Block



Terminal symbol	Terminal name	Function
SP*1	RS485 sending/receiving terminal + side	At + side of sending/receiving signal of RS485 communication. There are two SP terminals for wiring on the upstream side and the downstream side, and they are connected internally. If you use an external terminating resistor at the termination, connect it to this terminal.
SN*1	RS485 sending/receiving terminal - side	At - side of sending/receiving signal of RS485 communication. There are two SN terminals for wiring on the upstream side and the downstream side, and they are connected internally. For the termination, connect this terminal to the RP terminal and enable the built-in terminating resistor, or connect an external terminating resistor to this terminal.
RP	Enable terminating resistor terminal	A terminal which enables built-in terminating resistor (100Ω). The internal terminating resistor can be enabled when you connect the - side of RS485 communication sending/receiving terminal to RP.
CM1*2	Signal ground	You can connect a signal ground of an external communication device. (Also used by FM terminal)

*1. There are two terminals, which are connected internally.
*2. The CM1 terminal is internally connected to the negative side of the internal 24V.

● Wires

The sizes of the wires and ferrules connected to the RS485 communications terminal block are as follows. For the ferrules to be used, refer to *Recommended ferrules* on page 2-63.

Wire type	Wire size (mm^2)
Solid wire	0.14 mm^2 to 1.5 mm^2 (If two equal-sized wires are connected to one pole: 0.14 mm^2 to 0.5mm^2)
Stranded wire	0.14 mm^2 to 1.0mm^2 (If two equal-sized wires are connected to one pole: 0.14 mm^2 to 0.2mm^2)

● Wiring Method

Connect the communication wire to the control circuit terminal block.

Precautions for Correct Use

- Separate signal lines for control from the main circuit cable and other power supply or power lines when wiring.
- Do not solder the wire ends. Doing so may result in a contact failure.
- When ferrules are not used, the wire strip length must be approximately 5.0 mm.
- Connect the shielded wire to the CM1 terminal (frequency command common) of the 3G3RX2 Series Inverter. Do not connect it to the controller.
- Insulate the shielded part of the wire with tape or some other means so that it does not come into contact with other signal lines or equipment.

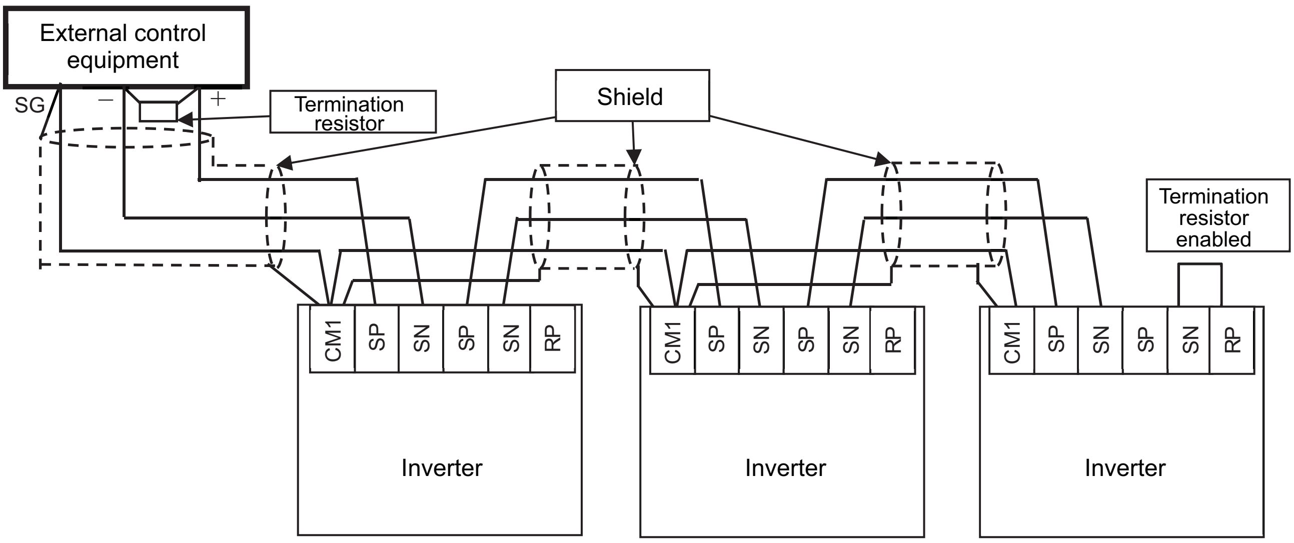
Installing Terminating Resistor

Connect each inverter in parallel as shown below.

For the terminating inverter, short-circuit between the RP and SN terminals.

When you connect only one inverter, also short-circuit between the RP and SN terminals.

The built-in terminating resistor (100Ω) of this inverter can be connected by shorting the RP and SN terminals.

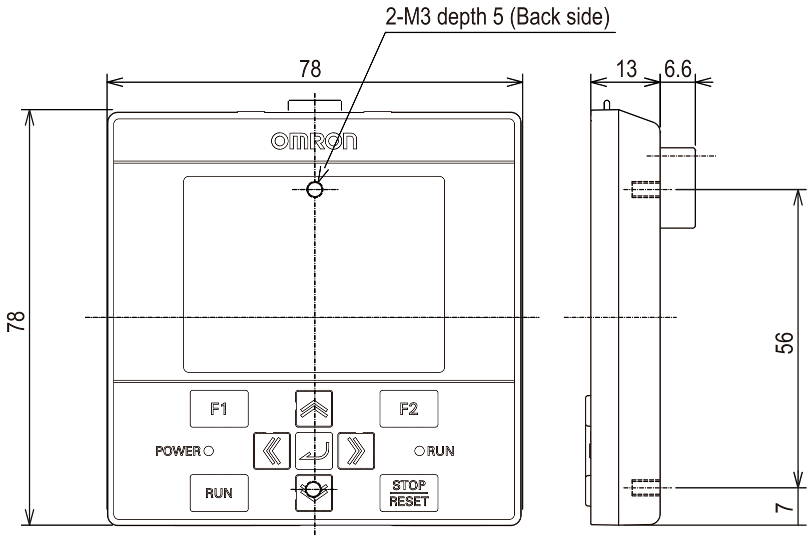


2-3-8 Wiring for LCD Operator

You can remove the LCD Operator of this inverter and operate it outside the control panel.

When you take out the LCD Operator from the inverter body for operation, use the optional dedicated cable.

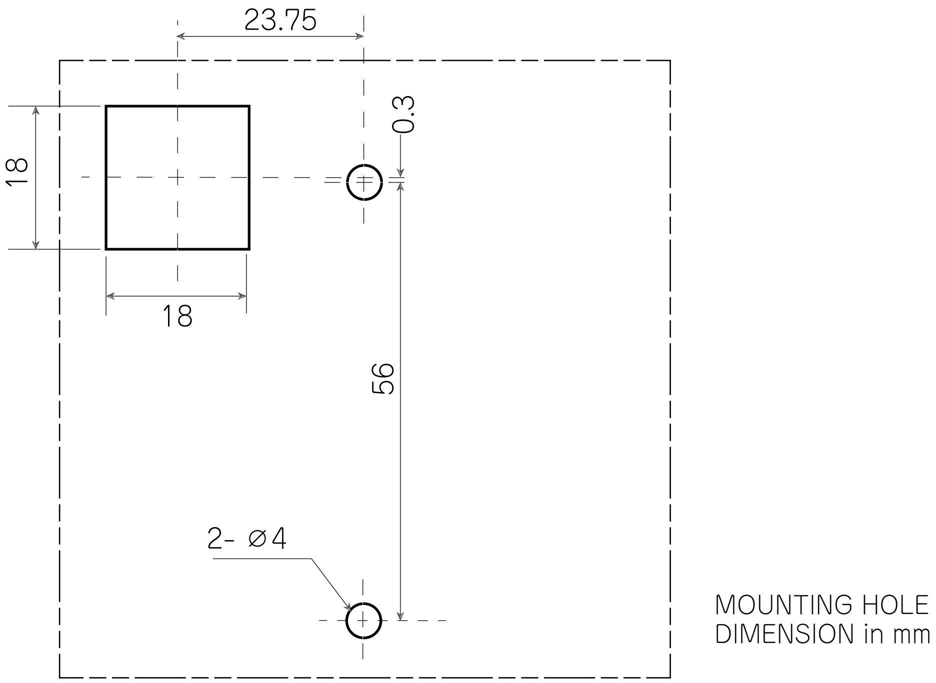
Outline Drawing of LCD Operator



LCD Operator’s Hight: 78 mm, Width: 78 mm

Panel Mounting

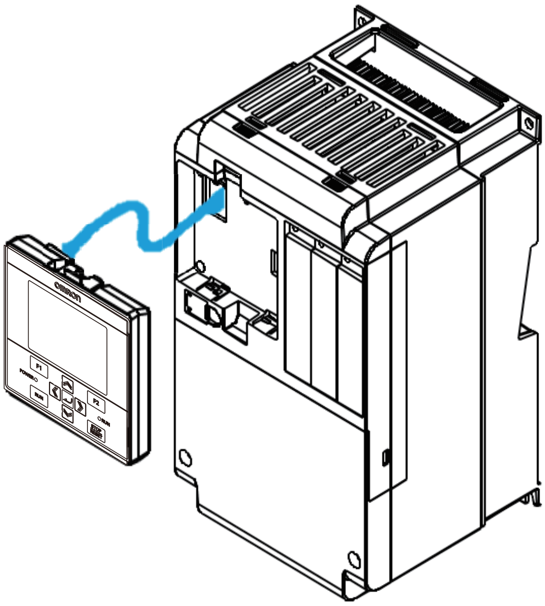
When fixing the LCD operator of this inverter to the control panel door, etc., processing is required according to the following mounting dimensions.



LCD Operator Connection Cable

When you take out the LCD operator from the inverter body for operation, use the optional dedicated cable.

Do not attach or remove the LCD Operator while power is supplied to the inverter.



Item	Model	
	3G3AX-OPCN1	3G3AX-OPCN3
Connector	RJ45 Connector	
Cable	EIA568 compliant cable (UTP Category 5 cable)	
Cable length (m)	1	2

2-4 STO Function

2-4-1 Overview of STO Function

The 3G3RX2 Series Inverter is equipped with the STO (Safe Torque Off) function defined in IEC61800-5-2.
The STO function is used to shut off the motor current with input signals from a safety controller and to stop the motor. This function is equivalent to stop category 0 defined in EN/IEC60204-1.

Precautions for Correct Use

Design
- The 3G3RX2 Series Inverter does not feature a function to retain STO status. When STO input is reset, the inverter goes into a state of operation enabled and starts the operation when operation command is input.
- Considering the above, configure the system so that the inverter disallows hazardous status when STO input is reset.
- At the factory default setting, the STO function is disabled by short-circuit wires.

Installment
- Qualified engineers that have enough knowledge about the function safety must install the inverter.

Wiring
- The 3G3RX2 Series Inverter does not feature a function to carry out diagnosis of STO input signals. Be sure to design the system that can provide 2 inputs normally. As necessary, carry out error diagnosis for input path with EDM signal output.
- STO input signals via two channels outside the inverter shall be separated and protected appropriately. No interruption should be made on each signal.
- The cable length for signals connected to ST1/ST2 or EDM terminal shall be each 20m or less.

Test Run
- Be sure to conduct a test run to verify the safety system and check the validity. The safety system without this check cannot be regarded as safe.

Maintenance
- STO function does not cut off the power supplies for the inverter main circuit and its peripheral circuit. When you make maintenance, be sure to separate the system away from the main power supply or devices like permanent magnet motors or capacitors to which voltage is likely supplied.
- Be sure to carry out the followings to discharge before the maintenance:
    1. Wait for 10 minutes or more*1 or 15 minutes or more*2 after cutting off power supply.
    2. Check that voltage between PN terminals is 45V or less after a charge LED goes out
- Be sure to conduct periodic function test every year.

Others
- Never modify the inverter. The modified inverter is out of conformity with criteria and product guarantee.

*1. In case of 3G3RX2-A2004 to -A2220 and -A4007 to -A4220
*2. In case of 3G3RX2-A2300 to -A2550, -A4300 to -A4550, -B4750, -B4900, -B411K, and -B413K

Response Time

Response time is defined as duration from input of an operation command for safety function to an activation of the function. In the case of STO function, the response time is duration until the power to the motor is shut off after STO signal is input.
The STO response time of the 3G3RX2 Series Inverter is 10ms or less.

Considering the response time, configure the system so that the device disallows hazardous status.

Self-diagnosis of Internal Path

The 3G3RX2 Series Inverter features a function to diagnose errors in the internal safety path.
When the function detects the errors in the internal safety path, it holds a state with outputs to motor being cut off regardless of STO signal status.

STO Input

To input STO signal, the redundant double signals are needed to input. Also, the separated double STO signals are needed to be input from outside the inverter. When both inputs are not used, the inputs can not conform to the criteria.

Monitoring Output (EDM Output) of STO Status

When you monitor the input status of STO signals or the detection status of errors in the internal safety path from external devices, use EDM output terminals.

Periodic Function Test

The periodic function test is carried out to verify the STO function properly. You need to conduct the test at least once a year in order to keep the SIL/PL level prescribed in the function safety system.
In this STO function test, check that output status to input ST1/ST2 and EDM signal status comply with Status 1 to Status 4 of Signal Matrix *Signal Matrix* on page 2-86 in STO Confirmation Signal Output (EDM Signal).

Safety Function

Function	Criteria/Standards
STO (Safe Torque Off)	IEC61800-5-2: 2016 EN61800-5-2: 2007
Stop category 0	EN60204-1: 2006/ A1: 2009

Response Time

Function	Value	Remarks
STO response time	10 ms	Time until the power to the motor is shut off after ST1/ST2 signals go into STO status
EDM response time	20 ms	Time until EDM signals are turned ON after ST1/ST2 signals go into STO status

Safety Related Parameter

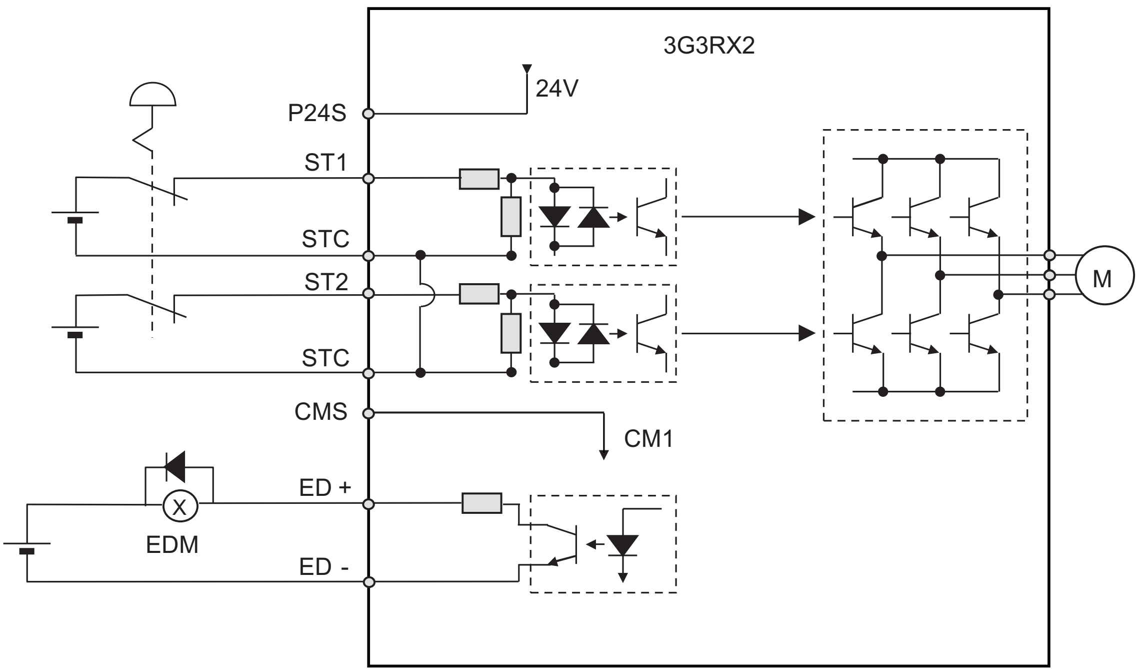
Parameter	Value	Criteria/Standards
PL	e	EN ISO 13849-1: 2015
CAT.	4	
MTTFd	100 years	
DCavg	99.8%	
SIL	3	IEC61508: 2010 IEC61800-5-2: 2016 EN61800-5-2: 2007 IEC/ EN62061: 2012
HFT	1	
SFF	99.9%	
PFH	1.18×10^{-9}	
PFD	1.03×10^{-4}	

2-4-2 Wiring for STO Function

STO Signal Input

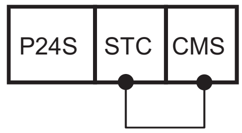
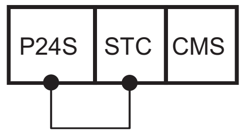
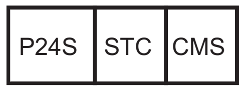
● STO Signal input

Input of STO signal is performed by redundant input of STO terminals ST1 and ST2.
When voltage is applied to each input terminal and current flows, operation of safety path is enabled.
If voltage is not applied to at least one of the input terminals, the corresponding blocking path shuts off output of the inverter.



- The diagram above is dedicated for functional explanation. For actual wiring, make sure that the configuration meets the required reliability, such as using a safety controller.
- There are two STC terminals and they are internally connected. Be sure not to short-circuit the power supply when ST1 and ST2 are configured with different power supplies.

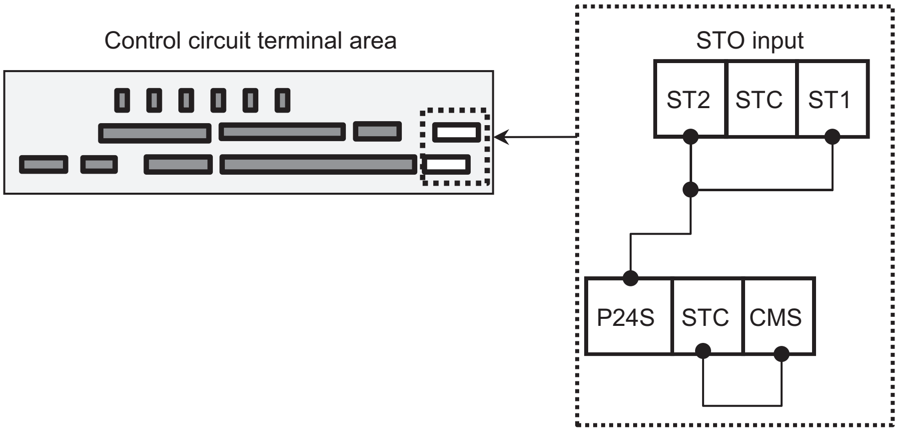
● Terminal Specifications

Terminal symbol	Terminal name	Description	Electrical characteristics
P24S	24 V output terminal (for STO input only)	A 24 VDC power supply for contact signals dedicated for ST1/ST2 terminals. The common terminal is CMS.	Maximum output current: 100 mA
CMS	24 V output terminal common (for STO input only)	A common terminal for 24 VDC power supply for contact signals dedicated for ST1/ST2 terminals.	
STC	Common Terminal for inputs	• This is a common terminal for the STO signals, dedicated to wire ST1 / ST2 terminals. • There are two STC terminals and connected internally. • When using P24S terminal for power supply, use the attached short-circuit wire to switch the configuration between the source logic and sink logic. • When configuration with the external 24V power supply, remove the attached short-circuit wire and connect the input signal between ST1-STC and ST2-STC.*1	<For source logic>  <For sink logic>  <When using external power supply> 
ST1/ST2	STO input terminal	An input terminal of STO.	Voltage between ST1 and STC, between ST2 and STC • ON voltage: Min.15 VDC • OFF voltage: Max. 5 VDC • Maximum allowable voltage: 27 VDC • Load current 5.8 mA (at 27 VDC) Internal resistance: 4.7 kΩ
ED+	EDM signal output terminal (+)	A plus terminal of EDM signal (STO status monitoring).	Between ED+ and ED- • Open collector output • Voltage drop at ON: 4 V or less • Maximum allowable voltage: 27 V • Maximum allowable current: 50 mA
ED-	EDM signal output terminal (-)	A minus terminal of EDM signal (STO status monitoring).	

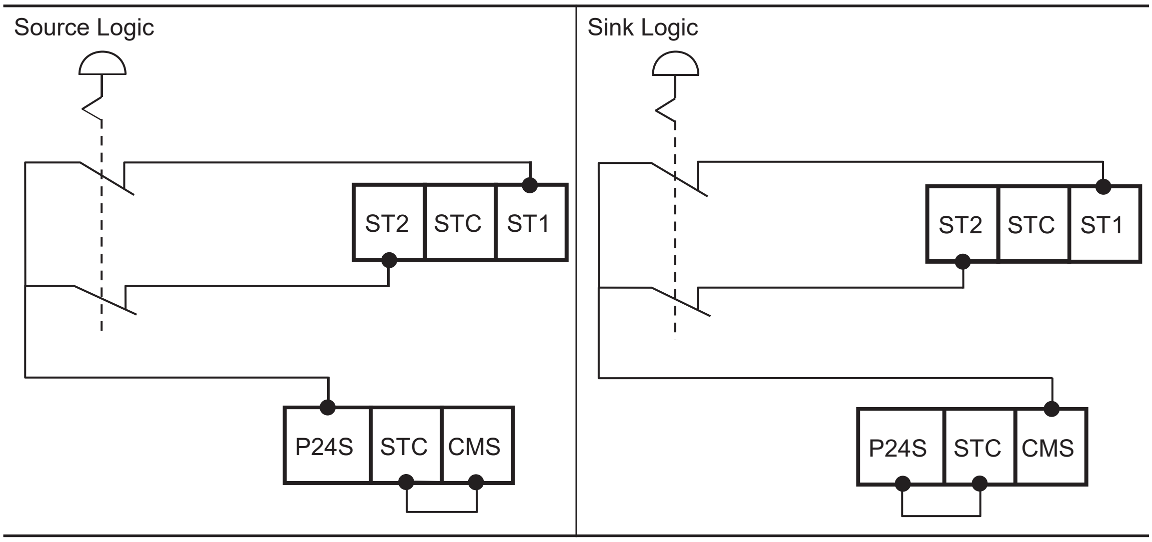
*1. When the short-circuit wire is removed, it is recommended not to throw the wire away since they may be useful in case when disable STO at maintenance or inspection.

● Wiring Example

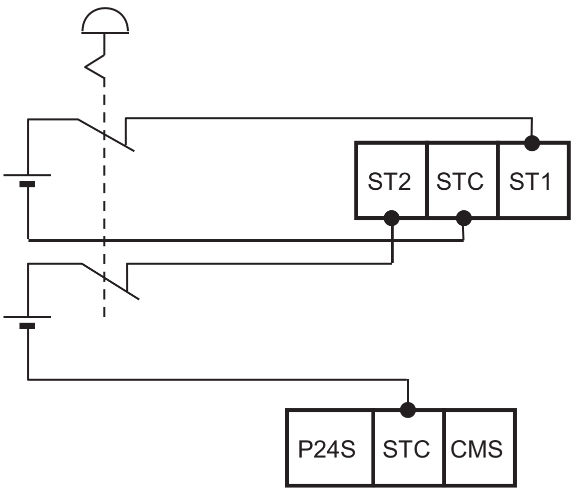
• Disable Wiring
At the factory default setting, the STO function is disabled by the short circuit wiring shown below, to keep the drive operation always enabled.



- Using internal power supply



- Using external power supply



Precautions for Correct Use

The diagram above is dedicated for functional explanation. For actual wiring, make sure that the configuration meets the required reliability, such as using a safety controller.

Retaining Requirements of STO Status

The retention function that retains the blocked status of the internal safety path even if STO input is canceled is not implemented as a safety circuit.
Therefore, if an operation command is input after cancellation of STO input or if STO input is canceled while it is input, the inverter starts output to the motor. Hence, to satisfy the requirement about cancellation of emergency stop specified in EN/IEC60204-1, you need to take either of the following measures.

a. When STO is enabled, this function is used to stop an operation command given to an inverter. It gives the operation command to the inverter when a user intentionally requires the inverter to restart.
b. Design a system in which STO input is reset when a user intentionally requires the inverter to restart.

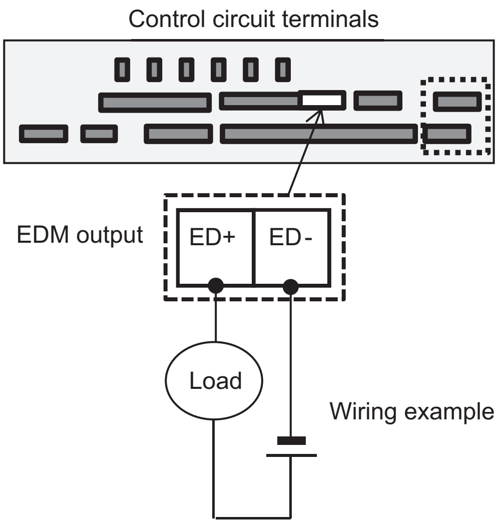
Additional Information

- If two STO input systems to the inverter are not input at the same time, the inverter is shut off and enters the standby mode until STO input for the two systems is input.
- By setting parameters of the main unit, STO input can trip the inverter. In this case, the inverter is tripped and output is stopped until power is shut off or the error reset signal for the inverter is input.

STO Confirmation Signal Output (EDM Signal)

The STO confirmation signal output (EDM output) is the output signal for monitoring the input status of STO signal and the failure detection status on the internal safety path.

● EDM Output (ED+/ED-) Terminal and Wiring Example



Refer to Signal Matrix in the next section for the operation of the STO confirmation signal output for ST1 and ST2 and the failure detection status. Turn EDM ON only when both ST1 and ST2 are input correctly and internal errors are not detected.

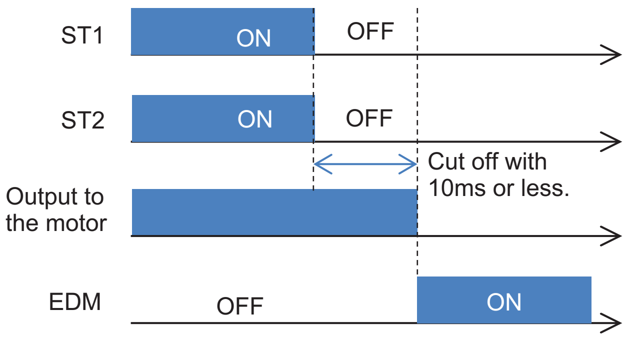
● Signal Matrix

Signal		Status 1	Status 2	Status 3	Status 4	Status 5
Input	**ST1**	OFF	ON	OFF	ON	Ignored*1
	ST2	OFF	OFF	ON	ON	Ignored*1
Internal status	**Failure detection**	None	None	None	None	Detected
Output	**EDM**	ON	OFF	OFF	OFF	OFF
	Output to the motor	Cut off	Cut off	Cut off	Output permitted	Cut off

*1. If Status 2 or Status 3 lasts for a long time, it indicates that ST1 and ST2 are not input at the same time.

Timing Chart

The following shows the timing chart of output to the motor and output of EDM signals for STO inputs ST1 and ST2.



2-4-3 Status Indication and Cut-off Based on Self-diagnosis

By setting the parameters, the cutoff status by the safety signal ST1 and ST2 circuit and the cutoff status based on the diagnosis result are displayed as follows.
You can use parameter settings to set the process of cutoff based on the diagnosis result and the necessity of error occurrence. The display is shown in the status display of the STO function at the upper right of the LCD Operator screen.
It can also be checked with the monitor parameter **Integrated output power monitor** (dA-45).

STO Transition Status Table

Even if either ST1 and ST2 is set to STO, the (E090) error does not occur.

Integrated Output Power Monitor (dA-45)	Status Display on LCD Operator	Motor output	Status description	Transition destination	Transition condition
00: Non	(None)	Output permitted	Both ST1 and ST2 are ON. Normal operation is permitted.	01: P-1A	ST1 is OFF
				02: P-2A	ST2 is OFF

Integrated Output Power Monitor (dA-45)	Status Display on LCD Opera-tor	Motor output	Status description	Transition destina-tion	Transition con-dition
01: P-1A	P-1A	Cut off	From the status that both ST1 and ST2 are ON (operation is permitted), only ST2 turns OFF (STO). Waiting for ST1 to turn OFF.	07: STO	ST1 is OFF and ST2 is OFF
				03: P-1b	(bd-02) Time up
02: P-2A	P-2A	Cut off	From the status that both ST1 and ST2 are ON (operation is permitted), only ST1 turns OFF (STO). Waiting for ST2 to turn OFF.	07: STO	ST1 is OFF and ST2 is OFF
				04: P-2b	(bd-02) Time up
03: P-1b	P-1b	Cut off*2	(1) The P-1A or P-1C status is kept until **STO input change time** (bd-02) has elapsed.	E092 *1 (P-1b is re-tained even when an error occurs.)	To clear the warn-ing, turn ON the RS terminal after turning ON both ST1 and ST2, or cycle the power supply.
			(2) ST2 returned to ON (operation is per-mitted) from the P-1A status. (The emer-gency stop circuit detected an abnormal input operation.)		
04: P-2b	P-2b	Cut off*2	(1) The P-2A or P-2C status is kept until **STO input change time** (bd-02) has elapsed.	E093 *1 (P-2b is re-tained even when an error occurs.)	
			(2) ST1 returned to ON (operation is per-mitted) from the P-2A status. (The emer-gency stop circuit detected an abnormal input operation.)		
05: P-1C	P-1C	Cut off	From the status that both ST1 and ST2 is STO (both contact points OFF), ST2 tran-sitions to be operation permitted (contact point ON) and waiting for ST1 to turn ON.	07: STO	ST2 is OFF
				00: Non	ST1 is ON and ST2 is ON
				03: P-1b	(bd-02) Time up
06: P-2C	P-2C	Cut off	From the status that both ST1 and ST2 is STO (both contact points OFF), ST1 tran-sitions to be operation permitted (contact point ON) and waiting for ST2 to turn ON.	07: STO	ST1 is OFF
				00: Non	ST1 is ON and ST2 is ON
				04: P-2b	(bd-02) Time up
07: STO	STO	Cut off	Both ST1 and ST2 are in STO (contact point OFF). It resets the time monitoring timer for **STO input change time** (bd-02).	05: P-1C	ST2 is ON
				06: P-2C	ST1 is ON

*1. If **Action selection after STO input change time** (bd-04) is set to *02: Trip* (the (E092) and (E093) error detection enabled), the STO monitor and STO column on the LCD Operator screen maintain the display of P-1b/P-2b even while the (E092) and (E093) errors are detected.

*2. Cut-off due to a warning. The inverter shuts off regardless of the circuit status of ST1 and ST2. Ensure safe-ty by adjusting the safety controller so that the ST1 and ST2 inputs are kept OFF until the redundant inputs match or until the inverter completely stops.

Parameters Related to STO Function Display

Item	Parameter	Data	Description
STO input display selection	bd-01	00	If input of both ST1 and ST2 is STO (input contact point is OFF), *STO* is displayed on the LCD Operator screen.
		01	If input of both ST1 and ST2 is STO (input contact point is OFF), *STO* is not displayed on the LCD Operator screen.
		02	If input of both ST1 and ST2 is STO (input contact point is OFF), the (E090) error occurs.[*1]
STO change time	bd-02	0.00 to 60.00 (s)	Set the allowable time during which input status of ST1 and ST2 is different (e.g., input contact point: ST1=ON, ST2=OFF). If there is a difference between the switching time of ST1 and that of ST2, set the maximum allowable time the difference can be generated. If it is set to 0.00, the determination of allowable time becomes invalid.
STO indication selection within allowable input time	bd-03	00	Displays a warning at the time difference of status occurs between ST1 and ST2 until the STO allowable input switch time configured in (bd-02) has elapsed.
		01	Does not display a warning at the time difference of status occurs between ST1 and ST2 until the STO allowable input switch time configured in (bd-02) has elapsed.
STO operation selection after allowable input time	bd-04	00	Displays a warning after the STO allowable input switch time configured in (bd-02) has elapsed.
		01	Does not display a warning after the STO allowable input switch time configured in (bd-02) has elapsed.
		02	After the STO allowable input switch time configured in (bd-02) has elapsed, the (E092) or (E093) error occurs.

*1. Even if either ST1 and ST2 is set to STO, the (E090) error does not occur.

Integrated Output Power Monitor (dA-45) and Status Display on Upper Right of LCD Operator

Integrated Output Power Monitor dA-45 data display	Status Display on LCD Operator	Transition condition[*1]	Description
00: Non	(No indication)	<1>	Operation is permitted on both ST1 and ST2 (contact point is ON) and inverter output is available.
01: P-1A	P-1A	<2>	When operation is permitted on both ST1 and ST2 (contact point is ON), only ST2 changes to STO (contact point is OFF). Then, operation is permitted (contact point is ON) on ST1 again for **STO input change time** (bd-02).

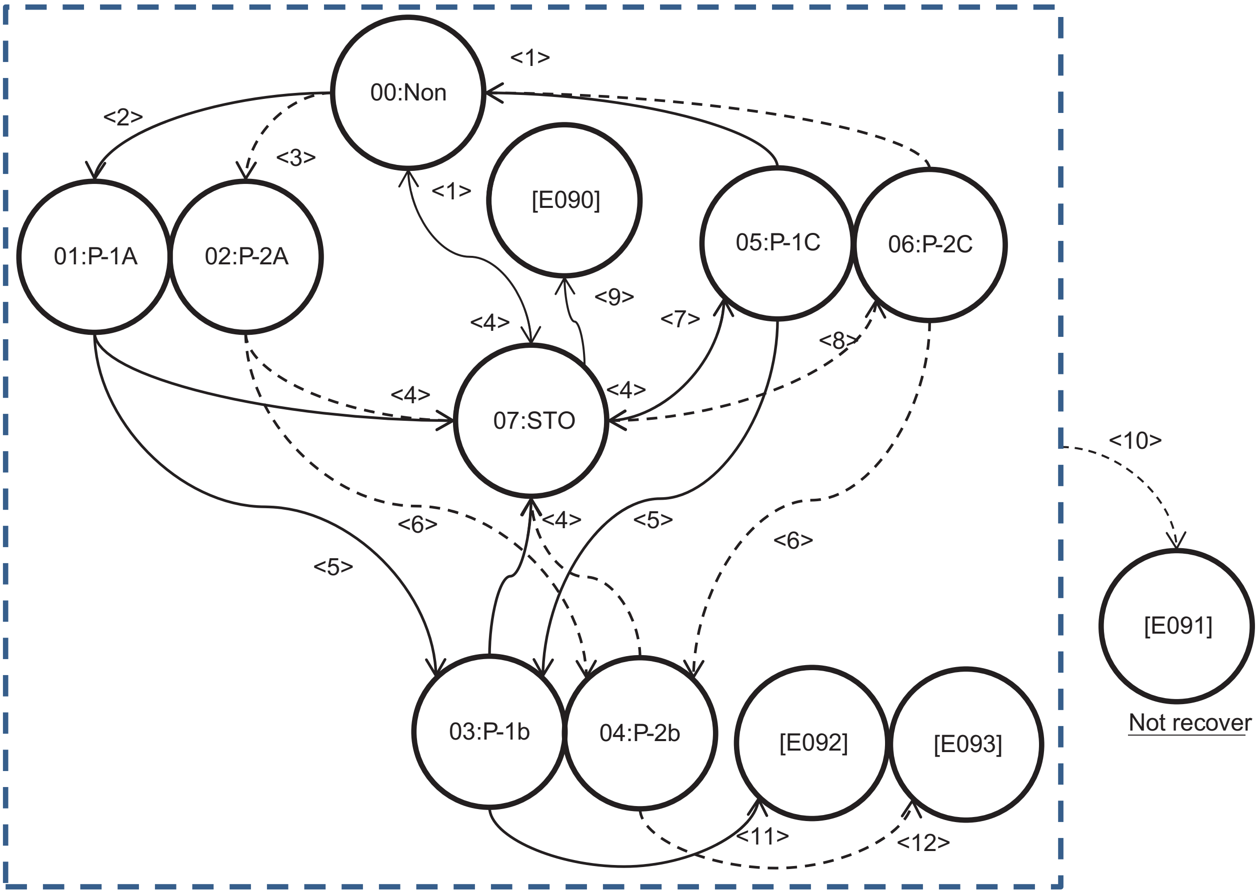
Integrated Output Power Monitor dA-45 data display	Status Display on LCD Operator	Transition condition[*1]	Description
02: P-2A	P-2A	<3>	When operation is permitted on both ST1 and ST2 (contact point is ON), only ST1 changes to STO (contact point is OFF). Then, operation is permitted (contact point is ON) on ST2 again for **STO input change time** (bd-02).
03: P-1b	P-1b	<5>	(1) The P-1A or P-1b status is kept until **STO input change time** (bd-02) has elapsed. (2) When operation is permitted on both ST1 and ST2 (contact point is ON), only ST2 changes to STO (contact point is OFF) and then the operation is permitted (contact point is ON) again.
04: P-2b	P-2b	<6>	(1) The P-12 or P-2b status is kept until **STO input change time** (bd-02) has elapsed. (2) When operation is permitted on both ST1 and ST2 (contact point is ON), only ST1 changes to STO (contact point is OFF), and then the operation is permitted (contact point is ON) again.
05: P-1C	P-1C	<7>	From the status that both ST1 and ST2 is STO (contact point is ON), operation is permitted (contact point is ON) only on ST2. Then, ST1 is at STO (contact point is OFF) again for **STO input change time** (bd-02).
06: P-2C	P-2C	<8>	From the status that both ST1 and ST2 is STO (contact point is ON), operation is permitted (contact point is ON) only on ST1. Then, ST2 is at STO (contact point is OFF) again for **STO input change time** (bd-02).
07: STO	STO	<4>	Both ST1 and ST2 are at STO (contact point is OFF).

*1. The numbers in the Condition column correspond to the symbols in the status transition chart. Refer to *Status Transition* on page 2-91.

Error Display

Item	Error	Condition	Description
STO shut-off error	E090	<9>	If **STO input display selection** (bd-01) is set to *02: Trip*, the error occurs when both ST1 and ST2 are input.
STO internal error	E091	<10>	The error occurs when internal failure is found. It cannot be canceled by reset operation.
STO path 1 error	E092	<11>	If **Action selection after STO input change time** (bd-04) is set to *02: Trip*, the error occurs at P-1b.
STO path 2 error	E093	<12>	If **Action selection after STO input change time** (bd-04) is set to *02: Trip*, the error occurs at P-2b.

Status Transition



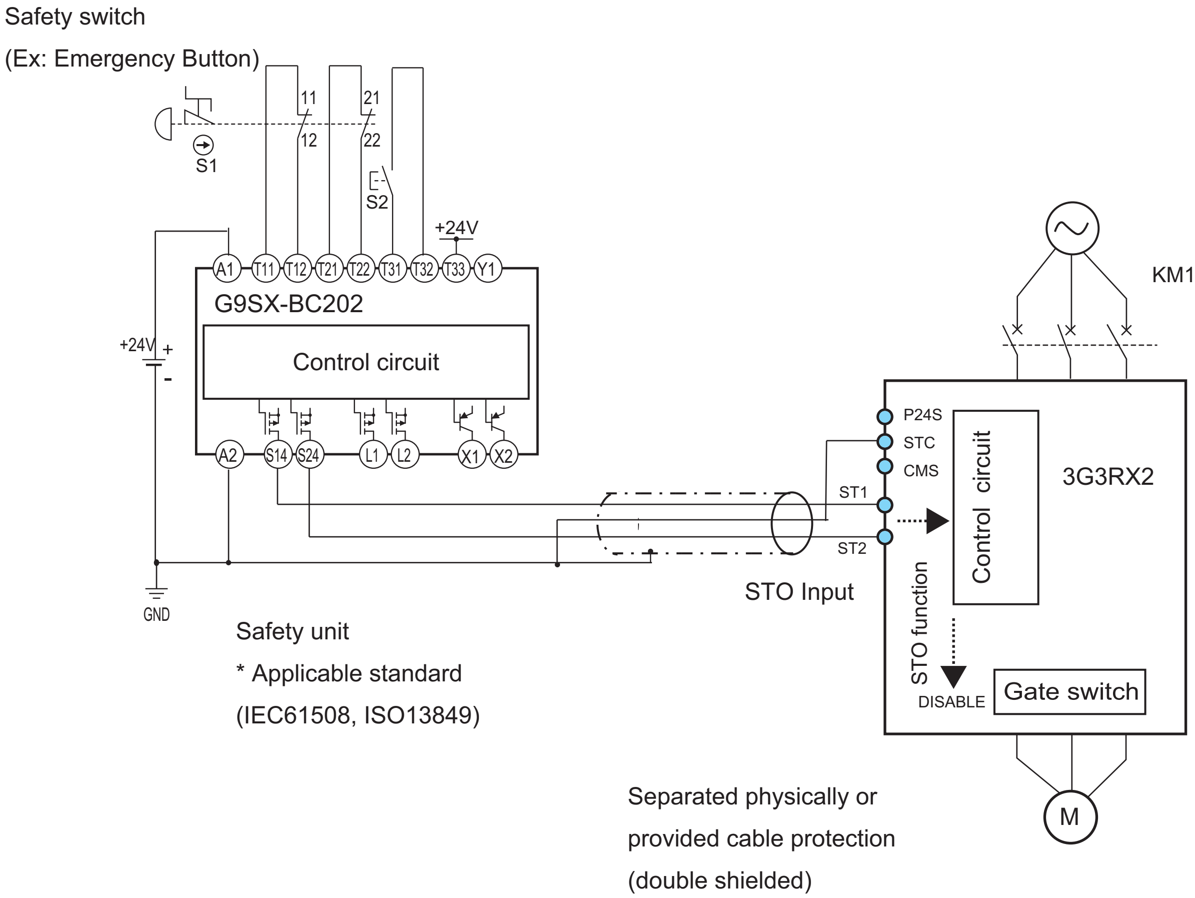
2-4-4 Example of Use

Wiring Example

Procedure for connecting STO input to a safety controller is shown as an example.

The condition for use is the followings:

- Use external power supply as one for STO input.
- Never use EDM output.



External Device

All power supplies connected to control terminals of the 3G3RX2 Series Inverter must comply with SELV and PELV.
Each ST1 and ST2 signal must be separated physically and protected appropriately.
All devices for communication of STO signals should comply with safety standards like ISO13849-1 and IEC61508, etc.
A safety system includes the 3G3RX2 Series Inverter must fulfill CAT.3, PL e /SIL3. Therefore, the 3G3RX2 Series Inverter must be combined with external safety devices that meet PL e/SIL3.
Test pulse input to ST1 and ST2 should be 300 us or less.

Combination of the 3G3RX2 Series Inverter with external safety devices is shown as below.

Manufacturer	Model	Applicable criteria/standards
OMRON	G9SA-301	ISO13849-1 cat4, SIL3
OMRON	G9SX-BC202-RC	IEC61508 SIL3
OMRON	G9SX-GS226-T15-RC	IEC61508 SIL1 to 3
OMRON	NE1A-SCPU01-V1	IEC61508 SIL3
OMRON	G9SP-N□□□	IEC61508 SIL3

2-5 Others

2-5-1 Conditions of Conformity of EU Directives

Note Note of European Directive, *Caution for Electrical Safety (Low Voltage Directive (LVD))* on page 2-95, and *Caution for EMC (Electromagnetic Compatibility)* on page 2-93 gives priority to the description written in English. Other language description is provided as a reference. Refer to the instruction manual (2824133-4) for English description.

Criteria/Standards

EMC	EN 61800-3:2004/A1:2012
Machinery	EN 61800-5-2:2007 STO SIL3 EN ISO 13849-1:2015 Cat.4 PLe EN 61800-5-1:2007/A1:2017

- This is a product designed for industrial environments.
  Use in residential area may cause radio wave interference. In that case, the user may be required to take adequate measures to reduce interference.
- This product is not intended to be connected to the power grid that supplies household facilities.

Manufacturer and EU Representative

Manufacturer:
OMRON Corporation
Shiokoji Horikawa, Shimogyo-ku, Kyoto, 600-8530 Japan
Representative and Importer in EU:
OMRON Europe B.V
Wegalaan 67-69, 2132 JD Hoofddorp, The Netherlands
GENERAL:
The 3G3RX2 Series Inverter is an "open type" AC inverter with three phase input and three phase output. It is intended to be used in an enclosure. It is used to provide both an adjustable voltage and adjustable frequency to the AC motor. The inverter automatically controls the required voltage and frequency for motor speed control. It is a multi-rated device, and the ratings are selectable according to load types by the operator with using the LCD Operator.

Caution for EMC (Electromagnetic Compatibility)

The 3G3RX2 Series Inverter conforms to requirements of Electromagnetic Compatibility (EMC) Directive (2014/30/EU). However, when using the inverter in Europe, you must comply with the following specifications and requirements to meet the EMC Directive and other standards in Europe:

⚠ WARNING	This equipment must be installed, adjusted, and maintained by qualified engineers who have expert knowledge of electric work, inverter operation, and the hazard ouscircumstances that can occur. Otherwise, personal injury may result.

● Power Supply Requirements

- Voltage fluctuation must be within -15% to +10%.
- Voltage imbalance must be within ±3%.
- Frequency variation must be within ±4%.
- Total harmonic distortion (THD) of voltage must be within ±10%.

● Installation requirements

- The 3G3RX2 Series Inverter includes a built-in EMC filter. The built-in EMC filter must be activated.
- According to EN61800-3, it is mandatory to mention that any inverter with only C3 filter inside may NOT be connected to a low voltage public power supply in residential areas where installation of C1 filter is required.
- When using an external filter for C2 compliant, the following note is required in EN61800-3. "This product may emit high frequency interference in residential areas which may require additional EMC measures".
- According to the EN6100-3-12, an additional AC reactor or DC reactor should be installed for reducing harmonics in the main power system.

● Wiring requirements

- A shielded wire (screened cable) must be used for motor wiring. The length of the cable must be according to the following table.
- The carrier frequency must be set according to the following table to meet an EMC requirement.
- The power input wiring must be separated from the motor wiring and signal line.

● Environmental requirements

(If a filter is used, the requirements must be met.)
The 3G3RX2 Series Inverter that enabled its built-in EMC filter must be used within the specification range shown in the table below.

Model 3G3RX2	Cat.	Cable length	Carrier frequency settings	Model 3G3RX2	Cat.	Cable length	Carrier frequency settings
A2004	C3	10m	2kHz	-	-	-	-
A2007	C3	10m	2kHz	A4007	C3	10m	2kHz
A2015	C3	10m	2kHz	A4015	C3	10m	2kHz
A2022	C3	10m	2kHz	A4022	C3	10m	2kHz
A2037	C3	10m	2kHz	A4037	C3	10m	2kHz
A2055	C3	5m	2kHz	A4055	C3	5m	2kHz
A2075	C3	5m	2kHz	A4075	C3	5m	2kHz
A2110	C3	5m	2kHz	A4110	C3	5m	2kHz
A2150	C3	10m	1kHz	A4150	C3	10m	2kHz
A2185	C3	10m	1kHz	A4185	C3	10m	2kHz
A2220	C3	10m	1kHz	A4220	C3	10m	2kHz
A2300	C3	5m	2kHz	A4300	C3	5m	2kHz
A2370	C3	5m	2kHz	A4370	C3	5m	2kHz
A2450	C3	5m	2kHz	A4450	C3	5m	2kHz
A2550	C3	5m	2kHz	A4550	C3	5m	2kHz
-	-	-	-	B4750	C3	3m	2kHz

Model 3G3RX2	Cat.	Cable length	Carrier frequency settings	Model 3G3RX2	Cat.	Cable length	Carrier frequency settings
-	-	-	-	B4900	C3	3m	2kHz
-	-	-	-	B411K	C3	3m	2kHz
-	-	-	-	B413K	C3	3m	2kHz

● Measures Against Noise

- For the power supply lines of the inverter, use a shield braided cable with a minimum cable length, and connect it via an EMC compliant input noise filter.
- Ground the cable shield.
- Keep the ground cable as short as possible. For 400-V class inverters, the ground terminal must be connected to the neutral point of a power supply. Also, ground the metal control panel as well as the door simultaneously.
- Use shield braided cables also for connection between the inverter and the motor.
  Ground the cable shield. Installing a ferrite core near the inverter output terminals is an effective countermeasure.
- Connect the cable shield directly to an earth (ground) plate with a conductive cable clamp.
- With the motor frame grounded directly, connect the ground cable from the motor directly to an EMC compliant input noise filter.
- For the control panel door, use a conductive gasket to improve the shielding effect.
- In the same control panel, do not install equipment that generates by design electromagnetic waves, especially radio waves.

Caution for Electrical Safety (Low Voltage Directive (LVD))

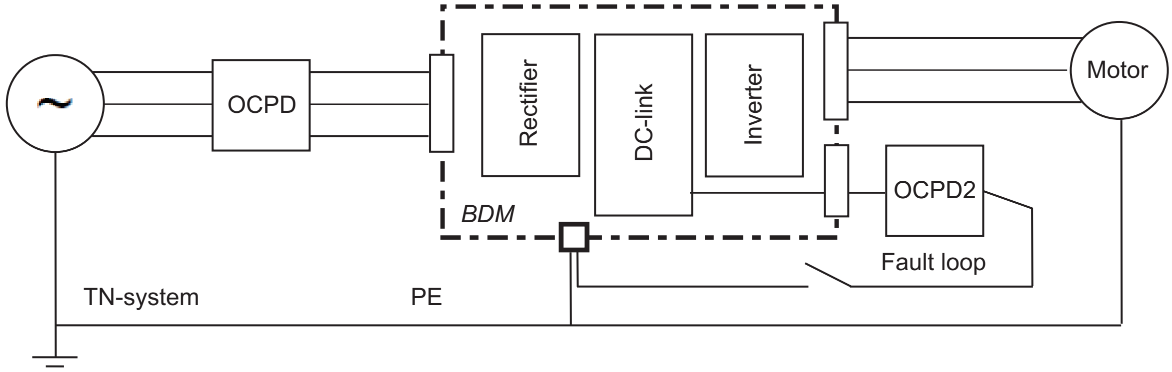
When using the inverter in Europe, you must comply with the following specifications and requirements to conform EU directive and other standards.

- To conform 3G3RX2 series to the directives, refer to *2-5-1 Conditions of Conformity of EU Directives* on page 2-93 and*2-5-2 Conformance Conditions of UL/CSA Standards* on page 2-96, and comply conditions for installation, wiring, and selection of protective fuse, etc.
- Regarding "electronic power output short-circuit protection circuitry" of the inverter, 3G3RX2 series complies with the requirements of IEC 60364-4-41:2005/AMD1:2017 *411. Protective measure: automatic disconnection of supply*,since it complies with the requirements of IEC 61800-5-1:2007+AMD1:2016 *4.3.9 Output short-circuit requirements*.

Technical standard		Requirement
(1)	IEC 61800-5-1:2007+AMD1:2016	4.3.9 Output short-circuit requirements
(2)	IEC 60364-4-41:2005/AMD1:2017	411. Protective measure: automatic disconnection of supply

- Regarding test on short-circuit between power terminals and protective earth, the conformance test performed on the circuit configuration as described on “Figure 13"

Technical standard	Test method
IEC 61800-5-1:2007+AMD1:2016	5.2.3.6.3.3 Short-circuit between phase terminals of power output and protective earth
	Figure 13 – Example of short-circuit test between CDM/BDM d.c. link power output and protective earth



A "Class J 30A Non time delay fuse" is used as the OCPD2 in "fault loop".

2-5-2 Conformance Conditions of UL/CSA Standards

Note “UL Caution” gives priority to the description written in English. Other language description is provided as a reference. Refer to the instruction manual (2824133-4) for English description.

Criteria/Standards

US	UL61800-5-1
CA	CSA C22.2 No.274
FS	IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe

UL Caution GENERAL:

The 3G3RX2 Series Inverter is an "open type" AC inverter with three phase input and three phase output. It is intended to be used in an enclosure. It is used to provide both an adjustable voltage and adjustable frequency to the AC motor. The inverter automatically maintains the required voltage-frequency ratio as the motor speed control function. It is a multi-rated device, and the ratings are selectable according to load types by the operator with using the LCD Operator.

Markings

The following is the markings related to “UL Caution.”

● Maximum Ambient Temperature in UL Certification

Normal Duty (ND)	50℃
Low Duty (LD)	50℃*1
Very Low Duty (VLD)	45℃*1
Storage environment temperature	65℃ (for transportation)
Instruction for installation	Pollution degree 2 environment, and Over voltage category III
Wiring	See the main circuit wiring diagram and the control circuit wiring diagram in this User’s Manual.

*1. For actual use, use within the temperature range indicated in the common specifications.

● Short Circuit Rating and Overcurrent Protection Rating

- 200 V class model (3G3RX2-A2□)
  Connect the inverter to a power system whose output current is limited to (a) Arms sine wave current or less and output voltage is (b) V or less in the table below.
- 400 V class models (3G3RX2-A4□ and -B4□)
  Connect the inverter to a power system whose output current is limited to (a) Arms sine wave current or less and output voltage is (b) V or less in the table below.

	3G3RX2-	(a) Short-circuit current	(b) Maximum voltage
200 V	A2004 to A2220	5,000 Arms	240 V
	A2300 to A2550	10,000 Arms	240 V
400 V	A4007 to A4220	5,000 Arms	500 V
	A4300 to A4550, B4750, B4900	10,000 Arms	500 V
	B411K, B413K	18,000 Arms	500 V

● Built-in Protection

USA:
Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
Canada:
Integral solid state short circuit protection does not provide branch circuit protection.
Branch circuit protection must be provided in accordance with the Canadian Electrical Code, part1 or the equivalent.

Field Wiring Terminal Conductor Size and Required Torque

Model 3G3RX2	Load type selection page 2-99	Required torque (N·m)	Conductor size (AWG)	Model 3G3RX2	Load type enable	Required torque (N·m)	Conductor size (AWG)
A2004	VLD	1.4	14				
	LD						
	ND						
A2007	VLD	1.4	14	A4007	VLD	1.4	14
	LD				LD		
	ND				ND		
A2015	VLD	1.4	14	A4015	VLD	1.4	14
	LD				LD		
	ND				ND		
A2022	VLD	1.4	10	A4022	VLD	1.4	14
	LD				LD		
	ND				ND		
A2037	VLD	1.4	10	A4037	VLD	1.4	12
	LD				LD		14
	ND				ND		

Model 3G3RX2	Load type selection page 2-99	Required torque (N·m)	Conductor size (AWG)
A2055	VLD	3	8
	LD		
	ND		
A2075	VLD	3	6
	LD		8
	ND		
A2110	VLD	4	4
	LD		
	ND		6
A2150	VLD	2.5 to 3.0	3
	LD		
	ND		4
A2185	VLD	2.5 to 3.0	1
	LD		2
	ND		3
A2220	VLD	5.5 to 6.6	2/0
	LD		1/0
	ND		1
A2300	VLD	6	Parallel of 1/0
	LD		
	ND		2/0
A2370	VLD	6 to 10	Parallel of 1/0
	LD		Parallel of 1/0
	ND	15	4/0
A2450	VLD	6 to 10	Parallel of 2/0
	LD		Parallel of 1/0
	ND		Parallel of 1/0
A2550	VLD	10 to 12	Parallel of 3/0
	LD		Parallel of 3/0
	ND		350kcmil

Model 3G3RX2	Load type enable	Required torque (N·m)	Conductor size (AWG)
A4055	VLD	3	10
	LD		12
	ND		
A4075	VLD	3	8
	LD		10
	ND		
A4110	VLD	4	8
	LD		
	ND		
A4150	VLD	4	8
	LD		
	ND		
A4185	VLD	4	6
	LD		
	ND		8
A4220	VLD	4	4
	LD		
	ND		6
A4300	VLD	6	1
	LD		2
	ND		3
A4370	VLD	15	1
	LD		
	ND		
A4450	VLD	15	1/0
	LD		
	ND		1
A4550	VLD	6 to 10	Parallel of 1/0
	LD	15	2/0
	ND		1/0
B4750	VLD	10 to 12	Parallel of 1/0
	LD		
	ND		
B4900	VLD	10 to 12	Parallel of 2/0
	LD		Parallel of 1/0
	ND		

Model 3G3RX2	Load type selection page 2-99	Required torque (N·m)	Conductor size (AWG)	Model 3G3RX2	Load type enable	Required torque (N·m)	Conductor size (AWG)
				B411K	VLD	10 to 12	Parallel of 3/0
					LD		Parallel of 2/0
					ND		
				B413K	VLD	10 to 12	Parallel of 250kcmil
					LD		Parallel of 4/0
					ND		Parallel of 3/0

Note 1. Temperature rating of field wiring installed conductors is 75°C only.
Note 2. Use copper conductors only.
Note 3. When changing **Load type selection** (Ub-03), the conditions for the conductor size will change. Please keep in mind. The size needs to correspond to Normal Duty (ND), Low Duty (LD), and Very Low Duty (VLD).

Required Protection by Fuse and Circuit-breakers

● 200V Class Model

Model 3G3RX2	Fuse			Circuit breaker	
	Type	Max. rating Voltage (V)	Max. rating Current (A)	Voltage (V)	Current (A)
A2004	Class J or T	600	15	-	-
A2007	Class J or T	600	30	-	-
A2015	Class J or T	600	40	-	-
A2022	Class J or T	600	40	-	-
A2037	Class J or T	600	50	-	-
A2055	Class J or T	600	100	-	-
A2075	Class J or T	600	150	-	-
A2110	Class J or T	600	150	-	-
A2150	Class J or T	600	150	-	-
A2185	Class J or T	600	200	-	-
A2220	Class J or T	600	200	-	-
A2300	Class J or T	600	300	-	-
A2370	Class J or T	600	300	-	-
A2450	Class J or T	600	400	-	-
A2550	Class J or T	600	500	-	-

● 400V Class Model

Model	Fuse			Circuit breaker	
	Type	Max. rating Voltage (V)	Max. rating Current (A)	Voltage (V)	Current (A)
A4007	Class J or T	600	15	-	-
A4015	Class J or T	600	20	-	-
A4022	Class J or T	600	30	-	-

Model	Fuse			Circuit breaker	
	Type	Max. rating Voltage (V)	Max. rating Current (A)	Voltage (V)	Current (A)
A4037	Class J or T	600	30	-	-
A4055	Class J or T	600	75	-	-
A4075	Class J or T	600	75	-	-
A4110	Class J or T	600	75	-	-
A4150	Class J or T	600	100	-	-
A4185	Class J or T	600	100	-	-
A4220	Class J or T	600	100	-	-
A4300	Class J or T	600	200	-	-
A4370	Class J or T	600	200	-	-
A4450	Class J or T	600	200	-	-
A4550	Class J or T	600	250	-	-
B4750	Class J or T	600	300	-	-
B4900	Class J or T	600	400	-	-
B411K	Class J or T	600	500	-	-
B413K	Class J or T	600	500	-	-

2-5-3 Korean Radio Regulation (KC)

사용자안내문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서
가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Guide for Users
This inverter has been evaluated for conformity in a commercial environment.
When used in a residential environment, it may cause radio interference.

2-5-4 Reference Manual for Options

The following describes outlines of option units and peripheral devices and reference manuals.

Regenerative Braking Unit (3G3AX-RBU□□)

When you desire to reduce the motor's deceleration time, use this unit in combination with braking resistor.

Name	Manual number
Regenerative Braking Unit 3G3AX-RBU□□ User's Manual	I563-E1

PG Option Unit (3G3AX-RX2-PG01)

A High accuracy operation which suppresses velocity fluctuation and positional control by pulse train position command input is achieved by feedback after detecting the rotation velocity of the encoder-equipped motor.

Name	Manual number
High-function General-purpose Inverter RX2 Series User's Manual	I620-E1

CX-Drive

This is a tool which enables you to edit inverter's parameter and monitor the inverter status.

Name	Manual number
CX-Drive Operation Manual	W453-E1

DriveProgramming

You can implement an easy sequence control by a single inverter.

Name	Manual number
DriveProgramming User's Manual	I620-E1

EtherCAT Communications Unit (3G3AX-RX2-ECT)

The option unit can perform the inverter control via EtherCAT communications.

Name	Catalog No
Inverter RX2 Series EtherCAT® Communication Unit User's Manual	SBCE-500

3

Operation

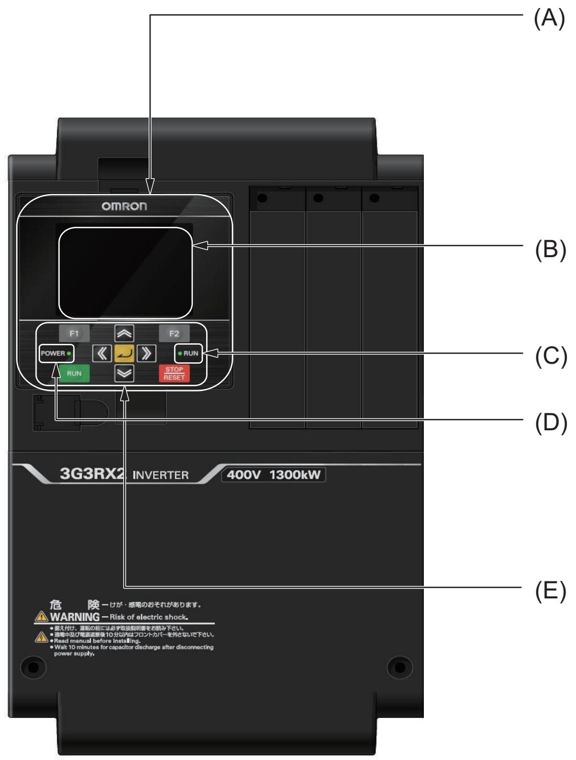
This section describes the LCD Operator and the support tool CX-Drive.

3-1 Overview of LCD Operator

Overview of LCD Operator is described.
This section describes the overview in the state that date and time are displayed in the trip history and in the retry history. In purchasing, the date and the time are not displayed. Instead, - is displayed. To display the date and the time, refer to *3-1-5 How to Set Battery and Make Clock Settings* on page 3-13, and set optional batteries (CR2032, 3V) to the LCD operator in order to enable the clock function.

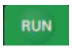
3-1-1 Part Names and Descriptions

Name and function of each part of the LCD Operator is described below.



Symbol	Name	Description
(A)	LCD Operator	Operated to set parameter constants and to monitor, star and stop operation of the inverter.
(B)	LCD Display	Displays the frequency command, output frequency, parameter constant and other relevant data.
(C)	RUN Lamp	Lights in green when operation is commanded.
(D)	POWER Lamp	Lights in green when power is supplied to the LCD Operator. When power is supplied to between the R0 and T0 terminals wired to the main circuit and between the P+ and P- terminals in the control terminal block, it is lit.
(E)	Operation keys	Operated for indicating and settings.

3-1-2 Names of Operation Keys

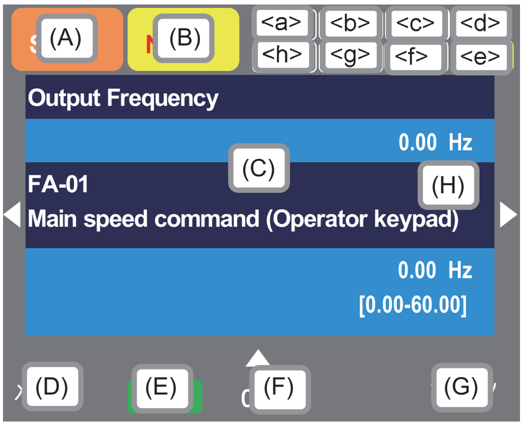
No.	Key image	Name	Function
(1)		F1 key	Performs *F1 key function* displayed at the bottom left of the screen.
(2)		F2 key	Performs *F2 key function* displayed at the bottom right of the screen.
(3)		RUN key	Inputs operation command.*Display (E): RUN key on LCD Operator Enabled/Disabled* on page 3-7 You can enter an operation command while the lamp described in is lit.
(4)		STOP/RESET key	Performs deceleration stop and trip reset.
(5)		ENTER key	With a screen selected, you can proceed to the selected screen. With a parameter displayed, you can edit the parameter. You can confirm and save the value and return to the previous screen.
(6)		UP key	Moves the cursor upward. Increases parameter numbers or parameter data.
(7)		DOWN key	Moves the cursor downward. Decreases parameter numbers or parameter data.
(8)		LEFT key	Moves the cursor leftward. Returns to the previous screen in the main monitor display mode.
(9)		RIGHT key	Moves the cursor rightward. Proceed to the next screen in they main monitor display mode.

Precautions for Safe Use

The STOP/RESET key of the LCD Operator is enabled only when it is set by the parameter.
You need to establish an emergency stop switch separately from the STOP/RESET key.
Since the stop operation after the deceleration stop command input depends on the parameter settings, you can also set the inverter to shut off the output and stop without decelerating. For details, refer to *7-6 Stop Conditions* on page 7-68.

3-1-3 LCD Display

Outline of Display Screen



Symbol	Description
(A)	Displays the operational status.
(B)	Displays the warning status.
(C)	Displays the status of data, parameters, and the inverter.
(D)	Displays details of the function assigned to the F1 key.
(E)	Displays if the RUN key on the LCD operator is enabled or disabled.
(F)	An auxiliary monitor. Displays frequency command, torque command, inverter name, clock, etc. For the setting method, refer to *3-7 Changing the Data Displayed at the Bottom Center* on page 3-36.
(G)	Displays details of the function assigned to the F2 key.
(H)	**LKS**: Locked by soft lock. **LKP**: Locked by password.

Symbol	Description
<a>	Displays the power supply status.
<b>	Displays the switching status of the first setting and second setting.
<c>	Displays the status of parameter display selection.
<d>	Displays the screen number.
<e>	Displays the status of the STO function.
<f>	Displays whether the control command is speed control, position control, or position control.
<g>	Displays the operation of DriveProgramming.
<h>	Displays the special status of the inverter.

Display (A): Operation Status

Display	Description
RUN FW	Displayed during forward rotation operation.
RUN RV	Displayed during reverse rotation operation.
RUN OHz	Output is in process by 0Hz command. • Output frequency is 0.00Hz and the operation status is *In operation*. And when the frequency command is below the minimum output frequency in the control method that cuts off the output below the minimum output frequency. • When [DB], [FOC] or [SON] is input.
TRIP	Displayed during trip after the occurrence of error. Errors that can be canceled are cleared by the reset operation.
WARN	Displayed when setting inconsistency occurs. Resolve the inconsistency.
STOP	This is displayed when the device is forcibly stopped by a function although an operation command is issued. The operation status is stopped although the operation command is issued. • The operation command is issued with frequency command at 0Hz. • When the operation command is issued from a source other than the LCD Operator, the device is stopped by the STOP key on the LCD Operator. • When the operation command is issued from a source other than the LCD Operator, the device is stopped by the breaking terminal function [RS], [FRS], etc. • The device is stopped by the momentary power interruption non-stop function. At this time, the RUN lamp blinks.
STOP	The device is stopped by turning off all operation commands. When FW turns OFF during operation, this is displayed when deceleration starts. The same applies when the STOP/RESET key, [FRS], [RS], etc. are turned ON during operation according to the operation command of the LCD operator.

Display (B): Warning Status

Display	Description
LIM	Displays the following status. • Under overload limit • Under torque limit • Under overcurrent suppression • Under overvoltage suppression • Under upper/lower limit operation • Under jump frequency operation • Under minimum frequency limit
ALT	Displays the following status. • Overload advance notice • Motor thermal advance notice • Inverter thermal advance notice • Motor heating advance notice

Display	Description
RETRY	Displayed during retry standby or restart standby.
NRDY	Operation is not started even if the operation command is issued. • Under insufficient voltage of the main power • Power is being supplied from an external 24V power supply (P+/P- terminals) or the R0 and T0 terminals, and the main circuit is OFF. • Under reset operation • Operation permission signal [REN] terminal is OFF (except when there is no allocation)
FAN	Displayed upon the fan life advance notice. The warning disappears when the fan life advance notice counter is cleared.
C	Displayed upon the capacitor life advance notice on the circuit board. The warning disappears when the capacitor life advance notice counter is cleared.
F/C	Displayed upon the fan life advance notice and capacitor life advance notice on the circuit board. The warning disappears when the counter of each life advance notice is cleared.
(None)	No warning

Display (C): Data, Parameter, and Inverter

It displays the status of data, parameters, and the inverter.

Display (D): F1 Key Function

It displays details of the function assigned to the F1 key.

Display (E): RUN key on LCD Operator Enabled/Disabled

It displays whether the operation command is entered or not when the RUN key is currently pressed at this moment, depending on the parameter setting status and the input terminal status.

Display	Description
oFW	The RUN key on the LCD operator is enabled. Pressing the key issues a forward rotation command. Settings by parameters and [SET] terminal are displayed.
oRV	The RUN key on the LCD operator is enabled. Pressing the key issues a reverse rotation command. Settings by parameters and [SET] terminal are displayed.
>FW	The RUN key of the LCD operator is enabled when the [F-OP] terminal is ON. Pressing the key issues a forward rotation command.
>RV	The RUN key of the LCD operator is enabled when the [F-OP] terminal is ON. Pressing the key issues a reverse rotation command.
(None)	The RUN key on the LCD operator is disabled. Pressing the key does not issue any operation command. Another input is selected for the operation command.

Display (F): Auxiliary Monitor

It is auxiliary data displayed at the bottom center. It displays frequency command, torque command, inverter name, clock, etc. The default is a frequency command.
You can select it with the F2 key (option) on the main screen. For details, refer to *3-7 Changing the Data Displayed at the Bottom Center* on page 3-36.

Display (G): F2 Key Function

Displays details of the function assigned to the F2 key.

Display (H): Soft Lock Function

When the soft lock function is enabled, it displays the **LKS** mark.
When the parameter is locked by a password, it displays the **LKP** mark.
Refer to *3-8-1 Parameter Protective Function* on page 3-37 for details of the soft lock, and *3-8-4 Protecting Parameters by Password* on page 3-52 for the password.

Display <a>: Power Supply Status

Display	Description
(None)	The main circuit power supply (L1, L2, L3) and the control power supply (R0, T0) are input.
CTRL	Main circuit power is OFF. Only the control power supply (R0, T0) is input.
24V	The control power supply (R0, T0) is OFF, and the external 24V page 3-8 is input to the control input terminals P + and P-. This is a specification for changing parameters while the main circuit power is OFF.

For details on wiring, refer to *Connection for Separating Inverter Control Circuit Power Supply from Main Power Supply* on page 2-60 and *Power Input/Output* on page 2-29.

Display <b>: Switching Status of First Setting and Second Setting

It displays whether the first setting or the second setting is enabled by the second control terminal of the parameter switching function [24: SET].

Display	Description
M1	First setting is enabled. The [SET] terminal is not selected, or the [SET] terminal is OFF.
M2	Second setting is enabled. The [SET] terminal is ON.

Display <c>: Parameter Display Selection

Display	Description
(None)	All-parameter display mode.

Display	Description
UTL	Function-specific display mode.
USR	User-setting display mode.
CMP	Data-comparison display mode.
MON	Monitor display mode.

Display <d>: Monitor Screen Numbers

Monitor screen numbers are listed below.

Screen No.	Name
H01	Three-line monitor screen
H02	Setting screen for rotating direction for LCD operator
H03	Setting screen
H04	Monitor with large characters
H05	Selection screen for parameter code
H06	Trip history
H07	Trip currently occurring
H08	Detailed trip history screen
H09	Retry history
H10	Detailed retry history screen
H11	Detailed limitation status icon screen
o01	Home screen option
o02	Inverter name setting
o03	Selection of data displayed at the bottom center
M01	Menu screen
R01	R/W function screen
R02	Screen for selecting data uploaded using the R/W function
R03	Screen for selecting saving location for data uploaded using the R/W function
R04	Screen for displaying progress status of uploading using the R/W function
R05	Screen for selecting data downloaded using the R/W function
R06	Screen for selecting the location for reading data downloaded using the R/W function
R07	Screen for displaying progress status of downloading using the R/W function
S01	System settings screen
S02	Language selection screen
S03	Dimming setting screen
S04	Setting screen for automatic light off time
S05	Setting screen for dimming at light off
S06	Setting screen for automatic home transition time
S07	Monitor screen for basic inverter information
S08	Selection screen for operator initialization
S09	Operator version display screen
S11	Date and time screen
S12	Date and time setting screen
S13	Selection screen for date and time display format
S14	Setting screen for battery level warning
S19	Inverter model selection screen
S21	Read lock selection screen

Screen No.	Name
S22	Selection screen for blinking at the time of trip
S23	Color setting screen
S25 to S35	Selection screen for self-check mode
S36	Setting screen for automatic home screen
S38	Remote mode switching screen
L01	Scroll menu
L02	Scroll screen
*1	Message screen

*1. If a message is displayed, see *12-3-3 Checking Messages* on page 12-30.

Display <e>: STO Function

Display	Output/ Cut off	Description
(None)	Output permit- ted	Both ST1 and ST2 are ON. Operation is permitted.
P-1A	Cut off	When operation is permitted on both ST1 and ST2 (contact point ON), only ST2 changes to STO (contact point OFF). Waiting for ST1 to turn OFF.
P-2A	Cut off	When operation is permitted on both ST1 and ST2 (contact point ON), only ST1 changes to STO (contact point OFF). Waiting for ST2 to turn OFF.
P-1b	Cut off	Warning status (1) The P-1A status is kept until **STO input change time** (bd-02) has elapsed.
		Warning status (2) From the P-1A status, ST2 turned ON and returned to the operation permitted (con- tact point ON) input status. (The emergency stop circuit detected an abnormal input op- eration.)
		Warning status (3) The P-1C status is kept until **STO input change time** (bd-02) has elapsed.
P-2b	Cut off	Warning status (1) The P-2A status is kept until **STO input change time** (bd-02) has elapsed.
		Warning status (2) From the P-2A status, ST1 turned ON and returned to the operation permitted (con- tact point ON) input status. (The emergency stop circuit detected an abnormal input op- eration.)
		Warning status (3) The P-2C status is kept until **STO input change time** (bd-02) has elapsed.
P-1C	Cut off	From the status that both ST1 and ST2 is STO (both contact points OFF), ST2 transi- tions to be operation permitted (contact point ON) and waiting for ST1 to turn ON.
P-2C	Cut off	From the status that both ST1 and ST2 is STO (both contact points OFF), ST1 transi- tions to be operation permitted (contact point ON) and waiting for ST2 to turn ON.
STO	Cut off	Both ST1 and ST2 are in STO (contact point OFF). It resets the time monitoring timer for **STO input change time** (bd-02).

Display <f>: Control Command Mode

Display	Description
(None)	Speed control mode

Display	Description
TRQ	Torque control mode
POS	Position control mode

Display <g>: DriveProgramming Operation Mode

Display	Description
(None)	DriveProgramming is disabled. **EzSQ function enable** (UE-02) is set to *00: Disabled*.
Ez_S	DriveProgramming is stopped.
Ez_R	DriveProgramming is in operation.

Display <h>: Special Status

This is a display related to the special status of the inverter.

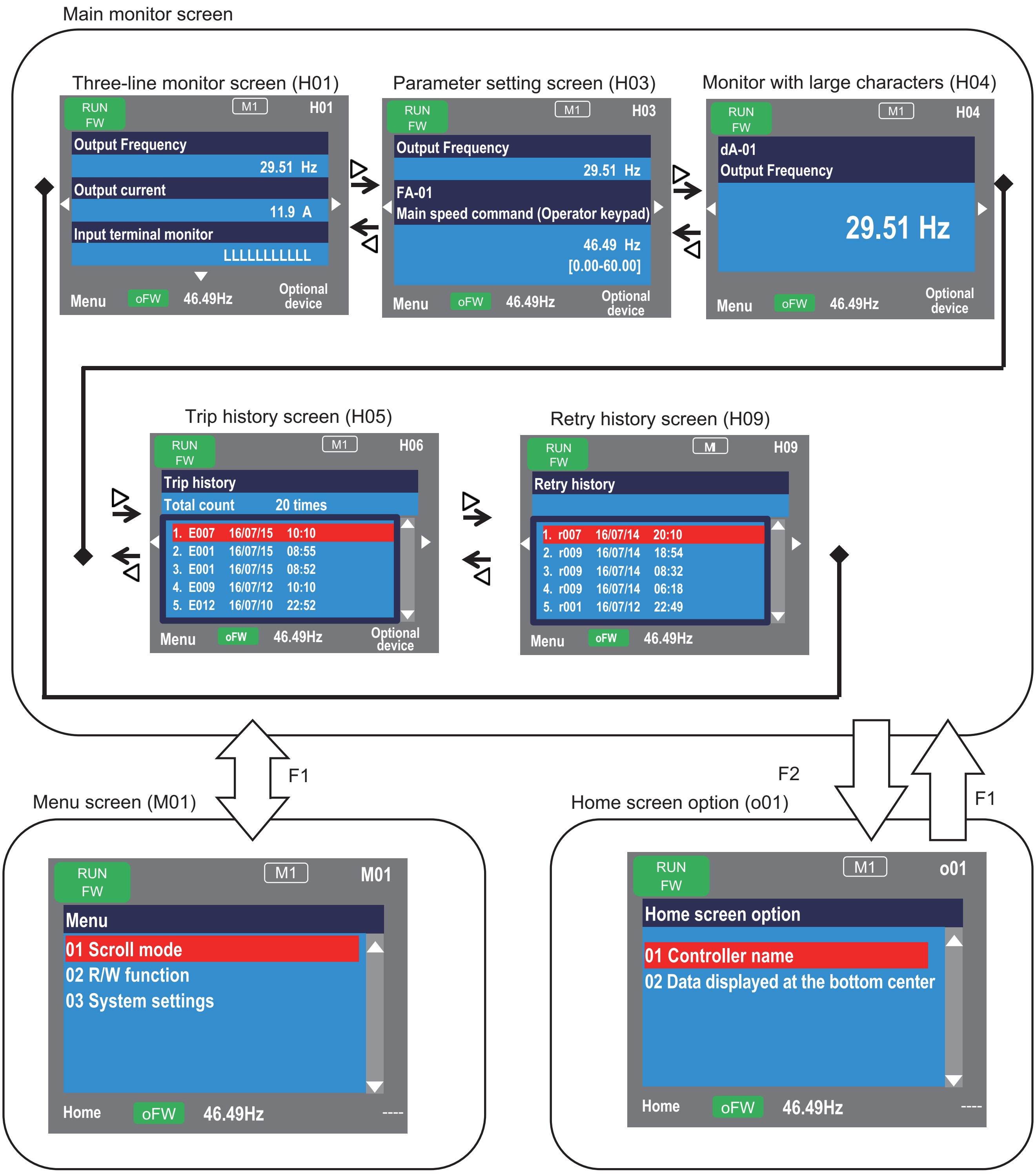
Display	Description
(None)	Not in a special state.
Auto tuning	During auto tuning.
Simulation mode	In the simulation mode.
Forced operation	During forced operation in an emergency.
Bypass mode	Bypass mode

LCD Display Backlight

For the LCD display backlight, two colors are provided: white and orange.
Colors varying depending on the inverter's status are shown in the table below.

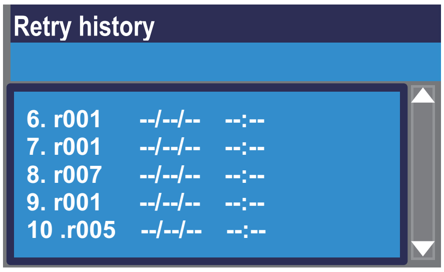
Backlight color	Status
White	Normal
Orange	Warning
White and orange blinks alternatively at one-second interval.	Trip

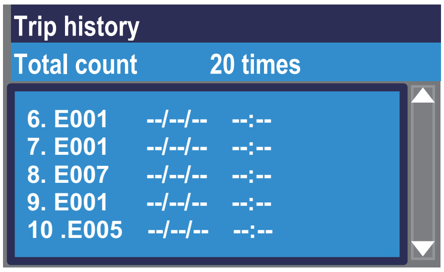
3-1-4 Transition of Screen Display



Additional Information

- To display time in trip history and retry history, you need to make the clock settings.
- To retain the time while the inverter is power off, an optional battery (CR2032, 3V) is required.
- When the time is not retained, the display of trip history and retry history are shown below.





3-1-5 How to Set Battery and Make Clock Settings

The clock function of the LCD Operator can display the date and the time of trip history and retry history. To use this function, prepare an optional battery (CR2032, 3V) for the LCD Operator.

● Procedure for Setting Clock Function and Inserting Battery

1. In the system setting screen of the LCD Operator, enable the battery level warning.
   Press the F1 key on the main monitor screen, and select from the menu screen **03 System setting**, **10 Battery level warning**, and **01 Enabled** in this order.
2. Power-off the inverter.
   Make sure that the POWER lamp on the LCD Operator is off.
3. Remove the LCD Operator from the inverter.
4. Open the lid on the back side of the LCD operator and insert a battery.
   Make sure the positive side of the battery can be seen.
5. Close the lid and set the LCD Operator to the inverter.
6. Power-on the inverter.
7. Make sure that the following screen comes up. Set the date and time.

8 Make sure that the battery is inserted properly.
Turn OFF the inverter and turn it ON again.
When the battery is properly inserted, the inverter starts without errors.
If the same screen shown in Step 7 comes up again, the battery is not set properly. Please try the setting procedure from Step 2.
You can set the time by **09 Date and time** of the system setting screen
Note that the clock function is not enabled just by inserting the battery. You need to set the date and time to enable the clock function.

Precautions for Safe Use

- When disposing of LCD operators and depleted batteries, follow the applicable ordinances of your local government. When disposing of the battery, insulate it using tape.

廢電池請回收

The following display must be indicated when products using lithium primary batteries (with more than 6 ppb of perchlorate) are transport to or through the State of California, USA.

Perchlorate Material - special handling may apply.
See https://dtsc.ca.gov/perchlorate/

When exporting your product containing a lithium primary battery to California, USA, please indicate the above labeling on the packing box or shipping box of your product.

- Do not short + and –, charge, disassemble, heat, put into the fire, or apply strong impact on the battery. The battery may leak, explode, produce heat or fire. Never use the battery which was applied strong impact due to such as fall on the floor, it may leak.
- UL standards establish that the battery shall be replaced by an expert engineer. The expert engineer must be in charge of the replacement and also replace the battery according to the method described in this manual.

Additional Information

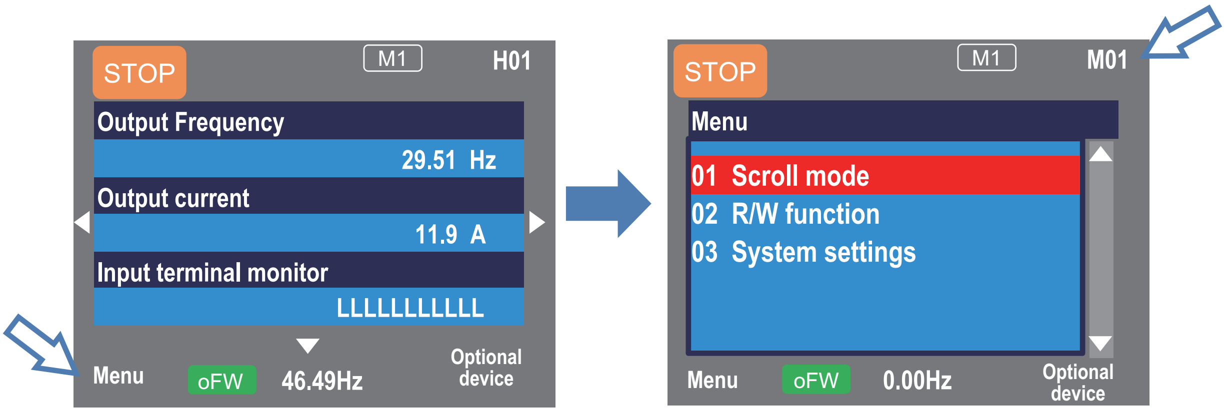
- The parameters and DriveProgramming programs saved in the LCD Operator are retained even without batteries.
- If the LCD operator display becomes unrecognizable at the end of its life, replace the LCD Operator.

3-2 Parameter Settings

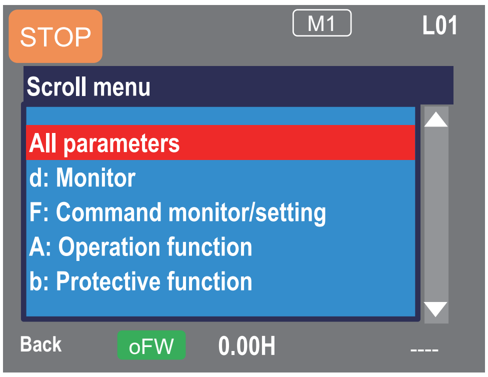
Two procedures are provided for parameter settings: *scroll mode* in which you can check list of setting data of parameters, and *concurrent monitor mode* you can change parameters while watching the monitor under operation.

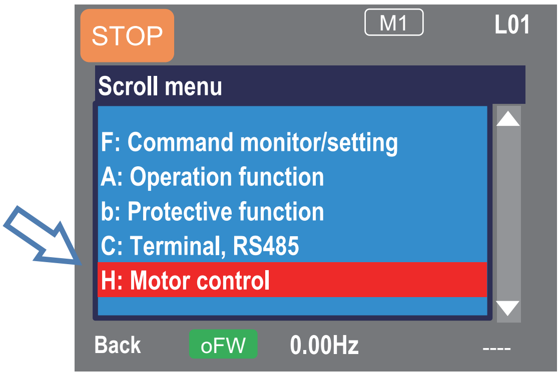
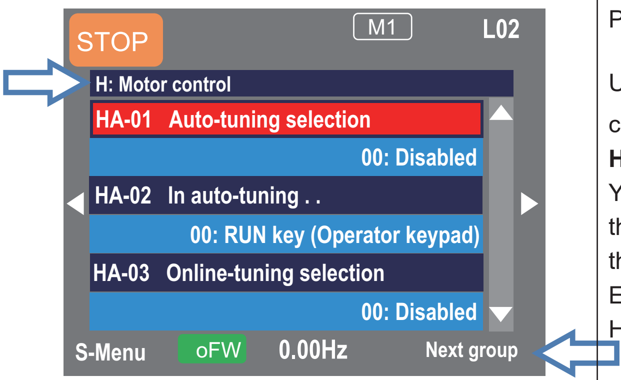
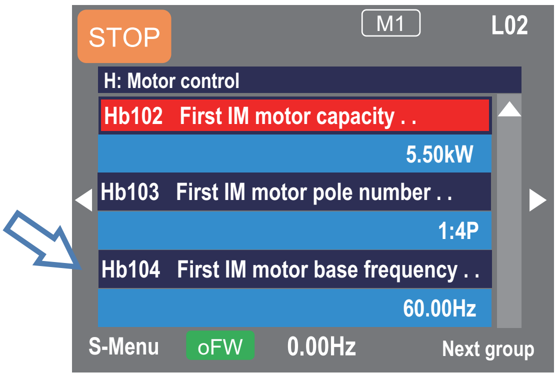
3-2-1 Scroll Mode

You can change parameters in the scroll mode when configuring the basic settings of motor, base frequency, rated voltage of motor, input and output of terminals, as well as when configuring individual functions.
You can check the list of setting data of parameters in the scroll mode, therefore, it is also effective when checking the settings.
Press the F1 key on the main monitor screen that is displayed upon power-on to move to the menu screen **M01**.

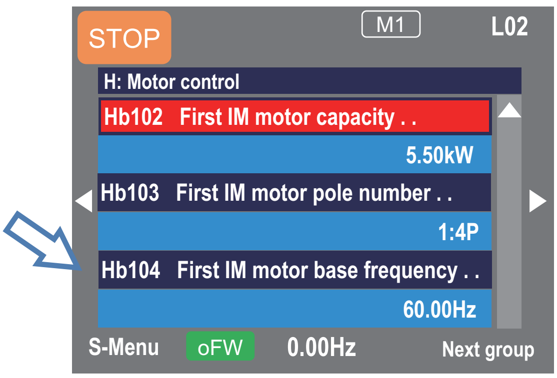


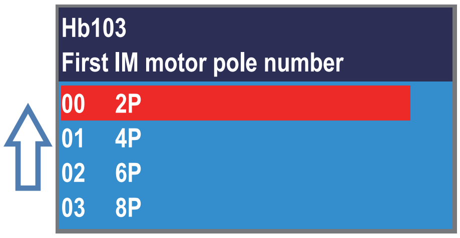
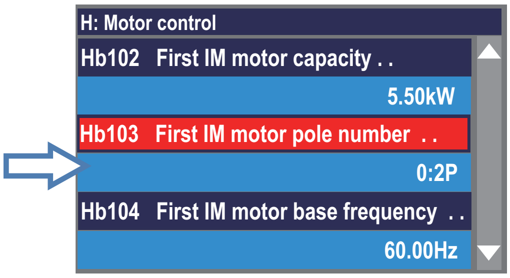
This means that pressing the F1 key will transition to **Menu**.
Scroll menu - Parameter selection screen

Display	Operation
	Choose **Scroll mode** on the system settings screen **M01** and press the ENTER key to show the scroll menu **L01**.

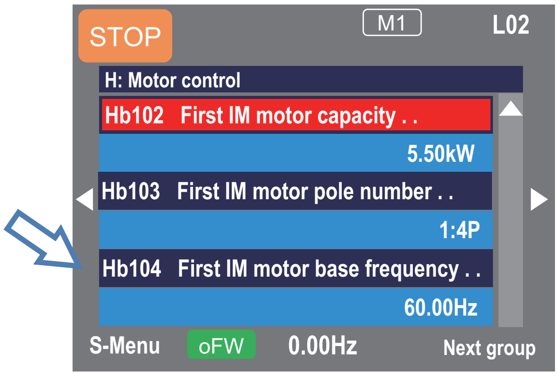
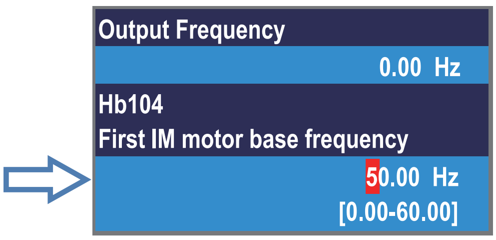
Display	Operation
	Choose a group you want to browse using the UP and DOWN ( ) keys, and then press the ENTER key to move to the parameter list display. For example, select **H: Motor control**. The following example shows how to check the **Hb** group, which is a basic parameter of the induction motor, and how to change the parameter.
	Parameters of **H: Motor control** are displayed. Using the UP and DOWN ( ) keys, you can check the parameters. Pressing the F2 key jumps to **Hb102** which is listed on top of the next group of **HA**. You can jump to the top parameter of the sub-group in the group (**HA**, **Hb**, etc. in the case of group H) using the F2 key. Example of group H: … ⇒ HA ⇒ Hb ⇒ HC ⇒ Hd ⇒ HA ⇒ …
	Using the UP and DOWN ( ) keys, you can check the parameters. Choose the parameter to change, and then press the ENTER key.

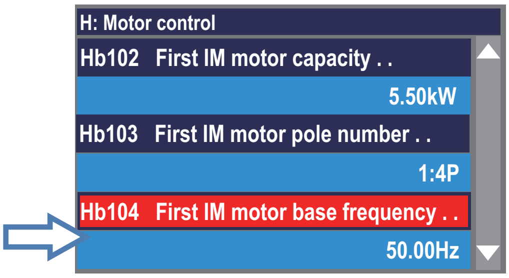
The following example shows how to change the parameters.
Example 1) Changing **Async.Motor poles setting, 1st-motor** (Hb103)

Display	Operation
	Use the UP and DOWN ( ) keys to select **Async.Motor poles setting, 1st-motor** (Hb103), and press the ENTER key.

<table>
<tr><th>Display</th><th>Operation</th></tr>
<tr><td>
</td><td>If the number of motor poles is 2, using the UP and DOWN ( ) keys to choose 00 2P, and press the F2 key ("Save").
Data is saved when the F2 key is pressed. The data is still saved even after the device is turned off. When you do not need to save the setting after changing it, press the F1 key ("Back"). The screen returns to the parameter list display.</td></tr>
<tr><td>
</td><td>To confirm if the data is correctly changed, check the lower section of the parameter display.
Press the F1 key to return to the monitor screen.</td></tr>
</table>

Example 2) Changing **Async.Motor Base frequency setting, 1st-motor** (Hb104)

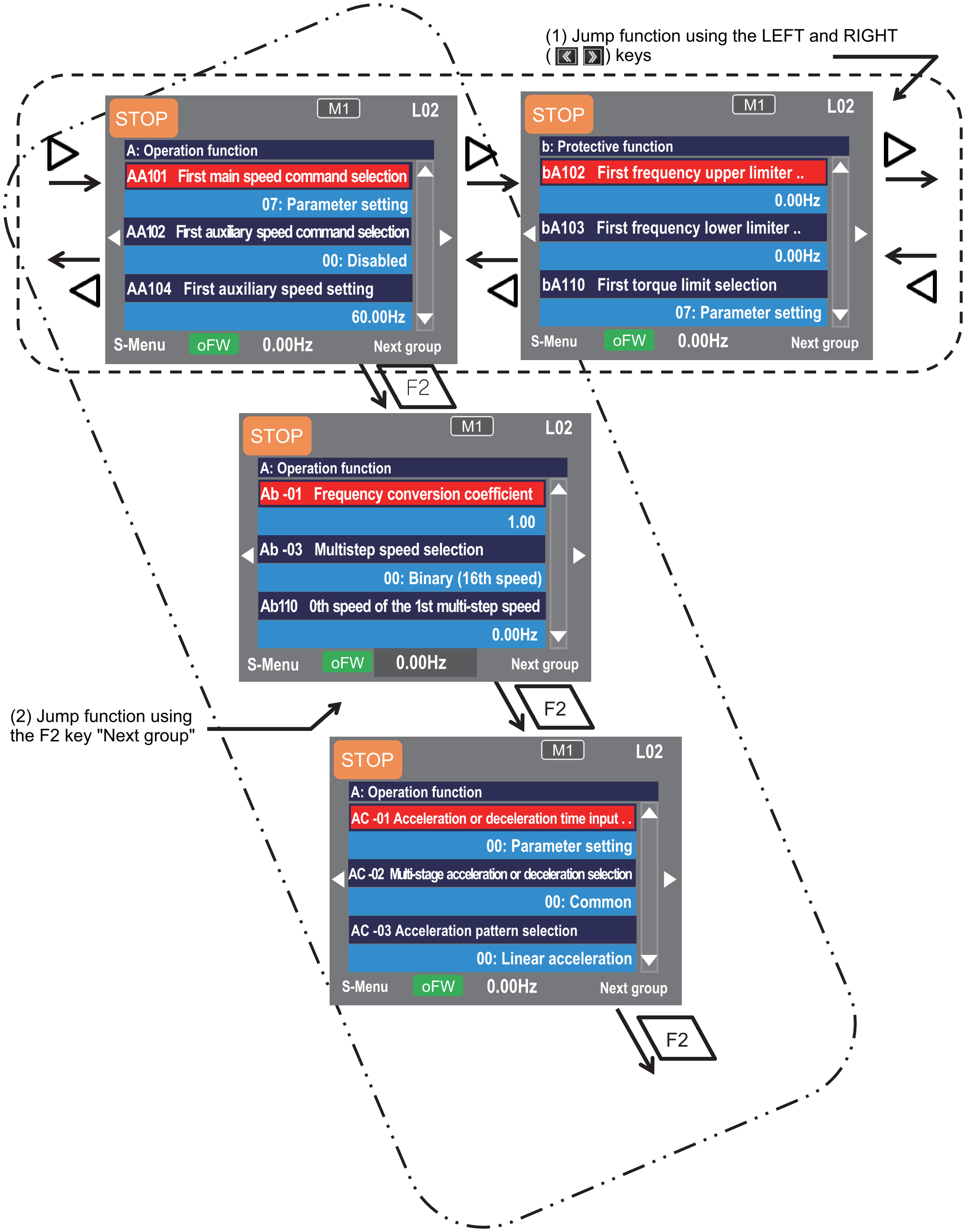
<table>
<tr><th>Display</th><th>Operation</th></tr>
<tr><td>
</td><td>Use the UP and DOWN ( ) keys to select Async.Motor Base frequency setting, 1st-motor (Hb104), and press the ENTER key.</td></tr>
<tr><td>
</td><td>You can change the right-most digit of data area. Change the value using the UP, DOWN, RIGHT, and LEFT ( ) keys and press the F2 key.
The figure on the left shows when the base frequency is changed to 50.00Hz. Data is saved when the F2 key is pressed.
When you do not need to save the setting after changing it, press the F1 key ("Back"). The screen returns to the parameter list display.
When you use the F2 key to save the data, it is still saved even after the device is turned off.
You can make adjustments while performing monitoring. The monitor on the upper area shows the parameter selected in the monitor with large characters.</td></tr>
</table>

Display	Operation
	To confirm if the data is correctly changed, check the lower section of the parameter display. Press the F1 key to return to the monitor screen.

On the scroll mode screen **L02**, you can change the display as follows.

a. You can jump to the top parameter of each group by using the RIGHT and LEFT () keys.
(… ⇔ All parameters ⇔ d: Monitor ⇔ F: Command monitor/setting ⇔ … ⇔ U: Initial setting, PDN ⇔ All parameters ⇔ …)

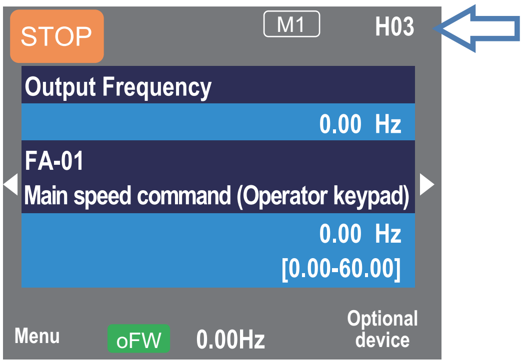
b. You can jump to the top parameter of the sub-group in the group (AA, Ab, etc.) using the F2 key (Next group). (Transition is performed in one direction (see below).)
Example of group A: … ⇒ AA ⇒ Ab ⇒ AC ⇒ … ⇒ AJ ⇒ AA ⇒ …


(1) Jump function using the LEFT and RIGHT
( ) keys
STOP
M1
L02
A: Operation function
AA101 First main speed command selection
07: Parameter setting
AA102 First auxiliary speed command selection
00: Disabled
AA104 First auxiliary speed setting
60.00Hz
S-Menu
oFW
0.00Hz
Next group
STOP
M1
L02
b: Protective function
bA102 First frequency upper limiter ..
0.00Hz
bA103 First frequency lower limiter ..
0.00Hz
bA110 First torque limit selection
07: Parameter setting
S-Menu
oFW
0.00Hz
Next group
F2
STOP
M1
L02
A: Operation function
Ab -01 Frequency conversion coefficient
1.00
Ab -03 Multistep speed selection
00: Binary (16th speed)
Ab110 0th speed of the 1st multi-step speed
0.00Hz
S-Menu
oFW
0.00Hz
Next group
(2) Jump function using
the F2 key "Next group"
F2
STOP
M1
L02
A: Operation function
AC -01 Acceleration or deceleration time input . .
00: Parameter setting
AC -02 Multi-stage acceleration or deceleration selection
00: Common
AC -03 Acceleration pattern selection
00: Linear acceleration
S-Menu
oFW
0.00Hz
Next group
F2

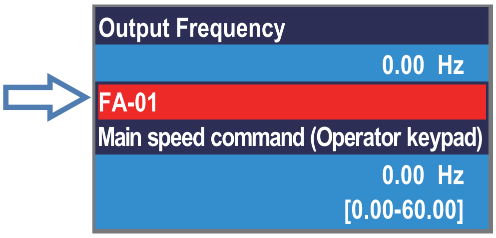
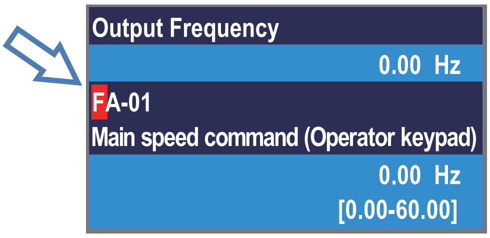
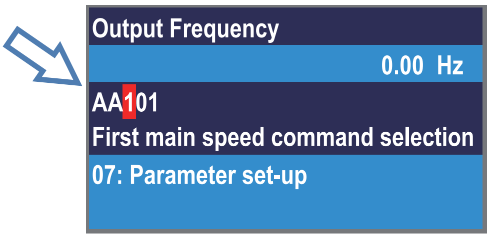
3-2-2 Setting Screen “Concurrent Monitor Mode”

You can change the settings, such as frequency command and acceleration/deceleration time, on this setting screen while watching the monitor during operation.

On the screen that is displayed upon power-on, use the RIGHT and LEFT () key to navigate to the Setting screen (H03).



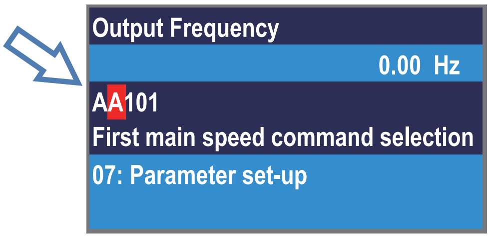
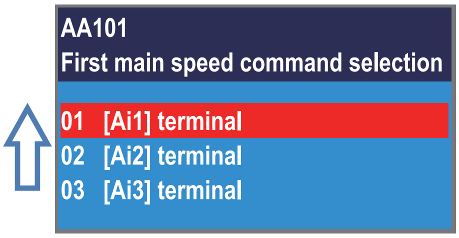
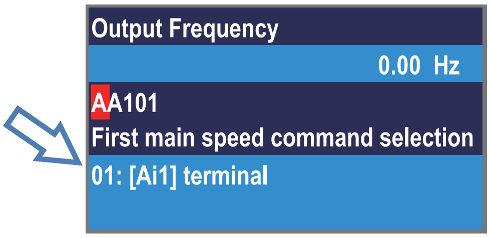
Monitor screen - Parameter selection screen

Display	Operation
	Press the ENTER key to change the color of the parameter field. Using the UP and DOWN () keys, you can choose to change the parameter or change the monitor.
	When you press the ENTER key again, the left-most letter of the parameter can be changed.
	Using the UP, DOWN, RIGHT, and LEFT ( ) key, change the parameter number that you want to change, and then press the ENTER key.

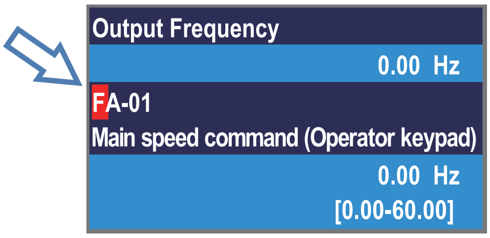
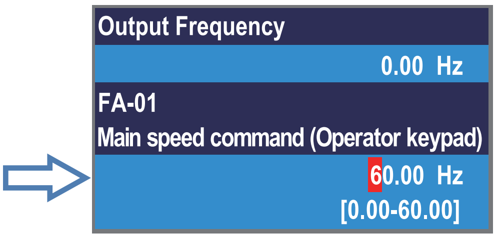
The following two examples show how to change the parameters.

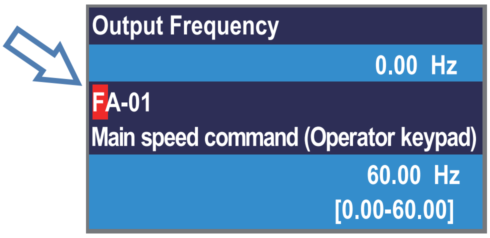
Example 1) Changing **Main speed input source selection, 1st-motor** (AA101) and enabling the analog input frequency command

Select the analog input terminal 1 [Ai1].

Display	Operation
	Press the ENTER key while **Main speed input source selection, 1st-motor** (AA101) is displayed. The information currently selected is shown in the lower section. *07: Parameter setting* is currently selected.
	Use the UP and DOWN ( ) keys to choose *01: Ai1 terminal* and press the F2 key. Data is saved when the F2 key is pressed. The data is still saved even after the device is turned off. When you do not need to save the setting after changing it, press the F1 key (Back). The screen returns to the monitor.
	To confirm if the data is correctly changed, check the lower section display. Press the F1 key to return to the monitor. The information currently selected is shown in the lower section. *01: Ai1 terminal* is currently selected.

Example 2) Editing **Main Speed reference monitor** (FA-01) directly and changing command frequency.
You can use this method when **Main speed input source selection, 1st-motor** (AA101) is set to *07: Parameter setting*.

Display	Operation
	Press the ENTER key while **Main Speed reference monitor** (FA-01) is displayed. When the parameter name is **Main Speed reference monitor (Operator keypad)** or **Main Speed reference monitor (Multistage speed)** (Multistage speed 1 to 15), you can edit the output frequency. If the parameter name is other than the above, such as analog input, the output frequency cannot be edited because it is for display only.
	You can change the right-most digit of data area. Change the value using the UP, DOWN, RIGHT, and LEFT ( ) keys and press the F2 key. The figure on the left shows when the base frequency is changed to 60.00Hz. Data is saved when the F2 key is pressed. The data is still saved even after the device is turned off. You can make adjustments while performing monitoring.

Display	Operation
	To confirm if the data is correctly changed, check the lower section display. Press the F1 key to return to the monitor. The current frequency command is shown in the lower section. Currently, 60.00Hz is input as the command.

Additional Information

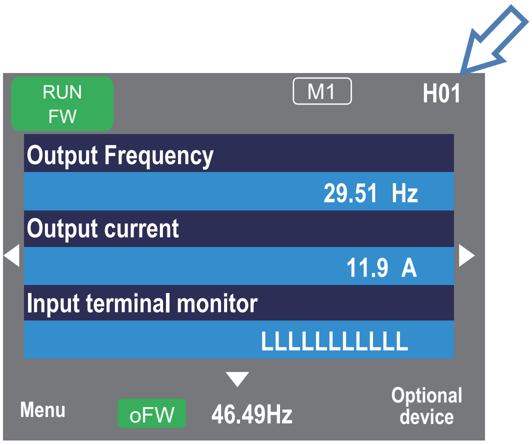
If you display a parameter that cannot be changed while the inverter is in operation and press the ENTER key, the parameter cannot be edited.

3-3 Monitoring Function

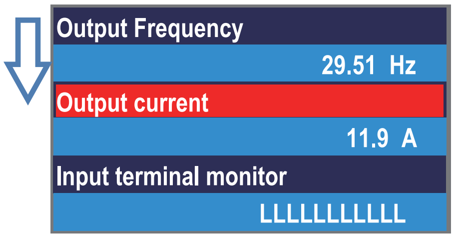
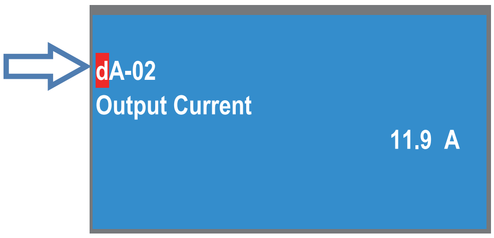
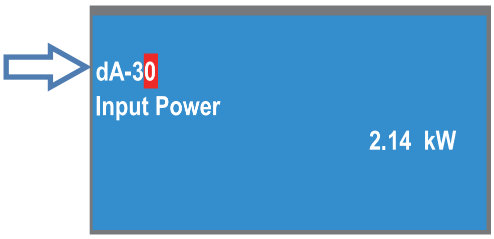
3-3-1 Three-line Monitor Screen

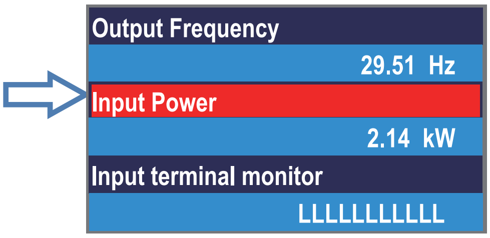
In the three-line monitor screen, you can monitor three types of information at the same time. You can change the items to monitor.

On the screen that is displayed upon power-on, press the RIGHT and LEFT ( ) keys to move to the the three-line monitor screen (H01).
After that, follow the procedure below.



Example) Change **Output current monitor** (dA-02) to **Input power monitor** (dA-30)

Display	Operation
	Press the ENTER key to change the color of the upper field. Use the UP or DOWN ( ) keys to move to the second line.
	When you press the ENTER key, the left-most letter of the parameter can be changed.
	Use the UP, DOWN, RIGHT, or LEFT ( ) keys to change the monitor item No. from (dA-02) to (dA-30).

<table>
<tr><th>Display</th><th>Operation</th></tr>
<tr><td>
</td><td>Press the ENTER key to confirm the monitoring target.
Press the F1 key to return to the monitor.</td></tr>
</table>

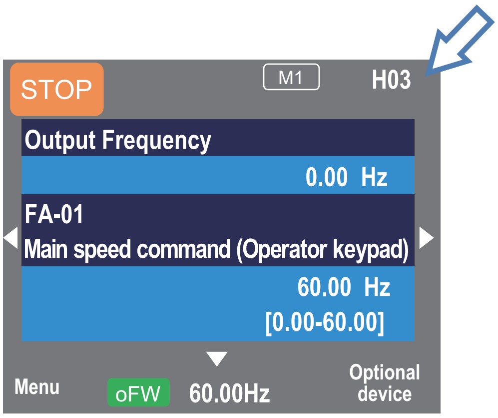
Additional Information

Data displayed in the first line on the three-line monitor screen (H01) is the same as that displayed on the upper area of the setting screen (H03) and the monitor with large characters (H04).

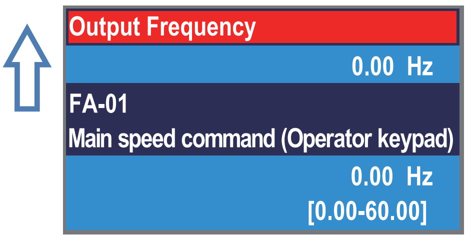
3-3-2 Setting Screen “Concurrent Monitor”

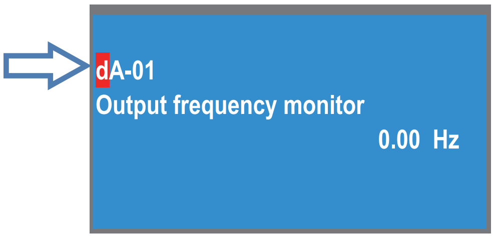
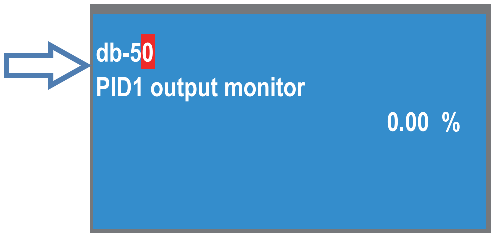
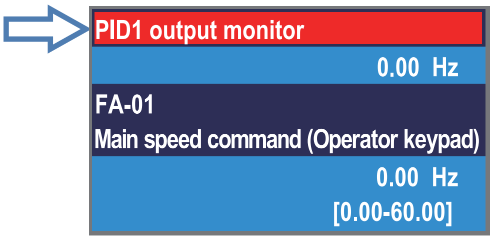
On the setting screen, you can control parameter data while performing monitoring.

On the screen that is displayed upon power-on, press the RIGHT and LEFT ( ) keys to move to the the setting screen (H03).
After that, follow the procedure below.



Example) Change the output frequency monitor to the PID1 output monitor

<table>
<tr><th>Display</th><th>Operation</th></tr>
<tr><td>
</td><td>Press the ENTER key to change the color of the parameter field. Use the UP or DOWN ( ) keys to move to the monitoring target.</td></tr>
</table>

Display	Operation
	When you press the ENTER key, the left-most letter of the parameter can be changed.
	Use the UP, DOWN, RIGHT, or LEFT ( ) keys to change (dA-01) to (db-50).
	Press the ENTER key to confirm the monitoring target. It is displayed on the upper line. Press the F1 key to return to the monitor. You can use UP and DOWN ( ) keys to make the parameter setting.

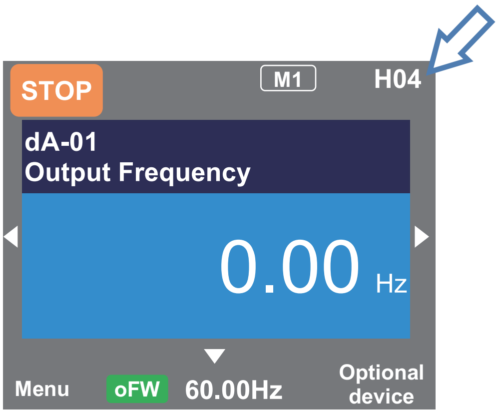
Additional Information

Data displayed in the upper area on the setting screen (H03) is the same as that displayed in the first line on the three-line monitor screen (H01) and the monitor with large characters (H04).

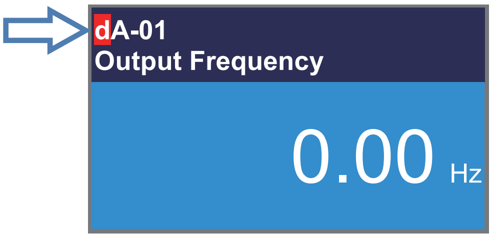
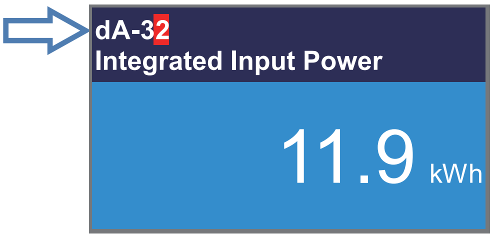
3-3-3 Monitor with Large Characters

In the monitor with large characters, you can display a parameter in bigger size.

On the screen that is displayed upon power-on, press the RIGHT and LEFT ( ) keys to move to the monitor with large characters (H04).
After that, follow the procedure below.



Example) Change the output frequency monitor to the integrated input power monitor

Display	Operation
	When you press the ENTER key, the left-most letter of the monitor item (parameter No.) can be changed.
	Use the UP, DOWN, RIGHT, or LEFT ( ) keys to change (dA-01) to (dA-32). Press the ENTER key to confirm it and return to the monitor.

Additional Information

Data displayed in the monitor with large characters (H04) is the same as that displayed on the upper area of the setting screen (H03) and the first line on the three-line monitor screen (H01).

3-4 Error History Display

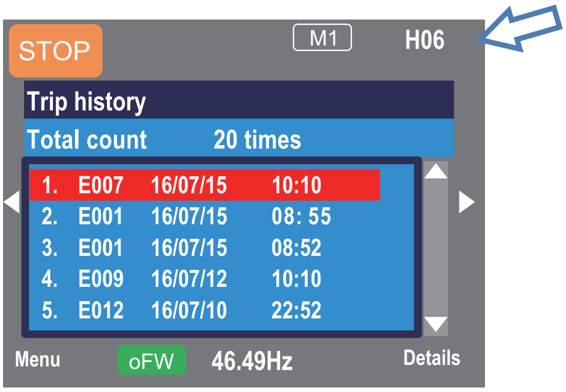
3-4-1 Trip History

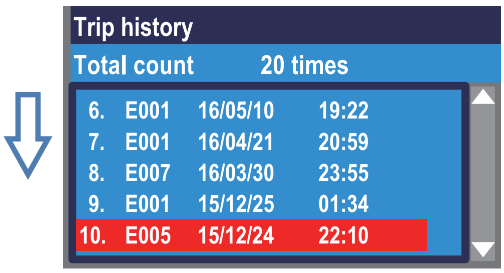
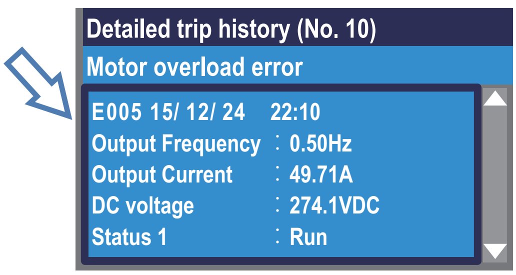
The trip history screen shows details of the errors that have occurred and the total number of times trip occurred.

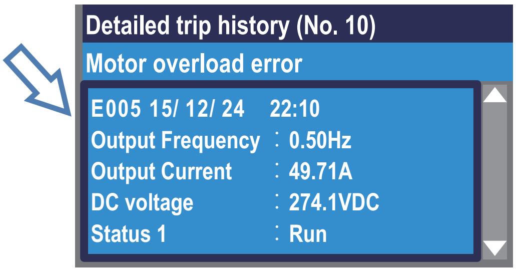
For details of errors, refer to *12-2 Error Numbers and Corresponding Measures* on page 12-5.

On the screen that is displayed upon power-on, press the RIGHT and LEFT ( ) keys to move to the trip history screen (H06).

After that, follow the procedure below.

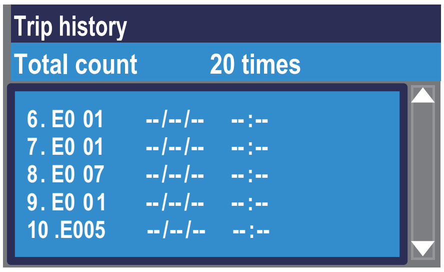


Display	Operation
	Use the UP and DOWN ( ) keys to select a trip history that you want to check.
	Press the ENTRY key to show details of the selected history.

Display	Operation
	Use the UP and DOWN ( ) keys to check the details. Press the F1 key to return to the monitor.

Additional Information

- To display time in trip history, you need to configure clock settings.
- To use the clock function, the optional battery (CR2032, 3V) is required.
- When the time is not retained, the display of trip history is shown below.



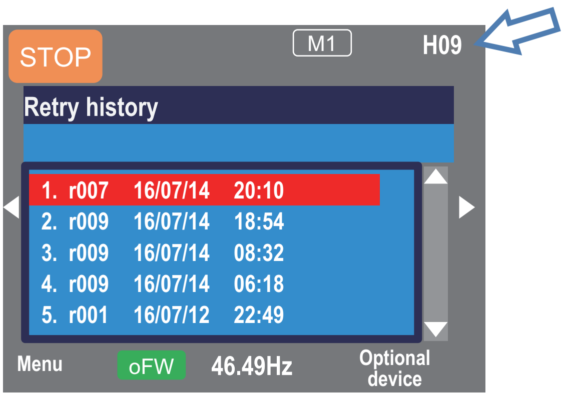
3-4-2 Retry History

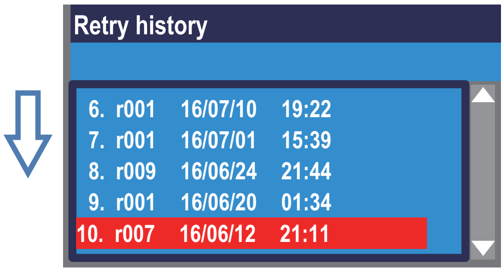
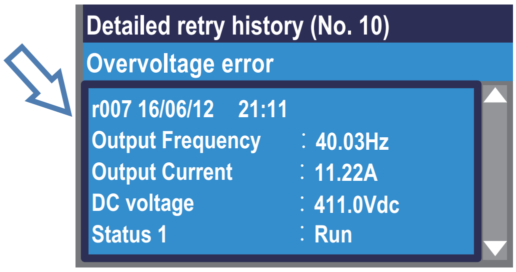
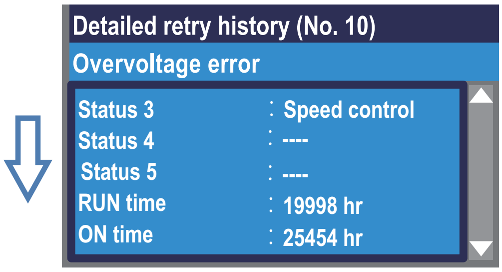
The retry history screen shows details of the errors that have occurred and the total number of times retry was performed.

For details of errors, refer to *12-1-1 Checking Trip Information* on page 12-2.

On the screen that is displayed upon power-on, press the RIGHT and LEFT ( ) keys to move to the retry history screen (H06).

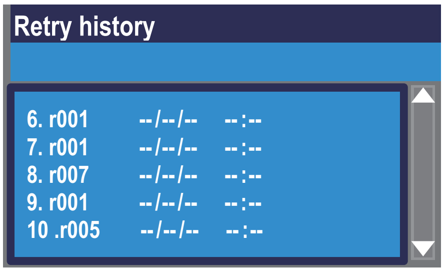
After that, follow the procedure below.



<table>
<tr><th>Display</th><th>Operation</th></tr>
<tr><td>
</td><td>Use the UP and DOWN ( ) keys to select a retry history that you want to check.</td></tr>
<tr><td>
</td><td>Press the ENTRY key to show details of the selected history.</td></tr>
<tr><td>
</td><td>Use the UP and DOWN ( ) keys to check the details.
Press the F1 key to return to the monitor.</td></tr>
</table>

Precautions for Correct Use

- To display time in retry history, you need to configure clock settings.
- To use the clock function, the optional battery (CR2032, 3V) is required.
- When the time is not retained, the display of retry history is shown below.



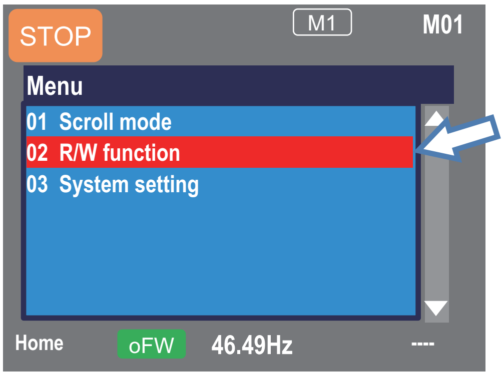
3-5 Data Copy Function

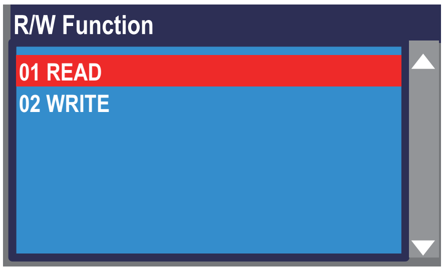
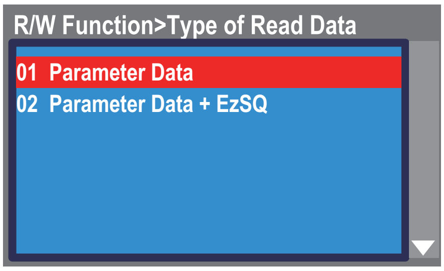
With the data copy function (R/W function), you can copy data from the inverter to the LCD operator or write the copied data to the inverter.
This function is used to rewrite a backup data to the inverter or to copy data from another inverter.
Only a set of data can be saved.

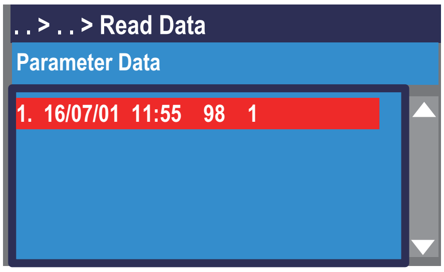
3-5-1 READ Function

This function is used to copy data from the inverter to the LCD Operator.
On the screen that is displayed upon power-on, press the F1 key to move to the menu screen **M01**.

Use the UP and DOWN ( ) keys and the ENTER key to select *02 R/W function*.



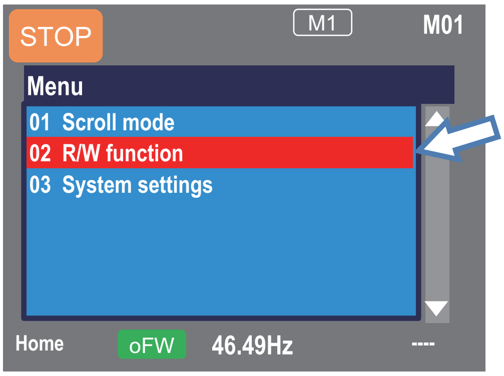
<table>
<tr><th>Display</th><th>Operation</th></tr>
<tr><td>
</td><td>Use the UP and DOWN ( ) keys to select READ and press the ENTER key.</td></tr>
<tr><td>
</td><td>Use the UP and DOWN ( ) keys to select READ and press the ENTER key.</td></tr>
</table>

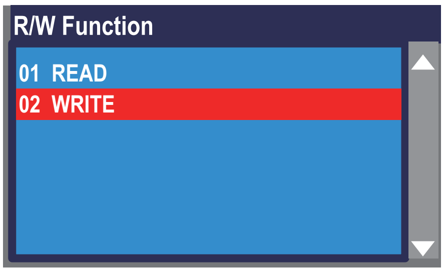
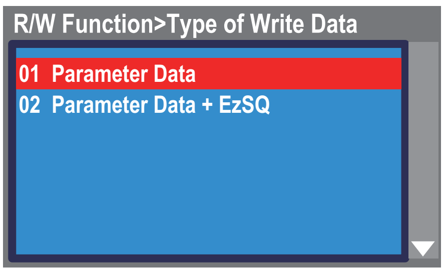
Display	Operation
 For details of display, refer to *3-5-3 Data Saved by Copy Function* on page 3-33.	Follow the instructions on the screen as follows. 1. Place the cursor on the location where the data to be saved and press the F2 key. 2. Press the F2 key again to start reading data from the inverter to the LCD Operator. 3. When the reading is completed, the end screen is displayed.

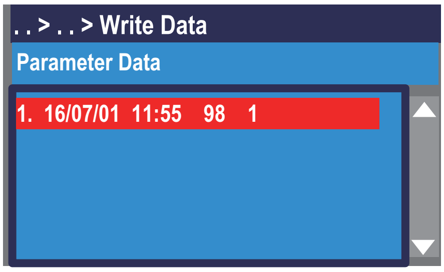
3-5-2 WRITE Function

This function is used to write the data copied in the LCD Operator to the inverter.
On the screen that is displayed upon power-on, press the F1 key to move to the menu screen **M01**.

Use the UP and DOWN ( ) keys and the ENTER key to select **02 R/W function**.



Display	Operation
	Use the UP and DOWN ( ) keys to select **02 WRITE** and press the ENTER key.
	Use the UP and DOWN ( ) keys to select the write data type and press the ENTER key.

Display	Operation
 For details of display, refer to *3-5-3 Data Saved by Copy Function* on page 3-33.	Follow the instructions on the screen as follows. 1. Place the cursor on the data to be written to the inverter and press the F2 key. 2. Press the F2 key again to start writing data from the LCD Operator to the inverter. 3. When the writing is completed, the end screen is displayed.

3-5-3 Data Saved by Copy Function

The display contents of the data saved by the copy function of the LCD operator are as follows.

Display

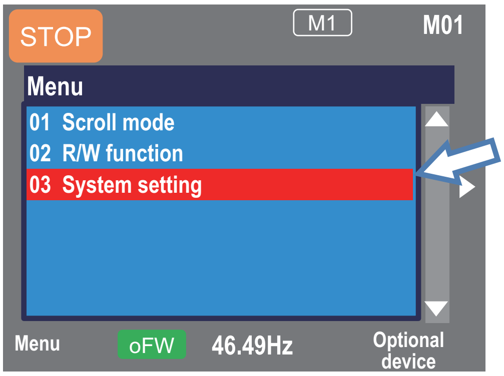
Item	Description
No.	Line number
Date*1*2	The clock information when the reading is saved is recorded.
Time*1*2	The clock information when the reading is saved is recorded.
Inverter identification number	The unique code of the inverter
Data type	1: Parameter only 2: Parameter + **DriveProgramming** program

*1. To record time in the saved data, you need to configure clock settings.

*2. To use the clock function, the optional battery (CR2032, 3V) is required.

3-6 System Settings

On the system settings screen, you can use extended functions.



On the screen that is displayed upon power-on, press the F1 key to move to the menu screen **M01**.

Use the ENTER key or the RIGHT () key to select the system settings screen.

No.	Name	Description
01	Language selection	Changes the language setting.
02	Dimming	Controls the brightness of LCD operator screen.
03	Automatic light off time*1	Controls the time to automatically light off the screen when the LCD Operator is not operated.
04	Dimming at light off*1	Controls the brightness when the screen is automatically lit off.
05	Automatic home transition time	Sets the time to automatically return to the home screen when the LCD Operator is not operated.
06	Initial home screen selection	Sets the screen that is displayed upon power-on and automatic return to the home screen. • **H01**Three-line monitor screen • **H03**Setting screen • **H04**Monitor with large characters • **L02**Scroll screen
07	Read lock	Limits the reading of data.
08	Blinking during trip	Sets whether blinking is performed or not during trip.
09	Date and time*2	Configures settings of time, display format, and battery level warning.
10	Battery level warning	Battery warning settings. Warns when the battery runs out or the residual voltage is low.
11	Color setting	Sets the background color.
12	Inverter basic information monitor	Checks information of the main unit.
13	Selection of connected model	Sets RX2.
14	LCD Operator version	Displays the version of the LCD Operator.
15	Initialization of LCD Operator	Initializes the LCD Operator.
16	Self-check mode	Operates self-check mode.

No.	Name	Description
17	Remote mode switching	If this setting is enabled, you can switch the frequency command and operation command to the commands issued from the LCD Operator by pressing the F1 key on the home screen 1 second or more.
18	Reserve	Do NOT change the setting from *OFF*.

*1. The light off function is disabled from the occurrence of trip until it is canceled.

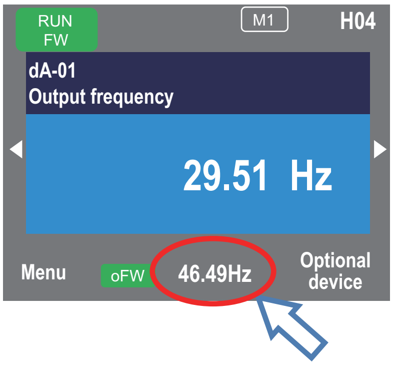
*2. To use the clock function, the optional battery (CR2032, 3V) is required. If no electricity is supplied to the inverter, the battery need to be replaced every two years.

Precautions for Correct Use

If there is an error in the memory area in the LCD Operator, an error message is displayed on the LCD Operator. In such a case, initialize the LCD Operator from the system settings, and confirm the settings.
If the error on the LCD Operator is not canceled, the internal memory may be damaged. You need to replace the LCD Operator.

3-7 Changing the Data Displayed at the Bottom Center

You can change the content of the data displayed at the bottom center.
The function to set the controller (inverter) name among the displayed data is explained.



On the screen that is displayed upon power-on, press the F2 key to move to the option screen **o01**. Then, press the ENTER key to select data that is shown at the bottom center. After selecting data, press the F2 key to save it.

You can set the items to display as follows.

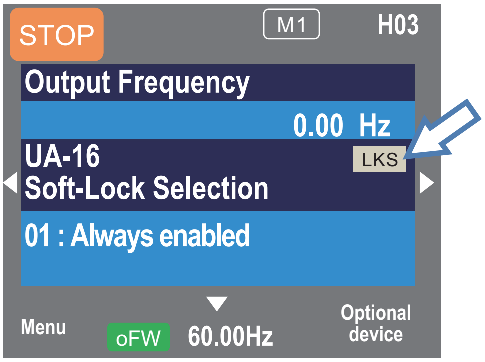
Display	Data	Description
Controller (inverter) name settings **o02**	________	You can specify the inverter name using 8-digit alphanumeric characters and symbols.
Data displayed at the bottom center **o03**	**00 Frequency command**	The current frequency command value is displayed.
	01 Torque command	The current torque command is displayed during torque control.
	02 Time	The current time is displayed.
	03 Controller name	The specified controller (inverter) name is displayed.

3-8 Parameter Function

3-8-1 Parameter Protective Function

You can protect the set parameters by disabling the parameters from being changed.
By setting **Soft Lock selection** (UA-16) and **Soft Lock target selection** (UA-17), you can prevent parameters from being changed.

While the soft lock function is enabled, the LKS mark (LKS) is shown on the right of parameters.



● Parameter

Item	Parameter	Data	Description
Soft Lock selection	UA-16[*1]	00	Normal state. When the soft lock terminal [SFT] is ON, data set to (UA-17) are locked.
		01	Data set to (UA-17) are locked.
Soft Lock target selection	UA-17	00	All data except (UA-16)[*1] cannot be changed.
		01	Data except (UA-16)[*1] and set frequency cannot be changed.

*1. Even while the soft lock function is enabled, you can change **Soft Lock selection** (UA-16).

● Input Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Soft lock	SFT	036	OFF: Soft lock disabled ON: Soft lock enabled[*1]

*1. You can set the soft lock function at the terminal independently of the parameter (UA-16).

3-8-2 Limiting Displayed Parameters

You can limit the parameters displayed to the LCD Operator according to your purpose.

Related Parameter

Item	Parameter	Data	Description
Display restriction selection	UA-10	00	All parameters are displayed.
		01	Parameters are displayed by function. Disabled functions are not displayed with some exceptions.
		02	Parameters set by the user are displayed. Parameters set to (UA-31) to (UA-62) are displayed with some exceptions.
		03	Parameters that have been changed from the factory default settings and some other parameters are displayed.
		04	Monitor parameters and some other parameters are displayed.
2nd-motor parameter display selection	UA-21	00	Hides parameters of second setting (**2**).
		01	Displays parameters of second setting (**2**).
Option parameter display selection	UA-22	00	Hides parameters that start with o.
		01	Displays parameters that start with o.
User parameter selection	UA-31 to UA-62	no	No assignment
		*****	Choose the code you want to display. (All codes are subjected.)

To show and check the changed parameters only, set **Display restriction selection** (UA-10) to *03: Data comparison display*.
To hide the parameters of the unused functions, set **Display restriction selection**(UA-10) to *01: By function*. The number of displays can be reduced.
If the second setting is not used, you can significantly reduce the number of displays by setting **2nd-motor parameter display selection** (UA-21) to *00: Not display* without assigning the second control terminal [24: SET] for **Input terminal function** (CA-01) to (CA-11).
If no option unit is mounted, you can reduce the number of displays related to the option unit by setting **Option parameter display selection** (UA-22) to *00: Not display*.

Function-specific Display: (UA-10)=01

If a function is disabled, parameters related to the function are hidden. The parameters that can be hidden are shown below.
For more information about the display condition, see the table below.
The * mark in the table is replaced by 1 or 2. 1 represents first and 2 represents second.

a. IM control parameters
   Display condition: When **Control mode selection, 1st-motor** (AA121) is set to any of the IM control methods *00, 01, 02, 03, 04, 05, 06, 07, 08, 09, or 10*, the parameters are displayed. When it is set to any of the SM/PMM control methods *11 or 12*, the parameters are hidden.
   - **Control mode selection, 1st-motor** (AA121) is set to *10* or below, and when the first setting is enabled, the parameters are displayed.
   - **Control mode selection, 2nd-motor** (AA221) is set to *10* or below, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
Hb*02	Async.Motor capacity setting, *-motor

Parameter	Name
Hb*03	Async.Motor poles setting, *-motor
Hb*04	Async.Motor Base frequency setting, *-motor
Hb*05	Async.Motor Maximum frequency setting, *-motor
Hb*06	Async.Motor rated voltage, *-motor
Hb*08	Async.Motor rated current, *-motor
Hb*10	Async.Motor constant R1, *-motor
Hb*12	Async.Motor constant R2, *-motor
Hb*14	Async.Motor constant L, *-motor
Hb*16	Async.Motor constant Io, *-motor
Hb*18	Async.Motor constant J, *-motor
Hb*30	Minimum frequency adjustment, *-motor
Hb*31	Reduced voltage start time setting, *-motor
Hb*40	Manual torque boost operational mode selection, *-motor
Hb*41	Manual torque boost value, *-motor
Hb*42	Manual torque boost Peak speed, *-motor
Hb*45	Eco drive enable, *-motor
Hb*46	Eco drive response adjustment, *-motor
Hb*50	Free-V/f frequency 1 setting, *-motor
Hb*51	Free-V/f Voltage 1 setting, *-motor
Hb*52	Free-V/f frequency 2 setting, *-motor
Hb*53	Free-V/f Voltage 2 setting, *-motor
Hb*54	Free-V/f frequency 3 setting, *-motor
Hb*55	Free-V/f Voltage 3 setting, *-motor
Hb*56	Free-V/f frequency 4 setting, *-motor
Hb*57	Free-V/f Voltage 4 setting, *-motor
Hb*58	Free-V/f frequency 5 setting, *-motor
Hb*59	Free-V/f Voltage 5 setting, *-motor
Hb*60	Free-V/f frequency 6 setting, *-motor
Hb*61	Free-V/f Voltage 6 setting, *-motor
Hb*62	Free-V/f frequency 7 setting, *-motor
Hb*63	Free-V/f Voltage 7 setting, *-motor
Hb*70	Slip Compensation P-gain with encoder, *-motor
Hb*71	Slip Compensation I-gain with encoder, *-motor
Hb*80	Output voltage gain,
HC*01	Automatic torque boost voltage compensation gain, *-motor
HC*02	Automatic torque boost slip compensation gain, *-motor
HC*10	Zero speed area limit for Async.M-0SLV, *-motor
HC*11	Boost value at start for Async.M-SLV/IM-CLV, *-motor
HC*12	Boost value at start for Async.M-0SLV, *-motor
HC*13	Secondary resistance correction, *-motor
HC*14	Counter direction run protection selection, *-motor
HC*20	Torque current reference filter time constant, *-motor
HC*21	Speed feedforward compensation gain, *-motor

b. SM/PMM control parameter

Display condition: When **Control mode selection, 1st-motor** (AA121) is set to any of the SM/PMM control methods *11 or 12*, the parameters are displayed. When it is set to any of the IM control methods *00, 01, 02, 03, 04, 05, 06, 07, 08, 09, or 10*, the parameters are hidden.

- **Control mode selection, 1st-motor** (AA121) is set to *11* or above, and when the first setting is enabled, the parameters are displayed.
- **Control mode selection, 2nd-motor** (AA221) is set to *11* or above, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
Hd*02	Sync.Motor capacity setting, *-motor
Hd*03	Sync.Motor poles setting, *-motor
Hd*04	Sync.Base frequency setting, *-motor
Hd*05	Sync.Maximum frequency setting, *-motor
Hd*06	Sync.Motor rated voltage, *-motor
Hd*08	Sync.Motor rated current, *-motor
Hd*10	Sync.Motor constant R, *-motor
Hd*12	Sync.Motor constant Ld, *-motor
Hd*14	Sync.Motor constant Lq, *-motor
Hd*16	Sync.Motor constant Ke, *-motor
Hd*18	Sync.Motor constant J, *-motor
Hd*30	Minimum Frequency for Sync.M-SLV, *-motor
Hd*31	No-Load current for Sync.M-SLV, *-motor
Hd*32	Starting Method for Sync.M, *-motor
Hd*33	IMPE 0V wait number for Sync.M, *-motor
Hd*34	IMPE detect wait number for Sync.M, *-motor
Hd*35	IMPE detect number for Sync.M, *-motor
Hd*36	IMPE voltage gain for Sync.M, *-motor
Hd*37	IMPE Mg-pole position offset, *-motor
Hd-41	Carrier frequency at IVMS
Hd-42	Filter gain of current detection at IVMS
Hd-43	Open phase voltage detection gain
Hd-44	Open phase switching threshold compensation
Hd-45	P-Gain for speed control, SM(PMM)-IVMS
Hd-46	I-Gain for speed control, SM(PMM)-IVMS
Hd-47	Wait time for open phase switching, SM(PMM)-IVMS
Hd-48	Limitation of decision about the drive direction, SM(PMM)-IVMS
Hd-49	Open phase voltage detection timing adjustment, SM(PMM)-IVMS
Hd-50	Minimum pulse width adjustment, SM(PMM)-IVMS
Hd-51	IVMS Current Limit for threshold
Hd-52	IVMS Threshold Gain
Hd-58	IVMS Carrier frequency start/end point

c. Position control parameter

Display condition: When **Vector control mode selection, 1st-motor** (AA123) is set to any of the position controls *01, 02, or 03*, the parameters are displayed. When it is set to *00: Speed/torque control mode*, the parameters are hidden.

- **Vector control mode selection, 1st-motor** (AA123) is set to a value other than *00*, and when the first setting is enabled, the parameters are displayed.

- **Vector control mode selection, 2nd-motor** (AA223) is set to a value other than *00*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
AE-01	Electronic gear setting point selection
AE-02	Electronic gear ratio numerator
AE-03	Electronic gear ratio denominator
AE-04	Positioning complete range setting
AE-05	Positioning complete delay time setting
AE-06	Position feed-forward gain setting
AE-07	Position loop gain setting

d. Orientation

Display condition: When **Vector control mode selection, 1st-motor** (AA123) is set to *01: Pulse string position control mode*, the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **Vector control mode selection, 1st-motor** (AA123) is set to *01*, and when the first setting is enabled, the parameters are displayed.
- When **Vector control mode selection, 2nd-motor** (AA223) is set to *01*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
AE-08	Position bias setting
AE-10	Stop position selection of Home search function
AE-11	Stop position of Home search function
AE-12	Speed reference of Home search function
AE-13	Direction of Home search function

e. Absolute position control

Display condition: When **Vector control mode selection, 1st-motor** (AA123) is set to *02: Absolute position control mode* or *03: High-resolution absolute position control mode*, the parameters are displayed. When it is set to a value other than these, the parameters are hidden.

- When **Vector control mode selection, 1st-motor** (AA123) is set to *02* or above, and when the first setting is enabled, the parameters are displayed.
- When **Vector control mode selection, 2nd-motor** (AA223) is set to *02* or above, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
AE-20 to 50	Position command 0-15
AE-52	Position control range setting(forward)
AE-54	Position control range setting(reverse)
AE-56	Position control mode selection
AE-60	Teach-in function target selection
AE-61	Current position saving at power-off
AE-62	Preset position data
AE-64	Deceleration stop distance calculation Gain
AE-65	Deceleration stop distance calculation Bias
AE-66	Speed Limit in APR control

Parameter	Name
AE-67	APR start speed
AE-70	Homing function selection
AE-71	Direction of homing function
AE-72	Low-speed of homing function
AE-73	High-Speed of homing function

f. Normal acceleration/deceleration speed
Display condition: When **Acceleration/Deceleration Selection** (AC-02) is set to *00: Common*, the parameters are displayed. When it is set to *01: Multi-stage acceleration/deceleration*, the parameters are hidden.

Parameter	Name
AC*15	Select method to switch to Accel2/Decel2 Profile, *-motor
AC*16	Accel1 to Accel2 Frequency transition point, *-motor
AC*17	Decel1 to Decel2 Frequency transition point, *-motor
AC*20	Acceleration time setting 1, *-motor
AC*22	Deceleration time setting 1, *-motor
AC*24	Acceleration time setting 2, *-motor
AC*26	Deceleration time setting 2, *-motor

g. Multi-stage acceleration/deceleration
Display condition: When **Acceleration/Deceleration Selection** (AC-02) is set to *01: Multi-stage acceleration/deceleration*, the parameters are displayed. When it is set to *00: Common*, the parameters are hidden.

Parameter	Name
AC-30	Acceleration time setting for Multispeed-1
AC-32	Deceleration time setting for Multispeed-1
AC-34	Acceleration time setting for Multispeed-2
AC-36	Deceleration time setting for Multispeed-2
AC-38	Acceleration time setting for Multispeed-3
AC-40	Deceleration time setting for Multispeed-3
AC-42	Acceleration time setting for Multispeed-4
AC-44	Deceleration time setting for Multispeed-4
AC-46	Acceleration time setting for Multispeed-5
AC-48	Deceleration time setting for Multispeed-5
AC-50	Acceleration time setting for Multispeed-6
AC-52	Deceleration time setting for Multispeed-6
AC-54	Acceleration time setting for Multispeed-7
AC-56	Deceleration time setting for Multispeed-7
AC-58	Acceleration time setting for Multispeed-8
AC-60	Deceleration time setting for Multispeed-8
AC-62	Acceleration time setting for Multispeed-9
AC-64	Deceleration time setting for Multispeed-9
AC-66	Acceleration time setting for Multispeed-10
AC-68	Deceleration time setting for Multispeed-10
AC-70	Acceleration time setting for Multispeed-11

Parameter	Name
AC-72	Deceleration time setting for Multispeed-11
AC-74	Acceleration time setting for Multispeed-12
AC-76	Deceleration time setting for Multispeed-12
AC-78	Acceleration time setting for Multispeed-13
AC-80	Deceleration time setting for Multispeed-13
AC-82	Acceleration time setting for Multispeed-14
AC-84	Deceleration time setting for Multispeed-14
AC-86	Acceleration time setting for Multispeed-15
AC-88	Deceleration time setting for Multispeed-15

h. Internal DC braking

Display condition: When **DC braking selection, 1st-motor** (AF101) is set to *01: Enabled* or *02: Frequency command*, the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **DC braking selection, 1st-motor** (AF101) is set to *01* or *02*, and when the first setting is enabled, the parameters are displayed.
- When **DC braking selection, 2nd-motor** (AF201) is set to *01* or *02*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
AF*02	Braking type selection, *-motor
AF*03	DC braking frequency, *-motor
AF*04	DC braking delay time, *-motor
AF*05	DC braking force setting, *-motor
AF*06	DC braking active time at stop, *-motor
AF*07	DC braking operation method selection, *-motor
AF*08	DC braking force at start, *-motor
AF*09	DC braking active time at stop, *-motor

i. Brake control 1

Display condition: When **Brake Control Enable, 1st-motor** (AF130) is set to *01: Brake control 1 common in forward/reverse rotation* or *02: Brake control 1 forward/reverse set individually*, the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **Brake Control Enable, 1st-motor** (AF130) is set to *01* or *02*, and when the first setting is enabled, the parameters are displayed.
- When **Brake Control Enable, 2nd-motor** (AF201) is set to *01* or *02*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
AF*31	Brake Wait Time for Release, *-motor
AF*32	Brake Wait Time for Accel., *-motor
AF*33	Brake Wait Time for Stopping, *-motor
AF*34	Brake Wait Time for Confirmation, *-motor
AF*35	Brake Release Frequency Setting, *-motor
AF*36	Brake Release Current Setting, *-motor
AF*37	Braking Frequency

j. Brake control 1 (Forward/reverse set individually)

Display condition: When **Brake Control Enable, 1st-motor** (AF130) is set to *02: Brake control 1 forward/reverse set individually* the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **Brake Control Enable, 1st-motor** (AF130) is set to *02*, and when the first setting is enabled, the parameters are displayed.
- When **Brake Control Enable, 2nd-motor** (AF230) is set to *02*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
AF*38	Brake Wait Time for Release, *-motor (Reverse side)
AF*39	Brake Wait Time for Accel. , *-motor (Reverse side)
AF*40	Brake Wait Time for Stopping, *-motor (Reverse side)
AF*41	Brake Wait Time for Confirmation, *-motor (Reverse side)
AF*42	Brake Release Frequency Setting, *-motor (Reverse side)
AF*43	Brake Release Current Setting, *-motor (Reverse side)
AF*44	Braking Frequency, *-motor (Reverse side)

k. Brake control 2

Display condition: When **Brake Control Enable, 1st-motor** (AF130) is set to *03: Brake control 2*, the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **Brake Control Enable, 1st-motor** (AF130) is set to *03* and when the first setting is enabled, the parameters are displayed.
- When **Brake Control Enable, 2nd-motor** (AF230) is set to *03* and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
AF*50	Brake open delay time, *-motor
AF*51	Brake close delay time, *-motor
AF*52	Brake answer back check time, *-motor
AF*53	Servo lock/ DC injection time at start, *-motor
AF*54	Servo lock/ DC injection time at stop, *-motor

l. Free electronic thermal

Display condition: When **Electronic thermal characteristic selection, 1st-motor** (bC111) is set to *02: Arbitrary setting*, the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **Electronic thermal characteristic selection, 1st-motor** (bC111) is set to *02*, and when the first setting is enabled, the parameters are displayed.
- When **Electronic thermal characteristic selection, 2nd-motor** (bC211) is set to *02* and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
bC*20	Free electronic thermal frequency-1, *-motor
bC*21	Free electronic thermal current-1, *-motor
bC*22	Free electronic thermal frequency-2, *-motor
bC*23	Free electronic thermal current-2, *-motor

Parameter	Name
bC*24	Free electronic thermal frequency-3, *-motor
bC*25	Free electronic thermal current-3, *-motor

m. Gain mapping 1

Display condition: When **Gain switching mode selection, 1st-motor** (HA120) is set to *00: [CAS] terminal*, the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **Gain switching mode selection, 1st-motor** (HA120) is set to *00*, and when the first setting is enabled, the parameters are displayed.
- When **Gain switching mode selection, 2nd-motor** (AA220) is set to *00*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
HA*21	ASR gain switching time setting, *-motor
HA*27	ASR gain mapping P-gain 1 at P-control, *-motor
HA*30	ASR gain mapping P-gain 2 at P-control, *-motor

n. Gain mapping 2

Display condition: When **Gain switching mode selection, 1st-motor** (HA120) is set to *01: Setting switch*, the parameters are displayed. When it is set to a value other than this, the parameters are hidden.

- When **Gain switching mode selection, 1st-motor** (HA120) is set to *01*, and when the first setting is enabled, the parameters are displayed.
- When **Gain switching mode selection, 2nd-motor** (AA220) is set to *01*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
HA*22	ASR gain mapping intermediate speed 1, *-motor
HA*23	ASR gain mapping intermediate speed 2, *-motor
HA*24	ASR gain mapping Maximum speed, *-motor
HA*31	ASR gain mapping P-gain 3, *-motor
HA*32	ASR gain mapping I-gain 3, *-motor
HA*33	ASR gain mapping P-gain 4, *-motor
HA*34	ASR gain mapping I-gain 4, *-motor

o. Instantaneous power failure non-stop

Display condition: When **Deceleration-stop at power failure** (bA-30) is set to *01 :Enabled: deceleration stop*, *02 :Enabled: no recovery*, or *03 :Enabled: with recovery*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- When **Deceleration-stop at power failure** (bA-30) is set to a value other than *00*, the parameters are displayed.

Parameter	Name
bA-31	Decel-stop at power failure starting voltage
bA-32	Decel-stop at power failure control target level
bA-34	Decel-stop at power failure deceleration time
bA-36	Decel-stop at power failure freq. width at deceleration start

Parameter	Name
bA-37	Decel-stop at power failure DC-bus voltage constant control P-gain
bA-38	Decel-stop at power failure DC-bus voltage constant control I-gain

p. Overvoltage suppression

Display condition: When **Over-voltage suppression enable, 1st-motor** (bA140) is set to any of *01: DC voltage constant deceleration*, *02: Acceleration only at deceleration*, or *03: Acceleration at constant speed/deceleration*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- **Over-voltage suppression enable, 1st-motor** (bA140) is set to a value other than *00*, and when the first setting is enabled, the parameters are displayed.
- **Over-voltage suppression enable, 2nd-motor** (bA240) is set to a value other than *00*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
bA*41	Over-voltage suppression active level, *-motor
bA*42	Over-voltage suppression action time, *-motor
bA*44	DC bus constant control proportional gain, *-motor
bA*45	DC bus constant control integral gain, *-motor

q. Overexcitation deceleration

Display condition: When **Over magnetization deceleration function selection, 1st-motor** (bA146) is set to any of *01: Regular operation*, *02: Operation only at deceleration*, *03: Level mode*, or *04: Level mode operation only at deceleration*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- **Over magnetization deceleration function selection, 1st-motor** (bA146) is set to a value other than *00*, and when the first setting is enabled, the parameters are displayed.
- **Over magnetization function selection, 2nd-motor** (bA246) is set to a value other than *00*, and when the second setting is enabled ([SET] terminal is ON), the parameters are displayed.

Parameter	Name
bA*47	Over magnetization output filter time constant, *-motor
bA*48	Over magnetization voltage gain, *-motor
bA*49	Over magnetization level setting, *-motor

r. PID1

Display condition: When **PID1 enable** (AH-01) is set to any of *01: Enabled Without reverse output* or *02: Enabled With reverse output*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- When **PID1 enable** (AH-01) is set to *01* or *02*, the parameters are displayed.

Parameter	Name
db-30	PID1 feedback data 1 monitor
db-32	PID1 feedback data 2 monitor
db-34	PID1 feedback data 3 monitor
db-42	PID1 target value monitor after calculation
db-44	PID1 feedback data
db-50	PID1 output monitor

Parameter	Name
db-51	PID1 deviation monitor
db-52	PID1 deviation 1 monitor
db-53	PID1 deviation 2 monitor
db-54	PID1 deviation 3 monitor
db-61	PID current P gain monitor
db-62	PID current I gain monitor
db-63	PID current D gain monitor
db-64	PID feed-forward monitor
FA-30	PID1 Set Value 1 monitor
FA-32	PID1 Set Value 2 monitor
FA-34	PID1 Set Value 3 monitor
AH-02	PID1 deviation inverse
AH-03	Unit selection for PID1
AH-04	PID1 scale adjustment (at 0%)
AH-05	PID1 scale adjustment (at 100%)
AH-06	PID1 scale adjustment (point position)
AH-07	Input source selection of Set-point 1 for PID1
AH-10	Set-point-1 setting for PID1
AH-12	PID1 Multi stage set-point 1 setting
AH-14	PID1 Multi stage set-point 2 setting
AH-16	PID1 Multi stage set-point 3 setting
AH-18	PID1 Multi stage set-point 4 setting
AH-20	PID1 Multi stage set-point 5 setting
AH-22	PID1 Multi stage set-point 6 setting
AH-24	PID1 Multi stage set-point 7 setting
AH-26	PID1 Multi stage set-point 8 setting
AH-28	PID1 Multi stage set-point 9 setting
AH-30	PID1 Multi stage set-point 10 setting
AH-32	PID1 Multi stage set-point 11 setting
AH-34	PID1 Multi stage set-point 12 setting
AH-36	PID1 Multi stage set-point 13 setting
AH-38	PID1 Multi stage set-point 14 setting
AH-40	PID1 Multi stage set-point 15 setting
AH-42	Input source selection of Set-point 2 for PID1
AH-44	Set-point 2 setting for PID1
AH-46	Input source selection of Setpoint 3 for PID1
AH-48	Set-point 3 setting for PID1
AH-50	Calculation symbol selection of Set-point 1 for PID1
AH-51	Input source selection of Process data 1 for PID1
AH-52	Input source selection of Process data 2 for PID1
AH-53	Input source selection of Process data 3 for PID1
AH-54	Calculation symbol selection of Process data for PID1
AH-60	PID1 gain change method selection
AH-61	PID1 proportional gain 1
AH-62	PID1 integral time constant 1
AH-63	PID1 derivative gain 1
AH-64	PID1 proportional gain 2

Parameter	Name
AH-65	PID1 integral time constant 2
AH-66	PID1 derivative gain 2
AH-67	PID1 gain change time
AH-70	PID feed-forward selection
AH-71	PID1 output range
AH-72	PID1 Deviation over level
AH-73	PID1 Feedback compare signal turn-off level
AH-74	PID1 Feedback compare signal turn-on level

s. PID2

Display condition: When **PID2 enable** (AJ-01) is set to any of *01: Enabled Without reverse output* or *02: Enabled With reverse output*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- When **PID2 enable** (AJ-01) is set to *01* or *02*, the parameters are displayed.

Parameter	Name
db-36	PID2 feedback data monitor
db-55	PID2 output monitor
db-56	PID2 deviation monitor
FA-36	PID2 Set Value monitor
AJ-02	PID2 deviation inverse
AJ-03	PID2 unit selection
AJ-04	PID2 scale adjustment (at 0%)
AJ-05	PID2 scale adjustment (at 100%)
AJ-06	PID2 scale adjustment (point position)
AJ-07	Input source selection of Set-point for PID2
AJ-10	Set-point setting for PID2
AJ-12	Input source selection of Process data for PID2
AJ-13	PID2 proportional gain
AJ-14	PID2 integral time constant
AJ-15	PID2 derivative gain
AJ-16	PID2 output range
AJ-17	PID2 Deviation over level
AJ-18	PID2 Feedback compare signal turn-off level
AJ-19	PID2 Feedback compare signal turn-on level

t. PID3

Display condition: When **PID3 enable** (AJ-21) is set to any of *01: Enabled Without reverse output* or *02: Enabled With reverse output*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- When **PID3 enable** (AJ-21) is set to *01* or *02*, the parameters are displayed.

Parameter	Name
db-38	PID3 feedback data monitor
db-57	PID3 output monitor
db-58	PID3 deviation monitor
FA-38	PID3 Set Value monitor

Parameter	Name
AJ-22	PID3 deviation inverse
AJ-23	PID3 unit selection
AJ-24	PID3 scale adjustment (at 0%)
AJ-25	PID3 scale adjustment (at 100%)
AJ-26	PID3 scale adjustment (point position)
AJ-27	Input source selection of Set-point for PID3
AJ-30	Set-point setting for PID3
AJ-32	Input source selection of Process data for PID3
AJ-33	PID3 proportional gain
AJ-34	PID3 integral time constant
AJ-35	PID3 derivative gain
AJ-36	PID3 output range
AJ-37	PID3 Deviation over level
AJ-38	PID3 Feedback compare signal turn-off level
AJ-39	PID3 Feedback compare signal turn-on level

u. PID4

Display condition: When **PID4 enable** (AJ-41) is set to any of *01: Enabled Without reverse output* or *02: Enabled With reverse output*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- When **PID4 enable** (AJ-41) is set to *01* or *02*, the parameters are displayed.

Parameter	Name
db-40	PID4 feedback data monitor
db-59	PID4 output monitor
db-60	PID4 deviation monitor
FA-40	PID4 Set Value monitor
AJ-42	PID4 deviation inverse
AJ-43	PID4 unit selection
AJ-44	PID4 scale adjustment (at 0%)
AJ-45	PID4 scale adjustment (at 100%)
AJ-46	PID4 scale adjustment (point position)
AJ-47	Input source selection of Set-point for PID4
AJ-50	Set-point setting for PID4
AJ-52	Input source selection of Process data for PID4
AJ-53	PID4 proportional gain
AJ-54	PID4 integral time constant
AJ-55	PID4 derivative gain
AJ-56	PID4 output range
AJ-57	PID4 Deviation over level
AJ-58	PID4 Feedback compare signal turn-off level
AJ-59	PID4 Feedback compare signal turn-on level

v. PID in general

Display condition: When any one or more of PID1 to PID4 is enabled, the parameters are displayed. When all of PID1 to PID4 is disabled, the parameters are hidden.

- When **PID1 enable** (AH-01) is set to *01* or *02*, the parameters are displayed.
- When **PID2 enable** (AJ-01) is set to *01* or *02*, the parameters are displayed.
- When **PID3 enable** (AJ-21) is set to *01* or *02*, the parameters are displayed.
- When **PID4 enable** (AJ-41) is set to *01* or *02*, the parameters are displayed.

Parameter	Name
AH-75	PID soft start function enable
AH-76	PID soft start target level
AH-78	Acceleration time setting for soft start function
AH-80	PID soft start time
AH-81	PID soft start error detection enable
AH-82	PID soft start error detection level
AH-85	PID sleep trigger selection
AH-86	PID sleep start level
AH-87	PID sleep active time
AH-88	Setpoint boost before PID sleep enable
AH-89	Setpoint boost time
AH-90	Setpoint boost value
AH-91	Minimum RUN time before PID sleep
AH-92	Minimum active time of PID sleep
AH-93	PID wake trigger selection
AH-94	PID wake start level
AH-95	PID wake start time
AH-96	PID wake start deviation value

w. Simulation Mode

Display condition: When **Simulation mode enable** (PA-20) is set to *01: Enabled*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

Parameter	Name
PA-21	Error code selection for Alarm test
PA-22	Output current monitor optional output enable
PA-23	Output current monitor optional output value setting
PA-24	DC-bus voltage monitor optional output enable
PA-25	DC-bus voltage monitor optional value output
PA-26	Output voltage monitor optional output enable
PA-27	Output voltage monitor optional output value setting
PA-28	Output torque monitor optional output enable
PA-29	Output torque monitor optional output value setting
PA-30	Start with frequency matching optional Setting enable
PA-31	Start with frequency matching optional value setting

x. DriveProgramming

Display condition: When **EzSQ function enable** (UE-02) is set to any of *01: PRG] terminal* or *02: Always*, the parameters are displayed. When it is set to *00: Disabled*, the parameters are hidden.

- When **EzSQ function enable** (UE-02) is set to *01* or *02*, the parameters are displayed.

Parameter	Name
db-01	Program download monitor
db-02	Program No. monitor
db-03 to db-07	Program counter (Task1-5)
db-08 to db-16	User monitor 0-4
db-18 to db-23	Analog output monitor YA0-YA5
UE-01	EzSQ operation cycle
UE-10 to UE-73	EzSQ user parameter U(00)-U(63)
UF-02 to UF-33	EzSQ user parameter UL(00)-UL(15)

User Setting: (UA-10)=02

Parameters set to **User parameter selection** (UA-31) to (UA-62), **Main Speed reference monitor** (FA-01), **Output frequency monitor** (dA-01) and **Display restriction selection** (UA-10) are displayed.

Data-comparison Display: (UA-10)=03

- Only parameters that have been changed from the factory default settings are displayed.
- All monitor displays (d****) and (F****), **Display restriction selection** (UA-10), and **Password input for display selection** (UA-01) are displayed.

Additional Information

- The default used for comparison is determined by the inverter model and the following settings.
  - **Initialize Data selection** (Ub-02)
  - **Load type selection** (Ub-03)
- If you change the **base frequency**, the value of the **motor constant Io** is changed, so it is judged as a changed parameter.

Monitor Display: (UA-10)=04

All monitor displays (d****) and (F****) and **Display restriction selection** (UA-10) are displayed.

3-8-3 Saving Changed Parameters

When you edit the parameter contents, the parameter number is automatically registered in the user setting display function.
If **User parameter auto setting function enable** (UA-30) is set to *01: Enabled*, the parameter numbers whose values have been changed are automatically saved in (UA-31) to (UA-62).

This function is capable of saving up to 32 changed parameters. Since the changed parameters are automatically recorded, you can use it as a history of changes. The newest data is saved in (UA-31) and the oldest data is in (UA-62).
If more than 32 parameters are changed, the oldest data in (UA-62) is deleted, and values are shifted by one parameter. Then, new data is saved in (UA-31).

If the same parameter changed twice, it will only be recorded once in the 32 records.

● Parameter

Item	Parameter	Data	Description
User parameter auto setting function enable	UA-30	00	Disabled
		01	Enabled When a parameter is changed, the parameter is automatically set to one of [UA-31] to [UA-62].
User parameter selection	UA-31 to UA-62	no	No assignment
		*****	When this function is enabled, automatically recorded parameters are displayed. (All codes are subjected.)

3-8-4 Protecting Parameters by Password

You can protect the parameters by password.
By setting a password to **Display restriction selection** (UA-10) and **Soft Lock selection** (UA-16), you can prevent parameters from being displayed or changed.

● Parameter

Item	Parameter	Data	Description
Password input for display selection	UA-01	0000 to FFFF	The password for the display restriction function.*1 Lock/unlock the parameter of **Display restriction selection** (UA-10).
Soft-lock password input	UA-02	0000 to FFFF	The password for the parameter protective function.*3 Lock/unlock the parameter of **Soft Lock selection** (UA-16). Changes made by the [SFT] terminal are also disabled.
Display restriction selection	UA-10*1	00	All parameters are displayed.
		01	Parameters are displayed by functions. Disabled functions are not displayed.
		02	Parameters specified by the user are displayed. Parameters set to (UA-31) to (UA-62) are displayed.
		03	Parameters that have been changed from the factory default settings.
		04	Monitor parameters are displayed.
Soft Lock selection	UA-16*2	00	When the soft-lock terminal [SFT] is ON, the data set to (UA-17) are locked.
		01	After the setting is performed, the data set to (UA-17) are locked.

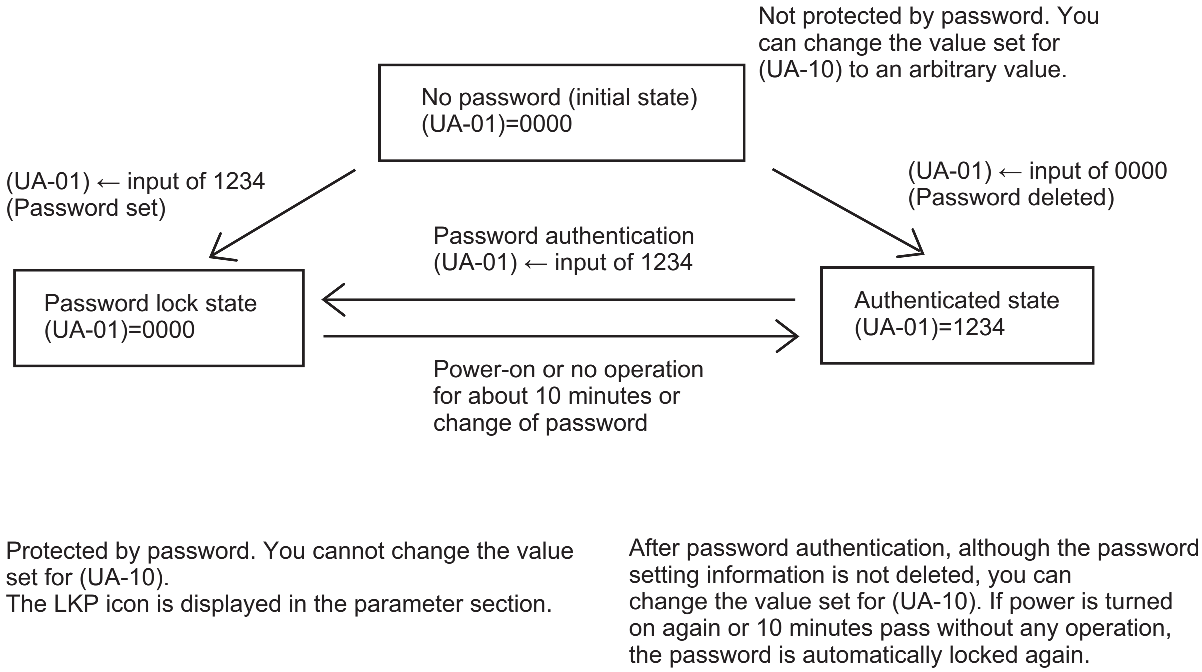
*1. Refer to *3-8-2 Limiting Displayed Parameters* on page 3-37 for details on the display restriction function.
*2. (UA-16) can be changed even while the soft lock function is enabled. It is locked only with (UA-02).
*3. Refer to *3-8-1 Parameter Protective Function* on page 3-37 for the parameter protective function.

● Input Terminal Function (CC-01) to (CC-07)

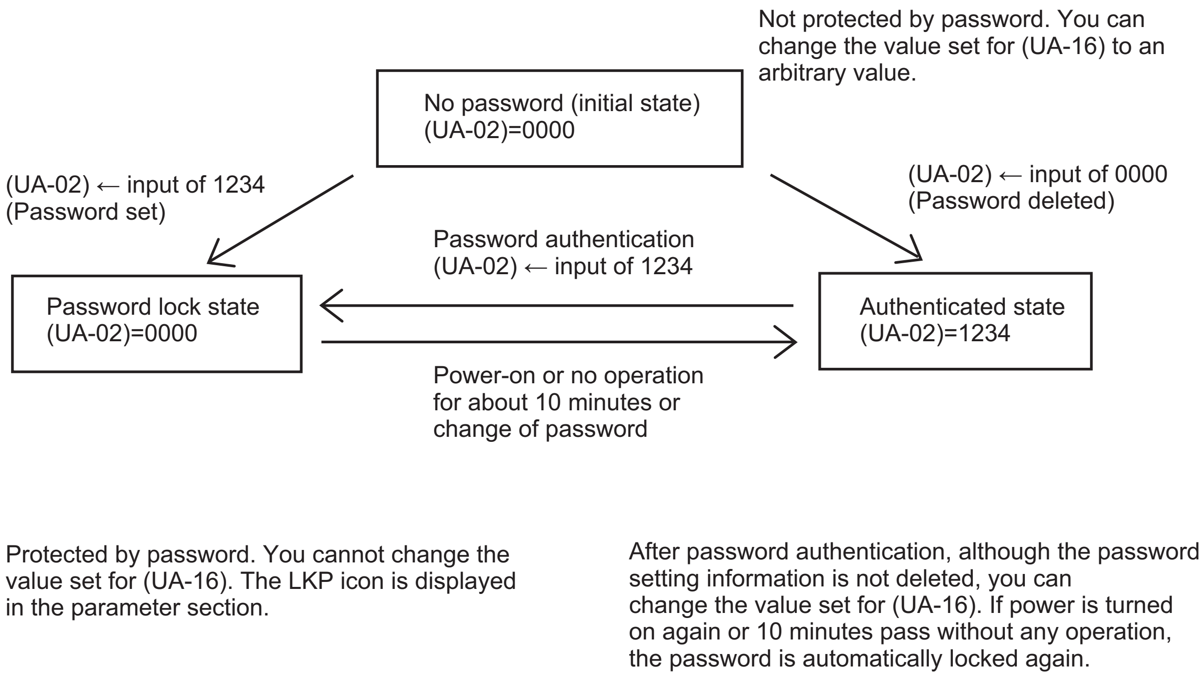
Item	Terminal name	Data	Description
Soft Lock	SFT	036	OFF: Soft lock disabled ON: Soft lock enabled*1

*1. You can set the soft lock function at the terminal independently of the parameter (UA-16).

Example of Password for Limiting Display



Example of a Soft-lock Password



Precautions for Correct Use

If you forget the set password, there is no way to unlock the password lock. The password cannot be investigated by OMRON, therefore, care must be taken when setting a password.

3-9 Display Fixation Function

You can fix the screen display other than the home screen by disabling the key input of the LCD operator.

3-9-1 DISP Terminal Input

When the input terminal *102: DISP Fixation of display* is turned ON, the key operations of the LCD Operator are disabled and the screen is fixed to the home screen.

- F1 key
- F2 key
- UP key
- DOWN key
- LEFT key
- RIGHT key
- ENTER key

● Input Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Fixation of display	DISP	102	ON: Key operations of the LCD Operator disabled OFF: Cancel

Additional Information

For the following keys, you can separately set the key operation prohibition. You cannot use the DISP terminal to prohibit the key operation.
- RUN key: Refer to *3-9-2 Enable/Disable Settings for RUN Key* on page 3-54.
- STOP/RESET key: Refer to *3-9-3 Limiting STOP/RESET Key* on page 3-55.

3-9-2 Enable/Disable Settings for RUN Key

You can enable or disable the RUN key on the LCD Operator by setting parameters or input terminals. In addition to the parameters, you can use the following settings to switch between enabled or disabled of the RUN key. The following settings take precedence over the parameters.

1. **Run-command input source selection, 1st-motor** (AA111) is set to *02: RUN key on LCD Operator*
2. [SET] terminal and **Run-command input source selection, 2nd-motor** (AA211)
3. [F-OP] terminal and **RUN command source selection at [F-OP] is active** (CA-71)

When you change the driving direction only by setting **RUN-key Direction of LCD operator** (AA-12), it will be the same direction.

● **Parameter**

Item	Parameter	Data	Description
Run-command input source selection, 1st-motor	AA111	00	[FW]/[RV] terminal
		01	3 wire
		02	RUN key on LCD Operator
		03	RS485
		04	Option 1
		05	Option 2
		06	Option 3
RUN-key Direction of LCD operator	AA-12	00	Normal rotation
		01	Reverse rotation

3-9-3 Limiting STOP/RESET Key

The STOP/RESET key on the LCD operator is enabled or disabled under the following conditions.

- **STOP-key enable at RUN-command from terminal** (AA-13) is set to *01: Enabled*: STOP is enabled when the key is pressed regardless of the type of operation command. RESET is enabled when an alarm occurs.
- **STOP-key enable at RUN-command from terminal** (AA-13) is set to *02: Only reset is enabled*: STOP is disabled, and RESET is enabled when an alarm occurs.
- **STOP-key enable at RUN-command from terminal** (AA-13) is set to *00: Disabled*: STOP and RESET are both disabled.

When the operation command can be input with the RUN key, STOP is enabled when the STOP/RESET key is pressed, in preference to the above settings.
Refer also to *6-3-7 Disabling Keys on LCD Operator* on page 6-22 for related descriptions.

● **Parameter**

Item	Parameter	Data	Description
STOP-key enable at RUN-command from terminal	AA-13	00	Disabled
		01	Enabled
		02	Only reset is enabled

3-10 Error Operation on the LCD Operator

3-10-1 Selection of Operation at Disconnection of LCD Operator

You can configure the inverter to trip or deceleration stop when the LCD operator is disconnected.
When about 5 seconds have passed after communication with the LCD operator is disconnected, it is determined that disconnection occurred.
For operation at disconnection, see the parameter table shown below.

● Parameter

Item	Parameter	Data	Description
Action selection at Keypad disconnection	UA-20	00	When disconnection occurs, the inverter trips due to the **LCD operator communication error** (E040).
		01	When disconnection occurs, the inverter trips due to the **LCD operator communication error** (E040) after deceleration stop.
		02	Ignores detection of disconnection.
		03	When disconnection occurs, the inverter performs the free-run stop. No error occurs.
		04	When disconnection occurs, the inverter decelerates and stops. No error occurs.

3-10-2 Display of Battery Level Warning

When the battery in the LCD Operator is run out, you can be notified of a battery replacement and trip the inverter.
Insert the battery into the LCD operator, make the time clock setting, and set **Low battery warning enable** (UA-19).
When the clock setting of the LCD operator returns to the default, it is judged as abnormal.
When **Low battery warning enable** (UA-19) is set to *01: Warning*, and if it is determined that abnormality occurs, the LCD operator battery insufficient output terminal [80: LBK] is turned ON.
When (UA-19) is set to *02*, and if it is determined that abnormality occurs, the inverter trips due to the RTC error (E042), and the [LBK] terminal is turned ON.
When time on LCD Operator is configured, the [LBK] terminal is turned OFF.

● Parameter

Item	Parameter	Data	Description
Low battery warning enable	UA-19	00	Disabled
		01	The output terminal function [080:LBK] is turned ON as a warning.
		02	Generates the RTC error (E042) and the inverter trips. Turns on the [LBK] terminal.

Additional Information

- You can cancel a trip due to the RTC error (E042) by performing the reset operation; however, if time is not configured, the error occurs again. In this case, the output terminal function [080: LBK] is ON.
- If you do not need the time function and do not insert the battery in the LCD Operator, set **Low battery warning enable** (UA-19) to *00: Disabled*.

3-11 Settings for Prohibiting Data Copy Function

You can set the READ and WRITE operation prohibition by the data copy function of the LCD Operator.
If you set **Data R/W selection** (UA-18) to *01: R/W disabled*, the Read/Write access of the LCD operator is disabled.
You can prevent unnecessary reading and writing by setting it to *01* after completing the adjustment of the inverter and reading the data for backup.

● Parameter

Item	Parameter	Data	Description
Data R/W selection	UA-18	00	R/W enabled. Read and write are possible.
		01	R/W disabled. Read and write are prohibited.

3-12 Inverter Initialization

When **Initialize Mode selection** (Ub-01) is chosen and **Initialize Enable** (Ub-05) is set to *01: Start initialization*, the designated data can be initialized to the factory default.
You can also clear only the trip history without initializing the stored parameter.

Precautions for Correct Use

After initializing the inverter, you need to reset the electronic thermal of the motor. If the inverter is used without the reset after initialization, the motor may burn out.

Additional Information

- The initialization begins when F2 key is pressed after **Initialize Enable**(Ub-05) set to *01*.
- The initialization sets the parameters to initial values. When you need the data before the initialization, read out it with the R/W function (Read) in the LCD operator, or use CX-Drive to store it in a PC.
- The following data cannot be initialized:
  - **EzSQ user parameter U**(UE-10) to (UE-73)
  - **Cumulative operating hours monitor during RUN**(dC-22)、
  - **Cumulative power-on time**(dC-24)
  - **Initialize Data selection**(Ub-02)
  - **Load type selection**(Ub-03)
  - **[Ai1] Voltage/Current zero-gain adjustment**(Cb-30) to **[Ai3] Voltage gain adjustment**(Cb-35)
  - **Thermistor gain adjustment**(Cb-41)
- The initialized parameters may not be displayed depending on**Display restriction selection**(UA-10). Change the data to *00: Full display*before performing initialization.
- When the setting of **Soft Lock selection**(UA-16) bans on a change of parameter values, the data can not be initialized. Be sure to reset the ban on a change of parameter values before carrying out the initialization.
- Initialization cannot be performed while the following symbols are displayed on the LCD operator.
  During operation (RUN)
  When the trip occurs (TRIP)
  During soft lock (LKS)
- Even when the operation command is input during initialization, the inverter ignores the command. Input the operation command again after the initialization is finished.

● Parameter

Item	Parameter	Data	Description
Initialize Mode selection	Ub-01	00	The initialization is disabled.
		01	The trip history and retry history are cleared.
		02	All parameters are initialized.
		03	The trip history, retry history, and all parameters are initialized.
		04	The trip history, retry history, all parameters, and program data for DriveProgramming are initialized.
		05	Parameters other than those of the I/O terminal function are initialized.
		06	Parameters other than those of the communication function are initialized.
		07	Parameters other than those of the I/O terminal function and communication function are initialized.
		08	Only the program data for DriveProgramming are initialized.
Initialize Data selection	Ub-02	01	Mode 1 (Factory setting)
Initialize Enable	Ub-05	00	Function disabled.
		01	Start initialization.

● Initialize Mode Selection (Ub-01)

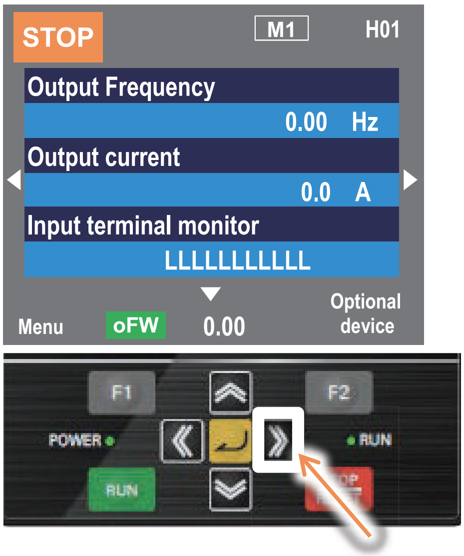
Initialization targets are indicated by ■.

Ub-01	(1) History data	(2) Setting of I/O terminal	(3) Communication function	(4) Other than parameters (2) and (3)	(5) DriveProgramming
00					
01	■				
02		■	■	■	
03	■	■	■	■	
04	■	■	■	■	■
05			■	■	
06		■		■	
07				■	
08					■

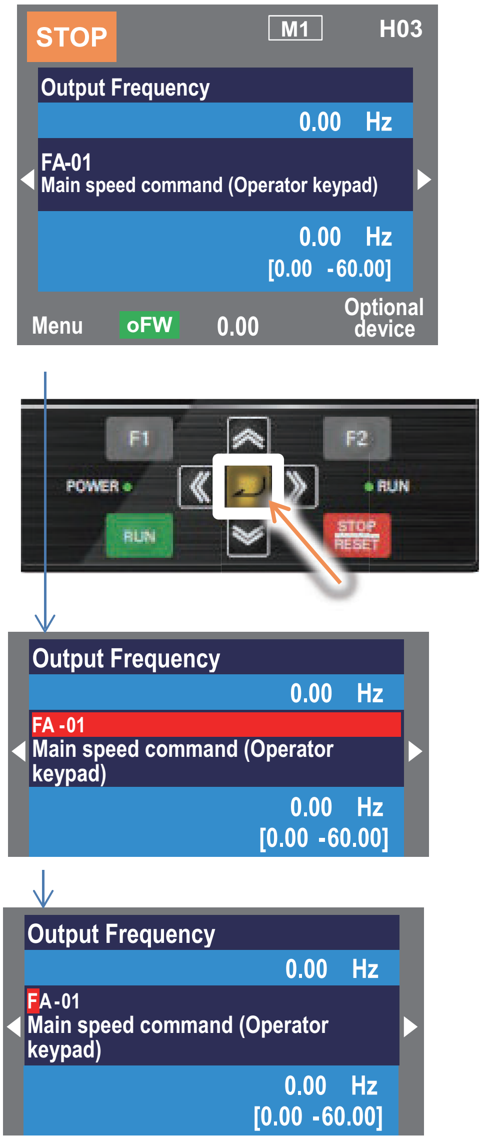
Item	Parameter range	Description
Input/Output terminal function	(CA-01) to (CA-11)	Input terminal selection
	(CA-21) to (CA-31)	NO/NC selection
	(CA-41) to (CA-51)	Input terminal response
	(Cb-40)	Thermistor selection
	(CC-01) to (CC-07)	Output terminal selection
	(CC-11) to (CC-17)	NO/NC selection
	(CC-20) to (CC-33)	Output delay
	(CC-40) to (CC-60)	Logical operation function
Communication function	(CF-01) to (CF-10)	Setting of RS485 communication
	(CF-20) to (CF-38)	Setting of EzCOM communication

● Example of initialization of the trip history, all the parameters, and the program data for DriveProgramming

1 Press the RIGHT () key on the LCD operator

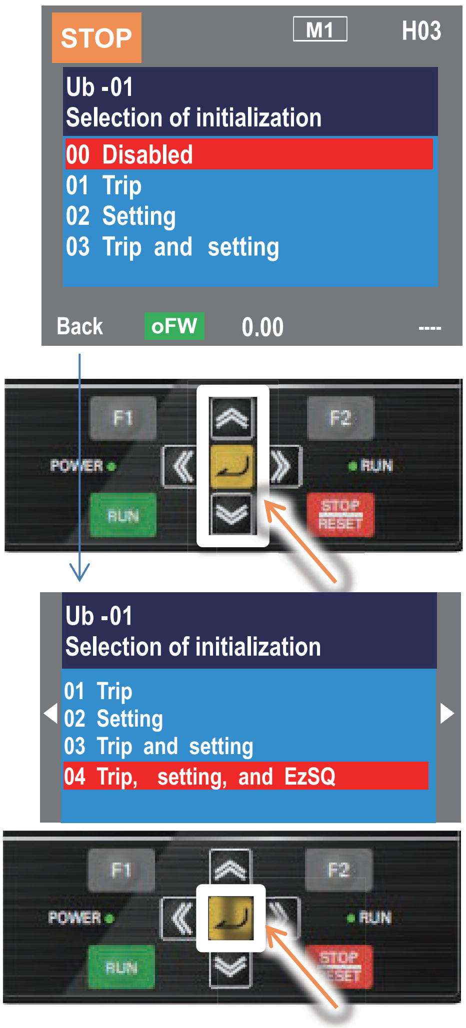


2 Press the ENTER key twice on the parameter settings display screen, and the parameter area begins blinking.

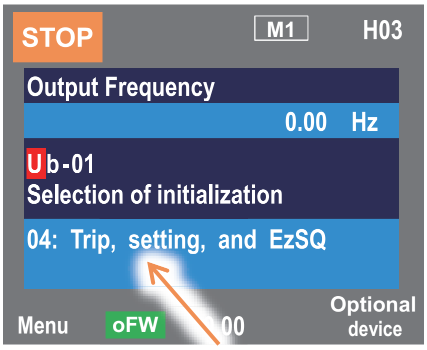


3 Use the UP, DOWN, RIGHT, and LEFT keys to choose a parameter and press the ENTER key to set it.

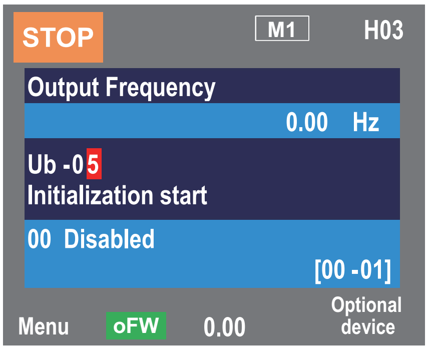
4 Use the UP and DOWN keys to select a mode and press the F2 key to set it.



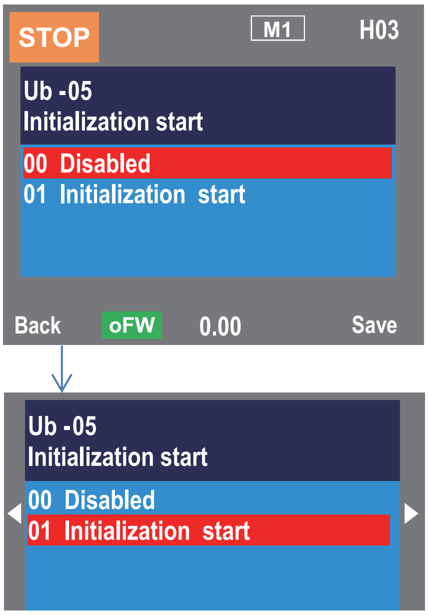
5 Check the content on the previous screen.
The initialization is not started yet.



6 Use the UP, DOWN, RIGHT, and LEFT keys to choose (Ub-05) and press the ENTER key to set it.



7 Choose Enabled*Enabled* and press the F2 key. Initialization begins.



8 Initialization is in progress.

9 Display showing message for initialization completed.

3-13 Connection and Functions of CX-Drive

The *Inverter/Servo support tool CX-Drive* is support software to edit the inverter parameter settings. When you install the OMRON *CX-One* software on your PC, the *CX-Drive* is also installed simultaneously.

The following or higher versions of the *CX-Drive* support the 3G3RX2 Series Inverter.

- CX-One: Ver. 4 or higher
- CX-Drive: Ver. 3.0

The following describes how to connect the *CX-Drive* to an inverter and provides an overview of its functions.

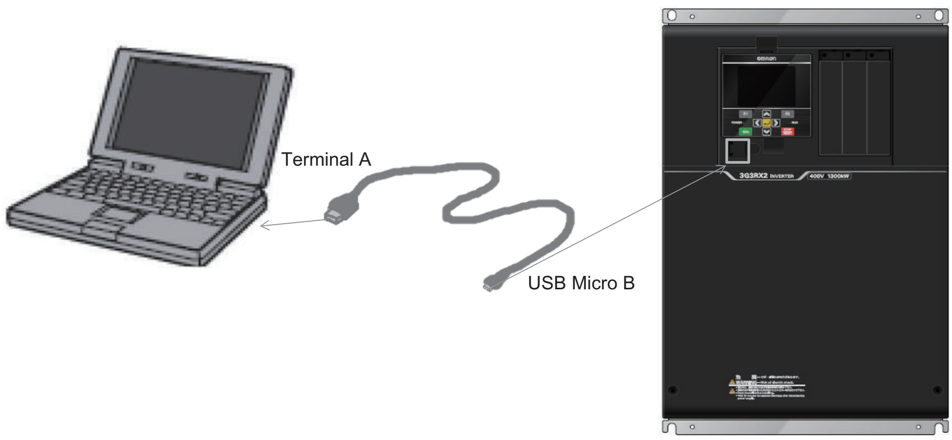
For details on the functions of the CX-Drive, refer to *CX-Drive Operation Manual (Cat. No. W453-E1)*.

3-13-1 CX-Drive Connection Method

The following shows how to connect the *3G3RX2 Series Inverter* with *Inverter/Servo support tool CX-Drive*.

Direct Connection via Serial Communications

Connect the CX-Drive directly to the serial communications port of the inverter.



CX-Drive Connection Procedures

There are two methods to connect the CX-Drive to the inverter.

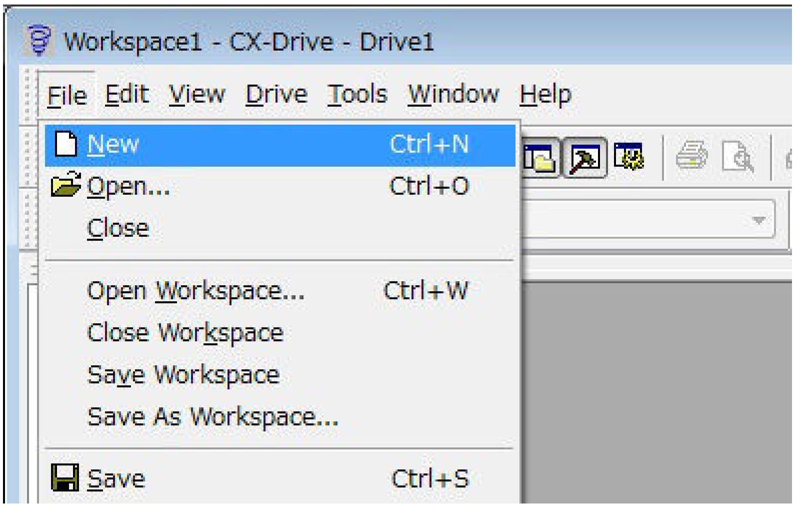
The procedure for each method is explained below.

● Connecting by Registering Inverter Connection Method Beforehand

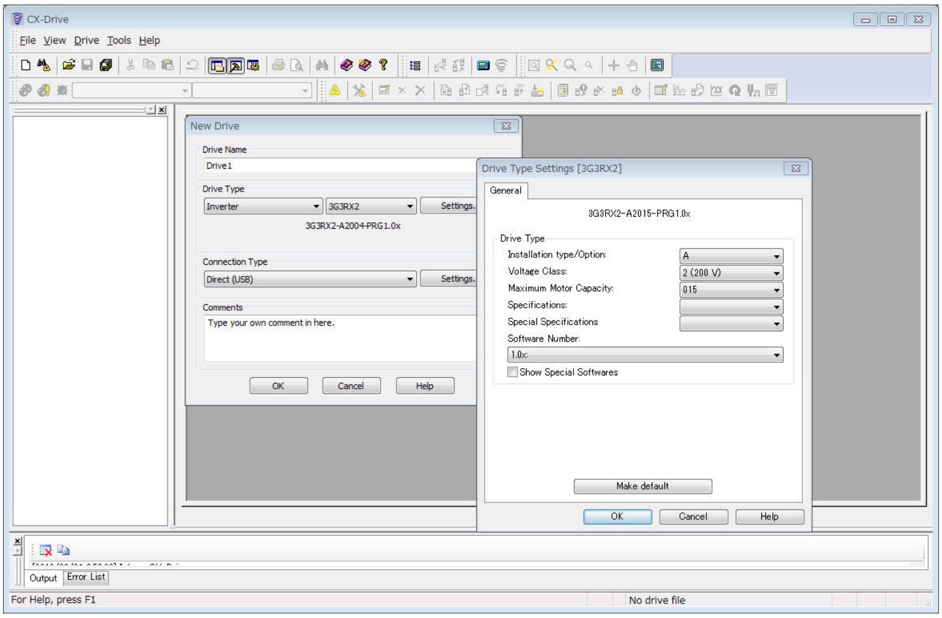
Connect the CX-Drive directly to the serial communications port of the inverter.

Follow the steps below.

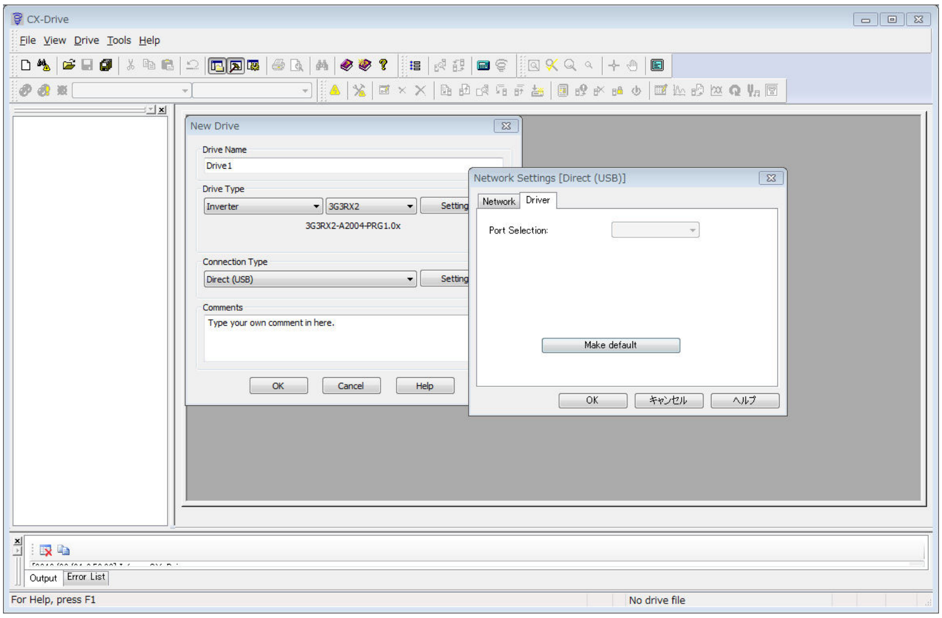
1 Start the CX-Drive and, from the **File** menu, select **New**.



2 In the **New Drive** window, set the drive type of the target inverter.
Select **3G3RX2** for **Dryve Type**, and then click the **Settings** button on the right.
Set the Inverter Protective Structure, Voltage Class, and Maximum Motor Capacity on the **Drive Type Settings** window.
After these settings, click the **OK** button to close the **Drive Type Settings**.



3 In the **New Drive** window, set the type of connection to the inverter.
Under **Connection Type**, select **Direct** and click the **Settings** button on the right.
On the **Driver** tab, set the Port Selection to the port name of the computer on which the CX-Drive is installed.

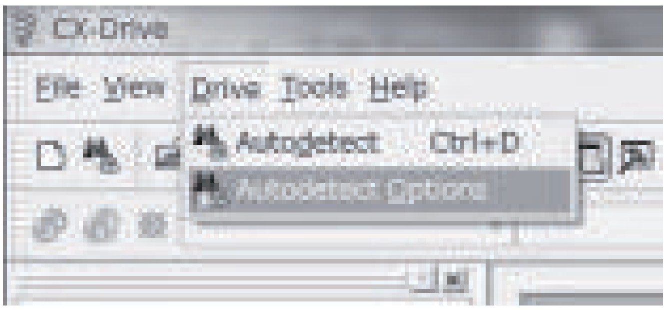


4 After setting these items, click the **OK** button and close all windows.
The new project is registered in the workspace.
Click the (Work Online) icon to connect to the inverter.

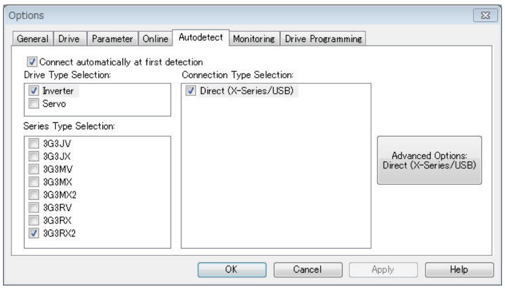
● Connecting by Using Automatic Detection Function of Connected Inverter

If you set the **Autodetect Options** in the CX-Drive, the automatic detection function automatically connects to the inverter.
Follow the steps below.

1 Start the CX-Drive and, from the **Drive** menu, select **Autodetect Options** to open the Options window.



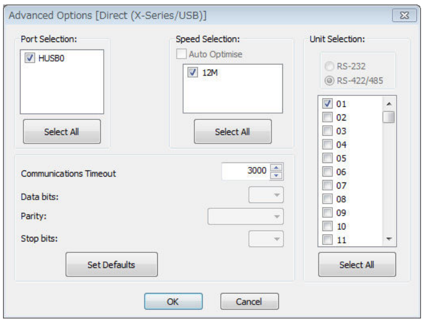
2 On the **Autodetect** tab, set the **Drive Type Selection**, **Series Type Selection**, and **Connection Type Selection**.
Under the **Drive Type Selection**, check the **Inverter** box and click **Inverter**.
Under the **Series Type Selection**, check the **3G3RX2** box.
Then, under the **Connection Type Selection**, check the **Direct** box and click the **Direct** button.
Click the**Advanced Options: Direct** button on the right.



Additional Information

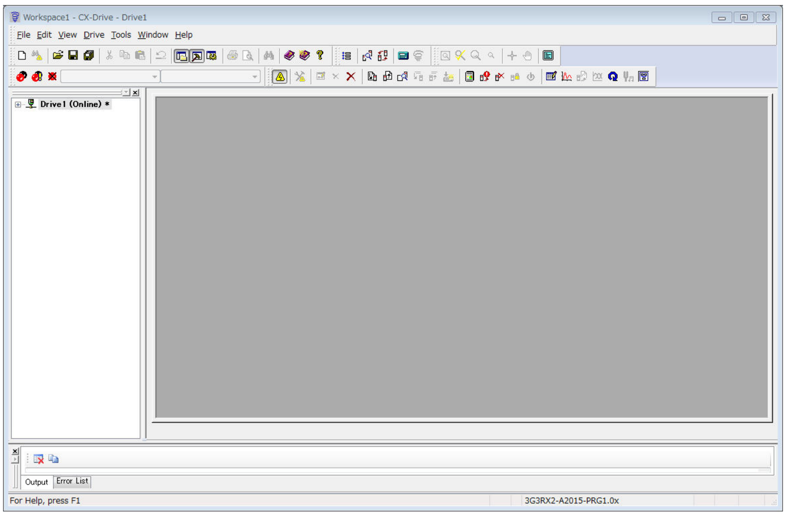
For the reduction of the automatic search time, deselect unnecessary check boxes to narrow down the scope of automatic detection.

3 In the **Advanced Options: Direct**window, set communications options.



4 After setting communications options, click the **OK** button and close all windows. Then, click **Autodetect**.

The Automatic detect function starts to create new drive projects automatically.



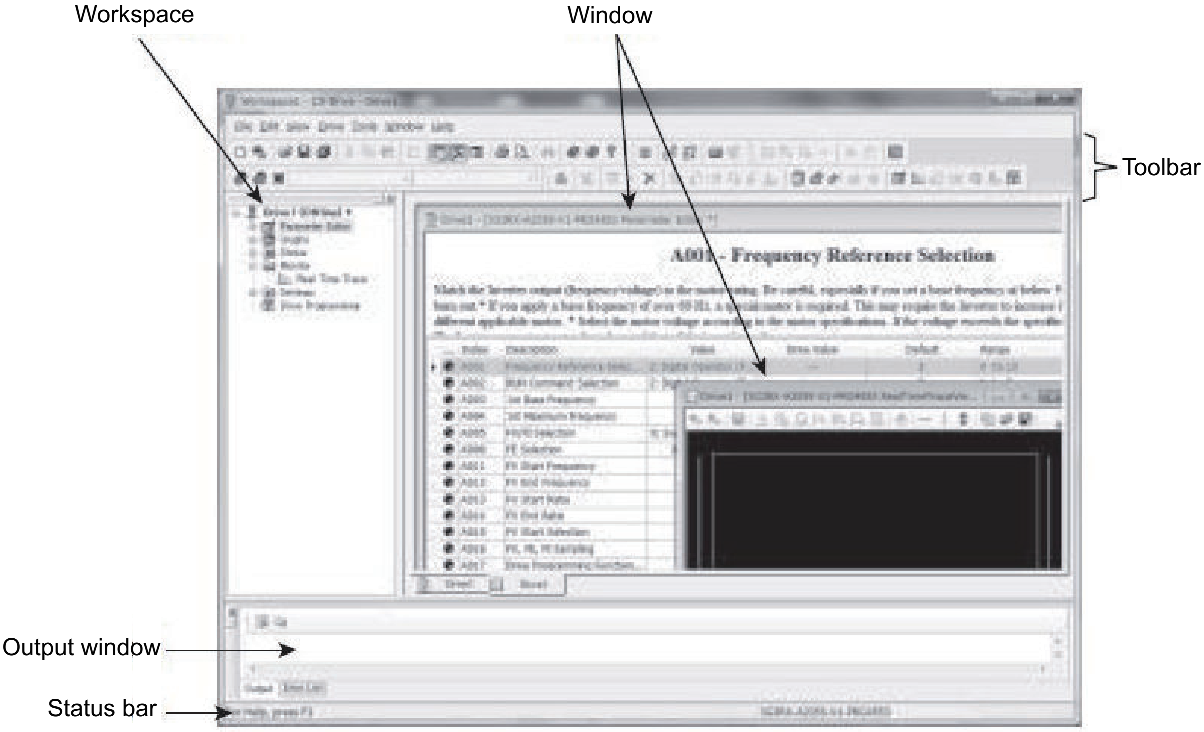
3-13-2 Outline of CX-Drive

The Inverter/Servo support tool CX-Drive enables you to edit inverter parameters and monitor the inverter status.

The following provides a functional outline of CX-Drive.

Screen Structure of CX-Drive

The screen structure of the CX-Drive is as shown below.
The workspace shows a list of registered drive projects. Double-clicking a project displays the functions contained in it.
Then, double-clicking each function opens a window corresponding to that function.



Precautions for Correct Use

CX-Drive, by default, does not allow connection to the inverter unless the software versions match.
- Software number of the inverter set in the CX-Drive project
- Software number of the inverter actually connected

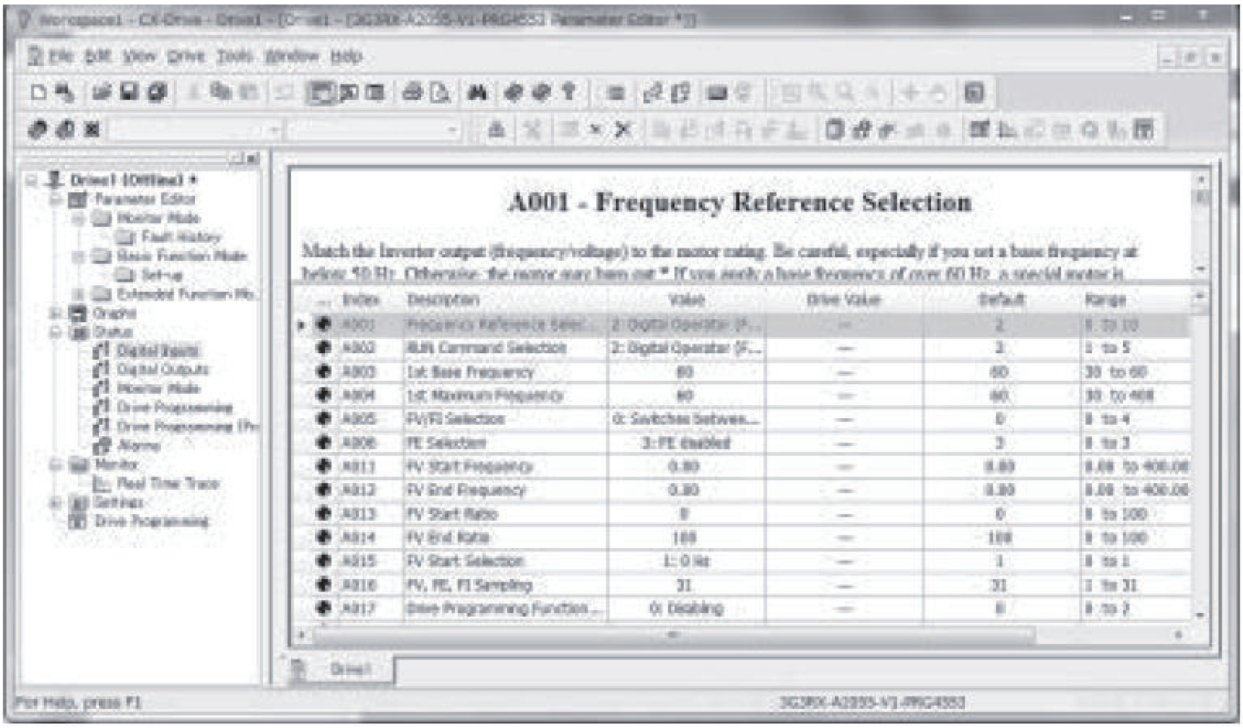
If you cannot connect to the inverter due to a software number mismatch, select **Tools** - **Options** in the menu bar.
Then, in the **Online** tab, deselect the **Check Drive Software Compatibility** check box. This allows CX-Drive to connect to the inverter to operate normally, although a warning display appears.
To match the software numbers, right-click the project, select **Properties**, and click the **Settings** button in the **Drive Type** section. In the **Drive Type Settings** window, set the Software Number that matches that of the inverter. If you cannot find the applicable software number in the CX-Drive's Software Number list, please upgrade the CX-Drive version.

Editing Parameters Using CX-Drive

Double-clicking **Parameter Editor** in the project opens a window in which all inverter parameters are listed (in ascending order by number).

You can edit inverter parameters in this window.
To upload/download inverter parameters, use the **Transfer** button in the toolbar.

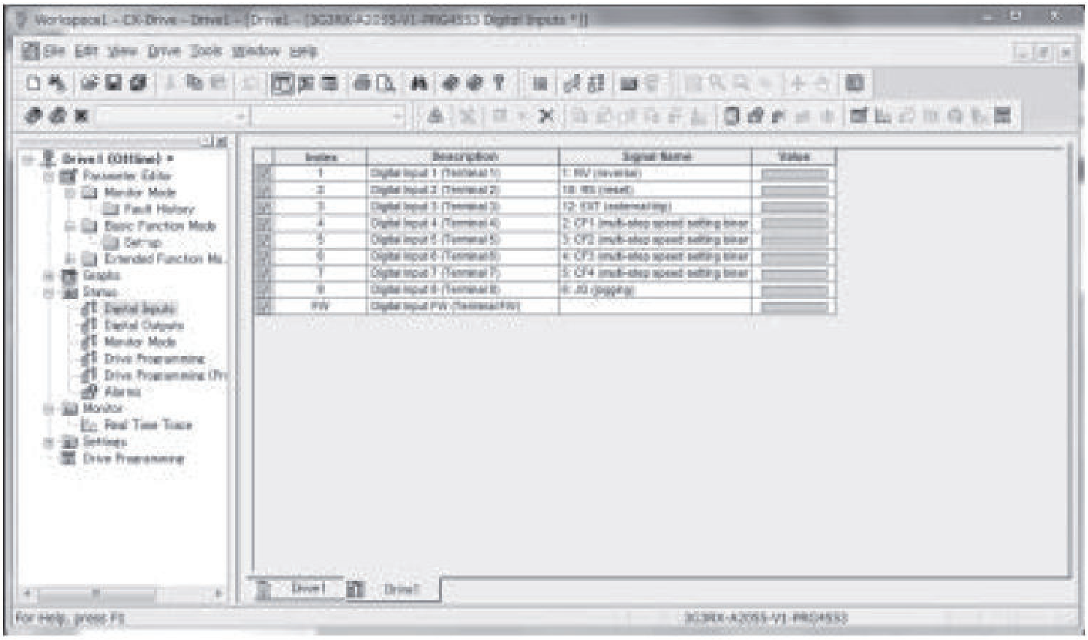
- Double-click one of the folders under Parameter Editor to narrow down the parameter list to only those parameters associated with it.
- Edit the value set for each parameter in the Value field of the parameter list.
- When a parameter is selected, the explanation of that parameter is displayed in the upper area.
- At the left end of the list, the status of parameter data are displayed. There are three types in the status: changed from the default, different from the connected inverter, and invalid parameters. You can display only parameters with the same status.
- You can select specific parameters and transfer data for only those selected parameters to the inverter.



Status Function of CX-Drive

Open the Status folder in the project and double-click the status information.
The window corresponding to the selected status information opens.

Status	Description
Digital Inputs	Displays the current *ON/ OFF* status information, including the input function settings for the selected inverter.
Digital Outputs	Displays the current *ON/ OFF* status information, including the output function settings for the selected inverter.
Monitor Mode	Displays the internal status values of the inverter. These status values are similar to those displayed in the monitor mode (dxxx) of the inverter.
Alarms	Displays an alarm history of the current and past alarms.

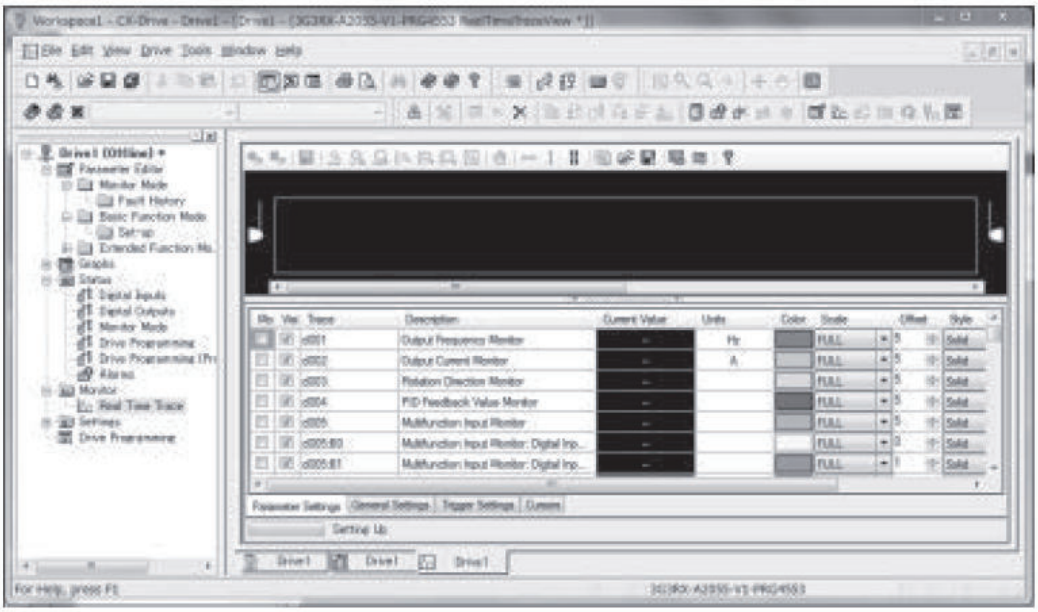


Monitor Function of CX-Drive

Open the Monitor folder in the project and double-click Real Time Trace.

The Real Time Trance window opens, in which you can monitor the operation status of the inverter.

- Up to 8 signals can be traced.
- Triggers can be set to the *ON/ OFF* timing of the inverter's internal status, or numerically.



4

Test Run

This section describes the test run procedure.

4-1 Test Run Procedure

To perform a test run, follow the procedures shown below.
Carefully read and understand *Safety Precautions* on page 19 and the relevant instructions in the following chart before starting works.
Perform a test run with no load connected to the motor and check the operation of the inverter. Then, turn off the power and connect the motor to the mechanical system.
In the test run, you can use the simulation mode to check the operation with the host device.

● Procedure

Procedure	Check item	Reference
1. Safety check	See the precautions required for handling the inverter.	See *Safety Precautions* on page 19.
2. Checking the inverter	Confirm that there is no abnormality in items included in the package of inverter and the appearance of the inverter.	See *Items to Check after Unpacking* on page 29.
3. Installation of the inverter	Confirm that the inverter is installed in a proper environment and in a proper setting.	See *1-3-4 External dimensions* on page 1-19.
4. Wiring	Confirm that wires are properly connected to the inverter.	See *2-3 Wiring* on page 2-17.
5. Setting up the operation method	Check how to operate the LCD operator.	See *Section 3 Operation* on page 3-1.
6. Setting up the running method	Set up the inverter running method.	See *6-3 Operation Command Settings* on page 6-18.
7. Selecting a control mode and protective function according to a load	Set up the inverter control method.	See *7-1 Selection of Motor Control Methods* on page 7-3. The items required for running the inverter are provided in the following article.
Completed		

4-2 Settings and Commands Required for Running the Inverter

To turn the motor, configure the following settings.

Precautions for Correct Use

This article explains the settings for operation. Please read *Safety Precautions* on page 19 carefully for the handling of the inverter.

Basic Setting for Motor

Set the following parameters in accordance with the nameplate of motor. Set the data indicating the basic characteristics of motor.
Refer to *6-2-1 Motor Basic Settings* on page 6-8 for details.

Item	Parameter	
	IM	SM/PMM
Async.Motor capacity setting, 1st-motor	Hb102	Hd102
Async.Motor poles setting, 1st-motor	Hb103	Hd103
Async.Motor Base frequency setting, 1st-motor	Hb104	Hd104
Async.Motor Maximum frequency setting, 1st-motor	Hb105	Hd105
Async.Motor rated voltage, 1st-motor	Hb106	Hd106
Async.Motor rated current, 1st-motor	Hb108	Hd108

Setting for Protection of Motor

The motor may be burned if a large current keeps on flowing in the motor; the setting therefore must be performed appropriately.
Refer to *6-6 Thermal Protection* on page 6-52 for details.

Item	Parameter
Electronic thermal level setting, 1st-motor	bC110
Electronic thermal characteristic selection, 1st-motor	bC111

Setting for Motor Control

Set the motor control method.
To drive an SM/PMM, you need to change the control method. Refer to *7-1 Selection of Motor Control Methods* on page 7-3 for details.

Item	Parameter
Control mode selection, 1st-motor	AA121

When driving an SM/PMM/ or using vector control, you need to set up the following motor constants:

- **For induction motor (IM)**

Item	Parameter
Async.Motor constant R1, 1st-motor	Hb110
Async.Motor constant R2, 1st-motor	Hb112
Async.Motor constant L, 1st-motor	Hb114
Async.Motor constant Io, 1st-motor	Hb116
Async.Motor constant J, 1st-motor	Hb118

- **For synchronous motor (permanent magnet motor) (SM/PMM)**

Item	Parameter
Sync.Motor constant R, 1st-motor	Hd110
Sync.Motor constant Ld, 1st-motor	Hd112
Sync.Motor constant Lq, 1st-motor	Hd114
Sync.Motor constant Ke, 1st-motor	Hd116
Sync.Motor constant J, 1st-motor	Hd118

Setting for Activating the Motor

In order for the inverter to output the voltage, both an operation command and frequency command are required. In the initial state, **Main Speed reference monitor** (FA-01) is used as a frequency command.
Refer to *6-4 Frequency Command Settings* on page 6-25 and *6-3 Operation Command Settings* on page 6-18 for details.

Item	Parameter
Main speed input source selection, 1st-motor	AA101
Run-command input source selection, 1st-motor	AA111
Main Speed reference monitor	FA-01

4-3 Conduct a Test Run with LCD Operator

This section describes how to conduct a test run with LCD operator.

To perform a test run only with the LCD operator, set the following parameters from the initial value and check them.

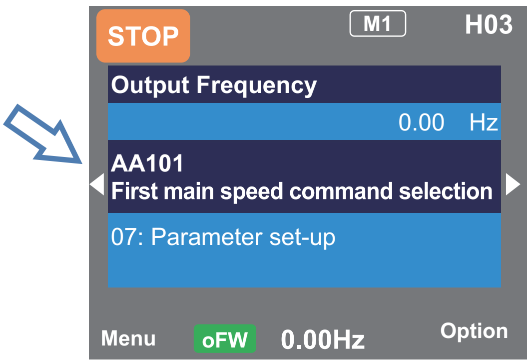
a. Frequency command source selection (**Main speed input source selection, 1st-motor** (AA101))
b. **Main Speed reference monitor** (FA-01)
c. Operation command source selection (**Run-command input source selection, 1st-motor** (AA111))

A test run can be performed with the LCD operator.

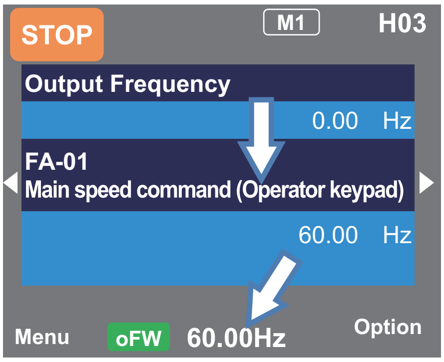
● Procedure

- From the initial screen displayed at power-on, move to **H03** with the LEFT/RIGHT ⟪ ⟫ keys.
- For procedure of changing parameters, refer to *3-2-1 Scroll Mode* on page 3-16.

1 Frequency command source selection (**Main speed input source selection, 1st-motor** (AA101))
Set the frequency command source to *07: Parameter setting*.



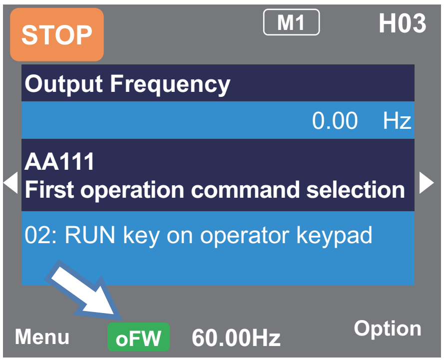
2 **Main Speed reference monitor** (FA-01)
When the frequency command source is set to *07: Parameter setting*, **Main Speed reference monitor (Operator keypad)** will be shown.
If a frequency command is set in this state, the value will be shown at the bottom command monitor area.



3 Operation command source selection (**Run-command input source selection, 1st-motor** (AA111))

When the operation command source is set to *02: RUN key on LCD Operator*, **oFW** will be shown at the bottom of the LCD operator.

When the operation command source is set to reverse, **oRV** is displayed.



4 Operation start

When you press the RUN key on the LCD operator, the inverter starts running and the motor rotates.

To stop the motor, press the STOP/RESET key to decelerate and stop.

4-4 Conduct a Test Run with Analog Input

This section describes how to conduct a test run by turning the forward input terminal [1: FW] ON/OFF and inputting voltage to the analog input terminal [Ai1].

To perform a test run with the analog input [Ai1], set the following parameters from the initial value and check them.

a. Frequency command source selection (**Main speed input source selection, 1st-motor** (AA101))
b. **Main Speed reference monitor** (FA-01)
c. Operation command source selection (**Run-command input source selection, 1st-motor** (AA111))

For how to wire the variable resistor knob to the analog input [Ai1], refer to *Analog Input/Output* on page 2-25. For the forward terminal [1: FW], refer to *Input Terminals* on page 2-21.

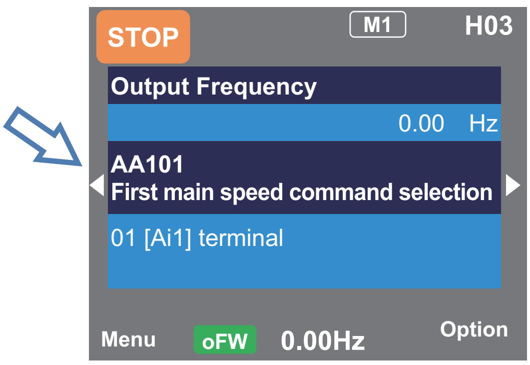
Precautions for Correct Use

- When using the analog input terminal [Ai1] or [Ai2], be sure to check the corresponding DIP switch SW1 and SW2 settings before wiring. An input beyond the specified voltage range may cause a malfunction.
- An input beyond the specified voltage range to the [Ai1] terminal, which has a 24V input or polarity in the opposite direction due to an adjustment error of the external power supply or a wiring error, may cause a failure.
- Be careful not to cause a short circuit between the H terminal and L terminal of the inverter internal power supply when the variable resistor is at 0Ω due to a wiring error.

● Procedure

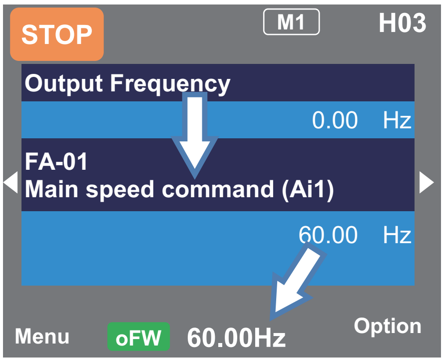
- From the initial screen displayed at power-on, move to **H03** with the LEFT/RIGHT keys.
- For procedure of changing parameters, refer to *3-2-1 Scroll Mode* on page 3-16.

1 Frequency command source selection (**Main speed input source selection, 1st-motor** (AA101))
Set the frequency command source to *01: Ai1 terminal input*.

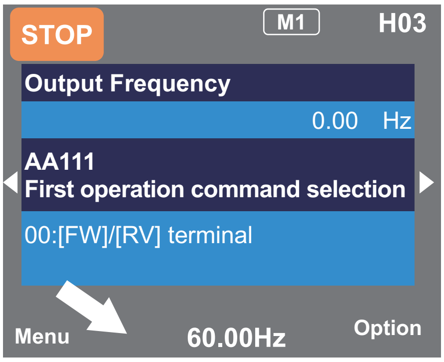


2 **Main speed command** (FA-01) check
When the frequency command source is set to *01: Ai1 terminal input*, **Main Speed reference monitor (Ai1)** will be shown.

If a frequency command is set in this state, the value will be shown on the command monitor at the bottom of the LCD operator.



3 Operation command source selection (**Run-command input source selection, 1st-motor** (AA111))
When the operation command source is set to *00: [FW]/[RV] terminal*, the display of RUN key enabled will disappear from the bottom of the LCD operator.



4 Operation start
When the [1: FW] terminal is turned ON, the inverter starts operation and the motor rotates in the forward direction. To rotate the motor in the reverse direction, turn ON the [2: RV] terminal. To stop the motor, turn OFF both the [1: FW] terminal and the [2: RV] terminal. The motor decelerates and stops.

4-5 Simulation Mode

In the simulation mode, because the inverter behaves just like a normal operation except that it cannot output to the motor, you can check terminals and communication operations.
It will be possible to change the internal data on a real-time basis by assigning a parameter or analog input to the internal data.
In addition to the normal power supply state, the simulation mode can be used without power supply to the main circuit, such as shutting off the main circuit power supply and supplying power from the external DC24V or using the control power supply R0-T0 separately.

If **Simulation mode enable** (PA-20) is set to *01: Enabled* and the power is turned on again, the inverter enters the simulation mode.
To cancel the simulation mode, set **Simulation mode enable** (PA-20) to *00: Disabled*, and then turn on the power again.

In the simulation mode, you can set any error in **Error code selection for Alarm test** (PA-21). A trip is issued as soon as the setting is made. To cancel a trip, turn ON the [28: RS] terminal or press the RESET key as usual. When the inverter is reset, **Error code selection for Alarm test** (PA-21) is automatically set to *00: Disabled*.

● Parameter

Item	Parameter	Data	Description
Simulation mode enable	PA-20	00	Disabled
		01	Enabled
Error code selection for Alarm test	PA-21	000 to 255	Issues a set error. Errors not listed in the selection do not occur.
Selection of simulation output value setting method Output current monitor optional output enable (PA-22) DC-bus voltage monitor optional output enable (PA-24) Output voltage monitor optional output enable (PA-26) Output torque monitor optional output enable (PA-28) Start with frequency matching optional Setting enable (PA-30)		00	Disabled
		01	Enabled: parameter setting
		02	Enabled: set from [Ai1]*1
		03	Enabled: set from [Ai2]*1
		04	Enabled: set from [Ai3]*1
		05	(Reserved)
		06	(Reserved)
		07	(Reserved)
Output current monitor optional output value setting	PA-23	0.0 to 3.0 × Inverter rated current (A)*2	When (PA-22) is *01*, it is reflected on **Output current monitor** (dA-02) during operation.
DC-bus voltage monitor optional value output	PA-25	200V class: 0.0 to 450.0 (Vdc) 400V class: 0.0 to 900.0 (Vdc)	When (PA-24) is *01*, it is reflected on **DC voltage monitor** (dA-40).

Item	Parameter	Data	Description
Output voltage monitor optional output value setting	PA-27	200V class: 0.0 to 300.0 (V) 400V class: 0.0 to 600.0 (V)	When (PA-26) is *01*, it is reflected on **Output voltage monitor** (dA-18) during operation.
Output torque monitor optional output value setting	PA-29	-500.0 to 500.0 (%)	When (PA-28) is *01*, it is reflected on **Output torque monitor** (dA-17) during operation.
Start with frequency matching optional value setting	PA-31	0.00 to 590.00 (Hz)	When (PA-30) is *01*, it is used as the detection value of the frequency matching start operation.

*1. The input value of the analog terminal becomes the inverter output value during simulation operation.

*2. On the current and voltage related parameters, the figures and the units to be handled vary in the setting path.

- When operating with the LCD operator and CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*.
- As reference information, when **Resister data selection** (CF-11) is set to *01: %*, the unit is 0.01% (rated ratio).

Additional Information

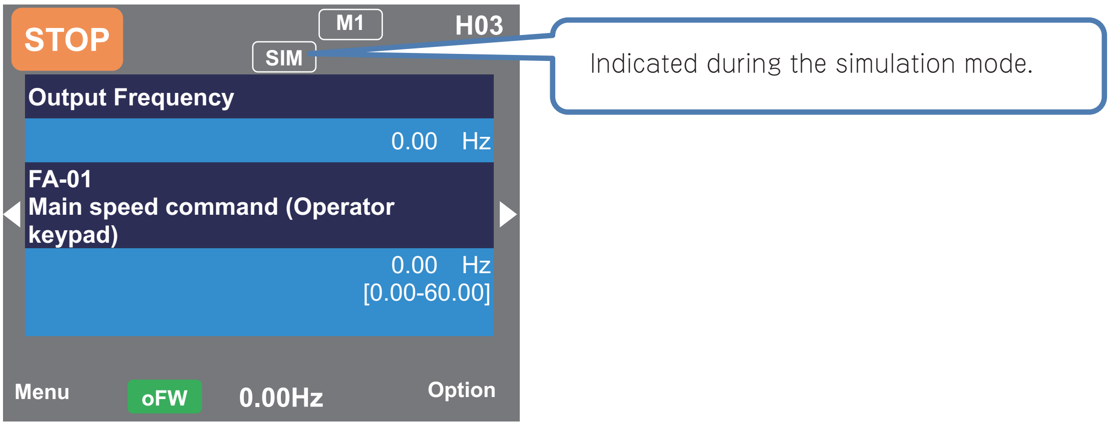
- To check the actual motor behavior, cancel the simulation mode.
- When using the simulation mode with only the external DC24V power supply, turn on the external DC24V after the main power supply (R, S, and T) and the control power supply (R0 and T0) are completely shut off. Normal operation is performed until the power is turned on again.
- Since the motor control does not operate in the simulation mode, the control cannot be confirmed.
- If an error not listed in **Error code selection for Alarm test** (PA-21) is entered, the error will not be generated.
- If a serious fault error is entered to **Error code selection for Alarm test** (PA-21), the error cannot be canceled by resetting with the [28: RS] terminal or the RESET key. The power needs to be turned on again.
  (Serious fault errors: E008, E010, E011, E014, E019, and E020)

● Start the Simulation Mode

1 Set **Simulation mode enable** (PA-20) to *01: Enabled*.

2 Turn off the power, and then turn it on again.
Wait for the LCD operator to completely discharge, and then turn on the power again.

3 The simulation mode becomes active.



● Canceling the Simulation Mode

1 Set **Simulation mode enable** (PA-20) to *00: Disabled*.

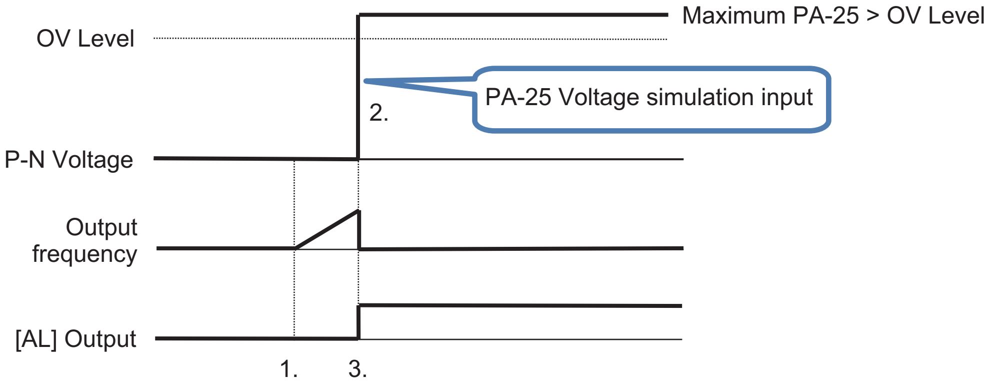
2 Turn off the power, and then turn it on again.
Wait for the LCD operator to completely discharge, and then turn on the power again.

3 The simulation mode is canceled.
The simulation mode display at the top of the LCD operator disappears.

● Example: Usage 1

Checking the behavior of the alarm output terminal [17: AL].

1. The operation was started.
2. **DC-bus voltage monitor optional output enable** (PA-24) was set to *01: Enabled*, and **DC-bus voltage monitor optional value output** (PA-25) was set to the maximum value.
3. An overvoltage error (E007) occurred and [17: AL] was ON.

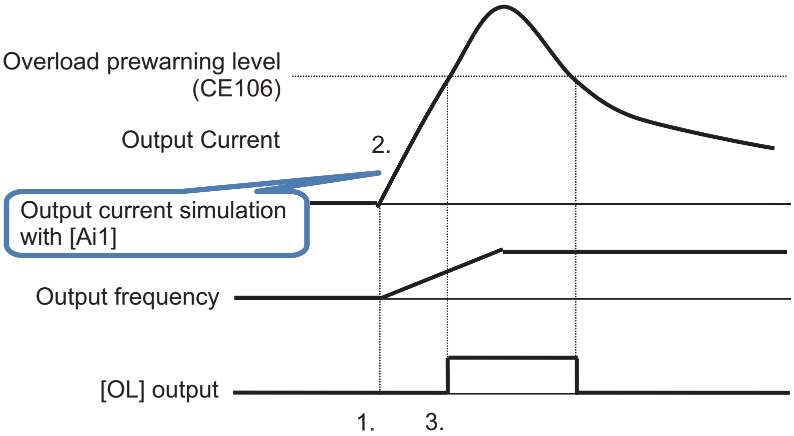


● Example: Usage 2

Checking the signal output of overload prewarning level [35: OL].

1. **Over current detection level 1, 1st motor** (CE106) was set, and the operation was started.
2. **Output current monitor optional output enable** (PA-22) was set to *02: Enabled: set from [Ai1]* and the [Ai1] terminal voltage was increased and decreased.

3. [35: OL] was turned ON because the output current exceeded **Over current detection level 1, 1st motor** (CE106).



5

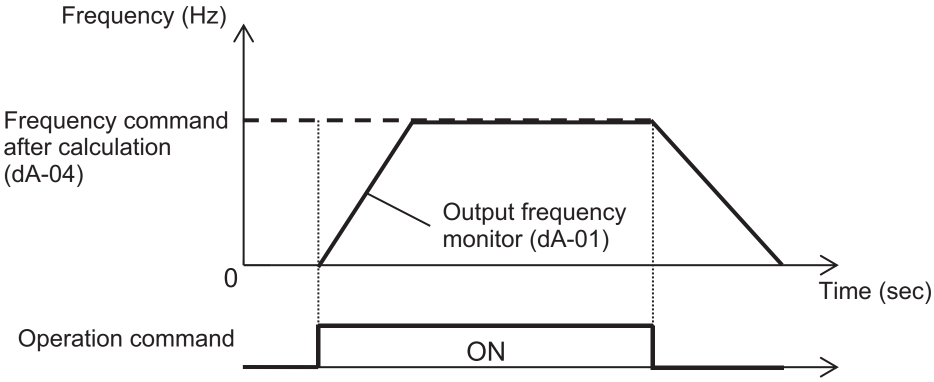
Monitors

This chapter describes the monitor functions of the inverter.

5-1 Frequency Monitor

5-1-1 Output Frequency Monitor

Displays the output frequency of the inverter.



● Parameter

Item	Parameter	Data	Description
Output frequency monitor	dA-01	0.00 to 590.00(Hz)	Displays the output frequency.
Output frequency monitor (with sign)	dA-12	-590.00 to 590.00(Hz)	Displays output frequency with a symbol. Forward rotation is + and reverse rotation is -.

5-1-2 Frequency Command Monitor

Frequency command after calculation (dA-04) displays the status of the final logic of the current command input.
Main Speed reference monitor(FA-01) show frequency set to **Main speed input source selection, 1st-motor** (AA101).
When **Main speed input source selection, 1st-motor**(AA101) is set to *07: Parameter setting*, you can change the frequency command directly by operating the up and down keys. If you press the Enter key to save, it will be saved in **Multispeed-0 setting, 1st-motor** (Ab110).
For **Sub Speed reference monitor** (FA-02), when **Sub frequency input source selection, 1st-motor** (AA102) is set to *07: Parameter setting*, the frequency command setting value can be changed by operating the up and down keys on the monitor.

Additional Information

By changing the **Main Speed reference monitor** (FA-01), the command destination parameter value can be changed at the same time in the following states.

- When multispeed is enabled and the command destination is one of **Multispeed1 - 15 setting** (Ab-11) to (Ab-25).
- When the [SET] terminal is used and the command destination is **Multispeed-0 setting, 2nd-motor** (Ab210).
- When the command destination is set in **Multispeed-0 setting, 1st-motor** (Ab110) by setting **Main speed input source selection** (AA101) to *07: Parameter setting*.
- When the command destination is set to **Multispeed-0 setting, 2nd-motor** (Ab210) by **Main speed input source selection, 2nd-motor** (AA201) on the [SET] terminal.

● **Parameter**

Item	Parameter	Data	Description
Frequency command after calculation	dA-04	-590.00 to 590.00(Hz)	Displays the frequency command. This frequency reflects functions such as jogging, multi-speed, and forced operation [F-OP].
Main Speed reference monitor	FA-01	0.00 to 590.00(Hz)	The frequency command selected by **Main speed input source selection**(AA101).
Sub speed reference monitor	FA-02	Monitor: 0.00 to 590.00 (Hz) Setting: -590.00 to 590.00 (Hz)	The frequency command set by **Sub frequency input source selection**(AA102).

Precautions for Correct Use

- If the **Frequency command after calculation** (dA-04) does not change even if you change the frequency command, it is possible that a command destination other than the intended command destination is reflected. For details, refer to *6-4 Frequency Command Settings* on page 6-25.

5-1-3 Frequency Conversion Monitor

The frequency conversion monitor displays the value obtained by multiplying the **Frequency command** by the coefficient set in **Frequency conversion gain** (Ab-01). It is used when you want to change the display such as the number of rotations of the motor.

The frequency display is converted as follows.

The displayed **Output frequency conversion monitor** (dA-06) = **Frequency command** (Hz) × **Frequency conversion gain** (Ab-01).

● **Parameter**

Item	Parameter	Data	Description
Output frequency conversion monitor	dA-06	0.00 to 59000.00(Hz)	Converted output frequency is displayed.
Frequency conversion gain	Ab-01	0.01 to 100.00	Conversion factor that multiplies the frequency.

Conversion Example: Display the Number of Motor Revolutions

The following shows the relationship between the frequency and the rotation speed of the motor.

Rotations N (min^{-1}) = (120 × *f* (Hz))/ *P* (pole)

From the above, when the motor frequency is 60Hz and the number of poles is 4 poles,

120×60/4=1800(min^{-1})

We get 1800 (min^{-1}) / 60 (Hz) = 30 (min^{-1} / Hz), and we can see that the conversion factor is 30.

When **Frequency conversion gain** (Ab-01) is set to *30.00*, 60×30.00 = 1800.00 (min^{-1}) is displayed at 60Hz output.

For reference, a conversion example of the number of poles, rated frequency, and rotation speed is shown below.

Motor frequency (Hz)	No. of motor poles (poles)	Frequency conversion gain (Ab-01)	Synchronous rotation speed (min^{-1})
50	2	60	3000
50	4	30	1500
50	6	15	750
50	8	7.5	375
60	2	60	3600
60	4	30	1800
60	6	15	900
60	8	7.5	450

5-1-4 Speed Detection Value Monitor

When using the feedback control by the encoder connected to the PG option unit or by pulse string input terminal of the main unit for motor control, the feedback speed data is displayed as frequency. For information on settings for encoder feedback control, refer to *7-10 Encoder Feedback* on page 7-77.

● Parameter

Item	Parameter	Data	Description
Speed detection value monitor	dA-08	-590.00 to 590.00(Hz)	Displays the feedback *3 speed detection value.
Encoder constant setting	CA-81	32 to 65535 (pls)	Set the resolution of the encoder connected to the pulse string input terminal of the inverter. Enabled when (CA-90) is set to *02*. *1*4
Pulse train detection (internal) control terminal [A] [B]	CA-90	00	Disabled
		01	Pulse train input frequency command is enabled.
		02	Speed feedback
		03	Pulse count

Item	Parameter	Data	Description
Encoder constant setting (Option)	ob-01	32 to 65535 (pls)	Set the resolution of the encoder connected to the PG option unit. *2*4
Async.Motor poles setting, 1st-motor	Hb103	2 to 48 (poles)	Sets the number of motor poles. *4

*1. When **Pulse train detection (internal) control terminal [A] [B]** (CA-90) is set to *02*, the A / B terminals of the inverter are used for feedback.

*2. When **Pulse train detection (internal) control terminal [A] [B]** (CA-90) is set to something other than *02*,the encoder of the PG option unit is used for feedback.

*3. If you are not using feedback, the frequency will not be displayed.

*4. If the number of encoder pulses and the number of motor poles are not set correctly, it will not be displayed correctly.

5-2 Acceleration/Deceleration Time Monitor

Displays the acceleration / deceleration time that is enabled when the acceleration / deceleration time is switched by either the 2-step acceleration / deceleration function or the multispeed function, or while changing the acceleration / deceleration time setting.
The displayed acceleration time is the time from 0Hz to the maximum frequency.
The displayed deceleration time is the time from the maximum frequency to 0Hz.

● Parameter

Item	Parameter	Data	Description
Acceleration time monitor	FA-10	0.00 to 3600.00(s)	Shows the acceleration time according to the enabled parameters.
Deceleration time monitor	FA-12	0.00 to 3600.00(s)	Shows the deceleration time according to the enabled parameters.

Additional Information

- The acceleration/deceleration time monitor displays acceleration/deceleration time parameters used for the following functions.
  - Acceleration/deceleration function
  - 2-step acceleration/deceleration function
  - Multispeed function
  - PID soft-start function
  - Acceleration/deceleration cancellation [LAC]
  - Second setting [SET] function
- The acceleration / deceleration time monitor is effective only during frequency control. Since the control method is different for torque control, the value indicated by the acceleration / deceleration time monitor is not used.
- Even when accelerating or decelerating by changing the acceleration / deceleration pattern, the time between 0Hz and the maximum frequency is displayed.

5-3 Operation Direction Monitor

The operation direction monitor displays the status of the operation commands and the rotation direction.
The rotation direction is determined by the operation command method and the sign associated with the frequency command.

● Parameter

Item	Parameter	Data	Description
Operation direction monitor	dA-03	00: o (Stopped)	Inverter is stopped.
		01: d (0Hz output)	Inverter is outputting 0 Hz.
		02: F (Normal rotation in process)	Inverter is running under forward rotation command.
		03: r (Reverse rotation in process)	Inverter is running under reverse rotation command.

Additional Information

- When in *01: d (0Hz output)* mode, it is likely that the output under 0Hz frequency command is due to DC injection braking function, the forcing function, or Zero-Hz range sensorless vector control, etc
- When there is no output to the motor, it is indicated by *00: o (Stopped)*.

5-4 I/O Terminal Monitor

5-4-1 Input Terminal Monitor

The input terminal monitor displays the physical ON (H)/OFF (L) status of terminals. It is not affected by the a/b contact setting.
The response of the input terminal monitor is slowed down by the response of the input terminal.

● Parameter

Item	Parameter	Data	Description
Input terminal monitor	dA-51	LLLLLLLLLLL to HHHHHHHHHHH	H: Input terminal ON state. L: Input terminal OFF state.

Precautions for Correct Use

- If the monitor status doesn't change when a terminal is turned ON and OFF, the input wires may be disconnected.
- When the [RS] terminal is turned ON, it will be in the reset state and cannot be checked on the input terminal monitor.

(Example) Input terminals 4 and 8 ON

	Data										
Terminal number	**B**	**A**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Monitor value	L	L	L	H	L	L	L	H	L	L	L

5-4-2 Output Terminal Monitor

The Output terminal monitor displays the physical ON (H)/OFF (L) status of the output terminals. It is not affected by the a/b contact setting.
The output terminal monitor operates as set by the on-delay and off-delay of the output terminal.

● Parameter

Item	Parameter	Data	Description
Output terminal monitor	dA-54	LLLLLLL to HHHHHHH	H: Output terminal ON state. L: Output terminal OFF state.

Additional Information

If the monitor status changes and the output terminal status does not change, in addition to an internal failure, the output line may also be disconnected.

(Example) Output terminal 15 and AL ON

	Data						
Terminal number	**AL**	**16**	**15**	**14**	**13**	**12**	**11**
Monitor value	H	L	H	L	L	L	L

5-4-3 Output Current Monitor

Displays the current output to the motor.

● Parameter

Item	Parameter	Data	Description
Output current monitor	dA-02	0.00 to 655.35 (A)	This is the effective value of the output current output to the motor.

Additional Information

The lower the carrier frequency, the more the inverter current fluctuates, which may cause the monitor value to fluctuate.

5-4-4 Output Voltage Monitor

Displays the voltage output to the motor.

● Parameter

Item	Parameter	Data	Description
Output voltage monitor	dA-18	0.0 to 800.0 (V)	Displays the voltage output to the motor.

5-5 P-N Voltage Monitor

Displays the voltage charged in the capacitor built into the main circuit of the inverter. The P-N voltage is the DC voltage between the P and N terminals of the main circuit terminal.

● Parameter

Item	Parameter	Data	Description
DC voltage monitor	dA-40	0.0 to 1000.0 (V)	This is the P-N voltage of the main circuit capacitor.

Additional Information

An overvoltage error (E007) occurs when the P-N voltage exceeds approximately DC405V for a 200V class inverter and approximately DC810V for a 400V class inverter.

5-6 Operation Time and Count Monitor

5-6-1 Cumulative Operating Hours Monitor During RUN

The cumulative operating hours monitor during RUN displays the duration of the time an inverter is generating output after it receives an operation command.

● Parameter

Item	Parameter	Data	Description
Cumulative operating hours monitor during RUN	dC-22	0 to 100000 (time)	The inverter output time period is recorded in memory and displayed.

Additional Information

The cumulative operating hours monitor during RUN cannot be cleared by initialization or similar method.

5-6-2 Cumulative Power-on Time Monitor

The cumulative power-on time monitor displays the total duration of power on time since the inverter's first power on.

● Parameter

Item	Parameter	Data	Description
Cumulative power-on time	dC-24	0 to 100000 (time)	The time from when the the inverter was powered-on is saved in memory and displayed.

Additional Information

The cumulative power ON time cannot be cleared by initialization or similar method.

5-6-3 Total Start-up Count Monitor

The total start-up count monitor displays the number of times there is output to a motor from the state where the inverter is stopped.

● Parameter

Item	Parameter	Data	Description
Total start-up count	dC-20	0 to 65535 (times)	Displays the number of times the operation has changed from the cutoff state to the running state.

Additional Information

The cumulative no. of startups count cannot be cleared by initialization or similar method.

5-6-4 Cumulative Power-on Count Monitor

The cumulative power-on count monitor displays the number of the times when the inverter was turned ON.

● Parameter

Item	Parameter	Data	Description
Power-on count	dC-21	0 to 65535 (times)	Displays the number of times the power supply for the control circuit has been turned on.

Additional Information

- The cumulative power on count monitor cannot be cleared by initialization or similar method.
- Retry restarts due to instantaneous power failures are not counted.

5-7 Cooling Fin Temperature Monitor

The cooling fin temperature monitor displays the temperature of the inverter's cooling fin.

● Parameter

Item	Parameter	Data	Description
Cooling fin temperature monitor	dC-15	-20.0 to 200.0(℃)	Display the cooling fin temperature.

Additional Information

If the cooling fin temperature exceeds a maximum of 120 ℃, a temperature error (E021) will occur.

5-8 Power Monitor

5-8-1 Input Power Monitor

The **Input power monitor** (dA-30) displays the power currently being input to the inverter.
The **Integrated input power monitor** (dA-32) displays the integrated value of the input power to the inverter.

● Parameter

Item	Parameter	Data	Description
Input power monitor	dA-30	0.00 to 600.00 (kW)	Displays the input power.
Integrated input power monitor	dA-32	0.0 to 100000.0(kWh)	Displays the integrated value of input power.
Clearing of integrated input power	UA-12	00	Disabled
		01	Clear
Display gain for Accumulation input power monitor	UA-13	1 to 1000	Multiplication factor for display.

● Input Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Clearing of integrated input power	KHC	39	ON: Clears the integrated input power to zero. OFF: Disabled

Additional Information

- Even if the output power is the same, the input power factor will differ due to the difference in power supply impedance.
- **Display gain for Accumulation input power monitor** (UA-13) can be used to convert the display contents into coefficients.
  Integrated input power monitor (dA-32) = *calculated input power (kWh)* / *coefficient* (UA-13)
- With Accumulation input power monitor clear (UA-12) set to *01: Enabled*, the integrated input power value can be cleared when triggered.
- You can also set the [39: KHC] terminal to one of the input terminals and clear it with the terminal.

5-8-2 Output Power Monitor

The **Output power monitor** (dA-34) displays the power currently being output to the motor.
The **Integrated output power monitor** (dA-36) displays the integrated value of the output power to the motor.

● Parameter

Item	Parameter	Data	Description
Output power monitor	dA-34	0.00 to 600.00 (kW)	Displays the output power.

Item	Parameter	Data	Description
Integrated output power monitor	dA-36	0.0 to 100000.0(kWh)	Displays the integrated value of output power.
Clearing of integrated output power	UA-14	00	Disable
		01	Clear
Display gain for Accumulation output power monitor	UA-15	1 to 1000	Multiplication factor for display.

● Input Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Clearing of integrated output power	OKHC	40	ON: Clears the integrated output power to zero. OFF: Disabled

Additional Information

- The **Display gain for Accumulation output power monitor** (UA-15) can be used to do a coefficient calculation on the displayed value.
  Integrated output power monitor (dA-36) = calculated output power (kWh) / coefficient (UA-15)
- With **Clearing of integrated output power** (UA-14) set to *01: Clear*, the integrated output power value can be cleared when triggered.
- You can also set the [40: OKHC] to one of the input terminals and clear it with the terminal.

5-9 Life Monitor

5-9-1 Life Diagnostic Monitor

The life diagnostic monitor displays the results of the following two service life diagnostics.

- Capacitor life on the main circuit board
- Cooling fan life

In addition to the monitor on the LCD operator, **Life diagnostic monitor** (dC-16), the capacitor life advance notice [29: AC] and fan life advance notice [30: WAF] can be assigned to the output terminals for output.

● Parameter

Item	Parameter	Data	Description
Life diagnostic monitor	dC-16	LL to HH	"H" indicates end of life. To the right is the life of the capacitor on the board. To the left is the cooling fan life.
Cooling FAN control method selection	bA-70	00	Always ON
		01	ON during operation. Continues to rotate for a while after stopping.
		02	Temperature dependent operation. The fan runs when the fin temperature rises.

● Output Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Capacitor life advance notice	WAC	29	ON: Indicates on-board capacitor is approaching end of life. OFF: No warning
Fan life advance notice	WAF	30	ON: Notifies that the rotation speed of the cooling fan has decreased. OFF: No warning

Precautions for Correct Use

- The Life diagnostic monitor updates the cumulative on-time for capacitor monitoring once every 10 minutes. In applications where the power is turned on and off repeatedly within this cycle time, the cumulative operating time is not updated, so the record is significantly shorter than the actual operating time, and the end of life warning cannot be given at the appropriate timing.
- If **Cooling FAN control method selection** is set to anything other than *00: Always ON*, no life diagnostics will be performed while the fan is stopped.

For cooling fan operation settings, refer to *8-5 Cooling Fan Control* on page 8-125.

5-9-2 Cumulative Operating Time of Cooling Fan Monitor

The cumulative operating time of cooling fan monitor shows how long the cooling fan has been running.

It can be used as a guide for replacing the cooling fan.

● Parameter

Item	Parameter	Data	Description
Cumulative operating time of cooling fan	dC-26	0 to 1000000 (time)	It measures and displays the time that the cooling fan has been running.
Cooling FAN accumulation running time clear selection	bA-71	00	Disabled.
		01	Clear is executed at the set timing.

Additional Information

By setting **Cooling FAN accumulation running time clear selection** (bA-71) to *01: Clear*, the **Cumulative operating time of cooling fan**(dC-26) can be cleared to *0*.

5-10 Electronic Thermal Load Ratio Monitor

5-10-1 Electronic Thermal Load Ratio Monitor of Motor

Display the electric thermal load ratio of the motor. The overload protection error [E005] is generated when the displayed thermal load ratio is about to exceed 100%.

● Parameter

Item	Parameter	Data	Description
Electronic thermal duty ratio monitor MTR	dA-42	0.00 to 100.00(%)	Displays the thermal load ratio of the motor.

Additional Information

Perform the appropriate basic settings of motor and electric thermal function settings.。

5-10-2 Electronic Thermal Load Ratio Monitor of Inverter

The monitor displays the electronic thermal load ratio of the inverter. The controller overload protection error (E039) is generated when the displayed value exceeds 100%.

● Parameter

Item	Parameter	Data	Description
Electronic thermal duty ratio monitor CTL	dA-43	0.00 to 100.00(%)	Displays the thermal load factor of the inverter.

Additional Information

With this function, the thermal characteristics of the inverter are predetermined and cannot be changed.

5-11 Inverter Rated Monitor

5-11-1 Load Rated Monitor

Displays the load rating set for the inverter.

● Parameter

Item	Parameter	Data	Description
Inverter load type selection monitor	dC-01	00	VLD: Very low duty
		01	LD: Low duty
		02	ND: Normal duty

5-11-2 Rated Current Monitor

Displays the rated current of the inverter.

● Parameter

Item	Parameter	Data	Description
Rated current moni-tor	dC-02	0.0 to 6553.5 (A)	Displays the rated current set in the inverter.

5-12 Braking Resistor Load Ratio Monitor

Displays the usage rate of the built-in braking resistor circuit.

● Parameter

Item	Parameter	Data	Description
BRD load factor monitor	dA-41	0.00 to 100.00(%)	Displays the load factor of the braking resistor.
Dynamic brake usage rate	bA-60	0.0 to 100.0(%)	Set the maximum use rate of the braking resistor.

Precautions for Correct Use

- Settings are required to use the braking resistor circuit.
  For details, refer to *8-2-5 Regenerative Braking Function* on page 8-54.
- The breaking resistor overload error [E006] is generated when the BRD load factor monitor (dA-41) value exceeds the value set for **Dynamic brake usage rate** (bA-60).

5-13 Inverter Status Monitor

Displays the current condition of inverter.

● Parameter

Item	Parameter	Data	Description
Detailed monitor for icon 2 LIM	dC-37	00 to 06	Refer to the information below and *Display (B): Warning Status* on page 3-6.
Detailed monitor for icon 2 ALT	dC-38	00 to 04	
Detailed monitor for icon 2 RETRY	dC-39	00 to 02	
Detailed monitor for icon 2 NRDY	dC-40	00 to 05	

5-13-1 Detailed Monitor for Icon 2 LIM (dC-37)

Data	Status	Description
01	Overcurrent suppression is applied due to increased current.	Under overcurrent suppression
02	Overload limiting function is applied due to increased current.	Under overload limit
03	The overvoltage suppression function is applied due to increased P-N voltage.	Under overvoltage suppression
04	The torque limiting function is applied due to increased current.	Under torque limit
05	The frequency is within the upper/lower limit or jump frequency limit.	Within upper limit Within lower limit Within jump frequency limit
06	A frequency command below the minimum frequency has been given.	Under minimum frequency limit
00	A state other than those above	A state other than those above

5-13-2 Detailed Monitor for Icon 2 ALT (dC-38)

Data	Status	Description
01	The current is increasing.	Overload warning
02	Motor thermal load is increasing	Under motor thermal advance notice
03	Inverter thermal load is increasing	Under controller thermal advance notice
04	Motor temperature is rising.	Motor heating advance notice active
00	A state other than those above	A state other than those above

5-13-3 Detailed Monitor for Icon 2 RETRY (dC-39)

Data	Status	Description
01	Waiting to retry after a trip.	Retry standby
02	Waiting to restart	Waiting to restart
00	A state other than those above	A state other than those above

5-13-4 Detailed Monitor for Icon 2 NRDY (dC-40)

Data	Status	Description
01	Trip occurred	A trip has occurred.
02	Power supply abnormality	Power failure or undervoltage state.
03	Resetting	Being reset or waiting to cancel reset.
04	STO	STO is enabled.
05	Standby	Waiting for inverter’s internal circuit or internal condition to be stable.
06	Data inconsistency	A setting inconsistency exists (warning).
07	Sequence abnormality	Abnormality during a sequence operation.
08	Free Run	Free-run is enabled (free-run operation).
09	Forced stop	Operation command isn’t permitted, or forced stop is being issued. (Deceleration stop behavior)
00	A state other than those above	A state other than those above

5-14 Analog Input Value Monitor

Displays the input values for Ai1, Ai2 and Ai3 that are currently input to the terminal block of the inverter.

● Parameter

Item	Parameter	Data	Description
Analog input [Ai1] monitor	dA-61	0.00 to 100.00(%) *1*3	Monitors analog input values.
Analog input [Ai2] monitor	dA-62	0.00 to 100.00(%) *1*3	
Analog input [Ai3] monitor	dA-63	-100.00 to 100.00(%) *2*3	

*1. Corresponds to voltage input (0 to 10V) or current input (0 to 20mA), depending on the switch settings.

*2. Corresponds to the input voltage range of -10 to 10V.

*3. The corresponding range can be adjusted by adjusting the analog input voltage. Refer to *8-12 Analog Input Terminal Function* on page 8-176.

5-15 Analog Terminal Setting Monitor

Displays the analog input/output switching status.

● Parameter

Item	Parame-ter	Data	Description
Analog I/O selection monitor	dA-60	VVVVVVVV to AAAAAAAA	Displays whether an analog input/output terminal is a voltage input/output terminal or a current input/out terminal. [Left side] (Reserved) (Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side] V: voltage/A: current

● Display Example: Factory Default Setting

	-	-	-	Ai3	Ao2	Ao1	Ai2	Ai1
dA-60	V	V	V	V	A	V	A	V

Precautions for Correct Use

- If the selection of the analog input switch does not match the electrical specifications of the actual input device, the data cannot be input properly and it may cause damage.
- If the selection of the analog output switch does not match the electrical specifications of the actual output device, the correct data cannot be output.
- If the monitor data of the analog switch does not switch even after executing the switch, it is possible that the switch is in progress, or has failed. Check the switch.

5-16 Terminal Block Type Monitor

Displays the terminal block type set for the inverter.

● Parameter

Item	Parameter	Data	Description
Terminal block option mounted state	dA-50	00	00:STD-TM1 Factory default setting. Use this setting.

5-17 Operation Command / Frequency Command Source Monitor

Displays the operation command sources and frequency command sources that are currently enabled.

● Parameter

<table>
<tr><th>Item</th><th>Parameter</th><th>Data</th><th>Description</th></tr>
<tr><td>Speed command destination monitor (main)</td><td>dC-07</td><td>01 to 07,
09 to 34</td><td rowspan="2">00: Disabled
01: Ai1
02: Ai2
03: Ai3
07: Multispeed-0 setting (Ab110)/(Ab210)
08: Auxiliary speed (AA104)/(AA204)
09: Multispeed-1 setting (Ab-11)
10: Multispeed-2 (Ab-12)
11: Multispeed-3 (Ab-13)
12: Multispeed-4 (Ab-14)
13: Multispeed-5 (Ab-15)
14: Multispeed-6 (Ab-16)
15: Multispeed-7 (Ab-17)
16: Multispeed-8 (Ab-18)
17: Multispeed-9 (Ab-19)
18: Multispeed-10 (Ab-20)
19: Multispeed-11 (Ab-21)
20: Multispeed-12 (Ab-22)
21: Multispeed-13 (Ab-23)
22: Multispeed-14 (Ab-24)
23: Multispeed-15 (Ab-25)
24: JG (AG-20)
25: RS485
29: Pulse string: Inverter
30: Pulse string: Option
31: DriveProgramming
32: PID
34: AHD retention speed</td></tr>
<tr><td>Speed command destination monitor (auxiliary)</td><td>dC-08</td><td>00 to 34</td></tr>
<tr><td>Operation command destination monitor</td><td>dC-10</td><td>00 to 06</td><td>00:[FW]/[RV] terminal
01: 3 wire
02: RUN key on LCD Operator
03: RS485 setting
04: Option 1
05: Option 2
06: Option 3</td></tr>
</table>

5-18 Option Monitor

Shows which optional unit is installed and which slot it is installed to.

Precautions for Correct Use

- The option unit is recognized when the power to the option unit is established.
- If the option unit has a bad connection or other failure, its state will be as disconnected.

● Parameter

Item	Parameter	Data	Description
Option slot 1 mounted state	dA-81	Option ID	Displays the ID of optional unit mounted in the option slot 1.
Option slot 2 mounted state	dA-82	Option ID	Displays the ID of optional unit mounted in the option slot 2.
Option slot 3 mounted state	dA-83	Option ID	Displays the ID of optional unit mounted in the option slot 3.

Option ID

ID	Optional Unit Type	Description
00	None	
09	3G3AX-RX2-ECT	EtherCAT Communication Unit
33	3G3AX-RX2-PG01	PG option unit

6

Basic Parameter Settings

This section describes the basic parameter settings.

Parameter

The parameter number structure is indicated below.
This section explains parameters without using the expression of **first setting**. Parameters that have both first setting and second setting are described using the code for the first setting. The setting values and operations of the second setting are the same as those of the first setting, unless otherwise specified.

Ab - 01

C
B
A

A	Parameter group		
B	SET function type	-	Common setting: always enabled in both the first and second settings.
		1	First setting: enabled when the [SET] terminal function is OFF.
		2	Second setting: enabled when the [SET] terminal function is ON.
C	In-group number		

To switch to the second setting, use the [SET] terminal function to be assigned to the input or output terminal. Refer to *8-4-1 Second Control (SET)* on page 8-78 for details of the second setting.

6-1 Basic Parameter Settings

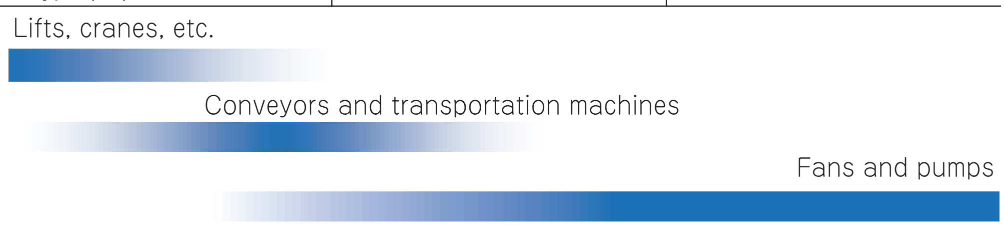
6-1-1 Inverter Load Rating Settings

The inverter load rating setting can be chosen from Normal Duty (ND), Low Duty (LD), and Very Low Duty (VLD).
Differences in load ratings include the rated current, overload capacity, and temperature rating of the inverter.
The inverter load rating setting is reflected immediately after**Load type selection**(Ub-03) is changed.

● Parameter

Item	Parameter	Data	Description	Default
Load type selection	Ub-03	00	VLD (Very Low Duty)	02
		01	LD (Low Duty)	
		02	ND (Normal Duty)	

For details about the load rating setting that you can set in the load type selection, see the following tables.

Load rating	Normal Duty (ND)	Low Duty (LD)	Very Low Duty (VLD)
Overload capacity	150% (1 min.), 200% (3 sec.)	120% (1 min.), 150% (3 sec.)	110% (1 min.), 120% (3 sec.)
Temperature rating characteristics	50°C (with derating)	45°C (with derating)	40°C (with derating)
Corresponding control type (AA121)	Induction motor IM • V/f control (00 to 03) • V/f control with sensor (04 to 07) • Sensorless vector control (SLV) (08) • Hz-range SLV control (09) • V/f control with sensor (10) Synchronous motor SM • SLV control (11) • IVMS start type SLV start type (12)	Induction motor IM • V/f control (00 to 03) • V/f control with sensor (04 to 07) • Sensorless vector control (SLV) (08) Synchronous motor SM • SLV control (11) • IVMS start type SLV start type (12)	Induction motor IM • V/f control (00 to 03) • V/f control with sensor (04 to 07) • Sensorless vector control (SLV) (08) Synchronous motor SM • SLV control
Major applications			

Additional Information

- If **Load type selection** (Ub-03) is changed, the parameter setting values related to current will change inside the inverter, so they need to be configured again. This is because the internal set value stored in the ratio (%) of the inverter rated current is interpreted in a unit of current (A); so all these parameters need to correspond to the new set value.
- The following functions related to the current setting need to be configured again after changing **Load type selection** (Ub-03). Applicable parameters are those use current as a unit for the overload limiting function, DC injection braking function, electronic thermal function, overload warning function, and low current detection function.
- If the control mode set in **Control mode selection** (AA121) does not support the Low Duty (LD) or Very Low Duty (VLD), when **Load type selection** (Ub-03) is set, **Control mode selection** (AA121) is automatically changed to *00: VF control* . When changing to the Very Low Duty (VLD) or Low Duty (LD), change the setting of **Load type selection** (Ub-03) and then check **Control mode selection** (AA121) again.

6-1-2 Inverter Initialization

When**Initialize Mode selection**(Ub-01) is chosen and**Initialize Enable**(Ub-05) is set to*01*, the designated data can be initialized to the default.
This is convenient when you use the 3G3RX2 Series Inverter for the first time or when you want to make the settings again after returning them to the factory default settings.

To initialize the inverter, set**Initialize Mode selection**(Ub-01) to*04: Trip history + parameters + DriveProgramming*and**Initialize Enable**(Ub-05) to*01*.

You can also clear only the trip history without initializing the stored parameter.
You do not need to change**Initialize Data selection**(Ub-02), so use the default value*01: Mode 1*.

Precautions for Correct Use

After initializing the inverter, you need to reset the electronic thermal of the motor. If the inverter is used without the reset after initialization, the motor may burn out.

Additional Information

- The initialization begins when F2 key is pressed after **Initialize Enable** (Ub-05) set to *01*.
- The initialization sets the parameters to initial values. When you need the data before the initialization, read out it with the R/W function (Read) in the LCD operator, or use CX-Drive to store it in a PC.
- The following data cannot be initialized:
  - **EzSQ user parameter U**(UE-10) to (UE-73)
  - **Cumulative operating hours monitor during RUN**(dC-22)、
  - **Cumulative power-on time**(dC-24)
  - **Initialize Data selection**(Ub-02)
  - **Load type selection**(Ub-03)
  - **[Ai1] Voltage/Current zero-gain adjustment**(Cb-30) to **[Ai3] Voltage gain adjustment** (Cb-35)
  - **Thermistor gain adjustment [TH+/TH-]** (Cb-41)
- The initialized parameters may not be displayed depending on **Display restriction selection** (UA-10). Change the data to *00: Full display* before performing initialization.
- When the setting of **Soft Lock selection** (UA-16) bans on a change of parameter values, the data can not be initialized. Be sure to reset the ban on a change of parameter values before carrying out the initialization.
- Initialization cannot be performed while the following symbols are displayed on the LCD operator.
  During operation (RUN)
  When the trip occurs (TRIP)
  During soft lock (LKS)
- Even when the operation command is input during initialization, the inverter ignores the command. Input the operation command again after the initialization is finished.

● Parameter

Item	Parameter	Data	Description	Default
Initialize Mode selection	Ub-01	00	The initialization is disabled.	00
		01	The trip history and retry history are cleared.	
		02	All parameters are initialized.	
		03	The trip history, retry history, and all parameters are initialized.	
		04	The trip history, retry history, all parameters, and program data for DriveProgramming are initialized.	
		05	Parameters other than those of the I/O terminal function are initialized.	
		06	Parameters other than those of the communication function are initialized.	
		07	Parameters other than those of the I/O terminal function and communication function are initialized.	
		08	Only the program data for DriveProgramming are initialized.	
Initialize Data selection	Ub-02	00	Mode 0	01
		01	Mode 1 (Factory setting)	
		02	Mode 2	
		03	Mode 3	
Initialize Enable	Ub-05	00	Function disabled	00
		01	Start initialization	

● Initialization Targets

Initialize Mode selection(Ub-01): Initialization targets are indicated by ■.

Ub-01	(1) History data	(2) Setting of I/O terminal parameter	(3) Communication function parameter	(4) Other parameters (other than (2) and (3))	(5) DriveProgramming
00					
01	■				
02		■	■	■	
03	■	■	■	■	
04	■	■	■	■	■
05			■	■	
06		■		■	
07				■	
08					■

Supplement: Parameters corresponding to (2) and (3) in the above table are as follows.

Item	Parameter range	Description
(2) Classification of I/O terminal functions	CA-01 to CA-11	Input terminal selection
	CA-21 to CA-31	NO/NC selection
	CA-41 to CA-51	Input terminal response
	Cb-40	Thermistor selection
	CC-01 to CC-07	Output terminal selection
	CC-11 to CC-17	NO/NC selection
	CC-20 to CC-33	Output delay
	CC-40 to CC-60	Logical operation function
(3) Classification of communication functions	CF-01 to CF-10	Setting of RS485 communication
	CF-20 to CF-38	Setting of EzCOM communication

● Initialize Data selection (Ub-02)

The data is initialized in the following manners, depending on the selected mode. The default is common in other parameters.
To initialize to the factory setting, set it to *01: Mode 1*.

Code	Name	Mode 0	Mode 1 (Factory setting)	Mode 2	Mode 3
AA101	Main speed input source selection, 1st-motor	07: Parameter setting	01: Ai1 terminal input	01: Ai1 terminal input	01: Ai1 terminal input
AA111	Run-command input source selection, 1st-motor	02: RUN key on LCD Operator	00: [FW]/[RV] terminal	00: [FW]/[RV] terminal	00: [FW]/[RV] terminal
AA201	Main speed input source selection, 2nd-motor	07: Parameter setting	01: Ai1 terminal input	01: Ai1 terminal input	01: Ai1 terminal input
AA211	Run-command input source selection, 2nd-motor	02: RUN key on LCD Operator	00: [FW]/[RV] terminal	00: [FW]/[RV] terminal	00: [FW]/[RV] terminal

Code	Name	Mode 0	Mode 1 (Factory setting)	Mode 2	Mode 3
bC111	Electronic thermal characteristic selection, 1st-motor	00: Reduction characteristics	01: Constant torque characteristics	01: Constant torque characteristics	01: Constant torque characteristics
bC211	Electronic thermal characteristic selection, 2nd-motor	00: Reduction characteristics	01: Constant torque characteristics	01: Constant torque characteristics	01: Constant torque characteristics
Hb104	Async.Motor Base frequency setting, 1st-motor	60.00	50.00	60.00	50.00
Hb105	Async.Motor Maximum frequency setting, 1st-motor	60.00	50.00	60.00	50.00
Hb106	Async.Motor rated voltage, 1st-motor	200 V class: 200 400 V class: 400	200 V class: 230 400 V class: 400	200 V class: 230 400 V class: 460	200 V class: 230 400 V class: 400
Hb204	Async.Motor Base frequency setting, 2nd-motor	60.00	50.00	60.00	50.00
Hb205	Async.Motor Maximum frequency setting, 2nd-motor	60.00	50.00	60.00	50.00
Hb206	Async.Motor rated voltage, 2nd-motor	200 V class: 200 400 V class: 400	200 V class: 230 400 V class: 400	200 V class: 230 400 V class: 460	200 V class: 230 400 V class: 400

6-2 Settings for Motor Related Parameter

This section describes the motor basic settings and motor constant settings as the settings for motor related parameters.

6-2-1 Motor Basic Settings

Basic parameters to control and protect the motor are set.
Regardless of the control method, set the following basic parameters for the motor.
If the motor parameters are properly set for the inverter, the control result will be an appropriate value, which has the effect of stabilizing the motor behavior.

There are separate parameters for induction motors (IM) and synchronous motors (SM) / permanent magnet motors (PMM).

- You need to match the base frequency to the rated frequency specified by the motor. If the base frequency is set lower than the rated frequency, the motor may burn out.
- Typical induction motors are designed with rated frequencies from 50Hz to 60Hz.
  When setting the maximum frequency to 60Hz or higher, check the motor specifications for the maximum allowable frequency. If you set the maximum frequency and rated voltage that exceed the motor specifications, the motor may burn out.

Basic Settings for Induction Motor (IM)

● Parameter

Item	Parameters of inverter		Setting range (unit)	Description	Default
Capacity	Hb102	Async.Motor capacity setting	0.01 to 160.00 (kW)	Sets the motor capacity.	Varies depending on inverter models and settings of load rating.
Number of poles	Hb103	Async.Motor poles setting	2 to 48 (poles)	Sets the number of motor poles.	4
Frequency	Hb104	Async.Motor Base frequency setting	10.00 to 590.00 (Hz)	Sets the base frequency of motor.	50.00*1
	Hb105	Async.Motor Maximum frequency setting	10.00 to 590.00 (Hz)	Sets the max. frequency of motor.	50.00*1
Voltage	Hb106	Async.Motor rated voltage	1 to 1000 (V)	Sets the rated voltage of motor.	200V: 230 *1 400V: 400 *1

Item	Parameters of inverter		Setting range (unit)	Description	Default
Cur-rent	Hb108	Async.Motor rated current	0.01 to 10000.00 (A)	Sets the rated current of motor.	Varies depending on inverter models and settings of load rating.

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

Basic Settings for Synchronous Motor (SM)/Permanent Magnet Motor (PMM)

● Parameter

Item	Parameters of inverter		Setting range (unit)	Description	Default
Capacity	Hd102	Sync.Motor capacity setting	0.01 to 160.00 (kW)	Sets the motor capacity.	Varies depending on inverter models and settings of load rating.
Number of poles	Hd103	Sync.Motor poles setting	2 to 48 (poles)	Sets the number of motor poles.	Varies depending on inverter models and settings of load rating.
Frequency	Hd104	Sync.Base frequency setting	10.00 to 590.00 (Hz)	Sets the base frequency of motor.	Varies depending on inverter models and settings of load rating.
	Hd105	Sync.Maximum frequency setting	10.00 to 590.00 (Hz)	Sets the max. frequency of motor.	Varies depending on inverter models and settings of load rating.
Voltage	Hd106	Sync.Motor rated voltage	1 to 1000 (V)	Sets the rated voltage of motor.	Varies depending on inverter models and settings of load rating.
Current	Hd108	Sync.Motor rated current	0.01 to 10000.00 (A)	Sets the rated current of motor.	Varies depending on inverter models and settings of load rating.

Capacity and Number of Poles

Note that if you change the capacity and the number of poles, the inverter will clear the motor constants.

After setting the capacity and number of poles, you need to auto-tune or manually enter the prepared motor constants. Setting the correct motor constant will optimize and stabilize the operation.
The cleared initial value is for auto tuning, and if it is far from the actual motor constant, the motor may not behave as expected, so set the motor constant correctly.

Base Frequency

Match **Async.Motor Base frequency setting** (Hb104) to the rated frequency of the motor.
The base (maximum) frequency is calculated from the rated rotation speed (min-1) and the number of poles of the motor as follows.

- Base frequency (Hz) = Rated rotation speed (min-1) x Number of poles (pole) / 120

Precautions for Correct Use

If the induction motor can be used above 60Hz, it may be a special motor. Since the power consumption exceeds the maximum applicable motor capacity of the inverter, it may be necessary to increase the inverter capacity.

Maximum Frequency

Set the maximum frequency of motor.

Rated Voltage

Set the rated voltage of motor according to the motor specifications.

Precautions for Correct Use

- If the motor rated voltage exceeds the receiving voltage or inverter rated voltage, the voltage exceeding the receiving voltage will not be output, so sufficient characteristics may not be obtained.
- When upgrading from the 3G3RX-V1 Series Inverter, set the rated voltage of the motor as follows.
  3G3RX Series: **Motor incoming voltage selection** (A082) and **Output voltage gain** (A045)
  3G3RX2 Series: **Async.Motor rated voltage** (Hb106)
  Async.Motor rated voltage (Hb106) = A082 × A045 / 100

Rated Current

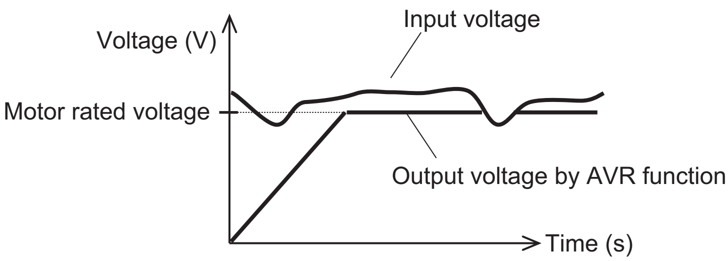
Set the rated current of motor according to the motor specifications. If the setting is inappropriate, the motor protection may not work properly.
If the motor rated current is not set correctly, the motor control may be unstable.

Precautions for Correct Use

If the motor rated current exceeds the inverter rated current, sufficient characteristics may not be obtained. An inverter overcurrent error may be detected before the motor rated current is reached.

Automatic Voltage Regulation Function (AVR Function)

This function automatically corrects the output voltage to the motor even if the inverter receiving voltage fluctuates.
It avoids a decrease in motor output torque and overexcitation.
However, it is not possible to output a voltage that exceeds the inverter receiving voltage.



Also, during deceleration, the regenerative power generated by the motor is charged inside the inverter, and the internal voltage may rise temporarily. The AVR responds to the input voltage and to this rise in the internal voltage to adjust the output voltage. The operation in which the AVR is turned off during deceleration and the voltage temporarily charged inside the inverter is ignored and added to the output voltage to decelerate is set by default.
While deceleration torque is likely to occur, this addition may cause an overcurrent error during deceleration. If an overcurrent occurs, set **Over magnetization deceleration function selection** (bA146) to *00: Disabled* (always AVR ON).

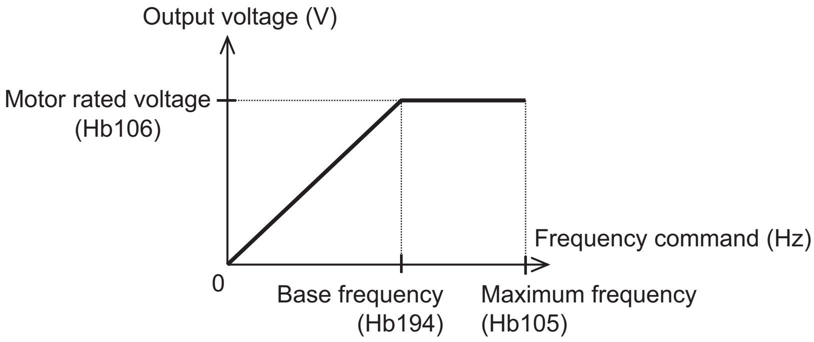
- In order to increase the deceleration torque during deceleration, the initial value is set to *02: Operation only at deceleration* (AVR OFF during deceleration).

● Parameter

Item	Parameter	Data	Description	Default
Over magnetization deceleration function selection	bA146	00	Disabled (always AVR ON)	02
		01	Regular operation (AVR OFF)	
		02	Operation only at deceleration (AVR OFF during deceleration)	
Async.Motor rated voltage	Hb106	1 to 1000 (V)	The motor rated voltage used for IM motor control.	200V: 230 400V: 400
Sync.Motor rated voltage	Hd106	1 to 1000 (V)	The motor rated voltage used for SM/PMM motor control.	200V: 230 400V: 400

General Control of IM Motor (V/f Control)

The general V/f control characteristics that are set according to the motor rated frequency and rated voltage are as follows.
For the base frequency and maximum frequency, enter the motor rated frequency.
The maximum output voltage from the base frequency to the maximum frequency is the motor rated voltage.



General Control of Synchronous Motor

The synchronous motor basically requires current calculation control, so use a sensorless vector dedicated to the synchronous motor.
Since a sensorless vector is to be used, refer to *6-2-1 Motor Basic Settings* on page 6-8 and *6-2-2 Motor Constant Settings* on page 6-12 to set the parameters of the synchronous motor.

6-2-2 Motor Constant Settings

Correctly setting the motor constant corrects the control and stabilizes the behavior of the motor.
In particular, for control methods, such as automatic boost function, automatic boost function with sensor, sensorless vector control function, Zero-Hz range sensorless vector control, and vector control with sensor, you need to set the motor constant according to the motor.

When **Async.Motor capacity setting** (Hb102) or **Async.Motor poles setting** (Hb103) is changed, the following motor constants disappear. So after setting **Async.Motor capacity setting** (Hb102) or **Async.Motor poles setting** (Hb103), auto-tune or manually enter the prepared motor constants.

- For IM motor constants: **Async.Motor constant R1** (Hb110) to **Async.Motor constant J** (Hb118)
- For SM/PMM motor constants: **Sync.Motor constant R** (Hd110) to **Sync.Motor constant J** (Hd118)

For information on auto-tuning, refer to *6-2-3 Auto-tuning of Motor* on page 6-13.

It is recommended to use the data copy function of the LCD operator to back up the parameters so that the motor constants can be restored even if they are initialized unexpectedly.
For the data copy function, refer to *3-5 Data Copy Function* on page 3-31.
For detailed information on how to adjust the control method, refer to *7-1 Selection of Motor Control Methods* on page 7-3.

IM Motor Constant Parameters

Item	Parameter	Data	Description	Default
Async.Motor constant R1	Hb110	0.000001 to 1000.000000 (Ω)	Sets the primary resistance value of IM.	Varies depending on inverter models and settings of load rating.
Async.Motor constant R2	Hb112	0.000001 to 1000.000000 (Ω)	Sets the secondary resistance value of IM.	
Async.Motor constant L	Hb114	0.000001 to 1000.000000 (mH)	Sets the leakage inductance value of IM.	
Async.Motor constant I0*1 *2	Hb116	0.01 to 10000.00 (A)	Sets the no-load current value of IM.	
Async.Motor constant J	Hb118	0.00001 to 10000.00000 (kgm^2)	Sets the moment of inertia of the system.	

*1. When upgrading from the 3G3RX-V1 Series Inverter, set **Async.Motor constant I0** (Hb116) as follows.
Async.Motor constant I0 (Hb116) = 50Hz / a × b
a: 3G3RX-V1 parameter **Base frequency** (A003)
b: 3G3RX-V1 parameter **Motor I0** (H023)
Or, **Motor I0 (auto-tuning data)** (H033)

*2. If **Async.Motor Base frequency setting** (Hb104) is changed after setting the motor constant, you need to reset the motor constant I0. (The set value on the parameter is maintained.) Reset **Async.Motor constant I0** (Hb116) from the obtained motor constant, or reacquire it by auto tuning.

SM/PMM Motor Constant Parameters

Item	Parameter	Data	Description	Default
Sync.Motor constant R	Hd110	0.000001 to 1000.000000 (Ω)	Sets the resistance value of SM/PMM.	Varies depending on inverter models and settings of load rating.
Sync.Motor constant Ld	Hd112	0.000001 to 1000.000000 (mH)	Sets the d-axis inductance of SM/PMM.	
Sync.Motor constant Lq	Hd114	0.000001 to 1000.000000 (mH)	Sets the q-axis inductance of SM/PMM.	
Sync.Motor constant Ke*1	Hd116	0.1 to 100000.0 (mVs/rad)	Sets the calculated value of induced voltage of SM/PMM.	
Sync.Motor constant J	Hd118	0.00001 to 10000.00000 (kgm^2)	Sets the moment of inertia of the system.	

*1. The motor constant Ke is the phase-induced voltage peak (mV) per electrical angular velocity (rad/s).

6-2-3 Auto-tuning of Motor

The auto-tuning is a function that measures and automatically sets the motor constants necessary for the motor control.
There are two types of auto-tuning functions: 1) Offline auto-tuning where the auto-tuning function finishes after a single measurement, and 2) online auto-tuning where the auto-tuning function measures a change in the constants due to motor temperature increase every time the motor is started or stopped.
Use the offline auto-tuning to measure the motor constants if you use a motor whose constants are unknown.

When *02: Rotation* is chosen in **Auto-tuning selection** (HA-01), the motor automatically begins rotating when the tuning starts.
Make sure of the followings.

- No problem occurs even if the motor rotates at a base frequency close to 80%.
- The motor is not driven from external.
- The braking is in the open state.

The torque is not high enough during the auto-tuning. Lifts or other machines may slip off. Remove the motor from the loading machine and perform the auto-tuning with the independent motor. (In this case, the moment of inertia J is that of the independent motor, and hence the moment of inertia of the loading machine should be converted to the value of the motor shaft and added to J.)
For machines with limited motor shaft rotation, such as lifts and ball screws, the motor may operate in excess of the allowable rotation and damage the machine. Therefore, chose *01: Non-rotation* in **Auto-tuning selection** (HA-01).
The online auto-tuning can make the behavior of the motor more stable by compensating for the temperature rise of the motor during operation.

● Parameter

Item	Parameter	Data	Description	Default
Auto-tuning selection	HA-01	00	Function disabled.	00
		01	Non-rotation auto-tuning is performed. After this parameter is set, an operation command starts the tuning.	
		02	Rotation auto-tuning is performed. After this parameter is set, an operation command starts the tuning.	
		03	Tuning for the IVMS control type is performed. After this parameter is set, an operation command starts the tuning.	
RUN command selection at Auto-tuning	HA-02	00	Auto-tuning is started with the RUN key of the LCD operator as a start signal.	00
		01	Auto-tuning is started with the selected operation command as a start signal.	
Online auto-tuning selection	HA-03	00	Function disabled.	00
		01	Online auto-tuning is performed. Online tuning is automatically performed after the deceleration stops in ordinary operations.	

- The constants of the standard IE3 motor are set for auto-tuning and operation check as default in the factory setting. The induction motor with similar characteristics can operate without offline auto-tuning; however, it is recommended to perform auto-tuning to obtain sufficient control characteristics.
- When you use a synchronous motor (SM or a permanent magnet motor PMM), set **Control mode selection, 1st-motor**(AA121) to *11: SM/PMM: Synchronous activation* or *12: SM/PMM: IVMS activation* and then perform the auto tuning.
- If no-load current is not given, perform the no-load operation test run in V/f control at base frequency to get the setting value. See the current on **Output current monitor** (dA-02) and input the value to**Async.Motor constant Io** (Hb116) before performing auto-tuning.
- If offline auto-tuning does not provide sufficient characteristics, adjust the parameters and motor constants individually.
- Before using the online auto-tuning function, perform offline auto-tuning. The motor constant is the data for one phase of Y connection.

- Offline auto-tuning automatically overwrites the acquired data with parameters. Online auto-tuning corrects the internal data and does not overwrite the parameter data.

Precautions for Correct Use

Even if *01: Non-rotation* is chosen for **Auto-tuning selection** (HA-01), the motor could make a half-turn at the maximum.

Parameter Data Overwritten in Offline Auto-tuning

IM/SM Selection	Parameters to be overwritten	
	SetAuto-tuning selection (HA-01) to *01: Non-rotation*.	Set Auto-tuning selection (HA-01) to *02: Rotation*
Induction motor (IM) Set **Control mode selection** (AA121) to *00* to *10*	**Async.Motor constant R1**(Hb110) **Async.Motor constant R2**(Hb112) **Async.Motor constant L**(Hb114)	**Async.Motor constant R1**(Hb110) **Async.Motor constant R2**(Hb112) **Async.Motor constant L**(Hb114) **Async.Motor constant Io**(Hb116) **Async.Motor constant J**(Hb118)
Synchronous motor/Permanent magnet motor (SM/PMM) Set **Control mode selection** (AA121) to *11* to *12*	**Sync.Motor constant R**(Hd110) **Sync.Motor constant Ld**(Hd112) **Sync.Motor constant Lq**(Hd114)	-

The above table shows the case where the 2nd control [24: SET] terminal is OFF or not selected. If the [SET] terminal is ON (2nd setting), the motor constant parameters of the 2nd control of (H*21*) ((Hb210) to (Hb218) and (Hd210) to (Hd218)) are enabled, according to**Control mode selection, 2nd-motor**(AA221).

Offline Auto-tuning

1 Check**Control mode selection**(AA121).
For the induction motor (IM), make sure that**Control mode selection**(AA121) is set to the control method for IM.
For the synchronous motor (SM) or permanent magnet motor (PMM), make sure that**Control mode selection**(AA121) is set to the control method for PMM.

2 Set**Auto-tuning selection**(HA-01).
Set **Auto-tuning selection** (HA-01) to *01: Non-rotation* or *02: Rotation*. Tuning does not begin at this stage. For the synchronous motor (SM) or permanent magnet motor (PMM), select *01: Non-rotation*. Tuning fails when *02: Rotation* is selected.

3 Enter the tuning start command.

Press the RUN key on the LCD Operator to start the offline auto-tuning. If you press the STOP button, the tuning stops in the middle. In this case, tuning data will not be stored.
In auto-tuning, the output pattern for measurement is output to the motor as a voltage.
If**Auto-tuning selection**(HA-01) is set to*01: Non-rotation*, three patterns of non-rotation output is given.
If**Auto-tuning selection**(HA-01) is set to*02: Rotation*, acceleration and deceleration are repeated twice in addition to the three patterns of the non-rotation output. The frequency increases up to 80% of the base frequency.
After the above operation finishes, the non-rotation output is made for final check.

4 Exit offline auto-tuning.
When tuning is complete, the offline auto-tuning end display appears.
At this time, the measured value is stored in the parameter.
Press the STOP key to cancel the end display.

Measures to Take If Offline Auto-tuning Fails

If the auto-tuning ends with a trip or tuning failure, normal data cannot be acquired. See the following table for how to deal with the failure.

The online auto-tuning runs for up to 5 seconds each time the operation stops, and the result is automatically reflected. If the operation is restarted during tuning, the result will not be reflected.
The factory default of the start signal for offline auto-tuning is the RUN key of the LCD operator. By changing **RUN command selection at Auto-tuning** (HA-02), you can change the setting to use the operation command as the start signal.

With the following settings, online auto-tuning will not be performed until the motor is in the free-run state.
- DC braking when stopped (**DC braking selection** (AF101) is set to *01* or *02*.)
- Servo ON function [SON], Forcing function [FOC] (Input terminal function [65: SON], [66: FOC])
- Brake control 2 (**Brake Control Enable** (AF130) is set to *03*.)

● Measures to Take If Offline Auto-tuning Failure Occurs in the Middle

Assumed cause	Example of measures
The control method is not suitable for the motor.	The tuning method is determined by whether **Control mode selection** (AA121) is IM control or SM/PMM control, so set it according to the motor.
The base frequency, motor rated voltage, or motor rated current is not suitable for the motor specifications.	Wrong basic parameters of the motor could cause overcurrent or trip, so check the basic parameters and set them appropriately.
STOP key was pressed.	Pressing the STOP key on the LCD operator interrupts the auto-tuning. Start the tuning again.
External factors such as braking caused a trip.	Factors that cause the trip need to be removed.
The input terminal function worked.	Inputs may interrupt the tuning during the auto-tuning. Make sure that the signal to the terminals (input terminals 1 to 9, A, and B) that caused the problem during auto-tuning is not changed.

Assumed cause	Example of measures
The motor capacity is too small for the applicable motor of the inverter.	Obtain the motor constant from the motor catalog or instruction manual, and set it in the motor constant parameter.

If auto-tuning fails, the motor constant data before tuning remains unupdated.

Online Auto-tuning

Each time the operation stops, the online auto-tuning runs for up to 5 seconds. For complete tuning, make sure that downtime is secured at least 5 seconds. Also, check before operation that the operation and stop can be performed normally with the tuned constants.

1 Perform offline auto-tuning.
Perform offline auto-tuning to set the motor constants to parameters.

2 Set **Online auto-tuning selection** (HA-03).
Set **Online auto-tuning selection** (HA-03) to *01: Enabled*.

3 Enter the operation command and deceleration stop to check the operation.
After the operation stops, check the operation of online auto-tuning for a few seconds.
Repeat the operation several times, and check that no trip or tuning failure is displayed.

4 Check the operation interval.
Online auto-tuning completes tuning within 5 seconds after the oeration stops. If you enter an operation signal before the tuning is completed, the measurement data will be discarded. For complete reflection of the measurement, make sure that downtime is secured at least 5 seconds.

IVMS Auto-tuning

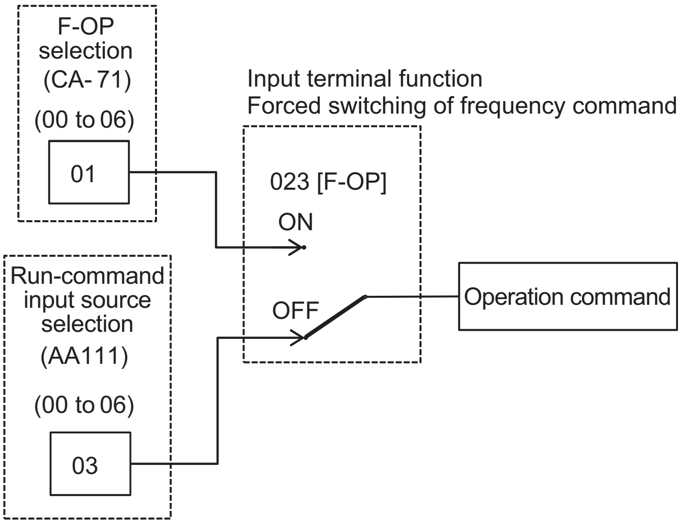
For the SM/PMM motor, use IVMS control when a high torque is required for activation.

- If a high torque is necessary for activation, use original IVMS control of this product. By setting **Auto-tuning selection** (HA-01) to *03*, the IVMS control method detects whether the target motor can be driven. However, combination check is required in advance.
- If the IVMS control auto-tuning fails, the motor is not applicable because the data required for IVMS control cannot be obtained. Therefore, set**Control mode selection**(AA121) to*11: Synchronous start type sensorless vector control (SM/PMM)*and drive.
- When tuning the IVMS control, use the motor alone and set**Control mode selection**(AA121) to*12: IVMS start type sensorless vector control (SM/PMM)*.

6-3 Operation Command Settings

6-3-1 Types of Operation Commands

Set the operation command in **Run-command input source selection** (AA111). You can switch the operation command by setting the forced operation [F-OP] of the input terminal function and **RUN command source selection at [F-OP] is active** (CA-71).
In addition to the operation command, a frequency command is required to operate the inverter.



Parameter	Setting item
CA-71 AA111	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD Operator 03: RS485 04: Option 1 05: Option 2 06: Option 3

When the forced operation [23: F-OP] is not assigned to **Input terminal function** (CA-01) to (CA-11), it is treated as Always OFF.

6-3-2 Operation with LCD Operator

Parameter settings allow frequency commands to be commanded by the LCD operator.
Use the RUN key and STOP/RESET key to start or stop the operation.
When driving with the LCD operator, the driving direction follows **RUN-key Direction of LCD operator** (AA-12).
In order for the inverter to output, a frequency command is required in addition to the operation command.

● Parameter

Item	Parameter	Data	Description	Default
Run-command input source selection	AA111	02	Operation command from the RUN key or Stop/RESET key on the LCD operator.	00*1
RUN-key Direction of LCD operator	AA-12	00	Forward rotation command during LCD operator operation.	00
		01	Reverse rotation command during LCD operator operation.	

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Output Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Operation command with LCD operator enabled	REF	11	ON: Operation command can be input with LCD operator OFF: Operation command with LCD operator disabled

6-3-3 Operation with Forward and Reverse Rotation Terminals

By setting the parameters, the forward rotation command [FW] and reverse rotation command [RV] on the control circuit terminal of the inverter can be used as the operation command of the inverter.
A forward rotation command can be input from the [FW] terminal and a reverse rotation command from the [RV] terminal. Operation starts when the input is ON, and stops when the input is OFF. For information on how to stop the operation, refer to*7-6-1 Stop by Operation Command* on page 7-68.

In the factory setting, the *1: FW* and *2: RV* terminals are assigned to the terminal No. 9 **Input terminal [9] function** (CA-09) and terminal No. 8 **Input terminal [8] function** (CA-08), respectively. Use **Input terminal function** (CA-01) to set any terminal.

The a/b contact (NO/NC) of each terminal can be changed by selecting the parameter corresponding to each input terminal **Input terminal active state** (CA-21) to (CA-31).
If a forward rotation command and a reverse rotation command are simultaneously input, it will be a stop command.
The relationship between the [FW] terminal and the [RV] terminal is as follows.

FW terminal	RV terminal	Operation command
OFF	OFF	Stop command
ON	OFF	Forward rotation command
OFF	ON	Reverse rotation command
ON	ON	Stop command

The [FW]/[RV] command of the DriveProgramming function can give a command in the same way.
In order for the inverter to output, a frequency command is required in addition to the operation command.

When the input terminal function *23: F-OP* is enabled, the command destination selected by the F-OP function is enabled regardless of this setting.

● **Parameter**

Item	Parameter	Data	Description	Default
Run-command input source selection	AA111	00	Run/Stop from the control circuit terminal block. ([FW]/[RV] terminals)	00[*1]
Input terminal active state	CA-21 to CA-31	00	Normally open: NO	-
		01	Normally closed: NC	

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

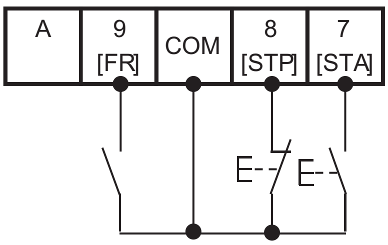
● **Input Terminal Function (CC-01) to (CC-11)**

Item	Terminal name	Data	Description
Terminal function FW	FW	1	ON: Forward rotation command
Terminal function RV	RV	2	ON: Reverse rotation command

6-3-4 Operation with 3 Wire Function of Terminal Block

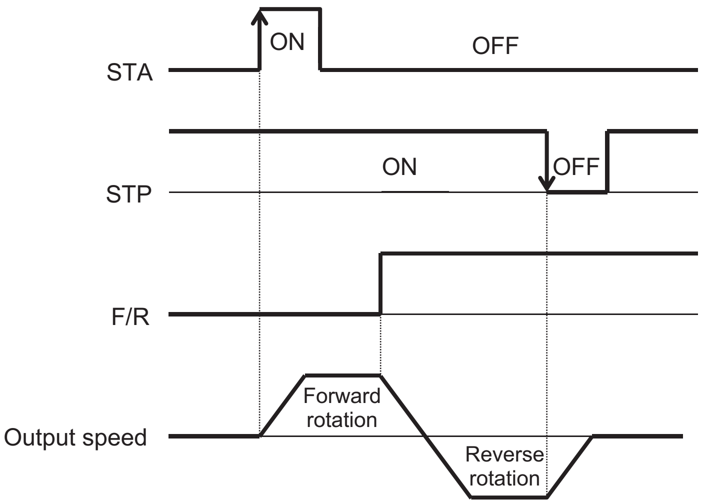
With the 3-wire terminal command, start, stop, and forward/reverse operations are possible. It is used when giving an operation command with an automatic reset contact such as a push button switch.
The operation start command can be input with the [16: STA] terminal, the stop command can be input with the [17: STP] terminal, and the operation direction can be input with [18: F/R].
For the 3 wire function, you need to set **Run-command input source selection** (AA111) to *01: 3 wire* and **Input terminal function** (CA-01) to (CA-11).

(Example) Assign the 3 wire function to the input terminal function as follows.



Terminal number	Item	Parameter	Set value	Remarks
Input terminal 7	Input terminal [7] function	CA-07	16	[STA] Operation start command
	Input terminal [7] active state	CA-27	00	Normally open (NO): Operation command at ON startup
Input terminal 8	Input terminal [8] function	CA-08	17	[STP] Stop command
	Input terminal [8] active state	CA-28	01	Normally closed (NC): Stop command at OFF falling
Input terminal 9	Input terminal [9] function	CA-09	18	[F/R] Forward/Reverse rotation command
	Input terminal [9] active state	CA-29	00	Normally open (NO): Reverse with ON

The terminal operation is performed as follows.



In order for the inverter to output, a frequency command is required in addition to the operation command.

● Parameter

Item	Parameter	Data	Description	Default
Run-command input source selection	AA111	01	3 wire	00*1

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
3-wire operation command	STA	16	ON: Operation command (startup)
3-wire stop command	STP	17	ON: Stop command (startup)
3-wire forward/reverse rotation	F/R	18	OFF: Forward rotation ON: Reverse rotation

6-3-5 Operation with RS485 Communication

The start and stop commands are given from RS485 communication.
In order for the inverter to output, a frequency command is required in addition to the operation command.

● Parameter

Item	Parameter	Data	Description	Default
Run-command input source selection	AA111	03	Start/Stop by RS485 communication command	00*1

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

6-3-6 Operation from Optional Unit

The start and stop commands are given from an option unit.
In order for the inverter to output, a frequency command is required in addition to the operation command.

● Parameter

Item	Parameter	Data	Description	Default
Run-command input source selection	AA111	04	Operation command from Option 1 enabled.	00*1
		05	Operation command from Option 2 enabled.	
		06	Operation command from Option 3 enabled	

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

6-3-7 Disabling Keys on LCD Operator

The STOP/RESET key on the LCD operator can set **STOP-key enable at RUN-command from terminal** (AA-13) to *00: Disabled*.
By default, **STOP-key enable at RUN-command from terminal** (AA-13) is set to *01: Enabled* so that you can stop the operation with the STOP/ RESET key on the LCD operator even if an operation command is given from other than the LCD operator.
To perform operation again after stopping with the STOP/RESET key, you need to temporarily turn off the operation command from the outside and then turn it on again.

If you want to use the STOP key only for a trip reset, set **STOP-key enable at RUN-command from terminal** (AA-13) to *02: Only reset is enabled*.
STOP-key enable at RUN-command from terminal (AA-13) is enabled when **Run-command input source selection** (AA111) is set to other than *02: RUN key on LCD Operator*.

● Parameter

Item	Parameter	Data	Description	Default
STOP-key enable at RUN-command from terminal	AA-13	00	STOP / RESET key disables STOP and RESET operations.	01
		01	STOP / RESET key enables STOP and RESET operations.	
		02	STOP / RESET key disables STOP operation and enables RESET operation.	

6-3-8 Temporary Change of Operation Command Destination

You can use the forced operation [23: F-OP] terminal to temporarily change the operation command destination.
When the forced operation [23: F-OP] terminal is turned ON, the command destination in **RUN command source selection at [F-OP] is active** (CA-71) is adopted with priority over the operation command destination set in **Run-command input source selection** (AA111).

Precautions for Correct Use

- When the forced operation [23: F-OP] terminal is ON, the frequency command selection set in **Speed reference source selection at [F-OP] is active** (CA-70) is also adopted for the frequency command destination.
- When different settings are made in **Run-command input source selection** (AA111) and **RUN command source selection at [F-OP] is active** (CA-71), if the forced operation [23: F-OP] terminal is turned on or off during the operation, the operation will be in a stopped state. The operation command is entered by turning the selected operation command off and then on.

● Parameter

Item	Parameter	Data	Description	Default
Speed reference source selection at [F-OP] is active	CA-70	01 to 15	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation	01
RUN command source selection at [F-OP] is active	CA-71	00 to 06	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD Operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	00
Run-command input source selection	AA111	00 to 06	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD Operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	00*1

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Input Terminal Function (CA-01) to (CA-11)

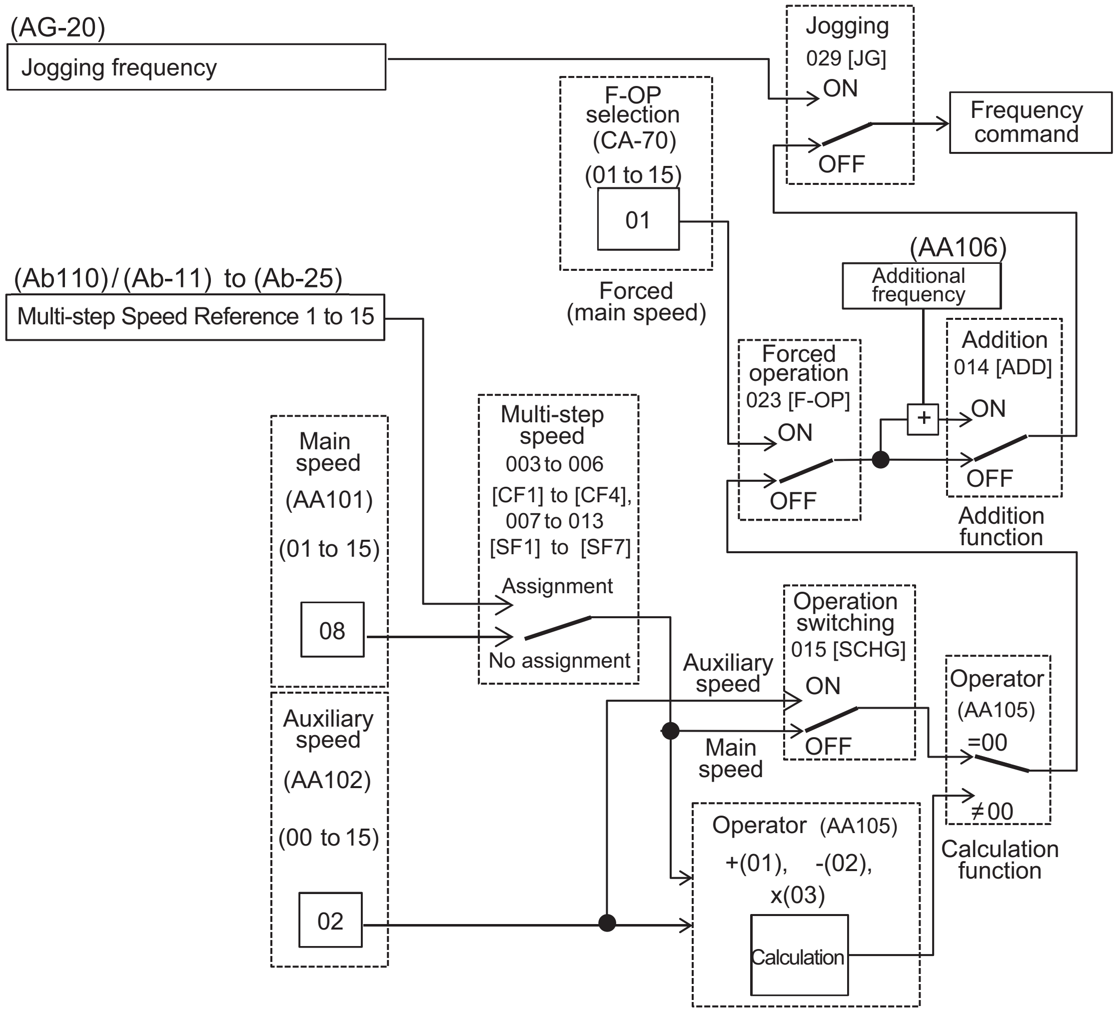
Item	Terminal name	Data	Description
Forced switching of operation	F-OP	23	ON: Forced switching of operation Enables the input selected in **[RUN command source selection at [F-OP] is active** (CA-71) and the frequency command selected in **Speed reference source selection at [F-OP] is active** (CA-70). OFF: Normal operation Follows **Run-command input source selection** (AA111), **Main speed input source selection** (AA101), etc.

6-4 Frequency Command Settings

6-4-1 Frequency Command Selection

The final frequency command is the result of selection and calculation by multiple functions. Set the frequency command by**Main speed input source selection**(AA101) and**Sub frequency input source selection**(AA102). You can switch the frequency command by setting**RUN command source selection at [F-OP] is active**(CA-70) and the forced operation [23: F-OP]. When the jogging [29: JG] terminal is turned ON,**Jogging frequency**(AG-20) becomes a frequency command.
Main Speed reference monitor(FA-01) displays the frequency command values that are enabled in the parameters.

In addition to the frequency command, an operation command is required to operate the inverter.
When using the 2nd setting switch [SET] of the input terminal function, replace the 3rd digit of the parameter from 1 to 2 and make the setting.
(Example)**Main speed input source selection, 1st-motor**(AA101) ->**Main speed input source selection, 2nd-motor**(AA201). If the 3rd digit is "-", the parameter is shared for the 1st and 2nd settings.
When **Lower frequency limit** (bA103) is set, the output frequency will be the frequency set by the lower limiter even if the final frequency command is less than the lower limiter. Since the lower limiter has priority even if the frequency command is set to 0 Hz, to stop the inverter, turn OFF the operation command.



Parameter	Setting item
CA-70 AA101 AA102	00: Disabled 01 to 03: Ai1 to Ai3 terminal input 07: Parameter setting (LCD Operator)*1 08: RS485 09 to 11: Option 1 to 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation

*1. When you specify the frequency with the LCD Operator keys, use *07: Parameter setting*.

- In the above example, *08: RS485* in (AA101) is enabled. For more information, refer to the detailed description below.
- Other command destinations can be chosen even when RS485 (Modbus communication and Ez-COM function) and the program function (DriveProgramming) are being used.
- When giving an operation command from the operation screen of the PC software CX-Drive, set (AA101) to *07* and (AA111) to *03*.

6-4-2 When Command Is Given from LCD Operator

A frequency command is given from the LCD operator.

For operation using the LCD operator, the operation direction can be changed by setting **RUN-key Direction of LCD operator** (AA-12).

- In order for the inverter to output (to drive the motor), an operation command is required in addition to the frequency command.
- The main and auxiliary speeds can be selected and calculated by using the command switching terminal [15: SCHG] and **Calculation symbol selection for Speed reference** (AA105). For details, refer to *6-4-8 When Command Is Given with Main Speed Command and Auxiliary Speed Command* on page 6-35.
- For direction switching not using the LCD operator, you need to switch FW/RV from each command.

● Parameter

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	07	The main speed command is given from the LCD operator. In this case, **Multispeed-0 setting** (Ab110) is the main speed command value.	01*1
Sub frequency input source selection	AA102	07	The auxiliary speed command is given from the LCD operator. In this case, **Sub speed setting** (AA104) is the auxiliary speed command value. The auxiliary speed command value is used for switching and calculation functions.	00
Multispeed-0 setting	Ab110	0.00 to 590.00 (Hz)	Frequency setting of the main speed on the LCD operator. Shared for the 0th speed of the multi-speed function.	0.00
Sub speed setting	AA104	0.00 to 590.00 (Hz)	Frequency setting of the auxiliary speed on the LCD operator.	0.00
RUN-key Direction of LCD operator	AA-12	00	Forward rotation operation	00
		01	Reverse rotation operation	

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Output Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Frequency command from LCD operator	FREF	10	ON: Frequency command from LCD operator **Multispeed-0 setting, 1st-motor** (Ab110) or **Multispeed-0 setting, 2nd-motor** (Ab210) is selected as the main speed. OFF: Another frequency command is selected.

6-4-3 When Command Is Given from Terminal Block Analog Signals

A frequency command is given by the analog input from the terminal block.
This inverter has three types of analog input terminals.

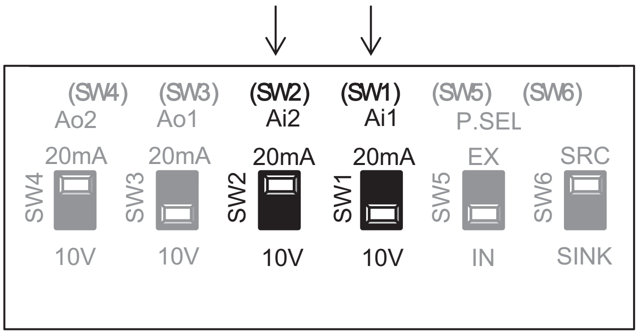
Terminal connection	Input range	Switching method
Ai1-L	0 to 10 V/0 to 20 mA switchable	SW1 on the board is switched.

Terminal connection	Input range	Switching method
Ai2-L	0 to 10 V/0 to 20 mA switchable	SW2 on the board is switched.
Ai3-L	-10 to 10 V	- (Fixed by voltage input)

The relationship between the input signal voltage (current) and the command (%) (frequency command, torque command, etc.) can be set individually for each analog input terminal.
To add or subtract multiple commands, set **Sub frequency input source selection** (AA102) and **Calculation symbol selection for Speed reference** (AA105) together. For details, refer to *8-12 Analog Input Terminal Function* on page 8-176.

In order for the inverter to output, an operation command is required in addition to the frequency command.
When the lower limiter is set, the frequency set in **Lower frequency limit** (bA103) will be output even if the analog signal is changed so that the frequency command is 0 Hz.
To stop the inverter, turn OFF the operation command.
Note that the terminal block switch switches between voltage input and current input.
For adjusting the analog input, refer to *8-10 Input Terminal Function* on page 8-160.

First, switch the voltage and current before wiring.



Next, set the command destination in **Main speed input source selection** (AA101).

● Parameter

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	01	Input between Ai1 and L enabled.	01*1
		02	Input between Ai2 and L enabled.	
		03	Input between Ai3 and L enabled.	
		04	(Reserved)	
		05	(Reserved)	
		06	(Reserved)	

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

6-4-4 When Command Is Given through R485 Communication

A frequency command is given through RS485 communication. For details, refer to *9-1 Communication Specifications* on page 9-2.

Additional Information

When the forced operation [23: F-OP] terminal is ON, the frequency command selection set in **Speed reference source selection at [F-OP] is active** (CA-70) is also adopted for the frequency command destination.

● **Parameter**

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	08	Command from RS485 communication	01*1

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

6-4-5 When Command Is Given from Pulse Train Input

A frequency command is given with the pulse train input.
To give a pulse string input, there are two methods. One is to use the open collector type main unit input terminals [A] and [B] terminals, and the other is to use the PG option unit line driver type pulse train input terminals [SAP], [SAN], [SBP], and [SBN].

When Command Is Given from Pulse Train Input of [A] and [B] Terminals

To use the input terminals [A] and [B] of the main body as a pulse train input frequency command, set**Main speed input source selection**(AA101) to*12*and**Pulse train detection (internal) control terminal [A] [B]**(CA-90) to*01*. Then, set the input pulse frequency at**Async.Motor Maximum frequency setting, 1st-motor**(Hb105) to**Pulse train frequency Scale**(CA-92).
As a result, the pulse train given as input to the [A] and [B] input terminals can be used as a frequency command/PID feedback value in each **Control mode selection** (AA121).
The pulse train input values to the [A] and [B] terminals can be monitored with **Pulse string input monitor main body** (dA-70).

Additional Information

- The Start/End function of analog input cannot be used. To limit the pulse train input frequency, make the setting as follows.
  -**Pulse train frequency Bias value**(CA-94)
  -**Pulse train frequency High Limit**(CA-95)
  -**Pulse train frequency detection low level**(CA-96)
- If**Pulse string input monitor main body**(dA-70) after applying**Pulse train frequency Bias value**(CA-94) is below**Pulse train frequency detection low level**(CA-96),**Frequency command after calculation**(dA-04) becomes 0Hz.
- If**Pulse train frequency detection low level**(CA-96) is set to a high value, the start may be slow.

● **Parameter (Main Body)**

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	12	Frequency command from pulse train input ([A] and [B] terminals)	01*1

Item	Parameter	Data	Description	Default
Pulse train detection object selection	CA-90	01	01: Pulse train input (Speed command/ torque command) 02: Encoder input 03: Counter input	00
Mode selection of pulse train input	CA-91	00	Mode 0: 90° phase difference pulse train	00
		01	Mode 1: Forward/Reverse rotation command and rotation direction	
		02	Mode 2: Forward rotation pulse train and reverse rotation pulse train	
Pulse train frequency Scale	CA-92	0.05 to 32.00 (kHz)	Inputs a pulse train frequency that corresponds to the maximum frequency.	25.00
Pulse train frequency Filter time constant	CA-93	0.01 to 2.00 (sec)	Applies a filter to the input of the pulse train frequency.	0.10
Pulse train frequency Bias value	CA-94	-100.0 to 100.0 (%)	Applies a bias to the input of the pulse train frequency.	0.0
Pulse train frequency High Limit	CA-95	0.0 to 100.0 (%)	Limits the output of the pulse train frequency input.	100.00
Pulse train frequency detection low level	CA-96	0.0 to 100.0 (%)	Sets pulses with the frequency lower than the limit to 0.0% when outputting the pulse train frequency input.	0.0

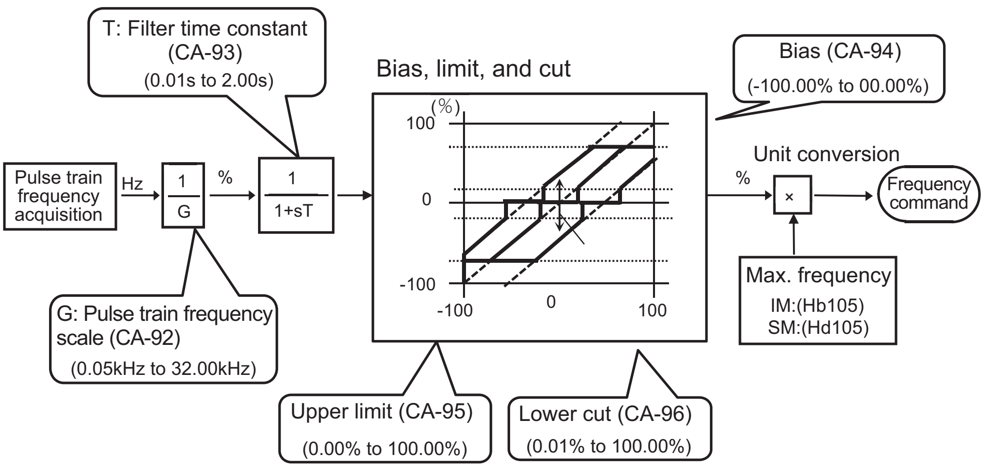
*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Monitor (Main Body)

Item	Parameter	Data	Description
Pulse string input monitor main body	dA-70	-100.00 to 100.00 (%)	Displays frequency command from pulse train input (input terminals [A] and [B])

● Internal Arithmetic Block Diagram

The internal processing is shown in a block diagram.



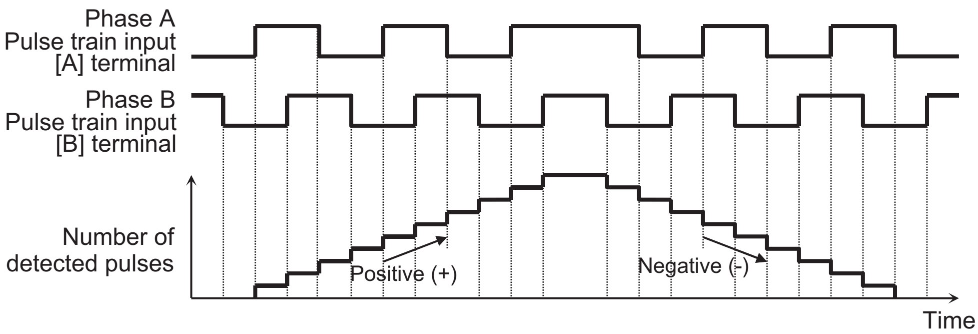
● Pulse Train Input Mode

Command frequency is determined by the frequency of the pulse train input.

The sign of the command frequency is determined as follows.

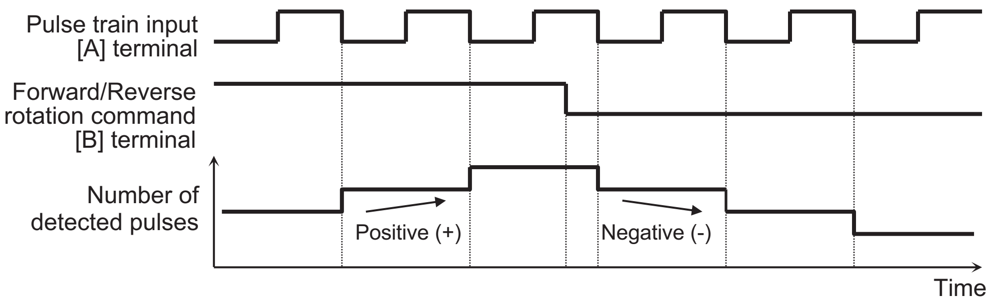
Mode 0: Set **Mode selection of pulse train input** (CA-91) to *00*

90° phase difference pulse train



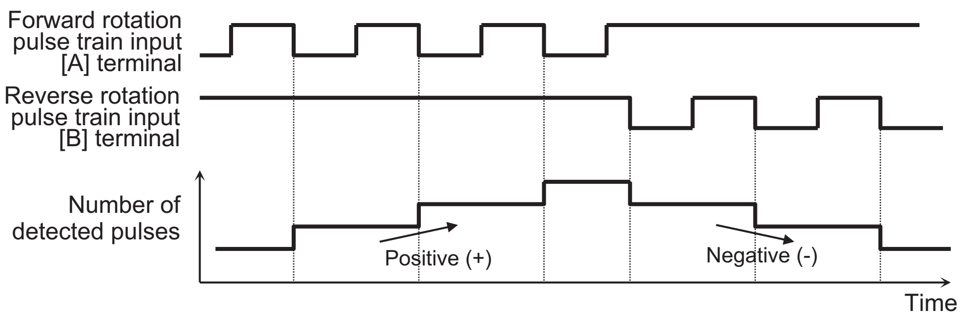
Mode 1: Set **Mode selection of pulse train input** (CA-91) to *01*

Forward/Reverse rotation command + Pulse train



Mode 2: Set **Mode selection of pulse train input** (CA-91) to *02*

Forward rotation pulse train + Reverse rotation pulse train



Precautions for Correct Use

SetMode selection of pulse train input (CA-91) according to the pulse train input to be used. If the settings are incorrect, the motor may make reverse rotations or other unintended movements.

When Command Is Given with PG Option Unit

To use the pulse train input to the input terminals [SAP], [SBP], [SAN], and [SBN] of the PG option unit as a frequency command, set the following three parameters.

- Set **Main speed input source selection** (AA101) to *13: Pulse string input: Option*.
- Set **Pulse train detection (option) terminal** (ob-10) to *00: Frequency command*.
- Set **Pulse train frequency Scale** (ob-12) to the input pulse frequency at the highest frequency.

As a result, the pulse train input to the PG option unit can be used as a frequency command or PID feedback value in each **Control mode selection** (AA121).

The pulse train input values to the PG option unit can be monitored with**Pulse string input monitor main body**(dA-71).

Additional Information

- The Start/End function of analog input cannot be used. To limit the pulse train input frequency, make the setting as follows.
  -**Pulse train frequency Bias value**(ob-14)
  -**Pulse train frequency High Limit**(ob-15)
  -**Pulse train frequency detection low level**(ob-16)
- If**Pulse string input monitor main body**(dA-71) after applying**Pulse train frequency Bias value**(ob-14) is below**Pulse train frequency detection low level**(ob-16),**Frequency command after calculation**(dA-04) becomes 0Hz.
- If**Pulse train frequency detection low level**(ob-16) is set to a high value, the start may be slow.

● Parameter (Main Body)

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	13	Frequency command from PG option unit enabled.	01[*1]
Pulse train detection object selection	ob-10	00	Used for frequency command.	00
Pulse train detection object selection	CA-90	00	00: The pulse train input (main unit) is not used for frequency command and torque command. (Follows **Input terminal function** (CA-10) and (CA-11).)	00
Mode selection of pulse train input	ob-11	00	Mode 0: 90° phase difference pulse train	01
		01	Mode 1: Forward/Reverse rotation command and rotation direction	
		02	Mode 2: Forward rotation pulse train and reverse rotation pulse train	
Pulse train frequency Scale	ob-12	0.05 to 200.0 (kHz)	Inputs a pulse train frequency that corresponds to the maximum frequency.	25
Pulse train frequency Filter time constant	ob-13	0.01 to 2.00 (sec)	Applies a filter to the input of the pulse train frequency.	0.1
Pulse train frequency Bias value	ob-14	-100.0 to 100.0 (%)	Applies a bias to the input of the pulse train frequency.	0.0
Pulse train frequency High Limit	ob-15	0.0 to 100.0 (%)	Limits the output of the pulse train frequency input.	100.0

Item	Parameter	Data	Description	Default
Pulse train frequency detection low level	ob-16	0.0 to 100.0 (%)	Sets pulses with the frequency lower than the limit to 0.0% when outputting the pulse train frequency input.	0.0

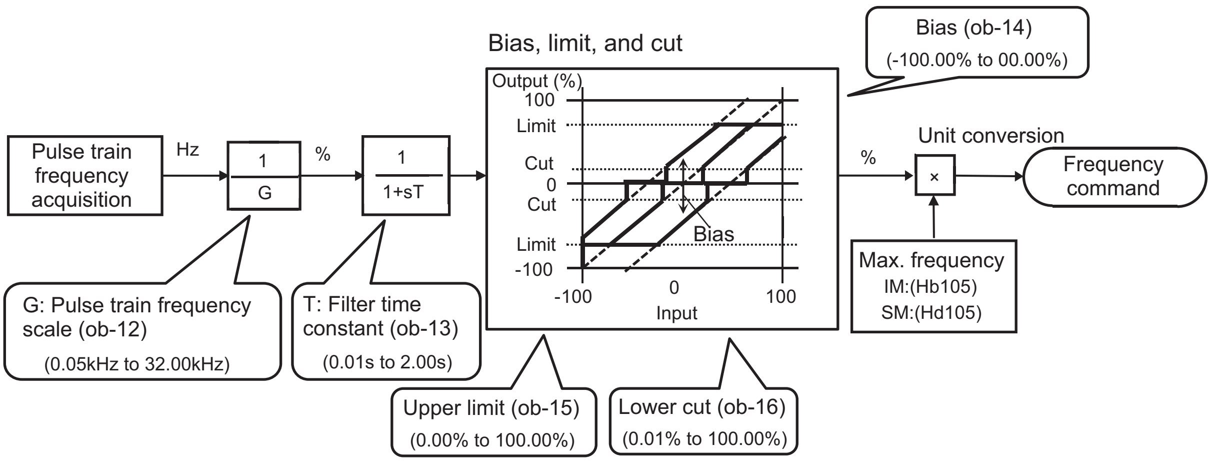
*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Monitor (Main Body)

Item	Parameter	Data	Description
Pulse string input monitor option	dA-71	-100.00 to 100.00 (%)	Frequency command from pulse train input (option input A phase / B phase)

● Internal Arithmetic Block Diagram

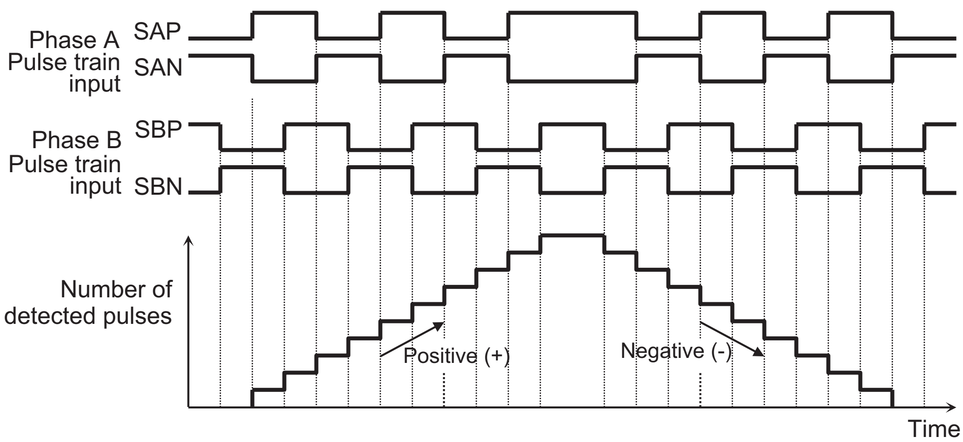
The internal processing is shown in a block diagram.



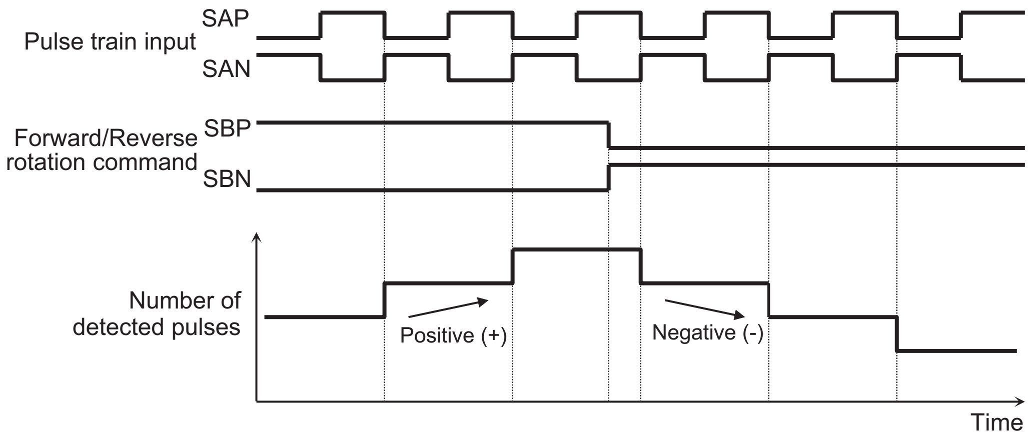
● Pulse Train Input Mode

Command frequency is determined by the frequency of the pulse train input.
The sign of the command frequency is determined as follows.

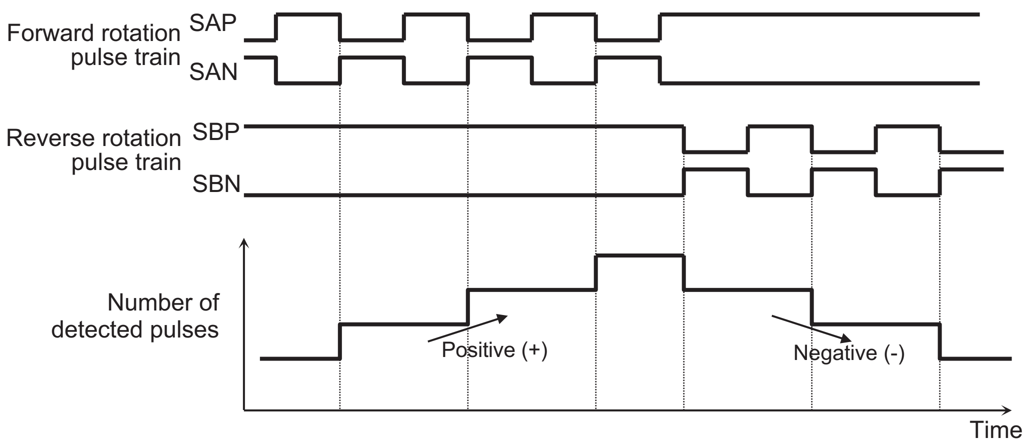
Mode 0: Set **Mode selection of pulse train input** (ob-11) to *00*
90° phase difference pulse train



Mode 1: Set **Mode selection of pulse train input** (ob-11) to *01*
Forward/Reverse rotation command + Pulse train



Mode 2: Set **Mode selection of pulse train input** (ob-11) to *02*
Forward rotation pulse train + Reverse rotation pulse train



Precautions for Correct Use

Set **Mode selection of pulse train input** (ob-11) according to the pulse train input to be used. If the settings are incorrect, the motor may make reverse rotations or other unintended movements.

6-4-6 When Command Is Given through DriveProgramming

Frequency command is given through DriveProgramming.
A frequency command can be given through DriveProgramming when the Set-Freq instruction is used in the program for DriveProgramming.

The program created by CX-Drive needs to be downloaded to the inverter.
When you enable the program operation of the DriveProgramming function, the downloaded program will be activated.
For details, refer to the *DriveProgramming User's Manual (Cat. No. I622)*.

● **Parameter**

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	14	Frequency command from the program function is enabled.	01*1
EzSQ function enable	UE-02	00	Actions of the downloaded programs disabled.	00
		01	The program starts when the [PRG] terminal is made ON.	
		02	The program starts after the setting or power activation.	

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

6-4-7 When Command Is Given with PID Control

Frequency command is given with PID control.
To use the PID control for motor control, set **Main speed input source selection** (AA101) to *15: PID calculation*. Then, set the PID control parameters. For details of PID control parameters, refer to *8-1 PID Control* on page 8-4.

● **Parameter**

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	15	The calculation result of PID control is output.	01*1

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

6-4-8 When Command Is Given with Main Speed Command and Auxiliary Speed Command

By setting in **Calculation symbol selection for Speed reference** (AA105), you can select from two methods. One is the method to multiply the main speed and auxiliary speed to make a frequency command (do not set *00* in (AA105)), and the other is the method to switch between main speed and auxiliary speed (set *00* to (AA105) to use a forced switching [15: SCHG] terminal).

● **Parameter**

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	01 to 15	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 07: Parameter setting 08: RS485 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 00: Disabled (only auxiliary speed)	01*1
Sub frequency input source selection	AA102			00

Item	Parameter	Data	Description	Default
Calculation symbol selection for Speed reference	AA105	00	The calculation function is disabled and can be switched by using the [15: SCHG] terminal.	00
		01	(Main speed) + (auxiliary speed) is used for the command.	
		02	(Main speed) - (auxiliary speed) is used for the command.	
		03	(Main speed) × (auxiliary speed) is used for the command.	

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Switching of calculation*1	SCHG	15	ON: Auxiliary speed is enabled OFF: Main speed is enabled

*1. Since **Calculation symbol selection for Speed reference** (AA105) has priority, switching is possible only when it is set to *00: Disabled*.

Calculation of Two Commands

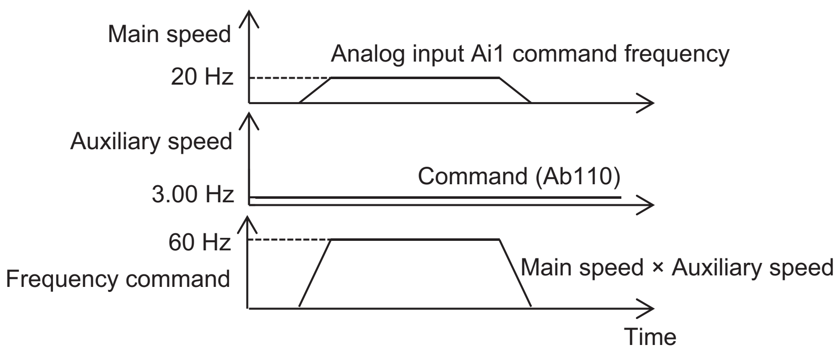
(Example 1) Multiplication

Set **Main speed input source selection** (AA101) to *01: Ai1 terminal input*.

Set **Sub frequency input source selection** (AA102) to *07: Parameter setting* (**Multispeed-0 setting** (Ab110)).

Set **Calculation symbol selection for Speed reference** (AA105) to *03: Multiplication*.

Set **Multispeed-0 setting** (Ab110) to *3.00(Hz)*.

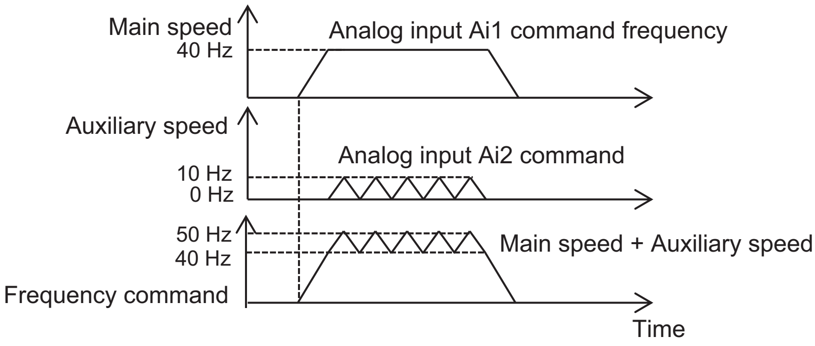


(Example 2) Command by addition

Set **Main speed input source selection** (AA101) to *01: Ai1 terminal input*.

Set **Sub frequency input source selection** (AA102) to *02: Ai2 terminal input*

Set **Calculation symbol selection for Speed reference** (AA105) to *01: Addition*.



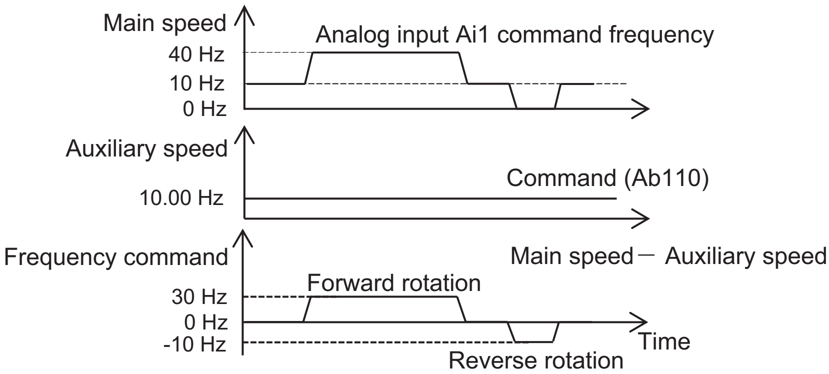
(Example 3) Command for high-speed forward rotation and low-speed reverse rotation

Set **Main speed input source selection** (AA101) to *01: Ai1 terminal input*.

Set **Sub frequency input source selection** (AA102) to *07: Parameter setting* (**Multispeed-0 setting** (Ab110)).

Set **Calculation symbol selection for Speed reference** (AA105) to *02: Subtraction*.

Set **Multispeed-0 setting** (Ab110) to *10.00(Hz)*.



Additional Information

You can make the same settings in **Main speed input source selection** (AA101) and **Sub frequency input source selection** (AA102). Square calculation by integration is also possible.

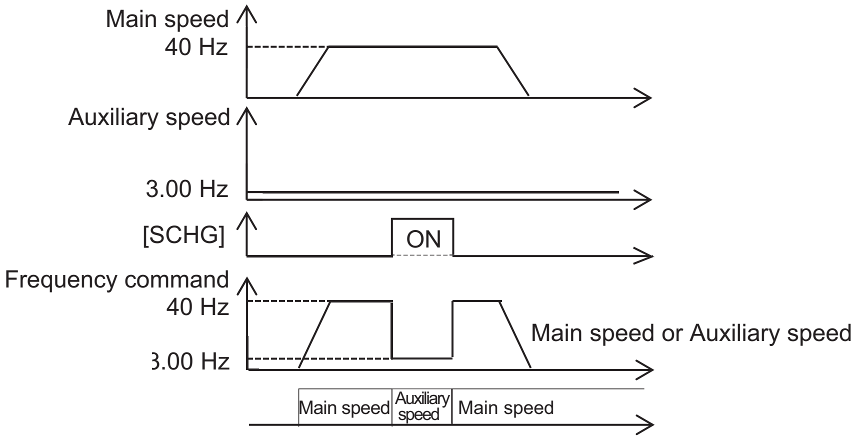
Switching between Two Commands

Set **Main speed input source selection** (AA101) to *01: Ai1 terminal input*.

Set **Sub frequency input source selection** (AA102) to *07: Parameter setting* (**Multispeed-0 setting** (Ab110)).

Set **Calculation symbol selection for Speed reference** (AA105) to *00: Disabled*.

Set **Multispeed-0 setting** (Ab110) to *3.00(Hz)*.



6-4-9 When Command Is Given with Multi-step Speed

A frequency command is controlled with a signal pattern by setting multiple command frequencies in advance.

There are two methods for the multi-speed command: **binary operation** is a method of giving a binary combination of *0: OFF* and *1: ON*, and **bit operation** is a method of giving one terminal with priority to the terminal.

In the **binary operation**, a frequency at maximum 16th speed with four terminals can be set. In the **bit operation**, a frequency at maximum 8th speed with seven terminals can be set.

Additional Information

- If **Main speed input source selection** (AA101) is set to *07: Parameter Settings*, rewriting **Main Speed with the LCD operator reference monitor** (FA-01) will automatically rewrite the enabled 0th speed frequency setting **Multispeed-0 setting** (Ab110).
- The frequency setting for the 1st to 15th speeds should be made in**Multispeed-1 setting**(Ab-11) to**Multispeed-15 setting**(Ab-25).
- With the multi-step speed function, you can set the acceleration/deceleration time individually for the frequency switching in the multi-step speed command. For details, refer to*6-7-3 Switching of Acceleration/Deceleration Time with Multistep Speed* on page 6-68.
- The multi-step speed function is enabled only for the main speed command. It is not applicable to the auxiliary speed command.
- For the 0th speed command frequency, the command set in **Main speed input source selection**(AA101) is used.

● Parameter

Item	Parameter	Data	Description	Default
Main Speed reference monitor	FA-01	Data depends on the frequency command selection.	The frequency command value is shown.	-
Multispeed operation selection	Ab-03	00	Binary operation, max. 16 speed modes	00
		01	Bit operation, max. 8 speed modes	

Item	Parame-ter	Data	Description	Default
Multispeed-0 setting	Ab110	0.00/Min. fre-quency to max. frequen-cy (Hz)	0th speed of the multi-step speed	0.00
Multispeed-1 to 15 set-ting	Ab-11 to Ab-25	0.00/Min. fre-quency to max. frequen-cy (Hz)	1st to 15th speeds of the multi-step speed	0.00
Multistage input deter-mination time	CA-55	0 to 2000 (ms)	This is the time to fix the frequency in switching the multi-step speed.	0

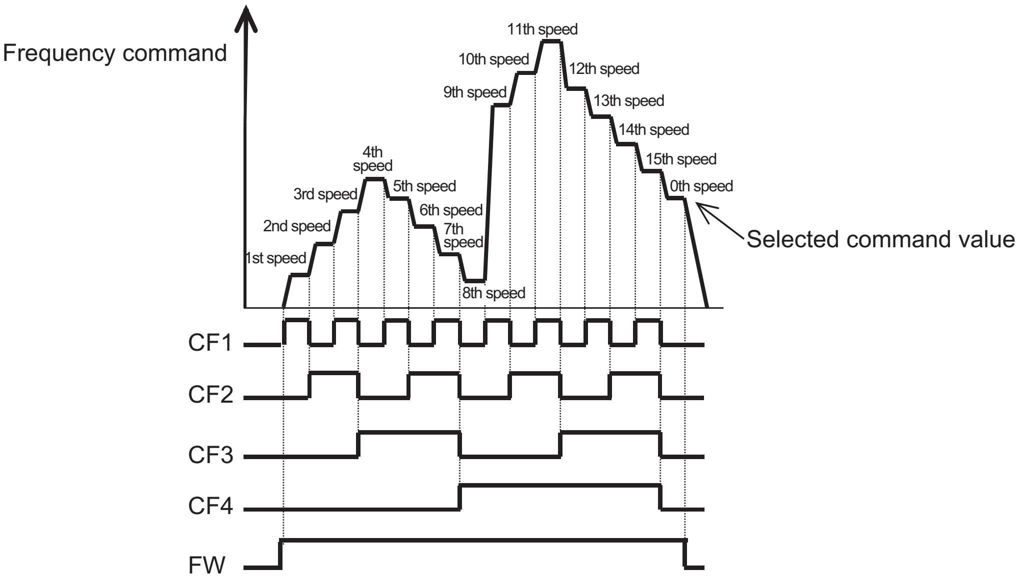
Binary Operation (Maximum 16-speed Command)

When you set **Multispeed operation selection** (Ab-03) to *00*, you can use a multi-speed command with **binary operation**. Multi-step speeds of 0th to 15th speeds can be chosen by assigning [3: CF1] to [6: CF4] to **Input terminal function** (CA-01) to (CA-11).

(Example 1) When **Main speed input source selection** (AA101) is set to *07: Parameter setting*
Operation Table

Multi-step speed	CF4	CF3	CF2	CF1	Parameter
0th speed	OFF	OFF	OFF	OFF	Ab110
1st speed	OFF	OFF	OFF	ON	Ab-11
2nd speed	OFF	OFF	ON	OFF	Ab-12
3rd speed	OFF	OFF	ON	ON	Ab-13
4th speed	OFF	ON	OFF	OFF	Ab-14
5th speed	OFF	ON	OFF	ON	Ab-15
6th speed	OFF	ON	ON	OFF	Ab-16
7th speed	OFF	ON	ON	ON	Ab-17
8th speed	ON	OFF	OFF	OFF	Ab-18
9th speed	ON	OFF	OFF	ON	Ab-19
10th speed	ON	OFF	ON	OFF	Ab-20
11th speed	ON	OFF	ON	ON	Ab-21
12th speed	ON	ON	OFF	OFF	Ab-22
13th speed	ON	ON	OFF	ON	Ab-23
14th speed	ON	ON	ON	OFF	Ab-24
15th speed	ON	ON	ON	ON	Ab-25

Operation Chart



Additional Information

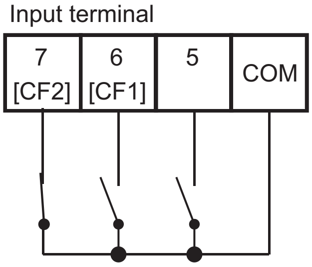
- For the binary operation, standby time until a terminal input is determined can be set in**Multistage input determination time**(CA-55). This can prevent transition during terminal switching.
- Data are fixed after the set time in**Multistage input determination time**(CA-55) passes with no change in the input. Note that increasing the confirmation time will slow down the input response.

(Example 2) When 2nd speed is enabled

Input terminal [6] function(CA-06) is set to [3: CF1].

Input terminal [7] function(CA-07) is set to [4: CF2].

No assignment is made for [5: CF3] and [6: CF4]. Only the [CF2] terminal of the input terminal [7] is ON.



	CF4	CF3	CF2	CF1
1st speed	OFF	OFF	OFF	ON
2nd speed	OFF	OFF	ON	OFF
3rd speed	OFF	OFF	ON	ON

Bit Operation (Maximum 8-speed Command)

When you set **Multispeed operation selection** (Ab-03) to *01*, you can use a multi-speed command with **bit operation**. Multi-step speeds of 0th to 7th can be chosen by assigning the [7: SF1] to [13: SF7] terminals to **Input terminal function** (CA-01) to (CA-07).
Make the frequency setting corresponding to [SF1] to [SF7] in**Multispeed-1 setting**(Ab-11) to**Multispeed-7 setting**(Ab-17).

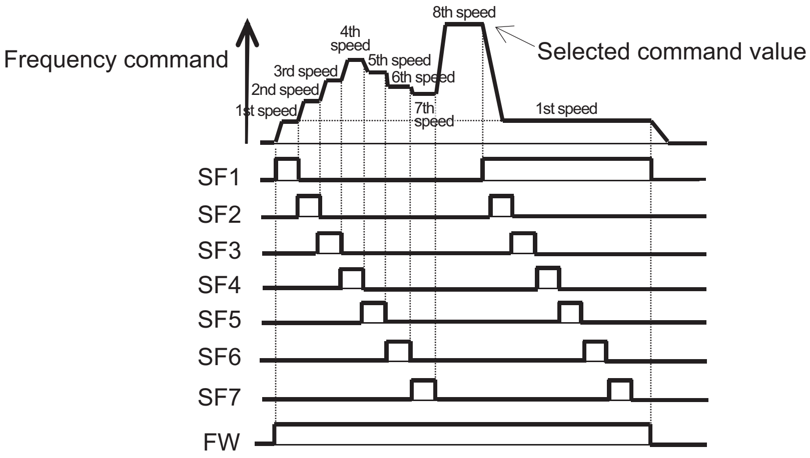
Additional Information

If multiple terminals are made ON simultaneously, the one with smaller number has priority. "-" in the table indicates that a frequency is chosen regardless of whether the terminal is ON or OFF.

(Example 3) When**Main speed input source selection**(AA101) is set to*07: Parameter setting*
Operation Table

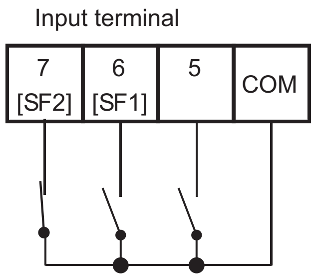
Multi-step speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1	Parameter
0th speed	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Ab110
1st speed	-	-	-	-	-	-	ON	Ab-11
2nd speed	-	-	-	-	-	ON	OFF	Ab-12
3rd speed	-	-	-	-	ON	OFF	OFF	Ab-13
4th speed	-	-	-	ON	OFF	OFF	OFF	Ab-14
5th speed	-	-	ON	OFF	OFF	OFF	OFF	Ab-15
6th speed	-	ON	OFF	OFF	OFF	OFF	OFF	Ab-16
7th speed	ON	OFF	OFF	OFF	OFF	OFF	OFF	Ab-17

Operation Graph



(Example 4) When 2nd speed is enabled
Input terminal [6] function(CA-06) is set to [7: SF1].
Input terminal [7] function(CA-07) is set to [8: SF2].
No assignment is made for [9: SF3] to [13: SF7], and the [SF2] terminal is made ON and the [SF1] terminal is made OFF.

If the [SF1] terminal changes to ON in this state, the 1st speed is selected because the [SF1] terminal has priority.



	SF4	SF3	SF2	SF1
1st speed	-	-	-	ON
2nd speed	-	-	ON	OFF
3rd speed	-	ON	OFF	OFF

6-4-10 Temporary Addition of Frequency Command

By assigning [14: ADD] to the input terminal function and turning ON the [ADD] terminal, the frequency input as a frequency command can be added and used for the frequency command.
The frequency command can be subtracted by setting the sign of **Add frequency setting** (AA106) to "-" (minus).

Precautions for Correct Use

- The frequency addition of the input terminal function [14: ADD] is used as a frequency command after rounding it within the effective range as a frequency command when the addition result exceeds the upper and lower limits or the maximum frequency.
- If the sign of the frequency command changes (from (-) to (+) and from (+) to (-)) as a result of the calculation, the rotation direction is reversed.
- The frequency addition is also effective for PID target value.

● Parameter

Item	Parameter	Data	Description	Default
Add frequency setting	AA106	-590.00 to 590.00 (Hz)	Sets the frequency to add.	0.00

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Addition of frequency	ADD	14	ON: Main speed command + **Add frequency setting** (AA106) OFF: The main speed command is used as the frequency command.

6-4-11 Up/Down Function (FUP, FDN)

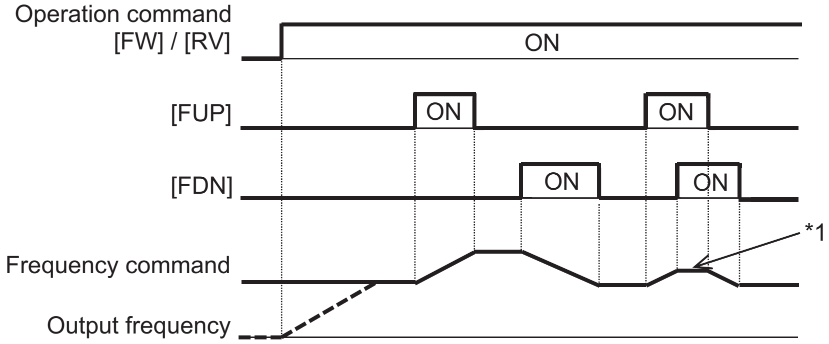
The frequency command of the inverter can be changed by assigning the [20: FUP] terminal and [21: FDN] terminal to the input terminal function and turning the external signal ON/OFF.
This function is effective when**Main speed input source selection**(AA101) is set to*07: Parameter setting*or when a multi-step speed command is given. While the [20: FUP] terminal is ON, the frequency command increases.
While the [21: FDN] terminal is ON, the frequency command decreases.
Acceleration/Deceleration follows**Acceleration time setting for FUP/FDN function**(CA-64) and**Deceleration time setting for FUP/FDN function**(CA-66).

- When**Main speed input source selection**(AA101) is set to other than*07: Parameter setting*(such as analog input and command from optional communication unit), inputting the [20: FUP] terminal and [21: FDN] terminal to the speed command is invalid. The frequency command does not change.
- When operating with the **multi-step speed command 1 to 15** using multi-speed switching, the frequency command increases or decreases with respect to the value of **Multispeed-1 setting to Multispeed-15 setting** (Ab-11 to Ab-25) regardless of the setting in **Main speed input source selection** (AA101).
- Frequency change made by the [20: FUP] terminal and [21: FDN] terminal is invalid for frequency commands by functions other than multi-step speed (jog command speed, etc.).
- If *01: Save* is chosen in **FUP/FDN data save enable** (CA-61), the frequency command data changed with the [FUP] and [FDN] terminals is saved when the power supply is cut off. The operation of an inverter can be resumed with the saved frequency command even after the power supply is cycled.
- The frequency command value can be cleared by the up/down function. When the [22: UDC] terminal is assigned to the input terminal and the [22: UDC] terminal is changed from ON to OFF, the frequency command becomes as follows according to the setting value of**FUP/FDN UDC selection**(CA-62).
  - 00: Clears the frequency command to 0Hz.
  - 01:**FUP/FDN data save enable**(CA-61) returns the value to the saved frequency command value.

Precautions for Correct Use

- When the [20: FUP] terminal and [21: FDN] terminal are made ON/OFF immediately after the power shutdown, data may not be able to be properly saved.
- While the jogging input terminal function [29: JG] is operating, frequency change made by the [20: FUP] terminal and [21: FDN] terminal is invalid. The frequency command does not change.

An example of operation of the [FUP] and [FDN] terminals is shown as follows:



*1: If the [FUP] and [FDN] terminals are made ON simultaneously, acceleration/deceleration is not performed.

● Parameter

Item	Parameter	Data	Description	Default
Main speed input source selection	AA101	01 to 15	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 07: Parameter setting 08: RS485 12: Pulse string input: Inverter 14: Program function 15: PID calculation	01*1
FUP/FDN overwrite target selection	CA-60	00	Overwrites the frequency command.	00
		01	Overwrites the PID target value.	
FUP/FDN data save enable	CA-61	00	The command is not saved in case of power shutdown.	00
		01	The command is saved in case of power shutdown.	
FUP/FDN UDC selection	CA-62	00	Cleared to 0 Hz.	00
		01	Cleared to the previously saved command.	
Acceleration time setting for FUP/FDN function	CA-64	0.00 to 3600.00 (s)	Sets acceleration time for FUP/FDN functions.	30.00
Deceleration time setting for FUP/FDN function	CA-66	0.00 to 3600.00 (s)	Sets deceleration time for FUP/FDN functions.	30.00

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● Input Terminal Function (CA-01) to (CA-11)

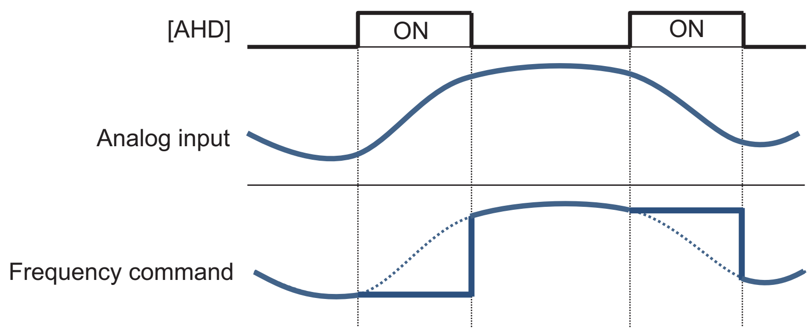
Item	Terminal name	Data	Description
Acceleration through remote operation	FUP	20	ON: Accelerate from the current speed while inputting a signal
Deceleration through remote operation	FDN	21	ON: Decelerate from the current speed while inputting a signal

Item	Terminal name	Data	Description
Clearing of remote operation data	UDC	22	ON: When setting **FUP/FDN data save enable** (CA-61) to *01*, the data to be saved when the power is turned off is cleared.

6-4-12 Analog Command Hold Function (AHD)

19: AHD Retention of analog command of the input terminal function holds the analog input command when the [AHD] terminal is turned ON, and returns the command to the analog input command when the [AHD] terminal is turned OFF.
This function is enabled when **Main speed input source selection** (AA101) is an analog input command *01* to *03*.
Even when the [19: AHD] terminal is ON, the held frequency command value can be increased or decreased by using the [FUP] / [FDN] function.

Data changed by the function of the [FUP] terminal and [FDN] terminal is not stored.
An example of operation when using the [AHD] terminal is shown below.



● Parameter

Item	Parameter	Data	Description
Main speed input source selection	AA101	01 to 15	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Retention of analog command	AHD	19	ON: Holds the analog command value and does not reflect the change in the analog input value until it is released. OFF: Releases the holding of the analog command value.

6-4-13 Temporary Change of Frequency Command Destination

You can use the [23: F-OP] terminal to temporarily change the frequency command destination.

When the [23: F-OP] terminal is turned ON, the command destination in **Speed reference source selection at [F-OP] is active** (CA-70) is adopted with priority over the frequency command destination set in **Main speed input source selection** (AA101).

Precautions for Correct Use

When the [F-OP] terminal is ON while the input function **23: Forced switching of command** is used, the operation command selection set in **RUN command source selection at [F-OP] is active** (CA-71) is also adopted for the operation command destination.

● Parameter

Item	Parameter	Data	Description	Default
Speed reference source selection at [F-OP] is active	CA-70	01 to 15	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation	01
RUN command source selection at [F-OP] is active	CA-71	00 to 06	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD Operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	00
Main speed input source selection	AA101	01 to 15	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation	01

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Forced switching of operation	F-OP	23	ON: Forced switching of operation Enables the input selected in **[RUN command source selection at [F-OP] is active** (CA-71) and the frequency command selected in **Speed reference source selection at [F-OP] is active** (CA-70). OFF: Normal operation Follows **Run-command input source selection** (AA111), **Main speed input source selection** (AA101), etc.

6-5 Limiting Frequency and Operation Commands

6-5-1 Limiting Frequency Command

You can set a limiter on the upper and lower limits of the frequency command. The upper limiter can be set from analog input by setting **Frequency limit selection** (bA101)).
The LIM icon is displayed to regulate the frequency while it is limited by the upper and lower limiters and the minimum frequency.

Set the maximum frequency, the upper frequency limiter (bA102), and the lower frequency limiter (bA103) in this order so that the set value in **Upper frequency limit** (bA102) and **Lower frequency limit** (bA103) to be as follows: Maximum frequency > (bA102) > (bA103). If it is set in a wrong order, some inputs outside the range will be possible, and if an input outside the range is made, a warning due to inconsistency will occur. For warnings, refer to *12-3-2 Checking Inconsistent Settings* on page 12-29.

The output frequency is limited to be in the range of **Upper frequency limit** (bA102) and **Lower frequency limit** (bA103).
When using **Upper frequency limit** (bA102), set **Frequency limit selection** (bA101) to *07: Parameter setting*.
When **Lower frequency limit** (bA103) is set, the output frequency will be the frequency set by the lower limiter even if the frequency command is less than the lower limiter. Since the lower limiter has priority even if the frequency command is set to 0 Hz, to stop the inverter, turn OFF the operation command.

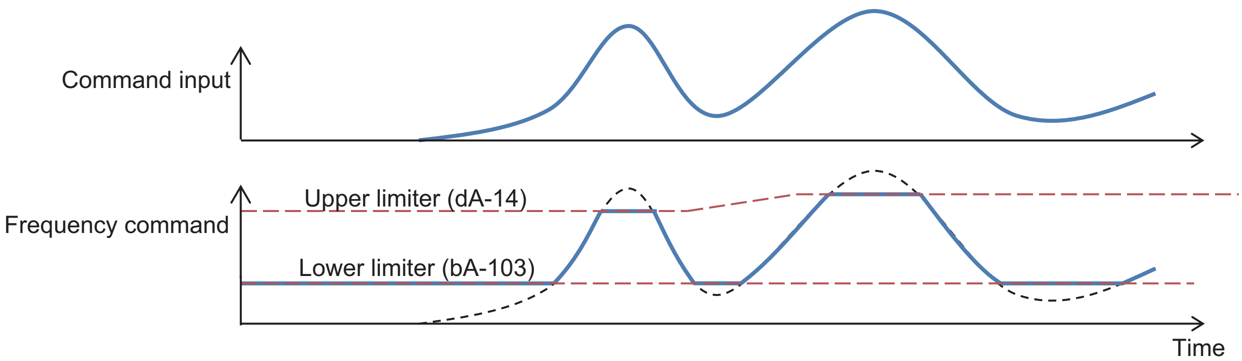
● Parameter

Item	Parameter	Data	Description	Default
Maximum frequency setting	Hb105 for IM, Hd105 for SM/PMM	10.00 to 590.00 (Hz)	Sets the max. frequency. IM: Induction motor Set**Control mode selection**(AA121) to*00*to*10*. SM/PMM: Synchronous motor (permanent magnet motor) Set**Control mode selection**(AA121) to*11*or*12*.	50.00*1
Minimum frequency adjustment	Hb130	0.10 to 10.00 (Hz)	Sets the min. frequency to start output. Disabled when**Control mode selection**(AA121) is set to*09*or*10*.	0.50

Item	Parameter	Data	Description	Default
Frequency limit selection	bA101	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	00
Upper frequency limit	bA102	0.00, lower frequency limiter to max. frequency (Hz)	Enabled when**Frequency limit selection**(bA101) is set to*07: Parameter setting*. Enter the upper limit of the frequency command. Do not enter a value smaller than**Lower Frequency limit**(bA103).	0.00
Lower frequency limit	bA103	0.00, start frequency to upper frequency limiter (Hz)	Enter the lower limit of the frequency command. Disabled when 0.00 is set. Lower limit is not applied.	0.00
Frequency upper limit monitor	dA-14	0.00 to 590.00 (Hz)	Displays the frequency upper limit value set by**Frequency limit selection**(bA101).	-

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

An operation example is shown below.



6-5-2 Limiting Operation Command Direction

If there is a problem such as damage to the load device to be controlled if the output is in the opposite direction, set the operation direction restriction selection.

You can set **RUN-direction restriction** (AA114) to limit the direction of rotation of the operation command.

When *01: Only normal rotation* or *02: Only reverse rotation* is set, the output of reverse rotation power is prevented even if the frequency command becomes negative as a result of calculation.
Output stops when the direction is being limited.

Precautions for Correct Use

- When a control other than V/f control (**Control mode selection** (AA121) is *8* to *12*) is applied, rotational force in the opposite direction may be generated even if this function is enabled. When vector control (**Control mode selection** (AA121) is *8* to *10*) is applied, enable the reverse rotation prevention function in addition to making the above settings. For details, refer to *6-5-3 Limiting Output Direction* on page 6-50.
- In a load device where an external force is applied, such as a repulsive force being generated in the reverse direction when the motor starts running, the motor may start in the reverse direction even if the output of the inverter is in the forward direction. To prevent reverse rotation, make sure that no external force is applied to the load device in the reverse direction when the motor starts running, in addition to using this function.

● **Parameter**

Item	Parameter	Data	Description	Default
RUN-direction restriction	AA114	00	Both forward and reverse rotations enabled	00
		01	Only forward rotation enabled	
		02	Only reverse rotation enabled	

6-5-3 Limiting Output Direction

If the load device to be controlled is damaged when the motor reverses, enable the reverse rotation prevention selection.
Due to the control of the inverter, the output may be in the direction opposite to the operation command direction in the low speed range. Use **Counter direction run protection selection** (HC114) to limit the output in the opposite direction to the operation command.
This function is enabled when **Control mode selection** (AA121) is selected for *08: Sensorless vector control* , *09: Zero-Hz range sensorless vector control*, or *10: Vector control with sensor*. It cannot be used with any other control method. For details on the control method, refer to *7-1 Selection of Motor Control Methods* on page 7-3.

Precautions for Correct Use

In a load device where an external force is applied, such as a repulsive force being generated in the reverse direction when the motor starts running, the motor may start in the reverse direction even if the output of the inverter is in the forward direction. To prevent reverse rotation, make sure that the motor does not rotate in the reverse direction.

● Parameter

Item	Parame-ter	Data	Description	Default
Control mode selection	AA121	08	Sensorless vector control	00
		09	Zero-Hz range sensorless vector control*1	
		10	Vector control with sensor*1	
Counter direction run protection selection	HC114	00	Disabled	00
		01	Enabled	

*1. Cannot be selected if **Load type selection** (Ub-03) is *01: Low duty (LD)* or *00: Very low duty (VLD)*.

6-5-4 Operation Permission

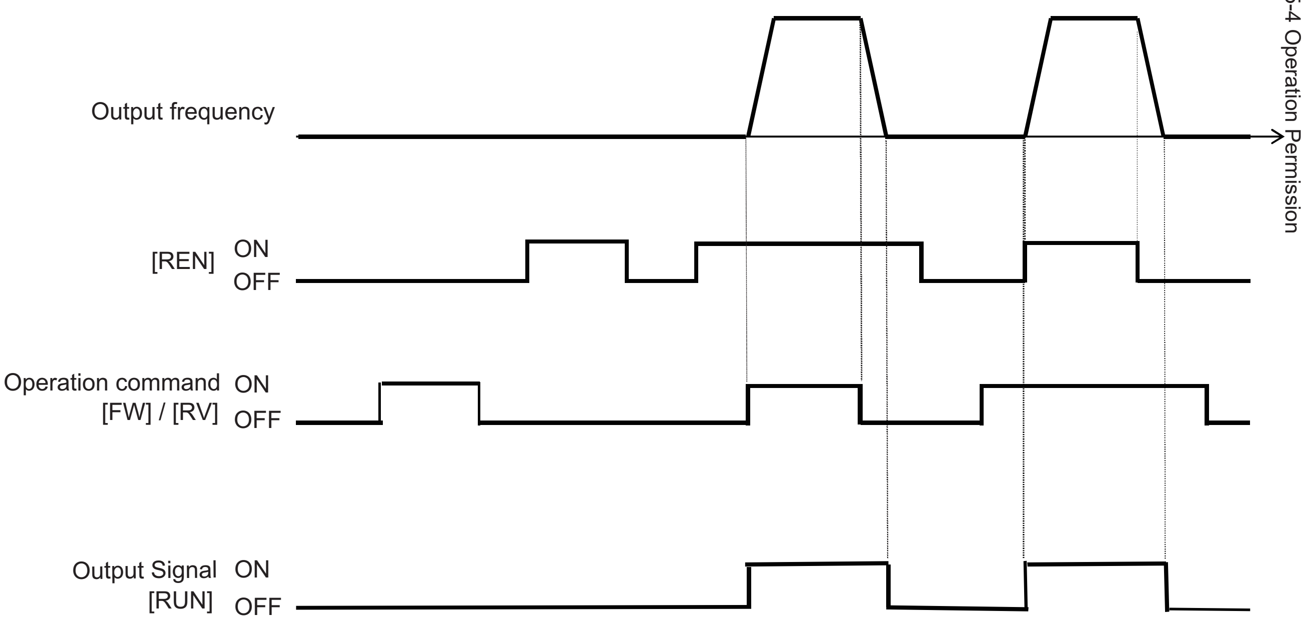
Apart from the operation command, using the system configuration, you can put restrictions that do not allow the inverter to operate until safety is confirmed.

This function becomes enabled when you assign the operation permission signal [101: REN] to any of **Input Terminal Function** (CA-01) to (CA-11).

Even if the operation command is turned ON, the inverter does not output the frequency until the [101: REN] terminal is turned ON.

Additional Information

The operation does not start if the [101: REN] terminal is set to OFF. If you want to make output from the inverter only with the operation command, for example in a test run, temporarily change **Input terminal selection** (CA-01) to (CA-11) set in the [REN] terminal to [0: no].



● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Operation permission signal	REN	101	ON: Operation command (startup) OFF: Operation prohibited

6-6 Thermal Protection

Thermal protection has three functions.

- Motor Electronic Thermal
- Inverter Electronic Thermal
- Motor temperature monitoring with a thermistor

Item	Motor Electronic Thermal	Inverter Electronic Thermal	Motor temperature monitoring with an external thermistor
Purpose	Monitors motor temperature.	Monitors inverter temperature.	Monitors temperature of the thermistor installation location.
Error detection level	Detected by **Electronic thermal level setting** (bC110). Adjust the set value according to the motor rated current (A).	Detected by the rated current value of the inverter and the fixed value corresponding to ND, LD, and VLD.	Detected by **Thermistor error level** (bb-70).
Detection characteristics (Frequency characteristics)	Depends on torque characteristics and output frequency.[*1]	Depends on frequency characteristics.[*2]	Error detection level[*3]
Thermal characteristic selection (Refer to the characteristic diagram.)	**Electronic thermal level setting** (bC110) **Electronic thermal characteristic selection**(bC111) 00: Reduction characteristics 01: Constant torque characteristics 02: Arbitrary setting	Depends on**Load type selection**(Ub-03). (Rated current value, overload capacity) Normal Duty (ND) Low Duty (LD) Very Low Duty (VLD)	-
Heat emission characteristics	Can be selected with**Electronic thermal Subtraction function enable**(bC112). 00: Constant period (10 minutes) 01: Subtraction (1 to 1000s)	Fixed: Constant period (10 minutes)	-
monitor	**Electronic thermal duty ratio monitor (Motor)** (dA-42)	**Electronic thermal duty ratio monitor (Inverter)** (dA-43)	**Motor temperature monitor**(dA-38)
Warning output	Outputs a warning with the output terminal with electronic thermal warning (motor) [26: THM] when**Electronic thermal warning level (MTR)** (CE-30) is exceeded.[*4]	Outputs a warning with the output terminal with electronic thermal warning (inverter) [27: THC] when**Electronic thermal warning level (CTL)**(CE-31) is exceeded.[*5]	-

Item	Motor Electronic Thermal	Inverter Electronic Thermal	Motor temperature monitoring with an external thermistor
Error trip	Motor overload error (E005)	Low-speed range overload error (0.2Hz) (E038) Controller overload error (E039)	Thermistor error (E025)

*1. Refer to*6-6-1 Motor Electronic Thermal* on page 6-53.
*2. Refer to*6-6-2 Inverter Electronic Thermal* on page 6-60.
*3. Refer to*6-6-3 Motor Thermal Protection with a Thermistor* on page 6-62.
*4. Refer to*8-6-8 Motor Thermal Warning Signal (THM)* on page 8-135.
*5. Refer to*8-6-9 Inverter Thermal Warning Signal (THC)* on page 8-136.

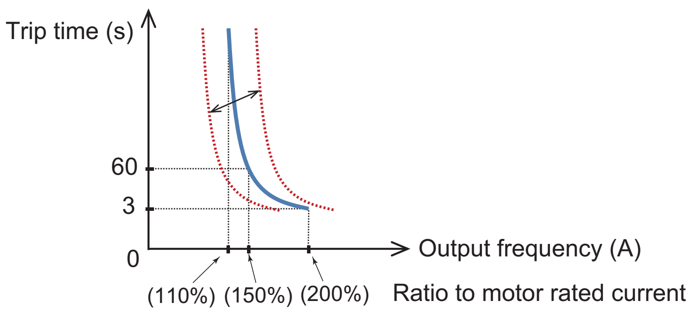
6-6-1 Motor Electronic Thermal

Electronic thermal setting enables a motor to be protected from thermals.

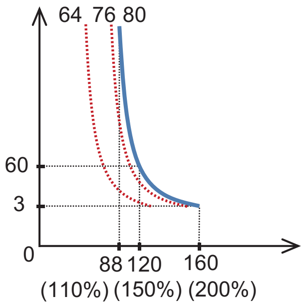
Change of Electronic Thermal Level

If you make settings according to the motor rated current, when the current continues to flow in the motor, an overcurrent error (E001) will occur to protect it.
Electronic thermal level setting(bC110) can be set in the range of 20% to 300% of the inverter rated current.
The set value in**Electronic thermal level setting**(bC110) can be treated as 100% of the output current of the detection characteristics, and the detection characteristics can be shifted. If the value smaller than the motor rated current is set, protection can be applied earlier.

When**Electronic thermal characteristic selection**(bC111) is set to*01: Constant torque characteristics*, the result is shown in the figure below.



(Example 2) When the motor rated current is selected to 80A with constant torque characteristics
The setting range of**Electronic thermal level setting**(bC110) is 20% to 300%, so it can be set in the range of 16A to 240A.
For example, when you set**Electronic thermal level setting**(bC110) to 64A, 110%, 150%, and 200% is equivalent to 70.4A, 96A, and 128A, respectively. If 128A, which is 200%, continues to flow for 3 seconds, an overcurrent error (E001) will occur. If 96A, which is 150%, flows for 60 seconds, an overcurrent error (E001) will occur.



Precautions for Correct Use

- This setting is required to protect the motor, so set the correct value.
- When thermal protection is on, a motor overload error (E005) will occur.
- Regardless of the thermal setting of the motor, the inverter electronic thermal for protecting the inverter body operates separately. For details, refer to*6-6-2 Inverter Electronic Thermal* on page 6-60.
- If the current surges, an overcurrent error (E001) may occur before the motor overload error (E005).
- The inverter electronic thermal operates independently of the motor electronic thermal. Since the detection conditions such as reduction ratio are different, an motor overload error (E005) may occur even if the motor electronic thermal level is set high.

● **Parameter**

Item	Parameter	Data	Description	Default
Electronic thermal level setting	bC110	In range of 20 to 300% of the inverter rated current (unit: A)*1	Sets the motor protection current.	1.00 × Inverter rated current

*1. The inverter rated current is switched by**Load type selection**(Ub-03). Even if**Electronic thermal level setting**(bC110) is set to be high, an overcurrent error (E001) will occur when the current exceeds the overcurrent level.

Change of Electronic Thermal Characteristics

Setting **Electronic thermal characteristic selection** (bC111) to *00* provides optimum protection characteristics, taking into account the reduced cooling capacity of the motor at low speeds.
Setting **Electronic thermal characteristic selection** (bC111) to *02* allows you to set frequency-dependent characteristics.

The autocooling motor needs to be used with a reduced load (current) without reducing the rotation speed, since the cooling function of the autocooling fan becomes less effective when the motor rotation speed decreases. When using the autocooling motor, select the reduced torque characteristics.

● Parameter

Item	Parameter	Data	Description	Default
Electronic thermal characteristic selection	bC111	00	Reduced torque characteristics: Pattern for cooling function deterioration at a low speed	01*1
		01	Constant torque characteristics: Pattern for constant output	
		02	Arbitrary setting: Multiple patterns are available according to the motor characteristics.	

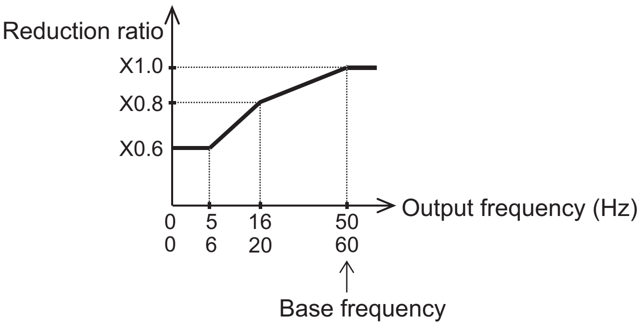
*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

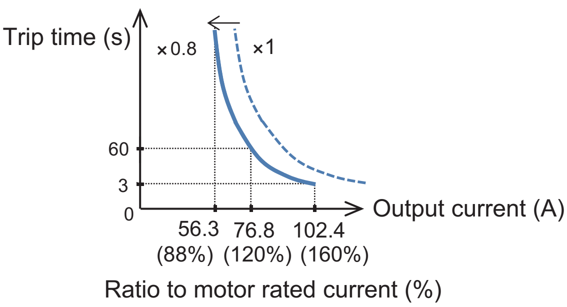
● Reduced Torque Characteristics

Set **Electronic thermal characteristic selection** (bC111) to *00* to obtain reduced torque characteristics.

It is used for applications where the load is reduced in the low speed range, such as when the cooling performance of the motor is reduced in the low speed range.

(Example 2) When the induction motor rated current is 64A,**Electronic thermal level setting**(bC110) is 64(A),**Async.Motor Base frequency setting**(Hb104) is 60Hz, and output frequency is 20Hz





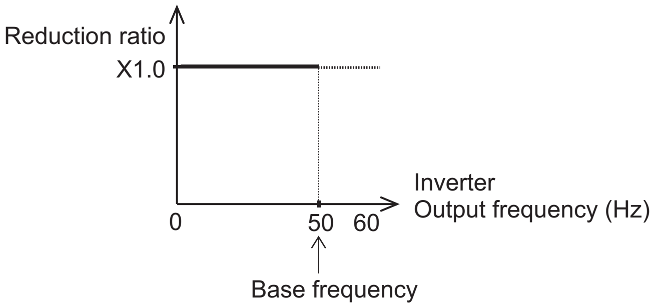
When**Electronic thermal level setting**(bC110) is 64A, the reduction ratio is ×0.8 for operations at a base frequency of 60 Hz and output frequency of 20 Hz, and the electronic thermal time-limited characteristics are given in the lower figure of Example 2.

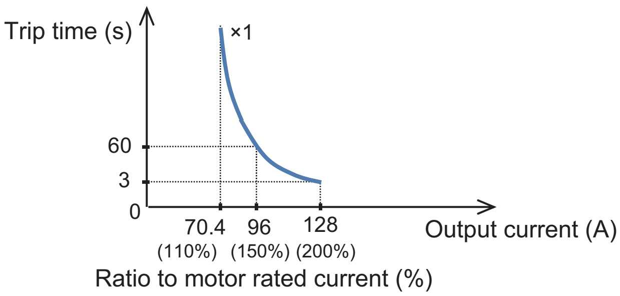
Since Example 1 shows the case of the reduction ratio ×1, a trip occurs in 60 seconds when an electric current of 150% ×1 of the motor rated current flows continuously. However in Example 2, a trip occurs in 60 seconds when an electric current of 150% × 0.8 = 120% of the motor rated current flows continuously.

● Constant Torque Characteristics

Set **Electronic thermal characteristic selection** (bC111) to *01* to obtain constant torque characteristics. This setting is used when a constant torque can be output in all speed ranges with an inverter motor or the like.

(Example 3) When the induction motor rated current is 64A,**Electronic thermal level setting**(bC110) is 64(A),**Async.Motor Base frequency setting**(Hb104) is 50Hz, and output frequency is 5Hz





When**Electronic thermal level setting**(bC110) is 64A, the reduction ratio is ×1.0 for operations at a base frequency of 50 Hz and output frequency of 5 Hz, and the electronic thermal time-limited characteristics are given in the lower figure of Example 3.
As in Example 1, it shows the case of the reduction ratio ×1.0, a trip occurs in 60 seconds when an electric current of 150% ×1.0 of the motor rated current flows continuously.

● Free Settings

If you set **Electronic thermal characteristic selection** (bC111) to *02*, you can freely set the electronic thermal characteristics.
You can freely set the characteristics, for example, to reduce the output below the level for protecting the motor by limiting to the speed range where the load is likely to cause trouble.

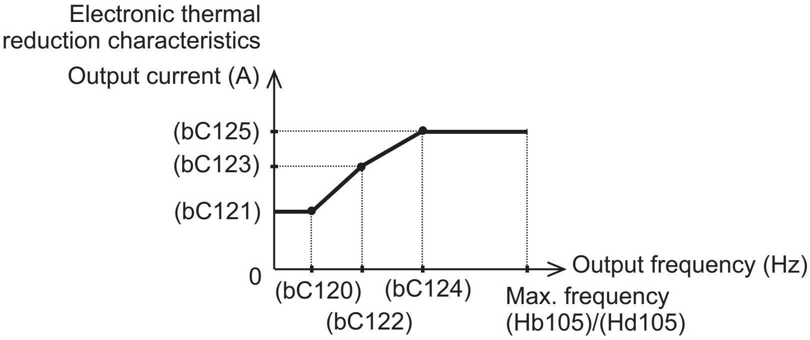
● Parameter

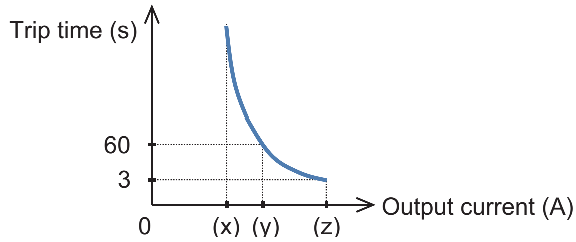
Item	Parameter	Data	Description	Default
Free electronic thermal frequency-1	bC120	0.00 to **Free electronic thermal frequency-2** (bC122) (Hz)	Frequency corresponding to free electronic thermal current 1	0.00

Item	Parameter	Data	Description	Default
Free electronic thermal current-1	bC121	Inverter rated current × 0% to 300% (A)*1	Current corresponding to free electronic thermal frequency 1	0.0
Free electronic thermal frequency-2	bC122	**Free electronic thermal frequency-1** (bC120) to **Free electronic thermal frequency-3** (bC124) (Hz)	Frequency corresponding to free electronic thermal current 2	0.00
Free electronic thermal current-2	bC123	Inverter rated current × 0% to 300% (A)*1	Current corresponding to free electronic thermal frequency 2	0.0
Free electronic thermal frequency-3	bC124	**Free electronic thermal frequency-2** (bC122) to 590.00 (Hz)	Frequency corresponding to free electronic thermal current 3	0.00
Free electronic thermal current-3	bC125	Inverter rated current × 0% to 300% (A)*1	Current corresponding to free electronic thermal frequency 3	0.0

*1. The inverter rated current is switched by **Load type selection** (Ub-03).

(Example 4) When the output frequency matches **Free electronic thermal frequency-2** (bC122)





(x): (bC123)×110%
(y): (bC123)×150%
(z): (bC123)×200%

When the output frequency matches **Free electronic thermal frequency-2** (bC122), the electronic thermal time-limited characteristics are given in the lower figure of Example 4.
In Example 4, a trip occurs in 60 seconds when an electric current of 150% of **Free electronic thermal current-2** (bC123) flows continuously.

Precautions for Correct Use

- When **Free electronic thermal current-1** (bC121), **Free electronic thermal current-2** (bC123), and **Free electronic thermal current-3** (bC125) are set as default *0.00*, and **Electronic thermal characteristic selection** (bC111) is set to *02*, a motor overload error (E005) will occur.
- Set the free electronic thermal frequency in the order of (bC125), (bC123), and (bC121), and in the following manner: (bC125) ≥ (bC123) ≥ (bC121).

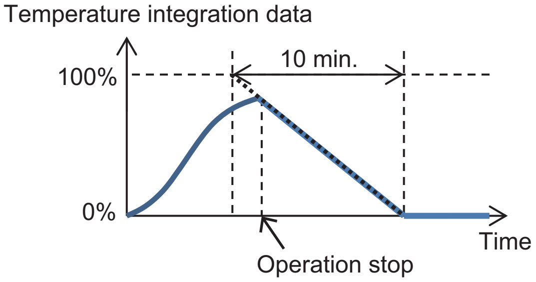
Change of Electronic Thermal Heat Emission Characteristics

When you set **Electronic thermal Subtraction function enable** (bC112) to *01: Enabled*, the electronic thermal is calculated by a subtraction method that matches the heat emission from the motor. With the subtraction method, when the motor current exceeds the electronic thermal level, the temperature integration data is increased, and when it is less than 100%, the temperature integration data is decreased.

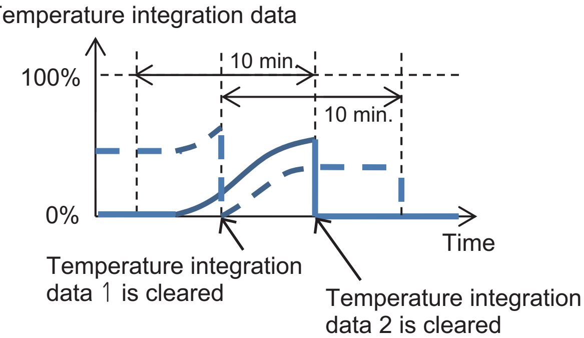
Additional Information

- The electronic thermal of the inverter works independently even when**Electronic thermal Subtraction time**(bC113) is made shorter. For details, refer to*6-6-2 Inverter Electronic Thermal* on page 6-60.
- Set appropriately according to the motor that you use.
- If **Electronic thermal Subtraction function enable** (bC112) is set to *00: Disabled*, resetting cannot be made in 10 seconds after a motor overload error (E005) occurs.
- If you want to operate this inverter in the same way as the 3G3RX-V1 Series Inverter, set**Electronic thermal Subtraction function enable**(bC112) to*00*.

(Example 1) Subtraction method
When**Electronic thermal Subtraction function enable**(bC112) is*01*and**Electronic thermal Subtraction time**(bC113) is 600s (10 minutes)



(Example 2) Constant period method
If **Electronic thermal Subtraction function enable** (bC112) is set to *00*, the electronic thermal is calculated by a constant period method.
With the constant period method, the duplicated counter is cleared in a constant period, but if one of the temperature integration values of the counter reaches 100% within the time until it is cleared, a motor overload error (E005) occurs and the inverter trips.



● **Parameter**

Item	Parameter	Data	Description	Default
Electronic thermal Subtraction function enable	bC112	00	Disabled: Constant period method The temperature integration data are cleared every 10 minutes.	01
		01	Enabled: Subtraction method The temperature integration data are subtracted in accordance with the heat emission from the motor.	
Electronic thermal Subtraction time	bC113	1 to 1000s	Should be set in accordance with the heat emission time of the motor. Sets the time for the temperature integration data to change form 100% to 0%.	600

Retention of Electronic Thermal Data at Power Shut-off or Inverter Reset

The temperature integration data of the motor are saved even when the power is shut off or the inverter trip is reset (refer to *12-1-3 Procedure for Resetting a Trip State* on page 12-4). If the motor current increases again after the power is turned on or the inverter is reset, the system restarts integration with the saved temperature integration data.

Additional Information

- When the data retention function is used, the integration data are held even if the inverter is powered off for a long period of time. Therefore, after the inverter is powered on, even a short-time operation could cause a motor overload error (E005).
- The temperature integration data of an inverter is reset when the power supply is shut-off.

● Parameter

Item	Parameter	Data	Description	Default
Electronic thermal counter memory selection at Power-off	bC-14	00	Not holding: The temperature integration data are cleared by the power shut-off and resetting.	01
		01	Holding: The temperature integration data are not cleared and subtracted only in the subtraction mode.	

Monitoring Motor Electronic Thermal Status

You can monitor the integration status of the motor electronic thermal with **Electronic thermal duty ratio monitor MTR** (dA-42).

If you want a warning signal when the motor electronic thermal exceeds a certain level, set it with the output signal function electronic thermal warning (motor) [26: THM] and **Electronic thermal warning level (MTR)** (CE-30). For details, refer to *8-6-8 Motor Thermal Warning Signal (THM)* on page 8-135.

Additional Information

The monitor value for the inverter electronic thermal is separately described. For details, refer to *Monitoring Inverter Electronic Thermal Status* on page 6-62.

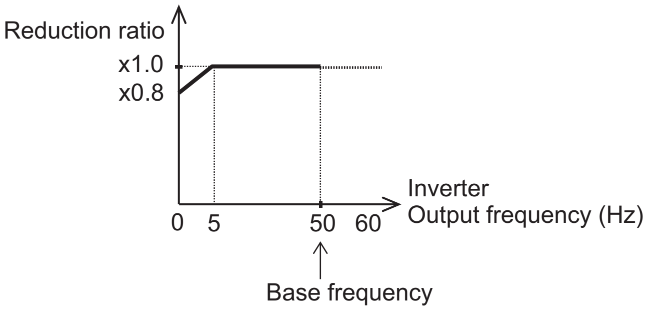
6-6-2 Inverter Electronic Thermal

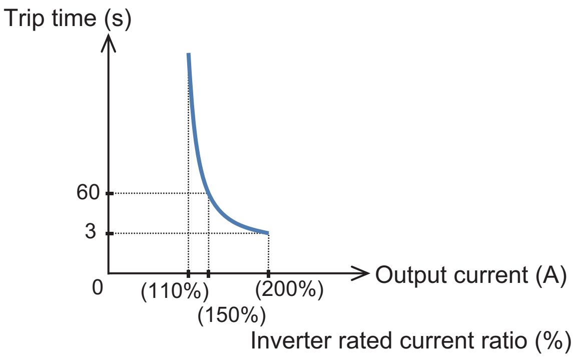
For the purpose of protecting the inverter, the electronic thermal is always in operation independently of the motor electronic thermal.

The detection characteristics differ depending on the load specification selected in **Load type selection** (Ub-03) as follows.

(Figure 1) Load specification: ND

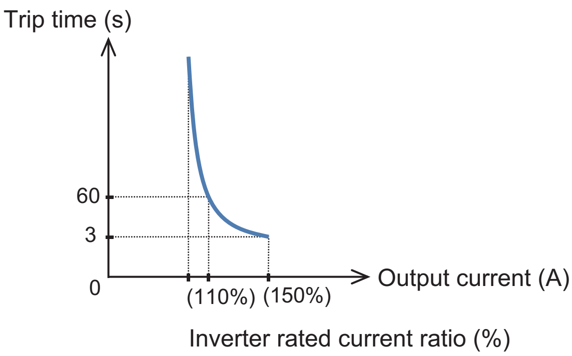
110%: asymptote, 150%: 60 seconds, 200%: 3 seconds





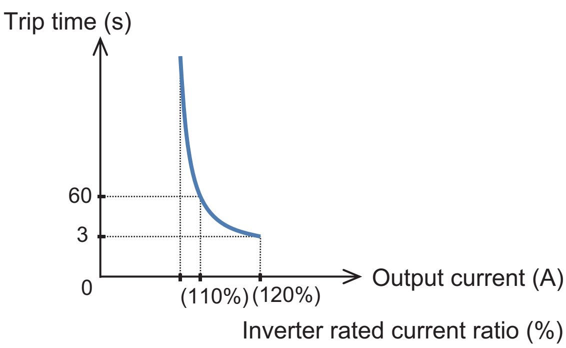
(Figure 2) Load specification: LD

----: asymptote, 120%: 60 seconds, 150%: 3 seconds



(Figure 3) Load specification: VLD

----: asymptote, 110%: 60 seconds, 120%: 3 seconds



Monitoring Inverter Electronic Thermal Status

You can monitor the integration status of the the inverter electronic thermal with **Electronic thermal duty ratio monitor CTL** (dA-43).
If you want a warning signal when the inverter electronic thermal exceeds a certain level, set it with the output signal function electronic thermal warning (inverter) [27: THC] and **Electronic thermal warning level (CTL)** (CE-31). For details, refer to *8-6-9 Inverter Thermal Warning Signal (THC)* on page 8-136.

Additional Information

The monitor value for the motor electronic thermal is separately described. For details, refer to *Monitoring Motor Electronic Thermal Status* on page 6-60.

6-6-3 Motor Thermal Protection with a Thermistor

You can provide thermal protection for the external device by wiring the thermistor installed in the external device such as a motor to the inverter and setting the function of the thermistor.
Wire the external thermistor between the control terminals TH+ and TH-.
Set **Thermistor selection** (Cb-40) and **Thermistor error level** (bb-70) (resistance value when an error occurs) according to the thermistor specifications.

When the thermistor resistance value reaches **Thermistor error level** (bb-70) due to the temperature of the external device, a thermistor error (E035) occurs.
As an adjustment, if you want to make the inverter to trip with a value smaller than **Thermistor error level** (bb-70), increase the value of **Thermistor gain adjustment** (Cb-41) to higher than 100%. If you want to make the inverter to trip with a value larger than **Thermistor error level** (bb-70), decrease the value of **Thermistor gain adjustment** (Cb-41).

Using the characteristics of the installed thermistor, if you set **Thermistor selection** (Cb-40) to *02*, **Motor temperature monitor** (dA-38) will display the detected motor temperature.
If you set *01: PTC resistance value enabled* that does not match the thermistor or *00: Disabled*, **Motor temperature monitor** (dA-38) displays 0 (zero) C°.

Additional Information

- If the external thermistor is not connected, setting **Thermistor selection** (Cb-40) to *01* or *02* will cause a trip.
- To use this function, the wiring distance between the motor and the inverter has to be 20 m or shorter. Since the current flowing in the thermistor is very weak, a measure such as wiring separation should be taken to prevent noise from the motor current.

● Parameter

Item	Parameter	Data	Description	Default
Thermistor error level	bb-70	0 to 10000 (Ω)	Set the resistance value for the temperature at which a trip occurs in accordance with the thermistor resistance specifications. Enabled when**Thermistor selection**(Cb-40) is*01*or*02*.	3000

Item	Parameter	Data	Description	Default
Thermistor selection	Cb-40	00	Disabled	00
		01	Positive temperature coefficient (PTC) resistance value enabled	
		02	Negative temperature coefficient (NTC) resistance value enabled	
Thermistor gain adjustment	Cb-41	0.0 to 1000.0	Used as gain adjustment.	100.0
Motor temperature monitor	dA-38	-20.0 to 200.0 (C°)	Indicate the detected motor temperature.	-

6-7 Acceleration/Deceleration Settings

6-7-1 Change of Acceleration/Deceleration Time

Set up the acceleration time and the deceleration time of the motor. Set a longer time for slower acceleration or deceleration; set a shorter time for faster acceleration or deceleration.
As for the acceleration time, set the time that it takes to rise from 0 Hz to the maximum frequency. As for the deceleration time, set the time that it takes to fall from the maximum frequency to 0 Hz. You can select the acceleration and deceleration time command destination with **Acceleration/Deceleration Time input selection** (AC-01).

In the default, **Acceleration time setting 1** (AC120) and **Deceleration time setting 1** (AC122) are enabled.
If you want the output frequency to follow the frequency command immediately, assign the **acceleration/deceleration cancellation** [71: LAC] terminal to **Input terminal function** (CA-01) to (CA-11) and turn ON the signal. The output frequency will follow the frequency command at the acceleration or deceleration time 0s.
The currently enabled acceleration time and deceleration time can be monitored with **Acceleration time monitor** (FA-10) and **Deceleration time monitor** (FA-12), respectively.

Additional Information

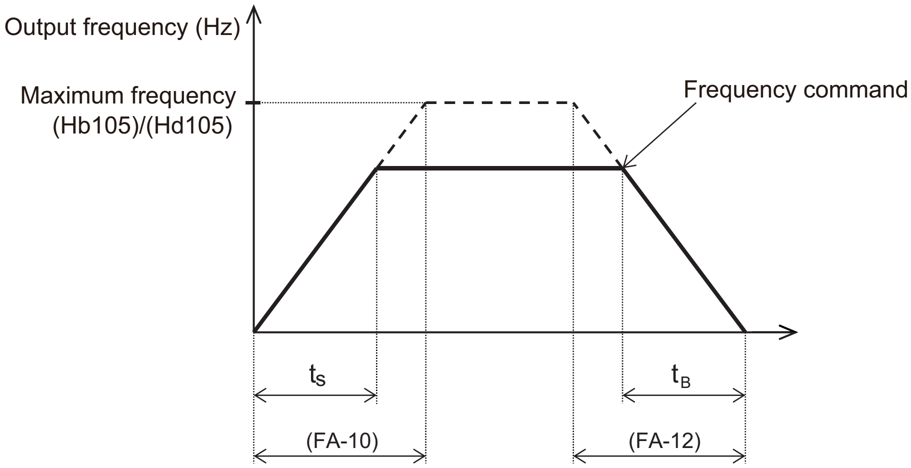
The acceleration and deceleration time can also be changed according to the command of the multistep speed function. For details, refer to*6-7-3 Switching of Acceleration/Deceleration Time with Multistep Speed* on page 6-68.

● Parameter

Item	Parameter	Data	Description	Default
Maximum frequency	Hb105 for IM, Hd105 for SM/PMM	10.00 to 590.00 (Hz)	Set the max. frequency.	50.00*1
Acceleration time setting 1	AC120	0.00 to 3600.00 (s)	Set the acceleration time from 0Hz to the maximum frequency.	30.00
Deceleration time setting 1	AC122	0.00 to 3600.00 (s)	Set the deceleration time from the maximum frequency to 0Hz.	30.00
Acceleration/Deceleration Time input selection	AC-01	00 to 04	00: Parameter setting 04: Program function DriveProgramming	00
Input terminal function	CA-01 to CA-11	71	Acceleration/deceleration cancellation function [LAC] OFF: Function disabled. ON: Ignore the acceleration or deceleration time, and follow the command.	-
Acceleration time monitor	FA-10	0.00 to 3600.00 (s)	Display the currently-enabled acceleration time.	-

Item	Parame-ter	Data	Description	Default
Deceleration time moni-tor	FA-12	0.00 to 3600.00 (s)	Display the currently-enabled decelera-tion time.	-

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.



Actual acceleration time

$$t_S = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_S + T_L)}$$

Actual deceleration time

$$t_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$$

J_L : Moment of inertia J of the load converted into that of the motor shaft ($kg \cdot m^2$)
J_M : Moment of inertia J of the motor ($kg \cdot m^2$)
N_M : Rotation speed of the motor (r/min)
T_S : Maximum acceleration torque of the motor driven by the inverter ($N \cdot m$)
T_B : Maximum deceleration torque of the motor driven by the inverter ($N \cdot m$)
T_L : Required operating torque ($N \cdot m$)

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Acceleration/decelera-tion cancellation	LAC	71	ON: Ignore the acceleration or deceleration time, and follow the command. OFF: Normal operation (Follow the acceleration time and deceleration time.)

Additional Information

Even if you set the acceleration or deceleration time very short, the actual acceleration or deceleration of the motor cannot be shorter than the minimum acceleration or deceleration time that is determined by the moment of inertia J of the mechanical system and the motor torque. An attempt to accelerate or decelerate the motor in a time shorter than the minimum acceleration or deceleration time may cause an overcurrent error (E001) or an overvoltage error (E007).

6-7-2 Switching of Acceleration/Deceleration Time in Two Stages

You can switch the acceleration or deceleration time according to the input terminal function, the value of the frequency command, and the rotation direction.

- When **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *00: [2CH] terminal* (switching by [2CH] terminal), you can switch the acceleration or deceleration time by setting [31: 2CH] in any of (CA-01) to (CA-11) and turning the target input terminal OFF and ON. See Example 1.
- When **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *01: Parameter setting* (switching by 2-stage acceleration or deceleration frequency), the acceleration or deceleration time can be switched depending on the relationship between the frequency command and **Accel1 to Accel2 Frequency transition point** (AC116) or **Decel1 to Decel2 Frequency transition point** (AC117). See Example 2.
- When **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *02: Switching normal/ reverse rotation* (enabled only when rotation is switched between forward and reverse), the acceleration or deceleration time can be switched between the forward and reverse rotation. See Example 3.

● Parameter

Item	Parameter	Data	Description	Default
Maximum frequency	Hb105 for IM, Hd105 for SM/PMM	10.00 to 590.00 (Hz)	Set the max. frequency.	50.00*1
Acceleration time setting 1	AC120	0.00 to 3600.00 (s)	Set the acceleration time from 0Hz to the maximum frequency.	30.00
Deceleration time setting 1	AC122	0.00 to 3600.00 (s)	Set the deceleration time from the maximum frequency to 0Hz.	30.00
Acceleration time setting 2	AC124	0.00 to 3600.00 (s)	Set the acceleration time from 0Hz to the maximum frequency.	15.00
Deceleration time setting 2	AC126	0.00 to 3600.00 (s)	Set the deceleration time from the maximum frequency to 0Hz.	15.00
Select method to switch to Accel2/Decel2 Profile	AC115	00	Switching by [2CH] terminal (Example 1)	00
		01	Switching by 2-stage acceleration or deceleration frequency (Example 2)	
		02	Enabled only when rotation is switched between forward and reverse (Example 3)	
Accel1 to Accel2 Frequency transition point	AC116	0.00 to 590.00 (Hz)	Enabled when**Select method to switch to Accel2/Decel2 Profile**(AC115) is set to*01*.	0.00
Decel1 to Decel2 Frequency transition point	AC117	0.00 to 590.00 (Hz)	Enabled when**Select method to switch to Accel2/Decel2 Profile**(AC115) is set to*01*.	0.00
Acceleration/Deceleration Time input selection	AC-01	00	Input from “Setting” of LCD operator.	00

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

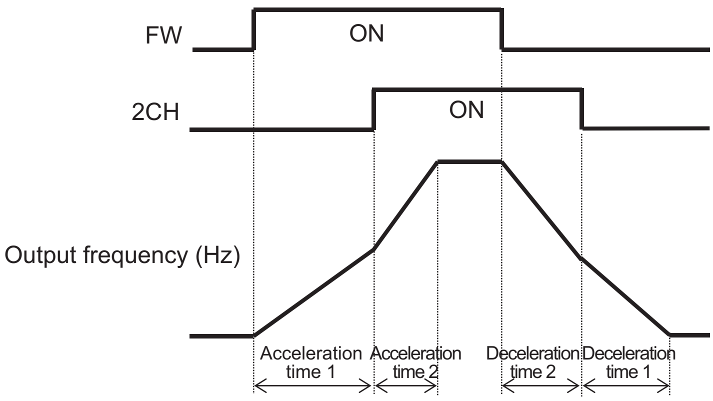
● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
2-step acceleration/ deceleration	2CH	31	Enabled when **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *00: [2CH] terminal*. ON: Follows **Acceleration time setting 2** (AC124) or **Deceleration time setting 2** (AC126). OFF: Follows the set acceleration and deceleration command.

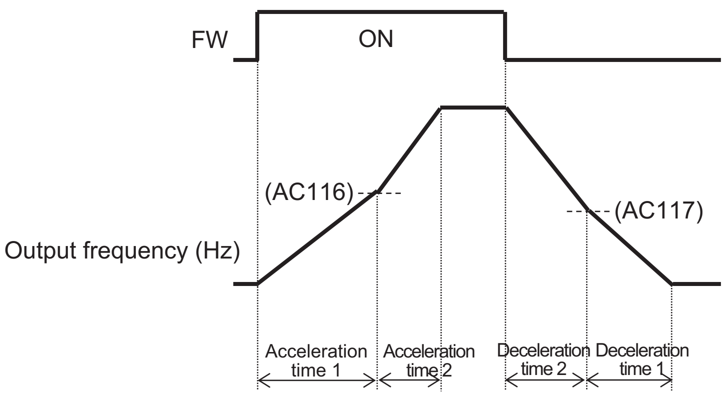
As for the acceleration time, set the time that it takes to rise from 0 Hz to the maximum frequency. As for the deceleration time, set the time that it takes to fall from the maximum frequency to 0 Hz.

You can select the acceleration or deceleration time switching method from the following three methods by using **Select method to switch to Accel2/Decel2 Profile** (AC115).

(Example 1) Switching by input terminal function [2CH]
When **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *00: [2CH] terminal*

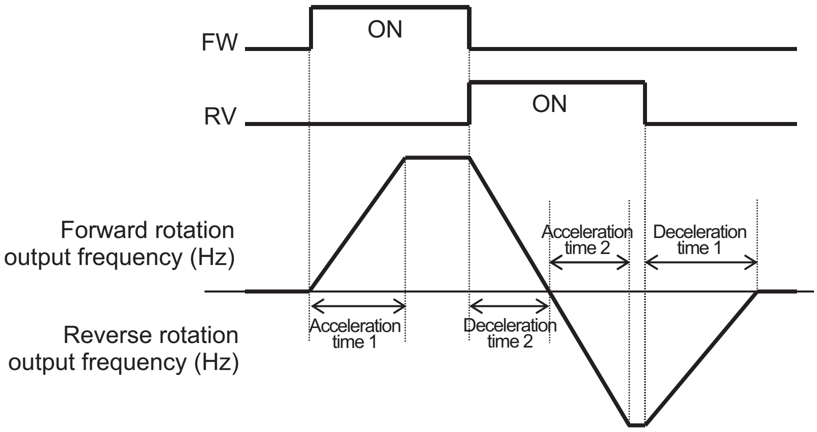


(Example 2) Automatic switching at any frequency
When **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *01: Parameter setting*



(Example 3) Automatic switching only when switched between the forward and reverse rotation

When **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *02: Switching normal/ reverse rotation*



6-7-3 Switching of Acceleration/Deceleration Time with Multistep Speed

The acceleration time and the deceleration time can be changed according to the multi-speed command.
When accelerating to a certain frequency, you can switch between multiple acceleration and deceleration times.

When using the input terminal function to switch the multistep speeds, set the multistage speed 1 [3: CF1] to multistage speed 4 [6: CF4] terminals or the multistage speed bit 1 [7: SF1] to multistage speed bit 7 [13: SF7] terminals in any of **Input terminal selection** (CA-01) to (CA-11), and then operate it.
When **Acceleration/Deceleration Selection** (AC-02) is set to *01: Multi-stage acceleration/ deceleration*, the 2-stage acceleration or deceleration function is disabled.

● Parameter

Item	Parameter	Data	Description	Default
Acceleration/ Deceleration Selection	AC-02	00	The acceleration or deceleration time follows **Acceleration time setting 1** (AC120) or **Deceleration time setting 1** (AC122), or **Acceleration time setting 2** (AC124) or **Deceleration time setting 2** (AC126) (when 2-stage acceleration or deceleration function is enabled).	00
		01	The acceleration or deceleration time is switched in accordance with the multi-speed command.	
Multi-speed command	Ab-11 to Ab-25	0.00 to 590.00 (Hz)	Set the multi-speed command with **Multispeed-1 setting** (Ab-11) to **Multispeed-15 setting** (Ab-25).	0.00

Item	Parame-ter	Data	Description	Default
Acceleration time setting for Multispeed-1 to Multispeed-15	AC-30, AC-34, AC-38, AC-42, AC-46, AC-50, AC-54, AC-58, AC-62, AC-66, AC-70, AC-74, AC-78, AC-82, AC-86	0.00 to 3600.00 (s)	Set the acceleration time from 0Hz to the maximum frequency for each multi-speed command.	0.00
Deceleration time setting for Multispeed-1 to Multispeed-15	AC-32, AC-36, AC-40, AC-44, AC-48, AC-52, AC-56, AC-60, AC-64, AC-68, AC-72, AC-76, AC-80, AC-84, AC-88	0.00 to 3600.00 (s)	Set the deceleration time from the maximum frequency to 0Hz for each multi-speed command.	0.00
Multispeed operation selection	Ab-03	00	Corresponding to 16-speed binary operation. [3: CF1] to [6: CF4]	00
		01	Corresponding to 8-speed bit operation. [7: SF1] to [13: SF7]	
Input terminal function	CA-01 to CA-11	3 to 6 and 7 to 13	Implement the multi-speed command. [3: CF1] to [6: CF4] and [7: SF1] to [13: SF7]	-

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Setting	Description
Multistep Speed Binary Command	CF1	3	Enabled when **Multispeed operation selection** (Ab-03) is set to *00: 16-speed binary operation*. See *Table for Binary Operation* on page 6-70.
	CF2	4	
	CF3	5	
	CF4	6	

Item	Terminal name	Setting	Description
Multistep Speed Bit Command	SF1	7	ON: Multispeed-1
	SF2	8	ON: Multispeed-2
	SF3	9	ON: Multispeed-3
	SF4	10	ON: Multispeed-4
	SF5	11	ON: Multispeed-5
	SF6	12	ON: Multispeed-6
	SF7	13	ON: Multispeed-7

The setting values corresponding to the binary operation and the bit operation are as follows.

Table for Binary Operation

When **Multispeed operation selection** (Ab-03) is *00: 16th speed* and **Input terminal selection** is Multistage speed 1 [3: CF1] to Multistage speed 4 [6: CF4].

Multi-step speed	CF4	CF3	CF2	CF1
0th speed	OFF	OFF	OFF	OFF
1st speed	OFF	OFF	OFF	ON
2nd speed	OFF	OFF	ON	OFF
3rd speed	OFF	OFF	ON	ON
4th speed	OFF	ON	OFF	OFF
5th speed	OFF	ON	OFF	ON
6th speed	OFF	ON	ON	OFF
7th speed	OFF	ON	ON	ON
8th speed	ON	OFF	OFF	OFF
9th speed	ON	OFF	OFF	ON
10th speed	ON	OFF	ON	OFF
11th speed	ON	OFF	ON	ON
12th speed	ON	ON	OFF	OFF
13th speed	ON	ON	OFF	ON
14th speed	ON	ON	ON	OFF
15th speed	ON	ON	ON	ON

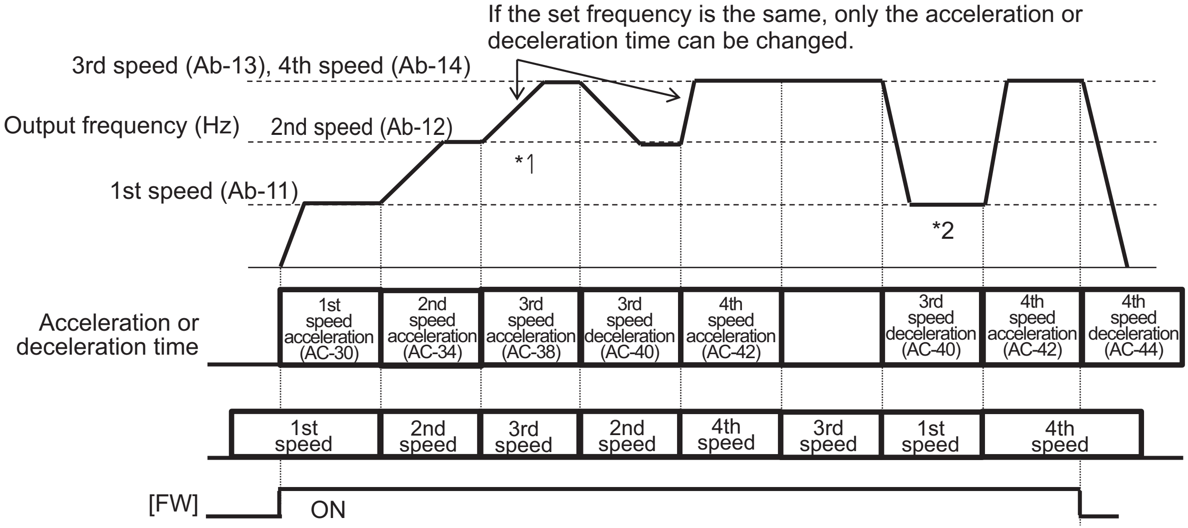
Table for Bit Operation

When **Multispeed operation selection** (Ab-03) is *01: 8th speed* and **Input terminal selection** is Multistage speed bit 1 [7: SF1] to Multistage speed bit 7 [13: SF7].

Multi-step speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1
0th speed	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1st speed	-	-	-	-	–	-	ON
2nd speed	-	-	-	-	–	ON	OFF
3rd speed	-	-	-	-	ON	OFF	OFF
4th speed	-	-	-	ON	OFF	OFF	OFF
5th speed	-	-	ON	OFF	OFF	OFF	OFF

Multi-step speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1
6th speed	-	ON	OFF	OFF	OFF	OFF	OFF
7th speed	ON	OFF	OFF	OFF	OFF	OFF	OFF

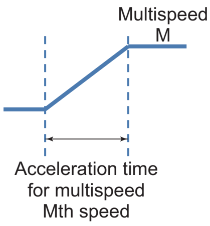
Operation Example

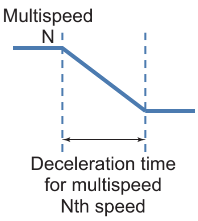


- If the multi-speed 3rd speed is engaged and the rotation is accelerating, **Acceleration time setting for Multispeed-3** (AC-38) is enabled.
- If the multi-speed 1st speed is engaged and the rotation is decelerating, **Deceleration time setting for Multispeed-3** (AC-40) for the multi-speed 3rd speed that has been engaged until the multi-speed 1st speed is engaged is enabled.

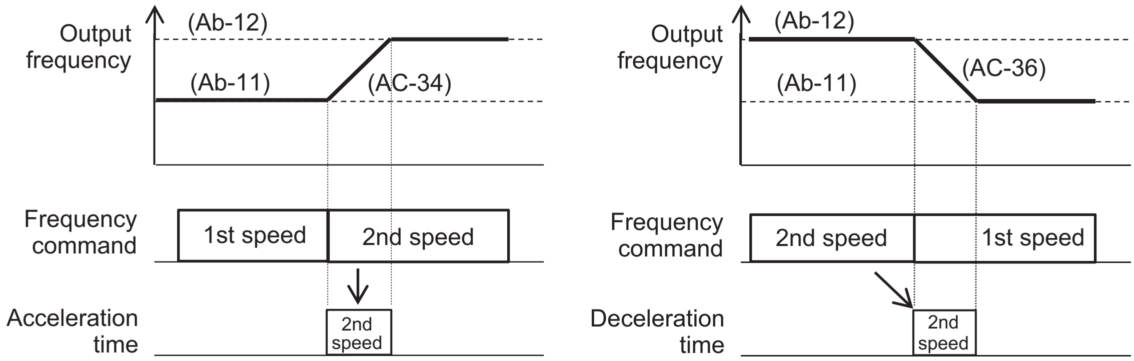
Acceleration/Deceleration Corresponding Time

The following tables show the multi-speed commands and their corresponding acceleration or deceleration times.

Setting state	Multi-speed command	Command state	Acceleration/deceleration time to be used
Acceleration state in which the frequency will be higher after the multi-speed command is ON.  	1st speed ON	**Multispeed-1 setting**(Ab-11) > Frequency before 1st speed is ON	**Acceleration time setting for Multispeed-1**(AC-30)
	2nd speed ON	**Multispeed-2 setting**(Ab-12) > Frequency before 2nd speed is ON	**Acceleration time setting for Multispeed-2**(AC-34)
	3rd speed ON	**Multispeed-3 setting**(Ab-13) > Frequency before 3rd speed is ON	**Acceleration time setting for Multispeed-3**(AC-38)
	4th speed ON	**Multispeed-4 setting**(Ab-14) > Frequency before 4th speed is ON	**Acceleration time setting for Multispeed-4**(AC-42)
	5th speed ON	**Multispeed-5 setting**(Ab-15) > Frequency before 5th speed is ON	**Acceleration time setting for Multispeed-5**(AC-46)
	6th speed ON	**Multispeed-6 setting**(Ab-16) > Frequency before 6th speed is ON	**Acceleration time setting for Multispeed-6**(AC-50)
	7th speed ON	**Multispeed-7 setting**(Ab-17) > Frequency before 7th speed is ON	**Acceleration time setting for Multispeed-7**(AC-54)
	8th speed ON	**Multispeed-8 setting**(Ab-18) > Frequency before 8th speed is ON	**Acceleration time setting for Multispeed-8**(AC-58)
	9th speed ON	**Multispeed-9 setting**(Ab-19) > Frequency before 9th speed is ON	**Acceleration time setting for Multispeed-9**(AC-62)
	10th speed ON	**Multispeed-10 setting**(Ab-20) > Frequency before 10th speed is ON	**Acceleration time setting for Multispeed-10**(AC-66)
	11th speed ON	**Multispeed-11 setting**(Ab-21) > Frequency before 11th speed is ON	**Acceleration time setting for Multispeed-11**(AC-70)
	12th speed ON	**Multispeed-12 setting**(Ab-22) > Frequency before 12th speed is ON	**Acceleration time setting for Multispeed-12**(AC-74)
	13th speed ON	**Multispeed-13 setting**(Ab-23) > Frequency before 13th speed is ON	**Acceleration time setting for Multispeed-13**(AC-78)
	14th speed ON	**Multispeed-14 setting**(Ab-24) > Frequency before 14th speed is ON	**Acceleration time setting for Multispeed-14**(AC-82)
	15th speed ON	**Multispeed-15 setting**(Ab-25) > Frequency before 15th speed is ON	**Acceleration time setting for Multispeed-15**(AC-86)
	No multi-speed	Other than those above	**Acceleration time setting 1**(AC120)

Setting state	Multi-speed com-mand	Command state	Acceleration/deceleration time to be used
Deceleration state in which the frequency will be lower after the multi-speed com-mand is OFF. 	1st speed OFF	**Multispeed-1 setting**(Ab-11) > Fre-quency after 1st speed is OFF	**Deceleration time setting for Multispeed-1**(AC-32)
	2nd speed OFF	**Multispeed-2 setting**(Ab-12) > Fre-quency after 2nd speed is OFF	**Deceleration time setting for Multispeed-2**(AC-36)
	3rd speed OFF	**Multispeed-3 setting**(Ab-13) > Fre-quency after 3rd speed is OFF	**Deceleration time setting for Multispeed-3**(AC-40)
	4th speed OFF	**Multispeed-4 setting**(Ab-14) > Fre-quency after 4th speed is OFF	**Deceleration time setting for Multispeed-4**(AC-44)
	5th speed OFF	**Multispeed-5 setting**(Ab-15) > Fre-quency after 5th speed is OFF	**Deceleration time setting for Multispeed-5**(AC-48)
	6th speed OFF	**Multispeed-6 setting**(Ab-16) > Fre-quency after 6th speed is OFF	**Deceleration time setting for Multispeed-6**(AC-52)
	7th speed OFF	**Multispeed-7 setting**(Ab-17) > Fre-quency after 7th speed is OFF	**Deceleration time setting for Multispeed-7**(AC-56)
	8th speed OFF	**Multispeed-8 setting**(Ab-18) > Fre-quency after 8th speed is OFF	**Deceleration time setting for Multispeed-8**(AC-60)
	9th speed OFF	**Multispeed-9 setting**(Ab-19) > Fre-quency after 9th speed is OFF	**Deceleration time setting for Multispeed-9**(AC-64)
	10th speed OFF	**Multispeed-10 setting**(Ab-20) > Frequency after 10th speed is OFF	**Deceleration time setting for Multispeed-10**(AC-68)
	11th speed OFF	**Multispeed-11 setting**(Ab-21) > Frequency after 11th speed is OFF	**Deceleration time setting for Multispeed-11**(AC-72)
	12th speed OFF	**Multispeed-12 setting**(Ab-22) > Frequency after 12th speed is OFF	**Deceleration time setting for Multispeed-12**(AC-76)
	13th speed OFF	**Multispeed-13 setting**Ab-23) > Fre-quency after 13th speed is OFF	**Deceleration time setting for Multispeed-13**(AC-80)
	14th speed OFF	**Multispeed-14 setting**(Ab-24) > Frequency after 14th speed is OFF	**Deceleration time setting for Multispeed-14**(AC-84)
	15th speed OFF	**Multispeed-15 setting**(Ab-25) > Frequency after 15th speed is OFF	**Deceleration time setting for Multispeed-15**(AC-88)
	No multi-speed	Other than those above	**Deceleration time setting 1**(AC122)

The switching timing of frequency command by multi-speed terminal command is different from that of the deceleration time.



6-7-4 Holding Acceleration/Deceleration

The holding function of the acceleration or deceleration is enabled when a mechanical moment of inertia is large.
The acceleration-hold function is to withhold further acceleration until the motor that is starting its rotation achieves a small enough slip. Use this function when an overcurrent error (E001) occurs at the start of the motor rotation.
The deceleration-hold function is to withhold further deceleration until the motor achieves a small enough slip. Use this function when an overvoltage error (E007) occurs during deceleration.

There are two methods of holding the acceleration or deceleration, and they can be used together.

- Acceleration (deceleration) hold that automatically holds it at any frequency for any length of time.
- Acceleration/deceleration hold that holds it by means of the **Input terminal selection** [100: HLD] terminal.

If the acceleration (deceleration) command is given while the acceleration (deceleration)-hold function is on, the hold operation is stopped and the switched command is followed.
Note that during acceleration/deceleration hold by the [100: HLD] terminal, operation command cannot change the hold operation to deceleration stop. The settings in **Acceleration curve selection** (AC-03) or **Deceleration curve selection** (AC-04) do not affect the holding operation. Hold is implemented in all selection setting patterns.

● Parameter

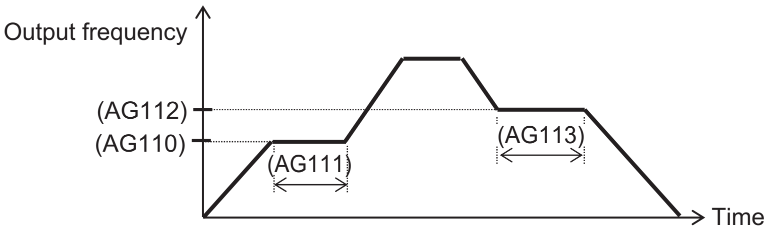
Item	Parameter	Data	Description	Default
Acceleration stop frequency setting	AG110	0.00 to 590.00 (Hz)	Set the frequency at which the acceleration is withheld. A setting of 0.00 is not valid.	0.00
Acceleration stop time setting	AG111	0.0 to 60.0 (s)	Set the length of time for which the acceleration is withheld.	0.0
Deceleration stop frequency setting	AG112	0.00 to 590.00 (Hz)	Set the frequency at which the deceleration is withheld. A setting of 0.00 is not valid.	0.00
Deceleration stop time setting	AG113	0.0 to 60.0 (s)	Set the length of time for which the deceleration is withheld.	0.0

Item	Parameter	Data	Description	Default
Input terminal selection	CA-01 to CA-11	100	The acceleration/deceleration-hold function [HLD]	-

● Input Terminal Function (CA-01) to (CA-11)

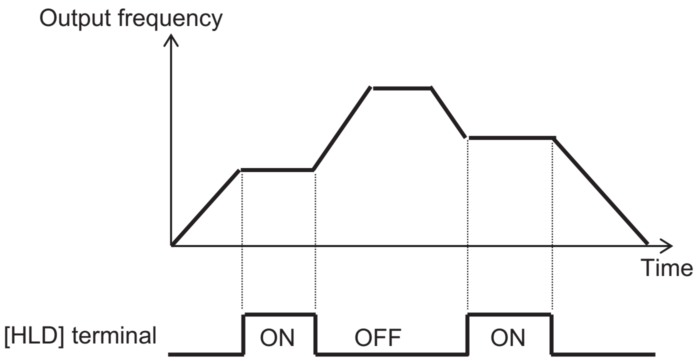
Item	Terminal name	Data	Description
Stopping of acceleration/deceleration	HLD	100	ON: Stopping of acceleration/deceleration OFF: Normal state (acceleration/deceleration possible)

When Holding for Set Time at Any Frequency



When Holding Frequency with Input terminal selection [100: HLD] Terminal Function

Set the acceleration/deceleration hold [100: HLD] in **Input terminal selection** and turn ON the signal to hold acceleration or deceleration.



6-7-5 Change of Acceleration/Deceleration Pattern

The acceleration pattern and the deceleration pattern can be set independently in**Acceleration curve selection**(AC-03) and**Deceleration curve selection**(AC-04).
When using an acceleration or deceleration pattern other than*00: Linear*, set the frequency command destination to the LCD Operator command or the multi-speed command that can be fixed to achieve stable operation.

Regardless of the acceleration pattern and deceleration pattern selection, set the time that it takes to rise from 0 Hz to the maximum frequency to the acceleration time parameter and the time that it takes to fall from the maximum frequency to 0 Hz to the deceleration time parameter.

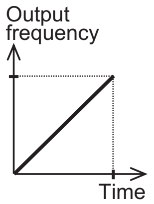
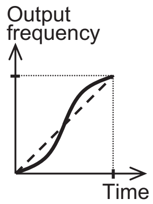
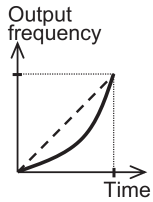
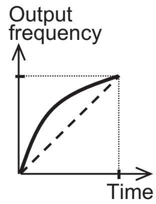
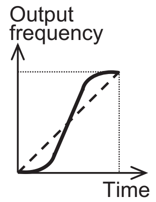
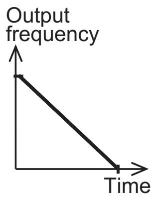
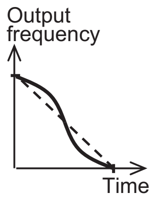
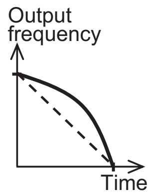
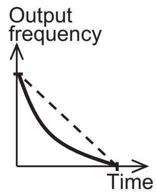
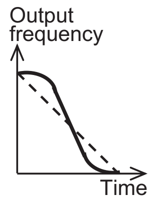
Calculation of the acceleration pattern when the motor starts is performed from the minimum frequency to the command frequency; and calculation of the deceleration pattern when the motor stops is performed from the command frequency to the minimum frequency.
In a control method in which the minimum frequency is disabled, the pattern is such that the minimum frequency is zero Hz.

Precautions for Correct Use

- Changing the acceleration or deceleration pattern may cause the gradient of acceleration or deceleration time to be partially steep.
- If an overcurrent error (E001) or overvoltage error (E007) occurs, adjust the acceleration or deceleration time.
- When any other acceleration or deceleration pattern than *00: Linear* is set, a change of command value during the acceleration or deceleration may cause a recalculation of the acceleration or deceleration pattern, which may result in a shock.
- When any other acceleration or deceleration pattern than *00: Linear* is set, use a frequency command other than the analog input. An unstable analog signal may cause a recalculation of the acceleration or deceleration pattern, which may prolong the actual acceleration or deceleration time.

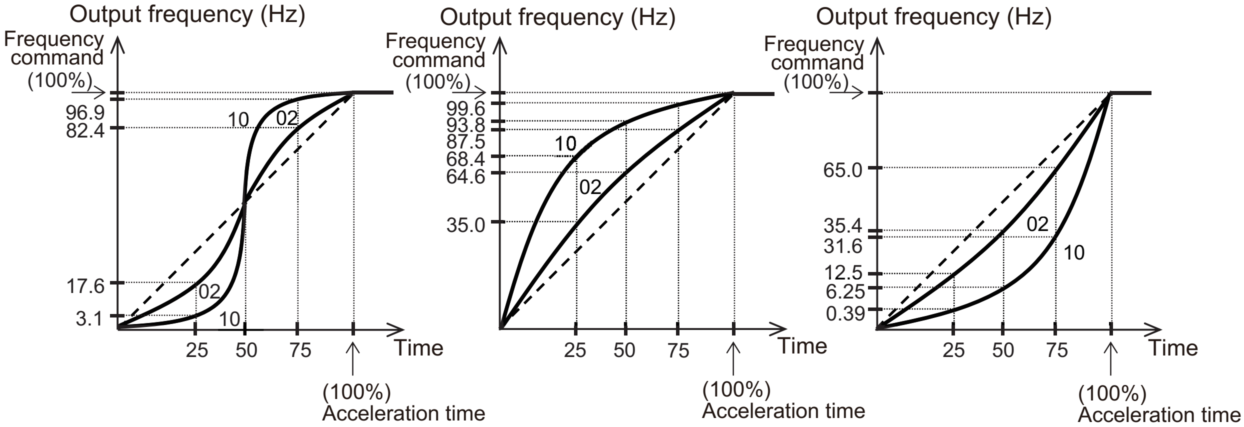
Pattern Selection

Select an acceleration or deceleration pattern referring the following table.

Set value	00	01	02	03	04
Curve	**Linear**	**S-shaped**	**U-shaped**	**Reverse U-shaped**	**EL-S-shaped**
AC-03 Acceleration					
AC-04 Deceleration					
Description	Providing a linear acceleration up or deceleration down to the set frequency value.	Effective in the prevention of load collapse in lifts or on conveyors, for example.	Effective when a winder or the like needs to control of the tension and/or prevent the object to be wound from being cut. Usable for 1-shot winding/feeding.		Providing a shock-less start/stop as in the case of the S-shaped curve, but providing a linear middle sector.

Curve Constant (Degree of Bulging) of Pattern

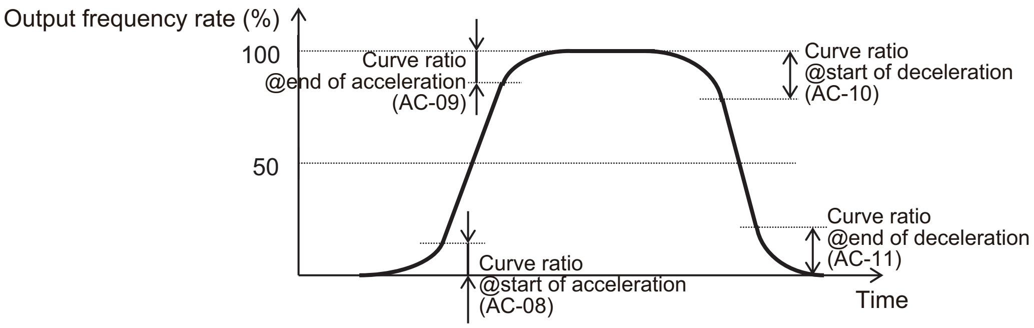
Determining the degree of bulging referring the following figures.



Disabled Functions

When using the EL-S-shaped curve, you can set the curve ratio during acceleration or deceleration to **EL-S-curve ratio @start of acceleration** (AC-08) to **EL-S-curve ratio @end of deceleration** (AC-11).
Setting all the curve ratio at 50 (%) makes the EL-S-shaped curve equivalent to an S-shaped curve.
When setting the pair of **EL-S-curve ratio @start of acceleration** (AC-08) and **EL-S-curve ratio @end of acceleration** (AC-09) or that of **EL-S-curve ratio @start of deceleration** (AC-10) and **EL-S-curve ratio @end of deceleration** (AC-11), divide 100 (%) into two segments. (The total of the two segments is up to 100%.)

For example, if you set **EL-S-curve ratio @start of acceleration** (AC-08) to *100* and **EL-S-curve ratio @end of acceleration** (AC-09) to *0*, the acceleration curve will be a U-shaped acceleration curve.



● **Parameter**

Item	Parameter	Data	Description	Default
Acceleration curve selection Deceleration curve selection	AC-03 AC-04	00	Linear acceleration/deceleration	00
		01	S-shaped acceleration/deceleration	
		02	U-shaped acceleration/deceleration	
		03	Reverse U-shaped acceleration/deceleration	
		04	EL-S-shaped acceleration/deceleration	
Acceleration curve constant setting Deceleration curve constant setting	AC-05 AC-06	1 to 10	1 (small bulging) ↕ 10 (large bulging)	2
EL-S-curve ratio @start of acceleration	AC-08	0 to 100 (%)	Designate the curve ratio of the curved sector when an EL-S-shaped curve is used. (For acceleration)	25
EL-S-curve ratio @end of acceleration	AC-09			
EL-S-curve ratio @start of deceleration	AC-10	0 to 100 (%)	Designate the curve ratio of the curved sector when an EL-S-shaped curve is used. (For deceleration)	25
EL-S-curve ratio @end of deceleration	AC-11			

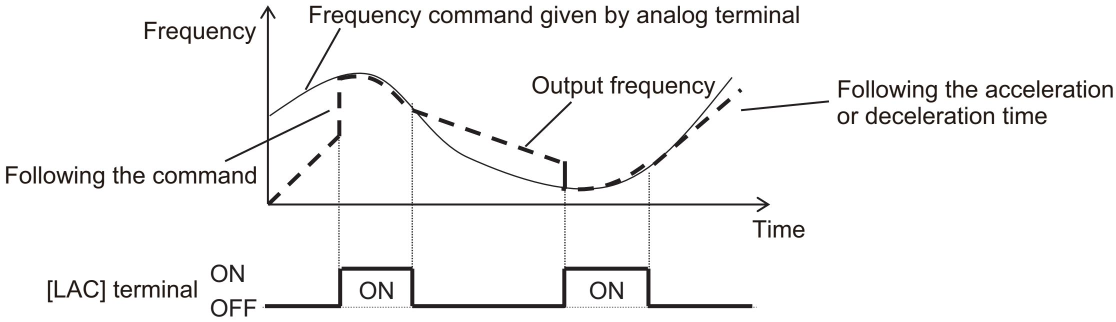
6-7-6 Control for Following Frequency Command

This function is used to immediately follow the input frequency command when synchronizing the inverter with peripheral devices.
The acceleration/deceleration cancellation function [LAC], which allows the output frequency to immediately follow the frequency command, reflects the frequency command from the analog command exactly to the output regardless of the acceleration time and deceleration time settings.
When the acceleration/deceleration cancellation [71: LAC] is set in**Input terminal function**(CA-01) to (CA11) and [71: LAC] is turned ON, the acceleration or deceleration time is ignored and the output frequency instantly follows the frequency command.

During acceleration/deceleration cancellation, if the input frequency command is suddenly increased or decreased, the output frequency will follow the command exactly. Therefore, if the change range is large, the motor cannot catch up and cause an overcurrent error (E001). Pay attention to the change range of the frequency command.
The acceleration/deceleration cancellation function [LAC] is enabled for any frequency command input.

● **Input Terminal Function (CA-01) to (CA-11)**

Item	Terminal name	Data	Description
Acceleration/deceleration cancellation	LAC	71	Enabled when **Select method to switch to Accel2/Decel2 Profile** (AC115) is set to *00: [2CH] terminal*. ON: Match the output to the frequency command without acceleration or deceleration.


Frequency
Frequency command given by analog terminal
Output frequency
Following the acceleration
or deceleration time
Following the command
Time
[LAC] terminal
ON
OFF
ON
ON

7

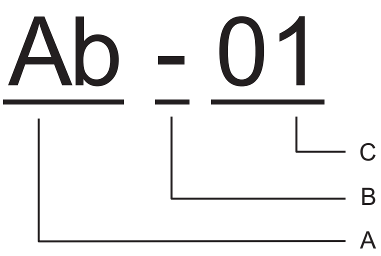
Advanced Settings

This section explains the advanced settings of the motor control.

Parameter

The parameter number structure is indicated below.

This section explains parameters without using the expression of **first setting**. Parameters that have both first setting and second setting are described using the code for the first setting. The setting values and operations of the second setting are the same as those of the first setting, unless otherwise specified.



A	Parameter group		
B	SET function type	-	Common setting: always enabled in both the first and second settings.
		1	First setting: enabled when the [SET] terminal function is OFF.
		2	Second setting: enabled when the [SET] terminal function is ON.
C	In-group number		

To switch to the second setting, use the [SET] terminal function to be assigned to the input or output terminal. Refer to *8-4-1 Second Control (SET)* on page 8-78 for details of the second setting.

7-1 Selection of Motor Control Methods

Select the control method according to the type of motor to be driven and the application. Set the control method to be used in **Control mode selection** (AA121).

The control method that can be used differs depending on the type of motor.

- To drive the induction motor (IM), set **Control mode selection** (AA121) to *00* to *10*.
- To drive the synchronous motor (SM) or permanent magnet motor (PMM), set **Control mode selection** (AA121) to *11* to *12*.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	00	[V/f] Fixed torque characteristics (IM)	00
		01	[V/f] Reducing torque characteristics (IM)	
		02	[V/f] Free V/f (IM)	
		03	Auto torque boost (IM)	
		04	[V/f with sensor] Fixed torque characteristics (IM)	
		05	[V/f with sensor] Reduced torque characteristics (IM)	
		06	[V/f with sensor] Free V/f (IM)	
		07	Auto torque boost with sensor (IM)	
		08	Sensorless vector control (IM)	
		09	Zero-Hz range sensorless vector control (IM)*1	
		10	Vector control with sensor (IM)*1	
		11	Synchronous start type sensorless vector control (SM/PMM)	
		12	IVMS start type sensorless vector control (SM/PMM)*2	
IM/SM monitor	dC-45	00	Induction motor IM being selected	-

*1. Cannot be selected if **Load type selection** (Ub-03) is *01: Low duty (LD)* or *00: Very low duty (VLD)*.

*2. Cannot be selected if **Load type selection** (Ub-03) is *00: Very low duty (VLD)*.

7-1-1 Procedure for Control Method Selection

1 Check the motor type.

Motor	Details
Induction motor (IM)	Refer to Procedure 2.
Synchronous motor (SM)	Refer to *7-2-9 Synchronous Motor (Permanent Magnet Motor) Control* on page 7-21.
Permanent magnet motor (PMM)	

2 Select a control method of the induction motor (IM).

Feed-back	Application	Control method	Reference
No feedback required Control without encoders or sensors	Applications that require a high torque at the startup, such as lifts and cranes	09: Zero-Hz range sensor-less vector control (IM)	*7-2-7 Zero-speed Range (Zero-Hz Range) Sensorless Vector Control* on page 7-17
	Applications that carry a heavy load and require a high torque, such as conveyors and machine tools	08: Sensorless vector control (IM)	*7-2-6 Sensorless Vector Control* on page 7-15
	Applications using V/f control that require a certain torque regardless of speed and where the load varies each time, such as conveyors	03: Auto torque boost (IM)	*7-2-4 Automatic Torque Boost* on page 7-12
	Applications where the frequency-voltage characteristics of a high-speed motor or special motor need to be changed freely as intended	02: [V/f] Free V/f (IM)	*7-2-3 V/f Control Free V/f Characteristics* on page 7-9
	Applications using V/f control where the energy consumption needs to be reduced according to a fan or pump	01: [V/f] Reducing torque characteristics (IM)	*7-2-2 V/f Control Reduced Torque Characteristics* on page 7-8
	Applications using V/f control that drive a general load	00: [V/f] Fixed torque characteristics (IM)	*7-2-1 V/f Control Constant Torque Characteristics* on page 7-7

Feed-back	Application	Control method	Reference
Feedback required Control using encoders or sensors	Applications that carry a heavy load; that require control needing a high torque; and that require position control	10: Vector control with sensor (IM)	*7-2-8 Vector Control with Sensor* on page 7-19
	Applications where a motor with an encoder is driven and where the frequency-voltage characteristics of a motor need to be changed freely as intended	06: [V/f with sensor] Free V/f (IM)	*7-2-5 V/f Control with Sensor* on page 7-14 *7-2-3 V/f Control Free V/f Characteristics* on page 7-9
	Applications where a motor with an encoder is driven; that require a certain torque at the startup; and where the motor rotation speed needs to match to that of the frequency command	07: Auto torque boost with sensor (IM)	*7-2-5 V/f Control with Sensor* on page 7-14 *7-2-4 Automatic Torque Boost* on page 7-12
	Applications where a motor with an encoder drives a fan or pump and where the motor rotation speed needs to match to that of the frequency command while the energy consumption is reduced	05: [V/f with sensor] Reduced torque characteristics (IM)	*7-2-5 V/f Control with Sensor* on page 7-14 *7-2-2 V/f Control Reduced Torque Characteristics* on page 7-8
	Applications where a motor with an encoder drives a general load	04: [V/f with sensor] Fixed torque characteristics (IM)	*7-2-5 V/f Control with Sensor* on page 7-14 *7-2-1 V/f Control Constant Torque Characteristics* on page 7-7

7-1-2 Vector Control

The vector control automatically adjusts the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.

The following vector controls are supported.

- Sensorless Vector Control
- Zero-speed Range (Zero-Hz Range) Sensorless Vector Control
- Vector control with sensor

Additional Information

In order to use vector control, you need to set the motor capacity, number of motor poles, base frequency, rated voltage, rated current, and load inertia according to the motor to be used. For the setting method, refer to *6-2-2 Motor Constant Settings* on page 6-12.

7-1-3 V/f Control

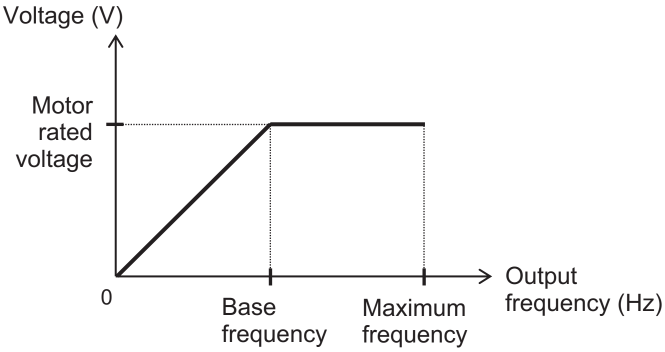
V/f control is a method in which the voltage corresponding to the output frequency is fixedly determined and controlled in order to match the basic characteristics of the IM motor. It is applicable to**Control mode selection***00*,*01*, and*02*.**Control mode selection***03*,*04*,*05*,*06*, and*07*are control methods that combine the basic V/f control with other controls.

When using V/f control (**Control mode selection** *00*, *01*, and *02*), if the tracking at the start of motor rotation is insufficient, first try manual torque boost. For information on manual torque boost, refer to *7-8 Manual Torque Boost* on page 7-74.
If you need feedback, see also*7-10 Encoder Feedback* on page 7-77.

7-2 Details of Motor Control Methods

7-2-1 V/f Control Constant Torque Characteristics

The V/f control constant torque characteristics are suitable when constant torque is required regardless of the rotation speed of dollies, conveyors and cranes, etc.
V/f control is a control method that outputs a voltage corresponding to the output frequency. With the constant torque characteristics, the output voltage is controlled as shown in the figure below.



In the area where the output frequency is below the base frequency, the output voltage is controlled so that it is proportional to the straight line drawn from the point 0 Hz/0 V to the intersection of the base frequency and the rated voltage. The output voltage is controlled so that the rated voltage is obtained when the output frequency exceeds the base frequency.

To use the V/f control constant torque characteristics, set **Control mode selection** (AA121) to *00: [V/f] Fixed torque characteristics*.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	00	Used with the [V/f] constant torque characteristics.	00
Stabilization constant	HA110	0 to 1000 (%)	Reduce the motor hunting.	100
Async.Motor Base frequency setting	Hb104	10.00 to maximum frequency (Hz)	Set the base frequency of motor.	50.00*1
Async.Motor Maximum frequency setting	Hb105	Base frequency to 590.00 (Hz)	Set the max. frequency of motor.	50.00*1
Async.Motor rated voltage	Hb106	1 to 1000 (V)	Set the rated voltage of motor.	200V: 230*1 400V: 400 *1

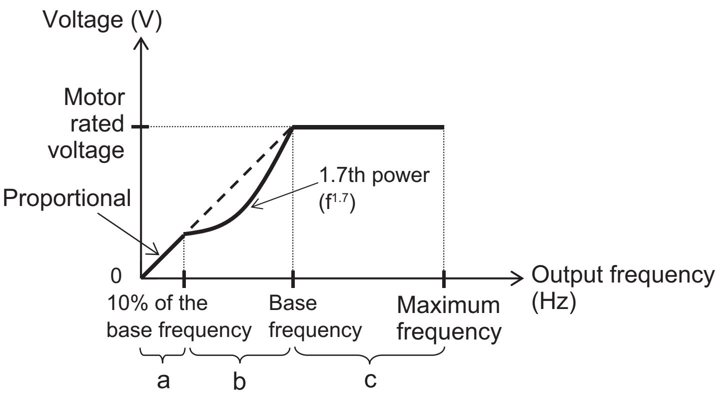
*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

Additional Information

V/f control (constant torque characteristics) is recommended when a single inverter runs multiple motors.

7-2-2 V/f Control Reduced Torque Characteristics

The V/f control reduced torque characteristics are suitable for applications, such as a fan and pump, that require no large torque at a low-speed range. As the output voltage is low at a low-speed range, improved efficiency, lower noise, and less vibration can be expected.
V/f control is a control method that outputs a voltage corresponding to the output frequency. With the reduced torque characteristics, the output voltage is controlled as shown in the figure below.



Range a:	From 0Hz to 10% of the base frequency is the same as the constant torque characteristics. The output voltage is controlled so that it is proportional to the frequency.
Range b:	From 10% of the base frequency to the base frequency, the output voltage is controlled by a curve of the 1.7th power of the frequency.
Range c:	The output voltage is controlled so that the rated voltage is obtained at frequencies above the base frequency.

To use the V/f control reduced torque characteristics, set **Control mode selection** (AA121) to *01: [[V/f] Reducing torque characteristics (IM)*.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	01	Used with the [V/f] reduced torque characteristics.	00
Stabilization constant	HA110	0 to 1000 (%)	Reduce the motor hunting.	100
Async.Motor Base frequency setting	Hb104	10.00 to maximum frequency (Hz)	Set the base frequency of motor.	50.00[*1]
Async.Motor Maximum frequency setting	Hb105	Base frequency to 590.00 (Hz)	Set the max. frequency of motor.	50.00[*1]

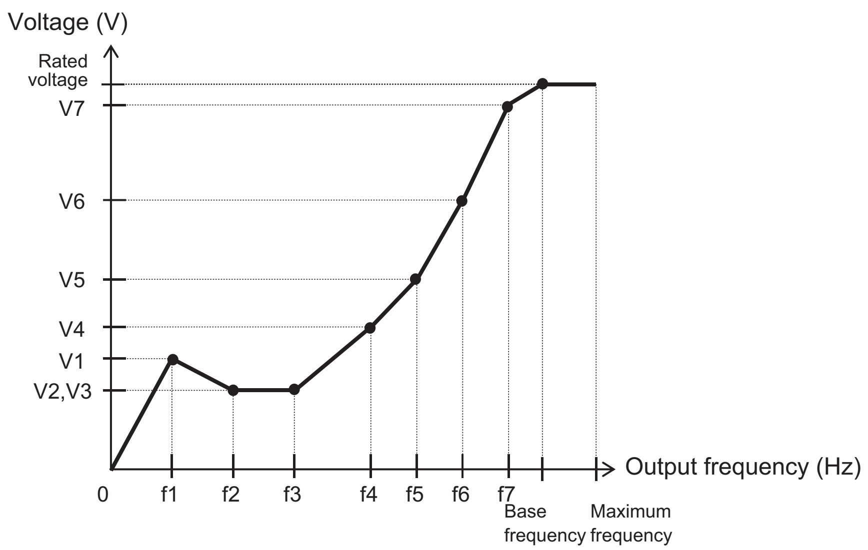
Item	Parameter	Data	Description	Default
Async.Motor rated voltage	Hb106	1 to 1000 (V)	Set the rated voltage of motor.	200V: 230*1 400V: 400 *1

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

7-2-3 V/f Control Free V/f Characteristics

The V/f control free V/f characteristics are suitable for applications where the load changes greatly depending on the rotation speed because the output voltage can be set according to the application.

V/f control is a control method that outputs a voltage corresponding to the output frequency. With the free V/f characteristics, the output voltage is controlled according to the V/f characteristics set as shown in the figure below. The rated voltage is output at frequencies above the base frequency.



To use the V/f control free V/f characteristics, set **Control mode selection** (AA121) to *02: [[V/f] Free V/f (IM)*.
The characteristics of free V/f are set by the pair of voltage and frequency. You can set up to 7 points in the pair of **Free-V/f frequency 1 setting** (Hb150) and **Free-V/f Voltage 1 setting** (Hb151) to **Free-V/f frequency 7 setting** (Hb162) and **Free-V/f Voltage 7 setting** (Hb163).
The values in **Free-V/f frequency 1 setting** (Hb150) to **Free-V/f frequency 7 setting** (Hb162) must satisfy the condition of 1 ≤ 2 ≤ ... ≤ 7 ≤ base frequency.
Set the free V/f frequency to *0* for unused points.
When all the values in **Free-V/f frequency 1 setting** (Hb150) to **Free-V/f frequency 7 setting** (Hb162) are set to *0*, you can not operate the inverter even if you give an operation command.
When using the V/f control free V/f characteristics, torque boost does not work even if manual torque boost is enabled.

Additional Information

- Set **Async.Motor Maximum frequency setting** (Hb105) and **Async.Motor Base frequency setting** (Hb104), and then make the settings in order of **Free-V/f frequency 7 setting** (Hb162), 6, 5, 4, 3, 2, and 1, to the point where it is used. You can easily make the subsequent settings.
- If the motor is hunting or vibrating, adjust **Stabilization constant** (HA110). For details, refer to *7-11-1 Stabilization Constant* on page 7-83.

● Parameter

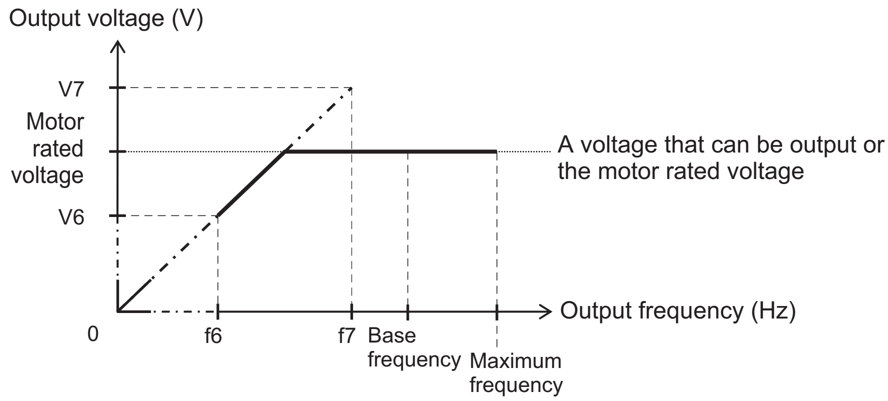
Item	Parameter	Data	Description	Default
Control mode selection	AA121	02: [V/f] Free V/f (IM)	Use the free V/f (IM).	00
Stabilization constant	HA110	0 to 1000 (%)	Reduce the motor hunting.	100
Async.Motor Maximum frequency setting	Hb105	Base frequency to 590.00 (Hz)	Set the max. frequency of motor.	50.00[*1]
Async.Motor Base frequency setting	Hb104	10.00 to maximum frequency (Hz)	Set the base frequency of motor.	50.00[*1]
Async.Motor rated voltage	Hb106	1 to 1000 (V)	Set the rated voltage of motor.	200V: 230[*1] 400V: 400[*1]

Item	Parameter	Data	Description	Default
Free-V/f frequency 7 setting	Hb162	**Free V/f frequency 6 setting** (Hb160) to base frequency (Hz)	Set the frequency at each break point.	0.00
Free-V/f frequency 6 setting	Hb160	**Free-V/f frequency 5 setting**(Hb158) to**Free-V/f frequency 7 setting**(Hb162) (Hz)		
Free-V/f frequency 5 setting	Hb158	**Free-V/f frequency 4 setting**(Hb156) to**Free-V/f frequency 6 setting**(Hb160) (Hz)		
Free-V/f frequency 4 setting	Hb156	**Free-V/f frequency 3 setting**(Hb154) to**Free-V/f frequency 5 setting**(Hb158) (Hz)		
Free-V/f frequency 3 setting	Hb154	**Free-V/f frequency 2 setting**(Hb152) to**Free-V/f frequency 4 setting**(Hb156) (Hz)		
Free-V/f frequency 2 setting	Hb152	**Free-V/f frequency 1 setting**(Hb150) to**Free-V/f frequency 3 setting**(Hb154) (Hz)		
Free-V/f frequency 1 setting	Hb150	0.00 to**Free-V/f frequency 2 setting**(Hb152) (Hz)		
Free-V/f Voltage 7 setting	Hb163	0.0 to 1000.0 (V)	Set the output voltage at each break point.	0.0
Free-V/f Voltage 6 setting	Hb161			
Free-V/f Voltage 5 setting	Hb159			
Free-V/f Voltage 4 setting	Hb157			
Free-V/f Voltage 3 setting	Hb155			
Free-V/f Voltage 2 setting	Hb153			
Free-V/f Voltage 1 setting	Hb151			

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

Precautions for Correct Use

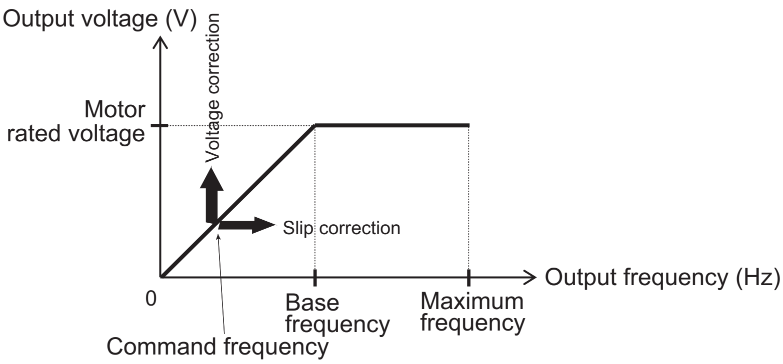
- The output voltage cannot exceed**Async.Motor rated voltage**(Hb106) or the input voltage.



- If the free V/f characteristics do not match the characteristics of the device, it may cause overcurrent during acceleration or deceleration and vibration of the motor or device.

7-2-4 Automatic Torque Boost

Among the applications for which the V/f control constant torque characteristic is selected, automatic torque boost is suitable for applications where the torque output fluctuates, such as when operating at a constant speed on a machine with a large or small load difference.



Automatic torque boost is a control method that automatically corrects the frequency and output voltage so that torque is generated according to the load condition of the motor based on the V/f control constant torque characteristics.
To use automatic torque boost, set **Control mode selection** (AA121) to *03: Auto torque boost (IM)*.

Automatic torque boost estimates motor slip from output current and frequency. The ratio of adding the estimated slip to the output frequency is adjusted by **Automatic torque boost slip compensation gain** (HC102).
The output voltage is added to generate torque according to the detected slip. You can use **Automatic torque boost voltage compensation gain** (HC101) for adjustment.

In order to estimate the slip of the motor with high accuracy, set the motor constant according to the motor to be used. For the setting method, refer to *6-2-2 Motor Constant Settings* on page 6-12.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	03	Use the automatic torque boost (IM).	00
Stabilization constant	HA110	0 to 1000 (%)	Reduce the motor hunting.	100
Async.Motor Base frequency setting	Hb104	10.00 to maximum frequency (Hz)	Set the base frequency of motor.	50.00*1
Async.Motor Maximum frequency setting	Hb105	Base frequency to 590.00 (Hz)	Set the max. frequency of motor.	50.00*1
Async.Motor rated voltage	Hb106	1 to 1000 (V)	Set the rated voltage of motor.	200V: 230*1 400V: 400 *1
Automatic torque boost voltage compensation gain	HC101	0 to 255	Adjust the amount of the voltage added by the automatic torque boost.	100
Automatic torque boost slip compensation gain	HC102	0 to 255	Adjust the amount of the frequency added by the automatic torque boost.	100

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

If you cannot obtain sufficient characteristics even after using the automatic torque boost, adjust it referring to the table below.

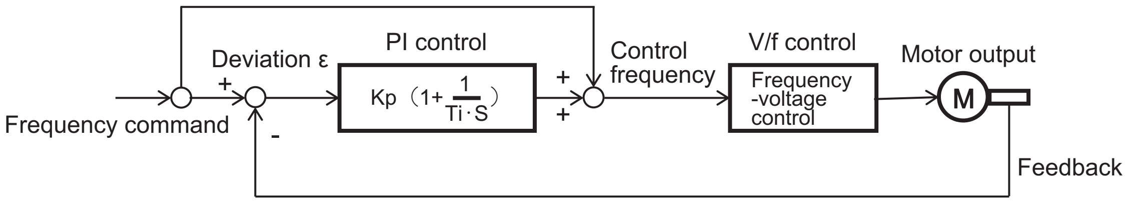
Phenomenon	Assumed cause	Example of measures
Slower motor rotation at low speeds than what is expected.	Insufficient output voltage, which in turn renders the torque insufficient.	Make an adjustment by incrementing**Automatic torque boost voltage compensation gain**(HC101) by approximately 5% each time.
	Insufficient frequency correction, which in turn renders the torque insufficient.	Make an adjustment by incrementing**Automatic torque boost slip compensation gain**(HC102) by approximately 5% each time.
A heavy load lowers the motor rotation frequency.	Insufficient frequency correction, which in turn renders the torque insufficient.	Make an adjustment by incrementing**Automatic torque boost slip compensation gain**(HC102) by approximately 5% each time.
A heavy load raises the motor rotation frequency.	An excessive frequency correction raises the frequency.	Make an adjustment by decrementing**Automatic torque boost slip compensation gain**(HC102) by approximately 5% each time.
With a heavy load, an acceleration causes an over current.	An excessive voltage correction increases the current.	Make an adjustment by decrementing**Automatic torque boost voltage compensation gain**(HC101) by approximately 5% each time.
	An excessive frequency correction raises the frequency.	Make an adjustment by decrementing**Automatic torque boost slip compensation gain**(HC102) by approximately 5% each time.

Additional Information

- If an application of load results in a great amount of change in **Output frequency monitor** (dA-01) of the inverter, check if a function that automatically changes the frequency, such as the overload limiting function, the momentary power interruption non-stop function, or the over voltage suppression function, is working.
- If the motor is hunting or vibrating, adjust **Stabilization constant** (HA110). For details, refer to *7-11-1 Stabilization Constant* on page 7-83.
- If an overcurrent error (E001) occurs during deceleration, set **Over magnetization deceleration function selection** (bA146) to *00: Disabled*.

7-2-5 V/f Control with Sensor

You can use V/f control with a sensor when you want to improve the tracking of the rotation speed of the motor to the frequency command.
The V/f control with a sensor is a function that improves the speed accuracy of V/f control by using feedback from the encoder.
It can be used with the constant torque characteristics, reduced torque characteristics, free V/f characteristics, and automatic torque boost using V/f control.
V/f control with a sensor performs PI control using the fed-back frequency.



Kp: proportional gain setting; Ti: integral time; s: operator; ε: deviation
Ki: integral gain setting (Ki = Ti/Kp)

To use V/f control with a sensor, set **Control mode selection** (AA121) to any of *04: [V/f with sensor] Fixed torque characteristics (IM)*, *05: [V/f with sensor] Reduced torque characteristics (IM)*, *06: [V/f with sensor] Free V/f (IM)*, and *07: Auto torque boost with sensor (IM)*.
For the setting method of V/f control, refer to *7-2-1 V/f Control Constant Torque Characteristics* on page 7-7, *7-2-2 V/f Control Reduced Torque Characteristics* on page 7-8, *7-2-3 V/f Control Free V/f Characteristics* on page 7-9, and *7-2-4 Automatic Torque Boost* on page 7-12.
Encoder feedback is required for V/f control with a sensor. For encoder feedback, refer to *7-10 Encoder Feedback* on page 7-77.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	05	Use V/f control with sensor reduced torque characteristics.	00
Slip Compensation P-gain with encoder	Hb170	0 to 1000 (%)	This is the P gain for the slip compensation of control with sensor.	100
Slip Compensation I-gain with encoder	Hb171	0 to 1000 (%)	This is the I gain for the slip compensation of control with sensor.	100

If you cannot obtain sufficient characteristics, make adjustments referring to the table below.

Phenomenon	Assumed cause	Example of measures
The motor speed follows the command slowly.	Response of the output is slow and the change in the fed-back value is slow.	Increment the proportional (P) gain (Hb170).
The motor operates unstably.	Response to the fed-back value is too quick.	Decrement the proportional (P) gain (Hb170).
Overshooting or hunting occurs.		
The motor speed oscillates gently.	Response to the integral operation is slow.	Increment the integral (I) gain (Hb171).
It takes time for the operation to stabilize.		
The command value and the motor speed do not easily match.	Response of the output is slow and the change in the fed-back value is slow.	Decrement the integral (I) gain (Hb171).

7-2-6 Sensorless Vector Control

Sensorless vector control is suitable for applications that carry a heavy load and require a high torque, such as conveyors and machine tools, or applications that require frequency tracking.
The vector control automatically adjusts the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.
The performance of sensorless vector control is slightly inferior to that of the vector control with a sensor, but the load can be driven in the optimum condition even in an open loop. Sensorless vector control does not require a special motor with a speed sensor (PG) and improves the speed accuracy and torque characteristics of the motor from the low frequency range to the high frequency range compared to V/f control.

To use sensorless vector control, set **Control mode selection** (AA121) to *08: Sensorless vector control (IM)*.
To use vector control, you need to set the motor capacity, number of motor poles, base frequency, rated voltage, rated current, and load inertia according to the motor to be used. For the setting method, refer to *6-2-2 Motor Constant Settings* on page 6-12.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	08	Use the sensorless vector control (IM).	00
Speed response for Async.M	HA115	0 to 1000 (%)	Adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Boost value at start for Async.M-SLV/IM-CLV (For sensorless vector control)	HC111	0 to 50 (%)	Adjust the current command at the start when the starting torque is not sufficient.	0

Item	Parameter	Data	Description	Default
Secondary resistance correction	HC113	00	Disable	00
		01	Enabled Compensate for slip changes due to temperature changes. In this case, you need to wire the thermistor for measuring the motor temperature to the [TH+] and [TH-] terminals, and set **Thermistor gain adjustment** (Cb-41) to *02*. (Refer to *6-6-1 Motor Electronic Thermal* on page 6-53.)	
Torque current reference filter time constant	HC120	0 to 100 (ms)	Adjust the filter for the torque current.	2
Speed feedforward compensation gain	HC121	0 to 1000 (%)	If the motor is hunting or vibrating, adjust the feed forward control of the speed controller.	0

If you cannot obtain sufficient characteristics, make adjustments referring to the table below.

Phenomenon	Assumed cause	Example of measures
Shocks occur during the rotations at the start.	The control system has a speed response that is too high.	• Make an adjustment by decrementing **Speed response for Async.M** (HA115) by 5% each time. • Make an adjustment by decrementing **Async.Motor constant J** (Hb118) by 5% each time. • Make an adjustment by decrementing **Boost value at start for Async.M-SLV/IM-CLV** (HC111) by 5% each time.
Unsteady rotations at low speeds, resulting in fluctuating rotations.	The control system has a speed response that is too low.	• Make an adjustment by incrementing **Speed response for Async.M** (HA115) by 5% each time. • Make an adjustment by incrementing **Async.Motor constant J** (Hb118) by 5% each time.
The motor is hunting.	The control system has a speed response that is too low.	• Make an adjustment by decrementing **Speed response for Async.M** (HA115) by 5% each time. • Make an adjustment by decrementing **Async.Motor constant J** (Hb118) by 5% each time.
When a load in the motor-stopping direction is applied to the motor, the rotation frequency becomes lower.	The motor constant R2 is set at too small a value.	Make an adjustment by incrementing **Async.Motor constant R2** (Hb112) by 5% of the current value each time.
When a load in the motor-stopping direction is applied to the motor, the rotation frequency becomes higher.	The motor constant R2 is set at too large a value.	Make an adjustment by decrementing **Async.Motor constant R2** (Hb112) by 5% of the current value each time.

Phenomenon	Assumed cause	Example of measures
When a load in the motor-stopping direction is applied to the motor at low speeds, the rotation frequency becomes higher.	Insufficient regenerative torque at low speeds.	• Make an adjustment by incrementing **Async.Motor constant R1** (Hb110) by 5% of the current value each time. • Make an adjustment by incrementing **Async.Motor constant Io** (Hb116) by 5% of the current value each time.
Rotation in the opposite direction to the command direction occurs for an instant.	A command demanding the rotation in the opposite direction is dispatched over the control system for an instant.	Enables **Counter direction run protection selection** (HC114).

Precautions for Correct Use

- Set **Carrier speed setting** (bb101) at a value of 2.0 kHz or higher. A set frequency less than 2.0 kHz may cause hunting.
- When the rotation of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. If the adjustment mentioned above makes no improvement, check if there is anything that interferes with the motor rotation.
- If an application of load results in a great amount of change in **Output frequency monitor** (dA-01) of the inverter, check if a function that automatically changes the frequency, such as the overload limiting function, the momentary power interruption non-stop function, or the over voltage suppression function, is working.

Additional Information

If the wiring length is long (approximately longer than 20 m), torque shortage may occur due to voltage drop.

7-2-7 Zero-speed Range (Zero-Hz Range) Sensorless Vector Control

Zero-speed range (zero-Hz range) sensorless vector control is suitable for applications that require a high torque from the start, such as lifts and cranes.
The vector control automatically adjusts the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.
In the zero-speed range (zero-Hz range) sensorless vector control, in addition to vector control, the output voltage is controlled so that torque is output from the extremely low speed in the zero speed range.

To use zero-speed range (zero-Hz range) sensorless vector control, set **Control mode selection** (AA121) to *09: Zero-Hz range sensorless vector control (IM)*.

To use vector control, you need to set the motor capacity, number of motor poles, base frequency, rated voltage, rated current, and load inertia according to the motor to be used. For the setting method, refer to*6-2-2 Motor Constant Settings* on page 6-12.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	09*1	Use the zero-speed range sensorless vector control (IM) function.	00
Speed response for Async.M	HA115	0 to 1000 (%)	Adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Zero speed area limit for Async.M-0SLV	HC110	0 to 100 (%)	Limit the current at the start so as not to allow the rising of the current to rise too high.	80
Boost value at start for Async.M-SLV/IM-CLV (For zero-speed range sensorless vector control)	HC112	0 to 50 (%)	Adjust the current command at the start when the starting torque is not sufficient.	0
Secondary resistance correction	HC113	00	Disabled	00
		01	Enabled Compensate for slip changes due to temperature changes. In this case, you need to wire the thermistor for measuring the motor temperature to the [TH+] and [TH-] terminals, and set**Thermistor gain adjustment**(Cb-41) to*02*. (Refer to*6-6-1 Motor Electronic Thermal* on page 6-53.)	
Torque current reference filter time constant	HC120	0 to 100 (ms)	Adjust the filter for the torque current.	2
Speed feedforward compensation gain	HC121	0 to 1000 (%)	If the motor is hunting or vibrating, adjust the feed forward control of the speed controller.	0

*1. Cannot be selected if **Load type selection** (Ub-03) is *01: Low duty (LD)* or *00: Very low duty (VLD)*.

If you cannot obtain sufficient characteristics, make adjustments referring to the table below in addition to items in*7-2-6 Sensorless Vector Control* on page 7-15.

Phenomenon	Assumed cause	Example of measures
Shocks occur during the rotations at the start. Over current occurs at the start	Boost amount is too large.	• Make an adjustment by decrementing**Zero speed area limit for Async.M-0SLV**(HC110) by 5% each time. • Make an adjustment by decrementing**Boost value at start for Async.M-0SLV**(HC112) by 5% each time.
The motor cannot provide enough torque for the motor at the start due to the high load.	Boost amount is too small.	Make an adjustment by incrementing**Boost value at start for Async.M-0SLV**(HC112) by 5% each time.

Precautions for Correct Use

- Set**Carrier speed setting**(bb101) at a value of 2.0 kHz or higher. A set frequency less than 2.0 kHz may cause hunting.
- When the rotation of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. If the adjustment mentioned above makes no improvement, check if there is anything that interferes with the motor rotation.
- If an application of load results in a great amount of change in**Output frequency monitor**(dA-01) of the inverter, check if a function that automatically changes the frequency, such as the overload limiting function, the momentary power interruption non-stop function, or the over voltage suppression function, is working.

Additional Information

If the wiring length is long (approximately longer than 20 m), torque shortage may occur due to voltage drop.

7-2-8 Vector Control with Sensor

Vector control with a sensor is suitable for applications that carry a heavy load and require a high torque, and that require position control.
The vector control automatically adjusts the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.
With vector control with a sensor, the rotational state of the motor can be detected by an encoder attached to the motor, enabling high-precision speed control and torque control at low speeds. In addition, vector control with a sensor is capable of position control.

To use vector control with a sensor, set **Control mode selection** (AA121) to *10: Vector control with sensor (IM)*.

To use vector control, you need to set the motor capacity, number of motor poles, base frequency, rated voltage, rated current, and load inertia according to the motor to be used. For the setting method, refer to *6-2-2 Motor Constant Settings* on page 6-12.

Encoder feedback is required for vector control with a sensor. For encoder feedback, refer to *7-10 Encoder Feedback* on page 7-77.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	10	Use the vector control with sensor (IM).	00
Speed response for Async.M	HA115	0 to 1000 (%)	Adjust the responsiveness of the control. A larger value enhances the responsiveness.	100

Item	Parameter	Data	Description	Default
Boost value at start for Async.M-SLV/IM-CLV (For sensorless vector control)	HC111	0 to 50 (%)	Adjust the current command at the start when the starting torque is not sufficient.	0
Secondary resistance correction	HC113	00	Disabled	00
		01	Enabled. Requiring a temperature thermistor.	
Torque current reference filter time constant	HC120	0 to 100 (ms)	Adjust the filter for the torque current.	2
Speed feedforward compensation gain	HC121	0 to 1000 (%)	Adjust the feed forward control of the speed controller.	0

If you cannot obtain sufficient characteristics, make adjustments referring to the table below.

Phenomenon	Assumed cause	Example of measures
The performance is not sufficient for what the motor control characteristics predict.	An improper motor constant is being used.	• The performance may be improved by auto-tuning. Refer to *6-2-3 Auto-tuning of Motor* on page 6-13.
Shocks occur during the rotations at the start.	The control system has a frequency response that is too high.	• Make an adjustment by decrementing**Speed response for Async.M**(HA115) by 5% each time. • Make an adjustment by decrementing**Async.Motor constant J**(Hb118) by 5% each time.
The motor is hunting.		
Unsteady rotations at low speeds, resulting in fluctuating rotations.	The control system has a frequency response that is too low.	• Make an adjustment by incrementing**Speed response for Async.M**(HA115) by 5% each time. • Make an adjustment by incrementing**Async.Motor constant J**(Hb118) by 5% each time.
Normal acceleration is impossible and the protection against the over load works.	An improper motor constant is being used.	• The performance may be improved by auto-tuning. Refer to *6-2-3 Auto-tuning of Motor* on page 6-13.
	An improper phase sequence is being used.	• Set **Control mode selection** (AA121) to V/f control *00* and check **Speed detection value monitor** (dA-08). • The wiring is correct if the forward operation [FW] has a positive (+) value and if the reversal operation [RV] has a negative (-) value. • If the forward and reverse operations have incorrect values, rearrange the phase sequence in the encoder or check again *7-10 Encoder Feedback* on page 7-77.

Precautions for Correct Use

- Set**Carrier speed setting**(bb101) at a value of 2.0 kHz or higher. A set frequency less than 2.0 kHz may cause hunting.
- When the rotation of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. If the adjustment mentioned above makes no improvement, check if there is anything that interferes with the motor rotation.
- If an application of load results in a great amount of change in**Output frequency monitor**(dA-01) of the inverter, check if a function that automatically changes the frequency, such as the overload limiting function, the momentary power interruption non-stop function, or the over voltage suppression function, is working depending on the inverter settings.

Additional Information

If the wiring length is long (approximately longer than 20 m), torque shortage may occur due to voltage drop.

Activation of Functions Dedicated to Vector Control with Sensor

The following functions are available only for vector control with a sensor. These functions are disabled with other control methods.

- Pulse train position control (AA123 = 01)
  Refer to *8-4-7 Pulse String Position Control* on page 8-98.
- Absolute position control (AA123 = 02 or 03)
  Refer to *8-4-9 Absolute Position Control Mode* on page 8-107.

● Parameter

Item	Parameter	Data	Description	Default
Vector control mode selection	AA123	00	Operate with speed control or torque control.	00
		01	Pulse string position control mode	
		02	Absolute position control mode	
		03	High-resolution absolute position control mode	

7-2-9 Synchronous Motor (Permanent Magnet Motor) Control

To control a synchronous motor (permanent magnet motor), you need to set up the motor constant. Refer to *6-2 Settings for Motor Related Parameter* on page 6-8. The motor constant is data corresponding to one phase of Y-connection including wiring.
For synchronous motor (permanent magnet motor) control, you can select synchronous start type sensorless vector control or IVMS start type sensorless vector control.

Precautions for Correct Use

- Check the current limit at which the motor does not demagnetize. The maximum current of the motor is 150% of**Over current detection level**(bb160). You can protect the motor with this setting. Note that the maximum current is the peak value, not the effective value. The rated output current shown in the specification table is an effective value.
- This control method can be used for reduced torque applications where the motor that has the same frame number as the inverter's rating needs a torque at the start that is 50% or smaller. This method cannot be used for applications that require high torque from low speeds or for applications that involve rapid acceleration or deceleration. In particular, never use this method for applications involving a gravity load, such as lifts.
- Synchronous motors (permanent magnet motors) cannot be operated by a direct input from the commercial power supply.
- Multiple synchronous motors (permanent magnet motors) cannot be driven by a single inverter.
- Synchronous motors (permanent magnet motors) are more likely to cause an overvoltage error (E007) than asynchronous motors (induction motors). If the rapid deceleration and/or the DC braking function need to be used, consider the possible use of an optional braking resistor or a regenerative braking unit.
- When a hold brake is used, release the brake before the motor starts operation. Otherwise, the motor may lose its synchronism.
- The motor may rotate in the reverse direction at the start of its rotation. Use**Starting Method for Sync.M**(Hd132) to prevent reverse rotation.
- Set**Carrier speed setting**(bb101) at a value of 8.0kHz or higher. Some low carrier frequencies may make the motor generate a lot of heat.
- The tolerable load moment of inertia is 50 times as large as the motor's moment of inertia or smaller. For some applications whose loads moment of inertia exceed the above mentioned range, sufficient characteristics may not be obtained.
- When driving a motor whose**Sync.Motor rated current**(Hd108) exceeds the inverter rated current or a motor whose frame number is smaller than the maximum applicable motor by 2 or more, sufficient characteristics may not be obtained.
- Set**Electronic thermal level setting**(bC110) in addition to**Sync.Motor rated current**(Hd108).
- If the initial position estimation is enabled in**Starting Method for Sync.M**(Hd132), a shrill sound caused by the position detection action may be heard, but this sound has nothing to do with any abnormality.
- If the initial position estimation is enabled in**Starting Method for Sync.M**(Hd132), start the operation from the state in which the motor stopped. Failure to acquire the correct position may occur, which may result in unintended rotation, over current, or loss of synchronization.

Additional Information

- If the wiring length is long (approximately longer than 20 m), the motor may not exhibit sufficient characteristics.
- If the wiring length is long (approximately longer than 20 m), frequency-synchronized re-start may cause an overcurrent error (E001).

Disabled Functions

The following functions cannot be used when the synchronous motor (permanent magnet motor) control is applied.

Even when these functions are enabled by parameter settings, they are actually disabled.

Item	Parameter	Description
Functions associated with torque control	FA-15, FA-16, dA-15, and dA-16	Torque command monitoring function
	Ad-01 to Ad-04, Ad-40 to Ad-43, and Input terminal [67: ATR]	Torque controlling function
	Ad-11 to Ad-14, and Input terminal [68: TBS]	Torque biasing function
	bA110 to bA116, bA210 to bA216, Input terminals [60: TL], [61: TRQ1], and [62: TRQ2], and Output terminal [22: TRQ]	Torque limiting function
	CE120 to CE123, and Output terminal [19: OTQ]	Over torque signal
Overcurrent suppression function	bA120 and bA121	Overcurrent suppression function
Functions associated with induction motor control	HA110	Stabilization adjustment gain
	Hb130, Hb131, HB140 to Hb142, Hb145, Hb146, Hb150 to Hb163, Hb170, Hb171, and Hb180	Functions associated with V/f control
	HC101 and HC102	Functions associated with automatic boost
	HC110 to HC114, HC120, and HC121	Sensorless vector control, Zero-speed range sensorless vector control
Part of gain mapping function	HA126 and HA129	Constant for I control
Part of auto-tuning	HA-01 = *02*	Rotating system tuning
	HA-03	Online auto-tuning
Commercial power supply switching function	Input terminal [35: CS]	Switching to commercial power supply
Acceleration or deceleration cancellation function	Input terminal [71: LAC]	Acceleration or deceleration cancellation function
Jogging operation	AG-20, AG-21, and Input terminal [29: JG]	Jogging operation function

Synchronous Start Type Sensorless Vector Control

At start-up, this control method operates in the order of magnetic-pole position estimation, synchronous start control, and sensorless vector control.
To use synchronous start type sensorless vector control, set **Control mode selection** (AA121) to *11: Synchronous start type sensorless vector control (SM/PMM)*.

In the magnetic-pole position estimation, you can select whether to start the motor after aligning the magnetic-pole positions with DC braking or after estimating the magnetic-pole positions.
If you want to start the motor after aligning the magnetic-pole positions with DC braking, set **Starting Method for Sync.M** (Hd132) to *00: Position estimation disabled*.
If you want to to start the motor after estimating the magnetic-pole positions, set **Starting Method for Sync.M** (Hd132) to *01: Position estimation enabled*.
If the magnetic poles and the output phases are unsynchronized by a great amount, or if a certain starting torque is required, use the DC braking at start-up to synchronize the magnetic-pole positions and the output phases before the acceleration. For details, refer to *7-4 DC Braking* on page 7-50.

Set the current during a synchronous starting in **DC braking force at start** (AF108). Even if **DC braking selection** (AF101) is set to *00: Disabled*, the settings in **DC braking force at start** (AF108) is effective. If the starting torque is insufficient, using IVMS start type sensorless vector control may improve it.
Set the frequency for switching from synchronous start control to sensorless vector control to **Minimum Frequency for Sync.M-SLV** (Hd130).

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	11	Use synchronous start type sensorless vector control (SM/PMM).	00
Speed response for Async.M	HA115	0 to 1000 (%)	Adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Minimum Frequency for Sync.M-SLV	Hd130	0 to 50 (%)	The frequency at which the sensorless vector control is started. Set the ratio to**Sync.Base frequency setting**(Hd104).	8
No-Load current for Sync.M-SLV	Hd131	0 to 100 (%)	Set the ratio of the no-load current to the rated current during the sensorless vector control.	10
Starting Method for Sync.M	Hd132	00	Initial position estimation is disabled.	00
		01	Initial position estimation is enabled.	
IMPE 0V wait number for Sync.M	Hd133	0 to 255	This is a stand-by adjustment value to stabilize the reference value for the initial position estimation detection.	10
IMPE detect wait number for Sync.M	Hd134	0 to 255	This is an adjustment value to stabilize the current rise of the initial position estimation operation.	10
IMPE detect number for Sync.M	Hd135	0 to 255	This is a detection-operation adjustment value of the initial position estimation operation.	30
IMPE voltage gain for Sync.M	Hd136	0 to 200 (%)	This is a output-voltage adjustment gain of the initial position estimation operation.	100
IMPE Mg-pole position offset	Hd137	0 to 359°	Make corrections when the initial position estimation operation has a certain error.	0
DC braking selection	AF101	01	Internal DC braking: enabled	00
DC braking force at start	AF108	0 to 100 (%)	Adjust the DC braking force. Setting of 100% will provide maximum braking force.	30
DC braking active time at start	AF109	0.00 to 60.00 (s)	Enabled during the internal DC braking. When the operation command is turned ON, DC braking is started.	0.00

Item	Parameter	Data	Description	Default
Over current detection level	bb160	Inverter ND rated current × (0.2 to 2.2)*1	Set the over current detection level.	2.2 × Inverter ND rated current

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V (When you operate with CX-Drive, set**Resister data selection**(CF-11) to*00: A, V*. When**Resister data selection**(CF-11) is not set to*00: A, V*, the data cannot be set or displayed correctly.)
2. Modbus: The current and the voltage vary depending on the setting of**Resister data selection**(CF-11).
When**Resister data selection**(CF-11) is set to*00: A,V*, units are 0.1A and 0.1V
When**Resister data selection**(CF-11) is set to*01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01% (Rated ratio)

If you cannot obtain sufficient characteristics, make the following adjustments.

Phenomenon	Assumed cause	Example of measures
At the start, the motor rotates temporarily in the opposite direction to the intended one.	Misalignment of the output phases and the motor's magnetic-pole positions	Enable the initial-position estimation function. (Set**Starting Method for Sync.M**(Hd132) to*01*.) If the motor moves slightly in the opposite direction even in the initial-position estimation function, make an adjustment by incrementing**IMPE Mg-pole position offset**(Hd137) by 5° at a time.
Over current occurs at the start.	• Insufficient starting torque • Misalignment of the output phases and the motor's magnetic-pole positions	• Enable the initial-position estimation function. (Set**Starting Method for Sync.M**(Hd132) to*01*.) • Set**DC braking selection**(AF101) to*01: Enabled*, and after the start, set the time needed for the motor to be stabilized in**DC braking active time at start**(AF109). In addition, make an adjustment by incrementing**DC braking force at start**(AF108) by 5% each time.
At the start, the motor loses synchronization and no acceleration is observed.		
A long starting time is required.	A long phase-synchronization time is required.	When the magnetic-pole positions are synchronized in the DC braking at start-up, enable the initial-position estimation function instead of the DC braking at start-up. (Set**Starting Method for Sync.M**(Hd132) to*01: Enabled*.)
Fluctuating rotations occur at low speeds (at the minimum frequency (switch) or even lower).	Insufficient starting torque	Make an adjustment by incrementing**DC braking force at start**(AF108) by 5% each time.
Hunting occurs at low speeds (at the minimum frequency (switch) or even lower).	There is a motor constant error.	Decrement**Sync.Motor constant R**(Hd110) little by little until the value reaches 0.7 times the set value.
		Increment little by little each of **Sync.Motor constant Ld** (Hd112) and **Sync.Motor constant Lq**(Hd114) until they reach their respective values = set values × 1.4. Note, however that Ld ≤ Lq.
Shock or over current occurs at around the minimum frequency (switch).	The speed response is too low.	Make an adjustment by incrementing**Speed response for Async.M**(HA115) by 5% each time.
	Load fluctuation occurs at around the switch.	Adjust**Minimum Frequency for Sync.M-SLV**(Hd130).

Phenomenon	Assumed cause	Example of measures
Hunting occurs at higher speeds (at the minimum frequency (switch) or higher).	Unsynchronized speed response.	Adjust**Speed response for Async.M**(HA115) by 5% each time. You can increment or decrement it to adjust.
	Distorted wave form of the radio wave.	Make an adjustment by incrementing**No-Load current for Sync.M-SLV**(Hd131) by 5% each time.
A long initial position estimation time is required.	Set value for the estimation is too large.	Lower the values of**IMPE 0V wait number for Sync.M**(Hd133) to**IMPE detect number for Sync.M**(Hd135) by the same ratio.*1
A movement in the opposite direction occurs while the initial position estimation is being used.	The estimation is improperly conducted.	Increment the values of**IMPE 0V wait number for Sync.M**(Hd133) to**IMPE detect number for Sync.M**(Hd135) by the same ratio. Or, increment**IMPE voltage gain for Sync.M**(Hd136) by 5% each time.
While the initial position estimation is being used, an overcurrent error occurs.	Voltage gain is too high.	Decrement**IMPE voltage gain for Sync.M**(Hd136) by 5% each time.
Frequency-synchronized re-start causes errors.	Too high rotation speeds and too large offset of the phases.	Make an adjustment by incrementing**Speed response for Async.M**(HA115) by 5% each time. Waiting a longer time for the re-start may improve the situation.

*1. Too low a value may result in an operation in the opposite direction.

Precautions for Correct Use

- When the rotation of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. If the adjustment mentioned above makes no improvement, check if there is anything that interferes with the motor rotation.
- If an application of load results in a great amount of change in**Output frequency monitor**(dA-01) of the inverter, a function that automatically changes the frequency, such as the overload limiting function, the momentary power interruption non-stop function, or the over voltage suppression function, may be working depending on the inverter settings.

IVMS Start Type Sensorless Vector Control

This control method can generate higher torque from the start than the synchronous start type sensorless vector control.
If the synchronous start type sensorless vector control does not provide sufficient torque, you can use IVMS start type sensorless vector control to improve the characteristics.

To use IVMS start type sensorless vector control, set **Control mode selection** (AA121) to *12: IVMS start type sensorless vector control (SM/PMM)*.
IVMS start type sensorless vector control requires IVMS-specific adjustments in addition to the synchronous start type sensorless vector control settings. When starting the adjustment, first perform IVMS auto-tuning and test run with the load removed.
At start-up, this control method operates in the order of magnetic-pole position estimation, IVMS start control, and sensorless vector control.

In this control mode, only the parameters set by the first setting are enabled. You cannot use the second setting. In the magnetic-pole position estimation, you can select whether to start the motor after aligning the magnetic-pole positions with DC braking or after estimating the magnetic-pole positions.
If you want to start the motor after aligning the magnetic-pole positions with DC braking, set **Starting Method for Sync.M** (Hd132) to *00: Position estimation disabled*. In this case, the motor starts on the assumption that the magnetic-pole positions match the output phases at the time of starting. If the motor magnetic pole positions at stop and the inverter output phases at start are unsynchronized by a great amount, the start will fail. Therefore, use the DC braking at start-up (DB at start) to synchronize the magnetic-pole positions and the output phases before the start.
If you want to to start the motor after estimating the magnetic-pole positions, set **Starting Method for Sync.M** (Hd132) to *01: Position estimation enabled*.

Precautions for Correct Use

- Some SM/PMM may be unable to start in the IVMS start type sensorless vector control.
- IVMS start type sensorless vector control requires precise adjustments.
- By setting **Auto-tuning selection** (HA-01) to *03: IVMS*, check that the target motor can be operated by IVMS start type sensorless vector control. If the auto-tuning fails, the target motor is not applicable to this control method. Consider operating the motor with synchronous start type sensorless vector control.
- IVMS start type sensorless vector control requires re-adjustment when the inverter is replaced. If you need to recover an inverter in a short time, for example after replacing the malfunctioning inverter with a new one, use the synchronous start type sensorless vector control.
- As IVMS start type sensorless vector control is a very special control, the inverter may make a unique operation sound as the starting sound.

● Parameters for IVMS Start Method

Item	Parameter	Data	Description	Default
Carrier frequency at IVMS	Hd-41	0.6 to 16.0 (kHz)	Set the carrier frequency during the IVMS drive. Usually, the value does not require to change.	2.00
Filter gain of current detection at IVMS	Hd-42	0 to 1000	The filter adjustment gain applied to the detection current during the IVMS drive.	100
Open phase voltage detection gain	Hd-43	00 to 04	The adjustment gain applied to the detection voltage during the IVMS drive.	00
Open phase switching threshold compensation	Hd-44	00	IVMS correction: Disabled (make no correction)	01
		01	IVMS correction: Enabled (make correction)	
P-Gain for speed control, SM(PMM)-IVMS	Hd-45	0 to 1000	Speed control P gain during the IVMS drive. A larger value enhances the responsiveness of the speed control.	100
I-Gain for speed control, SM(PMM)-IVMS	Hd-46	0 to 10000	Speed control I gain during the IVMS drive. A larger value enhances the responsiveness of the speed control.	100
Wait time for open phase switching, SM(PMM)-IVMS	Hd-47	0 to 1000	Waiting time for the open-phase switching during the IVMS drive. A larger value enhances the stability.	15

Item	Parameter	Data	Description	Default
Limitation of decision about the drive direction, SM(PMM)-IVMS	Hd-48	00	Rotation-direction determination: Disabled (no restriction)	01
		01	Rotation-direction determination: Enabled (restricted to the operation-command direction)	
Open phase voltage detection timing adjustment, SM(PMM)-IVMS	Hd-49	0 to 1000	Adjustment value of the IVMS detection timing. Usually, the value does not require to change.	10
Minimum pulse width adjustment, SM(PMM)-IVMS	Hd-50	0 to 1000	Adjust the width of the voltage pulse during the IVMS drive. A larger value renders the pulse width wider.	100
IVMS Current Limit for threshold	Hd-51	0 to 255	Set a limit on each of the upper and the lower limits of the detection current during the IVMS drive. Enabled when**Open phase switching threshold compensation**(Hd-44) is set to*01: Enabled*.	100
IVMS Threshold Gain	Hd-52	0 to 255	Adjust the IVMS auto-tuning value.	100
IVMS Carrier frequency start/end point	Hd-58	0 to 50 (%)	Adjust the point where the carrier frequency is switched in IVMS start type sensorless vector control. Usually, the value does not require to change.	5

● Parameters Common to IVMS Start Method and Synchronous Start Method

Item	Parameter	Data	Description	Default
Control mode selection	AA121	12*1	Use IVMS start type sensorless vector control (SM/PMM).	00
Speed response for Async.M	HA115	0 to 1000 (%)	Adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Minimum Frequency for Sync.M-SLV	Hd130	0 to 50 (%)	The frequency at which the sensorless vector control is started. Set the ratio to**Sync.Base frequency setting**(Hd104).	8
No-Load current for Sync.M-SLV	Hd131	0 to 100 (%)	Set the ratio of the no-load current to the rated current during the sensorless vector control.	10
Starting Method for Sync.M	Hd132	00	Initial position estimation is disabled.	00
		01	Initial position estimation is enabled.	
IMPE 0V wait number for Sync.M	Hd133	0 to 255	This is a stand-by adjustment value to stabilize the reference value for the initial position estimation detection.	10

Item	Parameter	Data	Description	Default
IMPE detect wait number for Sync.M	Hd134	0 to 255	This is an adjustment value to stabilize the current rise of the initial position estimation operation.	10
IMPE detect wait number for Sync.M	Hd135	0 to 255	This is a detection-operation adjustment value of the initial position estimation operation.	30
IMPE voltage gain for Sync.M	Hd136	0 to 200 (%)	This is a output-voltage adjustment gain of the initial position estimation operation.	100
IMPE Mg-pole position offset	Hd137	0 to 359 (°)	Make corrections when the initial position estimation operation has a certain error.	0
DC braking selection	AF101	01	Internal DC braking: Enabled	00
DC braking force at start	AF108	0 to 100 (%)	Adjust the DC braking force. Setting of 100% will provide maximum braking force.	30
DC braking active time at start	AF109	0.0 to 60.0 (s)	Enabled during the internal DC braking. When the operation command is turned ON, DC braking is started.	0.00
Over current detection level	bb160	Inverter ND rated current × (0.20 to 2.20)	Set the over current detection level.	2.20 × Inverter ND rated current

*1. Cannot be selected if **Load type selection** (Ub-03) is *00: Very low duty (VLD)*.

● Set-up Procedures for IVMS Start Type Sensorless Vector Control

1 Set the protection for the PM motor.

- **Over current detection level** (bb160)
- **Electronic thermal level setting** (bC110)

See also *6-6-1 Motor Electronic Thermal* on page 6-53 and set them appropriately.

Precautions for Correct Use

- Check the limit current that does not cause demagnetization to protect the motor.
- To protect the motor, set **Over current detection level** (bb160) of the inverter appropriately. Set the value so that 150% of (bb160) does not exceed the maximum value of the motor current. (Note the effective value is different from the peak value. Generally, the rated output current shown in the specification table is an effective value.)

2 Set nameplate data of the PM motor. Set the following parameters.

- **Sync.Motor capacity setting** (Hd102)
- **Sync.Motor poles setting** (Hd103)
- **Sync.Base frequency setting** (Hd104)
- **Sync.Maximum frequency setting** (Hd105)
- **Sync.Motor rated voltage** (Hd106)
- **Sync.Motor rated current** (Hd108)

See also *6-2-1 Motor Basic Settings* on page 6-8 and set them appropriately.

3 Set the PM motor constants. Set the following parameters.

- **Sync.Motor constant R** (Hd110)
- **Sync.Motor constant Ld** (Hd112)
- **Sync.Motor constant Lq** (Hd114)
- **Sync.Motor constant Ke** (Hd116)
- **Sync.Motor constant J** (Hd118)

See also *6-2-2 Motor Constant Settings* on page 6-12 and set them appropriately.

4 Conduct the IVMS auto-tuning.

1) Set **Control mode selection** (AA121) to *12: IVMS start type sensorless vector control (SM/PMM)*.
2) Set **Auto-tuning selection** (HA-01) to *03: IVMS*.
3) Input the operation command for starting the auto-tuning.
4) The inverter is in an automatic operation.
5) Tuning is finished.

For the procedures from the start to the end of auto-tuning, see *6-2-3 Auto-tuning of Motor* on page 6-13 and follow the procedures.

Additional Information

- When performing IVMS auto-tuning, do not attach anything to the motor shaft.
- Conduct IVMS auto-tuning as rotating the motor shaft little by little. When the motor shaft is locked, or when the load is heavy, even a normal finish of the auto-tuning may result in a adjustment failure.
- When an over current occurs during the automatic operation of the IVMS auto-tuning, check the following items.
  - Motor lock caused by braking and/or foreign objects.
  - Setting of **Over current detection level** (bb160)

  Check these items, and when there is no problem, conduct the IVMS auto-tuning by incrementing **Minimum pulse width adjustment, SM(PMM)-IVMS** (Hd-50) by 10 each time.
- The IVMS auto-tuning can take up to 5 minutes.

5 Carry out a test run. Set the following parameters and check that stable drive can be provided for the forward rotation, the reverse rotation, the acceleration, and the deceleration.

1) Set **Main Speed reference monitor** (FA-01) at a value that is smaller than **Minimum Frequency for Sync.M-SLV** (Hd130) and run the test.
2) Set **Main Speed reference monitor** (FA-01) at a value that is larger than **Minimum Frequency for Sync.M-SLV** (Hd130) and run the test.

Stable operation.
Finish the test run.

Unstable operation.

Change the following parameter settings and go back to *4. Conduct the IVMS auto-tuning* on page 7-30.

1. Adjust by incrementing the value of **Open phase voltage detection gain** (Hd-43) from *00* to *03* by one each time.
2. Adjust by incrementing the value of **Minimum pulse width adjustment, SM(PMM)-IVMS** (Hd-50) by 10 each time.

Precautions for Correct Use

When you make the adjustment repeatedly but cannot conduct a test run, it may be due to the unavailability of IVMS start type sensorless vector control for use. Use synchronous start type sensorless vector control.

6 Conduct regular operation.

- Assemble the target motor to a load device to be actually driven, and check if the start operation is stable. The drive performance may be improved by making a parameter adjustment with reference to the following.
- For higher speeds (at the minimum frequency (switch) or higher) adjustments, the control is common to the synchronous start type sensorless vector control, so check the adjustment items for the synchronous start type sensorless vector control.

Precautions for Correct Use

After assembling the motor to the load device, do not change the following set parameters. The operation may become unstable.

- **Open phase voltage detection gain** (Hd-43)
- **Minimum pulse width adjustment, SM(PMM)-IVMS** (Hd-50)

● Asjustment Description

Phenomenon	Assumed cause	Example of measures
Over current occurs at the start. At the start, the motor loses synchronization and no acceleration is observed.	• Insufficient starting torque • Misalignment of the output phases and the motor's magnetic-pole positions	• Enable **Open phase switching threshold compensation** (Hd-44). Adjust each value of **P-Gain for speed control, SM(PMM)-IVMS** (Hd-45) or **I-Gain for speed control, SM(PMM)-IVMS** (Hd-46) by 10 each time. Some motor characteristics require an adjustment by raising and lowering the settings. • Adjust by incrementing the value of **Wait time for open phase switching, SM(PMM)-IVMS** (Hd-47) by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.

<table>
<tr><th>Phenomenon</th><th>Assumed cause</th><th>Example of measures</th></tr>
<tr><td>Loss of synchronization, hunting, and/or over current occur at low speeds (at the minimum frequency (switch) or even lower).</td><td rowspan="2">• Insufficient torque
• Misalignment of the output phases and the motor's magnetic-pole positions</td><td rowspan="2">• Enable Open phase switching threshold compensation (Hd-44).
Adjust each value of P-Gain for speed control, SM(PMM)-IVMS (Hd-45) or I-Gain for speed control, SM(PMM)-IVMS (Hd-46) by 10 each time.
Some motor characteristics require an adjustment by raising and lowering the settings.
• Adjust by incrementing the value of Wait time for open phase switching, SM(PMM)-IVMS (Hd-47) by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.
• Adjust by decrementing the value of IVMS Current Limit for threshold (Hd-51) by 5 each time. Some motor characteristics may provide instability with excessively small settings.
• Adjust by decrementing the value of IVMS Threshold Gain (Hd-52) by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.</td></tr>
<tr><td>Loss of synchronization, hunting, and/or over current occur at low speeds (at the minimum frequency (switch) or even lower) and with a heavy load.</td></tr>
<tr><td>The drive becomes unstable at low speeds (at the minimum frequency (switch) or even lower).</td><td>Misalignment of the output phases and the motor's magnetic-pole positions</td><td>• Adjust by decrementing the value of Filter gain of current detection at IVMS (Hd-42) by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.
• Adjust by incrementing the value of Wait time for open phase switching, SM(PMM)-IVMS (Hd-47) by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.</td></tr>
</table>

7-3 Torque Control

7-3-1 Speed Control and Torque Control

There are two methods to control the motor.

- Speed control: Control to generate a torque that follows the motor speed according to the frequency command.
- Torque control: Control the motor output torque to follow the torque command

Both control methods control the output frequency and output voltage in order to generate torque.

	Speed control	Torque control
Control	Controlled to maintain the motor speed per frequency command.	Controlled to output the motor torque per torque command.
Operation	When the load is changed, output will be controlled to maintain the speed. When the load increases, the torque is controlled to be higher, and when the load decreases, the torque is controlled to be lower.	When the load is changed, output will be controlled to maintain the torque. By changing the rotation speed according to the load and external force, the torque is controlled to follow the command.
Control mode selection (AA121)	All control methods	08: Sensorless vector control (IM) 10: Vector control with sensor (IM)

	Speed control with torque limit
Control	The control that maintains the motor speed according to the frequency command and the torque limit function that limits the output torque not to exceed the upper limit operate at the same time.
Operation	When the load is changed, output will be controlled to maintain the speed. When the load increases, the torque is controlled to be higher, and when the load decreases, the torque is controlled to be lower. When the output torque exceeds the limit value, torque limit control takes precedence over speed control.
Control mode selection (AA121)	08: Sensorless vector control (IM) 09: Zero-Hz range sensorless vector control (IM) 10: Vector control with sensor (IM)

7-3-2 Control Gain Switching

When you want to switch the motor response depending on the conditions such as the rotation direction of the machine and the high speed or low speed.

There are two types of control gain switching functions, which can be selected with **ASR gain switching mode selection** (HA120).

- Control gain switching function: Two types of gain can be switched by turning the input terminal function [CAS] ON/OFF.
- Control gain mapping function: Four types of gain can be switched according to the speed.

To use this function, you need to set sensorless vector control, zero-speed range sensorless vector control, or vector control with sensor in **Control mode selection** (AA121).

● Parameter

Item	Parameter	Data	Description	Default
ASR gain switching mode selection	HA120	00	Switch gain 1 and 2 by the [CAS] terminal.	00
		01	Switch the gain according to the speed.	
ASR gain switching time setting	HA121	0 to 10000 (ms)	Switch the gain over the set time when [CAS] gain is switched.	100
ASR gain mapping intermediate speed 1	HA122	0.00 to 590.00 (Hz)	The frequency for which the control gain 2 of the gain mapping function is applied.	0.00
ASR gain mapping intermediate speed 2	HA123	0.00 to 590.00 (Hz)	The frequency for which the control gain 3 of the gain mapping function is applied.	0.00
ASR gain mapping Maximum speed	HA124	0.00 to 590.00 (Hz)	The frequency for which the control gain 4 of the gain mapping function is applied.	0.00
ASR gain mapping P-gain 1	HA125	0.0 to 1000.0 (%)	Set the P gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping I-gain 1	HA126	0.0 to 1000.0 (%)	Set the I gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping P-gain 1 at P-control	HA127	0.0 to 1000.0 (%)	Set the P gain of P control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping P-gain 2	HA128	0.0 to 1000.0 (%)	Set the P gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping I-gain 2	HA129	0.0 to 1000.0 (%)	Set the I gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping P-gain 2 at P-control	HA130	0.0 to 1000.0 (%)	Set the P gain of P control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping P-gain 3	HA131	0.0 to 1000.0 (%)	Set the P gain of PI control when the gain mapping intermediate speed is at 2.	100.0
ASR gain mapping I-gain 3	HA132	0.0 to 1000.0 (%)	Set the I gain of PI control when the gain mapping intermediate speed is at 2.	100.0
ASR gain mapping P-gain 4	HA133	0.0 to 1000.0 (%)	Set the P gain of PI control at the gain mapping maximum speed.	100.0
ASR gain mapping I-gain 4	HA134	0.0 to 1000.0 (%)	Set the I gain of PI control at the gain mapping maximum speed.	100.0

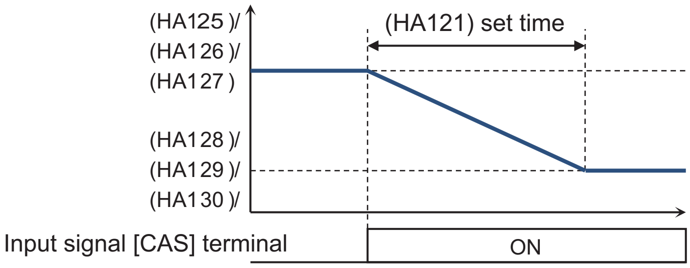
● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
P/PI control switch	PPI	063	OFF: Proportional Integral (PI) control ON: Proportional (P) control

Item	Terminal name	Data	Description
Control gain switch	CAS	064	Switch the gain. OFF: Gain 1 ON: Gain 2

Control Gain Switching Function

The control gain switching function switches the gain by turning the [CAS] terminal OFF/ON.
To use the control gain switching function, set **ASR gain switching mode selection** to *00: [CAS] terminal*.
Assign the control gain switch [64: CAS] to one of **Input terminal function** (CA-01) to (CA-11). Gain 1 and gain 2 can be switched by turning the [CAS] terminal OFF/ON.

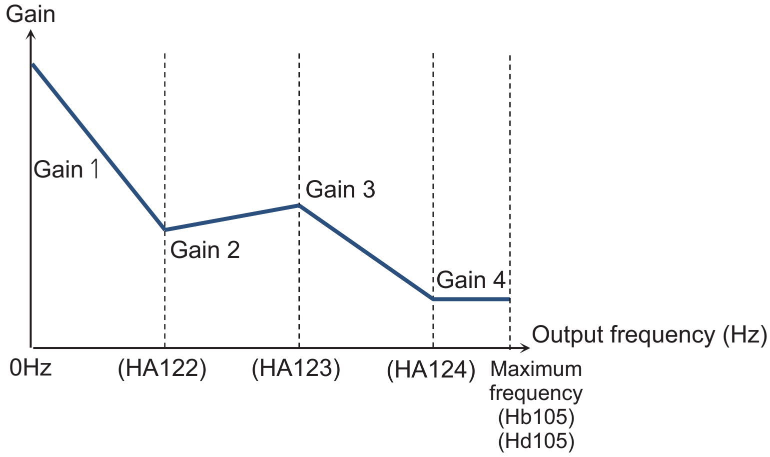


Switching between P control and PI control with the [PPI] terminal changes the applied gain.
The applied gains with the combination of the [PPI] and [CAS] terminals are as follows.

Terminal function	Applied gain	[PPI] OFF	[PPI] ON
[CAS] OFF	Gain 1	PI control P gain 1 (HA125) PI control I gain 1 (HA126)	P control P gain 1 (HA127)
[CAS] ON	Gain 2	PI control P gain 2 (HA128) PI control I gain 2 (HA129)	P control P gain 2 (HA130)

Control Gain Mapping Function

The control gain mapping function switches control gains according to the output frequency.
To use the control gain mapping function, set **ASR gain switching mode selection** (HA120) to *01: Setting switch*.



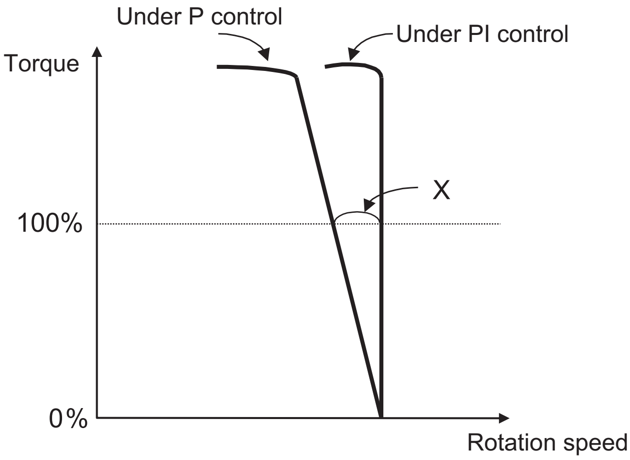
Switching between P control and PI control with the [PPI] terminal changes the applied gain.
The applied gains when switching between the control gain mapping function and the [PPI] terminal are as follows.

Output frequency	Applied gain	[PPI] OFF	[PPI] ON
Below Intermediate speed 1 (HA122)	Gain 1	PI control P gain 1 (HA125) PI control I gain 1 (HA126)	P control P gain 1 (HA127)
Intermediate speed 1 (HA122) or above	Gain 2	PI control P gain 2 (HA128) PI control I gain 2 (HA129)	P control P gain 2 (HA130)
Intermediate speed 2 (HA123) or above	Gain 3	PI control P gain 3 (HA131) PI control I gain 3 (HA132)	
Maximum frequency (HA124) or above	Gain 4	PI control P gain 4 (HA133) PI control I gain 4 (HA134)	

When using this function with SM/PMM control, P gain is adopted.
There are four types of PI control gain and two types of P control gain. If the [PPI] terminal is ON (P control) when the control gain mapping function is used, gain 2 (HA130) is applied for **ASR gain mapping intermediate speed 1** (HA122) or above.

7-3-3 P/PI Switching function

This function switches the control gain (ASR gain) of motor control from Proportional Integral (PI) control to Proportional (P) control.
When the motor control is switched to Proportional (P) control, the overall gain of a speed control loop is reduced, which has the effect of suppressing vibration, etc.
To use the P/PI switching function, assign the PPI control switch [63: PPI] terminal to one of **Input terminal function** (CA-01) to (CA-11). You can switch between PI control and P control by turning the [PPI] terminal OFF/ON.



For the above figure, the relational expression for obtaining the P control P gain is as follows.

$$\text{(P control P gain)} = \frac{10}{\text{(Speed fluctuation ratio)}} \%$$

The relationship between speed fluctuation ratio and speed tolerance is calculated based on the following schematic formula.

$$\text{(Speed fluctuation ratio)} = \frac{\text{Speed tolerance at the rated torque X(min}^{-1}\text{)}}{\text{Synchronous rotation at the base speed (min}^{-1}\text{)}} \times 100\%$$

To use this function, you need to set sensorless vector control, zero-speed range sensorless vector control, or vector control with sensor in**Control mode selection**(AA121).

● Parameter

Item	Parameter	Data	Description	Default
ASR gain mapping P-gain 1 at P-control	HA127	0.0 to 1000.0 (%)	This is the P gain at P control used when the output frequency is less than **ASR gain mapping intermediate speed 1** (HA122).	100.0
ASR gain mapping P-gain 2 at P-control	HA130	0.0 to 1000.0 (%)	This is the P gain at P control used when the output frequency is **ASR gain mapping intermediate speed 1** (HA122) or higher (or when the [CAS] terminal is ON).	100.0

When switching the gain, refer to *7-3-2 Control Gain Switching* on page 7-33.

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
P/PPI control switch terminal	PPI	63	OFF: Proportional Integral (PI) control ON: Proportional (P) control

7-3-4 Torque Limit Function

This function limits the torque so that it does not become too high by using contact positioning control, etc.
To use the torque limit function, you need to set sensorless vector control, zero-speed range sensorless vector control, or vector control with sensor in **Control mode selection** (AA121). When zero-speed range sensorless vector control is used, the torque limit function does not work in the zero-speed range. The control to generate the torque is prioritized.
The torque limit function is enabled in all of the speed control, position control, and torque control.

There are three types of torque limit functions.

- Torque limit by analog input
- Torque limit by quadrant-specific setting
- Torque limit by terminal switching

The torque reference value (100%) for this function is calculated as follows.
Torque reference value = 79.58 x motor capacity x number of poles / base frequency

(Example) Torque reference value = 79.58 x 5.5 (kW) x 4 (P) / 50 (Hz) ≒ 35Nm

Therefore, the output torque varies depending on the motor to be combined. Note that it is not the absolute value of torque.

● Parameter

Item	Parameter	Data	Description	Default
Torque limit selection	bA110	00 to 11	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3	07
Torque limit parameter mode selection	bA111	00	Four quadrant specific	00
		01	[TRQ] and [TRQ2] terminal switch	
Torque limit 1 Torque limit 2 Torque limit 3 Torque limit 4	bA112 bA113 bA114 bA115	0.0 to 500.00 (%)	The torque limit function will be on when the output torque exceeds this set value.	150.0

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Validation of torque limit	TL	60	Switch between enable and disable of the torque limit function.
Torque limit switchover 1	TRQ1	61	Switch terminal 1 of the torque limit command.

Item	Terminal name	Data	Description
Torque limit switchover 2	TRQ2	62	Switch terminal 2 of the torque limit command.

● **Output Terminal Function (CC-01) to (CC-07)**

Item	Terminal name	Data	Description
During torque limitation	TRQ	22	ON: Torque limit function is enabled.

Torque Limit by Analog Input

By selecting the Ai1, Ai2, or Ai3 terminal on the control terminal block in **Torque limit selection** (bA110), you can specify the torque limit value according to the applied voltage and current. The specified torque limit value is applied when torque limit is enabled in each operating status.

Torque values corresponding to analog input are as follows.

- Input to Ai1/Ai2 Terminal

0 to 10 (V) and 0 to 20 (mA) corresponding value
Torque command addition 0.0 to 500.0 (%)

- Input to Ai3 Terminal

-10 to 10 (V) corresponding value
Torque command addition -500.0 to 500.0 (%)

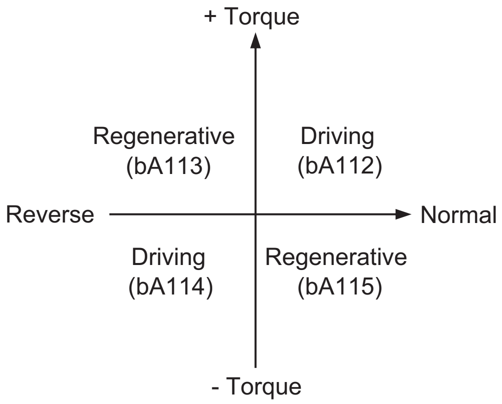
The ratio of torque command can be changed by adjusting the analog input start end function.

(Example) When specifying the torque bias addition value with the voltage input
When setting the torque command addition value to 0.0 to 50.0% for the input of 0 to 10 (V) to the [Ai1] terminal, you need to set **End value of Terminal [Ai1]** (Cb-04) to 10.0% so that the maximum value of 500.0% for the above torque command addition is changed to 50.0%.
((Cb-03)=0.0, (Cb-04)=10.0, (Cb-05)=0.0, and (Cb-06)=100.0)
For the setting method of each parameter, refer to*8-12 Analog Input Terminal Function* on page 8-176.

Torque Limit by Quadrant-specific Setting

It is a mode to set respective torque limits in the quadrants of forward driving, forward regenerative, reverse driving, and reverse regenerative. When setting **Torque limit selection** (bA110) to *07: Parameter setting* and **Torque limit parameter mode selection** (bA111) to *00: Four quadrant specific*, the four limit values ((bA112) to (bA115)) are enabled.
The relationship of quadrants and torque limits is shown in the figure below.

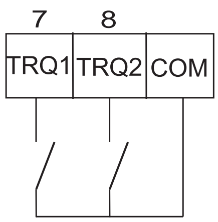
Enabled torque limit value



Torque Limit by Terminal Switching

It is a mode to switch the torque limits 1 (bA112) through 4 (bA115) by turning the input terminal ON/OFF.
When setting **Torque limit selection** (bA110) to *07: Parameter setting* and **Torque limit parameter mode selection** (bA111) to *01: [TRQ] terminal switch*, the torque limits 1 (bA112) through 4 (bA115) are switched by the ON/OFF signal to the input terminal.

(Setting example)
Set**Torque limit selection**(bA110) to*07: Parameter setting*
Set**orque limit parameter mode selection**(bA111) to*01: [TRQ] terminal switch*
Set**Input terminal [7] function**(CA-07) to*061: TRQ1 Torque limit switchover 1*
Set**Input terminal [8] function**(CA-08) to*062: TRQ2 Torque limit switchover 2*



The limit value can be specified by an external switch as follows.

[TRQ1]	[TRQ2]	Applied limit value	
		Item	Parameter
OFF	OFF	Torque limit 1	bA112
ON	OFF	Torque limit 2	bA113
OFF	ON	Torque limit 3	bA114
ON	ON	Torque limit 4	bA115

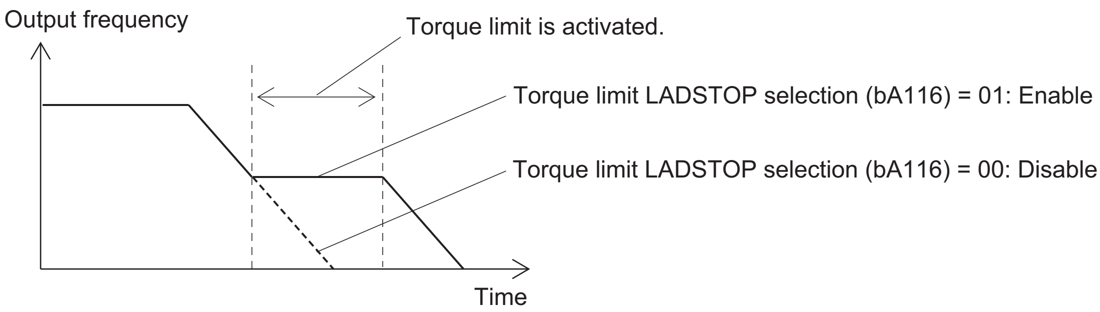
Torque LAD Stop Function

This function is used to stop the limit acceleration/deceleration function (LAD) temporarily and hold the frequency command when the torque limit function is operated. When the torque limit is reset, the limit acceleration/deceleration function (LAD) is resumed from the held frequency command.

This function operates only during the deceleration on the speed control. If the motor operation becomes unstable after the torque limit is reset, setting this function will stabilize it.
To use the torque LAD stop function, set **Torque limit LADSTOP selection** (bA116) to *01: Enabled*.

● Parameter

Item	Parameter	Data	Description	Default
Torque limit LADSTOP selection	bA116	00	Disabled	00
		01	Enabled: Retain frequency information when the torque limit is switched. (at the time of deceleration operation)	



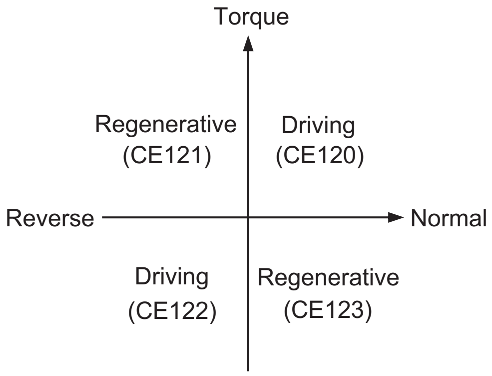
Over torque Signal Output

This function turns ON the output terminal when the torque value being output to the motor exceeds the over torque level.
It is used to detect the brake release signal of a lift and an abnormally high load.

To use this function, assign the over torque [19: OTQ] terminal to one of **Output terminal function** (CC-01) to (CC-05) or **Relay output terminal function** (CC-06) to (CC-07).
Set the over torque level to **Over torque level (Forward driving)** (CE120) to **Over torque level (Forward regenerative)** (CE123).
When the value of **Output torque monitor** (dA-17) exceeds the set over torque level, the [19: OTQ] terminal turns ON.
When using the [19: OTQ] terminal as an under torque signal, select *01: Normally closed* in **Output terminal active state** (CC-11) to (CC-17) of the output terminal function for which [19: OTQ] is set.

The torque reference value (100%) for this function is calculated as follows.
Torque reference value = 79.58 x motor capacity x number of poles / base frequency

(Example) In the case of 3G3RX2-A2055 (5.5kW)
Torque reference value = 79.58 x 5.5 (kW) x 4 (P) / 50 (Hz) ≒ 35Nm



● **Parameter**

Item	Parameter	Data	Description	Default
Over torque level (Forward driving)	CE120	0.0 to 500.0 (%)	Turn ON the [OTQ] terminal when the output torque exceeds the respective levels.	100.0
Over torque level (Reverse regenerative)	CE121			
Over torque level (Reverse driving)	CE122			
Over torque level (Forward regenerative)	CE123			

● **Output Terminal Function (CC-01) to (CC-07)**

Item	Terminal name	Data	Description
Over torque	OTQ	19	A signal turns ON when the output torque exceeds the over torque level.

Torque Limit Value Monitor

The torque limit value while the torque limit function is operating can be checked on **Torque limit monitor** (dA-16).

In the following cases, the value in **Torque limit monitor** (dA-16) is disabled. The number read out when the monitor is disabled is not the current torque limit value.

- When the torque limit function is disabled. Set **Torque limit selection** (bA110) to *00: Disabled*.
- When disabled by the TL terminal. Set [60: TL] to the input terminal function and turn OFF the [TL] terminal.
- When quadrant-specific mode is used. Set **Torque limit parameter mode selection** (bA111) to *00: Four quadrant specific* and **Torque limit selection** (bA110) to *07: Parameter setting*.

● **Parameter**

Item	Parameter	Data	Description	Default
Torque limit monitor	dA-16	-500.00 to 500.00 (%)	Display the limit value of the torque limit.	-
Output torque monitor	dA-17	-500.00 to 500.00 (%)	Display the output torque.	-

7-3-5 High-torque Multi-operation Control

High-torque multi-operation control can output high torque when two motors with the same specifications are connected to one inverter and sensorless vector control (IM) is carried out.
To use high-torque multi-operation control, set the parameters according to the following descriptions of the motor basic parameter, IM motor constant parameter, and parameter.

When two motors drive different loads, the load fluctuation on one motor may influence the operation of the other motor and cause inappropriate control. Make sure that they drive a load that can be considered as one load.

● Motor Basic Parameter

Item	Parameter	Data	Description	Default
Async.Motor capacity setting	Hb102	0.01 to 160.00 (kW)	Set a 2-fold capacity of a motor in high-torque multi-operation.	Varies depending on inverter models and settings of load rating.
Async.Motor poles setting	Hb103	2 to 48 (poles)	Set the number of poles of a motor.	4
Async.Motor Base frequency setting	Hb104	1.00 to 590.00 (Hz)	Set the base frequency of a motor.	50.00*1
Async.Motor Maximum frequency setting	Hb105	1.00 to 590.00 (Hz)	Set the maximum frequency of a motor.	50.00*1
Async.Motor rated voltage	Hb106	1 to 1000 (V)	Set the rated voltage of a motor.	200V: 230*1 400V: 400*1
Async.Motor rated current	Hb108	0.01 to 10000.00 (A)	Set a 2-fold rated current of a motor in high-torque multi-operation.	Varies depending on inverter models and settings of load rating.

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

● IM Motor Constant Parameter

Item	Parameter	Data	Description	Default
Async.Motor constant R1	Hb110	0.000001 to 1000.000000 (Ω)	Set half of primary resistance of a motor in high-torque multi-operation.	Varies depending on inverter models and settings of load rating.
Async.Motor constant R2	Hb112	0.000001 to 1000.000000 (Ω)	Set half of secondary resistance of a motor in high-torque multi-operation.	
Async.Motor constant L	Hb114	0.000001 to 1000.000000 (mH)	Set half of leaked inductance value of a motor in high-torque multi-operation.	
Async.Motor constant Io	Hb116	0.01 to 10000.00 (A)	Set a 2-fold non-load current value of a motor in high-torque multi-operation.	
Async.Motor constant J	Hb118	0.00001 to 10000.00000 (kgm^2)	Sets a 2-fold system inertia moment of a motor in high-torque multi-operation.	

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	08: Sensorless vector control (IM) 09: Zero-Hz range sensorless vector control (IM)*1	Use the sensorless vector control function or szero-speed range sensorless vector control.	00

*1. Cannot be selected if **Load type selection** (Ub-03) is *01: Low duty (LD)* or *00: Very low duty (VLD)*.

For adjusments, refer to *7-2-6 Sensorless Vector Control* on page 7-15 and *7-2-7 Zero-speed Range (Zero-Hz Range) Sensorless Vector Control* on page 7-17.

7-3-6 Torque Bias Function

This function is used to increase the torque command value temporarily at time of the operation start or when a lift is going up or down.
The torque bias function is enabled when **Control mode selection** (AA121) is set to *08: Sensorless vector control (IM)*, *09: Zero-Hz range sensorless vector control (IM)*, or *10: Vector control with sensor (IM)*.
The torque bias function is enabled in any of speed control, position control, and torque control.

To use the torque bias function, set the torque bias command destination in **Torque bias input source selection** (Ad-11). Assign the validation of torque bias [68: TBS] to one of **Input terminal function** (CA-01) to (CA-11). When the [TBS] terminal is turned ON, the torque bias function is enabled.
In the torque bias function, switching between forward rotation and reverse rotation can switch the adding direction.

a. When **Polarity selection for torque bias** (Ad-13) is set to *00: As per the sign*.
   Regardless of the operation direction, torque will be added to the forward direction when the torque bias value is (+), and to the reverse direction, when the torque bias value is (-).

b. When **Polarity selection for torque bias** (Ad-13) is set to *01: Follow the revolution direction*
The operation command direction determines whether the torque bias value is added or subtracted.
Forward command: Adds the torque bias value to the torque with the forward direction as (+).
Reverse command: Adds the torque bias value to the torque with the reverse direction as (+).
When commanding the torque bias by the analog input, the torque bias values corresponding to the analog input are as follows.

- Input to Ai1/Ai2 Terminal

0 to 10 (V) and 0 to 20 (mA) corresponding value
Torque command addition 0.0 to 500.0 (%)

- Input to Ai3 Terminal

0 to 10 (V) and 0 to 20 (mA) corresponding value
Torque command addition 0.0 to 500.0 (%)

The setting of the ratio above can be changed by adjusting the analog input start end function. Refer to *8-12 Analog Input Terminal Function* on page 8-176 for details.
(Example) When setting the torque command addition value to 0.0 to 50.0% for the input of 0 to 10 (V) and 0 to 20 (mA) as the [Ai1] terminal, 50.0% is set for the maximum 500.0%. So, set **[End value of Terminal [Ai1]** (Cb-04) to 10.0%. ((Cb-03)=0.0, (Cb-04)=10.0, (Cb-05)=0.0, and (Cb-06)=100.0)

Torque Bias Command Value Monitor

The commanded torque bias value can be checked on **Torque bias monitor** (FA-16).
When **Torque bias input source selection** (Ad-11) is set to *07: Parameter setting*, changing the value of **Torque bias monitor** (FA-16) will change the bias value and save the set value in **Torque bias value setting** (Ad-12).

Torque command monitor after calculation (dA-15) displays the torque command plus the torque bias value. **Torque command monitor after calculation** (dA-15) displays 0.0 because no bias is applied when torque calculation is not performed, such as when the inverter is not operating.

The torque reference value (100%) for this function is calculated as follows.
Torque reference value = 79.58 x motor capacity x number of poles / base frequency

(Example) Torque reference value = 79.58 x 5.5 (kW) x 4 (P) / 50 (Hz) ≒ 35Nm

● Parameter

Item	Parameter	Data	Description	Default
Torque bias input source selection	Ad-11	00 to 13, 15	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	00
Torque bias value setting	Ad-12	-500.0 to 500.0 (%)	Set the amount to add torque. Torque bias value when the setting is (Ad-11) = 07.	0.0
Polarity selection for torque bias	Ad-13	00: As per the sign	Regardless of the operation direction, torque will be added to the forward direction when the value is (+), and to the reverse direction when the the value is (-).	00
		01: Follow the revolution direction	The torque bias amount is added to the operation command direction when the value is (+), to the reverse direction when the value is (-).	
Terminal [TBS] active	Ad-14	00	Disabled	00
		01	Enabled	
Torque bias monitor	FA-16	-500.00 to 500.00 (%)	The torque bias set monitor.	-
Torque command monitor after calculation	dA-15	-500.00 to 500.00 (%)	The torque command monitor displaying calculation of the set value and bias value.	-

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Validation of torque bias	TBS	68	ON: Torque bias enabled OFF: Torque bias disabled

7-3-7 Torque Control/Speed Control Switching Function (ATR)

This function is used to switch between speed control and torque control such as when contact positioning control is used.

To use the torque control/speed control switching function, assign the validation of torque control [67: ATR] to one of **Input terminal function** (CA-01) to (CA-11). Turn the [ATR] terminal ON to switch to torque control, and turn the [ATR] terminal OFF to switch to speed control.

When switching from the torque command to the speed command, the torque command may change significantly. In this case, set **Switching time of Speed control to Torque control** (Ad-04) to slow the switching.

● Parameter

Item	Parameter	Data	Description	Default
Switching time of Speed control to Torque control	Ad-04	0 to 1000 (ms)	Switch speed control to torque control moderately in accordance with the set time.	100

● Input Terminal Function (CA-01) to (CA-11)

Item	Terminal name	Data	Description
Validation of torque control	ATR	67	OFF: Speed control ON: Torque control

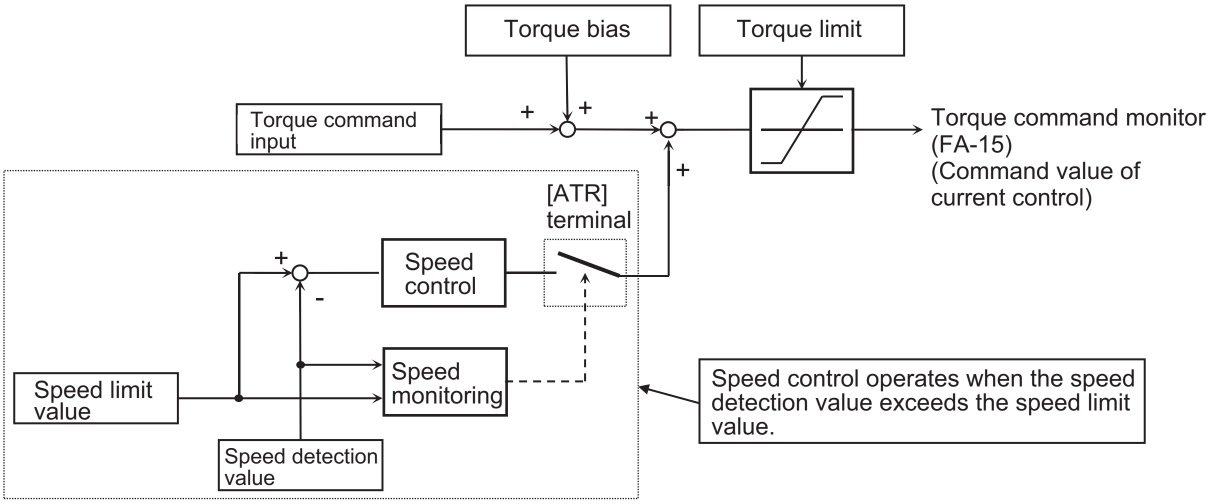
7-3-8 Torque Command

When sensorless vector control or vector control with a sensor is selected in **Control mode selection** (AA121), the torque command can drive the motor.
To operate with torque control, assign the validation of torque control [67: ATR] terminal to one of **Input terminal function** (CA-01) to (CA-11). When the [ATR] terminal is turned ON, speed control is switched to torque control.
The input value selected in **Torque reference input source selection** (Ad-01) is treated as a torque command.
If the torque bias function is used during torque control, the torque bias amount is added to the torque command.

The torque reference value (100%) for this function is calculated as follows.
Torque reference value = 79.58 x motor capacity x number of poles / base frequency

(Example) Torque reference value = 79.58 x 5.5 (kW) x 4 (P) / 50 (Hz) ≒ 35Nm

The motor speed during torque control is determined by the balance between torque and load, so it may be faster than expected. To prevent runaway, set **Input selection for speed limit at torque control** (Ad-40) to *07: Parameter setting*, **Speed limit at torque control (at Forward rotation)** (Ad-41), and **Speed limit at torque control (at Reverse rotation)** (Ad-42).



● Parameter

Item	Parameter	Data	Description	Default
Switching time of Speed control to Torque control	Ad-04	0 to 1000 (ms)	The switching time when switching between torque command and speed control, and the time constant of the primary delay filter processing that is input to the torque command during switching. When an error occurs while the control is switched, set the time longer than the set time.	100
Input selection for speed limit at torque control	Ad-40	01 to 13	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	07
Speed limit at torque control (at Forward rotation)	Ad-41	0.00 to 590.00 (Hz)	Set the frequency to limit in the forward rotation during torque control.	0.00
Speed limit at torque control (at Reverse rotation)	Ad-42	0.00 to 590.00 (Hz)	Set the frequency to limit in the reverse rotation during torque control.	0.00

Torque Command Monitor and Output Torque Monitor

Torque reference monitor (FA-15) displays a current command value that has been commanded.

When **Torque reference input source selection** (Ad-01) is set to *07: Parameter setting*, you can change the torque command set value on **Torque reference monitor** (FA-15). The changed value is stored in **Torque reference value setting** (Ad-02) and saved.

The torque reference value (100%) for this function is calculated as follows.
Torque reference value = 79.58 x motor capacity x number of poles / base frequency

(Example) Torque reference value = 79.58 x 5.5 (kW) x 4 (P) / 50 (Hz) ≒ 35Nm

Torque command monitor after calculation (dA-15) displays the current torque command plus the torque bias value.
The current output torque can be checked on **Output torque monitor** (FA-17).
The torque reference value (100%) for this function is the same as for the torque command monitor.

● Parameter

Item	Parameter	Data	Description	Default
Torque reference input source selection	Ad-01	01 to 13, 15	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	07
Torque reference value setting	Ad-02	-500.0 to 500.0 (%)	Torque command	0.0
Polarity selection for torque reference	Ad-03	00: As per the sign	Regardless of the operation direction, torque will be added to the forward direction when the value is (+), and to the reverse direction when the the value is (-).	00
		01: Follow the revolution direction	Change the sign of value and the direction of torque bias action based on the operation command direction.	
Torque command monitor after calculation	dA-15	-500.00 to 500.00 (%)	The torque command monitor displaying calculation of the set value and bias value.	-
Output torque monitor	dA-17	-500.00 to 500.00 (%)	Display the output torque.	-
Torque reference monitor	FA-15	-500.00 to 500.00 (%)	The torque command set monitor	-

7-4 DC Braking

DC braking is suitable for the following applications:

- When stopping and starting a motor that is rotating due to inertia etc. without regenerative processing.
- When the load is heavy and the motor does not stop at normal deceleration and rotates due to inertia.

DC braking is a function that applies a DC voltage to an induction motor to brake the motor and stop the rotation reliably.
There are two types of DC braking: external DC braking that manually applies DC braking from the input terminal, and internal DC braking that automatically applies DC braking during starting and stopping operation.
When using internal DC control with vector control, you can select the servo lock instead of DC braking.

● Parameter

Item	Parameter	Data	Description	Default
DC braking selection	AF101	00	Disabled	00
		01	Enabled (Operation command)	
		02	Enabled (Frequency command)	
Braking type selection	AF102	00	DC braking	00
		01	Speed servo lock	
		02	Position servo lock	
DC braking frequency	AF103	0.00 to 590.00 (Hz)	With internal DC braking enabled, DC braking is started when the output frequency reaches or becomes less than the frequency set for stopping.	0.50
DC braking delay time	AF104	0.00 to 5.00 (s)	The time to temporarily shut off the output and stand-by when DC braking operates.	0.00
DC braking force setting	AF105	0 to 100 (%)	Set the braking force for stopping.	30
DC braking active time at stop	AF106	0.00 to 60.00 (s)	Set the duration for DC braking during stopping operation.	0.00
DC braking operation method selection	AF107	00	Edge mode When the DC braking is released, the DC braking is maintained during **DC braking active time at stop** (AF106).	01
		01	Level mode When the DC braking is released, the DC braking is released immediately.	
DC braking force at start	AF108	0 to 100 (%)	Set the braking force for starting.	30
DC braking active time at start	AF109	0.00 to 60.00 (s)	Set the duration for DC braking during starting operation.	0.00

Item	Parameter	Data	Description	Default
Input terminal function	CA-01 to CA-11	30	DB external DC braking OFF: DC braking does not operate ON: DC braking operates	-

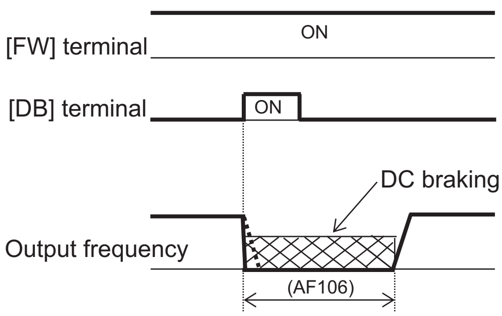
7-4-1 External DC Braking

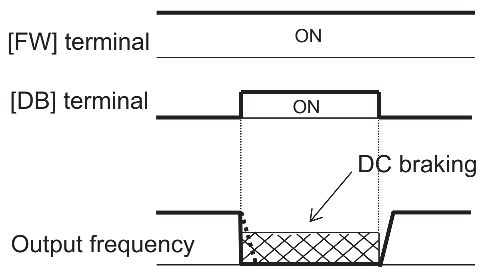
External DC braking is a function that manually applies DC braking from the input terminal.
To use external DC braking, assign the external DC braking [30: DB] terminal to one of **Input terminal function** (CA-01) to (CA-11). When the [30: DB] terminal is turned ON, DC braking is applied.
Set the DC braking force to **DC braking force setting** (AF105).
Set **DC braking operation method selection** (AF107) to *00: Edge mode* or *01: Level mode*.

Setting	Description
00: Edge mode	DC braking is applied from the time when the [30: DB] terminal is turned ON to the set time of **DC braking active time at stop** (AF106). (See Example 9 to 11.)
01: Level mode	DC braking is applied while the [30: DB] terminal is ON. (See Example 12 to 14.)

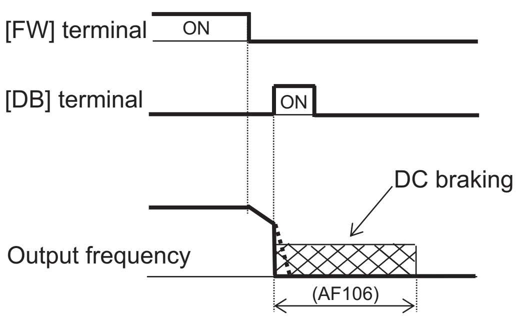
When **DC braking delay time** (AF104) is set, the output of the inverter is cut off from the time when the [30: DB] terminal is turned ON to the set time, and DC braking is applied after the set time has elapsed. (See Example 11 and 14.)

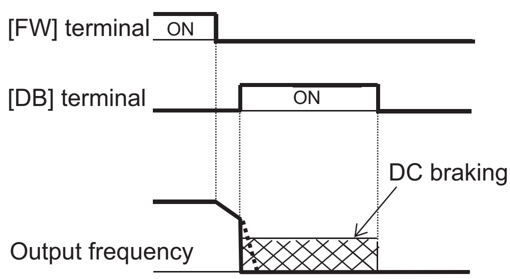
(AF107) is *00: Edge mode*	**(AF107) is *01: Level mode***
(Example 9)	(Example 12)

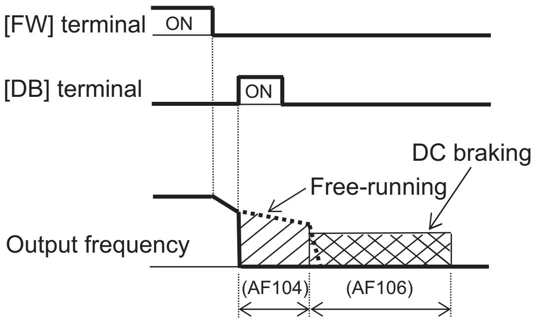
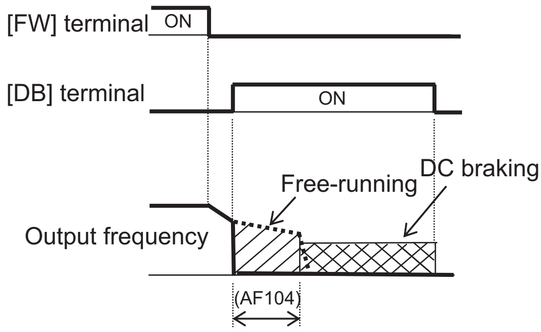




(Example 10)	(Example 13)





(AF107) is *00: Edge mode*	(AF107) is *01: Level mode*
(Example 11) 	(Example 14) 

Additional Information

- External DC braking takes precedence over operating commands. (See Example 9 and 12.)
- External DC braking does not use the setting of**Braking type selection**(AF102). Regardless of the setting, it operates when*00: DC braking*is set.

Precautions for Correct Use

- If the [30: DB] terminal is turned ON while the motor speed is high, an overcurrent error (E001) or overvoltage error (E007) may occur.
- When using external DC braking, set **DC braking selection** (AF101) to *00: Disabled* or *01: Enabled (Operation command)*. When you set it to *02: Enabled (Frequency command)*, DC breaking is not applied even if the [30:DB] terminal is turned ON.

7-4-2 Internal DC Braking

Internal DC braking is a function that automatically applies DC braking during starting and stopping operation.
To use internal DC braking, set **DC braking selection** (AF101) to *01: Enabled (Operation command)* or *02: Enabled (Frequency command)*.

Setting	Description
01: Enabled (Operation command)	DC braking is applied during starting and stopping operation according to the operation command.
02: Enabled (Frequency command)	DC braking is applied according to the frequency command.

With vector control, you can select the DC braking method. To select the method, set**Braking type selection**(AF102) to*00: DC braking*,*01: Speed servo lock*, or*02: Position servo lock*.

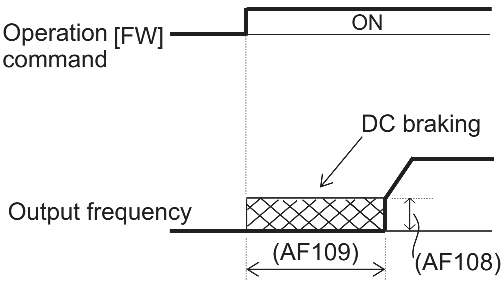
Setting	Description
00: DC braking	DC excitation is used for braking.
01: Speed servo lock	Speed control is used to control the speed to 0Hz.
02: Position servo lock	Position control is used to control the motor to stay at the commanded position.

DC Braking by Operation Command

When using DC braking by operation command, set **DC braking selection** (AF101) to *01: Enabled (Operation command)*.
With DC braking by operation command, DC braking is applied during starting and stopping operation according to the operation command.

● DC Braking at Start-up

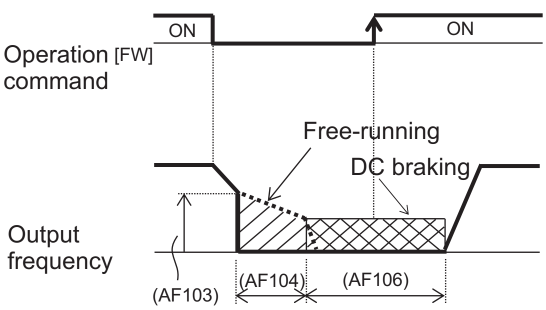
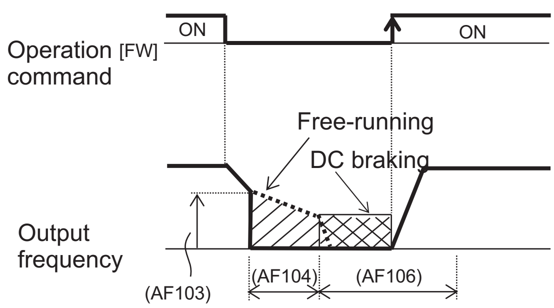
During starting operation, DC braking is applied from the time when the operation command is ON until the set time of **DC braking active time at start** (AF109) elapses.
Set the DC braking force to **DC braking force at start** (AF108).

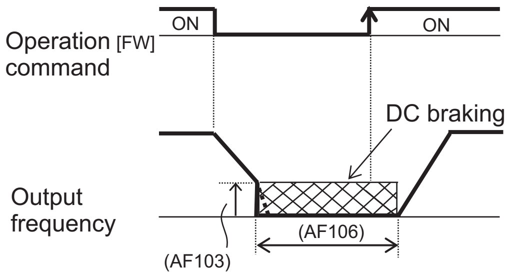
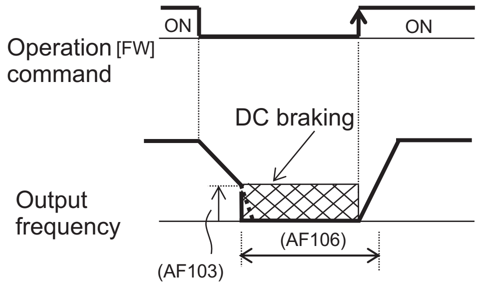


● DC Braking at Stop

During stopping operation, DC braking is applied from when the operation command is turned OFF and the frequency falls below the set value of **DC braking frequency** (AF103) until the set time of **DC braking active time at stop** (AF106) elapses.
Set the DC braking force to **DC braking force setting** (AF105).
To delay the time when DC braking is applied, set **DC braking delay time** (AF104).
You can select the return mode during DC braking. To select the return mode, set **DC braking operation method selection**(AF107) to *00: Edge mode* or *01: Level mode*.

Setting	Description
00: Edge mode	If the operation command is turned ON when DC braking is applied, DC braking is continued until the set time of **DC braking active time at stop** (AF106), and then operation is started. (See Example 9 to 11.)
01: Level mode	If the operation command is turned ON when DC braking is applied, DC braking is stopped and operation is started. (See Example 12 to 14.)

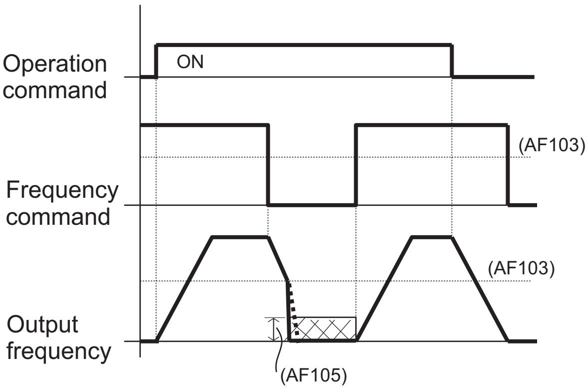
(AF107) is *00: Edge mode*	(AF107) is *01: Level mode*
(Example 1) At stop ((AF104) ≠ 0.00)  	(Example 3) At stop ((AF104) ≠ 0.00) 

(AF107) is *00: Edge mode*	(AF107) is *01: Level mode*
(Example 2) At stop ((AF104)= 0.00)  	(Example 4) At stop ((AF104)= 0.00) 

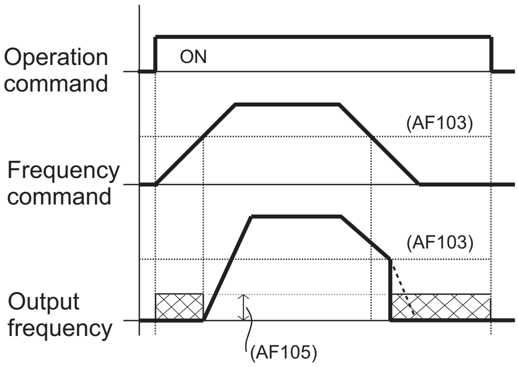
DC Braking by Frequency Command

When using DC braking, which starts braking based on the output frequency, set **DC braking selection** (AF101) to *02: Enabled (Frequency command)*.
When the operation command is ON and the frequency command and output frequency are less than or equal to the set value of**DC braking frequency**(AF103), DC braking is applied. When the frequency command exceeds the set value of**DC braking frequency**(AF103), normal operation returns.
When the operation command is turned ON, if the frequency command is less than or equal to the setting value of**DC braking frequency**(AF103), DC braking is applied. When the operation command is OFF, DC braking is not applied.
Set the DC braking force to**DC braking force setting**(AF105).

(Example 5)

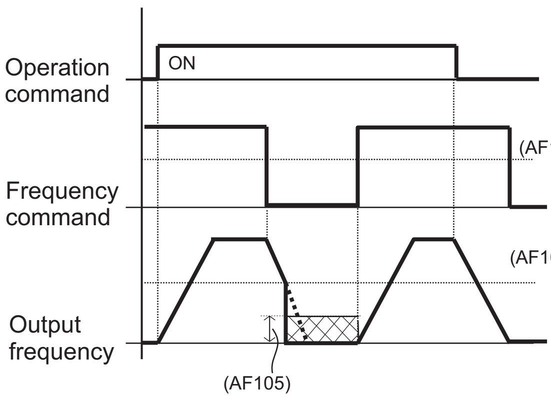
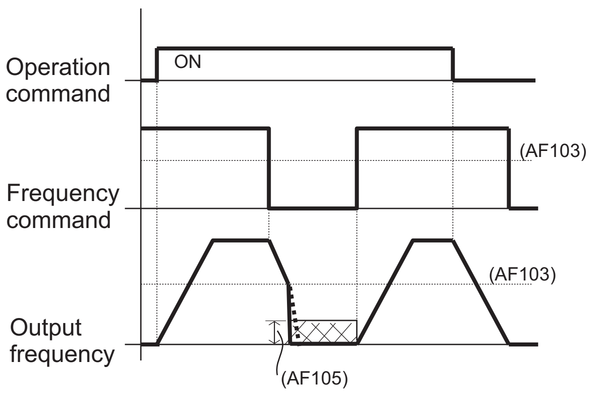


(Example 6)



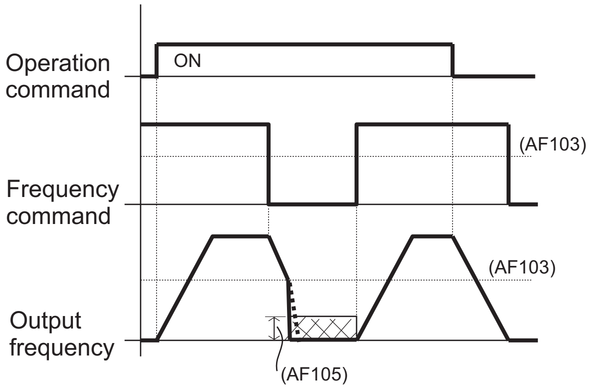
You can select the mode when returning from DC braking. To select the return mode, set**DC braking operation method selection**(AF107) to*00: Edge mode*or*01: Level mode*.

Setting	Description
00: Edge mode	If the frequency command exceeds the set value of **DC braking frequency** (AF103) while DC braking is applied, DC braking is continued during the set time of **DC braking active time at stop** (AF106), and then normal operation is resumed. (Example 7)
01: Level mode	When DC braking is applied, if the frequency command exceeds the set value of**DC braking frequency**(AF103), DC braking is stopped and normal operation is resumed. (Example 8)

(AF107) is*00: Edge mode*	**(AF107) is*01: Level mode***
(Example 7) 	(Example 8) 

DC Braking

Braking is applied by exciting DC to the motor. Regardless of the setting of **Control mode selection** (AA121), DC breaking is available in all control methods.
To apply braking with DC braking, set **Braking type selection** (AF102) to *00: DC braking*.



Speed Servo Lock

Vector control is used to control the speed to 0Hz. It can be used when **Control mode selection** (AA121) is set to *08: Sensorless vector control (IM)*, *09: Zero-Hz range sensorless vector control (IM)*, or *10: Vector control with sensor (IM)*.
To apply braking with speed servo lock control, set **Braking type selection** (AF102) to *01: Speed servo lock*.

Additional Information

- When **Control mode selection** (AA121) is set to other than *08: Sensorless vector control (IM)*, *09: Zero-Hz range sensorless vector control (IM)*, or *10: Vector control with sensor (IM)*, even if **Braking type selection** (AF102) is set to *01: Speed servo lock*, the inverter operates as it is set to *00: DC braking*.
- The output of servo lock control is automatically calculated according to the selected control method.
- **DC braking force setting** (AF105) is not used.

Position Servo Lock

Vector control with sensor is used to control the position of the motor so that it stays at the current position. It can be used when**Control mode selection**(AA121) is set to*10: Vector control with sensor (IM)*.
To apply braking with position servo lock control, set**Braking type selection**(AF102) to*02: Position servo lock*.

Additional Information

- When **Control mode selection** (AA121) is set to a value other than *10: Vector control with sensor (IM)*, even if **Braking type selection** (AF102) is set to *02: Position servo lock*, the inverter operates as it is set to *00: DC braking*.
- The output of servo lock control is automatically calculated according to the selected control method.
- **DC braking force setting**(AF105) is not used.

7-5 Start Conditions

7-5-1 Reduced Voltage Start

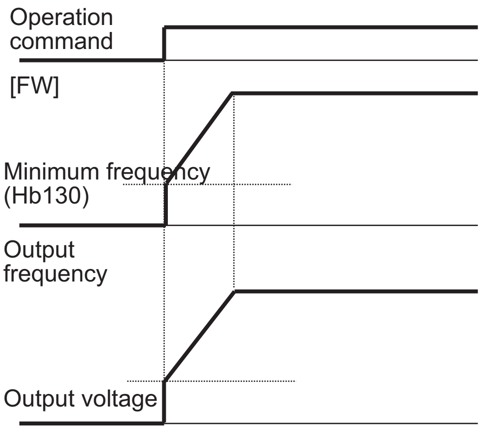
Reduced voltage start is used to suppress overcurrent at start when the minimum frequency is set high for a device that requires torque.
Reduced voltage start is a function that slowly raises the voltage while outputting the minimum frequency when the motor starts.

Set the time from the operation start until the output voltage corresponding to the set value of **Minimum frequency adjustment** (Hb130) is reached in **Reduced voltage start time setting** (Hb131).
It can be used when **Control mode selection** (AA121) is set to *00: [V/f] Fixed torque characteristics (IM)*, *01: [V/f] Reducing torque characteristics (IM)*, or *02: [V/f] Free V/f (IM)*.

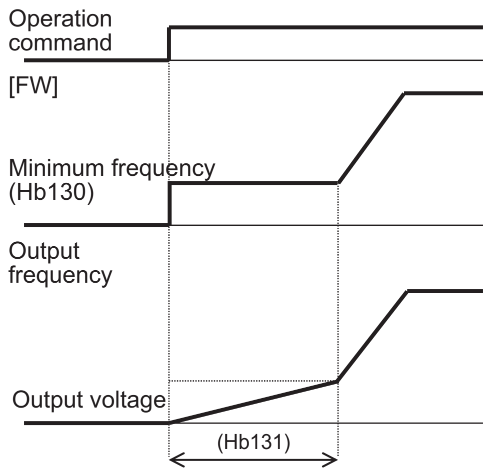
● Parameter

Item	Parameter	Data	Description	Default
Minimum frequency adjustment	Hb130	0.00 to 10.00 (Hz)	The start frequency	0.50
Reduced voltage start time setting	Hb131	0 to 2000 (ms)	Time from the start of operation until the output voltage corresponding to the minimum frequency is reached	36

When not using this function: Set (Hb131) to *0*.



When using this function:



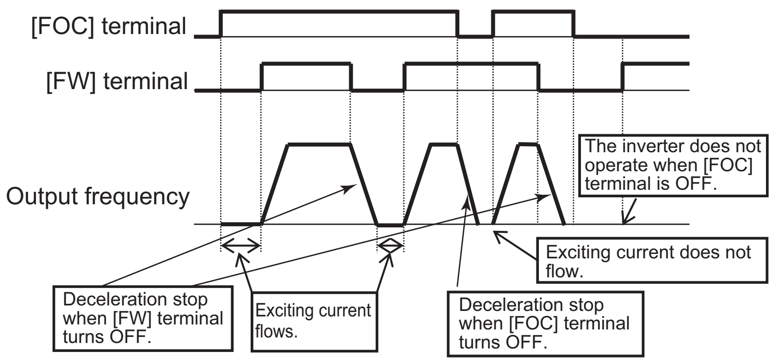
Precautions for Correct Use

- When **Control mode selection** (AA121) is set to other than *00: [V/f] Fixed torque characteristics (IM)*, *01: [V/f] Reducing torque characteristics (IM)*, or *02: [V/f] Free V/f (IM)*, **Reduced voltage start time setting** (Hb131) does not affect control.
- If you set a smaller value in **Reduced voltage start time setting** (Hb131), an overcurrent error is more likely to occur.

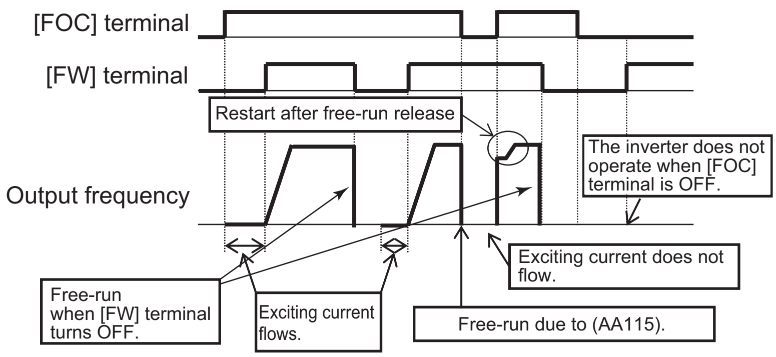
7-5-2 Forcing Function

The forcing function is used for applications that require torque response at startup, such as lift shafts.
The forcing function is a function that preliminarily establishes the magnetic flux by applying an exciting current before the start of operation.
To use the forcing function, assign the auxiliary excitation [66: FOC] to one of **Input terminal function** (CA-01) to (CA-11).
When the [66: FOC] terminal is turned ON, an exciting current flows. When the [66: FOC] terminal is ON, the operation command is accepted. When the [66: FOC] terminal is OFF, the operation command will not be accepted.
If the [66: FOC] terminal is turned OFF during operation, the inverter will stop according to **STOP mode selection** (AA115). When the [66: FOC] pin is turned ON, the inverter restarts.
The forcing function can be used when **Control mode selection** (AA121) is set to *08: Sensorless vector control (IM)*, *09: Zero-Hz range sensorless vector control (IM)*, or *10: Vector control with sensor (IM)*.

- When **STOP mode selection** (AA115) is *00: Deceleration stop*



- When **STOP mode selection** (AA115) is *01: Free run stop*



● Parameter

Item	Parameter	Data	Description	Default
Input terminal selection	CA-01 to CA-11	66	[FOC] Auxiliary excitation	-
STOP mode selection	AA115	00	Deceleration stop	00
		01	Free run stop	

Additional Information

- If the starting torque is insufficient, make the setting of *Boost value at start for Async.M-SLV/IM-CLV* (HC111), *Boost value at start for Async.M-0SLV* (HC112) and *Speed response for Async.M* (HA115).
- If the starting torque is insufficient, use the torque bias function. For details, refer to *7-3-6 Torque Bias Function* on page 7-44.

7-5-3 Restart

You can select from the following how to start when the power is turned on or the reset is released while the motor is rotating.

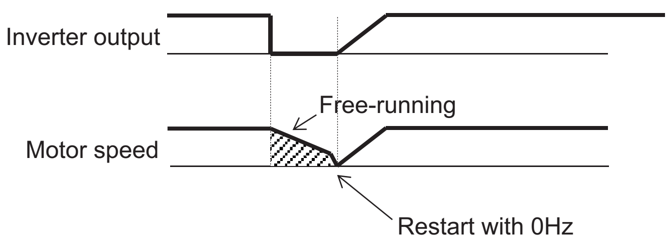
- 0Hz start
- Frequency matching start
- Frequency pull-in start
- Detection speed start
- Trip after frequency matching deceleration stop

The starting method can be selected after power-on, reset release, free-run stop, restart during power interruption/undervoltage, overvoltage restart, and overcurrent restart. For details, refer to each function.

Function	Page
Start after power-on	page 7-63
Start after reset release	page 7-64
Start after free-run stop	page 7-65
Restart during power interruption/under-voltage	page 8-56
Overvoltage restart	page 8-62
Overcurrent restart	page 8-60

0Hz Start

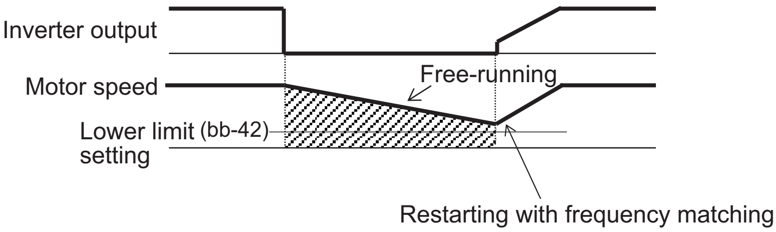
With 0Hz start, the inverter starts at 0Hz even if the motor is rotating.



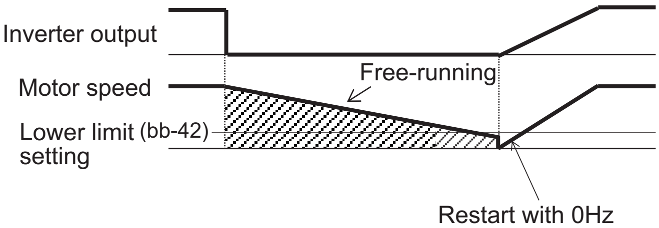
Frequency Matching Start

With frequency matching start, the frequency when the motor is rotating is detected and the inverter starts at that frequency.

If the motor speed at start is equal to or higher than the set value of **Restart frequency threshold** (bb-42), the motor frequency is detected and the inverter restarts without stopping the motor.



If the motor speed at restart is less than the set value of **Restart frequency threshold** (bb-42), the inverter starts at 0Hz.



● **Parameter**

Item	Parameter	Data	Description	Default
Restart frequency threshold	bb-42	0.00 to 590.00 (Hz)	Set the lower limit of the frequency at which the inverter restarts with frequency matching.	0.00

Precautions for Correct Use

- Even if the motor is rotating, the residual voltage of the motor may fall below the detectable voltage level and the rotation speed may not be detected. If it cannot be detected, the inverter will start at 0Hz.

Additional Information

If frequency matching start is not possible, you may be able to start the inverter by using frequency pull-in start. For information such as the setting method, refer to *Frequency Pull-in Start* on page 7-60.

Frequency Pull-in Start

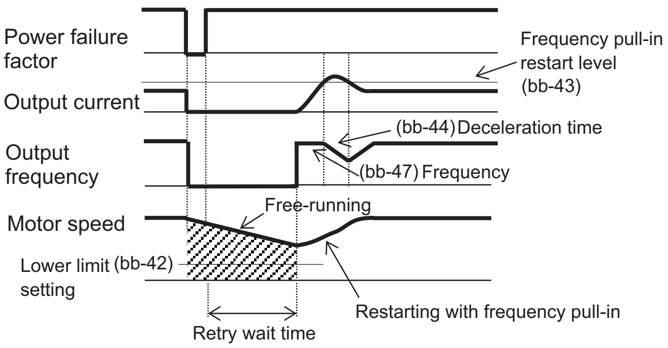
With frequency pull-in start, the inverter starts at the set frequency when the motor is rotating. Set the starting frequency in **Restart speed selection of Active frequency matching** (bb-47).

Since the difference between the motor speed and the output frequency becomes large during the pull-in operation, the inverter is controlled to start with the current limited. From the start of output to the motor until the set time of **Restart constant (Voltage) of Active frequency matching** (bb-45) elapses, the output voltage is suppressed to limit the current and wait for the motor to follow. When the control method is various V/f control, the control that lowers the frequency results in limiting the current. For the operation to lower the frequency, refer to the operation example in the figure below. When the control method is vector control, the current is not limited and the vector control performs pull-in operation.

If **OC-supress level of Active frequency matching** (bb-46) is exceeded when the current increase during the pull-in operation is large, regardless of the setting of **Over current suppress enable** (bA120), the overcurrent suppression function operates until the set time of **Restart constant (Voltage) of Active frequency matching** (bb-45) elapses.

When using frequency pull-in start, the output frequency is in the same direction as the command direction at the time of blocking. Frequency pull-in start can only be used with induction motors.

(Operation example) Frequency pull-in



1. The output is kept blocked from the time the blocking factor is released until the corresponding retry waiting time elapses. If the motor rotation speed falls below **Restart frequency threshold** (bb-42) during this period, the inverter does not restarts with pull-in, but starts at 0Hz.
2. After the corresponding retry standby time has elapsed, if the motor rotation speed is equal to or greater than the set value of **Restart frequency threshold** (bb-42), the frequency selected in **Restart speed selection of Active frequency matching** (bb-47) will be output. If the rotation speed of the motor is less than the set value of **Restart frequency threshold** (bb-42), the inverter starts at 0Hz.
3. When the output current exceeds **Restart level of Active frequency matching** (bb-43), the output frequency is lowered at the deceleration rate set by **Restart constant (speed) of Active frequency matching** (bb-44).
4. When the output frequency matches the motor speed and the output current falls below **Restart level of Active frequency matching** (bb-43), the inverter stops deceleration and accelerates to follow the frequency command.

● Parameter

Item	Parameter	Data	Description	Default
Restart frequency threshold	bb-42	0.00 to 590.00 (Hz)	When the detected value of the motor speed is equal to or lower than the set value, the inverter restarts at 0Hz.	0.00

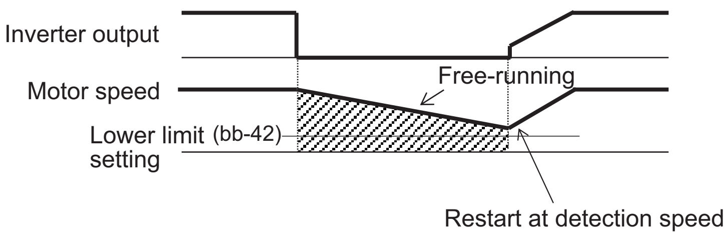
Item	Parameter	Data	Description	Default
Restart level of Active frequency matching	bb-43	(0.0 to 2.0) × Inverter rated current (A)	If it exceeds the set value during restart, the inverter decelerates according to **Restart constant (speed) of Active frequency matching** (bb-44).	1.0 × Inverter rated current
Restart constant (speed) of Active frequency matching	bb-44	0.10 to 30.00 (s)	This is the deceleration time for suppressing the current during the pull-in restart.	0.50
Restart constant (Voltage) of Active frequency matching	bb-45	0.10 to 30.00 (s)	This is the time for the suppression operation after the pull-in operation.	0.50
OC-supress level of Active frequency matching	bb-46	(0.0 to 2.0) × Inverter rated current (A)	If it exceeds the overcurrent suppression level at the time of wave number pull-in restart, the overcurrent suppression function operates automatically.	1.0 × Inverter rated current
Restart speed selection of Active frequency matching	bb-47	00	Cutoff frequency	00
		01	Maximum frequency	
		02	Setting frequency	

Precautions for Correct Use

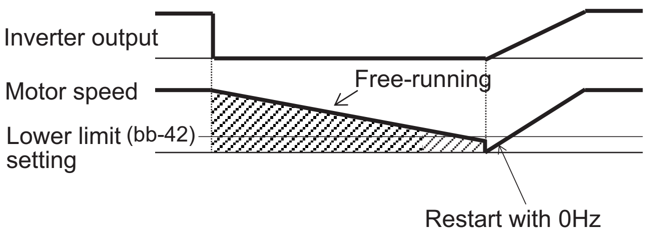
If **Control mode selection** (AA121) is other than V/f control, the restart operation may become unstable. In this case, frequency matching start may improve the operation. For more information on the settings, refer to *Frequency Matching Start* on page 7-59.

Detection Speed Start

With detection speed start, the inverter starts at the feedback speed from input terminals A and B or the feedback speed from the PG option unit when the motor is rotating.



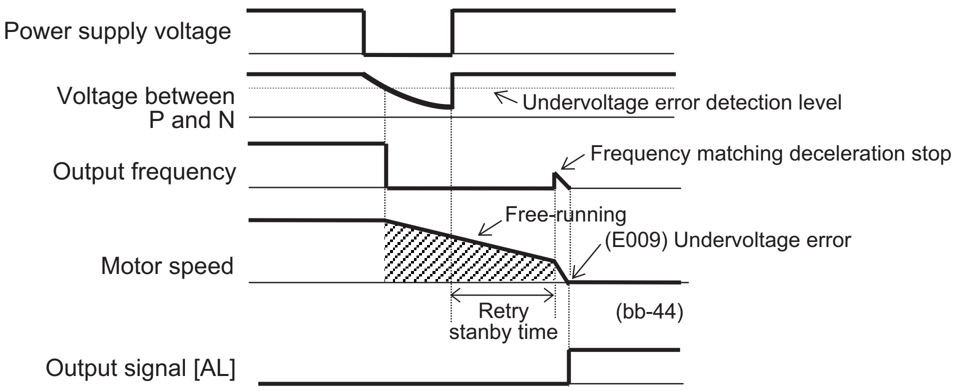
If the motor speed at restart is less than **Restart frequency threshold** (bb-42) , the inverter will start at 0Hz.



Trip After Frequency Matching Deceleration Stop

The trip after frequency matching deceleration stop detects the frequency in which the motor is rotating, operates at that frequency and make the inverter decelerate to stop. After the stop, an error will occur depending on the trip factor.

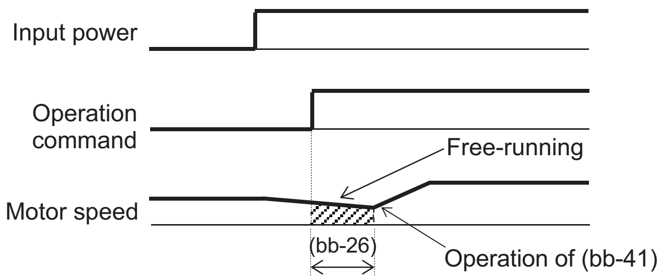
When a trip occurs due to undervoltage



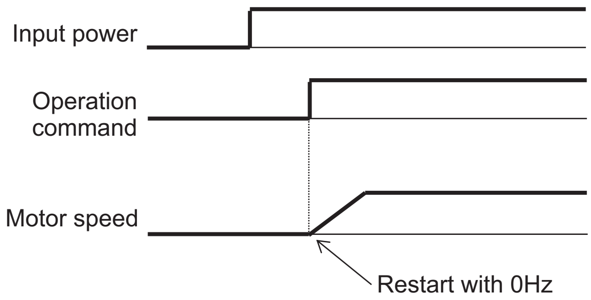
7-5-4 Start After Power-on

Start after power-on is suitable for applications where an operation command is given while the motor is idling or rotating due to external force.
Start after power-on is a function to set how to start when the operation command is first given after turning on the power.

Set the start method to **Restart mode after RS release** (bb-41). You can select *00: 0Hz*, *01: Frequency matching*, *02: Frequency entrainment*, or *03: Detection speed*. For details on starting method, refer to *7-5-3 Restart* on page 7-59.
Set the waiting time from the operation command ON to the inverter start, to **Retry wait time before motor restart** (bb-26).
After the power is turned on, the inverter will start after the waiting time elapses after the operation command is given.



When **Restart mode after RS release** (bb-41) is set to *00: 0Hz*, the inverter starts without waiting regardless of the set value of the waiting time.



● Parameter

Item	Parameter	Data	Description	Default
Restart mode after RS release	bb-41	00	0 Hz	00
		01	Frequency matching	
		02	Frequency entrainment	
		03	Detection speed	
Retry wait time before motor restart	bb-26	0.3 to 100.0 (s)	Waiting time from power supply voltage recovery to restart	0.3

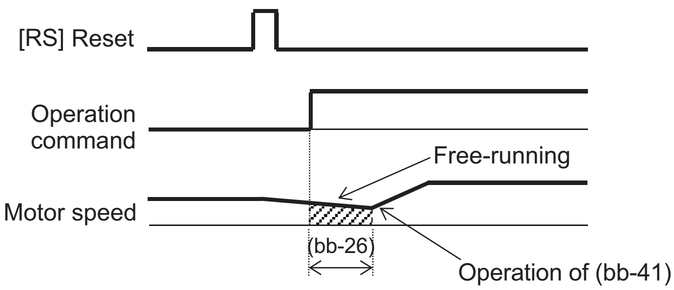
Additional Information

The parameters for the restart after power-on are common to the restart after reset release.

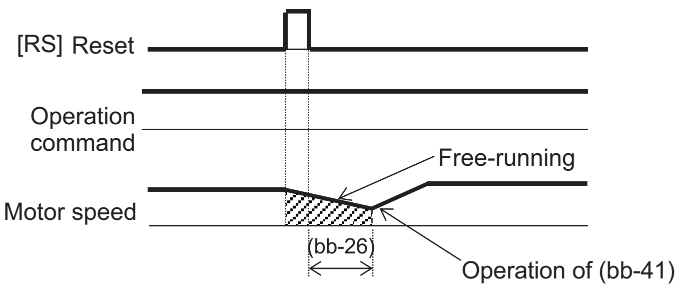
7-5-5 Restart After Reset Release

Restart after reset release is a function to set how to start after trip reset.
Set the start method to **Restart mode after RS release** (bb-41). You can select *00: 0Hz*, *01: Frequency matching*, *02: Frequency entrainment*, or *03: Detection speed*. For details on starting method, refer to *7-5-3 Restart* on page 7-59.
Set the waiting time from the time when operation is restarted after the reset release to the time when the system runs, to **Retry wait time before motor restart** (bb-26).

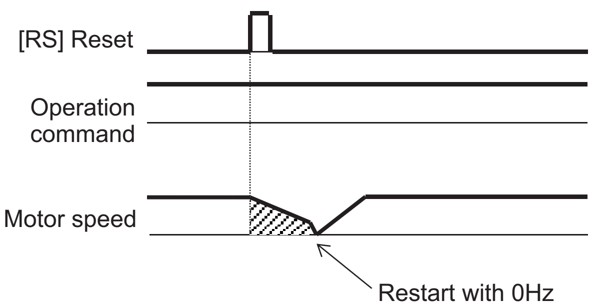
If an operation command is given after the reset is released, the system will start after the waiting time has elapsed since the operation command was given.



If the reset is released with the operation command entered, the system will start after the waiting time has elapsed since the reset was released.



When **Restart mode after RS release** (bb-41) is set to *00: 0Hz*, the system will start without waiting regardless of the wait time setting.



● Parameter

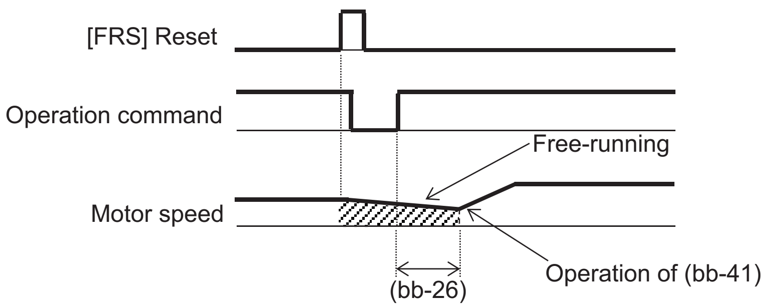
Item	Parameter	Data	Description	Default
Restart mode after RS release	bb-41	00	0 Hz	00
		01	Frequency matching	
		02	Frequency entrainment	
		03	Detection speed	
Retry wait time before motor restart	bb-26	0.3 to 100.0 (s)	Waiting time from the establishment of the operation start condition to the restart	0.3

7-5-6 Restart After Releasing Free-run

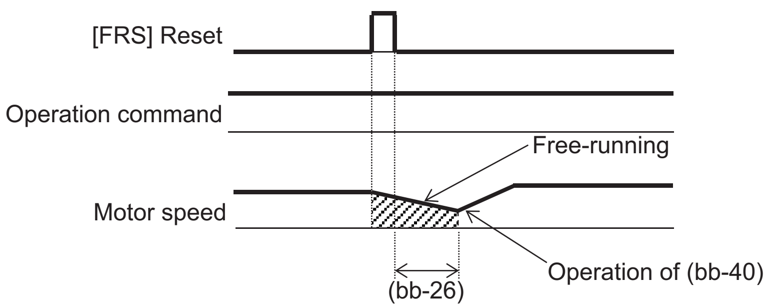
Restart after releasing free run is a function to set how to start after releasing the free run stop.

Set the starting method to **Restart mode after FRS release** (bb-40). You can select *00: 0Hz*, *01: Frequency matching*, *02: Frequency entrainment*, or *03: Detection speed*. For details on starting method, refer to *7-5-3 Restart* on page 7-59.
Set the waiting time from the time when operation is restarted after the free-run release to the time when the system runs, to **Retry wait time before motor restart** (bb-26).

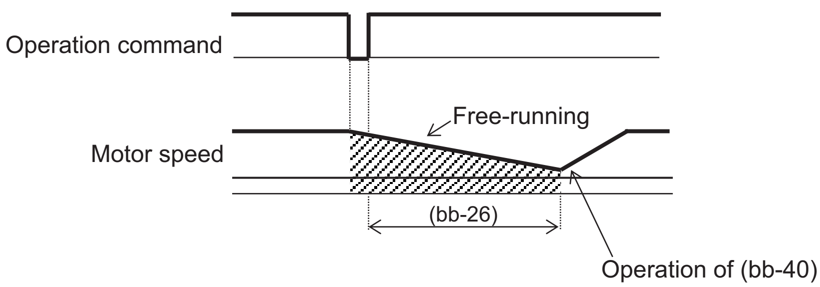
When the free-run stop [32: FRS] terminal is turned ON and when **STOP mode selection** (AA115) is set to *01: Free run stop* and the operation command is turned OFF, the system will free-run stop.
When the free run is ON by the [32: FRS] terminal, if an operation command is given after the [32: FRS] terminal is turned OFF, the system will start after the waiting time elapses after the operation command is given.



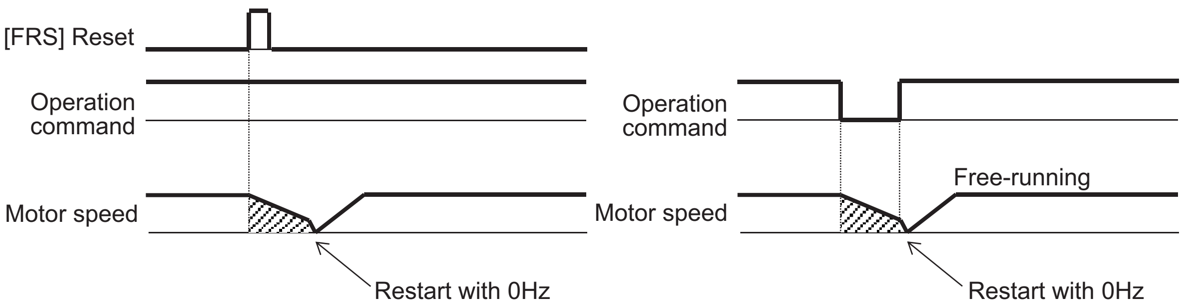
If the [32: FRS] terminal is turned OFF with the operation command entered, the system will start after the waiting time has elapsed since the terminal was turned OFF.



When the operation command is turned OFF and the free run is started, the system will start after the waiting time has elapsed since the operation command is turned ON.



If **Restart mode after FRS release** (bb-40) is set to *00: 0Hz*, the system will start without waiting regardless of the set value of the waiting time.



● Parameter

Item	Parameter	Data	Description	Default
Restart mode after FRS release	bb-40	00	0 Hz	00
		01	Frequency matching	
		02	Frequency entrainment	
		03	Detection speed	
Retry wait time before motor restart	bb-26	0.3 to 100.0 (s)	Waiting time from the establishment of the operation start condition to the restart	0.3
STOP mode selection	AA115	01	Free run stop	00
Input terminal function	CA-01 to CA-11	32	FRS: Free run stop	-

7-6 Stop Conditions

To stop the motor, you can either turn OFF the operation command or turn ON the free run stop [32: FRS] terminal.
When turning OFF the operation command, you can select deceleration stop or free run stop for the stopping method.

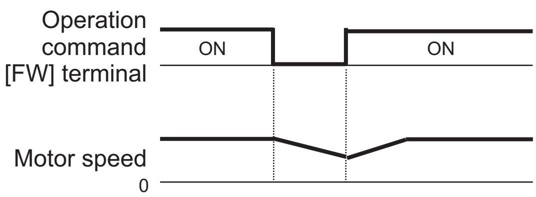
Of the stopping methods, free run stop is suitable for the following applications.

- When shutting off the output without decelerating a device that has a large inertia and causes over-voltage during the stopping operation.
- When shutting off the output of the inverter and stop with the mechanical brake.

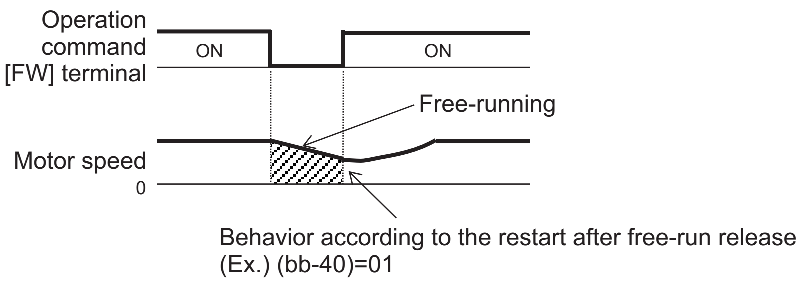
7-6-1 Stop by Operation Command

To select the stop method in the operation command, set **STOP mode selection** (AA115) to *00: Deceleration stop* or *01: Free run stop*.

With the deceleration stop, the motor decelerates and stops when the operation command is turned OFF. When the operation command is turned ON, the motor will resume the operation.



With the free run stop, the output to the motor is cut off when the operation command is turned OFF. When the operation command is turned ON, the motor will start according to the setting of restart after releasing free run. For details, refer to *7-5-6 Restart After Releasing Free-run* on page 7-65.



● Parameter

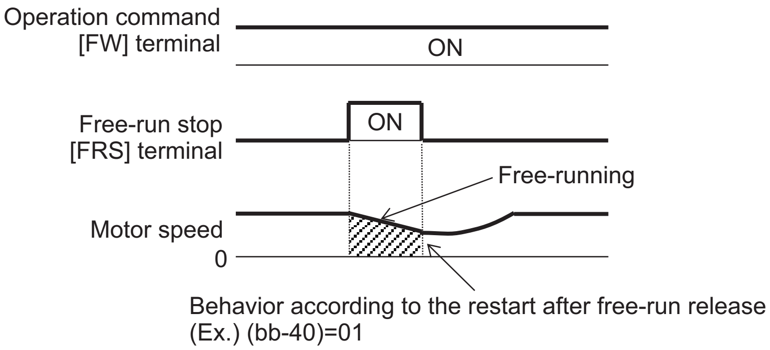
Item	Parameter	Data	Description	Default
STOP mode selection	AA115	00	Deceleration stop	00
		01	Free run stop	

7-6-2 Stop by Free Run Stop (FRS)

To stop the motor by the [32: FRS] terminal, assign the free run stop [32: FRS] to one of **Input terminal function** (CA-01) to (CA-11).

When the [32: FRS] terminal is turned ON, the output to the motor is cut off. When the [32: FRS] terminal is turned OFF, the motor starts according to the operation command.

For more information on how to start, refer to *7-5-6 Restart After Releasing Free-run* on page 7-65.



● Parameter

Item	Parameter	Data	Description	Default
Input terminal selection	CA-01 to CA-11	32	FRS: Free run stop	-

7-7 Reduction of Motor Noise, Noise and Inverter Heat Generation

7-7-1 Carrier Frequency

The electromagnetic noise from the motor, noise from the inverter, heat generation in the inverter, and motor hunting can be reduced/suppressed when you change the carrier frequency.
The inverter uses the PWM control method to supply voltage to the motor. The carrier frequency is the frequency that determines the pulse width modulation period in the PWM control method.
Set the carrier frequency to **Carrier speed setting** (bb101).

● Parameter

Item	Parameter	Data	Description	Default
Carrier speed setting	bb101	0.5 to 16.0 (kHz)*1	Carrier speed setting	2.0

*1. The setting range when **Load type selection** (Ub-03) is set to *02: Normal Duty (ND)*.
- It is 0.5 to 12.0 kHz for *01: Low Duty (LD)*.
- It is 0.5 to 10.0 kHz for *00: Very Low Duty (VLD)*.

*2. 3G3RX2-B4750 to 3G3RX2-B413K should be as follows.
- **Load type selection** (Ub-03) is set to *02: ND*: 0.5 to 10.0 kHz
- **Load type selection** (Ub-03) is set to *00: VLD* or *01: LD*: 0.5 to 8.0 kHz

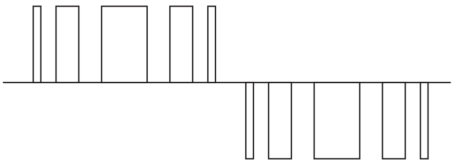
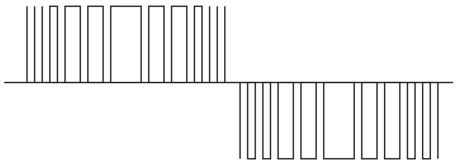
Precautions for Correct Use

- The relationship between the allowable output current and carrier frequency differs depending on the type of inverter. When increasing the carrier frequency, follow the graph in*Derating of Rated Output Current* on page 2-7and observe the current range.
- When the induction motor (IM) is driven, if**Control mode selection**(AA121) is set to*03: Auto torque boost (IM)*,*08: Sensorless vector control (IM)*, or*09: Zero-Hz range sensorless vector control (IM)*, set**Carrier speed setting**(bb101) to 2.0 kHz or higher. Otherwise, it may cause motor hunting.
- If**Control mode selection**(AA121) is set to*11: Synchronous start type sensorless vector control (SM/PMM)*, set the carrier frequency to 8.0 kHz or higher. If the carrier frequency is lowered, it may cause the motor to generate heat.
- Set the carrier frequency to be at least 10 times**IAsync.Motor Maximum frequency setting**(Hb105) or**Sync.Maximum frequency setting**(Hd105). If the carrier frequency is lowered, it may cause the motor to generate heat. For example, if**Sync.Maximum frequency setting**(Hd105) is*60Hz*, set**Carrier speed setting**(bb101) to*0.6kHz (600Hz)*or higher.

Carrier Frequency and Its Effect

The following table shows the carrier frequencies and their effects. Change the carrier frequency if necessary.
- If the electromagnetic noise of the motor is loud, increase the carrier frequency.
- To reduce noise and heat generation, lower the carrier frequency.
- To suppress motor hunting, gradually reduce the carrier frequency and find a stable point.

Effect of carrier frequency

	When carrier frequency is low	When carrier frequency is high
Motor electro-magnetic noise	Loud	Quiet
Noise	Low	High
Inverter heat generation	Little	Great
Leakage current	Low	High
Example of inverter output voltage waveform (PWM output)	Carrier frequency: Low 	Carrier frequency: High 

7-7-2 Automatic Carrier Reduction

Automatic carrier reduction has the effect of suppressing the temperature rise inside the inverter and extending the useful life of the internal elements.
Automatic carrier reduction is a function that automatically reduces the carrier frequency as the output current value increases or the temperature of the inverter rises.

To use automatic carrier reduction, set **Automatic-carrier reduction selection** (bb103) to *01: Enabled: current* or *02: Enabled: temperature*. *01: Enabled: current* lowers the carrier frequency according to the output current of the inverter. *02: Enabled: temperature* lowers the carrier frequency according to the internal temperature of the inverter.
If **Carrier speed setting** (bb101) is set to 2.0kHz or less, the carrier frequency will not be automatically reduced.

Additional Information

- The rate of change that reduces the carrier frequency during operation is 2kHz per second.
- When the automatic carrier reduction is activated, the electromagnetic noise of the motor changes as the carrier frequency changes.
- When using a synchronous motor (SM) or permanent magnet motor (PMM), set **Automatic-carrier reduction selection** (bb103) to *00: Disabled*. If the carrier frequency is lowered, it may cause the motor to generate heat.

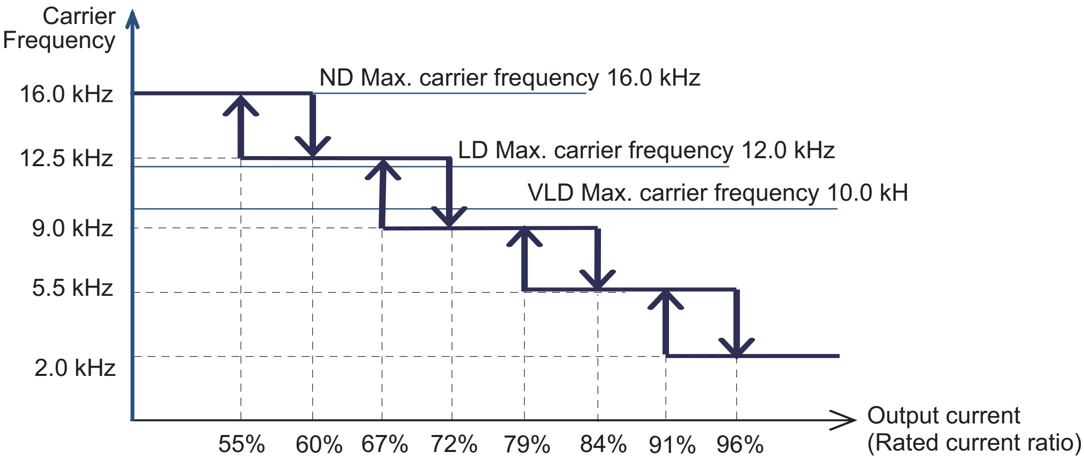
● Parameter

Item	Parameter	Data	Description	Default
Automatic-carrier reduction selection	bb103	00	Disabled	00
		01	Enabled: current	
		02	Enabled: temperature	

01: Enabled: current

When **Automatic-carrier reduction selection** (bb103) is set to *01: Enabled: current*, the carrier frequency reduction starts when the current value exceeds the rated current ratio shown in the figure below.
When the current value drops, the carrier frequency automatically returns to **Carrier speed setting** (bb101).

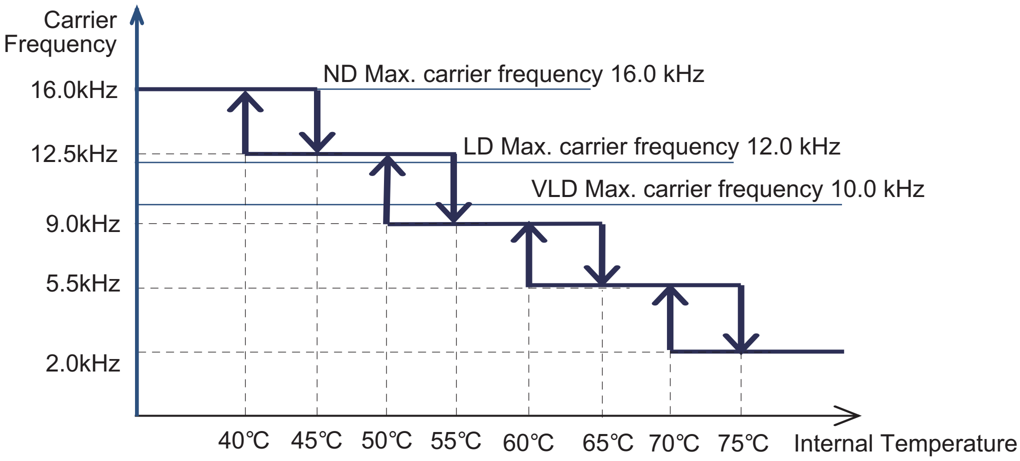
ND	Normal Duty	Max. carrier frequency	16.0 kHz
LD	Low Duty	Max. carrier frequency	12.0 kHz
VLD	Very Low Duty	Max. carrier frequency	10.0 kHz



02: Enabled: temperature

When **Automatic-carrier reduction selection** (bb103) is set to *02: Enabled: temperature*, the carrier frequency reduction starts when the temperature of the output element inside the inverter exceeds the temperature shown in the figure below.
When the temperature drops, the carrier frequency automatically returns to **Carrier speed setting** (bb101).

ND	Normal Duty	Max. carrier frequency	16.0 kHz
LD	Low Duty	Max. carrier frequency	12.0 kHz
VLD	Very Low Duty	Max. carrier frequency	10.0 kHz



7-7-3 Motor Electromagnetic Noise Reduction

Motor electromagnetic noise reduction has the effect of reducing the motor electromagnetic noise when it is loud.
Motor electromagnetic noise reduction is a function that changes the carrier frequency. By changing the carrier frequency, electromagnetic noise is reduced.

To use motor electromagnetic noise reduction, select a pattern that changes the carrier frequency in **Sprinkle carrier pattern selection** (bb102). Set patterns 1 to 3 and operate the motor, and then, select the one that reduces electromagnetic noise. When using motor electromagnetic noise reduction, do not use the set values of **Carrier speed setting** (bb101) or **Automatic-carrier reduction selection** (bb103). The motor instead outputs according to the carrier frequency that fluctuates in the pattern selected in **Sprinkle carrier pattern selection** (bb102).

● Parameter

Item	Parameter	Data	Description	Default
Sprinkle carrier pattern selection	bb102	00	Disabled (Carrier frequency constant)	00
		01	Pattern 1 enabled	
		02	Pattern 2 enabled	
		03	Pattern 3 enabled	

Additional Information

The control performance and heat generation are about the same as when the carrier frequency of the inverter is 3kHz.

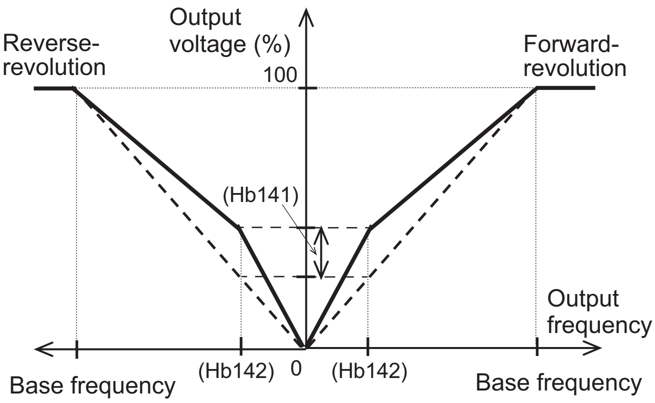
Precautions for Correct Use

When using a synchronous motor (SM) or permanent magnet motor (PMM), select *00: Disabled (Carrier frequency constant)*. If the carrier frequency is lowered, it may cause the motor to generate heat.

7-8 Manual Torque Boost

Manual torque boost is suitable for applications that require torque at start-up or at low speeds.
Manual torque boost is a function that improves the torque drop by adding the output voltage when the output frequency is low.

To use manual torque boost, set **Manual torque boost operational mode selection** (Hb140) to *01: Always enabled*, *02: Enabled only for forward revolution*, or *03: Enabled only for reverse revolution*.
Set the voltage amount to be added and the position to **Manual torque boost value** (Hb141) and **Manual torque boost Peak speed** (Hb142).
Set **Manual torque boost value** (Hb141) at the rate when **Async.Motor rated voltage** (Hb106) is 100%. Set **Manual torque boost Peak speed** (Hb142) at the rate when **Async.Motor Base frequency setting** (Hb104) is 100%.



Precautions for Correct Use

If you set the manual torque boost value too high, the motor may become overexcited. If the motor is overexcited, overload or overcurrent may occur, or the motor may burn out.

● Parameter

Item	Parameter	Data	Description	Default
Manual torque boost operational mode selection	Hb140	00	Disabled	01*1
		01	Always enabled	
		02	Enabled only for forward revolution	
		03	Enabled only for reverse revolution	
Manual torque boost value	Hb141	0.0 to 20.0 (%)	Set the maximum amount of torque boost for**Async.Motor rated voltage**(Hb106) at the time of setting the manual torque boost peak point.	0.0
Manual torque boost Peak speed	Hb142	0.0 to 50.0 (%)	Set, as a peak point, the ratio to**Async.Motor Base frequency setting**(Hb104).	0.0

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

Additional Information

- To obtain torque and prevent overload, check the output current of the inverter and adjust**Manual torque boost value**(Hb141) so that it is about 150% of the motor rated current. 150% is applicable when **Load type selection** (Ub-03) is set to *02: Normal Duty (ND)*. Apply 120% and 110% when it is set to *01: Light Duty (LD)* and *00: Very Light Duty (VLD)*, respectively.
- Use manual torque boost when**Control mode selection**(AA121) is set to*00: [V/f] Fixed torque characteristics (IM)*,*01 :[V/f] Reducing torque characteristics (IM)*,*04: [V/f with sensor] Fixed torque characteristics (IM)*, or*05: [V/f with sensor] Reduced torque characteristics (IM)*, and when the motor stalls at low speeds.
- If**Control mode selection**(AA121) is set to*03: Auto torque boost (IM)*or*07: Auto torque boost with sensor (IM)*, automatic torque boost is enabled. Therefore, you do not need to use manual torque boost. If you enable both, the adjustment will be difficult.

7-9 Energy-saving Operation Function

The energy-saving operation function is suitable for applications that do not require large torque in the low speed range, such as fans and pumps.
The energy-saving operation function is a function that automatically adjusts the inverter output power during constant speed operation to the minimum.

When using this function, set **Eco drive enable** (Hb145) to *01: Enabled*.
You can adjust the response and accuracy with **Eco drive response adjustment** (Hb146). The closer the setting is to 0%, the slower the response and the higher the accuracy. The closer the setting is to 100%, the faster the response and the lower the accuracy.

The energy-saving operation function operates only when **Control mode selection** (AA121) is set to *00: [V/f] Reducing torque characteristics (IM)* or *01: [V/f] Reducing torque characteristics (IM)*.

Precautions for Correct Use

Since this function controls the motor relatively slowly, the motor may stall and trip due to over-current if sudden load fluctuations such as impact load occur.

● Parameter

<table>
<tr><th>Item</th><th>Parameter</th><th>Data</th><th colspan="3">Description</th><th>Default</th></tr>
<tr><td>Eco drive enable</td><td>Hb145</td><td>00: Disabled
01: Enabled</td><td colspan="3">Select whether or not to conduct the energy-saving operation.</td><td>00</td></tr>
<tr><td rowspan="2">Eco drive response adjustment</td><td rowspan="2">Hb146</td><td rowspan="2">0 to 100 (%)</td><td>Setting</td><td>Response</td><td>Accuracy</td><td rowspan="2">50</td></tr>
<tr><td>0
↕
100</td><td>Slow
↕
Fast</td><td>High
↕
Low</td></tr>
</table>

7-10 Encoder Feedback

In the 3G3RX2 Series Inverter, input of feedback from a motor into a control circuit terminal block of the main unit or into a PG option unit allows the V/f control with sensor, vector control with sensor, and control with sensor and the absolute position control. For details on these control, refer to *7-2-5 V/f Control with Sensor* on page 7-14, *7-2-8 Vector Control with Sensor* on page 7-19, and *8-4-9 Absolute Position Control Mode* on page 8-107.

● Parameter

Item	Parameter	Data	Description	Default
Encoder constant setting	CA-81	0 to 65535 (pls)	Set the encoder constant.	1024
Encoder position selection	CA-82	00	Phase-A is leading.	00
		01	Phase-B is leading.	
Motor gear ratio Numerator	CA-83	1 to 10000	Set the numerator of the gear ratio of a motor.	1
Motor gear ratio Denominator	CA-84	1 to 10000	Set the denominator of the gear ratio of a motor.	1
Pulse train detection object selection	CA-90	00	Disabled	00
		01	Frequency command	
		02	Speed feedback	
		03	Pulse count	
Mode selection of pulse train input	CA-91	00	MD0: 90° phase difference	00
		01	MD1: Forward/reverse rotation command and rotation direction	
		02	MD2: forward/reverse rotation pulse string	
Encoder constant setting (Option)	ob-01	0 to 65535 (pls)	Set the encoder constant.	1024
Encoder position selection (Option)	ob-02	00	Phase-A is leading.	00
		01	Phase-B is leading.	
Motor gear ratio Numerator (Option)	ob-03	1 to 10000	Set the numerator of the gear ratio of a motor.	1
Motor gear ratio Denominator (Option)	ob-04	1 to 10000	Set the denominator of the gear ratio of a motor.	1
Pulse train detection object selection	ob-10	00	Command	00
		01	Pulse string position command	
Mode selection of pulse train input	ob-11	00	MD0: 90° phase difference pulse train	01
		01	MD1: Forward/reverse rotation command and rotation direction	
		02	MD2: forward/reverse rotation pulse string	

7-10-1 Encoder Feedback Input Wiring

Two wiring methods are selectable depending on the encoder type.

- When using a line driver type output encoder, install the optional unit 3G3AX-RX2-PG01 and wire it to the encoder signal input terminal. Encoders up to 200 kpps can be used with DC5V RS422 compliance. For details, check *2-3-6 Wiring for PG Option Unit* on page 2-68.
- You can use the A/B terminal of the input terminal function as encoder feedback. In this case, you need to use an encoder with complementary type output.
  With a pulse output voltage of 20V to 24V, encoders of 32 kpps or less can be used. For wiring, refer to *2-3-3 Arrangement and Function of Control Circuit Terminal Block* on page 2-18 and the connection example *Encoder Connection to Input Terminal* on page 2-65.

7-10-2 Encoder Feedback Input Settings

When inputting encoder feedback to the main unit terminal block, set**Pulse train detection object selection**(CA-90) to*02: Speed feedback*.
When inputting it to the PG option unit, set**Pulse train detection object selection**(CA-90) to*00: Disabled*,*01: Frequency command*, or*03: Pulse count*. The input of the PG option unit is enabled except for when*02: Speed feedback*is selected.

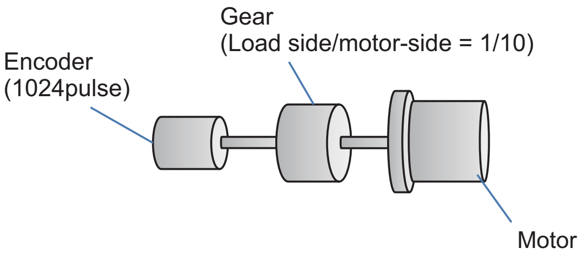
Set the following parameters depending on whether the [A] and [B] terminals of the main unit are used for the encoder feedback input or the [EAP], [EBP], [EAN], and [EBN] terminals of the PG option unit are used.

	Setting description	[A] and [B] terminals of main unit	[EAP], [EBP], [EAN], and [EBN] terminals of PG option unit
(1)	Encoder constant setting	CA-81	ob-01
(2)	Encoder position selection	CA-82	ob-02
(3)	Encoder gear ratio Numerator	CA-83	ob-03
(4)	Encoder gear ratio Denominator	CA-84	ob-04

Set the number of encoder pulses to (1) Encoder constant setting.
Set*00: Phase-A is leading*or*01: Phase-B is leading*to (2) Encoder position selection according to the encoder phase order.

To check whether the encoder feedback input is correct, set**Control mode selection**(AA121) to*00: [V/f] Fixed torque characteristics (IM)*and check**Speed detection value monitor**(dA-08). The wiring is correct if a positive (+) value is displayed for forward rotation operation [FW] and a negative (-) value is displayed for reverse rotation operation [RV]. If the wiring is incorrect, re-examine the wiring or change (2) Encoder position selection.

If the encoder and motor shaft are connected via gears, set the gear ratio to (3) Encoder gear ratio Numerator and (4) Encoder gear ratio Denominator. Set the value of ((3) / (4)) in the range of 1/50 to 20. If it is set outside the range, the internal calculation will be saturated and the correct speed cannot be detected.



For example, if the encoder pulse count is 1024 and the gear ratio is 1/10, set as follows.

(1) Encoder constant setting: 1024

(3) Encoder gear ratio Numerator: 1

(4) Encoder gear ratio Denominator: 10

Set**Async.Motor poles setting**(Hb103) to obtain the motor speed from the encoder feedback.

7-10-3 Encoder Feedback Function Selection

1 Check the encoder's set-up in the encoder specifications.

(1) Check the encoder or pulse train input specifications.

(2) Open collector input
Control using the [A] and [B] terminals of the inverter main body
⇒ Set**Pulse train detection object selection**(CA-90) to*02: Speed feedback*.

(3) Line driver input
Control using [EAP], [EAN], [EBP], and [EBN] terminals of PG option unit
⇒ Check that**Pulse train detection object selection**(CA-90) is not set to*02*.

2 Set up the control method.

(1) Select the speed control or absolute position control.

(2) Conduct the speed control.
In **Control mode selection** (AA121), select one from the following settings for the speed control with sensor.

- Set one of the following options for V/f control with sensor
  04: [V/f with sensor] Fixed torque characteristics (IM)
  05: [V/f with sensor] Reduced torque characteristics (IM)
  06: [V/f with sensor] Free V/f (IM)
- Set auto torque boost with sensor
  07: Auto torque boost with sensor (IM)
- Set vector control with sensor
  10: Vector control with sensor (IM)
  When selecting this setting, you also need to set **Vector control mode selection** (AA123) to *00*.

(Refer to*7-1 Selection of Motor Control Methods* on page 7-3.)

(3) Conduct the absolute position control.
Set **Control mode selection** (AA121) to *10: Vector control with sensor (IM)*, and then select one of the following modes in **Vector control mode selection** (AA123).

- 02: Absolute position control mode
- 03: High-resolution absolute position control mode

(Refer to*8-4-9 Absolute Position Control Mode* on page 8-107.)

7-10-4 Check of Pulse Train Input Setting

The following table shows the relationship between the [A] and [B] terminals of the main unit and the set values, and between the [EAP], [EAN], [EBP], [EBN], [SAP], [SAN], [SBP], and [SBN] terminals of the PG Option Unit and the set values.

<table>
<tr><th>Function</th><th>Setting check</th><th>Encoder</th><th>Pulse command input</th></tr>
<tr><td rowspan="3">Speed control with sensor</td><td rowspan="3">Required setting
• Set Control mode selection (AA121) to 04 to 07.
Or,
• Set Control mode selection (AA121) to 10 and Vector control mode selection (AA123) to 00.</td><td rowspan="2">When wiring the encoder to the PG option unit, set Pulse train detection (internal) control terminal [A] [B] (CA-90) to 00 or other values, where the A/B terminal is not used for pulse input, referring to the right column.*1</td><td>When using the A/B terminal for pulse train speed command, set Pulse train detection (internal) control terminal [A] [B] (CA-90) to 01.</td></tr>
<tr><td rowspan="2">When using the SA/SB terminal on the PG option unit for pulse train speed command, set Pulse train detection (option) terminal (ob-10) to 01.</td></tr>
<tr><td>When connecting the encoder to the A/B terminal, set Pulse train detection (internal) control terminal [A] [B] (CA-90) to 02.*2</td></tr>
</table>

Function	Setting check	Encoder	Pulse command input
Torque control with sensor	Required setting • Set **Control mode selection** (AA121) to *10* and **Vector control mode selection** (AA123) to *00*.	When wiring the encoder to the PG option unit, set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *00* or other values, where the A/B terminal is not used for pulse input, referring to the right column.[*1] When connecting the encoder to the A/B terminal, set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *02*.[*2]	When using the A/B terminal for pulse train torque command, set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *01*. When using the SA/SB terminal on the PG option unit for pulse train torque command, set **Pulse train detection (option) terminal** (ob-10) to *01*.
Absolute position control	Required setting • Set **Control mode selection** (AA121) to *10* and **Vector control mode selection** (AA123) to *02*. Or, • Set **Control mode selection** (AA121) to *10* and **Vector control mode selection** (AA123) to *03*.	Wire the encoder to the PG option unit.[*1] When connecting the encoder to the A/B terminal, set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *02*.	A position command cannot be input as a pulse.
Pulse train position control	Required setting • Set **Control mode selection** (AA121) to *10* and **Vector control mode selection** (AA123) to *01*. • **Pulse train detection (option) terminal** (ob-10) to *01*. Reference *8-4-7 Pulse String Position Control* on page 8-98	Wire the encoder to the PG option unit.[*1] When connecting the encoder to the A/B terminal, set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *02*.[*2]	The command pulse can be input only by the SA/SB command input of the PG option.
Pulse speed command with sensorless control	Set **Control mode selection** (AA121) as follows. V/f: 00, 01, 02, 0,3 ,04 Sensorless vector: 08, 09 SM/PMM: 11, 12	-	The A/B terminal can be input as speed command. Set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *01*. The SA/SB terminal on the PG option unit can be input as speed command. Set the **Pulse train detection (option) terminal** (ob-10) to *01*.

Function	Setting check	Encoder	Pulse command input
Pulse count function	Required setting • Set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *03: Pulse count*. Or,	-	A/B terminal is for pulse count only. Input pulse to the PG option unit cannot be used for pulse count.
	• Set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *00*, and CA-10 to *103: PLA* and CA-11 to *104: PLB*.	-	A/B terminal is for pulse count only. Input pulse to the PG option unit cannot be used for pulse count.

*1. When wiring the encoder to the [SAP], [SAN], [SBP], or [SBN] terminals of the PG option unit, do not set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *02*. If it is set to *02*, the encoder connected to the PG option unit is not used.

*2. In vector control with a sensor, input the encoder input to one of the [A] or [B] terminal of the main unit or [EAP], [EAN], [EBP], or [EBN] terminal of the PG option unit.

7-11 Motor Hunting Measures

7-11-1 Stabilization Constant

The stabilization constant has the effect of reducing the motor hunting or vibration.

The stabilization constant is a parameter that adjusts the gain of the internal control of the inverter.

If the hunting occurs, change the setting value little by little as follows and find a point where the hunting subsides.

- When using a motor that is larger than the rated capacity of the inverter, decrease the set value.
- When using a motor that is smaller than the rated capacity of the inverter, increase the set value.
- When involving a load with a large inertia such as a fan, reduce the set value.

● Parameter

Item	Parameter	Data	Description	Default
Stabilization constant	HA110	0 to 1000 (%)	Reduce the motor hunting.	100

Additional Information

- When a single inverter drives multiple motors, set **Stabilization constant** (HA110) to *0*.
- If **Stabilization constant** (HA110) fails to suppress the motor hunting, adjust **Carrier speed setting** (bb101) or **Output voltage gain** (Hb180).

7-11-2 Output Voltage Gain

Adjusting the output voltage gain has the effect of suppressing the motor hunting.

The output voltage gain is a parameter that adjusts the output voltage of the inverter.

For **Output voltage gain** (Hb180), set the gain applied to the output voltage in %. Gradually lower the set value during the motor hunting to find a point where the hunting subsides.

● Parameter

Item	Parameter	Data	Description	Default
Output voltage gain	Hb180	0 to 255 (%)	The voltage gain of the PWM output.	100

Precautions for Correct Use

- Do not perform steady operation when the setting of **Output voltage gain** (Hb180) exceeds 100%. Otherwise, the motor may burn out.
- Set **Output voltage gain** (Hb180) to 80% or more, as a guide. If the set value is too small, an overcurrent error (E001) will occur.

8

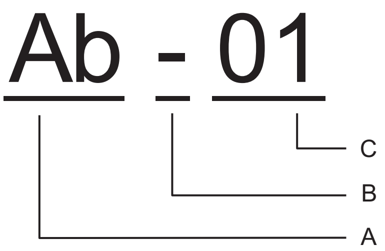
Applied Settings

This chapter explains the settings of the applied functions.

Parameter

The parameter number structure is indicated below.

This section explains parameters without using the expression of **first setting**. Parameters that have both first setting and second setting are described using the code for the first setting. The setting values and operations of the second setting are the same as those of the first setting, unless otherwise specified.



A	Parameter group		
B	SET function type	-	Common setting: always enabled in both the first and second settings.
		1	First setting: enabled when the [SET] terminal function is OFF.
		2	Second setting: enabled when the [SET] terminal function is ON.
C	In-group number		

To switch to the second setting, use the [SET] terminal function to be assigned to the input or output terminal. Refer to *8-4-1 Second Control (SET)* on page 8-78 for details of the second setting.

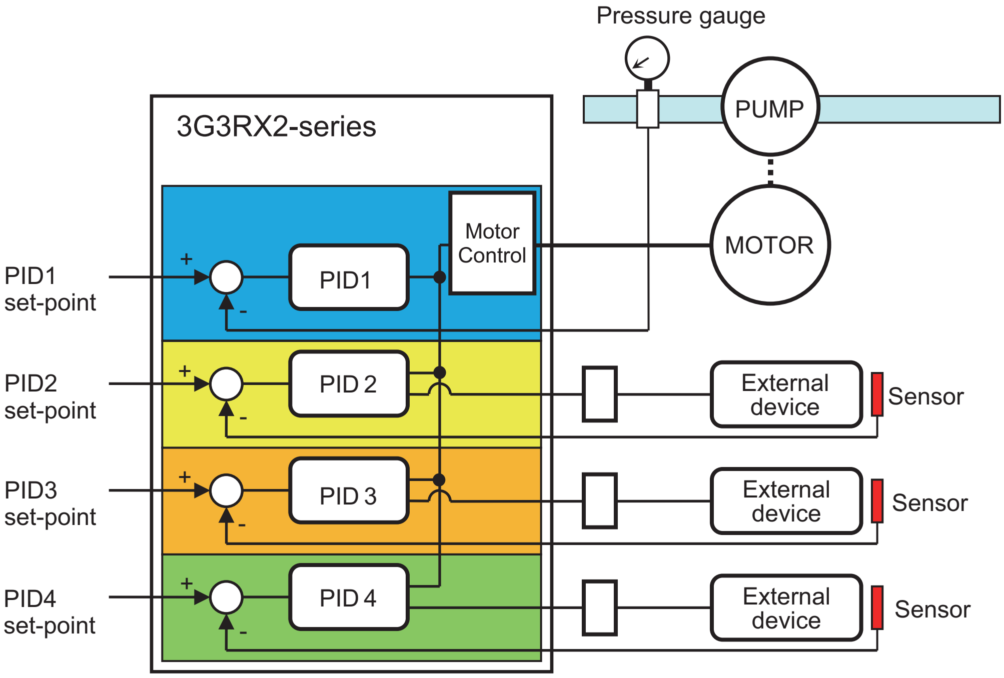
8-1 PID Control

8-1-1 Function Overview

3G3RX2 Series is equipped with 4 independent PID functions, and each PID can be set independently.
The four PID controls can be switched and used for motor control by combining the PID output switching [56: PIO] terminal and [57: PIO2] terminal.
PIDs that are not used for motor control can be freely used for external PID calculation that is not related to inverter control.
This is useful for space saving and cost saving because it is not necessary to install a separate PID controller.

The differences in the functions of PID1 to 4 are as follows.

	PID1	PID2	PID3	PID4
Set point selection and calculation	The set point can be set by either switching between three values, or can be used as an expression for the set point.	The set point can be set by selecting one value with parameters. Cannot be calculated	The set point can be set by selecting one value with parameters. Cannot be calculated	The set point can be set by selecting one value with parameters. Cannot be calculated
Set point multi stage switching	Switch between speeds 0 to 15	-	-	-
Feedback data selection and calculation	The feedback data can be set by either switching between three values, or the calculation result of three values can be used as an expression for the feedback data.	The feedback data can be set by selecting one value with parameters. Cannot be calculated	The feedback data can be set by selecting one value with parameters. Cannot be calculated	The feedback data can be set by selecting one value with parameters. Cannot be calculated
Gain switching	Select from 2 sets	Not selectable	Not selectable	Not selectable
Polarity inversion of deviation	Selectable	Selectable	Selectable	Selectable
Feed forward	Selectable	-	-	-
Cascade control	Selectable	Selectable	-	-
Output range	Selectable	Selectable	Selectable	Selectable
Reverse output	Selectable	Selectable	Selectable	Selectable
Control integral reset	Selectable	Selectable	Selectable	Selectable
PID soft-start	Selectable	-	-	-
PID sleep	Selectable	-	-	-
PID deviation excessive signal	Selectable	Selectable	Selectable	Selectable
PID feedback comparison signal	Selectable	Selectable	Selectable	Selectable
PID unit change	Selectable	Selectable	Selectable	Selectable



To control the output frequency to the motor with PID, it is necessary to select PID1 to 4 and set the frequency command.

During PID operation, the **Input terminal function** PID is disabled [41: PID], [43: PID2], [45: PID3], [47: PID4]. While the signal is ON, each PID function is disabled and the target value is reached. Normal output is performed with the selected command.

Precautions for Correct Use

In the case of controlling the motor by PID control, frequency command destination needs to be set to PID output.

The upper/lower limiter function operates for command frequency by PID output. It does not operate for PID set point.

● Example Setting Procedures

When you want to perform simple PID control by inputting the set-point [Ai1] and feedback (FB) value [Ai2] from the initial value of the parameter, set it according to the following procedure.

1 Set **PID1 enable** (AH-01) to *01:Enabled*.

2 Set **Main speed input source selection** (AA101) to *15: PID calculation*.

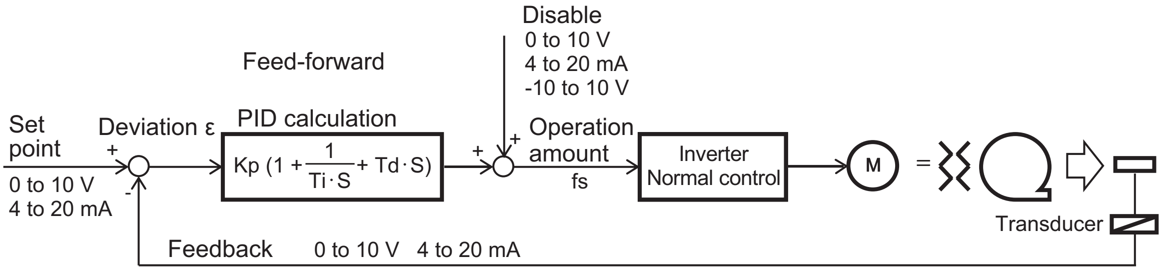
3 Set **Input source selection of Set-point for PID1** (AH-07) to *01: Setting by Terminal [Ai1]*.

4 Set **Input source selection of Set-point for PID1** (AH-51) to *02: Setting by Terminal [Ai2]*.

5 Set PID1 Gain to a value from (AH-61) to (AH-63) .

6 Enter the command set in **RUN Command Selection** (AA111) and start PID control.

Basic Composition of PID Control

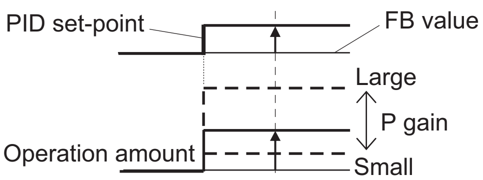
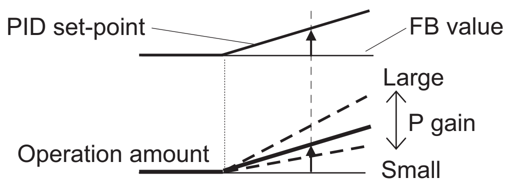


Kp: Proportional gain Ti: Integral time Td: Differential time s: Operator ε: Deviation
Ki: Integral gain setting (Ki = Ti / Kp) Kd: Differential gain setting (Kd = Kp × Td)

PID Operation

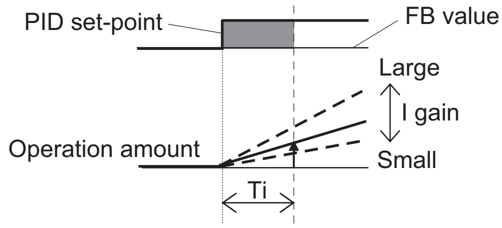
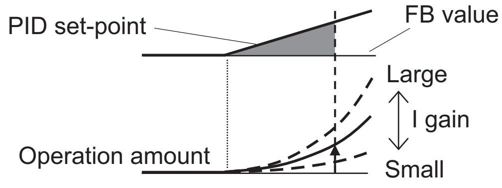
In this example, the PID set-point is constant and the feedback (FB) value changes.

a. P operation: Proportional gain Kp
The operation amount of the PID command value is proportional to the deviation between the PID set-point and the current feedback (FB) value.
The command manipulated variable can be adjusted with Proportional gain Kp.
The deviation is (PID set point - FB value).

When the set-point changes in steps	When the set-point changes like a ramp
	

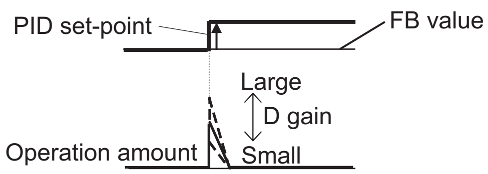
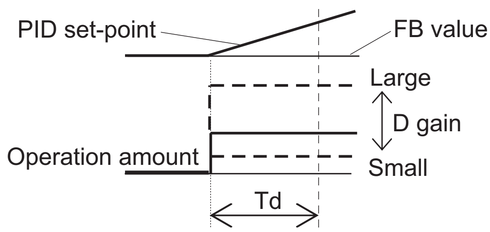
b. I operation: Integral time constant Ki (= Integral time Ti / Proportional gain Kp)
In a proportional operation, when the PID set-point and the feedback value are close to each other, the change in output becomes small and an offset occurs. Therefore, if you combine the proportional motion with the integral motion, the offset will decrease over time, and the measured value and the set value will match.

- Integral time Ti
It is a unit that indicates the strength of the integral movement. It is the time it takes for the integral operation amount to reach the same operation amount as the proportional operation with respect to the step-like deviation as shown in the figure below. The shorter the integral time, the stronger the correction by the integral operation. However, if it is made too short, the correction operation may become too strong and cause hunting.
The integral value is cleared by the PID Control Integral Reset Function [42: PIDC] terminal.

When the set-point changes in steps	When the set-point changes like a ramp
	

c. D operation: Derivative gain (= Proportional gain Kp × Derivative gain time Td)
The proportional operation and integral operation are correction operations for the control result, so the response will be slow. In order to make up for its shortcomings, the derivative operation gives a large amount of manipulation to sudden disturbances and works to quickly return to the original state. The correction operation is performed with an operation amount proportional to the slope (differential coefficient) at which the deviation occurs.

- Derivative time Td
  It is a unit that indicates the strength of the Derivative operation. It is the time it takes for the Derivative operation amount to reach the same operation amount as the proportional operation for the ramp-shaped deviation as shown in the figure below. The longer the derivative time, the stronger the correction by the derivative operation.

When the set-point changes in steps	When the set-point changes like a ramp
	

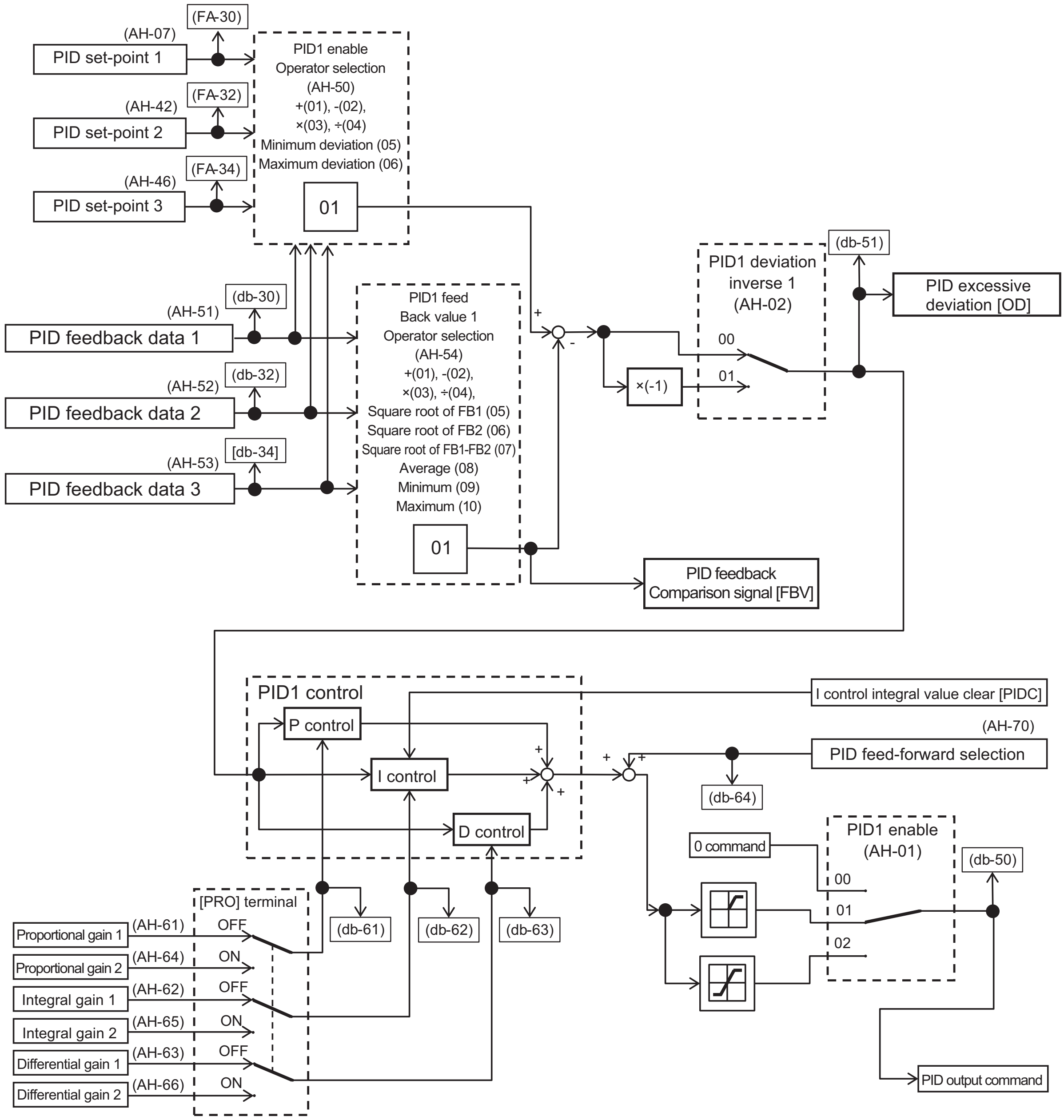
The PI operation is a combination of a and b.
The PD operation is a combination of a and c.
The PID operation is a combination of a, b, and c.

8-1-2 PID Parameters and Block Diagram

For PID1, you can enter three PID set-point values and 3 PID feedback values.
PID Gains 1 and 2 can be switched with the PID Gain switch [55: PRO] terminal. The PID1 output can be used as a cascading control for the set-point of PID2.
With Soft start function enable, you can automatically increase the output and then move to PID Control by performing normal operation for a certain section at the start of operation. Refer to *8-1-3 PID Soft-start Function* on page 8-22.

When the flow rate or air volume increases, sleep operation is also possible to improve energy saving. Refer to *8-1-4 PID Sleep Function* on page 8-24.

Block Diagram of PID Control



● Parameter

Item	Parameter	Data	Description	Default
PID1 enable	AH-01	00	Disabled	00
		01	Enabled (If the command is a negative value, it will NOT be output in the reverse direction)	
		02	Enabled (If the command is a negative, it WILL be output in the reverse direction)	
PID1 deviation inverse	AH-02	00	Disabled	00
		01	Enabled (polarity inversion of deviation)	

Item	Parameter	Data	Description	Default
Input source selection of Set-point 1 for PID1	AH-07	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	07
Set-point-1 setting for PID1	AH-10	0.00 to 100.00 (%)*1	This is the Set-point-1 setting for PID1	0.00
Input source selection of Set-point 2 for PID1	AH-42	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	00
Set-point 2 setting for PID1	AH-44	0.00 to 100.00 (%)*1	This is the Set-point 2 setting for PID1.	0.00
Input source selection of Set-point 3 for PID1	AH-46	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	00
Set-point 3 setting for PID1	AH-48	0.00 to 100.00 (%)*1	This is the Set-point 3 setting for PID1.	0.00

Item	Parameter	Data	Description	Default
Calculation symbol selection of Set-point 1 for PID1	AH-50	01	(Target value1) + (Target value2)	01
		02	(Target value1) - (Target value2)	
		03	(Target value1) × (Target value2)	
		04	(Target value1) ÷ (Target value2)	
		05	Input destination 1, 2, or 3 with the smallest deviation	
		06	Input destination 1, 2, or 3 with the largest deviation	

*1. The data range differs between **PID1 scale adjustment (at 0%)** (AH-04) and **PID1 scale adjustment (point position)** (AH-06).

Item	Parameter	Data	Description	Default
Input source selection of Process data 1 for PID1	AH-51	00 to 06, 08 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	01
Input source selection of Process data 2 for PID1	AH-52	00 to 06, 08 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	00
Input source selection of Process data 3 for PID1	AH-53	00 to 06, 08 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	00

Item	Parameter	Data	Description	Default
Calculation symbol selection of Process data for PID1	AH-54	01	(FB1) + (FB2)	01
		02	(FB1) - (FB2)	
		03	(FB1) × (FB2)	
		04	(FB1) ÷ (FB2)	
		05	Square root of FB1	
		06	Square root of FB2	
		07	Square root of (FB1 - FB2)	
		08	Square root of FB1 / FB2 / FB3	
		09	Minimum of FB1 / FB2 / FB3	
		10	Maximum of FB1 / FB2 / FB3	
PID1 gain change method selection	AH-60	00	Disabled (use gain 1)	00
		01	PID gain change method [55: PRO] Switching by terminal	
PID1 proportional Gain 1	AH-61	0.0 to 100.0	Proportional gain	1.0
PID1 integral Time constant 1	AH-62	0.0 to 3600.0 (s)	Integral time	1.0
PID1 derivative gain time 1	AH-63	0.00 to 100.00 (s)	Derivative gain time	0.00
PID1 proportional gain 2	AH-64	0.0 to 100.0	Proportional gain	0.0
PID1 integral Time constant 2	AH-65	0.0 to 3600.0 (s)	Integral time	0.0
PID1 derivative Time constant 2	AH-66	0.00 to 100.00 (s)	Derivative gain time	0.00
PID1 gain change time	AH-67	0 to 10000 (ms)	Change time by PID gain change [55:PRO] terminal operation	100
PID feed-forward selection	AH-70	00	Disabled	00
		01	Ai1 Terminal input	
		02	Ai2 Terminal input	
		03	Ai3 Terminal input	
		04	(Reserved)	
		05	(Reserved)	
		06	(Reserved)	

● Input Terminal Function

Item	Terminal name	Data	Description
PID1 disabled	PID	041	By turning on the terminal, the PID1 function is disabled. If it is disabled, the command set for the set-point will be used as the command frequency.
Resetting of PID1 integration	PIDC	042	Clears the integrated value of the I control of PID1.

Item	Terminal name	Data	Description
PID1 Multi stage set-point 1 setting	SVC1	051	Switches between multiple set-points.
PID1 Multi stage set-point 2 setting	SVC2	052	
PID1 Multi stage set-point 3 setting	SVC3	053	
PID1 Multi stage set-point 4 setting	SVC4	054	
Switching of PID gain	PRO	055	The PID gains 1 and 2 are switched by the terminal.

● Data Monitor

Item	Parameter	Data	Description
PID1 Set-point 1	FA-30	0.00 to 100.00 (%) *1	Displays the PID1 Set-point 1. If **Input source selection of Set-point 1 for PID1** (AH-07) is set to *07: Parameter setting*, or Multi stage set-point 1 to 15 are enabled, this value can be changed.
PID1 Set-point 2	FA-32	0.00 to 100.00 (%) *1	Displays the PID1 Set-point2. If **Input source selection of Set-point 2 for PID1** (AH-42) is set to *07: Parameter setting*, the value can be changed.
PID1 Set-point 3	FA-34	0.00 to 100.00 (%) *1	Displays the PID1 Set-point 3. If **Input source selection of Set-point 3 for PID1** (AH-46) is set to *07: Parameter setting*, the value can be changed.
PID1 Feedback Monitor 1	db-30	-100.00 to 100.00 (%) *1	Displays the PID1 feedback value1.
PID1 Feedback Monitor 2	db-32	-100.00 to 100.00 (%) *1	Displays the PID1 feedback value2.
PID1 Feedback Monitor 3	db-34	-100.00 to 100.00 (%) *1	Displays the PID1 feedback value3.
PID1 target value monitor after calculation	db-42	-100.00 to 100.00 (%) *1	Displays the value after calculation with **Calculation symbol selection of Set-point 1 for PID1** (AH-50).
PID1 target value monitor after calculation	db-44	-100.00 to 100.00 (%) *1	Displays the value after calculation with **Calculation symbol selection of Process data for PID1** (AH-54).
PID1 output monitor	db-50	-100.00 to 100.00 (%)	Displays the PID1 output value.
PID1 deviation monitor	db-51	-200.00 to 200.00 (%)	Displays the PID1 deviation.
PID1 deviation 1 monitor	db-52	-200.00 to 200.00 (%)	Monitors the 3 deviations of PID1 when **Calculation symbol selection of Set-point 1 for PID1** (AH-50) is set to *05: Square root of FB1*, or *06: Square root of FB2*.
PID1 deviation 2 monitor	db-53	-200.00 to 200.00 (%)	
PID1 deviation 3 monitor	db-54	-200.00 to 200.00 (%)	
PID current P gain monitor	db-61	0.0 to 100.0	Displays the current P gain.

Item	Parameter	Data	Description
PID current I gain monitor	db-62	0.00 to 3600.00 (s)	Displays the current I gain.
PID current D gain monitor	db-63	0.00 to 100.00 (s)	Displays the current D gain.
PID feed-forward monitor	db-64	-100.00 to 100.00 (%)	Displays the feed-forward command value.

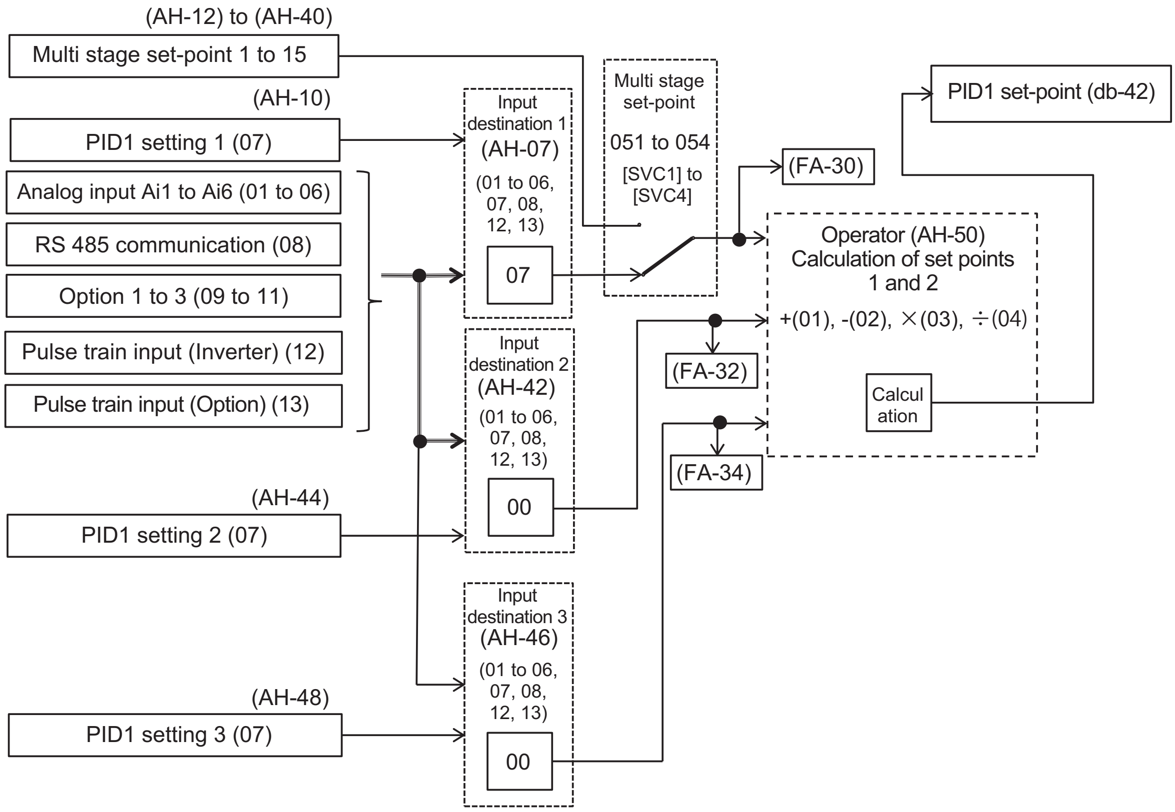
*1. The data range differs between **PID1 scale adjustment (at 0%)** (AH-04) and **PID1 scale adjustment (point position)** (AH-06).

PID1 Set-Point Selection

Select the PID1 set-point.
To set the set-point with input 1 only, disable inputs 2 and 3 by setting **Input source selection of Set-point 2 for PID1** (AH-42) and **Input source selection of Set-point 3 for PID1** (AH-46) to *00: Disabled* and setting **Input source selection of Set-point 1 for PID1** (AH-50) to *01: Addition*.
The operation result of **Calculation symbol selection of Set-point 1 for PID1** (AH-50) is limited to the range of -100.00 to 100.00 (%).

● PID Operation with Set-point 1 and 2

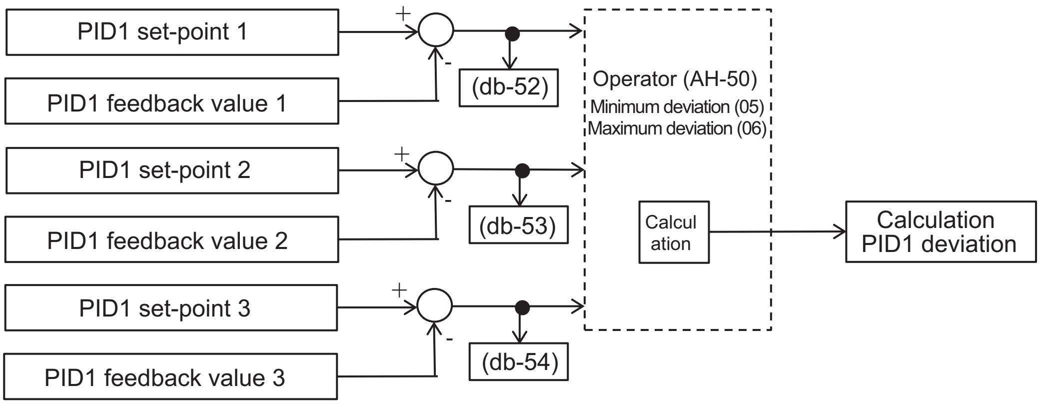
When **Calculation symbol selection of Set-point 1 for PID1** (AH-50) is set to one of the values *01* to *04*, set-points 1 and 2 will be used for the calculation.



● PID Calculation by Minimum Deviation and Maximum Deviation

When setting **Calculation symbol selection of Set-point 1 for PID1** (AH-50) with *05: Minimum deviation*, or *06: Maximum deviation*, use the minimum and maximum deviations and compare the following three deviations to perform the PID operation.

- (Set point 1) - (Feedback value 1)
- (Set point 2) - (Feedback value 2)
- (Set point 3) - (Feedback value 3)



Additional Information

Select *00: Disabled* for unused set-point and feedback values.

PID Set-point Multi-Stage Switch Function

By setting **Input terminal function** (CA-01) to (CA-11) to PID1 Multi stage set-point 1 to 4 [51: SVC1] to [54: SVC4] terminals, PID1 Multi-stage set-point speeds 0 to 15 can be selected.

Precautions for Correct Use

- You can set the standby time until the terminal input is confirmed with **Multistage input determination time** (CA-55). This makes it possible to prevent the transition state during the terminal switching operation from being used.
- If the waiting time set in **Multistage input determination time** (CA-55) elapses without any change in the input, the data will be confirmed. Increasing the wait time will slow down the input response.

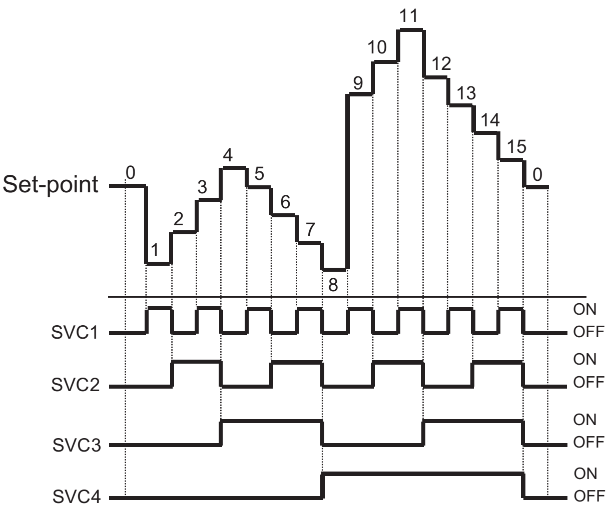
● Operation Table

Multi-stage Set-point	SVC4	SVC3	SVC2	SVC1	Parameter
Set-point 0	OFF	OFF	OFF	OFF	AH-10 *1
Set-point 1	OFF	OFF	OFF	ON	AH-12
Set-point 2	OFF	OFF	ON	OFF	AH-14
Set-point 3	OFF	OFF	ON	ON	AH-16
Set-point 4	OFF	ON	OFF	OFF	AH-18
Set-point 5	OFF	ON	OFF	ON	AH-20
Set-point 6	OFF	ON	ON	OFF	AH-22
Set-point 7	OFF	ON	ON	ON	AH-24

Multi-stage Set-point	SVC4	SVC3	SVC2	SVC1	Parameter
Set-point 8	ON	OFF	OFF	OFF	AH-26
Set-point 9	ON	OFF	OFF	ON	AH-28
Set-point 10	ON	OFF	ON	OFF	AH-30
Set-point 11	ON	OFF	ON	ON	AH-32
Set-point 12	ON	ON	OFF	OFF	AH-34
Set-point 13	ON	ON	OFF	ON	AH-36
Set-point 14	ON	ON	ON	OFF	AH-38
Set-point 15	ON	ON	ON	ON	AH-40

*1. When **Input source selection of Set-point 1 for PID1** (AH-07) is set to *07: Parameter setting*.

● Operation Graph



● Input Terminal Function

Item	Terminal name	Data	Description
PID1 Multi stage set-point 1 setting	SVC1	051	Switches between multiple set-points.
PID1 Multi stage set-point 2 setting	SVC2	052	
PID1 Multi stage set-point 3 setting	SVC3	053	
PID1 Multi stage set-point 4 setting	SVC4	054	

● PID1 Set-point

Item	Parameter	Data	Description	Default
Input source selection of Set-point 1 for PID1	AH-07	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	07

Item	Parameter	Data	Description	Default
Set-point 1 setting for PID1	AH-10	0.00 to 100.00 (%) *1	This is a parameter setting value.	0.00
PID1 Multi stage set-point 1 setting	AH-12			
PID1 Multi stage set-point 2 setting	AH-14			
PID1 Multi stage set-point 3 setting	AH-16			
PID1 Multi stage set-point 4 setting	AH-18			
PID1 Multi stage set-point 5 setting	AH-20			
PID1 Multi stage set-point 6 setting	AH-22			
PID1 Multi stage set-point 7 setting	AH-24			
PID1 Multi stage set-point 8 setting	AH-26			
PID1 Multi stage set-point 9 setting	AH-28			
PID1 Multi stage set-point 10 setting	AH-30			
PID1 Multi stage set-point 11 setting	AH-32			
PID1 Multi stage set-point 12 setting	AH-34			
PID1 Multi stage set-point 13 setting	AH-36			
PID1 Multi stage set-point 14 setting	AH-38			
PID1 Multi stage set-point 15 setting	AH-40			

Item	Parameter	Data	Description	Default
Input source selection of Set-point 2 for PID1	AH-42	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	00
Set-point 2 setting for PID1	AH-44	0.00 to 100.00 (%) *1	This is a parameter setting value.	0.00
Input source selection of Set-point 3 for PID1	AH-46	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	00
Set-point 3 setting for PID1	AH-48	0.00 to 100.00 (%) *1	This is a parameter setting value.	0.00
Calculation symbol selection of Set-point for PID1	AH-50	01	(Set-point1) + (Set-point2)	01
		02	(Set-point1) - (Set-point2)	
		03	(Set-point1) × (Set-point2)	
		04	(Set-point1) ÷ (Set-point2)	
		05	The smallest of Deviation 1 (Set-point1 - FB1), Deviation 2 (Set-point2 - FB2), Deviation 3 (Set-point3 - FB3)	
		06	The largest of Deviation 1 (Set-point1 - FB1), Deviation 2 (Set-point2 - FB2), Deviation 3 (Set-point3 - FB3)	

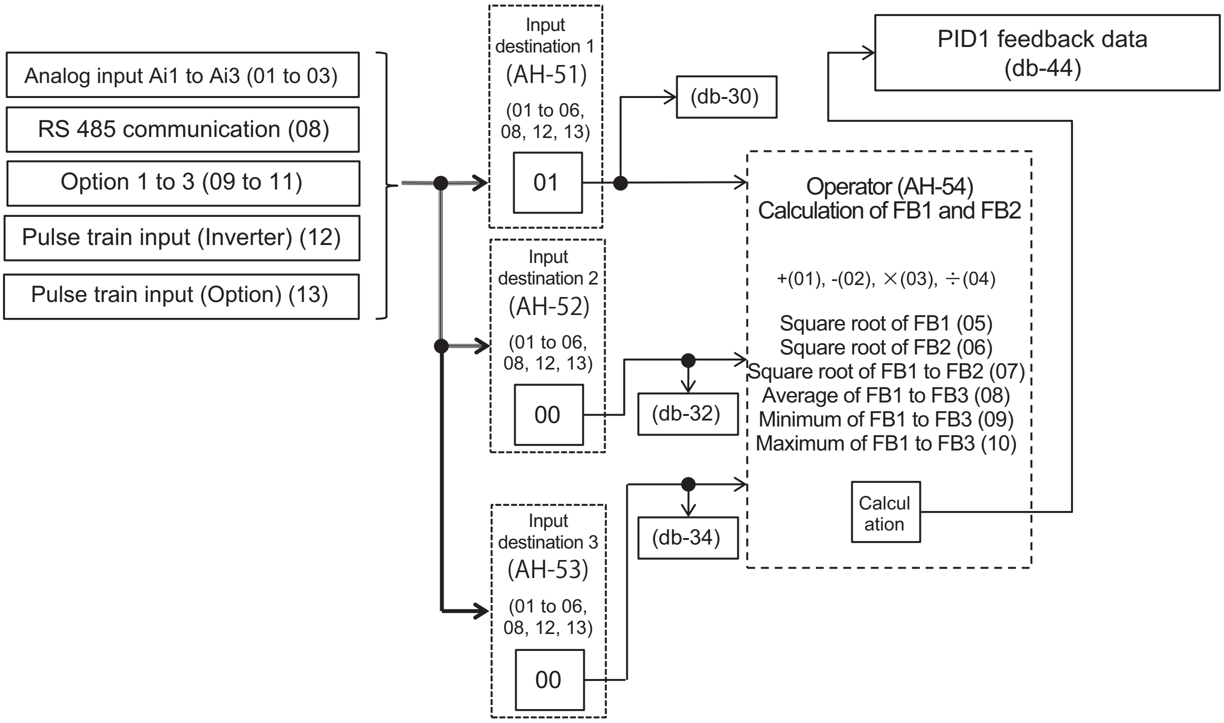
*1. The data range differs between **PID1 scale adjustment (at 0%)** (AH-04) and **PID1 scale adjustment (point position)** (AH-06).

PID1 Feedback Data Selection

Select the PID1 Feedback data.

If you want to set the Feedback data on Input 1 only, to disable Input 2 and 3, set **Input source selection of Process data for PID1** (AH-52) and **Input source selection of Process data 3 for PID1** (AH-53) to *00: Disabled* and **Calculation symbol selection of Process data for PID1** (AH-54) to *01: Addition*.

The calculation result of **Calculation symbol selection of Process data for PID1** (AH-54) is limited to the range of -100.00 to 100.00 (%).



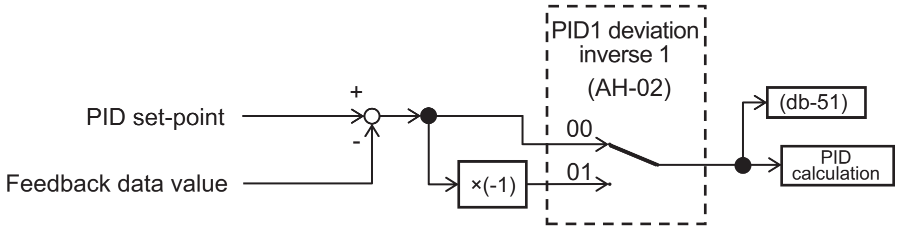
When the selection for **PID1 Calculation symbol selection of Process data** (AH-54) is *01* to *07*, Feedback data 1 and 2 are the calculation targets.
When the selection for **PID1 Calculation symbol selection of Process data** (AH-54) is *08* to *10*, Feedback data 1 and 3 are the calculation targets.

Additional Information

- Select *00: Disabled* for unused Feedback values.
- **Calculation symbol selection of Process data for PID1** (AH-54) is only enabled when the selection for **Calculation symbol selection of Set-point 1 for PID1** (AH-50) is *01* to *04*.

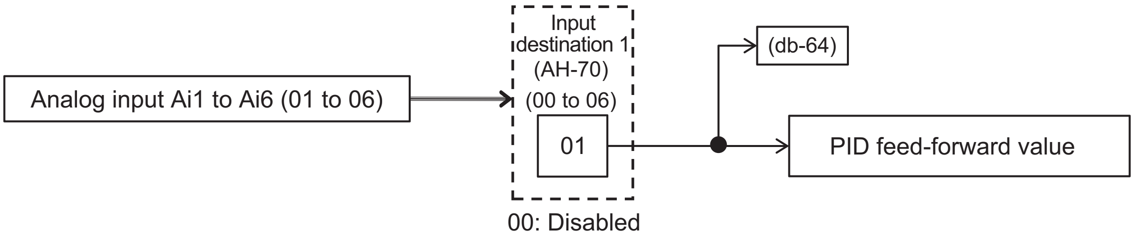
Output of ± Switching PID1 Deviation

The PID1 deviation can be output by switching ±.
This function is used when the polarity of the deviation between the PID set-point and the FB value does not match the command of the inverter due to the characteristics of the sensor.
When **PID1 deviation inverse** (AH-02) is *00: Disabled*, it is calculated by (PID set point - FB value), but when it is *01: Enabled*, 01: valid, the operation is the same as (FB value - PID set point).



PID Feed-forward Value Selection

Selects the PID Feed-forward value.
Feed forward control operates by setting **PID feed-forward selection** (AH-70) to a value other than *00: Disabled*.

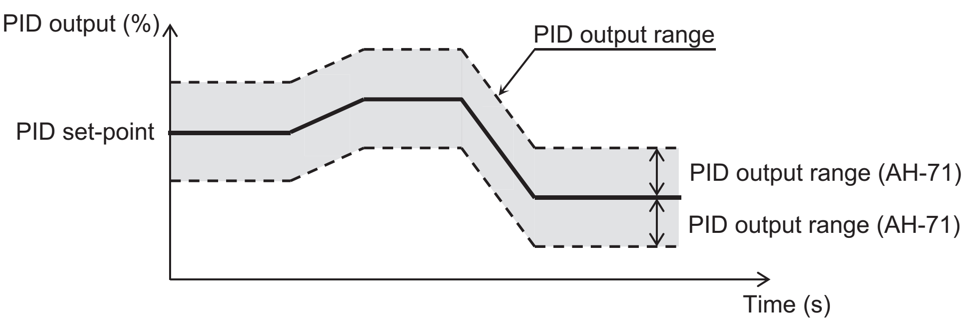


PID1 Output Range

PID Output range limit is a function that limits PID output within a variable range based on the PID Set-point.
If **PID1 output range** (AH-71) is set to *0.00 (%)* the function is disabled.

Precautions for Correct Use

To us the function, set **PID1 output range** (AH-71). The maximum speed is 100% and it is limited within the range of PID Set-point ± **PID1 output range** (AH-71).



● **Parameter**

Item	Parameter	Data	Description	Default
PID output range	AH-71	0.00 to 100.00 (%)	Output range based on Set-point	0.00

PID1 Reverse Output

In normal PID control, if the PID calculation result is negative, the inverter does not output the frequency command as negative and limits it to 0Hz. When **PID1 enable**(AH-01) is set to *02: Reverse*, if the PID calculation result is negative, the frequency command can be output in the reverse rotation direction.

Precautions for Correct Use

PID1 enable(AH-01) is set to *02: Reverse*, **PID1 output range**(AH-71) is extended in the negative direction.

PID1 Integration Reset

PID integration reset is a function that can clear (reset) the integration value of the PID operation by turning on the PID integration reset terminal [42: PIDC].
To use this function, turn on [42: PIDC] while the PID is not operating.

Precautions for Correct Use

If the PID1 Integration reset [42: PIDC] terminal is turned ON during PID operation, the integrated value added to the PID output command will be cleared, and the PID output command value will fluctuate rapidly, causing an overcurrent error, etc.

PID1 Disable

PID disable temporarily disables PID operation by turning on the PID disable terminal [41: PID], and outputs according to the frequency command.
The frequency command uses the value entered as the PID command.

Adjustment of PID1 Control

If the PID control response is not stable, adjust according to the table below.

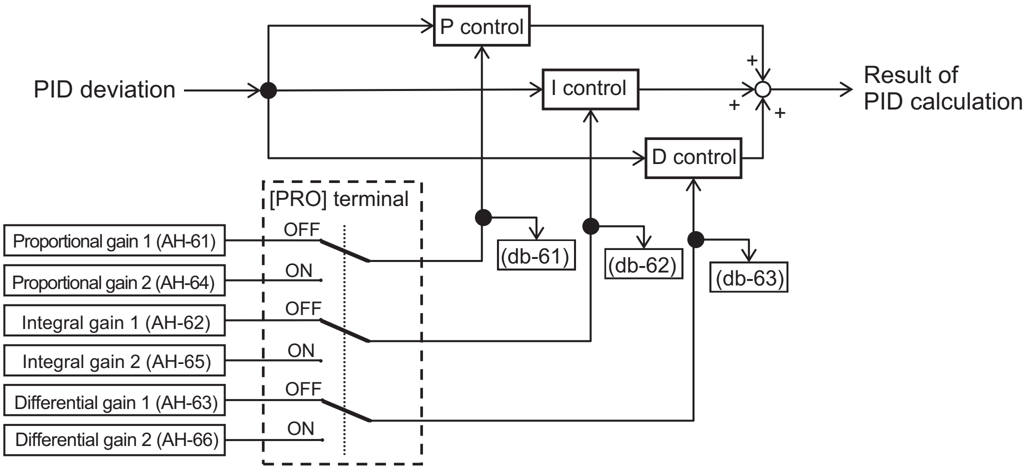
Phenomenon	Examples of Measures
Output response is slow and feedback value does not change swiftly even if PID set-point was changed.	Increase **PID1 proportional gain 1** (AH-61).
• The feedback value changes quickly and is not stable. • Overshooting or hunting occurs.	Decrease **PID1 proportional gain 1** (AH-61).
• The feedback value vibrates gently. • It takes time for the operation to stabilize.	Decrease **PID1 integral time constant 1** (AH-62).
The PID set-point and the feedback value do not easily match.	Increase **PID1 integral time constant 1** (AH-62).
• The response is slow even if the proportional gain is increased. • Fine hunting occurs.	Increase **PID1 derivative gain 1** (AH-63).
The reaction due to the disturbance becomes large, and it takes time to stabilize.	Decrease **PID1 derivative gain 1** (AH-63).

Precautions for Correct Use

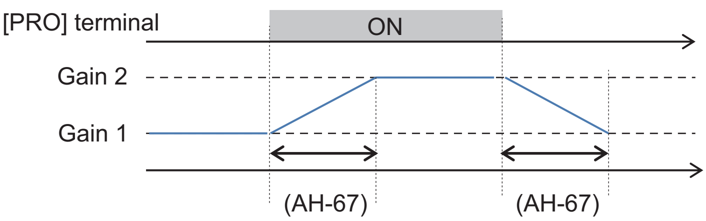
If the acceleration/deceleration time setting is long, the tracking of the output frequency will be delayed, and control may not be successful. In this case, set the acceleration/deceleration time shorter.

Switching PID1 Gain

The PID gain can be switched between gain 1 and gain 2 by turning the PID gain switching terminal [55: PRO] ON / OFF.
When using the PID gain change [55: PRO] terminal, set **PID1 gain change method selection** (AH-60) to *01: [PRO] terminal switch*.



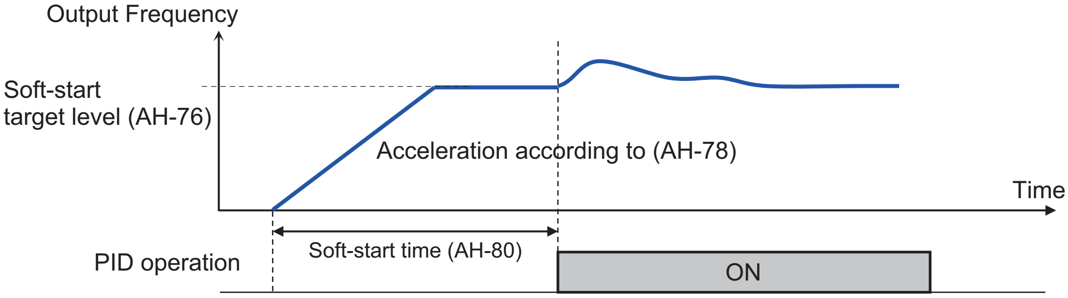
The PID gain changes continuously at the time set in **PID1 gain change time** (AH-67).
Each gain for the PID in use can be confirmed by **PID current P gain monitor** (db-61) to **PID current D gain monitor** (db-63).



8-1-3 PID Soft-start Function

PID Soft-start is a function for automatically shifting to PID control after the set soft start time has elapsed. To use the PID Soft-start Function, enable PID Control and set **PID soft start function enable** (AH-75) to *01: Enabled*.

When the time set in **PID soft start time** (AH-80) elapses, it automatically shifts to PID control.
At the time of the soft start, it accelerates to **PID soft start target level** (AH76) according to the acceleration time set in **Acceleration time setting for PID soft start function** (AH-78).



● Parameter

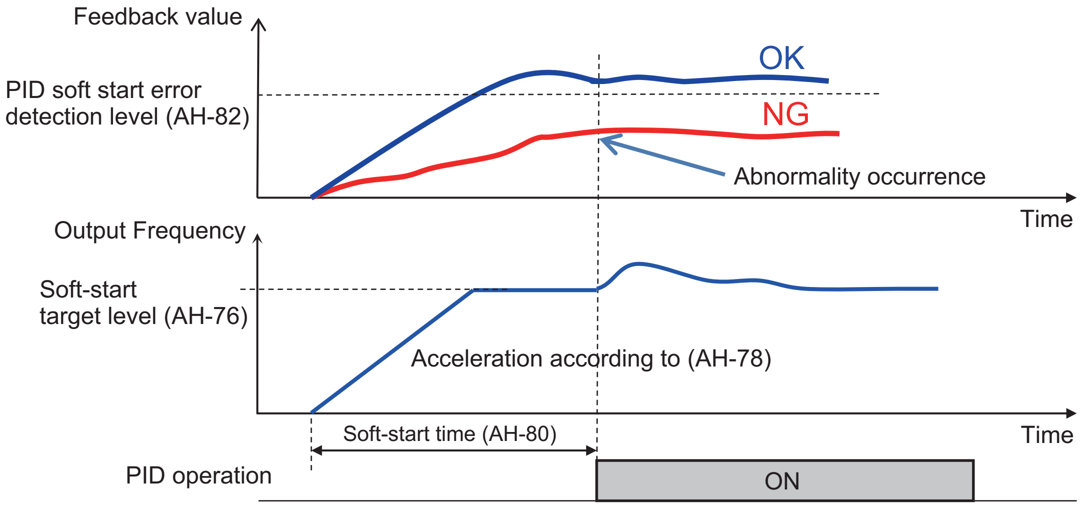
Item	Parameter	Data	Description	Default
PID soft start function enable	AH-75	00	Disabled	00
		01	Enabled	
PID soft start target level	AH-76	0.00 to 100.00 (%)	This is the set-point for the Soft start duration with the maximum frequency set to 100%.	100.00
Acceleration time setting for PID soft start function	AH-78	0.00 to 3600.00 (s)	Sets the acceleration time for the PID soft star.	30.00
PID soft start time	AH-80	0.00 to 600.00 (s)	The Soft start operation time.	0.00

PID Soft-start Error Detection

PID Soft-start error detection is a function for detecting pipe damage such as water leakage.
After the PID is started, if the PID - FB value is lower than the **PID soft start error detection level** (AH-82) and the **PID soft start time** (AH-80) has elapsed, it is judged as abnormal.

By setting **PID soft start error detection enable** (AH-81), you can select the operation at the time of an abnormal judgment.
Refer to the table below for details on how to set it.

Setting	Description
00: Disabled	Disabled. (No operation)
01: Enabled: error output	Function enabled. If the abnormal condition exceeds the time set for **PID soft start time** (AH-80), it will trip with a PID start abnormal error (E120).
02: Enabled: warning	Function enabled. If the abnormal condition exceeds the time set for **PID soft start time** (AH-80), PID soft start error [93: SSE] terminal turns ON. PID soft start error [93: SSE] terminal remains ON until it stops.



● **Parameter**

Item	Parameter	Data	Description	Default
PID soft start error detection enable	AH-81	00	Disabled	00
		01	Function enabled. Trips with PID soft start error (E120) when there is a startup error judgement.	
		02	Function enabled. The PID soft start error [93: SSE] terminal turns ON when a startup error is detected.	
PID soft start error detection level	AH-82	0.00 to 100.00 (%)	Sets the judgement level for soft start error detection.	0.00

8-1-4 PID Sleep Function

The PID sleep function can suspend (sleep) PID control for a certain period of time when the set sleep conditions are met. To use this function, set **PID sleep trigger selection** (AH-85) to either *01: Low output* or *02: [SLEP] terminal*. You can set the start and wake time and level of sleep according to your needs.

The method of waking up from PID sleep is determined by the parameter selected in **PID wake trigger selection** (AH-93); *01: Deviation amount* , *02: Low feedback* or *03: [WAKE] terminal*.
To wake the PID sleep by deviation, set **PID1 deviation inverse** (AH-02) to *01: Enabled*. In this case, even if the PID deviation ± is switched and output, it is canceled only when the deviation increases in the direction in which the output decreases.

● **Parameter**

Item	Parameter	Data	Description	Default
PID sleep trigger selection	AH-85	00	Disabled	00
		01	Starts sleep operation when output is low	
		02	Starts operation at the rising edge of the [SLEP] terminal	

Item	Parameter	Data	Description	Default
PID sleep start level	AH-86	0.00 to 590.00 (Hz)	When **PID sleep trigger selection** (AH-85) is set to *01*, it is the sleep start judgement level of the output speed.	0.00
PID sleep active time	AH-87	0.00 to 100.00 (s)	Stand-by time before shifting to sleep operation.	0.00
Setpoint boost before PID sleep enable	AH-88	00	Disabled	00
		01	Boost Set-point value before sleep operation.	
Setpoint boost time	AH-89	0.00 to 100.00 (s)	Is actuation time prior to PID sleep.	0.00
Setpoint boost value	AH-90	0.00 to 100.00 (%)	Sets a boost amount to be added to Set-point before sleep.	0.00
Minimum RUN time before PID sleep	AH-91	0.00 to 100.00 (s)	Sleep does not start until the time set for **Minimum RUN time before PID sleep** (AH-91) has elapsed.	0.00
Minimum active time of PID sleep	AH-92	0.00 to 100.00 (s)	Once sleep has started, sleep continues until the time set for **Minimum active time of PID sleep** (AH-92) elapses.	0.00
PID wake trigger selection	AH-93	01	Cancels the sleep operation when a deviation amount increases in a deceleration direction.	01
		02	Cancels the sleep operation when feedback value decreases.	
		03	Cancels the operation at the rising edge of the WAKE [59: WAKE] terminal operation.	
PID wake start level	AH-94	0.00 to 100.00 (%)	Cancels the operation when feedback value goes below the set value when **PID wake trigger selection** (AH-93) is *02: Low feedback*.	0.00
PID wake start time	AH-95	0.00 to 100.00 (s)	Stand-by time for canceling operation when **PID wake trigger selection** (AH-93) is *02: Low feedback*.	0.00
PID wake start deviation value	AH-96	0.00 to 100.00 (%)	Cancels the operation when a deviation between Set-point value and feedback value increases when **PID wake trigger selection** (AH-93) is *01: Deviation amount*.	0.00

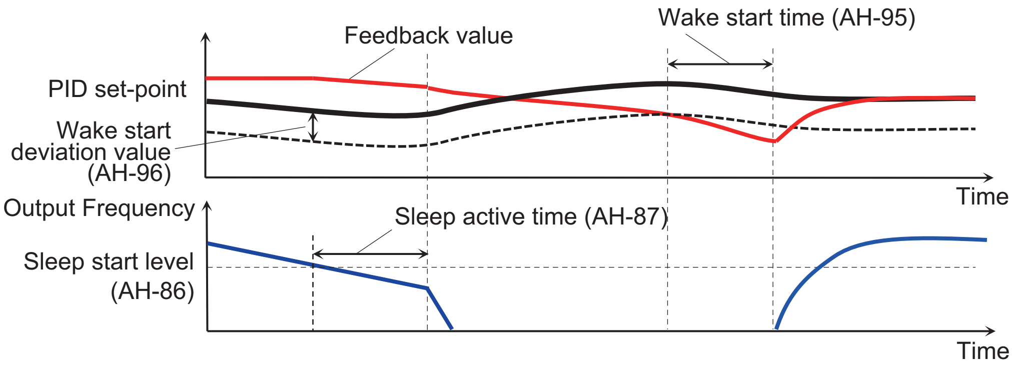
● Input Terminal Function

Item	Terminal name	Data	Description
Satisfaction of SLEEP condition	SLEP	058	When **PID sleep trigger selection** (AH-85) is set to *02: [SLEP] terminal* sleep starts when ON.
Satisfaction of WAKE condition	WAKE	059	When **PID wake trigger selection** (AH-93) is set to *03: [WAKE] terminal* sleep is cancelled when ON.

● Operation Example

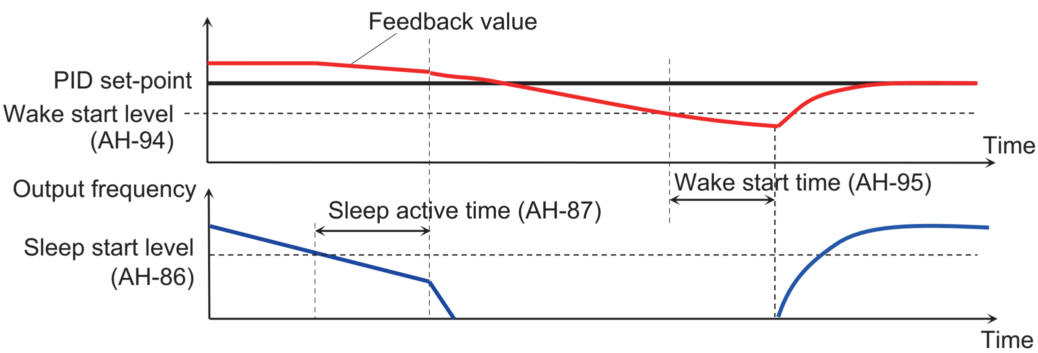
(Example 1) Sleep Trigger Selection: Low Output / Cancel Condition: Deviation Amount
Set **PID sleep trigger selection** (AH-85) to *01: Low output* and **PID wake trigger selection** (AH-93) to *01: Deviation amount*.

When the output frequency stays continuously below the **PID sleep start level** (AH-86) for the time set for **PID sleep active time** (AH-87), sleep starts.
When the PID deviation stays continuously over the **PID wake start deviation value** (AH-96) for the time set for **PID wake start time** (AH-95), sleep is canceled. Deviation operates with either negative or positive (±) values.



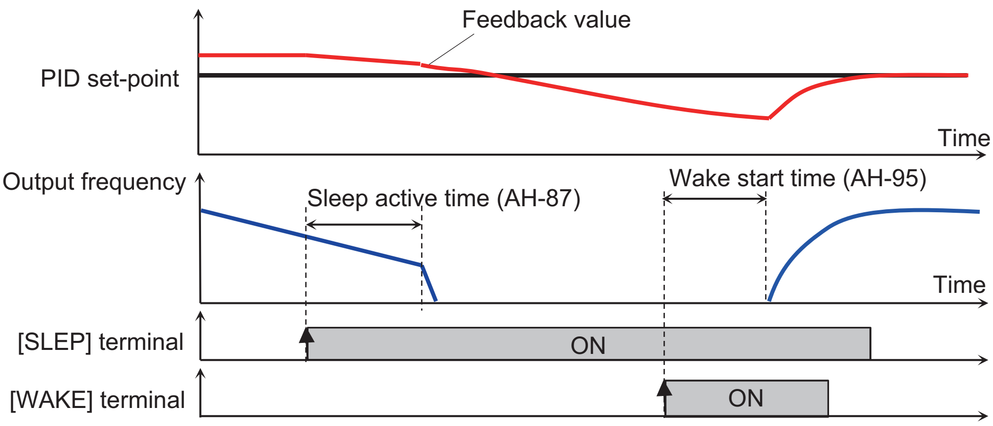
(Example 2) Sleep Trigger Selection: Low Output / Cancel Condition: Low Feedback
Set **PID sleep trigger selection** (AH-85) to *01: Low output* and **PID wake trigger selection** (AH-93) to *02: Low feedback*.

When the output frequency stays continuously below the **PID sleep start level** (AH-86) level for the time set for **PID sleep active time** (AH-87), sleep starts.
When the feedback stays continuously below the **PID wake start level value** (AH-94) for the time set for **PID wake start time** (AH-95), sleep is canceled.



(Example 3) Sleep Trigger Selection: [SLEP] Terminal / Cancel Condition: [WAKE] Terminal
Set **PID sleep start level** (AH-85) to *02: [SLEP] terminal* and **PID wake trigger selection** (AH-93) to *03: [WAKE] terminal*.

Sleep starts after the **PID sleep active time** (AH-87) time elapses from the ON edge of the [SLEP] terminal.
Sleep is cancelled after the **PID wake start time** (AH-95) time elapses from the ON edge of the [WAKE] terminal.



Precautions for Correct Use

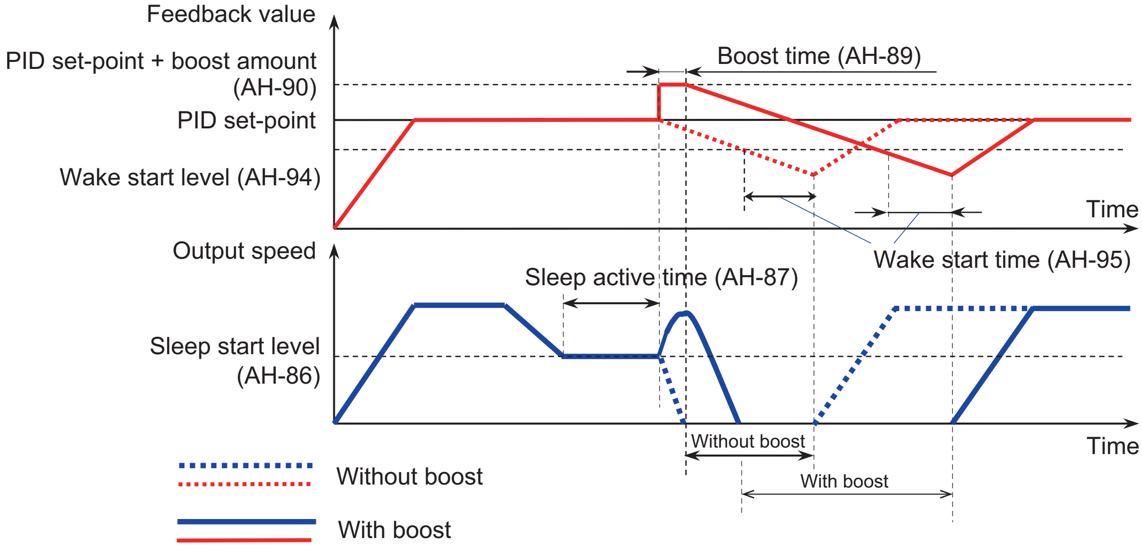
- When using the PID sleep start [58: SLEP] terminal, turn it on after the wake operation is completed.
- When using the satisfaction of WAKE condition [59: WAKE] terminal, turn it ON after the sleep operation is completed.

Setpoint Boost Before PID Sleep

Setpoint Boost Before PID Sleep is a function that raises the PID Setpoint before sleep to temporarily increase the amount of feedback. This makes it possible to keep the sleep state for a longer time.

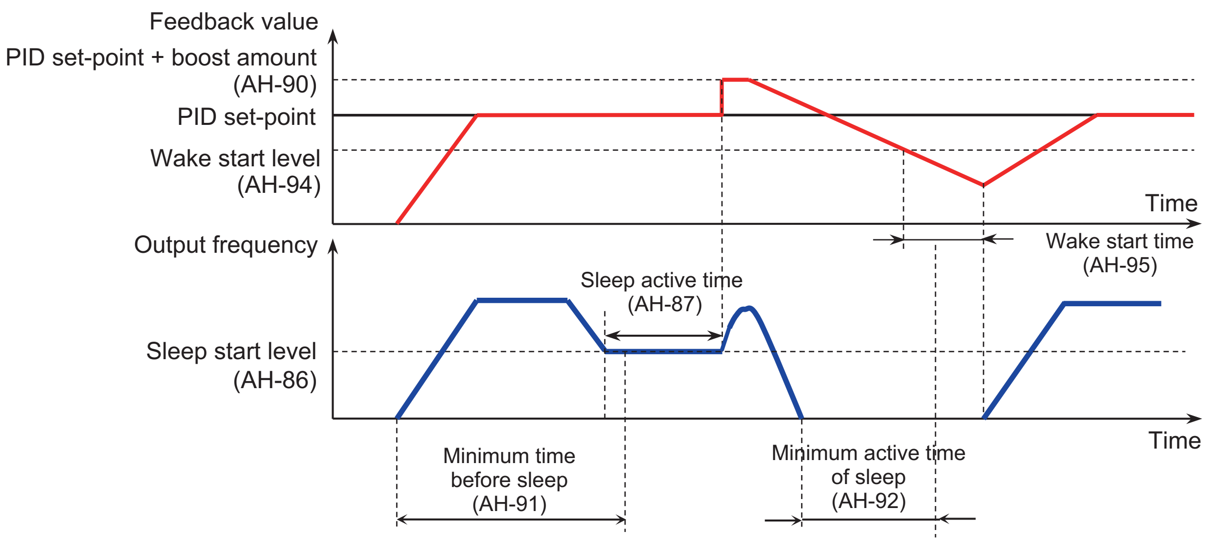
The figure below is an example for when **PID sleep trigger selection** (AH-85) is set to *01: Low output* and **PID wake trigger selection** (AH-93) is set to *02: [SLEP] terminal*.

When **PID sleep trigger selection** (AH-85) is set to *01: Low output*, if the output frequency is continually below the **PID sleep start level** (AH-86), the **Setpoint boost value** (AH-90) is added to the PID set-point for the time set in **Setpoint boost time** (AH-89).



Sleep Disable Time

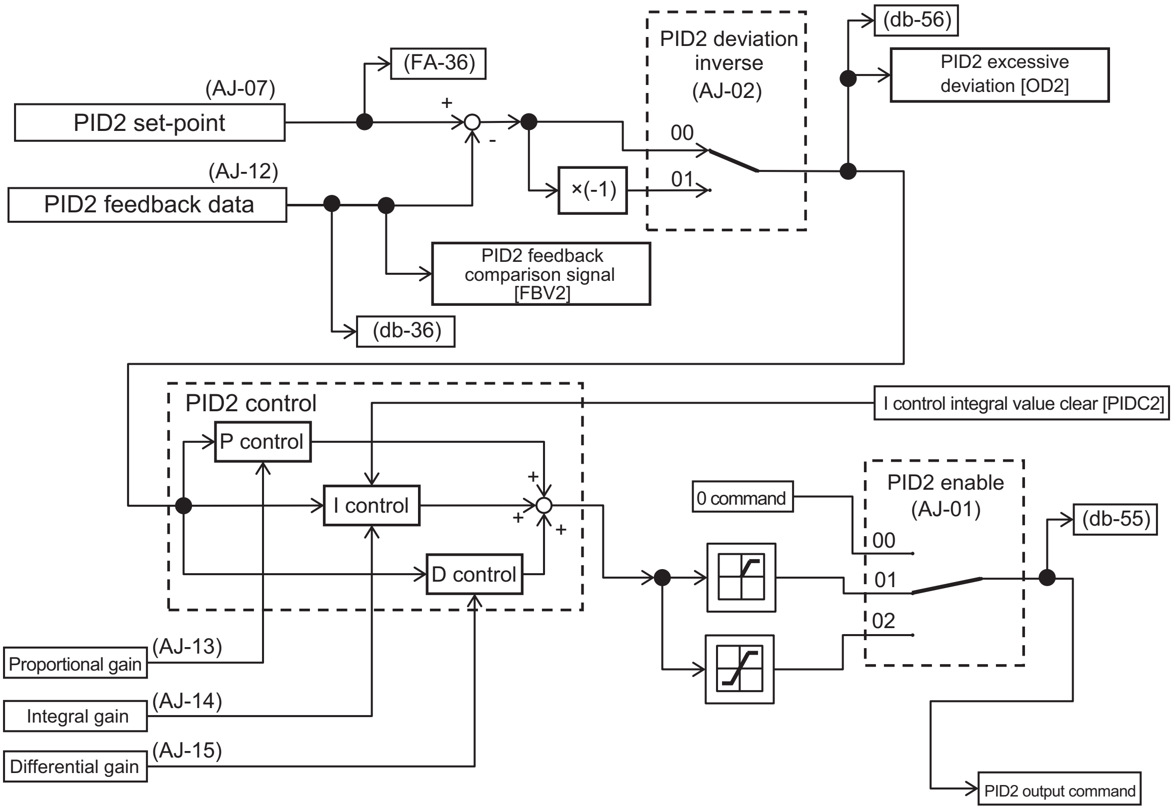
Sleep disable time is a function that prevents frequent switching between the sleep state and the operating state to occur. To use this function, specify the **Minimum RUN time before PID sleep** (AH-91) from the start of operation and **Minimum active time of PID sleep** (AH-92) from the start of sleep.



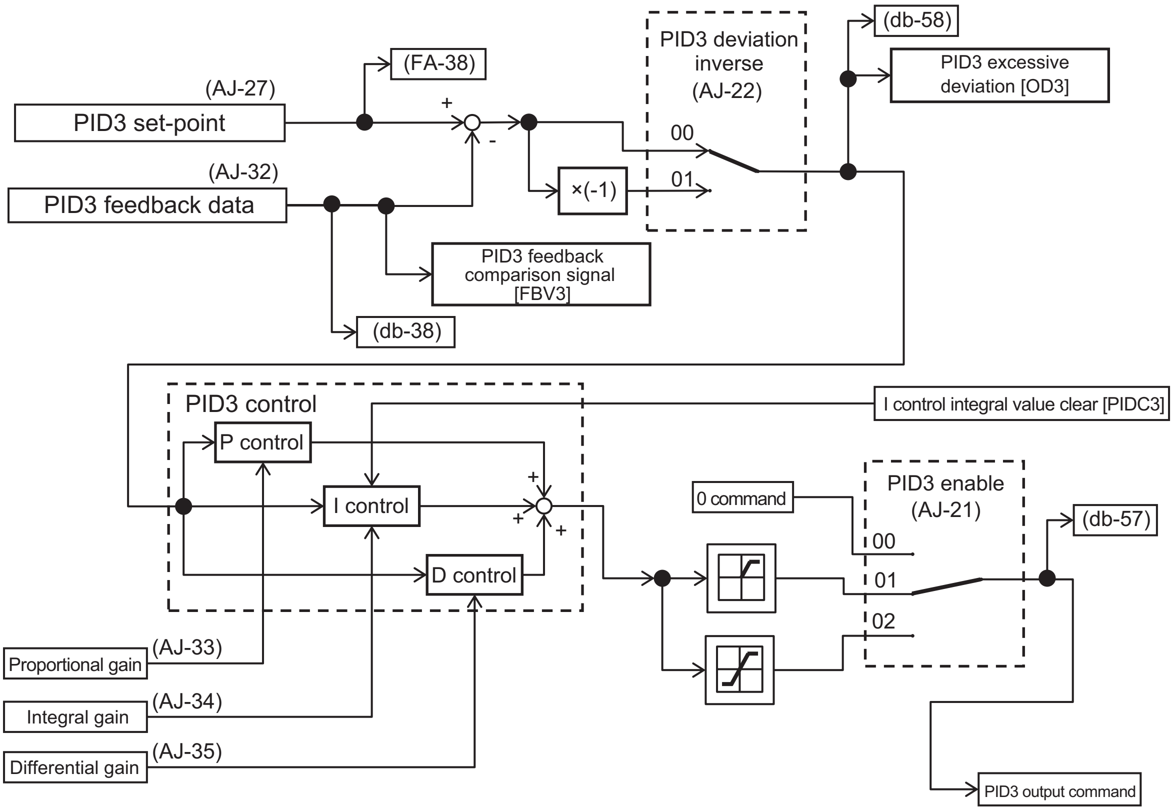
8-1-5 PID2 / PID3 / PID4 Control

PID1 to PID4 controls operate independently.
Switching PID1 to 4 by terminal enables the use for switching batch control, etc.
Selecting the output of PID1 as the PID2 set-point value allows control that takes into account the influence of the two systems.

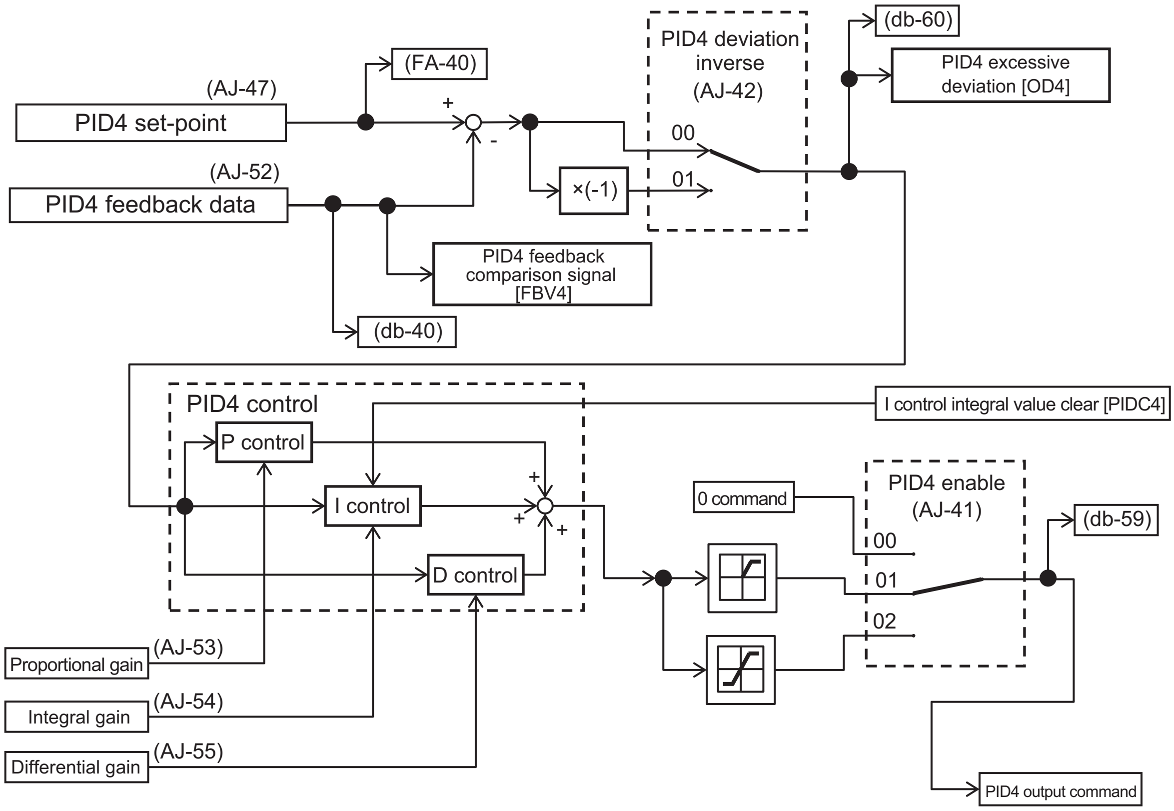
Schematic Diagram of PID2 Control



Schematic Diagram of PID3 Control



Schematic Diagram of PID4 Control



PID2/ PID3/ PID4 Related Parameters

● Parameters for PID2

Item	Parameter	Data	Description	Default
PID2 enable	AJ-01	00	Disabled	00
		01	Enabled (If the command is a negative value, it will NOT be output in the reverse direction)	
		02	Enabled (If the command is a negative, it WILL be output in the reverse direction)	
PID2 deviation inverse	AJ-02	00	Disabled	00
		01	Enabled (polarity inversion of deviation)	

Item	Parameter	Data	Description	Default
PID2 Set-point input	AJ-07	00 to 15	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting **Set-point setting for PID2** (AJ-10) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID1 calculation	07
Set-point setting for PID2	AJ-10	0.00 to 100.00 (%) *2	This is a parameter setting value.	0.00
Input source selection of Process data for PID2	AJ-12	00 to 06, 08 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	02
PID2 proportional (P) gain	AJ-13	0.0 to 100.0	Proportional gain	0.1
PID2 integral time (I) constant	AJ-14	0.0 to 3600.0 (s)	Integral time	0.1
PID2 derivative (D) gain	AJ-15	0.00 to 100.00 (s)	Derivative gain time	0.00

*1. The data range changes depending on **PID2 Set-point input**(AJ-07). when it is set to *07: Parameter setting*, **Set-point setting for PID2**(AJ-10) is the setpoint

*2. The setpoint depends on the scale, **PID2 scale adjustment (at 0%)**(AJ-04) - **PID scale adjustment (point position)** (AJ-06) parameters.

● Parameters for PID3

Item	Parameter	Data	Description	Default
PID3 enable	AJ-21	00	Disabled	00
		01	Enabled (If the command is a negative value, it will NOT be output in the reverse direction)	
		02	Enabled (If the command is a negative, it WILL be output in the reverse direction)	

8-1 PID Control

8

8-1-5 PID2 / PID3 / PID4 Control

Item	Parameter	Data	Description	Default
PID3 deviation inverse	AJ-22	00	Disabled	00
		01	Enabled (polarity inversion of deviation)	
PID3 Set-point input	AJ-27	00 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter **setting Set-point setting for PID3** (AJ-30) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	07
Set-point setting for PID3	AJ-30	0.00 to 100.00(%)*2	This is a parameter setting value.	0.00
Input source selection of Process data for PID3	AJ-32	00 to06, 08to13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	02
PID3 proportional (P) gain	AJ-33	0.0 to 100.0	Proportional gain	1.0
PID3 integral time (I) constant	AJ-34	0.0 to 3600.0(s)	Integral time	1.0
PID3 derivative (D) gain	AJ-35	0.00 to 100.00(s)	Derivative gain time	0.00

*1. The data range changes depending on **PID3 Set-point input** (AJ-27). When it is set to *07: Parameter setting*, **Set-point 3 setting for PID3** (AJ-30) is the setpoint.

*2. The data range changes depending on the selection of **PID3 scale adjustment (at 0%)** (AJ-24) to **PID3 scale adjustment (point position)** (AJ-26).

● Parameters for PID4

Item	Parameter	Data	Description	Default
PID4 enable	AJ-41	00	Disabled	00
		01	Enabled (If the command is a negative value, it will NOT be output in the reverse direction)	
		02	Enabled (If the command is a negative, it WILL be output in the reverse direction)	
PID4 deviation inverse	AJ-42	00	Disabled	00
		01	Enabled (polarity inversion of deviation)	
PID4 Set-point input	AJ-47	00 to 15	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting **Set-point setting for PID4**(AJ-50) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	07
Set-point setting for PID4	AJ-50	0.00 to 100.00 (%)*2	This is a parameter setting value.	0.00
Input source selection of Process data for PID4	AJ-52	00 to 06, 08 to 13	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	02
PID4 proportional (P) gain	AJ-53	0.0 to 100.0	Proportional gain	1.0
PID4 integral time (I) constant	AJ-54	0.0 to 3600.0 (s)	Integral time	1.0
PID4 derivative (D) gain	AJ-55	0.00 to 100.00 (s)	Derivative gain time	0.00

*1. The data range changes depending on **PID4 Set-point input**(AJ-47) when it is set to *07: Parameter setting***Set-point setting for PID4**(AJ-50) is the setpoint.

*2. The data range changes depending on the selection of **PID4 scale adjustment (at 0%)** (AJ-44) to **PID4 scale adjustment (point position)** (AJ-46).

● Input Terminal Function

Item	Terminal name	Data	Description
PID2 disabled	PID2	043	Turning this terminal ON disables PID2. When the terminal is ON, the frequency command is equivalent to the set-point of PID2.
Resetting of PID2 integration	PIDC2	044	Clears the integrated value of the I control of PID2.
PID3 disabled	PID3	045	Turning this terminal ON disables PID3. When the terminal is ON, the frequency command is equivalent to the set-point of PID3.
Resetting of PID3 integration	PIDC3	046	Clears the integrated value of the I control of PID3.
PID4 disabled	PID4	047	Turning this terminal ON disables PID4. When the terminal is ON, the frequency command is equivalent to the set-point of PID4.
Resetting of PID4 integration	PIDC4	048	Clears the integrated value of the I control of PID4.
Switching of PID output	PIO1	056	Switches PID output by a combination of PIO1 and PIO2.
Switching of PID output 2	PIO2	057	

● Data Monitor

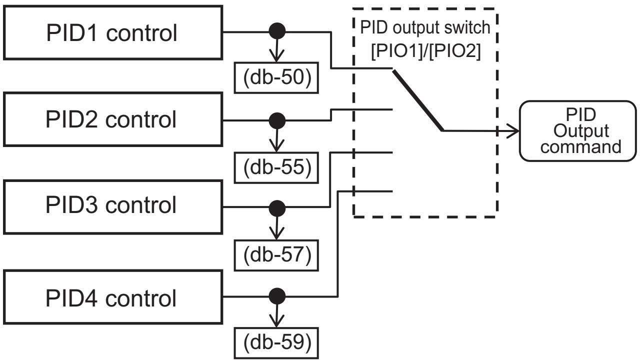
Item	Parameter	Data	Description
PID2 Set-point	FA-36	-100.00 to 100.00 (%) *1	Displays the PID2 Set-point2. When **Input source selection of Set-point for PID2** (AJ-07) is set to *09: Option 1*, the value can be changed.
PID2 feedback data monitor	db-36	-100.00 to 100.00 (%) *1	Displays the PID2 feedback value.
PID2 output monitor	db-55	-100.00 to 100.00 (%)	Displays the PID2 output value.
PID2 deviation monitor	db-56	-200.00 to 200.00 (%)	Displays the PID2 deviation.
PID3 Set-point	FA-38	-100.00 to 100.00 (%) *2	Displays the PID3 Set-point. When **Input source selection of Set-point for PID3** (AJ-27) is set to *09: Option 1*, the value can be changed.
PID3 feedback data monitor	db-38	-100.00 to 100.00 (%) *2	Displays the PID3 feedback value.
PID3 output monitor	db-57	-100.00 to 100.00 (%)	Displays the PID3 output value.
PID3 deviation inverse	db-58	-200.00 to 200.00 (%)	Displays the PID3 deviation.
PID4 Set-point	FA-40	-100.00 to 100.00 (%) *3	Display the PID4 Set-point. When **Input selection of Set-point for PID4** (AJ-47) is set to *09: Option 1*, the value can be changed.
PID4 feedback data monitor	db-40	-100.00 to 100.00 (%) *3	Displays the PID4 feedback value.
PID4 output monitor	db-59	-100.00 to 100.00 (%)	Displays the PID4 output value.

Item	Parameter	Data	Description
PID4 deviation monitor	db-60	-200.00 to 200.00 (%)	Displays the PID4 deviation.

*1. The data range changes depending on the selection of **PID2 scale adjustment (at 0%)** (AJ-04) to **PID scale adjustment (point position)** (AJ-06).
*2. The data range changes depending on the selection of **PID3 scale adjustment (at 0%)** (AJ-24) to **PID3 scale adjustment (point position)** (AJ-26).
*3. The data range changes depending on the selection of **PID4 scale adjustment (at 0%)** (AJ-44) to **PID4 scale adjustment (point position)** (AJ-46).

Switching PID1 to PID4

In **Input terminal function** (CA-01) to (CA-10) set the PID output switching terminals [56: PIO1] or [57: PIO2] and switch the terminal ON / OFF to switch through PID1 to 4 and control them.



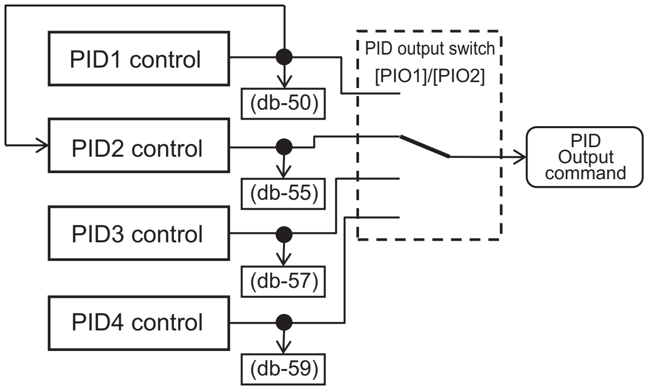
● Combination of PIO1 / PIO2

	PIO2	PIO1
PID1 is enabled	OFF	OFF
PID2 is enabled	OFF	ON
PID3 is enabled	ON	OFF
PID4 is enabled	ON	ON

PID Cascading Control by PID1 and PID2

For **Input source selection of Set-point for PID2** (AJ-07), select *15: PID calculation*.
By setting the set-point of PID2 to the output of PID1, cascading control of PID is possible. In this case, PID3 and PID4 cannot be selected.
Enable the PID2 output command as follows:

(AJ-07) = 15: PID calculation



● Combination of PIO1 / PIO2

	PIO2	PIO1
PID2 is enabled	OFF	ON

Adjust PID2 / PID3 / PID4 Control

If the response is not stable during PID operation, adjust the gain according to the gain correspondence table for PIDs 2 to 4 below.

Precautions for Correct Use

If the acceleration / deceleration time setting is long, the tracking of the output frequency will be delayed, and control may not be successful. In this case, set the acceleration/deceleration time to be shorter.

Phenomenon	Examples of Measures
Output response is slow and feedback value does not change swiftly even if PID set-point was changed.	Increase PID proportional gain according to the correspondence table [1].
• The feedback value changes quickly and is not stable. • Overshooting or hunting occurs.	Decrease PID proportional gain according to the correspondence table [1].
• The feedback value vibrates gently. • It takes time for the operation to stabilize.	Decrease PID Integral gain according to the correspondence table [2].
The PID set-point and the feedback value do not easily match.	Increase PID integral gain according to the correspondence table [2].
• The response is slow even if the proportional gain is increased. • Fine hunting occurs.	Increase PID Derivative gain according to the correspondence table [3].
The reaction due to the disturbance becomes large, and it takes time to stabilize.	Decrease PID Derivative gain according to the correspondence table [3].

● Gain Correspondence Table

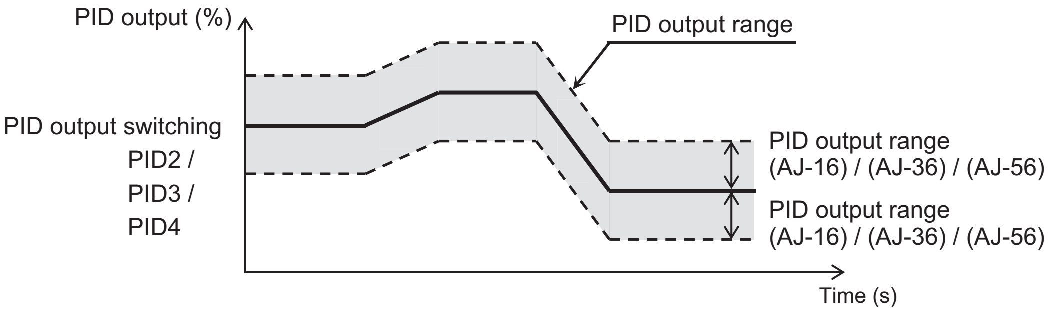
	[1] Proportional gain	[2] Integral gain	[3] Derivative gain
PID2	AJ-13	AJ-14	AJ-15
PID3	AJ-33	AJ-34	AJ-35

	[1] Proportional gain	[2] Integral gain	[3] Derivative gain
PID4	AJ-53	AJ-54	AJ-55

PID2 / PID3 / PID4 Output Range Limit

The PID output range limit function can limit the output of PID to a variable range relative to the PID set point value. If the Output range setting is *0.00 (%)*, the PID output limit will be disabled.

To use this function, set the corresponding **PID output range** (AJ-16), (AJ-36), and (AJ-56). It is limited within the range (PID set point ± output range) with maximum frequency set to 100%.



● Parameter

Item	Parameter	Data	Description	Default
PID2 output range	AJ-16	0.00 to 100.00 (%)	PID2 output range based on Set-point	0.00
PID3 output range	AJ-36	0.00 to 100.00 (%)	PID3 output range based on Set-point	0.00
PID4 output range	AJ-56	0.00 to 100.00 (%)	PID4 output range based on Set-point	0.00

PID2 / PID3 / PID4 Reverse Output

PID reverse output is a function that switches the frequency command in the reverse direction when the PID calculation function is negative.
In normal PID control, if the PID calculation result is negative, the inverter does not output the frequency command as negative and limits it to 0 Hz.

With this function, when **PID enable** for PID2/PID3/PID4 (AJ-01), (AJ-21), (AJ-41) is set to *02: Enabled with reverse output*, if the corresponding PID calculation result is negative, the frequency command can be output in the reverse rotation direction.

When **PID enable** (AJ-01), (AJ-21), (AJ-41) is set to *02: Enabled with reverse output*, **PID Output range** (AJ-16), (AJ-36), (AJ-56) is extended in the negative direction.

● **Parameter**

Item	Parameter	Data	Description	Default
PID2 enable	AJ-01	02	Enabled (If the command is a negative, it WILL be output in the reverse direction)	00
PID3 enable	AJ-21			00
PID4 enable	AJ-41			00

PID2 / PID3 / PID4 Integral Reset Function

The PID integral reset function can clear the integral value of the corresponding PID operation by turning on each [PIDC] terminal for PID2 to PID4.
Turn ON the PID integral reset terminals [44: PIDC2], [46: PIDC3], and [48: PIDC4] when the corresponding PID is not in operation.

Precautions for Correct Use

If the PID integral reset terminals [44: PIDC2], [46: PIDC3], [48: PIDC4] are turned ON during PID operation, the integral value added to the PID output command will be cleared, and the PID output command value will fluctuate rapidly, causing an overcurrent error, etc.

PID2 / PID3 / PID4 Disable Operation

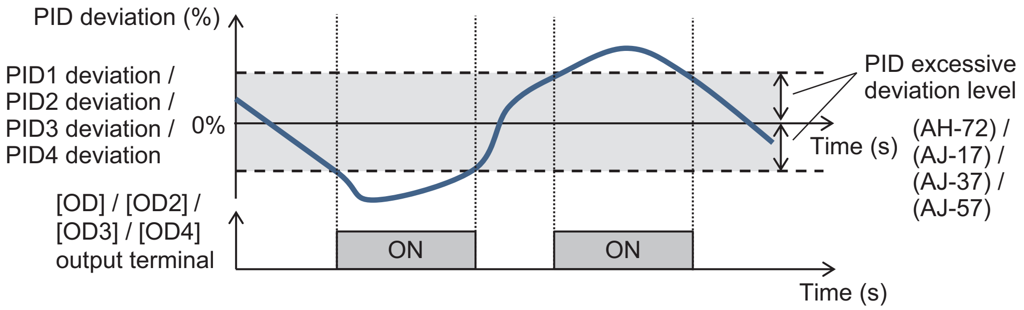
The PID disable function temporarily disables PID operation by turning on each PID disable terminal of PIDs 2 to PID4, [43: PID2], [45: PID3], [47: PID4]. This enables output according to the frequency command.
The frequency command uses the value entered as the PID command.

8-1-6 PID Signal Output

PID Excessive Deviation Signal (OD)

The PID excessive deviation signal is a function that outputs a signal when the deviation of PID1 to 4 exceeds the set deviation over level.

To use this function, assign PID excessive deviation [45: OD] to **Output terminal [11] to [15] selection** (CC-01) to (CC-05), or **Relay output terminal [16], [AL] function** (CC-06), (CC-07).



● Parameter

Item	Parameter	Data	Description	Default
PID1 Deviation over level	AH-72	0.00 to 100.00 (%)	PID1 Deviation over level [45: OD] signal output judgement level	3.00
PID2 Deviation over level	AJ-17	0.00 to 100.00 (%)	PID2 Deviation over level [47: OD2] signal output judgement level	
PID3 Deviation over level	AJ-37	0.00 to 100.00 (%)	PID3 Deviation over level [89: OD3] signal output judgement level	
PID4 Deviation over level	AJ-57	0.00 to 100.00 (%)	PID3 Deviation over level [91: OD4] signal output judgement level	

● Output Signal

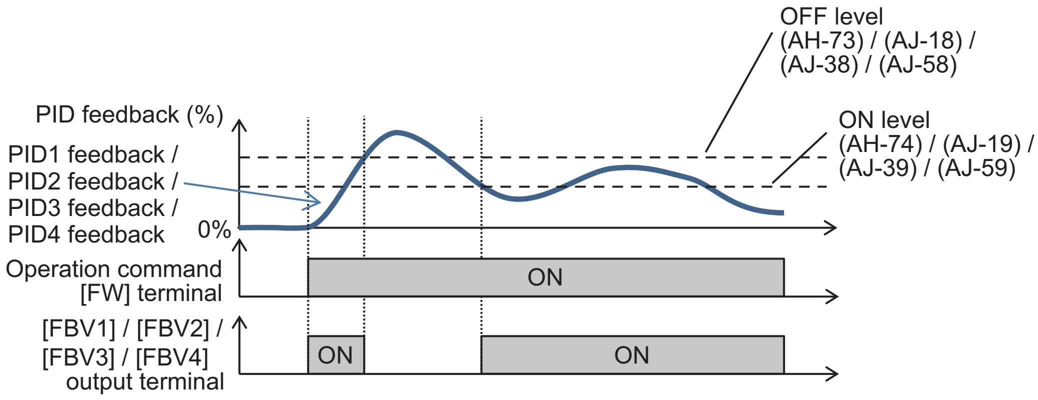
Item	Terminal name	Data	Description
PID1 excessive deviation signal	OD	045	If the difference between the PID set-point and the feedback value exceeds the range of PID1 deviation over level, the signal turns ON.
PID2 excessive deviation signal	OD2	047	If the difference between the PID set-point and the feedback value exceeds the range of PID2 deviation over level, the signal turns ON.
PID3 excessive deviation signal	OD3	089	If the difference between the PID set-point and the feedback value exceeds the range of PID3 deviation over level, the signal turns ON.
PID4 excessive deviation signal	OD4	091	If the difference between the PID set-point and the feedback value exceeds the range of PID4 deviation over level, the signal turns ON.

PID Feedback Comparison Signal (FBV)

The PID feedback comparison signal is a function that turns off the signal at the output terminal when the feedback of PID1 to 4 is out of the set feedback level range.
By setting the ON level / OFF level to something other than 0.00 (%), the feedback comparison signal will start being output.

Precautions for Correct Use

Set the PID feedback so that OFF level ≥ ON level. When set with OFF level < ON level, the OFF operation has priority.



● Parameter

Item	Parameter	Data	Description	Default
PID1 Feedback compare signal turn-off level	AH-73	0.00 to 100.00 (%)	FBV1 signal output OFF judgment level	100.00
PID1 Feedback compare signal turn-on level	AH-74	0.00 to 100.00 (%)	FBV1 signal output ON judgment level	0.00
PID2 Feedback compare signal turn-off level	AJ-18	0.00 to 100.00 (%)	FBV2 signal output OFF judgment level	100.00
PID2 Feedback compare signal turn-on level	AJ-19	0.00 to 100.00 (%)	FBV2 signal output ON judgment level	0.00
PID3 Feedback compare signal turn-off level	AJ-38	0.00 to 100.00 (%)	FBV3 signal output OFF judgment level	100.00
PID3 Feedback compare signal turn-on level	AJ-39	0.00 to 100.00 (%)	FBV3 signal output ON judgment level	0.00
PID4 Feedback compare signal turn-off level	AJ-58	0.00 to 100.00 (%)	FBV4 signal output OFF judgment level	100.00
PID4 Feedback compare signal turn-on level	AJ-59	0.00 to 100.00 (%)	FBV4 signal output ON judgment level	0.00

● Feedback Comparison Signal

Item	Terminal name	Data	Description
PID1 Feedback Comparison Signal	FBV1	046	PID1 Feedback comparison [46: FBV1] OFF: Exceeded the OFF level. ON: Went below the ON level.
PID2 Feedback Comparison Signal	FBV2	048	PID2 Feedback comparison [48: FBV2] OFF: Exceeded the OFF level. ON: Went below the ON level.
PID3 Feedback Comparison Signal	FBV3	090	PID3 Feedback comparison [90: FBV3] OFF: Exceeded the OFF level. ON: Went below the ON level.

Item	Terminal name	Data	Description
PID4 Feedback Comparison Signal	FBV4	092	PID4 Feedback comparison [92: FBV4] OFF: Exceeded the OFF level. ON: Went below the ON level.

8-1-7 PID Unit Change

PID Unit Change is a function to change the unit and scale of the following parameters. It can be changed by setting the displayed data for the zero point and maximum point.

PID1 Display Conversion Parameter

Item	Parameter
PID1 Set-point 1	FA-30
PID1 Set-point 2	FA-32
PID1 Set-point 3	FA-34
PID1 Feedback Monitor 1	db-30
PID1 Feedback Monitor 2	db-32
PID1 Feedback Monitor 3	db-34
PID1 target value monitor after calculation	db-42
PID1 feedback data monitor after calculation	db-44
Set-point 1 setting for PID1	AH-10
PID1 Multi stage set-point 1 to 15	AH-12 to AH-40
Set-point 2 setting for PID1	AH-44
Set-point 3 setting for PID1	AH-48

PID2 Display Conversion Parameter

Item	Parameter
PID2 Set-point	FA-36
PID2 feedback data monitor	db-36
Set-point setting for PID2	AJ-10

PID3 Display Conversion Parameter

Item	Parameter
PID3 Set-point	FA-38
PID3 feedback data monitor	db-38
Set-point setting for PID3	AJ-30

PID4 Display Conversion Parameter

Item	Parameter
PID4 Set-point	FA-40
PID4 feedback data monitor	db-40
Set-point setting for PID4	AJ-50

● Parameter

Item	Parameter	Data	Description	Default
Unit selection for PID1	AH-03	Refer to *Unit Table* on page 8-43	Sets the PID1 display conversion parameter.	1
PID1 scale adjustment (at 0%)	AH-04	-10000 to 10000	Sets the criteria for input 0% of PID1 display conversion parameter.	0
PID1 scale adjustment (at 100%)	AH-05	-10000 to 10000	Sets the criteria for input 100% of PID1 display conversion parameter.	10000
PID1 scale adjustment (point position)	AH-06	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	
Unit selection for PID2	AJ-03	Refer to *Unit Table* on page 8-43	Sets the PID2 display conversion parameter.	01
PID2 scale adjustment (at 0%)	AJ-04	-10000 to 10000	Sets the criteria for input 0% of PID2 display conversion parameter.	0
PID2 scale adjustment (at 100%)	AJ-05	-10000 to 10000	Sets the criteria for input 100% of PID2 display conversion parameter.	10000
PID2 scale adjustment (point position)	AJ-06	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	
PID3 unit selection	AJ-23	Refer to *Unit Table* on page 8-43	Sets the PID3 display conversion parameter.	01
PID3 scale adjustment (at 0%)	AJ-24	-10000 to 10000	Sets the criteria for input 0% of PID3 display conversion parameter.	0
PID3 scale adjustment (at 100%)	AJ-25	-10000 to 10000	Sets the criteria for input 100% of PID3 display conversion parameter.	10000
PID3 scale adjustment (point position)	AJ-26	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	
Unit selection for PID4	AJ-43	Refer to *Unit Table* on page 8-43	Sets the PID4 display conversion parameter.	01
PID4 scale adjustment (at 0%)	AJ-44	-10000 to 10000	Sets the criteria for input 0% of PID4 display conversion parameter.	0
PID4 scale adjustment (at 100%)	AJ-45	-10000 to 10000	Sets the criteria for input 100% of PID4 display conversion parameter.	10000
PID4 scale adjustment (point position)	AJ-46	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	

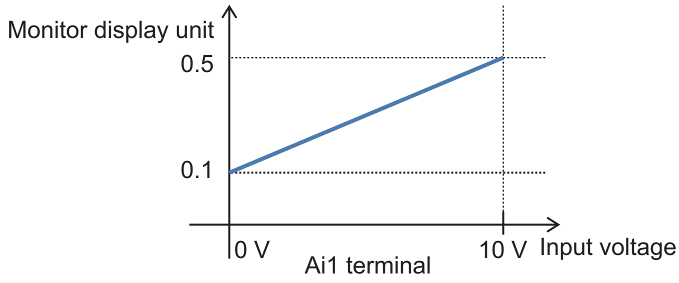
● Unit Table

No.	Unit	No.	Unit
00	non	31	cm
01	%	32	°F
02	A	33	l/s
03	Hz	34	l/min
04	V	35	l/h
05	kW	36	m^3/s
06	W	37	m^3/min
07	hr	38	m^3/h
08	s	39	kg/s
09	kHz	40	kg/min
10	ohm	41	kg/h
11	mA	42	t/min
12	ms	43	t/h
13	P	44	gal/s
14	kgm^2	45	gal/min
15	pls	46	gal/h
16	mH	47	ft^3/s
17	VDC	48	ft^3/min
18	°C	49	ft^3/h
19	kWh	50	lb/s
20	mF	51	lb/min
21	mVs/rad	52	lb/h
22	Nm	53	mbar
23	min^{-1}	54	bar
24	m/s	55	Pa
25	m/min	56	kPa
26	m/h	57	PSI
27	ft/s	58	mm
28	ft/min		
29	ft/h		
30	m		

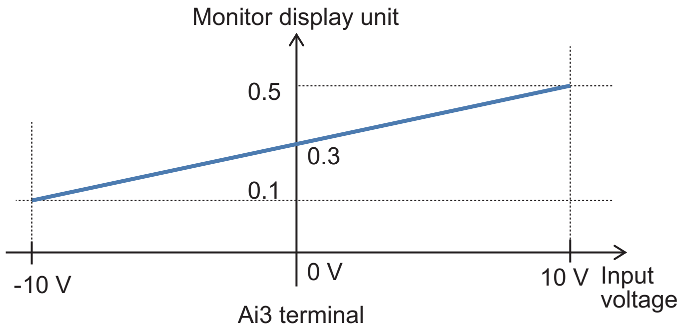
● Adjustment Examples

(Example 1) Change Voltage from 0 to 10 V (0 to 100%) → to 0.1 to 0.5 kPa

When you want to display 0 to 10 V (0 to 100%) as 0.1 to 0.5 kPa on the **Feedback data 1 monitor** (db-30) Feedback data 1 while there is voltage feedback to the Analog input [Ai1] monitor, set **Unit selection for PID1** (AH-03), **PID1 scale adjustment (point position)** (AH-06), **PID1 scale adjustment (at 0%)** (AH-04) and **PID1 scale adjustment (at 100%)** (AH-05) as follows.

Parameter	Set val-ue	Description	Adjustment Example
AH-03	56	kPa	
AH-06	02	000.00	
AH-04	10	0.1	
AH-05	50	0.5	

(Example 2) Change Voltage from -10 to 10 V (-100 to 100%) → to 0.1 to 0.5 kPa
When you want to display -10 to 10 V (-100 to 100%) as 0.1 to 0.5 kPa on the **Feedback data 1 monitor** (db-30) Feedback data 1 while there is voltage feedback to the Analog input [Ai3] monitor, set **Unit selection for PID1** (AH-03), **PID1 scale adjustment (point position)** (AH-06), **PID1 scale adjustment (at 0%)** (AH-04) and **PID1 scale adjustment (at 100%)** (AH-05) as follows.

Parameter	Set val-ue	Description	Adjustment Example
AH-03	56	kPa	
AH-06	02	000.00	
AH-04	30	0.3	
AH-05	50	0.5	

8-2 Tripless Functions

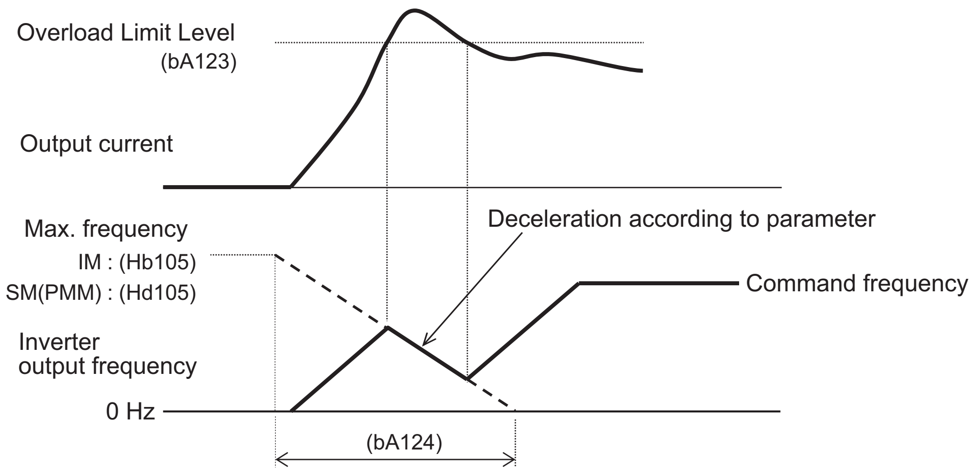
8-2-1 Overload Limit Level Function

The overload limit level function is a function that suppresses the rise in current by decelerating when the output current reaches the overload limit level, and suppresses the occurrence of the motor overload error, (E005).

To use this function, set **Overload restriction 1 mode selection** (bA122) to *01: Accelerate at constant speed*, *02: Only constant speed*, or *03: Accelerate at constant speed/Increase speed at regeneration*.

Setting	Description
01: Accelerate at constant speed	The output current is monitored during acceleration and at constant speed, and decelerates when the threshold is exceeded.
02: Only constant speed	The output current is monitored at constant speed, and decelerates when the threshold is exceeded.
03: Accelerate at constant speed/ Increase speed at regeneration	The output current is monitored during acceleration and at constant speed, and decelerates when the threshold is exceeded. In addition, it monitors during regenerative operation and accelerates when the threshold is exceeded.

Set the threshold for the Current monitor in **Overload restriction 1 active level** (bA123).
Set the acceleration/deceleration time of the overload restriction opration in **Overload restriction 1 action time** (bA124). The set value is the time to decelerate from the highest frequency to 0 Hz or accelerate from 0 Hz to the highest frequency.
Overload limit can be used in speed control. It does not work with position control or torque control.



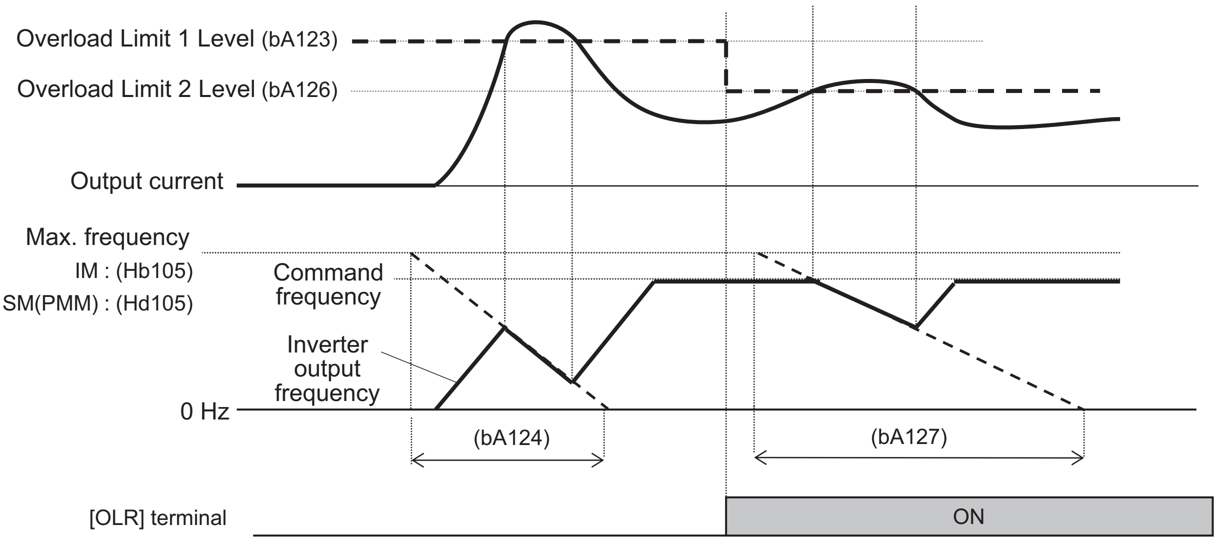
Additional Information

- Acceleration monitoring is used to prevent excessive moment of inertia during acceleration and overload due to sudden acceleration.
- Monitoring at low speeds is used to prevent overload due to sudden load fluctuations.
- Set the Overload restriction active level to 150% of the motor's rated current.
- If this function operates during acceleration and the frequency does not reach the target frequency, make the following adjustments.
  - Increase the acceleration time.
  - Adjust torque boost.
  - Increase the overload restriction active level.

Precautions for Correct Use

If the overload restriction action time is set too short, this function will cause automatic deceleration during acceleration, and regenerative energy will cause an over-voltage trip.

The overload limiting function can be used to switch between overload limit 1 and overload limit 2.
To switch the overload limit, assign [38: OLR] *Switching of overload limit* to one of **Input terminal function** (CA-01) to (CA-11). When the switching of overload limit [38:OLR] terminal turns ON, the inverter switches in to overload limit 2.
Overload limit 2 is set by the combination of **Overload restriction 2 mode selection** (bA126), **Overload restriction 2 active level** (bA127) and **Overload restriction 1 action time** (bA128). The settings are the same as for overload limit 1.



● Parameter

Item	Parameter	Data	Description	Default
Overload restriction 1 mode selection Overload restriction 2 mode selection	bA122 bA126	00	Disabled	01
		01	Enabled during acceleration and at constant speed	
		02	Enabled at constant speed	
		03	Enabled during acceleration and at constant speed (increase speed at regeneration)	

Item	Parameter	Data	Description	Default
Overload restriction 1 active level Overload restriction 2 active level	bA123 bA127	Inverter rated current ×(0.2 to 2.0) *1	The Overload limit function will operate when the output torque exceeds this set value.	1.5× Inverter rated current
Overload restriction 1 action time Overload restriction 2 action time	bA124 bA128	0.10 to 3600.00 (s)	The acceleration/deceleration time when overload restriction active level is exceeded.	1.00

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator, CX-Drive: For operation with CX-Drive 0.1 A, or 0.1 V, set **Resister data selection** (CF-11) to "00: A,V". If **Resister data selection** (CF-11) is not set to *00: A,V*, data cannot be set, or displayed correctly.
2. Modbus: Current and voltage vary, depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. Drive programming: 0.01% (Rated ratio)

● Input Terminal Function

Item	Terminal name	Data	Description
Input terminal function	CA-01 to CA-11	38	[38: OLR] Switching of overload limit OFF: Overload limit 1 enabled ON: Overload limit 2 enabled

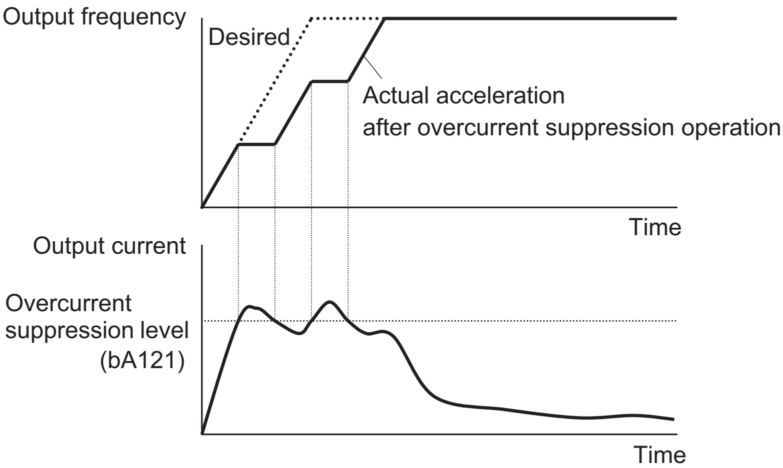
8-2-2 Overcurrent Suppression Function

Overcurrent suppression is a function that suppresses the rise in current by stopping acceleration when the output current reaches the overcurrent suppress level, and suppresses the occurrence of overcurrent trips.
To use this function, set **Over current suppress enable** (bA120) to *01: Enabled* and set the monitor current threshold to the **Over current suppress level** (bA121).

This function is automatically enabled during DC braking.
This function is enabled during position/torque control.
When using a synchronous motor or permanent magnet motor, overcurrent suppression is not performed even if the overcurrent suppression function is enabled.

Precautions for Correct Use

- Disable this function when using for elevators, etc. Suppressing the current causes insufficient torque, which may result in the cargo or items being lifted falling off.
- Overcurrent tripping may occur even if this function is enabled if the current increases sharply due to shock load, etc.



● **Parameter**

Item	Parameter	Data	Description	Default
Over current suppress enable	bA120	00	Disabled	1
		01	Enabled	
Over current suppress level	bA121	Inverter rated current × (0.0 to 2.0) *1	Sets the over current suppression level.	1.8 × Inverter rated current

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator, CX-Drive: For operation with CX-Drive 0.1 A, or 0.1 V, set **Resister data selection** (CF-11) to *00: A,V*. If **Resister data selection** (CF-11) is not set to *00: A,V*, data cannot be set, or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. Drive programming: 0.01% (Rated ratio)

8-2-3 Overvoltage Suppression During Deceleration

The overvoltage suppression during deceleration function suppresses the rise in voltage by consuming the regenerative energy generated during deceleration and suppresses the occurrence of overvoltage trips.
To use this function, set **Over-voltage suppression enable** (bA140) to one of the following, *01: DC voltage constant deceleration*, *02: Acceleration only at deceleration*, *03: Acceleration at constant speed/deceleration*.

Setting	Description
01: DC voltage constant deceleration	The main circuit DC voltage is constantly monitored and PI control is performed so that the DC voltage becomes constant when the threshold value is exceeded.
02: Acceleration only at deceleration	The main circuit DC voltage is monitored during deceleration, and acceleration is performed when the threshold is exceeded.
03: Acceleration at constant speed/deceleration	The main circuit DC voltage is monitored at constant speed and at deceleration and acceleration is performed when the threshold is exceeded.

In position control and torque control, overvoltage suppression during deceleration is not performed even if the function enabled.

Precautions for Correct Use

- Depending on the deceleration rate or load status, the overvoltage tripping may be triggered even if this function is enabled.
- Set **Over-voltage suppression active level** (bA141) to be receiving voltage x √2 × 1.1 or higher. Setting a value lower than the P-N voltage in operation may prevent the motor from stopping. Setting a value lower than the P-N voltage in operation may prevent the motor from stopping.
- When this function is used, set the **Dynamic brake usage rate** (bA-60) to *0.0* (BDR function is not activated) and the **Dynamic brake selection** (bA-61) to *00: Disabled*.

● Parameter

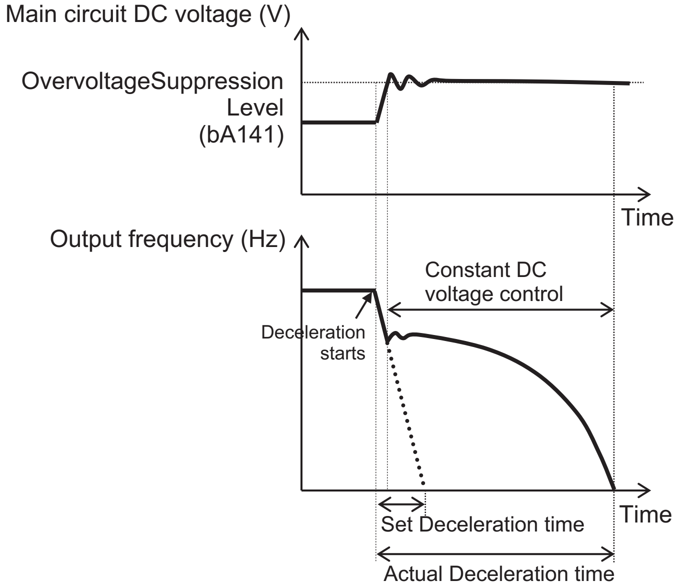
Item	Parameter	Data	Description	Default
Over-voltage suppression enable	bA140	00	Disabled	00
		01	DC voltage constant deceleration	
		02	Acceleration only at deceleration	
		03	Acceleration at constant speed/ deceleration	
Over-voltage suppression active level	bA141	200 V Class: 330.0 to 400.0 (V) 400 V Class: 660.0 to 800.0 (V)	Sets the starting level for over-voltage suppression enable.	200 V Class: 380.0 400 V Class: 760.0
Over-voltage suppression action time	bA142	0.00 to 3600.00 (s)	The acceleration time of over-voltage suppression enable operation.	1.00
DC bus constant control proportional gain	bA144	0.00 to 5.00	Proportional gain for PI control in DC bus constant control.	0.20
DC bus constant control integral gain	bA145	0.00 to 150.00	Integral gain for PI control in DC bus constant control.	1.00

DC Voltage Constant Deceleration Setting

When **Over-voltage suppression enable** (bA140) is set to *01: DC voltage constant deceleration*, the main circuit DC voltage is constantly monitored and PI control is performed so that the DC voltage becomes constant when the threshold value is exceeded.

To use the function, set the voltage monitoring threshold in **Over-voltage suppression active level** (bA141) and set the PI control gain in **DC bus constant control proportional gain** (bA144) and **DC bus constant control integral gain** (bA145).
Increasing the value set for **DC bus constant control proportional gain** (bA144) will speed up the response. However, setting it too high will tend to cause tripping.

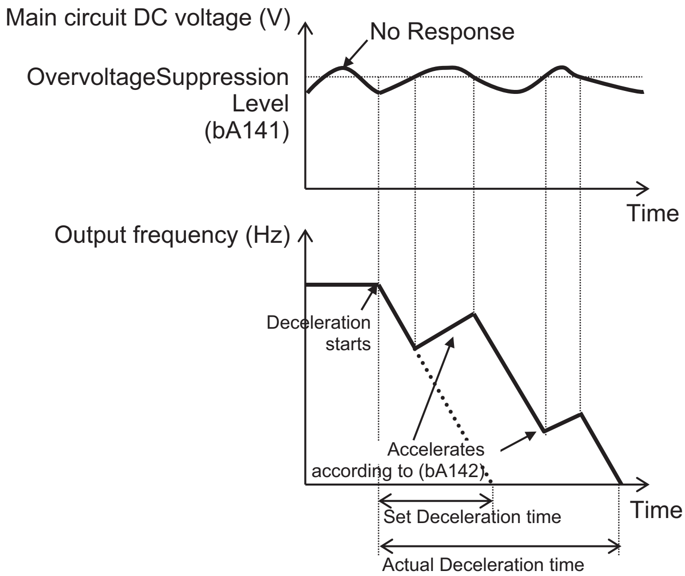
Decreasing the value set for **DC bus constant control integral gain** (bA145) will speed up the response. However, setting it too low will tend to cause tripping.



Acceleration only at Deceleration

When **Over-voltage suppression enable** (bA140) is set to *02: Acceleration only at deceleration*, the main circuit DC voltage is monitored during deceleration, and acceleration is performed when the threshold is exceeded.

To use the function, set the voltage monitoring threshold in **Over-voltage suppression active level** (bA141) and set the acceleration time in **Over-voltage suppression action time** (bA142). The set value is the time to accelerate from 0 Hz to the maximum frequency.
If it falls below the threshold, it will decelerate in the normal deceleration time.



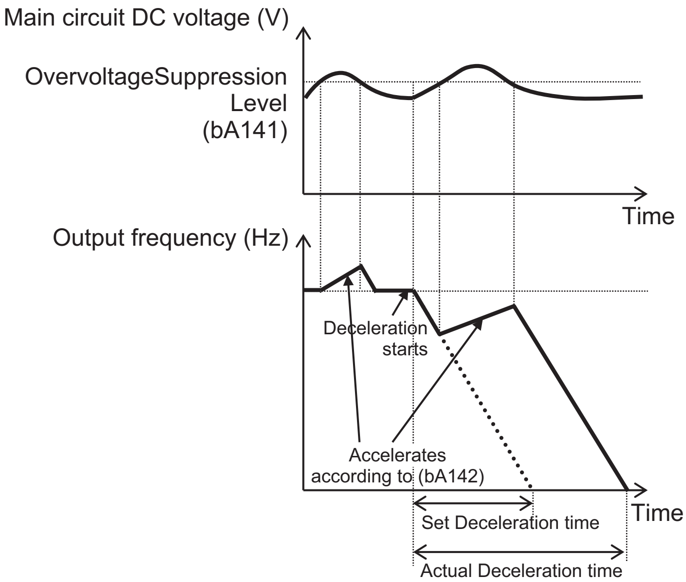
Precautions for Correct Use

If the **Over-voltage suppression action time** (bA142) is set too short, it accelerates beyond deceleration and may not stop. In this case, increase the value set for **Over-voltage suppression active level** (bA141).

Acceleration at Constant Speed / Deceleration Setting

When **Over-voltage suppression enable** (bA140) is set to *03: Acceleration at constant speed/ deceleration*, the main circuit DC voltage is monitored at both constant speed and during deceleration, and acceleration is performed when the threshold is exceeded.

To use the function, set the voltage monitoring threshold in **Over-voltage suppression active level** (bA141) and set the acceleration time in **Over-voltage suppression action time** (bA142). The set value is the time to accelerate from 0 Hz to the maximum frequency.
If it falls below the threshold, it will decelerate in the normal deceleration time.



Precautions for Correct Use

If the **Over-voltage suppression action time** (bA142) is set too short, it accelerates beyond deceleration and may not stop. In this case, increase the value set for **Over-voltage suppression active level** (bA141).

8-2-4 Over Magnetization Deceleration Function

The over magnetization deceleration function reduces regenerative energy by increasing motor loss in order to suppress the overvoltage and prevent tripping.
To use this function, set **Over magnetization deceleration function selection** (bA146) to one of the following: *01: Regular operation*, *02: Operation only at deceleration*, *03: Level mode*, or *04: Level mode only at deceleration*.

Setting	Description
01: Regular operation	Perform over magnetization deceleration during regular operation.

Setting	Description
02: Operation only at deceleration	Perform over magnetization deceleration during deceleration
03: Level mode	Constantly monitor voltage between P-N and perform over magnetization deceleration when the threshold value is exceeded.
04: Level mode only at deceleration	Monitor N voltage during deceleration and perform over magnetization deceleration when the threshold value is exceeded.

The over magnetization deceleration function is only enabled when **Control mode selection** (AA121) is set to *00: [V/f] Fixed torque characteristics (IM)*, *01: [V/f] Reducing torque characteristics (IM)*, or *02: [V/f] Free V/f (IM)*. If settings other than those are used, the over magnetization deceleration operation will not be performed even if the function appears enabled.

Precautions for Correct Use

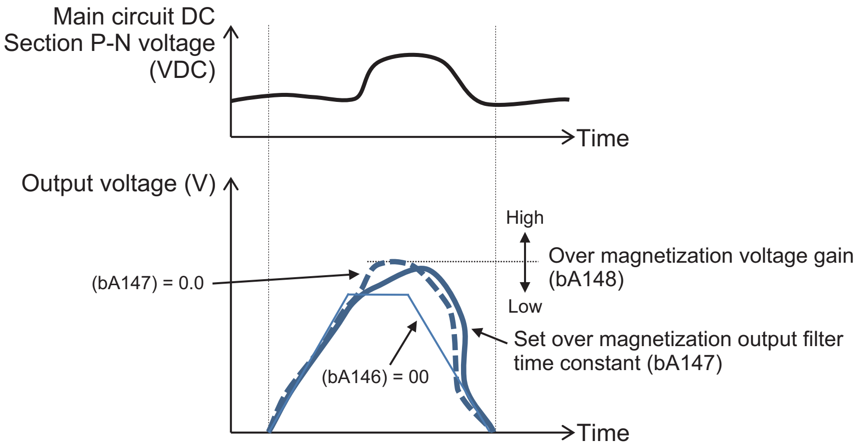
- When this function is enabled, the current may increase as the output voltage increases.
- When using this function, the motor will be overexcited and the heat generated by the motor may increase.
- Depending on the deceleration rate or load status, the overvoltage tripping may be triggered even if this function is enabled.

● Parameter

Item	Parameter	Data	Description	Default
Over magnetization deceleration function selection	bA146	00	Disabled	02
		01	Regular operation	
		02	Operation only at deceleration	
		03	Level mode	
		04	Level mode only at deceleration	
Over magnetization output filter time constant	bA147	0.00 to 1.00 (s)	The filter time constant applied to over magnetization output.	0.30
Over magnetization voltage gain	bA148	50 to 400 (%)	Gain for over magnetization voltage.	100
Over magnetization level setting	bA149	200 V Class: 330.0 to 400.0 (V) 400 V Class: 660.0 to 800.0 (V)	The level at which the over magnetization function starts operation.	200 V class: 360.0 400 V class: 720.0

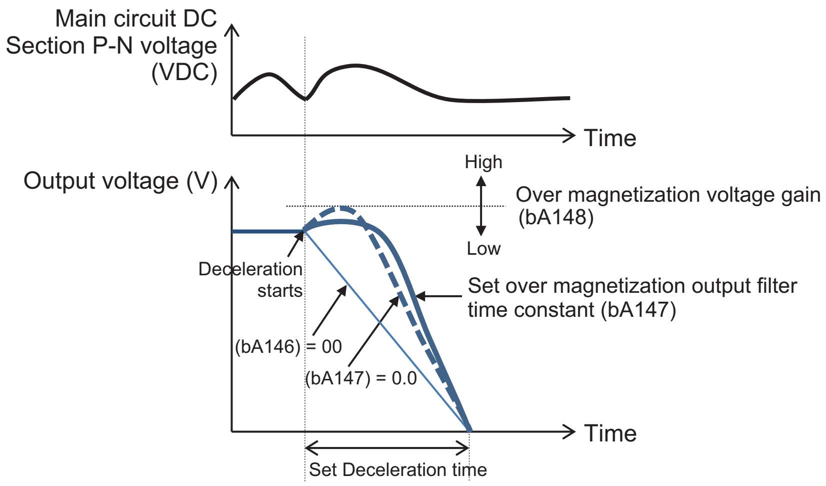
Regular Operation Setting

When **Over magnetization deceleration function selection** (bA146) is set to *01: Regular operation*, over magnetization deceleration is performed during regular operation.



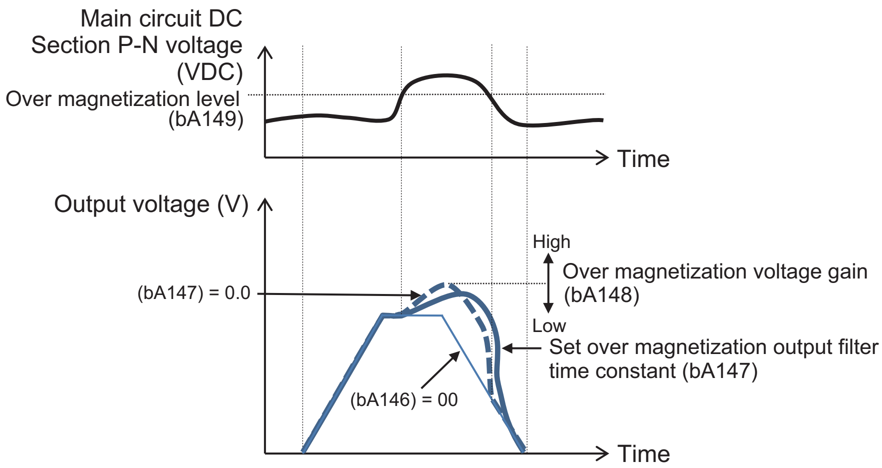
Operation Only at Deceleration

When **Over magnetization deceleration function selection** (bA146) is set to *02: Operation only at deceleration*, the operation is performed only at deceleration.



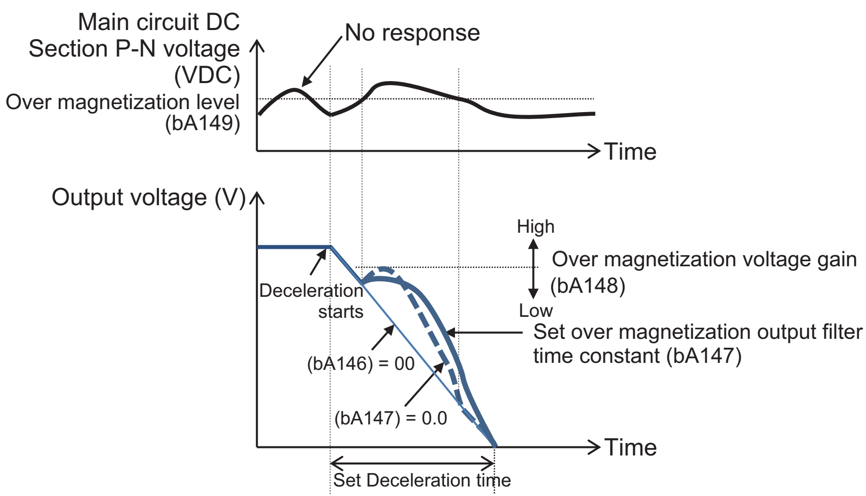
Level Mode Setting

When **Over magnetization deceleration function selection** (bA146) is set to *03: Level mode*, The voltage between PNs is constantly monitored, and when the threshold value is exceeded, the over magnetization deceleration operation is performed.
The threshold is set in **Over magnetization level setting** (bA149).



Level Mode Only at Deceleration

When **Over magnetization deceleration function selection** (bA146) is set to *04: Level mode only at deceleration*, the voltage between PNs is monitored during deceleration, and when the threshold value is exceeded, over magnetization deceleration operation is performed.
The threshold is set in **Over magnetization level setting** (bA149).



8-2-5 Regenerative Braking Function

When decelerating, generating downward movement, or when the output torque direction and the rotation direction are opposite due to the influence of an external load, the motor serves as a generator and the regenerated energy is fed back to the inverter. If the motor load inertia is large, the amount of regeneration may become large, which causes an overvoltage in the inverter during rapid deceleration or when driving an elevating axis.

Regenerative braking is a function that reduces the DC voltage inside the inverter by consuming the regenerative energy from the motor as heat with an external braking resistor.

The RX2 series includes models with a built-in braking resistor circuit (BRD) and models without a built-in braking resistor circuit. The following models include a built-in braking resistor circuit (BRD):

- 200 V: 3G3RX2-A2004 (0.4 kW) to 3G3RX2-A2220 (22 kW)
- 400 V: 3G3RX2-A4007 (0.75 kW) to 3G3RX2-A4370 (37 kW)

The table below shows connection support for braking resistor and regenerative braking unit.

Built-in braking resistor circuit (BRD)	Braking resistor	Regenerative braking unit
Built-in models	Can connect	Can connect
Models without built-in	Cannot connect	Can connect

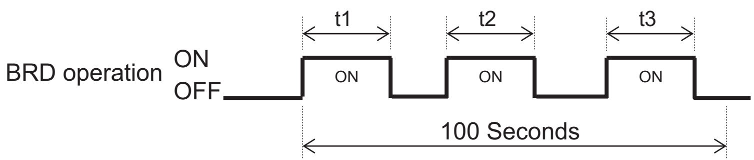
To use this function, set **Over-voltage suppression enable** (bA140) to *00: Disabled*.

When Using a Braking Resistor

When you want to connect a braking resistor to an inverter with a built-in braking resistor circuit (BRD), set **Dynamic brake selection** (bA-61). In this case you can choose between *01: Enabled: disabled at stop*, or *02: Enabled: enabled at stop*, but normally *01: Enabled: disabled at stop* is used.

Set the DC voltage threshold at which regenerative braking operates in **Dynamic brake active level** (bA-62). Normally, there is no need to change the default setting. This is used for adjusting the level according to the input power supply voltage.

Set the resistance value of the connected braking resistor in **Dynamic brake resister value** (bA-63). Set the usage condition of the braking resistor to be used in **Dynamic brake usage rate** (bA-60). If set to *0*, regenerative braking does not operate. The motor will trip when the operation rate exceeds the use rate.



$$\text{Operation Rate (\%)} = \frac{(t1 + t2 + t3)}{100\ \text{Seconds}} \times 100$$

Additional Information

The **Dynamic brake active level** (bA-62) setting is the main circuit DC voltage value. Since the main circuit DC voltage is AC, set it to a value that exceeds √2 times the input voltage.

When Using Regenerative Braking Unit

When connecting the regenerative braking unit, set **Dynamic brake selection** (bA-61) to *00: Disabled*.

Dynamic brake usage rate (bA-60), **Dynamic brake active level** (bA-62) and **Dynamic brake resister value** (bA-63) are not used.

● **Parameter**

Item	Parameter	Data	Description	Default
Dynamic brake usage rate	bA-60	0.0 to 100.0 (%) *1	If it is set to 0.0, the BRD function will not be activated. If the setting is other than 0.0, the motor will trip when **BRD load factor monitor** (dA-41) exceeds the BRD use rate.	10.0
Dynamic brake selection	bA-61	00	Disabled	00
		01	Enabled (disabled at stop)	
		02	Enabled (enabled at stop)	
Dynamic brake active level	bA-62	200 V Class: 330.0 to 400.0 (V) 400 V Class: 660.0 to 800.0 (V)	The ON level at which the BRD is activated.	200 V class: 360.0 400 V class: 720.0
Dynamic brake resister value	bA-63	Minimum resistance to 600 (Ω)	Setting the dynamic brake resister to be connected automatically sets the maximum value for **Dynamic brake usage rate** (bA-60).	Minimum resistance value *2

*1. The upper limit depends on **Dynamic brake resister value** (bA-63).
*2. The lower limit differs by inverter model.

● **Monitor**

Item	Parameter	Data	Description
BRD load factor monitor	dA-41	0.00 to 100.00 (%)	The value according to the BRD usage rate is displayed.

8-2-6 Restart during Power Interruption / Undervoltage

Undervoltage Restart

The under-voltage restart function is a function to deal with when the voltage of the input power supply to the inverter drops or when the power supply is cut off. You can set the method for a restart after P-N voltage drops below the threshold value and returns.
The threshold for detecting under-voltages is 160 VDC for 200 V models and 320 VDC for 400 V models.
When the P-N voltage falls below the threshold value, the output to the motor is cut off.
To use the function, set the restart method in **Selection of restart mode @Instantaneous power failure/ under-voltage trip** (bb-24). You can select *00: 0 Hz*, *01: Frequency matching*, *02: Frequency entrainment*, *03: Detection speed*, or *04: Trip after frequency matching deceleration stop*. For details on starting method, refer to *7-5-3 Restart* on page 7-59.

Set the waiting time from recovery of P-N voltage to start in **Retry wait time before motor restart** (bb-26).
Set the number of times to allow a restart in **The number of retries after under voltage** (bb-21).
When set to *0*, An undervoltage error (E009) occurs when an undervoltage is detected. When set to *1*

to *16*, it restarts up to the set number of times, and when that number of times is exceeded, an undervoltage error (E009) occurs when an undervoltage condition is detected. When *255* is set, there will be continuous restart attempts.

Additional Information

- The P-N voltage can be monitored by **DC voltage monitor** (dA-40).
- If the control power supply is completely shut off, follow the start-up after power-on.
- If you want to have as much control power supply as possible, connect P and N of the main circuit terminal block to control power supply.

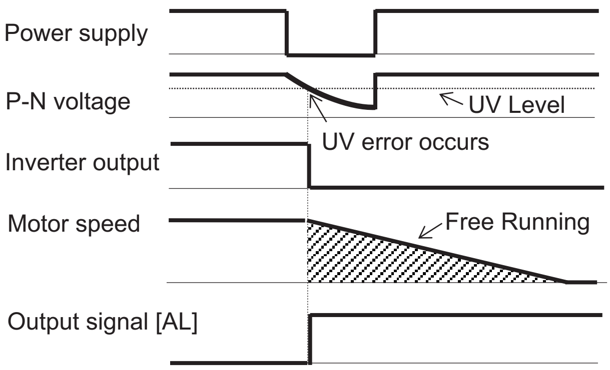
Precautions for Correct Use

- If the control power supply (R0, T0) is input to the inverter via the main power supply (R, S, T), a momentary trip or momentary retry may occur first.
- After 40 seconds of the main power supply (R, S, T) being cutoff, and undervoltage error (E009) will occur regardless of **Instantaneous power failure/under-voltage trip alarm enable** (bb-27) being set to *00: Disabled.*, or *02: Disabled at stop and deceleration stop*.

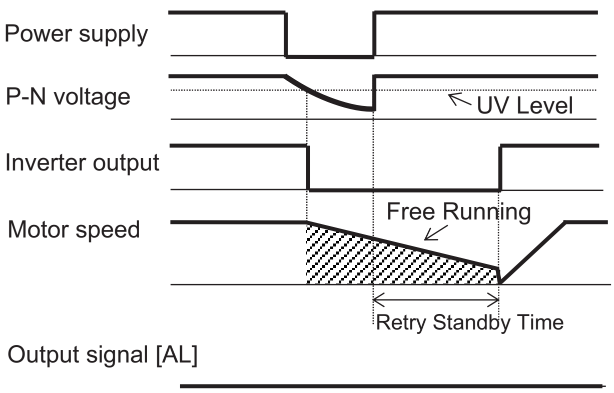
● Parameter

Item	Parameter	Data	Description	Default
The number of retries after under voltage	bb-21	0 to 16 / ∞(255) (counts)	Sets the undervoltage retry restarting counts. If this is set to 0, the motor will trip upon undervoltage.	0
Selection of restart mode @Instantaneous power failure/ under-voltage trip	bb-24	00	Restarts at 0 Hz	01
		01	Restarts with the frequency matching	
		02	Restarts upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trip after frequency matching deceleration stop	
Retry wait time before motor restart	bb-26	0.3 to 100.0 (s)	Starts after waiting for the set time upon power voltage recovery.	0.3
Instantaneous power failure/ under-voltage trip alarm enable	bb-27	00	Disabled	00
		01	Enabled	
		02	Disabled during stop and deceleration stop	

The following figure shows the case where an Undervoltage error occurs.
If the P-N voltage falls below the threshold value, the output to the motor will be cut off and an error will occur.



The following figure shows the case of restarting. The figure shows the case of restarts with the frequency matching.
If the P-N voltage falls below the threshold value, the output to the motor will be cut off. It starts after the retry wait time before motor restart elapses after the P-N voltage is restored.



Power Interruption Restart

Power interruption restart is a function to set how to start when the main power supply (R, S, T) is cut off and restored. When the power cutoff is detected, the output to the motor is cut off.

To use the function, set the restart method in **Selection of restart mode @Instantaneous power failure/ under-voltage trip** (bb-24). You can select *00: 0 Hz*, *01: Frequency matching*, *02: Frequency entrainment*, *03: Detection speed*, or *04: Trip after frequency matching deceleration stop*. For details on starting method, refer to *7-5-3 Restart* on page 7-59.

Set the allowable time for under-voltage in **Allowable under-voltage power failure time** (bb-25). After the power is cut off, it will restart if the power is restored within the set time. If the set time is exceeded, a Momentary interruption error (E016) will occur.
Set the waiting time from power recovery to start in **Retry wait time before motor restart** (bb-26).
Set the number of times to allow a restart in **The number of retries after instantaneous power failure** (bb-20). When set to *0*, a momentary interruption error (E016) will occur when a power interruption is detected. When set to *1* to *16*, it restarts up to the set number of times, and when that number of times is exceeded, a momentary interruption error (E016) occurs when a power interruption is detected. When *255* is set, there will be continuous restart attempts.

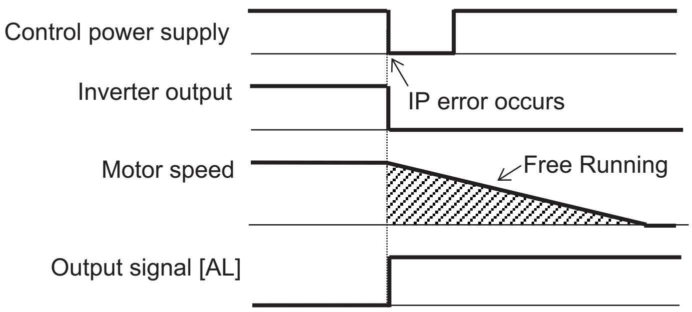
Additional Information

- If the control power supply is completely shut off, follow the start-up after power-on.
- If you want to have as much control power supply as possible, connect P and N of the main circuit terminal block to control power supply.

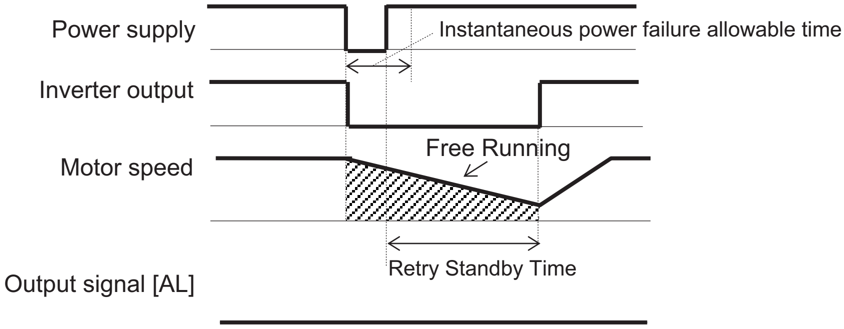
● Parameter

Item	Parameter	Data	Description	Default
The number of retries after instantaneous power failure	bb-20	0 to 16 / ∞(255) (counts)	Sets the retry counts in case of instantaneous power failure. If this is set to 0, the motor will trip upon recovery from instantaneous power failure.	0
Selection of restart mode @Instantaneous power failure/ under-voltage trip	bb-24	00	Restarts at 0 Hz	01
		01	Restarts with the frequency matching	
		02	Restarts upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trip after frequency matching deceleration stop	
Allowable undervoltage power failure time	bb-25	0.3 to 25.0 (s)	Restarts if the instantaneous power failure time is within the set value.	1.0
Retry wait time before motor restart	bb-26	0.3 to 100.0 (s)	Starts after waiting for the set time upon power voltage recovery.	0.3
Instantaneous power failure/ under-voltage trip alarm enable	bb-27	00	Disabled	00
		01	Enabled	
		02	Disabled during stop and deceleration stop	

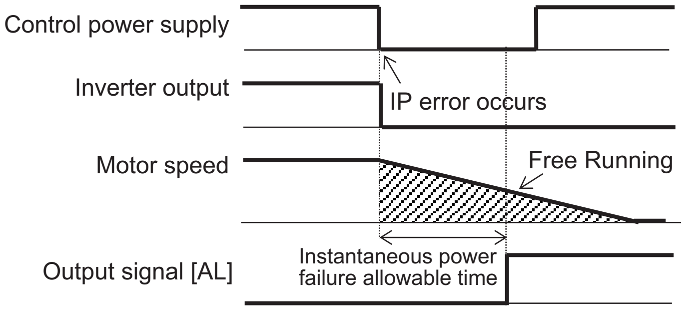
The following figure shows the case where an instantaneous power failure error occurs.
If the main power supply is cut off, the output to the motor will be cut off and an error will occur.



The following figure shows the case of restarting. The figure shows the case of restarts with the frequency matching.
If the main power supply is cut off, the output to the motor will be cut off. It starts after the retry wait time before motor restart elapses after the P-N voltage is restored.



An error occurs after the Allowable under-voltage power failure time.



8-2-7 Over-Current Restart

Over-current restart is a function that enables restart without an error when an over-current condition occurs. Set the current value at which to detect over-current in **Over current detection level** (bb160). When an over-current is detected, the output to the motor is cut off.

To use the function, set the restart method in **Selection of restart mode @over-current** (bb-28). You can select *00: 0 Hz*, *01: Frequency matching*, *02: Frequency entrainment*, *03: Detection speed*, or *04: Trip after frequency matching deceleration stop*. For details on starting method, refer to *7-5-3 Restart* on page 7-59.

Set the waiting time from current value recovery to start in **Wait time of restart @over-current** (bb-29).
Set the number of times to allow a restart in **The number of retries after over current** (bb-22). When set to *0*, over-current error (E001) occurs when an over-current is detected. When set to *1* to *5*, it restarts up to the set number of times, and when that number of times is exceeded, over-current error (E001) occurs when an over-current condition is detected.

Additional Information

If over-currents occur continuously, the acceleration time may be too short, the load may be heavy, or the motor may be locked.

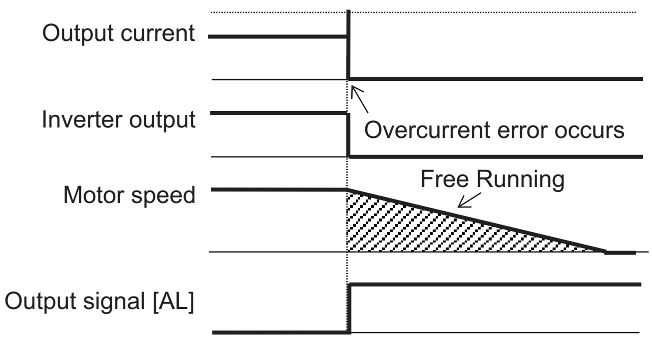
● Parameter

Item	Parameter	Data	Description	Default
Over current detection level	bb160	ND rated current × (0.2 to 2.2) *1	Sets the over current detection level.	2.2 x Inverter ND rated current
The number of retries after over current	bb-22	0 to 5 (Times)	Sets the retry counts when over-current occurs. When 0 times is set, an over-current trip will occur.	0
Selection of restart mode @over-current	bb-28	00	Restarts at 0 Hz	01
		01	Restart with the frequency matching	
		02	Restart upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trip after frequency matching deceleration stop	
Wait time of restart @over-current	bb-29	0.3 to 100.0 (s)	Retry after waiting for the set time upon over-current recovery.	0.3

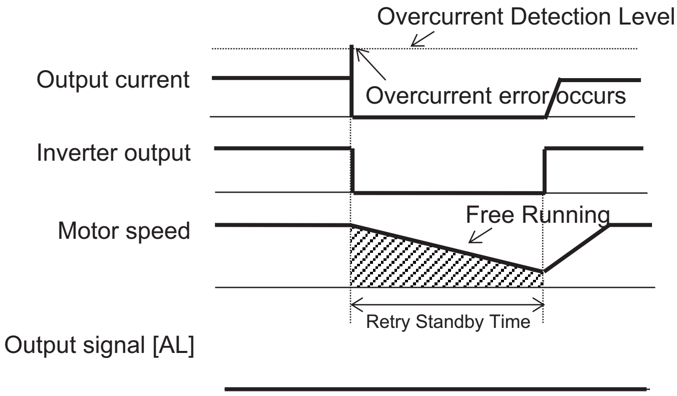
*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator, CX-Drive: For operation with CX-Drive 0.1 A, or 0.1 V, set **Resister data selection** (CF-11) to *00: A,V*. If **Resister data selection** (CF-11) is not set to *00: A,V*, data cannot be set, or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. Drive programming: 0.01 (Rated ratio)

The following figure shows the case where an over-current error occurs.
When an over-current condition is detected, output to the motor is cut off and an error will occur.



The following figure shows the case of restarting. The figure shows the case of restarts with the frequency matching.
When an over-current is detected, the output to the motor is cut off. It starts after the set retry wait time after current is restored has elapsed.



8-2-8 Over-Voltage Restart

Over-voltage restart is a function that enables restart without an error when an over-voltage condition occurs. Over-voltage is detected when the P-N voltage exceeds 410 VDC for 200 V class models and 820 VDC for 400 V class models. When an over-voltage is detected, the output to the motor is cut off.

To use the function, set the restart method in **Selection of restart mode @ overvoltage** (bb-30). You can select *00: 0 Hz*, *01: Frequency matching*, *02: Frequency entrainment*, *03: Detection speed*, or *04: Trip after frequency matching deceleration stop*. For details on starting method, refer to *7-5-3 Restart* on page 7-59.

Set the waiting time from voltage value recovery to start in **Wait time of restart @ overvoltage** (bb-31).
Set the number of times to allow a restart in **The number of retries after overvoltage** (bb-23). When set to *0*, over-voltage error (E007) occurs when an over-voltage condition is detected. When set to *1* to *5*, it restarts up to the set number of times, and when that number of times is exceeded, over-voltage error (E007) occurs when an over-voltage condition is detected.

Additional Information

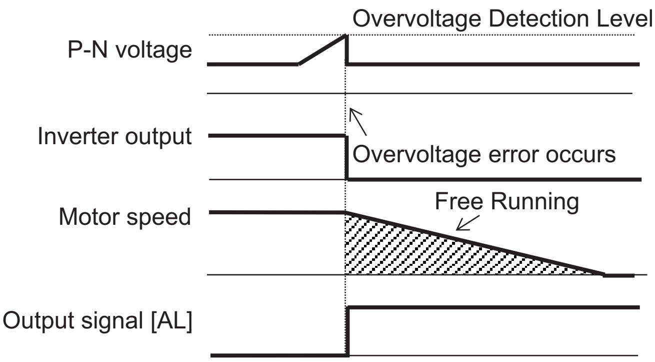
If overvoltage occurs continuously, the acceleration time may be too short, the load may be heavy, or the motor may be being rotated by an external force.

● Parameter

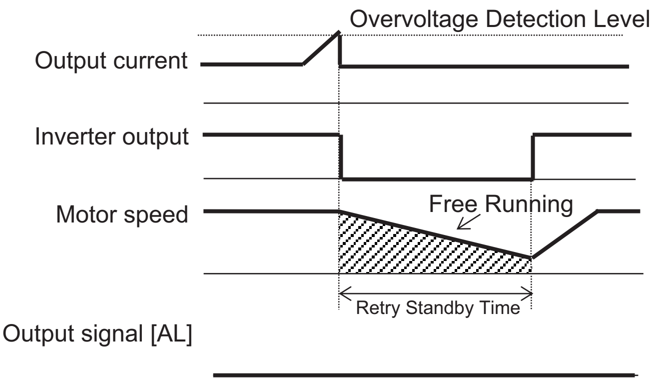
Item	Parameter	Data	Description	Default
The number of retries after over-voltage	**Selection of restart mode @over-voltage** (bb-23)	0 to 5 (Times)	Sets the retry counts when over-voltage occurs. When 0 times is set, an over-voltage trip will occur.	0

Item	Parameter	Data	Description	Default
Selection of re-start mode @over-voltage	bb-30	00	Restarts at 0 Hz	01
		01	Restarts with the frequency matching	
		02	Restarts upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trip after frequency matching deceleration stop	
Wait time of re-start @over-voltage	bb-31	0.3 to 100.0 (s)	Retry after waiting for the set time upon over-voltage recovery.	0.3

The following figure shows the case where an over-voltage error occurs.
When over-voltage condition is detected, output to the motor is cut off and an error will occur.



The following figure shows the case of restarting. The figure shows the case of restarts with frequency matching.
When an over-voltage is detected, the output to the motor is cut off. It starts after the elapsing of the set retry wait time after voltage is restored.



8-2-9 Deceleration-Stop at Power Failure

Deceleration stop at power failure is a function that enables deceleration to stop when the main power supply (R, S, T) is cut off during operation.
To use this function, set **Deceleration-stop at power failure** (bA-30) to one of *01: Enabled: deceleration stop*, *02: Enabled: no recovery*, or *03: Enabled: with recovery*.

8-2 Tripless Functions

8

8-2-9 Deceleration-Stop at Power Failure

Setting	Description
01: Enabled: deceleration stop	Decelerates and stops, and maintains the stop status.
02: Enabled: no recovery	Decelerates and stops with constant DC voltage control, and maintains the stop status.
03: Enabled with recovery	Decelerates and stops with constant DC voltage control, and maintains the stop status. If the power supply recovers during the process, the operation continues.

To restart the operation after stopping with the deceleration stop at power failure function, turn off the operation command and then turn it on again.
When P-N voltage falls below the under-voltage threshold, the output is cut off and the operation of this function is terminated. The operation at the time of voltage recovery follows the setting for under-voltage restart.

Additional Information

If you want to have as much Control power supply as possible, connect P and N of the Main circuit terminal block to Control power supply.

● Parameter

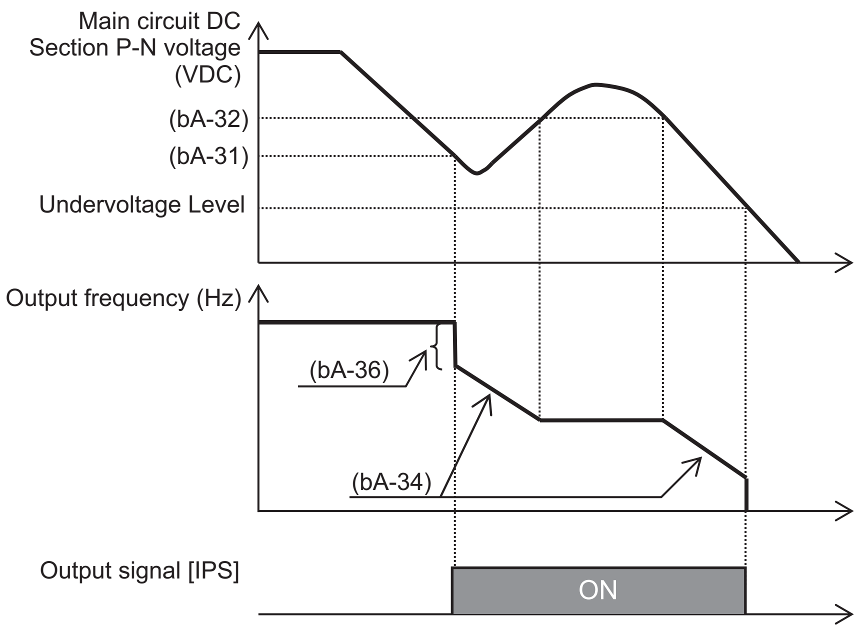
Item	Parameter	Data	Description	Default
Deceleration-stop at power failure	bA-30	00	Disabled	00
		01	Enabled: deceleration stop	
		02	Enabled: no recovery	
		03	Enabled: with recovery	
Decel-stop at power failure starting voltage	bA-31	200 V Class: 0.0 to 410.0 (V) 400 V Class: 0.0 to 820.0 (V)	The voltage level at which power failure non-stop control is started when the internal power supply voltage drops.	200 V Class: 220.0 400 V Class: 440.0
Decel-stop at power failure control target level	bA-32	200 V Class: 0.0 to 410.0(V) 400 V Class: 0.0 to 820.0 (V)	Deceleration is temporarily switched to constant speed operation when the internal power supply voltage rises due to deceleration.	200 V class: 360.0 400 V class: 720.0
Decel-stop at power failure deceleration time	bA-34	0.01 to 3600.00 (s)	The deceleration time setting for the deceleration stop at power failure function.	1.00
Decel-stop at power failure freq. width at deceleration start	bA-36	0.00 to 10.00 (Hz)	The setting to start deceleration by lowering the frequency during deceleration stop at power failure.	0.00
Decel-stop at power failure DC-bus voltage constant control P-gain	bA-37	0.00 to 5.00	Proportional gain of PI control performed during constant DC voltage control.	0.20

Item	Parameter	Data	Description	Default
Decel-stop at power failure DC-bus voltage constant control I-gain	bA-38	0.00 to 150.00 (s)	Integral time constant of PI control performed during constant DC voltage control.	1.00

Deceleration-Stop at Power Failure: Deceleration Stop

When **Deceleration-stop at power failure** (bA-30) is set to *01: Enabled: deceleration stop*, if power is cut off during operation and the P-N voltage falls below the starting voltage, the motor decelerates and stops. At this time, deceleration starts from the frequency obtained by subtracting the deceleration start width from the output frequency.
If the P-N voltage exceeds the target level during regeneration, deceleration is stopped and operation is at constant speed. If the voltage drops below the starting voltage, deceleration resumes. Even if the power is restored, the power failure non-stop operation continues.

Set the starting voltage in **Decel-stop at power failure starting voltage** (bA-31).
Set the deceleration start width in **Decel-stop at power failure freq. width at deceleration start** (bA-36).
Set the target level in **Decel-stop at power failure control target level** (bA-32).
Set the deceleration time in **Decel-stop at power failure deceleration time** (bA-34). The set value is the time to decelerate from maximum frequency to 0 Hz.



When **Decel-stop at power failure control target level** (bA-32) < **Decel-stop at power failure starting voltage** (bA-31), the target operation level is the value set for **Decel-stop at power failure starting voltage** (bA-31).

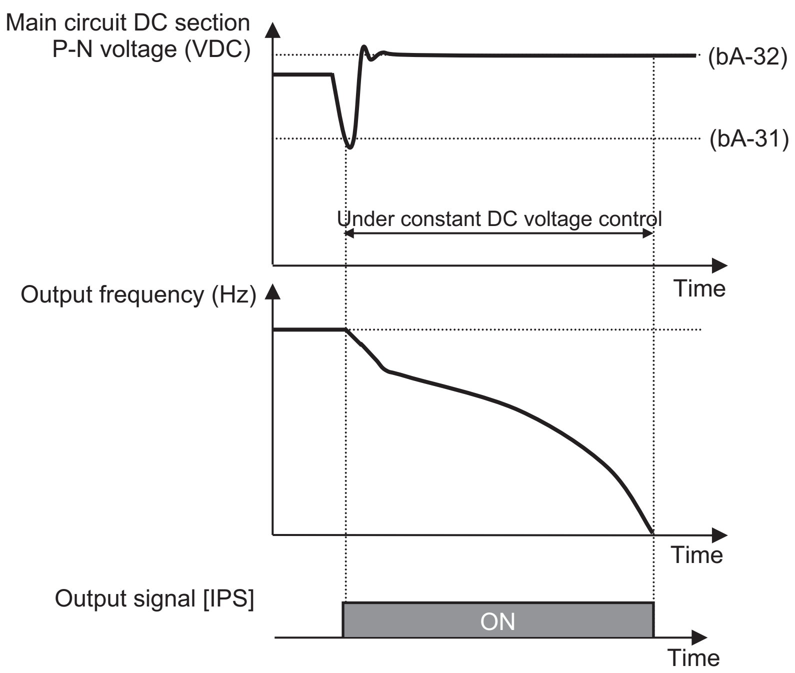
Precautions for Correct Use

- Set **Decel-stop at power failure control target level** (bA-32) to be a value greater than √2 times the input voltage. If it is less than √2 times the input voltage and power is restored during operation of this function, the constant speed state will be maintained and no deceleration will occur. Turn off the power to stop.
- Set the **Decel-stop at power failure starting voltage** (bA-31) and **Decel-stop at power failure control target level** (bA-32) values to be above the threshold for detecting under-voltage. The threshold for detecting under-voltage is 160 VDC for 200 V models and 320 VDC for 400 V models. This function does not operate when under-voltage occurs.
- If **Decel-stop at power failure deceleration time** (bA-34) is set too high, regeneration due to sudden acceleration will occur, resulting in an over-current error (E001).
- If the value set for **Decel-stop at power failure freq. width at deceleration start** (bA-36) is too small, or **Decel-stop at power failure deceleration time** (bA-34) is set tool long, under-voltage error (E009) will occur due to insufficient regeneration.

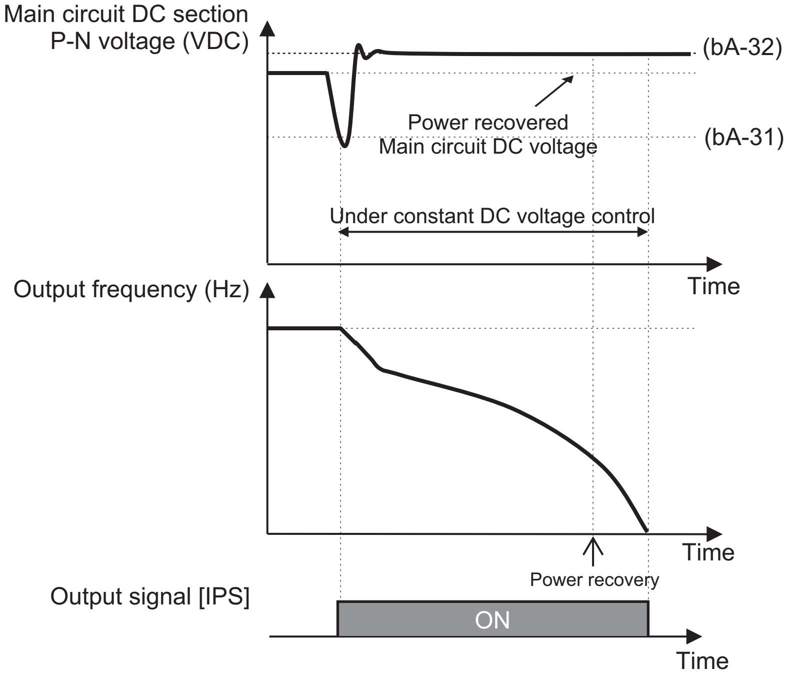
Deceleration-Stop at Power Failure: No Recovery

When **Deceleration-stop at power failure** (bA-30) is set to *02: Enabled: no recovery*, PI control is performed to keep the voltage at the target level when the P-N voltage falls below the starting voltage.

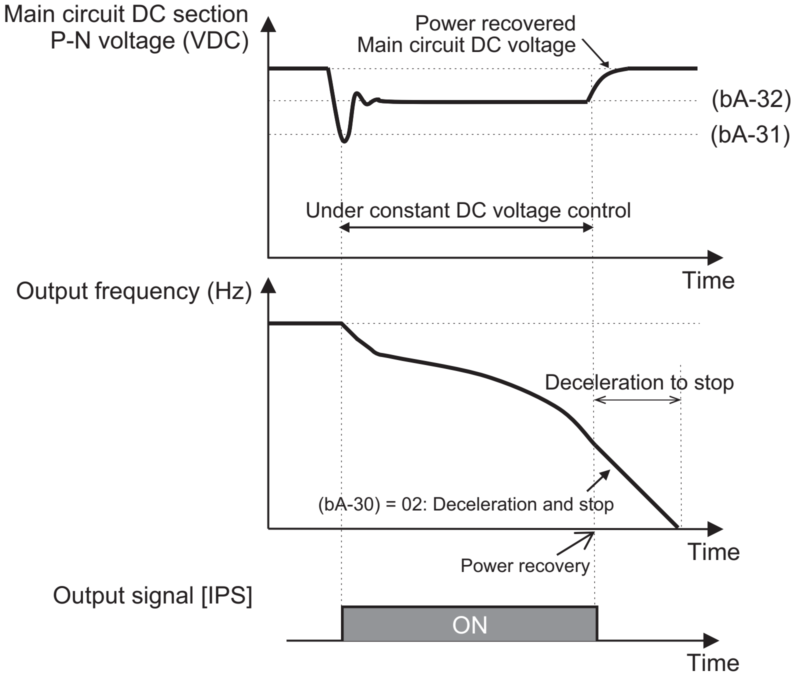
Set the starting voltage in **Decel-stop at power failure starting voltage** (bA-31).
Set the target level in **Decel-stop at power failure control target level** (bA-32).
Set the deceleration time in **Decel-stop at power failure deceleration time** (bA-34). The set value is the time to decelerate from Maximum frequency to 0 Hz.
Set the PI control gain in **Decel-stop at power failure DC-bus voltage constant control P-gain** (bA-37) and **Decel-stop at power failure DC-bus voltage constant control I-gain** (bA-38).



If the power is restored during PI control, the operation differs depending on the set value for **Decel-stop at power failure control target level** (bA-32). If **Decel-stop at power failure control target level** (bA-32) ≥ P-N voltage, PI control is continued.



If **Decel-stop at power failure control target level** (bA-32) < P-N voltage, decelerate to stop.



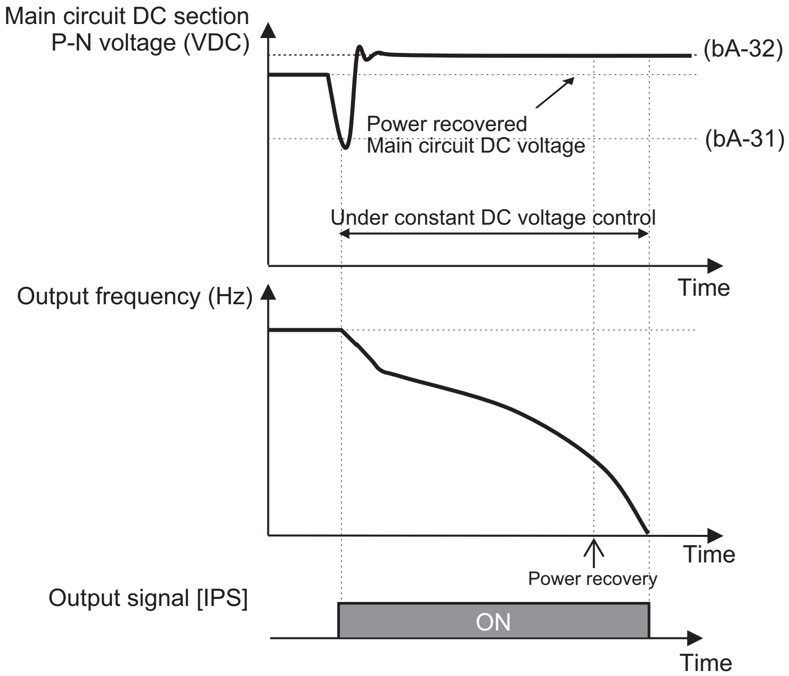
Precautions for Correct Use

- Set the **Decel-stop at power failure starting voltage** (bA-31) and **Decel-stop at power failure control target level** (bA-32) values to be above the threshold for detecting under-votage. The threshold for detecting under-voltages is 160 VDC for 200 V models and 320 VDC for 400 V models. This function does not operate when under-voltage occurs.
- If the difference between the set values for **Decel-stop at power failure starting voltage** (bA-31) and **Decel-stop at power failure control target level** (bA-32) is large, **Decel-stop at power failure DC-bus voltage constant control P-gain** (bA-37) value is large, or **Decel-stop at power failure DC-bus voltage constant control I-gain** (bA-38) value is small, a sudden acceleration and over-current error (E001) will occur.
- If the **Decel-stop at power failure DC-bus voltage constant control P-gain** (bA-37) value is small, an under-voltage error (E009) occurs due to the voltage drop.

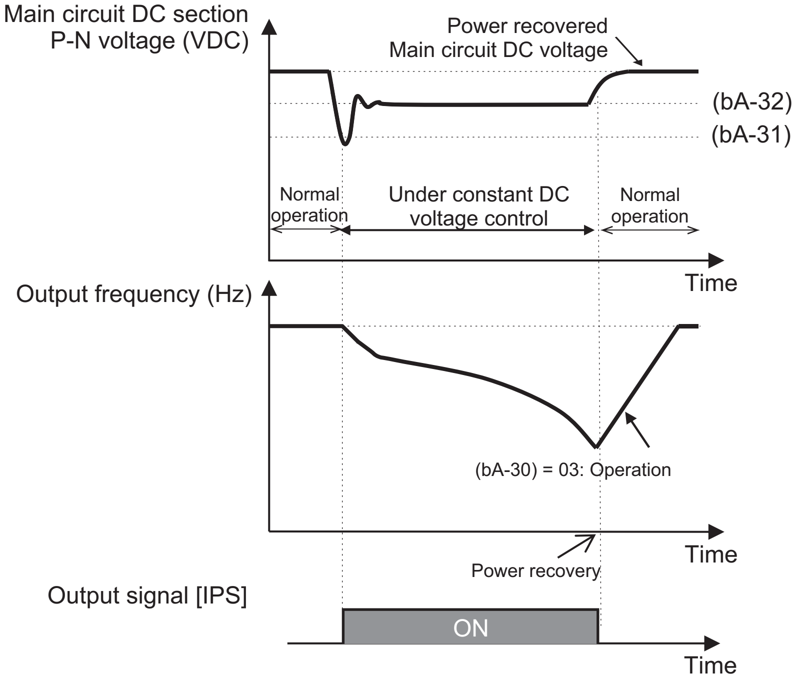
Deceleration-Stop at Power Failure: With Recovery

When **Deceleration-stop at power failure** (bA-30) is set to *03: Enabled: with recovery* and power is cut off during operation whereby the P-N voltage falls below the starting voltage, PI control is performed to keep the P-N voltage at the target level.
The behavior is the same as for **Deceleration-stop at power failure** (bA-30) set to *02: Enabled: no recovery* except for the operation when the power is restored.

If the power is restored during PI control, the operation differs depending on setting for **Decel-stop at power failure control target level** (bA-32). When **Decel-stop at power failure control target level** (bA-32) ≧ P-N voltage, PI control continues.



When **Decel-stop at power failure control target level** (bA-32) < P-N voltage, operation resumes.


Main circuit DC section
P-N voltage (VDC)
Power recovered
Main circuit DC voltage
(bA-32)
(bA-31)
Normal operation
Under constant DC voltage control
Normal operation
Time
Output frequency (Hz)
(bA-30) = 03: Operation
Time
Power recovery
Output signal [IPS]
ON
Time

8-3 Protective Functions

8-3-1 Input Power Supply Phase Loss Protection

Input power phase loss protection function detects open phase of the input power supply and shuts off the output.
To use the function, set **Input phase loss enable** (bb-65) to *01: Enabled*.

A phase loss is detected when the input power supply is out of phase for more than 1 second. Detection of an open phase shuts off the output and causes an input open-phase error (E024). If an input open-phase error (E024) occurs, disconnect the power supply to the inverter and check the wiring and breaker status.
When three-phase AC input is not the input to the power supply terminals R, S, and T, open phase is not detected regardless of the setting of **Input phase loss enable** (bb-65).
No phase loss is detected during a momentary power failure.

● Parameter

Item	Parameter	Data	Description	Default
Input phase loss enable	bb-65	00	Disabled	00
		01	Enabled	

8-3-2 Output Phase Loss Protection

The output phase loss protection function detects the open phase of the motor output line and shuts off the output.
To use the function, set **Output phase loss enable** (bb-66) to *01: Enabled*.

If the motor wire is out of phase for 1 second, it detects the open phase, shuts off the output and an output open-phase error (E034) occurs.
To adjust the sensitivity of the output open phase detection, set the value for **Output phase loss detection sensitivity** (bb-67) at 100% rated current.

Open phase is detected when the output frequency is in the range of 5Hz to 100Hz. It will not be detected outside this range.

Additional Information

- If the connected motor capacity is lower than the inverter capacity, there may be an erroneously detected output phase loss error (E034). Decrease the value for **Output phase loss detection sensitivity** (bb-67), or set **Output phase loss enable** (bb-66) to *00: Disabled*.
- If the **Carrier speed setting** (bb101) is low, an output phase loss may be erroneously detected.
- Set the value for **Output phase loss detection sensitivity** (bb-67) to be equal to or lower than the steadily flowing current.

Precautions for Correct Use

When a phase loss occurs, the following conditions may occur and the inverter may fail.
- The ripple current of the main capacitor increases and the life of the main capacitor is significantly shortened.
- Under a load condition, the inverter's internal converter may be damaged.

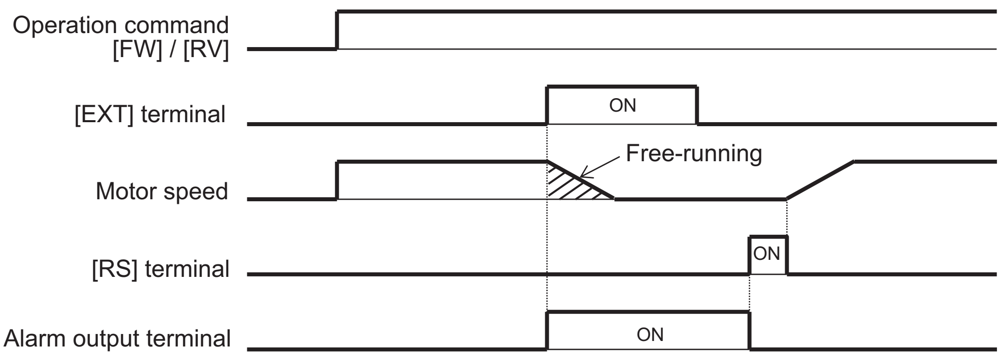
● Parameter

Item	Parameter	Data	Description	Default
Output phase loss enable	bb-66	00	Disabled	00
		01	Enabled	
Output phase loss detection sensitivity	bb-67	1 to 100 (%)	Adjusts the sensitivity of the output phase loss detection.	10

8-3-3 External Trip (EXT) Function

The external trip function is set in the input terminal and stops the inverter with an error. It is used when an error signal occurs in the peripheral system and you want to stop the inverter with the error.

To use this function, assign one of **Input terminal function** (CA-01) to (CA-11) to the external trip [33: EXT] terminal.
When the [33: EXT] terminal is turned ON, an external trip error (E012) occurs. To clear the error, turn the [33: EXT] terminal OFF and then reset.



Additional Information

- If you reset while the external trip error [33:EXT]is ON, the external trip error (E012) will occur again.
- For more detailed information on operation after this error is cleared, refer to *7-5-5 Restart After Reset Release* on page 7-64.
- An external trip error (E012) will occur if the External abnormality [33: EXT] terminal is turned on even when the output of the inverter is stopped.

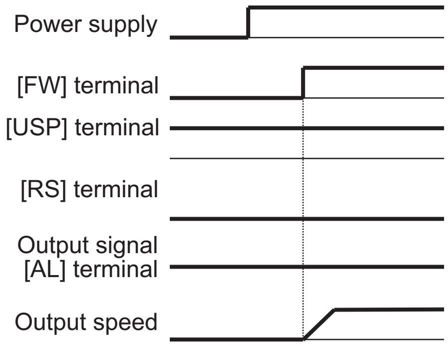
● Parameter

Item	Parameter	Data	Description
Input terminal function	CA-01 to CA-11	033	EXT External abnormality

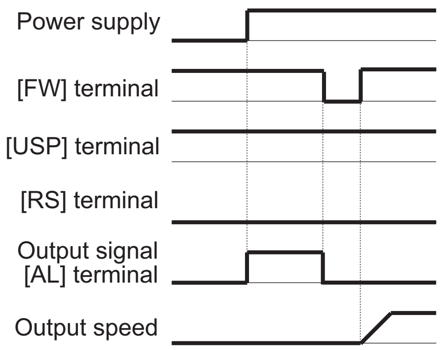
8-3-4 Power Recovery Restart Prevention Function (USP)

The power recovery restart prevention function provides the capability to not energize the motor when the power is turned on while the operation command is ON. It is used to prevent the motor from suddenly starting to rotate when the inverter power is turned on.
After turning on the control power, the operation command is monitored for 2 seconds, and if the operation command is ON, a USP error (E013) occurs.

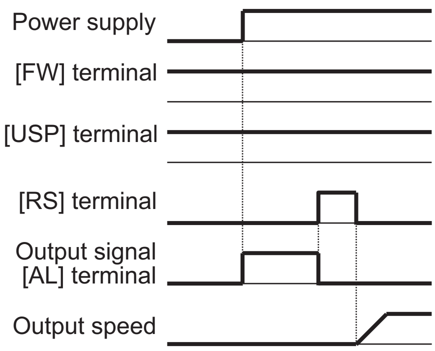
To use this function, assign one of **Input terminal function** (CA-01) to (CA-11) to [34: USP] *Prevention of power restoration restarting*. The function can be used if [34: USP] terminal is turned on before turning on the power.
The function operates when power is turned on while the [34: USP] terminal is ON, and then the operation command is turned ON.



If you turn on the power after turning on the operation command while the [34: USP] terminal is ON, a USP error (E013) will occur. While there is a USP error condition, turn off the operation command and turn it on again to start operation.



While there is a USP error condition, with the operation command ON, cancel the error by reset and start operation.



Additional Information

Unlike other errors, the USP error (E013) is cleared when the operation command is turned OFF.

● Parameter

Item	Parameter	Data	Description
Input terminal selection	CA-01 to CA-11	034	USP: Prevention of power restoration restarting

8-3-5 Over-Current Detection

Over-current detection function monitors the output current to the motor and shuts off the output to the motor when an over-current is detected. By detecting over-current on the motor output line, it is possible to detect a short circuit of the motor line due to a motor failure or the like.
To use the function, set the current at which to detect over-current in **Over current detection level** (bb160). If an overcurrent is detected, an overcurrent error (E001) will occur.

It is also possible to restart without causing an overcurrent error. For details, refer to *8-2-7 Over-Current Restart* on page 8-60.
In addition, the occurrences of overcurrent can be suppressed. For details, refer to *8-2-2 Overcurrent Suppression Function* on page 8-47.

Additional Information

Lowering the over current detection level makes it more likely that an over-current error (E001) will occur. In this case, it can be improved by lowering the detection values of the overload limiting function and over-current suppression functions. For details on those functions, refer to *8-2-1 Overload Limit Level Function* on page 8-45 and *8-2-2 Overcurrent Suppression Function* on page 8-47.

● Parameter

Item	Parameter	Data	Description	Default
Over current detection level	bb160	ND rated current × (0.2 to 2.2) *1	Set the over current detection level.	2.2 x Inverter ND rated current

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V. When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. If **Resister data selection** (CF-11) is not set to *00: A,V*, data cannot be set, or displayed correctly.
2. Modbus: Current and voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. Drive programming: 0.01 (Rated ratio)

8-3-6 Under-Voltage Detection

Under-voltage detection is a function that cuts off the output to the motor when the voltage of the main power supply (R, S, T) or the control power supply (R0, T0) drops below the standard.
An under-voltage error (E009) will occur if an undervoltage is detected.
Restart is also possible when the voltage recovers without an under-voltage error. For details, refer to *8-2-6 Restart during Power Interruption / Undervoltage* on page 8-56.

8-3-7 Instantaneous Power Failure Detection

The instantaneous power failure detection function detects that the main power supply (R, S, T) has been cut off and cuts off the output to the motor.
When an instantaneous power failure is detected, an instantaneous power failure error (E016) occurs.
It is also possible to restart when the power is restored without this an instantaneous power failure error. For details, refer to *8-2-6 Restart during Power Interruption / Undervoltage* on page 8-56.

This function starts detecting an instantaneous power failure after detecting that the three phases of the main power supply (R, S, T) have been input. Instantaneous power failure is not detected when DC is supplied to single-phase input or P and N.
When the control power supply (R0, T0) and the main power supply (R, S, T) are supplied separately, an instantaneous power failure error (E016) occurs after the main power supply (R, S, T) has a momentary power failure. There will be a delay of about 1 second before it occurs.

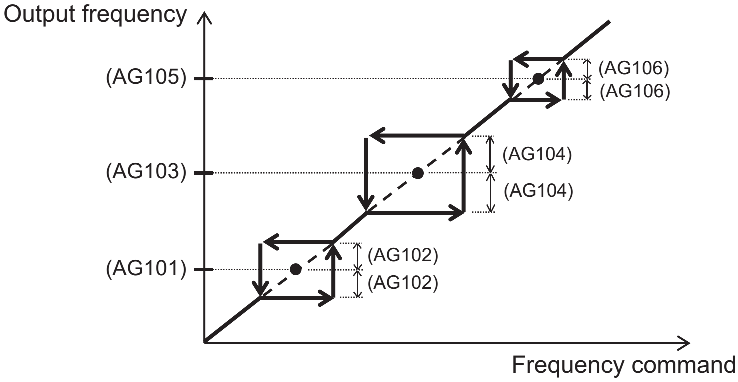
8-3-8 Frequency Jump Function

The frequency jump function allows you to not output specified frequencies. It is used to suppress vibration of the equipment. By not outputting the frequency that is the resonance point of a device, the vibration of the device can be suppressed.

To use this function, set the frequency to be output and the frequency range. The frequencies to not output can be set in one of **Jump frequency 1** (AG101), **Jump frequency 2** (AG103) and **Jump frequency 3** (AG105). Unused jump frequencies should be set to *0*.
Set the frequency width in **Jump frequency width 1** (AG102), **Jump frequency width 2** (AG104) and **Jump frequency width 3** (AG106).

The frequency jump function does not output the range of jump frequencies ± the jump frequency width. Frequencies are output as follows.

- When accelerating, frequencies under the lower limit of the range to not output are output.
- When decelerating, frequencies above the upper limit of the frequency range to not output are output.



● Parameter

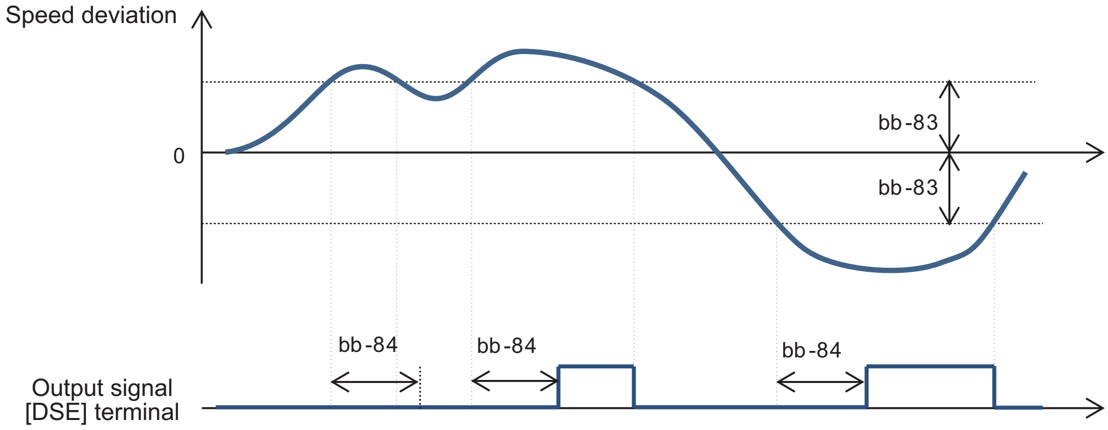
Item	Parameter	Data	Description	Default
Jump frequency 1	AG101	0.00 to 590.00 (Hz)	Set the frequencies not to output. At 0.00 Hz, the feature is disabled.	0.00
Jump frequency 2	AG103			
Jump frequency 3	AG105			
Jump frequency width 1	AG102	0.00 to 10.00 (Hz)	Set the width of the frequencies not to output. The range of jump frequency ± jump frequency width is not output.	0.00
Jump frequency width 2	AG104			
Jump frequency width 3	AG106			

8-3-9 Speed Deviation Error Detection

The speed deviation error detection function monitors the difference between the output frequency and the frequency detected by feedback, and determines that an error occurs when the threshold value is exceeded.
To use this function, set the threshold value to be judged as abnormal in **Speed deviation error detection level** (bb-83) at 100% of the maximum frequency. If *0.0* is set, no abnormality will be detected.

Set the time before an abnormal judgement in **Speed deviation error detection time** (bb-84).
Set the action to take when there is an abnormal judgement in **Speed deviation error mode selection** (bb-82). When set to *00: Warning*, normal operation continues. When set to *01: Error*, a speed deviation error (E105) occurs and output is cutoff.

The speed deviation is the difference between **Output frequency monitor** (dA-12) and **Speed detection value monitor** (dA-08).
If the absolute value of the speed deviation exceeds the **Speed deviation error detection level** (bb-83) and the **Speed deviation error detection time** (bb-84) elapses, it is judged as abnormal.



Feedback input is required to use this function.

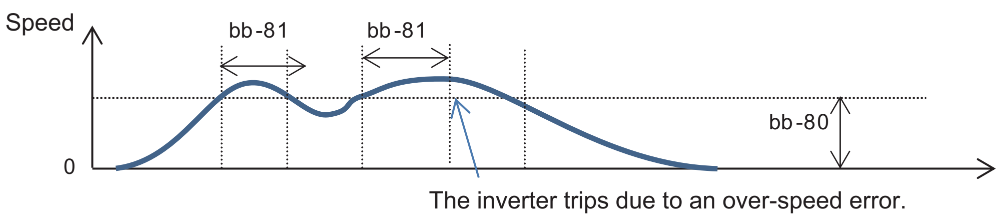
● Parameter

Item	Parameter	Data	Description	Default
Speed deviation error mode selection	bb-82	00	Warning	00
		01	Error	
Speed deviation error detection level	bb-83	0.0 to 100.0 (%)	The level at which speed deviation is judged to be excessive at 100% of the maximum frequency.	15.0
Speed deviation error detection time	bb-84	0.0 to 5.0 (s)	Set the time between an excessive deviation and an abnormal judgement.	0.5
Speed detection value monitor	dA-08	-590.00 to 590.00 (Hz)	Displays the frequency acquired by encoder feedback.	-
Output frequency monitor	dA-12	-590.00 to 590.00 (Hz)	Displays the frequency command from the inverter.	-

8-3-10 Over-speed Error Detection

The over-speed error detection function monitors the speed detected by the feedback, and gives an abnormal judgement when the threshold value is exceeded.
To use this function, set the threshold value to be judged as abnormal in **Over speed detection level** (bb-80) at 100% of the maximum frequency. If *0.0* is set, no abnormality will be detected.

Set the time before an abnormal judgement in **Overspeed detection time** (bb-81). When there is an abnormal judgement, an over-speed error (E107) will occur and the output will be cutoff.
Set the speed to monitor in **Speed detection value monitor** (dA-08). If the speed exceeds the **Over speed detection level** (bb-80) and the **Over speed detection time** (bb-81) elapses, it is judged as abnormal.



Feedback input is required to use this function.

● Parameter

Item	Parameter	Data	Description	Default
Over speed detection level	bb-80	0.0 to 150.0 (%)	Set the level at which the speed is judged to be excessive at a 100% rate of the maximum frequency.	135.0
Over speed detection time	bb-81	0.0 to 5.0 (s)	Set the time between an over-speed occurrence and an abnormal judgement.	0.5
Speed detection value monitor	dA-08	-590.00 to 590.00 (Hz)	Displays the frequency acquired by encoder feedback.	-

8-4 Control Function

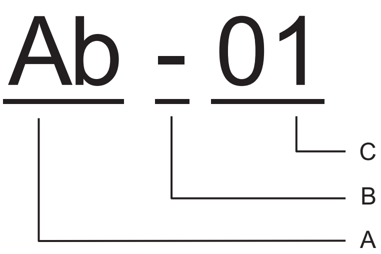
8-4-1 Second Control (SET)

The Second control function switches between the first control and the second control by turning the input terminal ON/OFF. The parameters that can be used will change when switching between first control and the second control.

If switching is required, assign the second control [24: SET] to one of **Input terminal function** (CA-01) to (CA-11).
When the [24: SET] terminal is OFF, it operates with the parameters of first control, and when it is ON, it operates with the parameters of second control.

Second control can be switched while the output of the inverter is turned off. If you execute switching during output, it will switch after the output is shut off.
Under second control, the display of the LCD operator changes and external devices can receive the output signal [12: SETM].

●Parameter Number Structure



A	Parameter Group
B	SET function type
C	In-Group Number

SET function type		Example	Description
-	Common Settings	(Ab-01), (bA-30), (CC-01), etc.	The parameters are the same for the 1st setting and 2nd setting regardless of the SET function. They are always active.
1	1st setting	(AA101), (bC112), (Hb102), etc.	When the second control [24: SET] terminal *2 is OFF, The first setting, which is the parameter of the first control, is enabled.
2	2nd setting	(AA201), (bC212), (Hb202), etc.	When the second control [24: SET] terminal is ON, the first setting, which is the parameter of the first control, is enabled.

*1. The third digit of the parameter is the SET function type. [24 SET] switches depending on the terminal status.
*2. If the second control [24 SET] terminal is not assigned to the input terminal, it is recognized as OFF and operation uses the first setting.

Example of Common Setting	Example of 1st Setting	Example of 2nd Setting
Ab - 01	AA 1 01	AA 2 01

Precautions for Correct Use

After switching the [24: SET] terminal OFF and ON, wait at least 1 second before starting operation.

● Parameter

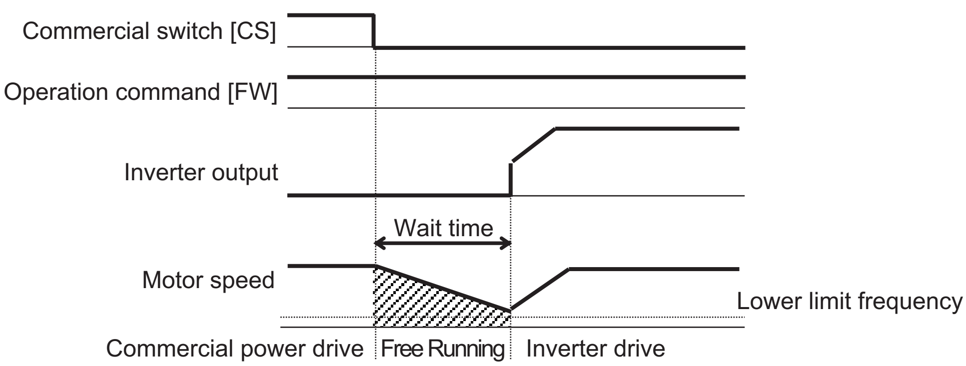
Item	Parameter	Data	Description
Input terminal function	CA-01 to CA-11	024	2nd control [24: SET]: 2nd setting function
Output terminal selection Relay output terminal [16] function Relay output terminal [AL] function	CC-01 to CC-05 CC-06 CC-07	012	Second control under selection [12: SETM]: 2nd setting function

8-4-2 Commercial Switch (CS)

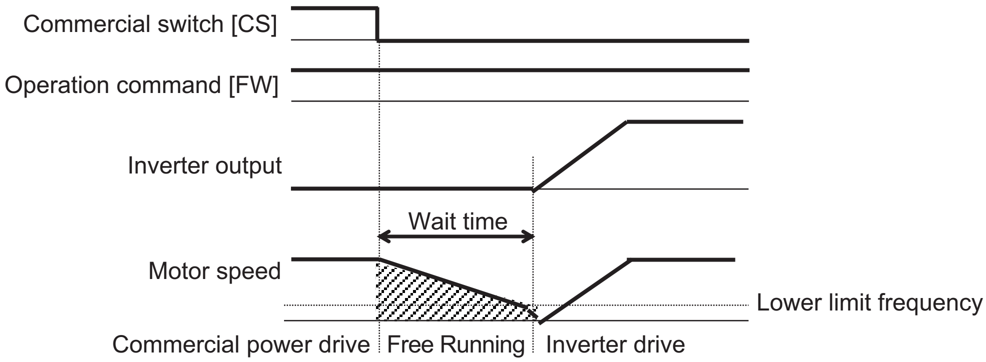
Commercial switch is a function that cuts off the output to the motor. By creating an external circuit and interlocking it, you can switch between inverter drive and commercial power drive. It is used when you want to use inverter drive for acceleration/deceleration and a commercial power supply drive for constant speed in a system with a large load inertia moment.

To use this function, assign [35: CS] *Commercial switch* to one of **Input terminal function** (CA-01) to (CA-11). When the [35: CS] terminal is OFF, the inverter drives the motor, and when it is ON, its output to the motor is shut off.

If the Commercial switch [35: CS] terminal is switched from ON to OFF with an operation command, the frequency at which the motor is rotating is detected after a wait time, and the motor starts at the detected frequency.
Set the wait time in **Retry wait time before motor restart** (bb-26).



If the detected frequency is lower than the lower limit frequency, it will start from 0 Hz.
Set the lower limit frequency in **Restart frequency threshold** (bb-42).



Additional Information

If an over-current error (E001) occurs when switching from commercial power drive to inverter drive, increase the value of **Retry wait time before motor restart** (bb-26).

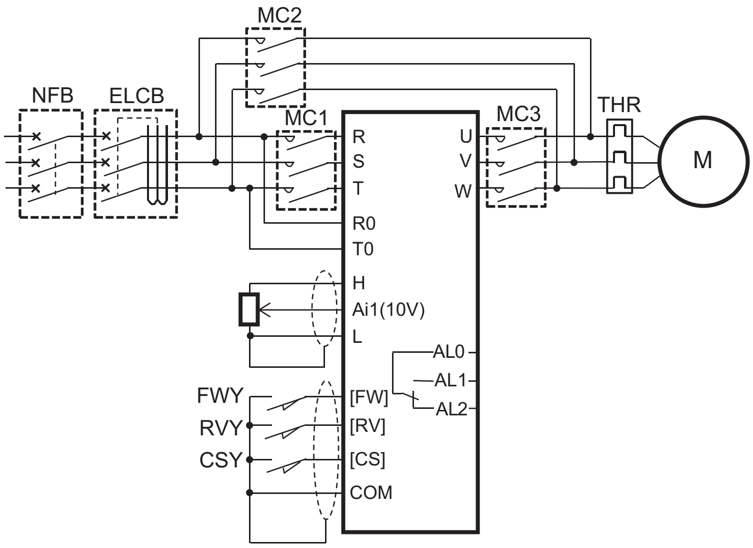
● Parameter

Item	Parameter	Data	Description
Input terminal function	CA-01 to CA-11	035	CS: Commercial switch
Power Interruption / Under-voltage Retry wait time before motor restart	bb-26	0.3 to 100.0 (s)	Set the restart wait time with frequency matching.
Restart frequency threshold	bb-42	0.00 to 590.00 (Hz)	Set the lower frequency limit for frequency matching restart.

● Connection Example

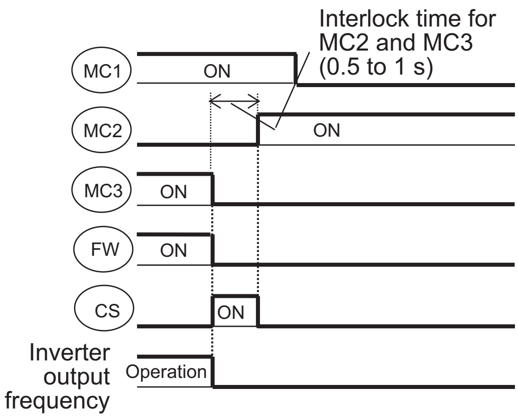
To use a commercial switch, you need to create an external circuit and interlock it. Create it by referring to the connection example and timing example shown below.

For FWY, RVY and CSY, use a light relay.
MC3 and MC2 should be mechanically interlocked so that the commercial power supply and inverter output are not supplying power to the motor at the same time.
If the earth leakage breaker ELCB trips due to a ground fault, the commercial circuit will not operate. If backup is required, connect another commercial circuit to MC2.

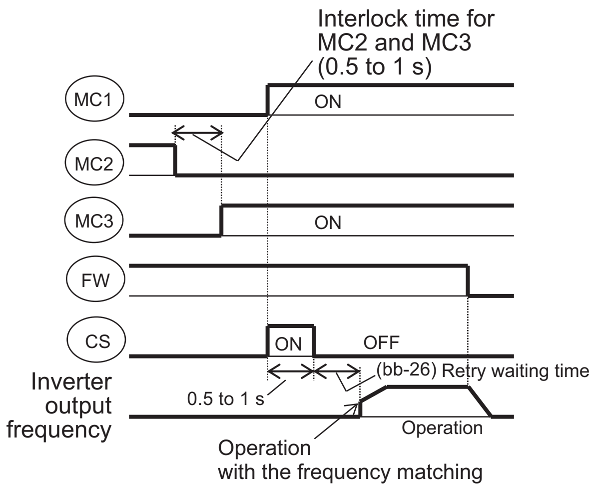


Connection diagram and timing example during commercial switch operation

INV → Commercial PS operation timing



Commercial PS → INV operation timing



Precautions for Correct Use

Make sure that the commercial power supply and the inverter output are not supplied to the motor at the same time. The inverter may be damaged.

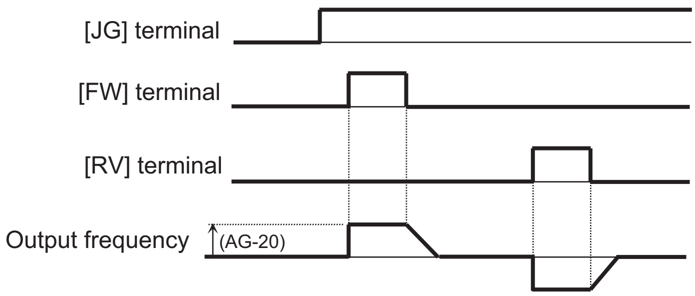
8-4-3 Jogging Operation Function (JG)

Jogging operation is used for fine adjustment of the position.
To start the jogging operation, set **Run-command input source selection** (AA111) to *00: [FW] / [RV] terminal*.
Assign Jogging [29: JG] to one of **Input terminal function** (CA-01) to (CA-11).

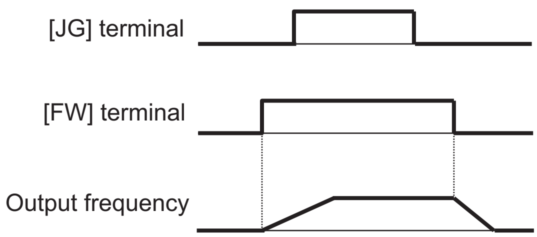
Set the frequency command of the jogging operation in **Jogging frequency**(AG-20).
Set the jogging start condition and stop method in **Jogging stop mode selection** (AG-21).

Settings for Jogging stop mode selection (AG-21).	Start Condition	Stop Method
00: Disabled during FRS operation at stop	During stop	Free run stop
01: Disabled during deceleration stop operation	During stop	Deceleration Stop
02: Disabled during DB operation at stop	During stop	DC braking stop
03: Enabled during FRS operation at stop	During stop, during operation	Free run stop
04: Enabled during deceleration stop operation	During stop, during operation	Deceleration Stop
05: Enabled during DB operation at stop	During stop, during operation	DC braking stop

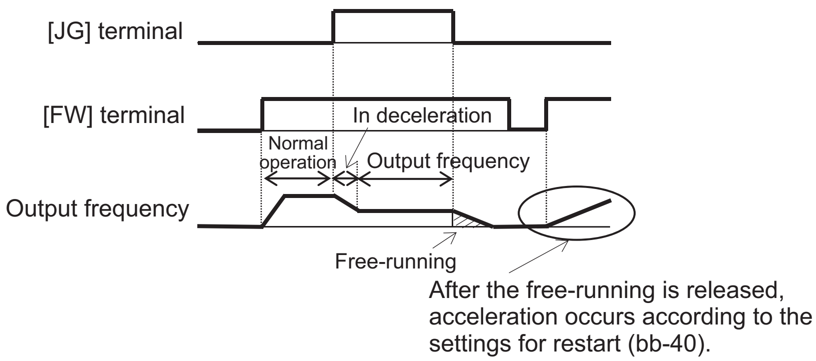
If you turn on the [29: JG] terminal and then the [FW] terminal or [RV] terminal while stopped, the frequency operates at the set frequency without accelerating. When the [FW] terminal or [RV] terminal is turned OFF, stop is executed according to the stop method. When [29: JG] terminal is turned OFF during operation, it will be a free run stop.



When the Start condition is *during stop*, normal operation continues even when the [29: JG] terminal is turned ON when the operation command is ON.



When the start condition is *during stop, during operation*, if the [29: JG] terminal is turned ON while the operation command is ON, jogging operation will start. When the operation command is OFF, it will stop according to the stop method. When the [29: JG] terminal is OFF while the operation command is ON, it will be a free run stop.



When the stop method is *free run stop*, free run operation must be set. When the stop method is *DC braking stop*, DC braking function must be set. For the setting method, refer to *7-6 Stop Conditions* on page 7-68.

Additional Information

Jogging operation outputs frequency commands immediately without acceleration time, making a trip more likely. If a trip occurs, adjust **Jogging frequency** (AG-20).

● Parameter

Item	Parameter	Data	Description	Default
Jogging frequency	AG-20	0.00 to 10.00 (Hz)	Frequency command at time of jogging operation	6.00
Jogging stop mode selection	AG-21	00	Invalid while operating Free-running at the time of the stop.	00
		01	Invalid while operating Deceleration stop at time of stop	
		02	Invalid while operating DC braking at time of stop	
		03	Valid while operating Free-running at the time of the stop.	
		04	Valid while operating Deceleration stop at time of stop	
		05	Valid while operating DC braking at time of stop	
Input terminal function	CA-01 to CA-11	029	JG: Jogging	-

8-4-4 Brake Control Function (BRK)

The brake control function controls the external brake with the output terminal of the inverter. It is used in elevating systems that control braking and driving in conjunction with each other.
The brake release signal is turned on when the operation is started, and the brake release signal is turned off when the operation is finished.

To use the function, set **Brake Control Enable** (AF130) to one of *01: Brake control 1 common in forward / reverse rotation*, *02: Brake control 1 forward / reverse set individually*, or *03: Brake control 2*.

Setting	Description
01: Brake control 1 common in forward / reverse rotation	Release and check the brake while outputting the frequency. Use the same parameters for forward and reverse rotation.
02: Brake control 1 forward / reverse set individually	Release and check the brake while outputting the frequency. Use separate parameters for forward and reverse rotation.
03: Brake control 2 common in forward / reverse rotation	The brake is controlled in conjunction with the servo lock control.

Assign brake release [37: BRK] to one of **Output terminal selection** (CC-01) to (CC-05) and **Relay output terminal function** (CC-06) to (CC-07).
When using brake feedback, assign brake check [37: BOK] to one of **Input terminal function** (CA-01) to (CA-11).

Additional Information

When using the brake control function, it is recommended to use the following control method that generates high torque at the start. Set **Control mode selection** (AA121).
08: Sensorless vector control
09: Zero-Hz range sensorless vector control
10: Vector control with sensor

Brake Control 1

When **Brake control enable** (AF130) is set to *01: Brake control 1 common in forward/reverse rotation*, brake control 1 releases and confirms the brake while outputting frequency.

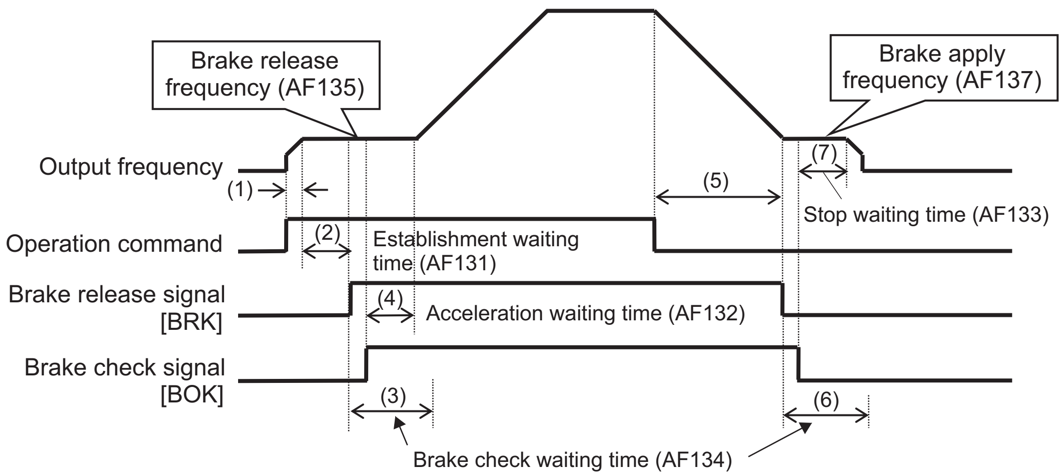
Precautions for Correct Use

- Do not use brake control 1 for position control / torque control.
- Do not use brake control 1 when using a Synchronous motor (permanent magnet motor).

When **Brake Control Enable** (AF130) is set to *01: Brake control 1 common in forward/reverse rotation*, the same parameters are used for both forward and reverse rotation.

Item	Forward and Reverse
Brake Wait Time for Release	AF131
Brake Wait Time for Accel.	AF132
Brake Wait Time for Stopping	AF133
Brake Wait Time for Confirmation	AF134
Brake Release Frequency Setting	AF135
Brake Release Current Setting	AF136
Braking Frequency	AF137

Brake control is performed in the following manner:



1. When an operation command is given, the inverter starts output and accelerates to the brake release frequency.
2. After the brake release frequency is reached and the wait time for setting brake release has elapsed, if the output current is equal to or greater than the release current, the Brake release signal [37: BRK] is turned ON. If the output current is less than the release current, a braking error (E036) will occur.
3. It operates as follows depending on the setting of the input terminal function.

With [37: BOK] Setting	Wait the duration of the brake wait time for confirmation until the brake confirmation signal [37: BOK] is input ON. If it turns ON within the time, proceed to item (4).After that, while the brake release signal [37: BRK] is ON, the [37: BOK] ON is monitored. If [37: BOK] turns OFF, braking error (E036) will occur. If it is not turned ON within the time, braking error (E036) will occur.
Without [37: BOK] Setting	Proceed to item (4).

4. After the acceleration wait time has elapsed, it accelerates to the command frequency.
5. When the operation command is turned OFF, the inverter decelerates to the apply brake frequency and turns off the brake release signal [37: BRK].
6. It operates as follows depending on the setting of the input terminal function.

With [37: BOK] Setting	Wait the duration of the brake wait time for confirmation until the brake confirmation signal [37: BOK] is input OFF. If it turns OFF within the time, proceed to item (7). If it does not turn OFF within the time, braking error (E036) will occur.
Without [37: BOK] Setting	Proceed to item (7).

7. After the brake wait time for stopping has elapsed, it decelerates to 0 Hz.

● Parameter

Item		Parameter	Data	Description	Default
Brake Control Enable		AF130	00	Disabled	00
			01	Brake control 1 enabled [*1]	
			02	Brake control 1 forward/reverse set individually	
Wait time for setting brake release	Forward	AF131	0.00 to 5.00 (s)	Sets the time after the release frequency is reached until the output current reaches the release current	0.00
	Reverse	AF138			0.00
Brake Wait Time for Accel.	Forward	AF132	0.00 to 5.00 (s)	Sets the mechanical delay time after the release signal is sent until the brake is released	0.00
	Reverse	AF139			0.00
Brake Wait Time for Stopping	Forward	AF133	0.00 to 5.00 (s)	Sets the mechanical delay time after the release signal is turned OFF until the brake is closed	0.00
	Reverse	AF140			0.00
Brake Wait Time for Confirmation	Forward	AF134	0.00 to 5.00 (s)	Set to be longer than the time from when the release signal is output until the release completion signal output from the brake is input to the inverter.	0.00
	Reverse	AF141			0.00
Brake Release Frequency Setting	Forward	AF135	0.00 to 590.0 (Hz)	Set the frequency to output the brake release signal [*2]	0.00
	Reverse	AF142			0.00
Brake Release Current Setting	Forward	AF136	Inverter rated current × (0.0 to 2.0) [*3]	Set the output current that allows the brake to be released [*4]	1.0 × Inverter rated current
	Reverse	AF143			1.0 × Inverter rated current
Braking Frequency	Forward	AF137	0.00 to 590.0 (Hz)	Set the frequency to close the brake when stopped [*2]	0.00
	Reverse	AF144			0.00
Input terminal function		CA-01 to CA-11	037	Brake check signal [37: BOK] OFF: Brake in operation ON: Brake is released	-

Item	Parameter	Data	Description	Default
Output terminal selection	CC-01 to CC-07	037	Brake release signal [37: BRK] OFF: Brake application command ON: Brake release command	-
		038	Brake abnormality signal [38: BER] OFF: Brake sequence is normal ON: Brake sequence is abnormal	

*1. When **Brake Control Enable** (AF130) is set to *01: Brake control 1 enabled*, any of the forward rotation settings **Brake Wait Time for Release, 1st-motor (Forward side)** (AF131) through **Braking Frequency, 1st-motor (Forward side)** (AF137) are valid for both forward and reverse rotation.

*2. Set a value higher than **Minimum frequency adjustment** (Hb130).

*3. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V. When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. If **Resister data selection** (CF-11) is not set to *00: A,V*, data cannot be set, or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. Drive programming: 0.01 (Rated ratio)

*4. Please note that if the setting is low, sufficient torque may not be output when the brake is released.

Brake Control 1 (Forward / Reverse Set Individually)

Brake control 1 (forward / reverse set individually) is used when you want to change the brake operation timing between forward rotation and reverse rotation, such as when the operation differs like winding and un-winding.
When **Brake Control Enable** (AF130) is set to *02: Brake control 1 forward/reverse set individually*, different parameters are used for forward rotation and reverse rotation.

Item	Forward	Reverse
Wait time for setting brake release	AF131	AF138
Brake Wait Time for Accel.	AF132	AF139
Brake Wait Time for Stopping	AF133	AF140
Brake Wait Time for Confirmation	AF134	AF141
Brake Release Frequency Setting	AF135	AF142
Brake Release Current Setting	AF136	AF143
Braking Frequency	AF137	AF144

If the operation command is for forward rotation, use the forward rotation parameter, and if it is reverse rotation, use the reverse rotation parameter.

- FW ON and output frequency positive → parameter on the forward rotation side
- FW ON and output frequency negative → parameter on the reverse rotation side
- RV ON and output frequency positive → parameter on the reverse rotation side
- RV ON and output frequency negative → parameter on the forward rotation side

For brake control operation, refer to *Brake Control 1* on page 8-84.

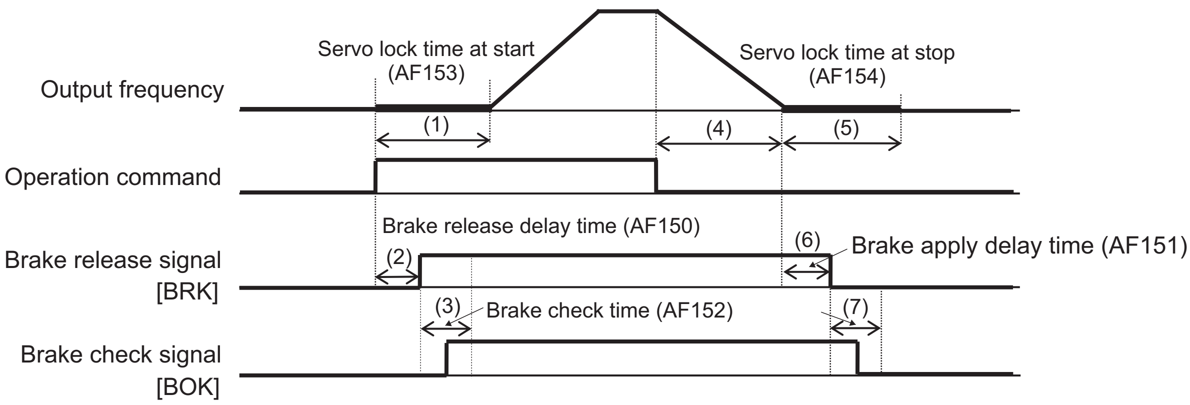
Brake Control 2

Brake control 2 controls the brake in conjunction with the servo lock control.
When **Brake control enable** (AF130) is set to *03: Brake control 2*, the following parameters are used.

Item	Valid for both forward and reverse
Brake open delay time	AF150
Brake close delay time	AF154
Brake answer back check time	AF152
Servo lock/ DC injection time at start	AF153
Servo lock/ DC injection time at stop	AF154

When **Control mode selection** (AA121) is set to *09: Zero-Hz range sensorless vector control*, or *10: Vector control with sensor*, servo lock control is performed. For other control mode selections, DC braking is performed instead of servo lock control.

Brake control is performed in the following manner:



1. When the operation command turns ON, the servo locks.
2. After the brake release delay time has elapsed, the brake release signal [37: BRK] is turned ON.
3. It operates as follows depending on the setting of the input terminal function.

with [BOK] Setting	Wait the duration of the brake check time for the input of the brake confirmation signal [37: BOK] to turn ON. If it turns ON within the time, proceed to item (4). After that, while the brake release signal [37: BRK] is ON, the [37: BOK] ON is monitored. If [37: BOK] turns OFF, braking error (E036) will occur. If it is not turned ON within the time, braking error (E036) will occur.
without [BOK] Setting	Proceed to item (4).

4. After the Servo lock/DC injection time at start has elapsed, it accelerates to the command frequency.
5. When the operation command is turned off, the inverter decelerates and the servo locks.

6. After the brake close delay time has elapsed, the brake release signal [37: BRK] is turned OFF.
7. It operates as follows depending on the setting of the input terminal function.

With [BOK] Setting	Wait the duration of the brake check time for the input of the brake confirmation signal [37: BOK] to turn OFF. If it turns OFF within the time, proceed to item (8). If it does not turn OFF within the time, braking error (E036) will occur.
Without [BOK] Setting	Proceed to item (8).

8. After the Servo lock / DC injection time at stop has elapsed, the servo lock is released.

● Parameter

Item	Parameter	Data	Description	Default
Brake control enable	AF130	00	Disabled	00
		01	Brake control 1 enabled	
		02	Brake control 1 forward/reverse set individually	
		03	Brake control 2 enabled	
Brake open delay time	AF150	0.00 to 2.00 (s)	Set the brake release delay time.	0.20
Brake close delay time	AF151	0.00 to 2.00 (s)	Set the brake close delay time.	0.20
Brake answer back check time	AF152	0.00 to 5.00 (s)	Set the brake answer back check time.	0.10
Servo lock / DC injection time at start	AF153	0.00 to 10.00 (s)	Set the servo lock time at start-up.	0.60
Servo lock / DC injection time at stop	AF154	0.00 to 10.00 (s)	Set the servo lock time at stopping.	0.60
DC braking force setting	AF105	0 to 100 (%)	If the control method is other than *09: Zero-Hz range sensorless vector control*, or *10: Vector control with sensor*, DC braking is used. Set the braking force (when stopped) at that time.	30
DC braking force at start	AF108	0 to 100 (%)	If the control method is other than *09: Zero-Hz range sensorless vector control*, or *10: Vector control with sensor*, DC braking is used. Set the braking force (when starting) at that time.	30

8-4-5 Contactor Control (CON)

Contactor control is a function that controls an external contactor with the output terminal of the inverter. The contactor control signal turns on when the operation is started, and it turns off when the operation is finished.

To use the function, set **Contactor Control Enable** (AF120) to one of *01: Enabled: primary side*, or *02: Enabled: secondary side*.

Setting	Description
01: Enabled: primary side	A contactor is installed on the primary side of the inverter to reduce standby power consumption.
02: Enabled: secondary side	A contactor is installed on the secondary side of the inverter to function as a brake sequence.

Set [39: CON] *Contactor control* to one of **Output terminal function** (CC-01) to (CC-05) and **Relay output terminal function** (CC-06) to (CC-07).
When using contactor feedback, assign [107: COK] *Contactor Control* to one of **input terminal function** (CA-01) to (CA-11).

Precautions for Correct Use

Use the contactor control function when inserting contactors on the primary and secondary sides of the motor. If the contactor is controlled externally, the contactor operates while there is output from the inverter, causing a surge and causing damage to the inverter.

● Parameter

Item	Parameter	Data	Description	Default
Contactor Control Enable	AF120	00	Disabled	00
		01	Enabled primary side A contactor is installed on the primary side of the inverter to reduce standby power consumption.	
		02	Enabled secondary side A contactor is installed on the secondary side of the inverter to function as a brake sequence.	
Run delay time	AF121	0.00 to 2.00 (s)	Set the wait time from the input of the operation command to the start of the inverter output.	0.20
Contactor off delay time	AF122	0.00 to 2.00 (s)	Set the time from the output cutoff of the inverter to the control of the contactor.	0.10
Contactor answer back check time	AF123	0.00 to 5.00 (s)	Set the time from the input of the operation command to the control of the contactor.	0.10
Input terminal function	CA-01 to CA-11	107	Contactor check signal [107: COK] OFF: Contactor is released ON: Contactor is in operation	-
Output terminal function	CC-01 to CC-07	039	Contactor control signal [39: CON] OFF: Contactor release command ON: Contactor application command	-

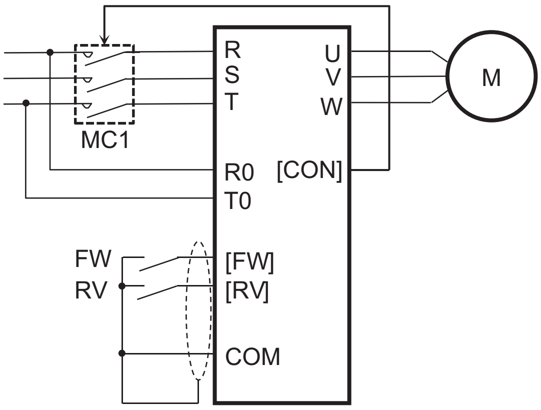
Contactor Control Enabled on the Primary Side

When **Contactor Control Enable** (AF120) is set to *01: Enabled: primary side*, the main circuit power input of the inverter is cut off while the output of the inverter is stopped. It is used to reduce standby power consumption.

To use the function set **Contactor Control Enable** (AF120) to *01: Enabled: primary side* and wire as shown in the figure below.

(Example 1)

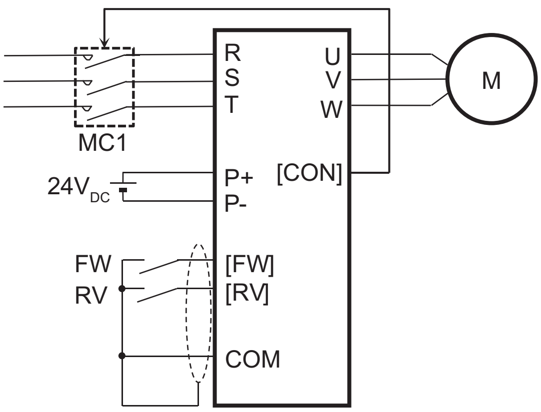
- Remove the wiring of the J51 connector from the control power supply (R0-T0) terminal, and make the wiring separate from the MC1 contactor of the main circuit power supply as shown in the figure below.
- Connect MC1 of the main circuit power supply to the contactor control [39: CON] terminal.



For the wiring of the R0-T0 terminal, also refer to *Connection for Separating Inverter Control Circuit Power Supply from Main Power Supply* on page 2-60.

(Example 2)

- Connect the external power supply 24 VDC to the control power supply P+ and P-.
- Connect MC1 of the main circuit power supply to the contactor control [39: CON] terminal.



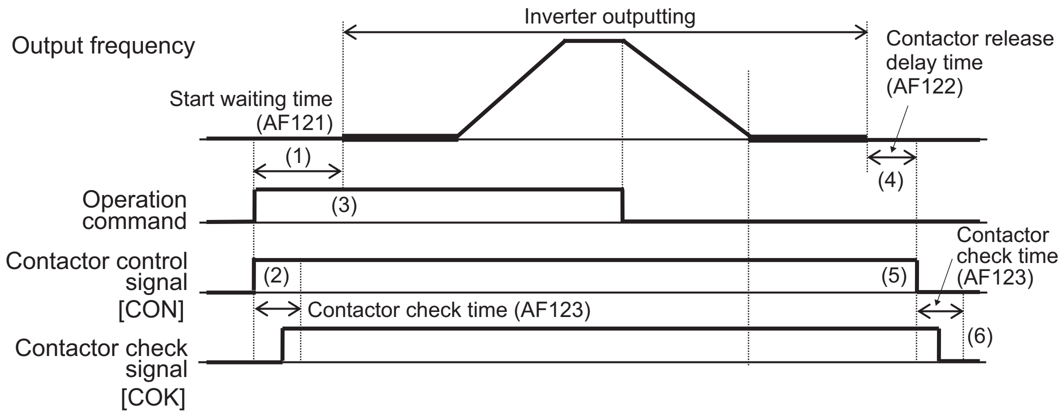
The external power supply 24 VDC is a backup power supply that is used only when the control power supply R0-T0 has a voltage drop. In this case, it is not necessary to change the wiring of the R0-T0 terminal.

8-4 Control Function

8

8-4-5 Contactor Control (CON)

Contactor control is performed as follows.



1. When the operation command turns on, contactor control [39: CON] turns on. At this time, there is no output to the motor.
2. It operates as follows depending on the setting of the input terminal function.

With [COK] setting	Wait the duration of the contactor wait time for confirmation until the contactor confirmation [107: COK] is input ON. If it turns ON within the time, proceed to item (3). After that, while the contactor control [39: CON] is ON, the [107: COK] ON is monitored. If [107: COK] turns OFF, a contactor error (E110) will occur. If it does not turn ON within the time, a contactor error (E110) will occur.
Without [COK] setting	Proceed to item (3).

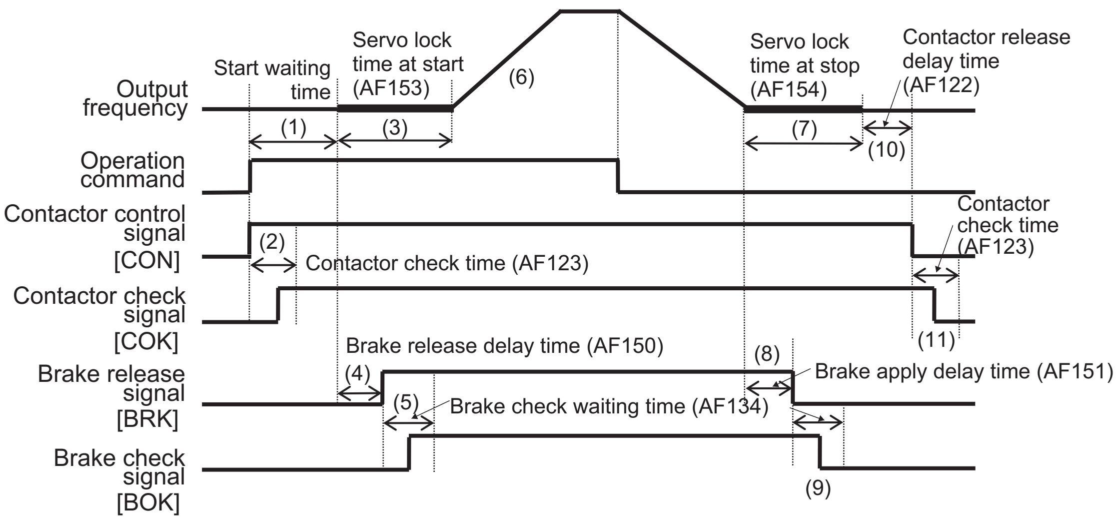
3. After the run delay time has elapsed, the output to the motor will start.
4. After the inverter stops outputting, there is a wait for the duration of the Contactor off delay time.
5. After the contactor off delay time has elapsed, the contactor control signal [39: CON] turns OFF.
6. It operates as follows depending on the setting of the input terminal function.

With [COK] setting	Wait the duration of the contactor wait time for confirmation until the contactor confirmation [107: COK] is input OFF. If it turns off within the time, nothing happens. If it does not turn OFF within the time, a contactor error (E110) will occur.
Without [COK] setting	Nothing happens.

Contactor Control Enabled on the Secondary Side

When **ContactorControl Enable** (AF120) is set to *02: Enabled: secondary side*, it can be used in combination with brake control 2.

Contactor control is performed as follows.



1. When the operation command is input, the inverter contactor control signal [39: CON] turns on.
2. The operation differs depending on whether the contactor check signal [107: COK] is set for the input terminal function.

With [COK] Setting	The inverter contactor control signal [39: CON] turns ON and a contactor error (E110) trip occurs if the small contactor check signal [107: COK] does not turn ON within the contactor check time.
Without [COK] Setting	After the control signal [39: CON] turns ON, there is wait for the run delay time to elapse.

3. The inverter starts outputting. It stays in its current position until it enters the servo lock state and the time set in **Servo lock / DC injection time at start** (AF153) elapses.
4. After the **Brake open delay time** (AF150) time elapses, the brake release signal [37: BRK] turns ON.
5. The operation differs depending on whether the brake check signal [37: BOK] is set for the input terminal function.

With [BOK] Setting	If the brake check signal [37: BOK] does not turn ON within the **brake check wait time** (AF134), the inverter trips with a brake error (E036) and outputs a brake error signal [38: BER].
Without [BOK] Setting	After the brake release signal [37: BRK] turns ON, there is a wait for the **Servo lock/ DC injection time at start** (AF153) time to elapse.

6. Acceleration starts after the **Servo lock / DC injection time at start** (AF153) time elapses.
7. When the operation command is turned off, the inverter decelerates and maintains the position servo lock state only for the **Servo lock / DC injection time at stop**.
8. After deceleration completes and the **Brake open delay time** elapses, brake release signal [37: BRK] turns OFF.
9. The operation differs depending on whether the brake check signal [37: BOK] is set for the input terminal function.

With [BOK] Setting	The inverter brake release signal [37: BRK] turns OFF, and if [37: BOK] does not turn OFF within the **Brake answer back check time**, the inverter trips with a brake error (E036) and the brake error signal [38: BER] is output
Without [BOK] Setting	After the brake release signal [37: BRK] turns OFF, there is a wait for the **Servo lock/ DC injection time at stop** to elapse.

10. The inverter shuts off the output, and after the **Contactor off delay time** (AF122) has elapsed, the contactor control signal [39: CON] turns OFF.
11. The operation differs depending on whether the contactor check signal [107: COK] is set for the input terminal function.

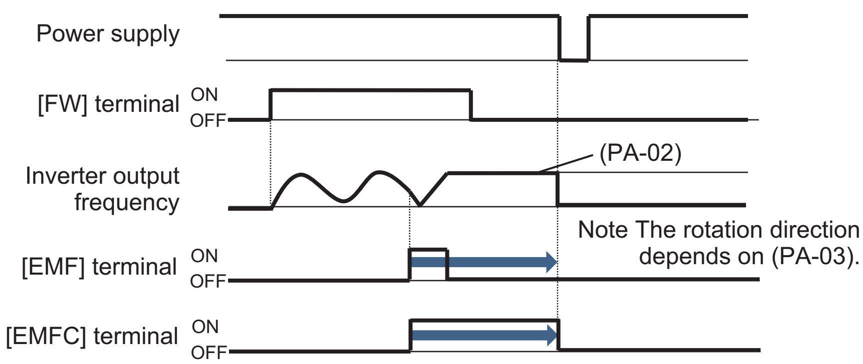
With [COK] Setting	The inverter trips with a contactor error (E110) if the contactor check signal [107: COK] does not turn OFF within the **Contactor answer back check time**.
Without [COK] Setting	The inverter does nothing.

8-4-6 Forced Operation

Forced Operation Mode

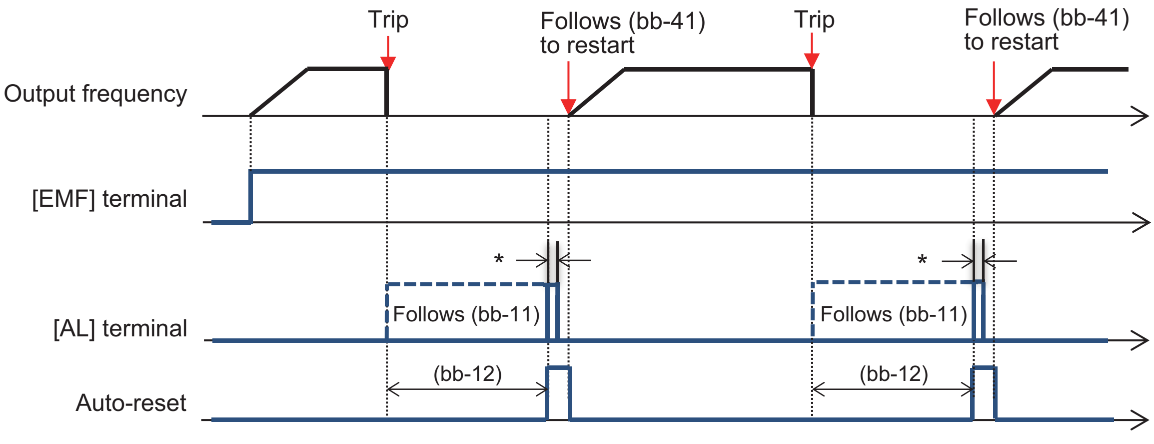
Forced operation switching is a function that operates the motor at a constant speed until the power is shut off.
To use this function, set **Mode selection for Emergency-force drive** (PA-01) to *01: Enabled* and assign Emergency forced operation terminal [105: EMF] to one of **Input terminal selection** (CA-01) to (CA-11). When the [105: EMF] terminal is turned ON, forced operation starts. Once forced operation is started, forced operation continues until the power is turned off.

Set the speed for forced operation in **Frequency reference setting at Emergency-force drive** (PA-02).
Set the rotation direction for forced operation in **Direction command at Emergency-force drive** (PA-03).



Parameters cannot be changed during forced operation.
During forced operation, operating the STOP / RESET keys on the operation panel has no effect.
If a trip occurs during forced operation, it will automatically reset and restart. Reset is executed according to the settings for **Alarm signal selection at Automatic error reset is active** (bb-11) and

Automatic error reset wait time (bb-12). Restarting operation follows the settings for **Restart mode after RS release** (bb-41).



* For the AL relay terminal, due to the MCU reset (equivalent to Power ON reset), ON for a moment no matter what is assigned.

When over-current, over-voltage, under-voltage, or momentary power failure is detected during forced operation, it operates according to the retry setting.
During forced operation, only Contactor check terminal input [107: COK] is valid. If you enter anything else, the corresponding function will not work.

Precautions for Correct Use

When using the forced operation mode, make sure that the system is safe for continuing operation before using the function.

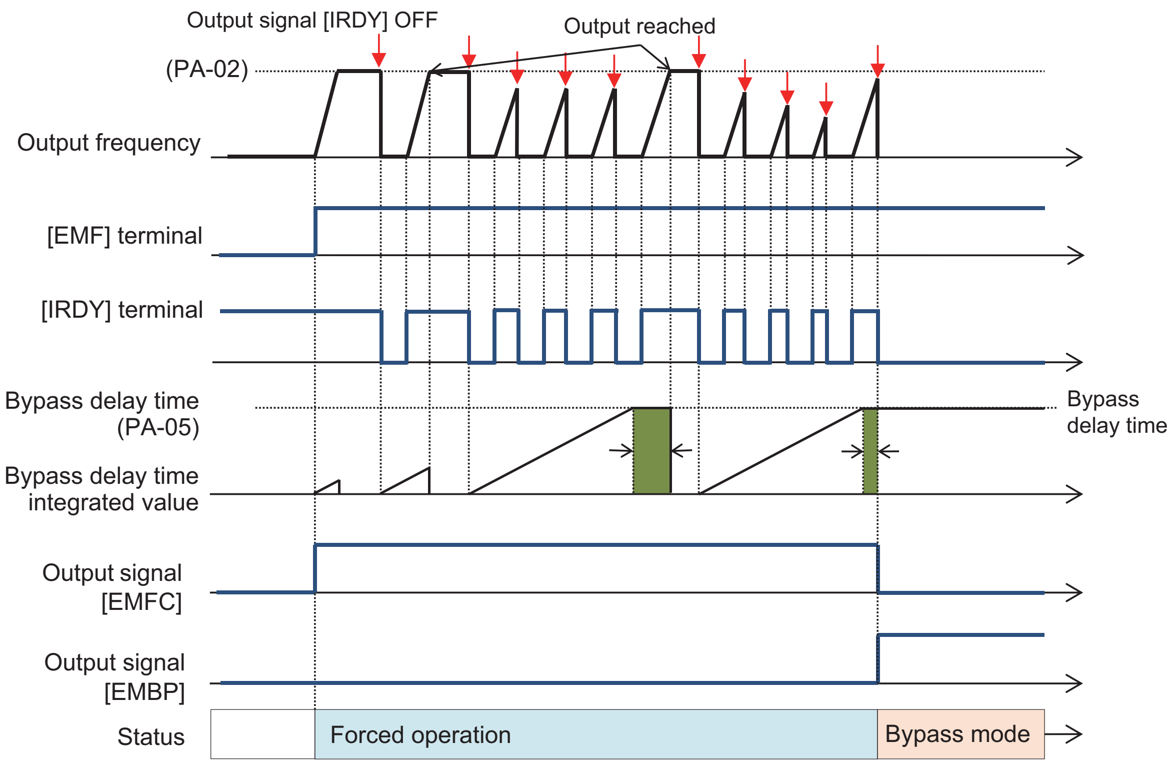
● Parameter

Item	Parameter	Data	Description	Default
Mode selection for Emergency-force drive	PA-01	00	Disabled	00
		01	Enabled	
Frequency reference setting at Emergency-force drive	PA-02	0.00 to 590.00 (Hz)	Sets the frequency command in the Emergency-force mode.	0.00
Direction command at Emergency-force drive	PA-03	00	Forward rotation command	00
		01	Reverse rotation command	
Input terminal selection	CA-01 to CA-11	105	EMF Emergency forced operation OFF: Disabled ON: Enabled	-
Output terminal function	CC-01 to CC-07	076	EMFC Forced operation in process OFF: Disabled ON: Forced operation in process	-

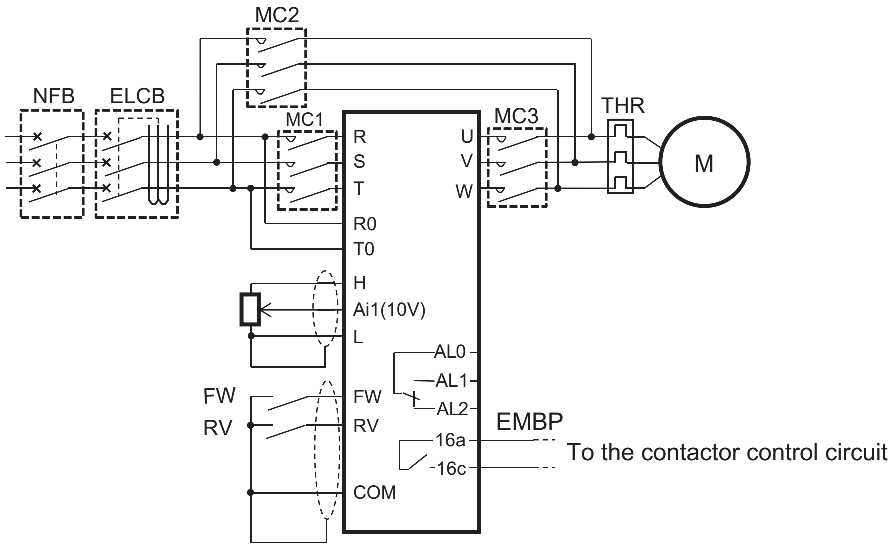
Commercial Operation Switching During Forced Operation (Bypass Mode)

Commercial operation switching during forced operation is a function that shuts off the output when the motor does not operate at the set frequency even during forced operation. You can continue the operation of the motor by connecting the motor directly to the commercial power supply after the output is shut off.

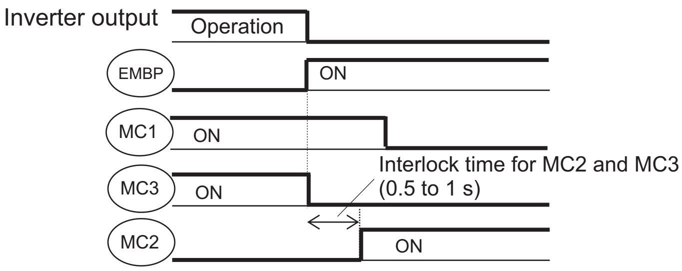
To use this function, set **Commercial power supply bypass function selection** (PA-04) to *01: Enabled* and **Delay time of Bypass function** (PA-05) to the threshold value.
During forced operation, power is shut off when the time limit for not reaching **Frequency reference setting at Emergency-force drive** (PA-02) is exceeded and the inverter enters the operation ready incomplete status (operation ready completion [7: IRDY] is OFF).



Refer to the diagram below for the connections to use and timing when using commercial operation switching during forced operation.
When output is shut off, the during-bypass-mode signal [77: EMBP] is turned ON. Use this output to control the contactor and interlock it so that the inverter output and commercial power are not supplied to the motor at the same time.
If the earth leakage breaker ELCB trips due to a ground fault, the commercial circuit will not operate. If backup is required, connect another commercial circuit to MC2.



Connection diagram example and timing when entering commercial power supply operation



Precautions for Correct Use

Make sure that the commercial power supply and the inverter output are not supplied to the motor at the same time. The inverter may be damaged.

Additional Information

Operation ready completion [7: IRDY] is turned off for about 1 second while the inverter is starting immediately after reset. There is no switch to commercial power.

● Parameter

Item	Parameter	Data	Description	Default
Commercial power supply bypass function selection	PA-04	00	Disabled	00
		01	Enabled	
Delay time of Bypass function	PA-05	0.0 to 1000.0 (s)	Set the delay time until bypass mode operation.	5.0
Output terminal function	CC-01 to CC-07	077	EMBP during-bypass-mode signal OFF: Disabled ON: During bypass mode	-

8-4-7 Pulse String Position Control

The pulse string position control function controls the motor by inputting the position command of the pulse string to the inverter. Input the Pulse string position control to the [SA / SB] terminal of the PG option unit type 3G3AX-PX2-PG01.
To use this function, perform the following settings.

1 Use Vector control with sensor.
Set **Control mode selection** (AA121) to *10: Vector control with sensor*.

2 Use Pulse string position control mode.
Set **Vector control mode selection** (AA123) to *01 : Pulse string position control mode*.

3 Set the speed feedback terminal for vector control and the position feedback terminal for position control.
When using the pulse input terminals [A] and [B] of the inverter, set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *02: Speed feedback*.
When using the [EAP], [EAN], [EBP], and [EBN] terminals of the PG option unit, do not set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *02: Speed feedback*.

4 Set the input terminal of pulse string position command in [SAP], [SAN], [SBP], and [SBN] of the PG option unit.
The pulse string position command can only be entered from the PG option unit.
Set **Pulse train detection (option) terminal** (ob-10) to *01: Pulse string position command*.

5 Allow the input of Pulse string position command.
Set [73: STAT] *Permission to inputting of Pulse string position command* to one of **Input terminal function** (CA-01) to (CA-11).
Turn on the [73: STAT] terminal and enter the Pulse string position command to operate the motor.
The speed at the time of pulse string position control is determined by the inverter according to the following formula.

$$\text{Speed command (Hz)} = \frac{P}{2} \times Kv \times \frac{\Delta P}{4 \times ENC}$$

P : Number of motor poles
Kv : Position loop gain
ENC : Number of encoder pulses
Δ P : Position deviation

For wiring, refer to *2-3-6 Wiring for PG Option Unit* on page 2-68. Also refer to *7-10 Encoder Feedback* on page 7-77.

Precautions for Correct Use

- Positioning completed [43: POK] terminal does not turn ON in pulse string position control mode.
- Only when **Load type selection** (Ub-03) is set to *02: ND* can **Control mode selection** (AA121) be set to the *10: Vector control with sensor* selection.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	10	Vector control with sensor	00
Vector control mode selection	AA123	01	Pulse string position control	00
Pulse train detection (option) terminal	ob-10	00	Pulse train frequency command	00
		01	Pulse string position command	
Mode selection of pulse train input	ob-11	00	MD0: 90° phase difference pulse train	01
		01	MD1: Reverse rotation command + Pulse train	
		02	MD2: Forward rotation pulse train + Reverse rotation pulse train	
Electronic gear setting point selection	AE-01	00	FB: Feedback side	00
		01	REF: Command side	
Electronic gear ratio numerator	AE-02	1 to 9999	The numerator of the electronic gear ratio.	1
Electronic gear ratio denominator	AE-03	1 to 9999	The denominator of the electronic gear ratio.	1
Position feed-forward gain setting *1	AE-06	0.00 to 655.35	The position feed-forward gain.	0.00
Position loop gain setting *2	AE-07	0.00 to 100.00	The position loop gain.	0.50
Position bias setting	AE-08	-2048 to 2048	Set the bias value of the position.	0
Add frequency setting	AA106	-590.00 to 590.00 (Hz)	Frequency added when the [ADD] terminal is turned on.	0.00
Position deviation error mode selection	bb-85	00	The excessive position deviation signal [33: PDD] is output.	00
		01	Trip due to the excessive positional deviation [33: PDD] output and position deviation error (E106).	
Position deviation error detection level	bb-86	0 to 65535 (× 100 pls)	Abnormality judgment level of position deviation.	4096
Position deviation error detection time	bb-87	0.0 to 5.0 (s)	Set the time from when Position deviation error detection level×100 pls is exceeded to when Excessive positional deviation [33: PDD] output and error occur.	0.5
Input terminal function	CA-01 to CA-11	014	ADD: Addition of frequency	-
		072	PCLR: Clearing of positional deviation	
		073	STAT: Permission to inputting of Pulse string position command	
		074	PUP: Addition of positional bias	
		075	PDN: Subtraction of positional bias	

Item	Parameter	Data	Description	Default
Output terminal selection	CC-01 to CC-07	042	PDD: Excessive positional deviation	-
Pulse train position deviation monitor	dA-26	-2147483647 to 2147483647	Displays the position deviation of the position command and position feedback.	-

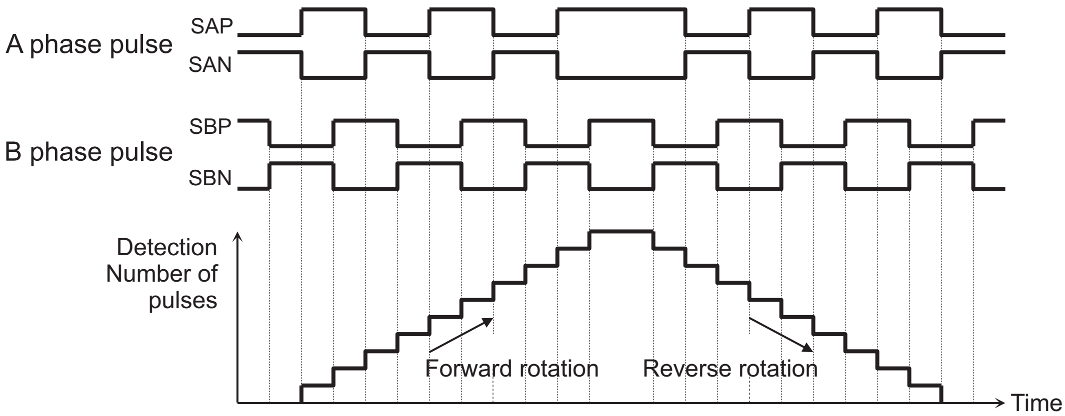
*1. When adjusting position feed-forward gain, it is recommended that you set the gain in **Position feed-forward gain setting** (AE-06) to *2.00*. If you want to reduce the positional deviation between the main motor and sub-motor, set **Position feed-forward gain setting** (AE-06) to a higher value. Also, if the motor is out of order, set **Position feed-forward gain setting** (AE-06) to a lower value.

*2. When adjusting the Position loop gain, it is recommended to set **Position loop gain setting** (AE-07) to *2.00* before making adjustments. If you wish to increase the positioning accuracy and holding power, set **Position loop gain setting** (AE-07) to a higher value. Also, if the position loop gain is set too high and causing a disturbance, set **Position loop gain setting** (AE-07) to a lower value.

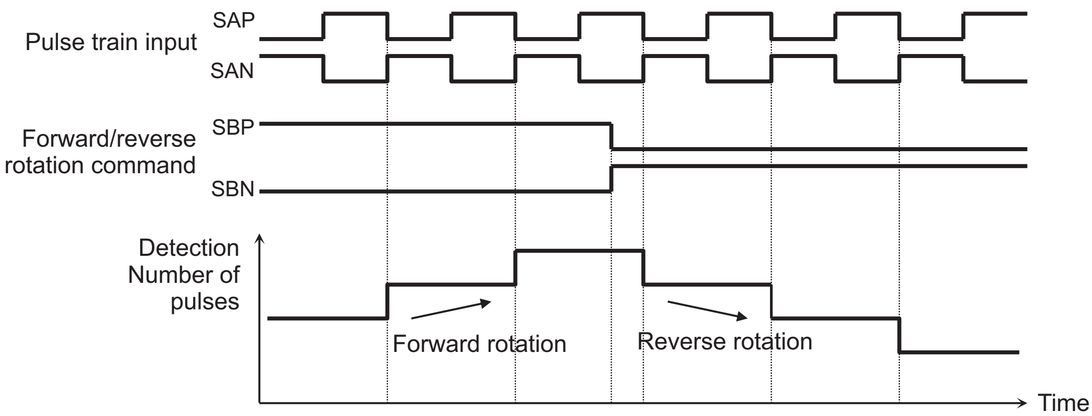
Pulse String Position Control Input Mode

The following are the three types of pulse string position control input modes.

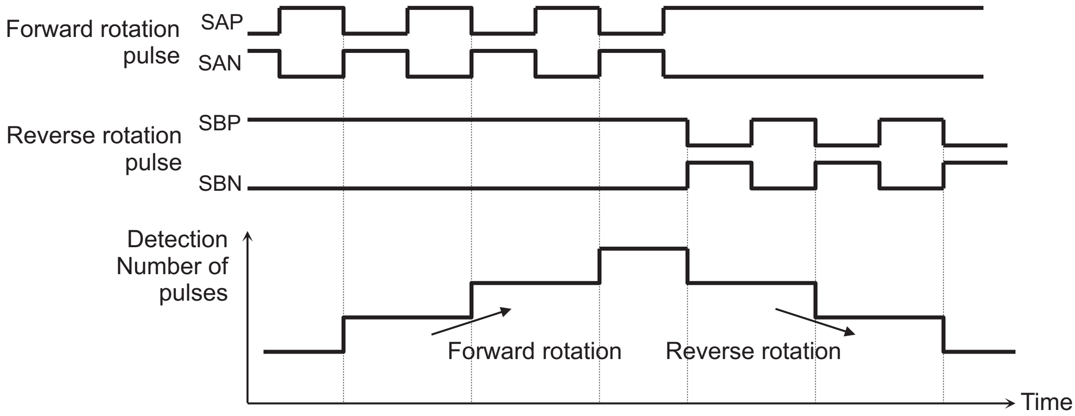
Mode 1: **Mode selection of pulse train input** (ob-11) set to *00: 90° phase difference*



Mode 2: **Mode selection of pulse train input** (ob-11) set to *01: forward / reverse rotation command and rotation direction*



Mode 3: **Mode selection of pulse train input** (ob-11) set to *02: forward/reverse rotation pulse string*



Electronic Gear Function

The electronic gear function is for setting the gain for the position command or position feedback.

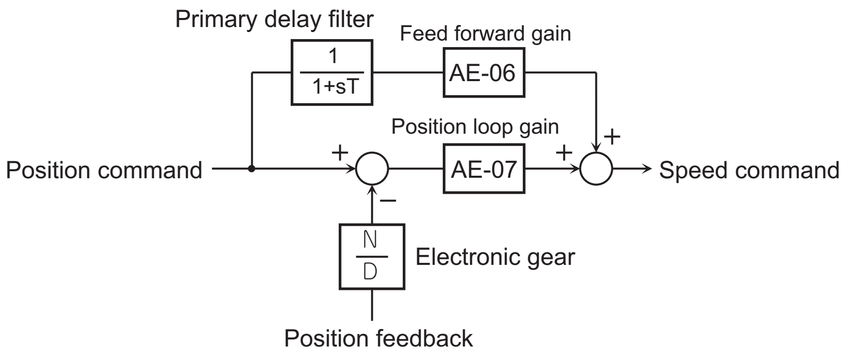
Precautions for Correct Use

Be sure to set the N/D in the range of 1 / 50 ≤ N/D ≤ 20. If it is set outside the range, the internal calculation will be saturated and the correct speed cannot be detected.

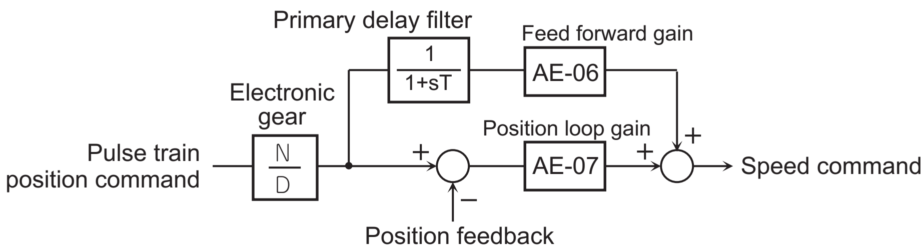
N: **Electronic gear ratio numerator** (AE-02)

D: **Electronic gear ratio denominator** (AE-03)

Electronic gear setting point selection (AE-01) set to *00: Feedback side*



Electronic gear setting point selection (AE-01) set to *01: Command side*



The time constant of the first-order lag filter is fixed at 10ms.

Synchronous Operation between Master and Slave

The slave unit can synchronize the operation of the main motor connected to the master unit with the sub-motor. To use this function, you must set the encoder output signal of the master unit to the pulse input of the slave unit.

The master can operate in any **Control mode selection** (AA121) selection.
The slave unit controls the pulse string position by vector control. In this case, **control mode selection** (AA121) is set to *10: Vector control with sensor*, **Vector control mode selection** (AA123) is set to *01 : Pulse string position control mode* and **Pulse train detection (option) terminal** (ob-10) is set to *01: Pulse string position command*.

Assign permission to inputting of pulse string position command [73: STAT] to any one of **Input terminal function** (CA-01) to (CA-11) and turn [73: STAT] terminal ON. If [73: STAT] is OFF, pulse string input will not be accepted.

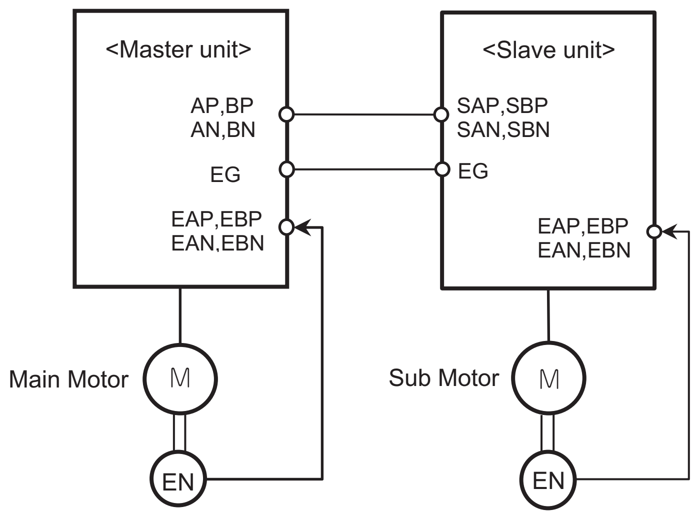
(Setting example)
- Main motor: Encoder pulse number 1024 pulses
- Sub-motor: Encoder pulse number 3000 pulses
- Main motor speed: Sub motor speed = 2 : 1

When operating under the above conditions, set the following data in the slave unit.
Mode selection of pulse train input (ob-11) set to *00: 90° phase difference*
Electronic gear setting point selection (AE-01) set to *01: Command side*
Electronic gear ratio numerator (AE-02) set to *3000*
Electronic gear ratio denominator (AE-03) set to *2048* (1024 × 2)

The main motor encoder outputs [AP], [BP], [AN], and [BN] are loaded as the slave unit pulse string position commands [SAP], [SBP], [SAN], and [SBN].
If the main motor is fast, the amount of pulse change per unit time will be large, and the speed command of the slave unit will also be large. If the main motor is slow, the value for the speed command of the slave unit will also be small.
As a result, the operation of the sub-motor follows the operation of the main motor.

Precautions for Correct Use

- When adjusting the Position feed-forward gain, it is recommended to set the **Position feed-forward gain setting** (AE-06) to *2.00* before making adjustments. When you want to reduce the positional deviation between the main motor and sub-motor, set **Position feed-forward gain setting** (AE-06) to a higher value. Also, if the motor is out of order, set **Position feed-forward gain setting** (AE-06) to a lower value.
- When adjusting the Position loop gain, it is recommended to set **Position loop gain setting** (AE-07) to *2.00* before making adjustments. If you wish to increase the positioning accuracy and holding power, set Position loop gain setting to a higher value. Also, if the **Position loop gain setting** (AE-07) is set too high and causing a disturbance, **Position loop gain setting** (AE-07) should be set lower.

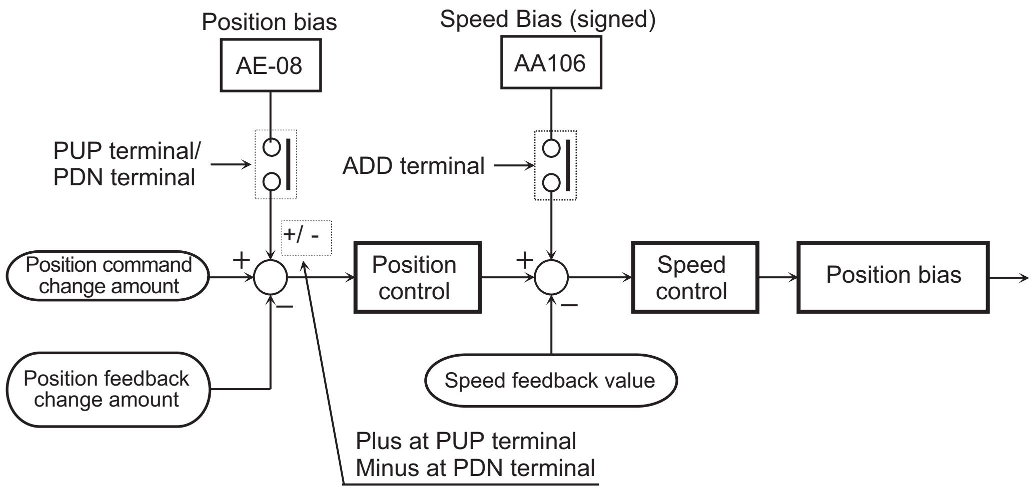


Position Bias Function

Position bias is a function that corrects the pulse string position command input to the inverter.
For example, it is used to correct an error in a command from the master when using *Synchronous Operation between Master and Slave*

To use this function, add or subtract the amount of bias to change the amount of the Pulse string position command at 1ms intervals, and set the bias amount in **Position bias setting** (AE-08).

Assign Addition of positional bias [74: PUP] or Subtraction of positional bias [75: PDN] to one of **Input terminal function** (CA-01) to (CA-11). The bias amount is added while the [74: PUP] terminal is ON, and subtracted while the [75: PDN] terminal is ON.



Speed Bias Function

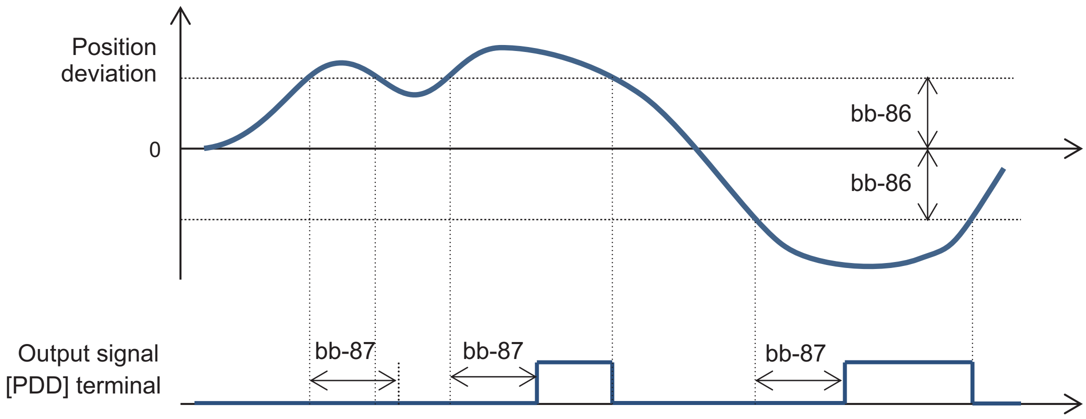
Speed bias is a function that adjusts the speed during Pulse string position control. Set the bias amount to **Addition of frequency** (AA106) and assign Addition of frequency [14: ADD] terminal to any of **Input terminal function** (CA-01) to CA-11). While the [ADD] terminal is ON, the bias amount is added / subtracted to the speed.

Clear the speed command bias amount before the positioning operation is completed. If the speed command bias amount is added even during stop, the stop position will shift by that amount.

Excessive Positional Deviation Detection

If the deviation of the position feedback with respect to the position command exceeds the **Position deviation error detection level** (bb-86) ×100pls and the time set for **Position deviation error detection time** (bb-87) elapses, it will be judged as an abnormal condition.
Position deviation is checked with the **Pulse train position deviation monitor** (dA-26).

To use this function, set the operation to execute at the time of abnormality in **Position deviation error mode selection** (bb-85).
When **Position deviation error mode selection** (bb-85) is set to *00: Warning*, Excessive positional deviation [42: PDD] turns ON and when **Position deviation error mode selection** (bb-85) is set to *01: Error*, excessive positional deviation [42: PDD] turns ON and a trip occurs with the position deviation error (E106).
The positional deviation can be cleared by turning the clearing of positional deviation [72: PCLR] ON / OFF or by trip reset.



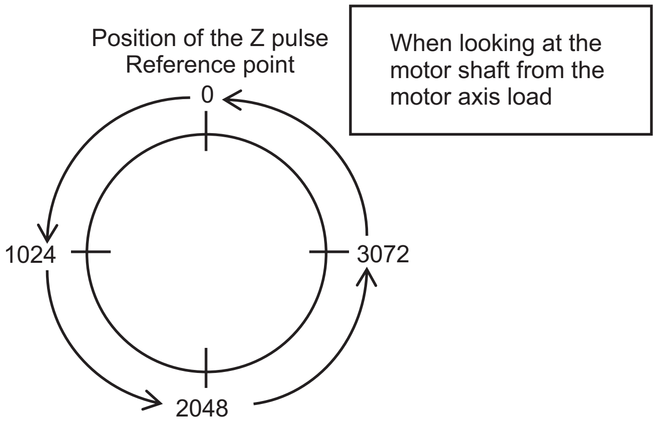
8-4-8 Orientation Control

The Orientation control function positions the motor at any one point during one rotation. It is used for purposes such as stopping at a fixed position during machine tool maintenance.

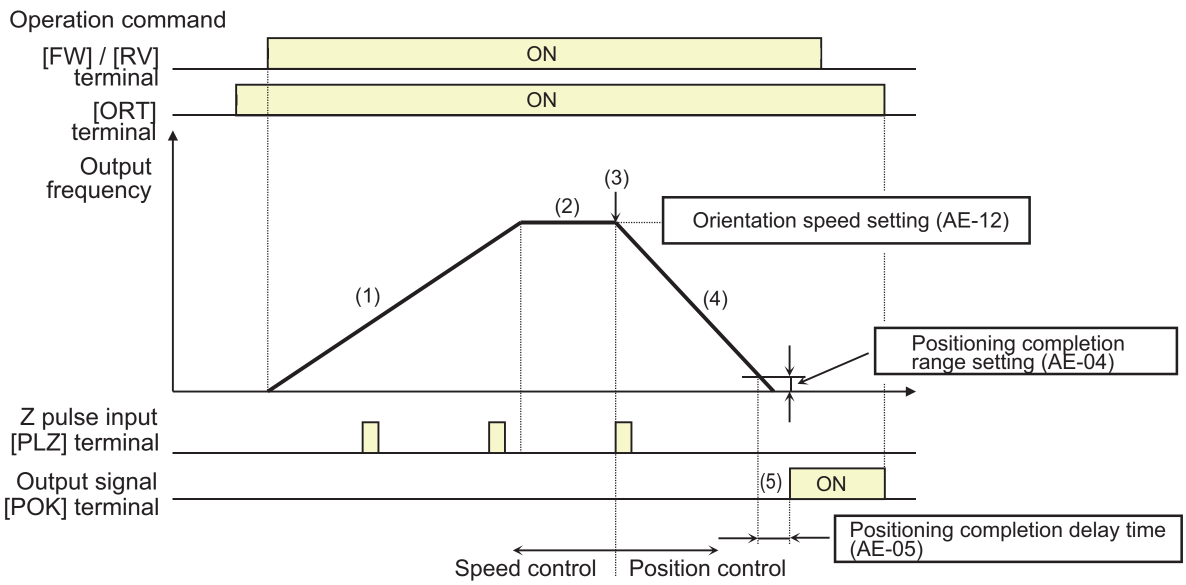
To use this function, set **Control mode selection** (AA121) to *10: Vector control with sensor* and set **Vector control mode selection** (AA123) to *00 : Speed/torque control mode* or *01 : Pulse string position control mode*.
Also, assign Orientation [69: JG] to one of **Input terminal function** (CA-01) to (CA-11).

The Z pulse (1 rotation position signal) is used as the reference signal for positioning. When connecting an encoder to the PG option unit, input a Z pulse between EZP and EZN. When connecting an encoder to the control circuit terminal block, set Pulse string input Z [109: PLZ] to one of the input terminals and input the Z pulse.

The stop position is set in **Stop position of Home search function** (AE-11) as one rotation from the Z pulse in the forward direction divided into 4095 (0 to 4095). One revolution is 4096 divisions regardless of the number of encoder pulses. In the case of positive phase connection, the stop position is as shown in the figure below when viewed from the motor shaft load side.



Orientation control is performed as follows.



1. If the operation command is turned ON while orientation [69: ORT] terminal is ON, the speed is accelerated to the level set in **Speed reference of Home search function** (AE-12).
2. It reaches constant speed. If the operation command is turned on first, the frequency command shifts to the speed set for **Speed reference of Home search function** (AE-12) from the time when the orientation [69: ORT] terminal turns on.
3. After reaching the orientation speed, the position control is switched to when the first Z pulse is detected.

4. The target position for position control when **direction of home search function** (AE-13) is set to *00: Normal rotation* is **Stop position of Home search function** (AE-11) +1 rotation and when it is set to *01: Reverse rotation*, it is **Stop position of Home search function** (AE-11)－2 rotations.
   In the deceleration operation by position control, as the **Position loop gain setting** (AE-07) is increased, the deceleration time becomes shorter. It does not follow the deceleration time setting.
5. After the number of remaining pulses is within the setting for **Positioning complete range setting** (AE-04) and the **Positioning complete delay time setting** (AE-05) has elapsed, the positioning complete [43: POK] signal is output. Output continues until Orientation [72: ORT] terminal turns OFF.
   After the positioning is completed, the servo lock state is maintained until the operation command is turned off.

   If the orientation [72: ORT] terminal is turned OFF while the motor is operating with orientation control, the motor is decelerated and stopped, and the output is cut off. If you want to restart operation, turn OFF the operation command once.

● Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	10	Vector control with sensor	00
Vector control mode selection	AA123	00	Speed / torque control mode	00
		01	Pulse string position control mode	
Pulse train detection (internal) control terminal [A] [B]	CA-90	00	Disabled	00
		01	Pulse train frequency command	
		02	Speed feedback	
		03	Pulse count	
Encoder constant setting	CA-81	32 to 65535	Set the number of pulses	1024
Encoder position selection	CA-82	00	Phase-A is leading	00
		01	Phase-B is leading	
Encoder constant setting (PG option unit)	ob-01	32 to 65535	Set the number of pulses	1024
Encoder position selection (PG option unit)	ob-02	00	Phase-A is leading	00
		01	Phase-B is leading	
Stop position selection of Home search function	AE-10	00	Parameter setting	00
		01	Option 1	
		02	Option 2	
		03	Option 3	
Stop position of Home search function	AE-11	0 to 4095	Set the amount of rotation from the position where the Z pulse is turned on. Refer to *1	0
Speed reference of Home search function	AE-12	0.00 to 120.00 (Hz)	Orientation speed frequency command *2	0.00
Direction of Home search function	AE-13	00	Forward	00
		01	Reverse rotation	

Item	Parameter	Data	Description	Default
Positioning complete range setting	AE-04	0 to 10000 (pls)	Set by double the value of encoder 4	5
Positioning complete delay time setting	AE-05	0.00 to 10.00 (s)	Set the time until the positioning complete [43: POK] signal is output after the positioning is completed.	0.00
Position feed-forward gain setting	AE-06	0 to 655.35	The position feed-forward gain.	0.00
Position loop gain setting	AE-07	0.00 to 100.00 (rad/s)	The position loop gain.	0.50
Input terminal function	CA-01 to CA-11	069	Orientation [69: ORT]	-
		109	Pulse string input Z [109: PLZ]	
Output terminal selection	CC-01 to CA-06	043	Positioning complete [43: POK]	-
Relay output terminal	CA-07			

*1. One revolution is 4096 divisions regardless of the number of encoder pulses.
*2. Set the speed so that it can stop at the target position in about 2 rotations. If the frequency is too high, you cannot perform stop.

Precautions for Correct Use

Do not set the Speed reference of Home search function to a high frequency, as the deceleration operation will be positioned within 2 revolutions. The operation may be abrupt and the impact on the device may increase, or trips may occur due to over-voltage protection.

8-4-9 Absolute Position Control Mode

The absolute position control function positions the position command so that it is in the absolute position with respect to the origin.
To use the function, set **Control mode selection** (AA121) to the *10: Vector control with sensor* selection and set **Vector control mode selection** (AA123) to *02 : Absolute position control mode* or *03 : High-resolution absolute position control mode*.
This function uses encoder feedback. For details, refer to *7-10 Encoder Feedback* on page 7-77.

When **Vector control mode selection** (AA123) is set to *03 : High-resolution absolute position control mode*, it is controlled by 4 times the number of pulses used for internal calculation. Set the multi-stage position command and position range specification to 4 times the accuracy.

In order to perform absolute position control, it is necessary to determine the origin. To determine the origin, return to the origin or preset the position data.
When the power is turned on, if **Current position saving at power-off** (AE-61) is set to *00: Disabled*, the position at the time of power ON is set as the origin (position = 0). When set to *01: Enabled*, The origin position is the origin position before the last time the power was shut-off.

Precautions for Correct Use

- In absolute position control mode, the Validation of torque control [67: ATR] terminal is disabled. Torque control will not operate.
- In absolute position control, the permission to inputting of Pulse string position command [72: STAT] terminal is disabled. Pulse string position control will not operate.

Parameter

Item	Parameter	Data	Description	Default
Control mode selection	AA121	10	Vector control with sensor *1	00
Vector control mode selection	AA123	02	Absolute position control mode	00
		03	High-resolution absolute position control	

*1. When using Vector control with sensor, set **Load type selection** (Ub-03) to *02: ND*.

Positioning with the Position Command

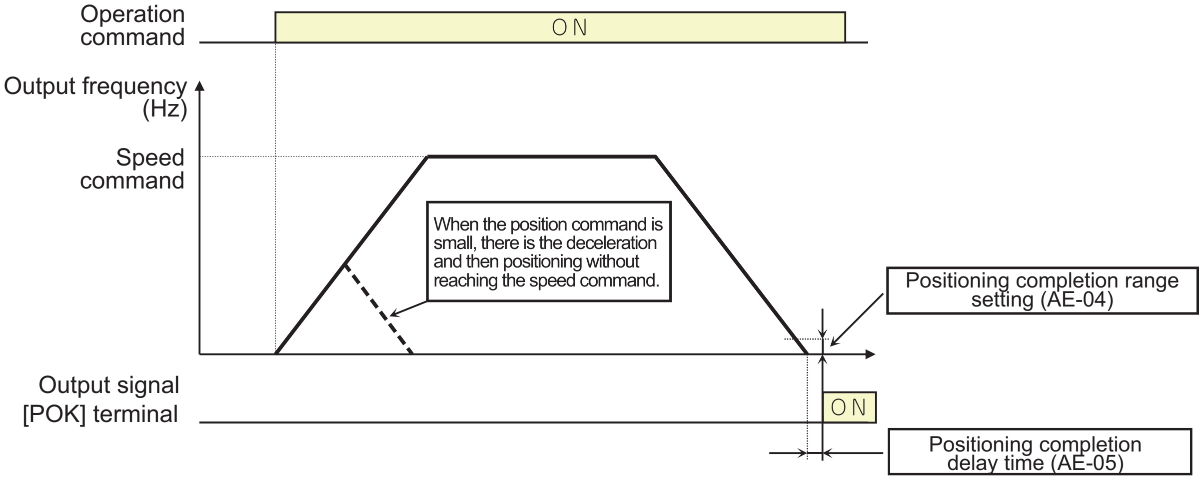
Absolute position control moves to the target position according to position command, speed command (frequency command), acceleration time, and deceleration time. After the stop, it will be in the position servo lock state. The servo lock state is held until the operation command is turned OFF.

Absolute position control is performed using the selection for the frequency command and acceleration / deceleration command set at that time. If the position command is small, it may decelerate and position without reaching the speed command value.
When the operation command is executed with the Normal rotation [1: FW] terminal and Reverse rotation [2: RV] terminal, both operate as operation / stop signals. Regardless of the command direction, if the "Target position - Current position" is positive, it will be forward rotation and if it is negative, it will be reverse rotation.

The current position command can be monitored with **Position command monitor** (FA-20) and the current position can be monitored with **Current position monitor** (dA-20).
If the clearing of positional deviation [72: PCLR] terminal is assigned, the current position is cleared by turning the [72: PCLR] terminal ON.

Additional Information

Trip reset or reset signal input does not clear the current position monitor.



● Parameter

Item	Parameter	Data	Description	Default
Position reference monitor	FA-20	Condition 1: -268435455 to +268435455 Condition 2: -1073741823 to +1073741823	Condition 1: Except for Condition 2 Condition 2: **Control mode selection** (AA121) is *10: Vector control with sensor* and **Vector control mode selection** (AA123) is *03 : High-resolution absolute position control mode*	-
Current position monitor	dA-20	Condition 1: -536870912 to 536870911 Condition 2: -2147483648 to 2147483647	Condition 1: Except for Condition 2 Condition 2: **Control mode selection** (AA121) is *10: Vector control with sensor* and **Vector control mode selection** (AA123) is *03 : High-resolution absolute position control mode*	-

Shortest Position Control

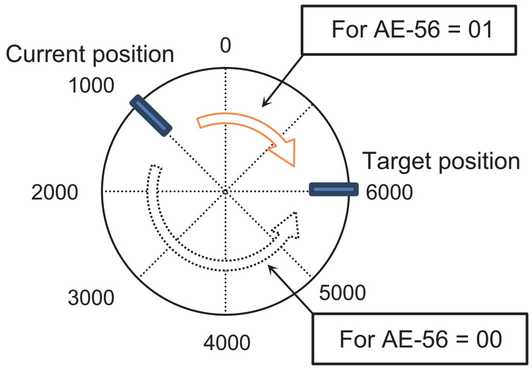
The shortest position control is a function that determines the rotation direction so that the amount of movement is the shortest and positions it at the target position. It is used, for example, when you want to minimize the movement distance to the target position with a rotating device such as a turntable.

To use this function, set **Position control mode selection** (AE-56) to *01: Without limit* and set the upper and lower limits of the position range. The upper limit of the position range is set in **Position control range setting(forward)** (AE-52) and the lower limit is set in **Position control range setting(reverse)** (AE-54).
When operation starts, it rotates in the direction that minimizes the amount of movement and is positioned at the target position.

(Setting example)
With the position range 0 to 7999, when trying to move from the current position 1000 pulse to the target position 6000 pulse, **Position control range setting(forward)** (AE-52) is set to *7999* and **Position control range setting(reverse)** (AE-54) is set to *0*.

When **Position control mode selection** (AE-56) is set to *01: Without limit*, the movement distance in the forward rotation direction is compared with the movement distance in the reverse rotation direction, and the movement distance is reduced.

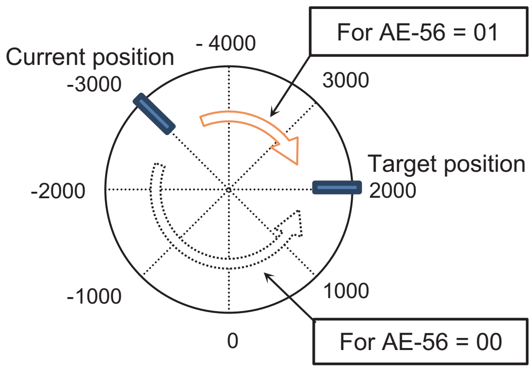
Distance traveled in the forward direction: +5000 pulse
Distance traveled in the reverse direction: -3000 pulse



When **Position control mode selection** (AE-56) is set to *00: With limit*, Target position - current position is +5000 pulse, so it moves in the forward direction.

The following settings can also be made to specify the position range.
Set **Position control range setting (forward)** (AE-52) to *3999*
Set **Position control range setting (reverse)** (AE-54) to *-4000*

When moving from the current position -3000 to the target position 2000, if **Position control mode selection** (AE-56) is set to *01: Without limit*, movement will be in the reverse direction, which reduces the movement distance.



Precautions for Correct Use

- When **Position control mode selection** (AE-56) is set to *01: Without limit*, no position control range error (E104) will occur.
- In the case of the above example, when moving from the 7000 pulse position to the 1000 pulse position, it moves beyond the forward rotation side position range (7999), but the current position monitor returns to 0.

● Parameter

<table>
<tr><th>Item</th><th>Parameter</th><th>Data</th><th>Description</th><th>Default</th></tr>
<tr><td>Position control range setting (forward)</td><td>AE-52</td><td>Condition 1:
0 to +268435455
Condition 2:
0 to +1073741823</td><td>Condition 1: Except for Condition 2
Condition 2: Control mode selection (AA121) is 10: Vector control with sensor and Vector control mode selection (AA123) is 03 : High-resolution absolute position control mode</td><td>268435455</td></tr>
<tr><td>Position control range setting (reverse)</td><td>AE-54</td><td>Condition 1:
-268435455 to 0
Condition 2:
-1073741823 to 0</td><td>Condition 1: Except for Condition 2
Condition 2: Control mode selection (AA121) is 10: Vector control with sensor and Vector control mode selection (AA123) is 03 : High-resolution absolute position control mode</td><td>-268435455</td></tr>
<tr><td rowspan="2">Position control mode selection</td><td rowspan="2">AE-56</td><td>00</td><td>With limit</td><td rowspan="2">00</td></tr>
<tr><td>01</td><td>Without limit</td></tr>
</table>

Multistage Position Switching Function

Multi-stage position commands 0 to 15 can be switched by combining the position command selection terminal [76: CP1] to [79: CP4].

Position reference is set with **position reference 0 to 15** (AE-20) to (AE-50).

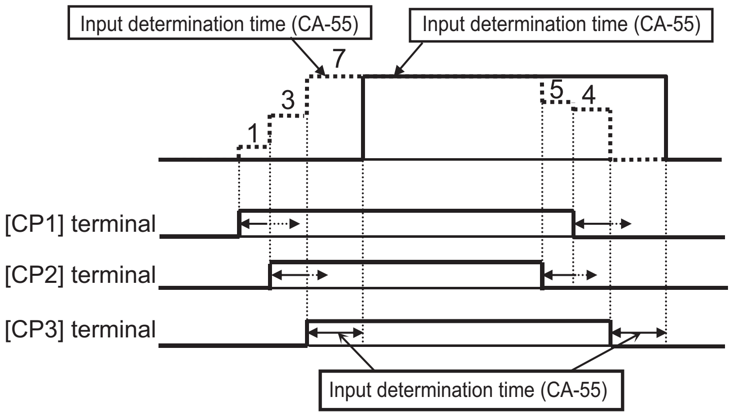
When the position reference terminal is not set, **Position reference 0** (AE-20) is used as the position reference.

Position reference	CP4	CP3	CP2	CP1
Multistage position 0	OFF	OFF	OFF	OFF
Multistage position 1	OFF	OFF	OFF	ON
Multistage position 2	OFF	OFF	ON	OFF
Multistage position 3	OFF	OFF	ON	ON
Multistage position 4	OFF	ON	OFF	OFF
Multistage position 5	OFF	ON	OFF	ON
Multistage position 6	OFF	ON	ON	OFF
Multistage position 7	OFF	ON	ON	ON
Multistage position 8	ON	OFF	OFF	OFF
Multistage position 9	ON	OFF	OFF	ON
Multistage position 10	ON	OFF	ON	OFF
Multistage position 11	ON	OFF	ON	ON
Multistage position 12	ON	ON	OFF	OFF
Multistage position 13	ON	ON	OFF	ON
Multistage position 14	ON	ON	ON	OFF
Multistage position 15	ON	ON	ON	ON

Precautions for Correct Use

- When inputting a multi-stage position command, you can set the standby time until the terminal input is confirmed. You can prevent the transition state before the input is confirmed from being adopted as the input.
- You can adjust the judgement time with **Multistage input determination time** (CA-55). Finally, the data is confirmed after the time set for **Multistage input determination time** (CA-55) has elapsed without any change in the input. Increasing the confirmation time will result in slower input response.

Example of using Position reference selection terminal 1 to 3 [76: CP1] to [78: CP3] as an input terminal



● **Parameter**

Item	Parameter	Data	Description	Default
Multistage position command 0	AE-20	AE-54 to AE-52	Set the position command for Multistage position command	0
Multistage position command 1	AE-22	AE-54 to AE-52		
Multistage position command 2	AE-24	AE-54 to AE-52		
Multistage position command 3	AE-26	AE-54 to AE-52		
Multistage position command 4	AE-28	AE-54 to AE-52		
Multistage position command 5	AE-30	AE-54 to AE-52		
Multistage position command 6	AE-32	AE-54 to AE-52		
Multistage position command 7	AE-34	AE-54 to AE-52		
Multistage position command 8	AE-36	AE-54 to AE-52		
Multistage position command 9	AE-38	AE-54 to AE-52		
Multistage position command 10	AE-40	AE-54 to AE-52		
Multistage position command 11	AE-42	AE-54 to AE-52		
Multistage position command 12	AE-44	AE-54 to AE-52		
Multistage position command 13	AE-46	AE-54 to AE-52		
Multistage position command 14	AE-48	AE-54 to AE-52		
Multistage position command 15	AE-50	AE-54 to AE-52		
Input terminal function	CA-01 to CA-11	076	CP1: Positional command selection 1	-
		077	CP2: Positional command selection 2	
		078	CP3: Positional command selection 3	
		079	CP4: Positional command selection 4	

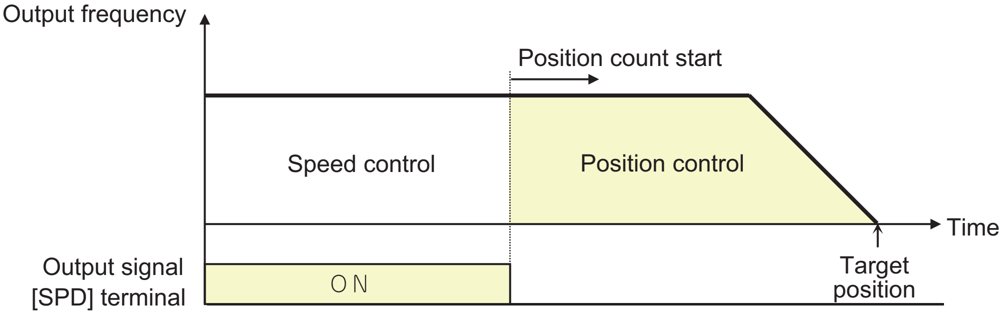
Speed/Position Switching Function

Speed / Position switching is a function that switches between speed control and position correction control. While using absolute position control, this function enables switching between speed control and position control.
To use this function, assign the switching of speed / position [84: SPD] terminal to one of **Input terminal function** (CA-01) to (CA-11).

When switching of speed / position [84: SPD] terminal is ON while operating in absolute position control, you can switch between position control ad speed control. While the switching of speed / position [84: SPD] terminal is ON, the current position becomes 0. If switching of speed / position [84: SPD] terminal is turned OFF during operation, the position control will switch from the point when it was turned off.

Precautions for Correct Use

- When switching from speed to position, if the deviation between the position command and the current position is 0, the stop operation is set at that point. Hunting may occur depending on the position loop gain setting.
- While the Switching of speed / position [84: SPD] terminal is ON, it will move in a direction based on the operation command. Pay attention to the sign of the command when switching from speed to position.



● Parameter

Item	Parameter	Data	Description	Default
Input terminal function	CA-01 to CA-11	084	SPD: Switching of speed / position	-

Teaching Function

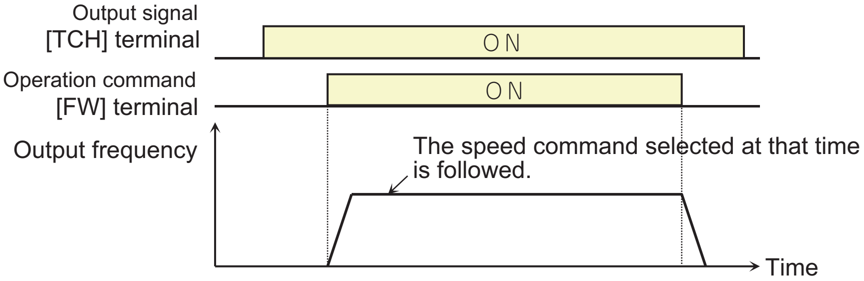
This function stores the current position in a selected position command area.
To use this function, assign [110: TCH] *Teaching signal* to one of **Input terminal function** (CA-01) to (CA-11).
Specify the position command area with **Teach-in function target selection** (AE-60) and while [110: TCH] terminal is ON, press Save (the “2” key) on the LCD operator to write the current position in the position command area.

● Use Case Example

1 Select the position command you wish to set in **Teach-in function target selection** (AE-60).

2 Move the workpiece.
With the teaching signal [110: TCH] terminal ON, enter the operation command. The speed is according to the settings for **Main Speed reference monitor** (FA-01) and **Acceleration time**

(FA-10). Use multi-speed, etc. to set an appropriate frequency command and acceleration time before turning the operation signal ON.



3 When you reach the desired position, press Save (the “2” key) on the LCD operator.
The current position is written in the area corresponding to the position command set by **Teach-in function target selection** (AE-60). The **Teach-in function target selection** (AE-60) itself is not saved. It will return to *00* after power is turned off or after a reset.

Teach-in function target selection (AE-60) setting value	The position command set
00	**Position command 0** (AE-20)
01	**Position command 1** (AE-22)
02	**Position command 2** (AE-24)
03	**Position command 3** (AE-26)
04	**Position command 4** (AE-28)
05	**Position command 5** (AE-30)
06	**Position command 6** (AE-32)
07	**Position command 7** (AE-34)
08	**Position command 8** (AE-36)
09	**Position command 9** (AE-38)
10	**Position command 10** (AE-40)
11	**Position command 11** (AE-42)
12	**Position command 12** (AE-44)
13	**Position command 13** (AE-46)
14	**Position command 14** (AE-48)
15	**Position command 15** (AE-50)

Teaching is possible if the inverter power supply (R0, T0) is input. Teaching can be done by moving the workpiece with an external device without turning on the main power supply (R, S, T).

Precautions for Correct Use

When moving the workpiece with an external device, make sure that the main power supply (R, S, T) of the inverter is cut off. Alternatively, make sure that the connection between the inverter output (U, V, W) and the motor is cut off. There is a risk of injury or damage.

● Parameter

Item	Parameter	Data	Description	Default
Teach-in function target selection	AE-60	00	**Multistage position command 0**(AE-20)	00
		01	**Multistage position command 1**(AE-22)	
		02	**Multistage position command 2**(AE-24)	
		03	**Multistage position command 3**(AE-26)	
		04	**Multistage position command 4**(AE-28)	
		05	**Multistage position command 5**(AE-30)	
		06	**Multistage position command 6**(AE-32)	
		07	**Multistage position command 7**(AE-34)	
		08	**Multistage position command 8**(AE-36)	
		09	**Multistage position command 9**(AE-38)	
		10	**Multistage position command 10**(AE-40)	
		11	**Multistage position command 11**(AE-42)	
		12	**Multistage position command 12**(AE-44)	
		13	**Multistage position command 13**(AE-46)	
		14	**Multistage position command 14**(AE-48)	
		15	**Multistage position command 15**(AE-50)	
Input terminal function	CA-01 to CA-11	110	TCH: Teaching	-

Zero Return Function

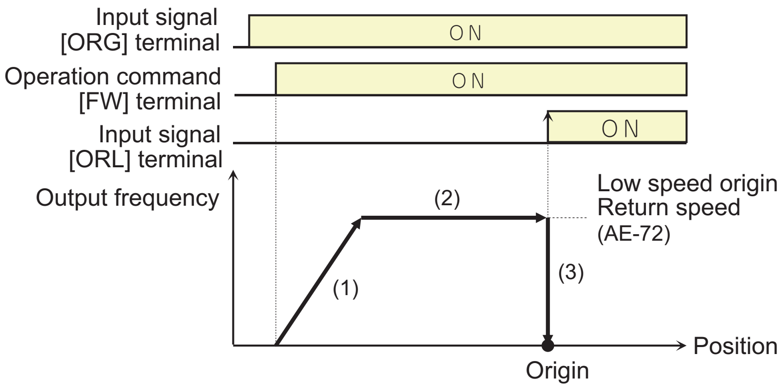
Zero return function is a function to determine the origin position.
If zero return function is not performed, the origin position is according to the setting of **Current position saving at power-off** (AE-61). When set to *00: Disabled*, the origin position is set as the position when power was turned on (position=0). When set to *01: Enabled*, The origin position is the origin position before the last time the power was shut-off.

To use this function, set Origin limit signal [80: ORL], Return-to-origin start up signal [81: ORG], and Servo-ON [65: SON] to any of the input terminal functions. After turning on the Servo-ON [65: SON] terminal, turn on the Return-to-origin start up signal [81: ORG] to start homing. When Origin limit signal [80: ORL] is ON, the origin is fixed and the current position is cleared to 0.

The direction for zero return is set in **Direction of homing function** (AE-71) and its operation is set in **Homing function selection** (AE-70). If the Return-to-origin start up signal [81: ORG] terminal is turned OFF during zero return operation, the position shifts to absolute position control.
There are three selections for the zero return function operation: low speed zero return, high speed zero return 1, and high speed zero return 2.

● Low Speed Zero Return

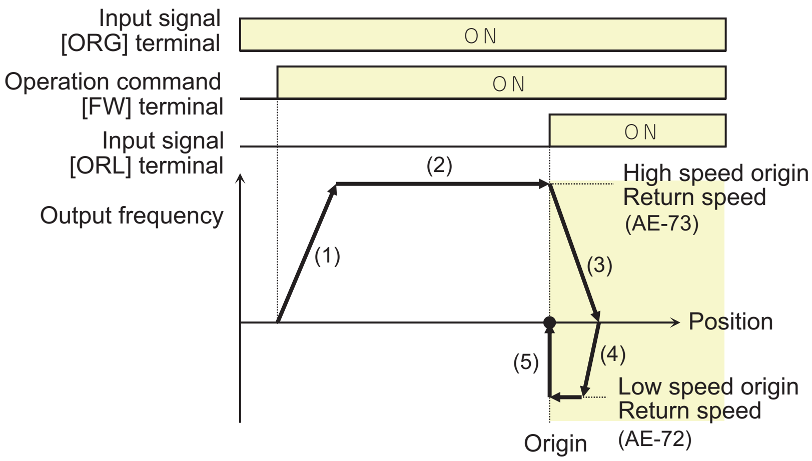
When **Homing function selection** (AE-70) is set to *00: Low speed zero return*



1. Accelerates to the Low speed zero return speed level according the the acceleration time.
2. Operates at the speed of Low speed zero return.
3. Positioning done at the point when the origin limit signal [81: ORL] is entered.

● High Speed Zero Return 1

When **Homing function selection** (AE-70) is set to *01: High speed zero return 1*

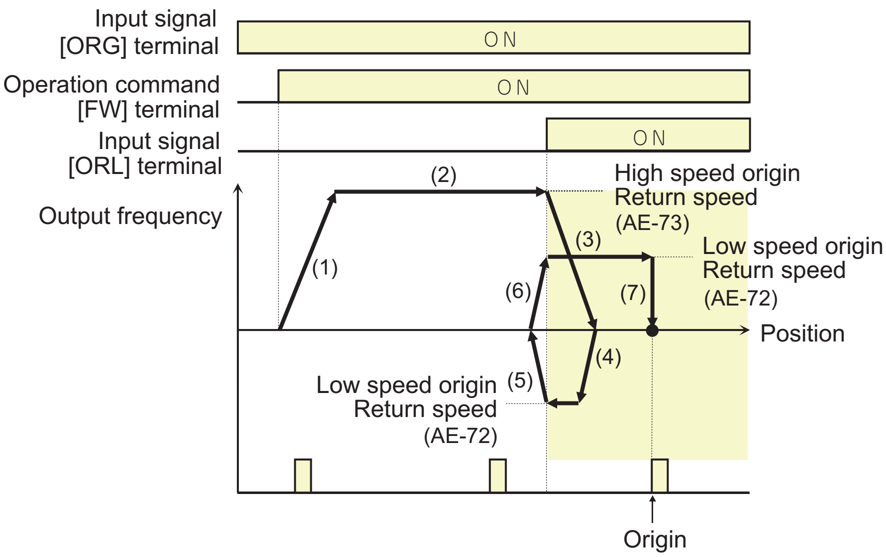


1. Accelerates to the High speed zero return speed level according the the acceleration time.
2. Operates at the speed of High speed zero return.
3. Deceleration starts when the ORL signal turns ON.

4. Operates at a low speed zero return speed in the reverse direction.
5. Positioning done at the point when the ORL signal turns OFF.

● High Speed Zero Return 2

When **Homing function selection** (AE-70) is set to *02: High speed zero return 2*



1. Accelerates to the High speed zero return speed level according the the acceleration time.
2. Operates at the speed of High speed zero return.
3. Deceleration starts when the ORL signal turns ON.
4. Operates at a low speed zero return speed in the reverse direction.
5. Deceleration starts when the ORL signal turns OFF.
6. Operation is in the forward rotation direction at the low speed of the homing function.
7. Positioning is done at the first Z pulse after the ORL signal is turned ON.

● Parameter

Item	Parameter	Data	Description	Default
Homing function selection	AE-70	00	Low speed zero return	00
		01	High speed zero return 1	
		02	High speed zero return 2	
Direction of homing function	AE-71	00	Forward	00
		01	Reverse	
Low-speed of homing function	AE-72	0.00 to 10.00 (Hz)	The speed of the low-speed of homing function.	0.00
High-Speed of homing function	AE-73	0.00 to 590.00 (Hz)	The speed of the high-speed of homing function.	0.00
Input terminal function	CA-01 to CA-11	065	SON: Servo-on	-
		080	ORL: Origin limit signal	
		081	ORG: Return-to-origin start up signal	

Forward/Reverse Drive Stop Function (FOT/ROT)

When a limit switch is installed at the mechanical end of a device,this function suppresses operation outside its operating range. It prevents deviation from the operation range using the signal from the control range limit switch.

To use this function, assign *82: Stopping of normal rotation driving* and *83: Stopping of reverse rotation driving* to one of **Input terminal function** (CA-01) to (CA-11).
When [82: FOT] terminal is input, the torque limit on the forward rotation side is limited to 10%, and when [83: ROT] terminal is input, the torque limit on the reverse rotation side is limited to 10%. Prepare a mechanical mechanism such as a stopper at the final end of the machine.

● Parameter

Item	Parameter	Data	Description	Default
Input terminal function	CA-01 to CA-11	082	FOT: Stopping of normal rotation driving	-
		083	ROT: Stopping of reverse rotation driving	-

Position Control Range Setting

Set the forward and reverse position control ranges in **Position control range setting(forward)** (AE-52) and **Position control range setting(reverse)** (AE-54). If the current position exceeds this setting range, it will trip with a position control range error (E104) and the inverter will be in a free-run state.

The upper limit of **Position command 0** (AE-20) to **Position command 7** (AE-50) is limited by the setting value of the position control range setting function. Position commands that exceed the position range specification cannot be set.

● Parameter

Item	Parameter	Data	Description	Default
Position control range setting (forward)	AE-52	Condition 1: 0 to +268435455 Condition 2: 0 to +1073741823	Condition 1: Except for Condition 2 Condition 2: **Control mode selection** (AA121) is *10: Vector control with sensor* and **Vector control mode selection** (AA123) is *03 : High-resolution absolute position control mode*	268435455
Position control range setting (reverse)	AE-54	Condition 1: -268435455 to 0 Condition 2: -1073741823 to 0	Condition 1: Except for Condition 2 Condition 2: **Control mode selection** (AA121) is *10: Vector control with sensor* and **Vector control mode selection** (AA123) is *03 : High-resolution absolute position control mode*	-268435455

Current Position Saving at Power-Off

This function saves the data of the current position monitor in EEPROM when inverter power is turned off and sets it in the current position monitor when the power is turned on next time. Once an origin position has been set by the zero return function, it can be used even after the power is turned on again.

By setting **Current position saving at power-off** (AE-61) to *01: Enabled*, it is possible to store the current position data when the power is turned off.
Use it for applications where the motor shaft is locked when power is cut off.

● Parameter

Item	Parameter	Data	Description	Default
Current position saving at power-off	AE-61	00	Disabled	00
		01	Enabled	

Precautions for Correct Use

- In a machine where the shaft spins when there is a power interruption, the memorized position may deviate from the current position when the power is turned on again.
- This function is used to remember the position when the main circuit power was cut off. Note that the position will not be recorded in a case where 24 V control power is being supplied after the loss of main circuit power.
- If the motor rotates while the power is cut off, the amount of rotation cannot be counted, which may cause misalignment. When there is a power interruption, use the brake to prevent the motor from rotating.
- If the motor rotates after the power is cut off, use the zero return function to fix the origin or zero position before operating.
- Even if the brakes are applied when the power is turned off, the position of the brakes may shift due backlash. Any misalignment will accumulate, so use the zero return function once every few times to eliminate the misalignment.

Presetting of Positional Data

Presetting of positional data is a function used to set the current position to an arbitrary value. It is used when restarting from the middle of the positioning process.

To use this function, assign presetting of positional data [85: PSET] terminal to one of **Input terminal function** (CA-01) to (CA-11) and set the position you wish to pre-set in **Presetting of positional data (**AE-62).
When the presetting of positional data [85: PSET] terminal is turned ON, the current position is overwritten by the value set in **Presetting of positional data** (AE-62).

● **Parameter**

Item	Parameter	Data	Description	Default
Preset position data	AE-62	Condition 1: -268435455 to +268435455 Condition 2: -1073741823 to +1073741823	Condition 1: Except for Condition 2 Condition 2: **Control mode selection** (AA121) is *10: Vector control with sensor* and **Vector control mode selection** (AA123) is *03 : High-resolution absolute position control mode*	0
Input terminal function	CA-01 to CA-11	085	PSET: Presetting of positional data	-

8-4-10 Servo-ON [65: SON]

Servo-ON is a function that puts the motor in a servo-locked state.
To use this function, set **Control mode selection** (AA121) to *09: Zero-Hz range sensorless vector control* or *10: Vector control with sensor* and assign Servo-ON [65: SON] terminal to one of **Input terminal function** (CA-01) to (CA-11). When Servo-ON [65: SON] terminal is turned ON, the motor is put into the servo lock state.

If you wish to perform position servo lock, set **Control mode selection** (AA121) to *10: Vector control with sensor* and set **Vector control mode selection** (AA123) to *02 : Absolute position control mode* or *03 : High-resolution absolute position control mode*.
If the setting is other than that, the Speed Servo Lock will be applied and the stop position will shift due to the speed offset.
If Servo-ON [65: SON] is turned OFF during operation, it operates according to the **STOP mode selection** (AA115). In the case of free running, the restart operation will be according to the settings for Restart mode after FRS release.

● **Parameter**

Item	Parameter	Data	Description	Default
Input terminal function	CA-01 to CA-11	065	SON: Servo-on	-
STOP mode selection	AA115	00	Decelerate and stop when the operation command is OFF.	00
		01	Free run when the operation command is OFF.	
Restart mode after FRS release	bb-40	00	re-start operation at 0 Hz.	00
		01	Restart with frequency matching. *1	
		02	Restart upon frequency pull-in. *2	
Retry wait time before motor restart	bb-26	0.3 to 100.0 (s)	Set the standby time after the operation command.	0.3

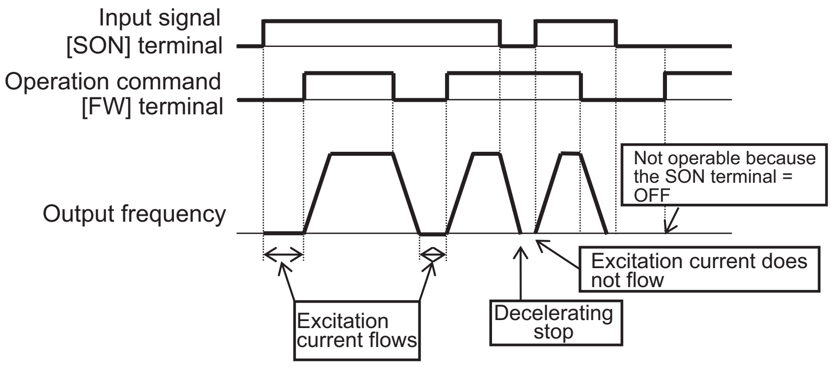
*1. Refer to *Frequency Matching Start* on page 7-59
*2. Refer to *Frequency Pull-in Start* on page 7-60

Precautions for Correct Use

- When Servo-ON [65: SON] is assigned to the Input terminal function, operation will not be accepted unless Servo-ON [65: SON] is turned ON.
- Servo-ON [65: SON] will not operate when the Auxiliary excitation [66: FOC] is assigned to the Input terminal.

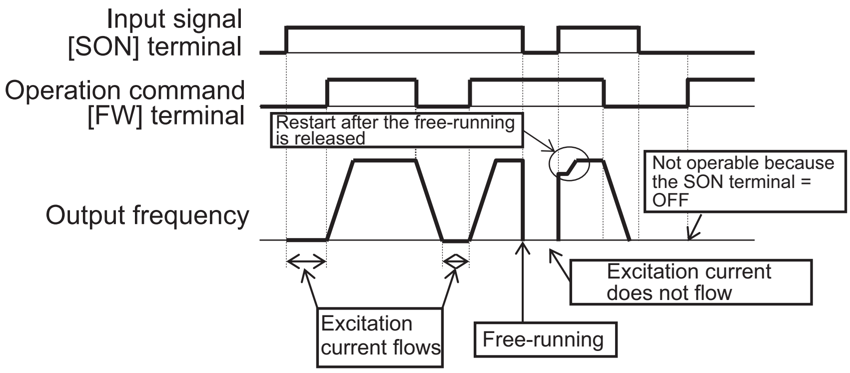
Deceleration Stop

When the **STOP mode selection** (AA115) is set to *00: Deceleration stop*



Free-Run Stop

When the **STOP mode selection** (AA115) is set to *01: Free run stop*



8-4-11 Adjustment of Position Control

This section describes the adjustment of the stop position by the parameters commonly used in the position control function. The position control functions related to this adjustment are as follows.

- Absolute position control mode
- Zero return
- Orientation Control
- Servo-ON (when position servo lock is controlled)
- DC braking (during position servo lock control)

Positioning Control Stop Position Adjustment

To adjust the stop position during positioning operation, follow the steps below.

Occurrence condition	Corrective action example
Stop position is extended Position overrun	Increase one of the following by 5% to see if it improves. • **Deceleration stop distance calculation Gain** (AE-64) • **Deceleration stop distance calculation Bias** (AE-65)
Stop position is shortened The position becomes shorter	Decrease one of the following by 5% and see if it improves. • **Deceleration stop distance calculation Gain** (AE-64) • **Deceleration stop distance calculation Bias** (AE-65)

● Parameter

Item	Parameter	Data	Description	Default
Deceleration stop distance calculation Gain	AE-64	50.00 to 200.00 (%)	Adjustment in relation to the stopping distance.	100.00
Deceleration stop distance calculation Bias	AE-65	0.00 to 655.35 (%)	adjust the output frequency during positioning operation.	0.00

Positioning Control Gain Adjustment

Adjust the control gain during positioning operation as follows.

Occurrence condition	Corrective action example
Poor tracking of positioning stop	make one of the following adjustments and see if it improves. • Incrementally increase **Position loop gain setting** (AE-07) by 5%. • Incrementally increase **APR start speed** (AE-67) and **Speed Limit in APR control** (AE-66) by 1%.
Sudden movement when positioning is stopped	Make one of the following adjustments and see if it improves. • Incrementally decrease **Position loop gain setting** (AE-07) by 5%. • Incrementally decrease **APR start speed** (AE-67) and **Speed Limit in APR control** (AE-66) by 1%.
Shaft vibration while stopping	Incrementally decrease **Position loop gain setting** (AE-07) by 5%.

Set **Speed Limit in APR control** (AE-66) and **APR start speed** (AE-67) percentages in relationship to **Max. frequency** (Hb105).
The speed at which positioning is performed is limited by the speed set in **Speed Limit in APR control** (AE-66). Acceleration / deceleration time becomes *0* during positioning, and is output according to the internal position control result. Control starts at the speed set in **APR start speed** (AE-67) when the positioning operation is started.

● Parameter

Item	Parameter	Data	Description	Default
Position loop gain setting	AE-07	0.00 to 100.00	Adjust position loop gain.	0.50
Speed Limit in APR control	AE-66	0.00 to 100.00 (%)	Limit the output during positioning.	1.00

Item	Parameter	Data	Description	Default
APR start speed	AE-67	0.00 to 100.00 (%)	Set the speed at the start of positioning.	0.20

8-5 Cooling Fan Control

Cooling fan control is a function that sets the operating conditions of the cooling fan of the inverter.
To use this function, set the cooling fan operating conditions in **Cooling FAN control method selection** (bA-70).
If an instantaneous or momentary power failure occurs while the cooling fan is operating, the cooling fan will pause and automatically recover after power is restored, regardless of the settings for **Cooling FAN control method selection** (bA-70).

● Parameter

Item	Parameter	Data	Description	Default
Cooling FAN control method selection	bA-70	00	Regular operation: The fan always operates.	00
		01	Running operation: When the inverter is in operation, the fan will operate automatically. The fan will continue to run for 3 minutes after the inverter is shut down, after which it will stop automatically. If the inverter cooling fin temperature exceeds 60℃, the cooling fan will operate. The cooling fan can stop after 3 minutes with the cooling fin temperature below 50℃.	
		02	Temperature dependent operation: The cooling fan operates when the cooling fin temperature of the inverter exceeds 40℃. The cooling fan will automatically shut down after 3 minutes of cooling fin temperature below 40℃.	

For how to check the cooling fin temperature, refer to *5-7 Cooling Fin Temperature Monitor* on page 5-14.
For how to determine if the cooling fin needs to be replaced, refer to *5-9 Life Monitor* on page 5-17.

8-6 Alarm Signal

8-6-1 Alarm Signal (AL)

When the inverter detects any abnormality such as an over-current or over-voltage condition, the output from the inverter is shut off and an alarm signal is generated. This is called a "Trip".
When the inverter is reset, the trip state is canceled and the alarm signal is also turned "OFF".
There are two ways to reset, one is to press the STOP / RESET key and the other is to enter the reset terminal. Some causes for trips cannot be resolved by resetting. In this case, it is necessary to do a power cycle.

The alarm signal [17: AL] is initially assigned to the **Relay output terminal [AL] function** (CC-07) of AL1-AL0 and AL2-AL0. The alarm signal [17: AL] can also be assigned to output terminals 11 to 15.
You can invert the logic and output of contacts a or b

Precautions for Correct Use

If the inverter outputs an error when the inverter power is intentionally shut off, it may be improved by changing the wiring and contact selection.

Alarm Relay AL

The operation of AL1-AL0 and AL2-AL0 are as follows.

CC-17	Control power supply	Inverter status	Output terminal state	
			AL1-AL0	AL2-AL0
00	ON	Alarm output	Close	Open
		Normal	Open	Close
	OFF	-	Open	Close
01	ON	Alarm output	Open	Close
		Normal	Close	Open
	OFF	-	Open	Close

The specifications of the relay contacts AL1-AL0 and AL2-AL0 are as follows.

		Resistive load	Inductive load
AL1-AL0	Maximum contact capacity	250 VAC, 2 A 30 VDC, 3 A	250 VAC, 0.2 A 30 VDC, 0.6 A
	Minimum contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	
AL2 AL0	Maximum contact capacity	250 VAC, 1 A 30 VDC, 1 A	250 VAC, 0.2 A 30 VDC, 0.2 A
	Minimum contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	

Relay Output 16C

The operation of 16C is as follows.

CC-16	Control power supply	Function operation	Output terminal state
00	ON	ON	Close
		OFF	Open
	OFF	-	Open
01	ON	ON	Open
		OFF	Close
	OFF	-	Open

The following is the specification for relay contact 16C.

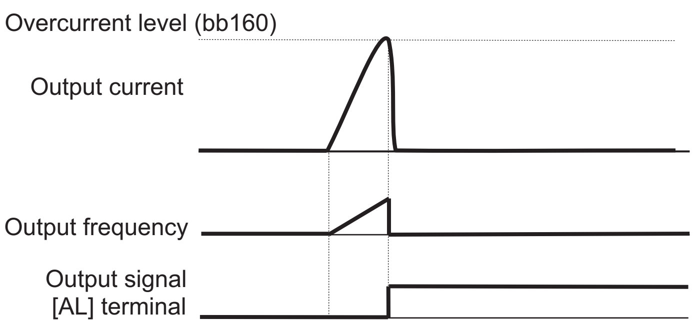
		Resistive load	Inductive load
16C	Maximum contact capacity	250 VAC, 2 A	250 VAC, 1 A
	Minimum contact capacity	250 VAC, 1 mA	

● Parameter

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	017	Alarm signal is output on the output terminal to which [17: AL] is assigned. ON: When an alarm has occurred OFF: When no alarm has occurred
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 and (AL2-AL0)	CC-07		
Output terminal selection	CC-11 to CC-15	00	Operates normally open: NO
		01	Operates normally closed: NC
1a Relay output terminal active state	CC-16	00	Operates normally open: NO
		01	Operates normally closed: NC
1c Relay output terminal active state	CC-17	00	Operates normally open: NO
		01	Operates normally closed: NC

Operating as Contact a: "ON" closes the contact and "OFF" opens the contact.
Operating as Contact b: "OFF" closes the contact and "ON" opens the contact.

(Example) An over-current error (E001) occurs when the current reaches the over-current level.



8-6-2 Severe Failure Signal (MJA)

The Severe failure signal [18: MJA] is output when a trip occurs due to a serious problem such as a hardware failure. It is different from the Alarm signal [17: AL] that is output for every trip.
Assign [18: MJA] *severe failure signal* to one of **Output terminal selection** (CC-01) to (CC-07).
The trips that are judged to be serious failures are shown in the table below.

Precautions for Correct Use

If this signal is output, the inverter hardware may be defective. Please check the trip history and take appropriate action.

Error code	Name	Description
E008	Memory error	There is something wrong with the memory element of the inverter.
E010	Current detector error	There is something wrong with the current detector of the inverter.
E011	CPU error	There is something wrong with the drive CPU of the inverter.
E014	Ground fault error	The inverter has a ground fault.
E019	Temperature detector error	There is something wrong with the temperature detector of the inverter.
E020	Cooling fan rotation speed reduction error	The cooling fan rotation speed of the inverter has reduced, preventing the inverter from dissipating heat.

● Parameter

<table>
<tr><th>Item</th><th>Parameter</th><th>Data</th><th>Description</th></tr>
<tr><td>Output terminal selection 11-15</td><td>CC-01 to CC-05</td><td rowspan="3">018</td><td rowspan="3">Outputs a signal when a serious failure error occurs at the output terminal to which Severe failure signal [18: MJA] is assigned.
OFF: No serious failure has occurred
ON: A serious failure has occurred</td></tr>
<tr><td>Relay output terminal function 16A-16C</td><td>CC-06</td></tr>
<tr><td>Relay output terminal function AL1-AL0 and (AL2-AL0)</td><td>CC-07</td></tr>
</table>

8-6-3 Alarm Code

Alarm code is used to output the inverter trip factor as a 3-bit or 4-bit code signal.
Assign alarm code 0 to 3 terminals [84: AC0] to [87: AC3] to one of **Output terminal selection** (CC-01) to (CC-07). If alarm code 3 [87: AC3] is set for the output terminal, it is output with a 4-bit code, and if it is not assigned, it is output with a 3-bit code.
Alarm codes output are shown in *Alarm Code* on page 8-129.

Additional Information

If any of the alarm codes 0 to 3 terminals [84: AC0] to [87: AC3] are assigned to **Output terminal selection** (CC-01) to (CC-07), even if all four signals are not set, those signals that are set will be output.

● **Parameter**

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	084 to 087	084: AC0 Alarm code 0 085: AC1 Alarm code 1 086: AC2 Alarm code 2 087: AC3 Alarm code 3 Output a signal to the assigned output terminal when a trip occurs.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 and (AL2-AL0)	CC-07		

Alarm Code

Output Terminal Function				When a 4-bit code is selected (with [AC3])		When a 3-bit code is selected (without [AC3])	
AC3	AC2	AC1	AC0	Cause code	Trip description	Cause code	Trip description
0	0	0	0	Normal	Normal	Normal	Normal
0	0	0	1	E001	Over-current error	E001	Over-current error
0	0	1	0	E005, E038, E039	Motor overload error, low-speed range overload error, controller overload error	E005, E038, E039	Motor overload error, low-speed range overload error, controller overload error
0	0	1	1	E007, E015	Overvoltage, incoming overvoltage error	E007, E015	Overvoltage, incoming overvoltage error
0	1	0	0	E009	Under-voltage error	E009	Under-voltage error
0	1	0	1	E016	Momentary interruption error	E016	Momentary interruption error
0	1	1	0	E030	IGBT error	E030	IGBT error
0	1	1	1	E006	Braking resistor overload error	-	Other than above
1	0	0	0	E008, E011	Memory element error, CPU error	-	-
1	0	0	1	E010	Detector error	-	-
1	0	1	0	E012, E013, E035, E036	External error, USP error, Thermistor error, Brake error	-	-
1	0	1	1	E014	Ground fault protection	-	-
1	1	0	0	E040, E041, E042, E043, E044, E045	Keypad communication error, RS485 communication error, RTC error, EzSQ executive instruction error, Overflow error, Illegal instruction error	-	-
1	1	0	1	E020, E021	Abnormal temperature error caused by reduced rotation speed of the cooling fan, Abnormal temperature error	-	-

Output Terminal Function				When a 4-bit code is selected (with [AC3])		When a 3-bit code is selected (without [AC3])	
AC3	AC2	AC1	AC0	Cause code	Trip description	Cause code	Trip description
1	1	1	0	E024, E034	Input open-phase error, Output open-phase error	-	-
1	1	1	1	Other than above	EzSQ assignment error 0 to 9, etc.	-	-

8-6-4 Overload Warning Function (OL / OL2)

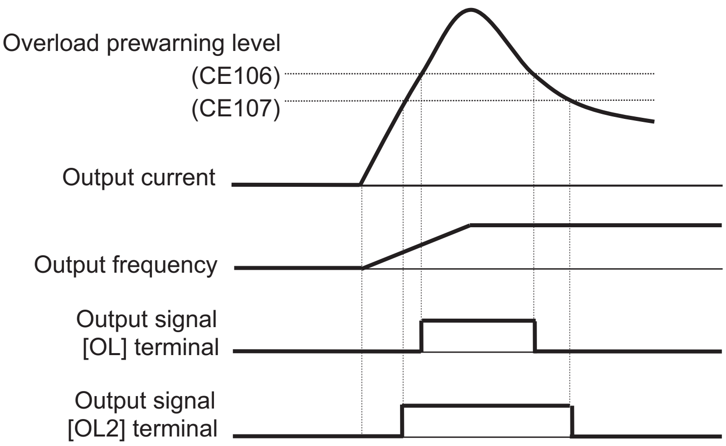
Overload warning outputs a warning signal before a trip due to a Motor overload error occurs. By using this signal, it is possible to prevent the failure of machines such as conveyors when the load increases due to overloading, and to prevent the transfer line from stopping due to an inverter motor overload error.

Assign either the overload advance notice signal 1 [35: OL] or the overload advance notice signal 2 [36: OL2] to one of **Output terminal selection** (CC-01) to (CC-07). The Overload advance notice signals [35: OL] and [36: OL2] are output when the output current exceeds their respective Over current detection level 1 values.
By setting the **Overload advance notice signal output mode selection** (CE105), a signal can be output according to the operating status.

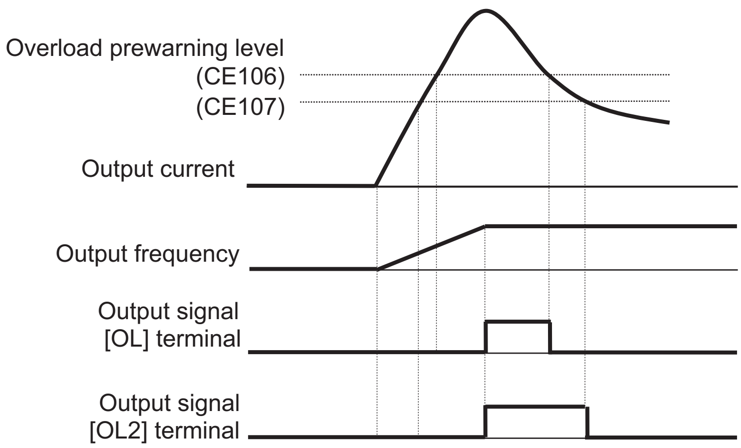
Precautions for Correct Use

- If the Overcurrent detection level is set too high, an overcurrent error may occur before the signal is output. In this case, lower the over current detection level.
- When analog input is used as the frequency command, it may not be judged as constant speed if the frequency input fluctuates finely. In which case, change the **Over current signal output mode selection** (CE105) setting to *00: During acceleration/deceleration, at constant speed*.

When **Over current signal output mode selection** (CE105) is set to *00: During acceleration/deceleration, at constant speed*



When **Over current signal output mode selection** (CE105) is set to *01: Only at constant speed*



● Parameter

Item	Parameter	Data	Description	Default
Output terminal selection 11 to 15	CC-01 to CC-05	035 036	Overload advance notice 1 [35: OL] is output. Overload advance notice 2 [36: OL2] is output. OFF: Below the over-current detection level ON: Above the over-current detection level	-
Relay output terminal function 16A-16C	CC-06			-
Relay output terminal AL1-AL0 / AL2-AL0	CC-07			-
Over current signal output mode selection	CE105	00	Valid in operation.	01
		01	Valid only in constant speed operation	
Over current detection signal level 1	CE106	(0.0 to 2.0) × Inverter rated current *1	Set the current level at which to output the Overload advance notice signal. A signal is output when the current exceeds the Overload advance notice signal level.	1.0 × Inverter rated current
Over current detection signal level 2	CE107			1.0 × Inverter rated current

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V. When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. If **Resister data selection** (CF-11) is not set to *00: A,V*, data cannot be set, or displayed correctly.
2. Modbus: Current and voltage vary, depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A, V*, 0.1 A, 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. Drive programming: 0.01% (Rated ratio)

8-6-5 Low Current Signal (LOC)

The low current signal is output when the output current goes below the value set for **Low current detection level** (CE102). When the load becomes lighter, a low current detection signal is output.

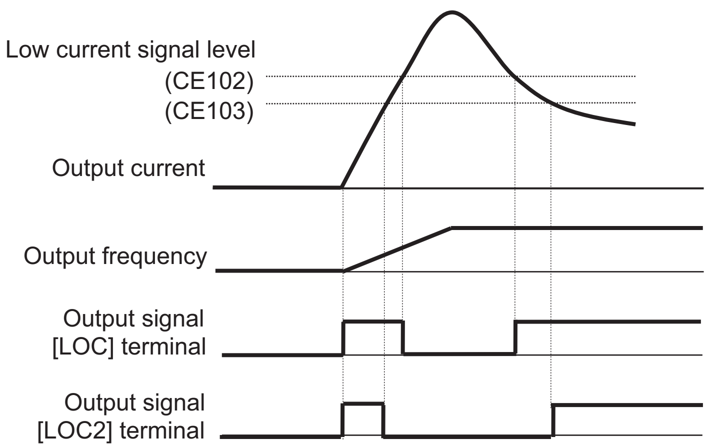
Set either the low current signal 1 [33: LOC] or the low current signal 2 [34: LOC2] terminal to one of **Output terminal selection** (CC-01) to (CC-07).

There are two Low current signals. Low current signal 1 [33: LOC] terminal outputs when the output current falls below the value set for **Low current detection level 1** (CE102). Low current signal 2 [34: LOC2] terminal outputs when the output current falls below the value set for **Low current detection level 2** (CE103).
By setting the **Low current signal output mode selection** (CE101), a signal can be output according to the operating status.

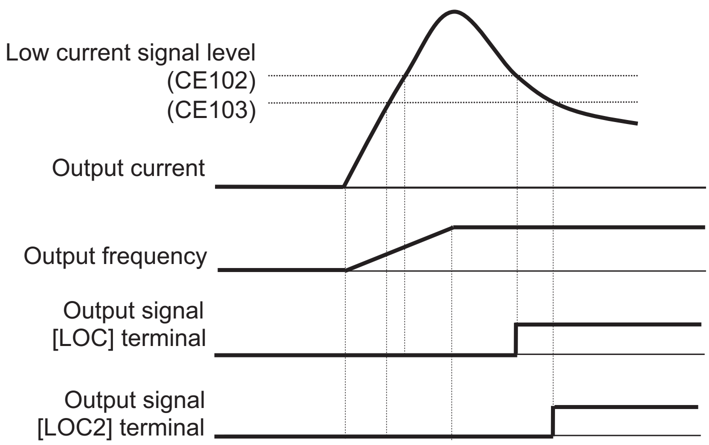
Precautions for Correct Use

When analog input is used as the frequency command, it may not be judged as constant speed if the frequency input fluctuates finely. In which case, change the **Low Current signal output mode selection** (CE101) setting to *00: During acceleration/deceleration, at constant speed*.

When **Low Current signal output mode selection** (CE101) is set to *00: During acceleration/ deceleration, at constant speed*



When **Low current signal output mode selection** (CE101) is set to *01: Only at constant speed*



● Parameter

Item	Parameter	Data	Description	Default
Output terminal selection 11 to 15	CC-01 to CC-05	033 034	Low Current 1 [33: LOC] is output. Low Current 2 [34: LOC2] is output. OFF: Below low current signal level ON: At or above low current signal level	-
Relay output terminal function 16A-16C	CC-06			-
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07			-
Low current signal output mode selection	CE101	00	Valid at deceleration and constant speed operation.	01
		01	Valid only in constant speed operation	
Low current detection level 1	CE102	(0.0 to 2.0) × Inverter rated current *1	Set the current level at which to output the low current notice signal. A signal is output when the current exceeds the low current detection level.	1.0 × Inverter rated current
Low current detection level 2	CE103			1.0 × Inverter rated current

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

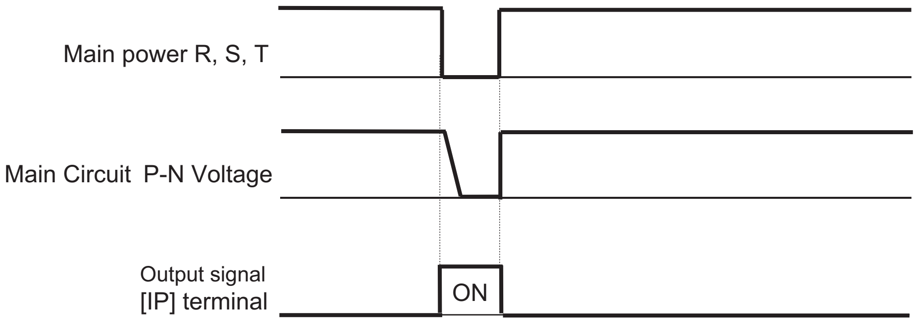
1. Operator or CX-Drive: 0.1 A or 0.1 V. When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A, V*, 0.1 A, 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. Drive programming: 0.01% (Rated ratio)

8-6-6 Momentary Power Interruption Signal (IP)

The momentary power interruption signal is output when a momentary power failure occurs in the inverter main power supply. An interruption in the main power can be output as a signal when the control power is supplied via a separate line.

Assign momentary power interruption signal [20: IP] to one of **Output terminal function** (CC-01) to (CC-07).
[20: IP] is valid when the main power is input from R, S, T. [20: IP] is output while the control power supply of the inverter remains (including 24V power supply).

(Momentary power interruption example)



Additional Information

For how to perform a retry restart operation without causing an error when a momentary power failure occurs,
refer to *8-2-6 Restart during Power Interruption / Undervoltage* on page 8-56.

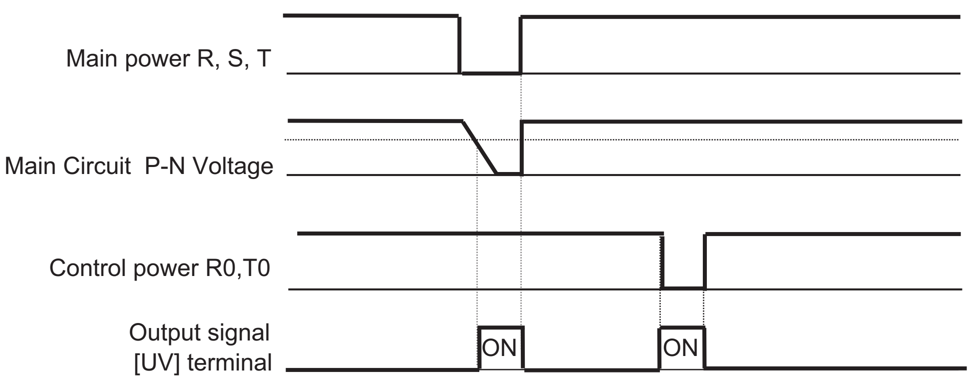
● **Parameter**

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	020	Momentary interruption signal [20: IP] is output. OFF: Input power to R-S-T has been established. ON: Input power to R-S-T was established and then interrupted.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-6-7 Under Insufficient Voltage Signal (UV)

The under insufficient voltage signal is output when a power failure occurs in the main power supply and control power supply.
Set the undervoltage signal [21: UV] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
The under-voltage signal [21: UV] is output while the control power supply of the inverter remains (including 24 V power supply).

(Example of under-voltage)
(R0, T0 / 24 V is supplied by another power supply)



Additional Information

The undervoltage signal [21: UV] detects the undervoltage and outputs it to the [21: UV] terminal regardless of the setting of **Instantaneous power failure / under-voltage trip alarm enable** (bb-27).

● Parameter

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	021	Under-voltage signal [UV] is output. OFF: Internal PN voltage and control power supply are established ON: Insufficient internal PN voltage or control power supply
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-6-8 Motor Thermal Warning Signal (THM)

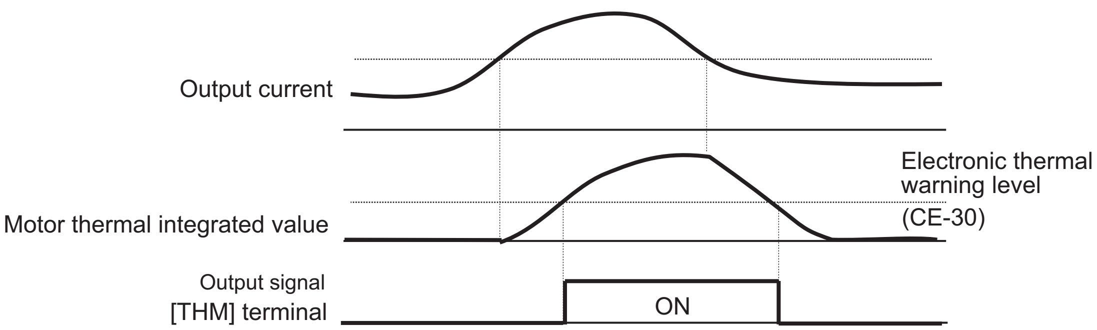
The Thermal warning (Motor) signal outputs a warning signal before a motor overload error (E005) occurs due to the electronic thermal function of the motor.

Assign the electronic thermal warning (motor) signal [26: THM] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
For information on the electronic thermal setting for the motor, refer to *6-6-1 Motor Electronic Thermal* on page 6-53.

Precautions for Correct Use

When the motor's thermal integrated value reaches 100.00%, a motor overload error (E005) occurs.

Example Operation (With Thermal Subtractions Enabled)



● **Parameter**

Item	Parameter	Data	Description	Default
Output terminal selection 11 to 15	CC-01 to CC-05	026	Electronic thermal warning (Motor) signal [26: THM] is output. OFF: Motor thermal integrated value is less than the level ON: Motor thermal integrated value is above the level	-
Relay output terminal function 16A-16C	CC-06			
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07			
Electronic thermal warning level (Motor)	CE-30	0.00 to 100.00 (%)	When the electronic thermal integrated value of the inverter is equal to or higher than the set level, the electronic thermal warning (Motor) [26: THM] is turned ON. No operation if set to 0.00.	80.0

8-6-9 Inverter Thermal Warning Signal (THC)

The electronic thermal warning signal (inverter) outputs a warning signal before the controller overload error (E039) occurs in the electronic thermal function of the inverter.
Assign the electronic thermal warning (inverter) [27: THC] terminal to one of **Output terminal selection**(CC-01) to (CC-07).

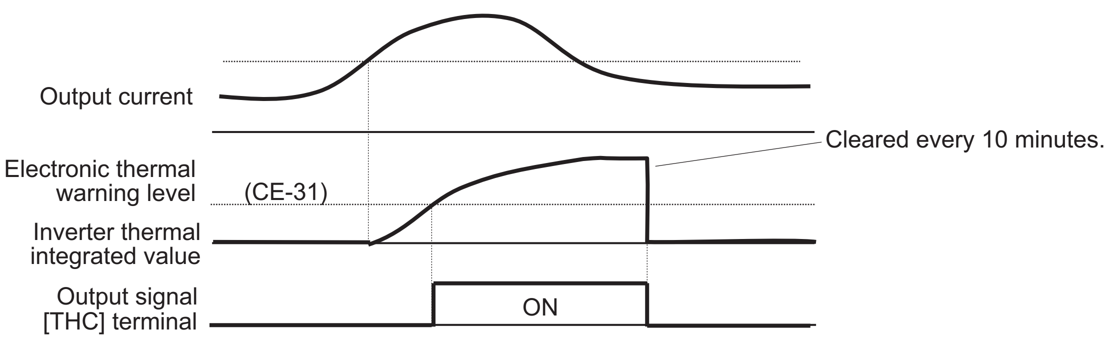
Additional Information

- The inverter electronic thermal has a fixed characteristic for each model type to protect the inverter.
- The inverter electronic thermal integrated value is cleared every 10 minutes. However, if the integration is performed by duplicate processing and the current is high and the integration value is rising, it may not be cleared.

Precautions for Correct Use

When the electronic thermal integrated value reaches 100.00%, a controller overload error (E039) occurs.

● **Operation Example**



● Parameter

Item	Parameter	Data	Description	Default
Output terminal selection 11 to 15	CC-01 to CC-05	027	Electronic thermal warning (inverter) signal [27: THC] is output. OFF: Inverter electronic thermal integrated value is less than the level ON: Inverter electronic thermal integrated value is above the level	-
Relay output terminal function 16A-16C	CC-06			
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07			
Electronic thermal warning level (inverter)	CE-31	0.00 to 100.00 (%)	When the electronic thermal integrated value of the inverter is equal to or higher than the set level, the electronic thermal warning (inverter) [27: THC] is turned ON.	80.0

8-6-10 Cooling Fin Heating Advance Notice (OHF)

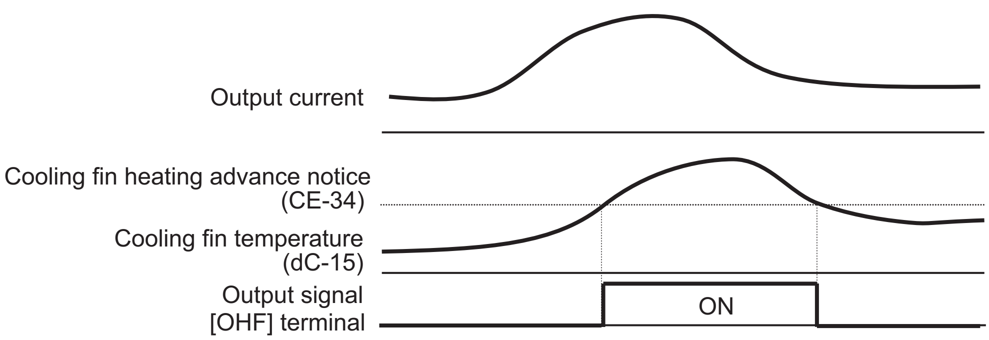
The cooling fin heating advance notice signal outputs a warning signal before a temperature error (E021) occurs in the Cooling fin over-heat warning level function.
Assign the cooling fin heating advance notice signal [32: OHF] terminal to one of **Output terminal selection** (CC-01) to (CC-07).

Set the temperature at which the cooling fin heating warning signal [32: OHF] is turned on in **Cooling fin over-heat warning level** (CE-34). If the cooling fin temperature is above the set level, the cooling fin heating advance notice signal [32: OHF] is turned ON.

Precautions for Correct Use

If the cooling fin temperature exceeds a maximum of 120℃, a temperature error (E021) will occur.

● Operation Example



● Parameter

Item	Parameter	Data	Description	Default
Output terminal selection 11 to 15	CC-01 to CC-05	032	Cooling fin heating advance notice signal [32: OHF] is output. OFF: Fin temperature is below the notice level ON: Fin temperature is above the notice level	-
Relay output terminal function 16A-16C	CC-06			
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07			
Cooling fin overheat warning level	CE-34	0 to 200 (°C)	If the cooling fin temperature is above the set level, the cooling fin heating advance notice signal [32: OHF] is turned ON.	120
Cooling fin temperature monitor	dC-15	-20.0 to +150.0 (℃)	Display the cooling fin temperature.	-

8-6-11 Capacitor Life Advance Notice Signal (WAC)

The capacitor life advance notice signal is output when the life diagnostics determines that the life of the capacitor on the board has expired.
Assign the capacitor life advance notice signal [29: WAC] terminal to one of **Output terminal selection** (CC-01) to (CC-07).

The capacitor life status can be monitored with **Life diagnostic monitor** (dc-16). Refer to *5-9 Life Monitor* on page 5-17.
The display icon on the LCD operator also displays a warning.

Additional Information

Life diagnostics is performed from the temperature inside the inverter and the energization time. For additional information on how capacitor life is judged, refer to *13-5-5 Smoothing Capacitor Life Curve* on page 13-14

Precautions for Correct Use

If a capacitor life warning occurs, it is recommended that you repair or replace the inverter.

● Parameter

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	029	Capacitor life advance notice [29: WAC] signal is output. OFF: No warning ON: Inverter repair or replacement time due to capacitor life
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

Item	Parameter	Data	Description
Life diagnostic monitor	dC-16	LL to HH	It becomes H at the end of its life. To the right is the life of the capacitor on the board. To the left is the cooling fan life.

8-6-12 Fan Life Advance Notice Signal (WAF)

The fan life advance notice function detects that the rotation speed of the inverter's built-in cooling fan has dropped to 75% or less and outputs a signal.
Assign the fan life advance notice signal [30: WAF] terminal to one of **Output terminal selection** (CC-01) to (CC-07). If **Cooling FAN control method selection** (bA-70) is set to *01: ON during operation*, (including 3 minutes after power is turned on and stopped) there will be no output while the fan is stopped.

The fan life status can be monitored with the Life diagnostic monitor. Refer to *5-9 Life Monitor* on page 5-17. The display icon on the LCD operator also displays a warning.

Precautions for Correct Use

If this signal is output, check the cooling fan for clogging.

● Parameter

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	030	Fan life advance notice signal [30: WAF] is output. OFF: No warning ON: Fan rotation speed reduction
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		
Life diagnostic monitor	dC-16	LL to HH	It becomes H at the end of its life. To the right is the life of the capacitor on the board. To the left is the cooling fan life.

8-6-13 RUN Time Elapsed Signal (RNT)

The RUN time elapsed signal is output when the accumulated inverter operation ON time exceeds the set detection time.
Assign the RUN time elapsed signal [24: RNT] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
Specify the RUN time/power-on time level in **Accum.RUN (RNT) / Accum.Power-on (ONT) time setting** (CE-36).

Precautions for Correct Use

When specifying the time level as a guideline for replacement, use a number with an adequate margin.

● **Parameter**

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	024	RUN time elapsed signal [24: RNT] is output. OFF: Below the RUN time level ON: RUN time level exceeded
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		
Accum.RUN (RNT) / Accum.Power-on (ONT) time setting	CE-36	0 to 100000 (hr)	No operation if set to 0. Set 1 to 100,000 hours.
Cumulative operating hours monitor during RUN	dC-22	0 to 100000 (hr)	The time output of the inverter is saved in memory and monitored.

8-6-14 Power ON Time Elapsed Signal

If the total RUN time or ON time of the inverter exceeds the **Accum.RUN (RNT) / Accum.Power-on (ONT) time setting** (CE-36), the inverter will output the power on time over signal (ONT).
Assign the power ON time elapsed signal [25: ONT] to one of **Output terminal selection** (CC-01) to (CC-07).
Set **Accum.RUN (RNT) / Accum.Power-on (ONT) time setting** (CE-36).

Precautions for Correct Use

When specifying the time level as a guideline for replacement, use a number with an adequate margin.

● **Parameter**

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	025	Power ON time elapsed [25: ONT] is output. OFF: Below the Power ON time level ON: Power ON time level exceeded
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		
Accum.RUN (RNT) / Accum.Power-on (ONT) time setting	CE-36	0 to 100000 (hour)	No operation if set to 0. Set 1 to 100,000 hours.
Cumulative power-on time	dC-24	0 to 100000 (hour)	The time from when the the inverter was powered-on is saved in memory and monitored.

8-6-15 Excessive Voltage of Accepted Power (OVS)

The Excessive voltage of accepted power signal is output when the voltage between the PNs of the main circuit exceeds the set voltage level for 100s continuously.
Assign the excessive voltage of accepted power signal [81: OVS] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
Set the incoming voltage level to detect as excessive voltage level in **Power supply over voltage level setting** (bb-62).
When **Power supply over voltage selection** (bb-61) is set to *00: Warning*, the [81: OVS] terminal turns ON.
When **Power supply over voltage selection** (bb-61) is set to *01: Error*, the [81: OVS] terminal turns ON and an incoming overvoltage error (E015) occurs.

Precautions for Correct Use

This function performs detection only when the inverter is stopped. This function does not work while the inverter is in operation.

● Parameter

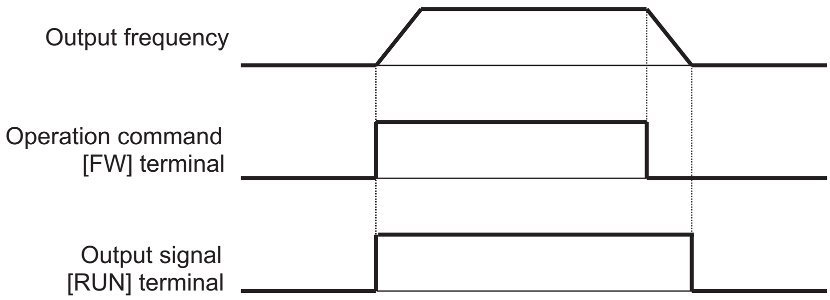
Item	Parameter	Data	Description	Default
Output terminal selection 11 to 15	CC-01 to CC-05	081	The excessive voltage of accepted power [81: OVS] is output when the incoming voltage is high. OFF: Below the excessive voltage of accepted power level ON: above the excessive voltage of accepted power level	-
Relay output terminal function 16A-16C	CC-06			
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07			
Power supply over voltage selection	bb-61	00	Excessive voltage of accepted power [81: OVS] is output.	00
		01	Excessive voltage of accepted power [81: OVS] is output and a trip occurs due to incoming over-voltage error (E015).	
Power supply over voltage level setting	bb-62	200 V Class: 300.0 VDC to 400.0 VDC 400 V Class: 600.0 VDC to 800.0 VDC	Set the incoming over-voltage warning value.	200 V class: 390.0 400 V class: 780.0

8-7 Terminal Output During Run

8-7-1 Operation Command Signal (RUN)

This signal is output while the inverter is in operation.
Assign the during operation [1: RUN] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
The during operation [1: RUN] terminal turns ON when the motor is rotating and operating, and when voltage is being output to the motor, such as during DC braking. The [1: RUN] terminal does not turn ON during retry waiting or DC braking waiting.

Refer to the timing chart below.
The during operation [1: RUN] signal is output until a motor stops even if the operation command [1: FW] is OFF.



● **Parameter**

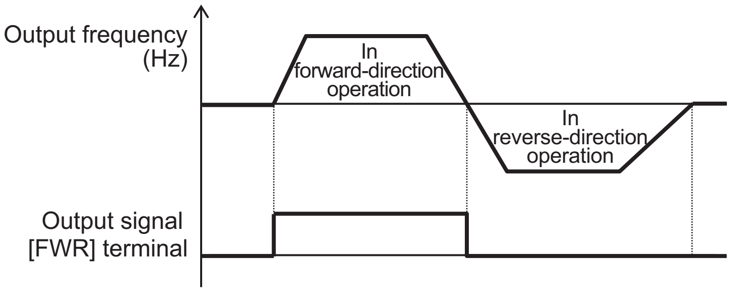
Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	001	Outputs a [1: RUN] signal to the assigned output terminal.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-7-2 During Forward / Reverse Operation Signals (FWR / RVR)

During Normal Rotation Operation Signal [8: FWR]

The during normal rotation operation signal is output during the normal rotation operation of the inverter.
Assign the during normal rotation operation [8: FWR] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
During normal rotation operation signal [8: FWR] terminal is ON while the inverter is in normal rotation operation. The during normal rotation operation [8: FWR] terminal is not turned on during reverse operation and stop.

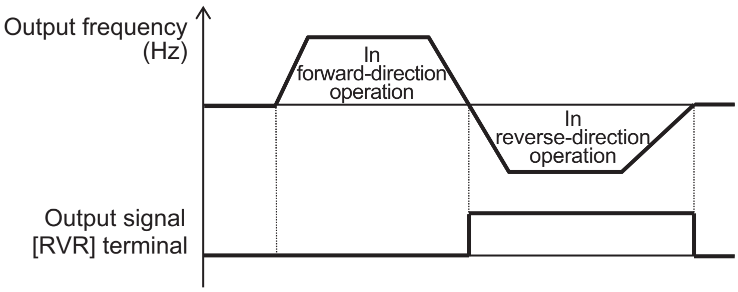
Refer to the timing chart below.



During Reverse Rotation Operation Signal [9: RVR]

The during reverse rotation operation signal is output during the reverse rotation operation of the inverter.
Assign the during reverse rotation operation [9: RVR] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
The during reverse rotation operation signal [9: RVR] terminal is ON while the inverter is in reverse rotation operation. The during reverse rotation operation [9: RVR] terminal is not turned on during forward operation and while stopped.

Refer to the timing chart below.



Precautions for Correct Use

The during normal rotation operation [8: FWR] and the during reverse rotation operation [9: RVR] are not output during DC braking or Servo on.

● Parameter

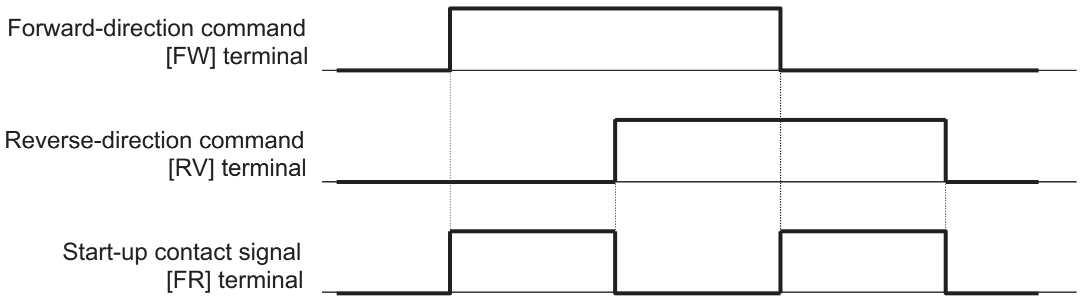
Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	008	During normal rotation operation [8: FWR]: Outputs the during normal rotation operation signal to the assigned output terminal.
Relay output terminal function 16A-16C	CC-06		
		009	During reverse rotation operation [9: RVR]: Outputs the during reverse rotation operation signal to the assigned output terminal.
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-7-3 Operation Command Signal (FR)

The operation command signal is output while the inverter is accepting operation commands.
Assign the operation command [31: FR] terminal to one of **Output terminal selection** (CC-01) to (CC-07).

The operation command signal [31: FR] terminal turns ON while the inverter is accepting operation commands. The operation command [31: FR] outputs according to the reception status of the operation command even if the operation command destination is other than the contact.
Refer to the timing chart below.

(Example) When using terminal command



Precautions for Correct Use

- When operating with the terminal command, if the forward rotation command [1: FW] and the reverse rotation command [2: RV] are input at the same time, the command will be inconsistent and a stop command will be issued. In this case, operation command signal [31: FR] is not output.
- The operation command signal [31: FR] is also output when the voltage is output to the motor, such as during DC braking as well as during motor rotation operation.
- The operation command signal [31: FR] is turned OFF when the operation permission signal [101: REN] is OFF because it cannot be operated.

● Parameter

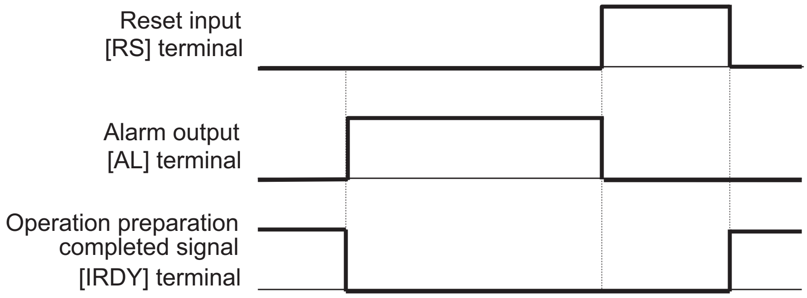
Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	031	Operation command signal [31: FR]: Outputs the operation command signal to the assigned output terminal.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-7-4 Operation Ready Completion Signal (IRDY)

The operation ready completion signal is output when the inverter can accept the operation command.
Assign the operation ready completion [7: IRDY] terminal to one of **Output terminal selection** (CC-01) to (CC-07).

Refer to the timing chart below.

(Example) When using terminal command



Precautions for Correct Use

- If this signal is not output, it will not operate even if an operation command is entered.
- If this signal is not output, check whether the output operation is disabled by conditions such as during preparation for starting when the power is turned on, insufficient input voltage to RST, trips, or a free run stop command.

● Parameter

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	007	Operation ready completion signal [7: IRDY]: Outputs the operation ready signal to the set output terminal.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-8 Frequency Attained Signals

The frequency attained signals are output when the output frequency reaches the specified frequency. The frequency attained signals include constant speed attained [2: FA1], equal to or above the set frequency [3: FA2], set frequency match [4: FA3], equal to or above the set frequency 2 [5: FA4], set frequency match 2 [6: FA5] and 0 Hz detection signal [40: ZS].

8-8-1 When Constant Speed is Attained Signal (FA1)

The constant speed attained signal is output when the output frequency reaches the frequency command.

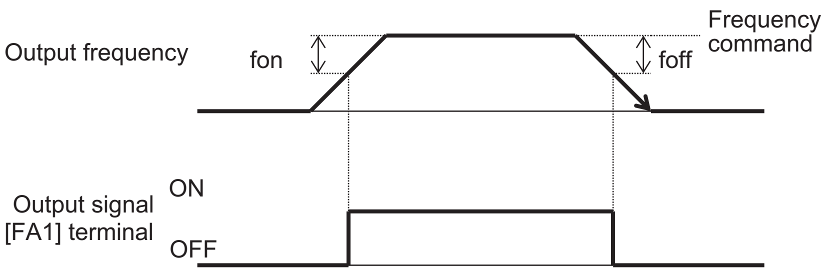
Assign the when constant speed is attained [2: FA1] terminal to one of **Output terminal selection** (CC-01) to (CC-07).

The signal turns ON and OFF at a frequency that includes hysteresis.

- ON: Frequency command - 1% of the maximum frequency (Hz)
- OFF: Frequency command - 2% of the maximum frequency (Hz)

Additional Information

If the frequency command fluctuates due to analog input command, or other factor., the [2: FA1] signal may not be output stably when the constant speed is attained. In this case, the ON / OFF delay function of the output terminal may improve the situation.



fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

(Operation example)
Maximum frequency: 60 Hz
Set frequency: 50 Hz
• fon = 60 × 0.01 = 0.6 Hz
• foff = 60 × 0.02 = 1.2 Hz
• In acceleration: On at 50 - 0.6 = 49.4 Hz
• In deceleration: On at 50 - 1.2 = 48.8 Hz

● Parameter

Item	Parameter	Data	Description
Output terminal selection	CC-01 to CC-05	002	When the constant speed is attained [2: FA1]: Outputs signal to the assigned output terminal when constant speed is attained.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-8-2 Equal to or Above the Set Frequency Signal (FA2 / FA4)

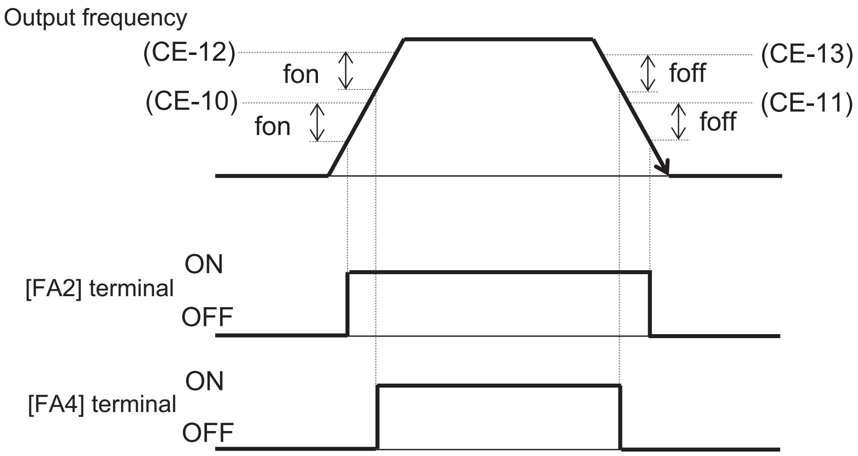
The equal to or above the set frequency signal is output when the output frequency is equal to or higher than the set "attained frequency".
There are two equal to or above the set frequency signals: equal to or above the set frequency [3: FA2] and equal to or above the set frequency 2 [5: FA4].
Assign one of the equal to or above the set frequency signals, [3: FA2] or [5:FA4] to one of **Output terminal selection** (CC-01) to (CC-07).

Set the frequency at which the equal to or above the set frequency [3: FA2] turns ON in **Arrival frequency setting during acceleration 1** (CE-10). Set the frequency at which it turns OFF in **Arrival frequency setting during deceleration 1** (CE-11).
Set the frequency at which the equal to or above the set frequency 2 [5: FA4] turns ON in **Arrival frequency setting during acceleration 2** (CE-12). Set the frequency at which it turns OFF in **Arrival frequency setting during deceleration 2** (CE-13). The **attained frequency** setting is shared with the set frequency match signal.

The signal turns ON and OFF at a frequency that includes hysteresis.

- ON: *Arrival frequency setting during acceleration*−1% of the maximum frequency (Hz)
- OFF: *Arrival frequency setting during deceleration*−2% of the maximum frequency (Hz)

Refer to the timing chart below.



fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

(Operation example)
Maximum frequency: 60 Hz
When (CE-10) = (CE-11) = 50 Hz
• fon = 60 × 0.01 = 0.6 Hz
• foff = 60 × 0.02 = 1.2 Hz
• In acceleration: On at 50 - 0.6 = 49.4 Hz
• In deceleration: On at 50 - 1.2 = 48.8 Hz

● **Parameter**

Item	Parameter	Data	Description
Output terminal selection	CC-01 to CC-05	003 005	Equal to or above the set frequency [3: FA2]: Outputs the equal to or above the set frequency signal to the assigned output terminal. Equal to or above the set frequency 2 [5: FA4]: Outputs the equal to or above the set frequency signal 2 to the assigned output terminal.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		
Arrival frequency setting during acceleration 1	CE-10	0.00 to 590.00 (Hz)	The frequency that determines the attained acceleration when the equal to or above the set frequency [3: FA2] is output.
Arrival frequency setting during deceleration 1	CE-11	0.00 to 590.00 (Hz)	The frequency that determines the attained deceleration when equal to or above the set frequency [3: FA2] is output.
Arrival frequency setting during acceleration 2	CE-12	0.00 to 590.00 (Hz)	The frequency that determines the attained acceleration when the equal to or above the set frequency 2 [5: FA4] is output.
Arrival frequency setting during deceleration 2	CE-13	0.00 to 590.00 (Hz)	The frequency that determines the attained deceleration when the equal to or above the set frequency 2 [5: FA4] is output.

8-8-3 Set Frequency Match Signal (FA3 / FA5)

The set frequency match signal is output when the output frequency matches the **Attained frequency** set.
There are two set frequency match signals: set frequency match [4: FA3] and set frequency match 2 [6: FA5].
Assign one of the set frequency match signals, [4: FA3] or [6:FA5] to one of **Output terminal selection** (CC-01) to (CC-07).

Set the frequency at which the set frequency match [4: FA3] turns ON at acceleration in **Arrival frequency setting during acceleration 1** (CE-10). Set the frequency at which it turns ON at deceleration in **Arrival frequency setting during deceleration 1** (CE-11).
Set the frequency at which the set frequency match 2 [6: FA5] turns ON at acceleration in **Arrival frequency setting during acceleration 2** (CE-12). Set the frequency at which it turns ON at deceleration in **Arrival frequency setting during deceleration 2** (CE-13).
The *attained frequency* setting is shared with the equal to or above the set frequency signals.

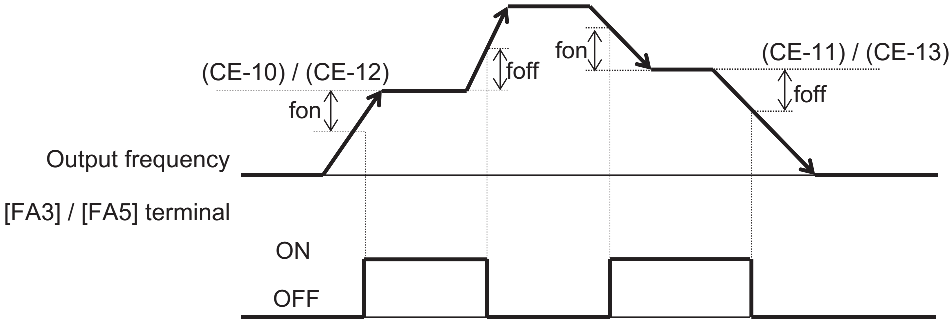
The signal turns ON and OFF at a frequency that includes hysteresis.
The ON and OFF conditions for acceleration are as follows.

- ON: **Arrival frequency setting during acceleration** − 1% of the maximum frequency (Hz)
- OFF: **Arrival frequency setting during acceleration** + 2% of the maximum frequency (Hz)

The ON and OFF conditions for deceleration are as follows.

- ON: **Arrival frequency setting during deceleration** + 1% of the maximum frequency (Hz)
- OFF: **Arrival frequency setting during deceleration** − 2% of the maximum frequency (Hz)

Refer to the timing chart below.



fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

(Operation example)
Maximum frequency: 60 Hz
When (CE-10) = (CE-11) = 50 Hz
• fon = 60 × 0.01 = 0.6 Hz
• foff = 60 × 0.02 = 1.2 Hz
• In acceleration: On at 50 - 0.6 = 49.4 Hz
Off at 50 + 1.2 = 51.2 Hz
• In deceleration: On at 50 + 0.6 = 50.6 Hz
Off at 50 - 1.2 = 48.8 Hz

● Parameter

Item	Parameter	Data	Description	Default
Output terminal selection	CC-01 to CC-05	004 006	Set frequency match [4: FA3]: The attained signal only for the set frequency is output to the assigned output terminal. Set frequency match 2 [6: FA5]: The attained signal 2 only for the set frequency is output to the assigned output terminal.	-
Relay output terminal function 16A-16C	CC-06			
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07			
Arrival frequency setting during acceleration 1	CE-10	0.00 to 590.00 (Hz)	The frequency that determines the attained acceleration when set frequency match [4: FA3] is output.	0.00
Arrival frequency setting during deceleration 1	CE-11	0.00 to 590.00 (Hz)	The frequency that determines the attained deceleration when set frequency match [4: FA3] is output.	0.00
Arrival frequency setting during acceleration 2	CE-12	0.00 to 590.00 (Hz)	The frequency that determines the attained acceleration when set frequency match 2 [6: FA5] is output.	0.00
Arrival frequency setting during deceleration 2	CE-13	0.00 to 590.00 (Hz)	The frequency that determines the attained deceleration when set frequency match 2 [6: FA5] is output.	0.00

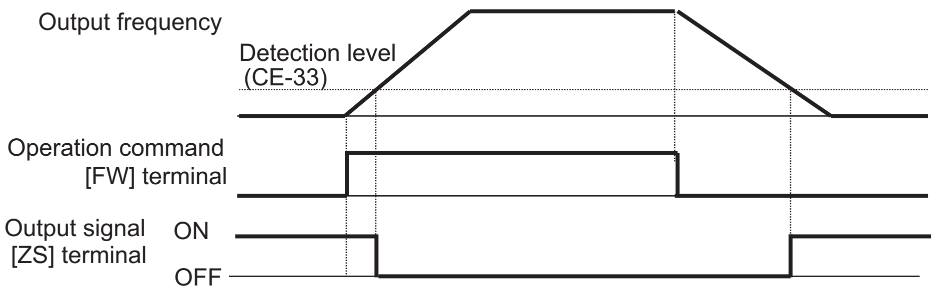
8-8-4 0 Hz Detection Signal (ZS)

The 0 Hz detection signal is output when the output frequency is below the Zero speed detection level.
Assign the 0 Hz detection signal [40: ZS] terminal to one of **Output terminal selection** (CC-01) to (CC-07).
Set the zero speed detection level in **Zero speed detection level** (CE-33).

If the speed is detected using the PG option unit 3G3AX-PX2-PG01, use the absolute value of **Speed detection value monitor** (dA-08) instead of the output frequency.

Precautions for Correct Use

When operation is stopped, the 0 Hz detection signal [40: ZS] is ON because the frequency is 0 Hz.



● Parameter

<table>
<tr><th>Item</th><th>Parameter</th><th>Data</th><th>Description</th><th>Default</th></tr>
<tr><td>Output terminal selection</td><td>CC-01 to CC-05</td><td rowspan="3">040</td><td rowspan="3">0 Hz detection signal [40: ZS]: Outputs the 0 Hz signal to the assigned output terminal.</td><td rowspan="3">-</td></tr>
<tr><td>Relay output terminal function 16A-16C</td><td>CC-06</td></tr>
<tr><td>Relay output terminal function AL1-AL0 / AL2-AL0</td><td>CC-07</td></tr>
<tr><td>Zero speed detection level</td><td>CE-33</td><td>0.00 to 100.00 (Hz)</td><td>The frequency setting value for judging the 0 Hz state when the 0 Hz detection signal [40: ZS] is output.</td><td>0.50</td></tr>
</table>

8-9 Applied Output

8-9-1 Window Comparator Signal (WCAi1 / WCAi2 / WCAi3)

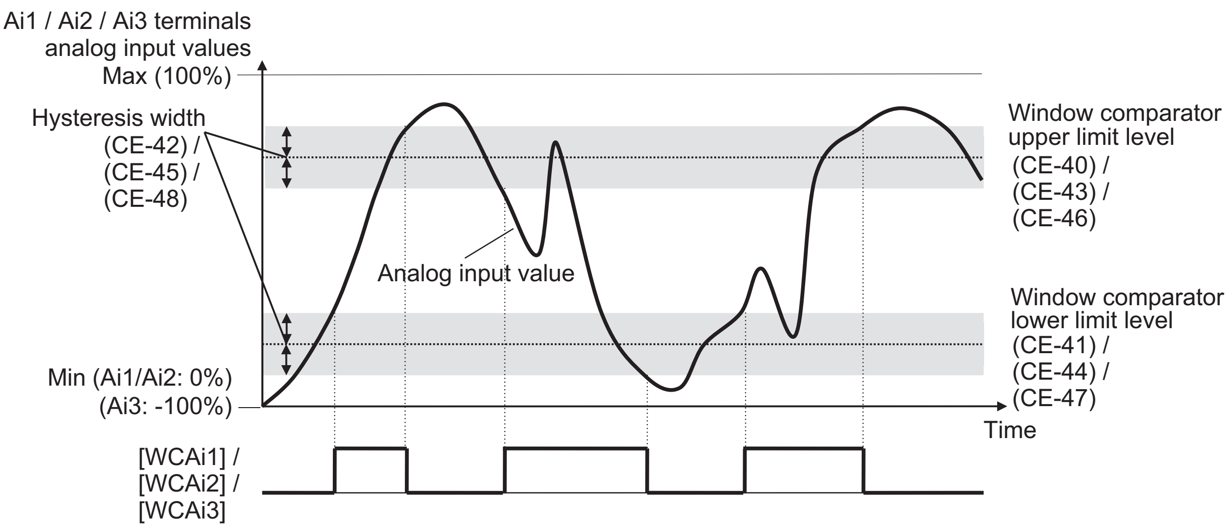
The window comparator signal is output when the analog input value from the analog input [Ai1] / [Ai2] / [Ai3] terminals is within the set range.
There is a window comparator [56: WCAi1] / [57: WCAi2] / [58: WCAi3] for each of the analog inputs [Ai1] / [Ai2] / [Ai3].

Set the window comparator 1 [56: WCAi1], window comparator 2 [57: WCAi2], and window comparator 3 [58: WCAi3] terminals to one of **Output terminal selection** (CC-01) to (CC-07).
Set the upper range limit in **Window Comparator Ai1 / Ai2 / Ai3 upper limit levels** (CE-40), (CE-43), (CE-46).
Set the lower range limit in **Window Comparator Ai1 / Ai2 / Ai3 lower limit levels** (CE-41), (CE-44), (CE-47).

You can set the hysteresis width to the upper and lower limit levels of the window comparator. Set the hysteresis in **Window comparator for [Ai1/Ai2/Ai3] hysteresis width** (CE-42), (CE-45), (CE-48).
The window comparator upper limit level, lower limit level, and hysteresis width are shared with analog disconnection detection.

Additional Information

To prevent signal output when the power is turned on, set **Output terminal on-delay time** (CC-20), (CC-22), (CC-24), (CC-26), (CC-28), (CC-30), (CC-32).



● Parameter

Item	Parameter	Data	Description
Window Comparator Ai1 / Ai2 / Ai3 upper limit levels	Ai1: CE-40 Ai2: CE-43	0 to 100 (%)	Specify the upper limits of the analog inputs. The set ranges are limited to the lower limits and higher.
	Ai3: CE-46	-100 to 100 (%)	

Item	Parameter	Data	Description
Window Comparator Ai1 / Ai2 / Ai3 lower limit levels	Ai1: CE-41 Ai2: CE-44	0 to 100 (%)	Specify the lower limits of the analog inputs. The set ranges are limited to the upper limits and lower.
	Ai3: CE-47	-100 to 100 (%)	
Window comparator Ai1 / Ai2 / Ai3 hysteresis width	Ai1: CE-42 Ai2: CE-45 Ai3: CE-48	0 to 10 (%)	The maximum hysteresis width is limited by (upper limit level - lower limit level) / 2.
Output terminal selection 11 to 15	CC-01 to CC-05	056 057 058	Window comparator [56: WCAi1], [57: WCAi2], and [58: WCAi3] are output to the set output terminal.
Relay output terminal function 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		

8-9-2 Analog Abnormality

This function is used when you want to change the operation when the value from the analog input terminal is different from its normal state.
The Analog disconnection signal is output when the analog input value from the analog input [Ai1] / [Ai2] / [Ai3] terminals are out of the set range.
For each of the analog inputs [Ai1] / [Ai2] / [Ai3], there is a corresponding analog disconnection signal [50: Ai1Dc] / [51: Ai2Dc] / [52: Ai3Dc]. (Hereinafter referred to as [Ai * DC].)

Use the same parameters as those for window comparator for judging what is outside the normal range.
When you wish to output [Ai * DC] outside the range of the window comparator, set **Operation level selection at [Ai*] disconnection** (CE-51), (CE-53), (CE-55) to *02: Enabled: out of range*.
Conversely, if you want to output [Ai * DC] within the range of the window comparator, set it to *01: Enabled: within the range*.
While the analog disconnection signal is ON, the adopted value of the analog input can be fixed to any value.

Additional Information

- To prevent signal output when the power is turned on, set **Output terminal on-delay time** (CC-20), (CC-22), (CC-24), (CC-26), (CC-28), (CC-30), (CC-32).
- When the retention of analog command [19: AHD] is enabled, the held analog input value is adopted as the input value of the window comparator.
- Since the analog disconnection signal is not related errors or alarms, it can be used as normal control even in the ON state.

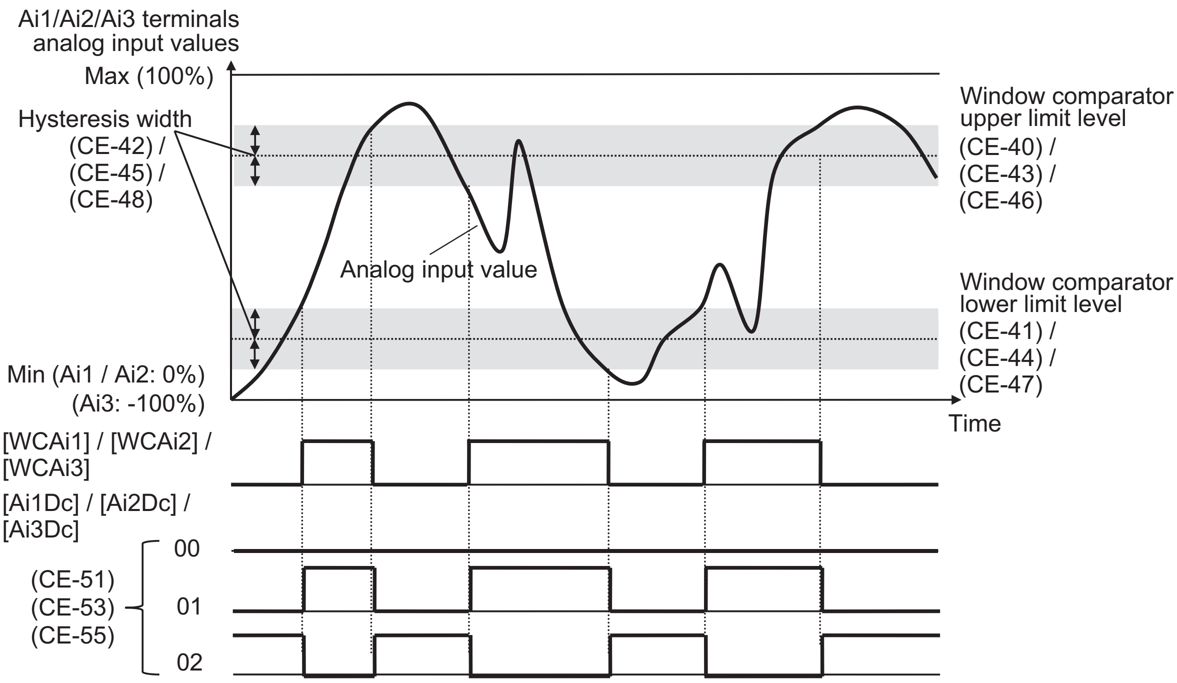
● Parameter

Item	Parameter	Data	Description
Window Comparator Ai1 / Ai2 / Ai3 upper limit levels	Ai1: CE-40 Ai2: CE-43	0 to 100 (%)	Specify the upper limits of the analog inputs. The set ranges are limited to the lower limits and higher.
	Ai3: CE-46	-100 to 100 (%)	

Item	Parameter	Data	Description
Window Comparator Ai1 / Ai2 / Ai3 lower limit levels	Ai1: CE-41 Ai2: CE-44	0 to 100 (%)	Specify the lower limits of the analog inputs. The set ranges are limited to the upper limits and lower.
	Ai3: CE-47	-100 to 100 (%)	
Window comparator Ai1 / Ai2 / Ai3 hysteresis width	Ai1: CE-42 Ai2: CE-45 Ai3: CE-48	0 to 10 (%)	The maximum hysteresis width is limited by (upper limit level - lower limit level) / 2.
Operation level at [Ai1] / [Ai2] / [Ai3] disconnection	Ai1: CE-50 Ai2: CE-52	0 to 100 (%)	Specify the input value when the input is within the range according to the operation level selection.
	Ai3: CE-54	-100 to 100 (%)	
[Ai1] / [Ai2] / Operation level selection at [Ai1] disconnection	Ai1: CE-51 Ai2: CE-53 Ai3: CE-55	00	Disabled
		01	When valid WC signal is operating (within range)
		02	When valid WC signal is not operating (outside range)

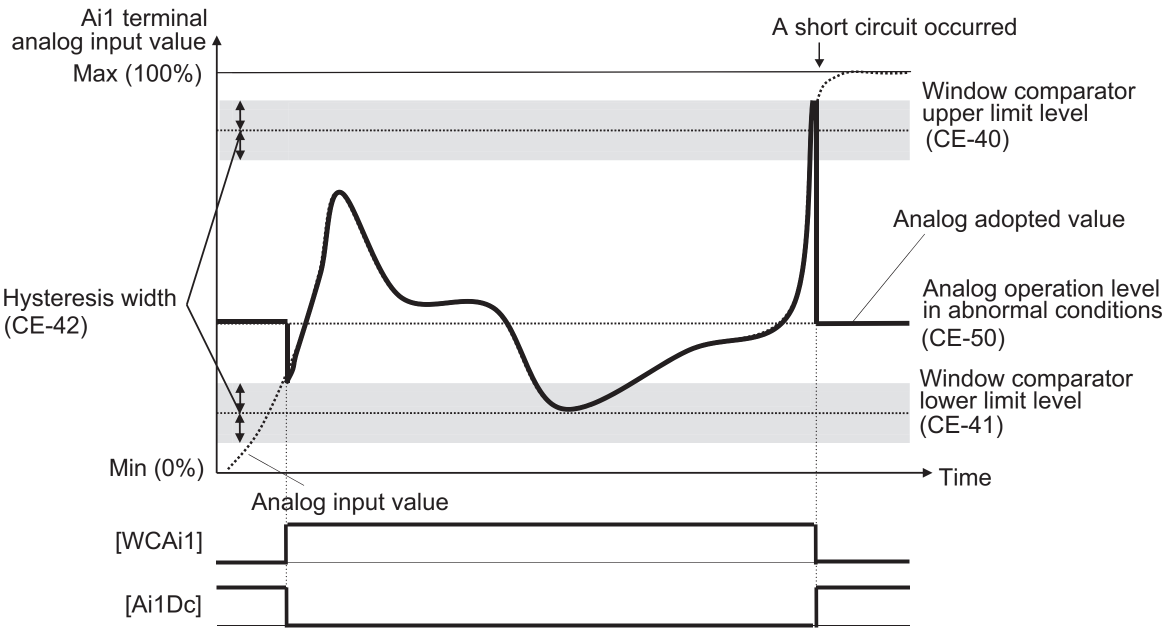
● Output Terminal Selection Parameter

Item	Parameter	Data	Description
Output terminal selection 11-15	CC-01 to CC-05	050 051 052	Output analog disconnection [50: Ai1Dc], [51: Ai2Dc], [52: Ai3Dc] to the set output terminal.
Relay output terminal selection 16A-16C	CC-06		
Relay output terminal function AL1-AL0 / AL2-AL0	CC-07		



Outside of Range Abnormality

Example for when **Operation level selection at [Ai1] disconnection** (CE-51), (CE-53), (CE-55) is set to *02: Enabled: out of range*.
The example is shown using the [Ai1] terminal, [WCAi1], and [Ai1Dc].

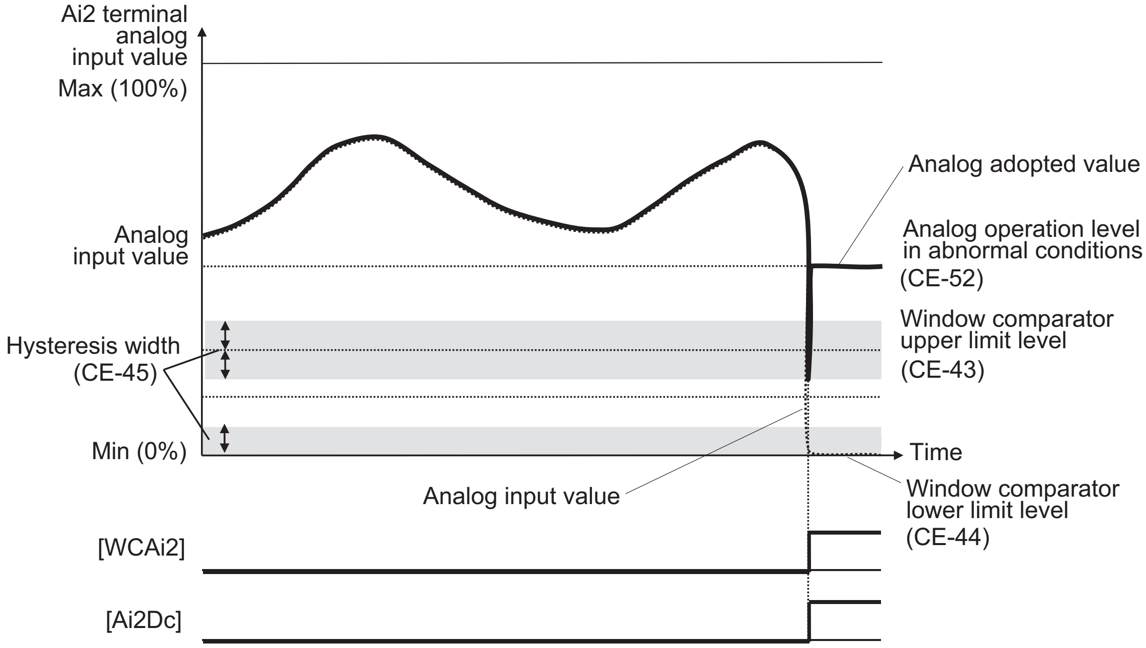


As shown in the figure, immediately after starting and when the voltage rises due to disconnection, it is out of range and the [Ai1Dc] terminal is ON.

Inside of Range Abnormality

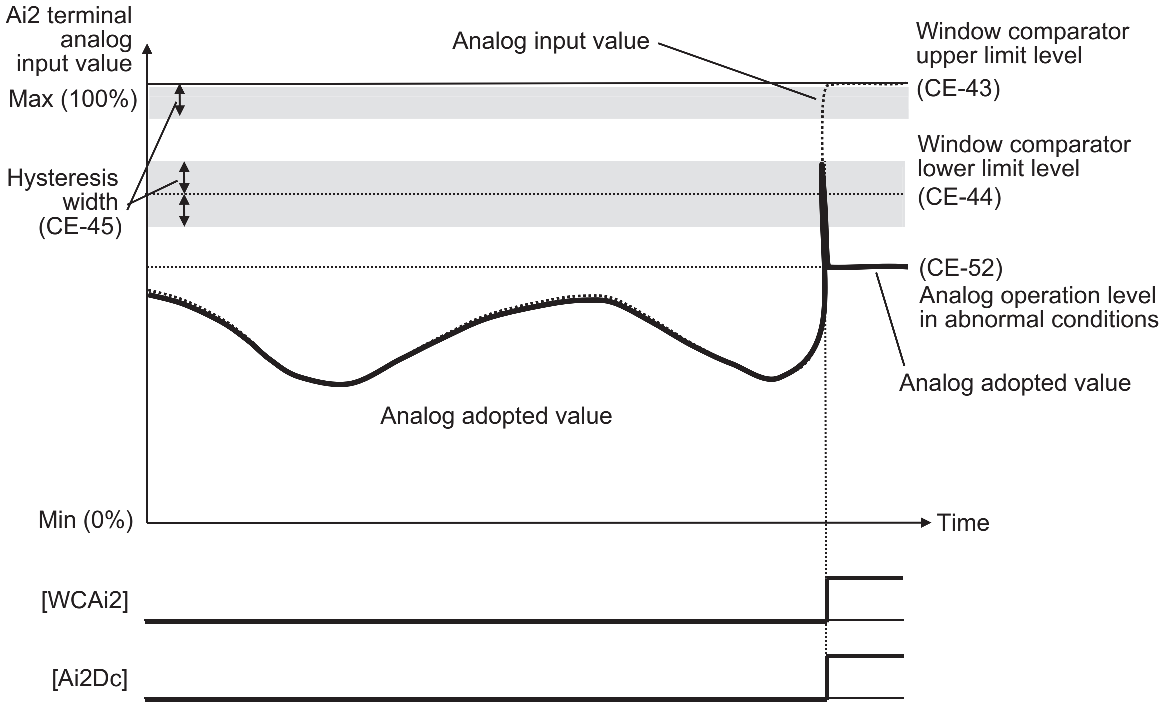
Example of when **Operation level selection at [Ai1] disconnection** (CE-51), (CE-53), (CE-55) is set to *01: Enabled: within the range*.
The example is shown using the [Ai2] terminal, [WCAi2], and [Ai2Dc].

- When you need to be vigilant about the minimum value (Min)



Normally, it is judged to be normal because it exceeds the upper limit level (CE-43). If the upper limit level is exceeded due to a short circuit, etc., the [Ai2Dc] terminal turns ON.

- When you need to be vigilant about the Maximum value (Max)



Normally, it is judged to be normal because it is below the lower limit level (CE-44). If the lower limit level is exceeded due to disconnection, etc., the [Ai2Dc] terminal turns ON.

Analog Adoption Value at Abnormality

The adopted value of the analog input can be fixed to any value according to the output of the analog disconnection [50: Ai1Dc] / [51: Ai2Dc] / [52: Ai3Dc].

In the case where **Operation level selection at [Ai1]/ [Ai2]/ [Ai3] disconnection** (CE-51), (CE-53), (CE-55) are set to *01: Enabled: within the range* (WC signal in operation), or set to *02: out of range* (WC signal not in operation), the analog adoption value is fixed to be at the same time when the analog disconnection [50: Ai1Dc] / [51: Ai2Dc] / [52: Ai3Dc] turns ON.

Set the analog input adoption value to set as a fixed value in **Operation level at [Ai3] disconnection** (CE-50), (CE-52), (CE-54).

8-9-3 Logical Operation Output Signal (LOG1) to (LOG7)

The logical operation output signal outputs the result of the inverter's internal logical operation of the output signal.
There are three operators that can be selected: AND, OR, and XOR.
Logical operations can be performed on all output signals except for Logical operation output [62: LOG1] to [68: LOG7].

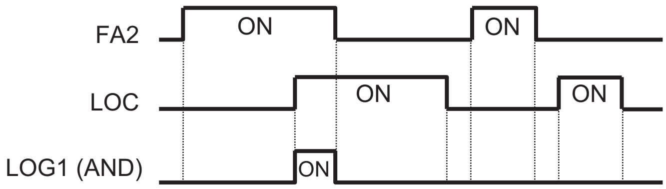
Assign the logical calculation terminals 1 [62: LOG1] to 7 [68: LOG7] to one of **Output terminal selection** (CC-01) to (CC-07).

The parameters that need to be set differ depending on the selected logical operation result. Set the required parameters referring to the table below.

Selected symbol	Logical operation target 1 selection	Logical operation target 2 selection	Operator selection
068: Logical operation output signal 1 (LOG1)	CC-40	CC-41	CC-42
069: Logical operation output signal 2 (LOG2)	CC-43	CC-44	CC-45
070: Logical operation output signal 3 (LOG3)	CC-46	CC-47	CC-48
071: Logical operation output signal 4 (LOG4)	CC-49	CC-50	CC-51
072: Logical operation output signal 5 (LOG5)	CC-52	CC-53	CC-54
073: Logical operation output signal 6 (LOG6)	CC-55	CC-56	CC-57
074: Logical operation output signal 7 (LOG7)	CC-58	CC-59	CC-60

(Example 1) Turn on the logical operation output when the current drops after the frequency is established.
This is achieved by performing an AND operation with the equal to or above the set frequency signal [3: FA2] and the low current signal [33: LOC].

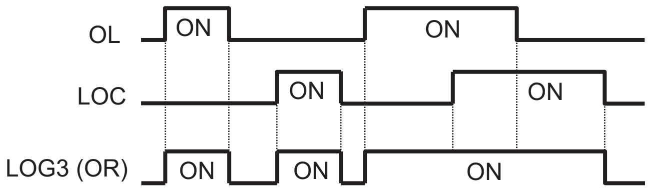
- **Output terminal [11] function** (CC-01): *62: LOG1*
- **Logical calculation target 1 selection of LOG1** (CC-40): *3: FA2*
- **Logical calculation target 2 selection of LOG1** (CC-41): *33: LOC*
- **Logical calculation symbol selection of LOG1** (CC-42): *00: AND*



(Example 2) Turn on the logical operation output when the current is out of range.

This is achieved by performing an OR operation of the over current detection signal [35: OL] and the electronic thermal warning signal [26: THM].

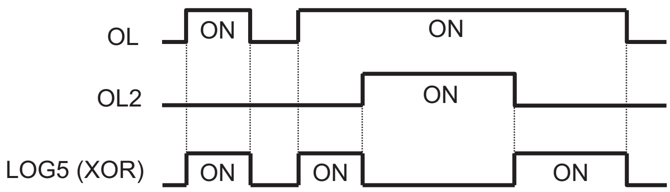
- **Output terminal [12] selection** (CC-02): *64: LOG3*
- **Logical calculation target 1 selection of LOG2** (CC-43): *35: OL*
- **Logical calculation target 2 selection of LOG2** (CC-44): *26: THM*
- **Logical calculation symbol selection of LOG2** (CC-45): *01: OR*



(Example 3) Turn on the logical operation output when the current is within a certain range.

This is achieved by performing an XOR operation of the over current detection signal [35: OL] and the over current detection signal 2 [36: OL2].

- **Output terminal [13] selection** (CC-03): *66: LOG5*
- **Logical calculation target 1 selection of LOG3** (CC-46): *35: OL*
- **Logical calculation target 2 selection of LOG3** (CC-47): *36: OL2*
- **Logical calculation symbol of LOG3** (CC-48): *02: XOR*



● Parameter

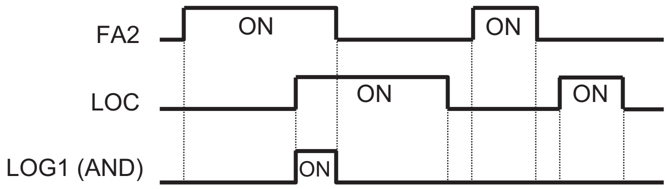
Item	Parameter	Data	Description
Output terminal selection Relay output Terminal selection	CC-01 to CC-05	062 063 064 065 066 067 068	LOG1 Logical calculation target 1 LOG2 Logical calculation target 2 LOG3 Logical calculation target 3 LOG4 Logical calculation target 4 LOG5 Logical calculation target 5 LOG6 Logical calculation target 6 LOG7 Logical calculation target 7
16 Relay output Terminal selection	CC-06		
AL Relay output Terminal selection	CC-07		
Logical calculation symbol target 1 selection	CC-40, CC-43, CC-46, CC-49, CC-52, CC-55, CC-58	Select from output terminal selection data (excluding LOG1 to LOG7)	Select calculation 1
Logical calculation symbol target 2 selection	CC-41, CC-44, CC-47, CC-50, CC-53, CC-56, CC-59	Select from output terminal selection data (excluding LOG1 to LOG7)	Select calculation 2
Logical calculation symbol Calculation symbol selection	CC-42, CC-45, CC-48, CC-51, CC-54, CC-57, CC-60	00	AND
		01	OR
		02	XOR

■ Examples

(Example 1)） Turn on the logical operation output when the current drops after the frequency is established.

This is achieved by performing an AND operation with the equal to or above the set frequency signal [3: FA2] and the low current signal [33: LOC].

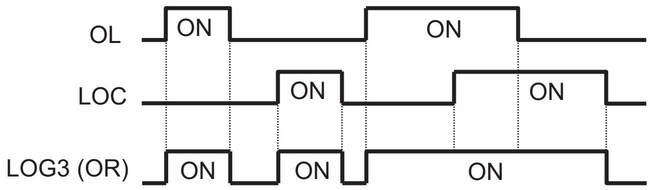
- **Output terminal [11] function** (CC-01) : *62: LOG1*
- **Logical calculation target 1 selection of LOG1** (CC-40) : *3: FA2*
- **Logical calculation target 2 selection of LOG1**(CC-41) : *33: LOC*
- **Logical calculation symbol selection of LOG1** (CC-42) : *00: AND*



(Example 2) Turn on the logical operation output when the current is out of range.

This is achieved by performing an OR operation of the over current detection signal [35: OL] and the electronic thermal warning signal [26: THM].

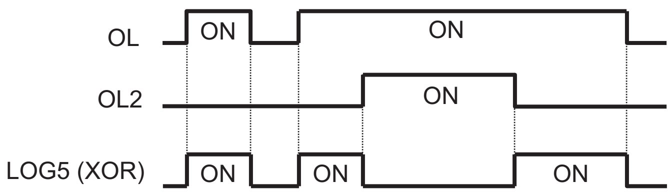
- **Output terminal [12] selection** (CC-02) : *64: LOG3*
- **Logical calculation target 1 selection of LOG2** (CC-43) : *35: OL*
- **Logical calculation target 2 selection of LOG2** (CC-44) : *26: THM*
- **Logical calculation symbol selection of LOG2** (CC-45) : *01: OR*



(Example 3) Turn on the logical operation output when the current is within a certain range.

This is achieved by performing an XOR operation of the over current detection signal [35: OL] and the over current detection signal 2 [36: OL2].

- **Output terminal [13] selection** (CC-03) : *66: LOG5*
- **Logical calculation target 1 selection of LOG3** (CC-46) : *35: OL*
- **Logical calculation target 2 selection of LOG3** (CC-47) : *36: OL2*
- **Logical calculation symbol of LOG3** (CC-48) : *02: XOR*



8-10 Input Terminal Function

8-10-1 Overview

The inverter has 11 input terminals. Input terminals 1 to 9, A, and B are open collector inputs. Pulse input is possible for Terminals A and B.
To use the input terminal function, set the function you want to use to **Input terminals [1] to [B] selection** (CA-01) to (CA-11).

Set the input signal logic in **Input terminal active state** (CA-21) to (CA-31).
If the same function is set for multiple input terminals, the one with the last parameter number is valid.

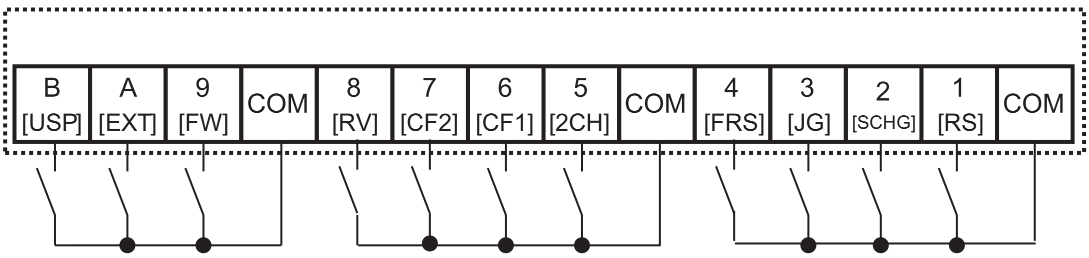
Precautions for Correct Use

If you want to use the input terminal function at the input terminals [A] and [B], set **Pulse train detection (internal) control terminal [A] [B]** (CA-90) to *00: Disabled*. If anything other than *00: Disabled* is selected, the settings for **Input terminal [A] function** (CA-10) and **Input terminal [B] function** (CA-11) will be ignored.
For details, refer to *8-14 Pulse String Input Terminal Function* on page 8-195.

● Parameter

Item	Parameter	Data	Description
Input terminal function	CA-01 to CA-11	Refer to *List of Input Terminal Functions* on page 8-160.	Operates function assigned to the input terminal.
Input terminal active state	CA-21 to CA-31	00	Operates normally open: NO
		01	Operates normally closed: NC

● Terminals Corresponding to Parameters



● List of Input Terminal Functions

Function No.	Abbreviation	Function Name	Page
000	no	Without allocation	-
001	FW	Normal rotation	page 6-19
002	RV	Reverse rotation	page 6-19
003	CF1	Multistage speed 1	page 6-38
004	CF2	Multistage speed 2	page 6-38
005	CF3	Multistage speed 3	page 6-38
006	CF4	Multistage speed 4	page 6-38

Function No.	Abbre-viation	Function Name	Page
007	SF1	Multispeed bit 1	page 6-38
008	SF2	Multispeed bit 2	page 6-38
009	SF3	Multispeed bit 3	page 6-38
010	SF4	Multispeed bit 4	page 6-38
011	SF5	Multispeed bit 5	page 6-38
012	SF6	Multispeed bit 6	page 6-38
013	SF7	Multispeed bit 7	page 6-38
014	ADD	Addition of frequency	page 6-42
015	SCHG	Switching of command	page 6-35
016	STA	3-wire starting up	page 6-20
017	STP	3-wire stopping	page 6-20
018	F/R	3-wire normal and reverse	page 6-20
019	AHD	Retention of analog command	page 6-45
020	FUP	Acceleration through remote operation	page 6-43
021	FDN	Deceleration through remote operation	page 6-43
022	UDC	Clearing of remote operation data	page 6-43
023	F-OP	Forced switching of command	page 6-45
024	SET	Second control	page 8-78
028	RS	Reset	page 8-164
029	JG	Jogging	page 8-81
030	DB	Braking with external direct current	page 7-51
031	2CH	2-step acceleration/deceleration	page 6-65
032	FRS	Free-run stop	page 7-69
033	EXT	External abnormality	page 8-71
034	USP	Prevention of power restoration restarting	page 8-72
035	CS	Commercial switch	page 8-79
036	SFT	Soft Lock	page 3-52
037	BOK	Brake check	page 8-83
038	OLR	Switching of overload limit	page 8-45
039	KHC	Clearing of integrated input power	page 8-45
040	OKHC	Clearing of integrated output power	page 5-15
041	PID	PID1 Disable	page 8-7
042	PIDC	PID1 Integration Reset	page 8-7
043	PID2	PID2 disabled	page 8-28
044	PIDC2	Resetting of PID2 integration	page 8-28
045	PID3	PID3 disabled	page 8-28
046	PIDC3	Resetting of PID3 integration	page 8-28
047	PID4	PID4 disabled	page 8-28
048	PIDC4	Resetting of PID4 integration	page 8-28
051	SVC1	PID1 Multi stage set-point 1 setting	page 8-7
052	SVC2	PID1 Multi stage set-point 2 setting	page 8-7
053	SVC3	PID1 Multi stage set-point 3 setting	page 8-7
054	SVC4	PID1 Multi stage set-point 4 setting	page 8-7
055	PRO	Switching of PID gain	page 8-7
056	PIO1	Switching of PID output	page 8-28
057	PIO2	Switching of PID output 2	page 8-28

Function No.	Abbre-viation	Function Name	Page
058	SLEP	Satisfaction of SLEEP condition	page 8-24
059	WAKE	Satisfaction of WAKE condition	page 8-24
060	TL	Validation of torque limit	page 7-38
061	TRQ1	Torque limit switchover 1	page 7-38
062	TRQ2	Torque limit switchover 2	page 7-38
063	PPI	PPI control switch	page 7-33
064	CAS	Control gain switch	page 7-33
065	SON	Servo-on	page 8-121
066	FOC	Auxiliary excitation	page 7-58
067	ATR	Validation of torque control	page 7-46
068	TBS	Validation of torque bias	page 7-44
069	ORT	Orientation	page 8-104
071	LAC	Cancellation of LAD	page 6-64
072	PCLR	Clearing of positional deviation	page 8-98
073	STAT	Permission to inputting of Pulse string position command	page 8-98
074	PUP	Addition of positional bias	page 8-98
075	PDN	Subtraction of positional bias	page 8-98
076	CP1	Positional command selection 1	page 8-111
077	CP2	Positional command selection 2	page 8-111
078	CP3	Positional command selection 3	page 8-111
079	CP4	Positional command selection 4	page 8-111
080	ORL	Origin limit signal	page 8-116
081	ORG	Return-to-origin start up signal	page 8-116
082	FOT	Stopping of normal rotation driving	page 8-119
083	ROT	Stopping of reverse rotation driving	page 8-119
084	SPD	Switching of speed position	page 8-113
085	PSET	Presetting of positional data	page 8-120
086	Mi1	General purpose input 1	-
087	Mi2	General purpose input 2	-
088	Mi3	General purpose input 3	-
089	Mi4	General purpose input 4	-
090	Mi5	General purpose input 5	-
091	Mi6	General purpose input 6	-
092	Mi7	General purpose input 7	-
093	Mi8	General purpose input 8	-
094	MI9	General purpose input 9	-
095	MI10	General purpose input 10	-
096	MI11	General purpose input 11	-
097	PCC	Clearing of pulse counter	page 8-169
098	ECOM	Starting up of EzCOM	page 9-137
099	PRG	Starting of EzSQ program	page 6-34
100	HLD	Stopping of acceleration/deceleration	page 6-74
101	REN	Operation permission signal	page 6-51
102	DISP	Fixation of display	page 3-54
103	PLA	Pulse string input A	page 8-169

Function No.	Abbre-viation	Function Name	Page
104	PLB	Pulse string input B	page 8-169
105	EMF	Emergency forced operation	page 8-94
107	COK	Contactor check signal	page 8-89
109	PLZ	Pulse string input Z	page 8-104
110	TCH	Teaching signal	page 8-114

8-10-2 Input Terminal Active State

You can set Contact a or Contact b for each of the input terminals [1] to [9], [A], and [B].

- Operating as Contact a: **ON** closes the contact and **OFF** opens the contact.
- Operating as Contact b: **OFF** closes the contact and **ON** opens the contact.

Precautions for Correct Use

Even if you use the input terminal a / b selection on the terminal where the reset [28: RS] signal is set, it always operates as Contact a (NO).

● Parameter

Item	Parameter	Data	Description
Input terminals [1] to [9], [A], [B] active state	CA-21 to CA-31	00	Contact a (NO: Normally open).
		01	Contact b (NC: Normally closed).

8-10-3 Input Terminal Response Time

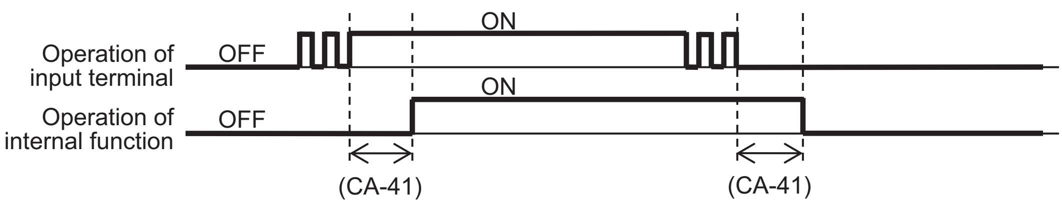
You can set the response time of the input terminals for each input terminal. It can be used to remove noise such as chattering of input signals.
If stable terminal input is not possible, increase the data value. However, the larger the data value, the less responsive it is.

● Parameter

Item	Parameter	Data	Description
Input terminals [1] to [9], [A], [B] response time [A], [B] response time	CA-41 to CA-49, CA-50, CA-51	0 to 400 (ms) *1	Set the response time.

*1. When set to "0", it operates in about 1ms.

(Example 1) Input terminal 1 operation



8-10-4 Reset

When an inverter trip occurs, it can be reset using the reset function.
To reset, press the Stop / Reset key of the LCD operator or turn ON the reset [28: RS] terminal.
To use the reset terminal, assign the reset signal [28: RS] to one of **Input terminal function** (CA-01) to (CA-11).

The [28: RS] terminal operates with the Contact a (NO) regardless of the setting.
Set the timing for resetting a trip by [28: RS] terminal in **Reset mode selection** (CA-72). It is also possible to enable the [28: RS] terminal to reset a trip only in the event of an abnormality.

Refer to *7-5-5 Restart After Reset Release* on page 7-64

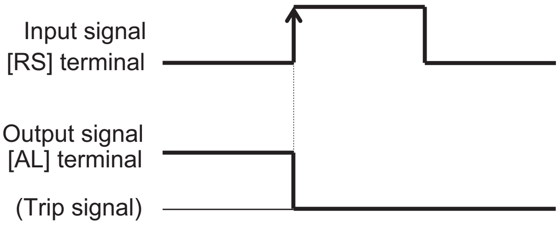
Precautions for Correct Use

- Do not use the reset [28: RS] terminal for the purpose of shutting off the output of the inverter. When shutting off the output of the inverter by signal input, use the free-run stop [32: FRS] terminal of the input terminal functions.
- If a reset signal is input while waiting for a retry, the system will start without the frequency at the time of interruption being cleared

● Parameter

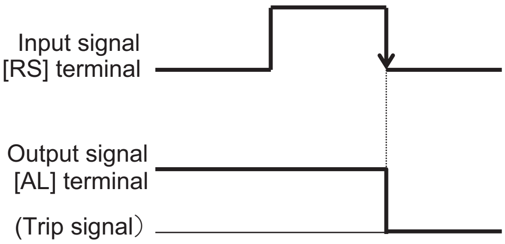
Item	Parameter	Data	Description	Default
Reset mode selection	CA-72	00	Cancel trip when ON (Examples 1 and 3) Normal operation: Output shutoff Abnormal operation: Cancel trip	00
		01	Cancel trip when OFF (Examples 2 and 3) Normal operation: Output shutoff Abnormal operation: Cancel trip	
		02	Cancel trip when ON (Examples 1 and 4) Normal operation: Disabled Abnormal operation: Cancel trip	
		03	Cancel trip when OFF (Examples 2 and 4) Normal operation: Disabled Abnormal operation: Cancel trip	
Input terminals [1] to [9], [A], [B]	CA-01 to CA-11	028	Reset [28: RS] function	-

(Example 1) Cancel trip when ON
When **Reset mode selection** (CA-72) is set to *00: On to Release Trip* or *02: On to Release at Trip*.



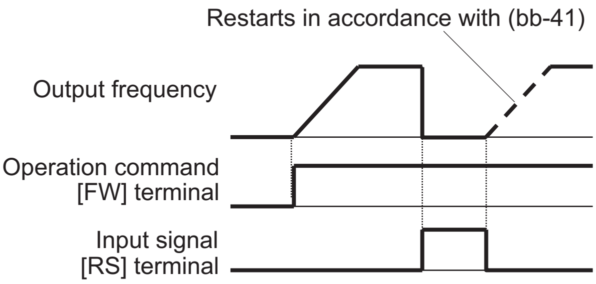
(Example 2) Cancel trip when OFF

When **Reset mode selection** (CA-72) is set to *01: OFF to Release Trip* or *03: Off to Release at Trip*.



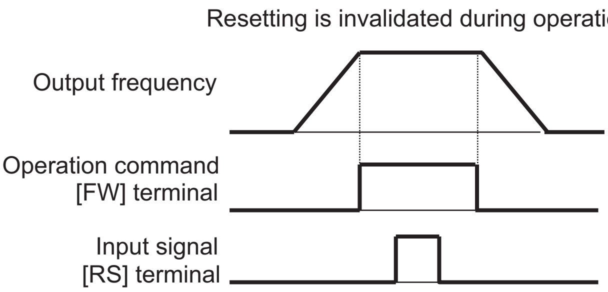
(Example 3) Reset at normal operation enabled

When **Reset mode selection** (CA-72) is set to *00: On to Release Trip* or *01: Off to Release Trip*.



(Example 4) Reset at normal operation disabled

When **Reset mode selection** (CA-72) is set to *02: On to Release at Trip* or *03: Off to Release at Trip*.



8-10-5 Automatic Reset Function

The automatic reset function is used to automatically perform a reset when an error occurs.

When **Automatic error reset selection** (bb-10) is set to *01: Enabled with operation command OFF*, the wait time before reset is performed will be from the time when the operation command is turned OFF. The wait time is set in **Automatic error reset wait time** (bb-12).
When **Automatic error reset selection** (bb-10) is set to *02: Enable after the setting time*, the wait time before reset is performed will be from the point that the error occurs. The wait time is set in **Automatic error reset wait time** (bb-12).

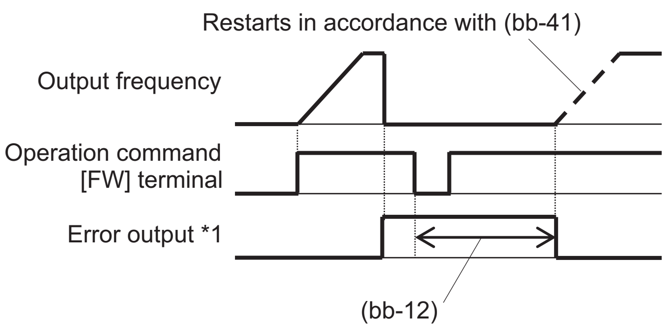
By setting **Alarm signal selection at Automatic error reset is active** (bb-11) to *01: Not output*, it is possible to disable the output of the alarm signal [17: AL] during the automatic reset operation.
If the automatic reset is performed the number of times set in **Automatic error reset number** (bb-13), the error will not be cleared and the trip state will occur.

Precautions for Correct Use

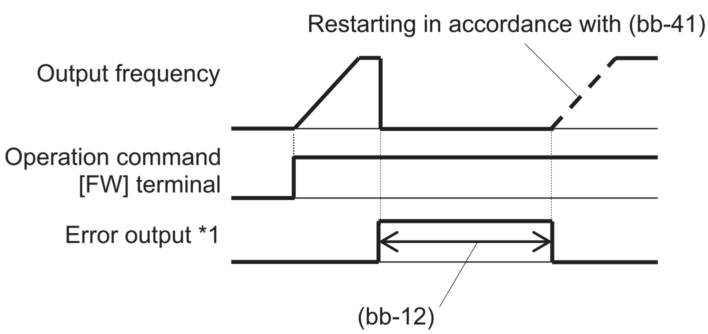
- When **Automatic error reset selection** (bb-10) set to *01: Enabled with operation command OFF*, if a command is issued by the LCD operator, pressing the STOP / RESET key will reset it.
- If you reset manually or the control power is turned on again, the number of automatic resets that were counted internally will be cleared.

An example of automatic reset operation is shown below.

(Example 1): Automatic error reset selection (bb-10) set to *01: Enabled with operation command OFF*



(Example 2): Automatic error reset selection (bb-10) set to *02: Enable after the setting time*



When **Alarm signal selection at Automatic error reset is active** (bb-11) is set to *00*, the error output will be the alarm signal [17: AL].

● Parameter

Item	Parameter	Data	Description	Default
Automatic error reset selection	bb-10	00	Disabled	00
		01	Start reset when operation command turns OFF	
		02	Start reset after the setting time	
Alarm signal selection at Automatic error reset is active	bb-11	00	Output	00
		01	Not output	
Automatic error reset wait time	bb-12	0 to 600 (s)	Set the waiting time from the start of the reset to the actual reset.	2
Automatic error reset number	bb-13	0 to 10 (Times)	Set the number of times for automatic reset.	3

● Automatic Reset Support

Error No.	Error name	Supported
E001	Over-current error	Yes
E005	Motor overload error	Yes
E006	Braking resistor overload error	Yes
E007	Over-voltage error	Yes
E008	Memory error	
E009	Under-voltage error	Yes
E010	Current detector error	
E011	CPU error	
E012	External trip error	
E013	USP error	
E014	Ground fault error	
E015	Incoming overvoltage error	
E016	Momentary interruption error	Yes
E019	Temperature detector error	Yes
E020	Cooling fan rotation speed reduction temperature error	Yes
E021	Temperature error	Yes
E024	Input open-phase error	Yes
E030	IGBT error	Yes
E034	Output open-phase error	Yes
E035	Thermistor error	
E036	Brake error	Yes
E038	Low-speed range overload error	Yes
E039	controller overload error	Yes
E040	Operator keypad disconnection error	Yes
E041	RS485 communication error	Yes
E042	RTC error	Yes
E043	EzSQ Illegal instruction error	
E044	EzSQ nest count error	
E045	EzSQ executive instruction error	
E050	EzSQ user-assigned error 0	
E051	EzSQ user-assigned error 1	

Error No.	Error name	Supported
E052	EzSQ user-assigned error 2	
E053	EzSQ user-assigned error 3	
E054	EzSQ user-assigned error 4	
E055	EzSQ user-assigned error 5	
E056	EzSQ user-assigned error 6	
E057	EzSQ user-assigned error 7	
E058	EzSQ user-assigned error 8	
E059	EzSQ user-assigned error 9	
E060	Option 1 error 0	Yes
E061	Option 1 error 1	Yes
E062	Option 1 error 2	Yes
E063	Option 1 error 3	Yes
E064	Option 1 error 4	Yes
E065	Option 1 error 5	Yes
E066	Option 1 error 6	Yes
E067	Option 1 error 7	Yes
E068	Option 1 error 8	Yes
E069	Option 1 error 9	
E070	Option 2 error 0	Yes
E071	Option 2 error 1	Yes
E072	Option 2 error 2	Yes
E073	Option 2 error 3	Yes
E074	Option 2 error 4	Yes
E075	Option 2 error 5	Yes
E076	Option 2 error 6	Yes
E077	Option 2 error 7	Yes
E078	Option 2 error 8	Yes
E079	Option 2 error 9	
E080	Option 3 error 0	Yes
E081	Option 3 error 1	Yes
E082	Option 3 error 2	Yes
E083	Option 3 error 3	Yes
E084	Option 3 error 4	Yes
E085	Option 3 error 5	Yes
E086	Option 3 error 6	Yes
E087	Option 3 error 7	Yes
E088	Option 3 error 8	Yes
E089	Option 3 error 9	
E090	STO shutoff error	
E091	STO internal error	
E092	STO path 1 error	
E093	STO path 2 error	
E094	FS option internal error	
E095	FS option path 1 error	
E096	FS option path 2 error	
E097	FS option connection error	
E100	Encoder disconnection error	

Error No.	Error name	Supported
E104	position control range error	Yes
E105	Speed deviation error	Yes
E106	Position deviation error	Yes
E107	Over-speed error	Yes
E110	Contactor error	Yes
E112	FB option connection error	
E120	PID-Start Error Detection	Yes

8-10-6 Pulse Count Function

By assigning the Pulse string input A [103: PLA] or Pulse string input B [104: PLB] to one of **Input terminal function** (CA-01) to (CA-11), the pulse signals can be counted. For more details, refer to *8-14-5 Pulse Count Function* on page 8-199.

8-11 Output Terminal Function

8-11-1 Overview

The inverter has 5 open collector output terminals and 2 relay output terminals. Output terminals 11 to 15 are open collector outputs, and relay output terminals 16 and 17 are relay outputs. Relay output 16 is Contact a relay and Relay output 17 is a Contact c relay.

To use output terminal functions, set the function you want to use in **Output terminal selection** (CC-01) to (CC-07).
Set the logic of the output signal in **Output terminal active state** (CC-11) to (CC-17).

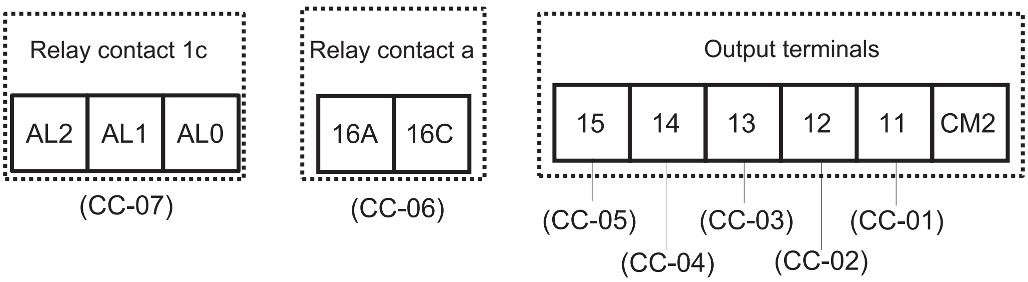
Precautions for Correct Use

When using relay output 17 Contact c, check the status of the control circuit power supply and the Open/Close status of the relay output terminal.

● Parameter

Item	Parameter	Data	Description
Output terminal selection	CC-01 to CC-05	Refer to *List of Output Terminal Functions* on page 8-171.	Outputs the assigned function to the corresponding output terminal.
Relay output terminal [16] function	CC-06		
Relay output terminal [AL] function	CC-07		
Output terminal active state	CC-11 to CC-15	00	Operates normally open: NO
Relay output terminal active state	CC-16		
		01	Operates normally closed: NC
Relay output terminal active state	CC-17		

● Terminals Corresponding to Parameters



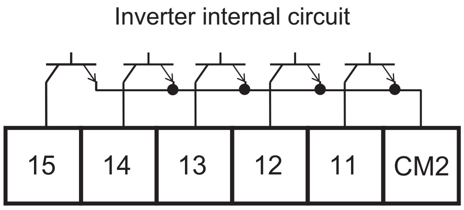
● List of Output Terminal Functions

Function No.	Abbre-viation	Function Name	Page
000	no	Without allocation	-
001	RUN	During operation	page 8-144
002	FA1	When the constant speed is attained	page 8-146
003	FA2	Equal to or above the set frequency	page 8-147
004	FA3	Set frequency match	page 8-148
005	FA4	Equal to or above the set frequency 2	page 8-147
006	FA5	Set frequency match 2	page 8-148
007	IRDY	Operation ready completion	page 8-144
008	FWR	During normal rotation operation	page 8-144
009	RVR	During reverse rotation operation	page 8-144
010	FREF	Frequency command panel	page 6-26
011	REF	Operation command panel	page 6-18
012	SETM	Second control under selection	page 8-78
016	OPO	Optional output	Setting prohibited (do not use)
017	AL	Alarm signal	page 8-126
018	MJA	Severe failure signal	page 8-128
019	OTQ	Over torque	page 7-41
020	IP	During instantaneous power failure	page 8-133
021	UV	Under insufficient voltage	page 8-134
022	TRQ	During torque limitation	page 7-38
023	IPS	During power failure deceleration	page 8-63
024	RNT	RUN time elapsed	page 8-139
025	ONT	Power ON time elapsed	page 8-140
026	THM	Electronic thermal warning (Motor)	page 8-135
027	THC	Electronic thermal warning (Inverter)	page 8-136
029	WAC	Capacitor life advance notice	page 8-138
030	WAF	Fan life advance notice	page 8-139
031	FR	Operation command signal	page 8-142
032	OHF	Cooling fin heating advance notice	page 8-137
033	LOC	Low current signal	page 8-131
034	LOC2	Low current signal 2	page 8-131
035	OL	Overload advance notice	page 8-130
036	OL2	Overload advance notice 2	page 8-130
037	BRK	Brake release	page 8-83
038	BER	Brake abnormality	page 8-83
039	CON	Contactor control	page 8-89
040	ZS	0 Hz detection signal	page 8-150
041	DSE	Excessive speed deviation	page 8-75
042	PDD	Excessive positional deviation	page 8-104
043	POK	Positioning completed	page 8-107 page 8-104
044	PCMP	Pulse count compare-match output	page 8-199
045	OD	PID excessive deviation	page 8-38
046	FBV	PID feedback comparison	page 8-39

Function No.	Abbre-viation	Function Name	Page
047	OD2	PID2 excessive deviation	page 8-38
048	FBV2	PID2 feedback comparison	page 8-39
049	NDc	Communication disconnection	page 9-5
050	Ai1Dc	Analog disconnection Ai1	page 8-152
051	Ai2Dc	Analog disconnection Ai2	page 8-152
052	Ai3Dc	Analog disconnection Ai3	page 8-152
056	WCAi1	Window comparator Ai1	page 8-151
057	WCAi2	Window comparator Ai2	page 8-151
058	WCAi3	Window comparator Ai3	page 8-151
062	LOG1	Result of logical operation 1	page 8-156
063	LOG2	Result of logical operation 2	page 8-156
064	LOG3	Result of logical operation 3	page 8-156
065	LOG4	Result of logical operation 4	page 8-156
066	LOG5	Result of logical operation 5	page 8-156
067	LOG6	Result of logical operation 6	page 8-156
068	LOG7	Result of logical operation 7	page 8-156
069	MO1	General purpose output 1	-
070	MO2	General purpose output 2	-
071	MO3	General purpose output 3	-
072	MO4	General purpose output 4	-
073	MO5	General purpose output 5	-
074	MO6	General purpose output 6	-
075	MO7	General purpose output 7	-
076	EMFC	Forced operation in process signal	page 8-94
077	EMBP	During-bypass-mode signal	page 8-96
080	LBK	LCD operator battery insufficient	page 3-56
081	OVS	Excessive voltage of accepted power	page 8-141
084	AC0	Alarm code bit 0	page 8-128
085	AC1	Alarm code bit 1	page 8-128
086	AC2	Alarm code bit 2	page 8-128
087	AC3	Alarm code bit 3	page 8-128
089	OD3	PID3 excessive deviation	page 8-38
090	FBV3	PID3 feedback comparison	page 8-39
091	OD4	PID4 excessive deviation	page 8-38
092	FBV4	PID4 feedback comparison	page 8-39
093	SSE	PID soft start abnormality	page 8-23

Open Collector Output Terminal

The following are the specifications for output terminals 11 to 15. All have the same specifications.



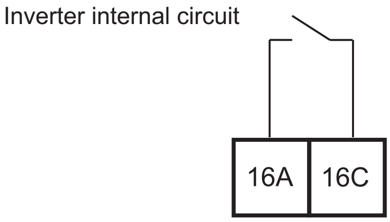
	Electrical characteristics
Each terminal (11 to 15) - CM2	Voltage drop at ON: 4 V or below Allowable maximum voltage: 27 VDC Allowable maximum current: 50 mA

The open collector output operation is as shown below.

CC-11 to CC-15	Control power supply	Inverter function output	Open collector operation
00 (Contact a)	ON	ON	Close
		OFF	Open
	OFF	-	-
01 (Contact b)	ON	ON	Open
		OFF	Close
	OFF	-	-

1a Relay Output Terminal

The following is the specifications of the 1a Relay output terminals 16A-16C.



	Electrical characteristics
16A-16C	Voltage drop at ON: 4 V or below Allowable maximum voltage: 27 VDC Allowable maximum current: 50 mA

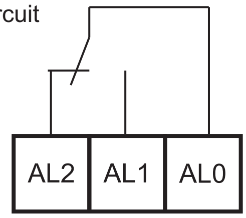
The operation of 16A-16C is as follows.

CC-16	Control power supply	Inverter function output	Relay operation
00 (Contact a)	ON	ON	Close
		OFF	Open
	OFF	-	Open
01 (Contact b)	ON	ON	Open
		OFF	Close
	OFF	-	Open

1c Relay output terminal

The following is the specifications of the 1c Relay output terminals AL1-AL0 and AL2-AL0.

Inverter internal circuit



		Resistive load	Inductive load
AL1-AL0	Maximum contact capacity	250 VAC, 2 A 30 VDC, 3 A	250 VAC, 0.2 A 30 VDC, 0.6 A
	Minimum contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	
AL2-AL0	Maximum contact capacity	250 VAC, 1 A 30 VDC, 1 A	250 VAC, 0.2 A 30 VDC, 0.2 A
	Minimum contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	

The operation of AL1-AL0 and AL2-AL0 are as follows.

CC-17	Control power supply	Inverter Function output	Output terminal state	
			AL1-AL0	AL2-AL0
00	ON	ON	Close	Open
		OFF	Open	Close
	OFF	-	Open	Close
01 (default)	ON	ON	Open	Close
		OFF	Close	Open
	OFF	-	Open	Close

8-11-2 Output Terminal Active State

You can set Contact a or Contact b for each of the Output terminals 11 to 15 and Relay output terminals 16, AL.

- Operating as Contact a: "ON" closes the contact and "OFF" opens the contact.
- Operating as Contact b: "OFF" closes the contact and "ON" opens the contact.

● Parameter

Item	Parameter	Data	Description
Output terminals [11] to [16] 1a Relay output terminal [16], 1b Relay output terminal [AL] active state	CC-11 to CC-15 CC-16, CC-17	00	Contact a (NO: Normally open).
		01	Contact b (NC: Normally closed).

8-11-3 Output Terminal ON Delay/OFF Delay

You can set an on-delay/off-delay time per output terminal. Use it to remove chattering of the output signal.

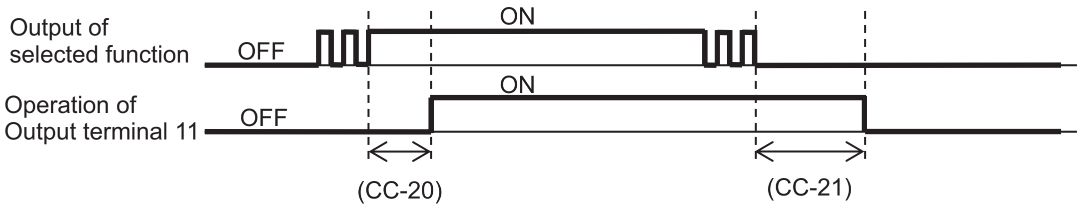
You can make a setting per output terminal. For the correspondence between output terminals and parameters, please refer to the table shown below.

Output terminal	On-delay time	Off-delay time
11	CC-20	CC-21
12	CC-22	CC-23
13	CC-24	CC-25
14	CC-26	CC-27
15	CC-28	CC-29
16A-16C	CC-30	CC-31
AL1-AL0/ AL2-AL0	CC-32	CC-33

● Parameter

Item	Parameter	Data	Description
Output On-delay time	CC-20, CC-22, CC-24, CC-26, CC-28, CC-30, CC-32	0.00 to 100.00 (s)	Set the on-delay time.
Output off-delay time	CC-21, CC-23, CC-25, CC-27, CC-29, CC-31, CC-33	0.00 to 100.00 (s)	Set the off-delay time.

(Example) Output terminal 11 operation



8-12 Analog Input Terminal Function

The analog input terminal function can be used as a means to input command values from peripheral devices to the inverter as voltage or current and to realize motor control according to the surrounding conditions.

There are three analog input terminals, [Ai1], [Ai2] and [Ai3].
The analog input signal can be used for frequency command, torque command, PID Set-point value, PID feedback value, PID feed-forward value, and frequency upper limit value.

If you want to use analog inputs, set the following:
- Switch setting
- Bias adjustment
- Gain adjustment
- Filter settings
- When using for frequency command, set the start amount value and end amount value

Parameters That Can Be Used with Analog Input Signals

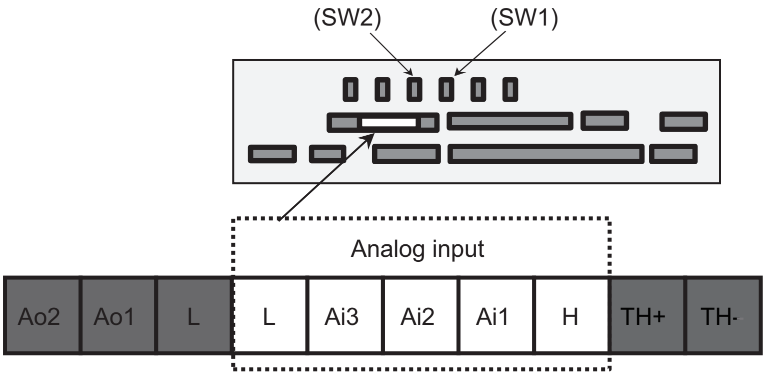
If you set the analog input terminals [Ai1], [Ai2], and [Ai3] as the input destination for the following parameters, they can be used for analog input operation.

Parameter	Description
AA101	Main speed input source selection, 1st-motor
AA102	Sub frequency input source selection, 1st-motor
AA201	Main speed input source selection, 2nd-motor
AA202	Sub speed input source selection, 2nd-motor
Ad-01	Torque reference input source selection
Ad-11	Torque bias input source selection
Ad-40	Input selection for speed limit at torque control
AH-07	Input source selection of Set-point 1 for PID1
AH-42	Input source selection of Set-point 2 for PID1
AH-46	Input source selection of Set-point 3 for PID1
AH-51	Input source selection of Process data 1 for PID1
AH-52	Input source selection of Process data 2 for PID1
AH-53	Input source selection of Process data 3 for PID1
AH-70	PID feed-forward selection
AJ-07	Input source selection of Set-point for PID2
AJ-12	Input source selection of Process data for PID2
AJ-27	Input source selection of Set-point for PID3
AJ-32	Input source selection of Process data for PID3
AH-47	Input source selection of Set-point for PID4
AJ-52	Input source selection of Process data for PID4
bA101	Frequency limit selection, 1st-motor
bA110	Torque limit selection, 1st-motor
bA201	Upper frequency limit, 2nd motor
bA210	Torque limit selection, 2nd-motor

Parameter	Description
CA-70	[F-OP] Frequency command

8-12-1 Switch Setting

The analog input terminals [Ai1] and [Ai2] can be switched between voltage input and current input with switches SW1 and SW2 on the board. The factory settings are [Ai1] for voltage input and [Ai2] for current input. For more information on switch setting, refer to *Switch Configurations* on page 2-19



Voltage Input: 0 V to 10 V or -10 V to +10 V
Current input: 0 mA to 20 mA

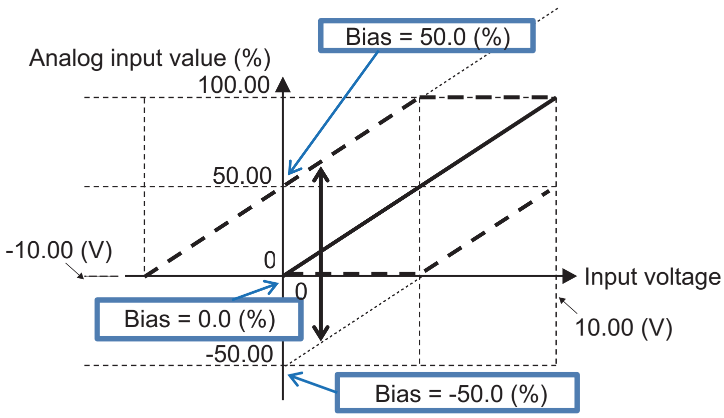
Precautions for Correct Use

Make sure that the inverter is turned OFF before changing the switches on the board.

8-12-2 Bias Adjustment

Bias adjustment is a function that adjusts the 0 point of data. The bias can be adjusted for each analog input terminal.

To adjust the bias on analog input terminal [Ai1], enter the voltage (0 V) or current (0 mA) at which **Analog input [Ai1] monitor** (dA-61) becomes 0.00% and then change **[Ai1] Voltage / Current zero-gain adjustment** (Cb-30) so that **Analog input [Ai1] monitor** (dA-61) becomes 0.00%.
The same procedure applies to the adjustment of analog input [Ai2] and analog input [Ai3].



● Parameter

Item	Parameter	Data	Description	Default
[Ai1] Voltage/ Current zero-gain adjustment	Cb-30	-100.00 to 100.00	The bias setting value for the voltage and current of the [Ai1] terminal.	0.00
[Ai2] Voltage/ Current zero-gain adjustment	Cb-32	-100.00 to 100.00	The bias setting value for the voltage and current of the [Ai2] terminal.	0.00
[Ai3] Voltage/ Current zero-gain adjustment	Cb-34	-100.00 to 100.00	The bias setting value for the voltage of the [Ai3] terminal.	0.00
Analog input [Ai1] monitor	dA-61	-100.00 to 100.00	The input value for [Ai1] terminal.	-
Analog input [Ai2] monitor	dA-62	-100.00 to 100.00	The input value for [Ai2] terminal.	-
Analog input [Ai3] monitor	dA-63	-100.00 to 100.00	The input value for [Ai3] terminal.	-

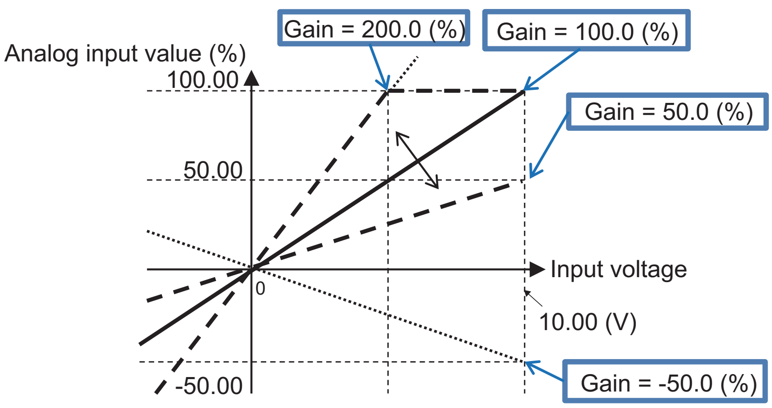
Additional Information

The values of analog input devices may change due to ambient temperature and aging.
Adjust as necessary, such as when synchronization between multiple inverters is required.

8-12-3 Gain Adjustment

Gain adjustment is a function that adjusts the slope of data. The gain can be adjusted for each analog input terminal.

To adjust the gain of Analog input terminal [Ai1], input the voltage or current that makes **Analog input [Ai1] monitor** (dA-61) become 100.00 (%) and change **[Ai1] Voltage/Current gain adjustment** (Cb-31) so that **Analog input [Ai1] monitor** (dA-61) becomes 100.00.
The same procedure applies to the adjustment of analog input [Ai2] and analog input [Ai3].



● Parameter

Item	Parameter	Data	Description	Default
[Ai1] Voltage/ Current gain adjustment	Cb-31	0 to 200.00	The gain setting value for the voltage and current of the [Ai1] terminal.	100.00
[Ai2] Voltage/ Current gain adjustment	Cb-33	0 to 200.00	The gain setting value for the voltage and current of the [Ai2] terminal.	100.00
[Ai3] Voltage gain adjustment	Cb-35	0 to 200.00	The gain setting value for the voltage of the [Ai3] terminal.	100.00
Analog input [Ai1] monitor	dA-61	-100.00 to 100.00	The input value for [Ai1] terminal.	-
Analog input [Ai2] monitor	dA-62	-100.00 to 100.00	The input value for [Ai2] terminal.	-
Analog input [Ai3] monitor	dA-63	-100.00 to 100.00	The input value for [Ai3] terminal.	-

Additional Information

- **The values of analog input devices may change due to ambient temperature and aging.** Adjust as necessary, such as when synchronization between multiple inverters is required.
- If you also use a negative voltage, **adjust the gain in consideration of the negative voltage.**

8-12-4 Filter Settings

Filters are effective in removing noise from analog input signals. The filter is set to the input filter time constant of each analog input terminal.

If stable operation is not possible due to the influence of noise, increase the filter time constant of Volume on LCD Operator. Increasing the setting will stabilize it, however the analog input value will be less responsive.

● Parameter

Item	Parameter	Data	Description	Default
Filter time constant of Terminal [Ai1]	Cb-01	1 to 500 (ms)	Set the time constant of the input filter.	16
Filter time constant of Terminal [Ai2]	Cb-11	1 to 500 (ms)	Set the time constant of the input filter.	16
Filter time constant of Terminal [Ai3]	Cb-21	1 to 500 (ms)	Set the time constant of the input filter.	16

Additional Information

When using the analog input as feedback data for the PID function, the analog filter time constant of Volume on LCD Operator has a delayed response to the feedback. If the PID gain is still fluctuating or the tracking is poor, return the analog filter time constant of Volume on LCD Operator to its default value and adjust with the PID parameter.

8-12-5 Start Value and End Value of Volume on LCD Operator

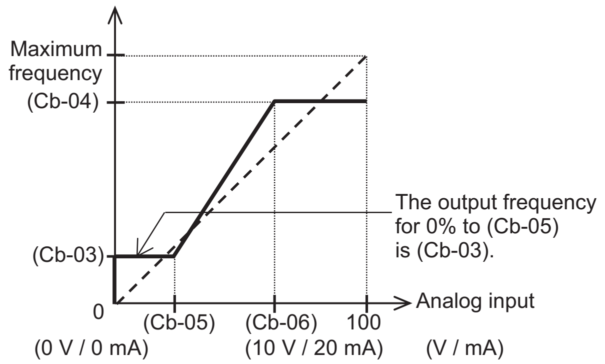
Set the relationship between the command value and the analog input value when using the analog input as a frequency command with **Main speed input source selection** (AA101) or **Sub speed input source selection** (AA102) or when using the analog input as a torque command with **Torque reference input source selection** (Ad-01).

The Association Between Analog Input Ai1 and Frequency Command

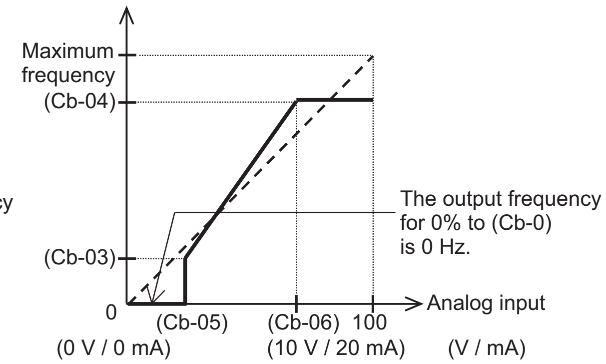
The following parameters are used to set the relationship between analog input Ai1 and frequency command.

Item	Parameter	Data	Description	Default
Filter time constant of Terminal [Ai1]	Cb-01	1 to 500 (ms)	Apply a filter to the input.	16
Start value of Terminal [Ai1]	Cb-03	0.00 to 100.00 (%)	Set the start frequency command as a percentage of the maximum frequency	0.00
End value of Terminal [Ai1]	Cb-04	0.00 to 100.00 (%)	Set the End frequency command as a percentage of the maximum frequency	100.00
Start rate of Terminal [Ai1]	Cb-05	0.0 to **End rate of Terminal [Ai1]** (Cb-06) (%)	Set the start value of analog input 0 to 10 V / 0 to 20 mA as a ratio to 10 V / 20 mA	0.0
End rate of Terminal [Ai1]	Cb-06	**Start rate of Terminal [Ai1]** (Cb-05) to 100.0 (%)	Set the end value of analog input 0 to 10 V / 0 to 20 mA as a ratio to 10 V / 2 0mA	100.0
Start point selection of Terminal [Ai1]	Cb-07	00	A command using the lower value between 0.00% to **Start value of Terminal [Ai1]** (Cb-03), or **End value of Terminal [Ai1]** (Cb-04), will output the lower value between **Start value of Terminal [Ai1]** (Cb-03) and **End value of Terminal [Ai1]** (Cb-04).	01
		01	Command values from 0.00% to **Start value of Terminal [Ai1]** (Cb-03), or **End value of Terminal [Ai1]** (Cb-04), whichever is lower, will output a value of 0.00%	

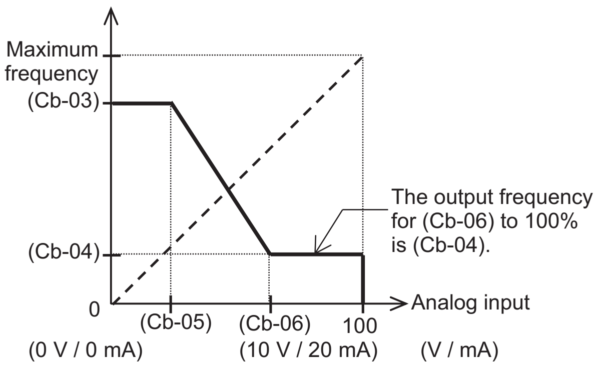
(Ex.1-1) Set “00” to (Cb-07)



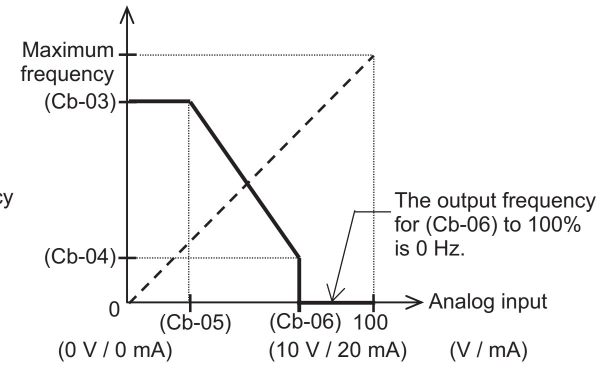
(Ex.1-2) Set “01” to (Cb-07)



(Ex.1-3) Set “00” to (Cb-07)



(Ex.1-4) Set “01” to (Cb-07)



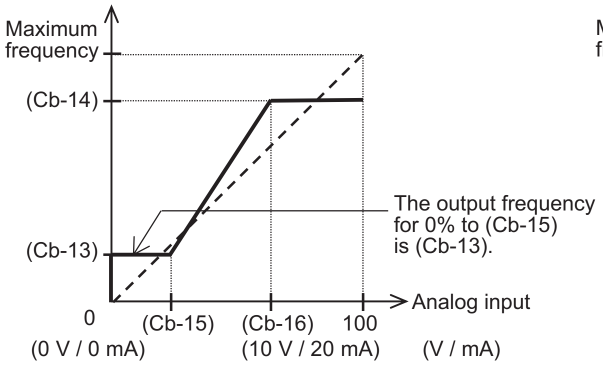
The Association Between Analog Input Ai2 and Frequency Command

The following parameters are used to set the relationship between analog input Ai2 and frequency command.

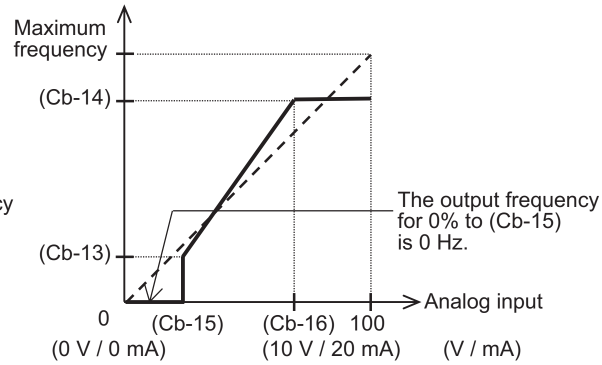
Item	Parameter	Data	Description	Default
Filter time constant of Terminal [Ai2]	Cb-11	1 to 500 (ms)	Apply a filter to the input.	16
Start value of Terminal [Ai2]	Cb-13	0.00 to 100.00 (%)	Set the start frequency command as a percentage of the maximum frequency	0.00
End value of Terminal [Ai2]	Cb-14	0.00 to 100.00 (%)	Set the End frequency command as a percentage of the maximum frequency	100.00
Start rate of Terminal [Ai2]	Cb-15	0.0 to **End rate of Terminal [Ai2]** (Cb-16) (%)	Set the start value of analog input 0-10 V / 0-20 mA as a ratio to 10 V / 20 mA	20.0
End rate of Terminal [Ai2]	Cb-16	**Start rate of Terminal [Ai2]** (Cb-15) to 100.0 (%)	Set the end value of analog input 0-10 V / 0-20 mA as a ratio to 10 V / 20 mA	100.0

Item	Parameter	Data	Description	Default
Start point selection of Terminal [Ai2]	Cb-17	00	A command using the lower value between 0.00% to **Start value of Terminal [Ai2]** (Cb-13), or **End value of Terminal [Ai2]** (Cb-14), will output the lower value between **Start value of Terminal [Ai2]** (Cb-13) and **End value of Terminal [Ai2]** (Cb-14)..	01
		01	A command using the lower value between 0.00% to **Start value of Terminal [Ai2]** (Cb-13), or **End value of Terminal [Ai2]** (Cb-14), will output a value of 0.00%.	

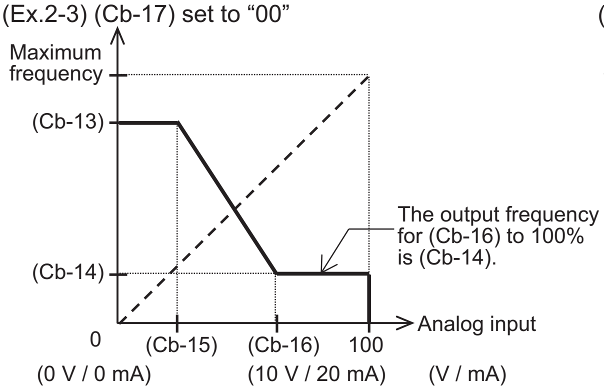
(Ex.2-1) (Cb-17) set to “00”



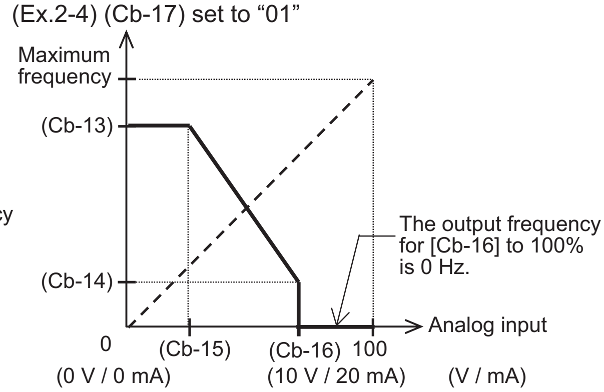
(Ex.2-2) (Cb-17) set to “01”



(Ex.2-3) (Cb-17) set to “00”



(Ex.2-4) (Cb-17) set to “01”



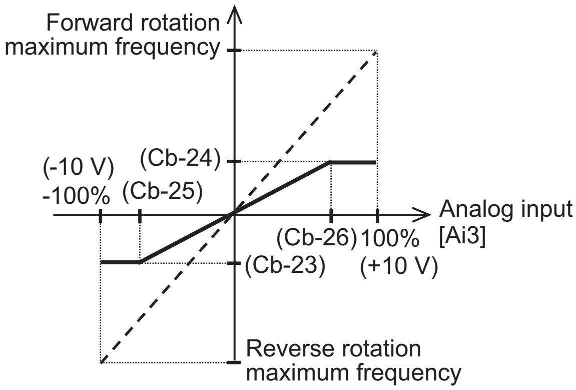
The Association Between Analog Input Ai3 and Frequency Command

The following shows the association between Analog Input Ai3 and frequency command

Item	Parameter	Data	Description	Default
Filter time constant of Terminal [Ai3]	Cb-21	1 to 500 (ms)	Apply a filter to the input.	16

Item	Parameter	Data	Description	Default
Terminal [Ai3] selection	Cb-22	00	Single	00
		01	[Added to Ai1] / [Ai2]: with reversibility	
		02	[Added to Ai1] / [Ai2]: without reversibility	
Start value of Terminal [Ai3]	Cb-23	-100.00 to 100.00 (%)	Set the start frequency command as a percentage of the maximum frequency	-100.00
End value of Terminal [Ai3]	Cb-24	-100.00 to 100.00 (%)	Set the End frequency command as a percentage of the maximum frequency	100.00
Start rate of Terminal [Ai3]	Cb-25	-100.0 to **End rate of Terminal [Ai3]** (Cb-26) (%)	Set the start value of analog input -10 to 10 V as a ratio to -10 to 10 V.	-100.00
End rate of Terminal [Ai3]	Cb-26	**Start rate of Terminal [Ai3]** (Cb-25) to 100.0 (%)	Set the End value of analog input -10 to 10 V as a ratio to -10 to 10 V.	100.00

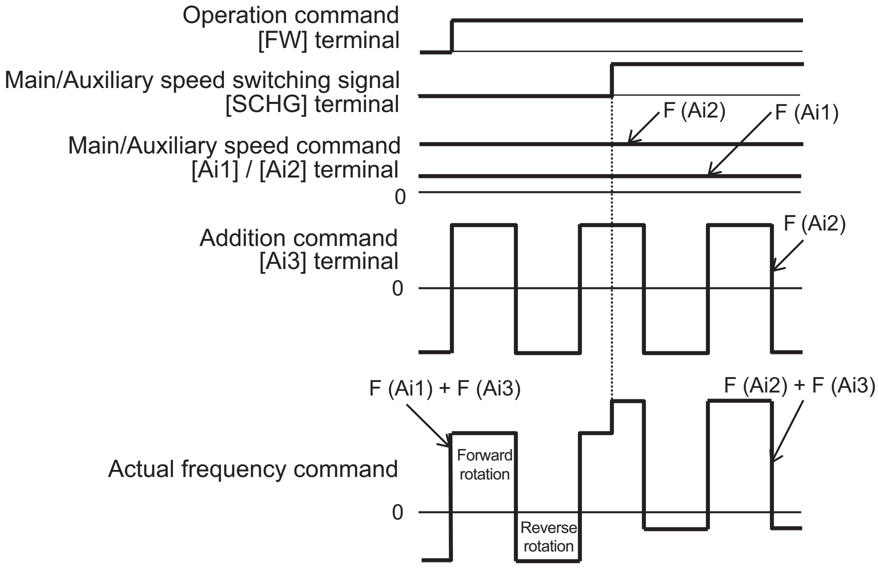
（Ex.3）



8-12-6 Adding Analog Input Ai3 to Analog Inputs Ai1 and Ai2

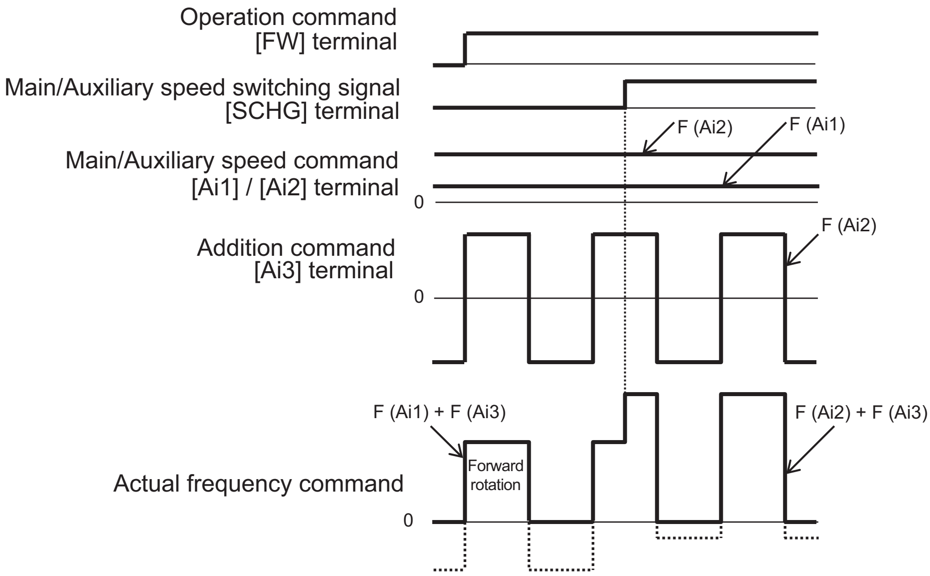
You can add the input of [Ai3] terminal to [Ai1] terminal and [Ai2] terminal respectively.
It can be always added by selecting *01: Added to Ai1 / Ai2: with reversibility* for **Terminal [Ai3] selection** (Cb-22). If you select *02: Added to Ai1 / Ai2: without reversibility*, the added value will be limited to positive numbers.

(Example 1): Setting Terminal Ai3 selection (Cb-22) to *01: Added to Ai1 / Ai2: with reversibility*.
When Ai1 is selected as the main speed command and Ai2 is selected as the sub speed input source selection and the main speed and auxiliary speed are switched at the [15: SCHG] terminal.



(Example 2): Terminal Ai3 selection (Cb-22) = 02: Added to Ai1 / Ai2: without reversibility

When Ai1 is selected as the main speed command and Ai2 is selected as the sub speed input source selection and the main speed and auxiliary speed are switched at the [15: SCHG] terminal.



● Parameter

Item	Parameter	Data	Description	Default
Terminal [Ai3] selection	Cb-22	00	Without addition	00
		01	[Added to Ai1] / [Ai2]: with reversibility	
		02	[Added to Ai1] / [Ai2]: without reversibility	

8-13 Analog Output Terminal Function

8-13-1 Overview

The analog output terminal function can be used as a means for the peripheral circuit to realize control according to the motor operation by transmitting the control state inside the inverter to the peripheral circuit by voltage or current.
There are two analog output terminals, [Ao1] and [Ao2]. Not all monitor parameters can be output to the analog output signal.

If you want to use an analog output signal, set the following:
- Switch setting
- Bias adjustment
- Gain adjustment
- Filter settings

● Parameter

Item	Parameter	Data	Description	Default
[Ao1] monitor output selection	Cd-04	0000 to FFFF	Set the register number of the item to be monitored. Refer to page 8-186	(dA-01)
[Ao2] monitor output selection	Cd-05			(dA-01)
Analog monitor adjust mode enable	Cd-10	00	Disabled.	00
		01	Function enabled. Outputs the output level in adjustment mode to each terminal.	
Filter time constant of [Ao1] monitor	Cd-21	1 to 500 (ms)	Filters the selected data and outputs it.	100
[Ao1] Data type selection	Cd-22	00	Outputs the absolute value of the data.	00
		01	Outputs the data as signed.	
[Ao1] monitor bias adjustment	Cd-23	-100.0 to 100.0 (%)	Biases data to adjust Point 0 of data.	0.0
[Ao1] monitor gain adjustment	Cd-24	-1000.0 to 1000.0 (%)	Apply gain to the data and adjust the slope of the data	100.0
Output level setting at [Ao1] monitor adjust mode	Cd-25	-100.0 to 100.0 (%)	Adjust the output for adjustment mode. The maximum output 100.0% and minimum output 0.0% (when **[Ao1] Data type selection** (Cd-22) set to *00: absolute value*) or the minimum output at -100.0% (when **[Ao1] Data type selection** (Cd-22) set to *01: with sign*).	100.0
Filter time constant of [Ao2] monitor	Cd-31	1 to 500 (ms)	Filters the selected data and outputs it.	100

Item	Parameter	Data	Description	Default
[Ao2] Data type enable	Cd-32	00	Outputs the absolute value of the data.	0
		01	Outputs the data as signed.	
[Ao2] monitor bias adjustment	Cd-33	-100.0 to 100.0 (%)	Biases data to adjust Point 0 of data.	20.0
[Ao2] monitor gain adjustment	Cd-34	-1000.0 to 1000.0 (%)	Apply gain to the data and adjust the slope of the data	80.0
Output level setting at [Ao2] monitor adjust mode	Cd-35	-100.0 to 100.0 (%)	Adjust the output for adjustment mode. The maximum output 100.0% and minimum output 0.0% (when **[Ao2] Data type selection** (Cd-32) set to *00: absolute value*) or the minimum output at -100.0% (when **[Ao2] Data type selection** (Cd-32) set to *01: with sign*).	100.0

Parameters that can be output by analog signals

The following table shows the monitor parameters that can be output by analog output signals.
Set the register number for the monitor parameters you wish to use in **[Ao1] monitor output selection** (Cd-04) and **[Ao2] monitor output selection** (Cd-05).
As an example, if you want to output the **Output current monitor** (dA-02) from the [Ao1] terminal, set **[Ao1] monitor output selection** (Cd-04) to *10002 (2712h)*.

Code	Register No.	Name	Output scale range (0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
dA-01	2711h	Output frequency monitor	0.00 to Maximum frequency (Hz)	
dA-02	2712h	Output current monitor	(0.00 to 2.00) × Inverter rated current (A)	
dA-04	2713h	Frequency command after calculation	0.00 to Maximum frequency (Hz)	Can be output with (±)
dA-08	2718h	Speed detection value monitor	0.00 to Maximum frequency (Hz)	Can be output with (±)
dA-12	271Ch	Output frequency monitor (with sign)	0.00 to Maximum frequency (Hz)	Can be output with (±)
dA-14	271Eh	Frequency upper limit monitor	0.00 to Maximum frequency (Hz)	
dA-15	271Fh	Torque command monitor after calculation	0 to 500% of the torque reference value (Nm) *1	Can be output with (±)
dA-16	2720h	Torque limit monitor	0 to 500% of the torque reference value (Nm) *1	Can be output with (±)
dA-17	2721h	Output torque monitor	0 to 500% of the torque reference value (Nm) *1	Can be output with (±)
dA-18	2722h	Output voltage monitor	0 to Rated voltage×133% (V)	
dA-30	272Eh	Input power monitor	0.00 to 200% (kW) of inverter capacity	

Code	Regis-ter No.	Name	Output scale range (0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
dA-34	2732h	Output power monitor	0.00 to 200% (kW) of inverter capacity	Can be output with (±) Output is (+) during power running and (-) during regeneration.
dA-38	2736h	Motor temperature monitor	-20.0 to 200.0 (°C)	
dA-40	2738h	DC voltage monitor	200 V Class: 0.0 to 400.0 (VDC) 400 V Class: 0.0 to 800.0 (VDC)	
dA-41	2739h	braking resistor circuit (BRD) load factor monitor	0.00 to 100.00 (%)	
dA-42	273Ah	Electronic thermal duty ratio monitor MTR	0.00 to 100.00 (%)	
dA-43	273Bh	Electronic thermal duty ratio monitor CTL	0.00 to 100.00 (%)	
dA-61	274Dh	Analog input [Ai1] monitor	0.00 to 100.00 (%)	
dA-62	274Eh	Analog input [Ai2] monitor	0.00 to 100.00 (%)	
dA-63	274Fh	Analog input [Ai3] monitor	-100.00 to 100.00 (%)	Can be output with (±)
dA-70	2756h	Pulse string input monitor main body	-100.00 to 100.00 (%)	Can be output with (±)
dA-71	2757h	Pulse string input monitor option	-100.00 to 100.00 (%)	Can be output with (±)
db-18	2786h	Analog output monitor YA0	0.00 to 100.00	
db-19	2787h	Analog output monitor YA1	0.00 to 100.00	
db-20	2788h	Analog output monitor YA2	0.00 to 100.00	
db-30	2792h	PID1 feedback data 1 monitor	-100.00 to 100.00 (%) *2	Can be output with (±)
db-32	2794h	PID1 feedback data 2 monitor	-100.00 to 100.00 (%) *2	Can be output with (±)
db-34	2796h	PID1 feedback data 3 monitor	-100.00 to 100.00 (%) *2	Can be output with (±)
db-36	2798h	PID2 feedback data monitor	-100.00 to 100.00 (%) *3	Can be output with (±)
db-38	279Ah	PID3 feedback data monitor	-100.00 to 100.00 (%) *4	Can be output with (±)
db-40	279Ch	PID4 feedback data monitor	-100.00 to 100.00 (%) *5	Can be output with (±)
db-42	279Eh	PID1 target value monitor after calculation	-100.00 to 100.00 (%) *2	Can be output with (±)
db-44	27A0h	PID1 feedback data monitor after calculation	-100.00 to 100.00 (%) *2	Can be output with (±)
db-50	27A6h	PID1 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-51	27A7h	PID1 deviation monitor	-200.00 to 200.00 (%)	Can be output with (±)

Code	Register No.	Name	Output scale range (0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
db-52	27A8h	PID1 deviation 1 monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-53	27A9h	PID1 deviation 2 monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-54	27AAh	PID1 deviation 3 monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-55	27ABh	PID2 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-56	27ACh	PID2 deviation monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-57	27ADh	PID3 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-58	27AEh	PID3 deviation inverse	-200.00 to 200.00 (%)	Can be output with (±)
db-59	27AFh	PID4 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-60	27B0h	PID4 deviation monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-64	27B4h	PID feed-forward monitor	0.00 to 100.00 (%)	
dC-15	27E7h	Cooling fin temperature monitor	-20.0 to 200.0 (°C)	
FA-01	2AF9h	Main Speed reference monitor	0.00 to 590.00 (Hz)	
FA-02	2AFAh	Sub speed reference monitor	0.00 to 590.00 (Hz)	
FA-15	2B07h	Torque reference monitor	Torque reference value x (-500.0 to 500.0 (%)) *1	Can be output with (±)
FA-16	2B08h	Torque bias monitor	Torque reference value x (-500.0 to 500.0 (%)) *1	Can be output with (±)
FA-30	2B16h	PID1 Set Value 1 monitor	0.00 to 100.00 (%) *2	
FA-32	2B18h	PID1 Set Value 2 monitor	0.00 to 100.00 (%) *2	
FA-34	2B1Ah	PID1 Set Value 3 monitor	0.00 to 100.00 (%) *2	
FA-36	2B1Ch	PID2 Set Value monitor	0.00 to 100.00 (%) *3	
FA-38	2B1Eh	PID3 Set Value monitor	0.00 to 100.00 (%) *4	
FA-40	2B20h	PID4 Set Value monitor	0.00 to 100.00 (%) *5	

*1. The torque reference value (100%) is calculated as follows. Torque reference value = 79.58 x motor capacity x number of poles / base frequency
(Example) Torque reference value = 79.58 x 5.5 (kW) x 4 (P) / 50 (Hz) ≒ 35 Nm

*2. The data range differs between **PID1 scale adjustment(at 0%)** (AH-04) and **PID1 scale adjustment (point position)** (AH-06).

*3. The data range changes depending on the selection of **PID2 scale adjustment (at 0%)** (AJ-04) to **PID scale adjustment (point position)** (AJ-06).

*4. The data range changes depending on the selection of **PID3 scale adjustment (at 0%)** (AJ-24) to **PID3 scale adjustment (point position)** (AJ-26).

*5. The data range changes depending on the selection of **PID4 scale adjustment (at 0%)** (AJ-44) to **PID4 scale adjustment (point position)** (AJ-46).

● Parameter

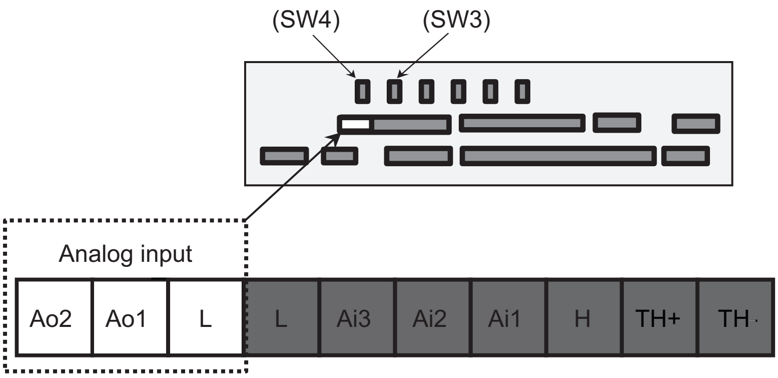
Item	Parameter	Data	Description	Default
[Ao1] monitor output selection	Cd-04	0000 to FFFF	Set the register number of the item to be monitored. Refer to *List of Output Monitor Functions* on page 15-85	(dA-01)
[Ao2] monitor output selection	Cd-05			(dA-01)

Precautions for Correct Use

The data used for the analog output terminals [Ao1] and [Ao2] can be (±) when **[Ao1] Data type selection** (Cd-22) or **[Ao2] Data type selection** (Cd-32) are set to *01: with sign*. Conversely, if they are set to *00: absolute value*,The (-) data is output as (+) data as an absolute value.

8-13-2 Switch setting

The analog output terminals [Ao1] and [Ao2] can be switched between voltage output and current output with switches SW3 and SW4 on the board. The factory settings are [Ao1] for voltage output and [Ao2] for current output. Refer to *Switch Configurations* on page 2-19 for more information on Switch setting.



Voltage output: 0 V to 10 V or -10 V to + 10 V
Current output: 0 mA to 20 mA

Precautions for Correct Use

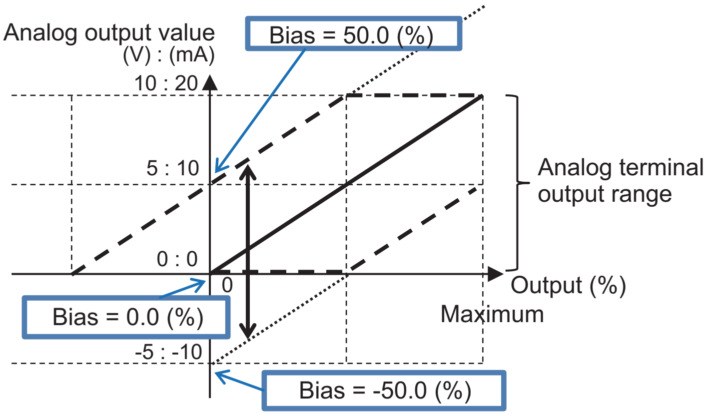
Make sure that the inverter is turned OFF before changing the switches on the board.

8-13-3 Bias Adjustment

Bias adjustment is a function that adjusts the value of 0, which is the reference point of data. The bias can be adjusted for each analog output terminal.

To adjust the bias of the analog output terminal [Ao1], set **[Output level setting at [Ao1] monitor adjust mode** (Cd-25) to *0.00%* and measure the voltage output or current output from the analog output terminal [Ao1]. Change the **[Ao1] monitor bias adjustment** (Cd-23) so that the voltage (0 V) or current (0 mA) becomes 0.00%.

The same procedure also applies to the adjustment of the analog output terminal [Ao2]. Refer to *8-13-6 Analog Monitor Adjust Mode* on page 8-192 for the adjustment method.



● Parameter

Item	Parameter	Data	Description	Default
[Ao1] monitor bias adjustment	Cd-23	-100.0 to 100.0 (%)	Biases data to adjust Point 0 of data.	0.0
[Ao2] monitor bias adjustment	Cd-33	-100.0 to 100.0 (%)	Biases data to adjust Point 0 of data.	20.0

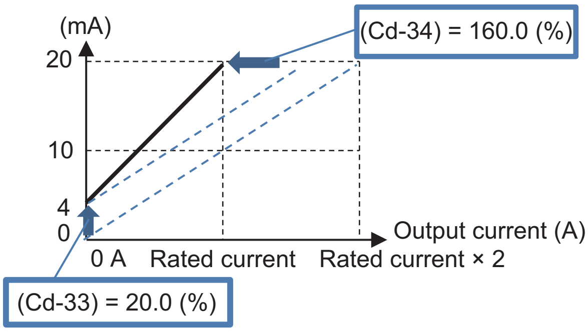
8-13-4 Gain Adjustment

Gain adjustment is a function that adjusts the slope of data. The gain can be adjusted for each analog output terminal.

To adjust the bias of the analog output terminal [Ao1], set **[Output level setting at [Ao1] monitor adjust mode** (Cd-25) to *100.00%* and measure the voltage output or current output from the analog output terminal [Ao1]. Change the **[Ao1] monitor Gain adjustment** (Cd-24) so that the voltage (10 V) or current (20 mA) becomes 100.00%.

Adjust the analog output [Ao2] in the same way. Refer to *8-13-6 Analog Monitor Adjust Mode* on page 8-192 for the adjustment method.

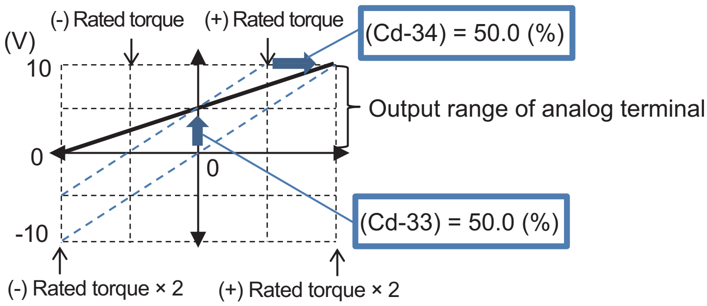
(Example): Output data for current monitor to [Ao2] with 4 to 20mA current
Monitor from 0 A to the rated current of the inverter.
Set **[Ao2] monitor bias adjustment** (Cd-33) to *20.0 (%)* and set **[Ao2] monitor gain adjustment** (Cd-34) to *160.0 (%)*



(Example): Output data for Torque monitor to [Ao2] with 0 to 10 V voltage

Set -200 to 200% of torque to voltage output of 0 to 10 V.

Set **[Ao2] Data type selection** (Cd-32) to *01: with sign*, set **[Ao2] monitor bias adjustment** (Cd-33) to *50.0 (%)* and set **[Ao2] monitor gain adjustment** (Cd-34) to *50.0 (%)*.



When **Ao2 Data type selection** (Cd-32) is set to *00: absolute value*, (-) On the rated torque side, 0 to -200% is output with a value equivalent to 5 to 10 V.

● Parameter

Item	Parameter	Data	Description	Default
[Ao1] monitor gain adjustment	Cd-24	-1000.0 to 1000.0 (%)	Apply gain to the data and adjust the slope of the data	100.0
[Ao2] monitor gain adjustment	Cd-34	-1000.0 to 1000.0 (%)	Apply gain to the data and adjust the slope of the data	80.0

8-13-5 Filter settings

When the device receiving the analog output signal cannot withstand the sudden change in the analog signal, sudden fluctuation of the analog output from the inverter is suppressed.

The filter is set to the output filter time constant of each analog output terminal. If the output filter time constant is increased, sudden changes will be suppressed before output.

● Parameter

Item	Parameter	Data	Description	Default
Filter time constant of [Ao1] monitor	Cd-21	1 to 500 (ms)	Filters the selected data and outputs it.	100

Item	Parameter	Data	Description	Default
Filter time constant of [Ao2] monitor	Cd-31	1 to 500 (ms)	Filters the selected data and outputs it.	100

8-13-6 Analog Monitor Adjust Mode

Analog monitor adjust mode is a function that outputs an arbitrary setting value to the analog output terminal.
In Analog monitor adjust mode, you can use the voltage or current output from the analog output terminal to adjust the bias and gain.

To use the function, set **Analog monitor adjust mode enable** (Cd-10) to *01: Enabled*.
Set the values to output in **Output level setting at [Ao1] monitor adjust mode** (Cd-25) and **[Output level setting at [Ao2] monitor adjust mode** (Cd-35).

For the [Ao1] terminal, the value set in **Output level setting at [Ao1] monitor adjust mode** (Cd-25) is output according to the monitor parameter output scale range set for **[Ao1] monitor output selection** (Cd-04).
For the [Ao2] terminal, the value set in **Output level setting at [Ao2] monitor adjust mode** (Cd-35) is output according to the monitor parameter output scale range set for **[Ao2] monitor output selection** (Cd-05).

● Parameter

Item	Parameter	Data	Description	Default
Analog monitor adjust mode enable	Cd-10	00	Disabled.	00
		01	Function enabled. Outputs the output level in adjustment mode to each terminal.	
[Ao1] Data type selection	Cd-22	00	Outputs the absolute value of the data.	00
		01	Outputs the data as signed.	
Output level setting at [Ao1] monitor adjust mode	Cd-25	-100.0 to 100.0 (%)	Adjust the output for adjustment mode. The maximum output 100.0% and minimum output 0.0% (when **[Ao1] Data type selection** (Cd-22) set to *00: absolute value*) or the minimum output at -100.0% (when **[Ao1] Data type selection** (Cd-22) set to *01: with sign*).	100.0
[Ao2] Data type selection	Cd-32	00	Outputs the absolute value of the data.	0
		01	Outputs the data as signed.	

Item	Parameter	Data	Description	Default
Output level setting at [Ao2] monitor adjust mode	Cd-35	-100.0 to 100.0 (%)	Adjust the output for adjustment mode. The maximum output 100.0% and minimum output 0.0% (when **[Ao2] Data type selection** (Cd-32) set to *00: absolute value*) or the minimum output at -100.0% (when **[Ao2] Data type selection** (Cd-32) set to *01: with sign*).	100.0

● Adjustment Use Case Example

Bias adjustment and gain adjustment when the output current monitor is output from [Ao1] at 4 to 20 mA.

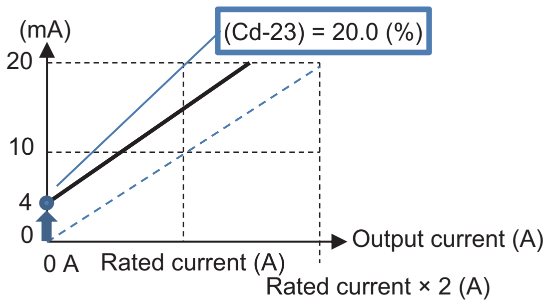
When the output current monitor is 0 to the inverter rated current x 2 [A], adjust so that the output of the [Ao1] terminal is 4 to 20 mA.

Code	Register No.	Name	Output scale range (0 to 10 V / 0 to 20 mA)
dA-02	2712h	Output current monitor	(0.00 to 2.00) × Inverter rated current (A)

1 Make sure that [SW3] on the board has a current of 20 mA, and then turn on the power.
When the following parameters are set, 0 mA is output from the [Ao1] terminal.

- Set **[Ao1] monitor output selection** (Cd-04) to *10002 (2712h)*.
- Set **Analog monitor adjust mode enable** (Cd-10) to *01: Enabled*.
- Set **Output level setting at [Ao1] monitor adjust mode** (Cd-25) to *0.0%*.

2 Adjust to output 4 mA from the [Ao1] terminal corresponding to the output reference 0 A.
Adjust the **[Ao1] monitor bias adjustment** (Cd-23) from about 20.0% and confirm that 4 mA is output.
Consider how it changes for 15.0 to 25.0%.



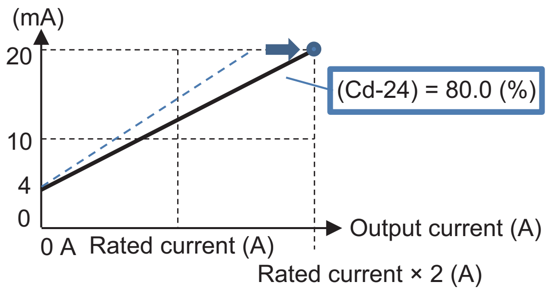
3 Check the output from the [Ao1] terminal corresponding to 100% output.
When **Output level setting at [Ao1] monitor adjust mode** (Cd-25) is set to *100.0 (%)*, the output from the [Ao1] teminal will be approximately 20 mA.

4 Adjust the gain and adjust the output from the [Ao1] terminal at 100% in **[Ao1] monitor gain adjustment** (Cd-24).
Change the **[Ao1] monitor gain adjustment** (Cd-24) in small increments so that the output from the [Ao2] terminal becomes less than the point where it starts to drop from *20 (mA)*.

- Set **[Ao1] monitor bias adjustment** (Cd-23) to *20.0 (%)*

- Set **[Ao1] monitor gain adjustment** (Cd-24) to *80.0 (%)*

Consider how it changes for 75.0 to 85.0%.



5 Exit the analog monitor adjustment mode and the [Ao1] terminal starts the output corresponding to the output current monitor.
Return the **Analog monitor adjust mode enable** (Cd-10) to *00: Disabled* to begin outputting the adjusted current from the [Ao1] terminal.

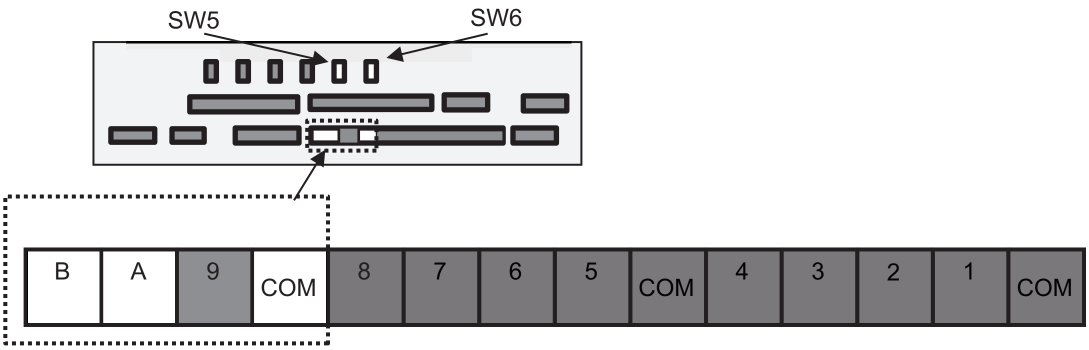
8-14 Pulse String Input Terminal Function

8-14-1 Overview

The pulse input terminals [A] and [B] can be used as command values, used as sensor inputs such as Vector control with sensor, and can also be used as a pulse count function.

● Terminals Corresponding to Parameters

Pulse input terminal [A], pulse input terminal [B]



Additional Information

The maximum pulse speed is 32 kpps.

Precautions for Correct Use

The values set in **Input terminal response time** (CA-41) to (CA-51) are also valid when inputting a pulse string. Depending on the setting, signals at the maximum pulse speed of 32 kpps may not be counted. Be sure to check for proper operation.

8-14-2 Pulse Input Method

The pulse input terminals [A] and [B] have two input methods, terminal input monitoring mode and phase coefficient monitoring mode.
When **Pulse train detection (internal) control terminal [A] [B]** (CA-90) is set to *00: Disabled*, it is in terminal input monitoring mode.
When **Pulse train detection (internal) control terminal [A] [B]** (CA-90) is set to something other than *00: Disabled*, it is in phase coefficient monitoring mode.

Usage	Description	Pulse train detection (internal) control terminal [A] [B] (CA-90)	Pulse input method
General-purpose input terminal	As a general-purpose input terminal, the function is operated by selecting the input terminal function.	00: Disabled	Terminal input monitoring mode

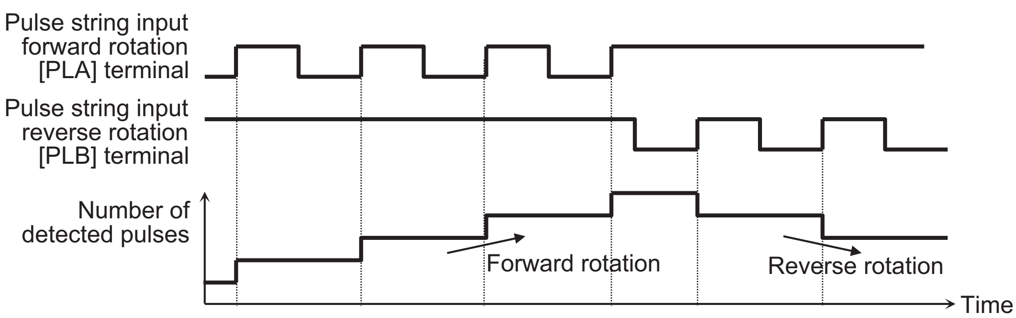
Usage	Description	Pulse train detection (internal) control terminal [A] [B] (CA-90)	Pulse input method
Pulse string command	Used for frequency commands and torque commands.	01: Frequency command	Phase coefficient monitoring mode
Sensor (speed) feedback	Vector control with sensor, used as sensor input for V / f control with sensor.	02: Speed feedback	
Pulse count function	Count the pulses on Pulse input A and B terminals and output as a compare match.	03: Pulse count	

● **Parameter**

Item	Parameter	Data	Description	Default
Pulse train detection (internal) control terminal [A] [B]	CA-90	Set the usage of input terminals [A] and [B].		
		00	Disabled (Treat as general-purpose input and select the function with the input terminal function)	00
		01	Frequency command	
		02	Speed feedback	
		03	Pulse count	

Terminal Input Monitoring Mode

The terminal input monitoring mode uses the pulse input terminals [A] and [B] as general-purpose inputs.
Assign the pulse string input terminals [103: PLA] and [104: PLB] to one of **Input terminal function** (CA-01) to (CA-11).
The pulse signal is counted by forward rotation of pulse string input terminal [103: PLA] (addition) and reverse rotation (subtraction) of [104: PLB].

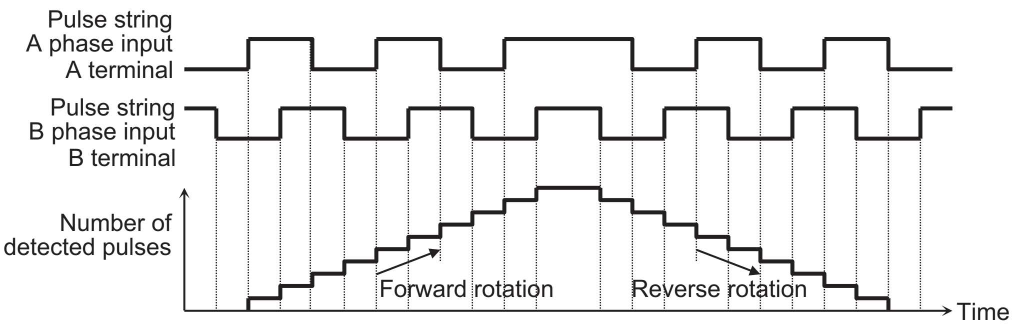


Phase Coefficient Monitoring Mode

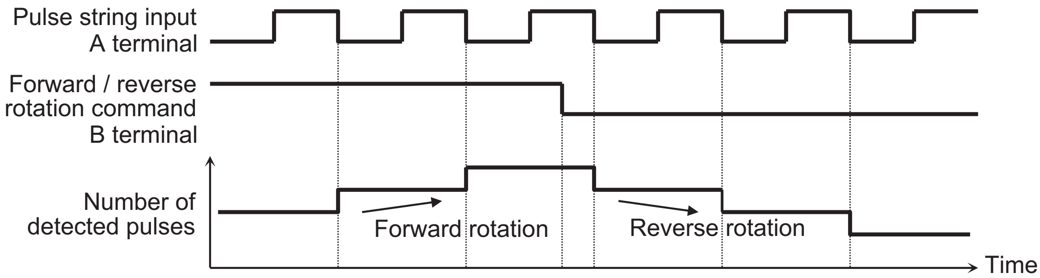
The phase coefficient monitoring mode uses the pulse input terminals [A] and [B] as pulse inputs.

In phase coefficient monitoring mode, the type of pulse string to input can be selected in **Mode selection of pulse train input** (CA-91).

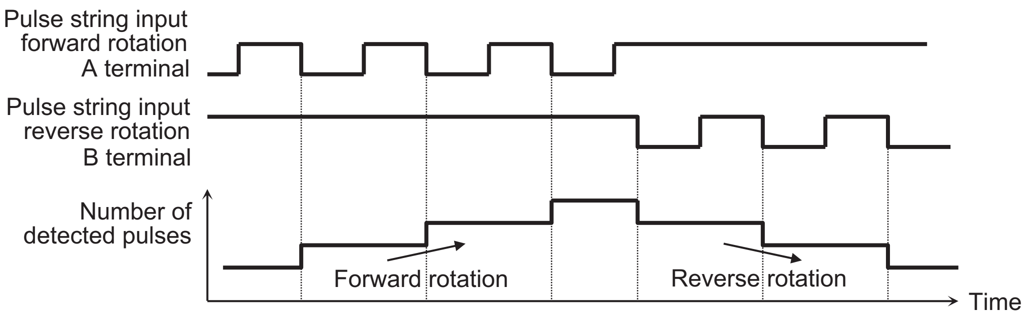
When **Mode selection of pulse train input (CA-91) is set to *00: 90° phase difference (4x)***



When **Mode selection of pulse train input (CA-91) is set to *01: forward / reverse rotation command and rotation direction***



When **Mode selection of pulse train input (CA-91) is set to *02: forward / reverse rotation pulse string***



● Parameter

Item	Parameter	Data	Description	Default
Mode selection of pulse train input	CA-91	0	90° phase difference pulse train	00
		1	Forward / reverse rotation command and rotation direction	
		2	Forward / reverse rotation pulse string	

8-14 Pulse String Input Terminal Function

8

8-14-2 Pulse Input Method

8-14-3 Pulse String Input Commands

When **Pulse train detection (internal) control terminal [A] [B]** (CA-90) is set to *01: Frequency command*, the pulse count value can be used for commands such as frequency command, torque command, PID set-point, PID feedback value, PID feed-forward, and frequency upper limit.
Set the following command function parameters in *12: Pulse string: Inverter*.

Code	Name
AA101	Main speed input source selection, 1st-motor
AA102	Sub frequency input source selection, 1st-motor
AA201	Main speed input source selection, 2nd-motor
AA202	Sub speed input source selection, 2nd-motor
Ad-01	Torque reference input source selection
Ad-11	Torque bias input source selection
Ad-40	Input selection for speed limit at torque control
AH-07	Input source selection of Set-point 1 for PID1
AH-42	Input source selection of Set-point 2 for PID1
AH-46	Input source selection of Set-point 3 for PID1
AH-51	Input source selection of Process data 1 for PID1
AH-52	Input source selection of Process data 2 for PID1
AH-53	Input source selection of Process data 3 for PID1
AH-70	PID feed-forward selection
AJ-07	Input source selection of Set-point for PID2
AJ-12	Input source selection of Process data for PID2
AJ-27	Input source selection of Set-point for PID3
AJ-32	Input source selection of Process data for PID3
AJ-47	Input source selection of Set-point for PID4
AJ-52	Input source selection of Process data for PID4
bA101	Frequency limit selection, 1st-motor
bA110	Torque limit selection, 1st-motor
bA201	Frequency limit selection, 2nd motor
bA210	Torque limit selection, 2nd-motor
CA-70	Speed reference source selection at [F-OP] is active

8-14-4 Speed Feedback

When **Pulse train detection (internal) control terminal [A] [B]** (CA-90) is set to *02: Speed feedback*, the speed feedback value is calculated from the input pulse signal.
Used as sensor input to Vector control with sensor and sensor input for V/f control.

The supported selections in **Control mode selection** (AA121) are as follows.

04 : [V/f with sign] Fixed torque characteristics (IM)
05 : [V/f with sign] Reduced torque characteristics (IM)
06: [V/f with sign] Free V/f (IM)
07: V/f with sensor] Auto torque boost (IM)
08: Sensorless vector control (IM)

The speed feedback value can be monitored with **Speed detection value monitor** (dA-08).

● **Parameter**

Item	Parameter	Data	Description	Default
Speed detection value monitor	dA-08	-590.00 to 590.00 (Hz)	Displays the data acquired by encoder feedback.	-

8-14-5 Pulse Count Function

When **Pulse train detection (internal) control terminal [A] [B]** (CA-90) is set to *03: Pulse count*, the input pulse string is counted.

To use this function, set the maximum count value in **Comparing match output Maximum value for Pulse count** (CA-99). The count value is a ring counter that becomes 0 when the maximum value is exceeded.
The pulse count value can be monitored with **Pulse counter monitor** (dA-28).

● **Parameter**

Item	Parameter	Data	Description	Default
Pulse counter monitor	dA-28	0 to 2147483647	Display the cumulative counter value.	-
Comparing match output Maximum value for Pulse count	CA-99	0 to 65535	When the cumulative counter value reaches the set value, the cumulative counter value becomes 0 and the count continues. If this setting is 0, the **Pulse counter monitor** (dA-28) repeats 0 and 1.	0
Input terminal function	CA-01 to CA-11	097	Clearing of pulse counter [97: PCC] clear the integrated value.	-

Clearing of Pulse Counter

The pulse count value can be cleared at any time.
Assign the [97: PCC] *clearing of pulse counter* to one of **Terminal input function** (CA-01) to (CA-11).
When the clearing of pulse counter [97: PCC] terminal is turned ON, the pulse count value is cleared to 0.

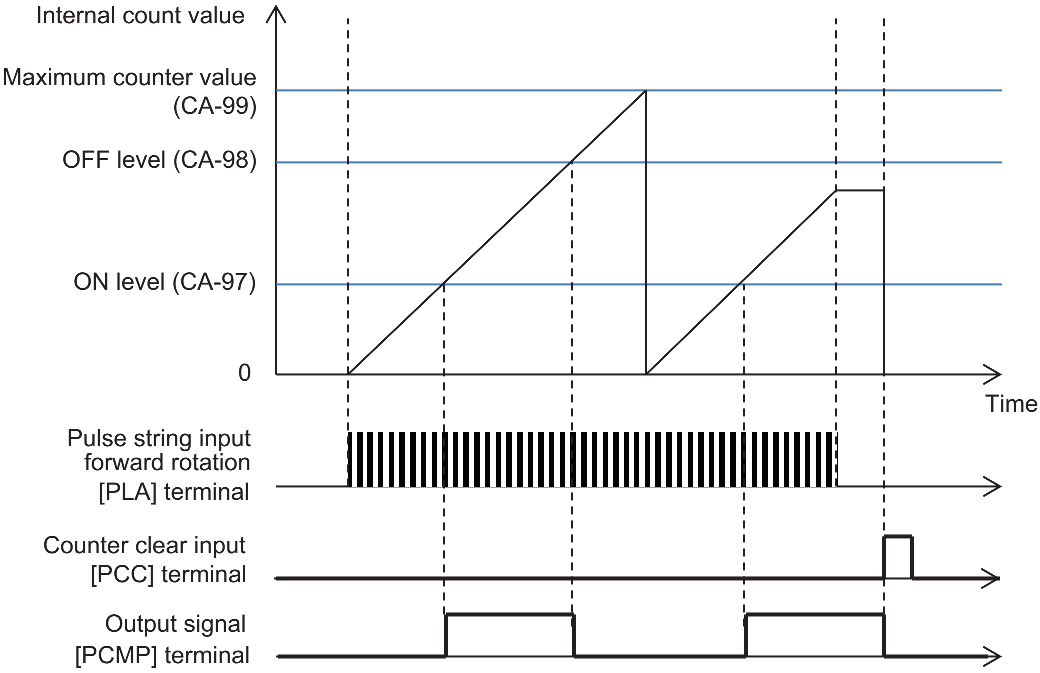
● **Parameter**

Item	Parameter	Data	Description	Default
Input terminal selection	CA-01 to CA-11	097	Clearing of pulse counter [97: PCC] clear the integrated value.	-

Compare Match

Compares the pulse count value with the compare match level and turns ON the output terminal.
To use this function, assign the pulse count compare match [44: PCMP] terminal to one of **Output terminal selection** (CC-01) to (CC-07).

Set the level at which it turns ON in **Comparing match output ON-level for Pulse count** (CA-97).
Set the level at which it turns OFF in **Comparing match output OFF-level for Pulse count** (CA-98).
When the pulse counter value is between the ON level and the OFF level, the pulse count compare match [44: PCMP] terminal turns ON.



● Parameter

Item	Parameter	Data	Description	Default
Comparing match output ON-level for Pulse count	CA-97	0 to 65535	When the cumulative counter value reaches this set value, the pulse count compare match output [44: PCMP] is turned ON.	0
Comparing match output OFF-level for Pulse count	CA-98	0 to 65535	When the cumulative counter value reaches this set value, the pulse count compare match output [44: PCMP] is turned OFF.	0
Output terminal selection	CC-01 to CC-07	044	Pulse count compare-match output [44: PCMP]	-

8-15 Digital Pulse Output Terminal Function

8-15-1 Overview

The digital pulse output terminal function can be used as a means for the peripheral circuit to realize control according to the motor operation by transmitting the control state inside the inverter to the peripheral circuit by the pulse width of the voltage or frequency output.

The digital pulse output terminal is one point of [FM]. Not all monitor parameters can be output to the digital pulse output terminal. You can select PWM output or digital frequency output for the digital pulse output.

When using the digital pulse output terminal, set the following.
- Pulse form settings
- Bias adjustment
- Gain adjustment
- Filter settings

● Parameter

Item	Parameter	Data	Description	Default
[FM] monitor output wave form selection	Cd-01	00	PWM output (6.4 ms cycle)	00
		01	Digital frequency output	
[FM] monitor output base frequency (at PWM output)	Cd-02	0 to 3600 (Hz)	[FM] terminal output frequency at full scale.	2880
[FM] monitor output selection	Cd-03	0000 to FFFF	Set the register number of the item to be monitored. Refer to *List of Output Monitor Functions* on page 15-85	(dA-01)
Analog monitor adjust mode enable	Cd-10	00	Disabled.	00
		01	Function enabled. Outputs the output level in adjustment mode to each terminal.	
Filter time constant of [FM]monitor	Cd-11	1 to 500 (ms)	Filters FM output data.	100
[FM] Data type selection	Cd-12	00	Outputs the absolute value of the data.	00
		01	Outputs data with a symbol.	
[FM] monitor bias adjustment	Cd-13	-100.0 to 100.0 (%)	Biases data to adjust Point 0 of data.	0.0
[FM] monitor gain adjustment	Cd-14	-1000.0 to 1000.0 (%)	Apply gain to the data and adjust the slope of the data	100.0

Item	Parameter	Data	Description	Default
Output level setting at [FM] monitor adjust mode	Cd-15	-100.0 to 100.0 (%)	Adjust the output for adjustment mode. The maximum output 100.0% and minimum output 0.0% (when **[FM] Data type selection** (Cd-12) set to *00: absolute value*) or the minimum output at -100.0% (when **[FM] Data type selection** (Cd-12) set to *01: with sign*).	100.0

Parameters that can be output by Digital Pulse Output

The following table shows the monitor parameters that can be output by the digital pulse output terminal.

Set the register number for the monitor parameters you wish to use in **[FM] monitor output selection** (Cd-03).

As an example, if you want to output the **Output current monitor** (dA-02) from the [FM] terminal, set **[FM] monitor output selection** (Cd-03) to *10002 (2712h)*.

Code	Register No.	Name	Output scale range	Remarks
dA-01	2711h	Output frequency monitor	0.00 to Maximum frequency (Hz)	
dA-02	2712h	Output current monitor	(0.00 to 2.00) × Inverter rated current (A)	
dA-04	2713h	Frequency command after calculation	0.00 to Maximum frequency (Hz)	Can be output with (±)
dA-08	2718h	Speed detection value monitor	0.00 to Maximum frequency (Hz)	Can be output with (±)
dA-12	271Ch	Output frequency monitor (with sign)	0.00 to Maximum frequency (Hz)	Can be output with (±)
dA-14	271Eh	Frequency upper limit monitor	0.00 to Maximum frequency (Hz)	
dA-15	271Fh	Torque command monitor after calculation	0 to 500% of the torque reference value (Nm) *1	Can be output with (±)
dA-16	2720h	Torque limit monitor	0 to 500% of the torque reference value (Nm) *1	Can be output with (±)
dA-17	2721h	Output torque monitor	0 to 500% of the torque reference value (Nm) *1	Can be output with (±)
dA-18	2722h	Output voltage monitor	0 to Rated voltage × 133% (V)	
dA-30	272Eh	Input power monitor	0.00 to 200% (kW) of inverter capacity	
dA-34	2732h	Output power monitor	0.00 to 200% (kW) of inverter capacity	Can be output with (±) Output is (+) during power running and (-) during regeneration.
dA-38	2736h	Motor temperature monitor	-20.0 to 200.0 (°C)	

Code	Register No.	Name	Output scale range	Remarks
dA-40	2738h	DC voltage monitor	200 V Class: 0.0 to 400.0 (VDC) 400 V Class: 0.0 to 800.0 (VDC)	
dA-41	2739h	braking resistor circuit (BRD) load factor monitor	0.00 to 100.00 (%)	
dA-42	273Ah	Electronic thermal duty ratio monitor MTR	0.00 to 100.00 (%)	
dA-43	273Bh	Electronic thermal duty ratio monitor CTL	0.00 to 100.00 (%)	
dA-61	274Dh	Analog input [Ai1] monitor	0.00 to 100.00 (%)	
dA-62	274Eh	Analog input [Ai2] monitor	0.00 to 100.00 (%)	
dA-63	274Fh	Analog input [Ai3] monitor	-100.00 to 100.00 (%)	Can be output with (±)
dA-70	2756h	Pulse string input monitor main body	-100.00 to 100.00 (%)	Can be output with (±)
dA-71	2757h	Pulse string input monitor option	-100.00 to 100.00 (%)	Can be output with (±)
db-18	2786h	Analog output monitor YA0	0.00 to 100.00	
db-19	2787h	Analog output monitor YA1	0.00 to 100.00	
db-20	2788h	Analog output monitor YA2	0.00 to 100.00	
db-30	2792h	PID1 feedback data 1 monitor	-100.00 to 100.00 (%) *2	Can be output with (±)
db-32	2794h	PID1 feedback data 2 monitor	-100.00 to 100.00 (%) *2	Can be output with (±)
db-34	2796h	PID1 feedback data 3 monitor	-100.00 to 100.00 (%) *2	Can be output with (±)
db-36	2798h	PID2 feedback data monitor	-100.00 to 100.00 (%) *3	Can be output with (±)
db-38	279Ah	PID3 feedback data monitor	-100.00 to 100.00 (%) *4	Can be output with (±)
db-40	279Ch	PID4 feedback data monitor	-100.00 to 100.00 (%) *5	Can be output with (±)
db-42	279Eh	PID1 target value monitor after calculation	-100.00 to 100.00 (%) *2	Can be output with (±)
db-44	27A0h	PID1 feedback data monitor after calculation	-100.00 to 100.00 (%) *2	Can be output with (±)
db-50	27A6h	PID1 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-51	27A7h	PID1 deviation monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-52	27A8h	PID1 deviation 1 monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-53	27A9h	PID1 deviation 2 monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-54	27AAh	PID1 deviation 3 monitor	-200.00 to 200.00 (%)	Can be output with (±)

Code	Register No.	Name	Output scale range	Remarks
db-55	27ABh	PID2 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-56	27ACh	PID2 deviation monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-57	27ADh	PID3 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-58	27AEh	PID3 deviation inverse	-200.00 to 200.00 (%)	Can be output with (±)
db-59	27AFh	PID4 output monitor	-100.00 to 100.00 (%)	Can be output with (±)
db-60	27B0h	PID4 deviation monitor	-200.00 to 200.00 (%)	Can be output with (±)
db-64	27B4h	PID feed-forward monitor	0.00 to 100.00 (%)	
dC-15	27E7h	Cooling fin temperature monitor	-20.0 to 200.0 (°C)	
FA-01	2AF9h	Main Speed reference monitor	0.00 to 590.00 (Hz)	
FA-02	2AFAh	Sub speed reference	0.00 to 590.00 (Hz)	
FA-15	2B07h	Torque reference monitor	Torque reference value x (-500.0 to 500.0 (%)) *1	Can be output with (±)
FA-16	2B08h	Torque bias monitor	Torque reference value x (-500.0 to 500.0 (%)) *1	Can be output with (±)
FA-30	2B16h	PID1 Set-point 1	0.00 to 100.00 (%) *2	
FA-32	2B18h	PID1 Set-point 2	0.00 to 100.00 (%) *2	
FA-34	2B1Ah	PID1 Set-point 3	0.00 to 100.00 (%) *2	
FA-36	2B1Ch	PID2 Set-point	0.00 to 100.00 (%) *3	
FA-38	2B1Eh	PID3 Set-point	0.00 to 100.00 (%) *4	
FA-40	2B20h	PID4 Set-point	0.00 to 100.00 (%) *5	

*1. The torque reference value (100%) is calculated as follows. Torque reference value = 79.58 x motor capacity x number of poles / base frequency
(Example) Torque reference value = 79.58 x 5.5 (kW) x 4 (P) / 50 (Hz) ≒ 35Nm

*2. The data range differs between **PID1 scale adjustment (at 0%)** (AH-04) and **PID1 scale adjustment (point position)** (AH-06).

*3. The data range changes depending on the selection of **PID2 scale adjustment (at 0%)** (AJ-04) to **PID scale adjustment (point position)** (AJ-06).

*4. The data range changes depending on the selection of **PID3 scale adjustment (at 0%)** (AJ-24) to **PID3 scale adjustment (point position)** (AJ-26).

*5. The data range changes depending on the selection of **PID4 scale adjustment (at 0%)** (AJ-44) to **PID4 scale adjustment (point position)** (AJ-46).

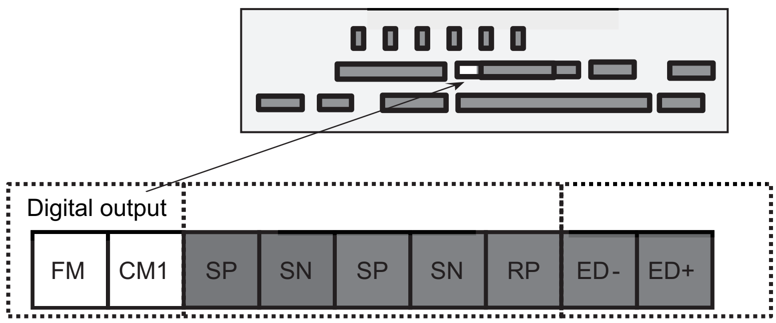
Precautions for Correct Use

- The final output cannot exceed the output range of the digital pulse output terminal [FM].
- The data adopted for the digital pulse output terminal [FM] is (±) when **[FM] Data type selection** (Cd-12) is set to *01: with sign*. Conversely, if they are set to *00: absolute value*, the (-) data is output as (+) data as an absolute value.

● Parameter

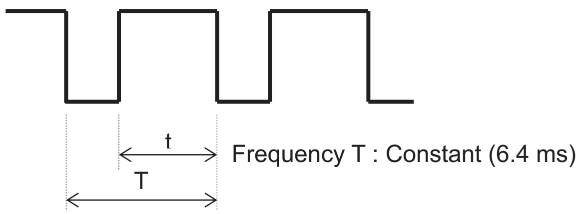
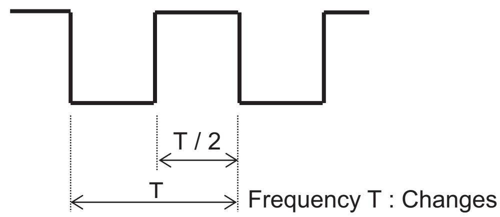
Item	Parameter	Data	Description	Default
[FM] monitor output selection	Cd-03	0000 to FFFF	Set the register number of the item to be monitored. Refer to *List of Output Monitor Functions* on page 15-85	(dA-01)

● Terminals corresponding to parameters



8-15-2 Pulse Form

You can select PWM output or digital frequency output for the digital pulse output.

When **[FM] monitor output wave form selection** (Cd-01) is set to *00*, PWM is output	When **[FM] monitor output wave form selection** (Cd-01) is set to *01*, digital frequency is output
 Duty ratio t / T : Changes	 Duty ratio t / T : Fixed (approximately 1 / 2)

● Parameter

Item	Parameter	Data	Description	Default
[FM] monitor output wave form selection	Cd-01	00	PWM output (6.4 ms cycle)	00
		01	Digital frequency output	
[FM] monitor output base frequency (at PWM output)	Cd-02	0 to 3600 (Hz)	[FM] terminal output frequency at full scale.	2880
[FM] Data type selection	Cd-12	00	Outputs the absolute value of the data.	00
		01	Outputs data with a symbol.	

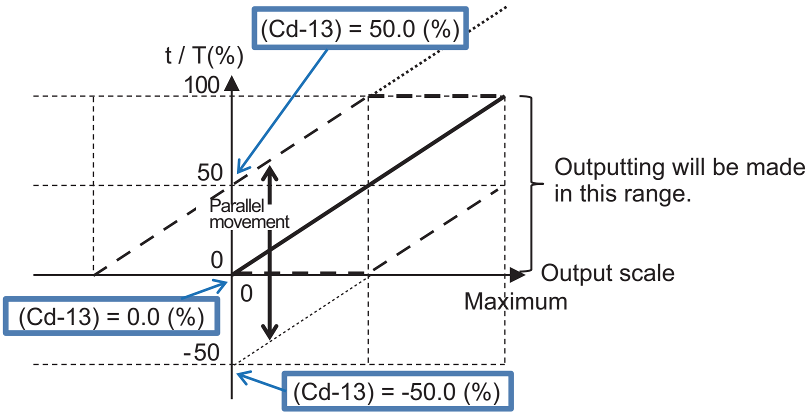
8-15-3 Bias Adjustment

Bias is a value that can be set to add a fixed value to the output. It is used to adjust the 0 value, which is the reference point for the data.

To adjust the bias, use the analog monitor adjustment mode. Set **Output level setting at [FM] monitor adjust mode** (Cd-15) to *0.00%* and measure the output pulse from the digital pulse output [FM] terminal. Adjust the **[FM] monitor bias adjustment** (Cd-13) setting so that the measured pulse becomes 0.00%.
Refer to *8-15-6 Analog monitor adjust mode* on page 8-208 for the adjustment method.

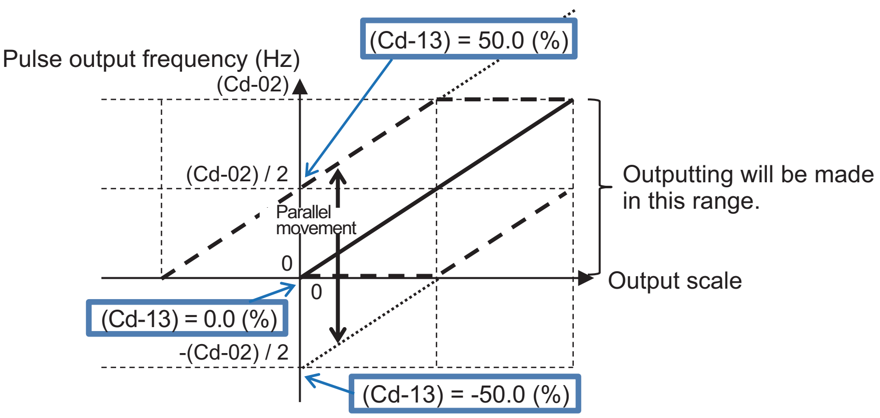
[FM] Output Terminal Pulse Form set to PWM

When **[FM] monitor output wave form selection** (Cd-01) is set to *00: PWM*



[FM] Output Terminal Pulse Form set to Frequency

When **[FM] monitor output wave form selection** (Cd-01) is set to *01: Frequency*



- **Parameter**

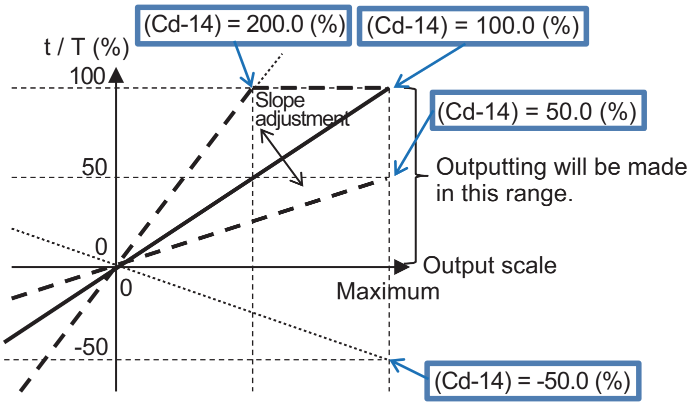
Item	Parameter	Data	Description	Default
[FM] monitor bias adjustment	Cd-13	-100.0 to 100.0 (%)	Biases data to adjust Point 0 of data.	0.0

8-15-4 Gain Adjustment

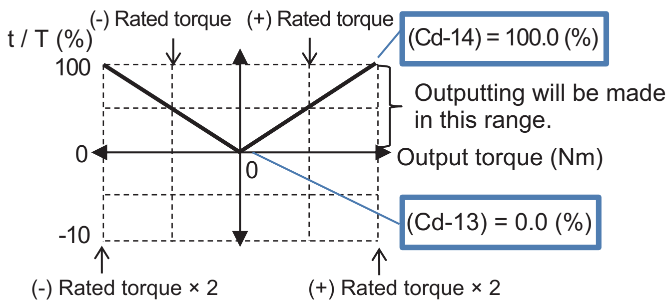
Gain is a setting value that is output by multiplying the input value by a particular ratio. It is used to adjust the slope when the graph is displayed.

To adjust the gain setting, use the analog monitor adjustment mode. Set **Output level setting at [FM] monitor adjust mode** (Cd-15) to *100.00%* and measure the output pulse from the digital pulse output [FM] terminal. Adjust the **[FM] monitor gain adjustment** (Cd-14) setting so that the measured value is a pulse showing 100.00 (%)
For the adjustment method, refer to *8-15-6 Analog monitor adjust mode* on page 8-208

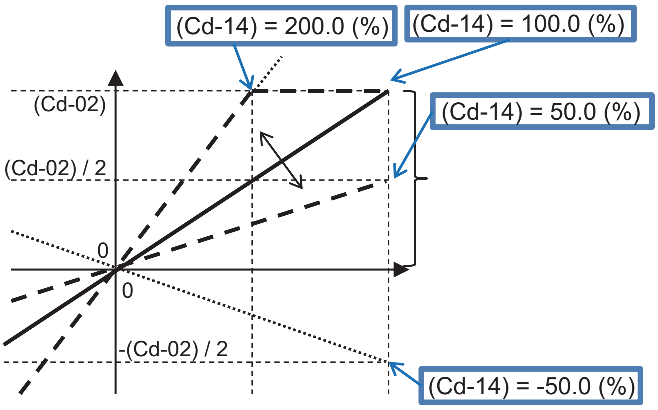
When [FM] monitor output wave form selection (Cd-01) is set to *00: PWM*



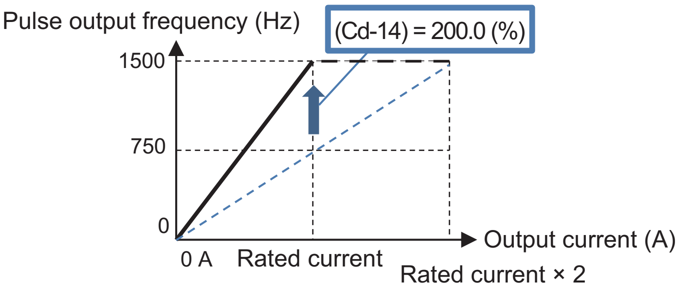
(Example): Output PWM for Output torque monitor (dA-17)
Set 0 to ± 200% of torque to PWM output of 0 to 100%.
Set **[FM] Data type selection** (Cd-12) to *00: absolute value*, **[FM] monitor bias adjustment** (Cd-13) to *0.0 (%)* and **[FM] monitor gain adjustment** (Cd-14) to *100.0 (%)*.



When [FM] monitor output wave form selection (Cd-01) is set to *01: Frequency*



(Example): [FM] monitor output base frequency (at PWM output) (Cd-02) set to *1500 Hz*.
Set **[FM] monitor bias adjustment** (Cd-13) to *0.0 (%)* and **[FM] monitor gain adjustment** (Cd-14) to *200.0 (%)*.



● **Parameter**

Item	Parameter	Data	Description	Default
[FM] monitor gain adjustment	Cd-14	-1000.0 to 1000.0 (%)	Apply gain to the data and adjust the slope of the data	100.0

8-15-5 Digital Pulse Output Filter Settings

Set the time constant of the digital pulse filter.
When the device receiving the digital pulse output signal cannot withstand the sudden change in the digital pulse signal, sudden fluctuation of the digital pulse output from the inverter is suppressed.
If the output filter time constant is increased, sudden changes will be suppressed before output.

● **Parameter**

Item	Parameter	Data	Description	Default
Filter time constant of [FM] monitor	Cd-11	1 to 500 (ms)	Filters the selected data and outputs it.	100

8-15-6 Analog monitor adjust mode

The analog monitor adjustment mode is a function that outputs the set value to the digital pulse output terminal.

When adjusting the bias and gain, you can specify any output value in the analog monitor adjustment mode, so you can check the adjustment status.

To use the function, set **Analog monitor adjust mode enable** (Cd-10) to *01: Enabled*.
Set the output value in **Output level setting at [FM] monitor adjust mode** (Cd-15).
For the output value, the value set in **Output level setting at [FM] monitor adjust mode** (Cd-15) is output according to the monitor parameter output scale range set for **[FM] monitor output selection** (Cd-03).

● Parameter

Item	Parameter	Data	Description	Default
Analog monitor adjust mode enable	Cd-10	00	Disabled	00
		01	Function enabled. Outputs the output level in adjustment mode to each terminal.	
[FM] Data type selection	Cd-12	00	Outputs the absolute value of the data.	00
		01	Outputs data with a symbol.	
Output level setting at [FM] monitor adjust mode	Cd-15	-100.0 to 100.0 (%)	Adjust the output for adjustment mode. The maximum output 100.0% and minimum output 0.0% (when **[FM] Data type selection** (Cd-12) set to *00: absolute value*) or the minimum output at -100.0% (when **[FM] Data type selection** (Cd-12) set to *01: with sign*).	100.0

● Adjustment Use Case Example

(Example) Output PWM for Output Current Monitor

The value set for **Output level setting at [FM] monitor adjust mode** (Cd-15) is output according to the monitor parameter output scale range set for **[FM] monitor output selection** (Cd-03).
Outputs at 100% PWM output when the current flowing is equivalent to the rated current of the inverter.
(The reference point is the rated current of the inverter)

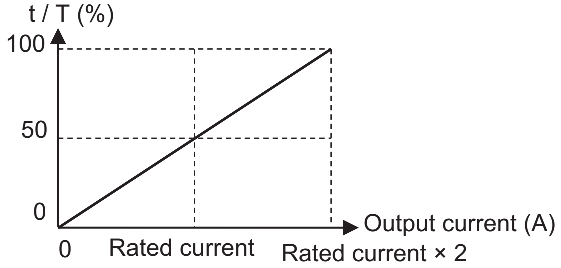
Code	Name	Output scale range
dA-02	Output current monitor	(0.00 to 2.00) × Inverter rated current (A)

1 Set the parameters of the [FM] terminal and enter the analog monitor adjustment mode.
Set the following parameters.

- Set **[FM] monitor output wave form selection** (Cd-01) to *00* to output PWM.
- Set **[FM] monitor output selection** (Cd-03) to *dA-02*.
- Set **Analog monitor adjust mode enable** (Cd-10) to *01: Enabled*.
- Set **[FM] Data type selection** (Cd-12) to *00*.
- Set **Output level setting at [FM] monitor adjust mode** (Cd-15) to *0.0 (%)*.

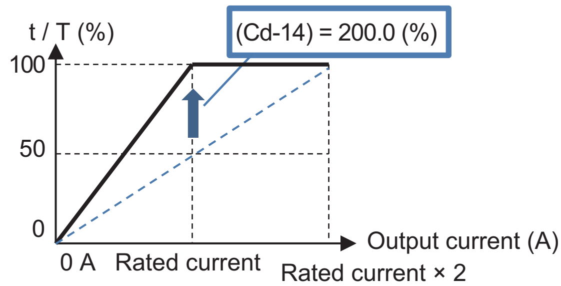
The value set for **Output level setting at [FM] monitor adjust mode** (Cd-15) is output according to the monitor parameter output scale range set for **[FM] monitor output selection** (Cd-03).

2 Check the output from the [FM] terminal corresponding to output reference point.
In this example, the reference point is the rated current of the inverter. The maximum scale of (dA-02) is "rated current x 2.00", so the reference point is a point half that value. When **Output level setting at [FM] monitor adjust mode** (Cd-15) is set to *50.0 (%)*, the output is equivalent to the inverter's rated current.
In this state, 50% duty PWM, which is the output at the rated current (= rated current x 2.00 x 50.0%), is output from the [FM] terminal.



If necessary, adjust **[FM] monitor bias adjustment** (Cd-13), but in this example, no adjustment of *0.0 (%)* is needed.

3 Adjust the gain.
Adjust the slope using **[FM] monitor gain adjustment** (Cd-14). In this example, it is set to full scale at the rated current. Adjust **[FM] monitor gain adjustment** (Cd-14) to the point where PWM becomes 100% duty output. As a guide, adjust in the range of 190.0 to 210.0%.
Set **[FM] monitor bias adjustment** (Cd-13) to *0.0 (%)* and **[FM] monitor gain adjustment** (Cd-14) to *200.0 (%)*.



4 Exit the analog monitor adjustment mode and the [FM] terminal starts the output corresponding to the output current monitor.
Return the **Analog monitor adjust mode enable** (Cd-10) to **00: Disabled** to begin outputting the adjusted PWM from the [FM] terminal.

9

Communication function

This section describes the communication function.

9-1 Communication Specifications

The 3G3RX2 Series Inverter has an RS485 communications capability that enables the inverter to communicate with an external controller from its RS485 communications terminal block on the control terminal block PCB.

Communication Specifications

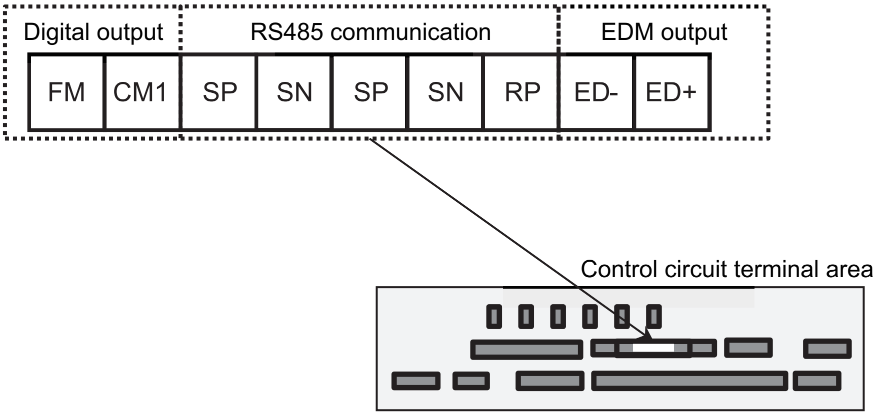
Item	Modbus method	Remarks
Transmission speed (baud rate)	2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200 bps	**RS485 communication baud rate selection** (CF-01)
Communication method	Half duplex communication	
Synchronous method	Non-synchronous method	
Transmission code	Binary	
Transmission method	Transmission starts with Least Significant Bit (LSB first)	
Applicable interface	RS-485	
Data bit length	8 bits	
Parity	None, Even, Odd	**RS485 communication parity selection** (CF-03)
Stop bit length	1/2 bits	**RS485 communication stop-bit selection** (CF-04)
Start method	Half side start method by host side command	
Waiting time	0 to 1000 (ms)	**RS485 communication wait time setting** (CF-07)
Connection form	1:N (N=32)	
slave address	1 to 247	**RS485 communication Node allocation** (CF-02)
Error check	Overrun, Framing, CRC-16, Horizontal parity	

9-1-1 Specifications of RS485 Communication Terminal Block

The RS485 communications function uses RS485 communication terminal block for terminals of the control circuit.

Terminal Block Specifications

The terminals for RS485 communications are as follows.



Terminal symbol	Terminal name	Function
SP[*1]	RS485 sending / receiving terminal + side	At + side of sending/receiving signal of RS485 communication. There are two SP terminals for wiring on the upstream side and the downstream side, and they are connected internally. If you use an external terminating resistor at the termination, connect it to this terminal.
SN[*1]	RS485 sending / receiving terminal - side	At - side of sending/receiving signal of RS485 communication. There are two SN terminals for wiring on the upstream side and the downstream side, and they are connected internally. For the termination, connect this terminal to the RP terminal and enable the built-in terminating resistor, or connect an external terminating resistor to this terminal.
RP	Enable terminating resistor terminal	A terminal which enables built-in terminating resistor (100 Ω). The internal terminating resistor can be enabled when you connect the - side of RS485 communication sending/receiving terminal to RP.
CM1[*2]	Signal ground	You can connect a signal ground of an external communication device. (Also for FM terminal)

*1. There are two terminals, which are connected internally.
*2. The CM1 terminal is internally connected to the negative side of the internal 24 V.

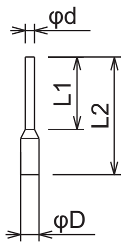
Wires

The following sizes are recommended for the wire to be connected to the RS485 communication terminal block.

Wire type	Wire size (mm^2)
Solid wire	0.14 to 1.5 (If two equal-sized wires are connected to one pole: 0.14 to 0.5)
Stranded wire	0.14 to 1.0 (If two equal-sized wires are connected to one pole: 0.14 to 0.2)

- **Ferrules with sleeve**

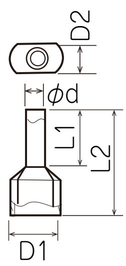
Wire size mm^2 (AWG)	L1 [mm]	L2 [mm]	φd [mm]	φD [mm]
0.25 (24)	8	12.5	0.8	2.0
0.34 (22)	8	12.5	0.8	2.0
0.5 (20)	8	14	1.1	2.5
0.75 (18)	8	14	1.3	2.8



- **Twin-wire ferrule with sleeve**

Ferrule with sleeve, twin-wire insertion type (Phoenix Contact AI-TWIN 2X 0.5-8)

Wire size mm^2 (AWG)	L1 [mm]	L2 [mm]	φd [mm]	D1 [mm]	D2 [mm]
0.25 (24)×2	8	15.0	1.5	4.7	2.5
0.34 (22)×2					
0.5 (20)×2					

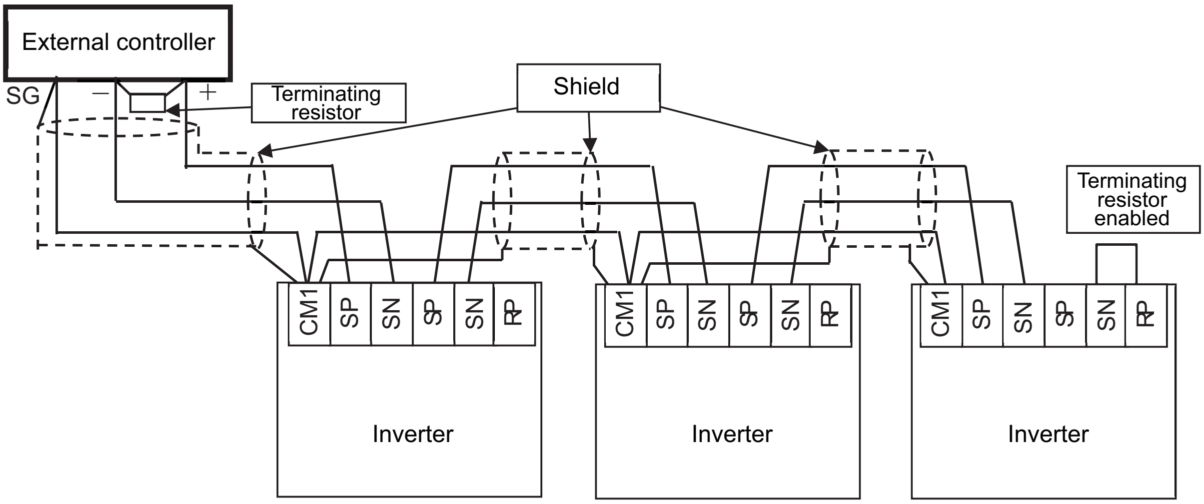


When using the wiring of Example 2 under the connection example below, select a thin wire so that two wires can be wired in one pole, and attach a twin-wire insertion type ferrule if necessary.

Connection Example

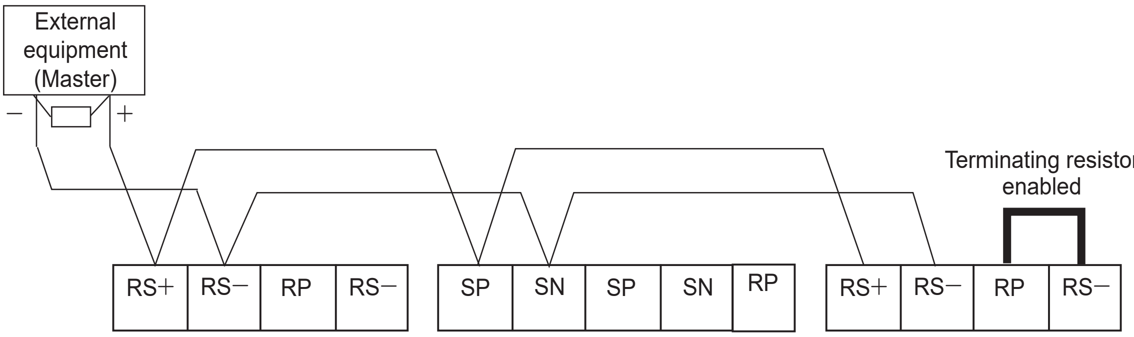
- **Example 1**

Connect the inverters in parallel and install a terminating resistor between the SP and SN terminals of the terminating inverter. Use the terminating resistor even if only one inverter is connected.
Selecting a terminating resistor that matches the cable impedance improves the terminating effect.
This inverter has a built-in terminating resistor (100 Ω). Short-circuit between the RP and SN terminals as shown in the figure below to enable the terminating resistor.



- **Example 2**

When wiring with mixed communication, such as when upgrading the inverter (3G3RX-V1) used in the existing equipment with the new 3G3RX2 Series Inverter, it is possible to use the existing wiring members. In this case, replace the [RS +] terminal with [SP], and the [RS-] terminal with [SN] for wiring.



Upgrade from 3G3RX-V1 to 3G3RX2

9-1-2 Communication Parameter Settings

To configure the 3G3RX2 Series Inverter for RS485 communications, the following settings are required.

● Parameter

Parameter No.	Function name	Data	Default	Unit
CF-01	RS485 communication baud rate selection (baud rate selection)	03: 2400bps	05	
		04: 4800bps		
		05: 9600bps		
		06: 19200bps		
		07: 38400bps		
		08: 57600bps		
		09: 76800bps		
		10: 115200bps		

Parameter No.	Function name	Data	Default	Unit
CF-02	RS485 communication Node allocation	1 to 247: Allocate each inverter's station number. Set station numbers to control several inverters simultaneously.	1	
CF-03	RS485 communication parity selection	00: Without parity	00	
		01: Even number parity		
		02: Odd number parity		
CF-04	RS485 communication stop-bit selection	01: 1 bit	01	
		02: 2 bit		
CF-05	RS485 communication error selection	00: Error	02	
		01: Trip after deceleration stop		
		02: Ignore		
		03: Free run		
		04: Deceleration stop		
CF-06	RS485 communication timeout setting	0.00: Function disabled	0.00	s
		0.01 to 100.00: Length of time to occurrence of a communications timeout		
CF-07	RS485 communication wait time setting	0 to 1000: Time to wait for response from the inverter	2	ms
CF-08	RS485 communication mode selection	01: Modbus-RTU	01	
		02: EzCOM		
		03: EzCOM management		

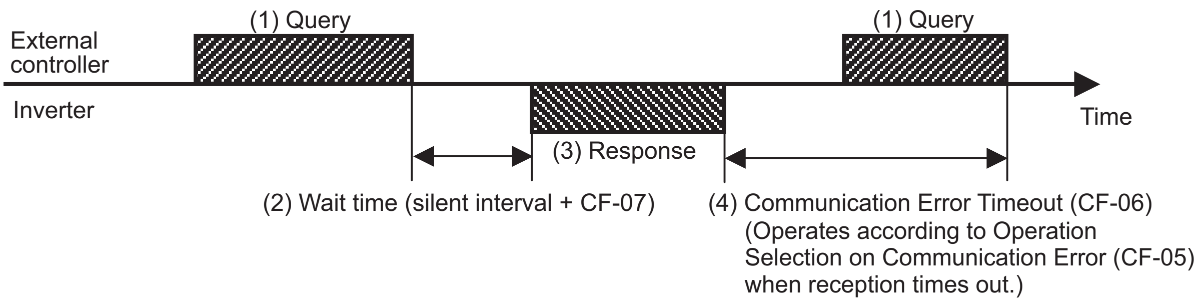
● Output Terminal Function (CC-01) to (CC-07)

Item	Terminal name	Data	Description
Communication disconnection	NDc	049	ON: A disconnection occurs in the communication line between the SP and SN terminals, or **RS485 communication timeout setting** (CF-06) has exceeded. OFF: Normal After detection, it returns to OFF when the error is cleared.

9-2 Modbus Method

Communication Procedure

The inverter communicates with an external controller as follows.



1. Frame (Query) that is sent from the external controller to the inverter.
2. After receiving a query frame, the inverter waits for the total time of the Silent Interval and **RS485 communication wait time setting**(CF-07), before returning a response.
   [Silent Interval]
   The wait time that is specified on Modbus communication. Its data length is 3.5 characters (bytes). It depends on the Modbus communication speed setting.
3. Frame (Response) that is sent from the inverter back to the external controller.
4. After sending a response, the inverter monitors the time until it completes receiving the query frame from the external controller. The inverter judges it as a communications error if it receives no response within **RS485 communication timeout setting** (CF-06).
   Then, the inverter operates according **RS485 communication error selection**(CF-05), while waiting for the reception of the first data again.
   The monitoring of the communication error timeout starts from the first sending/receiving operation is established after the power supply is cycled or after the inverter is reset.
   The inverter does not recognize as a communications error timeout if the sending/receiving operation is not established at all.
   For setting details, refer to the following information.

Parameter No.	Function name	Data	Default	Unit
CF-05	RS485 communication error selection	00: Error Trip after reception timeout (E041)	02	-
		01: Trip after deceleration stop Deceleration stop after timeout in principle. Trip after stop (E041)		
		02: Ignore The inverter does not trip or output an alarm.		
		03: Free run Free run stop after reception timeout. The inverter does not trip or output an alarm.		
		04: Deceleration stop Deceleration stop after reception timeout. The inverter does not trip or output an alarm.		
CF-06	RS485 communication timeout setting	0.00: Function disabled	0.00	s
		0.01 to 100.00: Length of time to occurrence of a communications error timeout		
CF-07	RS485 communication wait time setting	0 to 1000: Time to wait for response from the inverter (exclude silent inverter)	2	ms

Query Frame Configuration

The format of a query frame (command) is as follows.

Slave address
Function code
Data
Error check

<Slave Address>

- A serial number from 1 to 32 preset for each inverter (slave). Only the inverter that matches the slave address specified in the query will capture that query.
- Set the slave address to *0* to perform broadcasting (distributing a query to all slave addresses at a time).
- During a broadcast, you cannot perform data call or loop-back operation.

<Function code>

This specifies the function to be performed by the inverter.

Function code

Function code	Function	Maximum number of data bytes per message	Maximum number of coils/registers per message
01 hex	Reads out the state of coil	4	32 coils (bitwise)
03 hex	Reads out the content of holding register	32	16 registers (in bytes)

Function code	Function	Maximum number of data bytes per message	Maximum number of coils/registers per message
05 hex	Writes to coil	2	1 coil (bitwise)
06 hex	Writes to holding register	2	1 registers (in bytes)
08 hex	Loop back test	-	-
0F hex	Writes to multiple coils	4	32 coil (bitwise)
10 hex	Writes to multiple holding registers	32	16 registers (in bytes)

<Data>

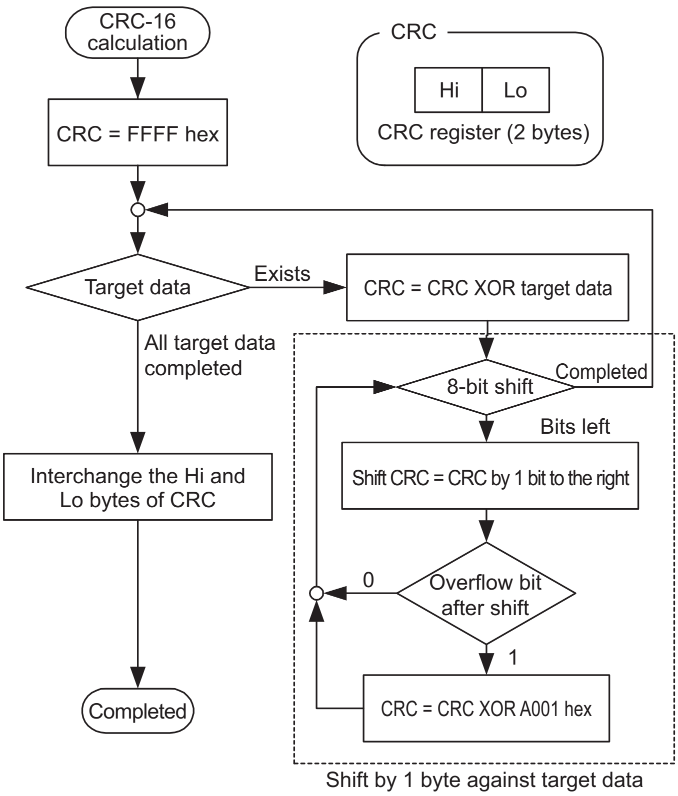
- This sends the function instruction.
- The data format differs depending on the function code.

Data name	Description
Coil	Data of two values (1 bit length) that can be read and written.
Holding register	Data with 16 bit length that can be read and written.

<Error Check>

- CRC (Cyclic Redundancy Check) is used for error checking.
- The CRC code is 16-bit data generated for any data block with a data length in 8-bit unit.
- For CRC code generation, the following generator polynomial is used: CRC-16($X^{16} + X^{15} + X^{2} + 1$).

CRC-16 Polynomial Calculation Example



<Header/Trailer (Silent Interval)>

- The silent interval is the length of time during which the inverter waits after receiving a query from the master, before sending back a response to it.
- Be sure to include a silent interval of 3.5 characters (3.5 bytes) as the wait time. If it is less than 3.5 characters, the inverter will send no response.
- The actual wait time during communications is the sum of the silent interval *3.5 characters* and **RS485 communication wait time setting** (CF-07).

Response Frame Configuration

<Required Communications Time>

- The time that the inverter takes to send a response after receiving a query is the sum of the silent interval *3.5 characters* and **RS485 communication wait time setting** (CF-07).
- After receiving a response from an inverter, be sure to include an interval equivalent to the silent interval *3.5 characters* or more before sending the next query to the inverter.

<Normal Response>

- If a query includes the loop-back function code (08 hex), the inverter sends back a response with the same content as that of the query.
- If a query includes a function code for writing data to a holding register or coil (05 hex, 06 hex, 0F hex, 10 hex), the inverter returns the query as a response.
- If a query includes a function code for reading data from a holding register or coil (01 hex, 03 hex), the inverter sends back a response that includes the same slave address and function code as the query, with the read data.

<Abnormal Response>

Field Configuration

Slave address
Function code
Exception code
CRC-16

- If an error (except for a communications error) is found in the query content, the inverter will return an exception response without performing any operation.
- For the cause of an error, check the function code for the response. The function code for an exception response is the sum of the function code for the query and 80 hex.
- For the cause of an error, check the exception code.

Exception code

Code	Description
01 hex	An unsupported function is specified.
02 hex	The specified address does not exist.
03 hex	The specified data is in an unacceptable format.
21 hex	Writing to a holding register is specified, but the data is out of the range allowed for the inverter.

Code	Description
22 hex	The inverter does not allow this function because: • Inverter is in an operation busy state. • Function attempts to change a register that cannot be changed during RUN. • Function attempts to issue the Enter instruction during RUN (in an undervoltage state). • Function attempts to write data to a register during trip (in an undervoltage state). • Function attempts to write data to a read-only register (coil).
23 hex	The writing function code is used in the read-only function parameter.
26 hex	While data is being written into the inverter, or the inverter's data is being initialized, some data is written into the inverter.
27 hex	There was an access to only the higher side register of 2 register long parameter.

<No Response>

The inverter will ignore the query and send back no response if:

- It receives a broadcast query.
- It detects a communications error in receiving a query.
- The slave address specified in a query does not match the inverter's slave address setting.
- The length of the time interval set for the inverter to receive the next data of the message after receiving a message is less than 3.5 characters.
- The data length of a query is inappropriate.
- The length of the reception interval in a frame exceeds the 1.5 characters.
- The error check code specified in a query does not match (CRC error).
- When it received a group-specific broadcast (query of slave address 250 to 254).

Note Provide a timer on the master side for monitoring the response and set it to resend the same query if no response is received within the set time.

9-3 Explanation of Each Function Code

Read Coil Status [01 hex]

Reads the ON/OFF coil status.

Precautions for Correct Use

The byte order was changed when data over 1 byte is processed with reading function of several coils via Modbus communication. Receive data in the data layout as shown below, according to the number of data bytes to be read.

- Data received as 1-byte data (1 to 8 coils)

Coil 8 to Coil 1

- Data received as 2-byte data (9 to 16 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9

- Data received as 3-byte data (17 to 24 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17

- Data received as 4-byte data (25 to 32 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17	Coil 32 to Coil 25

(Example)

<u>When inverter's input terminal function 1 to 6 with slave address 8 is read out</u>

The input terminal status is shown in the table below.

Item	Data					
Input terminal No.	1	2	3	4	5	6
Coil number	0005 hex	0006 hex	0007 hex	0008 hex	0009 hex	000A hex
Terminal status	ON	ON	ON	OFF	ON	OFF

Coil number 000B hex and 000C hex are OFF.

Query

No.	Field name	Example (hex)	Remarks
1	Slave address*1	08	
2	Function code	01	
3	Coil start number (MSB)*2	00	(Coil address) = (Coil number) - 1
4	Coil start number (LSB)*2	04	
5	Number of coils (MSB)*3	00	
6	Number of coils (LSB)*3	06	
7	CRC-16 (MSB)	5C	
8	CRC-16 (LSB)	90	

*1. Broadcasting cannot be performed.

*2. Note that the coil start number is *0004*, which is 1 less than the coil number *0005*.

*3. If the number of coils to be read is set to 0 or more than 32, an error code (03 hex) will be returned.

Response

No.	Field name	Example (hex)	Remarks
1	Slave address	08	
2	Function code	01	
3	Data bytes	01	
4	Coil data*1	17	17h = 0 0 0 1 0 1 1 1 Input terminal 6 Input terminal 1
5	CRC-16 (MSB)	12	
6	CRC-16 (LSB)	1A	

*1. Data is transferred for the number of data bytes.

Data received to a response shows status of coil number 0005 hex to 000F hex (Input terminal 1 to 9, A, and B).
Therefore, the received data *17 hex = 00010111b* can be read from the LSB that shows the status of coil number 0007 hex, as follows.

Coil number	00F hex	00E hex	00D hex	00C hex	00B hex	00A hex	009 hex	008 hex	007 hex	006 hex	005 hex
Coil status	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	ON	ON
Input terminal No.	B	A	9	8	7	6	5	4	3	2	1

If, in the last coil data, the read coil exceeds the defined coil range, such out-of-range coil data will be transferred as *0*.
If the Read Coil Status function is not executed normally, refer to *Exception Response* on page 9-19.

Read from Holding Register [03 hex]

Reads the contents of consecutive holding registers. From the specified holding register, the specified number of holding registers can be read.
(Example)
<u>To read past trip data from the inverter with slave address 5.</u>
(Read out factors of trip monitor 1 and output frequency.)

	Trip monitor 1 (Factor)	Trip monitor 1 (Output frequency)
Holding register number	03E9 hex	03EA hex, 03EB hex
Data	Overvoltage (E007) (0007 hex)	60.00 Hz (0000 hex, 1770 hex)

Query

No.	Field name	Example (hex)	Remarks
1	Slave address*1	05	

No.	Field name	Example (hex)	Remarks
2	Function code	03	
3	Register start number (MSB)*2	03	(Register address) = (Register number) - 1
4	Register start number (LSB)*2	E8	
5	Number of holding registers (MSB)	00	3 registers
6	Number of holding registers (LSB)	03	
7	CRC-16 (MSB)	84	
8	CRC-16 (LSB)	3F	

*1. Broadcasting cannot be performed.

*2. Note that the register start number is *03E8 hex*, which is 1 less than the register number *03E9 hex*.

Response

No.	Field name	Example (hex)	Remarks
1	Slave address	05	
2	Function code	03	
3	Data bytes*1	06	
4	Register start number (MSB)	00	0007 hex → 07 decimal → E007 (Factor: Overvoltage)
5	Register start number (LSB)	07	
6	Register start number +1 (MSB)	00	60.00 Hz (000 hex, 1770 hex)
7	Register start number +1 (LSB)	00	
8	Register start number +2 (MSB)	17	
9	Register start number +2 (LSB)	70	
10	CRC-16 (MSB)	A8	
11	CRC-16 (LSB)	61	

*1. Data is transferred for the number of data bytes. In this example, the inverter sends back 4 bytes of data from two holding registers.

If the Read from Holding Register function is not executed normally, refer to *Exception Response* on page 9-19.

Write to Coil [05 hex]

Writes the ON/OFF status to a single coil. The coil status changes as shown in the table below.

Data	Coil status	
	OFF to ON	ON to OFF
Written data (MSB)	FF hex	00 hex
Written data (LSB)	00 hex	00 hex

(Example)

To issue the RUN command to the inverter with slave address 10.

To operate the inverter, you need to set **Run-command input source selection, 1st-motor** (AA111) to *03*. Write the RUN command to the coil number 0001.

Query

No.	Field name	Example (hex)	Remarks
1	Slave address*1	0A	
2	Function code	05	
3	Coil start number (MSB)*2	00	(Coil address) = (Coil number) - 1
4	Coil start number (LSB)*2	00	
5	Written data (MSB)	FF	OFF→ON: FF00 hex
6	Written data (LSB)	00	
7	CRC-16 (MSB)	8D	
8	CRC-16 (LSB)	41	

*1. During a broadcast, no response will be sent back.
*2. Note that the coil start number is *0000*, which is 1 less than the coil number *0001*.

Response

No.	Field name	Example (hex)
1	Slave address	0A
2	Function code	05
3	Coil start number (MSB)	00
4	Coil start number (LSB)	00
5	Written data (MSB)	FF
6	Written data (LSB)	00
7	CRC-16 (MSB)	8D
8	CRC-16 (LSB)	41

If the Write to Coil function is not executed normally, refer to *Exception Response* on page 9-19.

Write to Holding Register [06 hex]

Writes data to the specified holding register.
(Example)
To write 50 Hz to the inverter with slave address 1 as the base frequency.
The holding register *2F4E hex* for **Multispeed-0 setting, 1st-motor** (Ab110) has a data resolution of 0.01 Hz. So if you want to set 50 Hz, you need to set the changed data to 5000 (1388 hex).

Query

No.*3	Field name	Example (hex)
1	Slave address*1	01
2	Function code	06
3	Register start number (MSB)*2	2F
4	Register start number (LSB)*2	4D
5	Changed data (MSB)	13
6	Changed data (LSB)	88
7	CRC-16 (MSB)	1C
8	CRC-16 (LSB)	5F

*1. During a broadcast, no response will be sent back.
*2. Note that the register start number is *2F4D hex*, which is 1 less than the register number *2F4E hex*.

Response

No.	Field name	Example (hex)
1	Slave address	01
2	Function code	06
3	Register start number (MSB)	2F
4	Register start number (LSB)	4D
5	Changed data (MSB)	13
6	Changed data (LSB)	88
7	CRC-16 (MSB)	1C
8	CRC-16 (LSB)	5F

Note that, except for **Main Speed reference monitor** (FA-01), overwriting the parameters on the data display does not update the displayed data in real time.
To show the updated value, once return to the parameter display and then display the data again.
If the Write to Holding Register function is not executed normally, refer to *Exception Response* on page 9-19.

Loop-back Test [08 hex]

Checks the communications between the master and the slave. Any value can be used for test data.
(Example)
To perform a loop-back test on the inverter with slave address 1.

Query

No.	Field name	Example (hex)
1	Slave address*1	01
2	Function code	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Any
6	Data (LSB)	Any
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

*1. Broadcasting cannot be performed.

Response

No.	Field name	Example (hex)
1	Slave address*1	01
2	Function code	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Any
6	Data (LSB)	Any

No.	Field name	Example (hex)
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

*1. Broadcasting cannot be performed.

The test sub code supports the Echo Query Data command (00 hex, 00 hex) only. Other commands are not supported.

Write to Multiple Coils [0F hex]

Rewrites the ON/OFF status to consecutive multiple coils.

Precautions for Correct Use

The byte order was changed when data over 1 byte is processed with writing function of multiple coils via Modbus communication. In addition, due to the specifications of Modbus communication, the inverter cannot process any odd number of bytes.
If the data to be written has an odd number of bytes, add 1 byte of padding data. Send data in the data layout for an even number of bytes as shown below, according to the number of data bytes to be written.

- Data sent as 1-byte data (1 to 8 coils)

Coil 8 to Coil 1

- Data sent as 2-byte data (9 to 16 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9

- Data sent as 3-byte data (17 to 24 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17

- Data sent as 4-byte data (25 to 32 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17	Coil 32 to Coil 25

Note, however, that this Inverter does not send data of 2 bytes or more because it can write to coil numbers *0001 hex* to *000F hex*.

(Example)

Change the ON/OFF status of the input terminals 1 to 6 for the inverter with slave address 5.

Change the input terminals into statuses shown below table.

Item	Data					
Input terminal No.	1	2	3	4	5	6
Coil number	0005 hex	0006 hex	0007 hex	0008 hex	0009 hex	000A hex
Terminal status	ON	ON	ON	OFF	ON	OFF

Query

No.	Field name	Example (hex)	Remarks
1	Slave address[*1]	05	
2	Function code	0F	
3	Coil start number (MSB)[*2]	00	(Coil address) = (Coil number) - 1
4	Coil start number (LSB)[*2]	04	
5	Number of coils (MSB)	00	
6	Number of coils (LSB)	06	
7	Data bytes[*3]	02	
8	Changed data (MSB)[*3]	17	17h = 0 0 0 1 0 1 1 1 Input terminal 6 Input terminal 1
9	Changed data (LSB)[*3]	00	
10	CRC-16 (MSB)	DB	
11	CRC-16 (LSB)	3E	

*1. During a broadcast, no response will be sent back.
*2. Note that the coil start number is *0004*, which is 1 less than the coil number *0005*.
*3. Since the changed data comprises both MSB and LSB as a set, make the byte to be an even number by adding 1, even if the byte which actually needs to be changed is an odd number.

Response

No.	Field name	Example (hex)
1	Slave address	05
2	Function code	0F
3	Coil start number (MSB)	00
4	Coil start number (LSB)	04
5	Number of coils (MSB)	00
6	Number of coils (LSB)	06
7	CRC-16 (MSB)	34
8	CRC-16 (LSB)	4C

Input terminal is recognized as ON when either the terminal block input or the communications setting turns ON.
If the Write to Holding Register function is not executed normally, refer to *Exception Response* on page 9-19.

Write to Multiple Holding Registers [10 hex]

Writes data to consecutive multiple holding registers.
(Example)
To write 3,000 seconds to the inverter with slave address 1 as **Acceleration time monitor** (FA-10).
The holding registers *2B02 hex* to *2B03 hex* for **Acceleration time monitor** (FA-10) have a data resolution of 0.01 seconds. So if you want to set 3,000 seconds, you need to set the changed data to *300000 (493E0 hex)*.

Query

No.	Field name	Example (hex)	Remarks
1	Slave address*1	01	
2	Function code	10	
3	Register start address (MSB)*2	2B	(Register address) = (Register number) - 1
4	Register start address (LSB)*2	01	
5	Number of holding registers (MSB)	00	
6	Number of holding registers (LSB)	02	
7	Data bytes*3	04	
8	Written data 1 (MSB)	00	000493E0 hex → 300000 decimal → 3000.00 seconds
9	Written data 1 (LSB)	04	
10	Written data 2 (MSB)	93	
11	Written data 2 (LSB)	E0	
12	CRC-16 (MSB)	9E	
13	CRC-16 (LSB)	9F	

*1. During a broadcast, no response will be sent back.

*2. Note that the register start address *2B01 hex*, which is 1 less than the register number *2B02 hex*.

*3. This is not the number of holding registers, but the number of bytes to be changed actually.

Response

No.	Field name	Example (hex)
1	Slave address	01
2	Function code	10
3	Register start address (MSB)	2B
4	Register start address (LSB)	01
5	Number of holding registers (MSB)	00
6	Number of holding registers (LSB)	02
7	CRC-16 (MSB)	E5
8	CRC-16 (LSB)	34

If the Write to Holding Register function is not executed normally, refer to *Exception Response* on page 9-19.

Exception Response

The broadcast and master request for response.

Although the slave inverter normally returns a response to the query, it will return an exception response if the query has an error.

A exception response has the following field configuration.

Field configuration
Slave address
Function code

Field configuration
Exception code
CRC-16

The details of the field configuration are as shown below.
An exception response will have a function code, which is the sum of the function code value of the query and 80 hex. An exception code shows the reason why the exception response is returned.

Function code

Query	Exception response
01 hex	81 hex
03 hex	83 hex
05 hex	85 hex
06 hex	86 hex
0F hex	8F hex
10 hex	90 hex

Exception code

Code	Description
01 hex	An unsupported function is specified.
02 hex	The specified address does not exist.
03 hex	The specified data is in an unacceptable format.
21 hex	Writing to a holding register is specified, but the data is out of the range allowed for the inverter.
22 hex	The inverter does not allow this function because:
	Function attempts to change a register that cannot be changed during RUN.
	Data was written to a register to which soft-lock has been applied.
	An Enter instruction was executed during RUN.
	An Enter instruction was executed during undervoltage.
	Function attempts to write to a register when auto-tuning is enabled, etc.
23 hex	The writing function code is used in the read-only function parameter.
26 hex	While data is being written into the inverter, or the inverter's data is being initialized, some data is written into the inverter.
27 hex	There was an access to only the higher side register of 2 register long parameter.

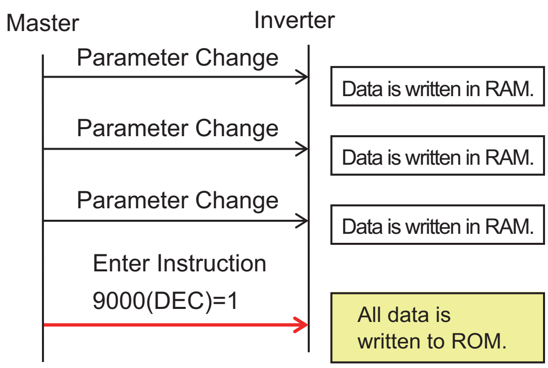
9-4 Saving a Change to Holding Register (Enter Instruction)

The Write to Holding Register (06 hex) or Write to Consecutive Holding Registers (10 hex) function is used to enable the new data. However, the new data is not stored in the EEPROM of the inverter and is restored to the previous value when the inverter power supply is shut off.
To store a change to holding registers in the inverter's EEPROM memory, issue the Enter instruction according to the following procedure.
In addition, after changing the control constant, you need to recalculate the motor constant.

How to Issue Enter Instruction

Write 1 to Holding Register (9000 (DEC)) with the Write to Holding Register (06 hex) command.

Enter Instruction



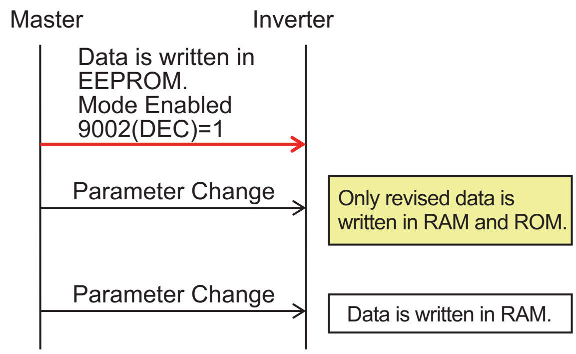
Data Write Mode

To change to the data write mode, use the Write to Holding Register (06 hex) command to write *1* in the holding register (9002 (DEC)).
The new data that is changed using the Write to Holding Register (06 hex) command in the data write mode is stored in both the temporary RAM and non-volatile ROM. Concurrently, the data write mode is canceled.
If a command other than the Write to Holding Register (06 hex) is received in the data write mode, the data write mode is canceled.

Precautions for Correct Use

- After receiving the Enter instruction, the inverter returns a response to the host and writes the value to the EEPROM memory. You can monitor the during data write signal (Coil No. 0049 hex) to check whether the data is written.
- Since the inverter's EEPROM memory has a limit for the number of rewrites (approximately 100,000 times), the inverter life may be shortened if the Enter instruction is frequently used.

Data Writing Mode



Re-calculation of Control Processing Internal Variable

The control processing internal variable is re-calculated when *1* is written to the holding register (9010 (DEC)) with the Write to Holding Register (06 hex) command.

9-5 Modbus Communication Register Number List

9-5-1 Coil Number List

R/W in the list shows whether data can be read from, or written to, the coil or holding register.

R: Read only

R/W: Read and Write enabled

Precautions for Correct Use

- The *Coil No.* in the table shows the coil number used inside the inverter.
- The *Modbus coil spec. No.* in the table shows the coil number used to actually specify the coil in the Modbus communication process.
  This coil number is 1 less than the inverter *Coil No.* according to the Modbus communication specifications.

<Coil Number List>

Coil No.	Modbus coil spec. No.	Item	R/W	Setting description
0000 hex		(Reserved)		
0001 hex	0000 hex	Operation command	R/W	1: Run 0: Stop (enabled when **Run-command input source selection** (AA111) or (AA211) is *03*)
0002 hex	0001 hex	Rotation direction command	R/W	1: Reverse 0: Normal (enabled when **Run-command input source selection** (AA111) or (AA211) is *03*)
0003 hex	0002 hex	External trip (EXT)	R/W	1: Trip 0: Not trip
0004 hex	0003 hex	Trip reset (RS)	R/W	1: Reset 0: Not reset
0005 hex	0004 hex	Input terminal 1	R/W	1: ON 0: OFF*1
0006 hex	0005 hex	Input terminal 2	R/W	1: ON 0: OFF*1
0007 hex	0006 hex	Input terminal 3	R/W	1: ON 0: OFF*1
0008 hex	0007 hex	Input terminal 4	R/W	1: ON 0: OFF*1
0009 hex	0008 hex	Input terminal 5	R/W	1: ON 0: OFF*1

Coil No.	Modbus coil spec. No.	Item	R/W	Setting description
000A hex	0009 hex	Input terminal 6	R/W	1: ON 0: OFF*1
000B hex	000A hex	Input terminal 7	R/W	1: ON 0: OFF*1
000C hex	000B hex	Input terminal 8	R/W	1: ON 0: OFF*1
000D hex	000C hex	Input terminal 9	R/W	1: ON 0: OFF*1
000E hex	000D hex	Input terminal A	R/W	1: ON 0: OFF*1
000F hex	000E hex	Input terminal B	R/W	1: ON 0: OFF*1
0010 to 0014 hex	000F to 0013 hex	(Reserved)		
0015 hex	0014 hex	Operating status	R	1: Rotating in normal direction, rotating in reverse direction 0：Other state (linked with**Operation direction monitor**(dA-03))
0016 hex	0015 hex	Rotation direction	R	1: Rotating in reverse direction 0: Rotating in normal direction (linked with **Operation direction monitor** (dA-03))
0017 hex	0016 hex	Inverter operation ready completion	R	1: Ready 0: Not ready
0018 hex	0017 hex	(Reserved)		
0019 hex	0018 hex	Output terminal 11	R	1: ON 0: OFF
001A hex	0019 hex	Output terminal 12	R	1: ON 0: OFF
001B hex	001A hex	Output terminal 13	R	1: ON 0: OFF
001C hex	001B hex	Output terminal 14	R	1: ON 0: OFF
001D hex	001C hex	Output terminal 15	R	1: ON 0: OFF
001E hex	001D hex	Output terminal 16	R	1: ON 0: OFF
001F hex	001E hex	Output terminal AL	R	1: ON 0: OFF
0020 to 0048 hex	001F to 0047 hex	(Reserved)		
0049 hex	0048 hex	Data being written	R	1: Being written 0: Normal state
004A hex	0049 hex	CRC error	R	1: With error 0: No error*2
004B hex	004A hex	Overrun error	R	1: With error 0: No error*2

Coil No.	Modbus coil spec. No.	Item	R/W	Setting description
004C hex	004B hex	Framing error	R	1: With error 0: No error*2
004D hex	004C hex	Parity error	R	1: With error 0: No error*2
004E hex	004D hex	Sum check error	R	1: With error 0: No error*2
004F hex	004E hex	(Reserved)		

*1. While either the control circuit terminal block or the coil is ON, the input terminal turns ON.
The input of the control circuit terminal block is prioritized.
In some cases, the coil ON status cannot be reset from the master due to communication disconnection. To turn the coil OFF, change the control circuit terminal block from ON to OFF.

*2. The communication error status is kept until an error reset is input. It can be reset during the operation.

9-5-2 Group d Register List

Precautions for Correct Use

- The *Coil No.* in the table shows the coil number used inside the inverter.
- The *Modbus coil spec. No* in the table shows the coil number used to actually specify the coil in the Modbus communication process.
  This coil number is 1 less than the inverter *Coil No* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2711 hex	2710 hex	Output frequency monitor	dA-01	R	0 to 59000	0.01 Hz
2712 hex	2711 hex	Output current monitor	dA-02	R	0 to 65535	0.01 A
2713 hex	2712 hex	Operation direction monitor	dA-03	R	00: o (Stopped) 01: d (0 Hz output) 02: F (Normal rotation in process) 03: r (Reverse rotation in process)	-
2714 hex	2713 hex	Frequency command after calculation	dA-04 (HIGH)	R	-59000 to 59000	0.01 Hz
2715 hex	2714 hex		dA-05 (LOW)	R		
2716 hex	2715 hex	Output frequency conversion monitor	dA-06 (HIGH)	R	0 to 5900000	0.01
2717 hex	2716 hex		dA-07 (LOW)	R		
2718 hex	2717 hex	Speed detection value monitor	dA-08 (HIGH)	R	-59000 to 59000	0.01 Hz
2719 hex	2718 hex		dA-09 (LOW)	R		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
271C hex	2719 hex	Output frequency monitor (with sign)	dA-12 (HIGH)	R	-59000 to 59000	0.01 Hz
271D hex	271C hex		dA-13 (LOW)	R		
271E hex	271D hex	Frequency upper limit moni-tor	dA-14	R	0 to 59000	0.01 Hz
271F hex	271E hex	Torque command monitor after calculation	dA-15	R	-10000 to 10000	0.10%
2720 hex	271F hex	Torque limit monitor	dA-16	R	0 to 5000	0.10%
2721 hex	2720 hex	Output torque monitor	dA-17	R	-10000 to 10000	0.10%
2722 hex	2721 hex	Output voltage monitor	dA-18	R	0 to 8000	0.1 V
2724 hex	2723 hex	Current position monitor	dA-20 (HIGH)	R	In case of (AA121) is “10” and (AA123) is “03”, the data range is -2147483648 to 2147483647 In the case of the settings other than the above, da-ta range is -536870912 to 536870911	1 pls
2725 hex	2724 hex		dA-21 (LOW)	R		
272A hex	2729 hex	Pulse train position devia-tion monitor	dA-26 (HIGH)	R	-2147483647 to 2147483647	1 pls
272B hex	272A hex		dA-27 (LOW)	R		
272C hex	272B hex	Pulse counter monitor	dA-28 (HIGH)	R	0 to 2147483647	1 pls
272D hex	272C hex		dA-29 (LOW)	R		
272E hex	272D hex	Input power monitor	dA-30	R	0 to 60000 (132 kW max.) 0 to 20000 (160 kW min.)	0.01 kWh 0.1 kWh
2730 hex	273F hex	Integrated input power monitor	dA-32 (HIGH)	R	0 to 10000000	0.1 kWh
2731 hex	2730 hex		dA-33 (LOW)	R		
2732 hex	2731 hex	Output power monitor	dA-34	R	0 to 60000 (132 kW max.) 0 to 20000 (160 kW min.)	0.01 kWh 0.1 kWh
2734 hex	2733 hex	Integrated output power monitor	dA-36 (HIGH)	R	0 to 10000000	0.1 kWh
2735 hex	2734 hex		dA-37 (LOW)	R		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2736 hex	2735 hex	Motor temperature monitor	dA-38	R	-200 to 2000	0.1℃
2738 hex	2737 hex	DC voltage monitor	dA-40	R	0 to 10000	0.1 VDC
2739 hex	2738 hex	BRD load factor monitor	dA-41	R	0 to 10000	0.01%
273A hex	2739 hex	Electronic thermal duty ratio monitor MTR	dA-42	R	0 to 10000	0.01%
273B hex	273A hex	Electronic thermal duty ratio monitor CTL	dA-43	R	0 to 10000	0.01%
273D hex	273C hex	Integrated output power monitor	dA-45	R	00: No input 01: P-1A 02: P-2A 03: P-1b 04: P-2b 05: P-1C 06: P-2C 07: STO	-
2742 hex	2741 hex	Terminal block option mounted state	dA-50	R	00: STD-TM1 (fixed val-ue)	-
2743 hex	2742 hex	Input terminal monitor	dA-51	R	LLLLLLLLLLL to HHHHHHHHHHH [L: OFF / H: ON] [Left side] (terminal B) (terminal A) (terminal 9) - (termianl 1) [Right side]	1
2746 hex	2725 hex	Output terminal monitor	dA-54	R	LLLLLLL to HHHHHHH [L: OFF / H: ON] [Left side] (terminal AL) (terminal 16C) (terminal 15) - (termianl 11) [Right side]	1
274C hex	274B hex	Analog I/O selection moni-tor	dA-60	R	AAAAAAAA to VVVVVVVV [A: current / V: voltage] [Left side] (Reserved) (Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (termi-nal Ai1) [Right side]	1
274D hex	274C hex	Analog input [Ai1] monitor	dA-61	R	0 to 10000	0.01%
274E hex	274D hex	Analog input [Ai2] monitor	dA-62	R	0 to 10000	0.01%
274F hex	274E hex	Analog input [Ai3] monitor	dA-63	R	-10000 to 10000	0.01%

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2756 hex	2755 hex	Pulse string input monitor main body	dA-70	R	-10000 to 10000	0.01%
2757 hex	2756 hex	Pulse string input monitor option	dA-71	R	-10000 to 10000	0.01%
2761 hex	2760 hex	Option slot 1 mounted state	dA-81	R	00: None 09: RX2-ECT 33: RX2-PG	-
2762 hex	2761 hex	Option slot 2 mounted state	dA-82	R		-
2763 hex	2762 hex	Option slot 3 mounted state	dA-83	R		-
2775 hex	2774 hex	Program download monitor	db-01	R	00: Without a program 01: With a program	-
2776 hex	2775 hex	Program No. monitor	db-02	R	0 to 9999	1
2777 hex	2776 hex	Program counter (Task-1)	db-03	R	1 to 1024	1
2778 hex	2777 hex	Program counter (Task-2)	db-04	R		1
2779 hex	2778 hex	Program counter (Task-3)	db-05	R		1
277A hex	2779 hex	Program counter (Task-4)	db-06	R		1
277B hex	277A hex	Program counter (Task-5)	db-07	R		1
277C hex	277B hex	User monitor 0	db-08 (HIGH)	R	-2147483647 to 2147483647	1
277D hex	277C hex		db-09 (LOW)	R		
277E hex	277D hex	User monitor 1	db-10 (HIGH)	R		1
277F hex	277E hex		db-11 (LOW)	R		
2780 hex	277F hex	User monitor 2	db-12 (HIGH)	R		1
2781 hex	2780 hex		db-13 (LOW)	R		
2782 hex	2781 hex	User monitor 3	db-14 (HIGH)	R		1
2783 hex	2782 hex		db-15 (LOW)	R		
2784 hex	2783 hex	User monitor 4	db-16 (HIGH)	R		1
2785 hex	2784 hex		db-17 (LOW)	R		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2786 hex	2785 hex	Analog output monitor YA0	db-18	R	0 to 10000	0.01%
2787 hex	2786 hex	Analog output monitor YA1	db-19	R		0.01%
2788 hex	2787 hex	Analog output monitor YA2	db-20	R		0.01%
2792 hex	2791 hex	PID1 feedback data 1 monitor	db-30 (HIGH)	R	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)**(AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
2793 hex	2792 hex		db-31 (LOW)	R		
2794 hex	2793 hex	PID1 feedback data 2 monitor	db-32 (HIGH)	R	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
2795 hex	2794 hex		db-33 (LOW)	R		
2796 hex	2795 hex	PID1 feedback data 3 monitor	db-34 (HIGH)	R	**PID1 scale adjustment (at 0%)**(AH-04) to **PID1 scale adjustment (point position)**(AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
2797 hex	2796 hex		db-35 (LOW)	R		
2798 hex	2797 hex	PID2 feedback data monitor	db-36 (HIGH)	R	**PID2 scale adjustment (at 0%)**(AJ-04) to **PID2 scale adjustment (point position)**(AJ-06)	AJ-03 と AJ-06 設定による
2799 hex	2798 hex		db-37 (LOW)	R		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
279A hex	2799 hex	PID3 feedback data monitor	db-38 (HIGH)	R	**PID3 scale adjustment (at 0%)**(AJ-24) to **PID3 scale adjustment (point position)**(AJ-26)	[PID3 scale adjustment (at 0%)] (AJ-24) to [PID3 scale adjustment (pointposition)] (AJ-26) Unit differs depending on the AJ-23 and AJ-26 settings.
279B hex	279A hex		db-39 (LOW)	R		
279C hex	279B hex	PID4 feedback data monitor	db-40 (HIGH)	R	**PID4 scale adjustment (at 0%)**(AJ-44) to **PID4 scale adjustment (point position)**(AJ-46)	Unit differs depending on the AJ-43 and AJ-46 settings.
279D hex	279C hex		db-41 (LOW)	R		
279E hex	279D hex	PID1 target value monitor after calculation	db-42 (HIGH)	R	**PID1 scale adjustment (at 0%)**(AH-04) to **PID1 scale adjustment (point position)**	Unit differs depending on the AH-03 and AH-06 settings.
279F hex	279E hex		db-43 (LOW)	R		
27A0 hex	279F hex	PID1 feedback data	db-44 (HIGH)	R	**PID1 scale adjustment (at 0%)**(AH-04) to **PID1 scale adjustment (point position)**(AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
27A1 hex	27A0 hex		db-45 (LOW)	R		
27A6 hex	27A5 hex	PID1 output monitor	db-50	R	-10000 to 10000	0.01%

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
27A7 hex	27A6 hex	PID1 deviation monitor	db-51	R	-20000 to 20000	0.01%
27A8 hex	27A7 hex	PID1 deviation 1 monitor	db-52	R		0.01%
27A9 hex	27A8 hex	PID1 deviation 2 monitor	db-53	R		0.01%
27AA hex	27A9 hex	PID1 deviation 3 monitor	db-54	R		0.01%
27AB hex	27AA hex	PID2 output monitor	db-55	R	-10000 to 10000	0.01%
27AC hex	27AB hex	PID2 deviation monitor	db-56	R	-20000 to 20000	0.01%
27AD hex	27AC hex	PID3 output monitor	db-57	R	-10000 to 10000	0.01%
27AE hex	27AD hex	PID3 deviation monitor	db-58	R	-20000 to 20000	0.01%
27AF hex	27AE hex	PID4 output monitor	db-59	R	-10000 to 10000	0.01%
27B0 hex	27AF hex	PID4 deviation monitor	db-60	R	-20000 to 20000	0.01%
27B1 hex	27B0 hex	PID current P gain monitor	db-61	R	0 to 1000	0.1%
27B2 hex	27B1 hex	PID current I gain monitor	db-62	R	0 to 36000	0.1 s
27B3 hex	27B2 hex	PID current D gain monitor	db-63	R	0 to 10000	0.01 s
27B4 hex	27B3 hex	PID feed-forward monitor	db-64	R	-10000 to 10000	0.01%
27D9 hex	27D8 hex	Inverter load type selection monitor	dC-01	R	00: Very low duty 01: Low duty 02: Normal duty	-
27DA hex	27D9 hex	Rated current monitor	dC-02	R	0 to 65535	0.1 A

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
27DF hex	27DE hex	Speed command destination monitor (main)	dC-07	R	00: Disabled 01: Ai1 02: Ai2 03: Ai3 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Multistage speed 0 08: Sub speed 09: Multistage speed 1 10: Multistage speed 2 11: Multistage speed 3 12: Multistage speed 4 13: Multistage speed 5 14: Multistage speed 6 15: Multistage speed 7 16: Multistage speed 8 17: Multistage speed 9 18: Multistage speed 10 19: Multistage speed 11 20: Multistage speed 12 21: Multistage speed 13 22: Multistage speed 14 23: Multistage speed 15 24: JG 25: RS485 26: Option 1 27: Option 2 28: Option 3 29: Pulse string: Inverter 30: Pulse string: Option 31: DriveProgramming 32: PID 33: (Reserved) 34: AHD retention speed	-
28DF hex	27DF hex	Speed command destination monitor (auxiliary)	dC-08	R		-
27E2 hex	27E1 hex	Operation command destination monitor	dC-10	R	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 setting 04: Option 1 05: Option 2 06: Option 3	-
27E7 hex	27E6 hex	Cooling fin temperature monitor	dC-15	R	-200 to 2000	0.1℃
27E8 hex	27E7 hex	Life diagnostic monitor	dC-16	R	0 to 0xFF	1
27EC hex	27EB hex	Total start-up count	dC-20	R	1 to 65535	1

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
27ED hex	27EC hex	Power-on count	dC-21	R	1 to 65535	1
27EE hex	27ED hex	Cumulative operating hours monitor during RUN	dC-22 (HIGH)	R	0 to 1000000	1 hr
27EF hex	27EE hex		dC-23 (LOW)			
27F0 hex	27EF hex	Cumulative power-on time	dC-24 (HIGH)	R	0 to 1000000	1 hr
27F1 hex	27F0 hex		dC-25 (LOW)			
27F2 hex	27F1 hex	Cumulative operating time of cooling fan	dC-26 (HIGH)	R	0 to 1000000	1 hr
27F3 hex	27F2 hex		dC-27 (LOW)			
27FD hex	27F3 hex	Detailed monitor for icon 2 LIM	dC-37	R	00: Condition other than below 01: Overcurrent suppression in process 02: Overload being limited 03: Overvoltage suppression in process 04: Torque being limited 05: Upper/lower limit and jump frequency setting being limited 06: Setting of minimum frequency being limited	-
27FE hex	27FD hex	Detailed monitor for icon 2 ALT	dC-38	R	00: Condition other than below 01: Overload advance notice 02: Motor thermal advance notice 03: Controller thermal advance notice 04: Motor overheat advance notice	-
27FF hex	27FE hex	Detailed monitor for icon 2 RETRY	dC-39	R	00: Condition other than below 01: Retry standby 02: Restart standby	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2800 hex	27FF hex	Detailed monitor for icon 2 NRDY	dC-40	R	00: Preparation completed condition other than below IRDY=OFF 01: Trip occurred 02: Power supply abnormality 03: Resetting 04: STO 05: Standby 06: Data inconsistency and Others (including no FB, consistency of settings of A and B phases, etc.) 07: Sequence abnormality 08: Free run 09: Forced stop	-
2805 hex	2804 hex	IM/SM monitor	dC-45	R	00: Induction motor IM being selected 01: Synchronous motor SM (permanent magnet motor PMM) being selected	-
280A hex	2809 hex	Firmware Ver. monitor	dC-50	R	0 to FFFF Upper 1 byte: Major version Lower 1 byte: Minor version 1	1
280D hex	280C hex	Firmware Gr. monitor	dC-53	R	00: Standard	-
03E8 hex	03E7 hex	Trip count monitor	dE-01	R	0 to 65535	1

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
03E9 hex	03E8 hex	Trip monitor 1 Factor	dE-11	R	1 to 255	1
03EA hex	03E9 hex	Trip monitor 1 Output fre-quency (with sign)			-59000 to 59000	0.01 Hz
03EB hex	03EA hex	Trip monitor 1 Output fre-quency (with sign)				
03EC hex	03EB hex	Trip monitor 1 Output cur-rent			0 to 65535	0.01 A
03ED hex	03EC hex	Trip monitor 1 P-N DC volt-age			0 to 10000	0.1 VDC
03EE hex	03ED hex	Trip monitor 1 Inverter state			0 to 8*1	1
03EF hex	03EE hex	Trip monitor 1 LAD state			0 to 5*1	1
03F0 hex	03EF hex	Trip monitor 1 INV control mode			0 to 11*1	1
03F1 hex	03F0 hex	Trip monitor 1 Limit state			0 to 6*1	1
03F2 hex	03F1 hex	Trip monitor 1 Special state			0 to 6*1	1
03F4 hex	03F3 hex	Trip monitor 1 RUN time (HIGH)			0 to 1000000	1 hr
03F5 hex	03F4 hex	Trip monitor 1 RUN time (LOW)				
03F6 hex	03F5 hex	Trip monitor 1 Power ON time (HIGH)			0 to 1000000	1 hr
03F7 hex	03F6 hex	Trip monitor 1 Power ON time (LOW)				
03F8 hex	03F7 hex	Trip monitor 1 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	1
03F9 hex	03F8 hex	Trip monitor 1 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	1
03FA hex	03F9 hex	Trip monitor 1 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	1

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
03FD hex	03FC hex	Trip monitor 2 Factor	dE-12	R	1 to 255	1
03FE hex	03FD hex	Trip monitor 2 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
03FF hex	03FE hex	Trip monitor 2 Output frequency (with sign) (LOW)				
0400 hex	03FF hex	Trip monitor 2 Output current			0 to 65535	0.01 A
0401 hex	0400 hex	Trip monitor 2 P-N DC voltage			0 to 10000	0.1 VDC
0402 hex	0401 hex	Trip monitor 2 Inverter state			0 to 8*1	1
0403 hex	0402 hex	Trip monitor 2 LAD state			0 to 5*1	1
0404 hex	0403 hex	Trip monitor 2 INV control mode			0 to 11*1	1
0405 hex	0404 hex	Trip monitor 2 Limit state			0 to 6*1	1
0406 hex	0405 hex	Trip monitor 2 Special state			0 to 6*1	1
0408 hex	0407 hex	Trip monitor 2 RUN time (HIGH)			0 to 1000000	1 hr
0409 hex	0408 hex	Trip monitor 2 RUN time (LOW)				
040A hex	0409 hex	Trip monitor 2 Power ON time (HIGH)			0 to 1000000	1 hr
040B hex	040A hex	Trip monitor 2 Power ON time (LOW)				
040C hex	040B hex	Trip monitor 2 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
040D hex	040C hex	Trip monitor 2 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
040E hex	040D hex	Trip monitor 2 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
0411 hex	0410 hex	Trip monitor 3 Factor	dE-13	R	1 to 255	-
0412 hex	0411 hex	Trip monitor 3 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0413 hex	0412 hex	Trip monitor 3 Output frequency (with sign) (LOW)				
0414 hex	0413 hex	Trip monitor 3 Output current			0 to 65535	0.01 A
0415 hex	0414 hex	Trip monitor 3 P-N DC voltage			0 to 10000	0.1 VDC
0416 hex	0415 hex	Trip monitor 3 Inverter state			0 to 8*1	1
0417 hex	0416 hex	Trip monitor 3 LAD state			0 to 5*1	1
0418 hex	0417 hex	Trip monitor 3 INV control mode			0 to 11*1	1
0419 hex	0418 hex	Trip monitor 3 Limit state			0 to 6*1	1
041A hex	0419 hex	Trip monitor 3 Special state			0 to 6*1	1
041C hex	041B hex	Trip monitor 3 RUN time (HIGH)			0 to 1000000	1 hr
041D hex	041C hex	Trip monitor 3 RUN time (LOW)				
041E hex	041D hex	Trip monitor 3 Power ON time (HIGH)			0 to 1000000	1 hr
041F hex	041E hex	Trip monitor 3 Power ON time (LOW)				
0420 hex	041F hex	Trip monitor 3 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0421 hex	0420 hex	Trip monitor 3 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0422 hex	0421 hex	Trip monitor 3 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
0425 hex	0424 hex	Trip monitor 4 Factor	dE-14	R	1 to 255	1
0426 hex	0425 hex	Trip monitor 4 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0427 hex	0426 hex	Trip monitor 4 Output frequency (with sign) (LOW)				
0428 hex	0427 hex	Trip monitor 4 Output current			0 to 65535	0.01 A
0429 hex	0428 hex	Trip monitor 4 P-N DC voltage			0 to 10000	0.1 VDC
042A hex	0429 hex	Trip monitor 4 Inverter state			0 to 8*1	1
042B hex	042A hex	Trip monitor 4 LAD state			0 to 5*1	1
042C hex	042B hex	Trip monitor 4 INV control mode			0 to 11*1	1
042D hex	042C hex	Trip monitor 4 Limit state			0 to 6*1	1
042E hex	042D hex	Trip monitor 4 Special state			0 to 6*1	1
0430 hex	042F hex	Trip monitor 4 RUN time (HIGH)			0 to 1000000	1 hr
0431 hex	0430 hex	Trip monitor 4 RUN time (LOW)				
0432 hex	0431 hex	Trip monitor 4 Power ON time (HIGH)			0 to 1000000	1 hr
0433 hex	0432 hex	Trip monitor 4 Power ON time (LOW)				
0434 hex	0433 hex	Trip monitor 4 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0435 hex	0434 hex	Trip monitor 4 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0436 hex	0435 hex	Trip monitor 4 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
0439 hex	0438 hex	Trip monitor 5 Factor	dE-15	R	1 to 255	1
043A hex	0439 hex	Trip monitor 5 Output fre-quency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
043B hex	043A hex	Trip monitor 5 Output fre-quency (with sign) (LOW)				
043C hex	043B hex	Trip monitor 5 Output cur-rent			0 to 65535	0.01 A
043D hex	043C hex	Trip monitor 5 P-N DC volt-age			0 to 10000	0.1 VDC
043E hex	043D hex	Trip monitor 5 Inverter state			0 to 8*1	1
043F hex	043E hex	Trip monitor 5 LAD state			0 to 5*1	1
0440 hex	043F hex	Trip monitor 5 INV control mode			0 to 11*1	1
0441 hex	0440 hex	Trip monitor 5 Limit state			0 to 6*1	1
0442 hex	0441 hex	Trip monitor 5 Special state			0 to 6*1	1
0444 hex	0443 hex	Trip monitor 5 RUN time (HIGH)			0 to 1000000	1 hr
0445 hex	0444 hex	Trip monitor 5 RUN time (LOW)				
0446 hex	0445 hex	Trip monitor 5 Power ON time (HIGH)			0 to 1000000	1 hr
0447 hex	0446 hex	Trip monitor 5 Power ON time (LOW)				
0448 hex	0447 hex	Trip monitor 5 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0449 hex	0448 hex	Trip monitor 5 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
044A hex	0449 hex	Trip monitor 5 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
044D hex	044C hex	Trip monitor 6 Factor	dE-16	R	1 to 255	1
044E hex	044D hex	Trip monitor 6 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
044F hex	044E hex	Trip monitor 6 Output frequency (with sign) (LOW)				
0450 hex	044F hex	Trip monitor 6 Output current			0 to 65535	0.01 A
0451 hex	0450 hex	Trip monitor 6 P-N DC voltage			0 to 10000	0.1 VDC
0452 hex	0451 hex	Trip monitor 6 Inverter state			0 to 8*1	1
0453 hex	0452 hex	Trip monitor 6 LAD state			0 to 5*1	1
0454 hex	0453 hex	Trip monitor 6 INV control mode			0 to 11*1	1
0455 hex	0454 hex	Trip monitor 6 Limit state			0 to 6*1	1
0456 hex	0455 hex	Trip monitor 6 Special state			0 to 6*1	1
0458 hex	0457 hex	Trip monitor 6 RUN time (HIGH)			0 to 1000000	1 hr
0459 hex	0458 hex	Trip monitor 6 RUN time (LOW)				
045A hex	0459 hex	Trip monitor 6 Power ON time (HIGH)			0 to 1000000	1 hr
045B hex	045A hex	Trip monitor 6 Power ON time (LOW)				
045C hex	045B hex	Trip monitor 6 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
045D hex	045C hex	Trip monitor 6 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
045E hex	045D hex	Trip monitor 6 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
0461 hex	0460 hex	Trip monitor 7 Factor	dE-17	R	1 to 255	1
0462 hex	0461 hex	Trip monitor 7 Output fre-quency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0463 hex	0462 hex	Trip monitor 7 Output fre-quency (with sign) (LOW)				
0464 hex	0463 hex	Trip monitor 7 Output cur-rent			0 to 65535	0.01 A
0465 hex	0464 hex	Trip monitor 7 P-N DC volt-age			0 to 10000	0.1 VDC
0466 hex	0465 hex	Trip monitor 7 Inverter state			0 to 8*1	1
0467 hex	0466 hex	Trip monitor 7 LAD state			0 to 5*1	1
0468 hex	0467 hex	Trip monitor 7 INV control mode			0 to 11*1	1
0469 hex	0468 hex	Trip monitor 7 Limit state			0 to 6*1	1
046A hex	0469 hex	Trip monitor 7 Special state			0 to 6*1	1
046C hex	046A hex	Trip monitor 7 RUN time (HIGH)			0 to 1000000	1 hr
046D hex	046C hex	Trip monitor 7 RUN time (LOW)				
046E hex	046D hex	Trip monitor 7 Power ON time (HIGH)			0 to 1000000	1 hr
046F hex	046E hex	Trip monitor 7 Power ON time (LOW)				
0470 hex	046F hex	Trip monitor 7 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0471 hex	0470 hex	Trip monitor 7 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0472 hex	0471 hex	Trip monitor 7 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
0475 hex	0474 hex	Trip monitor 8 Factor	dE-18	R	1 to 255	1
0476 hex	0475 hex	Trip monitor 8 Output fre-quency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0477 hex	0476 hex	Trip monitor 8 Output fre-quency (with sign) (LOW)				
0478 hex	0477 hex	Trip monitor 8 Output cur-rent			0 to 65535	0.01 A
0479 hex	0478 hex	Trip monitor 8 P-N DC volt-age			0 to 10000	0.1 VDC
047A hex	0479 hex	Trip monitor 8 Inverter state			0 to 8*1	1
047B hex	047A hex	Trip monitor 8 LAD state			0 to 5*1	1
047C hex	047B hex	Trip monitor 8 INV control mode			0 to 11*1	1
047D hex	047C hex	Trip monitor 8 Limit state			0 to 6*1	1
047E hex	047D hex	Trip monitor 8 Special state			0 to 6*1	1
0480 hex	047E hex	Trip monitor 8 RUN time (HIGH)			0 to 1000000	1 hr
0481 hex	0480 hex	Trip monitor 8 RUN time (LOW)				
0482 hex	0481 hex	Trip monitor 8 Power ON time (HIGH)			0 to 1000000	1 hr
0483 hex	0482 hex	Trip monitor 8 Power ON time (LOW)				
0484 hex	0483 hex	Trip monitor 8 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0485 hex	0484 hex	Trip monitor 8 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0486 hex	0485 hex	Trip monitor 8 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
0489 hex	0488 hex	Trip monitor 9 Factor	dE-19	R	1 to 255	1
048A hex	0489 hex	Trip monitor 9 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
048B hex	048A hex	Trip monitor 9 Output frequency (with sign) (LOW)				
048C hex	048B hex	Trip monitor 9 Output current			0 to 65535	0.01 A
048D hex	048C hex	Trip monitor 9 P-N DC voltage			0 to 10000	0.1 VDC
048E hex	048D hex	Trip monitor 9 Inverter state			0 to 8*1	1
048F hex	048E hex	Trip monitor 9 LAD state			0 to 5*1	1
0490 hex	048F hex	Trip monitor 9 INV control mode			0 to 11*1	1
0491 hex	0490 hex	Trip monitor 9 Limit state			0 to 6*1	1
0492 hex	0491 hex	Trip monitor 9 Special state			0 to 6*1	1
0494 hex	0493 hex	Trip monitor 9 RUN time (HIGH)			0 to 1000000	1 hr
0495 hex	0494 hex	Trip monitor 9 RUN time (LOW)				
0496 hex	0495 hex	Trip monitor 9 Power ON time (HIGH)			0 to 1000000	1 hr
0497 hex	0496 hex	Trip monitor 9 Power ON time (LOW)				
0498 hex	0497 hex	Trip monitor 9 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0499 hex	0498 hex	Trip monitor 9 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
049A hex	0499 hex	Trip monitor 9 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
049D hex	049C hex	Trip monitor 10 Factor	dE-20	R	1 to 255	1
049E hex	049D hex	Trip monitor 10 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
049F hex	049E hex	Trip monitor 10 Output frequency (with sign) (LOW)				
04A0 hex	049F hex	Trip monitor 10 Output current			0 to 65535	0.01 A
04A1 hex	04A0 hex	Trip monitor 10 P-N DC voltage			0 to 10000	0.1 VDC
04A2 hex	04A1 hex	Trip monitor 10 Inverter state			0 to 8*1	1
04A3 hex	04A2 hex	Trip monitor 10 LAD state			0 to 5*1	1
04A4 hex	04A3 hex	Trip monitor 10 INV control mode			0 to 11*1	1
04A5 hex	04A4 hex	Trip monitor 10 Limit state			0 to 6*1	1
04A6 hex	04A5 hex	Trip monitor 10 Special state			0 to 6*1	1
04A8 hex	04A7 hex	Trip monitor 10 RUN time (HIGH)			0 to 1000000	1 hr
04A9 hex	04A8 hex	Trip monitor 10 RUN time (LOW)				
04AA hex	04A9 hex	Trip monitor 10 Power ON time (HIGH)			0 to 1000000	1 hr
04AB hex	04AA hex	Trip monitor 10 Power ON time (LOW)				
04AC hex	04AB hex	Trip monitor 10 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04AD hex	04AC hex	Trip monitor 10 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04AE hex	04AD hex	Trip monitor 10 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
04B1 hex	04B1 hex	Retry monitor 1 Factor	dE-31	R	1 to 255	1
04B2 hex	04B1 hex	Trip monitor 1 Output fre-quency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
04B3 hex	04B2 hex	Trip monitor 1 Output fre-quency (with sign) (LOW)				
04B4 hex	04B3 hex	Retry monitor 1 Output cur-rent			0 to 65535	0.01 A
04B5 hex	04B4 hex	Retry monitor 1 P-N DC voltage			0 to 10000	0.1 VDC
04B6 hex	04B5 hex	Retry monitor 1 Inverter state			0 to 8*1	1
04B7 hex	04B6 hex	Retry monitor 1 LAD state			0 to 5*1	1
04B8 hex	04B7 hex	Retry monitor 1 INV control mode			0 to 11*1	1
04B9 hex	04B8 hex	Retry monitor 1 Limit state			0 to 6*1	1
04BA hex	04B9 hex	Retry monitor 1 Special state			0 to 6*1	1
04BC hex	04BB hex	Retry monitor 1 RUN time (HIGH)			0 to 1000000	1 hr
04BD hex	04BC hex	Retry monitor 1 RUN time (LOW)				
04BE hex	04BD hex	Retry monitor 1 Power ON time (HIGH)			0 to 1000000	1 hr
04BF hex	04BE hex	Retry monitor 1 Power ON time (LOW)				
04C0 hex	04BF hex	Retry monitor 1 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04C1 hex	04C0 hex	Retry monitor 1 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04C2 hex	04C1 hex	Retry monitor 1 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
04C5 hex	04C4 hex	Retry monitor 2 Factor	dE-32	R	1 to 255	1
04C6 hex	04C5 hex	Trip monitor 2 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
04C7 hex	04C6 hex	Trip monitor 2 Output frequency (with sign) (LOW)				
04C8 hex	04C7 hex	Retry monitor 2 Output current			0 to 65535	0.01 A
04C9 hex	04C8 hex	Retry monitor 2 P-N DC voltage			0 to 10000	0.1 VDC
04CA hex	04C9 hex	Retry monitor 2 Inverter state			0 to 8*1	1
04CB hex	04CA hex	Retry monitor 2 LAD state			0 to 5*1	1
04CC hex	04CB hex	Retry monitor 2 INV control mode			0 to 11*1	1
04CD hex	04CC hex	Retry monitor 2 Limit state			0 to 6*1	1
04CE hex	04CD hex	Retry monitor 2 Special state			0 to 6*1	1
04D0 hex	04CF hex	Retry monitor 2 RUN time (HIGH)			0 to 1000000	1 hr
04D1 hex	04D0 hex	Retry monitor 2 RUN time (LOW)				
04D2 hex	04D1 hex	Retry monitor 2 Power ON time (HIGH)			0 to 1000000	1 hr
04D3 hex	04D2 hex	Retry monitor 2 Power ON time (LOW)				
04D4 hex	04D3 hex	Retry monitor 2 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04D5 hex	04D4 hex	Retry monitor 2 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04D6 hex	04D5 hex	Retry monitor 2 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
04D9 hex	04D8 hex	Retry monitor 3 Factor	dE-33	R	1 to 255	1
04DA hex	04D9 hex	Trip monitor 3 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
04DB hex	04DA hex	Trip monitor 3 Output frequency (with sign) (LOW)				
04DC hex	04DB hex	Retry monitor 3 Output current			0 to 65535	0.01 A
04DD hex	04DC hex	Retry monitor 3 P-N DC voltage			0 to 10000	0.1 VDC
04DE hex	04DD hex	Retry monitor 3 Inverter state			0 to 8*1	1
04DF hex	04DE hex	Retry monitor 3 LAD state			0 to 5*1	1
04E0 hex	04DF hex	Retry monitor 3 INV control mode			0 to 11*1	1
04E1 hex	04E0 hex	Retry monitor 3 Limit state			0 to 6*1	1
04E2 hex	04E1 hex	Retry monitor 3 Special state			0 to 6*1	1
04E4 hex	04E3 hex	Retry monitor 3 RUN time (HIGH)			0 to 1000000	1 hr
04E5 hex	04E4 hex	Retry monitor 3 RUN time (LOW)				
04E6 hex	04E5 hex	Retry monitor 3 Power ON time (HIGH)			0 to 1000000	1hr
04E7 hex	04E6 hex	Retry monitor 3 Power ON time (LOW)				
04E8 hex	04E7 hex	Retry monitor 3 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04E9 hex	04E8 hex	Retry monitor 3 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04EA hex	04E9 hex	Retry monitor 3 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
04ED hex	04EC hex	Retry monitor 4 Factor	dE-34	R	1 to 255	1
04EE hex	04ED hex	Trip monitor 4 Output fre-quency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
04EF hex	04EE hex	Trip monitor 4 Output fre-quency (with sign) (LOW)				
04F0 hex	04EF hex	Retry monitor 4 Output cur-rent			0 to 65535	0.01 A
04F1 hex	04F0 hex	Retry monitor 4 P-N DC voltage			0 to 10000	0.1 VDC
04F2 hex	04F1 hex	Retry monitor 4 Inverter state			0 to 8*1	1
04F3 hex	04F2 hex	Retry monitor 4 LAD state			0 to 5*1	1
04F4 hex	04F3 hex	Retry monitor 4 INV control mode			0 to 11*1	1
04F5 hex	04F4 hex	Retry monitor 4 Limit state			0 to 6*1	1
04F6 hex	04F5 hex	Retry monitor 4 Special state			0 to 6*1	1
04F8 hex	04F7 hex	Retry monitor 4 RUN time (HIGH)			0 to 1000000	1 hr
04F9 hex	04F8 hex	Retry monitor 4 RUN time (LOW)				
04FA hex	04F9 hex	Retry monitor 4 Power ON time (HIGH)			0 to 1000000	1 hr
04FB hex	04FA hex	Retry monitor 4 Power ON time (LOW)				
04FC hex	04FB hex	Retry monitor 4 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04FD hex	04FC hex	Retry monitor 4 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04FE hex	04FD hex	Retry monitor 4 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
0501 hex	0500 hex	Retry monitor 5 Factor	dE-35	R	1 to 255	1
0502 hex	0501 hex	Trip monitor 5 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0503 hex	0502 hex	Trip monitor 5 Output frequency (with sign) (LOW)				
0504 hex	0503 hex	Retry monitor 5 Output current			0 to 65535	0.01 A
0505 hex	0504 hex	Retry monitor 5 P-N DC voltage			0 to 10000	0.1 VDC
0506 hex	0505 hex	Retry monitor 5 Inverter state			0 to 8*1	1
0507 hex	0506 hex	Retry monitor 5 LAD state			0 to 5*1	1
0508 hex	0507 hex	Retry monitor 5 INV control mode			0 to 11*1	1
0509 hex	0508 hex	Retry monitor 5 Limit state			0 to 6*1	1
050A hex	0509 hex	Retry monitor 5 Special state			0 to 6*1	1
050C hex	050B hex	Retry monitor 5 RUN time (HIGH)			0 to 1000000	1 hr
050D hex	050C hex	Retry monitor 5 RUN time (LOW)				
050E hex	050D hex	Retry monitor 5 Power ON time (HIGH)			0 to 1000000	1 hr
050F hex	050E hex	Retry monitor 5 Power ON time (LOW)				
0510 hex	050F hex	Retry monitor 5 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0511 hex	0510 hex	Retry monitor 5 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0512 hex	0511 hex	Retry monitor 5 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
0515 hex	0514 hex	Retry monitor 6 Factor	dE-36	R	1 to 255	1
0516 hex	0515 hex	Trip monitor 6 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0517 hex	0516 hex	Trip monitor 6 Output frequency (with sign) (LOW)				
0518 hex	0517 hex	Retry monitor 6 Output current			0 to 65535	0.01 A
0519 hex	0518 hex	Retry monitor 6 P-N DC voltage			0 to 10000	0.1 VDC
051A hex	0519 hex	Retry monitor 6 Inverter state			0 to 8*1	1
051B hex	051A hex	Retry monitor 6 LAD state			0 to 5*1	1
051C hex	051B hex	Retry monitor 6 INV control mode			0 to 11*1	1
051D hex	051C hex	Retry monitor 6 Limit state			0 to 6*1	1
051E hex	051D hex	Retry monitor 6 Special state			0 to 6*1	1
0520 hex	051F hex	Retry monitor 6 RUN time (HIGH)			0 to 1000000	1 hr
0521 hex	0520 hex	Retry monitor 6 RUN time (LOW)				
0522 hex	0521 hex	Retry monitor 6 Power ON time (HIGH)			0 to 1000000	1 hr
0523 hex	0522 hex	Retry monitor 6 Power ON time (LOW)				
0524 hex	0523 hex	Retry monitor 6 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0525 hex	0524 hex	Retry monitor 6 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0526 hex	0525 hex	Retry monitor 6 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
0529 hex	0528 hex	Retry monitor 7 Factor	dE-37	R	1 to 255	1
052A hex	0529 hex	Trip monitor 7 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
052B hex	052A hex	Trip monitor 7 Output frequency (with sign) (LOW)				
052C hex	052B hex	Retry monitor 7 Output current			0 to 65535	0.01 A
052D hex	052C hex	Retry monitor 7 P-N DC voltage			0 to 10000	0.1 VDC
052E hex	052D hex	Retry monitor 7 Inverter state			0 to 8*1	1
052F hex	052E hex	Retry monitor 7 LAD state			0 to 5*1	1
0530 hex	052F hex	Retry monitor 7 INV control mode			0 to 11*1	1
0531 hex	0530 hex	Retry monitor 7 Limit state			0 to 6*1	1
0532 hex	0531 hex	Retry monitor 7 Special state			0 to 6*1	1
0534 hex	0533 hex	Retry monitor 7 RUN time (HIGH)			0 to 1000000	1 hr
0535 hex	0534 hex	Retry monitor 7 RUN time (LOW)				
0536 hex	0535 hex	Retry monitor 7 Power ON time (HIGH)			0 to 1000000	1 hr
0537 hex	0536 hex	Retry monitor 7 Power ON time (LOW)				
0538 hex	0537 hex	Retry monitor 7 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0539 hex	0538 hex	Retry monitor 7 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
053A hex	0539 hex	Retry monitor 7 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
053D hex	053C hex	Retry monitor 8 Factor	dE-38	R	1 to 255	1
053E hex	053D hex	Trip monitor 8 Output fre-quency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
053F hex	053E hex	Trip monitor 8 Output fre-quency (with sign) (LOW)				
0540 hex	053F hex	Retry monitor 8 Output cur-rent			0 to 65535	0.01 A
0541 hex	0540 hex	Retry monitor 8 P-N DC voltage			0 to 10000	0.1 VDC
0542 hex	0541 hex	Retry monitor 8 Inverter state			0 to 8*1	1
0543 hex	0542 hex	Retry monitor 8 LAD state			0 to 5*1	1
0544 hex	0543 hex	Retry monitor 8 INV control mode			0 to 11*1	1
0545 hex	0544 hex	Retry monitor 8 Limit state			0 to 6*1	1
0546 hex	0545 hex	Retry monitor 8 Special state			0 to 6*1	1
0548 hex	0547 hex	Retry monitor 8 RUN time (HIGH)			0 to 1000000	1 hr
0549 hex	0548 hex	Retry monitor 8 RUN time (LOW)				
054A hex	0549 hex	Retry monitor 8 Power ON time (HIGH)			0 to 1000000	1 hr
054B hex	054A hex	Retry monitor 8 Power ON time (LOW)				
054C hex	054B hex	Retry monitor 8 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
054D hex	054C hex	Retry monitor 8 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
054E hex	054D hex	Retry monitor 8 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
0551 hex	0550 hex	Retry monitor 9 Factor	dE-39	R	1 to 255	1
0552 hex	0551 hex	Trip monitor 9 Output fre-quency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0553 hex	0552 hex	Trip monitor 9 Output fre-quency (with sign) (LOW)				
0554 hex	0553 hex	Retry monitor 9 Output cur-rent			0 to 65535	0.01 A
0555 hex	0554 hex	Retry monitor 9 P-N DC voltage			0 to 10000	0.1 VDC
0556 hex	0555 hex	Retry monitor 9 Inverter state			0 to 8*1	1
0557 hex	0556 hex	Retry monitor 9 LAD state			0 to 5*1	1
0558 hex	0557 hex	Retry monitor 9 INV control mode			0 to 11*1	1
0559 hex	0558 hex	Retry monitor 9 Limit state			0 to 6*1	1
055A hex	0559 hex	Retry monitor 9 Special state			0 to 6*1	1
055C hex	055B hex	Retry monitor 9 RUN time (HIGH)			0 to 1000000	1 hr
055D hex	055C hex	Retry monitor 9 RUN time (LOW)				
055E hex	055D hex	Retry monitor 9 Power ON time (HIGH)			0 to 1000000	1 hr
055F hex	055E hex	Retry monitor 9 Power ON time (LOW)				
0560 hex	055F hex	Retry monitor 9 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0561 hex	0560 hex	Retry monitor 9 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0562 hex	0561 hex	Retry monitor 9 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
0565 hex	0564 hex	Retry monitor 10 Factor	dE-40	R	1 to 255	1
0566 hex	0565 hex	Trip monitor 10 Output frequency (with sign) (HIGH)			-59000 to 59000	0.01 Hz
0567 hex	0566 hex	Trip monitor 10 Output frequency (with sign) (LOW)				
0568 hex	0567 hex	Retry monitor 10 Output current			0 to 65535	0.01 A
0569 hex	0568 hex	Retry monitor 10 P-N DC voltage			0 to 10000	0.1 VDC
056A hex	0569 hex	Retry monitor 10 Inverter state			0 to 8*1	1
056B hex	056A hex	Retry monitor 10 LAD state			0 to 5*1	1
056C hex	056B hex	Retry monitor 10 INV control mode			0 to 11*1	1
056D hex	056C hex	Retry monitor 10 Limit state			0 to 6*1	1
056E hex	056D hex	Retry monitor 10 Special state			0 to 6*1	1
0570 hex	056F hex	Retry monitor 10 RUN time (HIGH)			0 to 1000000	1 hr
0571 hex	0570 hex	Retry monitor 10 RUN time (LOW)				
0572 hex	0571 hex	Retry monitor 10 Power ON time (HIGH)			0 to 1000000	1 hr
0573 hex	0572 hex	Retry monitor 10 Power ON time (LOW)				
0574 hex	0573 hex	Retry monitor 10 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0575 hex	0574 hex	Retry monitor 10 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0576 hex	0575 hex	Retry monitor 10 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
05DC hex	050B hex	Warning monitor	dE-50	R	0 to 65535	1
2328 hex	2327 hex	ENTER instruction (Writing to Data Flash)	-	W	01: Writing all parameters	-
232A hex	2329 hex	1 register writing mode	-	W	01: Enabled	-
2332 hex	2321 hex	Motor constant recalculation (motor constant standard data not to be developed)	-	W	01: Enabled	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2906 hex	2905 hex	RS485 Set frequency (Signed) (Common to main speed and auxiliary speed) (HIGH)	-	R/W	-59000 to 59000	0.01 Hz
2907 hex	2906 hex	RS485 Set frequency (Signed) (Common to main speed and auxiliary speed) (LOW)	-	R/W		
291E hex	291D hex	RS485 Torque command	-	R/W	-5000 to 5000	0.1%
2922 hex	2921 hex	RS485 Torque bias	-	R/W	-5000 to 5000	0.1%
2926 hex	2925 hex	RS485 Torque control speed limit value (for normal rotation)	-	R/W	0 to 59000	0.01 Hz
2927 hex	2926 hex	RS485 Torque control speed limit value (for reverse rotation)	-	R/W	0 to 59000	0.01 Hz
2932 hex	2931 hex	RS485 PID target value (HIGH)	-	R/W	-10000 to 10000	0.01%
2933 hex	2932 hex	RS485 PID target value (LOW)	-	R/W		
293A hex	2939 hex	RS485 PID feedback data (HIGH)	-	R/W	-10000 to 10000	0.01%
293B hex	293A hex	RS485 PID feedback data (LOW)	-	R/W		
2946 hex	2945 hex	RS485 Torque limit	-	R/W	0 to 5000	0.1%
3EB5 hex	3EB4 hex	Output terminal function option output (OPO output)[*2]	-	R/W	0 to 0x7F (Access prohibited)	-
3EBC hex	3EBB hex	Coil data 0 (coil No. 0001 hex to 000F hex)	-	R/W	0 to 0xFFFF	1
3EBD hex	3EBC hex	Coil data 1 (coil No. 0010 hex to 001F hex)	-	R		1
3EBE hex	3EDD hex	Coil data 2 (coil No. 0020 hex to 002F hex)	-	R		1
3EBF hex	3EDE hex	Coil data 3 (coil No. 0030 hex to 003F hex)	-	R		1
3EC0 hex	3EBF hex	Coil data 4 (coil No. 0040 hex to 004F hex)	-	R		1
-	-	(Reserved)	dA-46 dA-47	-	-	-

*1. For more information on the values, refer to *Details of Trip and Retry* on page 15-21.

*2. OPO output is not supported in the latest version. Do not access.

9-5-3 Group F Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2AF9 hex	2AF8 hex	Main Speed reference monitor	FA-01	R/W	0 to 59000	0.01 Hz
2AFA hex	2AF9 hex	Sub Speed reference monitor	FA-02 (HIGH)	R/W	-59000 to 59000 (monitor) 0 to 59000 (setting)	0.01 Hz
2AFB hex	2AFA hex		FA-03 (LOW)	R/W		
2B02 hex	2B01 hex	Acceleration time monitor	FA-10 (HIGH)	R/W	0 to 360000	0.01 s
2B03 hex	2B02 hex		FA-11 (LOW)	R/W		
2B04 hex	2B03 hex	Deceleration time monitor	FA-12 (HIGH)	R/W	0 to 360000	0.01 s
2B05 hex	2B04 hex		FA-13 (LOW)	R/W		
2B07 hex	2B06 hex	Torque reference monitor	FA-15	R/W	-5000 to 5000	0.1%
2B08 hex	2B07 hex	Torque bias monitor	FA-16	R/W	-5000 to 5000	0.1%
2B0C hex	2B0B hex	Position reference monitor	FA-20 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1
2B0D hex	2B0C hex		FA-21 (LOW)	R/W		
2B16 hex	2B15 hex	PID1 Set Value 1 monitor	FA-30 (HIGH)	R/W	**PID1 scale adjustment (at 0%)**(AH-04) to **PID1 scale adjustment (point position)**(AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
2B17 hex	2B16 hex		FA-31 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2B18 hex	2B17 hex	PID1 Set Value 2 monitor	FA-32 (HIGH)	R/W	**PID1 scale adjustment (at 0%)**(AH-04) to **PID1 scale adjustment (point position)**(AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
2B19 hex	2B18 hex		FA-33 (LOW)	R/W		
2B1A hex	2B19 hex	PID1 Set Value 3 monitor	FA-34 (H		**PID1 scale adjustment(at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
2B1B hex	2B1A hex		FA-35 (LOW)	R/W		
2B1C hex	2B1B hex	PID2 Set Value monitor	FA-36 (HIGH)	R/W	**PID2 scale adjustment (at 0%)**(AJ-04) to **PID2 scale adjustment (point position)**(AJ-06)	Unit differs depending on the AJ-03 and AJ-06 settings.
2B1D hex	2B1C hex		FA-37 (LOW)	R/W		
2B1E hex	2B1D hex	PID3 Set Value monitor	FA-38 (HIGH)	R/W	**PID3 scale adjustment (at 0%)**(AJ-24) to **PID3 scale adjustment (pointposition)**(AJ-26)	Unit differs depending on the AJ-23 and AJ-26 settings.
2B1F hex	2B1E hex		FA-39 (LOW)	R/W		
2B20 hex	2B1F hex	PID4 Set Value monitor	FA-40 (HIGH)	R/W	**PID4 scale adjustment (at 0%)**(AJ-44) to **PID4 scale adjustment (point position)**(AJ-46)	Unit differs depending on the AJ-43 and AJ-46 settings.
2B21 hex	2B20 hex		FA-41 (LOW)	R/W		

9-5-4 Group A Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2EE1 hex	2EF0 hex	Main speed input source selection, 1st-motor	AA101	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-
2EE2 hex	2EE1 hex	Sub frequency input source selection, 1st-motor	AA102	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-
2EE4 hex	2EE3 hex	Sub speed setting, 1st-motor	AA104	R/W	0 to 59000	0.01 Hz
2EE5 hex	2EE4 hex	Calculation symbol selection for Speed reference, 1st-motor	AA105	R/W	00: Disabled 01: Addition 02: Subtraction 03: Multiplication	-
2EE6 hex	2EE5 hex	Add frequency setting, 1st-motor (SET-POINT)	AA106 (HIGH)	R/W	-59000 to 59000	0.01 Hz
2EE7 hex	2EE6 hex		AA107 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2EEB hex	2EEA hex	Run-command input source selection, 1st-motor	AA111	R/W	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-
2EEC hex	2EEB hex	RUN-key Direction of LCD operator	AA-12	R/W	00: Normal rotation 01: Reverse rotation	-
2EED hex	2EEC hex	STOP-key enable at RUN-command from terminal	AA-13	R/W	00: Disabled 01: Enabled 02: Only reset is enabled	-
2EEE hex	2EED hex	RUN-direction restriction, 1st-motor	AA114	R/W	00 : No limitation 01 : Only normal rotation 02 : Only reverse rotation	-
2EEF hex	2EEE hex	STOP mode selection, 1st-motor	AA115	R/W	00: Deceleration stop 01: Free run stop	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2EF5 hex	2EF4 hex	Control mode selection, 1st-motor	AA121	R/W	IM control 00: [V/f] Fixed torque characteristics (IM) 01: [V/f] Reducing torque characteristics (IM) 02: [V/f] Free V/f (IM) 03: Auto torque boost (IM) 04: [V/f with sensor] Fixed torque characteristics (IM) 05: [V/f with sensor] Reduced torque characteristics (IM) 06: [V/f with sensor] Free V/f (IM) 07: Auto torque boost with sensor (IM) 08: Sensorless vector control (IM) 09: Zero-Hz range sensorless vector control (IM)*1 10: Vector control with sensor (IM)*1 SM/PMM control 11: Synchronous start type sensorless vector control (SM/PMM) 12: IVMS start type sensorless vector control (SM/PMM) *2	-
2EF7 hex	2EF6 hex	Vector control mode selection, 1st-motor	AA123	R/W	00: Speed/torque control mode 01 : Pulse string position control mode 02: Absolute position control mode 03: High-resolution absolute position control mode	-
2F45 hex	2F44 hex	Frequency conversion gain	Ab-01	R/W	1 to 10000	0.01
2F47 hex	2F46 hex	Multispeed operation selection	Ab-03	R/W	00: 16th speed: binary (CF1-CF4) 01: 8th speed: bit (SF1-SF7)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2F4E hex	2F4D hex	Multispeed-0 setting, 1st-motor	Ab110	R/W	0 to 59000	0.01 Hz
2F4F hex	2F4E hex	Multispeed-1 setting	Ab-11	R/W		0.01 Hz
2F50 hex	2F4F hex	Multispeed-2 setting	Ab-12	R/W		0.01 Hz
2F51 hex	2F50 hex	Multispeed-3 setting	Ab-13	R/W		0.01 Hz
2F52 hex	2F51 hex	Multispeed-4 setting	Ab-14	R/W		0.01 Hz
2F53 hex	2F52 hex	Multispeed-5 setting	Ab-15	R/W		0.01 Hz
2F54 hex	2F53 hex	Multispeed-6 setting	Ab-16	R/W		0.01 Hz
2F55 hex	2F54 hex	Multispeed-7 setting	Ab-17	R/W		0.01 Hz
2F56 hex	2F55 hex	Multispeed-8 setting	Ab-18	R/W		0.01 Hz
2F57 hex	2F56 hex	Multispeed-9 setting	Ab-19	R/W		0.01 Hz
2F58 hex	2F57 hex	Multispeed-10 setting	Ab-20	R/W		0.01 Hz
2F59 hex	2F58 hex	Multispeed-11 setting	Ab-21	R/W		0.01 Hz
2F5A hex	2F59 hex	Multispeed-12 setting	Ab-22	R/W		0.01 Hz
2F5B hex	2F5A hex	Multispeed-13 setting	Ab-23	R/W		0.01 Hz
2F5C hex	2F5B hex	Multispeed-14 setting	Ab-24	R/W		0.01 Hz
2F5D hex	2F5C hex	Multispeed-15 setting	Ab-25	R/W		0.01 Hz
2FA9 hex	2FA8 hex	Acceleration/ Deceleration Time input selection	AC-01	R/W	00: Parameter setting 01: Option 1 02: Option 2 03: Option 3 04: DriveProgramming	-
2FAA hex	2FA9 hex	Acceleration/ Deceleration Selection	AC-02	R/W	00: Common 01: Multi-stage accelera-tion/deceleration	-
2FAB hex	2FAA hex	Acceleration curve selection	AC-03	R/W	00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2FAC hex	2FAB hex	Deceleration curve selec-tion	AC-04	R/W	00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped	-
2FAD hex	2FAC hex	Acceleration curve constant setting	AC-05	R/W	1 to 10	1
2FAE hex	2FAD hex	Deceleration curve constant setting	AC-06	R/W	1 to 10	1
2FB0 hex	2FAF hex	EL-S-curve ratio @start of acceleration	AC-08	R/W	0 to 100	1%
2FB1 hex	2FB0 hex	EL-S-curve ratio @end of acceleration	AC-09	R/W	0 to 100	1%
2FB2 hex	2FB1 hex	EL-S-curve ratio @start of deceleration	AC-10	R/W	0 to 100	1%
2FB3 hex	2FB2 hex	EL-S-curve ratio @end of deceleration	AC-11	R/W	0 to 100	1%
2FB7 hex	2FB6 hex	Select method to switch to Accel2/Decel2 Profile, 1st-motor	AC115	R/W	00: [2CH] terminal 01: Parameter setting 02: Switching normal/ reverse rotation	-
2FB8 hex	2FB7 hex	Accel1 to Accel2 Frequency transition point, 1st-motor	AC116	R/W	0 to 59000	0.01 Hz
2FB9 hex	2FB8 hex	Decel1 to Decel2 Frequen-cy transition point, 1st-mo-tor	AC117	R/W	0 to 59000	0.01 Hz
2FBC hex	2FBB hex	Acceleration time setting 1, 1st-motor	AC120 (HIGH)	R/W	0 to 360000	0.01 s
2FBD hex	2FBC hex		AC121 (LOW)	R/W		
2FBE hex	2FBD hex	Deceleration time setting 1, 1st-motor	AC122 (HIGH)	R/W	0 to 360000	0.01 s
2FBF hex	2FBE hex		AC123 (LOW)	R/W		
2FC0 hex	2FBF hex	Acceleration time setting 2, 1st-motor	AC124 (HIGH)	R/W	0 to 360000	0.01 s
2FC1 hex	2FC0 hex		AC125 (LOW)	R/W		
2FC2 hex	2FC1 hex	Deceleration time setting 2, 1st-motor	AC126 (HIGH)	R/W	0 to 360000	0.01 s
2FC3 hex	2FC2 hex		AC127 (LOW)	R/W		
2FC6 hex	2FC5 hex	Acceleration time setting for Multispeed-1	AC-30 (HIGH)	R/W	0 to 360000	0.01 s
2FC7 hex	2FC6 hex		AC-31 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2FC8 hex	2FC7 hex	Deceleration time setting for Multispeed-1	AC-32 (HIGH)	R/W	0 to 360000	0.01 s
2FC9 hex	2FC8 hex		AC-33 (LOW)	R/W		
2FCA hex	2FC9 hex	Acceleration time setting for Multispeed-2	AC-34 (HIGH)	R/W	0 to 360000	0.01 s
2FCB hex	2FCA hex		AC-35 (LOW)	R/W		
2FCC hex	2FCB hex	Deceleration time setting for Multispeed-2	AC-36 (HIGH)	R/W	0 to 360000	0.01 s
2FCD hex	2FCC hex		AC-37 (LOW)	R/W		
2FCE hex	2FCD hex	Acceleration time setting for Multispeed-3	AC-38 (HIGH)	R/W	0 to 360000	0.01 s
2FCF hex	2FCE hex		AC-39 (LOW)	R/W		
2FD0 hex	2FCF hex	Deceleration time setting for Multispeed-3	AC-40 (HIGH)	R/W	0 to 360000	0.01 s
2FD1 hex	2FD0 hex		AC-41 (LOW)	R/W		
2FD2 hex	2FD1 hex	Acceleration time setting for Multispeed-4	AC-42 (HIGH)	R/W	0 to 360000	0.01 s
2FD3 hex	2FD2 hex		AC-43 (LOW)	R/W		
2FD4 hex	2FD3 hex	Deceleration time setting for Multispeed-4	AC-44 (HIGH)	R/W	0 to 360000	0.01 s
2FD5 hex	2FD4 hex		AC-45 (LOW)	R/W		
2FD6 hex	2FD5 hex	Acceleration time setting for Multispeed-5	AC-46 (HIGH)	R/W	0 to 360000	0.01 s
2FD7 hex	2FD6 hex		AC-47 (LOW)	R/W		
2FD8 hex	2FD7 hex	Deceleration time setting for Multispeed-5	AC-48 (HIGH)	R/W	0 to 360000	0.01 s
2FD9 hex	2FD8 hex		AC-49 (LOW)	R/W		
2FDA hex	2FD9 hex	Acceleration time setting for Multispeed-6	AC-50 (HIGH)	R/W	0 to 360000	0.01 s
2FDB hex	2FDA hex		AC-51 (LOW)	R/W		
2FDC hex	2FDB hex	Deceleration time setting for Multispeed-6	AC-52 (HIGH)	R/W	0 to 360000	0.01 s
2FDD hex	2FDC hex		AC-53 (LOW)	R/W		
2FDE hex	2FDD hex	Acceleration time setting for Multispeed-7	AC-54 (HIGH)	R/W	0 to 360000	0.01 s
2FDF hex	2FDE hex		AC-55 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
2FE0 hex	2FDF hex	Deceleration time setting for Multispeed-7	AC-56 (HIGH)	R/W	0 to 360000	0.01 s
2FE1 hex	2FE0 hex		AC-57 (LOW)	R/W		
2FE2 hex	2FE1 hex	Acceleration time setting for Multispeed-8	AC-58 (HIGH)	R/W	0 to 360000	0.01 s
2FE3 hex	2FE2 hex		AC-59 (LOW)	R/W		
2FE4 hex	2FE3 hex	Deceleration time setting for Multispeed-8	AC-60 (HIGH)	R/W	0 to 360000	0.01 s
2FE5 hex	2FE4 hex		AC-61 (LOW)	R/W		
2FE6 hex	2FE5 hex	Acceleration time setting for Multispeed-9	AC-62 (HIGH)	R/W	0 to 360000	0.01 s
2FE7 hex	2FE6 hex		AC-63 (LOW)	R/W		
2FE8 hex	2FE7 hex	Deceleration time setting for Multispeed-9	AC-64 (HIGH)	R/W	0 to 360000	0.01 s
2FE9 hex	2FE8 hex		AC-65 (LOW)	R/W		
2FEA hex	2FE9 hex	Acceleration time setting for Multispeed-10	AC-66 (HIGH)	R/W	0 to 360000	0.01 s
2FEB hex	2FEA hex		AC-67 (LOW)	R/W		
2FEC hex	2FEB hex	Deceleration time setting for Multispeed-10	AC-68 (HIGH)	R/W	0 to 360000	0.01 s
2FED hex	2FEC hex		AC-69 (LOW)	R/W		
2FEE hex	2FED hex	Acceleration time setting for Multispeed-11	AC-70 (HIGH)	R/W	0 to 360000	0.01 s
2FEF hex	2FEE hex		AC-71 (LOW)	R/W		
2FF0 hex	2FEF hex	Deceleration time setting for Multispeed-11	AC-72 (HIGH)	R/W	0 to 360000	0.01 s
2FF1 hex	2FF0 hex		AC-73 (LOW)	R/W		
2FF2 hex	2FF1 hex	Acceleration time setting for Multispeed-12	AC-74 (HIGH)	R/W	0 to 360000	0.01 s
2FF3 hex	2FF2 hex		AC-75 (LOW)	R/W		
2FF4 hex	2FF3 hex	Deceleration time setting for Multispeed-12	AC-76 (HIGH)	R/W	0 to 360000	0.01 s
2FF5 hex	2FF4 hex		AC-77 (LOW)	R/W		
2FF6 hex	2FF5 hex	Acceleration time setting for Multispeed-13	AC-78 (HIGH)	R/W	0 to 360000	0.01 s
2FF7 hex	2FF6 hex		AC-79 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
2FF8 hex	2FF7 hex	Deceleration time setting for Multispeed-13	AC-80 (HIGH)	R/W	0 to 360000	0.01 s
2FF9 hex	2FF8 hex		AC-81 (LOW)	R/W		
2FFA hex	2FF9 hex	Acceleration time setting for Multispeed-14	AC-82 (HIGH)	R/W	0 to 360000	0.01 s
2FFB hex	2FFA hex		AC-83 (LOW)	R/W		
2FFC hex	2FFB hex	Deceleration time setting for Multispeed-14	AC-84 (HIGH)	R/W	0 to 360000	0.01 s
2FFD hex	2FFC hex		AC-85 (LOW)	R/W		
2FFE hex	2FFD hex	Acceleration time setting for Multispeed-15	AC-86 (HIGH)	R/W	0 to 360000	0.01 s
2FFF hex	2FFE hex		AC-87 (LOW)	R/W		
3000 hex	2FFF hex	Deceleration time setting for Multispeed-15	AC-88 (HIGH)	R/W	0 to 360000	0.01 s
3001 hex	3000 hex		AC-89 (LOW)	R/W		
300D hex	300C hex	Torque reference input source selection	Ad-01	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-
300E hex	300D hex	Torque reference value setting	Ad-02	R/W	-5000 to 5000	0.1%
300F hex	300E hex	Polarity selection for torque reference	Ad-03	R/W	00: As per the sign 01: Follow the revolution direction	-
3010 hex	300F hex	Switching time of Speed control to Torque control	Ad-04	R/W	0 to 1000	1 ms

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3017 hex	3016 hex	Torque bias input source selection	Ad-11	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-
3018 hex	3017 hex	Torque bias value setting	Ad-12	R/W	-5000 to 5000	0.1%
3019 hex	3018 hex	Polarity selection for torque bias	Ad-13	R/W	00: As per the sign 01: Follow the revolution direction	-
301A hex	3019 hex	Terminal [TBS] active	Ad-14	R/W	00: Disabled 01: Enabled	-
3034 hex	3033 hex	Input selection for speed limit at torque control	Ad-40	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
3035 hex	3034 hex	Speed limit at torque control (at Forward rotation)	Ad-41	R/W	0 to 59000	0.01 Hz
3036 hex	3035 hex	Speed limit at torque control (at Reverse rotation)	Ad-42	R/W	0 to 59000	0.01 Hz
3071 hex	3070 hex	Electronic gear setting point selection	AE-01	R/W	00: Feedback side 01: Command side	-
3072 hex	3071 hex	Electronic gear ratio numerator	AE-02	R/W	1 to 10000	1
3073 hex	3072 hex	Electronic gear ratio denominator	AE-03	R/W	1 to 10000	1

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
3074 hex	3073 hex	Positioning complete range setting	AE-04	R/W	0 to 10000	1 pls
3075 hex	3074 hex	Positioning complete delay time setting	AE-05	R/W	0 to 1000	0.01 s
3076 hex	3075 hex	Position feed-forward gain setting	AE-06	R/W	0 to 65535	0.01
3077 hex	3076 hex	Position loop gain setting	AE-07	R/W	0 to 10000	0.01
3078 hex	3077 hex	Position bias setting	AE-08	R/W	-2048 to 2048	1 pls
307A hex	3078 hex	Stop position selection of Home search function	AE-10	R/W	00: Parameter setting 01: Option 1 02: Option 2 03: Option 3	-
307B hex	307A hex	Stop position of Home search function	AE-11	R/W	0 to 4095	1
307C hex	307B hex	Speed reference of Home search function	AE-12	R/W	0 to 12000	0.01 Hz
307D hex	307C hex	Direction of Home search function	AE-13	R/W	00: Normal rotation 01: Reverse rotation	-
3084 hex	3083 hex	Position reference 0 setting	AE-20 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3085 hex	3084 hex		AE-21 (LOW)	R/W		
3086 hex	3085 hex	Position reference 1 setting	AE-22 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3087 hex	3086 hex		AE-23 (LOW)	R/W		
3088 hex	3087 hex	Position reference 2 setting	AE-24 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3089 hex	3088 hex		AE-25 (LOW)	R/W		
308A hex	3089 hex	Position reference 3 setting	AE-26 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
308B hex	308A hex		AE-27 (LOW)	R/W		
308C hex	308B hex	Position reference 4 setting	AE-28 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
308D hex	308C hex		AE-29 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
308E hex	308D hex	Position reference 5 setting	AE-30 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
308F hex	308E hex		AE-31 (LOW)	R/W		
3090 hex	308F hex	Position reference 6 setting	AE-32 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3091 hex	3090 hex		AE-33 (LOW)	R/W		
3092 hex	3091 hex	Position reference 7 setting	AE-34 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3093 hex	3092 hex		AE-35 (LOW)	R/W		
3094 hex	3093 hex	Position reference 8 setting	AE-36 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3095 hex	3094 hex		AE-37 (LOW)	R/W		
3096 hex	3095 hex	Position reference 9 setting	AE-38 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3097 hex	3096 hex		AE-39 (LOW)	R/W		
3098 hex	3097 hex	Position reference 10 setting	AE-40 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
3099 hex	3098 hex		AE-41 (LOW)	R/W		
309A hex	3099 hex	Position reference 11 setting	AE-42 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
309B hex	309A hex		AE-43 (LOW)	R/W		
309C hex	309B hex	Position reference 12 setting	AE-44 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
309D hex	309C hex		AE-45 (LOW)	R/W		
309E hex	309D hex	Position reference 13 setting	AE-46 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
309F hex	309E hex		AE-47 (LOW)	R/W		
30A0 hex	309F hex	Position reference 14 setting	AE-48 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
30A1 hex	30A0 hex		AE-49 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
30A2 hex	30A1 hex	Position reference 15 setting	AE-50 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
30A3 hex	30A2 hex		AE-51 (LOW)	R/W		
30A4 hex	30A3 hex	Position control range setting(forward)	AE-52 (HIGH)	R/W	0 to 268435455 In high resolution mode: 0 to 1073741823	1 pls
30A5 hex	30A4 hex		AE-53 (LOW)	R/W		
30A6 hex	30A5 hex	Position control range setting(reverse)	AE-54 (HIGH)	R/W	-268435455 to 0 In high resolution mode: -1073741823 to 0	1 pls
30A7 hex	30A6 hex		AE-55 (LOW)	R/W		
30A8 hex	30A7 hex	Position control mode selection	AE-56	R/W	00: With limit 01: Without limit	-
30Ac hex	30AB hex	Teach-in function target selection	AE-60	R/W	00 to 15 (X00 to X15)	-
30Ad hex	30AC hex	Current position saving at power-off	AE-61	R/W	00: Disabled 01: Enabled	-
30Ae hex	30AD hex	Preset position data	AE-62 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls
30Af hex	30AE hex		AE-63 (LOW)	R/W		
30B0 hex	30AF hex	Deceleration stop distance calculation Gain	AE-64	R/W	5000 to 20000	0.01%
30B1 hex	30B0 hex	Deceleration stop distance calculation Bias	AE-65	R/W	0 to 65535	0.01%
30B2 hex	30B1 hex	Speed Limit in APR control	AE-66	R/W	0 to 10000	0.01%
30B3 hex	30B2 hex	APR start speed	AE-67	R/W	0 to 10000	0.01%
30B6 hex	30B5 hex	Homing function selection	AE-70	R/W	00: Low speed zero return 01: High speed zero return 1 02: High speed zero return 2	-
30B7 hex	30B6 hex	Direction of homing function	AE-71	R/W	00: Normal rotation 01: Reverse rotation	-
30B8 hex	30B7 hex	Low-speed of homing function	AE-72	R/W	0 to 1000	0.01 Hz
30B9 hex	30B8 hex	High-Speed of homing function	AE-73	R/W	0 to 59000	0.01 Hz
30D5 hex	30D4 hex	DC braking selection, 1st-motor	AF101	R/W	00: Disabled 01: Enabled (Operation command) 02: Enabled (Frequency command)	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
30D6 hex	30D5 hex	Braking type selection, 1st-motor	AF102	R/W	00: DC braking 01: Speed servo lock 02: Position servo lock	-
30D7 hex	30D6 hex	DC braking frequency, 1st-motor	AF103	R/W	0 to 59000	0.01 Hz
30D8 hex	30D7 hex	DC braking delay time, 1st-motor	AF104	R/W	0 to 500	0.01 s
30D9 hex	30D8 hex	DC braking force setting, 1st-motor	AF105	R/W	0 to 100	1%
30Da hex	30D9 hex	DC braking active time at stop, 1st-motor	AF106	R/W	0 to 6000	0.01 s
30DB hex	30DA hex	DC braking operation meth-od selection, 1st-motor	AF107	R/W	00: Edge mode 01: Level mode	-
30DC hex	30DB hex	DC braking force at start, 1st-motor	AF108	R/W	0 to 100	1%
30DD hex	30DC hex	DC braking active time at start, 1st-motor	AF109	R/W	0 to 6000	0.01 s
30E8 hex	30E7 hex	Contactor Control Enable, 1st-motor	AF120	R/W	00: Disabled 01: Enabled: primary side 02: Enabled: secondary side	-
30E9 hex	30E8 hex	Run delay time, 1st-motor	AF121	R/W	0 to 200	0.01 s
30Ea hex	30E9 hex	Contactor off delay time, 1st-motor	AF122	R/W	0 to 200	0.01 s
30Eb hex	30Ea hex	Contactor answer back check time, 1st-motor	AF123	R/W	0 to 500	0.01 s
30F2 hex	30F1 hex	Brake Control Enable, 1st-motor	AF130	R/W	00: Disabled 01: Brake control 1 com-mon in forward/reverse rotation 02: Brake control 1 for-ward/reverse set individu-ally 03: Brake control 2 com-mon in forward/reverse rotation	-
30F3 hex	30F2 hex	Brake Wait Time for Re-lease, 1st-motor (Forward side)	AF131	R/W	0 to 500	0.01 s
30F4 hex	30F3 hex	Brake Wait Time for Accel. , 1st-motor (Forward side)	AF132	R/W	0 to 500	0.01 s
30F5 hex	30F4 hex	Brake Wait Time for Stop-ping, 1st-motor (Forward side)	AF133	R/W	0 to 500	0.01 s
30F6 hex	30F5 hex	Brake Wait Time for Confir-mation, 1st-motor (Forward side)	AF134	R/W	0 to 500	0.01 s

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
30F7 hex	30F6 hex	Brake Release Frequency Setting, 1st-motor (Forward side)	AF135	R/W	0 to 59000	0.01 Hz
30F8 hex	30F7 hex	Brake Release Current Setting, 1st-motor (Forward side)	AF136	R/W	(0.0 to 2.0) × Inverter rated current*3	0.1 A
30F9 hex	30F8 hex	Braking Frequency, 1st-motor (Forward side)	AF137	R/W	0 to 59000	0.01 Hz
30Fa hex	30F9 hex	Brake Wait Time for Release, 1st-motor (Reverse side)	AF138	R/W	0 to 500	0.01 s
30FB hex	30FA hex	Brake Wait Time for Accel. , 1st-motor (Reverse side)	AF139	R/W	0 to 500	0.01 s
30FC hex	30FB hex	Brake Wait Time for Stopping, 1st-motor (Reverse side)	AF140	R/W	0 to 500	0.01 s
30FD hex	30FC hex	Brake Wait Time for Confirmation, 1st-motor (Reverse side)	AF141	R/W	0 to 500	0.01 s
30Fe hex	30FD hex	Brake Release Frequency Setting, 1st-motor (Reverse side)	AF142	R/W	0 to 59000	0.01 Hz
30FF hex	30FE hex	Brake Release Current Setting, 1st-motor (Reverse side)	AF143	R/W	(0.0 to 2.0) × Inverter rated current*3	0.1 A
3100 hex	30FF hex	Braking Frequency, 1st-motor (Reverse side)	AF144	R/W	0 to 59000	0.01 Hz
3106 hex	3105 hex	Brake open delay time, 1st-motor	AF150	R/W	0 to 200	0.01 s
3107 hex	3106 hex	Brake close delay time, 1st-motor	AF151	R/W	0 to 200	0.01 s
3108 hex	3107 hex	Brake answer back check time, 1st-motor	AF152	R/W	0 to 500	0.01 s
3109 hex	3108 hex	Servo lock/ DC injection time at start, 1st-motor	AF153	R/W	0 to 1000	0.01 s
310A hex	3109 hex	Servo lock/ DC injection time at stop, 1st-motor	AF154	R/W	0 to 1000	0.01 s
3139 hex	3138 hex	Jump frequency 1, 1st-motor	AG101	R/W	0 to 59000	0.01 Hz
313A hex	3139 hex	Jump frequency width 1, 1st-motor	AG102	R/W	0 to 1000	0.01 Hz
313B hex	313A hex	Jump frequency 2, 1st-motor	AG103	R/W	0 to 59000	0.01 Hz
313C hex	313B hex	Jump frequency width 2, 1st-motor	AG104	R/W	0 to 1000	0.01 Hz
313D hex	313C hex	Jump frequency 3, 1st-motor	AG105	R/W	0 to 59000	0.01 Hz

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
313E hex	313D hex	Jump frequency width 3, 1st-motor	AG106	R/W	0 to 1000	0.01 Hz
3142 hex	3141 hex	Acceleration stop frequency setting, 1st-motor	AG110	R/W	0 to 59000	0.01 Hz
3143 hex	3142 hex	Acceleration stop time setting, 1st-motor	AG111	R/W	0 to 600	0.1 s
3144 hex	3143 hex	Deceleration stop frequency setting, 1st-motor	AG112	R/W	0 to 59000	0.01 Hz
3145 hex	3144 hex	Acceleration stop time setting, 1st-motor	AG113	R/W	0 to 600	0.1 s
314C hex	314B hex	Jogging frequency	AG-20	R/W	0 to 1000	0.01 Hz
314D hex	314C hex	Jogging stop mode selection	AG-21	R/W	00: Disabled during FRS operation at stop 01: Disabled during deceleration stop operation 02: Disabled during DB operation at stop 03: Enabled during FRS operation at stop 04: Enabled during deceleration stop operation 05: Enabled during DB operation at stop	-
319D hex	319C hex	PID1 enable	AH-01	R/W	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-
319E hex	319D hex	PID1 deviation inverse	AH-02	R/W	00: Disabled 01: Enabled	-
319F hex	319E hex	Unit selection for PID1	AH-03	R/W	0 to 58 Refer to *Unit Options* on page 15-115.	-
31A0 hex	319F hex	PID1 scale adjustment (at 0%)	AH-04	R/W	-10000 to 10000	1
31A1 hex	31A0 hex	PID1 scale adjustment (at 100%)	AH-05	R/W	-10000 to 10000	1
31A2 hex	31A1 hex	PID1 scale adjustment (point position)	AH-06	R/W	00: 00000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	1

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
31A3 hex	31A2 hex	Input source selection of Set-point 1 for PID1	AH-07	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	1
31A6 hex	31A5 hex	Set-point 1 setting for PID1	AH-10 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31A7 hex	31A6 hex		AH-11 (LOW)	R/W		
31A8 hex	31A7 hex	PID1 Multi stage set-point 1 setting	AH-12 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31A9 hex	31A8 hex		AH-13 (LOW)	R/W		
31Aa hex	31A9 hex	PID1 Multi stage set-point 2 setting	AH-14 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31Ab hex	31Aa hex		AH-15 (LOW)	R/W		
31Ac hex	31Ab hex	PID1 Multi stage set-point 3 setting	AH-16 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31Ad hex	31Ac hex		AH-17 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
31Ae hex	31Ad hex	PID1 Multi stage set-point 4 setting	AH-18 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31Af hex	31Ae hex		AH-19 (LOW)	R/W		
31B0 hex	31Af hex	PID1 Multi stage set-point 5 setting	AH-20 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31B1 hex	31B0 hex		AH-21 (LOW)	R/W		
31B2 hex	31B1 hex	PID1 Multi stage set-point 6 setting	AH-22 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31B3 hex	31B2 hex		AH-23 (LOW)	R/W		
31B4 hex	31B3 hex	PID1 Multi stage set-point 7 setting	AH-24 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31B5 hex	31B4 hex		AH-25 (LOW)	R/W		
31B6 hex	31B5 hex	PID1 Multi stage set-point 8 setting	AH-26 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31B7 hex	31B6 hex		AH-27 (LOW)	R/W		
31B8 hex	31B7 hex	PID1 Multi stage set-point 9 setting	AH-28 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31B9 hex	31B8 hex		AH-29 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
31Ba hex	31B9 hex	PID1 Multi stage set-point 10 setting	AH-30 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31BB hex	31Ba hex		AH-31 (LOW)	R/W		
31BC hex	31BB hex	PID1 Multi stage set-point 11 setting	AH-32 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31BD hex	31BC hex		AH-33 (LOW)	R/W		
31Be hex	31BD hex	PID1 Multi stage set-point 12 setting	AH-34 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31BF hex	31Be hex		AH-35 (LOW)	R/W		
31C0 hex	31BF hex	PID1 Multi stage set-point 13 setting	AH-36 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31C1 hex	31C0 hex		AH-37 (LOW)	R/W		
31C2 hex	31C1 hex	PID1 Multi stage set-point 14 setting	AH-38 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31C3 hex	31C2 hex		AH-39 (LOW)	R/W		
31C4 hex	31C3 hex	PID1 Multi stage set-point 15 setting	AH-40 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31C5 hex	31C4 hex		AH-41 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
31C6 hex	31C5 hex	Input source selection of Set-point 2 for PID1	AH-42	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31C8 hex	31C7 hex	Set-point 2 setting for PID1	AH-44 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31C9 hex	31C8 hex		AH-45 (LOW)	R/W		
31Ca hex	31C9 hex	Input source selection of Set-point 3 for PID1	AH-46	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31CC hex	31CB hex	Set-point 3 setting for PID1	AH-48 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.
31CD hex	31CC hex		AH-49 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
31Ce hex	31CD hex	Calculation symbol selection of Set-point 1 for PID1	AH-50	R/W	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Minimum deviation 06: Maximum deviation	-
31CF hex	31CE hex	Input source selection of Process data 1 for PID1	AH-51	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31D0 hex	31CF hex	Input source selection of Process data 2 for PID1	AH-52	R/W		-
31D1 hex	31D0 hex	Input source selection of Process data 3 for PID1	AH-53	R/W		-
31D2 hex	31D1 hex	Calculation symbol selection of Process data for PID1	AH-54	R/W	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Square root of FB1 06: Square root of FB2 07: Square root of (FB1-FB2) 08: Average of PV-1 to PV-3 09: Minimum data of PV-1 to PV-3 10: Maximum data of PV-1 to PV-3	-
31D8 hex	31D7 hex	PID1 gain change method selection	AH-60	R/W	00: Only gain 1 01: [PRO] terminal switch	-
31D9 hex	31D8 hex	PID1 proportional gain 1	AH-61	R/W	0 to 1000	0.1
31Da hex	31D9 hex	PID1 integral time constant 1	AH-62	R/W	0 to 36000	0.1 s
31DB hex	31DA hex	PID1 derivative gain 1	AH-63	R/W	0 to 10000	0.01 s
31DC hex	31DB hex	PID1 proportional gain 2	AH-64	R/W	0 to 1000	0.1
31DD hex	31DC hex	PID1 integral time constant 2	AH-65	R/W	0 to 36000	0.1 s
31De hex	31DD hex	PID1 derivative gain 2	AH-66	R/W	0 to 10000	0.01 s

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
31DF hex	31DE hex	PID1 gain change time	AH-67	R/W	0 to 10000	1 ms
31E2 hex	31E1 hex	PID feed-forward selection	AH-70	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved)	-
31E3 hex	31E2 hex	PID1 output range	AH-71	R/W	0 to 10000	0.01%
31E4 hex	31E3 hex	PID1 Deviation over level	AH-72	R/W	0 to 10000	0.01%
31E5 hex	31E4 hex	PID1 Feedback compare signal turn-off level	AH-73	R/W	0 to 10000	0.01%
31E6 hex	31E5 hex	PID1 Feedback compare signal turn-on level	AH-74	R/W	0 to 10000	0.01%
31E7 hex	31E6 hex	PID soft start function ena-ble	AH-75	R/W	00: Disabled 01: Enabled	-
31E8 hex	31E7 hex	PID soft start target level	AH-76	R/W	0 to 10000	0.01%
31Ea hex	31E9 hex	Acceleration time setting for soft start function	AH-78 (HIGH)	R/W	0 to 360000	0.01 s
31Eb hex	31EA hex		AH-79 (LOW)	R/W		
31Ec hex	31EB hex	PID soft start time	AH-80	R/W	0 to 60000	0.01 s
31Ed hex	31EC hex	PID soft start error detec-tion enable	AH-81	R/W	00: Disabled 01: Enabled: error output 02: Enabled: warning	-
31Ee hex	31ED hex	PID soft start error detec-tion level	AH-82	R/W	0 to 10000	0.01%
31F1 hex	31F0 hex	PID sleep trigger selection	AH-85	R/W	00: Disabled 01: Low output 02: [SLEP] terminal	-
31F2 hex	31F1 hex	PID sleep start level	AH-86	R/W	0 to 59000	0.01 Hz
31F3 hex	31F2 hex	PID sleep active time	AH-87	R/W	0 to 10000	0.01 s
31F4 hex	31F3 hex	Setpoint boost before PID sleep enable	AH-88	R/W	00: Disabled 01: Enabled	-
31F5 hex	31F4 hex	Setpoint boost time	AH-89	R/W	0 to 10000	0.01 s
31F6 hex	31F5 hex	Setpoint boost value	AH-90	R/W	0 to 10000	0.01%
31F7 hex	31F6 hex	Minimum RUN time before PID sleep	AH-91	R/W	0 to 10000	0.01 s

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
31F8 hex	31F7 hex	Minimum active time of PID sleep	AH-92	R/W	0 to 10000	0.01 s
31F9 hex	31F8 hex	PID wake trigger selection	AH-93	R/W	01: Deviation amount 02: Low feedback 03: [WAKE] terminal	-
31Fa hex	31F9 hex	PID wake start level	AH-94	R/W	0 to 10000	0.01%
31FB hex	31FA hex	PID wake start time	AH-95	R/W	0 to 10000	0.01 s
31FC hex	31FB hex	PID wake start deviation value	AH-96	R/W	0 to 10000	0.01%
3201 hex	3200 hex	PID2 enable	AJ-01	R/W	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-
3202 hex	3201 hex	PID2 deviation inverse	AJ-02	R/W	00: Disabled 01: Enabled	-
3203 hex	3202 hex	PID2 unit selection	AJ-03	R/W	0 to 58 Refer to *Unit Options* on page 15-115.	-
3204 hex	3203 hex	PID2 scale adjustment (at 0%)	AJ-04	R/W	-10000 to 10000	1
3205 hex	3204 hex	PID2 scale adjustment (at 100%)	AJ-05	R/W	-10000 to 10000	1
3206 hex	3205 hex	PID2 scale adjustment (point position)	AJ-06	R/W	00: 00000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	-
3207 hex	3206 hex	Input source selection of Set-point for PID2	AJ-07	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
320A hex	3209 hex	Set-point setting for PID2	AJ-10 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AJ-04), (AJ-05), and (AJ-06).	Unit differs depending on the AJ-03 and AJ-06 settings.
320B hex	320A hex		AJ-11 (LOW)	R/W		
320C hex	320B hex	Input source selection of Process data for PID2	AJ-12	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
320D hex	320C hex	PID2 proportional gain	AJ-13	R/W	0 to 1000	0.1
320E hex	320D hex	PID2 integral time constant	AJ-14	R/W	0 to 36000	0.1 s
320F hex	320E hex	PID2 derivative gain	AJ-15	R/W	0 to 10000	0.01 s
3210 hex	320F hex	PID2 output range	AJ-16	R/W	0 to 10000	0.01%
3211 hex	3210 hex	PID2 Deviation over level	AJ-17	R/W	0 to 10000	0.01%
3212 hex	3211 hex	PID2 Feedback compare signal turn-off level	AJ-18	R/W	0 to 10000	0.01%
3213 hex	3212 hex	PID2 Feedback compare signal turn-on level	AJ-19	R/W	0 to 10000	0.01%
3215 hex	3214 hex	PID3 enable	AJ-21	R/W	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-
3216 hex	3215 hex	PID3 deviation inverse	AJ-22	R/W	00: Disabled 01: Enabled	-
3217 hex	3216 hex	PID3 unit selection	AJ-23	R/W	0 to 58 Refer to *Unit Options* on page 15-115.	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3218 hex	3217 hex	PID3 scale adjustment (at 0%)	AJ-24	R/W	-10000 to 10000	1
3219 hex	3218 hex	PID3 scale adjustment (at 100%)	AJ-25	R/W	-10000 to 10000	1
321A hex	3219 hex	PID3 scale adjustment (point position)	AJ-26	R/W	00: 00000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	-
321B hex	321A hex	Input source selection of Set-point for PID3	AJ-27	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-
321E hex	321D hex	Set-point setting for PID3	AJ-30 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AJ-24), (AJ-25), and (AJ-26).	Unit differs depending on the AJ-23 and AJ-26 settings.
321F hex	321E hex		AJ-31 (LOW)	R/W		
3220 hex	321F hex	Input source selection of Process data for PID3	AJ-32	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
3221 hex	3220 hex	PID3 proportional gain	AJ-33	R/W	0 to 1000	0.1
3222 hex	3221 hex	PID3 integral time constant	AJ-34	R/W	0 to 36000	0.1 s
3223 hex	3222 hex	PID3 derivative gain	AJ-35	R/W	0 to 10000	0.01 s
3224 hex	3223 hex	PID3 output range	AJ-36	R/W	0 to 10000	0.01%
3225 hex	3224 hex	PID3 Deviation over level	AJ-37	R/W	0 to 10000	0.01%
3226 hex	3225 hex	PID3 Feedback compare signal turn-off level	AJ-38	R/W	0 to 10000	0.01%
3227 hex	3226 hex	PID3 Feedback compare signal turn-on level	AJ-39	R/W	0 to 10000	0.01%
3229 hex	3228 hex	PID4 enable	AJ-41	R/W	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-
322A hex	3229 hex	PID4 deviation inverse	AJ-42	R/W	00: Disabled 01: Enabled	-
322B hex	322A hex	PID4 unit selection	AJ-43	R/W	0 to 58 Refer to *Unit Options* on page 15-115.	-
322C hex	322B hex	PID4 scale adjustment (at 0%)	AJ-44	R/W	-10000 to 10000	1
322D hex	322C hex	PID4 scale adjustment (at 100%)	AJ-45	R/W	-10000 to 10000	1
322E hex	322D hex	PID4 scale adjustment (point position)	AJ-46	R/W	00: 00000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
322F hex	322E hex	Input source selection of Set-point for PID4	AJ-47	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-
3232 hex	3221 hex	Set-point setting for PID4	AJ-50 (HIGH)	R/W	0.00 to 100.00 The display range can be changed arbitrarily by setting (AJ-44), (AJ-45), and (AJ-46).	Unit differs depending on the AJ-43 and AJ-46 settings.
3233 hex	3232 hex		AJ-51 (LOW)	R/W		
3234 hex	3233 hex	Input source selection of Process data for PID4	AJ-52	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
3235 hex	3234 hex	PID4 proportional gain	AJ-53	R/W	0 to 1000	0.1
3236 hex	3235 hex	PID4 integral time constant	AJ-54	R/W	0 to 36000	0.1 s
3237 hex	3236 hex	PID4 derivative gain	AJ-55	R/W	0 to 10000	0.01 s
3238 hex	3237 hex	PID4 output range	AJ-56	R/W	0 to 10000	0.01%

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3239 hex	3238 hex	PID4 Deviation over level	AJ-57	R/W	0 to 10000	0.01%
323A hex	3239 hex	PID4 Feedback compare signal turn-off level	AJ-58	R/W	0 to 10000	0.01%
323B hex	323A hex	PID4 Feedback compare signal turn-on level	AJ-59	R/W	0 to 10000	0.01%
55F1 hex	55F0 hex	Main speed input source selection, 2nd-motor	AA201	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-
55F2 hex	55F1 hex	Sub speed input source selection, 2nd-motor	AA202	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-
55F4 hex	55F3 hex	Sub speed setting, 2nd-motor	AA204	R/W	0 to 59000	0.01 Hz
55F5 hex	55F4 hex	Calculation symbol selection for Speed reference, 2nd-motor	AA205	R/W	00: Disabled 01: Addition 02: Subtraction 03: Multiplication	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
55F6 hex	55F5 hex	Add frequency setting, 2nd-motor (SET-POINT)	AA206 (HIGH)	R/W	-59000 to 59000	0.01 Hz
55F7 hex	55F6 hex		AA207 (LOW)	R/W		
55FB hex	55FA hex	Run-command input source selection, 2nd-motor	AA211	R/W	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-
55FE hex	55FD hex	RUN-direction restriction, 2nd-motor	AA214	R/W	00: No limitation 01: Only normal rotation 02: Only reverse rotation	-
55FF hex	55FE hex	STOP mode selection, 2nd-motor	AA215	R/W	00: Deceleration stop 01: Free run stop	-
5605 hex	5604 hex	Control mode selection, 2nd-motor	AA221	R/W	IM control 00: [V/f] Fixed torque characteristics (IM) 01: [V/f] Reducing torque characteristics (IM) 02: [V/f] Free V/f (IM) 03: Auto torque boost (IM) 04: [V/f with sensor] Fixed torque characteristics (IM) 05: [V/f with sensor] Reduced torque characteristics (IM) 06: [V/f with sensor] Free V/f (IM) 07: Auto torque boost with sensor (IM) 08: Sensorless vector control (IM) 09: Zero-Hz range sensorless vector control (IM)*1 10: Vector control with sensor (IM)*1 SM/PMM control 11: Synchronous start type sensorless vector control (SM/PMM)	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
5607 hex	5606 hex	Vector control mode selection, 2nd-motor	AA223	R/W	00: Speed/torque control mode 01 : Pulse string position control mode 02: Absolute position control mode 03: High-resolution absolute position control mode	-
565E hex	565D hex	Multispeed-0 setting, 2nd-motor	Ab210	R/W	0 to 59000	0.01 Hz
56C7 hex	56C6 hex	Select method to switch to Accel2/Decel2 Profile, 2nd-motor	AC215	R/W	00: [2CH] terminal 01: Parameter setting 02: Switching normal/reverse rotation	-
56C8 hex	56C7 hex	Accel1 to Accel2 Frequency transition point, 2nd-motor	AC216	R/W	0 to 59000	0.01 Hz
56C9 hex	56C8 hex	Decel1 to Decel2 Frequency transition point, 2nd-motor	AC217	R/W	0 to 59000	0.01 Hz
56CC hex	56CB hex	Acceleration time setting 1, 2nd-motor	AC220 (HIGH)	R/W	0 to 360000	0.01 s
56CD hex	56CC hex		AC221 (LOW)	R/W		
56Ce hex	56CD hex	Deceleration time setting 1, 2nd-motor	AC222 (HIGH)	R/W		0.01 s
56CF hex	56Ce hex		AC223 (LOW)	R/W		
56D0 hex	56CF hex	Acceleration time setting 2, 2nd-motor	AC224 (HIGH)	R/W		0.01 s
56D1 hex	56D0 hex		AC225 (LOW)	R/W		
56D2 hex	56D1 hex	Deceleration time setting 2, 2nd-motor	AC226 (HIGH)	R/W		0.01 s
56D3 hex	56D2 hex		AC227 (LOW)	R/W		
57E5 hex	57E4 hex	DC braking selection, 2nd-motor	AF201	R/W	00: Disabled 01: Enabled (Operation command) 02: Enabled (Frequency command)	-
57E6 hex	57E5 hex	Braking type selection, 2nd-motor	AF202	R/W	00: DC braking 01: Speed servo lock 02: Position servo lock	-
57E7 hex	57E6 hex	DC braking frequency, 2nd-motor	AF203	R/W	0 to 59000	0.01 Hz
57E8 hex	57E7 hex	DC braking delay time, 2nd-motor	AF204	R/W	0 to 500	0.01 s
57E9 hex	57E8 hex	DC braking force setting, 2nd-motor	AF205	R/W	0 to 100	1%

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
57Ea hex	57E9 hex	DC braking active time at stop, 2nd-motor	AF206	R/W	0 to 6000	0.01 s
57Eb hex	57EA hex	DC braking operation meth-od selection, 2nd-motor	AF207	R/W	00: Edge mode 01: Level mode	-
57Ec hex	57EB hex	DC braking force at start, 2nd-motor	AF208	R/W	0 to 100	1%
57Ed hex	57EC hex	DC braking active time at start, 2nd-motor	AF209	R/W	0 to 6000	0.01 s
57F8 hex	57ED hex	Contactor Control Enable, 2nd-motor	AF220	R/W	00: Disabled 01: Enabled: primary side 02: Enabled: secondary side	-
57F9 hex	57F8 hex	Run delay time, 2nd-motor	AF221	R/W	0 to 200	0.01 s
57Fa hex	57F9 hex	Contactor off delay time, 2nd-motor	AF222	R/W	0 to 200	0.01 s
57FB hex	57FA hex	Contactor answer back check time, 2nd-motor	AF223	R/W	0 to 500	0.01 s
5802 hex	5801 hex	Brake Control Enable, 2nd-motor	AF230	R/W	00: Disabled 01: Brake control 1 com-mon in forward/reverse rotation 02: Brake control 1 for-ward/reverse set individu-ally 03: Brake control 2 com-mon in forward/reverse rotation	-
5803 hex	5802 hex	Brake Wait Time for Re-lease, 2nd-motor (Forward side)	AF231	R/W	0 to 500	0.01 s
5804 hex	5803 hex	Brake Wait Time for Accel. , 2nd-motor (Reverse side)	AF232	R/W	0 to 500	0.01 s
5805 hex	5804 hex	Brake Wait Time for Stop-ping, 2nd-motor (Forward side)	AF233	R/W	0 to 500	0.01 s
5806 hex	5805 hex	Brake Wait Time for Confir-mation, 2nd-motor (Forward side)	AF234	R/W	0 to 500	0.01 s
5807 hex	5806 hex	Brake Release Frequency Setting, 2nd-motor (For-ward side)	AF235	R/W	0 to 59000	0.01 Hz
5808 hex	5807 hex	Brake Release Current Set-ting, 2nd-motor (Forward side)	AF236	R/W	(0.0 to 2.0) × Inverter rat-ed current*3	0.1 A
5809 hex	5808 hex	Braking Frequency, 2nd-motor (Forward side)	AF237	R/W	0 to 59000	0.01 Hz

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
580A hex	5809 hex	Brake Wait Time for Release, 2nd-motor (Reverse side)	AF238	R/W	0 to 500	0.01 s
580B hex	580A hex	Brake Wait Time for Accel. , 2nd-motor (Reverse side)	AF239	R/W	0 to 500	0.01 s
580C hex	580B hex	Brake Wait Time for Stopping, 2nd-motor (Reverse side)	AF240	R/W	0 to 500	0.01 s
580D hex	580C hex	Brake Wait Time for Confirmation, 2nd-motor (Reverse side)	AF241	R/W	0 to 500	0.01 s
580E hex	580D hex	Brake Release Frequency Setting, 2nd-motor (Reverse side)	AF242	R/W	0 to 59000	0.01 Hz
580F hex	580E hex	Brake Release Current Setting, 2nd-motor (Reverse side)	AF243	R/W	(0.0 to 2.0) × Inverter rated current*3	0.1 A
5810 hex	580F hex	Braking Frequency, 2nd-motor (Reverse side)	AF244	R/W	0 to 59000	0.01 Hz
5816 hex	5815 hex	Brake open delay time, 2nd-motor	AF250	R/W	0 to 200	0.01 s
5817 hex	5816 hex	Brake close delay time, 2nd-motor	AF251	R/W	0 to 200	0.01 s
5818 hex	5817 hex	Brake answer back check time, 2nd-motor	AF252	R/W	0 to 500	0.01 s
5819 hex	5818 hex	Servo lock/ DC injection time at start, 2nd-motor	AF253	R/W	0 to 1000	0.01 s
581A hex	5819 hex	Servo lock/ DC injection time at stop, 2nd-motor	AF254	R/W	0 to 1000	0.01 s
5849 hex	5848 hex	Jump frequency 1, 2nd-motor	AG201	R/W	0 to 59000	0.01 Hz
584A hex	5849 hex	Jump frequency width 1, 2nd-motor	AG202	R/W	0 to 1000	0.01 Hz
584B hex	584A hex	Jump frequency 2, 2nd-motor	AG203	R/W	0 to 59000	0.01 Hz
584C hex	584B hex	Jump frequency width 2, 2nd-motor	AG204	R/W	0 to 1000	0.01 Hz
584D hex	584C hex	Jump frequency 3, 2nd-motor	AG205	R/W	0 to 59000	0.01 Hz
584E hex	584D hex	Jump frequency width 3, 2nd-motor	AG206	R/W	0 to 1000	0.01 Hz
5852 hex	5851 hex	Acceleration stop frequency setting, 2nd-motor	AG210	R/W	0 to 59000	0.01 Hz
5853 hex	5852 hex	Acceleration stop time setting, 2nd-motor	AG211	R/W	0 to 600	0.1 s
5854 hex	5853 hex	Deceleration stop frequency setting, 2nd-motor	AG212	R/W	0 to 59000	0.01 Hz

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
5854 hex	5853 hex	Deceleration stop time setting	AG213	R/W	0 to 600	0.1 s

*1. Cannot be selected if **Load type selection** (Ub-03) is *01: Low duty (LD)* or *00: Very low duty (VLD)*.

*2. Cannot be selected if **Load type selection** (Ub-03) is *00: Very low duty (VLD)*.

*3. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V (When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.)
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01% (Rated ratio)

9-5-5 Group b Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
32C9 hex	32C8 hex	Frequency limit selection, 1st-motor	bA101	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
32Ca hex	32C9 hex	Upper Frequency limit, 1st-motor	bA102	R/W	0 to 59000	0.01 Hz
32CB hex	32CA hex	Lower Frequency limit, 1st-motor	bA103	R/W	0 to 59000	0.01 Hz

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
32D2 hex	32D1 hex	Torque limit selection, 1st-motor	bA110	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3	-
32D3 hex	32D2 hex	Torque limit parameter mode selection, 1st-motor	bA111	R/W	00: Four quadrant specific 01: [TRQ] terminal switch	-
32D4 hex	32D3 hex	Torque limit 1 (Forward driving), 1st-motor	bA112	R/W	0 to 5000	0.1%
32D5 hex	32D4 hex	Torque limit 2 (Reverse regenerative), 1st-motor	bA113	R/W		0.1%
32D6 hex	32D5 hex	Torque limit 3 (Reverse driving), 1st-motor	bA114	R/W		0.1%
32D7 hex	32D6 hex	Torque limit 4 (Forward regenerative), 1st-motor	bA115	R/W		0.1%
32D8 hex	32D7 hex	Torque limit LADSTOP selection, 1st-motor	bA116	R/W	00: Disabled 01: Enabled	-
32DC hex	32DB hex	Over current suppress enable, 1st-motor	bA120	R/W	00: Disabled 01: Enabled	1
32DD hex	32DC hex	Over current suppress Level, 1st-motor	bA121	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
32De hex	32DD hex	Overload restriction 1 mode selection, 1st-motor	bA122	R/W	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneration	-
32DF hex	32De hex	Overload restriction 1 active level, 1st-motor	bA123	R/W	(0.2 to 2.0) × Inverter rated current*1	0.1 A
32E0 hex	32DF hex	Overload restriction 1 action time, 1st-motor	bA124 (HIGH)	R/W	10 to 360000	0.01 s
32E1 hex	32E0 hex		bA125 (LOW)	R/W		
32E2 hex	32E1 hex	Overload restriction 2 mode selection, 1st-motor	bA126	R/W	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneration	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
32E3 hex	32E2 hex	Overload restriction 2 active level, 1st-motor	bA127	R/W	(0.2 to 2.0) × Inverter rated current[*1]	0.1 A
32E4 hex	32E3 hex	Overload restriction 2 Action time, 1st-motor	bA128 (HIGH)	R/W	10 to 360000	0.01 s
32E5 hex	32E4 hex		bA129 (LOW)	R/W		
32E6 hex	32E5 hex	Deceleration-stop at power failure	bA-30	R/W	00: Disabled 01: Enabled: deceleration stop 02: Enabled: no recovery 03: Enabled with recovery	-
32E7 hex	32E6 hex	Decel-stop at power failure starting voltage	bA-31	R/W	200 V class: 0 to 4100 400 V class: 0 to 8200	0.1 VDC
32E8 hex	32E7 hex	Decel-stop at power failure control target level	bA-32	R/W	200 V class: 0 to 4100 400 V class: 0 to 8200	0.1 VDC
32EA hex	32E9 hex	Decel-stop at power failure deceleration time	bA-34 (HIGH)	R/W	1 to 360000	0.01 s
32EB hex	32EA hex		bA-35 (LOW)	R/W		
32EC hex	32EB hex	Decel-stop at power failure freq. width at deceleration start	bA-36	R/W	0 to 1000	0.01 Hz
32ED hex	32EC hex	Decel-stop at power failure DC-bus voltage constant control P-gain	bA-37	R/W	0 to 500	0.01
32EE hex	32ED hex	Decel-stop at power failure DC-bus voltage constant control I-gain	bA-38	R/W	0 to 15000	0.01 s
32F0 hex	32EF hex	Over-voltage suppression enable, 1st-motor	bA140	R/W	00: Disabled 01: DC voltage constant deceleration 02: Acceleration only at deceleration 03: Acceleration at constant speed/deceleration	-
32F1 hex	32F0 hex	Over-voltage suppression active level, 1st-motor	bA141	R/W	200 V class: 3300 to 4000 400 V class: 6600 to 8000	0.1 VDC
32F2 hex	32F1 hex	Over-voltage suppression action time, 1st-motor	bA142 (HIGH)	R/W	0 to 360000	0.01 s
32F3 hex	32F2 hex		bA143 (LOW)	R/W		
32F4 hex	32F3 hex	DC bus constant control proportional gain, 1st-motor	bA144	R/W	0 to 500	0.01
32F5 hex	32F4 hex	DC bus constant control integral gain, 1st-motor	bA145	R/W	0 to 15000	0.01 s

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
32F6 hex	32F5 hex	Over magnetization deceleration function selection, 1st-motor	bA146	R/W	00: Disabled 01: Regular operation 02: Operation only at deceleration 03: Level mode 04: Level mode only at deceleration	-
32F7 hex	32F6 hex	Over magnetization output filter time constant, 1st_motor	bA147	R/W	0 to 100	0.01 s
32F8 hex	32F7 hex	Over magnetization voltage gain, 1st_motor	bA148	R/W	50 to 400	1%
32F9 hex	32F8 hex	Over magnetization level setting, 1st_motor	bA149	R/W	200 V class: 3300 to 4000 400 V class: 6600 to 8000	0.1 VDC
3304 hex	3303 hex	Dynamic brake usage rate	bA-60	R/W	0.0 to 10.0 × ((bA-63) / minimum resistance)^2 *2	0.1%
3305 hex	3304 hex	Dynamic brake selection	bA-61	R/W	00: Disabled 01: Enabled: disabled at stop 02: Enabled: enabled at stop	-
3306 hex	3305 hex	Dynamic brake active level	bA-62	R/W	200 V class: 3300 to 4000 400 V class: 6600 to 8000	0.1 VDC
3307 hex	3306 hex	Dynamic brake resister value	bA-63	R/W	Minimum resistance to 600.0*2	0.1Ω
330E hex	330D hex	Cooling FAN control method selection	bA-70	R/W	00: Always ON 01: ON during operation 02: Temperature dependent	-
330F hex	330E hex	Cooling FAN accumulation running time clear selection	bA-71	R/W	00: Disabled 01: Clear	-
332D hex	332C hex	Carrier speed setting, 1st-motor	bb101	R/W	Normal Duty (ND) 0.5 to 16.0 Low Duty (LD) 0.5 to 12.0 Very Low Duty (VLD) 0.5 to 10.0*3	0.1 kHz
332E hex	332D hex	Sprinkle carrier pattern selection, 1st-motor	bb102	R/W	00: Disabled 01: Pattern 1 enabled 02: Pattern 2 enabled 03: Pattern 3 enabled	-
332F hex	332E hex	Automatic-carrier reduction selection, 1st-motor	bb103	R/W	00: Disabled 01: Enabled: current 02: Enabled: temperature	-
3336 hex	3335 hex	Automatic error reset selection	bb-10	R/W	00: Disabled 01: Enabled with operation command OFF 02: Enable after the setting time	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
3337 hex	3336 hex	Alarm signal selection at Automatic error reset is active	bb-11	R/W	00: Output 01: Not output	-
3338 hex	3337 hex	Automatic error reset wait time	bb-12	R/W	0 to 600	1 s
3339 hex	3338 hex	Automatic error reset number	bb-13	R/W	0 to 10	1
3340 hex	3339 hex	The number of retries after instantaneous power failure	bb-20	R/W	0 to 16 / ∞(255)	1
3341 hex	3340 hex	The number of retries after under voltage	bb-21	R/W	0 to 16 / ∞(255)	1
3342 hex	3341 hex	The number of retries after over current	bb-22	R/W	0 to 5	1
3343 hex	3342 hex	The number of retries after over-voltage	bb-23	R/W	0 to 5	1
3344 hex	3343 hex	Selection of restart mode @Instantaneous power failure/ under-voltage trip	bb-24	R/W	00: 0 Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-
3345 hex	3344 hex	Allowable under-voltage power failure time	bb-25	R/W	3 to 250	0.1 s
3346 hex	3345 hex	Retry wait time before motor restart	bb-26	R/W	3 to 1000	0.1 s
3347 hex	3346 hex	Instantaneous power failure/under-voltage trip alarm enable	bb-27	R/W	00: Disabled 01: Enabled at stop 02: Disabled at stop and deceleration stop	-
3348 hex	3347 hex	Selection of restart mode @over-current	bb-28	R/W	00: 0 Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-
3349 hex	3348 hex	Wait time of restart @over-current	bb-29	R/W	3 to 1000	0.1 s
334A hex	3349 hex	Selection of restart mode @over-voltage	bb-30	R/W	00: 0 Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
334B hex	334A hex	Wait time of restart @over-voltage	bb-31	R/W	3 to 1000	0.1 s
3354 hex	3353 hex	Restart mode after FRS release	bb-40	R/W	00: 0 Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed[*4]	-
3355 hex	3354 hex	Restart mode after RS release	bb-41	R/W		
3356 hex	3355 hex	Restart frequency threshold	bb-42	R/W	0 to 59000	0.01 Hz
3357 hex	3356 hex	Restart level of Active frequency matching	bb-43	R/W	(0.0 to 2.0) × Inverter rated current[*1]	0.01 Hz
3358 hex	3357 hex	Restart constant (speed) of Active frequency matching	bb-44	R/W	10 to 3000	0.01 s
3359 hex	3358 hex	Restart constant (Voltage) of Active frequency matching	bb-45	R/W	10 to 3000	0.01 s
335A hex	3359 hex	OC-supress level of Active frequency matching	bb-46	R/W	(0.0 to 2.0) × Inverter rated current[*1]	0.1 A
335B hex	335A hex	Restart speed selection of Active frequency matching	bb-47	R/W	00: Cutoff frequency 01: Maximum frequency 02: Setting frequency	-
3368 hex	3367 hex	Over current detection level, 1st-motor	bb160	R/W	(0.2 to 2.2) x Inverter ND rated current[*1]	0.1 A
3369 hex	3368 hex	Power supply over voltage selection	bb-61	R/W	00: Warning 01: Error	-
336A hex	3369 hex	Power supply over voltage level setting	bb-62	R/W	200 V class: 3000 to 4100 400 V class: 6000 to 8200	0.1 VDC
336C hex	336B hex	Ground fault selection	bb-64	R/W	00: Disabled 01: Enabled	-
336D hex	336C hex	Input phase loss enable	bb-65	R/W		
336E hex	336D hex	Output phase loss enable	bb-66	R/W		
336F hex	336E hex	Output phase loss detection sensitivity	bb-67	R/W	1 to 100	1%
3372 hex	3371 hex	Thermistor error level	bb-70	R/W	0 to 10000	1Ω
337C hex	377B hex	Over speed detection level	bb-80	R/W	0 to 1500	0.1%
337D hex	337C hex	Over speed detection time	bb-81	R/W	0 to 50	0.1 s
337E hex	337D hex	Speed deviation error mode selection	bb-82	R/W	00: Warning 01: Error	-
337F hex	337E hex	Speed deviation error detection level	bb-83	R/W	0 to 1000	0.1%
3380 hex	337F hex	Speed deviation error detection time	bb-84	R/W	0 to 50	0.1 s

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3381 hex	3380 hex	Position deviation error mode selection	bb-85	R/W	00: Warning 01: Error	-
3382 hex	3381 hex	Position deviation error detection level	bb-86	R/W	0 to 65535	1 × 100 pls
3383 hex	3382 hex	Position deviation error detection time	bb-87	R/W	0 to 50	0.1 s
33F5 hex	33F4 hex	STO input display selection	bd-01	R/W	00: With indication 01: Without indication 02: Trip	-
33F6 hex	33F5 hex	STO input change time	bd-02	R/W	0 to 6000	0.01 s
33F7 hex	33F6 hex	Display selection at STO input change time	bd-03	R/W	00: With indication 01: Without indication	-
33F8 hex	33F7 hex	Action selection after STO input change time	bd-04	R/W	00: Retain only the condition 01: Disabled 02: Trip	-
59D9 hex	59D8 hex	Frequency limit selection, 2nd motor	bA201	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
59Da hex	59D9 hex	Upper frequency limit, 2nd motor	bA202	R/W	0 to 59000	0.01 Hz
59DB hex	59DA hex	Lower frequency limit, 2nd motor	bA203	R/W	0 to 59000	0.01 Hz
59E2 hex	59E1 hex	Torque limit selection, 2nd-motor	bA210	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
59E3 hex	59E2 hex	Torque limit parameter mode selection, 2nd-motor	bA211	R/W	00: Four quadrant specific 01: [TRQ] terminal switch	-
59E4 hex	59E3 hex	Torque limit 1 (Forward driving), 2nd-motor	bA212	R/W	0 to 5000	0.1%
59E5 hex	59E4 hex	Torque limit 2 (Reverse regenerative), 2nd-motor	bA213	R/W		0.1%
59E6 hex	59E5 hex	Torque limit 3 (Reverse driving), 2nd-motor	bA214	R/W		0.1%
59E7 hex	59E6 hex	Torque limit 4 (Forward regenerative), 2nd motor	bA215	R/W		0.1%
59E8 hex	59E7 hex	Torque limit LADSTOP selection, 1st-motor	bA216	R/W	00: Disabled 01: Enabled	-
59Ec hex	59EB hex	Over current suppress enable, 2nd-motor	bA220	R/W	00: Disabled 01: Enabled	1
59Ed hex	59EC hex	Over current suppress Level, 2nd-motor	bA221	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
59Ee hex	59ED hex	Overload restriction 1 mode selection, 2nd-motor	bA222	R/W	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneration	-
59Ef hex	59EE hex	Overload restriction 1 active level, 2nd-motor	bA223	R/W	(0.2 to 2.0) × Inverter rated current*1	0.1 A
59F0 hex	59EF hex	Overload restriction 1 action time, 2nd-motor	bA224 (HIGH)	R/W	10 to 360000	0.01 s
59F1 hex	59F0 hex		bA225 (LOW)	R/W		
59F2 hex	59F1 hex	Overload restriction 2 mode selection, 2nd-motor	bA226	R/W	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneration	-
59F3 hex	59F2 hex	Overload restriction 2 active level, 2nd-motor	bA227	R/W	(0.2 to 2.0) × Inverter rated current*1	0.1 A
59F4 hex	59F3 hex	Overload restriction 2 action time, 2nd-motor	bA228 (HIGH)	R/W	10 to 360000	0.01 s
59F5 hex	59F4 hex		bA229 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
5A00 hex	59FF hex	Over-voltage suppression enable, 2nd-motor	bA240	R/W	00: Disabled 01: DC voltage constant deceleration 02: Acceleration only at deceleration 03: Acceleration at constant speed/deceleration	-
5A01 hex	5A00 hex	Over-voltage suppression active level, 2nd-motor	bA241	R/W	200 V class: 3300 to 4000 400 V class: 6600 to 8000	0.1 VDC
5A02 hex	5A01 hex	Over-voltage suppression action time, 2nd-motor	bA242 (HIGH)	R/W	0 to 360000	0.01 s
5A03 hex	5A02 hex		bA243 (LOW)	R/W		
5A04 hex	5A03 hex	DC bus constant control proportional gain, 2nd-motor	bA244	R/W	0 to 500	0.01
5A05 hex	5A04 hex	DC bus constant control integral gain, 2nd-motor	bA245	R/W	0 to 15000	0.01 s
5A06 hex	5A05 hex	Over magnetization function selection, 2nd-motor	bA246	R/W	00: Disabled 01: Regular operation 02: Operation only at deceleration 03: Level mode 04: Level mode only at deceleration	-
5A07 hex	5A06 hex	Over magnetization output filter time constant, 2nd-motor	bA247	R/W	0 to 100	0.01 s
5A08 hex	5A07 hex	Over magnetization voltage gain, 2nd-motor	bA248	R/W	50 to 400	1%
5A09 hex	5A08 hex	Over magnetization level setting, 2nd-motor	bA249	R/W	200 V class: 3300 to 4000 400 V class: 6600 to 8000	0.1 VDC
5A3D hex	5A3C hex	Carrier speed setting, 2nd-motor	bb201	R/W	Normal Duty (ND) 0.5 to 16.0 Low Duty (LD) 0.5 to 12.0 Very Low Duty (VLD) 0.5 to 10.0*3	0.1 kHz
5A3E hex	5A3D hex	Sprinkle carrier pattern selection, 2nd-motor	bb202	R/W	00: Disabled 01: Pattern 1 enabled 02: Pattern 2 enabled 03: Pattern 3 enabled	-
5A3F hex	5A3E hex	Automatic-carrier reduction selection, 2nd-motor	bb203	R/W	00: Disabled 01: Enabled: current 02: Enabled: temperature	-
5A78 hex	5A77 hex	Over current detection level, 2nd-motor	bb260	R/W	(0.2 to 2.2) x Inverter ND rated current*1	0.1 A

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
339A hex	3399 hex	Electronic thermal level setting, 1st-motor	bC110	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A
339B hex	339A hex	Electronic thermal characteristic selection, 1st-motor	bC111	R/W	00: Reduction characteristics 01: Constant torque characteristics 02: Arbitrary setting	-
339C hex	339B hex	Electronic thermal Subtraction function enable, 1st-motor	bC112	R/W	00: Disabled 01: Enabled	-
339D hex	339C hex	Electronic thermal Subtraction time, 1st-motor	bC113	R/W	1 to 1000	1 s
339E hex	339D hex	Electronic thermal counter memory selection at Power-off	bC-14	R/W	00: Disabled 01: Enabled	-
33A4 hex	33A3 hex	Free electronic thermal frequency-1, 1st-motor	bC120	R/W	0.00 to **Free electronic thermal frequency-2, 1st-motor**(bC122)	0.01 Hz
33A5 hex	33A4 hex	Free electronic thermal current-1, 1st-motor	bC121	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A
33A6 hex	33A5 hex	Free electronic thermal frequency-2, 1st-motor	bC122	R/W	**Free electronic thermal frequency-1, 1st-motor**(bC120) to **Free electronic thermal frequency-3,1st-motor**(bC124)	0.01 Hz
33A7 hex	33A6 hex	Free electronic thermal current-2, 1st-motor	bC123	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A
33A8 hex	33A7 hex	Free electronic thermal frequency-3, 1st-motor	bC124	R/W	**Free electronic thermal current-2**(bC122) to 590.00	0.01 Hz
33A9 hex	33A8 hex	Free electronic thermal current-3, 1st-motor	bC125	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A
5AAA hex	33A9 hex	Electronic thermal level setting, 2nd-motor	bC210	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A
5AAB hex	5AAA hex	Electronic thermal characteristic selection, 2nd-motor	bC211	R/W	00: Reduction characteristics 01: Constant torque characteristics 02: Arbitrary setting	-
5AAC hex	5AAB hex	Electronic thermal Subtraction function enable, 2nd-motor	bC212	R/W	00: Disabled 01: Enabled	-
5AAD hex	5AAC hex	Electronic thermal Subtraction time, 2nd-motor	bC213	R/W	1 to 1000	1 s
5AB4 hex	5AB3 hex	Free electronic thermal frequency-1, 2nd-motor	bC220	R/W	0.00 to **Free electronic thermal frequency-1, 2ndmotor**(bC222)	0.01 Hz

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
5AB5 hex	5AB4 hex	Free electronic thermal current-1, 2nd-motor	bC221	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A
5AB6 hex	5AB5 hex	Free electronic thermal frequency-2, 2nd-motor	bC222	R/W	**Free electronic thermal frequency-1, 2nd-motor**(bC220) to **Free electronic thermal frequency-3, 2nd-motor**(bC224)	0.01 Hz
5AB7 hex	5AB6 hex	Free electronic thermal current-2, 2nd-motor	bC223	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A
5AB8 hex	5AB7 hex	Free electronic thermal frequency-3, 2nd-motor	bC224	R/W	**Free electronic thermal current-2, 2nd-motor**(bC222) to 590.00	0.01 Hz
5AB9 hex	5AB8 hex	Free electronic thermal current-3, 2nd-motor	bC225	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1 A

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V. When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01% (Rated ratio)

*2. Minimum resistance values vary in inverter model.

*3. 3G3RX2-B4750 to 3G3RX2-B413K should be as follows.
Load type selection (Ub-03) is set to *02: ND*: 0.5 to 10.0 kHz
Load type selection (Ub-03) is set to *00: VLD* or *01: LD*: 0.5 to 8.0 kHz

*4. The feedback input to input terminals A and B and the feedback input to option cassette RX2-PG are necessary.

9-5-6 Group C Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
36B1 hex	36B0 hex	Input terminal [1] function	CA-01	R/W	Refer to *List of Input Terminal Functions* on page 15-81.	-
36B2 hex	36B1 hex	Input terminal [2] function	CA-02	R/W		
36B3 hex	36B2 hex	Input terminal [3] function	CA-03	R/W		
36B4 hex	36B3 hex	Input terminal [4] function	CA-04	R/W		
36B5 hex	36B4 hex	Input terminal [5] function	CA-05	R/W		
36B6 hex	36B5 hex	Input terminal [6] function	CA-06	R/W		
36B7 hex	36B6 hex	Input terminal [7] function	CA-07	R/W		
36B8 hex	36B7 hex	Input terminal [8] function	CA-08	R/W		
36B9 hex	36B8 hex	Input terminal [9] function	CA-09	R/W		
36Ba hex	36B9 hex	Input terminal [A] function	CA-10	R/W		
36BB hex	36BA hex	Input terminal [B] function	CA-11	R/W		
36C5 hex	36C4 hex	Input terminal [1] active state	CA-21	R/W	00: Normally open: NO 01: Normally closed: NC	-
36C6 hex	36C5 hex	Input terminal [2] active state	CA-22	R/W		
36C7 hex	36C6 hex	Input terminal [3] active state	CA-23	R/W		
36C8 hex	36C7 hex	Input terminal [4] active state	CA-24	R/W		
36C9 hex	36C8 hex	Input terminal [5] active state	CA-25	R/W		
36Ca hex	36C9 hex	Input terminal [6] active state	CA-26	R/W		
36CB hex	36CA hex	Input terminal [7] active state	CA-27	R/W		
36CC hex	36CB hex	Input terminal [8] active state	CA-28	R/W		
36CD hex	36CC hex	Input terminal [9] active state	CA-29	R/W		
36Ce hex	36CD hex	Input terminal [A] active state	CA-30	R/W		
36CF hex	36CE hex	Input terminal [B] active state	CA-31	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
36D9 hex	36D8 hex	Input terminal [1] response time	CA-41	R/W	0 to 400	1 ms
36Da hex	36D9 hex	Input terminal [2] response time	CA-42	R/W		1 ms
36DB hex	36Da hex	Input terminal [3] response time	CA-43	R/W		1 ms
36DC hex	36DB hex	Input terminal [4] response time	CA-44	R/W		1 ms
36DD hex	36DC hex	Input terminal [5] response time	CA-45	R/W		1 ms
36De hex	36DD hex	Input terminal [6] response time	CA-46	R/W		1 ms
36DF hex	36DE hex	Input terminal [7] response time	CA-47	R/W		1 ms
36E0 hex	36DF hex	Input terminal [8] response time	CA-48	R/W		1 ms
36E1 hex	36E0 hex	Input terminal [9] response time	CA-49	R/W		1 ms
36E2 hex	36E1 hex	Input terminal [A] response time	CA-50	R/W		1 ms
36E3 hex	36E2 hex	Input terminal [B] response time	CA-51	R/W		1 ms
36E7 hex	36E6 hex	Multistage input determina-tion time	CA-55	R/W	0 to 2000	1 ms
36Ec hex	36EB hex	FUP/FDN overwrite target selection	CA-60	R/W	00: Frequency command 01: PID1	-
36Ed hex	36EC hex	FUP/FDN data save enable	CA-61	R/W	00: Not save 01: Save	-
36Ee hex	36ED hex	FUP/FDN UDC selection	CA-62	R/W	00: 0Hz 01: Saved data	-
36F0 hex	36EF hex	Acceleration time setting for FUP/FDN function	CA-64 (HIGH)	R/W	0 to 360000	0.01 s
36F1 hex	36F0 hex		CA-65 (LOW)	R/W		
36F2 hex	36F1 hex	Deceleration time setting for FUP/FDN function	CA-66 (HIGH)	R/W	0 to 360000	0.01 s
36F3 hex	36F2 hex		CA-67 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
36F6 hex	36F5 hex	Speed reference source selection at [F-OP] is active	CA-70	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-
36F7 hex	36F6 hex	RUN command source selection at [F-OP] is active	CA-71	R/W	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-
36F8 hex	36F7 hex	Reset mode selection	CA-72	R/W	00: ON to Release Trip 01: OFF to Release Trip 02: On to Release at Trip 03: OFF to Release at Trip	-
3701 hex	3700 hex	Encoder constant setting	CA-81	R/W	32 to 65535	1 pls
3702 hex	3701 hex	Encoder position selection	CA-82	R/W	00: Phase-A is leading 01: Phase-B is leading	-
3703 hex	3702 hex	Motor gear ratio Numerator	CA-83	R/W	1 to 10000	1
3704 hex	3703 hex	Motor gear ratio Denominator	CA-84	R/W	1 to 10000	1
370A hex	3709 hex	Pulse train detection (internal) control terminal [A] [B]	CA-90	R/W	00: Disabled 01: Frequency command 02: Speed feedback 03: Pulse count	-
370B hex	370A hex	Mode selection of pulse train input	CA-91	R/W	00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
370C hex	370B hex	Pulse train frequency Scale	CA-92	R/W	5 to 3200	0.01 kHz
370D hex	370C hex	Pulse train frequency Filter time constant	CA-93	R/W	1 to 200	0.01 s
370E hex	370D hex	Pulse train frequency Bias value	CA-94	R/W	-1000 to 1000	0.1%
370F hex	370E hex	Pulse train frequency High Limit	CA-95	R/W	0 to 1000	0.1%
3710 hex	370F hex	Pulse train frequency detection low level	CA-96	R/W	0 to 1000	0.1%
3711 hex	3710 hex	Comparing match output ON-level for Pulse count	CA-97	R/W	0 to 65535	1
3712 hex	3711 hex	Comparing match output OFF-level for Pulse count	CA-98	R/W	0 to 65535	1
3713 hex	3712 hex	Comparing match output Maximum value for Pulse count	CA-99	R/W	0 to 65535	1
3715 hex	3714 hex	Filter time constant of Terminal [Ai1]	Cb-01	R/W	1 to 500	1 ms
3717 hex	3716 hex	Start value of Terminal [Ai1]	Cb-03	R/W	0 to 10000	0.01%
3718 hex	3717 hex	End value of Terminal [Ai1]	Cb-04	R/W	0 to 10000	0.01%
3719 hex	3718 hex	Start rate of Terminal [Ai1]	Cb-05	R/W	0 to **End rate of Terminal [Ai1]**(Cb-06)	0.1%
371A hex	3719 hex	End rate of Terminal [Ai1]	Cb-06	R/W	**Start rate of Terminal [Ai1]**(Cb-05) to 1000	0.1%
371B hex	371A hex	Start point selection of Terminal [Ai1]	Cb-07	R/W	00: Start amount 01: 0%	1
371F hex	371E hex	Filter time constant of Terminal [Ai2]	Cb-11	R/W	1 to 500	1 ms
3721 hex	3720 hex	Start value of Terminal [Ai2]	Cb-13	R/W	0 to 10000	0.01%
3722 hex	3721 hex	End value of Terminal [Ai2]	Cb-14	R/W	0 to 10000	0.01%
3723 hex	3722 hex	Start rate of Terminal [Ai2]	Cb-15	R/W	0 to **End rate of Terminal [Ai2]**(Cb-16)	0.1%
3724 hex	3723 hex	End rate of Terminal [Ai2]	Cb-16	R/W	**Start rate of Terminal [Ai2]**(Cb-15) to 1000	0.1%
3725 hex	3724 hex	Start point selection of Terminal [Ai2]	Cb-17	R/W	00: Start amount 01: 0%	-
3729 hex	3728 hex	Filter time constant of Terminal [Ai3]	Cb-21	R/W	1 to 500	1 ms
372A hex	3729 hex	Terminal [Ai3] selection	Cb-22	R/W	00: Single 01: Added to Ai1/Ai2: with reversibility 02: Added to Ai1/Ai2: without reversibility	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
372B hex	372A hex	Start value of Terminal [Ai3]	Cb-23	R/W	-10000 to 10000	0.01%
372C hex	372B hex	End value of Terminal [Ai3]	Cb-24	R/W	-10000 to 10000	0.01%
372D hex	372C hex	Start rate of Terminal [Ai3]	Cb-25	R/W	-1000 to **End rate of Terminal [Ai3]**(Cb-26)	0.1%
372E hex	372D hex	End rate of Terminal [Ai3]	Cb-26	R/W	**Start rate of Terminal [Ai3]**(Cb-25) to 1000	0.1%
3732 hex	3731 hex	[Ai1] Voltage/Current zero-gain adjustment	Cb-30	R/W	-10000 to 10000	0.01%
3733 hex	3732 hex	[Ai1] Voltage/Current gain adjustment	Cb-31	R/W	0 to 20000	0.01%
3734 hex	3733 hex	[Ai2] Voltage/Current zero-gain adjustment	Cb-32	R/W	-10000 to 10000	0.01%
3735 hex	3734 hex	[Ai2] Voltage/Current gain adjustment	Cb-33	R/W	0 to 20000	0.01%
3736 hex	3735 hex	[Ai3] Voltage/Current zero-gain adjustment	Cb-34	R/W	-10000 to 10000	0.01%
3737 hex	3736 hex	[Ai3] Voltage gain adjustment	Cb-35	R/W	0 to 20000	0.01%
373C hex	373B hex	Thermistor selection	Cb-40	R/W	00: Disabled 01: PTC resistance value enabled 02: NTC resistance value enabled	-
373D hex	373C hex	Thermistor gain adjustment	Cb-41	R/W	0 to 10000	0.1
3779 hex	3778 hex	Output terminal [11] function	CC-01	R/W	Refer to *List of Output Terminal Functions* on page 15-83.	--
377A hex	3779 hex	Output terminal [12] function	CC-02	R/W		
377B hex	377A hex	Output terminal [13] function	CC-03	R/W		
377C hex	377B hex	Output terminal [14] function	CC-04	R/W		
377D hex	377C hex	Output terminal [15] function	CC-05	R/W		
377E hex	377D hex	Relay output terminal [16] function	CC-06	R/W		
377F hex	377E hex	Relay output terminal [AL] function	CC-07	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3783 hex	3782 hex	Output terminal [11] active state	CC-11	R/W	00: Normally open: NO 01: Normally closed: NC	-
3784 hex	3783 hex	Output terminal [12] active state	CC-12	R/W		
3785 hex	3784 hex	Output terminal [13] active state	CC-13	R/W		
3786 hex	3785 hex	Output terminal [14] active state	CC-14	R/W		
3787 hex	3786 hex	Output terminal [15] active state	CC-15	R/W		
3788 hex	3787 hex	Output terminal [16] active state	CC-16	R/W		
3789 hex	3788 hex	Output terminal [AL] active state	CC-17	R/W		
378C hex	378B hex	Output terminal [11] on-delay time	CC-20	R/W	0 to 10000	0.01 s
378D hex	378C hex	Output terminal [11] off-delay time	CC-21	R/W		0.01 s
378E hex	378D hex	Output relay [12] on-delay time	CC-22	R/W		0.01 s
378F hex	378E hex	Output terminal [12] off-delay time	CC-23	R/W		0.01 s
3790 hex	378F hex	Output terminal [13] on-delay time	CC-24	R/W		0.01 s
3791 hex	3790 hex	Output terminal [13] off-delay time	CC-25	R/W		0.01 s
3792 hex	3791 hex	Output terminal [14] on-delay time	CC-26	R/W		0.01 s
3793 hex	3792 hex	Output terminal [14] off-delay time	CC-27	R/W		0.01 s
3794 hex	3793 hex	Output terminal [15] on-delay time	CC-28	R/W		0.01 s
3795 hex	3794 hex	Output terminal [15] off-delay time	CC-29	R/W		0.01 s
3796 hex	3795 hex	Output terminal [16] on-delay time	CC-30	R/W		0.01 s
3797 hex	3796 hex	Output terminal [16] off-delay time	CC-31	R/W		0.01 s
3798 hex	3797 hex	Output relay [AL] on-delay time	CC-32	R/W		0.01 s
3799 hex	3798 hex	Output relay [AL] off-delay time	CC-33	R/W		0.01 s
37A0 hex	379F hex	Logical calculation target 1 selection of LOG1	CC-40	R/W	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-
37A1 hex	37A0 hex	Logical calculation target 2 selection of LOG1	CC-41	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
37A2 hex	37A1 hex	Logical calculation symbol selection of LOG1	CC-42	R/W	00: AND 01: OR 02: XOR	-
37A3 hex	37A2 hex	Logical calculation target 1 selection of LOG2	CC-43	R/W	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-
37A4 hex	37A3 hex	Logical calculation target 2 selection of LOG2	CC-44	R/W		
37A5 hex	37A4 hex	Logical calculation symbol selection of LOG2	CC-45	R/W	00: AND 01: OR 02: XOR	-
37A6 hex	37A5 hex	Logical calculation target 1 selection of LOG3	CC-46	R/W	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-
37A7 hex	37A6 hex	Logical calculation target 2 selection of LOG3	CC-47	R/W		-
37A8 hex	37A7 hex	Logical calculation symbol selection of LOG3	CC-48	R/W	00: AND 01: OR 02: XOR	-
37A9 hex	37A8 hex	Logical calculation target 1 selection of LOG4	CC-49	R/W	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-
37Aa hex	37A9 hex	Logical calculation target 2 selection of LOG4	CC-50	R/W		-
37Ab hex	37AA hex	Logical calculation symbol selection of LOG4	CC-51	R/W	00: AND 01: OR 02: XOR	-
37Ac hex	37AB hex	Logical calculation target 1 selection of LOG5	CC-52	R/W	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-
37Ad hex	37AC hex	Logical calculation target 2 selection of LOG5	CC-53	R/W		-
37Ae hex	37AD hex	Logical calculation symbol selection of LOG5	CC-54	R/W	00: AND 01: OR 02: XOR	-
37Af hex	37AE hex	Logical calculation target 1 selection of LOG6	CC-55	R/W	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-
37B0 hex	37AF hex	Logical calculation target 2 selection of LOG6	CC-56	R/W		-
37B1 hex	37B0 hex	Logical calculation symbol selection of LOG6	CC-57	R/W	00: AND 01: OR 02: XOR	-
37B2 hex	37B1 hex	Logical calculation target 1 selection of LOG7	CC-58	R/W	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-
37B3 hex	37B2 hex	Logical calculation target 2 selection of LOG7	CC-59	R/W		-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
37B4 hex	37B3 hex	Logical calculation symbol selection of LOG7	CC-60	R/W	00: AND 01: OR 02: XOR	-
37DD hex	37DC hex	[FM] monitor output wave form selection	Cd-01	R/W	00: PWM 01: Frequency	-
37De hex	37DD hex	[FM] monitor output base frequency (at PWM output)	Cd-02	R/W	0 to 3600	1 Hz
37DF hex	37DE hex	[FM] monitor output selec-tion	Cd-03	R/W	Refer to *List of Output Monitor Functions* on page 15-85.	1
37E0 hex	37DF hex	[Ao1] monitor output selec-tion	Cd-04	R/W	Refer to *List of Output Monitor Functions* on page 15-85.	1
37E1 hex	37E0 hex	[Ao2] monitor output selec-tion	Cd-05	R/W	Refer to *List of Output Monitor Functions* on page 15-85.	1
37E6 hex	37E5 hex	Analog monitor adjust mode enable	Cd-10	R/W	00: Disabled 01: Enabled	-
37E7 hex	37E6 hex	Filter time constant of [FM]monitor	Cd-11	R/W	1 to 500	1 ms
37E8 hex	37E7 hex	[FM] Data type selection	Cd-12	R/W	00: Absolute value 01: with sign	-
37E9 hex	37E8 hex	[FM] monitor bias adjust-ment	Cd-13	R/W	-1000 to 1000	0.1%
37Ea hex	37E9 hex	[FM] monitor gain adjust-ment	Cd-14	R/W	-10000 to 10000	0.1%
37Eb hex	37EA hex	Output level setting at [FM] monitor adjust mode	Cd-15	R/W	-1000 to 1000	0.1%
37F1 hex	37F0 hex	Filter time constant of [Ao1] monitor	Cd-21	R/W	1 to 500	1 ms
37F2 hex	37F1 hex	[Ao1] Data type selection	Cd-22	R/W	00: Absolute value 01: with sign	-
37F3 hex	37F2 hex	[Ao1] monitor bias adjust-ment	Cd-23	R/W	-1000 to 1000	0.1%
37F4 hex	37F3 hex	[Ao1] monitor gain adjust-ment	Cd-24	R/W	-10000 to 10000	0.1%
37F5 hex	37F4 hex	Output level setting at [Ao1] monitor adjust mode	Cd-25	R/W	-1000 to 1000	0.1%
37FB hex	37FA hex	Filter time constant of [Ao2] monitor	Cd-31	R/W	1 to 500	1 ms
37FC hex	37FB hex	[Ao2] Data type selection	Cd-32	R/W	00: Absolute value 01: with sign	-
37FD hex	37FC hex	[Ao2] monitor bias adjust-ment	Cd-33	R/W	-1000 to 1000	0.1%
37Fe hex	37FD hex	[Ao2] monitor gain adjust-ment	Cd-34	R/W	-10000 to 10000	0.1%
37FF hex	37FE hex	Output level setting at [Ao2] monitor adjust mode	Cd-35	R/W	-1000 to 1000	0.1%

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3841 hex	3840 hex	Low current signal output mode selection, 1st motor	CE101	R/W	00: During acceleration/ deceleration, at constant speed 01: Only at constant speed	-
3842 hex	3841 hex	Low current detection level 1, 1st motor	CE102	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
3843 hex	3842 hex	Low current detection level 2, 1st motor	CE103	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
3845 hex	3844 hex	Over current signal output mode selection, 1st motor	CE105	R/W	00: During acceleration/ deceleration, at constant speed 01: Only at constant speed	-
3846 hex	3845 hex	Over current detection level 1, 1st motor	CE106	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
3847 hex	3846 hex	Over current detection level 2, 1st motor	CE107	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
384A hex	3849 hex	Arrival frequency setting during acceleration 1	CE-10	R/W	0 to 59000	0.01 Hz
384B hex	384A hex	Arrival frequency setting during deceleration 1	CE-11	R/W		0.01 Hz
384C hex	384B hex	Arrival frequency setting during acceleration 2	CE-12	R/W		0.01 Hz
384D hex	384C hex	Arrival frequency setting during deceleration 2	CE-13	R/W		0.01 Hz
3854 hex	3853 hex	Over torque level (Forward driving), 1st motor	CE120	R/W	0 to 5000	0.1%
3855 hex	3854 hex	Over torque level (Reverse regenerative), 1st motor	CE121	R/W		0.1%
3856 hex	3855 hex	Over torque level (Reverse driving), 1st motor	CE122	R/W		0.1%
3857 hex	3856 hex	Over torque level (Forward regenerative), 1st motor	CE123	R/W		0.1%
385E hex	385D hex	Electronic thermal warning level (MTR)	CE-30	R/W	0 to 10000	0.01%
385F hex	385E hex	Electronic thermal warning level (CTL)	CE-31	R/W	0 to 10000	0.01%
3861 hex	3860 hex	Zero speed detection level	CE-33	R/W	0 to 10000	0.01 Hz
3862 hex	3861 hex	Cooling FAN over-heat warning level	CE-34	R/W	0 to 200	1℃
3864 hex	3863 hex	Accum.RUN(RNT)/ Accum.Power-on(ONT) time setting	CE-36 (HIGH)	R/W	0 to 100000	1 hr
3865 hex	3864 hex		CE-37 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3868 hex	3867 hex	Window comparator for [Ai1] higher level	CE-40	R/W	0 to 100	1%
3869 hex	3868 hex	Window comparator for [Ai1] lower level	CE-41	R/W	0 to 100	1%
386A hex	3869 hex	Window comparator for [Ai1] hysteresis width	CE-42	R/W	0 to 10	1%
386B hex	386A hex	Window comparator for [Ai2] higher level	CE-43	R/W	0 to 100	1%
386C hex	386B hex	Window comparator for [Ai2] lower level	CE-44	R/W	0 to 100	1%
386D hex	386C hex	Window comparator for [Ai2] hysteresis width	CE-45	R/W	0 to 10	1%
386E hex	386D hex	Window comparator for [Ai3] higher level	CE-46	R/W	-100 to 100	1%
386F hex	386E hex	Window comparator for [Ai3] lower level	CE-47	R/W	-100 to 100	1%
3870 hex	386F hex	Window comparator for [Ai3] hysteresis width	CE-48	R/W	0 to 10	1%
3872 hex	3871 hex	Operation level at [Ai1] disconnection	CE-50	R/W	0 to 100	1%
3873 hex	3872 hex	Operation level selection at [Ai1] disconnection	CE-51	R/W	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-
3874 hex	3873 hex	Operation level at [Ai2] disconnection	CE-52	R/W	0 to 100	1%
3875 hex	3874 hex	Operation level selection at [Ai2] disconnection	CE-53	R/W	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-
3876 hex	3875 hex	Operation level at [Ai3] disconnection	CE-54	R/W	-100 to 100	1%
3877 hex	3876 hex	Operation level selection at [Ai3] disconnection	CE-55	R/W	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-
38A5 hex	38A4 hex	RS485 communication baud rate selection	CF-01	R/W	03: 2400 bps 04: 4800 bps 05: 9600 bps 06: 19.2 kbps 07: 38.4 kbps 08: 57.6 kbps 09: 76.8 kbps 10: 115.2 kbps	-
38A6 hex	38A5 hex	RS485 communication Node allocation	CF-02	R/W	1 to 247	1
38A7 hex	38A6 hex	RS485 communication parity selection	CF-03	R/W	00: Without parity 01: Even number parity 02: Odd number parity	-

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
38A8 hex	38A7 hex	RS485 communication stop-bit selection	CF-04	R/W	01: 1 bit 02: 2 bit	-
38A9 hex	38A8 hex	RS485 communication error selection	CF-05	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-
38Aa hex	38A9 hex	RS485 communication timeout setting	CF-06	R/W	0 to 10000 (0: Disable Communica-tion Timeout)	0.01 s
38Ab hex	38AA hex	RS485 communication wait time setting	CF-07	R/W	0 to 1000	1 ms
38Ac hex	38AB hex	RS485 communication mode selection	CF-08	R/W	01: Modbus-RTU 02: EzCOM 03: EzCOM management	-
38AF hex	38AE hex	Resister data selection	CF-11	R/W	00: A, V 01: %	-
38B8 hex	38B7 hex	EzCOM Start node No.	CF-20	R/W	01 to 08	1
38B9 hex	38B8 hex	EzCOM End node No.	CF-21	R/W	01 to 08	1
38Ba hex	38B9 hex	EzCOM Start method selec-tion	CF-22	R/W	00: ECOM terminal 01: Modbus spec	-
38BB hex	38BA hex	EzCOM data size	CF-23	R/W	01 to 05	1
38BC hex	38BB hex	EzCOM destination address 1	CF-24	R/W	1 to 247	1
38BD hex	38BC hex	EzCOM destination resister 1	CF-25	R/W	0 to FFFF	1
38Be hex	38BD hex	EzCOM source resister 1	CF-26	R/W	0 to FFFF	1
38BF hex	38BE hex	EzCOM destination address 2	CF-27	R/W	1 to 247	1
38C0 hex	38BF hex	EzCOM destination resister 2	CF-28	R/W	0 to FFFF	1
38C1 hex	38C0 hex	EzCOM source resister 2	CF-29	R/W	0 to FFFF	1
38C2 hex	38C1 hex	EzCOM destination address 3	CF-30	R/W	1 to 247	1
38C3 hex	38C2 hex	EzCOM destination resister 3	CF-31	R/W	0 to FFFF	1
38C4 hex	38C3 hex	EzCOM source resister 3	CF-32	R/W	0 to FFFF	1
38C5 hex	38C4 hex	EzCOM destination address 4	CF-33	R/W	1 to 247	1
38C6 hex	38C5 hex	EzCOM destination resister 4	CF-34	R/W	0 to FFFF	1

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
38C7 hex	38C6 hex	EzCOM source resister 4	CF-35	R/W	0 to FFFF	1
38C8 hex	38C7 hex	EzCOM destination address 5	CF-36	R/W	1 to 247	1
38C9 hex	38C8 hex	EzCOM destination resister 5	CF-37	R/W	0 to FFFF	1
38Ca hex	38C9 hex	EzCOM source resister 5	CF-38	R/W	0 to FFFF	1
38D6 hex	38D5 hex	USB communication Node allocation	CF-50	R/W	1 to 247	1
5F51 hex	5F50 hex	Low current signal output mode selection, 2nd-motor	CE201	R/W	00: During acceleration/ deceleration, at constant speed 01: Only at constant speed	-
5F52 hex	5F51 hex	Low current detection level 1, 2nd-motor	CE202	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
5F53 hex	5F52 hex	Low current detection level 2, 2nd-motor	CE203	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
5F55 hex	5F54 hex	Over current signal output mode selection, 2nd-motor	CE205	R/W	00: During acceleration/ deceleration, at constant speed 01: Only at constant speed	-
5F56 hex	5F55 hex	Over current detection level 1, 2nd-motor	CE206	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
5F57 hex	5F56 hex	Over current detection level 2, 2nd-motor	CE207	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1 A
5F64 hex	5F63 hex	Over torque level (Forward driving), 2nd-motor	CE220	R/W	0 to 5000	0.1%
5F65 hex	5F64 hex	Over torque level (Reverse regenerative), 2nd-motor	CE221	R/W		0.1%
5F66 hex	5F65 hex	Over torque level (Reverse driving), 2nd-motor	CE222	R/W		0.1%
5F67 hex	5F66 hex	Over torque level (Forward regenerative), 2nd motor	CE223	R/W		0.1%

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V. When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11). When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01% (Rated ratio)

9-5-7 Group H Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3A99 hex	3A98 hex	Auto-tuning selection	HA-01	R/W	00: Disabled 01: Non-rotation 02: Rotation 03: IVMS	-
3A9A hex	3A99 hex	RUN command selection at Auto-tuning	HA-02	R/W	00: RUN key on LCD operator 01: (AA111) / (AA211)	-
3A9B hex	3A9A hex	Online auto-tuning selection	HA-03	R/W	00: Disabled 01: Enabled	-
3AA2 hex	3AA1 hex	Stabilization constant, 1st-motor	HA110	R/W	0 to 1000	1%
3AA7 hex	3AA6 hex	Speed response for Async.M, 1st-motor	HA115	R/W	0 to 1000	1%
3AAC hex	3AAB hex	ASR gain switching mode selection, 1st-motor	HA120	R/W	00: [CAS] terminal 01: setting switch	-
3AAD hex	3AAC hex	ASR gain switching time setting, 1st-motor	HA121	R/W	0 to 10000	1 ms
3AAE hex	3AAD hex	ASR gain mapping intermediate speed 1, 1st-motor	HA122	R/W	0 to 59000	0.01 Hz
3AAF hex	3AAE hex	ASR gain mapping intermediate speed 2, 1st-motor	HA123	R/W	0 to 59000	0.01 Hz
3AB0 hex	3AAF hex	ASR gain mapping Maximum speed, 1st-motor	HA124	R/W	0 to 59000	0.01 Hz

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3AB1 hex	3AB0 hex	ASR gain mapping P-gain 1, 1st-motor	HA125	R/W	0 to 10000	0.1%
3AB2 hex	3AB1 hex	ASR gain mapping I-gain 1, 1st-motor	HA126	R/W		0.1%
3AB3 hex	3AB2 hex	ASR gain mapping P-gain 1 at P-control, 1st-motor	HA127	R/W		0.1%
3AB4 hex	3AB3 hex	ASR gain mapping P-gain 2, 1st-motor	HA128	R/W		0.1%
3AB5 hex	3AB4 hex	ASR gain mapping I-gain 2, 1st-motor	HA129	R/W		0.1%
3AB6 hex	3AB5 hex	ASR gain mapping P-gain 2 at P-control, 1st-motor	HA130	R/W		0.1%
3AB7 hex	3AB6 hex	ASR gain mapping P-gain 3, 1st-motor	HA131	R/W		0.1%
3AB8 hex	3AB7 hex	ASR gain mapping I-gain 3, 1st-motor	HA132	R/W		0.1%
3AB9 hex	3AB8 hex	ASR gain mapping P-gain 4, 1st-motor	HA133	R/W		0.1%
3ABA hex	3AB9 hex	ASR gain mapping I-gain 4, 1st-motor	HA134	R/W		0.1%
3AFE hex	3AFD hex	Async.Motor capacity setting, 1st-motor	Hb102	R/W	1 to 16000	0.01 kW
3AFF hex	3AFE hex	Async.Motor poles setting, 1st-motor	Hb103	R/W	2 to 48	1 Pole
3B00 hex	3AFF hex	Async.Motor Base frequency setting, 1st-motor	Hb104	R/W	1000 to 59000	0.01 Hz
3B01 hex	3B00 hex	Async.Motor Maximum frequency setting, 1st-motor	Hb105	R/W	1000 to 59000	0.01 Hz
3B02 hex	3B01 hex	Async.Motor rated voltage, 1st-motor	Hb106	R/W	1 to 1000	1 V
3B04 hex	3B03 hex	Async.Motor rated current, 1st-motor	Hb108 (HIGH)	R/W	1 to 1000000	0.01 A
3B05 hex	3B04 hex		Hb109 (LOW)	R/W		
3B06 hex	3B05 hex	Async.Motor constant R1, 1st-motor	Hb110 (HIGH)	R/W	1 to 1000000000	0.000001 Ω
3B07 hex	3B06 hex		Hb111 (LOW)	R/W		
3B08 hex	3B07 hex	Async.Motor constant R2, 1st-motor	Hb112 (HIGH)	R/W	1 to 1000000000	0.000001Ω
3B09 hex	3B08 hex		Hb113 (LOW)	R/W		
3B0A hex	3B09 hex	Async.Motor constant L, 1st-motor	Hb114 (HIGH)	R/W	1 to 1000000000	0.000001 mH
3B0B hex	3B0A hex		Hb115 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
3B0C hex	3B0B hex	Async.Motor constant Io, 1st-motor	Hb116 (HIGH)	R/W	1 to 1000000	0.01 A
3B0D hex	3B0C hex		Hb117 (LOW)	R/W		
3B0E hex	3B0D hex	Async.Motor constant J, 1st-motor	Hb118 (HIGH)	R/W	1 to 1000000000	0.00001 kg･m^2
3B0F hex	3B0E hex		Hb119 (LOW)	R/W		
3B1A hex	3B19 hex	Minimum frequency adjust-ment, 1st-motor	Hb130	R/W	10 to 1000	0.01 Hz
3B1B hex	3B1A hex	Reduced voltage start time setting, 1st-motor	Hb131	R/W	0 to 2000	1 ms
3B24 hex	3B23 hex	Manual torque boost opera-tional mode selection, 1st-motor	Hb140	R/W	00: Disabled 01: Always enabled 02: Enabled only for for-ward revolution 03: Enabled only for re-verse revolution	-
3B25 hex	3B24 hex	Manual torque boost value, 1st-motor	Hb141	R/W	0 to 200	0.1%
3B26 hex	3B25 hex	Manual torque boost Peak speed, 1st-motor	Hb142	R/W	0 to 500	0.1%
3B29 hex	3B28 hex	Eco drive enable, 1st-motor	Hb145	R/W	00: Disabled 01: Enabled	-
3B2A hex	3B29 hex	Eco drive response adjust-ment, 1st-motor	Hb146	R/W	0 to 100	1%
3B2E hex	3B2D hex	Free-V/f frequency 1 set-ting, 1st-motor	Hb150	R/W	0 to **Free-V/f frequency 2 setting, 1st-motor**(Hb152)	0.01 Hz
3B2F hex	3B2E hex	Free-V/f Voltage 1 setting, 1st-motor	Hb151	R/W	0 to 10000	0.1 V
3B30 hex	3B2F hex	Free-V/f frequency 2 set-ting, 1st-motor	Hb152	R/W	**Free-V/f frequency 1 setting,1st-motor** (Hb150) to**Free-V/f frequency 3 setting, 1st-motor** (Hb154)	0.01 Hz
3B31 hex	3B30 hex	Free-V/f Voltage 2 setting, 1st-motor	Hb153	R/W	0 to 10000	0.1 V
3B32 hex	3B31 hex	Free-V/f frequency 3 set-ting, 1st-motor	Hb154	R/W	**Free-V/f frequency 2 setting,1st-motor** (Hb152) to **Free-V/f frequency 4 setting, 1st-motor** (Hb156)	0.01 Hz
3B33 hex	3B32 hex	Free-V/f Voltage 3 setting, 1st-motor	Hb155	R/W	0 to 10000	0.1 V

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3B34 hex	3B33 hex	Free-V/f frequency 4 setting, 1st-motor	Hb156	R/W	**Free-V/f frequency 3 setting, 1st-motor**(Hb154) to **Free-V/f frequency 5 setting,1st-motor** (Hb158)	0.01 Hz
3B35 hex	3B34 hex	Free-V/f Voltage 4 setting, 1st-motor	Hb157	R/W	0 to 10000	0.1 V
3B36 hex	3B35 hex	Free-V/f frequency 5 setting, 1st-motor	Hb158	R/W	**Free-V/f frequency 4 setting, 1st-motor**(Hb156) to **Free-V/f frequency 6 setting, 1st-motor** (Hb160)	0.01 Hz
3B37 hex	3B36 hex	Free-V/f Voltage 5 setting, 1st-motor	Hb159	R/W	0 to 10000	0.1 V
3B38 hex	3B37 hex	Free-V/f frequency 6 setting, 1st-motor	Hb160	R/W	**Free-V/f frequency 5 setting,1st-motor**(Hb158) to **Free-V/f frequency 7 setting, 1st-motor** (Hb162)	0.01 Hz
3B39 hex	3B38 hex	Free-V/f Voltage 6 setting, 1st-motor	Hb161	R/W	0 to 10000	0.1 V
3B3A hex	3B39 hex	Free-V/f frequency 7 setting, 1st-motor	Hb162	R/W	**Free-V/f frequency 6 setting,1st-motor**(Hb160) to **Async.Motor Base frequencysetting, 1st-motor** (Hb104)	0.01 Hz
3B3B hex	3B3A hex	Free-V/f Voltage 7 setting, 1st-motor	Hb163	R/W	0 to 10000	0.1 V
3B42 hex	3B41 hex	Slip Compensation P-gain with encoder, 1st-motor	Hb170	R/W	0 to 1000	1%
3B43 hex	3B42 hex	Slip Compensation I-gain with encoder, 1st-motor	Hb171	R/W	0 to 1000	1%
3B4C hex	3B4B hex	Output voltage gain, 1st-motor	Hb180	R/W	0 to 255	1%
3B61 hex	3B60 hex	Automatic torque boost voltage compensation gain, 1st-motor	HC101	R/W	0 to 255	1%
3B62 hex	3B61 hex	Automatic torque boost slip compensation gain, 1st-motor	HC102	R/W	0 to 255	1%
3B6A hex	3B69 hex	Zero speed area limit for Async.M-0SLV, 1st-motor	HC110	R/W	0 to 100	1%
3B6B hex	3B6A hex	Boost value at start for Async.M-SLV/IM-CLV, 1st-motor	HC111	R/W	0 to 50	1%
3B6C hex	3B6B hex	Boost value at start for Async.M-0SLV, 1st-motor	HC112	R/W	0 to 50	1%

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
3B6D hex	3B6C hex	Secondary resistance correction, 1st-motor	HC113	R/W	00: Disabled 01: Enabled	-
3B6E hex	3B6D hex	Counter direction run protection selection, 1st-motor	HC114	R/W	00: Disabled 01: Enabled	-
3B74 hex	3B73 hex	Torque current reference filter time constant, 1st-motor	HC120	R/W	0 to 100	1 ms
3B75 hex	3B74 hex	Speed feedforward compensation gain, 1st-motor	HC121	R/W	0 to 1000	1%
3BC6 hex	3BC5 hex	Sync.Motor capacity setting, 1st-motor	Hd102	R/W	1 to 16000	0.01 kW
3BC7 hex	3BC6 hex	Sync.Motor poles setting, 1st-motor	Hd103	R/W	2 to 48	1 Pole
3BC8 hex	3BC7 hex	Sync.Base frequency setting, 1st-motor	Hd104	R/W	1000 to 59000	0.01 Hz
3BC9 hex	3BC8 hex	Sync.Maximum frequency setting, 1st-motor	Hd105	R/W	1000 to 59000	0.01 Hz
3BCA hex	3BC9 hex	Sync.Motor rated voltage, 1st-motor	Hd106	R/W	1 to 1000	1 V
3BCC hex	3BCB hex	Sync.Motor rated current, 1st-motor	Hd108 (HIGH)	R/W	1 to 1000000	0.01 A
3BCD hex	3BCC hex		Hd109 (LOW)	R/W		
3BCE hex	3BCD hex	Sync.Motor constant R, 1st-motor	Hd110 (HIGH)	R/W	1 to 1000000000	0.000001 Ω
3BCF hex	3BCE hex		Hd111 (LOW)	R/W		
3BD0 hex	3BCF hex	Sync.Motor constant Ld, 1st-motor	Hd112 (HIGH)	R/W	1 to 1000000000	0.000001 mH
3BD1 hex	3BD0 hex		Hd113 (LOW)	R/W		
3BD2 hex	3BD1 hex	Sync.Motor constant Lq, 1st-motor	Hd114 (HIGH)	R/W	1 to 1000000000	0.000001 mH
3BD3 hex	3BD2 hex		Hd115 (LOW)	R/W		
3BD4 hex	3BD3 hex	Sync.Motor constant Ke, 1st-motor	Hd116 (HIGH)	R/W	1 to 1000000	0.1 mVs/rad
3BD5 hex	3BD4 hex		Hd117 (LOW)	R/W		
3BD6 hex	3BD5 hex	Sync.Motor constant J, 1st-motor	Hd118 (HIGH)	R/W	1 to 1000000000	0.00001 kg・m^2
3BD7 hex	3BD6 hex		Hd119 (LOW)	R/W		
3BE2 hex	3BE1 hex	Minimum Frequency for Sync.M-SLV, 1st-motor	Hd130	R/W	0 to 50	1%
3BE3 hex	3BE2 hex	No-Load current for Sync.M-SLV, 1st-motor	Hd131	R/W	0 to 100	1%

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
3BE4 hex	3BE3 hex	Starting Method for Sync.M, 1st-motor	Hd132	R/W	00: Position estimation disabled 01: Position estimation enabled	-
3BE5 hex	3BE4 hex	IMPE 0V wait number for Sync.M, 1st-motor	Hd133	R/W	0 to 255	1
3BE6 hex	3BE5 hex	IMPE detect wait number for Sync.M, 1st-motor	Hd134	R/W	0 to 255	1
3BE7 hex	3BE6 hex	IMPE detect number for Sync.M, 1st-motor	Hd135	R/W	0 to 255	1
3BE8 hex	3BE7 hex	IMPE voltage gain for Sync.M, 1st-motor	Hd136	R/W	0 to 200	1%
3BE9 hex	3BE8 hex	IMPE Mg-pole position off-set, 1st-motor	Hd137	R/W	0 to 359	1 deg
3BED hex	3BEC hex	Carrier frequency at IVMS	Hd-41	R/W	5 to 160	0.1 kHz
3BEE hex	3BED hex	Filter gain of current detec-tion at IVMS	Hd-42	R/W	0 to 1000	1
3BEF hex	3BEE hex	Open phase voltage detec-tion gain	Hd-43	R/W	00: Gain 0 01: Gain 1 02: Gain 2 03: Gain 3	1
3BF0 hex	3BEF hex	Open phase switching threshold compensation	Hd-44	R/W	00: Disabled 01: Enabled	-
3BF1 hex	3BF0 hex	P-Gain for speed control, SM(PMM)-IVMS	Hd-45	R/W	0 to 1000	1
3BF2 hex	3BF1 hex	I-Gain for speed control, SM(PMM)-IVMS	Hd-46	R/W	0 to 10000	1
3BF3 hex	3BF2 hex	Wait time for open phase switching, SM(PMM)-IVMS	Hd-47	R/W	0 to 1000	1
3BF4 hex	3BF3 hex	Limitation of decision about the drive direction, SM(PMM)-IVMS	Hd-48	R/W	00: Disabled 01: Enabled	-
3BF5 hex	3BF4 hex	Open phase voltage detec-tion timing adjustment, SM(PMM)-IVMS	Hd-49	R/W	0 to 1000	1
3BF6 hex	3BF5 hex	Minimum pulse width ad-justment, SM(PMM)-IVMS	Hd-50	R/W	0 to 1000	1
3BF7 hex	3BF6 hex	IVMS Current Limit for threshold	Hd-51	R/W	0 to 255	1
3BF8 hex	3BF7 hex	IVMS Threshold Gain	Hd-52	R/W	0 to 255	1
3BFE hex	3BFD hex	IVMS Carrier frequency start/end point	Hd-58	R/W	0 to 50	1%
61B2 hex	61B1 hex	Stabilization constant, 2nd-motor	HA210	R/W	0 to 1000	1%
61B7 hex	61B6 hex	Speed response for Async.M, 2nd-motor	HA215	R/W	0 to 1000	1%

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
61BC hex	61BB hex	ASR gain switching mode selection, 2nd-motor	HA220	R/W	00: [CAS] terminal 01: setting switch	1
61BD hex	61BC hex	ASR gain switching time setting, 2nd-motor	HA221	R/W	0 to 10000	1 ms
61Be hex	61BD hex	ASR gain mapping intermidiate speed 1, 2nd-motor	HA222	R/W	0 to 59000	0.01 Hz
61BF hex	61BE hex	ASR gain mapping intermidiate speed 2, 2nd-motor	HA223	R/W	0 to 59000	0.01 Hz
61C0 hex	61BF hex	ASR gain mapping Maximum speed, 2nd-motor	HA224	R/W	0 to 59000	0.01 Hz
61C1 hex	61C0 hex	ASR gain mapping P-gain 1, 2nd-motor	HA225	R/W	0 to 10000	0.1%
61C2 hex	61C1 hex	ASR gain mapping I-gain 1, 2nd-motor	HA226	R/W		0.1%
61C3 hex	61C2 hex	ASR gain mapping P-gain 1 at P-control, 2nd-motor	HA227	R/W		0.1%
61C4 hex	61C3 hex	ASR gain mapping P-gain 2, 2nd-motor	HA228	R/W		0.1%
61C5 hex	61C4 hex	ASR gain mapping I-gain 2, 2nd-motor	HA229	R/W		0.1%
61C6 hex	61C5 hex	ASR gain mapping P-gain 2 at P-control, 2nd-motor	HA230	R/W		0.1%
61C7 hex	61C6 hex	ASR gain mapping P-gain 3, 2nd-motor	HA231	R/W		0.1%
61C8 hex	61C7 hex	ASR gain mapping I-gain 3, 2nd-motor	HA232	R/W		0.1%
61C9 hex	61C8 hex	ASR gain mapping P-gain 4, 2nd-motor	HA233	R/W		0.1%
61Ca hex	61C9 hex	ASR gain mapping I-gain 4, 2nd-motor	HA234	R/W		0.1%
620E hex	620D hex	Async.Motor capacity setting, 2nd-motor	Hb202	R/W	1 to 16000	0.01 kW
620F hex	620E hex	Async.Motor poles setting, 2nd-motor	Hb203	R/W	2 to 48	1
6210 hex	620F hex	Async.Motor Base frequency setting, 2nd-motor	Hb204	R/W	1000 to 59000	0.01 Hz
6211 hex	6210 hex	Async.Motor Maximum frequency setting, 2nd-motor	Hb205	R/W	1000 to 59000	0.01 Hz
6212 hex	6211 hex	Async.Motor rated voltage, 2nd-motor	Hb206	R/W	1 to 1000	1 V
6214 hex	6213 hex	Async.Motor rated current, 2nd-motor	Hb208 (HIGH)	R/W	1 to 1000000	0.01 A
6215 hex	6214 hex		Hb209 (LOW)	R/W		
6216 hex	6215 hex	Async.Motor constant R1, 2nd-motor	Hb210 (HIGH)	R/W	1 to 1000000000	0.000001 Ω
6217 hex	6216 hex		Hb211 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
6218 hex	6217 hex	Async.Motor constant R2, 2nd-motor	Hb212 (HIGH)	R/W	1 to 1000000000	0.000001 Ω
6219 hex	6218 hex		Hb213 (LOW)	R/W		
621A hex	6219 hex	Async.Motor constant L, 2nd-motor	Hb214 (HIGH)	R/W	1 to 1000000000	0.000001 mH
621B hex	621A hex		Hb215 (LOW)	R/W		
621C hex	621B hex	Async.Motor constant Io, 2nd-motor	Hb216 (HIGH)	R/W	1 to 1000000	0.01 A
621D hex	621C hex		Hb217 (LOW)	R/W		
621E hex	621D hex	Async.Motor constant J, 2nd-motor	Hb218 (HIGH)	R/W	1 to 1000000000	0.00001 kg・m^2
621F hex	621E hex		Hb219 (LOW)	R/W		
622A hex	6229 hex	Minimum frequency adjustment, 2nd-motor	Hb230	R/W	10 to 1000	0.01 Hz
622B hex	622A hex	Reduced voltage start time setting, 2nd-motor	Hb231	R/W	0 to 2000	1 ms
6234 hex	6233 hex	Manual torque boost operational mode selection, 2nd-motor	Hb240	R/W	00: Disabled 01: Always enabled 02: Enabled only for forward revolution 03: Enabled only for reverse revolution	-
6235 hex	6234 hex	Manual torque boost value, 2nd-motor	Hb241	R/W	0 to 200	0.1%
6236 hex	6235 hex	Manual torque boost Peak speed, 2nd-motor	Hb242	R/W	0 to 500	0.1%
6239 hex	6238 hex	Eco drive enable, 2nd-motor	Hb245	R/W	00: Disabled 01: Enabled	-
623A hex	6239 hex	Eco drive response adjustment, 2nd-motor	Hb246	R/W	0 to 100	1%
623E hex	623D hex	Free-V/f frequency 1 setting, 2nd-motor	Hb250	R/W	0 to **Free-V/f frequency 2 setting, 2nd-motor** (Hb252)	0.01 Hz
623F hex	623E hex	Free-V/f Voltage 1 setting, 2nd-motor	Hb251	R/W	0 to 10000	0.1 V
6240 hex	623F hex	Free-V/f frequency 2 setting, 2nd-motor	Hb252	R/W	**Free-V/f frequency 1 setting, 2nd-motor** (Hb250) to **Free-V/f frequency 3 setting, 2nd-motor** (Hb254)	0.01 Hz
6241 hex	6240 hex	Free-V/f Voltage 2 setting, 2nd-motor	Hb253	R/W	0 to 10000	0.1 V

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
6242 hex	6241 hex	Free-V/f frequency 3 setting, 2nd-motor	Hb254	R/W	**Free-V/f frequency 2 setting, 2nd-motor** (Hb252) to **Free-V/f frequency 4 setting, 2nd-motor** (Hb256)	0.01 Hz
6243 hex	6242 hex	Free-V/f Voltage 3 setting, 2nd-motor	Hb255	R/W	0 to 10000	0.1 V
6244 hex	6243 hex	Free-V/f frequency 4 setting, 2nd-motor	Hb256	R/W	**Free-V/f frequency 3 setting, 2nd-motor** (Hb254) to **Free-V/f frequency 5 setting, 2nd-motor** (Hb258)	0.01 Hz
6245 hex	6244 hex	Free-V/f Voltage 4 setting, 2nd-motor	Hb257	R/W	0 to 10000	0.1 V
6246 hex	6245 hex	Free-V/f frequency 5 setting, 2nd-motor	Hb258	R/W	**Free-V/f frequency 4 setting, 2nd-motor** (Hb256) to **Free-V/f frequency 6 setting, 2nd-motor** (Hb260)	0.01 Hz
6247 hex	6246 hex	Free-V/f Voltage 5 setting, 2nd-motor	Hb259	R/W	0 to 10000	0.1 V
6248 hex	6247 hex	Free-V/f frequency 6 setting, 2nd-motor	Hb260	R/W	**Free-V/f frequency 5 setting, 2nd-motor** (Hb258) to **Free-V/f frequency 7 setting, 2nd-motor** (Hb262)	0.01 Hz
6249 hex	6248 hex	Free-V/f Voltage 6 setting, 2nd-motor	Hb261	R/W	0 to 10000	0.1 V
624A hex	6249 hex	Free-V/f frequency 7 setting, 2nd-motor	Hb262	R/W	**Free-V/f frequency 6 setting, 2nd-motor** (Hb260) to **Async.Motor Base frequency setting, 2nd-motor** (Hb204)	0.01 Hz
624B hex	624A hex	Free-V/f Voltage 7 setting, 2nd-motor	Hb263	R/W	0 to 10000	0.1 V
6252 hex	6251 hex	Slip Compensation P-gain with encoder, 2nd-motor	Hb270	R/W	0 to 1000	1%
6253 hex	6252 hex	Slip Compensation I-gain witn encoder, 2nd-motor	Hb271	R/W	0 to 1000	1%
625C hex	625B hex	Output voltage gain, 2nd-motor (V/f)	Hb280	R/W	0 to 255	1%
6271 hex	6270 hex	Automatic torque boost voltage compensation gain, 2nd-motor	HC201	R/W	0 to 255	1%
6272 hex	6271 hex	Automatic torque boost slip compensation gain, 2nd-motor	HC202	R/W	0 to 255	1%
627A hex	6279 hex	Zero speed area limit for Async.M-0SLV, 2nd-motor	HC210	R/W	0 to 100	1%

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
627B hex	627A hex	Boost value at start for Async.M-SLV/IM-CLV, 2nd-motor	HC211	R/W	0 to 50	1%
627C hex	627B hex	Boost value at start for Async.M-0SLV, 2nd-motor	HC212	R/W	0 to 50	1%
627D hex	627C hex	Secondary resistance correction, 2nd-motor	HC213	R/W	00: Disabled 01: Enabled	-
627E hex	627D hex	Counter direction run protection selection, 2nd-motor	HC214	R/W	00: Disabled 01: Enabled	-
6284 hex	6283 hex	Torque current reference filter time constant, 2nd-motor	HC220	R/W	0 to 100	1 ms
6285 hex	6284 hex	Speed feedforward compensation gain, 2nd-motor	HC221	R/W	0 to 1000	1%
62D6 hex	62D5 hex	Sync.Motor capacity setting, 2nd-motor	Hd202	R/W	1 to 16000	0.01 kW
62D7 hex	62D6 hex	Sync.Motor poles setting, 2nd-motor	Hd203	R/W	2 to 48	1
62D8 hex	62D7 hex	Sync.Base frequency setting, 2nd-motor	Hd204	R/W	1000 to 59000	0.01 Hz
62D9 hex	62D8 hex	Sync.Maximum frequency setting, 2nd-motor	Hd205	R/W	1000 to 59000	0.01 Hz
62Da hex	62D9 hex	Sync.Motor rated voltage, 2nd-motor	Hd206	R/W	1 to 1000	1 V
62DC hex	62DB hex	Sync.Motor rated current, 2nd-motor	Hd208 (HIGH)	R/W	1 to 1000000	0.01 A
62DD hex	62DC hex		Hd209 (LOW)	R/W		
62De hex	62DD hex	Sync.Motor constant R, 2nd-motor	Hd210 (HIGH)	R/W	1 to 1000000000	0.000001 Ω
62DF hex	62DE hex		Hd211 (LOW)	R/W		
62E0 hex	62DF hex	Sync.Motor constant Ld, 2nd-motor	Hd212 (HIGH)	R/W	1 to 1000000000	0.000001 mH
62E1 hex	62E0 hex		Hd213 (LOW)	R/W		
62E2 hex	62E1 hex	Sync.Motor constant Lq, 2nd-motor	Hd214 (HIGH)	R/W	1 to 1000000000	0.000001 mH
62E3 hex	62E2 hex		Hd215 (LOW)	R/W		
62E4 hex	62E3 hex	Sync.Motor constant Ke, 2nd-motor	Hd216 (HIGH)	R/W	1 to 1000000	0.1 mVs/rad
62E5 hex	62E4 hex		Hd217 (LOW)	R/W		
62E6 hex	62E5 hex	Sync.Motor constant J, 2nd-motor	Hd218 (HIGH)	R/W	1 to 1000000000	0.00001 kg·m^2
62E7 hex	62E6 hex		Hd219 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
62F2 hex	62F1 hex	Minimum Frequency for Sync.M-SLV, 2nd-motor	Hd230	R/W	0 to 50	1%
62F3 hex	62F2 hex	No-Load current for Sync.M-SLV, 2nd-motor	Hd231	R/W	0 to 100	1%
62F4 hex	62F3 hex	Starting Method for Sync.M, 2nd-motor	Hd232	R/W	00: Position estimation disabled 01: Position estimation enabled	-
62F5 hex	62F4 hex	IMPE 0V wait number for Sync.M, 2nd-motor	Hd233	R/W	0 to 255	1
62F6 hex	62F5 hex	IMPE detect wait number for Sync.M, 2nd-motor	Hd234	R/W	0 to 255	1
62F7 hex	62F6 hex	IMPE detect number for Sync.M, 2nd-motor	Hd235	R/W	0 to 255	1
62F8 hex	62F7 hex	IMPE voltage gain for Sync.M, 2nd-motor	Hd236	R/W	0 to 200	1%
62F9 hex	62F8 hex	IMPE Mg-pole position offset, 2nd-motor	Hd237	R/W	0 to 359	1 deg

9-5-8 Group P Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
4269 hex	4268 hex	Mode selection for Emergency-force drive	PA-01	R/W	00: Disabled 01: Enabled	-
426A hex	4269 hex	Frequency reference setting at Emergency-force drive	PA-02	R/W	0 to 59000	0.01 Hz
426B hex	426A hex	Direction command at Emergency-force drive	PA-03	R/W	00: Normal rotation 01: Reverse rotation	-
426C hex	426B hex	Commercial power supply bypass function selection	PA-04	R/W	00: Disabled 01: Enabled	-
426D hex	426C hex	Delay time of Bypass function	PA-05	R/W	0 to 10000	0.1 s
427C hex	427B hex	Simulation mode enable	PA-20	R/W	00: Disabled 01: Enabled	-
427D hex	427C hex	Error code selection for Alarm test	PA-21	R/W	0 to 255	1

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
427E hex	427D hex	Output current monitor optional output enable	PA-22	R/W	00: Disabled 01: Enabled: parameter setting (PA-23) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
427F hex	427E hex	Output current monitor optional output value setting	PA-23	R/W	(0.00 to 3.00) × Inverter rated current*1	0.1 A
4280 hex	427F hex	DC-bus voltage monitor optional output enable	PA-24	R/W	00: Disabled 01: Enabled: parameter setting (PA-25) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4281 hex	4280 hex	DC-bus voltage monitor optional value output	PA-25	R/W	200V class: 0 to 4500 400V class: 0 to 9000	0.1 VDC
4282 hex	4281 hex	Output voltage monitor optional output enable	PA-26	R/W	00: Disabled 01: Enabled: parameter setting (PA-27) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4283 hex	4282 hex	Output voltage monitor optional output value setting	PA-27	R/W	200V class: 0 to 3000 400V class: 0 to 6000	0.1 V

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
4284 hex	4283 hex	Output torque monitor optional output enable	PA-28	R/W	00: Disabled 01: Enabled: parameter setting (PA-29) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4285 hex	4284 hex	Output torque monitor optional output value setting	PA-29	R/W	-5000 to 5000	0.1%
4286 hex	4285 hex	Start with frequency matching optional Setting enable	PA-30	R/W	00: Disabled 01: Enabled: parameter setting (PA-31) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4287 hex	4286 hex	Start with frequency matching optional value setting	PA-31	R/W	0 to 59000	0.01 Hz

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V. When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01% (Rated ratio)

9-5-9 Group U Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
-	-	Password input for display selection	UA-01	-	-	-
-	-	Soft-lock password input	UA-02	-	-	-
465Ah	4659h	Display restriction selection	UA-10	R/W	00: Full display 01: By function 02: User setting 03: Data comparison display 04: Only monitor display	-
465Ch	465Bh	Accumulation input power monitor clear	UA-12	R/W	00: Disabled 01: Clear	-
465D hex	465C hex	Display gain for Accumulation input power monitor	UA-13	R/W	1 to 1000	1
465E hex	465D hex	Accumulation output power monitor clear	UA-14	R/W	00: Disabled 01: Clear	-
465F hex	465E hex	Display gain for Accumulation output power monitor	UA-15	R/W	1 to 1000	1
4660 hex	465F hex	Soft Lock selection	UA-16	R/W	00: [SFT] terminal 01: Always enabled	-
4661 hex	4660 hex	Soft Lock target selection	UA-17	R/W	00: All data cannot be changed 01: Data other than set frequency cannot be changed	-
4662 hex	4661 hex	Data R/W selection	UA-18	R/W	00: R/W enabled 01: R/W disabled	-
4663 hex	4662 hex	Low battery warning enable	UA-19	R/W	00: Disabled 01: Warning 02: Error	-
4664 hex	4663 hex	Action selection at Keypad disconnection	UA-20	R/W	00: Error 01: Error after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-
4665 hex	4664 hex	2nd-motor parameter display selection	UA-21	R/W	00: Not display 01: Display	-
4666 hex	4665 hex	Option parameter display selection	UA-22	R/W	00: Not display 01: Display	-
466E hex	466D hex	User parameter auto setting function enable	UA-30	R/W	00: Disabled 01: Enabled	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
466F hex	466E hex	User parameter 1 selection	UA-31	R/W	no/***** (select a parameter)	1
4670 hex	466F hex	User parameter 2 selection	UA-32	R/W		1
4671 hex	4670 hex	User parameter 3 selection	UA-33	R/W		1
4672 hex	4671 hex	User parameter 4 selection	UA-34	R/W		1
4673 hex	4672 hex	User parameter 5 selection	UA-35	R/W		1
4674 hex	4673 hex	User parameter 6 selection	UA-36	R/W		1
4675 hex	4674 hex	User parameter 7 selection	UA-37	R/W		1
4676 hex	4675 hex	User parameter 8 selection	UA-38	R/W		1
4677 hex	4676 hex	User parameter 9 selection	UA-39	R/W		1
4678 hex	4677 hex	User parameter 10 selection	UA-40	R/W		1
4679 hex	4678 hex	User parameter 11 selection	UA-41	R/W	no/***** (select a parameter)	1
467A hex	4679 hex	User parameter 12 selection	UA-42	R/W		1
467B hex	467A hex	User parameter 13 selection	UA-43	R/W		1
467C hex	467B hex	User parameter 14 selection	UA-44	R/W		1
467D hex	467C hex	User parameter 15 selection	UA-45	R/W		1
467E hex	467D hex	User parameter 16 selection	UA-46	R/W		1
467F hex	467E hex	User parameter 17 selection	UA-47	R/W		1
4680 hex	467F hex	User parameter 18 selection	UA-48	R/W		1
4681 hex	4680 hex	User parameter 19 selection	UA-49	R/W		1
4682 hex	4681 hex	User parameter 20 selection	UA-50	R/W		1

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
4683 hex	4682 hex	User parameter 21 selection	UA-51	R/W	no/***** (select a parameter)	1
4684 hex	4683 hex	User parameter 22 selection	UA-52	R/W		1
4685 hex	4684 hex	User parameter 23 selection	UA-53	R/W		1
4686 hex	4685 hex	User parameter 24 selection	UA-54	R/W		1
4687 hex	4686 hex	User parameter 25 selection	UA-55	R/W		1
4688 hex	4687 hex	User parameter 26 selection	UA-56	R/W		1
4689 hex	4688 hex	User parameter 27 selection	UA-57	R/W		1
468A hex	4689 hex	User parameter 28 selection	UA-58	R/W		1
468B hex	468A hex	User parameter 29 selection	UA-59	R/W		1
468C hex	468B hex	User parameter 30 selection	UA-60	R/W		1
468D hex	468C hex	User parameter 31 selection	UA-61	R/W	no/***** (select a parameter)	1
468E hex	468D hex	User parameter 32 selection	UA-62	R/W		1
46B5 hex	46B4 hex	Initialize Mode selection	Ub-01	R/W	00: Disabled 01: Trip history 02: Parameter initialization 03: Trip history + parameters 04: Trip history + parameters + DriveProgramming 05: Other than terminal function 06: Other than communication function 07: Other than terminal & communication functions 08: Only DriveProgramming	-
46B6 hex	46B5 hex	Initialize Data selection	Ub-02	R/W	00: Mode 0 01: Mode 1 02: Mode 2 03: Mode 3	-
46B7 hex	46B6 hex	Load type selection	Ub-03	R/W	00: VLD 01: LD 02: ND	-
46B9 hex	46B8 hex	Initialize Enable	Ub-05	R/W	00: Disabled 01: Start initialization	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
4719 hex	4718 hex	Debug mode enable	UC-01	R/W	(do not change)	1
47E1 hex	47E0 hex	EzSQ operation cycle	UE-01	R/W	00: 1ms 01: 2ms	-
47E2 hex	47E1 hex	EzSQ function enable	UE-02	R/W	00: Disabled 01: [PRG] terminal 02: Always	-
47EA hex	47E9 hex	EzSQ user parameter U (00)	UE-10	R/W	0 to 65535	1
47EB hex	47EA hex	EzSQ user parameter U (01)	UE-11	R/W	0 to 65535	1
47EC hex	47EB hex	EzSQ user parameter U (02)	UE-12	R/W	0 to 65535	1
47ED hex	47EC hex	EzSQ user parameter U (03)	UE-13	R/W	0 to 65535	1
47EE hex	47ED hex	EzSQ user parameter U (04)	UE-14	R/W	0 to 65535	1
47EF hex	47EE hex	EzSQ user parameter U (05)	UE-15	R/W	0 to 65535	1
47F0 hex	47EF hex	EzSQ user parameter U (06)	UE-16	R/W	0 to 65535	1
47F1 hex	47F0 hex	EzSQ user parameter U (07)	UE-17	R/W	0 to 65535	1
47F2 hex	47F1 hex	EzSQ user parameter U (08)	UE-18	R/W	0 to 65535	1
47F3 hex	47F2 hex	EzSQ user parameter U (09)	UE-19	R/W	0 to 65535	1
47F4 hex	47F3 hex	EzSQ user parameter U (10)	UE-20	R/W	0 to 65535	1
47F5 hex	47F4 hex	EzSQ user parameter U (11)	UE-21	R/W	0 to 65535	1
47F6 hex	47F5 hex	EzSQ user parameter U (12)	UE-22	R/W	0 to 65535	1
47F7 hex	47F6 hex	EzSQ user parameter U (13)	UE-23	R/W	0 to 65535	1
47F8 hex	47F7 hex	EzSQ user parameter U (14)	UE-24	R/W	0 to 65535	1
47F9 hex	47F8 hex	EzSQ user parameter U (15)	UE-25	R/W	0 to 65535	1
47FA hex	47F9 hex	EzSQ user parameter U (16)	UE-26	R/W	0 to 65535	1
47FB hex	47FA hex	EzSQ user parameter U (17)	UE-27	R/W	0 to 65535	1
47FC hex	47FB hex	EzSQ user parameter U (18)	UE-28	R/W	0 to 65535	1
47FD hex	47FC hex	EzSQ user parameter U (19)	UE-29	R/W	0 to 65535	1

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
47FE hex	47FD hex	EzSQ user parameter U (20)	UE-30	R/W	0 to 65535	1
47FF hex	47FE hex	EzSQ user parameter U (21)	UE-31	R/W	0 to 65535	1
4800 hex	47FF hex	EzSQ user parameter U (22)	UE-32	R/W	0 to 65535	1
4801 hex	4800 hex	EzSQ user parameter U (23)	UE-33	R/W	0 to 65535	1
4802 hex	4801 hex	EzSQ user parameter U (24)	UE-34	R/W	0 to 65535	1
4803 hex	4802 hex	EzSQ user parameter U (25)	UE-35	R/W	0 to 65535	1
4804 hex	4803 hex	EzSQ user parameter U (26)	UE-36	R/W	0 to 65535	1
4805 hex	4804 hex	EzSQ user parameter U (27)	UE-37	R/W	0 to 65535	1
4806 hex	4805 hex	EzSQ user parameter U (28)	UE-38	R/W	0 to 65535	1
4807 hex	4806 hex	EzSQ user parameter U (29)	UE-39	R/W	0 to 65535	1
4808 hex	4807 hex	EzSQ user parameter U (30)	UE-40	R/W	0 to 65535	1
4809 hex	4808 hex	EzSQ user parameter U (31)	UE-41	R/W	0 to 65535	1
480A hex	4809 hex	EzSQ user parameter U (32)	UE-42	R/W	0 to 65535	1
480B hex	480A hex	EzSQ user parameter U (33)	UE-43	R/W	0 to 65535	1
480C hex	480B hex	EzSQ user parameter U (34)	UE-44	R/W	0 to 65535	1
480D hex	480C hex	EzSQ user parameter U (35)	UE-45	R/W	0 to 65535	1
480E hex	480D hex	EzSQ user parameter U (36)	UE-46	R/W	0 to 65535	1
480F hex	480E hex	EzSQ user parameter U (37)	UE-47	R/W	0 to 65535	1
4810 hex	480F hex	EzSQ user parameter U (38)	UE-48	R/W	0 to 65535	1
4811 hex	4810 hex	EzSQ user parameter U (39)	UE-49	R/W	0 to 65535	1
4812 hex	4811 hex	EzSQ user parameter U (40)	UE-50	R/W	0 to 65535	1
4813 hex	4812 hex	EzSQ user parameter U (41)	UE-51	R/W	0 to 65535	1
4814 hex	4813 hex	EzSQ user parameter U (42)	UE-52	R/W	0 to 65535	1
4815 hex	4814 hex	EzSQ user parameter U (43)	UE-53	R/W	0 to 65535	1

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
4816 hex	4815 hex	EzSQ user parameter U (44)	UE-54	R/W	0 to 65535	1
4817 hex	4816 hex	EzSQ user parameter U (45)	UE-55	R/W	0 to 65535	1
4818 hex	4817 hex	EzSQ user parameter U (46)	UE-56	R/W	0 to 65535	1
4819 hex	4818 hex	EzSQ user parameter U (47)	UE-57	R/W	0 to 65535	1
481A hex	4819 hex	EzSQ user parameter U (48)	UE-58	R/W	0 to 65535	1
481B hex	481A hex	EzSQ user parameter U (49)	UE-59	R/W	0 to 65535	1
481C hex	481B hex	EzSQ user parameter U (50)	UE-60	R/W	0 to 65535	1
481D hex	481C hex	EzSQ user parameter U (51)	UE-61	R/W	0 to 65535	1
481E hex	481D hex	EzSQ user parameter U (52)	UE-62	R/W	0 to 65535	1
481F hex	481E hex	EzSQ user parameter U (53)	UE-63	R/W	0 to 65535	1
4820 hex	481F hex	EzSQ user parameter U (54)	UE-64	R/W	0 to 65535	1
4821 hex	4820 hex	EzSQ user parameter U (55)	UE-65	R/W	0 to 65535	1
4822 hex	4821 hex	EzSQ user parameter U (56)	UE-66	R/W	0 to 65535	1
4823 hex	4822 hex	EzSQ user parameter U (57)	UE-67	R/W	0 to 65535	1
4824 hex	4823 hex	EzSQ user parameter U (58)	UE-68	R/W	0 to 65535	1
4825 hex	4824 hex	EzSQ user parameter U (59)	UE-69	R/W	0 to 65535	1
4826 hex	4825 hex	EzSQ user parameter U (60)	UE-70	R/W	0 to 65535	1
4827 hex	4826 hex	EzSQ user parameter U (61)	UE-71	R/W	0 to 65535	1
4828 hex	4827 hex	EzSQ user parameter U (62)	UE-72	R/W	0 to 65535	1
4829 hex	4828 hex	EzSQ user parameter U (63)	UE-73	R/W	0 to 65535	1
4846 hex	4845 hex	EzSQ user parameter UL (00)	UF-02 (HIGH)	R/W	-2147483647 to 2147483647	1
4847 hex	4846 hex		UF-03 (LOW)	R/W		
4848 hex	4847 hex	EzSQ user parameter UL (01)	UF-04 (HIGH)	R/W	-2147483647 to 2147483647	1
4849 hex	4848 hex		UF-05 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter code	R/W	Monitor or setting data	Unit
484A hex	4849 hex	EzSQ user parameter UL (02)	UF-06 (HIGH)	R/W	-2147483647 to 2147483647	1
484B hex	484A hex		UF-07 (LOW)	R/W		
484C hex	484B hex	EzSQ user parameter UL (03)	UF-08 (HIGH)	R/W	-2147483647 to 2147483647	1
484D hex	484C hex		UF-09 (LOW)	R/W		
484E hex	484D hex	EzSQ user parameter UL (04)	UF-10 (HIGH)	R/W	-2147483647 to 2147483647	1
484F hex	484E hex		UF-11 (LOW)	R/W		
4850 hex	484F hex	EzSQ user parameter UL (05)	UF-12 (HIGH)	R/W	-2147483647 to 2147483647	1
4851 hex	4850 hex		UF-13 (LOW)	R/W		
4852 hex	4851 hex	EzSQ user parameter UL (06)	UF-14 (HIGH)	R/W	-2147483647 to 2147483647	1
4853 hex	4852 hex		UF-15 (LOW)	R/W		
4854 hex	4853 hex	EzSQ user parameter UL (07)	UF-16 (HIGH)	R/W	-2147483647 to 2147483647	1
4855 hex	4854 hex		UF-17 (LOW)	R/W		
4856 hex	4855 hex	EzSQ user parameter UL (08)	UF-18 (HIGH)	R/W	-2147483647 to 2147483647	1
4857 hex	4856 hex		UF-19 (LOW)	R/W		
4858 hex	4857 hex	EzSQ user parameter UL (09)	UF-20 (HIGH)	R/W	-2147483647 to 2147483647	1
4859 hex	4858 hex		UF-21 (LOW)	R/W		
485A hex	4859 hex	EzSQ user parameter UL (10)	UF-22 (HIGH)	R/W	-2147483647 to 2147483647	1
485B hex	485A hex		UF-23 (LOW)	R/W		
485C hex	485B hex	EzSQ user parameter UL (11)	UF-24 (HIGH)	R/W	-2147483647 to 2147483647	1
485D hex	485C hex		UF-25 (LOW)	R/W		
485E hex	485D hex	EzSQ user parameter UL (12)	UF-26 (HIGH)	R/W	-2147483647 to 2147483647	1
485F hex	485E hex		UF-27 (LOW)	R/W		
4860 hex	485F hex	EzSQ user parameter UL (13)	UF-28 (HIGH)	R/W	-2147483647 to 2147483647	1
4861 hex	4860 hex		UF-29 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or setting data	Unit
4862 hex	4861 hex	EzSQ user parameter UL (14)	UF-30 (HIGH)	R/W	-2147483647 to 2147483647	1
4863 hex	4862 hex		UF-31 (LOW)	R/W		
4864 hex	4863 hex	EzSQ user parameter UL (15)	UF-32 (HIGH)	R/W	-2147483647 to 2147483647	1
4865 hex	4864 hex		UF-33 (LOW)	R/W		

9-5-10 Group o Register List

Precautions for Correct Use

- The *Register No.* in the table shows the register number used inside the inverter.
- The *Modbus register spec. No.* in the table shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter *Register No.* according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or Setting item	Unit
3E8A hex	3E89 hex	Operation mode on option card error (SLOT-1)	oA-10	R/W	00: Error 01: Continue operation	-
3E8B hex	3E8A hex	Communication Watch Dog Timer	oA-11	R/W	0 to 10000	0.01 s
3E8C hex	3E8B hex	Action selection at communication error	oA-12	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-
3E8D hex	3E8C hex	Run command enable option during the option card (SLOT-1) start-up	oA-13	R/W	00: Operation command disabled 01: Operation command enabled	-
3E94 hex	3E93 hex	Operation mode on option card error (SLOT-2)	oA-20	R/W	00: Error 01: Continue operation	-
3E95 hex	3E94 hex	Communication Watch Dog Timer	oA-21	R/W	0 to 10000	0.01 s
3E96 hex	3E95 hex	Action selection at communication error	oA-22	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-

Register No.	Modbus register spec. No.	Function name	Parameter code	R/W	Monitor or Setting item	Unit
3E97 hex	3E96 hex	Run command enable option during the option card (SLOT-2) start-up	oA-23	R/W	00: Operation command disabled 01: Operation command enabled	-
3E9E hex	3E9D hex	Operation mode on option card error (SLOT-3)	oA-30	R/W	00: Error 01: Continue operation	-
3E9F hex	3E9E hex	Communication Watch Dog Timer	oA-31	R/W	0 to 10000	0.01 s
3EA0 hex	3E9F hex	Action selection at communication error	oA-32	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-
3EA1 hex	3EA0 hex	Run command enable option during the option card (SLOT-3) start-up	oA-33	R/W	00: Operation command disabled 01: Operation command enabled	-
3EE5 hex	3EE4 hex	Encoder constant setting (Option)	ob-01	R/W	32 to 65535	1 pls
3EE6 hex	3EE5 hex	Encoder position selection (Option)	ob-02	R/W	00: Phase-A is leading 01: Phase-B is leading	--
3EE7 hex	3EE6 hex	Motor gear ratio Numerator (Option)	ob-03	R/W	1 to 10000	1
3EE8 hex	3EE7 hex	Motor gear ratio Numerator (Option)	ob-04	R/W	1 to 10000	1
3EEE hex	3EED hex	Pulse train detection (option) terminal	ob-10	R/W	00: Command 01: Pulse string position command	-
3EEF hex	3EEE hex	Mode selection of pulse train input	ob-11	R/W	00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string	-
3EF0 hex	3EEF hex	Pulse train frequency Scale	ob-12	R/W	5 to 20000	0.01 kHz
3EF1 hex	3EF0 hex	Pulse train frequency Filter time constant	ob-13	R/W	1 to 200	0.01 s
3EF2 hex	3EF1 hex	Pulse train frequency Bias value	ob-14	R/W	-1000 to 1000	0.1%
3EF3 hex	3EF2 hex	Pulse train frequency High Limit	ob-15	R/W	0 to 1000	0.1%
3EF4 hex	3EF3 hex	Pulse train frequency detection low level	ob-16	R/W	0 to 1000	0.1%

9-6 Inter-inverter Communication

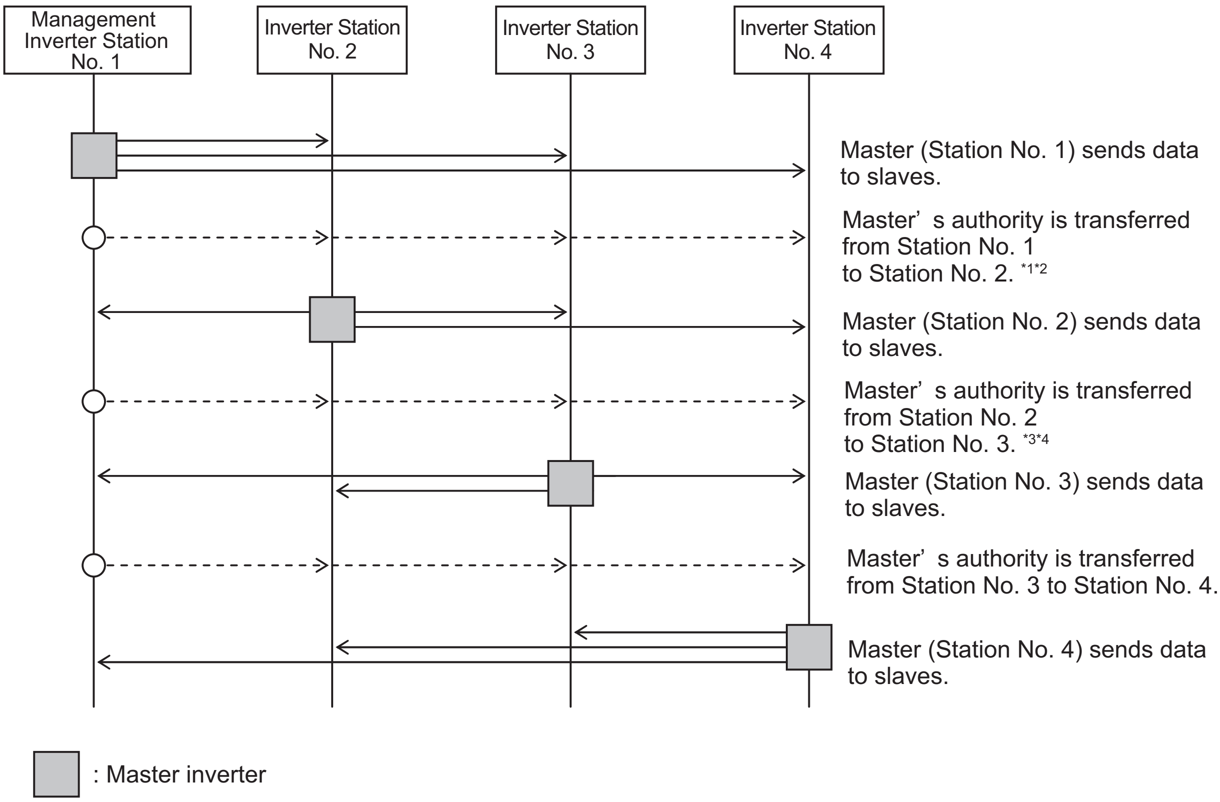
In addition to the standard Modbus communication (slave), the 3G3RX2 Series Inverter provides the inter-inverter communication function, which enables more than one 3G3RX2 Series Inverter to communicate mutually without master equipment such as a computer or PLC.

In inter-inverter communication, the inverters are assigned as *management inverter*, *master inverter*, or *slave inverter*. The management inverter specifies the master inverter according to the user settings. The others are slave inverters. The management inverter is always fixed, but the master inverter changes sequentially. Therefore, the management inverter may serve as the master or a slave inverter. Other conditions are as follows.

- One management inverter is required within a network.
- Up to 11 inverters can serve as the master inverter.
- Up to 247 inverters can be connected within the entire network (32 inverters without repeaters in compliance with the RS485 specifications).

In inter-inverter communication, be sure to assign the Station No. 1, which serves as the management inverter.

The master inverter can write data to the holding registers on any slave inverter. At this time, up to five different station numbers and holding registers can be specified at once. On completion of each data transmission session between the master and a slave (or slaves), the master's authority is transferred to the next inverter in a sequential manner. In this way, data transmission is repeated according to the settings for each master inverter.



*1. Switching of the master is performed automatically by the management inverter.

*2. The management inverter sends the master switching instruction from Inverter No. 01 to 02 when the total time of the silent interval and the communication wait time elapses after data is sent from Inverter 01 (master) to a slave (or slaves).

*3. After receiving data from the master inverter, the management inverter sends the next master switching instruction when the total time of the silent interval and the communication wait time elapses.
If the management inverter cannot receive the data sent from the master inverter within the communication error timeout time, a communication timeout occurs and the management inverter follows the operation set in the operation selection on communication error.

*4. Be sure to enable the communication error timeout time setting (= 0.01 to 99.99) on the management inverter. When this setting is disabled (= 0), the inter-inverter communication will stop if the management inverter cannot receive data from the master.
In this case, cycle the power supply for the management inverter, or reset the management inverter (by turning ON/OFF the RS terminal).

9-6-1 Inter-inverter Communication Parameters

The parameters required to establish inter-inverter communication are shown in the table below.

Parameter No.	Function name	Data	Default	Unit	Inverter*[*1]
CF-02[*2]	RS485 communication Node allocation	1 to 247[*3]	1	-	ALL[*4]
CF-05[*5]	RS485 communication error selection	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	02	-	ALL
CF-06	RS485 communication timeout setting	0.00: Timeout disabled 0.01 to 99.99	0.00	s	ALL
CF-07	RS485 communication wait time setting	0 to 1000	2	ms	ALL
CF-08[*2]	RS485 communication mode selection	01: Modbus communication	01	-	-
		02: EzCOM communication			B
		03: EzCOM communication(management inverter)			A
CF-20[*2]	EzCOM Start node No.	1 to 8 Setting required only for management inverter[*6]	1	-	A
CF-21[*2]	EzCOM End node No.	1 to 8 Setting required only for management inverter[*6]	1	-	A
CF-22[*2]	EzCOM Start method selection	00: EzCOM terminal[*7]	-	-	A
		01: Modbus spec[*8]			A
CF-23	EzCOM data size	1 to 5	1	-	M
CF-24	EzCOM destination address 1	1 to 247[*9]	1	-	M

Parameter No.	Function name	Data	Default	Unit	Inverter*[1]
CF-25	EzCOM destination resister 1	0 to 65535	0	-	M
CF-26	EzCOM source resister 1	0 to 65535	0	-	M
CF-27	EzCOM destination address 2	1 to 247	2	-	M
CF-28	EzCOM destination resister 2	0 to 65535	0	-	M
CF-29	EzCOM source resister 2	0 to 65535	0	-	M
CF-30	EzCOM destination address 3	1 to 247	3	-	M
CF-31	EzCOM destination resister 3	0 to 65535	0	-	M
CF-32	EzCOM source resister 3	0 to 65535	0	-	M
CF-33	EzCOM destination address 4	1 to 247	4	-	M
CF-34	EzCOM destination resister 4	0 to 65535	0	-	M
CF-35	EzCOM source resister 4	0 to 65535	0	-	M
CF-36	EzCOM destination address 5	1 to 247	5	-	M
CF-37	EzCOM destination resister 5	0 to 65535	0	-	M
CF-38	EzCOM source resister 5	0 to 65535	0	-	M
CA-01 to CA-11	Input terminal 1 to 9, A, and B	98: Starting up of EzCOM*[7]	-	-	A

*1. The following are the details.
ALL: Setting required for all connected inverters.
A: Setting required only for management inverter (Station No. 1).
B: Setting required for inverters other than management inverter (Station No. 1).
M: Setting required only for inverters set in (CF-20) to (CF-21) (= inverters assigned with master authority).

*2. After changing the data in any of (CF-02), (CF-08), and (CF-20) to (CF-22) on the management inverter, be sure to cycle the power supply to apply the changes. For inverters other than the management inverter, these changes will be applied immediately.

*3. To switch the master inverter among more than one inverter, be sure to set sequential station numbers. If the set station numbers include any skipped number, communications cannot be established.

*4. For the management inverter, set the station number to 1 (CF-02 = 1).

*5. When **RS485 communication error selection** (CF-05) is not set to *02: Ignore* on the management inverter, the inter-inverter communication session will stop if a communications timeout error occurs on the management inverter. In this case, cycle the power supply of the management inverter.

*6. Set these parameters so that (CF-20) is equal to or less than (CF-21).

*7. If you set **EzCOM Start method selection** (CF-22) to *00: EzCOM terminal*, assign [98: ECOM] *Starting up of EzCOM* to any of input terminals 1 to 9, A, and B (CA-01) to (CA-11).

*8. If you set **EzCOM Start method selection** (CF-22) to *01: Modbus spec*, the management inverter starts sending data as soon as the power supply is turned on. At this time, if the next master inverter is delayed in

the startup and cannot receive the master switching instruction, the master inverter cannot send the data, which results in a communications timeout error on the management inverter.
When you set (CF-22) to 01, check that the startup of the other inverters is completed, and then power on the management inverter.

*9. Although, in master-to-slave communications, you set recipient slave's station number, actually, data is sent to all stations via broadcast communications (Station No. 00). Slaves that are not specified as the recipient on the master side discard the received data.

9-6-2 Communication Settings

- Set the station numbers for each inverter in inter-inverter communication so that they do not overlap among the inverters. Do not forget to set the station No. 1. The inverter with the station No.1 serves as the *management inverter*.
- For the management inverter, set **RS485 communication mode selection** (CF-08) to *03: EzCOM management*. For inverters other than the management inverter, set **RS485 communication mode selection** (CF-08) to *02: EzCOM*.
- Set a station number 1 to 8 on inverters that serve as the master inverter. To switch the master inverter among more than one inverter, the station numbering must be sequential. On the management inverter, set the smallest master station number in **EzCOM Start node No.** (CF-20), and the largest master station number in **EzCOM End node No.** (CF-21).
- Set the inverter communication start method on the management inverter. If you set **RS485 communication mode selection** (CF-08) to *01: Modbus-RTU*, assign *98: Starting up of EzCOM* to one of **Input terminal function** (CA-01) to (CA-11).
- In (CF-23) to (CF-38), set the following parameters, which are required when the master inverter writes data: the number of sent data, recipient station number, recipient register address, and sender register address.

Inter-inverter Communication Operation

1 The master inverter sends data to one or more slave inverters according to the settings for that master inverter.
This data is also sent to the management inverter that does not serve as the master inverter.

2 The management inverter sends the master switching instruction and the master inverter is switched accordingly.

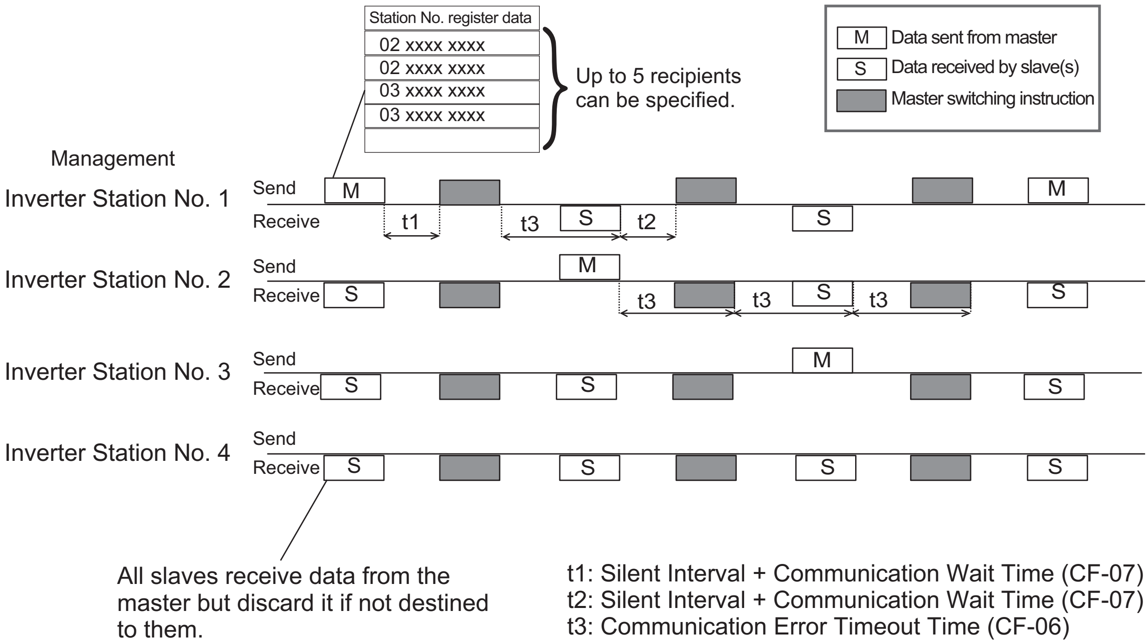
3 The next master inverter sends data to one or more slave inverters in the same manner as explained in Step 1.
This data is also sent to the management inverter that does not serve as the master inverter.

4 Steps 2 and 3 are followed repeatedly.

Note Because this inverter is designed to establish inter-inverter communication via broadcast communications (Station No. 00), communications data is sent to all stations. Therefore, slaves that are not specified as the recipient on the master side receive the data once, but internally discard the data if not destined to them.

Example of Inter-inverter Communication Sequence

The sequence diagram below shows inter-inverter communication among four inverters with Station No. 1 to 4, where Station No. 1 to 3 are set as the master inverter.



- Do NOT set **RS485 communication timeout setting** (CF-06) to *0.00* (1 second or longer is recommended) on the management inverter. When you set it to *0.00*, the inverter's communications function will stop if no data is received from the master. If the management inverter stops working, cycle the power supply.
- The communications error timeout timer starts when the inverter starts waiting for data reception and times out when it cannot complete data reception within the set time. If a timeout occurs, the inverter performs the operation set in **RS485 communication error selection** (CF-05). (See t3 in the above diagram.)
- When the management inverter is the master, the master switching instruction will be sent when the total time of the silent interval and the **RS485 communication wait time setting** (CF-07) elapses after the master sends data. (See t1 in the above diagram.)
- When an inverter other than the management inverter is the master, the master switching instruction will be sent when the total time of the silent interval and the **RS485 communication wait time setting** (CF-07) elapses after the inverter receives the data sent from the master inverter. (See t2 in the above diagram.)
- When **EzCOM Start method selection** (CF-22) is set to *01: Modbus spec*, the management inverter starts sending data as soon as the power supply is turned on. Therefore, if the power-on timing of any other inverter is delayed, the communications cannot be established normally, which results in a communications timeout error on the management inverter. When you make this settings, check that the startup of the other inverters is completed, and then power on the management inverter.
- Do not set *EEPROM Write* or *EEPROM Write Mode Selection* in the recipient registers. Doing so causes the inter-inverter communication session to stop in the EEPROM write process.
- After changing any of the (CF-08), and (CF-20) to (CF-22) data, be sure to cycle the power supply to apply the changes.

10

DriveProgramming

This section provides an overview of the DriveProgramming.

10-1 Overview of DriveProgramming

The 3G3RX2 Series Inverter has the built-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control.
You can create programs easily by using the CX-Drive. The user programs you created can be downloaded onto the inverter for programmed inverter operation.

Features of DriveProgramming

- The DriveProgramming supports both flowchart and text language method programming.
- Five tasks can be processed in parallel.
- ON/OFF by input terminals enables a start of user programs.
- The user programs enable the input terminals and output terminals to use reading and writing functions.
- The LCD Operator enables you to change the settings of the output frequency, acceleration/deceleration time, and other parameters that require on-site adjustment by specifying the user parameters (UE-10) to (UE-73), without connecting the computer.
- Because user programs are stored in the internal EEPROM of the inverter, you can start a program immediately after the inverter power supply is turned on.
- Connecting the optional LCD Operator enables the control of the inverter by using the LCD Operator’s clock function.

Precautions for Safe Use

- If the clock function is used in DriveProgramming, an unexpected operation may occur due to weak battery.
  Take measures such as detecting a weak battery by the RTC error (E042) and stopping the inverter or programs.
  When the LCD Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock function.
- If the DriveProgramming stops while the output terminal function is making output, the output status is held. Take safety precautions such as stopping peripheral devices.

DriveProgramming Function

The details of the main DrvieProgramming function are as follows.

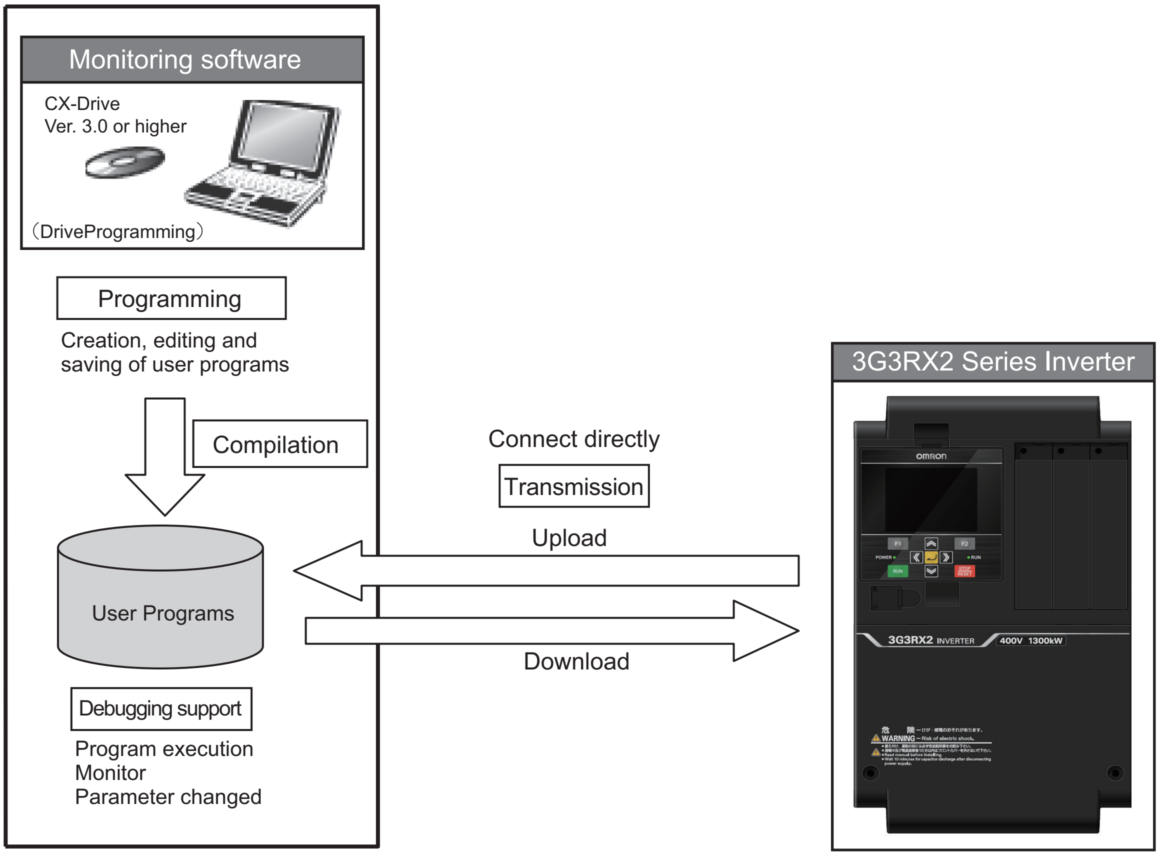
Item		Specifications
Program specifications	Programming language	Flowchart and text language method
	Input device	Windows Personnel Computer As for supported operation system, refer to the *CX-One User's Manual* (Cat. No. W463).
	Program capacity	max. 1,024 steps per task, total maximun 7,680 bytes per 5 tasks
	Programming support function	Functions supported in Inverter/Servo support tool CX-Drive • Program editing and display • Program compilation (Program syntax check) • Program downloading, uploading, and all clear
	Execution format	• Execution by interpreter • Execution cycle: selectable from 1 or 2ms/step (5 commands executable through 5-task parallel processing) • Subroutine call supported (Nesting in 8 levels max.)

The main functions of the DriveProgramming Editor available in CX-Drive are as shown below.

Function	Description
Programming	Supports the creation, editing, saving, reading, and printing of user programs.
Compilation	Compiles a user programs.[*1]
Transfer	Downloads a user program to the inverter, or uploads a user program from the inverter.
Debugging support	Starts and stops the execution of a program. This allows the user to check the inverter status monitor etc.

*1. Compilation is the process to generate an intermediate code after a program check.

For details, refer to the *DriveProgramming User's Manual* (Cat. No. I622).


Monitoring software
CX-Drive
Ver. 3.0 or higher
(DriveProgramming)
Programming
Creation, editing and saving of user programs
Compilation
User Programs
Debugging support
Program execution
Monitor
Parameter changed
Connect directly
Transmission
Upload
Download
3G3RX2 Series Inverter

11

Options

This section describes the optional units.

11-1 Overview of Optional Equipment

This section provides an overview of the optional equipment available with the 3G3RX2 Series Inverter. For details, refer to the manual for each optional product.

11-1-1 Part Names and Descriptions

DC Reactor (Model: 3G3AX-DL□□□□)/ AC Reactor (Model: 3G3AX-AL□□□□)

Use these reactors to suppress harmonics generated from the inverter.
The AC reactor is used when the power supply voltage unbalance factor is 3% or more, the inverter capacity is 500 kVA or more, or rapid change in the power supply voltage occurs to reduce its effect.
The DC/AC reactor also has an effect of improving the power factor.
For details, refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-31 and *Harmonic Current Measures and DC/AC Reactor Wiring (PD, P)* on page 2-51.

Regenerative Braking Unit (Model: 3G3AX-RBU□□)/ Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

The braking resistor absorbs the regenerative energy generated when a load decelerates or the elevating shaft descends to prevent overvoltage detection of the inverter.
For details, refer to *External Braking Resistor Connection Terminal (P, RB) and Regenerative Braking Unit Connection Terminal (P, N)* on page 2-57.

Input Noise Filter (Model: 3G3AX-NFI□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines.
For details, refer to *Installing Input Noise Filter* on page 2-48.

Output Noise Filter (Model: 3G3AX-NFO□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to the motor side wires.
For details, refer to *Installing Output Noise Filter* on page 2-55.

Radio Noise Filter (Model: 3G3AX-ZCL□)

Use this filter to reduce the radiated noise generated in the inverter and emitted from the power-supply line side and motor side wires.
For details, refer to *Measures Against Radio Noise* on page 2-55.

EMC Noise Filter (Model: 3G3AX-EFI□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines for compliance with European EC Directives.
For details, refer to *2-5-1 Conditions of Conformity of EU Directives* on page 2-93.

PG Option Unit (Model: 3G3AX-RX2-PG01)

This option detects the rotation speed of the motor with an encoder and feeds back the detected value to enable high-accuracy operation with reduced speed variation, as well as position control via pulse train position command input.
See *2-3-6 Wiring for PG Option Unit* on page 2-68 for detail.

EtherCAT Communications unit (3G3AX-RX2-ECT)

This option unit can control the inverter via EtherCAT communications.
For details, refer to *Inverter RX2 Series EtherCAT® Communication Unit User's Manual (I663).*

11-2 Regenerative Braking Unit (Model: 3G3AX-RBU□□)

11-2-1 Specifications

Built-in Resistor Type (Model: 3G3AX-RBU21 / RBU22 / RBU41)

Applicable voltage class		3-phase 200-V class		3-phase 400-V class
Model		3G3AX-RBU21	3G3AX-RBU22	3G3AX-RBU41*1
Connection resistance		17 Ω min.	17 Ω min.	34 Ω min.
Operating voltage (ON/OFF)		OFF: 355 ± 5 V ON: 362.5 ± 5 V (–5% or –10% setting available)		ON: 725 ± 5 V OFF: 710 ± 5 V (–5% or –10% setting available)
Operation indication		LED ON (Lit)		
Maximum number of units for parallel interlocking operation*2		5 units		
Built-in resistor	Internal resistance	120 W, 180 Ω	120 W, 20 Ω	120W, 180 Ω x 2 in series
	Allowable continuous ON time	10 s max.	0.5 s max.	10 s max.
	Allowable operation cycle	Cycle 1 / 10 (ON for 10 s / OFF for 90 s)	Cycle 1 / 80 (ON for 0.5 s / OFF for 40 s)	Cycle 1 / 10 (ON for 10 s / OFF for 90 s)
	Power consumption	Instantaneous: 0.73 kW Short-time rating: 120 W	Instantaneous: 6.6 kW Short-time rating: 120 W	Instantaneous: 1.46 kW Short-time rating: 240 W
Protective function	Built-in resistor overheat protection	Built-in relay specifications ・Built-in resistor temperature: Relay is activated at approximately 200°C or higher and reset at approximately 170°C or lower. ・Built-in thermal fuse (No resetting)*3 ・Contact rating: 250 VAC 200 mA (R load) 12 VAC 500 mA (R load) 42 VDC 200 mA (R load) ・Minimum load: 1 mA		
Operating environment	Operating ambient temperature	–10 to 50°C		
	Storage ambient temperature	–20 to 65°C		
	Operating ambient humidity	20% to 90% (with no condensation)		
	Vibration resistance	5.9 m/s² (0.6 G) 10 to 55 Hz		
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)		

Applicable voltage class	3-phase 200-V class	3-phase 400-V class
Paint color	Munselle 5Y7/1 (except for cooling fan with aluminum base color)	

*1. To use the braking resistor (Model: 3G3AX-RAB / RBB / RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches to set the number of connected units.

*3. The built-in resistor has a thermal fuse. If the alarm terminals are not connected, the fuse may blow out in order to prevent the resistor from burning due to overheating. If the fuse blows out, the built-in resistor must be replaced.

External Resistor Type (Model: 3G3AX-RBU23 / RBU24 / RBU42 / RBU43)

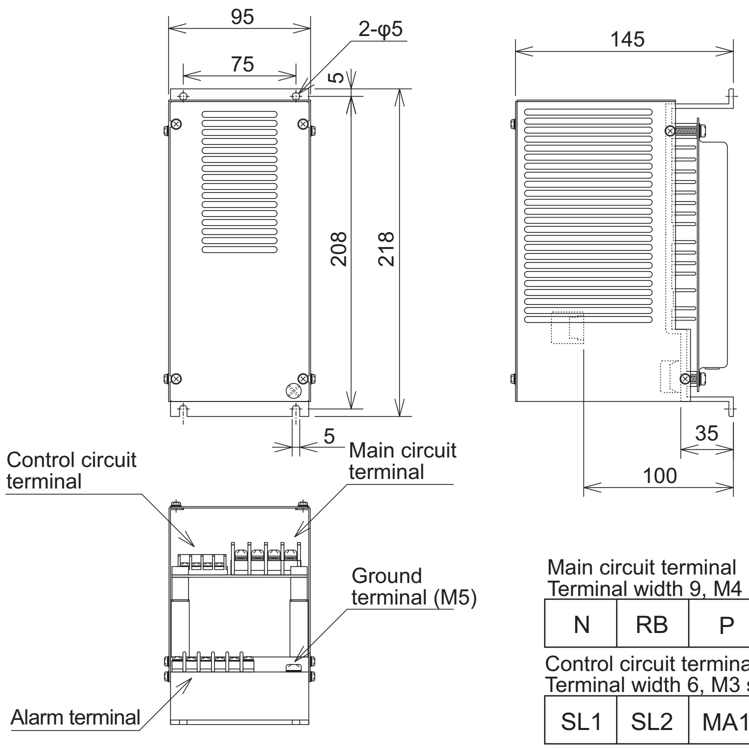
Applicable voltage class		3-phase 200-V class		3-phase 400-V class	
Model		3G3AX-RBU23	3G3AX-RBU24	3G3AX-RBU42[*1]	3G3AX-RBU43[*1]
Connection resistance	Continuous operation	6 Ω min.	4 Ω min.	24 Ω min.	12 Ω min.
	Short-time operation/Allowable operation cycle/ Allowable continuous ON time	4 Ω min. Cycle 1 / 5 (ON for 2 min / OFF for 8 min) 2 min	2 Ω min. Cycle 1 / 5 (ON for 2 min / OFF for 8 min) 2 min	10 Ω min. Cycle 1 / 10 (ON for 10 s / OFF for 90 s) 10 s	6 Ω min. Cycle 1 / 5 (ON for 2 min / OFF for 8 min) 2 min
Operating voltage (ON/OFF)		ON: 362.5 ± 5 V, OFF: 355 ± 5 V (–5% or –10% setting available)		ON: 725 ± 5 V, OFF: 710 ± 5 V (–5% or –10% setting available)	
Operation indication		LED ON (Lit)			
Maximum number of units for parallel interlocking operation[*2]		2 units			
Protective function	Internal power module overheat protection	Built-in relay specifications ・Cooling fin temperature: Relay operates at approximately 100°C or higher. ・Contact rating: 240 VAC 3 A (R load) 36 VDC 2 A (R load) ・Minimum load: 5 VDC 50 mA (R load)			
Operating environment	Operating ambient temperature	–10 to 50°C			
	Storage ambient temperature	–20 to 65°C			
	Operating ambient humidity	20% to 90% (with no condensation)			
	Vibration resistance	4.9 m/s^2 (0.5 G), 10 to 55 Hz			
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)			
Paint color		Munselle 5Y7/1 (except for cooling fan with aluminum base color)			

*1. To use the braking resistor (3G3AX-RAB / RBB / RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches to set the number of connected units.

11-2-2 External Dimensions

3G3AX-RBU21/RBU22/RBU41



Main circuit terminal
Terminal width 9, M4 screw

N	RB	P	P

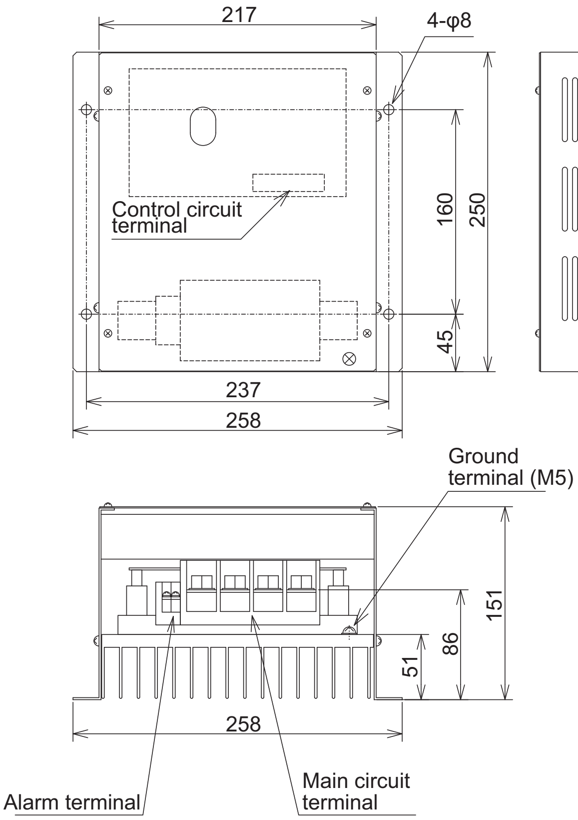
Control circuit terminal
Terminal width 6, M3 screw

SL1	SL2	MA1	MA2

Ground terminal
Terminal width 7, M3 screw

AL1	AL2	R1	R2

3G3AX-RBU23



Main circuit terminal
Terminal width 23, M8 screw

N	RB	P	P

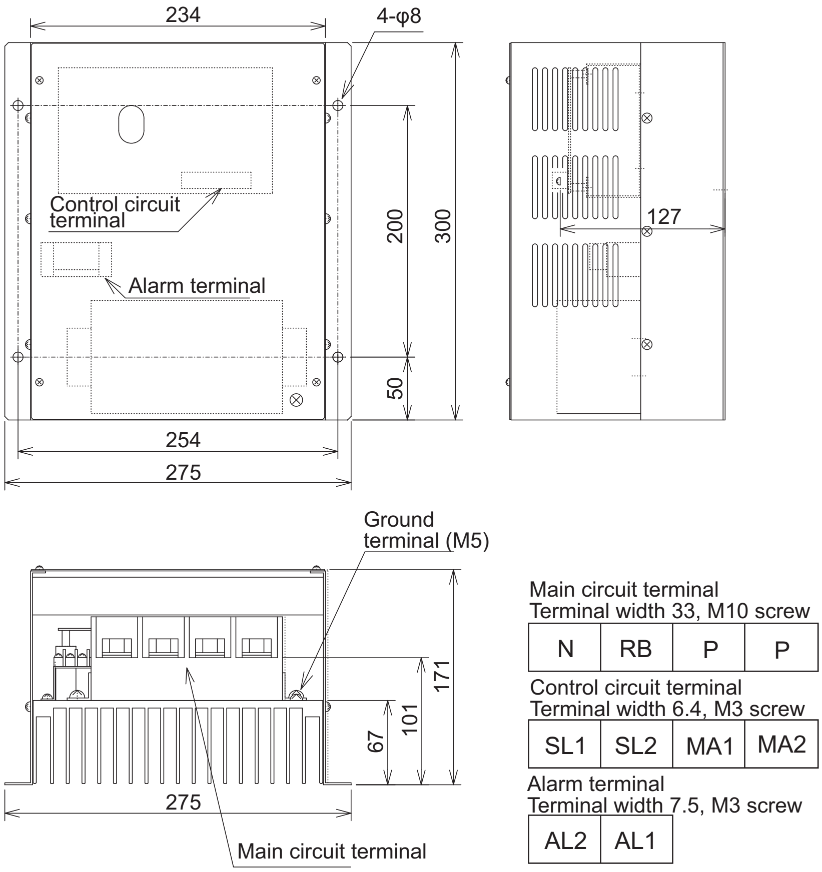
Control circuit terminal
Terminal width 6.4, M3 screw

SL1	SL2	MA1	MA2

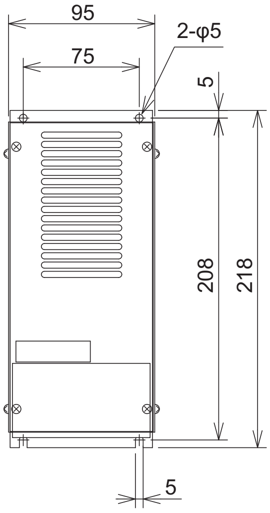
Alarm terminal
Terminal width 5.9, M3 screw

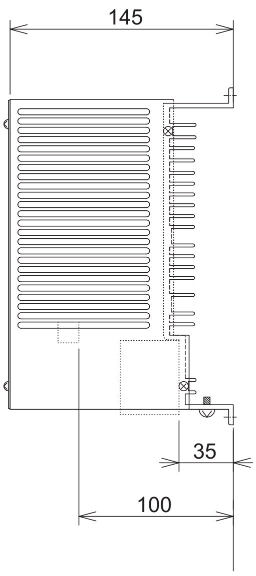
AL2	AL1

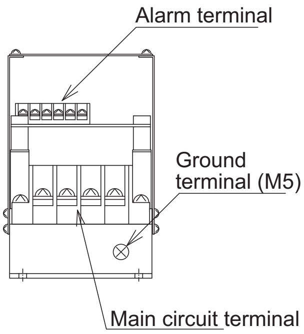
3G3AX-RBU24


234
4-φ8
Control circuit terminal
Alarm terminal
200
300
50
254
275
127
Ground terminal (M5)
171
101
67
275
Main circuit terminal
Main circuit terminal
Terminal width 33, M10 screw
N
RB
P
P
Control circuit terminal
Terminal width 6.4, M3 screw
SL1
SL2
MA1
MA2
Alarm terminal
Terminal width 7.5, M3 screw
AL2
AL1

3G3AX-RBU42







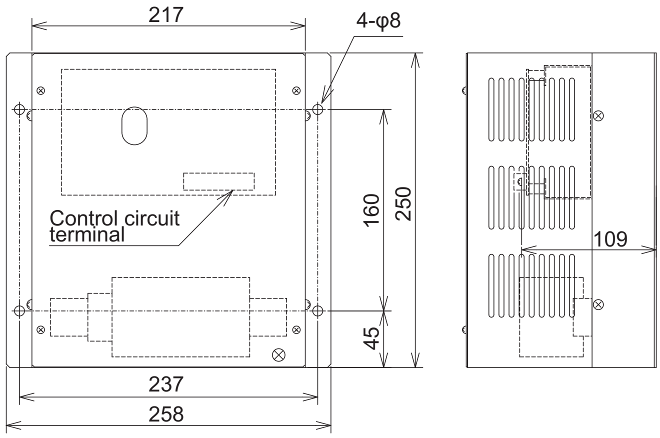
Main circuit terminal
Terminal width 13, M5 screw

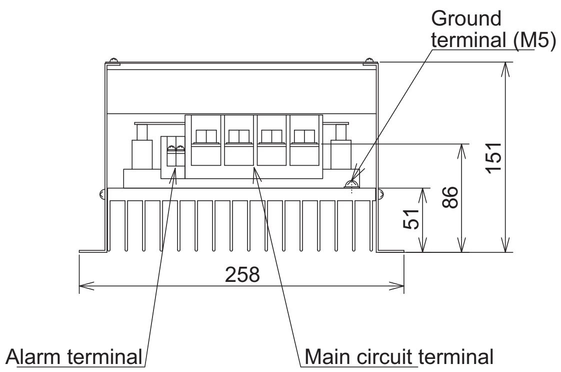
N	RB	P	P

Control circuit terminal
Terminal width 6, M3 screw

SL1	SL2	MA1	MA2	AL1	AL2

3G3AX-RBU43





Main circuit terminal
Terminal width 23, M8 screw

N	RB	P	P

Control circuit terminal
Terminal width 6.4, M3 screw

SL1	SL2	MA1	MA2

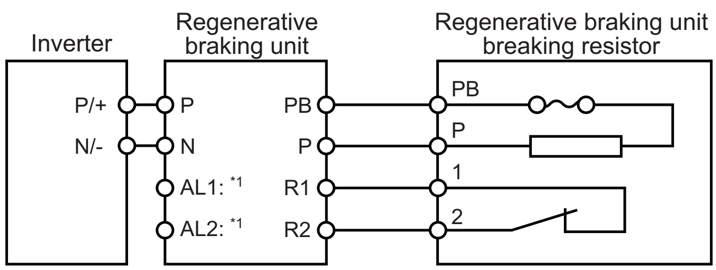
Alarm terminal
Terminal width 5.9, M3 screw

AL2	AL1

11-2-3 Connection Examples

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P, RB) and Regenerative Braking Unit Connection Terminal (P, N)* on page 2-57 in this manual. When you desire to shorten a motor deceleration time, use an inverter combined with a braking resistor.

Example of Connection



*1. Alarm output terminal for the regenerative braking unit
When a thermal relay for its built-in resistor or the braking resistor as an option is operated, set a circuit to shut the power supply of the inverter at the primary side.

Precautions for Correct Use

A thermal fuse is built in the braking resistor (RBA, RBB and RBC). After an alarm is issued from the thermal relay between terminals 1 and 2, overheat may result in a breakage of the thermal fuse. If the fuse is broken, the braking resistor can't be restored. Replace the braking resistor with new one.
Wire the alarm output terminals properly. When thermal abnormality is detected, stop the inverter operation and cool the braking resistor thoroughly. After that, start the inverter.

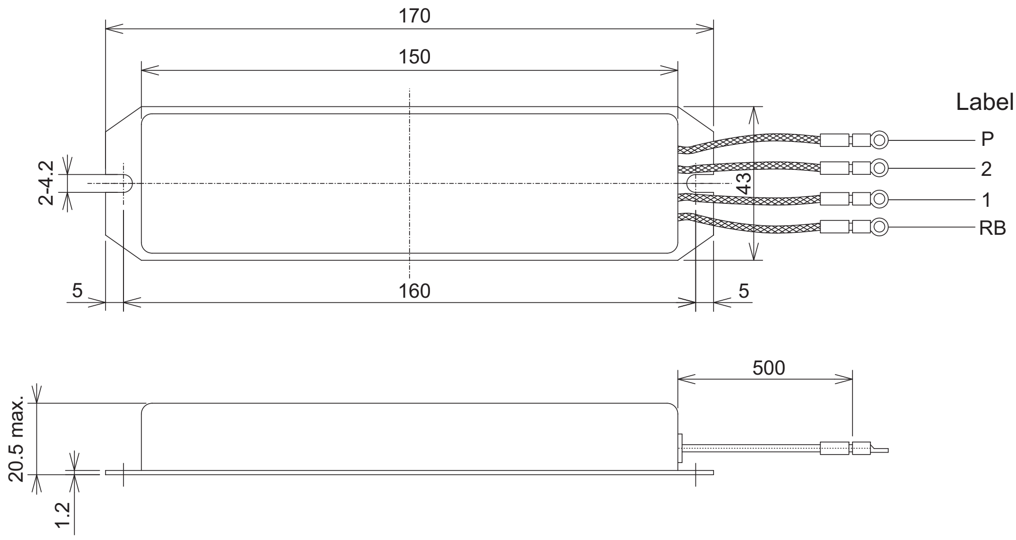
11-3 Braking Resistor (Model: 3G3AX-RBA / RBB / RBC□□□□)

11-3-1 Specifications

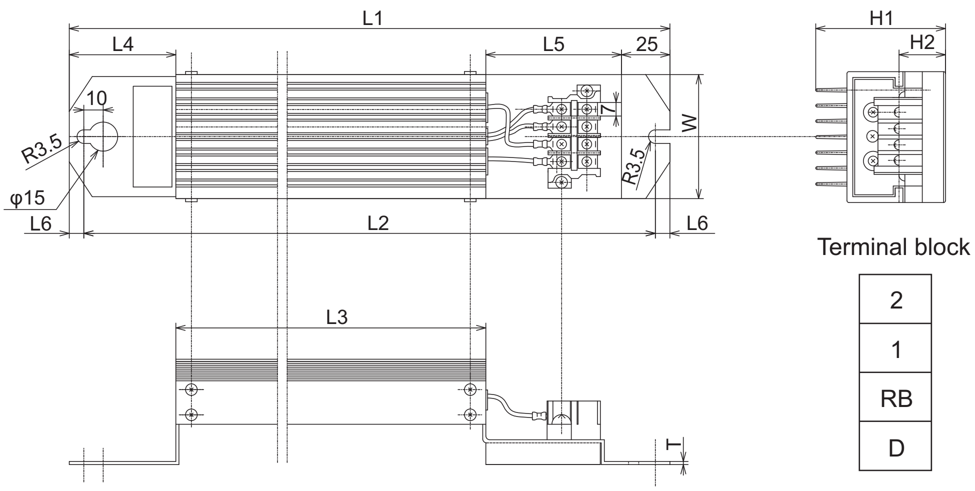
Model		Compact type (3G3AX-RBA□□□□)				Standard type (3G3AX-RBB□□□□)				Medium capacity type (3G3AX-RBC□□□□)		
		1201	**1202**	**1203**	**1204**	**2001**	**2002**	**3001**	**4001**	**4001**	**6001**	**12001**
Resistance	Capacity	120 W				200 W		300 W	400 W	400 W	600 W	1200 W
	Resistance [Ω]	180	100	50	35	180	100	50	35	50	35	17
Allowable braking frequency [%]		5	2.5	1.5	1.0	10	7.5			10		
Allowable continuous braking time [s]		20	12	5	3	30			20	10		
Weight [kg]		0.27				0.97		1.68	2.85	2.5	3.6	6.5
Error detection function		Built-in thermal (Contact capacity: 240 VAC 2 A max., minimum current: 5 mA) Normally ON (NC contact) Built-in thermal fuse (No resetting)								Built-in thermal relay Normally ON (NC contact) Contact capacity: 240 VAC 3 A (resistance load) 0.2 A (L load), 36 VDC 2 A (resistance load)		
General specifications	Operating ambient temperature	–10 to 50°C										
	Storage ambient temperature	–20 to 65°C										
	Operating ambient humidity	20% to 90% (with no condensation)										
	Vibration resistance	5.9 m/s^2 (0.6 G) 10 to 55 Hz										
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)										
	Cooling method	Self-cooling										

11-3-2 External Dimensions

3G3AX-RBA□□□□

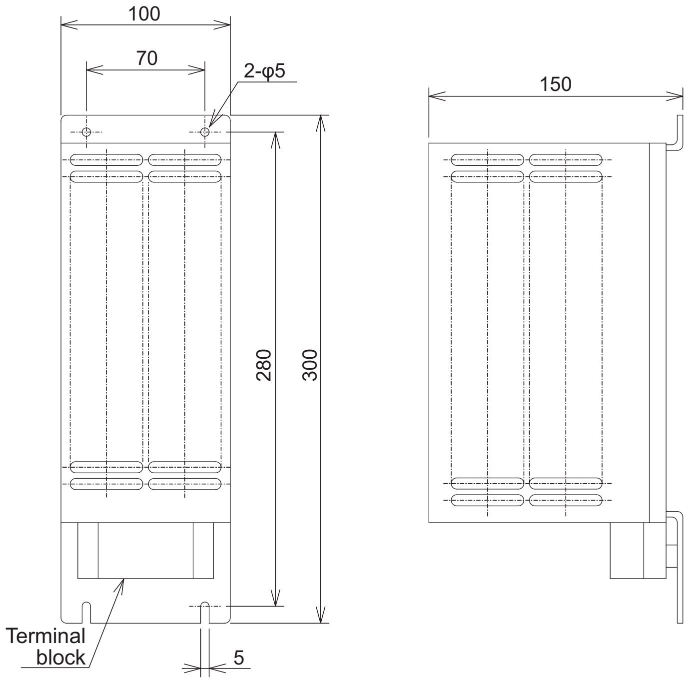


3G3AX-RBB□□□□



Model (3G3AX-□□□□□□□)	Rated capaci-ty [W]	Resist-ance [Ω]	Dimensions [mm]										Weight [kg]	Terminal screw
			L1	L2	L3	L	L5	L6	H1	H2	W	T		
RBB2001	200	180	310	295	160	55	70	7.5	67	12	64	1.6	0.97	M3.5
RBB2002	200	100	310	295	160	55	70	7.5	67	12	64	1.6	0.97	
RBB3001	300	50	470	455	320	55	70	7.5	67	12	64	1.6	1.68	
RBB4001	400	35	435	422	300	50	60	6.5	94	15	76	2	2.85	

3G3AX-RBC4001

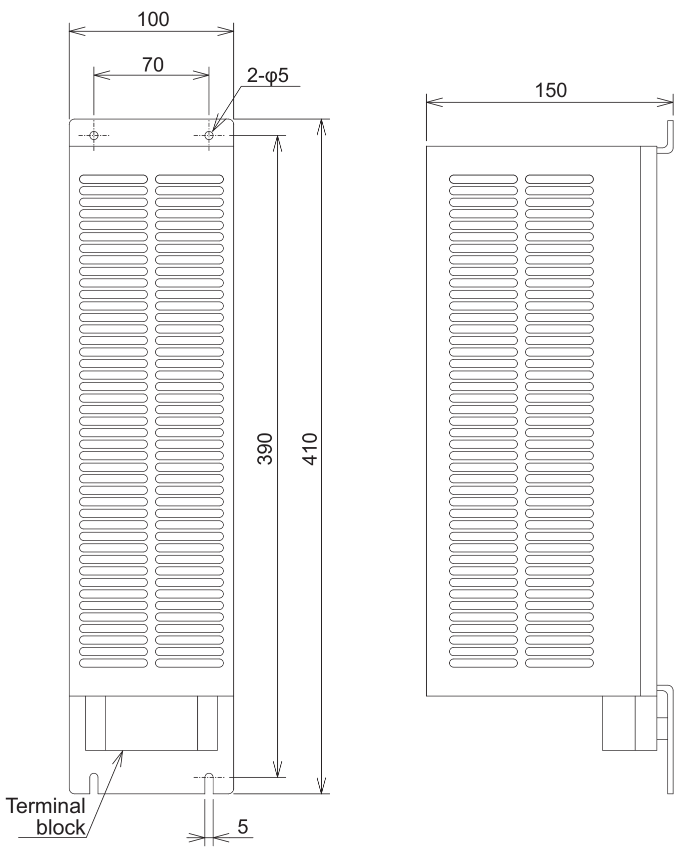


Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

3G3AX-RBC6001

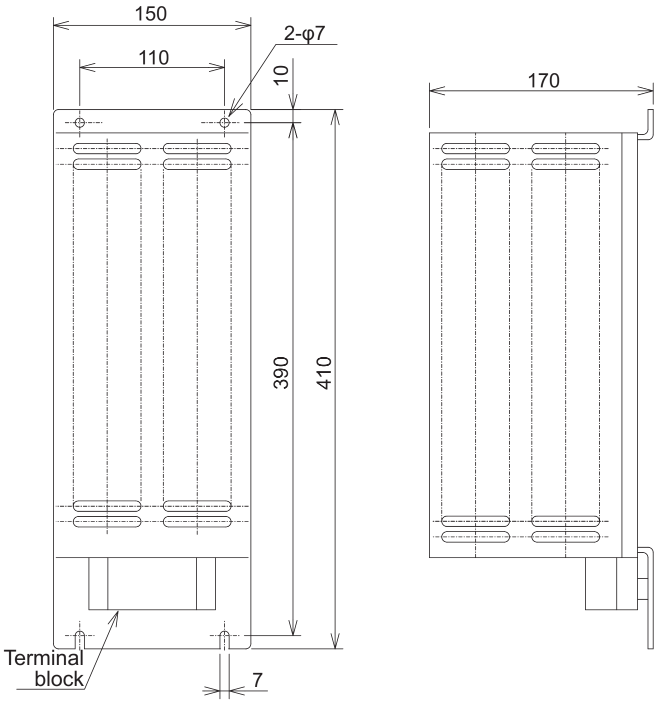


Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

3G3AX-RBC12001



Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

11-3-3 Connection Example

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P, RB) and Regenerative Braking Unit Connection Terminal (P, N)* on page 2-57 in this manual.

11-4 Regenerative Braking Unit and Braking Resistor Combination Selection Table

Select the combination of the regenerative braking unit(s) and the braking resistor(s) as follows, according to your inverter. If the usage rate exceeds 10% ED, or if you need a torque larger than the approximate braking torque, you need to follow the instruction provided in *A-1 Overview of Inverter Selection* on page A-2.

- Inverter:
  Select the model of your inverter.
  The table below assumes that your inverter is used in the heavy load mode and connected to a single motor with the same capacity. Make sure that the approximate braking torque in the table shows the assumed value per a motor with the same capacity at ND mode. When using this inverter at LD or VLD mode, you need to calculate the torque value by *dividing VLD by ND*.
- Operating conditions:
  Show the torque during deceleration and the deceleration time (in % ED) calculated as a percentage of the cycle time for 1 cycle of operation including the stop time.
- Regenerative braking unit/Braking resistor:
  Show the required model and number of units.
- Connection form:
  Shows the configuration of the regenerative braking unit(s) and braking resistor(s) illustrated in the Connection Form Table (page 11-22).
- Restrictions:
  Show the maximum deceleration time allowable for the combination shown here and the minimum resistance that can be connected to the inverter's built-in regenerative braking circuit or external regenerative braking unit(s).

11-4-1 200-V class Specifications

Inverter voltage class: 200-V

Inverter		Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	%ED [%]	Approximate braking torque [%]	Model (3G3AX-□□□□□)	No. of units	Model (3G3AX-□□□□□□□□)	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
0.4	A2004	3%	220%	Built into unit	-	RBA1201	1	1	20	50
		10.0%	220%		-	RBB2001	1	1	30	50
0.75	A2007	3.0%	120%	Built into unit	-	RBA1201	1	1	20	50
		10.0%	120%		-	RBB2001	1	1	30	50

Inverter		Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	%ED [%]	Approximate braking torque [%]	Model (3G3AX-□□□□□)	No. of units	Model (3G3AX-□□□□□□□)	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
1.5	A2015	2.5%	110%	Built into unit	-	RBA1202	1	1	12	35
		10.0%	215%		-	RBC4001	1	1	10	35
2.2	A2022	3.0%	150%	Built into unit	-	RBB3001	1	1	30	35
		10.0%	150%		-	RBC4001	1	1	10	35
3.7	A2037	3.0%	125%	Built into unit	-	RBB4001	1	1	20	35
		10.0%	125%		-	RBC6001	1	1	10	35
5.5	A2055	3%	120%	Built into unit	-	RBB3001	2	2	30	16
		10.0%	120%		-	RBC4001	2	2	10	16
7.5	A2075	3.0%	125%	Built into unit	-	RBB4001	2	2	20	10
		10.0%	125%		-	RBC6001	2	2	10	10
11	A2110	3.0%	125%	Built into unit	-	RBB4001	3	4	20	10
		10.0%	125%		-	RBC6001	3	4	10	10
15	A2150	3.0%	130%	Built into unit	-	RBC12001	2	2	10	7.5
		10.0%	130%		-	RBC12001	2	2	10	7.5
18.5	A2185	3.0%	105%	Built into unit	-	RBC12001	2	2	10	7.5
		10.0%	105%		-	RBC12001	2	2	10	7.5
22	A2220	3.0%	130%	Built into unit	-	RBC12001	3	4	10	5
		10.0%	130%		-	RBC12001	3	4	10	5
30	A2300	3.0%	160%	RBU24	1	RBC12001	5	11	10	2
		10.0%	160%	RBU24	1	RBC12001	5	11	10	2
37	A2370	3.0%	130%	RBU24	1	RBC12001	5	11	10	2
		10.0%	130%	RBU24	1	RBC12001	5	11	10	2
45	A2450	3.0%	130%	RBU24	1	RBC12001	6	12	10	2
		10.0%	130%	RBU24	1	RBC12001	6	12	10	2
55	A2550	3.0%	120%	RBU24	1	RBC12001	7	13	10	2
		10.0%	120%	RBU24	1	RBC12001	7	13	10	2

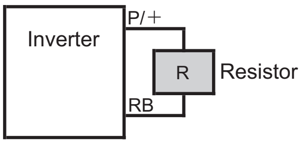
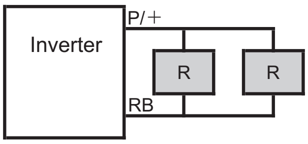
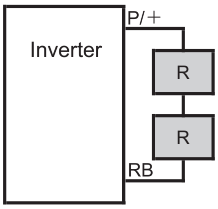
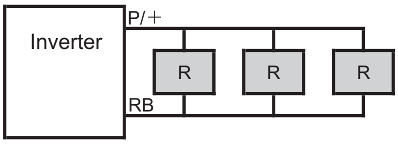
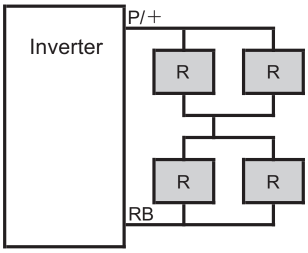
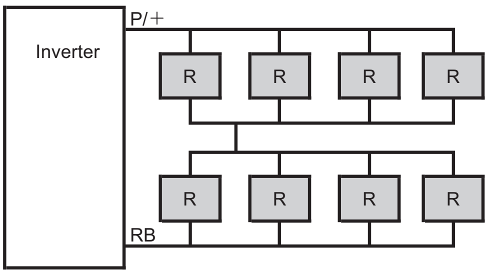
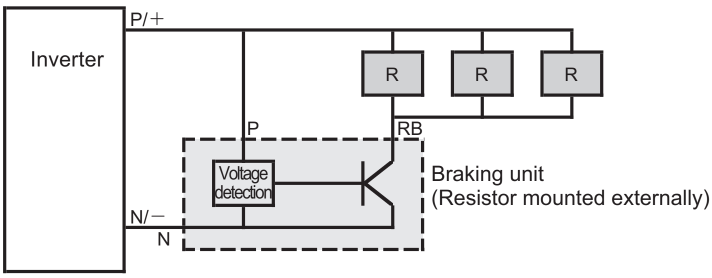
11-4-2 400-V class Specifications

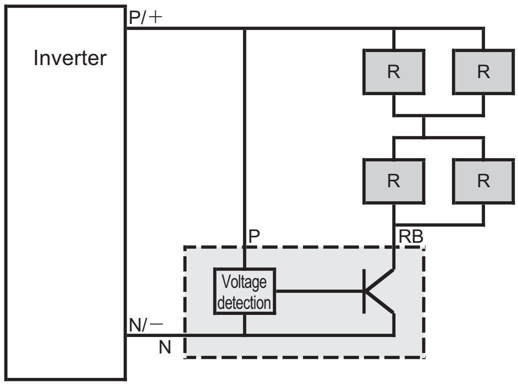
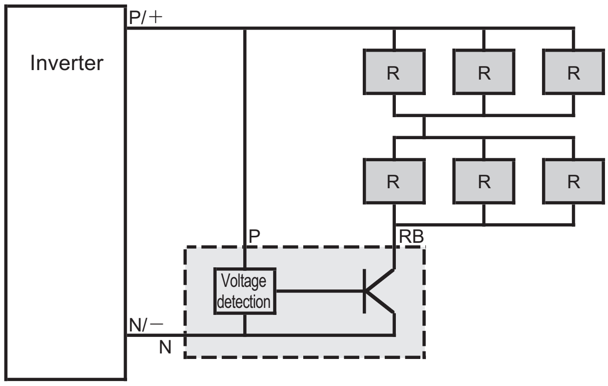
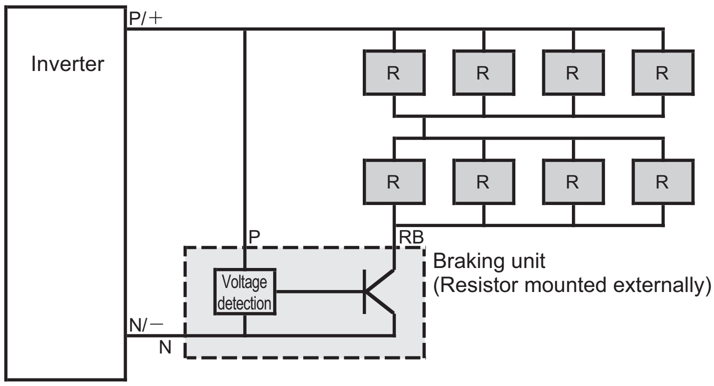
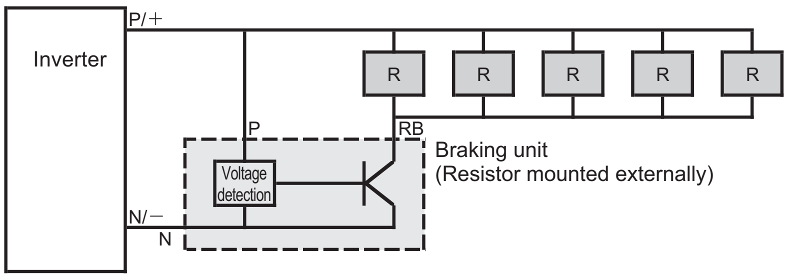
Inverter voltage class: 400-V

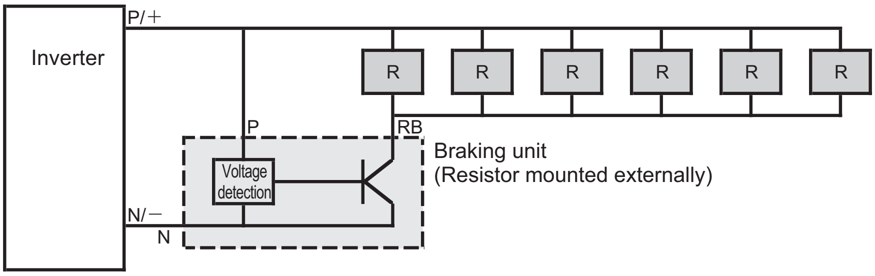
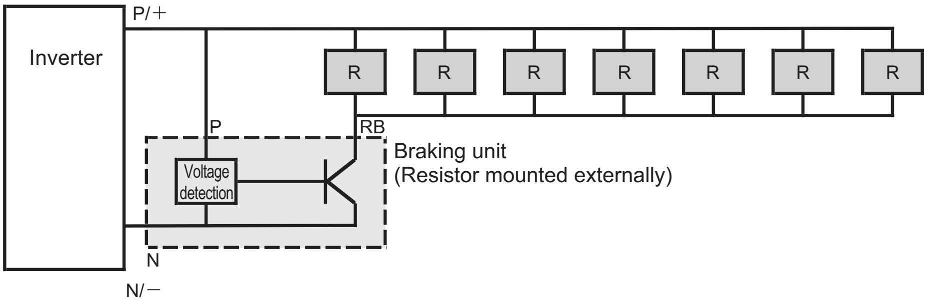
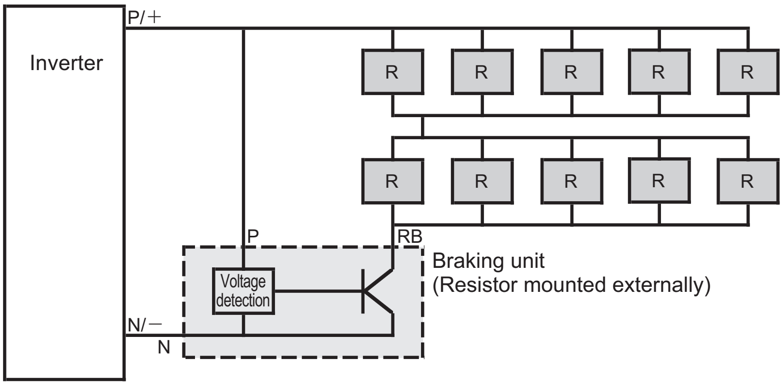
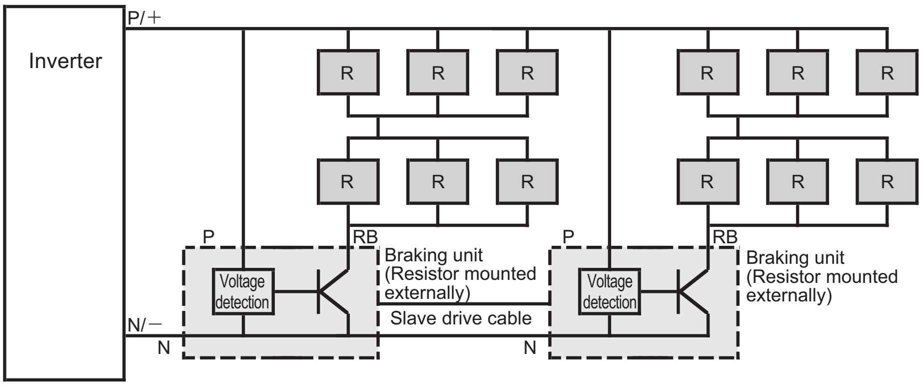
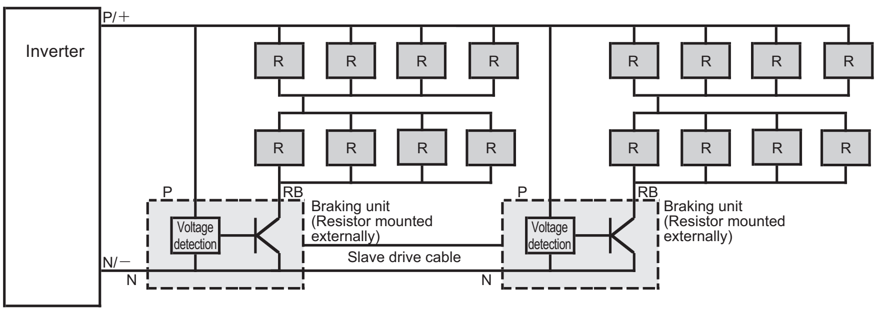
Inverter		Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	%ED [%]	Approximate braking torque [%]	Model (3G3AX-□□□□□)	No. of units	Model (3G3AX-□□□□□□□□)	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
0.75	A4007	3.0%	220%	Built into unit	-	RBA1201	2	3	20	100
		10.0%	220%		-	RBB2001	2	3	30	100
1.5	A4015	3.0%	120%	Built into unit	-	RBA1201	2	3	20	100
		10.0%	120%		-	RBB2001	2	3	30	100
2.2	A4022	2.5%	150%	Built into unit	-	RBA1202	2	3	12	100
		10.0%	220%		-	RBC4001	2	3	10	100
3.7	A4037	3.0%	175%	Built into unit	-	RBB3001	2	3	30	70
		10.0%	175%		-	RBC4001	2	3	10	70
5.5	A4055	3.0%	120%	Built into unit	-	RBB3001	2	3	30	70
		10.0%	120%		-	RBC4001	2	3	10	70
7.5	A4075	3.0%	125%	Built into unit	-	RBB4001	2	3	20	35
		10.0%	125%		-	RBC6001	2	3	10	35
11	A4110	3.0%	120%	Built into unit	-	RBB3001	4	5	30	35
		10.0%	120%		-	RBC4001	4	5	10	35
15	A4150	3.0%	125%	Built into unit	-	RBB4001	4	5	20	24
		10.0%	125%		-	RBC6001	4	5	10	24
18.5	A4185	3.0%	140%	Built into unit	-	RBB3001	8	6	30	24
		10.0%	140%		-	RBC4001	8	6	10	24
22	A4220	3.0%	120%	Built into unit	-	RBB3001	8	6	30	20
		10.0%	120%		-	RBC4001	8	6	10	20
30	A4300	10.0%	100%	Built into unit	-	RBC12001	4	5	10	15
		10.0%	150%	RBU42	1	RBC12001	6	9	10	10
37	A4370	3.0%	100%	Built into unit	-	RBC12001	4	5	10	15
		10.0%	155%	RBU43	1	RBC12001	6	9	10	6
45	A4450	3.0%	130%	RBU43	1	RBC12001	6	9	10	6
		10.0%	130%	RBU43	1	RBC12001	6	9	10	6
55	A4550	3.0%	140%	RBU43	1	RBC12001	8	10	10	6
		10.0%	140%	RBU43	1	RBC12001	8	10	10	6
75	B4750	3.0%	130%	RBU43	1	RBC12001	10	14	10	6
		10.0%	130%	RBU43	1	RBC12001	10	14	10	6
90	B4900	3.0%	105%	RBU43	1	RBC12001	10	14	10	6
		10.0%	105%	RBU43	1	RBC12001	10	14	10	6
110	B411K	3.0%	105%	RBU43	2	RBC12001	12	15	10	6
		10.0%	105%	RBU43	2	RBC12001	12	15	10	6

Inverter		Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	%ED [%]	Approximate braking torque [%]	Model (3G3AX-□□□□□)	No. of units	Model (3G3AX-□□□□□□□□)	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
132	B413K	3.0%	115%	RBU43	2	RBC12001	16	16	10	6
		10.0%	115%	RBU43	2	RBC12001	16	16	10	6

11-4-3 Connection Form Table

No.	Connection form	
1	1 resistor unit	
2	2 resistor units connected in parallel	
3	2 resistor units series-connected	
4	3 resistor units connected in parallel	
5	2 groups of 2 parallel resistor units are series-connected	
6	2 groups of 4 parallel resistor units are series-connected	
7	1 braking unit and 3 resistor units connected in parallel	

No.	Connection form	
8	1 Braking unit and 2 groups of 2 parallel resistor units are series-connected	
9	1 Braking unit and 2 groups of 3 parallel resistor units are series-connected	
10	1 Braking unit and 2 groups of 4 parallel resistor units are series-connected	
11	1 Braking unit and 5 resistor units connected in parallel	

No.	Connection form	
12	1 Braking unit and 6 resistor units connected in parallel	
13	1 Braking unit and 7 resistor units connected in parallel	
14	1 Braking unit and 2 groups of 5 parallel resistor units are series-connected	
15	2 Braking units and 2 groups of 3 parallel resistor units are each series-connected	
16	2 Braking units and 2 groups of 4 parallel resistor units are each series-connected	

11-5 DC Reactor (Model: 3G3AX-DL□□□□)

11-5-1 200-V class Specifications

Inverter voltage class: 200-V

DC reactor specifications

- Operating ambient temperature: –10 to 50°C
- Operating ambient humidity: 20% to 90%
- Location: At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)

Inverter					DC reactor specifications		
Max. applicable motor capacity [kW]	(3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
0.4	A2004	ND	0.4	3.3	DL2004	10.7	8
		LD	0.75	3.9	DL2007	6.75	15
		VLD	0.75	3.9			
0.75	A2007	ND	0.75	5.5	DL2007	6.75	15
		LD	1.5	7.2	DL2015	3.51	25
		VLD	1.5	7.2			
1.5	A2015	ND	1.5	8.3	DL2015	3.51	25
		LD	2.2	10.8	DL2022	2.51	35
		VLD	2.2	10.8			
2.2	A2022	ND	2.2	12	DL2022	2.51	35
		LD	3.7	13.9	DL2037	1.60	45
		VLD	3.7	13.9			
3.7	A2037	ND	3.7	18	DL2037	1.60	45
		LD	5.5	23	DL2055	1.11	55
		VLD	5.5	23			
5.5	A2055	ND	5.5	26	DL2055	1.11	55
		LD	7.5	37	DL2075	0.84	95
		VLD	7.5	37			
7.5	A2075	ND	7.5	35	DL2075	0.84	95
		LD	11	48	DL2110	0.59	80
		VLD	11	48			
11	A2110	ND	11	51	DL2110	0.59	80
		LD	15	64	DL2150	0.44	135
		VLD	15	64			
15	A2150	ND	15	70	DL2150	0.44	135
		LD	18.5	80	DL2220	0.30	200
		VLD	18.5	80			
18.5	A2185	ND	18.5	84	DL2220	0.30	200
		LD	22	94			
		VLD	22	94			

Inverter					DC reactor specifications		
Max. applicable motor capacity [kW]	(3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
22	A2220	ND	22	105	DL2220	0.30	200
		LD	30	120	DL2300	0.23	220
		VLD	30	120			
30	A2300	ND	30	133	DL2300	0.23	220
		LD	37	150	DL2370	0.19	275
		VLD	37	150			
37	A2370	ND	37	160	DL2370	0.19	275
		LD	45	186	DL2450	0.16	335
		VLD	45	186			
45	A2450	ND	45	200	DL2450	0.16	335
		LD	55	240	DL2550	0.13	360
		VLD	55	240			
55	A2550	ND	55	242	DL2550	0.13	360
		LD	75	280	-	-	-
		VLD	75	280			

11-5-2 400-V class Specifications

Inverter voltage class: 400-V

DC reactor specifications

- Operating ambient temperature: –10 to 50°C
- Operating ambient humidity: 20% to 90%
- Location: At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)

Inverter					DC reactor specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
0.75	A4007	ND	0.75	2.8	DL4007	27.0	15
		LD	1.5	4.3	DL4015	14.0	25
		VLD	1.5	4.3			
1.5	A4015	ND	1.5	4.2	DL4015	14.0	25
		LD	2.2	5.9	DL4022	10.1	35
		VLD	2.2	5.9			
2.2	A4022	ND	2.2	5.8	DL4022	10.1	35
		LD	3.7	8.1	DL4037	6.4	45
		VLD	3.7	8.1			
3.7	A4037	ND	3.7	9.8	DL4037	6.4	45
		LD	5.5	13.3	DL4055	4.41	55
		VLD	5.5	13.3			

Inverter					DC reactor specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
5.5	A4055	ND	5.5	15	DL4055	4.41	55
		LD	7.5	20	DL4075	3.35	95
		VLD	7.5	20			
7.5	A4075	ND	7.5	21	DL4075	3.35	95
		LD	11	24	DL4110	2.33	80
		VLD	11	24			
11	A4110	ND	11	28	DL4110	2.33	80
		LD	15	32	DL4150	1.75	135
		VLD	15	32			
15	A4150	ND	15	35	DL4150	1.75	135
		LD	18.5	41	DL4220	1.20	200
		VLD	18.5	41			
18.5	A4185	ND	18.5	42	DL4220	1.20	200
		LD	22	47			
		VLD	22	47			
22	A4220	ND	22	53	DL4220	1.20	200
		LD	30	63	DL4300	0.92	230
		VLD	30	63			
30	A4300	ND	30	64	DL4300	0.92	230
		LD	37	77	DL4370	0.74	275
		VLD	37	77			
37	A4370	ND	37	83	DL4370	0.74	275
		LD	45	94	DL4450	0.61	340
		VLD	45	94			
45	A4450	ND	45	100	DL4450	0.61	340
		LD	55	116	DL4550	0.5	400
		VLD	55	116			
55	A4550	ND	55	121	DL4550	0.5	400
		LD	75	149	-	-	-
		VLD	75	149			

11-5-3 External Dimensions

Inverter input power supply	Model (3G3AX-□□□□□□)	Fig. No.	Applica-ble motor capacity [kW]	Dimensions [mm]									Weight [kg]	Standard applica-ble wire
				W	D	H	A	B	X	Y	C	K		
3-phase/ single-phase 200 VAC	DL2002	Fig. 1	0.2	66	90	98	-	85	56	72	5.2 ×8	M4	0.8	1.25 mm^2 min.
	DL2004		0.4	66	90	98	-	95	56	72	5.2 x 8	M4	1.0	1.25 mm^2 min.
	DL2007		0.75	66	90	98	-	105	56	72	5.2 x 8	M4	1.3	2 mm^2 min.
	DL2015		1.5	66	90	98	-	115	56	72	5.2 x 8	M4	1.6	2 mm^2 min.
	DL2022		2.2	86	100	116	-	105	71	80	6 x 9	M4	2.1	2 mm^2 min.
	DL2037		3.7	86	100	118	-	120	71	80	6 x 9	M4	2.6	3.5 mm^2 min.
	DL2055	Fig. 2	5.5	111	100	210	-	110	95	80	7 x 11	M5	3.6	8 mm^2 min.
	DL2075		7.5	111	100	212	-	120	95	80	7 x 11	M6	3.9	14 mm^2 min.
	DL2110		11	146	120	252	-	110	124	96	7 x 11	M6	6.5	22 mm^2 min.
	DL2150		15	146	120	256	-	120	124	96	7 x 11	M8	7.0	38 mm^2 min.
	DL2220	Fig. 3	18.5, 22	120	175	356	140	145	98	151	7 x 11	M8	9.0	60 mm^2 min.
	DL2300		30	120	175	386	155	150	98	151	7 x 11	M8	13.0	38 mm^2 x 2 min.
	DL2370		37	120	175	390	155	150	98	151	7 x 11	M10	13.5	38 mm^2 x 2 min.
	DL2450		45	160	190	420	180	150	120	168	7 x 11	M10	19.0	60 mm^2 x 2 min.
	DL2550		55	160	190	424	180	180	120	168	7 x 11	M12	24.0	80 mm^2 x 2 min.

Inverter input power supply	Model (3G3AX-□□□□□□)	Fig. No.	Applicable motor capacity [kW]	Dimensions [mm]									Weight [kg]	Standard applicable wire
				W	D	H	A	B	X	Y	C	K		
3-phase 400 VAC	DL4007	Fig. 1	0.75	66	90	98	-	95	56	72	5.2 x 8	M4	1.1	1.25 mm² min.
	DL4015		1.5	66	90	98	-	115	56	72	5.2 x 8	M4	1.6	2 mm² min.
	DL4022		2.2	86	100	116	-	105	71	80	6 x 9	M4	2.1	2 mm² min.
	DL4037		3.7	86	100	116	-	120	71	80	6 x 9	M4	2.6	2 mm² min.
	DL4055		5.5	111	100	138	-	110	95	80	7 x 11	M4	3.6	3.5 mm² min.
	DL4075		7.5	111	100	138	-	115	95	80	7 x 11	M4	3.9	3.5 mm² min.
3-phase 400 VAC	DL4110	Fig. 2	11	146	120	250	-	105	124	96	7 x 11	M5	5.2	5.5 mm² min.
	DL4150		15	146	120	252	-	120	124	96	7 x 11	M6	7.0	14 mm² min.
	DL4220	Fig. 3	18.5, 22	120	175	352	140	145	98	151	7 x 11	M6	9.5	22 mm² min.
	DL4300		30	120	175	356	140	145	98	151	7 x 11	M8	9.5	30 mm² min.
	DL4370		37	120	175	386	155	150	98	151	7 x 11	M8	13.5	38 mm² min.
	DL4450		45	160	190	416	180	145	120	168	7 x 11	M8	16.5	60 mm² min.
	DL4550		55	160	190	416	190	170	120	168	7 x 11	M8	23.0	38 mm² x 2 min.

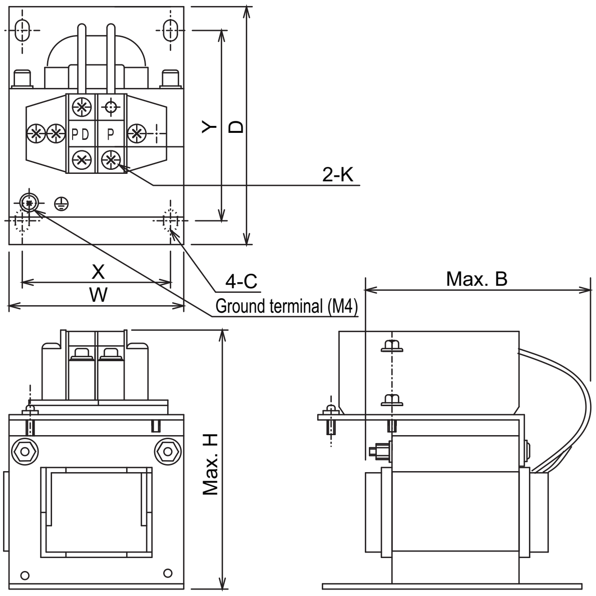


Fig. 1

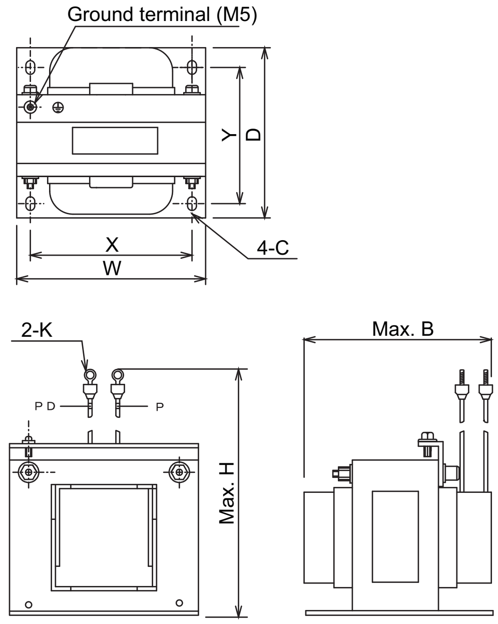


Fig. 2

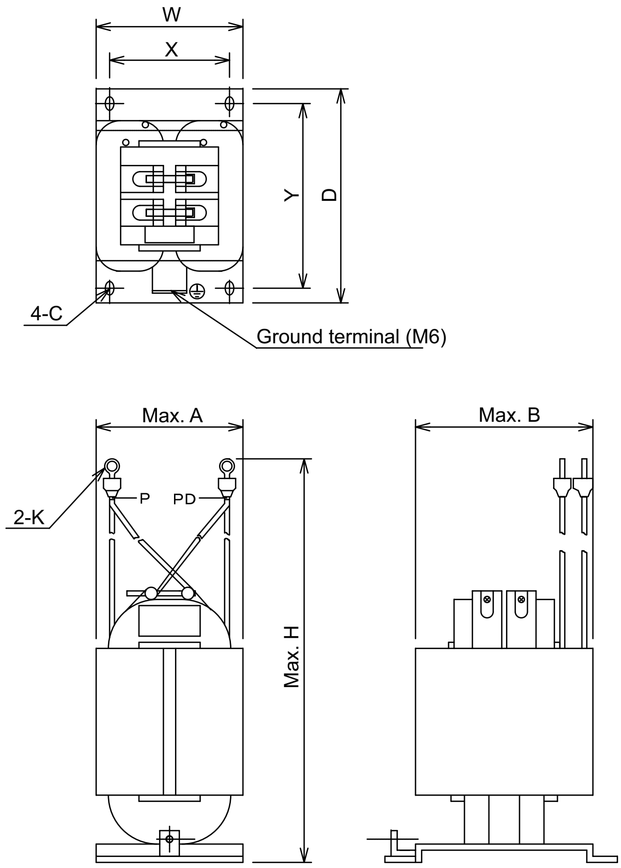
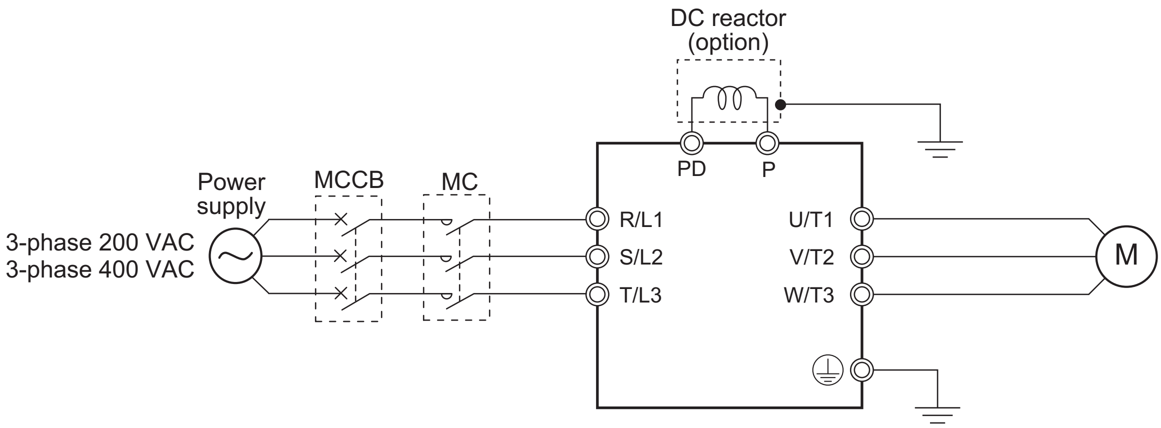


Fig. 3

11-5-4 Connection Examples



DC Reactor Connection Terminals (PD, P)

- These terminals are used to connect the optional DC reactor for power factor improvement.
  By factory setting, a short-circuit bar is connected between the terminals PD and P. Before connecting the DC reactor, remove this short-circuit bar.
- The length of the DC reactor connection cable must be 5 m or shorter.
- The DC reactor has no polarity.

Precautions for Correct Use

Remove the short-circuit bar only if you connect the DC reactor for use.
If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

11-6 AC Reactor (Model: 3G3AX-AL□□□□)

11-6-1 200-V class Specifications

Inverter voltage class: 200-V

AC reactor specifications

- Operating ambient temperature: –10 to 50°C
- Operating ambient humidity: 20% to 90%
- Location: At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)

Inverter					AC reactor specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
0.4	A2004	ND	0.4	3.3	AL2025	2.8	12
		LD	0.75	3.9			
		VLD	0.75	3.9			
0.75	A2007	ND	0.75	5.5	AL2025	2.8	12
		LD	1.5	7.2			
		VLD	1.5	7.2			
1.5	A2015	ND	1.5	8.3	AL2025	2.8	12
		LD	2.2	10.8	AL2055	0.88	25
		VLD	2.2	10.8			
2.2	A2022	ND	2.2	12	AL2055	0.88	25
		LD	3.7	13.9			
		VLD	3.7	13.9			
3.7	A2037	ND	3.7	18	AL2055	0.88	25
		LD	5.5	23	AL2110	0.35	50
		VLD	5.5	23			
5.5	A2055	ND	5.5	26	AL2110	0.35	50
		LD	7.5	37			
		VLD	7.5	37			
7.5	A2075	ND	7.5	35	AL2110	0.35	50
		LD	11	48	AL2220	0.18	50
		VLD	11	48			
11	A2110	ND	11	51	AL2220	0.18	50
		LD	15	64			
		VLD	15	64			
15	A2150	ND	15	70	AL2220	0.18	50
		LD	18.5	80	AL2330	0.09	85
		VLD	18.5	80			
18.5	A2185	ND	18.5	84	AL2330	0.09	85
		LD	22	94			
		VLD	22	94			

Inverter					AC reactor specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
22	A2220	ND	22	105	AL2330	0.09	85
		LD	30	120	AL2500	0.071	95
		VLD	30	120			
30	A2300	ND	30	133	AL2500	0.071	95
		LD	37	150			
		VLD	37	150			
37	A2370	ND	37	160	AL2500	0.071	95
		LD	45	186	AL2750	0.046	100
		VLD	45	186			
45	A2450	ND	45	200	AL2750	0.046	100
		LD	55	240			
		VLD	55	240			
55	A2550	ND	55	242	AL2750	0.046	100
		LD	75	280	-	-	-
		VLD	75	280			

11-6-2 400-V class Specifications

Inverter voltage class: 400-V

AC reactor specifications

- Operating ambient temperature: –10 to 50°C
- Operating ambient humidity: 20% to 90%
- Location: At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)

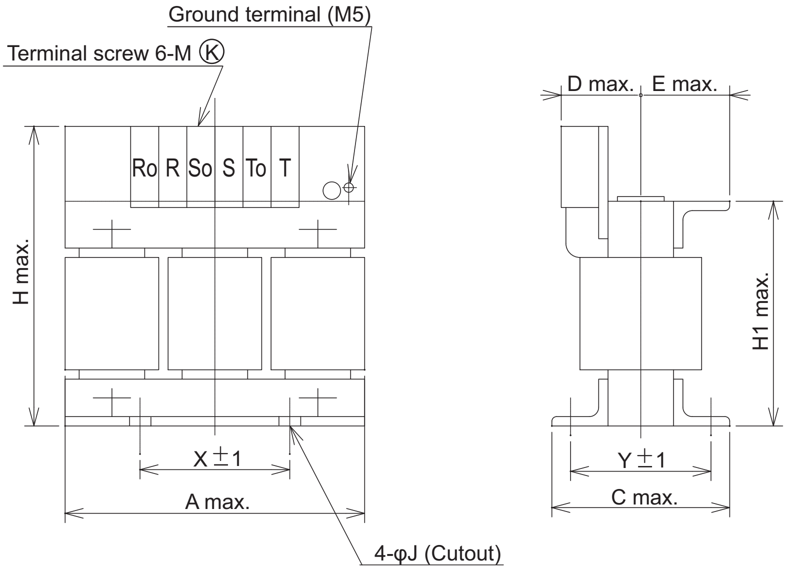
Inverter					AC reactor specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
0.75	A4007	ND	0.75	2.8	AL4025	7.7	12
		LD	1.5	4.3			
		VLD	1.5	4.3			
1.5	A4015	ND	1.5	4.2	AL4025	7.7	12
		LD	2.2	5.9	AL4055	3.5	25
		VLD	2.2	5.9			
2.2	A4022	ND	2.2	5.8	AL4055	3.5	25
		LD	3.7	8.1			
		VLD	3.7	8.1			
3.7	A4037	ND	3.7	9.8	AL4055	3.5	25
		LD	5.5	13.3	AL4110	1.3	50
		VLD	5.5	13.3			

Inverter					AC reactor specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□□)	Inductance [mH]	Heat generation [W]
5.5	A4055	ND	5.5	15	AL4110	1.3	50
		LD	7.5	20			
		VLD	7.5	20			
7.5	A4075	ND	7.5	21	AL4110	1.3	50
		LD	11	24	AL4220	0.74	60
		VLD	11	24			
11	A4110	ND	11	28	AL4220	0.74	60
		LD	15	32			
		VLD	15	32			
15	A4150	ND	15	35	AL4220	0.74	60
		LD	18.5	41	AL4330	0.36	90
		VLD	18.5	41			
18.5	A4185	ND	18.5	42	AL4330	0.36	90
		LD	22	47			
		VLD	22	47			
22	A4220	ND	22	53	AL4330	0.36	90
		LD	30	63	AL4500	0.29	95
		VLD	30	63			
30	A4300	ND	30	64	AL4500	0.29	95
		LD	37	77			
		VLD	37	77			
37	A4370	ND	37	83	AL4500	0.29	95
		LD	45	94	AL4750	0.19	100
		VLD	45	94			
45	A4450	ND	45	100	AL4750	0.19	100
		LD	55	116			
		VLD	55	116			
55	A4550	ND	55	121	AL4750	0.19	100
		LD	75	149	-	-	-
		VLD	75	149			

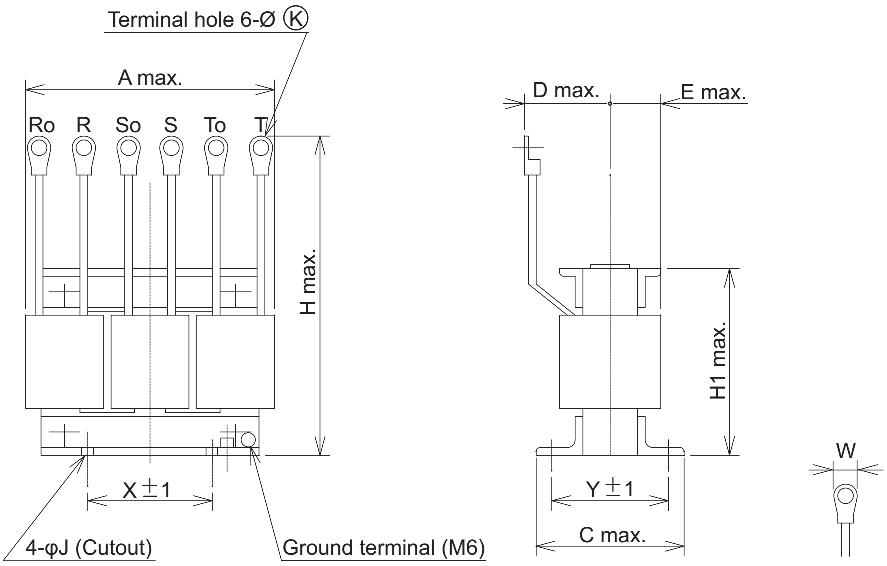
11-6-3 External Dimensions

Inverter input power supply	Model (3G3AX-□□□□□□)	Applicable motor capacity [kW]	Dimensions [mm]											Weight [kg]
			A	C	D	E	H	H1	X	Y	J	K	W	
3-phase 200 VAC	AL2025	0.2 to 1.5	120	82	60	40	150	94	50	67	6	4.0	9.5	2.8
	AL2055	2.2, 3.7	120	98	60	40	150	94	50	75	6	4.0	9.5	4.0
	AL2110	5.5, 7.5	150	103	70	55	170	108	60	80	6	5.3	12.0	5.0
	AL2220	11, 15	180	113	75	55	190	140	90	90	6	8.4	16.5	10.0
	AL2330	18.5, 22	180	113	85	60	230	140	125	90	6	8.4	22.0	11.0
	AL2500	30, 37	260	113	85	60	290	202	100	90	7	8.4	27.0	19.0
	AL2750	45, 55	260	144	110	80	290	207	125	112	7	8.4	28.5	25.0
3-phase 400 VAC	AL4025	0.4 to 1.5	130	82	60	40	150	94	50	67	6	4	9.5	2.7
	AL4055	2.2, 3.7	130	98	60	40	150	94	50	75	6	5	12.5	4.0
	AL4110	5.5, 7.5	150	116	75	55	170	106	60	98	6	5	12.5	6.0
	AL4220	11, 15	180	103	75	55	190	140	100	80	6	5.3	12.0	10.0
	AL4330	18.5, 22	180	123	85	60	230	140	100	100	6	6.4	16.5	11.5
	AL4500	30, 37	260	113	85	60	290	202	100	90	7	8.4	22.0	19.0
	AL4750	45, 55	260	146	110	80	290	207	125	112	7	8.4	22.0	25.0

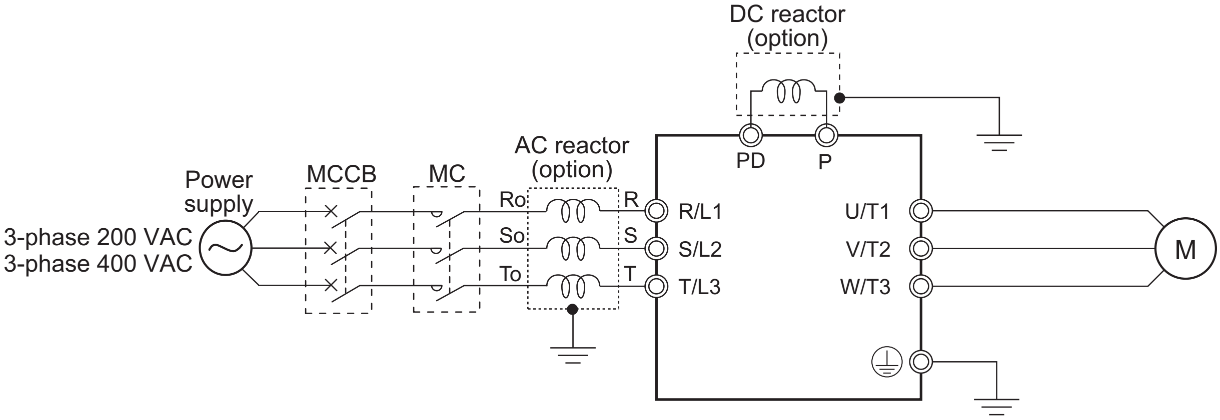
3G3AX-AL2025/AL2055/AL4025/AL4055/AL4110



3G3AX-AL2110/AL2220/AL2330/AL2500/AL2750/AL4220/AL4330/AL4500/AL4750



11-6-4 Connection Examples



11-7 Input Noise Filter (Model: 3G3AX-NFI□□)

11-7-1 200-V class Specifications

Inverter voltage class: 200-V

Input noise filter specifications

- Leakage current (at 60 Hz): 1.5 mA max. (250 VAC)
- Max. input voltage: 250 VAC+10%

Inverter					Input noise filter specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input current (at 50°C)	Heat generation [W]
0.4	A2004	ND	0.4	3.3	NFI21	6 A	3
		LD	0.75	3.9			
		VLD	0.75	3.9			
0.75	A2007	ND	0.75	5.5	NFI21	6A	3
		LD	1.5	7.2	NFI22	10 A	4
		VLD	1.5	7.2			
1.5	A2015	ND	1.5	8.3	NFI22	10A	4
		LD	2.2	10.8	NFI23	20 A	6
		VLD	2.2	10.8			
2.2	A2022	ND	2.2	12	NFI23	20A	6
		LD	3.7	13.9			
		VLD	3.7	13.9			
3.7	A2037	ND	3.7	18	NFI23	20A	6
		LD	5.5	23	NFI24	30 A	9
		VLD	5.5	23			
5.5	A2055	ND	5.5	26	NFI24	30A	9
		LD	7.5	37	NFI25	40 A	12
		VLD	7.5	37			
7.5	A2075	ND	7.5	35	NFI25	40A	12
		LD	11	48	NFI26	60 A	17
		VLD	11	48			
11	A2110	ND	11	51	NFI26	60A	17
		LD	15	64	NFI27	80 A	21
		VLD	15	64			
15	A2150	ND	15	70	NFI27	80A	21
		LD	18.5	80	NFI28	100 A	23
		VLD	18.5	80			
18.5	A2185	ND	18.5	84	NFI28	100A	23
		LD	22	94	NFI29	150 A	45
		VLD	22	94			

Inverter					Input noise filter specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input current (at 50°C)	Heat generation [W]
22	A2220	ND	22	105	NFI29	150A	45
		LD	30	120			
		VLD	30	120			
30	A2300	ND	30	133	NFI29	150A	45
		LD	37	150	NFI2A	200 A	50
		VLD	37	150			
37	A2370	ND	37	160	NFI2A	200A	50
		LD	45	186	NFI2B	250 A	68
		VLD	45	186			
45	A2450	ND	45	200	NFI2B	250A	68
		LD	55	240	NFI2C	300 A	56
		VLD	55	240			
55	A2550	ND	55	242	NFI2C	300A	56
		LD	75	280	-	-	-
		VLD	75	280			

11-7-2 400-V class Specifications

Inverter voltage class: 400-V

Input noise filter specifications

- Leakage current (at 60 Hz): 7.5 mA max. (480 VAC)
- Max. input voltage: 480 VAC+10%

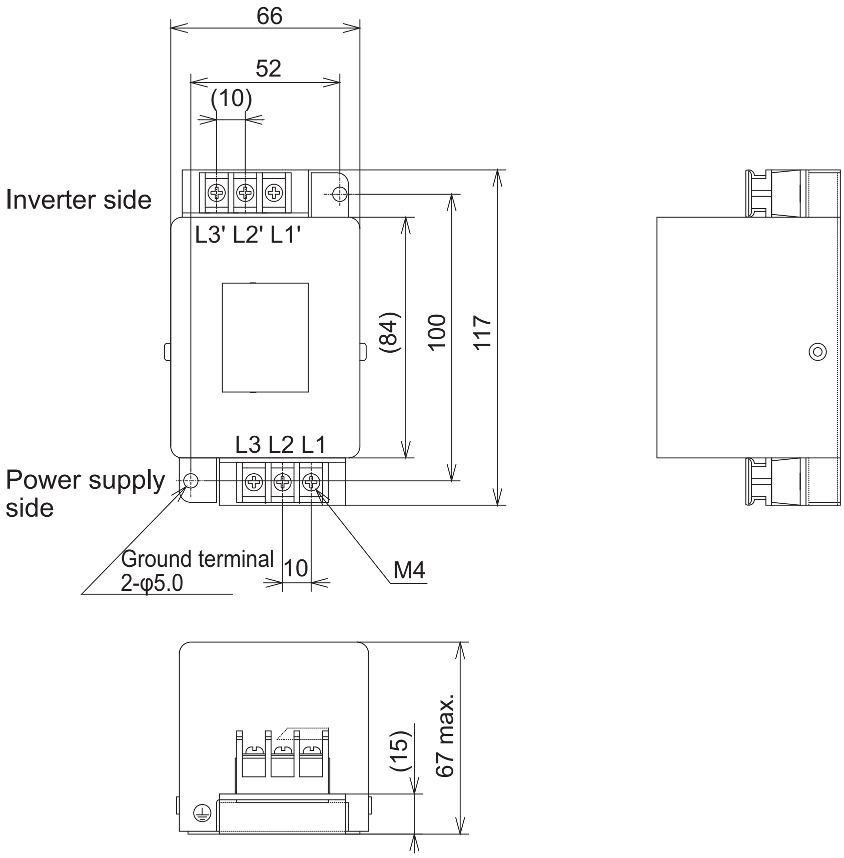
Inverter					Input noise filter specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input current (at 50°C)	Heat generation [W]
0.75	A4007	ND	0.75	2.8	NFI41	7 A	2
		LD	1.5	4.3			
		VLD	1.5	4.3			
1.5	A4015	ND	1.5	4.2	NFI41	7A	2
		LD	2.2	5.9			
		VLD	2.2	5.9			
2.2	A4022	ND	2.2	5.8	NFI41	7A	2
		LD	3.7	8.1	NFI42	10 A	4
		VLD	3.7	8.1			
3.7	A4037	ND	3.7	9.8	NFI42	10A	4
		LD	5.5	13.3	NFI43	20 A	6
		VLD	5.5	13.3			

Inverter					Input noise filter specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input current (at 50°C)	Heat generation [W]
5.5	A4055	ND	5.5	15	NFI43	20A	6
		LD	7.5	20			
		VLD	7.5	20			
7.5	A4075	ND	7.5	21	NFI43	20A	6
		LD	11	24	NFI44	30 A	9
		VLD	11	24			
11	A4110	ND	11	28	NFI44	30A	9
		LD	15	32	NFI45	40 A	12
		VLD	15	32			
15	A4150	ND	15	35	NFI45	40A	12
		LD	18.5	41	NFI46	50 A	15
		VLD	18.5	41			
18.5	A4185	ND	18.5	42	NFI46	50A	15
		LD	22	47	NFI47	60 A	17
		VLD	22	47			
22	A4220	ND	22	53	NFI47	60A	17
		LD	30	63	NFI48	80 A	21
		VLD	30	63			
30	A4300	ND	30	64	NFI48	80A	21
		LD	37	77	NFI49	100 A	23
		VLD	37	77			
37	A4370	ND	37	83	NFI49	100A	23
		LD	45	94	NFI4A	150 A	45
		VLD	45	94			
45	A4450	ND	45	100	NFI4A	150A	45
		LD	55	116			
		VLD	55	116			
55	A4550	ND	55	121	NFI4A	150A	45
		LD	75	149	-	-	-
		VLD	75	149			

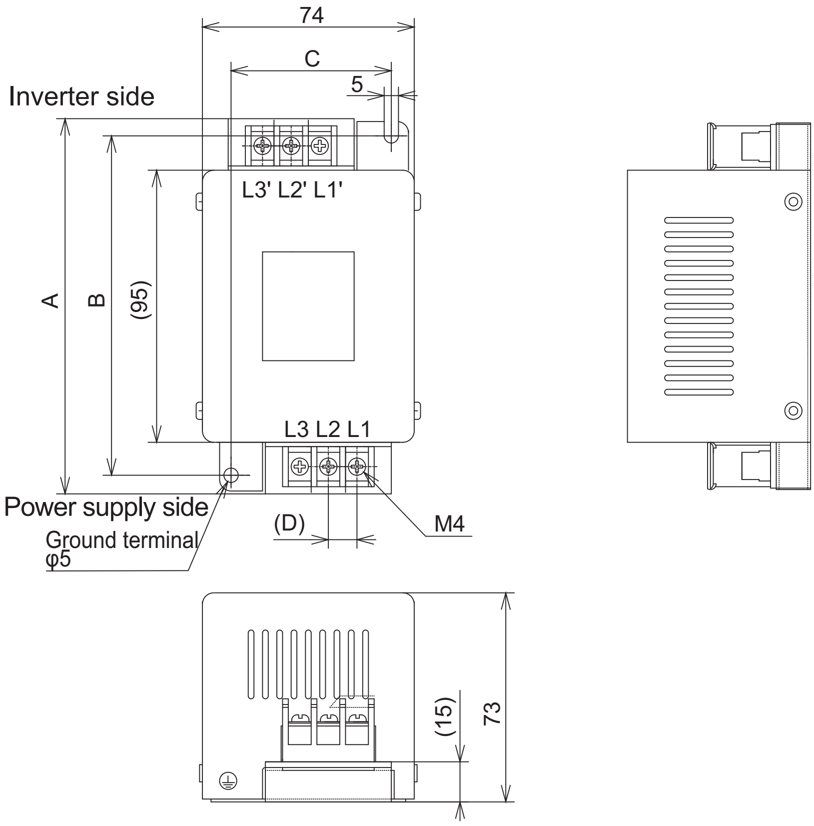
11-7-3 External Dimensions

Model (3G3AX-□□□□□)	Case, enclosure rating	Terminal size	Wire diameter	Weight [kg]
NFI21	Plastic, IP00	M4	1.25 mm^2	0.5
NFI22	Plastic, IP00	M4	2 mm^2	0.6
NFI23	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
NFI24	Plastic, IP00	M4	5.5 mm^2	0.8
NFI25	Plastic, IP00	M5	8 mm^2	1.4
NFI26	Plastic, IP00	M5	14 mm^2	1.8
NFI27	Metal, IP00	M6	22 mm^2	3.6
NFI28	Metal, IP00	M8	30 mm^2	4.6
NFI29	Metal, IP00	M8	38 mm^2, 60 mm^2	9.0
NFI2A	Metal, IP00	M10	100 mm^2 or 38 mm^2 2 wires parallel	16
NFI2B	Metal, IP00	M10	100 mm^2 or 38 mm^2 2 wires parallel	16
NFI2C	Metal, IP00	M10	150 mm^2 or 60 mm^2 2 wires parallel	23
NFI41	Plastic, IP00	M4	1.25 mm^2, 2 mm^2	0.7
NFI42	Plastic, IP00	M4	2 mm^2	0.7
NFI43	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
NFI44	Plastic, IP00	M4	5.5 mm^2	0.8
NFI45	Plastic, IP00	M5	8 mm^2	1.4
NFI46	Plastic, IP00	M5	14 mm^2	1.6
NFI47	Plastic, IP00	M5	14 mm^2	1.8
NFI48	Metal, IP00	M6	22 mm^2	3.6
NFI49	Metal, IP00	M8	38 mm^2	4.6
NFI4A	Metal, IP00	M8	38 mm^2, 60 mm^2	9.0

3G3AX-NFI21/NFI22

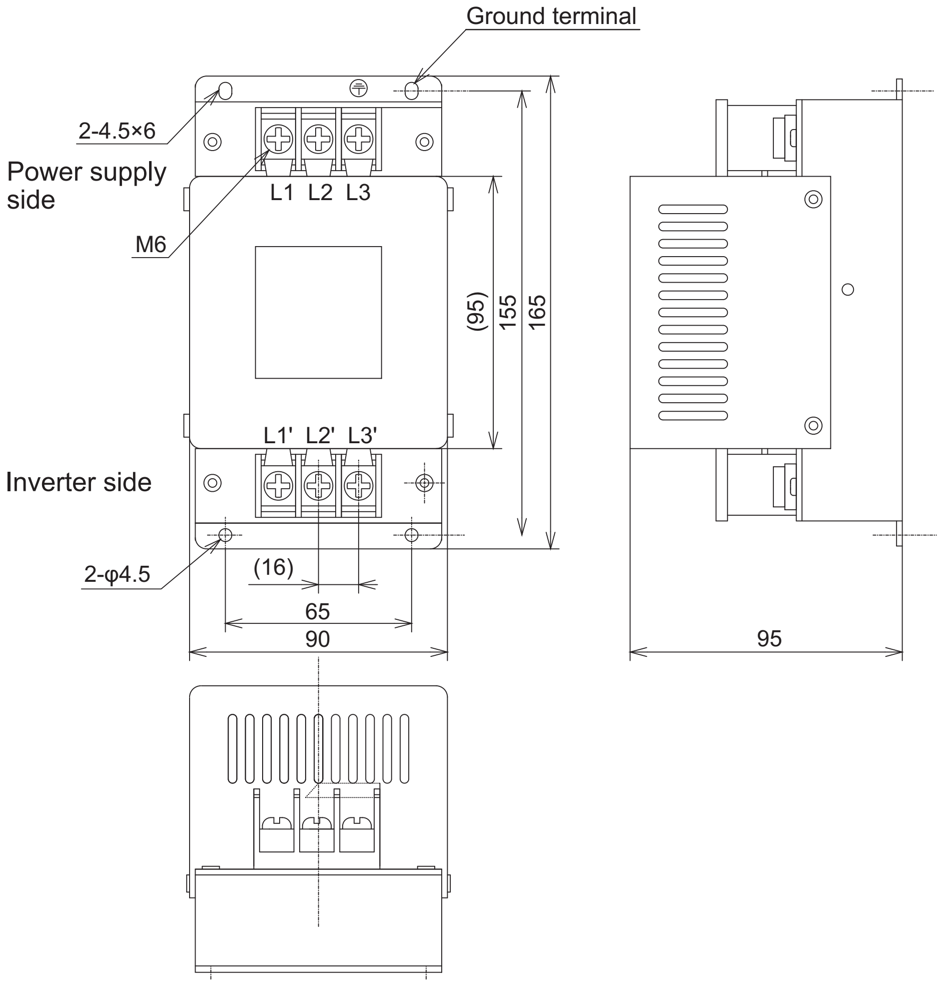


3G3AX-NFI23/NFI24/NFI41/NFI42/NFI43/NFI44

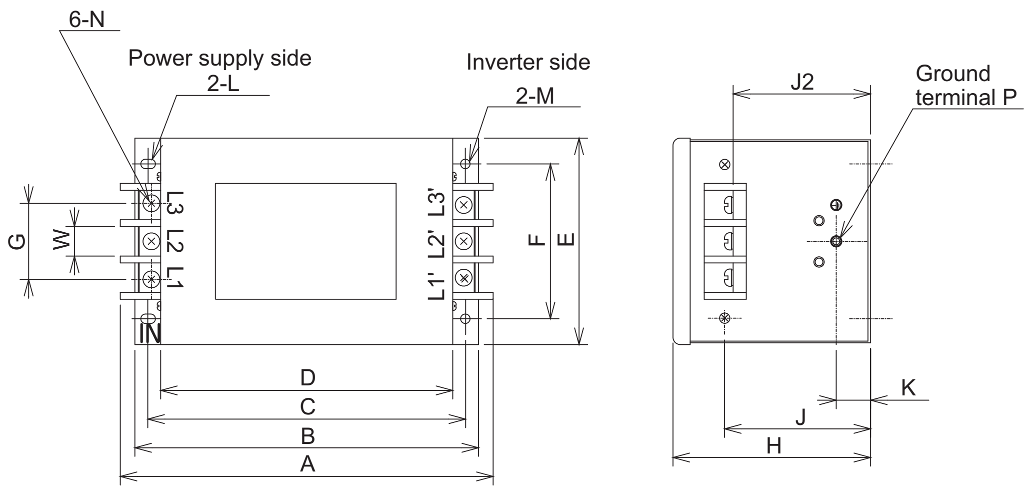


Model (3G3AX-□□□□□)	Dimensions [mm]			
	A	B	C	D
NFI23	128	118	56	10
NFI24	144	130	56	11
NFI41	144	130	56	11
NFI42	144	130	56	11
NFI43	144	130	56	11
NFI44	144	130	56	11

3G3AX-NFI25/NFI26/NFI45/NFI46/NFI47

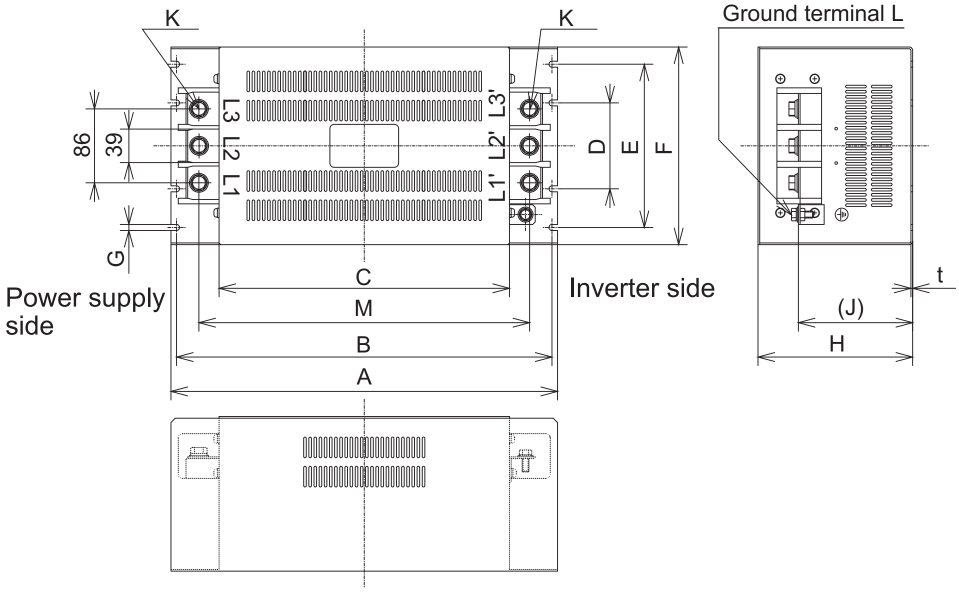


3G3AX-NFI27/NFI28/NFI29/NFI48/NFI49/NFI4A



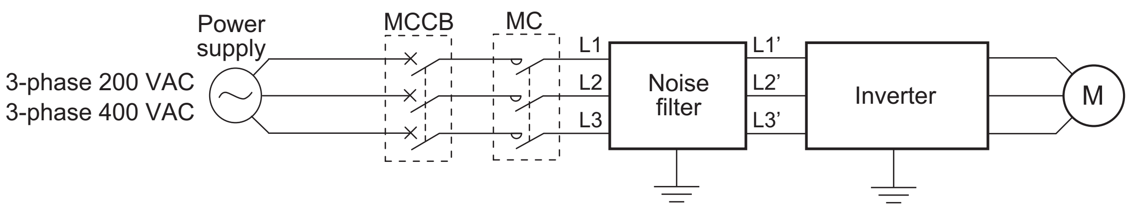
Model (3G3AX-□□□□□)	Dimensions [mm]															
	A	B	C	D	E	F	G	H	J	J2	K	L	M	N	P	W
NFI27	217	200	185	170	120	90	44	115	85	82	20	R2.75 Length 7	5.5 dia.	M6	M4	17
NFI28	254	230	215	200	150	120	57	115	80	75	30	R3.75 Length 8	6.5 dia.	M8	M6	23
NFI29	314	300	280	260	200	170	57	130	90	85	35	R3.75 Length 8	6.5 dia.	M8	M6	23
NFI48	217	200	185	170	120	90	44	115	85	85	20	R2.75 Length 7	5.5 dia.	M6	M4	17
NFI49	254	230	215	200	150	120	57	115	80	75	30	R3.75 Length 8	6.5 dia.	M8	M6	23
NFI4A	314	300	280	260	200	170	57	130	90	85	35	R3.75 Length 8	6.5 dia.	M8	M6	23

3G3AX-NFI2A/NFI2B/NFI2C



Model (3G3AX-□□□□□)	Dimensions [mm]												
	A	B	C	D	E	F	G	H	J	K	L	M	t
NFI2A	450	430	338	100	190	230	7	180	(133)	M10	M8	385	1.0
NFI2B													
NFI2C	500	475	400	-	160	200	12	180	(133)	M10	M8	445	1.2

11-7-4 Connection Examples



11-8 Output Noise Filter (Model: 3G3AX-NFO□□)

11-8-1 200-V class Specifications

Inverter voltage class: 200-V

Output noise filter Rated voltage: 500 VAC

Inverter					Output noise filter specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated output current [A]	Model (3G3AX-□□□□□)	Rated input current [A]	Weight [kg]
0.4	A2004	ND	0.4	3.0	NFO01	6	0.7
		LD	0.75	3.7			
		VLD	0.75	3.7			
0.75	A2007	ND	0.75	5.0	NFO01	6	0.7
		LD	1.5	6.3	NFO02	12	0.9
		VLD	1.5	6.3			
1.5	A2015	ND	1.5	7.5	NFO02	12	0.9
		LD	2.2	9.4			
		VLD	2.2	9.4			
2.2	A2022	ND	2.2	10.5	NFO02	12	0.9
		LD	3.7	12	NFO03	25	2.1
		VLD	3.7	12			
3.7	A2037	ND	3.7	16.5	NFO03	25	2.1
		LD	5.5	19.6			
		VLD	5.5	19.6			
5.5	A2055	ND	5.5	24	NFO03	25	2.1
		LD	7.5	30	NFO04	50	3.7
		VLD	7.5	30			
7.5	A2075	ND	7.5	32	NFO04	50	3.7
		LD	11	44			
		VLD	11	44			
11	A2110	ND	11	46	NFO04	50	3.7
		LD	15	58	NFO05	75	5.7
		VLD	15	58			
15	A2150	ND	15	64	NFO05	75	5.7
		LD	18.5	73	NFO06	100	8.4
		VLD	18.5	73			
18.5	A2185	ND	18.5	76	NFO06	100	8.4
		LD	22	85			
		VLD	22	85			
22	A2220	ND	22	95	NFO06	100	8.4
		LD	30	113	NFO07	150	9.0
		VLD	30	113			

Inverter					Output noise filter specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated output current [A]	Model (3G3AX-□□□□□)	Rated input current [A]	Weight [kg]
30	A2300	ND	30	121	NFO07	150	9.0
		LD	37	140			
		VLD	37	140			
37	A2370	ND	37	145	NFO07	150	9.0
		LD	45	169	-	-	-
		VLD	45	169			

11-8-2 400-V class Specifications

Inverter voltage class: 400-V

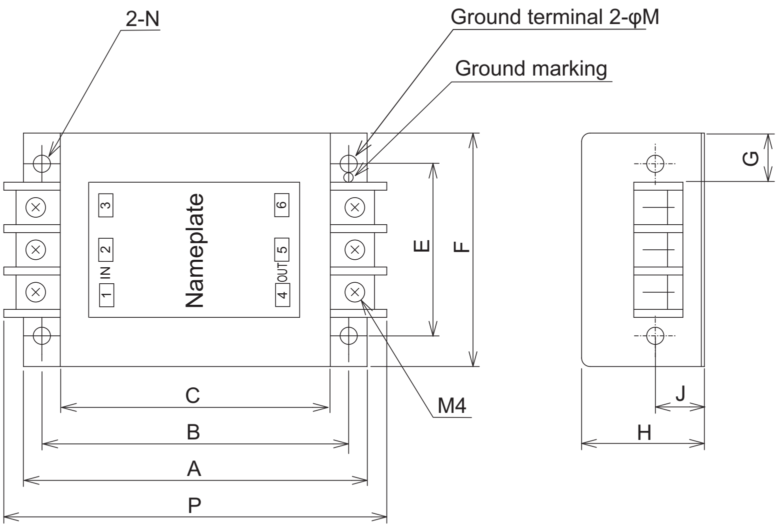
Output noise filter Rated voltage: 500 VAC

Inverter					Output noise filter specifications		
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated output current [A]	Model (3G3AX-□□□□□)	Rated input current [A]	Weight [kg]
0.75	A4007	ND	0.75	2.5	NFO01	6	0.7
		LD	1.5	3.1			
		VLD	1.5	3.1			
1.5	A4015	ND	1.5	3.8	NFO01	6	0.7
		LD	2.2	4.8			
		VLD	2.2	4.8			
2.2	A4022	ND	2.2	5.3	NFO01	6	0.7
		LD	3.7	6.7	NFO02	12	0.9
		VLD	3.7	6.7			
3.7	A4037	ND	3.7	9.0	NFO02	12	0.9
		LD	5.5	11.1	NFO03	25	2.1
		VLD	5.5	11.1			
5.5	A4055	ND	5.5	14	NFO03	25	2.1
		LD	7.5	16			
		VLD	7.5	16			
7.5	A4075	ND	7.5	19	NFO03	25	2.1
		LD	11	22			
		VLD	11	22			
11	A4110	ND	11	25	NFO03	25	2.1
		LD	15	29	NFO04	50	3.7
		VLD	15	29			
15	A4150	ND	15	32	NFO04	50	3.7
		LD	18.5	37			
		VLD	18.5	37			

Inverter					Output noise filter specifications		
Max. applicable motor capacity [kW]	**Model (3G3RX2-□□□□□)**	**Load specification selection**	**Max. applicable motor capacity [kW]**	**Rated output current [A]**	**Model (3G3AX-□□□□□)**	**Rated input current [A]**	**Weight [kg]**
18.5	A4185	ND	18.5	38	NFO04	50	3.7
		LD	22	43			
		VLD	22	43			
22	A4220	ND	22	48	NFO04	50	3.7
		LD	30	57	NFO05	75	5.7
		VLD	30	57			
30	A4300	ND	30	58	NFO05	75	5.7
		LD	37	70			
		VLD	37	70			
37	A4370	ND	37	75	NFO05	75	5.7
		LD	45	85	NFO06	100	8.4
		VLD	45	85			
45	A4450	ND	45	91	NFO06	100	8.4
		LD	55	105	NFO07	150	9.0
		VLD	55	105			
55	A4550	ND	55	112	NFO07	150	9.0
		LD	75	135			
		VLD	75	135			
75	B4750	ND	75	149	NFO07	150	9.0
		LD	90	160	-	-	-
		VLD	90	160			

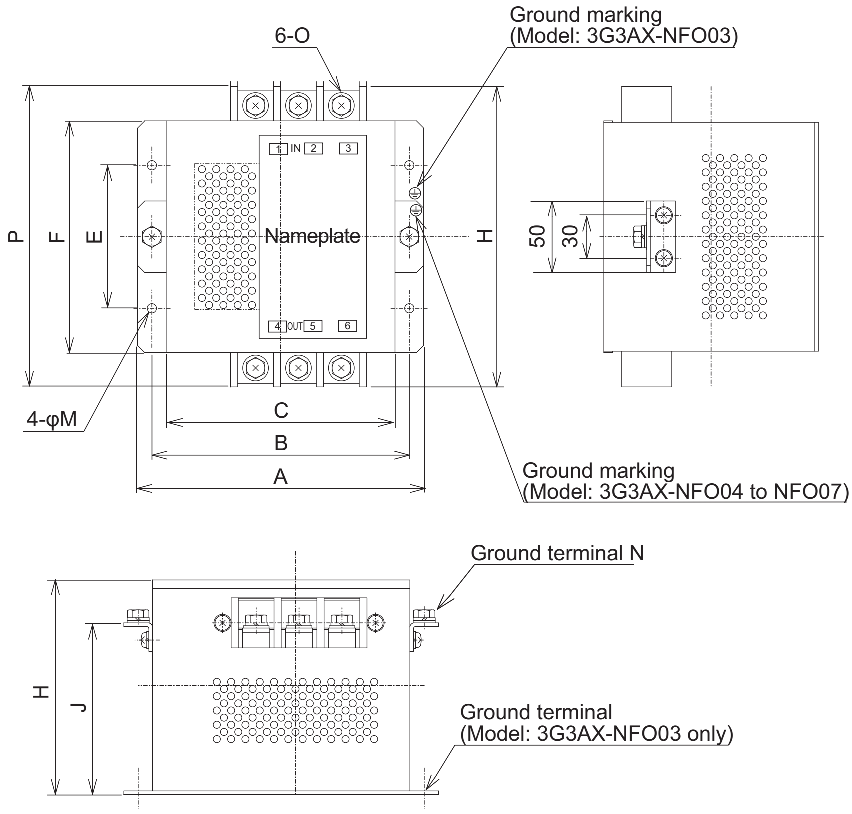
11-8-3 External Dimensions

3G3AX-NFO01/NFO02



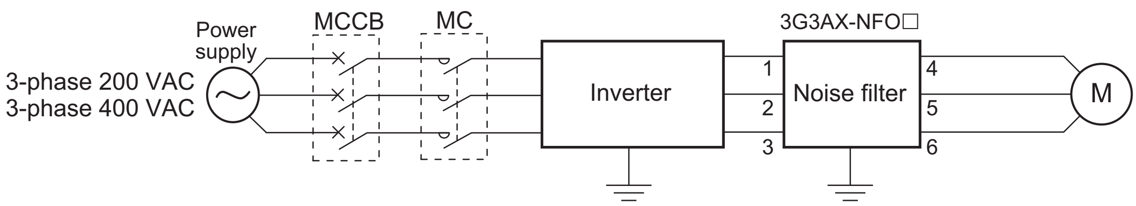
Model (3G3AX-□□□□□)	Dimensions [mm]									
	A	B	C	E	F	G	H	J	M	P	N
NFO01	140	125	110	70	95	22	50	20	4.5	156	2-R2.25 Length 6
NFO02	160	145	130	80	110	30	70	25	5.5	176	2-R2.75 Length 7

3G3AX-NFO03/NFO04/NFO05/NFO06/NFO07



Model (3G3AX-□□□□□)	Dimensions [mm]									
	A	B	C	E	F	H	J	M	N	O	P
NFO03	160	145	130	80	112	120	-	6.5 dia.	-	M4	154
NFO04	200	180	160	100	162	150	120	6.5 dia.	M5	M5	210
NFO05	220	200	180	100	182	170	140	6.5 dia.	M6	M6	230
NFO06	220	200	180	100	182	170	140	6.5 dia.	M8	M8	237
NFO07	240	220	200	150	202	170	140	6.5 dia.	M8	M8	257

11-8-4 Connection Example



11-9 Radio Noise Filter (Model: 3G3AX-ZCL□)

11-9-1 Specifications

Select the radio noise filter according to the applicable motor capacity for the heavy/light load mode of the inverter.
When using at ND mode, you need to select the maximum motor capacity; at LD or VLD mode, select one larger in capacity to meet with the motor capacity (kW).

3G3AX-ZCL1

Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.2	1	4	1	4	1	4	1	4
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
2.2	1	4	1	4	1	4	1	4
3.0	1	4	1	4	1	4	1	4
3.7	1	4	1	4	1	4	1	4
4.0	1	4	1	4	1	4	1	4
5.5	1	4	1	4	1	4	1	4
7.5	1	4	1	4	1	4	1	4
11	1	4	1	4	1	4	1	4
15	1	4	1	4	1	4	1	4

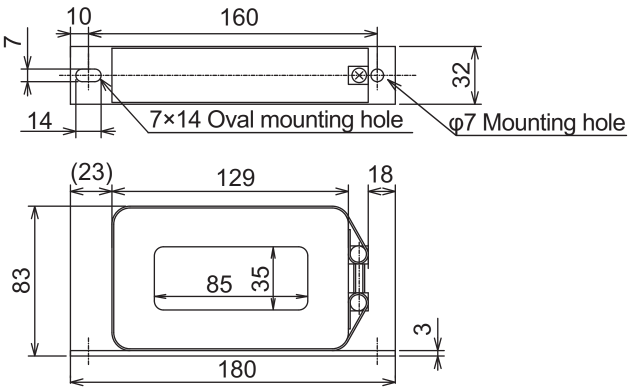
3G3AX-ZCL2

Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.1	1	4	1	4	1	4	1	4
0.2	1	4	1	4	1	4	1	4
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
2.2	1	4	1	4	1	4	1	4
3.0	1	4	1	4	1	4	1	4
3.7	1	4	1	4	1	4	1	4
4.0	1	4	1	4	1	4	1	4
5.5	1	4	1	4	1	4	1	4

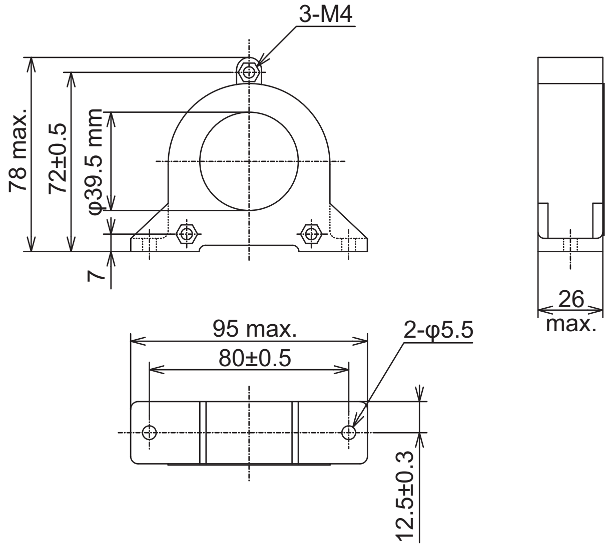
Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
7.5	1	4	1	4	1	4	1	4

11-9-2 External Dimensions

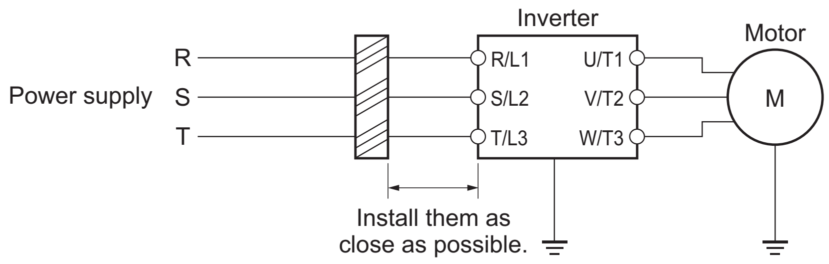
3G3AX-ZCL1



3G3AX-ZCL2



11-9-3 Connection Example



Precautions for Correct Use

- Wind the phase R/S/T wire in the same direction.
- This noise filter can be used in the same manner on both the input and output side of the inverter.

11-10 EMC Noise Filter (Model: 3G3AX-EFI□□)

11-10-1 200-V class Specifications

Inverter voltage class: 200-V

EMC noise filter specifications

- Max. input voltage: 250 VAC+10%
- Class: A

Inverter					EMC noise filter specifications			
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input current [A]	Heat generation [W]	Leakage current (at 250 VAC 60 Hz)
0.4	A2004	ND	0.4	3.3	EFI41	7	4	150 mA max.
		LD	0.75	3.9				
		VLD	0.75	3.9				
0.75	A2007	ND	0.75	5.5	EFI41	7	4	150 mA MAX
		LD	1.5	7.2	EFI42	10	4	150 mA max.
		VLD	1.5	7.2				
1.5	A2015	ND	1.5	8.3	EFI42	10	4	150 mA MAX
		LD	2.2	10.8	EFI43	20	8	170 mA max.
		VLD	2.2	10.8				
2.2	A2022	ND	2.2	12	EFI43	20	8	170 mA MAX
		LD	3.7	13.9				
		VLD	3.7	13.9				
3.7	A2037	ND	3.7	18	EFI43	20	8	170 mA MAX
		LD	5.5	23	EFI44	30	9	170 mA max.
		VLD	5.5	23				
5.5	A2055	ND	5.5	26	EFI44	30	9	170 mA MAX
		LD	7.5	37	EFI45	40	15	170 mA max.
		VLD	7.5	37				
7.5	A2075	ND	7.5	35	EFI45	40	15	170 mA MAX
		LD	11	48	EFI47	60	15	250 mA max.
		VLD	11	48				
11	A2110	ND	11	51	EFI47	60	15	250 mA MAX
		LD	15	64	EFI48	80	21	250 mA max.
		VLD	15	64				

Inverter					EMC noise filter specifications			
Max. appli-cable motor capaci-ty [kW]	Model (3G3RX2-□□□□□)	Load specifi-cation selec-tion	Max. appli-cable motor capaci-ty [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input cur-rent [A]	Heat gener-ation [W]	Leakage current (at 250 VAC 60 Hz)
15	A2150	ND	15	70	EFI48	80	21	250 mA MAX
		LD	18.5	80	EFI49	100	23	250 mA max.
		VLD	18.5	80				
18.5	A2185	ND	18.5	84	EFI49	100	23	250 mA MAX
		LD	22	94	EFI4A	150	45	250 mA max.
		VLD	22	94				
22	A2220	ND	22	105	EFI4A	150	45	250 mA MAX
		LD	30	120				
		VLD	30	120				
30	A2300	ND	30	133	EFI4A	150	45	250 mA MAX
		LD	37	150	EFI4B	200	50	250 mA max.
		VLD	37	150				
37	A2370	ND	37	160	EFI4B	200	50	250 mA MAX
		LD	45	186	-	-	-	-
		VLD	45	186				

11-10-2 400-V class Specifications

Inverter voltage class: 400-V

EMC noise filter specifications

- Max. input voltage: 480 VAC+10%
- Class: A

Inverter					EMC noise filter specifications			
Max. appli-cable motor capaci-ty [kW]	Model (3G3RX2-□□□□□)	Load specifi-cation selec-tion	Max. appli-cable motor capaci-ty [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input cur-rent [A]	Heat gener-ation [W]	Leakage current (at 480 VAC 60 Hz)
0.75	A4007	ND	0.75	2.8	EFI41	7	4	150 mA max.
		LD	1.5	4.3				
		VLD	1.5	4.3				
1.5	A4015	ND	1.5	4.2	EFI41	7	4	150 mA MAX
		LD	2.2	5.9				
		VLD	2.2	5.9				

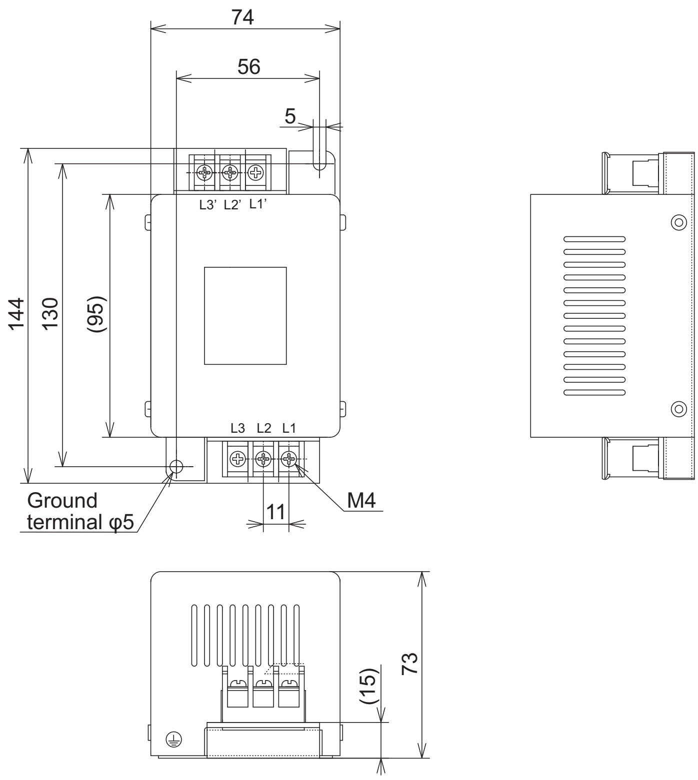
Inverter					EMC noise filter specifications			
Max. applicable motor capacity [kW]	Model (3G3RX2-□□□□□)	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model (3G3AX-□□□□□)	Rated input current [A]	Heat generation [W]	Leakage current (at 480 VAC 60 Hz)
2.2	A4022	ND	2.2	5.8	EFI41	7	4	150 mA MAX
		LD	3.7	8.1	EFI42	10	4	150 mA max.
		VLD	3.7	8.1				
3.7	A4037	ND	3.7	9.8	EFI42	10	4	150 mA MAX
		LD	5.5	13.3	EFI43	20	8	170 mA max.
		VLD	5.5	13.3				
5.5	A4055	ND	5.5	15	EFI43	20	8	170 mA MAX
		LD	7.5	20				
		VLD	7.5	20				
7.5	A4075	ND	7.5	21	EFI43	20	8	170 mA MAX
		LD	11	24	EFI44	30	9	170 mA max.
		VLD	11	24				
11	A4110	ND	11	28	EFI44	30	9	170 mA MAX
		LD	15	32	EFI45	40	15	170 mA max.
		VLD	15	32				
15	A4150	ND	15	35	EFI45	40	15	170 mA MAX
		LD	18.5	41	EFI46	50	15	250 mA max.
		VLD	18.5	41				
18.5	A4185	ND	18.5	42	EFI46	50	15	250 mA MAX
		LD	22	47	EFI47	60	15	250 mA max.
		VLD	22	47				
22	A4220	ND	22	53	EFI47	60	15	250 mA MAX
		LD	30	63	EFI48	80	21	250 mA max.
		VLD	30	63				
30	A4300	ND	30	64	EFI48	80	21	250 mA MAX
		LD	37	77	EFI49	100	23	250 mA max.
		VLD	37	77				
37	A4370	ND	37	83	EFI49	100	23	250 mA MAX
		LD	45	94	EFI4A	150	45	250 mA max.
		VLD	45	94				
45	A4450	ND	45	100	EFI4A	150	45	250 mA MAX
		LD	55	116				
		VLD	55	116				

Inverter					EMC noise filter specifications			
Max. applicable motor capacity [kW]	**Model (3G3RX2-□□□□□)**	**Load specification selection**	**Max. applicable motor capacity [kW]**	**Rated input current [A]**	**Model (3G3AX-□□□□□)**	**Rated input current [A]**	**Heat generation [W]**	**Leakage current (at 480 VAC 60 Hz)**
55	A4550	ND	55	121	EFI4A	150	45	250 mA MAX
		LD	75	149	EFI4B	200	50	250 mA max.
		VLD	75	149				
75	B4750	ND	75	164	EFI4B	200	50	250 mA MAX
		LD	90	176				
		VLD	90	176				
90	B4900	ND	90	194	EFI4B	200	50	250 mA MAX
		LD	110	199	-	-	-	-
		VLD	110	199				

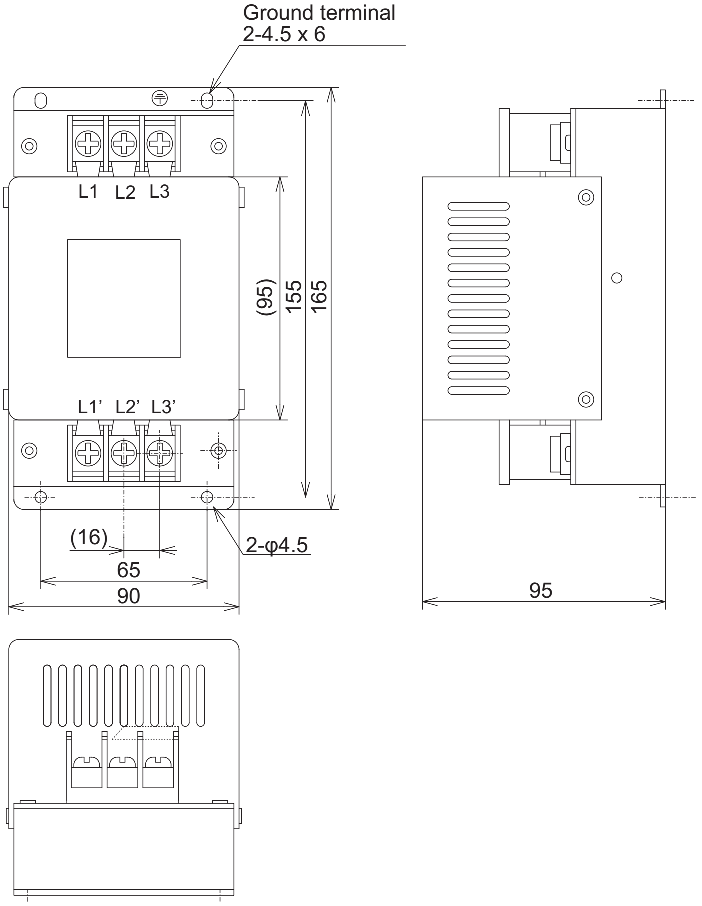
11-10-3 External Dimensions

Model (3G3AX-□□□□□)	Case, enclosure rating	Screw size	Wire size	Weight (kg)
EFI41	Plastic, IP00	M4	1.25 mm^2, 2 mm^2	0.7
EFI42			2 mm^2	0.7
EFI43		M5	2 mm^2, 3.5 mm^2	1.0
EFI44			5.5 mm^2	1.3
EFI45			8 mm^2	1.4
EFI46	Metal, IP00	M6	14 mm^2	2.9
EFI47			14 mm^2	3.0
EFI48			22 mm^2	3.6
EFI49		M8	30 mm^2, 38 mm^2	4.3
EFI4A			38 mm^2, 60 mm^2	9.0
EFI4B		M10	100 mm^2, or 38 mm^2 2 wires parallel	16.0

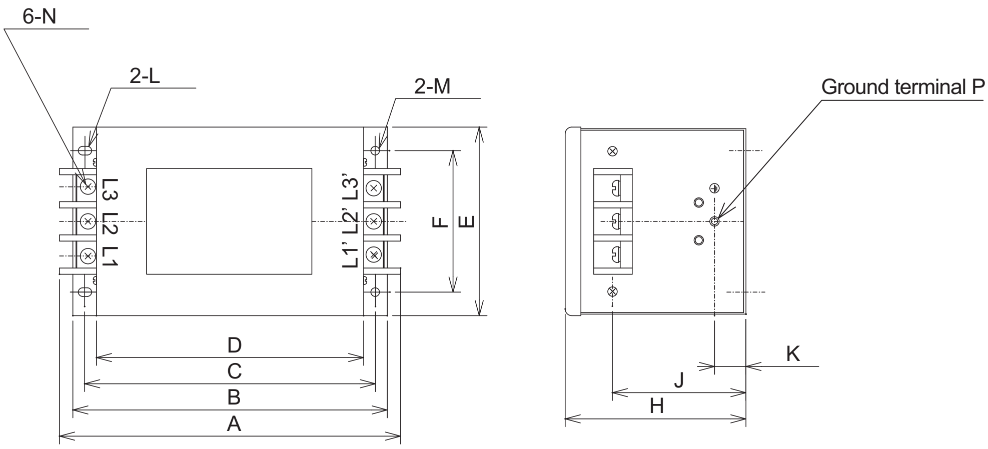
3G3AX-EFI41/EFI42



3G3AX-EFI43/EFI44/EFI45



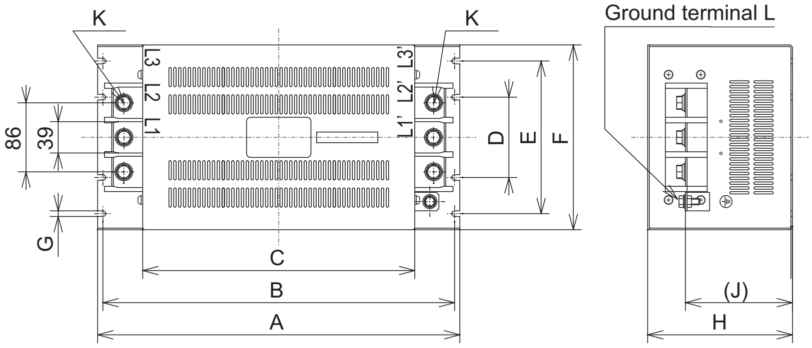
3G3AX-EFI46/EFI47/EFI48/EFI49/EFI4A



Model (3G3AX-□□□□□)	Dimensions [mm]												
	A	B	C	D	E	F	H	J	K	L	M	N	P
EFI46	217	220	185	170	120	90	115	85	20	R2.75, Length 7	5.5 dia.	M6	M4
EFI47													
EFI48													

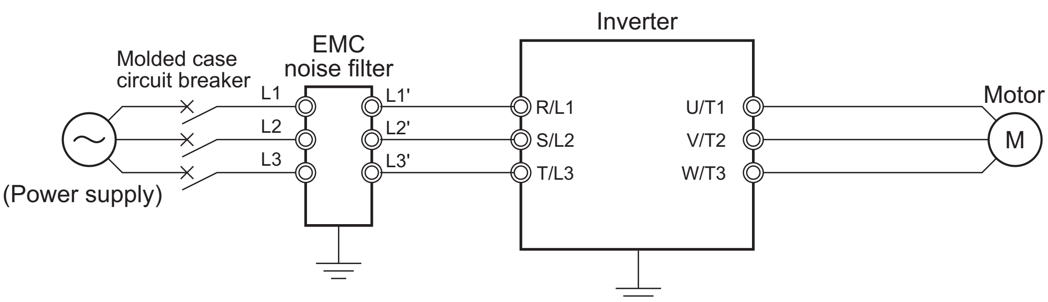
Model (3G3AX-□□□□□)	Dimensions [mm]											
	A	B	C	D	E	F	H	J	K	L	M	N	P
EFI49	254	230	215	200	150	120	115	80	30	R3.25, Length 8	6.5 dia.	M8	M6
EFI4A	314	300	280	260	200	170	130	90	35	R3.25, Length 8	6.5 dia.	M8	M6

3G3AX-EFI4B



Model (3G3AX-□□□□□)	Dimensions [mm]									
	A	B	C	D	E	F	G	H	J	K	L
EFI4B	450	430	338	100	190	230	7	180	(133)	M10	M8

11-10-4 Connection Example

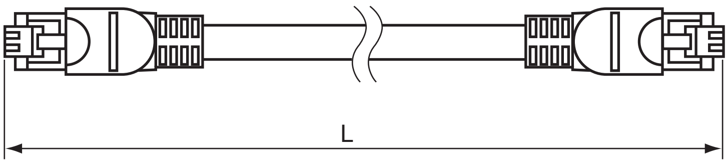


11-11 LCD Operator Cable (Model: 3G3AX-OPCN□)

11-11-1 Specifications

Item	Model (3G3AX-□□□□□)	
	OPCN1	OPCN3
Connector	RJ45 connector	
Cable	EIA568-compliant cable (UTP category 5)	
Cable length [m]	1	3

11-11-2 External Dimensions



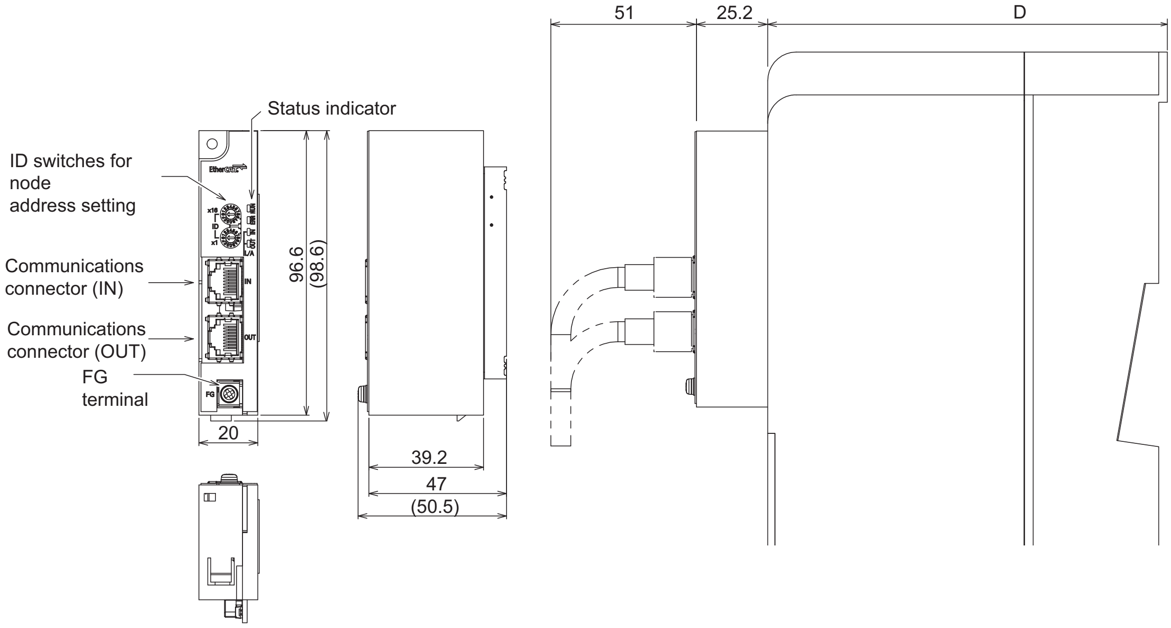
Model (3G3AX-□□□□□)	Cable Length L(m)
OPCN1	1
OPCN3	3

11-12 EtherCAT Communications Unit (Model: 3G3AX-RX2-ECT)

11-12-1 Specifications

Item		Model (3G3AX-RX2-ECT) Specifications
Common Specifications	Power supply	Supplied from the inverter
	Protective structure	Open type (IP20)
	Ambient operating temperature	−10 to 50°C
	Ambient storage temperature	−20 to 65°C
	Ambient operating humidity	20% to 90% (with no condensation)
	Vibration	5.9m/s^2 (0.6G)、10 to 55Hz
	Application environment	Indoors (There should be no corrosive gas, oil mist, or metal dust.)
	Weight	100 g max. (Shipping weight: approx. 200 g)
EtherCAT Communications Specifications	Communications standard	IEC61158 Type12、IEC61800-7 CiA402 drive profile
	Physical layer	100BASE-TX（IEEE802.3）
	Connector	RJ45 × 2 (shielded type)
		ECAT IN: EtherCAT input
		ECAT OUT: EtherCAT output
	Communications media	Category 5 or higher (cable with double, aluminum tape and braided shielding) is recommended.
	Communications distance	Distance between nodes: 100 m max.
	Process data	Fixed PDO mapping User PDO mapping
	Mailbox (CoE)	Emergency messages, SDO requests, and SDO responses
	Synchronization mode	FreeRun mode
	LED display	L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1 ERR × 1
	CiA402 drive profile	Velocity mode

11-12-2 External Dimensions



For the overall depth when the EtherCAT Communication Unit is installed with an EtherCAT cable connected, add 77 mm to the dimension D of the Inverter. The dimension D differs depending on its capacity of the Inverter. Please refer to *1-3-4 External dimensions* on page 1-19.

12

Troubleshooting

This section describes how to check for abnormalities and how to deal with them.

12-1 Checking the Alarm Display

12-1-1 Checking Trip Information

The trip history includes the last 10 trips that have occurred. The latest trip history is displayed on Trip Monitor 1.

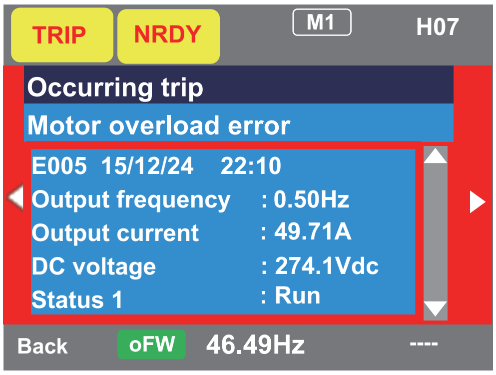
The following content is displayed.

a. The trip error factor
b. Output frequency (Hz) at time of trip
c. Output current (A) at time of trip
d. Main circuit DC voltage (V) at time of trip
e. Operation state at time of trip
f. Cumulative time (h) that the inverter was operating until the trip

Precautions for Correct Use

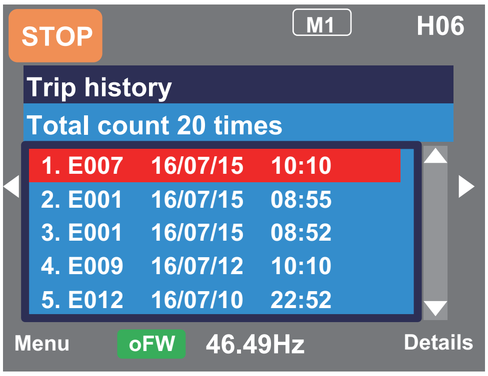
- In the case of a forced hardware shut-down of the inverter, it may not be possible to accurately capture the information at the time of the error.
- If the trip state occurred due to an error while output from the inverter is stopped, the recorded value for each data may become *0*.
- In the case of a ground fault or a momentary over-current, the recorded current value may be low.
- The trip monitor and trip count monitor can be cleared by initializing the history.

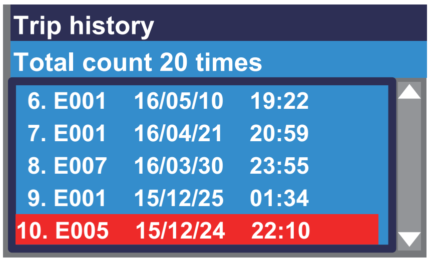
Display During a Trip

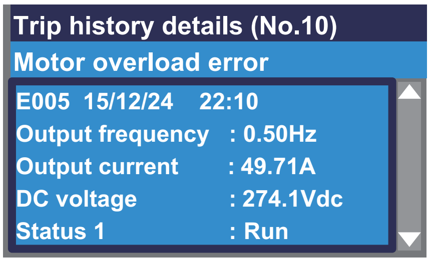


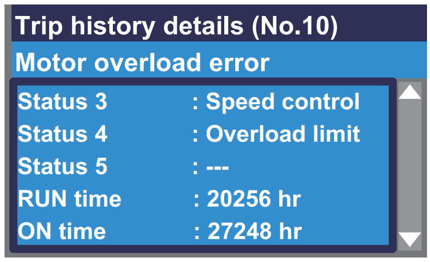
Checking the Trip History

You can look through the history using the arrow and ENTER keys.









12-1-2 Checking the Retry Information

The retry history includes the last 10 retries that have occurred. The latest retry history is displayed on the Retry monitor 1.

The following content is displayed.

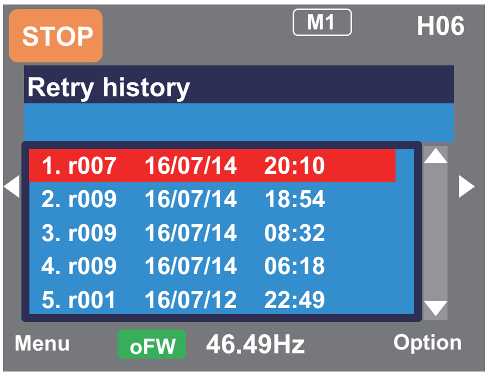
a. The retry error factor
b. Output frequency (Hz) at time of retry
c. Output current (A) at time of retry
d. Main circuit DC voltage (V) at time of retry
e. Operation state at time of retry
f. Cumulative time (h) that the inverter was operating until the retry
g. Cumulative time (h) that the inverter was powered-on until the retry

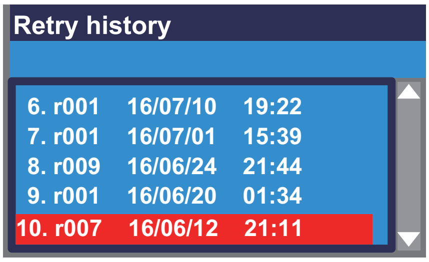
Precautions for Correct Use

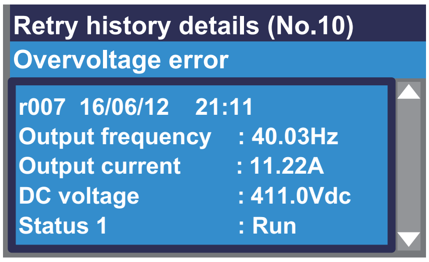
- During the retry operation, the inverter tries to continue operation. For trips that occur after retries, information remains in the trip history.
- In the case of a forced hardware shut-down of the inverter, it may not be possible to accurately capture the information at the time of the error.
- In the case of a momentary over-current, the recorded current value may be low.
- If you want to display the time in the trip history and retry history, you need to set the time. To retain the time, an optional battery (CR2032, 3V) is required. For details, refer to *3-1-5 How to Set Battery and Make Clock Settings* on page 3-13.

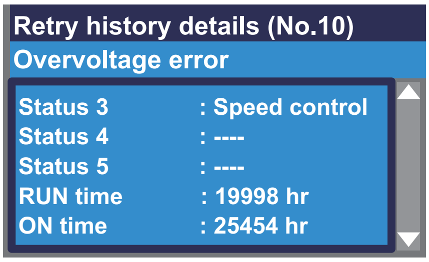
Checking the Retry Information

You can look through the history using the arrow and ENTER keys.









12-1-3 Procedure for Resetting a Trip State

To reset after a trip occurs, press the Stop / Reset key of the LCD operator or turn on the [RS] reset terminal.
To use the reset terminal method, assign reset [28: RS] to the input terminal function. In this case, the reset terminal will use the Contact a (NO) setting regardless of what is manually set.

The timing for resetting a trip by the [RS] terminal can be set in **Reset mode selection** (CA-72). It is also possible to enable the RS terminal only to reset a trip in the event of an abnormality.
Depending on the cause of the trip, it may not be possible to cancel a trip by resetting. In which case, turn off the power to the inverter and then turn it on again.

Precautions for Correct Use

- Do not use the reset [RS] terminal for the purpose of shutting off the output of the inverter. When shutting off the output of the inverter by signal input, use the free-run stop [32: FRS] terminal of the input terminal functions.
- Even if a reset signal is input, the internal data will not be cleared.
- If a reset signal is input while waiting for a retry, the cutoff time frequency will not be cleared and the system will start.

12-2 Error Numbers and Corresponding Measures

12-2-1 Error Number List

The corrective action differs depending on the content of the error number.
Refer to the relevant section in the table below.

Error No.	Error name	Explanation page
E001	Over-current error	page 12-7
E005	Motor overload error *2	page 12-8
E006	Braking resistor overload error	page 12-8
E007	Over-voltage error	page 12-9
E008	Memory error	page 12-10
E009	Under-voltage error	page 12-10
E010	Current detector error *1	page 12-10
E011	CPU error *1	page 12-11
E012	External trip error	page 12-11
E013	USP error	page 12-12
E014	Ground fault error *1	page 12-12
E015	Incoming overvoltage error	page 12-12
E016	Momentary interruption error	page 12-13
E019	Temperature detector error *1	page 12-13
E020	Cooling fan rotation speed reduction temperature error *1	page 12-13
E021	Temperature error	page 12-13
E024	Input open-phase error	page 12-14
E030	IGBT error	page 12-14
E034	Output open-phase error	page 12-15
E035	Thermistor error	page 12-15
E036	Brake error	page 12-15
E038	Low-speed range overload error	page 12-16
E039	Controller overload error *2	page 12-16
E040	Operator keypad disconnected error	page 12-17
E041	RS485 communication error	page 12-17
E042	RTC error	page 12-17
E043	EzSQ Illegal instruction error	page 12-17
E044	EzSQ nest count error	page 12-18
E045	Executive instruction error	page 12-18
E050	EzSQ user-assigned error 0	page 12-18
E051	EzSQ user-assigned error 1	page 12-18
E052	EzSQ user-assigned error 2	page 12-18
E053	EzSQ user-assigned error 3	page 12-18
E054	EzSQ user-assigned error 4	page 12-18
E055	EzSQ user-assigned error 5	page 12-18
E056	EzSQ user-assigned error 6	page 12-18

Error No.	Error name	Explanation page
E057	EzSQ user-assigned error 7	page 12-18
E058	EzSQ user-assigned error 8	page 12-18
E059	EzSQ user-assigned error 9	page 12-18
E060	Option 1 error 0	page 12-18
E061	Option 1 error 1	page 12-18
E062	Option 1 error 2	page 12-18
E063	Option 1 error 3	page 12-18
E064	Option 1 error 4	page 12-18
E065	Option 1 error 5	page 12-18
E066	Option 1 error 6	page 12-18
E067	Option 1 error 7	page 12-18
E068	Option 1 error 8	page 12-18
E069	Option 1 error 9	page 12-18
E070	Option 2 error 0	page 12-19
E071	Option 2 error 1	page 12-19
E072	Option 2 error 2	page 12-19
E073	Option 2 error 3	page 12-19
E074	Option 2 error 4	page 12-19
E075	Option 2 error 5	page 12-19
E076	Option 2 error 6	page 12-19
E077	Option 2 error 7	page 12-19
E078	Option 2 error 8	page 12-19
E079	Option 2 error 9	page 12-19
E080	Option 3 error 0	page 12-19
E081	Option 3 error 1	page 12-19
E082	Option 3 error 2	page 12-19
E083	Option 3 error 3	page 12-19
E084	Option 3 error 4	page 12-19
E085	Option 3 error 5	page 12-19
E086	Option 3 error 6	page 12-19
E087	Option 3 error 7	page 12-19
E088	Option 3 error 8	page 12-19
E089	Option 3 error 9	page 12-19
E090	STO shut-off error	page 12-19
E091	STO internal error	page 12-19
E092	STO path 1 error	page 12-19
E093	STO path 2 error	page 12-19
E100	Encoder disconnection error	page 12-19
E104	Position control range error	page 12-20
E105	Speed deviation error	page 12-20
E106	Position deviation error	page 12-20
E107	Over-speed error	page 12-21
E110	Contactor error	page 12-21
E112	PG option unit connection error	page 12-21
E120	PID-Start Error Detection	page 12-22

*1. If a serious failure error occurs, it cannot be canceled by the reset operation.

*2. If a controller overload error occurs, or if a motor overload error occurs with **Electronic thermal Subtraction function enable, 1st-motor** (bC112) set to *00: Disabled*, the reset input will not be accepted for 10 seconds. In which case, wait for a while before performing the reset operation.

12-2-2 Details about Errors

E001 Over-Current Error

If there is a large current surge to the inverter, it may cause a malfunction, so its output is cut off. Parameters can be set to enable you to retry a certain number of times without issuing an error. The over-current level is set in **Over current detection level, 1st-motor** (bb160).

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs suddenly during operation	Sudden load fluctuation occurred	• The overcurrent suppression function and overload limiting function are can suppress over-current conditions. • When using vector control, there may be improvement from adjusting **Speed response for Async.M, 1st-motor** (HA115).
	Motor turbulence	• It may be improved by setting **Async.Motor capacity setting, 1st-motor** (Hb102), or **Async.Motor poles setting, 1st-motor** (Hb103), or by performing **Auto-tuning selection** (HA-01). • It may be improved by adjusting **Stabilization constant, 1st-motor** (HA110).
Occurred during acceleration	• Acceleration time is set too short • Insufficient acceleration torque • High load inertia • High friction torque	• Insufficient acceleration torque can be alleviated by lengthening the value for **Acceleration time monitor** (FA-10). • If acceleration torque is required, it may be improved by adjusting the manual torque boost function or consider another control method such as automatic torque boost with **Control mode selection, 1st-motor** (AA121). • It may be improved by reviewing the load conditions.
Occurred during deceleration	• Deceleration time is set too short • Insufficient regenerative torque • High load inertia	• Insufficient regenerative torque can be alleviated by lengthening the value for **Deceleration time monitor** (FA-12). • If regenerative torque is required, it may be improved by adjusting the manual torque boost function or consider another control method such as automatic torque boost with **Control mode selection, 1st-motor** (AA121). • It may be improved by reviewing the load conditions.
Occurred immediately after inputting an operation command	• A ground fault occurred • The output line is short-circuited or out of phase • Output element failure	• If it occurs even when the output line to the motor is disconnected after the power is cut off and the power is turned on by the inverter alone, there is a possibility of failure. • If the output line to the motor is removed and it does not occur, it is necessary to check the wiring and motor.
	• There is some restraint on the motor • High load inertia	• It may occur if the rotation of the motor is restricted. • It may be improved by dealing with it when it occurs during acceleration.
Occurs immediately after turning on the power	• Output element failure • Current detector failure	There may be a failure of the output element or current detector. It needs to be investigated and repaired.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs after long use	Changes to the system environment	It may also be improved by reducing the motor load and maintaining the system (cleaning the fan to be driven, clearing duct clogging, etc.).
	Aging of equipment	If it is not resolved by reducing the load, there is a possibility that parts may have deteriorate over time. Repair is required.

E005 Motor Overload Error

It monitors the output current of the inverter and shuts off the output when the built-in electronic thermal detects a motor overload. It trips according to the setting of the motor electronic thermal function. If a motor overload error occurs, the reset input will not be accepted for 10 seconds.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs after a certain period of operation	Continuous heavy load conditions	It may be improved by reviewing the operating conditions and improving the load conditions.
	The subtraction rate of the thermal integrated value does not match the motor	If adjusting the **Electronic thermal level setting, 1st-motor** (bC110) or the **Electronic thermal Subtraction time, 1st-motor** (bC113) does not resolve the problem, it may be improved by reviewing other settings.
Occurs during acceleration	• Insufficient acceleration torque • High load inertia • High friction torque	• Insufficient acceleration torque can be alleviated by lengthening the value for **Acceleration time monitor** (FA-10). • If Acceleration torque is required, it may be improved by adjusting the manual torque boost function or consider another control method such as automatic torque boost with **Control mode selection, 1st-motor** (AA121). • It may be improved by reviewing the load conditions.
	The function to suppress over-current is in operation	There may be a factor causing an over-current condition. It is necessary to review the acceleration time and load conditions.
Occurs during deceleration	High load inertia	• Insufficient regenerative torque can be alleviated by lengthening the value for **Deceleration time monitor** (FA-12). • If regenerative torque is required, it may be improved by adjusting the manual torque boost function or by considering another control method such as automatic torque boost with **Control mode selection, 1st-motor** (AA121). • It may be improved by reviewing the load conditions.
	The function to suppress over-voltage is in operation	Current may increase as a result of suppressing over-voltage. Review the settings for **Deceleration time monitor** (FA-12) and load conditions.
Occurs after long-term use	Changes to the system environment	It may also be improved by reducing the motor load and maintaining the system (cleaning the fan to be driven, clearing duct clogging, etc.).
	Aging of equipment	If it is not resolved by reducing the load, there is a possibility that parts may have deteriorate over time. Repair is required

E006 Braking Resistor Overload Error

If **Dynamic brake usage rate** (bA-60) exceeds the preset usage rate, the output will be cut off.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs during deceleration	• Deceleration time is set too short • High load inertia • The capacity of the braking resistor is too small	If you are decelerating suddenly, you may get an improvement by increasing the value for **Deceleration time monitor** (FA-12). If the deceleration time cannot be shortened, the resistor selection needs to be reviewed.
Occurs while running	• Continual regenerative operation • The capacity of the braking resistor is too small	Since the regenerative power returned from the motor is high, it may not be consumed by the resistor. It is necessary to review the load conditions or the selection of resistors.
	Turning caused by external force	When the fan is turned by a strong wind or when the pay-load is unloaded with a crane, the regenerative power returned from the motor becomes high, so the resistor may not fully consume it. It is necessary to review the load conditions or the selection of resistors.
Occurs by repeated operation	High frequency of operation cycle	There is potential for improvement by reducing the frequency of run cycles. You may get improvement by adjusting the **Deceleration time monitor** (FA-12) and reviewing the selection of resistors.

E007 Over-Voltage Error

If the P-N voltage becomes too high, it may cause a failure, so the output is cut off. When the P-N voltage exceeds about 410 VDC (200 V class) and about 820 VDC (400 V class), it shuts off. Parameters can be set to enable you to retry a certain number of times without issuing an error.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs during deceleration	• Deceleration time is set too short • High load inertia	If you are decelerating suddenly, you may get an improvement by increasing the value for **Deceleration time monitor** (FA-12). If the deceleration time cannot be shortened, it is necessary to review the load conditions, use the over-voltage suppression function, use braking resistors, braking units, and regenerative converters.
Occurs while running	High load inertia	If there is high load inertia, the regenerative power returned from the motor is high, so an over-voltage condition is likely to occur. It is necessary to review the load conditions, use the over-voltage suppression function, use braking resistors, braking units, and regenerative converters.
	The motor is being rotated by an external force (Fan, crane)	If the number of motor revolutions becomes higher than the inverter output frequency (No. of rotations), an over-voltage condition is likely to occur. It is necessary to review the load conditions, use the over-voltage suppression function, use braking resistors, braking units, and regenerative converters.
Occurs while stopped	Abnormal power supply voltage	The power supply voltage may be rising or fluctuating. It may be improved by reviewing the power supply environment or inserting an AC reactor.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs during dop-ing control	Mutual interference caused by two units trying to strictly con-trol each other's mo-tors	When two motors that drive the same axis are controlled by two inverters, the control may diverge in an attempt to generate torque from each other. It may be improved by changing one of the con-trols to P control. Refer to *7-3-3 P/PI Switching function* on page 7-36.

E008 Memory Error

When an error occurs in the internal memory, the output is cut off. It may result in a CPU error.
It will recover when the power is turned on again, but it is necessary to check if there are any abnor-malities in the parameters. If you have previously backed up to the LCD operator, you may be able to recover your data.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs shortly after the power is turned on	Noise contamination	Physical measures such as placing a shielding plate may be re-quired to prevent external noise.
The power was pre-viously turned off unintentionally	Power off while ac-cessing memory	You will need to recover the data using the data previously backed up to the LCD operator. If it cannot be recovered, it needs to be re-initialized. Refer to *6-1-2 Inverter Initialization* on page 6-4. If it cannot be recovered by re-initializing, repair will be required.

E009 Under-Voltage Error

If the main power supplied to the inverter goes down, it may damage the circuit, so the output is shut off. When the P-N voltage falls below about 160 VDC (200 V class) or about 320 VDC (400 V class), it shuts off. Parameters can be set to enable you to retry a certain number of times without issuing an error. You can also make setting changes to disable under-voltage errors when stopped.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs when stop-ped	The power supply voltage has dropped	If the internal power supply does not turn off completely, you can restart it after the power is restored by setting the retry function.
Occurs while run-ning	• The power supply voltage has drop-ped • Insufficient power capacity	If the power supply voltage drops or the power supply capacity is insufficient, you should review the power supply environment.
The inverter does not start	Insufficient power supply voltage	Supply power according to the voltage class of the inverter.
Occurs after long-term use	• Changes to the system environ-ment • Deterioration of capacitors • Circuit failure	Frequent under-voltage conditions can lead to degraded life or failure. Repair is required.

E010 Current Detector Error

If an error occurs in the inverter’s built-in current detector, the output will be shut off.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after turning the power on	The current detection circuit is broken	If it occurs again after a reset operation, the current detection circuit may be defective. Repair is required
	A nearby source of noise	If there is a noise source nearby, it may be improved by taking noise countermeasures such as keeping the noise source away or inserting a shielding plate.
Occurs after long-term use	The current detection circuit is broken	If it occurs again after a reset operation, the current detection circuit may be defective. Repair is required

E011 CPU Error

When a malfunction or abnormality occurs in the built-in CPU, the output is blocked and an error is displayed.
If it does not recover when the power is turned on again, the CPU may be damaged.

Occurrence	Assumed cause(s)	Example measures to be taken
It occurred suddenly	Internal CPU is corrupted	• It may be restored by reset operation, power cycle, or initialization operation. After recovery, re-initialization is required. • If it does not recover, it may be defective. Repair is required
	A nearby source of noise	If there is a noise source nearby, you may get improvement by taking noise countermeasures such as keeping the noise source away or inserting a shielding plate.
Occurs when writing data	Data inconsistency	It may be restored by reset operation, power cycle, or initialization operation. After recovery, re-initialization is required. Refer to *6-1-2 Inverter Initialization* on page 6-4

E012 External Trip Error

The inverter receives a signal command from an external device and shuts off the output. (When the external trip function is selected)

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs unintentionally	• The terminal logic is reversed • The wiring is wrong	• It is necessary to check the operational status of the external device, review the terminal allocation of the external trip to the inverter input terminal, the setting of the a/b contact, and the communication of external trip commands. • The a/b contact setting for the terminal can be changed in the inverter settings.

E013 USP Error

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs unintentionally	The timing of the operation command is too early	It is necessary to review the sequence for entering the operation command. It is necessary to wait at least 2 seconds after turning on the power before issuing the operation command.
	The operation command has not been released	It is necessary to cancel the operation command when the power is turned on.
	When trying to operate with a command other than the terminal	When USP is enabled, commands such as LCD operators and communication commands will also result in an error. It is necessary to wait at least 2 seconds after turning on the power before issuing the operation command.

E014 Ground Fault Error

When the power is turned on, it protects the inverter by detecting a ground fault between the output of the inverter and the motor. This function does not operate if there is a motor-induced voltage due to idling, etc., or if there is a trip.
If the control circuit power supply (R0, T0 or 24 V power supply) is turned on before the main circuit power supply R, S, T, it operates at the timing when the main circuit power supply is turned on.
You can disable the ground fault detection operation by setting **Ground fault selection** (bb-64) to *00: Disabled*. It is enabled when set to *01: Enabled*.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after turning the power on	• Wiring, motor ground fault • Deterioration of motor insulation	• After turning off the power, disconnect the wiring to the motor and check the motor and wiring. There may be a ground fault. • Turning on the power when there is a ground fault condition may cause a malfunction. Check the motor and motor wiring without turning on the power.

E015 Power Supply Incoming Over-Voltage Error

This error occurs when **Power supply over voltage selection** (bb-61) is set to *01: Error*, the output of the inverter is stopped, and the received voltage value is high and it continues for 100 seconds continuously. It occurs when the P-N voltage exceeds the value set in **Power supply over voltage level setting** (bb-62) due to the increase in received voltage.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after turning power on	Received voltage is high	You must consider the power supply environment.
Occurs after long-term use	Power supply became unstable	The power supply environment may have changed due to equipment replacement, etc. You must consider the power supply environment.

E016 Momentary Interruption Error

If a momentary power failure occurs, the output will be cut off. If the power failure time is long, it is usually considered as a power failure.
An error occurs when the main power supply R, S, and T drop. If the J51 connector is removed and the control circuit power supplies R0 and T0 are input in different systems, the voltage drop of R0 and T0 will not occur.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs after long-term use	The power supply voltage has dropped	In the case of interruption due to an external factor such as a power failure, it is possible to restart after the power is restored by using the retry function.
	A contact failure occurred in the circuit breaker	The magnetic contactor or earth leakage breaker may be defective. There is a possibility of recovery, but repair is required.
Occurs at the start of operation	The power supply voltage has dropped	If there has been no momentary power outage, the power supply capacity may be insufficient. You must consider the power supply environment.

E019 Temperature Detector Error

Occurs when there is an abnormality such as disconnection in the temperature detection circuit.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs after operation	The temperature detection circuit is disconnected or broken	The temperature detection circuit is malfunctioning. Repair is required

E020 Cooling Fan Rotation Speed Reduction Temperature Error

If the inverter becomes hot due to a decrease in the cooling fan speed and cooling performance, the output is cut off. See also Temperature error (E021).

Occurrence	Assumed cause(s)	Example measures to be taken
The cooling fan has stopped	Foreign matter is caught in the fan	If there is a foreign matter, removing it may resolved the error.
	Cooling fan is at end of life	The cooling fan needs to be replaced.
The cooling fan is running	The end of life of the cooling fan is approaching	The cooling performance has deteriorated and the cooling fan needs to be replaced.

E021 Temperature Error

The output is cut off when the inverter becomes hot.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs while operating	Carrier frequency is high	The higher the carrier frequency, the more likely it is for the internal temperature of the inverter to rise. Decrease the carrier frequency setting.
	The fins are clogged	The cooling performance has deteriorated, so cleaning the fins may improve it.
	• Use in high temperature environment • Poor cooling of the surrounding environment	It may be improved by improving the usage environment and cooling environment.
	Does not meet the required installation conditions	If the inverter is not installed correctly, it may cause a malfunction. Install it correctly according to this manual.
Occurs while stopped	The temperature detection circuit is broken	If the error continues after resetting, the temperature detection circuit is defective. Repair is required

E024 Input Open-Phase Error

When **Input phase loss enable** (bb-65) is *01: Enabled* and an open phase of the input line is detected, the output is cut off.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after the turning power on	Poor contact or disconnection of input line or motor	It is necessary to turn off the power and check the wiring status of the input line and the breaker. It may also occur due to poor power supply voltage, poor contacts, or poor screw tightening.
	Single-phase input	The input line should be a three-phase connection.
Occurs after long-term use	Poor contact or disconnection of input line or breaker	It may be improved by fixing a contact failure due to a loosened screw or any abnormality with the breaker.

E030 IGBT Error

In the event of an instantaneous over-current or failure of the main element, the output of the inverter is cut off to protect the main element.
An over-current error may also occur.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after operating	• A ground fault occurred • The output line has short-circuited	After turning off the power, it is necessary to check the wiring to the motor and check for disconnection of the motor. If it occurs when the motor wiring is disconnected, it is out of order and needs to be repaired.
	There is some restraint on the motor rotation	If the motor is constrained during operation, a large current may flow. The cause of the constraint must be removed.
	The output element is broken	If the output element is defective, it needs to be repaired.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after turning on the power	The output element is broken	If the output element is defective, it needs to be repaired.
Occurs while operating	There is some restraint on the motor rotation	If the motor is constrained during operation, a large current may flow. The cause of the constraint must be removed.

E034 Output Open-Phase Error

When **Output phase loss enable** (bb-66) is *01: Enabled*, if a poor contact of the output line, a disconnected wire, or a disconnection inside the motor is detected, the output is cut off. A phase open state is detected in the interval from 5Hz to 100Hz.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after operating	Poor contact or disconnection of output line or motor	It is necessary to turn off the power and check the wiring status of the output line and motor. It may also occur due to breakdown of motor insulation or improper tightening of screws.
	Single-phase output	The output line should be a three-phase connection.
Occurs after long-term operation	Poor contact or disconnection of output line or motor	It is necessary to turn off the power and check the wiring status of the output line and motor. If a screw is loose, re-tightening the screw may resolve the problem.

E035 Thermistor Error

Detects changes in the resistance value of the external thermistor and shuts off the output of the inverter if the temperature is abnormal. (When the thermistor function is enabled)

Occurrence	Assumed cause(s)	Example measures to be taken
The motor is generating heat	Motor cooling is not working	The cooling environment needs to be improved
	Continual heavy load conditions	It is necessary to review the environment in which the motor is being run
The motor is not generating heat	Incorrect setting of thermistor function	It may be improved by reviewing the thermistor function settings.
	The thermistor is broken	The thermistor requires repair.
	Malfunction due to noise	It may be improved by noise countermeasures such as wiring separation.

E036 Brake Error

Occurs when the ON / OFF of the brake check signal cannot be confirmed within the brake check wait time after the inverter outputs the brake release signal. (When the brake control function is enabled)

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs after long-term operation	Signal line disconnection	Check the wiring of the brake confirmation signal and the presence or absence of the signal.
	Brake function settings	It may be improved by reviewing the setting for **Brake Wait Time for Confirmation, 1st-motor (Forward side)** (AF134) and the logic of the input terminal according to the signal sequence.

E038 Low-Speed Range Overload Error

When outputting at a low frequency of 0.2 Hz or less, it protects the main element. If the electronic thermal built into the inverter detects it, the output is cut off.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs at low speed output	Heavy motor load	It is necessary to reduce the load in the low speed range. If errors occur frequently, it is necessary to select an inverter with a large capacity for the motor.

E039 Controller (Inverter) Overload Error

It monitors the output current of the inverter (controller) and shuts off the output when the inverter's built-in electronic thermal detects an overload condition.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs after a certain period of operation	Continuous heavy load conditions	It may be improved by reviewing the operating conditions and improving the load conditions.
Occurs during acceleration	• Insufficient acceleration torque • High load inertia • High friction torque	• Insufficient acceleration torque can be alleviated by lengthening the value for **Acceleration time monitor** (FA-10). • If Acceleration torque is required, it may be improved by adjusting the manual torque boost function or considering another control method such as automatic torque boost with **Control mode selection, 1st-motor** (AA121). • It may be improved by reviewing the load conditions.
	The function to suppress over-current is in operation	There may be a factor causing an over-current condition. It is necessary to review the acceleration time and load conditions.
Occurs during deceleration	High load inertia	• Insufficient regenerative torque can be alleviated by lengthening the value for **Deceleration time monitor** (FA-12). • If regenerative torque is required, it may be improved by adjusting the manual torque boost function or considering another control method such as automatic torque boost with **Control mode selection, 1st-motor** (AA121). • It may be improved by reviewing the load conditions.
	The function to suppress over-voltage is in operation	Current may increase as a result of suppressing over-voltage. It is necessary to review the deceleration time and load conditions.
Occurs after long-term use	Changes to the system environment	It may also be improved by reducing the motor load and maintaining the system (cleaning the fan to be driven, clearing duct clogging, etc.).
	Aging of equipment	If it is not resolved by reducing the load, there is a possibility that parts may have deteriorate over time. Repair is required

E040 LCD Operator Communication Error

Displayed when a timeout occurs due to malfunction, poor contact, disconnection, etc., caused by such things as noise on the communication line with the LCD operator.
You can enable or disable the error by setting.**Action selection at Keypad disconnection** (UA-20).

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs after communication started	• Poor contact • Disconnection	Review the wiring and make sure the connections are correct.
	Noise contamination	It may be improved by noise countermeasures such as wiring separation.

E041 RS485 Communication Error

RS485 communication (Modbus-RTU, etc.) Displayed only when a timeout occurs due to malfunction caused by line noise, poor contact, disconnection, etc.
You can make settings in **RS485 communication error selection** (CF-05) to enable or disable the error.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs right after communication starts	• Poor contact • Disconnection	Review the wiring and make sure the connections are correct.
	Noise contamination	It may be improved by noise countermeasures such as wiring separation.

E042 RTC Error

An error occurs when the RTC data built into the LCD operator has returned to the initial value.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs when turning the inverter power on	The battery in the LCD operator may be dead	Try reattaching the battery and resetting the date and time. If the battery is dead, it will occur when the inverter power is turned on again.

E043 EzSQ Illegal Instruction Error

When using the EzSQ program function, an error is output when an invalid instruction is given during the operation of the program downloaded to the inverter.
An error will be output even if an empty program is run.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs when trying to run the program	Write error due to noise	EzSQ program writing may have failed, and if there is a noise source nearby, it may be improved by writing after applying noise countermeasures such as moving the noise source away.
	There is no program	EzSQ program writing is required after resetting factory defaults or re-initialization. Try writing the program again.

E044 EzSQ Nest Count Error

When using EzSQ program function, if the number of nested subroutines, “for” statements, “next” statements, etc. in the program exceeds 8, an error is output.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs when trying to run the program	The structure of the program is too complicated	The hierarchy of subroutines, “for” statements, or “next” statements is too deep, and the number of nestings exceeds 8, so it is necessary to improve the program structure.

E045 EzSQ Executive Instruction Error

When using EzSQ program function, if an error occurs during the operation of the program downloaded to the inverter that prevents the program from executing, an error will occur.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs when trying to run the program	The program flow is invalid	An error will occur if there is no nested start such as “for” at the jump destination of “goto”, or if it is preceded by a nested termination such as “next”. Check the configuration of the “for” statement and “next” statement and correct it.
	The data is corrupted	Overflow, underflow, and division by zero may occur in the four arithmetic operations, so check the result of the operation and correct it.
		In the "chg param" and "mon param" instructions, if a parameter that does not exist is referenced or is out of the setting range, an error will occur. Check the content described in the instruction and correct it.

E050 to E059 EzSQ User-Assigned Errors 0 to 9

When using EzSQ program function, if a user-specified error-generating program is executed while the program downloaded to the inverter is running, an error will be generated.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs when trying to run the program	The program contains an error instruction	If a user-specified error occurs unintentionally, check the contents of the trip instruction in the program and correct it.

E060 to E069 Option 1 Errors 0 to 9

Detects errors in options installed in option slot 1 (left slot).
For details, refer to guide for the installed option.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurred after installing the option	Option not securely attached	Check the installation as the option may not be installed securely.
	There is a mistake in usage	The error differs depending on the option. For more information, refer to the guide for the specific option.

E070 to E079 Option 2 Errors 0 to 9

Detects errors in options installed in option slot 2 (middle slot).
For details, refer to guide for the installed option.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurred after installing the option	Option not securely attached	Check the installation as the option may not be installed securely.
	There is a mistake in usage	The error differs depending on the option. For more information, refer to the guide for the specific option.

E080 to E089 Option 3 Errors 0 to 9

Detects errors in options installed in option slot 3 (right slot).
For details, refer to guide for the installed option.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurred after installing the option	Option not securely attached	Check the installation as the option may not be installed securely.
	There is a mistake in usage	The error differs depending on the option. For more information, refer to the guide for the specific option.

E090 to E093 STO Errors

Errors output due to abnormality in the functional safety circuit.
For details on E090 to E093, refer to *2-4-3 Status Indication and Cut-off Based on Self-diagnosis* on page 2-87 and *Parameters Related to STO Function Display* on page 2-89.

Occurrence	Assumed cause(s)	Example measures to be taken
When using safety functions	There is a problem with the safety function system	Refer to *2-4 STO Function* on page 2-81.

E100 Encoder Disconnection Error

This is an error related to the feedback option. It is possible to cause a trip to occur with an encoder disconnection error (E100) by setting the switch on the top of the feedback PG option unit. The setting is done with the DIP switch.
For details refer to *2-3-6 Wiring for PG Option Unit* on page 2-68 and *PG Option Unit Disconnection Detection* on page 2-76

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs immediately after turning the power on	Encoder wire or encoder error	• Check the encoder signal and wiring. • When using an external encoder power supply, make sure that there is no delay in starting and supplying the encoder power compared to power supply to the inverter when the power is turned on.
Occurs suddenly during operation	Encoder wire or encoder error	Check the encoder signal and wiring.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs when inverter power is shut off Or this error history was added every time the power was turned on.	Inverter internal power supply error or encoder power supply error	• When using the inverter's dedicated power supply for the encoder, check for a failure of the inverter or an overload condition for the power supply for the encoder. • When using an external encoder power supply, make sure that there is no loss of encoder power supply before the inverter.

E104 Position Control Range Error

If the current position counter exceeds the forward / reverse position control ranges set respectively in **Position control range setting (forward)** (AE-52) and **Position control range setting (reverse)** (AE-54), the output is cut off and an error is displayed.
For usage of related functions, see *8-4-9 Absolute Position Control Mode* on page 8-107

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs while operating	Insufficient torque	It may be improved by reviewing the operating conditions and improving the load conditions.
	Slip/shift caused by improper encoder setting	Check the encoder installation and consider any factors that cause slippage.
	Encoder setting error	Check the settings such as the encoder constant setting.
	Electronic gear setting error	Re-check the electronic gear settings.

E105 Speed Deviation Error

If the deviation between the frequency command and the speed obtained from feedback is larger than what is set for **Speed deviation error detection level** (bb-83), it is judged as abnormal. When **Speed deviation error mode selection** (bb-82) is set to *01: Error*, the output terminal [41: DSE] is turned ON by a speed deviation error to shut off the output and display an error.
For usage of related functions, see *8-3-9 Speed Deviation Error Detection* on page 8-75

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs while operating	Insufficient torque	It may be improved by reviewing the operating conditions and improving the load conditions.
	Slip/shift caused by improper encoder setting	Check the encoder installation and consider any factors that cause slippage.
	Encoder setting error	Check the settings such as the encoder constant setting.
	Electronic gear setting error	Re-check the electronic gear settings.

E106 Position Deviation Error

If the deviation of the position feedback with respect to the position command exceeds the **Position deviation error detection level** (bb-86) for longer than the time set for **Position deviation error**

detection time (bb-87), it will be judged as an abnormal condition. When **Position deviation error mode selection** (bb-85) is set to *01: Error*, the output terminal [PDD] turns ON to shut off the output and display an error.

For usage of related functions, see *Excessive Positional Deviation Detection* on page 8-104

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs while operating	Insufficient torque	It may be improved by reviewing the operating conditions and improving the load conditions.
	Slip/shift caused by improper encoder setting	Check the encoder installation and consider any factors that cause slippage.
	Encoder setting error	Check the settings such as the encoder constant setting.
	Electronic gear setting error	Re-check the electronic gear settings.

E107 Over-Speed Error

If the speed exceeds the value set for **Over speed detection level** (bb-80) and the **Over speed detection time** (bb-81) elapses, the output will be cut off and an error will be displayed.

For usage of related functions, see *8-3-10 Over-speed Error Detection* on page 8-76

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs while operating	Insufficient torque	It may be improved by reviewing the operating conditions and improving the load conditions.
	Encoder setting error	Check the settings such as the encoder constant setting.
	Electronic gear setting error	Re-check the electronic gear settings.

E110 Contactor Error

When an error occurs in the contactor sequence, the output is shut off.

For usage of related functions, see *8-4-5 Contactor Control (CON)* on page 8-89

Occurrence	Assumed cause(s)	Example measures to be taken
[COK] did not turn ON within the contactor answer back check time at start-up	Wiring failure	Check the input terminal function settings and wiring.
	Contactor response failure	Check the operation including the response time of the contactor.
[COK] did not turn OFF within the contactor answer back check time when stopped	Wiring failure	Check the input terminal function settings and wiring.
	Contactor response failure	Check the operation including the response time of the contactor.

E112 PG Option Unit Connection Error

This is an error related to the feedback option.

If the PG option unit comes off after being set in the slot, it trips with a PG option unit connection error (E112).

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs suddenly during operation	The connector may have loosened or come off	• Check that the mounting screws of the PG option unit are not loose. • Check the contacts and check for any dust, etc on the connector.

E120 PID Soft Start Error Detection

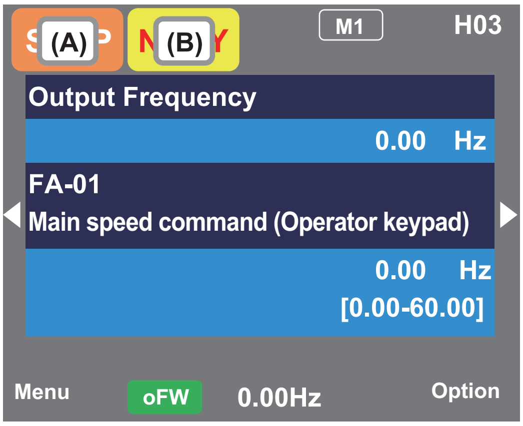
This error will occur when **PID soft start function enable** (AH-75) is set to *01: Enabled* and **PID soft start error detection enable** (AH-81) is set to *01: Enabled: error output* and a PID operation is performed after the inverter has started running. Under this condition, if the PID feedback does not reach the value set for **PID soft start error detection level** (AH-82) before the **PID soft start time** (AH-80) elapses, the error will occur.

Occurrence	Assumed cause(s)	Example measures to be taken
Occurs while operating	Target value is too low	It may be improved by reviewing the setting for **PID soft start target level** (AH-76).
	The wire is broken	PID feedback may not have been entered properly. Review the wiring and check **PID1 feedback data monitor after calculation** (db-44).

12-3 Alarm Display and Measures

12-3-1 Checking the Alarm Display

The status of the inverter is displayed in the following location on the LCD operator.



Display (A) Main Operation Status

No.	Display	Description
A1	RUN FW	Displayed during forward rotation operation. Some parameters cannot be changed during operation.
A2	RUN RV	Displayed during reverse rotation operation. Some parameters cannot be changed during operation.
A3	RUN 0Hz	Output is in process by 0 Hz command. It may occur when using the DB, FOC, or SON functions. Some parameters cannot be changed during operation.
A4	TRIP	Displayed during trip after the occurrence of error. Errors that can be canceled are cleared by the reset operation. ⇒ Refer to *12-1 Checking the Alarm Display* on page 12-2
A5	WARN	Displayed when setting inconsistency occurs. Resolve the inconsistency. ⇒ Refer to *12-3-2 Checking Inconsistent Settings* on page 12-29
A6	STOP	This is displayed when the device is forcibly stopped by a function although an operation command is issued. • The operation command is issued with frequency command at 0 Hz. • When the operation command is issued from a source other than the LCD Operator, the device is stopped by the STOP key on the LCD Operator. • The device is stopped by the momentary power interruption non-stop function. At this time, the RUN lamp blinks.
A7	STOP	It is stopped due to no operation command received. Operation is not possible if the input terminals such as [RS], [FRS], or the STO function are ON.

Display (B) Warning Status

No.	Display	Description
B1	LIM	Displayed in the following functions: **Detailed Monitor for Icon 2 LIM** (dC-37) • Under overload limit • Under torque limit • Under overcurrent suppression • Under overvoltage suppression • Under upper/lower limit operation • Under jump frequency operation • Under minimum frequency limit
B2	ALT	Displayed in the following functions: **Detailed Monitor for Icon 2 ALT** (dC-38) • Overload advance notice • Motor thermal advance notice • Inverter thermal advance notice • Motor heating advance notice
B3	RETRY	Displayed during retry standby or restart standby. **Detailed Monitor for Icon 2 RETRY** (dC-39)
B4	NRDY	Operation is not started even if the operation command is issued. **Detailed Monitor for Icon 2 NRDY** (dC-40) • Under insufficient voltage of the main power • Operating with only 24 V power supply • Under reset operation • OFF when [REN] terminal function is enabled
B5	FAN	Displayed upon the fan life advance notice.
B6	C	Displayed upon the capacitor life advance notice on the circuit board.
B7	F/ C	Displayed upon the fan life advance notice and capacitor life advance notice on the circuit board.
B8	(None)	A state other than those above

You can see the details of the warning display by pressing the UP-key on the 3-line monitor screen.

STOP (in red)

When STOP is displayed in red, it is due to one of the following conditions.

Occurrence	Typical cause(s)	Example measures to be taken
RUN key on the operator was pressed [FW] terminal was turned ON Operation command was entered	If the LIM is lit, the command is below the minimum frequency. Consider the following causes. • The operation command was entered, but the frequency command was not. • Frequency command destination selection is wrong.	• Check that **Main Speed reference monitor** (FA-01) is not set to 0.00Hz. • Check whether the command is entered from the command destination indicated on the right of **Main Speed reference monitor** (FA-01). • Check **Main speed input source selection, 1st-motor** (AA101).
After STOP key on operator is pressed, inverter doesn't operate with RUN key.	The STOP key on the LCD operator was pressed when the operation command was entered from a source other than the LCD operator.	Turn off the command at the operation command destination once.
Momentary power failure occurred	The device is stopped by the momentary power interruption non-stop function.	To start operation, turn off the command entered to the operation command destination and turn on again.

WARN

When WARN is displayed, it is due to one of the following conditions.

Occurrence	Assumed cause(s)	Example measures to be taken
A setting is changed	An invalid or inconsistent parameter	Refer to *12-3-2 Checking Inconsistent Settings* on page 12-29.

Icon 2 LIM

When LIM is shown, the inverter is in one of the following condition(s).
You can see the status of LIM by pressing the UP key on the three-line monitor or on **Detailed monitor for icon 2 LIM** (dC-37).

Occurrence	Assumed cause(s)	Example measures to be taken
The output current is high and **Detailed monitor for icon 2 LIM** (dC-37) is set to "01".	**Over current suppress enable, 2nd-motor** (bA120) is enabled and current increased due to load, or other factor.	Remove the factor for the increased load. (Cleaning the flow path, reviewing the load, etc.)
	The current was increased by the high ratio of motor rotation during DC braking that was caused by the selection of [DB] terminal or **DC braking selection, 1st-motor** (AF101).	• Decrease the **DC braking force setting, 1st-motor** (AF105) or **DC braking force at start, 1st-motor** (AF108). • If it occurs at stopping, set **DC braking active time at stop, 1st-motor** (AF106) to be longer. • If it is a retry operation at start-up, increase the delay time depending on the cause factor. **Retry wait time before motor restart** (bb-26), **Wait time of restart @over-current** (bb-29), **Wait time of restart @over-voltage** (bb-31)
	Acceleration time monitor (FA-10) is set too short	Set a longer time in **Acceleration time monitor** (FA-10).

Occurrence	Assumed cause(s)	Example measures to be taken
The output current is high and **Detailed monitor for icon 2 LIM** (dC-37) is set to “02”.	**Overload restriction 1 mode selection** (bA122) is enabled and the current increased due to the load.	Remove the factor for the increased load. (Cleaning the flow path, reviewing the load, etc.)
	Overload limiting function such as **Overload restriction 1 mode selection** (bA122) is enabled and **Acceleration time monitor** (FA-10) is set too short.	Set a longer time in **Acceleration time monitor** (FA-10).
Error occurred during deceleration and **Detailed monitor for icon 2 LIM** (dC-37) was set to “03”.	The over-voltage suppression function of **Over-voltage suppression enable, 1st-motor** (bA140) is enabled and the P-N voltage increased due to regenerative load, etc.	Remove the factor causing the regenerative load. (External rotation of motor, reviewing the load conditions, etc.)
	Overload limiting function such as **Overload restriction 1 mode selection** (bA122) is enabled and **Deceleration time monitor** (FA-12) is set too short.	Set a longer time in **Deceleration time monitor** (FA-12).
Error occurred at sudden acceleration and **Detailed monitor for icon 2 LIM** (dC-37) was set to “03”.	The over-voltage suppression function of **Over-voltage suppression enable, 1st-motor** (bA140) is enabled and the P-N voltage increased due to regenerative load, etc.	Remove the factor causing the regenerative load. (External rotation of motor, reviewing the load conditions, etc.)
The output current was high and **Detailed monitor for icon 2 LIM** (dC-37) was set to “04”.	A torque limiting function such as **Torque limit selection, 1st-motor** (bA110) is enabled and the current increased due to the load, etc.	Remove the factor for the increased load. (Cleaning the flow path, reviewing the load, etc.)
	Torque limiting function such as **Torque limit selection, 1st-motor** (bA110) is enabled and **Acceleration time monitor** (FA-10) is set too short	Set a longer time in **Acceleration time monitor** (FA-10).
Error occurred during Run and **Detailed monitor for icon 2 LIM** (dC-37) was set to “05”.	Normally limited by jump frequencies such as **Upper frequency limit, 1st-motor** (bA102), **Lower frequency limit, 1st-motor** (bA103), or **Jump frequency 1, 1st-motor** (AG101)	If necessary, review the upper and lower limiter and jump frequency settings.
Error occurred during Run and **Detailed monitor for icon 2 LIM** (dC-37) was set to “06”.	A frequency command below the minimum, **Minimum frequency adjustment, 1st-motor** (Hb130) was entered	Set the frequency command at the minimum frequency or higher in **Main Speed reference monitor** (FA-01).

Icon 2 ALT

When ALT is shown, the inverter is in one of the following condition(s).
You can see the status of ALT by pressing the UP key on the three-line monitor or on **Detailed monitor for icon 2 ALT** (dC-38).

Occurrence	Assumed cause(s)	Example measures to be taken
The output current is high and **Detailed monitor for icon 2 ALT** (dC-38) is set to “01”.	The current increased due to load, etc., and exceeded an overload warning level such as **Over current detection level 1, 1st motor** (CE106)	• Remove the factor for the increased load. (Cleaning obstructions in the flow path, etc.) • Enable overload limit function or similar function.
The output current is high and **Detailed monitor for icon 2 ALT** (dC-38) is set to “02”.	The electronic thermal function of the motor was activated due to the increase in current, and it exceeded the setting for **Electronic thermal warning level (MTR)** (CE-30).	• Remove the factor for the increased load. (Cleaning obstructions in the flow path, etc.) • Review the electronic thermal settings.
The output current is high and **Detailed monitor for icon 2 ALT** (dC-38) is set to “03”.	The electronic thermal function of the Inverter was activated due to the increase in current, and it exceeded the setting for **Electronic thermal warning level (CTL)** (CE-31).	Remove the factor for the increased load. (Cleaning obstructions in the flow path, etc.)

Icon 2 RETRY

When RETRY is shown, the inverter is in one of the following condition(s).
You can see the status of RETRY by pressing the UP key on the three-line monitor or on **Detailed monitor for icon 2 RETRY** (dC-39).

Occurrence	Assumed cause(s)	Example measures to be taken
Output was shut off and RETRY setting of **Detailed monitor for icon 2 RETRY** (dC-39) is set to “01”	The inverter is in the wait mode after a trip retry operation due to increased current or P-N voltage fluctuation.	• If the wait time become longer, the following delay times become shorter. **Retry wait time before motor restart** (bb-26), **Wait time of restart @over-current** (bb-29), **Wait time of restart @over-voltage** (bb-31) • If this error is continually generated, make the wait time longer. **Retry wait time before motor restart** (bb-26), **Wait time of restart @over-current** (bb-29), **Wait time of restart @over-voltage** (bb-31)
Output was shut off and RETRY setting of **Detailed monitor for icon 2 RETRY** (dC-39) is set to “02”	The inverter is in the wait mode before restart after power-off by [RS], [FRS], or [CS] terminal.	If the wait time becomes longer, the following delay time becomes shorter. **Retry wait time before motor restart** (bb-26)

Icon 2 NRDY

When NRDY is shown, the inverter is in one of the following condition(s).
You can see the status of NRDY by pressing the UP key on the three-line monitor or on **Detailed monitor for icon 2 NRDY** (dC-40).

Occurrence	Assumed cause(s)	Example measures to be taken
TRIP is displayed and NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "01"	There was an error factor, which caused the inverter to trip.	Remove the error factor. Consult this section.
CTRL icon is shown and NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "02"	The control power supply (R0, T0) has been input, whereas the main circuit power supply R-S-T hasn't been input.	Check the input of main circuit power supply and examine the breaker, wiring, etc.
24 V icon is shown and NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "02"	Only 24V has been input to the backup power supply P+-P-.	Check the input of main circuit power and control power and examine the breaker, wiring, etc.
NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "03"	[RS] terminal is ON and the inverter is being reset.	Check the wiring and operation state of [RS] terminal.
NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "04"	The STO circuit is turned OFF or broken.	Check the ST1/ST2 terminals.
NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "05"	The inverter is doing a check of the internal circuit, LCD operator, options, etc.	If this error is not released, check the LCD operator for contact failure or other problem.
NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "06"	There is an inconsistency in the setting	Although **Control mode selection, 1st-motor** (AA121) is set to *10: Vector control with sensor*, the PG option unit is not attached. Refer to *12-3-2 Checking Inconsistent Settings* on page 12-29.
NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "07"	There is a sequence operation problem in the brake control.	Check the setting and signal operation of **Brake Control Enable, 1st-motor** (AF130) or similar parameter.
NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "08"	• [FRS] terminal or [CS] terminal is ON • The [FRS] or [CS] command was sent over communication	Check the signal operation of input terminal for [FRS] or [CS].
NRDY of **Detailed monitor for icon 2 NRDY** (dC-40) is set to "09"	Operation command isn't permitted	The [REN] terminal has been assigned and is turned OFF.
	Forced stop is being issued. (Deceleration stop operation)	STOP key was pressed when command had been entered from a source other than the LCD operator.

12-3-2 Checking Inconsistent Settings

The corrective action differs depending on the content of the warning number. Refer to the table below. Switching between Induction motor (IM) control and Synchronous motor/Permanent magnet motor (SM/ PMM) control is done with **Control mode selection, 1st-motor** (AA121).

Occurrence	Assumed cause(s)	Example measures to be taken
Warning 102	(First max. frequency) < (First upper limiter) IM: (Hb105) < (bA102) SM/PMM: (Hd105) < (bA102)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 1st-motor** (Hb105) and **Sync.Maximum frequency setting** (Hd105). • Decrease **Upper frequency limit, 1st motor** (bA102).
Warning 103	(First max. frequency) < (First lower limiter) IM: (Hb105) < (bA103) SM/PMM: (Hd105) < (bA103)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 1st-motor** (Hb105) and **Sync.Maximum frequency setting** (Hd105). • Decrease **Lower frequency limit, 1st motor** (bA103).
Warning 106	(First max. frequency) < (First main speed command) IM: (Hb105) < (Ab110) SM/PMM: (Hd105) < (Ab110)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 1st-motor** (Hb105) and **Sync.Maximum frequency setting** (Hd105). • Decrease the Multispeed-0 setting, 1st-motor (Ab110).
Warning 107	(First max. frequency) < (First auxiliary speed command) IM: (Hb105) < (AA104) SM/PMM: (Hd105) < (AA104)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 1st-motor** (Hb105) and **Sync.Maximum frequency setting** (Hd105). • Decrease the sub speed setting, 1st-motor (AA104).
Warning 202	(Second max. frequency) < (Second upper limiter) IM: (Hb205) < (bA202) SM/PMM: (Hd205) < (bA202)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 2nd-motor** (Hb205) and **Sync.Maximum frequency setting, 2nd-motor** (Hd205). • Decrease the **Upper frequency limit, 2nd motor** (bA202).
Warning 203	(Second max. frequency) < (Second lower limiter) IM: (Hb205) < (bA203) SM/PMM: (Hd205) < (bA203)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 2nd-motor** (Hb205) and **Sync.Maximum frequency setting, 2nd-motor** (Hd205). • Decrease the **Lower frequency limit, 2nd motor** (bA203).

Occurrence	Assumed cause(s)	Example measures to be taken
Warning 206	(Second max. frequency) < (Second main speed command) IM: (Hb205) < (Ab210) SM/PMM: (Hd205) < (Ab210)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 2nd-motor** (Hb205) and **Sync.Maximum frequency setting, 2nd-motor** (Hd205). • Decrease the **Multispeed-0 setting, 2nd-motor** (Ab210).
Warning 207	(Second max. frequency) < (Second auxiliary speed command) IM: (Hb205) < (AA204) SM/PMM: (Hd205) < (AA204)	• Increase the max frequency, **Async.Motor Maximum frequency setting, 2nd-motor** (Hb205) and **Sync.Maximum frequency setting, 2nd-motor** (Hd205). • Decrease the **sub speed setting, 2nd-motor** (AA204).

12-3-3 Checking Messages

Messages associated with communication errors, under-voltage, auto-tuning results, etc., are displayed.
A screen transition is performed by pressing the ENTER key, but if an error occurred, the cause of the error needs to be resolved.
The “XX key” in the table is the ENTER key on the LCD Operator.

Message	Assumed cause(s)	Example measures to be taken
Warning xxxxxxxxxxxxxxx Press the XX key	A setting inconsistency warning. There is an inconsistency in the settings displayed in the warning	This can be resolved by adjusting the displayed parameter settings.
Auto-tuning (non-revolving) completed. xxxxxxxxxxxxxxx Press the XX key	Non-revolving auto-tuning process completed.	Refer to *6-2-3 Auto-tuning of Motor* on page 6-13.
Auto-tuning (revolving) completed. xxxxxxxxxxxxxxx Press the XX key	Revolving auto-tuning process completed.	Refer to *6-2-3 Auto-tuning of Motor* on page 6-13.
Auto-tuning failed. Review the settings and wiring Press the XX key	The auto-tuning process was interrupted and did not complete	For troubleshooting, refer to *6-2-3 Auto-tuning of Motor* on page 6-13
Initializing... Please wait.	The inverter is being initialized.	The initialization completion screen will appear after a while.
Clearing history... Please wait.	The inverter is being initialized.	The history cleared screen will appear after a while.

Message	Assumed cause(s)	Example measures to be taken
Initialization completed !! Target: ##:xxxxxxxxxxxx **Initialize Data selection** (Ub-02) xxxxxxxxxxxxx Load type selection (Ub-03) xxxxxxxxxxxxx Press the XX key	The initialization is completed.	Press the ENTER key to exit the initialization complete screen.
History clearance completed !! Trip history cleared Press the XX key	Clear history is completed.	Press the ENTER key to exit the clear history complete screen.
Operation command is limited Please check operation command.	• Contains a command direction in the operation command that is restricted by **RUN-direction restriction, 1st-motor** (AA114). • In the command direction restricted by **RUN-direction restriction, 1st-motor** (AA114), the frequency command becomes negative due to the calculation of the main speed and auxiliary speed, and the rotation is reversed.	• Check the setting for **RUN-direction restriction, 1st-motor** (AA114). • Check the terminal command FW/RW and the command direction of communication command. • Check if the calculated frequency command is negative.
Resetting. Inverter is being reset. Press the XX key	• [RS] terminal is ON. • Trip reset was performed (the screen transitions automatically at trip reset)	The inverter is in an [RS] terminal ON state. Review the state of the input terminal.
Retrying. Retrying and restarting. Press the XX key	The inverter is waiting for restart. (This mode is released after the set wait time has elapsed.) • The inverter may not start if the incoming voltage is low.	• If the wait time for restart is long, the message will continue to be displayed. Refer to *7-5 Start Conditions* on page 7-57 • If the incoming voltage is low, check the input voltage.
Main circuit under instantaneous power failure. Power of main circuit is turned OFF. Press the XX key	The main circuit power supply (R, S, T) is turned OFF due to lightning strikes, power supply environment, or other factors.	• Check the state of input power supply. • The inverter will recover when the power supply returns.
Main circuit under insufficient voltage. Please check the main circuit power. Press the XX key	The control circuit power supply (R0, T0) has been input, whereas the main circuit power supply (R, S, T) has been cut.	• Check the state of input power supply. • The inverter will recover when the power supply of main circuit returns.
POWER OFF POWER OFF Press the XX key	The power supply to the inverter is turned OFF.	• Check the state of input power supply. • The inverter will recover when the power supply returns.

Message	Assumed cause(s)	Example measures to be taken
Control power under insufficient voltage. Please check the control power supply. Press the XX key	The control circuit power supply (R0, T0) is turned OFF.	• Check the state of input power supply. • The inverter will recover when the power supply of control circuit returns.
Power feeding by external 24 VDC. Only external 24 VDC is feeding power. Press the XX key	The inverter is operating only with 24V power supply input to P+ and P- terminals.	If the input power is on, check its status.
Changing load type... Please wait.	The load type of inverter is being changed.	The load type change complete screen will appear after a while.
Load type change completion !! **Load type selection** (Ub-03) Rated current value changed. Check current-related parameters. Press the XX key	The load type change is completed.	Press the ENTER key to exit the load type change complete screen.

12-4 Troubleshooting

When there are failures or errors on operations, investigate the possible causes and take the appropriate measures.

Occurrence	Assumed cause(s)	Example measures to be taken
LCD Operator doesn't turn ON (LCD operator POWER lamp does not light)	The power supply is not turned ON.	• Check that the power supply that meets the specifications is turned ON. • When different powers are supplied to the control power supplies R0 and T0, and to P+ and P- terminals, check that R0, T0, or 24 V power supply is turned ON.
	LCD Operator is not securely attached	The issue will be solved by securely attaching the LCD Operator.
	The J51 connector is disconnected.	The J51 connector supplies power to the control power supplies R0 and T0 from the main power supplies R, S, and T. Keep the connector connected if you do not supply power to the control power supply with a different system.
	• The power input path is disconnected • 200 V power is being supplied to R0 and T0 for 400 V class.	• The breaker or wires may be disconnected. You need to re-examine the wiring. • When different power is supplied to the control power supplies R0 and T0, you also need to re-examine R0 and T0.

Occurrence	Assumed cause(s)	Example measures to be taken
LCD Operator doesn't turn ON (The POWER lamp of the LCD operator is lit)	LCD operator is in automatic light off mode	• Press the key on the LCD operator to turn on the screen. • You can disable the automatic light off feature from the LCD operator's system settings.
	LCD operator display light / dark setting is low	You can adjust the brightness of the display by changing the dimming setting from the LCD operator's system settings.
	LCD Operator is not securely attached	The issue will be solved by securely attaching the LCD Operator. (Check the RJ45 connector)
	The LCD display is at end of life	You need to replace the LCD Operator.

Occurrence	Assumed cause(s)	Example measures to be taken
The motor doesn't rotate although an operation command was entered.	The inverter is tripping.	• When the inverter trips due to an error, you need to remove the error factor and reset the inverter. • Refer to *12-2 Error Numbers and Corresponding Measures* on page 12-5.
	A warning is indicated	• If a warning is indicated, you need to eliminate the data inconsistency. • Refer to *12-3-2 Checking Inconsistent Settings* on page 12-29.
	The operation command isn't entered.	The operation command destination may be wrong, or the operation command may not be accepted. → See *Operation command destination or operation command is wrong* page 12-36
	The frequency command destination isn't entered.	The frequency command destination may be wrong, or the frequency command may be 0. → See *The frequency command destination or frequency command is incorrect* page 12-37
	A shutoff function is activated	The function safety terminal, terminal function [RS], or [FRS] terminal may be enabled, or [ROK] terminal may be disabled. → See *A shutoff function is activated* page 12-38
	A limit function is activated	The command direction may be limited by the rotation direction limit function. → See *A limit function is activated* page 12-39
	The motor is locked.	If the motor shaft is constrained by something that interferes with the brakes or motor rotation (such as something clogged), the cause must be eliminated.
	Disconnected wiring, etc.	Check for abnormalities such as disconnection of the output line to the motor or disconnection within the motor.

Occurrence	Assumed cause(s)	Example measures to be taken
Operation command destination or operation command is wrong.	Even though the operation command is entered, the motor is not being driven.	If the LED for RUN on the LCD Operator is lit or the operation display appears, the operation command has been entered normally. There is another cause for why the motor is not being driven. →See*The motor doesn't rotate although an operation command was entered* page 12-35
	↓	
	There is a mismatch of the operation command input and the operation command destination	Check the operation command destination. Check the status of **Run-command input source selection, 1st-motor** (AA111) and the terminal function. For details, refer to *6-3 Operation Command Settings* on page 6-18.
	↓	
	You wish to operate with the LCD operator, but entered the wrong setting.	Verify that oFW or oRV is displayed at the bottom of the LCD operator. If it is not displayed, check that **Run-command input source selection, 1st-motor** (AA111) is set to *02: RUN key on LCD Operator*. If it is displayed, you must check the terminal function.
	↓	
	You wish to operate with the [FW] terminal, but entered the wrong setting.	Set **Run-command input source selection, 1st-motor** (AA111) to *00: [FW] / [RV] terminal*. If RUN is not shown when the [FW] terminal is turned ON, other terminal functions need to be checked.
	↓	
	There is a cause other than the operation command.	• If the LCD Operator doesn't show RUN, a shutoff function may be enabled or the main power supply may not be turned ON. • There is another cause for why the motor is not being driven. →See *The motor doesn't rotate although an operation command was entered* page 12-35

Occurrence	Assumed cause(s)	Example measures to be taken
The frequency command destination or frequency command is incorrect	• Frequency command is “0” • **Frequency command after calculation** (dA-04) is set to “0”	The frequency command destination may be incorrect, or the command source setting or the input voltage of the frequency setter may be 0. Set the setting destination to something other than 0.
	↓	
	Frequency command destination is wrong.	Check the frequency command destination. Check the status of **Main speed input source selection, 1st-motor** (AA101) and the terminal function. Refer to *6-4 Frequency Command Settings* on page 6-25
	↓	
	You wish to set the frequency command, but **Main Speed reference monitor** (FA-01) is “0”	Set **Main speed input source selection, 1st-motor** (AA101) to “07”, set the parameters and change **Main speed reference monitor** (FA-01) from the LCD operator.
	↓	
	Main speed reference monitor (FA-01) is “0” even after the frequency setter is turned.	Connect **Main speed input source selection, 1st-motor** (AA101) according to the analog input to be used and operate the frequency setter.
	↓	
	Main speed reference monitor (FA-01) is not “0” and the cause is something other than the frequency command.	• If there is no data in **Main speed reference monitor** (FA-01), the frequency command is normal. • There is another cause for why the motor is not being driven. →See *The motor doesn’t rotate although an operation command was entered* page 12-35

Occurrence	Assumed cause(s)	Example measures to be taken
A shutoff function is activated	The main power supply is not turned ON.	If the power supply is split into R, S, T and R0, T0 (J51 connector part), operation will not be possible if the power supply on the R, S, T side is turned off. Check the power supply.
	[RS] terminal is ON	If the [RS] terminal is ON, it will be in a reset state and will not accept operation commands. You must turn OFF the [RS] terminal.
	[FRS] terminal is ON	If the [FRS] terminal is ON, it will be in a free-run stop state and will not accept operation commands. You must turn OFF the [FRS] terminal.
	[CS] terminal is ON	If the [CS] terminal is ON, the commercial power supply will be shut off and no operation command will be accepted. Check the commercial switching function.
	[REN] Terminal is assigned and is OFF	When using the [REN] terminal, the operation command will not be accepted if the terminal function is OFF. Check the operation permission signal.
	The STO terminal is not wired correctly or is OFF	If you do not use the function of STO terminal, you need to attach a short-circuit wire to it.
	The inverter is tripping.	When the inverter is tripping, it does not accept operation commands. Identify the cause of the trip.
	Shutoff functions are not enabled.	There is another cause for the motor not being driven because it does not have a shutoff function. → See *The motor doesn't rotate although an operation command was entered* page 12-35

Occurrence	Assumed cause(s)	Example measures to be taken
A limit function is activated	The operation permission signal has been assigned to the input terminal function and the signal is turned OFF.	When the operation permission signal has been assigned, the operation permission signal needs to be turned ON.
	↓	
	A command was issued for a restricted drive direction.	Check the operation command direction restrictions.
	↓	
	Both [FW] and [RV] terminals are ON by the operation command from the input terminal.	If both the [FW] and [RV] terminals are ON, the input will be inconsistent and the system will stop. Operate with only one.
The motor speed does not increase	An overload limit function is activated	• The overload limit function lowers the frequency to limit the current when the output current exceeds the overload limit level. • It may be resolved by increasing the setting level.
	↓	
	The frequency command is limited	If the upper limiter and the maximum frequency is set too low, there may be improvement by setting them to higher level. To limit frequencies, use the upper limiter function instead of the maximum frequency.
	↓	
	The frequency command is low.	If a high priority frequency command is included for jogging, multi-speed command, etc., the command will be lower. You must review the terminal function and frequency command destination.
	↓	
	Acceleration time is long.	If the acceleration time is set too long, acceleration becomes slow. Set the acceleration time shorter.
The parameter you are looking for is not shown.	A limit on display has been set	A display limit function may be active. Cancel the limit in **Display restriction selection** (UA-10).
	↓	
	The display is fixed	Operation on the LCD Operator isn't accepted if the input terminal function [102: DISP] is ON. Turn OFF the terminal.
The LCD operator cannot be operated	The display is fixed	Operation on the LCD Operator isn't accepted if the input terminal function [102: DISP] is ON. Turn OFF the terminal.

Occurrence	Assumed cause(s)	Example measures to be taken
A setting can not be made	The inverter is running	Some parameters cannot be changed while the inverter is running. If that is the case, turn OFF the inverter once.
Motor rotates in a reverse direction.	The wiring to the motor is out of phase	The rotation is reversed by swapping the two phases of the wiring to the motor.
	When the RUN key on the LCD Operator is used, the rotation direction setting is wrong.	You must switch the RUN key direction with **RUN-key Direction of LCD operator** (AA-12).
	When the 3-wire function is used, the input of input terminal function F/R is reversed.	Check the logic of 3-wire forward / reverse rotation terminal [18: F/R].
The motor and machinery is noisy	Carrier frequency is set low.	Set **Carrier speed setting, 1st-motor** (bb101) to be higher. However, noise generated from the inverter and leakage current may increase. Also, depending on the model, derating may be required for the output current.
	The rotation frequency of the motor and the natural frequency of the machine resonate.	Change the set frequency. If resonance occurs during acceleration or deceleration, use the frequency jump functions, **Jump frequency 1, 1st-motor** (AG101) to **Jump frequency 3, 1st-motor** (AG106) to avoid the resonance frequency.
Output frequency becomes unstable.	Various parameters are incorrect	Examine the basic parameter settings for the motor and set them accordingly.
	Load fluctuates significantly.	You may need to re-examination the selected capacity of both the motor and inverter.
	PS voltage fluctuates.	Use of an optional ALI or DCL reactor, or a noise filter on the input side to minimize the power fluctuation may give some improvement.

Occurrence	Assumed cause(s)	Example measures to be taken
Torque is not generated.	V/f control is used.	Use torque boost, sensorless vector control, or other control instead.
	↓	
	The inverter is used for lowering.	Use a braking resistor or regenerative braking unit if the torque is not sufficient for regenerative operation.
	↓	
	The load is too heavy.	You may need to re-examination the selected capacity of both the motor and inverter.
LCD operator disconnection error is issued.	Operation selection at disconnection of operator is inappropriate.	Set the operation selection when the operator is disconnected to *02: Ignore*.

Occurrence	Assumed cause(s)	Example measures to be taken
Operation and settings cannot be performed over Modbus communication.	Changes made to communication parameters haven't been reflected.	If **RS485 communication baud rate selection** (CF-01) to **EzCOM source resister 5** (CF-38) are changed, the control power is shut off and then restarted.
	The operation command selection is not set to RS485.	Check that **Run-command input source selection, 1st-motor** (AA111) is set to *03: RS485*.
	The frequency command selection is not set to RS485.	Check that **Run-command input source selection, 1st-motor** (AA111) is set to *03: RS485*.
	The communication speed setting is wrong.	Set the correct value in **RS485 communication baud rate selection** (CF-01), shut off the control power supply and restart.
	Station numbers are set incorrectly or overlap each other.	Set the correct value in **RS485 communication Node allocation** (CF-02), shut off the control power supply and restart.
	The communication parity setting is wrong.	Set the correct value in **RS485 communication parity selection** (CF-03), shut off the control power supply and restart.
	The communication stop bit setting is wrong.	Set the correct value in **RS485 communication stop-bit selection** (CF-04), shut off the control power supply and restart.
	The wiring is wrong	Connect wires properly to the SP and SN terminals on the control circuit terminal block.
The earth leakage circuit breaker is activated while inverter is operating.	There is high leakage current in the inverter.	• Lower the value for **Carrier speed setting, 1st-motor** (bb101). • Raise the sensitivity current in the earth leakage circuit breaker, or replace the breaker with the one with higher sensitivity current.

Occurrence	Assumed cause(s)	Example measures to be taken
DC braking does not work	DC braking force is not set	Set **DC braking force setting, 1st-motor** (AF105) and **DC braking force at start, 1st-motor** (AF108).
	The DC braking active time is not set.	Set **DC braking active time at stop, 1st-motor** (AF106) and **DC braking active time at start, 1st-motor** (AF109).
Noise interference in nearby TV or radio	Radiation noise from the inverter	• Locate the inverter wires as far as possible from a TV or radio. • Install ZCL to the main power supply input of the inverter and the inverter output.

13

Maintenance and Inspection

This section describes the maintenance and inspection.

13-1 Daily Inspection

Check the followings while the inverter is running.

No.	Description	✓
1	The motor operates according to the settings.	☐
2	There is no abnormality in the environment where the device is installed.	☐
3	There is no abnormality in the cooling system.	☐
4	No abnormal vibration or sound is observed.	☐
5	No abnormal overheat or discoloration is observed.	☐
6	No abnormal smell is observed.	☐

While the inverter is running, check the input voltage of inverter using a tester, etc.

No.	Description	✓
1	There is no frequent occurrence of variation of power supply voltage.	☐
2	Line voltage keeps a good balance.	☐

13-2 Periodic Inspection

Check sections that cannot be inspected unless operation is stopped and sections requiring periodic inspection.

No.	Description	✓
1	There is no abnormality in the cooling system. Cleaning of the air filter and other components	☐
2	Checking tightness and re-tightening Due to effects of vibration or temperature change, tightened portions of screws or bolts may loosen. Make sure to carefully check and perform the work.	☐
3	No corrosion or damage is observed on the conductors and insulators.	☐
4	Measurement of insulation resistance	☐
5	Checking and replacing the cooling fan, smoothing capacitor, and relay	☐

13-3 Inspection Items

Target section	Item	Details	Interval			Method	Criteria	Meas-urement instru-ment
			Daily	Periodic				
				1 year	2 years			
General	Ambient envi-ronment	Check the am-bient tempera-ture, humidity, dust, etc.	Yes			See the instal-lation method.	The ambient temperature and humidity are within the usable range. No freezing, condensation, dust, corrosive gas, explosive gas, flammable gas, mist of grinding fluid, hydrogen sul-fide, and salts are permissi-ble.	Ther-mometer Hydro-meter Recorder
	Entire device	No abnormal vibration or sound is ob-served.	Yes			By visual check and hearing	There must be no abnormality.	
	Power supply voltage	The main cir-cuit voltage is normal.	Yes			Measure line voltage be-tween inverter main circuit ter-minals R, S, and T.	They are within the allowable variation range of AC voltage.	Tester and digi-tal multi-meter

Target section	Item	Details	Interval			Method	Criteria	Measurement instrument
			Daily	Periodic				
				1 year	2 years			
Main circuit	General	(1) Megger check (between the main circuit terminals and earth terminals)		Yes		Remove the input/output wires of main circuit terminal block of the inverter, remove the control terminal block board, then, remove the short bar for switching the functions of filter included in the inverter. Then, using a megger, perform measurement between each portion where R, S, T, U, V, W, P, PD, N, RB, R0, and T0 terminals are shorted and earth terminal.	The measured value shall be 5 MΩ or above.	500-VDC class megger
		(2) Fastened portions are not loosened.		Yes		Re-tighten the portion.	There must be no abnormality.	
		(3) No residual mark of overheat is observed on each component.		Yes		By visual check.	There must be no abnormality.	
	Connected conductor and wire	(1) The conductor is not distorted.		Yes		By visual check.	There must be no abnormality.	
		(2) The coatings of wires are not torn.		Yes				
	Terminal block	It is not damaged.		Yes		By visual check.	There must be no abnormality.	

Target section	Item	Details	Interval			Method	Criteria	Measurement instrument
			Daily	Periodic				
				1 year	2 years			
Main circuit	Inverter Converter (including resistor)	Check resistance between each terminal			Yes	Remove the wires of the main circuit terminal block of inverter, and perform measurement between terminals R, S, T and terminals P, N, and between terminals U, V, W and terminals P, N at the range of tester ×1 Ω.	See . Appropriate replacement interval of inverter, converter, and thyristor Start/stop: 10^6 cycles	Analog tester
	Smoothing capacitor	(1) There is no leakage of fluid.	Yes			By visual check.	There must be no abnormality. Appropriate service years for replacement: 10 years*1*2*3	
		(2) The belly(safety valve) shall not stick and there shall be no bump.		Yes				
	Relay	(1) There shall be no beat noise during operation.		Yes		By hearing.	There must be no abnormality.	
		(2) There are no worn contacts.		Yes		By visual check.	There must be no abnormality.	
Control circuit Protective circuit	Operation check	(1) Through unit operation of inverter, check balance of output voltage between each phase.		Yes		Measure line voltage between inverter main circuit terminals U, T, and W.	Inter-phase voltage balance 200 V class: To be within 4 V. 400 V class: To be within 8 V.	Digital multimeter Flowmeter Voltmeter
		(2) By conducting the sequence protective operation test, check there is no abnormality in protective operation and display circuit.		Yes		Simulate short or open condition of the protective circuit output of inverter.	The error is generated on the sequence.	

Target section	Item	Details	Interval			Method	Criteria	Meas-urement instru-ment
			Daily	Periodic				
				1 year	2 years			
Cooling system	Cooling fan	(1) No abnormal vibration or sound is observed.	Yes			By hearing and visual check. (Warning indication on the operator keypad)	To rotate smoothly. There must be no abnormality. Wind brows in upper section. Appropriate service years for replacement: 10 years*1*4*5	
		(2) Connections are not loosened.		Yes		By visual check.		
	Cooling fin	There is no clogging.		Yes		By visual check.	There is no clogging.	
Indication	Indication	(1) The LED lamp and screen display are normal.	Yes			By visual check.	Check the lamp/display lights up.	
		(2) Cleaning.		Yes		Clean with a waste cloth.		
	External meter	The indicated values are normal.	Yes			Check indicated values of the meters on the boards.	Satisfy the specification values and control values.	Voltmeter, ammeter, etc.
Motor	General	(1) No abnormal vibration or sound is observed.	Yes			By hearing, sensing, and visual check.	There must be no abnormality.	
		(2) No abnormal smell is observed.	Yes			Check for abnormal smell due to overheat, damage, etc.	There must be no abnormality.	
	Insulation resistance	Megger check (between the main circuit terminals and earth terminals)			*6	Disconnect U, V, and W inverter main circuit terminals, short the motor line (for three phases), and perform measurement between the motor wire and earth terminal using a megger.	The measured value shall be 5 MΩ or above.	500-VDC class megger

*1. The replacement period (number of years / cycles) and *13-5-5 Smoothing Capacitor Life Curve* on page 13-14 are based on the designed expected life, which is not a guaranteed value.

*2. The service life of smoothing capacitor is affected by the ambient temperature. See *13-5-5 Smoothing Capacitor Life Curve* on page 13-14 to determine replacement period.

*3. When you replace with a capacitor that has passed storage period more than three years, perform aging in the following conditions before using it.
- Initially apply 80% of rated voltage of capacitor for one hour in normal temperature
- Then, increase the voltage to 90% and apply for one hour
- Lastly, apply rated voltage for five hours in normal temperature

*4. The life of cooling fan varies depending on the environment conditions such as ambient temperature and dust. Check operating conditions by daily inspection.

*5. If the cooling fan is locked due to dust, etc., it takes about 5 to 10 seconds until re-rotation is enabled even if dust is removed.

*6. Perform inspection in accordance with the instruction manual of motor.

13-4 Cleaning

Make sure to always keep the inverter clean for operation.

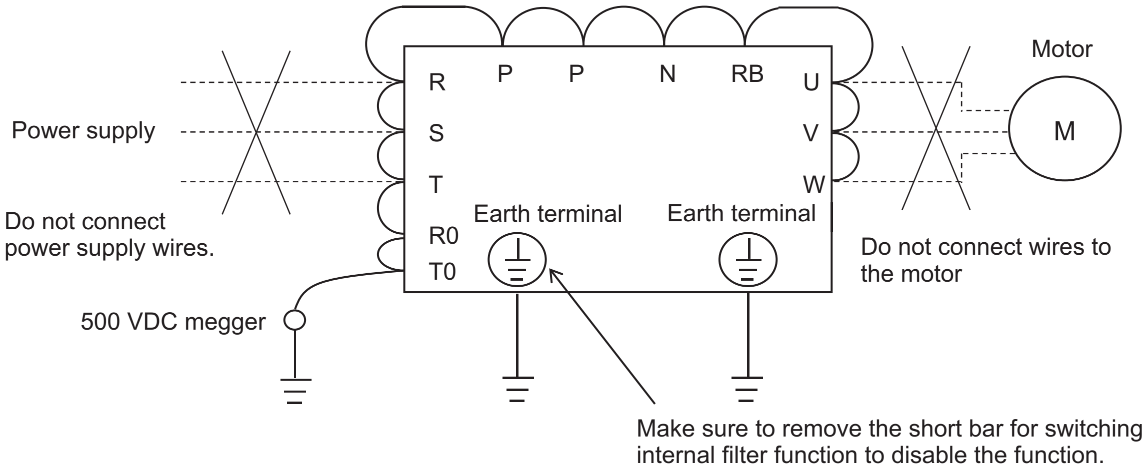
No.	Description	✓
1	For cleaning, lightly wipe off dirt with a soft cloth dampened with neutral detergent.	☐
2	Solvents such as acetone, benzene, toluene, and alcohol may cause the inverter surface to dissolve or its coating to peel off, therefore, do not use them.	☐
3	Do not clean the display section including the LCD Operator using a detergent or alcohol.	☐

13-5 Test Methods

13-5-1 Megger Test

When conducting megger test on the external circuit, remove all terminals of the inverter so that the test voltage is not applied to the inverter. For energization test on the control circuit, use a tester (high-resistance range), and do not use a megger or buzzer.
Conduct megger test for the inverter itself only on the main circuit, and do not perform megger test on the control circuit. For megger test, use a 500 VDC megger.

Before conducting a megger test on the inverter main circuit, make sure to remove the short bar for switching the filtering function included in the inverter, and short terminals R, S, T, U, V, W, P, PD, N, RB, R0, and T0 as shown in the figure below.
After megger test, remove the wires on which R, S, T, U, V, W, P, PD, N, RB, R0, and T0 terminals that are shorted, and connect the short bar for switching the filter function included in the inverter to the original position.



13-5-2 Pressure Test

Do not perform pressure test.
If pressure test is conducted, it is dangerous because the components inside the inverter may be damaged or deteriorated.

13-5-3 Method of Checking Inverter and Converter Condition

Using a tester, you can check the good-or-bad condition of the inverter and converter.

1. Remove the power lines connected from an external source (R, S, T), wires connecting to the motor (U, V, W), and regenerative braking resistor (P, RB).

2. Measure the voltage between the P and N terminals with a tester.

Measure the voltage between the P and N terminals in the DC voltage range and check that electricity is fully discharged from the smoothing capacitor before performing check.

3 Check the condition with a tester for resistance measurement.
Use the 1Ω resistance measurement range.

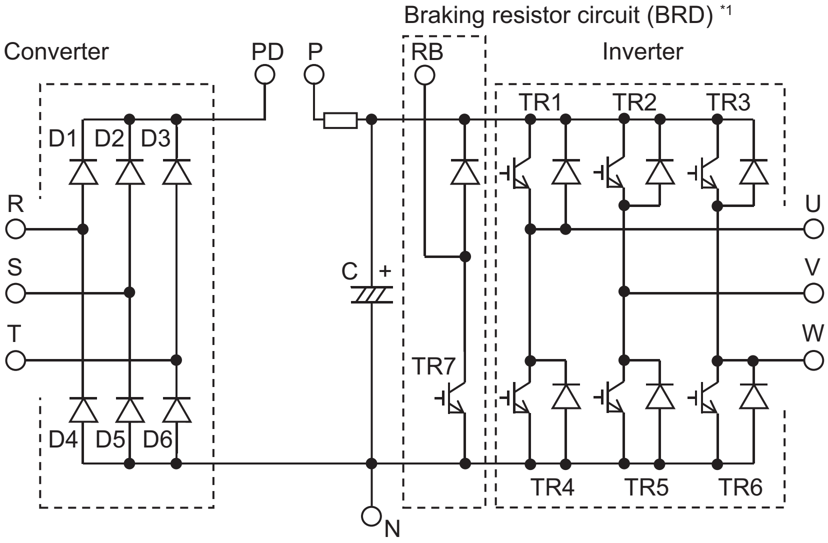
● Checking method

You can determine the good-or-bad condition of conduction status of terminals on the inverter main circuit terminal block R, S, T, U, V, W, RB, P, and N by alternately changing the polarity of tester for measurement.

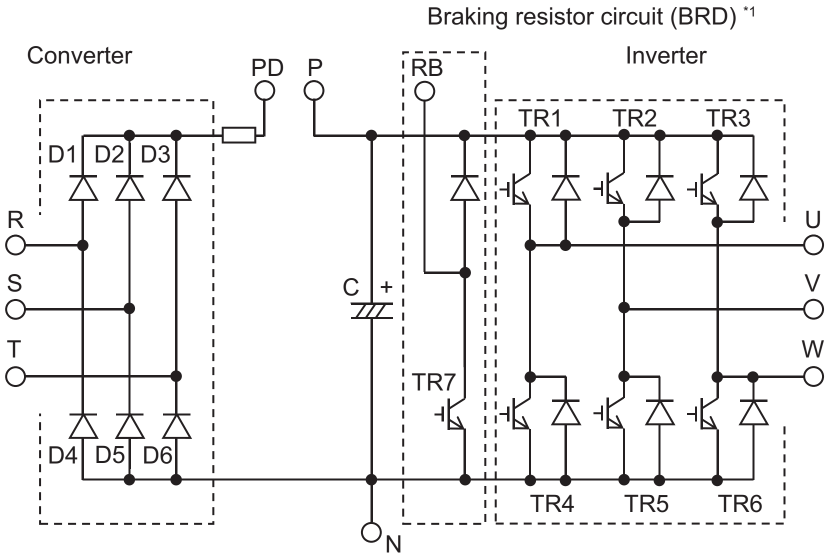
		Tester polarity		Measured value*1
		⊕(Red)	⊖(Black)	
Converter	D1	R	PD	Non-conductive
		PD	R	Conductive
	D2	S	PD	Non-conductive
		PD	S	Conductive
	D3	T	PD	Non-conductive
		PD	T	Conductive
	D4	R	N	Conductive
		N	R	Non-conductive
	D5	S	N	Conductive
		N	S	Non-conductive
	D6	T	N	Conductive
		N	T	Non-conductive
Inverter	TR1	U	P	Non-conductive
		P	U	Conductive
	TR2	V	P	Non-conductive
		P	V	Conductive
	TR3	W	P	Non-conductive
		P	W	Conductive
	TR4	U	N	Conductive
		N	U	Non-conductive
	TR5	V	N	Conductive
		N	V	Non-conductive
	TR6	W	N	Conductive
		N	W	Non-conductive
BRD	TR7	RB	P	Non-conductive
		P	RB	Conductive
		RB	N	Non-conductive

*1. When electricity is not conducted, a nearly infinite value is demonstrated. Due to effects of the smoothing capacitor, electricity may be conducted instantly, not showing an infinite value. When electricity is conducted, a numeric value range will be indicated from some to dozens in a unit of Ω. The values vary depending on the element type, tester, type, etc. However, it is acceptable if numeric values obtained for each item are nearly the same. The measured value may be varied some degree in Ω by the reason of the preventing inrush current of current limiting resistor.

Model 3G3RX2-****
200 V class: A2004 to A2110 400 V class: A4007 to B411K



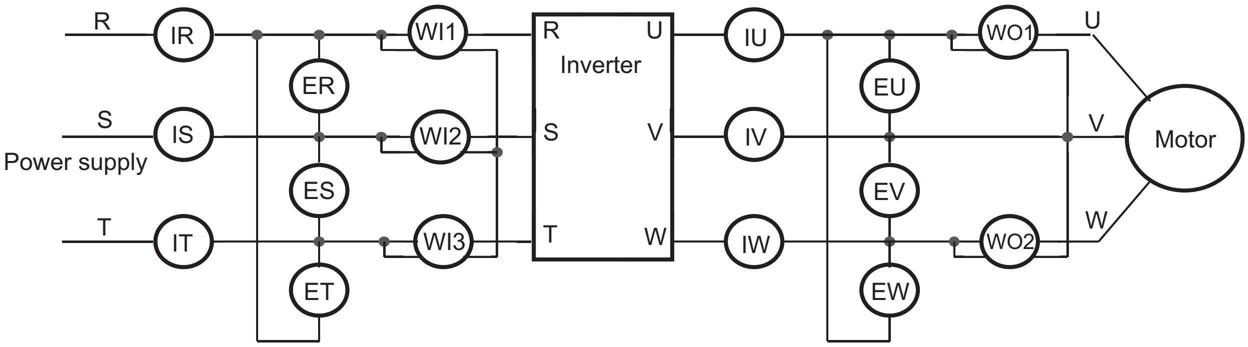
Model 3G3RX2-****
200 V class: A2150 to A2550 400 V class: A4150 to B413K



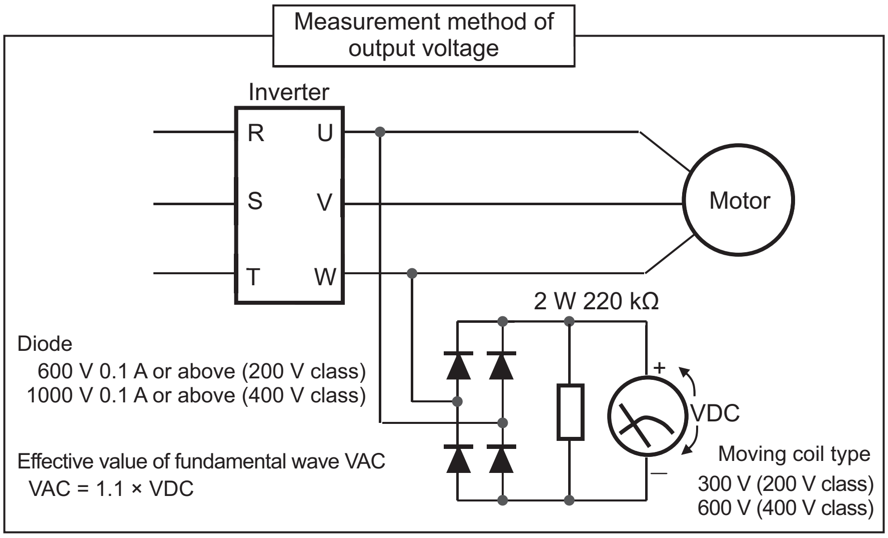
*1. The braking resistor circuit (BRD) is equipped as standard on the following models:
3G3RX2-A2004 to 3G3RX2-A2220
3G3RX2-A4007 to 3G3RX2-A4370

13-5-4 Measurement Method of I/O Voltage, Current and Power

The following shows general measurement instruments used for measurement of input/output voltage, current, and power.



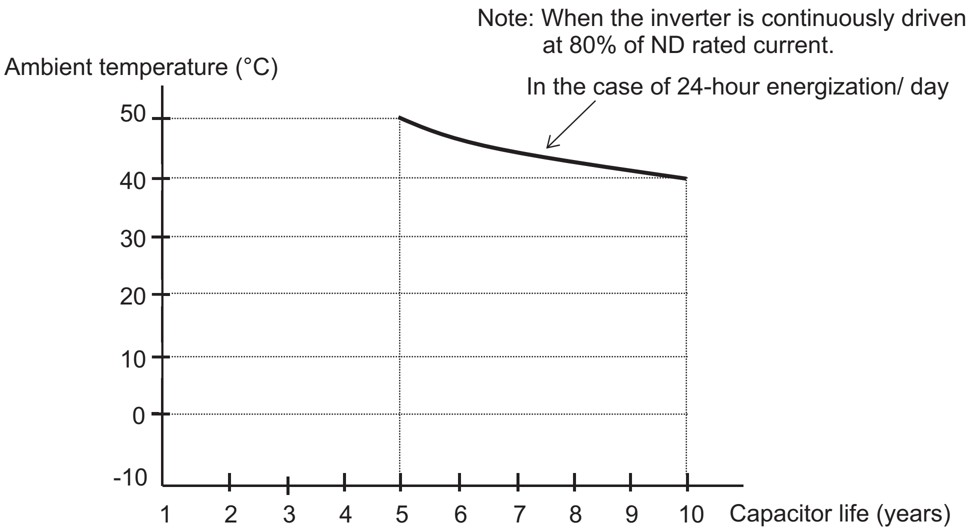
Measurement item	Target section	Measurement instrument	Remarks	Criteria
Power supply voltage E_{IN}	Between R-S, S-T, and T-R (ER), (ES), (ET)	Moving iron voltmeter or Rectifier type voltmeter	All effective values	200 V class: 200 to 240 V 50 / 60 Hz 400 V class: 380 to 500 V 50 / 60 Hz
Power supply current I_{IN}	Current of R, S, and T (IR), (IS), (IT)	Moving iron ammeter	All effective values	If input current is imbalanced I_{IN}= (IR+IS+IT) /3
Power from power supply W_{IN}	Between R-S, S-T, and T-R (WI1) + (WI2) + (WI3)	Electrodynamometer type wattmeter	All effective values	Three wattmeter method
Power factor of power supply P_{fIN}	This value is calculated using measurement values of power supply voltage E_{IN}, and power supply current I_{IN}, and Power from power supply W_{IN}. $P_{fIN} = \frac{W_{IN}}{\sqrt{3} \cdot E_{IN} \cdot I_{IN}} \times 100$			
Output voltage E_{OUT}	Between U-V, V-W, and W-U (EU), (EV), (EW)	See the figure below or Rectifier type voltmeter	Effective value of fundamental wave	
Output current I_{OUT}	Current of U, V, and W (IU), (IV), (IW)	Moving iron ammeter	All effective values	
Output power W_{OUT}	Between U-V and V-W (WO1) + (WO2)	Electrodynamometer type wattmeter	All effective values	Two wattmeter method (or three wattmeter method)
Output power facto P_{fOUT}	This value is calculated using measurement values of output voltage E_{OUT}, output current I_{OUT}, and output power W_{OUT}. $P_{fOUT} = \frac{W_{OUT}}{\sqrt{3} \cdot E_{OUT} \cdot I_{OUT}} \times 100$			



Notes on measurement :

1. Use an instrument that indicates effective values of fundamental wave for output voltage, and use instruments that indicate all effective values for current and power.
2. The output waveform of inverter generates errors especially at low frequency because it is a waveform control by PWM. In many cases, testers (general-purpose products) are not capable of accurate measurements due to noise.

13-5-5 Smoothing Capacitor Life Curve



Note 1. The ambient temperature is a temperature measured at a position about 5 cm from the bottom center of the inverter. (atmospheric temperature)
If the inverter is stored inside the panel, it is in-panel temperature.

Note 2. The smoothing capacitor is a finite life component which occurs chemical reaction inside, replacement is required after 10 years of use. (It is a designed expected life, not a guaranteed value.)
However, if the inverter is used in an environment at high temperature or in a heavy-load environment where the its rated current is exceeded, the life is significantly shortened.

13-5-6 Life Alarming Output

When the life a component (smoothing capacitor or cooling fan on the board, excluding the main circuit smoothing capacitor) is near its end, an alarm can be generated based on self-diagnosis. Use this alarm as a sign of part replacement period. For details, see the **life diagnosis monitor** (dC-16) and **output terminal function selection** (CC-01) to (CC-07). Note that alarms are generated based on diagnosis of designed expected life (not a guaranteed value). There will be differences due to use environments, operating conditions, etc. Please conduct maintenance in advance.

14

Upgrading from 3G3RX (V1)

This section provides precautions when replacing the 3G3RX Series V1 Inverter with the 3G3RX2 Series Inverter.

14-1 Comparison of External Dimensions

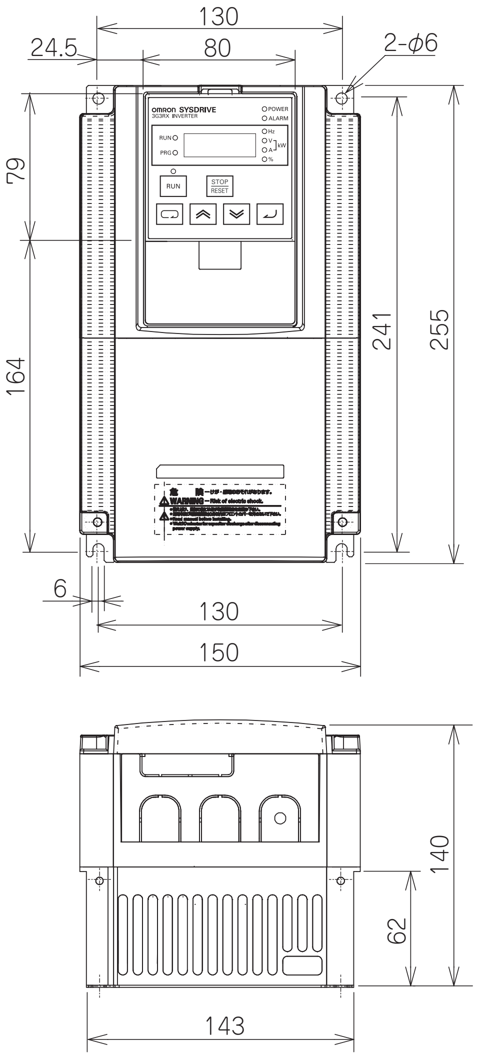
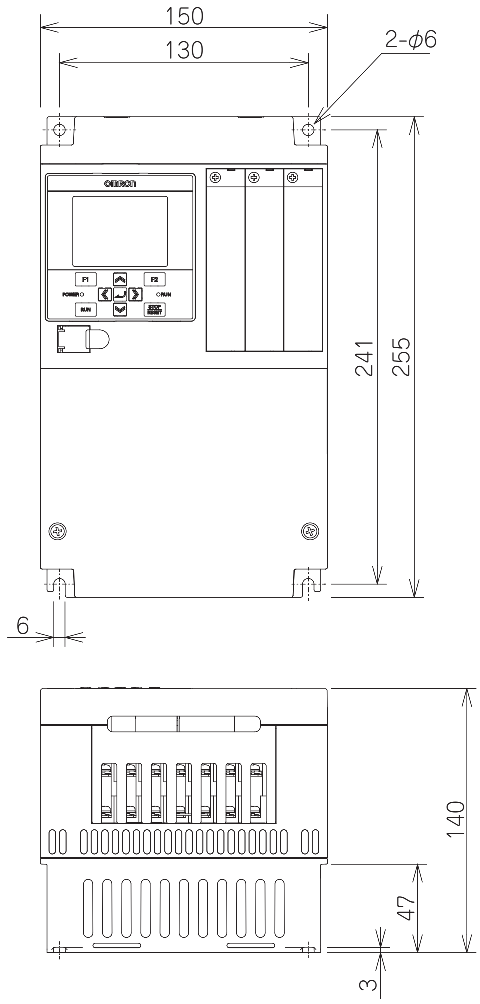
- The mounting pitch for the 3G3RX Series V1 Inverter is compatible with that for the 3G3RX2 Series Inverter. When upgrading from the 3G3RX Series V1 Inverter, you can use the same mounting pitch to install the 3G3RX2 Series Inverter.
- When installing the 3G3RX2 Series Inverter, refer to *1-3-4 External dimensions* on page 1-19.

Precautions for Correct Use

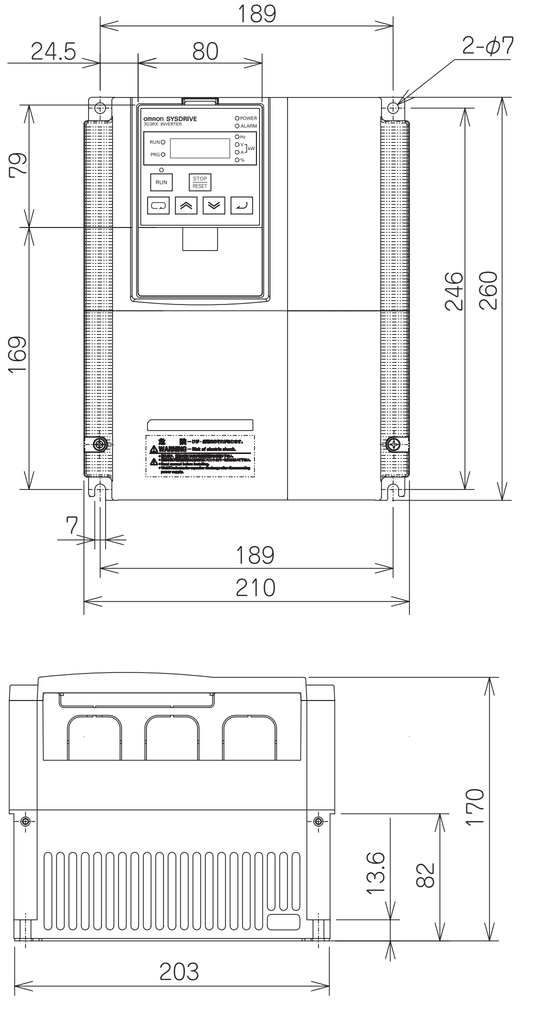
You can change the duty rating (ND/LD/VLD) on **Duty type selection** (Ub-03).

14-1-1 3G3RX-series V1 and 3G3RX2-series

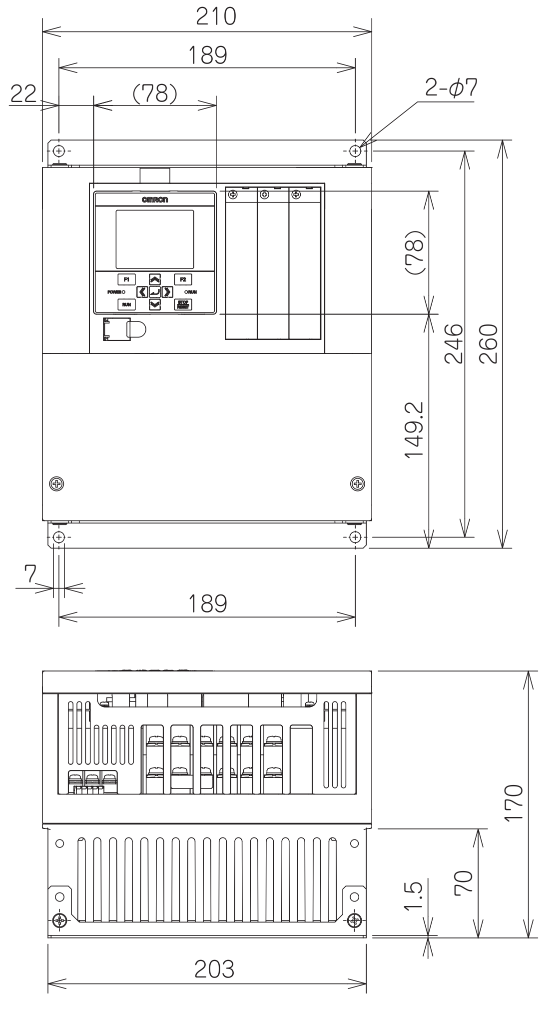
3G3RX-series V1	⇒	3G3RX2-series
3G3RX-A2004- V1	⇒	3G3RX2-A2004
3G3RX-A2007- V1	⇒	3G3RX2-A2007
3G3RX-A2015- V1	⇒	3G3RX2-A2015
3G3RX-A2022- V1	⇒	3G3RX2-A2022
3G3RX-A2037- V1	⇒	3G3RX2-A2037
3G3RX-A4007- V1	⇒	3G3RX2-A4007
3G3RX-A4015- V1	⇒	3G3RX2-A4015
3G3RX-A4022- V1	⇒	3G3RX2-A4022
3G3RX-A4037- V1	⇒	3G3RX2-A4037

3G3RX-series V1	⇒	3G3RX2-series
	⇒	

3G3RX-series V1	⇒	3G3RX2-series
3G3RX-A2055- V1	⇒	3G3RX2-A2055
3G3RX-A2075- V1	⇒	3G3RX2-A2075
3G3RX-A2110- V1	⇒	3G3RX2-A2110*1
3G3RX-A4055- V1	⇒	3G3RX2-A4055
3G3RX-A4075- V1	⇒	3G3RX2-A4075
3G3RX-A4110- V1	⇒	3G3RX2-A4110

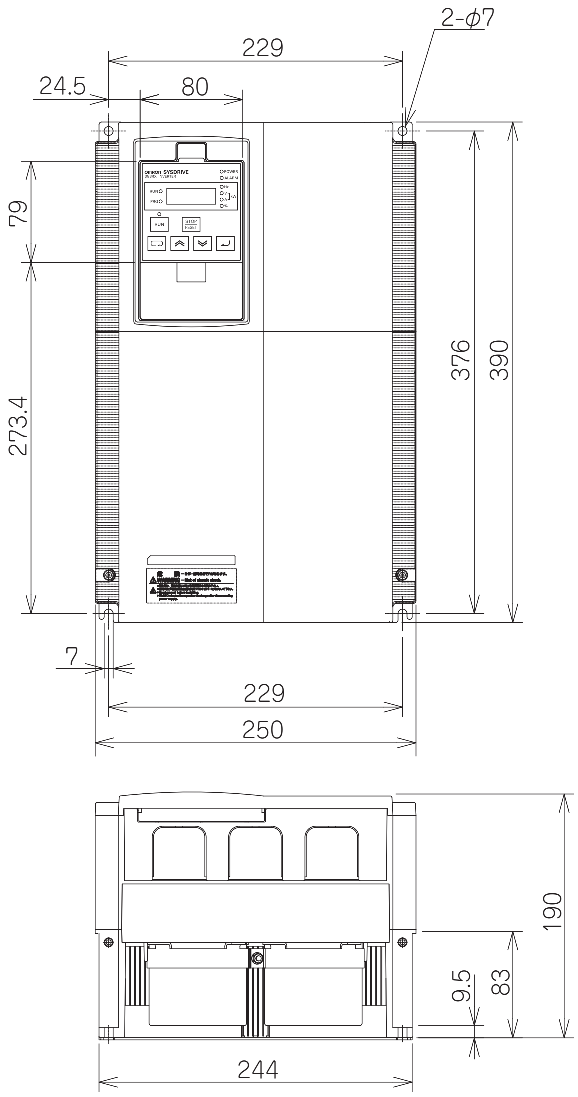


⇒

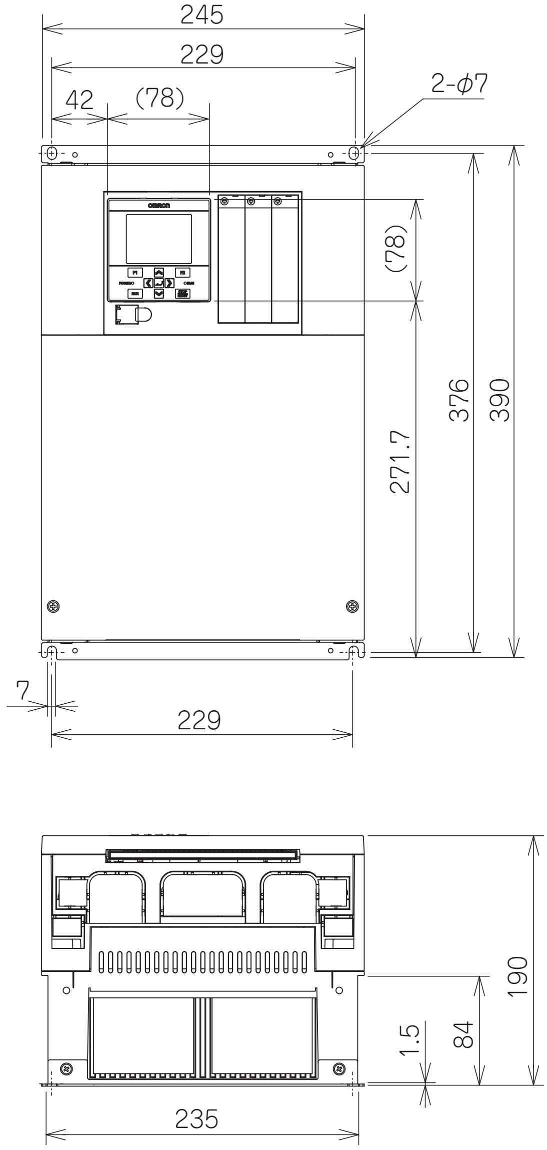


*1. To use 3G3RX2-A2110 at Low Duty (LD) or Very Low Duty (VLD), a larger depth dimension is required. As for the detail, refer to *2-1-1 Precaution for Installation* on page 2-2.

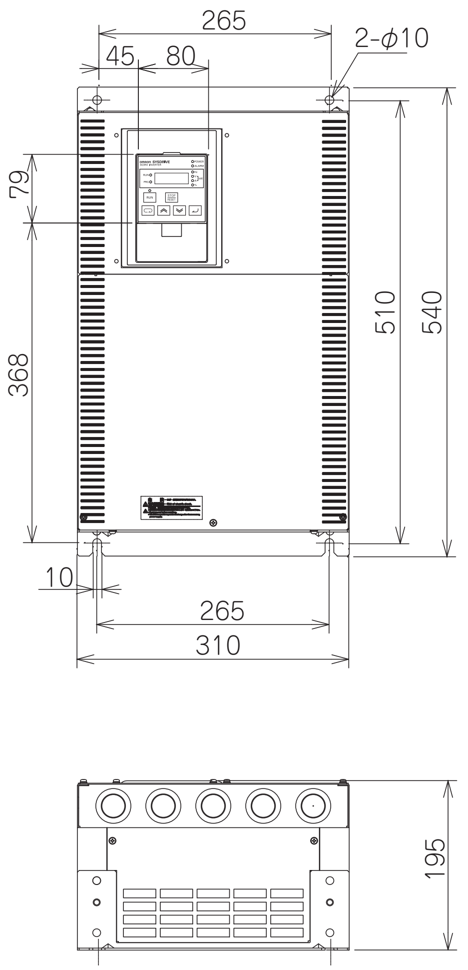
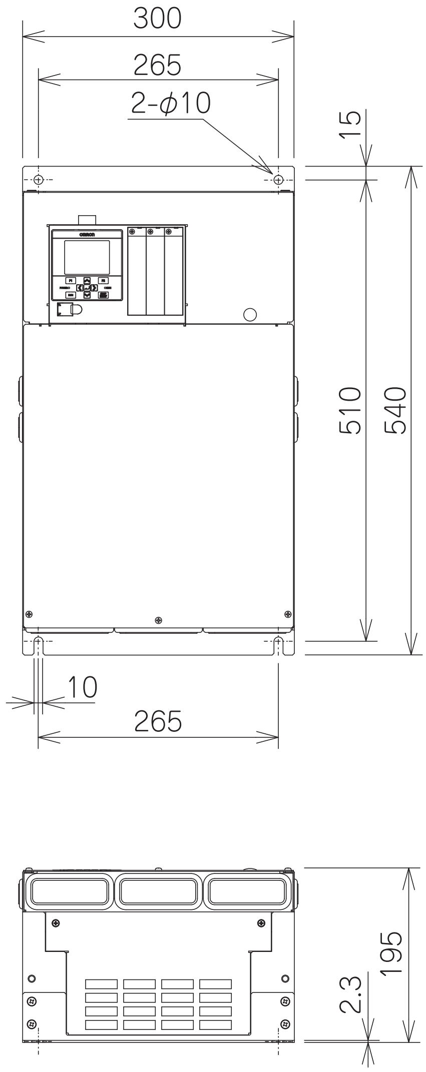
3G3RX-series V1	⇒	3G3RX2-series
3G3RX-A2150- V1	⇒	3G3RX2-A2150
3G3RX-A2185- V1	⇒	3G3RX2-A2185
3G3RX-A2220- V1	⇒	3G3RX2-A2220*1
3G3RX-A4150- V1	⇒	3G3RX2-A4150
3G3RX-A4185- V1	⇒	3G3RX2-A4185
3G3RX-A4220- V1	⇒	3G3RX2-A4220

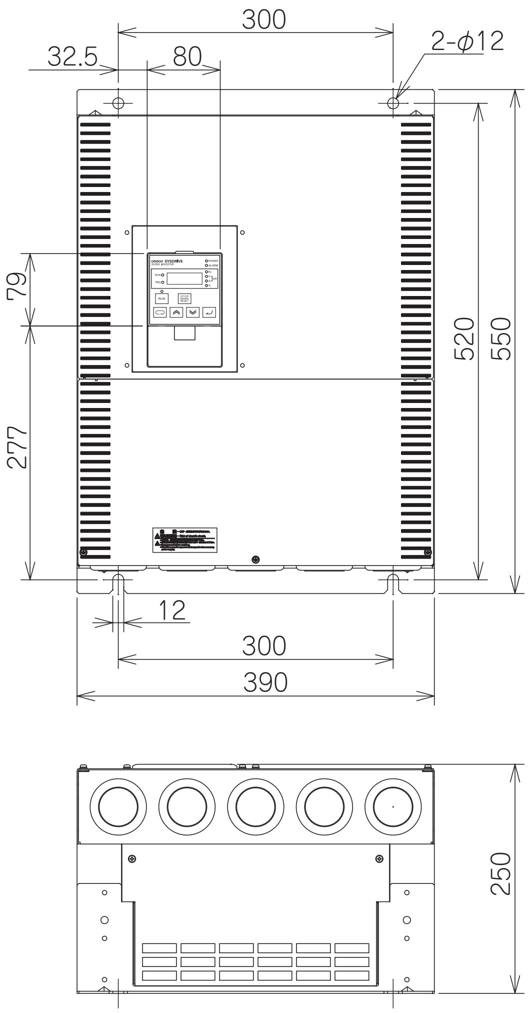
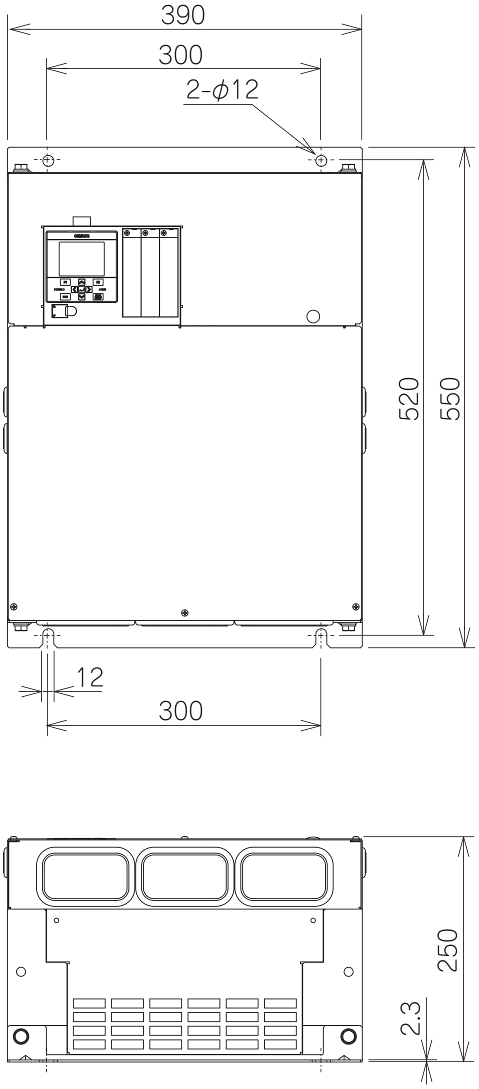


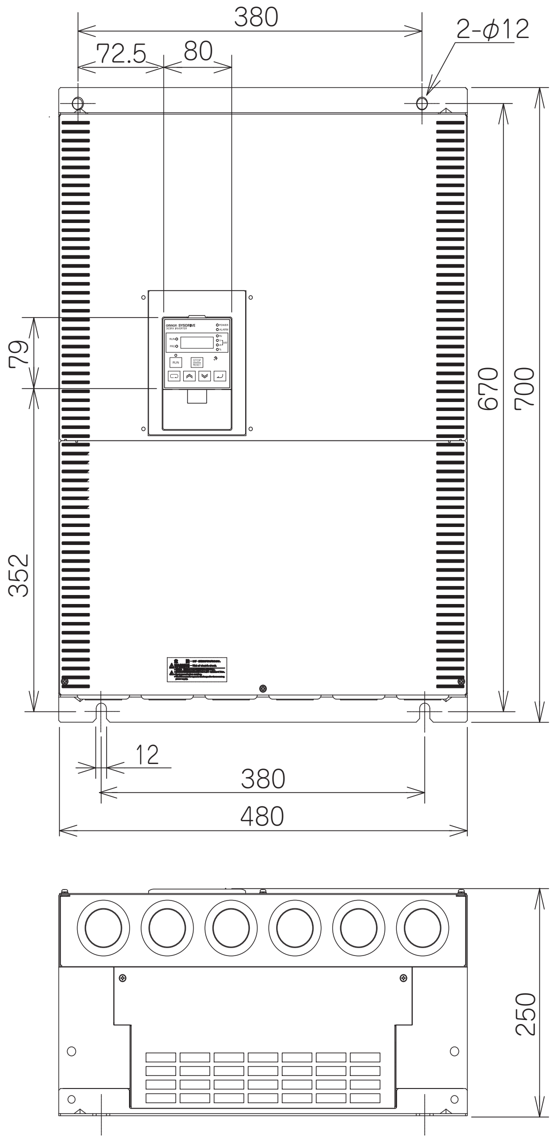
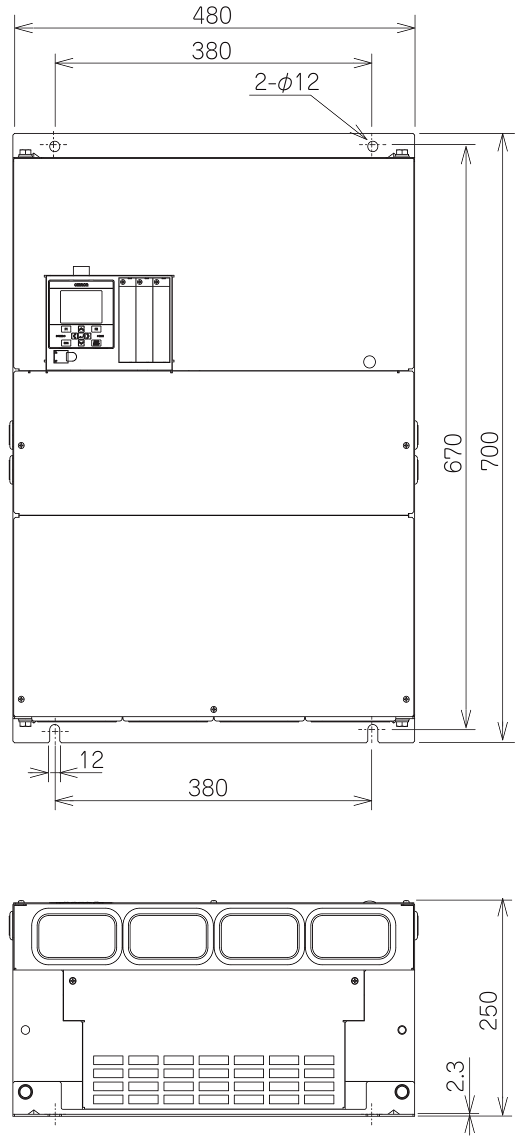
⇒

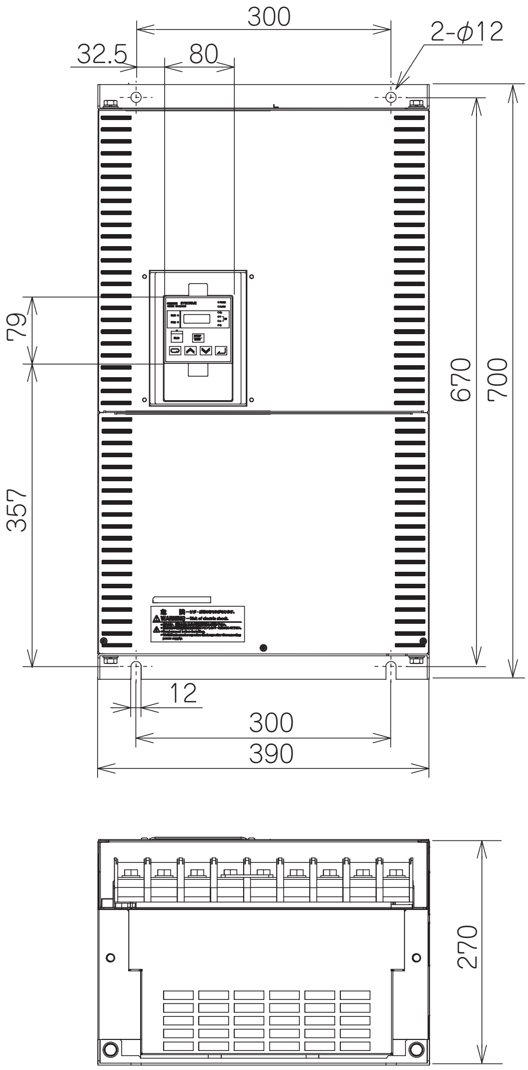
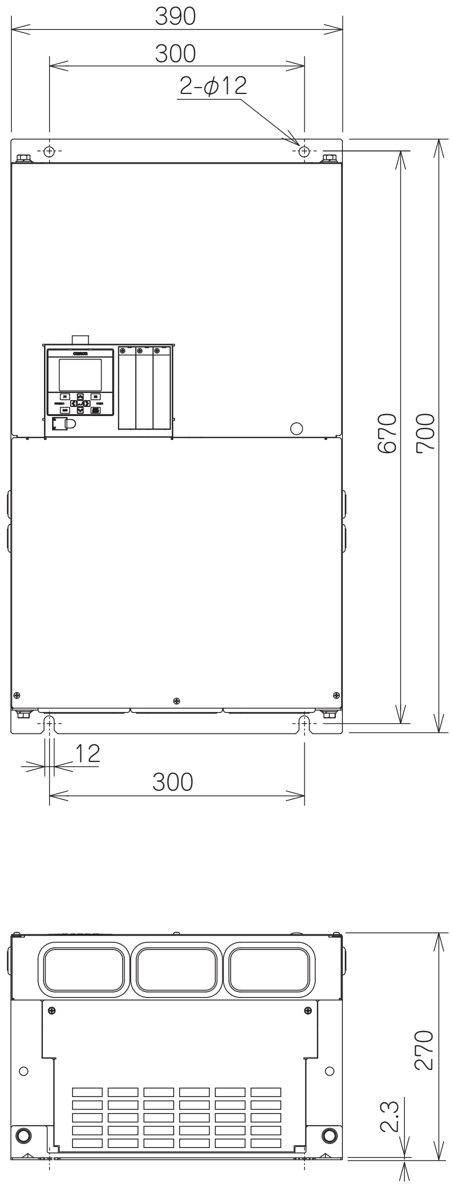


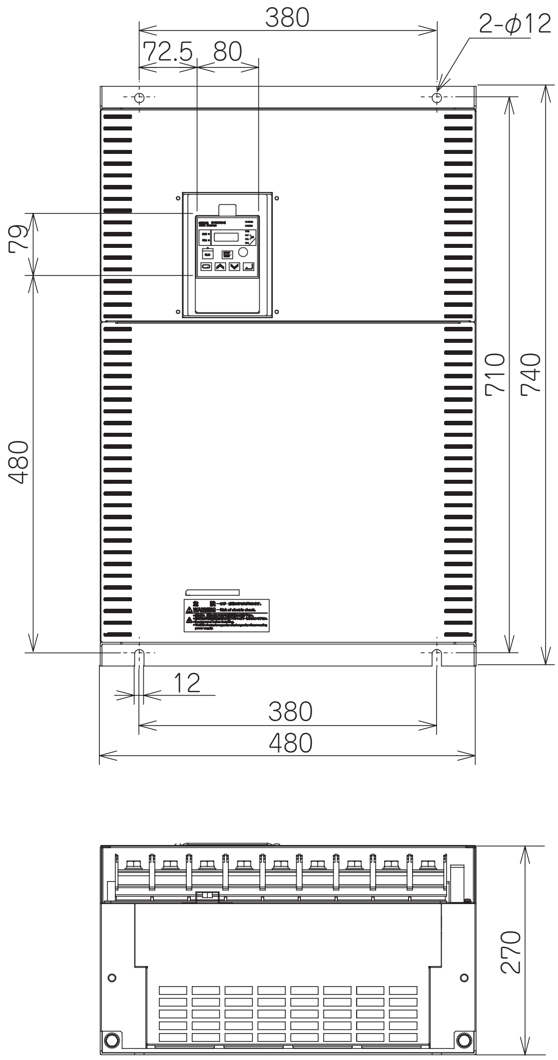
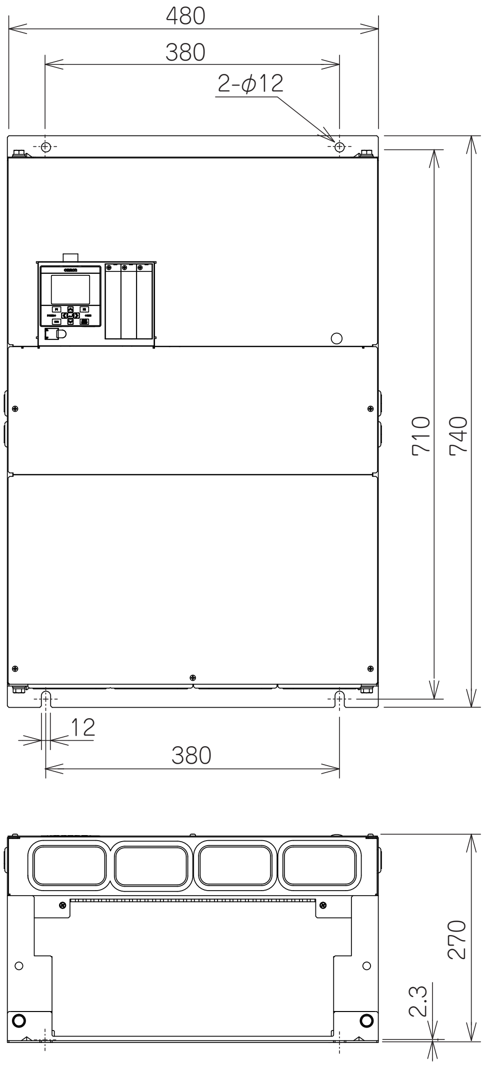
*1. To use 3G3RX2-A2220 at Very Low Duty (VLD), a larger depth dimension is required. As for the detail, refer to *2-1-1 Precaution for Installation* on page 2-2.

3G3RX-series V1	⇒	3G3RX2-series
3G3RX-A2300 - V1	⇒	3G3RX2-A2300
3G3RX-A4300 - V1	⇒	3G3RX2-A4300
	⇒	

3G3RX-series V1	⇒	3G3RX2-series
3G3RX-A2370- V1	⇒	3G3RX2-A2370
3G3RX-A2450- V1	⇒	3G3RX2-A2450
3G3RX-A4370- V1	⇒	3G3RX2-A4370
3G3RX-A4450- V1	⇒	3G3RX2-A4450
3G3RX-A4550- V1	⇒	3G3RX2-A4550
	⇒	

3G3RX-series V1	⇒	3G3RX2-series
3G3RX-A2550- V1	⇒	3G3RX2-A2550
	⇒	

3G3RX-series V1	⇒	3G3RX2-series
3G3RX-B4750- V1	⇒	3G3RX2-B4750
3G3RX-B4900- V1	⇒	3G3RX2-B4900
	⇒	

3G3RX-series V1	⇒	3G3RX2-series
3G3RX-B411K- V1	⇒	3G3RX2-B411K
3G3RX-B413K- V1	⇒	3G3RX2-B413K
	⇒	

14-2 Parameter Comparison

The parameter contents may differ between the 3G3RX Series V1 Inverter and the 3G3RX2 Series Inverter. Carefully check the description about functions before setting the parameters.

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
d001	Output frequency monitor	dA-01	
d002	Output current monitor	dA-02	
d003	Operation direction monitor	dA-03	
d004	PID feedback monitor	db-30	
d005	Intelligent input monitor	dA-51	
d006	Intelligent output monitor	dA-54	
d007	Frequency conversion monitor	dA-06	
d008	Real frequency monitor	dA-08	
d009	Torque command monitor	FA-15	
d010	Torque bias monitor	FA-16	
d012	Output torque monitor	dA-17	
d013	Output voltage monitor	dA-18	
d014	Input power monitor	dA-30	
d015	Integrated power monitor	dA-32	
d016	Cumulative operating hours monitor during RUN	dC-22	
d017	Cumulative power-on time	dC-24	
d018	Cooling fin temperature monitor	dC-15	
d019	Motor temperature monitor	dA-38	
d022	Life diagnostic monitor	dC-16	
d023	Program counter	db-03	
d024	Program number monitor	db-02	
d025	User monitor 0	db-08	
d026	User monitor 1	db-10	
d027	User monitor 2	db-12	
d028	Pulse counter monitor	dA-28	
d029	Position command monitor	FA-20	
d030	Current position monitor	dA-20	
d060	Inverter mode monitor	dC-01 dC-45	The monitor can be checked with **Inverter load type selection monitor** (dC-01) and **IM/SM monitor** (dC-45).
d080	Trip frequency monitor		Display function is equipped on the LCD Operator.
d081	Trip history monitor 1		Display function is equipped on the LCD Operator.
d082	Trip history monitor 2		Display function is equipped on the LCD Operator.
d083	Trip history monitor 3		Display function is equipped on the LCD Operator.

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
d084	Trip history monitor 4		Display function is equipped on the LCD Operator.
d085	Trip history monitor 5		Display function is equipped on the LCD Operator.
d086	Trip history monitor 6		Display function is equipped on the LCD Operator.
d090	Warning monitor		Display function is equipped on the LCD Operator.
d102	DC voltage monitor	dA-40	
d103	BRD load factor monitor	dA-41	
d104	BRD thermal load factor monitor	dA-42	
F001	Output frequency setting	FA-01	
F002	First acceleration time setting	AC120	
F202	Second acceleration time setting	AC220	
F302	Third acceleration time setting		Abolition of third control
F003	First deceleration time setting	AC122	
F203	Second deceleration time setting	AC222	
F303	Third deceleration time setting		Abolition of third control
F004	Operation direction selection	AA-12	
A001	Frequency command selection	AA101	Addition of individual settings for second control
A002	Operation command selection	AA111	
A003	First base frequency	Hb104/Hd104	**Async.Motor Base frequency setting, 1st-motor** (Hb104), **Sync.Base frequency setting, 1st-motor** (Hd104)
A203	Second base frequency	Hb204/Hd204	**Async.Motor Base frequency setting, 2nd-motor** (Hb204), **Sync.Base frequency setting, 2nd-motor** (Hd204)
A303	Third base frequency		Abolition of third control
A004	First maximum frequency	Hb105/Hd105	**Async.Motor Maximum frequency setting, 1st-motor** (Hb105), **Sync.Maximum frequency setting, 1st-motor** (Hd105)
A204	Second maximum frequency	Hb205/Hd205	**Async.Motor Maximum frequency setting, 2nd-motor** (Hb205), **Sync.Maximum frequency setting, 2nd-motor** (Hd205)
A304	Third maximum frequency		Abolition of third control
A005	AT terminal selection		This function is substituted by the setting of **Main speed input source selection, 1st-motor** (AA101) / **Sub frequency input source selection, 1st-motor** (AA102), and input terminal [15: SCHG].

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
A006	O2 selection		This function is substituted by the setting of **Terminal [Ai3] selection** (Cb-22).
A011	0 start	Cb-03	For Ai1
A012	0 end	Cb-04	For Ai1
A013	0 start ratio	Cb-05	For Ai1
A014	0 end ratio	Cb-06	For Ai1
A015	0 start selection	Cb-07	For Ai1
A016	Analog input filter	Cb-01	For Ai1 Ai2: (Cb-11), Ai3: (Cb-21)
A017	Simplified sequence function selection	UE-02	
A019	Multistep speed selection	Ab-03	
A020	0th speed of the 1st multi-step speed	Ab110	
A220	0th speed of the 2nd multi-step speed	Ab210	
A320	0th speed of the 3rd multi-step speed		Abolition of third control
A021	1st speed of the multi-step speed	Ab-11	
A022	2nd speed of the multi-step speed	Ab-12	
A023	3rd speed of the multi-step speed	Ab-13	
A024	4th speed of the multi-step speed	Ab-14	
A025	5th speed of the multi-step speed	Ab-15	
A026	6th speed of the multi-step speed	Ab-16	
A027	7th speed of the multi-step speed	Ab-17	
A028	8th speed of the multi-step speed	Ab-18	
A029	9th speed of the multi-step speed	Ab-19	
A030	10th speed of the multi-step speed	Ab-20	
A031	11th speed of the multi-step speed	Ab-21	
A032	12th speed of the multi-step speed	Ab-22	
A033	13th speed of the multi-step speed	Ab-23	
A034	14th speed of the multi-step speed	Ab-24	
A035	15th speed of the multi-step speed	Ab-25	
A038	Jogging frequency	AG-20	
A039	Jogging selection	AG-21	
A041	First torque boost selection	AA121	When A041 is set to 01, select *03: Auto torque boost (IM)* for **Control mode selection, 1st-motor** (AA121).
A241	Second torque boost selection	AA221	When A241 is set to 01, select *03: Auto torque boost (IM)* for **Control mode selection, 2nd-motor** (AA221).
A042	First manual torque boost volume	Hb141	* Re-confirmation is required for setting.
A242	Second manual torque boost volume	Hb241	* Re-confirmation is required for setting.
A342	Third manual torque boost volume		Abolition of third control
A043	First manual torque boost break point	Hb142	* Re-confirmation is required for setting.
A243	Second manual torque boost break point	Hb242	* Re-confirmation is required for setting.

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
A343	Third manual torque boost break point		Abolition of third control
A044	First control mode	AA121	* Re-confirmation is required for setting.
A244	Second control mode	AA221	* Re-confirmation is required for setting.
A344	Third control mode		Abolition of third control
A045	Output voltage gain	Hb180	Addition of individual settings for second control
A046	First voltage compensation gain for automatic torque boost	HC101	
A246	Second voltage compensation gain for automatic torque boost	HC201	
A047	First slip compensation gain for automatic torque boost	HC102	
A247	Second slip compensation gain for automatic torque boost	HC202	
A051	DC braking selection	AF101	Addition of individual settings for second control
A052	DC braking frequency	AF103	Addition of individual settings for second control
A053	DC braking delay time	AF104	Addition of individual settings for second control
A054	DC braking force	AF105	Addition of individual settings for second control
A055	DC braking time	AF106	Addition of individual settings for second control
A056	DC braking edge/level selection	AF107	Addition of individual settings for second control
A057	DC braking force at the start	AF108	Addition of individual settings for second control
A058	DC braking time at the start	AF109	Addition of individual settings for second control
A059	DC braking carrier frequency		Integrated into **Carrier speed setting, 1st-motor** (bb101).
A061	First frequency upper limiter	bA102	
A261	Second frequency upper limiter	bA202	
A062	First frequency lower limiter	bA103	
A262	Second frequency lower limiter	bA203	
A063	Jump frequency 1	AG101	Addition of individual settings for second control
A064	Jump frequency width 1	AG102	Addition of individual settings for second control
A065	Jump frequency 2	AG103	Addition of individual settings for second control
A066	Jump frequency width 2	AG104	Addition of individual settings for second control
A067	Jump frequency 3	AG105	Addition of individual settings for second control

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
A068	Jump frequency width 3	AG106	Addition of individual settings for second control
A069	Acceleration stop frequency	AG110	Addition of individual settings for second control
A070	Acceleration stop time	AG111	Addition of individual settings for second control
A071	PID selection	AH-01	
A072	PID P gain	AH-61	
A073	PID I gain	AH-62	
A074	PID D gain	AH-63	
A075	PID scale		Configured with **PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06).
A076	PID feedback selection	AH-51	
A077	PID deviation reverse output	AH-02	
A078	PID changeable range	AH-71	
A079	PID feed forward selection	AH-70	
A081	AVR selection	bA146	Second control extension * 00→00, 01→01, 02→02 The same values are used for equivalent operations.
A082	Motor incoming voltage selection	Hb106/Hd106	Configured with **Async.Motor rated voltage, 1st-motor** (Hb106) / **Sync.Motor rated voltage, 1st-motor** (Hd106).
A085	Operation mode selection	Hb145	Addition of individual settings for second control
A086	Energy-saving response / accuracy adjustment	Hb146	Addition of individual settings for second control
A092	First acceleration time 2	AC124	
A292	Second acceleration time 2	AC224	
A392	Third acceleration time 2		Abolition of third control
A093	First deceleration time 2	AC126	
A293	Second deceleration time 2	AC226	
A393	Third deceleration time 2		Abolition of third control
A094	First 2-step acceleration / deceleration selection	AC115	
A294	Second 2-step acceleration / deceleration selection	AC215	
A095	First 2-stage acceleration frequency	AC116	
A295	Second 2-stage acceleration frequency	AC216	
A096	First 2-stage deceleration frequency	AC117	
A296	Second 2-stage deceleration frequency	AC217	
A097	Acceleration pattern selection	AC-03	
A098	Deceleration pattern selection	AC-04	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
A101	OI start	Cb-13	For Ai2
A102	OI end	Cb-14	For Ai2
A103	OI start ratio	Cb-15	For Ai2
A104	OI end ratio	Cb-16	For Ai2
A105	OI start selection	Cb-17	For Ai2
A111	O2 start	Cb-23	For Ai3
A112	O2 end	Cb-24	For Ai3
A113	O2 start ratio	Cb-25	For Ai3
A114	O2 end ratio	Cb-26	For Ai3
A131	Acceleration curve constant	AC-05	
A132	Deceleration curve constant	AC-06	
A141	Operation frequency selection 1	AA101	Integrated into main speed / auxiliary speed command. Addition of individual settings for second control
A142	Arithmetic operation frequency selection 2	AA102	Integrated into main speed / auxiliary speed command. Addition of individual settings for second control
A143	Arithmetic operation operator selection	AA105	Addition of individual settings for second control
A145	Additional frequency setting	AA106	Addition of individual settings for second control
A146	Additional frequency sign selection		You can change the sign by setting **Add frequency setting, 1st-motor** (AA106) with ±.
A150	Curvature 1 for EL-S-shaped acceleration	AC-08	
A151	Curvature 2 for EL-S-shaped acceleration	AC-09	
A152	Curvature 1 for EL-S-shaped deceleration	AC-10	
A153	Curvature 2 for EL-S-shaped deceleration	AC-11	
b001	Selection of instantaneous power failure / undervoltage restart	bb-24	Specify b001=00 (trip) with The **number of retries after instantaneous power failure** (bb-20) or The **number of retries after under voltage**(bb-21) as zero.
b002	Allowable instantaneous power failure time	bb-25	
b003	Retry stand-by time for instantaneous power failure and insufficient voltage	bb-26	
b004	Instantaneous power failure / undervoltage tripping selection during stop	bb-27	
b005	Selection of instantaneous power failure retry count	bb-20	0: trip, 255: infinite
b006	Input phase loss selection	bb-65	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
b007	f matching lower limit frequency setting	bb-42	
b008	Trip retry selection	bb-28	Specify b008=00 (trip) with The **number of retries after over current** (bb-22) or The **number of retries after over voltage** (bb-23) as zero.
b009	Selection of undervoltage retry count	bb-21	0: trip, 255: infinite
b010	Selection of overvoltage / overcurrent retry count	bb-22 bb-23	Specify **The number of retries after over current** (bb-22) and **The number of retries after over voltage** (bb-23) individually.
b011	Trip retry standby time	bb-29	
b012	First electronic thermal level	bC110	
b212	Second electronic thermal level	bC210	
b312	Third electronic thermal level		Abolition of third control
b013	Selection of first electronic thermal characteristics	bC111	
b213	Selection of second electronic thermal characteristics	bC211	
b313	Selection of third electronic thermal characteristics		Abolition of third control
b015	Free electronic thermal frequency 1	bC120	Addition of individual settings for second control
b016	Free electronic thermal current 1	bC121	Addition of individual settings for second control
b017	Free electronic thermal frequency 2	bC122	Addition of individual settings for second control
b018	Free electronic thermal current 2	bC123	Addition of individual settings for second control
b019	Free electronic thermal frequency 3	bC124	Addition of individual settings for second control
b020	Free electronic thermal current 3	bC125	Addition of individual settings for second control
b021	Overload limit selection	bA122	Addition of individual settings for second control
b022	Overload limit level	bA123	Addition of individual settings for second control
b023	Overload limit constant	bA124	Addition of individual settings for second control
b024	Overload limit selection 2	bA126	Addition of individual settings for second control
b025	Overload limit level 2	bA127	Addition of individual settings for second control
b026	Overload limit constant 2	bA128	Addition of individual settings for second control
b027	Overcurrent suppression selection	bA120	Addition of individual settings for second control
b028	Frequency pull-in restart level	bb-43	
b029	Frequency pull-in restart constant	bb-44	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
b030	Start frequency selection for frequency pull-in restart	bb-47	
b031	Soft-lock selection	UA-16	
b034	RUN time / power supply ON time level	CE-36	
b035	Operation direction limit selection	AA114	Addition of individual settings for second control
b036	Reduced voltage start selection	Hb131	Addition of individual settings for second control
b037	Display selection	UA-10	
b038	Initial screen selection	UA-91	For the LCD Operator, you can select an initial screen in System settings of LCD Operator
b039	User parameter automatic setting function	UA-30	
b040	Torque limit selection	bA110	Addition of individual settings for second control
b041	Torque limit 1 (Four-quadrant mode normal powered)	bA112	Addition of individual settings for second control
b042	Torque limit 2 (Four-quadrant mode reverse regenerative)	bA113	Addition of individual settings for second control
b043	Torque limit 3 (Four-quadrant mode reverse powered)	bA114	Addition of individual settings for second control
b044	Torque limit 4 (Four-quadrant mode normal regenerative)	bA115	Addition of individual settings for second control
b045	Torque LADSTOP selection	bA116	Addition of individual settings for second control
b046	Selection of reversal prevention	HC114	Addition of individual settings for second control
b050	Instantaneous power failure non-stop selection	bA-30	
b051	Instantaneous power failure non-stop starting voltage	bA-31	
b052	Instantaneous power failure non-stop OV-LADSTOP level (target voltage level)	bA-32	
b053	Instantaneous power failure non-stop deceleration time	bA-34	
b054	Instantaneous power failure non-stop deceleration start range	bA-36	
b055	Instantaneous power failure non-stop proportional gain setting	bA-37	
b056	Instantaneous power failure non-stop integrated time setting	bA-38	
b060	Window comparator O upper limit	CE-40	
b061	Window comparator O lower limit	CE-41	
b062	Window comparator O hysteresis width	CE-42	
b063	Window comparator OI upper limit level	CE-43	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
b064	Window comparator OI lower limit level	CE-44	
b065	Window comparator OI hysteresis width	CE-45	
b066	Window comparator O2 upper limit lev-el	CE-46	
b067	Window comparator O2 lower limit lev-el	CE-47	
b068	Window comparator O2 hysteresis width	CE-48	
b070	O operation level at disconnection	CE-50	
b071	OI operation level at disconnection	CE-52	
b072	O2 operation level at disconnection	CE-54	
b078	Deletion of integrated power	UA-12	
b079	Integrated power display gain	UA-13	
b082	Starting frequency	Hb130	Addition of individual settings for sec-ond control
b083	Carrier frequency	bb101	Addition of individual settings for sec-ond control
b084	Selection of initialization	Ub-01	
b085	Initialization data selection	Ub-02	
b086	Frequency conversion coefficient	Ab-01	
b087	Stop key selection	AA-13	
b088	Free-run stop selection	bb-40	
b089	Automatic carrier reduction	bb103	Addition of individual settings for sec-ond control
b090	BRD use rate	bA-60	
b091	Stop mode selection	AA115	Addition of individual settings for sec-ond control
b092	Cooling fan operation selection	bA-70	
b095	BRD selection	bA-61	
b096	BRD on level	bA-62	
b098	Thermistor selection	Cb-40	
b099	Thermistor error level	bb-70	
b100	Free V/f frequency 1	Hb150	Addition of individual settings for sec-ond control
b101	Free V/f voltage 1	Hb151	Addition of individual settings for sec-ond control
b102	Free V/f frequency 2	Hb152	Addition of individual settings for sec-ond control
b103	Free V/f voltage 2	Hb153	Addition of individual settings for sec-ond control
b104	Free V/f frequency 3	Hb154	Addition of individual settings for sec-ond control
b105	Free V/f voltage 3	Hb155	Addition of individual settings for sec-ond control
b106	Free V/f frequency 4	Hb156	Addition of individual settings for sec-ond control

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
b107	Free V/f voltage 4	Hb157	Addition of individual settings for second control
b108	Free V/f frequency 5	Hb158	Addition of individual settings for second control
b109	Free V/f voltage 5	Hb159	Addition of individual settings for second control
b110	Free V/f frequency 6	Hb160	Addition of individual settings for second control
b111	Free V/f voltage 6	Hb161	Addition of individual settings for second control
b112	Free V/f frequency 7	Hb162	Addition of individual settings for second control
b113	Free V/f voltage 7	Hb163	Addition of individual settings for second control
b120	Brake control selection	AF130	Addition of individual settings for second control
b121	Establishment waiting time	AF131	Addition of individual settings for second control
b122	Acceleration waiting time	AF132	Addition of individual settings for second control
b123	Stop waiting time	AF133	Addition of individual settings for second control
b124	Brake check waiting time	AF134	Addition of individual settings for second control
b125	Brake release frequency	AF135	Addition of individual settings for second control
b126	Brake release current	AF136	Addition of individual settings for second control
b127	Brake apply frequency	AF137	Addition of individual settings for second control
b130	Overvoltage suppression function selection	bA140	Addition of individual settings for second control
b131	Overvoltage suppression level	bA141	Addition of individual settings for second control
b132	Overvoltage suppression constant	bA142	Addition of individual settings for second control
b133	Overvoltage suppression proportional gain setting	bA144	Addition of individual settings for second control
b134	Overvoltage suppression integrated time setting	bA145	Addition of individual settings for second control
C001	Selection of intelligent input terminal 1	CA-01	
C002	Selection of intelligent input terminal 2	CA-02	
C003	Selection of intelligent input terminal 3	CA-03	
C004	Selection of intelligent input terminal 4	CA-04	
C005	Selection of intelligent input terminal 5	CA-05	
C006	Selection of intelligent input terminal 6	CA-06	
C007	Selection of intelligent input terminal 7	CA-07	
C008	Selection of intelligent input terminal 8	CA-08	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
C011	Selection of intelligent input terminal 1a/b (NO/NC)	CA-21	
C012	Selection of intelligent input terminal 2a/b (NO/NC)	CA-22	
C013	Selection of intelligent input terminal 3a/b (NO/NC)	CA-23	
C014	Selection of intelligent input terminal 4a/b (NO/NC)	CA-24	
C015	Selection of intelligent input terminal 5a/b (NO/NC)	CA-25	
C016	Selection of intelligent input terminal 6a/b (NO/NC)	CA-26	
C017	Selection of intelligent input terminal 7a/b (NO/NC)	CA-27	
C018	Selection of intelligent input terminal 8a/b (NO/NC)	CA-28	
C019	Selection of FW terminal a/b (NO/NC)	CA-29	For **Input terminal [9] function** (CA-09) = [001: FW]
C021	Selection of intelligent output terminal 11	CC-01	
C022	Selection of intelligent output terminal 12	CC-02	
C023	Selection of intelligent output terminal 13	CC-03	
C024	Selection of intelligent output terminal 14	CC-04	
C025	Selection of intelligent output terminal 15	CC-05	
C026	Selection of intelligent relay terminal	CC-07	
C027	FM selection	Cd-03	
C028	AM selection	Cd-04	
C029	AMI selection	Cd-05	
C030	Reference value of digital current mon-itor		Configured with **[FM] monitor output base frequency (at PWM output)** (Cd-02). (settings need to be checked)
C031	Selection of intelligent output terminal 11a/b (NO/NC)	CC-11	
C032	Selection of intelligent output terminal 12a/b (NO/NC)	CC-12	
C033	Selection of intelligent output terminal 13a/b (NO/NC)	CC-13	
C034	Selection of intelligent output terminal 14a/b (NO/NC)	CC-14	
C035	Selection of intelligent output terminal 15a/b (NO/NC)	CC-15	
C036	Selection of intelligent relay a/b (NO/NC)	CC-17	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
C038	Low current signal output mode selection	CE101	Addition of individual settings for second control
C039	Low current detection level	CE102	Addition of individual settings for second control
C040	Overload advance notice signal output mode selection	CE105	Addition of individual settings for second control
C041	Overload advance notice level	CE106	Addition of individual settings for second control
C042	Acceleration reaching frequency	CE-10	
C043	Deceleration reaching frequency	CE-11	
C044	PID excessive deviation level	AH-72	
C045	Acceleration reaching frequency 2	CE-12	
C046	Deceleration reaching frequency 2	CE-13	
C052	Feedback comparison signal OFF level	AH-73	
C053	Feedback comparison signal ON level	AH-74	
C055	Overtorque level (normal rotation powered)	CE120	Addition of individual settings for second control
C056	Overtorque level (reverse rotation regenerative)	CE121	Addition of individual settings for second control
C057	Overtorque level (reverse rotation powered)	CE122	Addition of individual settings for second control
C058	Overtorque level (normal rotation regenerative)	CE123	Addition of individual settings for second control
C061	Thermal warning level	CE-30	
C062	Alarm code selection		This function is enabled when an alarm code [084] to [087] is set to an input terminal.
C063	0 Hz detection level	CE-33	
C064	Cooling fin overheat advance notice level	CE-34	
C071	Communication transmission speed selection	CF-01	
C072	Communication station number selection	CF-02	
C073	Communication bit length selection		Abolished due to Modbus communication
C074	Communication parity selection	CF-03	
C075	Communication stop bit selection	CF-04	
C076	Communication error selection	CF-05	
C077	Communication trip time	CF-06	
C078	Stop waiting time	CF-07	
C079	Communication method selection		Abolished due to Modbus communication
C081	O adjustment		Adjusted with **[Ai1] Voltage / Current zero-gain adjustment** (Cb-30) or **[Ai1] Voltage / Current gain adjustment** (Cb-31).

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
C082	OI adjustment		Adjusted with **[Ai2] Voltage / Current zero-gain adjustment** (Cb-32) or **[Ai2] Voltage / Current gain adjustment** (Cb-33).
C083	O2 adjustment		Adjusted with **[Ai3] Voltage zero-gain adjustment** (Cb-34) or **[Ai3] Voltage gain adjustment** (Cb-35).
C085	Thermistor adjustment	Cb-41	
C091	Debug mode selection	UC-01	
C101	UP / DWN memory selection	CA-61	
C102	Reset selection	CA-72	
C103	Reset f matching selection	bb-41	
C105	FM gain setting	Cd-14	
C106	AM gain setting	Cd-24	
C107	AMI gain setting	Cd-34	
C109	AM bias setting	Cd-23	
C110	AMI bias setting	Cd-33	
C111	Overload advance notice level 2	CE107	
C121	O zero adjustment	Cb-30/Cb-31	Adjusted with **[Ai1] Voltage / Current zero-gain adjustment** (Cb-30) or **[Ai1] Voltage / Current gain adjustment** (Cb-31).
C122	OI zero adjustment	Cb-32/Cb-33	Adjusted with **[Ai2] Voltage / Current zero-gain adjustment** (Cb-32) or **[Ai2] Voltage / Current gain adjustment** (Cb-33).
C123	O2 zero adjustment	Cb-34/Cb-35	Adjusted with **[Ai3] Voltage zero-gain adjustment** (Cb-34) or **[Ai3] Voltage gain adjustment** (Cb-35).
C130	Output 11 on-delay time	CC-20	
C131	Output 11 off-delay time	CC-21	
C132	Output 12 on-delay time	CC-22	
C133	Output 12 off-delay time	CC-23	
C134	Output 13 on-delay time	CC-24	
C135	Output 13 off-delay time	CC-25	
C136	Output 14 on-delay time	CC-26	
C137	Output 14 off-delay time	CC-27	
C138	Output 15 on-delay time	CC-28	
C139	Output 15 off-delay time	CC-29	
C140	Output RY on-delay time	CC-32	
C141	Output RY off-delay time	CC-33	
C142	Logical output signal 1 selection 1	CC-40	
C143	Logical output signal 1 selection 2	CC-41	
C144	Logical output signal 1 operator selection	CC-42	
C145	Logical output signal 2 selection 1	CC-43	
C146	Logical output signal 2 selection 2	CC-44	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
C147	Logical output signal 2 operator selection	CC-45	
C148	Logical output signal 3 selection 1	CC-46	
C149	Logical output signal 3 selection 2	CC-47	
C150	Logical output signal 3 operator selection	CC-48	
C151	Logical output signal 4 selection 1	CC-49	
C152	Logical output signal 4 selection 2	CC-50	
C153	Logical output signal 4 operator selection	CC-51	
C154	Logical output signal 5 selection 1	CC-52	
C155	Logical output signal 5 selection 2	CC-53	
C156	Logical output signal 5 operator selection	CC-54	
C157	Logical output signal 6 selection 1	CC-55	
C158	Logical output signal 6 selection 2	CC-56	
C159	Logical output signal 6 operator selection	CC-57	
C160	Input terminal response time 1	CA-41	
C161	Input terminal response time 2	CA-42	
C162	Input terminal response time 3	CA-43	
C163	Input terminal response time 4	CA-44	
C164	Input terminal response time 5	CA-45	
C165	Input terminal response time 6	CA-46	
C166	Input terminal response time 7	CA-47	
C167	Input terminal response time 8	CA-48	
C168	Input terminal response time FW	CA-49	
C169	Multistage speed / position determination time	CA-55	
H001	Auto-tuning selection	HA-01	
H002	First motor constant selection		Abolition of selection (setting of IE3 motor)
H202	Second motor constant selection		Abolition of selection (setting of IE3 motor)
H003	First motor capacity selection	Hb102	
H203	Second motor capacity selection	Hb202	
H004	First selection of the number of motor poles	Hb103	
H204	Second selection of the number of motor poles	Hb203	
H005	First speed response	HA115	* Adjustment may be required.
H205	Second speed response	HA215	* Adjustment may be required.
H006	First stability constant	HA110	* Adjustment may be required.
H206	Second stability constant	HA210	* Adjustment may be required.
H306	Third stability constant		Abolition of third control
H020	First motor R1	Hb110	* Adjustment may be required.
H220	Second motor R1	Hb210	* Adjustment may be required.

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
H021	First motor R2	Hb112	* Adjustment may be required.
H221	Second motor R2	Hb212	* Adjustment may be required.
H022	First motor L	Hb114	* Adjustment may be required.
H222	Second motor L	Hb214	* Adjustment may be required.
H023	First motor I0	Hb116	* Adjustment may be required.
H223	Second motor I0	Hb216	* Adjustment may be required.
H024	First motor J	Hb118	* Adjustment may be required.
H224	Second motor J	Hb218	* Adjustment may be required.
H030	First motor R1 (auto-tuning data)		**Async.Motor constant R1, 1st-motor** (Hb110): Integration of setting location
H230	Second motor R1 (auto-tuning data)		**Async.Motor constant R1, 2nd-motor** (Hb210): Integration of setting location
H031	First motor R2 (auto-tuning data)		**Async.Motor constant R2, 1st-motor** (Hb112): Integration of setting location
H231	Second motor R2 (auto-tuning data)		**Async.Motor constant R2, 2nd-motor** (Hb212): Integration of setting location
H032	First motor L (auto-tuning data)		**Async.Motor constant L, 1st-motor** (Hb114): Integration of setting location
H232	Second motor L (auto-tuning data)		**Async.Motor constant L, 2nd-motor** (Hb214): Integration of setting location
H033	First motor I0 (auto-tuning data)		**Async.Motor constant Io, 1st-motor** (Hb116): Integration of setting location
H233	Second motor I0 (auto-tuning data)		**Async.Motor constant Io, 2nd-motor** (Hb216): Integration of setting location
H034	First motor J (auto-tuning data)		**Async.Motor constant J, 1st-motor** (Hb118): Integration of setting location
H234	Second motor J (auto-tuning data)		**Async.Motor constant J, 2nd-motor** (Hb218): Integration of setting location
H050	First PI proportional gain	HA125	* Adjustment may be required.
H250	Second PI proportional gain	HA225	* Adjustment may be required.
H051	First PI integrated gain	HA126	* Adjustment may be required.
H251	Second PI integrated gain	HA226	* Adjustment may be required.
H052	First P proportional gain	HA127	* Adjustment may be required.
H252	Second P proportional gain	HA227	* Adjustment may be required.
H060	First 0 Hz range limiter	HC110	
H260	Second 0 Hz range limiter	HC210	
H061	First 0 Hz range SLV start boost volume	HC112	
H261	Second 0 Hz range SLV start boost volume	HC212	
H070	For switching PI proportional gain	HA128	* Adjustment may be required.
H071	For switching PI integrated gain	HA129	* Adjustment may be required.
H072	For switching P proportional gain	HA130	* Adjustment may be required.
H073	Gain switch time	HA121	
P001	Selection of operation at option 1 error	oA-12	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
P002	Selection of operation at option 2 error	oA-22	
P011	Number of pulses of encoder	ob-01	
P012	V2 control mode selection	AA123	
P013	Pulse string mode selection	ob-11	
P014	Orientation stop position	AE-11	
P015	Orientation speed setting	AE-12	
P016	Orientation direction setting	AE-13	
P017	Positioning completion range setting	AE-04	
P018	Positioning completion delay time setting	AE-05	
P019	Electronic gear installation position selection	AE-01	
P020	Numerator of electronic gear ratio	AE-02	
P021	Denominator of electronic gear ratio	AE-03	
P022	Positioning control feed forward gain	AE-06	
P023	Position loop gain	AE-07	
P024	Position bias volume	AE-08	
P025	Selection of whether a secondary-resistance correction is to be conducted.	HC113	Addition of individual settings for second control
P026	Overspeed error detection level	bb-80	
P027	Overspeed deviation error detection level	bb-81	
P028	Numerator of motor gear ratio	ob-03	
P029	Denominator of motor gear ratio	ob-04	
P031	Acceleration or deceleration time input type	AC-01	
P032	Orientation stop position input type	AE-10	
P033	Torque command input selection	Ad-01	
P034	Torque command setting	Ad-02	
P035	Selection of pole at torque command by O2	Ad-03	Not limited to Ai3.
P036	Torque bias mode	Ad-11	
P037	Torque bias value	Ad-12	
P038	Torque bias polarity selection	Ad-13	
P039	Torque control speed limit value (for normal rotation)	Ad-41	
P040	Torque control speed limit value (for reverse rotation)	Ad-42	
P044	Timer setting for monitoring of DeviceNet operation command	oA-11	
P045	Operation setting at the time of communication error	oA-12	
P046	OUTPUT assembly instance No. setting	(reserved)	
P047	INPUT assembly instance No. setting	(reserved)	
P048	Operation setting at the time of detection of idle mode	(reserved)	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
P049	Setting of the number of poles for rotation speed		Integrated to **Async.Motor poles setting, 1st-motor** (Hb103) or **Sync.Motor poles setting, 1st-motor** (Hd103).
P055	Pulse string frequency scale	ob-12	
P056	Pulse string frequency time constant	ob-13	
P057	Position string bias volume	ob-14	
P058	Pulse string limit	ob-15	
P060	Position command 0	AE-20	
P061	Position command 1	AE-22	
P062	Position command 2	AE-24	
P063	Position command 3	AE-26	
P064	Position command 4	AE-28	
P065	Position command 5	AE-30	
P066	Position command 6	AE-32	
P067	Position command 7	AE-34	
P068	Zero return mode	AE-70	
P069	Zero return direction selection	AE-71	
P070	Low speed zero return frequency	AE-72	
P071	High speed zero return frequency	AE-73	
P072	Position range designation (forward rotation side)	AE-52	
P073	Position range designation (reverse rotation side)	AE-54	
P074	Teaching selection	AE-60	
P100	Simplified sequence function user parameter U (00)	UE-10	
P101	Simplified sequence function user parameter U (01)	UE-11	
P102	Simplified sequence function user parameter U (02)	UE-12	
P103	Simplified sequence function user parameter U (03)	UE-13	
P104	Simplified sequence function user parameter U (04)	UE-14	
P105	Simplified sequence function user parameter U (05)	UE-15	
P106	Simplified sequence function user parameter U (06)	UE-16	
P107	Simplified sequence function user parameter U (07)	UE-17	
P108	Simplified sequence function user parameter U (08)	UE-18	
P109	Simplified sequence function user parameter U (09)	UE-19	
P110	Simplified sequence function user parameter U (10)	UE-20	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
P111	Simplified sequence function user parameter U (11)	UE-21	
P112	Simplified sequence function user parameter U (12)	UE-22	
P113	Simplified sequence function user parameter U (13)	UE-23	
P114	Simplified sequence function user parameter U (14)	UE-24	
P115	Simplified sequence function user parameter U (15)	UE-25	
P116	Simplified sequence function user parameter U (16)	UE-26	
P117	Simplified sequence function user parameter U (17)	UE-27	
P118	Simplified sequence function user parameter U (18)	UE-28	
P119	Simplified sequence function user parameter U (19)	UE-29	
P120	Simplified sequence function user parameter U (20)	UE-30	
P121	Simplified sequence function user parameter U (21)	UE-31	
P122	Simplified sequence function user parameter U (22)	UE-32	
P123	Simplified sequence function user parameter U (23)	UE-33	
P124	Simplified sequence function user parameter U (24)	UE-34	
P125	Simplified sequence function user parameter U (25)	UE-35	
P126	Simplified sequence function user parameter U (26)	UE-36	
P127	Simplified sequence function user parameter U (27)	UE-37	
P128	Simplified sequence function user parameter U (28)	UE-38	
P129	Simplified sequence function user parameter U (29)	UE-39	
P130	Simplified sequence function user parameter U (30)	UE-40	
P131	Simplified sequence function user parameter U (31)	UE-41	
U001	User 1 selection	UA-31	
U002	User 2 selection	UA-32	
U003	User 3 selection	UA-33	
U004	User 4 selection	UA-34	
U005	User 5 selection	UA-35	
U006	User 6 selection	UA-36	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
U007	User 7 selection	UA-37	
U008	User 8 selection	UA-38	
U009	User 9 selection	UA-39	
U010	User 10 selection	UA-40	
U011	User 11 selection	UA-41	
U012	User 12 selection	UA-42	

15

Table of Parameters

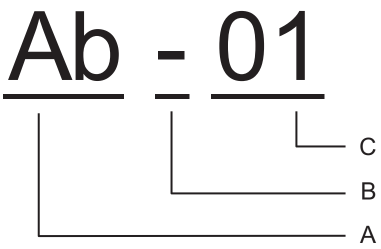
This section describes the monitor list and parameter list as well as the setting range and default of each parameter.

15

15-1 Parameter Notation

Structure of Parameter Number

- A parameter consists of a parameter group, a switch recognition number assigned by the [024: SET] terminal, and an in-group number.
- If the switch recognition number assigned by [024: SET] terminal function is “-”, the parameter is enabled in both first setting and second setting.
- If the [024: SET] function is not set to **Input terminal function** (CA-01) to (CA-11), the first setting is valid.



A	Parameter group		
B	SET function type	-	Common setting: always enabled in both the first and second settings.
		1	First setting: enabled when the [SET] terminal function is OFF.
		2	Second setting: enabled when the [SET] terminal function is ON.
C	In-group number		

Refer to *8-4-1 Second Control (SET)* on page 8-78 for details of the second setting.

Notes on Monitor

The following items are included in the monitor list since there is no need to write to monitor items.

Code	Name	Data range	Unit
XX-01	Monitor name	Range of data	Unit of data

Notes on Parameter

Code	Change during operation	Name	Data range	Unit	Default
YY101	-	Parameter name	Range of data	01	00

Code	Change during operation	Name	Data range	Unit	Default
YY-02	Yes[*1]	Parameter name	200 V class: Range of data 400 V class: Range of data	200 V class: Unit 400 V class: Unit	200 V class: VV 400 V class: WW

*1. Shows that the codes can be changed during operation.

Before setting the parameters, we expect you to fully understand the various precautions.

Precautions for Correct Use

- Make sure to check and set the following parameters to protect the motor.
  - (Hb102) to (Hb108) (for IM)
  - (Hd102) to (Hd108) (for SM/PMM)
  - **Electronic thermal level setting** (bC110)
  - **Over current detection level** (bb160)
- When setting the thermal subtraction characteristics, set a value in accordance with the characteristics of motor. Otherwise, the motor may be burned.

After configuring settings for motor protection, choose the frequency command destination and operation command destination to run the device.

- Set the frequency command destination in **Main speed input source selection, 1st-motor** (AA101).
- Set the operation command destination in **Run-command input source selection, 1st-motor** (AA111).
- Confirm that the frequency command is set in **Main Speed reference monitor** (FA-01).

To run the inverter, a frequency command and operation command are required. When commands are given with V/f control, the inverter does not output if the frequency command is 0 Hz.
Parameters that *cannot be changed during operation* can be changed only while the inverter is stopped. If you cannot change the parameter, wait for the inverter to decelerate to a stop and to completely stop the output. Aside from this, when the soft lock function is enabled, you cannot change the parameter.

For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Setting from Operator or CX-Drive
   Set **Resister data selection** (CF-11) to *00: A, V*. You can enter numerical values in units of 0.1 A or 0.1 V.
2. Setting through Modbus communication
   You can select *00: A, V* or (%) in **Resister data selection** (CF-11). The value in the (%) unit is the ratio to the rated current of the inverter. Since it is also affected by the load rating set in **Load type selection** (Ub-03), you are recommended to set to *00: A, V*.
3. Numerical values in DriveProgramming
   It is always 0.01% of the rated current (A) and rated voltage (V).

15-2 Monitor List

15-2-1 Monitors Related to Output

Code	Name	Data range	Unit
dA-01	Output Frequency Monitor	0.00 to 590.00	0.01 Hz
dA-02	Output Current Monitor	0.00 to 655.35	0.01 A
dA-03	Operation Direction Monitor	00: o (Stopped) 01: d (0Hz output) 02: F (Normal rotation in process) 03: r (Reverse rotation in process)	-
dA-04	Frequency command after calculation	-590.00 to 590.00	0.01 Hz
dA-06	Output frequency conversion monitor	0.00 to 59000.00	0.01
dA-08	Speed Detection Value Monitor	-590.00 to 590.00	0.01 Hz
dA-12	Output frequency monitor (with sign)	-590.00 to 590.00	0.01 Hz
dA-14	Frequency upper limit monitor	0.00 to 590.00	0.01 Hz
dA-15	Torque command monitor after calculation	-1000.0 to 1000.0	0.10%
dA-16	Torque limit monitor	0.0 to 500.0	0.10%
dA-17	Output torque monitor*1	-1000.0 to 1000.0	0.10%
dA-18	Output Voltage Monitor	0.0 to 800.0	0.1 V
dA-20	Current position monitor	In case of (AA121) is *10* and (AA123) is *03*, the data range is -2147483648 to 2147483647 In the case of the settings other than the above, data range is -536870912 to 536870911	1 pls
dA-26	Pulse train position deviation monitor	-2147483647 to 2147483647	1 pls
dA-28	Pulse counter monitor	0 to 2147483647	1 pls
dA-30	Input Power Monitor	0.00 to 600.00 (132 kW max.) 0.0 to 2000.0 (160 kW min.)	0.01 kWh 0.1 kWh
dA-32	Integrated input power monitor	0.0 to 1000000.0	0.1 kWh
dA-34	Output Power Monitor	0.00 to 600.00 (132 kW max.) 0.0 to 2000.0 (160 kW min.)	0.01 kWh 0.1 kWh
dA-36	Integrated output power monitor	0.0 to 1000000.0	0.1 kWh
dA-38	Motor temperature monitor	-20.0 to 200.0	0.1℃
dA-40	DC voltage monitor	0.0 to 1000.0	0.1 VDC
dA-41	BRD load factor monitor	0.00 to 100.00	0.01%
dA-42	Electronic thermal duty ratio monitor MTR	0.00 to 100.00	0.01%

Code	Name	Data range	Unit
dA-43	Electronic thermal duty ratio monitor CTL	0.00 to 100.00	0.01%

*1. Disabled when **Control mode selection** (AA121) or (AA221) is set to *00 to 06: V/f control mode*.

15-2-2 Monitors Related to Control Circuit

Code	Name	Data range	Unit
dA-45	Safety STO monitor	00: No input 01: P-1A 02: P-2A 03: P-1b 04: P-2b 05: P-1C 06: P-2C 07: STO	-
dA-50	Terminal block option mounted state	00: STD-TM1 (fixed value)	-
dA-51	Input Terminal Monitor	LLLLLLLLLLL to HHHHHHHHHHH [L: OFF / H: ON] [Left side] (terminal B) (terminal A) (terminal 9) to (terminal 1) [Right side]	1
dA-54	Output Terminal Monitor	LLLLLLL to HHHHHHH [L: OFF / H: ON] [Left side] (terminal AL) (terminal 16C) (terminal 15) to (terminal 11) [Right side]	1
dA-60	Analog I/O selection monitor	AAAAAAAA to VVVVVVVV [A: current / V: voltage] [Left side] (Reserved) (Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side]	1
dA-61	Analog input [Ai1] monitor	0.00 to 100.00	0.01%
dA-62	Analog input [Ai2] monitor	0.00 to 100.00	0.01%
dA-63	Analog input [Ai3] monitor	-100.00 to 100.00	0.01%
dA-70	Pulse string input monitor main body	-100.00 to 100.00	0.01%
dA-71	Pulse string input monitor option	-100.00 to 100.00	0.01%
dA-46 dA-47	Reserved	-	-
dA-64 to dA-66	Reserved	-	-

15-2-3 Option Slot Monitors

Code	Name	Data range	Unit
dA-81	Option slot 1 mounted state	00: None 09: RX2-ECT 33: RX2-PG	-
dA-82	Option slot 2 mounted state		
dA-83	Option slot 3 mounted state		

15-2-4 Monitors Related to Program Function EzSQ

Code	Name	Data range	Unit
db-01	Program download monitor	00: Without a program 01: With a program	-
db-02	Program No. monitor	0 to 9999	1
db-03	Program counter (Task-1)	1 to 1024	1
db-04	Program counter (Task-2)		1
db-05	Program counter (Task-3)		1
db-06	Program counter (Task-4)		1
db-07	Program counter (Task-5)		1
db-08	User monitor 0	-2147483647 to 2147483647	1
db-10	User monitor 1		1
db-12	User monitor 2		1
db-14	User monitor 3		1
db-16	User monitor 4		1
db-18	Analog output monitor YA0	0.00 to 100.00	0.01%
db-19	Analog output monitor YA1		0.01%
db-20	Analog output monitor YA2		0.01%
db-21 to db-23	Reserved	-	-

15-2-5 Monitors Related to PID Function

Code	Name	Data range	Unit
db-30	PID1 feedback data 1 monitor	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
db-32	PID1 feedback data 2 monitor	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
db-34	PID1 feedback data 3 monitor	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
db-36	PID2 feedback data monitor	**PID2 scale adjustment (at 0%)** (AJ-04) to **PID2 scale adjustment (point position)** (AJ-06)	Unit differs depending on the AJ-03 and AJ-06 settings.

Code	Name	Data range	Unit
db-38	PID3 feedback data monitor	**PID3 scale adjustment (at 0%)** (AJ-24) to **PID3 scale adjustment (point position)** (AJ-26)	Unit differs depending on the AJ-23 and AJ-26 settings.
db-40	PID4 feedback data monitor	**PID4 scale adjustment (at 0%)** (AJ-44) to **PID4 scale adjustment (point position)** (AJ-46)	Unit differs depending on the AJ-43 and AJ-46 settings.
db-42	PID1 target value monitor after calculation	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
db-44	PID1 feedback data	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
db-50	PID1 output monitor	-100.00 to 100.00	0.01%
db-51	PID1 deviation monitor	-200.00 to 200.00	0.01%
db-52	PID1 deviation 1 monitor		0.01%
db-53	PID1 deviation 2 monitor		0.01%
db-54	PID1 deviation 3 monitor		0.01%
db-55	PID2 output monitor	-100.00 to 100.00	0.01%
db-56	PID2 deviation monitor	-200.00 to 200.00	0.01%
db-57	PID3 output monitor	-100.00 to 100.00	0.01%
db-58	PID3 deviation monitor	-200.00 to 200.00	0.01%
db-59	PID4 output monitor	-100.00 to 100.00	0.01%
db-60	PID4 deviation monitor	-200.00 to 200.00	0.01%
db-61	PID current P gain monitor	0.0 to 100.0	0.1%
db-62	PID current I gain monitor	0.0 to 3600.0	0.1 s
db-63	PID current D gain monitor	0.00 to 100.00	0.01 s
db-64	PID feed-forward monitor	-100.00 to 100.00	0.01%

15-2-6 Monitors for Checking Internal Condition

Code	Name	Data range	Unit
dC-01	Inverter load type selection monitor	00: Very low duty 01: Low duty 02: Normal duty	-
dC-02	Rated Current Monitor	0 to 65535	0.1 A

Code	Name	Data range	Unit
dC-07	Speed command destination monitor (main)	00: Disabled 01: Ai1 02: Ai2 03: Ai3 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Multistage speed 0 08: Sub speed 09: Multistage speed 1 10: Multistage speed 2 11: Multistage speed 3 12: Multistage speed 4 13: Multistage speed 5 14: Multistage speed 6 15: Multistage speed 7 16: Multistage speed 8 17: Multistage speed 9 18: Multistage speed 10 19: Multistage speed 11 20: Multistage speed 12 21: Multistage speed 13 22: Multistage speed 14 23: Multistage speed 15 24: JG 25: RS485 26: Option 1 27: Option 2 28: Option 3 29: Pulse string: Inverter 30: Pulse string: Option 31: DriveProgramming 32: PID 33: (Reserved) 34: AHD retention speed	-

Code	Name	Data range	Unit
dC-08	Speed command destination monitor (auxiliary)	00: Disabled 01: Ai1 02: Ai2 03: Ai3 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Multistage speed 0 08: Sub speed 09: Multistage speed 1 10: Multistage speed 2 11: Multistage speed 3 12: Multistage speed 4 13: Multistage speed 5 14: Multistage speed 6 15: Multistage speed 7 16: Multistage speed 8 17: Multistage speed 9 18: Multistage speed 10 19: Multistage speed 11 20: Multistage speed 12 21: Multistage speed 13 22: Multistage speed 14 23: Multistage speed 15 24: JG 25: RS485 26: Option 1 27: Option 2 28: Option 3 29: Pulse string: Inverter 30: Pulse string: Option 31: DriveProgramming 32: PID 33: (Reserved) 34: AHD retention speed	-
dC-10	Operation command destination monitor	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 setting 04: Option 1 05: Option 2 06: Option 3	-
dC-15	Cooling Fin Temperature Monitor	-20.0 to 200.0	0.1℃
dC-16	Life Diagnostic Monitor	0 to 0xFF	1
dC-20	Total start-up count	1 to 65535	1
dC-21	Power-on count	1 to 65535	1
dC-22	Cumulative operating hours monitor during RUN	0 to 1000000	1 hr
dC-24	Cumulative power-on time	0 to 1000000	1 hr
dC-26	Cumulative operating time of cooling fan	0 to 1000000	1 hr

Code	Name	Data range	Unit
dC-37	Detailed monitor for icon 2 LIM	00: Condition other than below 01: Overcurrent suppression in process 02: Overload being limited 03: Overvoltage suppression in process 04: Torque being limited 05: Upper/lower limit and jump frequency setting being limited 06: Setting of minimum frequency being limited	-
dC-38	Detailed monitor for icon 2 ALT	00: Condition other than below 01: Overload advance notice 02: Motor thermal advance notice 03: Controller thermal advance notice 04: Motor overheat advance notice	-
dC-39	Detailed monitor for icon 2 RETRY	00: Condition other than below 01: Retry standby 02: Restart standby	-
dC-40	Detailed monitor for icon 2 NRDY	00: Preparation completed condition other than below IRDY=OFF 01: Trip occurred 02: Power supply abnormality 03: Resetting 04: STO 05: Standby 06: Data inconsistency and Others (including no FB, consistency of settings of A and B phases, etc.) 07: Sequence abnormality 08: Free run 09: Forced stop	-
dC-45	IM/SM monitor	00: Induction motor IM being selected 01: Synchronous motor SM (permanent magnet motor PMM) being selected	-
dC-50	Firmware Ver. monitor	0 to FFFF Upper 1 byte: Major version Lower 1 byte: Minor version 1	1
dC-53	Firmware Gr. monitor	00: Standard	-

15-2-7 Trip State Monitors

Code	Name	Data range	Unit
dE-01	Trip count monitor	0 to 65535	1

Code	Name	Data range	Unit
dE-11	Trip monitor 1 Factor	1 to 255	1
	Trip monitor 1 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 1 Output frequency (with sign) (LOW)		
	Trip monitor 1 Output current	0.00 to 655.35	0.01 A
	Trip monitor 1 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 1 Inverter state	0 to 8*1	1
	Trip monitor 1 LAD state	0 to 5*1	1
	Trip monitor 1 INV control mode	0 to 11*1	1
	Trip monitor 1 Limit state	0 to 6*1	1
	Trip monitor 1 Special state	0 to 6*1	1
	Trip monitor 1 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 1 RUN time (LOW)		
	Trip monitor 1 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 1 Power ON time (LOW)		
	Trip monitor 1 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	1
	Trip monitor 1 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	1
	Trip monitor 1 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	1
dE-12	Trip monitor 2 Factor	1 to 255	1
	Trip monitor 2 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 2 Output frequency (with sign) (LOW)		
	Trip monitor 2 Output current	0.00 to 655.35	0.01 A
	Trip monitor 2 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 2 Inverter state	0 to 8*1	1
	Trip monitor 2 LAD state	0 to 5*1	1
	Trip monitor 2 INV control mode	0 to 11*1	1
	Trip monitor 2 Limit state	0 to 6*1	1
	Trip monitor 2 Special state	0 to 6*1	1
	Trip monitor 2 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 2 RUN time (LOW)		
	Trip monitor 2 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 2 Power ON time (LOW)		
	Trip monitor 2 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 2 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 2 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-13	Trip monitor 3 Factor	1 to 255	-
	Trip monitor 3 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 3 Output frequency (with sign) (LOW)		
	Trip monitor 3 Output current	0.00 to 655.35	0.01 A
	Trip monitor 3 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 3 Inverter state	0 to 8*1	1
	Trip monitor 3 LAD state	0 to 5*1	1
	Trip monitor 3 INV control mode	0 to 11*1	1
	Trip monitor 3 Limit state	0 to 6*1	1
	Trip monitor 3 Special state	0 to 6*1	1
	Trip monitor 3 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 3 RUN time (LOW)		
	Trip monitor 3 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 3 Power ON time (LOW)		
	Trip monitor 3 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 3 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 3 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-14	Trip monitor 4 Factor	1 to 255	1
	Trip monitor 4 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 4 Output frequency (with sign) (LOW)		
	Trip monitor 4 Output current	0.00 to 655.35	0.01 A
	Trip monitor 4 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 4 Inverter state	0 to 8*1	1
	Trip monitor 4 LAD state	0 to 5*1	1
	Trip monitor 4 INV control mode	0 to 11*1	1
	Trip monitor 4 Limit state	0 to 6*1	1
	Trip monitor 4 Special state	0 to 6*1	1
	Trip monitor 4 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 4 RUN time (LOW)		
	Trip monitor 4 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 4 Power ON time (LOW)		
	Trip monitor 4 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 4 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 4 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-15	Trip monitor 5 Factor	1 to 255	1
	Trip monitor 5 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 5 Output frequency (with sign) (LOW)		
	Trip monitor 5 Output current	0.00 to 655.35	0.01 A
	Trip monitor 5 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 5 Inverter state	0 to 8*1	1
	Trip monitor 5 LAD state	0 to 5*1	1
	Trip monitor 5 INV control mode	0 to 11*1	1
	Trip monitor 5 Limit state	0 to 6*1	1
	Trip monitor 5 Special state	0 to 6*1	1
	Trip monitor 5 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 5 RUN time (LOW)		
	Trip monitor 5 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 5 Power ON time (LOW)		
	Trip monitor 5 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 5 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 5 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-16	Trip monitor 6 Factor	1 to 255	1
	Trip monitor 6 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 6 Output frequency (with sign) (LOW)		
	Trip monitor 6 Output current	0.00 to 655.35	0.01 A
	Trip monitor 6 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 6 Inverter state	0 to 8*1	1
	Trip monitor 6 LAD state	0 to 5*1	1
	Trip monitor 6 INV control mode	0 to 11*1	1
	Trip monitor 6 Limit state	0 to 6*1	1
	Trip monitor 6 Special state	0 to 6*1	1
	Trip monitor 6 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 6 RUN time (LOW)		
	Trip monitor 6 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 6 Power ON time (LOW)		
	Trip monitor 6 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 6 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 6 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-17	Trip monitor 7 Factor	1 to 255	1
	Trip monitor 7 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 7 Output frequency (with sign) (LOW)		
	Trip monitor 7 Output current	0.00 to 655.35	0.01 A
	Trip monitor 7 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 7 Inverter state	0 to 8*1	1
	Trip monitor 7 LAD state	0 to 5*1	1
	Trip monitor 7 INV control mode	0 to 11*1	1
	Trip monitor 7 Limit state	0 to 6*1	1
	Trip monitor 7 Special state	0 to 6*1	1
	Trip monitor 7 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 7 RUN time (LOW)		
	Trip monitor 7 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 7 Power ON time (LOW)		
	Trip monitor 7 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 7 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 7 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-18	Trip monitor 8 Factor	1 to 255	1
	Trip monitor 8 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 8 Output frequency (with sign) (LOW)		
	Trip monitor 8 Output current	0.00 to 655.35	0.01 A
	Trip monitor 8 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 8 Inverter state	0 to 8*1	1
	Trip monitor 8 LAD state	0 to 5*1	1
	Trip monitor 8 INV control mode	0 to 11*1	1
	Trip monitor 8 Limit state	0 to 6*1	1
	Trip monitor 8 Special state	0 to 6*1	1
	Trip monitor 8 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 8 RUN time (LOW)		
	Trip monitor 8 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 8 Power ON time (LOW)		
	Trip monitor 8 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 8 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 8 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-19	Trip monitor 9 Factor	1 to 255	1
	Trip monitor 9 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 9 Output frequency (with sign) (LOW)		
	Trip monitor 9 Output current	0.00 to 655.35	0.01 A
	Trip monitor 9 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 9 Inverter state	0 to 8*1	1
	Trip monitor 9 LAD state	0 to 5*1	1
	Trip monitor 9 INV control mode	0 to 11*1	1
	Trip monitor 9 Limit state	0 to 6*1	1
	Trip monitor 9 Special state	0 to 6*1	1
	Trip monitor 9 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 9 RUN time (LOW)		
	Trip monitor 9 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 9 Power ON time (LOW)		
	Trip monitor 9 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 9 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 9 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-20	Trip monitor 10 Factor	1 to 255	1
	Trip monitor 10 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 10 Output frequency (with sign) (LOW)		
	Trip monitor 10 Output current	0.00 to 655.35	0.01 A
	Trip monitor 10 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Trip monitor 10 Inverter state	0 to 8*1	1
	Trip monitor 10 LAD state	0 to 5*1	1
	Trip monitor 10 INV control mode	0 to 11*1	1
	Trip monitor 10 Limit state	0 to 6*1	1
	Trip monitor 10 Special state	0 to 6*1	1
	Trip monitor 10 RUN time (HIGH)	0 to 1000000	1 hr
	Trip monitor 10 RUN time (LOW)		
	Trip monitor 10 Power ON time (HIGH)	0 to 1000000	1 hr
	Trip monitor 10 Power ON time (LOW)		
	Trip monitor 10 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Trip monitor 10 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Trip monitor 10 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

*1. Refer to *Details of Trip and Retry* on page 15-21 for details.

15-2-8 Retry State Monitors

Code	Name	Data range	Unit
dE-31	Retry monitor 1 Factor	1 to 255	1
	Trip monitor 1 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 1 Output frequency (with sign) (LOW)		
	Retry monitor 1 Output current	0.00 to 655.35	0.01 A
	Retry monitor 1 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 1 Inverter state	0 to 8*1	1
	Retry monitor 1 LAD state	0 to 5*1	1
	Retry monitor 1 INV control mode	0 to 11*1	1
	Retry monitor 1 Limit state	0 to 6*1	1
	Retry monitor 1 Special state	0 to 6*1	1
	Retry monitor 1 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 1 RUN time (LOW)		
	Retry monitor 1 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 1 Power ON time (LOW)		
	Retry monitor 1 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 1 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 1 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-32	Retry monitor 2 Factor	1 to 255	1
	Trip monitor 2 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 2 Output frequency (with sign) (LOW)		
	Retry monitor 2 Output current	0.00 to 655.35	0.01 A
	Retry monitor 2 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 2 Inverter state	0 to 8*1	1
	Retry monitor 2 LAD state	0 to 5*1	1
	Retry monitor 2 INV control mode	0 to 11*1	1
	Retry monitor 2 Limit state	0 to 6*1	1
	Retry monitor 2 Special state	0 to 6*1	1
	Retry monitor 2 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 2 RUN time (LOW)		
	Retry monitor 2 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 2 Power ON time (LOW)		
	Retry monitor 2 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 2 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 2 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-33	Retry monitor 3 Factor	1 to 255	1
	Trip monitor 3 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 3 Output frequency (with sign) (LOW)		
	Retry monitor 3 Output current	0.00 to 655.35	0.01 A
	Retry monitor 3 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 3 Inverter state	0 to 8*1	1
	Retry monitor 3 LAD state	0 to 5*1	1
	Retry monitor 3 INV control mode	0 to 11*1	1
	Retry monitor 3 Limit state	0 to 6*1	1
	Retry monitor 3 Special state	0 to 6*1	1
	Retry monitor 3 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 3 RUN time (LOW)		
	Retry monitor 3 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 3 Power ON time (LOW)		
	Retry monitor 3 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 3 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 3 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-34	Retry monitor 4 Factor	1 to 255	1
	Trip monitor 4 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 4 Output frequency (with sign) (LOW)		
	Retry monitor 4 Output current	0.00 to 655.35	0.01 A
	Retry monitor 4 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 4 Inverter state	0 to 8*1	1
	Retry monitor 4 LAD state	0 to 5*1	1
	Retry monitor 4 INV control mode	0 to 11*1	1
	Retry monitor 4 Limit state	0 to 6*1	1
	Retry monitor 4 Special state	0 to 6*1	1
	Retry monitor 4 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 4 RUN time (LOW)		
	Retry monitor 4 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 4 Power ON time (LOW)		
	Retry monitor 4 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 4 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 4 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-35	Retry monitor 5 Factor	1 to 255	1
	Trip monitor 5 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 5 Output frequency (with sign) (LOW)		
	Retry monitor 5 Output current	0.00 to 655.35	0.01 A
	Retry monitor 5 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 5 Inverter state	0 to 8*1	1
	Retry monitor 5 LAD state	0 to 5*1	1
	Retry monitor 5 INV control mode	0 to 11*1	1
	Retry monitor 5 Limit state	0 to 6*1	1
	Retry monitor 5 Special state	0 to 6*1	1
	Retry monitor 5 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 5 RUN time (LOW)		
	Retry monitor 5 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 5 Power ON time (LOW)		
	Retry monitor 5 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 5 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 5 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-36	Retry monitor 6 Factor	1 to 255	1
	Trip monitor 6 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 6 Output frequency (with sign) (LOW)		
	Retry monitor 6 Output current	0.00 to 655.35	0.01 A
	Retry monitor 6 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 6 Inverter state	0 to 8*1	1
	Retry monitor 6 LAD state	0 to 5*1	1
	Retry monitor 6 INV control mode	0 to 11*1	1
	Retry monitor 6 Limit state	0 to 6*1	1
	Retry monitor 6 Special state	0 to 6*1	1
	Retry monitor 6 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 6 RUN time (LOW)		
	Retry monitor 6 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 6 Power ON time (LOW)		
	Retry monitor 6 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 6 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 6 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-37	Retry monitor 7 Factor	1 to 255	1
	Trip monitor 7 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 7 Output frequency (with sign) (LOW)		
	Retry monitor 7 Output current	0.00 to 655.35	0.01 A
	Retry monitor 7 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 7 Inverter state	0 to 8*1	1
	Retry monitor 7 LAD state	0 to 5*1	1
	Retry monitor 7 INV control mode	0 to 11*1	1
	Retry monitor 7 Limit state	0 to 6*1	1
	Retry monitor 7 Special state	0 to 6*1	1
	Retry monitor 7 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 7 RUN time (LOW)		
	Retry monitor 7 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 7 Power ON time (LOW)		
	Retry monitor 7 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 7 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 7 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-38	Retry monitor 8 Factor	1 to 255	1
	Trip monitor 8 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 8 Output frequency (with sign) (LOW)		
	Retry monitor 8 Output current	0.00 to 655.35	0.01 A
	Retry monitor 8 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 8 Inverter state	0 to 8*1	1
	Retry monitor 8 LAD state	0 to 5*1	1
	Retry monitor 8 INV control mode	0 to 11*1	1
	Retry monitor 8 Limit state	0 to 6*1	1
	Retry monitor 8 Special state	0 to 6*1	1
	Retry monitor 8 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 8 RUN time (LOW)		
	Retry monitor 8 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 8 Power ON time (LOW)		
	Retry monitor 8 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 8 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 8 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-

Code	Name	Data range	Unit
dE-39	Retry monitor 9 Factor	1 to 255	1
	Trip monitor 9 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 9 Output frequency (with sign) (LOW)		
	Retry monitor 9 Output current	0.00 to 655.35	0.01 A
	Retry monitor 9 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 9 Inverter state	0 to 8*1	1
	Retry monitor 9 LAD state	0 to 5*1	1
	Retry monitor 9 INV control mode	0 to 11*1	1
	Retry monitor 9 Limit state	0 to 6*1	1
	Retry monitor 9 Special state	0 to 6*1	1
	Retry monitor 9 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 9 RUN time (LOW)		
	Retry monitor 9 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 9 Power ON time (LOW)		
	Retry monitor 9 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 9 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 9 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-40	Retry monitor 10 Factor	1 to 255	1
	Trip monitor 10 Output frequency (with sign) (HIGH)	-590.00 to 590.00	0.01 Hz
	Trip monitor 10 Output frequency (with sign) (LOW)		
	Retry monitor 10 Output current	0.00 to 655.35	0.01 A
	Retry monitor 10 P-N DC voltage	0.0 to 1000.0	0.1 VDC
	Retry monitor 10 Inverter state	0 to 8*1	1
	Retry monitor 10 LAD state	0 to 5*1	1
	Retry monitor 10 INV control mode	0 to 11*1	1
	Retry monitor 10 Limit state	0 to 6*1	1
	Retry monitor 10 Special state	0 to 6*1	1
	Retry monitor 10 RUN time (HIGH)	0 to 1000000	1 hr
	Retry monitor 10 RUN time (LOW)		
	Retry monitor 10 Power ON time (HIGH)	0 to 1000000	1 hr
	Retry monitor 10 Power ON time (LOW)		
	Retry monitor 10 Absolute time (year, month)	00 to 99 (BCD code) 01 to 12 (BCD code)	-
	Retry monitor 10 Absolute time (day, day of the week)	01 to 31 (BCD code) 00 to 06 (BCD code)	-
	Retry monitor 10 Absolute time (hour, minute)	00 to 23 (BCD code) 00 to 59 (BCD code)	-
dE-50	Warning monitor	0 to 65535	1

*1. Refer to *Details of Trip and Retry* on page 15-21 for details.

Details of Trip and Retry

Function name	Code	Mode	LCD Operator display
Inverter state	0	During power supply turned ON, reset, customer-initializing	INIT.
	1	Ground fault detecting	GND fault
	2	During stop	Stop
	3	Operation standby (contactor applied)	Run PREP.1
	4	Operation ready (magnetic position detecting)	Run PREP.2
	5	During RUN (including DB, Servo ON, forcing)	Run
	6	Stop Standby (contactor open)	Stop PREP.
	7	Retry waiting	Retry PREP.
	8	During retry	Retry
LAD state	0	Zero (output shut off, DB, Servo On, forcing)	-
	1	At startup, forward/reverse switching,voltage reducing start	MIN.
	2	During acceleration	ACCEL.
	3	During deceleration	DECEL.
	4	During constant speed	CONST.
	5	During restart	Restart
INV control mode	0	Power shut off	-
	1	During speed control	SPD CNTL
	2	During startup	Starting
	3	During DB	DB
	4	During forcing	Forcing
	5	During Servo ON	Servo ON
	6	During position control	POS CNTL
	7	During torque control	TRQ CNTL
	8	During restart	Restarting
	9	During detection of magnetic pole position	Axis POS
	10	During ground fault detection	GND fault
	11	During measurement of auto-tuning R1R2L	Tuning
Limit state	0	Not limited status	-
	1	During overcurrent suppression (priority order of display is high)	OC SUPPR
	2	During overload suppression	OL SUPPR
	3	During overvoltage suppression	OV SUPPR
	4	During torque limit (priority order of display is low)	TRQ Limit
	5	During setting limitation of upper and lower limit and jump frequency	Freq Limit
	6	During setting limitation of minimum frequency	Min.Freq

Function name	Code	Mode	LCD Operator display
Special state	0	Not particular status	-
	1	During auto-tuning	Tuning
	2	During simulation mode	Simulation
	3	(Reserved)	-
	4	During forced emergency operation	Force Run
	5	During bypass mode	Bypass
	6	(Reserved)	-

15-2-9 Monitors and Parameters for Changing the Current Commands

FA parameters indicate the current command value, and automatically display data of the command destination that is being adopted.

If the command destination is the LCD Operator, it can be changed using the UP, DOWN, LEFT, and RIGHT keys.

If the command destination is the analog input Ai1, it can be changed by changing input to the [Ai1] terminal.

Code	Change during operation	Name	Data range	Unit
FA-01	Yes	Main Speed reference monitor	0.00 to 590.00	0.01 Hz
FA-02	Yes	Sub speed reference monitor	-590.00 to 590.00 (monitor) 0.00 to 590.00 (setting)	0.01 Hz
FA-10	Yes	Acceleration time monitor	0.00 to 3600.00	0.01 s
FA-12	Yes	Deceleration time monitor	0.00 to 3600.00	0.01 s
FA-15	Yes	Torque reference monitor	-500.0 to 500.0	0.1%
FA-16	Yes	Torque bias monitor	-500.0 to 500.0	0.1%
FA-20	Yes	Position reference monitor	-268435455 to 268435455	1
FA-30	Yes	PID1 Set Value 1 monitor	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
FA-32	Yes	PID1 Set Value 2 monitor	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.

Code	Change during operation	Name	Data range	Unit
FA-34	Yes	PID1 Set Value 3 monitor	**PID1 scale adjustment (at 0%)** (AH-04) to **PID1 scale adjustment (point position)** (AH-06)	Unit differs depending on the AH-03 and AH-06 settings.
FA-36	Yes	PID2 Set Value monitor	**PID2 scale adjustment (at 0%)** (AJ-04) to **PID2 scale adjustment (point position)** (AJ-06)	Unit differs depending on the AJ-03 and AJ-06 settings.
FA-38	Yes	PID3 Set Value monitor	**PID3 scale adjustment (at 0%)** (AJ-24) to **PID3 scale adjustment (point position)** (AJ-26)	Unit differs depending on the AJ-23 and AJ-26 settings.
FA-40	Yes	PID4 Set Value monitor	**PID4 scale adjustment (at 0%)** (AJ-44) to **PID4 scale adjustment (point position)** (AJ-46)	Unit differs depending on the AJ-43 and AJ-46 settings.

15-3 Parameter List

15-3-1 Parameter (Code A)

Code	Change during operation	Name	Data range	Unit	Default
AA101	-	Main speed input source selection, 1st-motor	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-	01*1
AA102	-	Sub frequency input source selection, 1st-motor	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-	00
AA104	Yes	Sub speed setting, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AA105	-	Calculation symbol selection for Speed reference, 1st-motor	00: Disabled 01: Addition 02: Subtraction 03: Multiplication	-	00
AA106	Yes	Add frequency setting, 1st-motor	-590.00 to 590.00	0.01 Hz	0.00

Code	Change during operation	Name	Data range	Unit	Default
AA111	-	Run-command input source selection, 1st-motor	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-	00*1
AA-12	Yes	RUN-key Direction of LCD operator	00: Normal rotation 01: Reverse rotation	-	00
AA-13	-	STOP-key enable at RUN-command from terminal	00: Disabled 01: Enabled 02: Only reset is enabled	-	01
AA114	-	RUN-direction restriction, 1st-motor	00: No limitation 01: Only normal rotation 02: Only reverse rotation	-	00
AA115	-	STOP mode selection, 1st-motor	00: Deceleration stop 01: Free run stop	-	00
AA121	-	Control mode selection, 1st-motor	IM control 00: [V/f] Fixed torque characteristics (IM) 01: [V/f] Reducing torque characteristics (IM) 02: [V/f] Free V/f (IM) 03: Auto torque boost (IM) 04: [V/f with sensor] Fixed torque characteristics (IM) 05: [V/f with sensor] Reduced torque characteristics (IM) 06: [V/f with sensor] Free V/f (IM) 07: Auto torque boost with sensor (IM) 08: Sensorless vector control (IM) 09: Zero-Hz range sensorless vector control (IM)*2 10: Vector control with sensor (IM)*2 SM/PMM control 11: Synchronous start type sensorless vector control (SM/PMM) 12: IVMS start type sensorless vector control (SM/PMM)*3	-	00
AA123	-	Vector control mode selection, 1st-motor	00: Speed/torque control mode 01 : Pulse string position control mode 02: Absolute position control mode 03: High-resolution absolute position control mode	-	00

Code	Change during operation	Name	Data range	Unit	Default
AA201	-	Main speed input source selection, 2nd-motor	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-	01*1
AA202	-	Sub speed input source selection, 2nd-motor	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-	0
AA204	Yes	Sub speed setting, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
AA205	-	Calculation symbol selection for Speed reference, 2nd-motor	00: Disabled 01: Addition 02: Subtraction 03: Multiplication	-	0
AA206	Yes	Add frequency setting, 2nd-motor	-590.00 to 590.00	0.01 Hz	0.00
AA211	-	Run-command input source selection, 2nd-motor	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-	00*1

Code	Change during operation	Name	Data range	Unit	Default
AA214	-	RUN-direction restriction, 2nd-motor	00: No limitation 01: Only normal rotation 02: Only reverse rotation	-	00
AA215	-	STOP mode selection, 2nd-motor	00: Deceleration stop 01: Free run stop	-	00
AA221	-	Control mode selection, 2nd-motor	IM control 00: [V/f] Fixed torque characteristics (IM) 01: [V/f] Reducing torque characteristics (IM) 02: [V/f] Free V/f (IM) 03: Auto torque boost (IM) 04: [V/f with sensor] Fixed torque characteristics (IM) 05: [V/f with sensor] Reduced torque characteristics (IM) 06: [V/f with sensor] Free V/f (IM) 07: Auto torque boost with sensor (IM) 08: Sensorless vector control (IM) 09: Zero-Hz range sensorless vector control (IM)*2 10: Vector control with sensor (IM)*2 SM/PMM control 11: Synchronous start type sensorless vector control (SM/PMM)	-	00
AA223	-	Vector control mode selection, 2nd-motor	00: Speed/torque control mode 01 : Pulse string position control mode 02: Absolute position control mode 03: High-resolution absolute position control mode	-	00

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.
*2. Cannot be selected if **Load type selection** (Ub-03) is *01: Low duty (LD)* or *00: Very low duty (VLD)*.
*3. Cannot be selected if **Load type selection** (Ub-03) is *00: Very low duty (VLD)*.

Code	Change during operation	Name	Range of data	Unit	Default
Ab-01	-	Frequency conversion gain	0.01 to 100.00	0.01	1.00
Ab-03	-	Multispeed operation selection	00: 16th speed: binary (CF1-CF4) 01: 8th speed: bit (SF1-SF7)	-	00
Ab110	Yes	Multispeed-0 setting, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
Ab-11	Yes	Multispeed-1 setting		0.01 Hz	0.00
Ab-12	Yes	Multispeed-2 setting		0.01 Hz	0.00
Ab-13	Yes	Multispeed-3 setting		0.01 Hz	0.00
Ab-14	Yes	Multispeed-4 setting		0.01 Hz	0.00
Ab-15	Yes	Multispeed-5 setting		0.01 Hz	0.00
Ab-16	Yes	Multispeed-6 setting		0.01 Hz	0.00
Ab-17	Yes	Multispeed-7 setting		0.01 Hz	0.00
Ab-18	Yes	Multispeed-8 setting		0.01 Hz	0.00
Ab-19	Yes	Multispeed-9 setting		0.01 Hz	0.00
Ab-20	Yes	Multispeed-10 setting		0.01 Hz	0.00
Ab-21	Yes	Multispeed-11 setting		0.01 Hz	0.00
Ab-22	Yes	Multispeed-12 setting		0.01 Hz	0.00
Ab-23	Yes	Multispeed-13 setting		0.01 Hz	0.00
Ab-24	Yes	Multispeed-14 setting		0.01 Hz	0.00
Ab-25	Yes	Multispeed-15 setting		0.01 Hz	0.00
Ab210	Yes	Multispeed-0 setting, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AC-01	-	Acceleration/ Deceleration Time input selection	00: Parameter setting 01: Option 1 02: Option 2 03: Option 3 04: DriveProgramming	-	00
AC-02	-	Acceleration/ Deceleration Selection	00: Common 01: Multi-stage acceleration/deceleration	-	00
AC-03	-	Acceleration curve selection	00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped	-	00
AC-04	-	Deceleration curve selection	00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped	-	00
AC-05	-	Acceleration curve constant setting	1 to 10	1	2
AC-06	-	Deceleration curve constant setting	1 to 10	1	2
AC-08	-	EL-S-curve ratio @start of acceleration	0 to 100	1%	25
AC-09	-	EL-S-curve ratio @end of acceleration	0 to 100	1%	25
AC-10	-	EL-S-curve ratio @start of deceleration	0 to 100	1%	25
AC-11	-	EL-S-curve ratio @end of deceleration	0 to 100	1%	25
AC115	-	Select method to switch to Accel2/Decel2 Profile, 1st-motor	00: [2CH] terminal 01: Parameter setting 02: Switching normal/reverse rotation	-	00
AC116	Yes	Accel1 to Accel2 Frequency transition point, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AC117	Yes	Decel1 to Decel2 Frequency transition point, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AC120	Yes	Acceleration time setting 1, 1st-motor	0.00 to 3600.00	0.01 s	30.00
AC122	Yes	Deceleration time setting 1, 1st-motor	0.00 to 3600.00	0.01 s	30.00
AC124	Yes	Acceleration time setting 2, 1st-motor	0.00 to 3600.00	0.01 s	15.00

Code	Change during operation	Name	Range of data	Unit	Default
AC126	Yes	Deceleration time setting 2, 1st-motor	0.00 to 3600.00	0.01 s	15.00
AC-30	Yes	Acceleration time setting for Multispeed-1	0.00 to 3600.00	0.01 s	0.00
AC-32	Yes	Deceleration time setting for Multispeed-1		0.01 s	0.00
AC-34	Yes	Acceleration time setting for Multispeed-2		0.01 s	0.00
AC-36	Yes	Deceleration time setting for Multispeed-2		0.01 s	0.00
AC-38	Yes	Acceleration time setting for Multispeed-3		0.01 s	0.00
AC-40	Yes	Deceleration time setting for Multispeed-3		0.01 s	0.00
AC-42	Yes	Acceleration time setting for Multispeed-4		0.01 s	0.00
AC-44	Yes	Deceleration time setting for Multispeed-4		0.01 s	0.00
AC-46	Yes	Acceleration time setting for Multispeed-5		0.01 s	0.00
AC-48	Yes	Deceleration time setting for Multispeed-5		0.01 s	0.00
AC-50	Yes	Acceleration time setting for Multispeed-6		0.01 s	0.00
AC-52	Yes	Deceleration time setting for Multispeed-6		0.01 s	0.00
AC-54	Yes	Acceleration time setting for Multispeed-7		0.01 s	0.00
AC-56	Yes	Deceleration time setting for Multispeed-7		0.01 s	0.00
AC-58	Yes	Acceleration time setting for Multispeed-8		0.01 s	0.00
AC-60	Yes	Deceleration time setting for Multispeed-8		0.01 s	0.00
AC-62	Yes	Acceleration time setting for Multispeed-9		0.01 s	0.00
AC-64	Yes	Deceleration time setting for Multispeed-9		0.01 s	0.00
AC-66	Yes	Acceleration time setting for Multispeed-10		0.01 s	0.00
AC-68	Yes	Deceleration time setting for Multispeed-10		0.01 s	0.00
AC-70	Yes	Acceleration time setting for Multispeed-11		0.01 s	0.00
AC-72	Yes	Deceleration time setting for Multispeed-11		0.01 s	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AC-74	Yes	Acceleration time setting for Multispeed-12		0.01 s	0.00
AC-76	Yes	Deceleration time setting for Multispeed-12		0.01 s	0.00
AC-78	Yes	Acceleration time setting for Multispeed-13		0.01 s	0.00
AC-80	Yes	Deceleration time setting for Multispeed-13		0.01 s	0.00
AC-82	Yes	Acceleration time setting for Multispeed-14		0.01 s	0.00
AC-84	Yes	Deceleration time setting for Multispeed-14		0.01 s	0.00
AC-86	Yes	Acceleration time setting for Multispeed-15		0.01 s	0.00
AC-88	Yes	Deceleration time setting for Multispeed-15		0.01 s	0.00
AC215	-	Select method to switch to Accel2/Decel2 Profile, 2nd-motor	00: [2CH] terminal 01: Parameter setting 02: Switching normal/reverse rotation	-	00
AC216	Yes	Accel1 to Accel2 Frequency transition point, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
AC217	Yes	Decel1 to Decel2 Frequency transition point, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
AC220	Yes	Acceleration time setting 1, 2nd-motor	0.00 to 3600.00	0.01 s	30.00
AC222	Yes	Deceleration time setting 1, 2nd-motor		0.01 s	30.00
AC224	Yes	Acceleration time setting 2, 2nd-motor		0.01 s	15.00
AC226	Yes	Deceleration time setting 2, 2nd-motor		0.01 s	15.00

Code	Change during operation	Name	Range of data	Unit	Default
Ad-01	-	Torque reference input source selection	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-	07
Ad-02	Yes	Torque reference value setting	-500.0 to 500.0 (Limited at a torque equivalent to 200% of inverter ND rating)	0.1%	0.0
Ad-03	-	Polarity selection for torque reference	00: As per the sign 01: Follow the revolution direction	-	00
Ad-04	Yes	Switching time of Speed control to Torque control	0 to 1000	1 ms	100
Ad-11	-	Torque bias input source selection	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-	00
Ad-12	Yes	Torque bias value setting	-500.0 to 500.0 (Limited at a torque equivalent to 200% of inverter ND rating)	0.1%	0.0
Ad-13	-	Polarity selection for torque bias	00: As per the sign 01: Follow the revolution direction	-	00
Ad-14	-	Terminal [TBS] active	00: Disabled 01: Enabled	-	00

Code	Change during operation	Name	Range of data	Unit	Default
Ad-40	-	Input selection for speed limit at torque control	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	07
Ad-41	Yes	Speed limit at torque control (at Forward rotation)	0.00 to 590.00	0.01 Hz	0.00
Ad-42	Yes	Speed limit at torque control (at Reverse rotation)	0.00 to 590.00	0.01 Hz	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AE-01	-	Electronic gear setting point selection	00: Feedback side 01: Command side	-	00
AE-02	-	Electronic gear ratio numerator	1 to 10000	1	1
AE-03	-	Electronic gear ratio denominator	1 to 10000	1	1
AE-04	-	Positioning complete range setting	0 to 10000	1 pls	5
AE-05	-	Positioning complete delay time setting	0.00 to 10.00	0.01 s	0.00
AE-06	-	Position feed-forward gain setting	0.00 to 655.35	0.01	0.00
AE-07	-	Position loop gain setting	0.00 to 100.00	0.01	0.50
AE-08	-	Position bias setting	-2048 to 2048	1 pls	0
AE-10	-	Stop position selection of Home search function	00: Parameter setting 01: Option 1 02: Option 2 03: Option 3	-	00
AE-11	Yes	Stop position of Home search function	0 to 4095	1	0
AE-12	Yes	Speed reference of Home search function	0.00 to 120.00	0.01 Hz	0.00
AE-13	-	Direction of Home search function	00: Normal rotation 01: Reverse rotation	-	00

Code	Change during operation	Name	Range of data	Unit	Default
AE-20	Yes	Position reference 0 setting	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls	0
AE-22	Yes	Position reference 1 setting		1 pls	0
AE-24	Yes	Position reference 2 setting		1 pls	0
AE-26	Yes	Position reference 3 setting		1 pls	0
AE-28	Yes	Position reference 4 setting		1 pls	0
AE-30	Yes	Position reference 5 setting		1 pls	0
AE-32	Yes	Position reference 6 setting		1 pls	0
AE-34	Yes	Position reference 7 setting		1 pls	0
AE-36	Yes	Position reference 8 setting		1 pls	0
AE-38	Yes	Position reference 9 setting		1 pls	0
AE-40	Yes	Position reference 10 setting		1 pls	0
AE-42	Yes	Position reference 11 setting		1 pls	0
AE-44	Yes	Position reference 12 setting		1 pls	0
AE-46	Yes	Position reference 13 setting		1 pls	0
AE-48	Yes	Position reference 14 setting		1 pls	0
AE-50	Yes	Position reference 15 setting		1 pls	0
AE-52	Yes	Position control range setting (forward)	0 to 268435455 In high resolution mode: 0 to 1073741823	1 pls	268435455
AE-54	Yes	Position control range setting (reverse)	-268435455 to 0 In high resolution mode: -1073741823 to 0	1 pls	-268435455
AE-56	-	Position control mode selection	00: With limit 01: Without limit	-	00
AE-60	Yes	Teach-in function target selection	00 (X00) to 15 (X15)	-	00
AE-61	-	Current position saving at power-off	00: Disabled 01: Enabled	-	00
AE-62	Yes	Preset position data	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1 pls	0

Code	Change during operation	Name	Range of data	Unit	Default
AE-64	Yes	Deceleration stop distance calculation Gain	50.00 to 200.00	0.01%	100.00
AE-65	Yes	Deceleration stop distance calculation Bias	0.00 to 655.35	0.01%	0.00
AE-66	Yes	Speed Limit in APR control	0.00 to 100.00	0.01%	1.00
AE-67	Yes	APR start speed	0.00 to 100.00	0.01%	0.20
AE-70	-	Homing function selection	00: Low speed zero return 01: High speed zero return 1 02: High speed zero return 2	-	00
AE-71	-	Direction of homing function	00: Normal rotation 01: Reverse rotation	-	00
AE-72	Yes	Low-speed of homing function	0.00 to 10.00	0.01 Hz	0.00
AE-73	Yes	High-Speed of homing function	0.00 to 590.00	0.01 Hz	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AF101	-	DC braking selection, 1st-motor	00: Disabled 01: Enabled (Operation command) 02: Enabled (Frequency command)	-	00
AF102	-	Braking type selection, 1st-motor	00: DC braking 01: Speed servo lock 02: Position servo lock	-	00
AF103	Yes	DC braking frequency, 1st-motor	0.00 to 590.00	0.01 Hz	0.50
AF104	Yes	DC braking delay time, 1st-motor	0.00 to 5.00	0.01 s	0.00
AF105	Yes	DC braking force setting, 1st-motor	0 to 100	1%	30
AF106	Yes	DC braking active time at stop, 1st-motor	0.00 to 60.00	0.01 s	0.00
AF107	Yes	DC braking operation method selection, 1st-motor	00: Edge mode 01: Level mode	-	01
AF108	Yes	DC braking force at start, 1st-motor	0 to 100	1%	30
AF109	Yes	DC braking active time at start, 1st-motor	0.00 to 60.00	0.01 s	0.00
AF120	-	Contactor Control Enable, 1st-motor	00: Disabled 01: Enabled: primary side 02: Enabled: secondary side	-	00
AF121	Yes	Run delay time, 1st-motor	0.00 to 2.00	0.01 s	0.20
AF122	Yes	Contactor off delay time, 1st-motor	0.00 to 2.00	0.01 s	0.10
AF123	Yes	Contactor answer back check time, 1st-motor	0.00 to 5.00	0.01 s	0.10
AF130	-	Brake Control Enable, 1st-motor	00: Disabled 01: Brake control 1 common in forward/reverse rotation 02: Brake control 1 forward/reverse set individually 03: Brake control 2 common in forward/reverse rotation	-	00
AF131	Yes	Brake Wait Time for Release, 1st-motor (Forward side)	0.00 to 5.00	0.01 s	0.00
AF132	Yes	Brake Wait Time for Accel. , 1st-motor (Forward side)	0.00 to 5.00	0.01 s	0.00
AF133	Yes	Brake Wait Time for Stopping, 1st-motor (Forward side)	0.00 to 5.00	0.01 s	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AF134	Yes	Brake Wait Time for Confirmation, 1st-motor (Forward side)	0.00 to 5.00	0.01 s	0.00
AF135	Yes	Brake Release Frequency Setting, 1st-motor (Forward side)	0.00 to 590.00	0.01 Hz	0.00
AF136	Yes	Brake Release Current Setting, 1st-motor (Forward side)	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
AF137	Yes	Braking Frequency, 1st-motor (Forward side)	0.00 to 590.00	0.01 Hz	0.00
AF138	Yes	Brake Wait Time for Release, 1st-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF139	Yes	Brake Wait Time for Accel. , 1st-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF140	Yes	Brake Wait Time for Stopping, 1st-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF141	Yes	Brake Wait Time for Confirmation, 1st-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF142	Yes	Brake Release Frequency Setting, 1st-motor (Reverse side)	0.00 to 590.00	0.01 Hz	0.00
AF143	Yes	Brake Release Current Setting, 1st-motor (Reverse side)	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
AF144	Yes	Braking Frequency, 1st-motor (Reverse side)	0.00 to 590.00	0.01 Hz	0.00
AF150	Yes	Brake open delay time, 1st-motor	0.00 to 2.00	0.01 s	0.20
AF151	Yes	Brake close delay time, 1st-motor	0.00 to 2.00	0.01 s	0.20
AF152	Yes	Brake answer back check time, 1st-motor	0.00 to 5.00	0.01 s	0.10
AF153	Yes	Servo lock/ DC injection time at start, 1st-motor	0.00 to 10.00	0.01 s	0.60
AF154	Yes	Servo lock/ DC injection time at stop, 1st-motor	0.00 to 10.00	0.01 s	0.60
AF201	-	DC braking selection, 2nd-motor	00: Disabled 01: Enabled (Operation command) 02: Enabled (Frequency command)	-	00

Code	Change during operation	Name	Range of data	Unit	Default
AF202	-	Braking type selection, 2nd-motor	00: DC braking 01: Speed servo lock 02: Position servo lock	-	00
AF203	Yes	DC braking frequency, 2nd-motor	0.00 to 590.00	0.01 Hz	0.50
AF204	Yes	DC braking delay time, 2nd-motor	0.00 to 5.00	0.01 s	0.00
AF205	Yes	DC braking force setting, 2nd-motor	0 to 100	1%	30
AF206	Yes	DC braking active time at stop, 2nd-motor	0.00 to 60.00	0.01 s	0.00
AF207	Yes	DC braking operation method selection, 2nd-motor	00: Edge mode 01: Level mode	-	01
AF208	Yes	DC braking force at start, 2nd-motor	0 to 100	1%	30
AF209	Yes	DC braking active time at start, 2nd-motor	0.00 to 60.00	0.01 s	0.00
AF220	-	Contactor Control Enable, 2nd-motor	00: Disabled 01: Enabled: primary side 02: Enabled: secondary side	-	00
AF221	Yes	Run delay time, 2nd-motor	0.00 to 2.00	0.01 s	0.20
AF222	Yes	Contactor off delay time, 2nd-motor	0.00 to 2.00	0.01 s	0.10
AF223	Yes	Contactor answer back check time, 2nd-motor	0.00 to 5.00	0.01 s	0.10
AF230	-	Brake Control Enable, 2nd-motor	00: Disabled 01: Brake control 1 common in forward/reverse rotation 02: Brake control 1 forward/reverse set individually 03: Brake control 2 common in forward/reverse rotation	-	00
AF231	Yes	Brake Wait Time for Release, 2nd-motor (Forward side)	0.00 to 5.00	0.01 s	0.00
AF232	Yes	Brake Wait Time for Accel. , 2nd-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF233	Yes	Brake Wait Time for Stopping, 2nd-motor (Forward side)	0.00 to 5.00	0.01 s	0.00
AF234	Yes	Brake Wait Time for Confirmation, 2nd-motor (Forward side)	0.00 to 5.00	0.01 s	0.00
AF235	Yes	Brake Release Frequency Setting, 2nd-motor (Forward side)	0.00 to 590.00	0.01 Hz	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AF236	Yes	Brake Release Current Setting, 2nd-motor (Forward side)	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
AF237	Yes	Braking Frequency, 2nd-motor (Forward side)	0.00 to 590.00	0.01 Hz	0.00
AF238	Yes	Brake Wait Time for Release, 2nd-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF239	Yes	Brake Wait Time for Accel. , 2nd-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF240	Yes	Brake Wait Time for Stopping, 2nd-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF241	Yes	Brake Wait Time for Confirmation, 2nd-motor (Reverse side)	0.00 to 5.00	0.01 s	0.00
AF242	Yes	Brake Release Frequency Setting, 2nd-motor (Reverse side)	0.00 to 590.00	0.01 Hz	0.00
AF243	Yes	Brake Release Current Setting, 2nd-motor (Reverse side)	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
AF244	Yes	Braking Frequency, 2nd-motor (Reverse side)	0.00 to 590.00	0.01 Hz	0.00
AF250	Yes	Brake open delay time, 2nd-motor	0.00 to 2.00	0.01 s	0.20
AF251	Yes	Brake close delay time, 2nd-motor	0.00 to 2.00	0.01 s	0.20
AF252	Yes	Brake answer back check time, 2nd-motor	0.00 to 5.00	0.01 s	0.10
AF253	Yes	Servo lock/ DC injection time at start, 2nd-motor	0.00 to 10.00	0.01 s	0.60
AF254	Yes	Servo lock/ DC injection time at stop, 2nd-motor	0.00 to 10.00	0.01 s	0.60

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V (When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*.
   When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.)
2. Modbus: The current and the voltage vary depending on the setting of Resister data selection (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1A and 0.1V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01 (Rated ratio)

Code	Change during operation	Name	Range of data	Unit	Default
AG101	Yes	Jump frequency 1, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AG102	Yes	Jump frequency width 1, 1st-motor	0.00 to 10.00	0.01 Hz	0.00
AG103	Yes	Jump frequency 2, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AG104	Yes	Jump frequency width 2, 1st-motor	0.00 to 10.00	0.01 Hz	0.00
AG105	Yes	Jump frequency 3, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AG106	Yes	Jump frequency width 3, 1st-motor	0.00 to 10.00	0.01 Hz	0.00
AG110	Yes	Acceleration stop frequency setting, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AG111	Yes	Acceleration stop time setting, 1st-motor	0.0 to 60.0	0.1 s	0
AG112	Yes	Deceleration stop frequency setting, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
AG113	Yes	Acceleration stop time setting, 1st-motor	0.0 to 60.0	0.1 s	0
AG-20	Yes	Jogging frequency	0.00 to 10.00	0.01 Hz	6.00
AG-21	-	Jogging stop mode selection	00: Disabled during FRS operation at stop 01: Disabled during deceleration stop operation 02: Disabled during DB operation at stop 03: Enabled during FRS operation at stop 04: Enabled during deceleration stop operation 05: Enabled during DB operation at stop	-	00
AG201	Yes	Jump frequency 1, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
AG202	Yes	Jump frequency width 1, 2nd-motor	0.00 to 10.00	0.01 Hz	0.00
AG203	Yes	Jump frequency 2, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
AG204	Yes	Jump frequency width 2, 2nd-motor	0.00 to 10.00	0.01 Hz	0.00
AG205	Yes	Jump frequency 3, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
AG206	Yes	Jump frequency width 3, 2nd-motor	0.00 to 10.00	0.01 Hz	0.00
AG210	Yes	Acceleration stop frequency setting, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AG211	Yes	Acceleration stop time setting, 2nd-motor	0.0 to 60.0	0.1 s	0.0
AG212	Yes	Deceleration stop frequency setting, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
AG213	Yes	Deceleration stop time setting	0.0 to 60.0	0.1 s	0.0

Code	Change during operation	Name	Range of data	Unit	Default
AH-01	-	PID1 enable	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-	00
AH-02	-	PID1 deviation inverse	00: Disabled 01: Enabled	-	00
AH-03	-	Unit selection for PID1	0 to 58 Refer to *Unit Options* on page 15-115.	-	01
AH-04	Yes	PID1 scale adjustment (at 0%)	-10000 to 10000	1	0
AH-05	Yes	PID1 scale adjustment (at 100%)	-10000 to 10000	1	10000
AH-06	Yes	PID1 scale adjustment (point position)	00: 0000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	-	02
AH-07	-	Input source selection of Set-point 1 for PID1	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	07
AH-10	Yes	Set-point 1 setting for PID1	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-12	Yes	PID1 Multi stage set-point 1 setting		Unit differs depending on the AH-03 and AH-06 settings.	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AH-14	Yes	PID1 Multi stage set-point 2 setting		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-16	Yes	PID1 Multi stage set-point 3 setting		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-18	Yes	PID1 Multi stage set-point 4 setting		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-20	Yes	PID1 Multi stage set-point 5 setting		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-22	Yes	PID1 multistage target value 6		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-24	Yes	PID1 multistage target value 7		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-26	Yes	PID1 multistage target value 8		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-28	Yes	PID1 multistage target value 9		Unit differs depending on the AH-03 and AH-06 settings.	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AH-30	Yes	PID1 multistage target value 10		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-32	Yes	PID1 multistage target value 11		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-34	Yes	PID1 multistage target value 12		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-36	Yes	PID1 multistage target value 13		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-38	Yes	PID1 multistage target value 14		Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-40	Yes	PID1 Multi stage set-point 15 setting		Unit differs depending on the AH-03 and AH-06 settings.	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AH-42	-	Input source selection of Set-point 2 for PID1	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	00
AH-44	Yes	Set-point 2 setting for PID1	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-46	-	Input source selection of Set-point 3 for PID1	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	00
AH-48	Yes	Set-point 3 setting for PID1	0.00 to 100.00 The display range can be changed arbitrarily by setting (AH-04), (AH-05), and (AH-06).	Unit differs depending on the AH-03 and AH-06 settings.	0.00
AH-50	-	Calculation symbol selection of Set-point 1 for PID1	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Minimum deviation 06: Maximum deviation	-	01

Code	Change during operation	Name	Range of data	Unit	Default
AH-51	-	Input source selection of Process data 1 for PID1	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	01
AH-52	-	Input source selection of Process data 2 for PID1	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	00
AH-53	-	Input source selection of Process data 3 for PID1	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	00
AH-54	-	Calculation symbol selection of Process data for PID1	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Square root of FB1 06: Square root of FB2 07: Square root of (FB1-FB2) 08: Average of PV-1 to PV-3 09: Minimum data of PV-1 to PV-3 10: Maximum data of PV-1 to PV-3	-	01

Code	Change during operation	Name	Range of data	Unit	Default
AH-60	-	PID1 gain change method selection	00: Only gain 1 01: [PRO] terminal switch	-	00
AH-61	Yes	PID1 proportional gain 1	0.0 to 100.0	0.1	1.0
AH-62	Yes	PID1 integral time constant 1	0.0 to 3600.0	0.1 s	1.0
AH-63	Yes	PID1 derivative gain 1	0.00 to 100.00	0.01 s	0.00
AH-64	Yes	PID1 proportional gain 2	0.0 to 100.0	0.1	0.0
AH-65	Yes	PID1 integral time constant 2	0.0 to 3600.0	0.1 s	0.0
AH-66	Yes	PID1 derivative gain 2	0.00 to 100.00	0.01 s	0.00
AH-67	Yes	PID1 gain change time	0 to 10000	1 ms	100
AH-70	-	PID feed-forward selection	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved)	-	00
AH-71	Yes	PID1 output range	0.00 to 100.00	0.01%	0.00
AH-72	Yes	PID1 Deviation over level	0.00 to 100.00	0.01%	3.00
AH-73	Yes	PID1 Feedback compare signal turn-off level	0.00 to 100.00	0.01%	100.00
AH-74	Yes	PID1 Feedback compare signal turn-on level	0.00 to 100.00	0.01%	0.00
AH-75	-	PID soft start function enable	00: Disabled 01: Enabled	-	00
AH-76	Yes	PID soft start target level	0.00 to 100.00	0.01%	100.00
AH-78	Yes	Acceleration time setting for soft start function	0.00 to 3600.00	0.01 s	30.00
AH-80	Yes	PID soft start time	0.00 to 600.00	0.01 s	0.00
AH-81	-	PID soft start error detection enable	00: Disabled 01: Enabled: error output 02: Enabled: warning	-	00
AH-82	Yes	PID soft start error detection level	0.00 to 100.00	0.01%	0.00
AH-85	-	PID sleep trigger selection	00: Disabled 01: Low output 02: [SLEP] terminal	-	00
AH-86	Yes	PID sleep start level	0.00 to 590.00	0.01 Hz	0.00
AH-87	Yes	PID sleep active time	0.00 to 100.00	0.01 s	0.00
AH-88	-	Setpoint boost before PID sleep enable	00: Disabled 01: Enabled	-	00
AH-89	Yes	Setpoint boost time	0.00 to 100.00	0.01 s	0.00
AH-90	Yes	Setpoint boost value	0.00 to 100.00	0.01%	0.00
AH-91	Yes	Minimum RUN time before PID sleep	0.00 to 100.00	0.01 s	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AH-92	Yes	Minimum active time of PID sleep	0.00 to 100.00	0.01 s	0.00
AH-93	-	PID wake trigger selection	01: Deviation amount 02: Low feedback 03: [WAKE] terminal	-	01
AH-94	Yes	PID wake start level	0.00 to 100.00	0.01%	0.00
AH-95	Yes	PID wake start time	0.00 to 100.00	0.01 s	0.00
AH-96	Yes	PID wake start deviation value	0.00 to 100.00	0.01%	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AJ-01	-	PID2 enable	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-	00
AJ-02	-	PID2 deviation inverse	00: Disabled 01: Enabled	-	00
AJ-03	-	PID2 unit selection	0 to 58 Refer to *Unit Options* on page 15-115.	-	01
AJ-04	Yes	PID2 scale adjustment (at 0%)	-10000 to 10000	1	0
AJ-05	Yes	PID2 scale adjustment (at 100%)	-10000 to 10000	1	10000
AJ-06	Yes	PID2 scale adjustment (point position)	00: 0000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	-	02
AJ-07	-	Input source selection of Set-point for PID2	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-	07
AJ-10	Yes	Set-point setting for PID2	0.00 to 100.00 The display range can be changed arbitrarily by setting (AJ-04), (AJ-05), and (AJ-06).	Unit differs depending on the AJ-03 and AJ-06 settings.	0.00

Code	Change during operation	Name	Range of data	Unit	Default
AJ-12	-	Input source selection of Process data for PID2	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	02
AJ-13	Yes	PID2 proportional gain	0.0 to 100.0	0.1	0.1
AJ-14	Yes	PID2 integral time constant	0.0 to 3600.0	0.1 s	0.1
AJ-15	Yes	PID2 derivative gain	0.00 to 100.00	0.01 s	0.00
AJ-16	Yes	PID2 output range	0.00 to 100.00	0.01%	0.00
AJ-17	Yes	PID2 Deviation over level	0.00 to 100.00	0.01%	3.00
AJ-18	Yes	PID2 Feedback compare signal turn-off level	0.00 to 100.00	0.01%	100.00
AJ-19	Yes	PID2 Feedback compare signal turn-on level	0.00 to 100.00	0.01%	0.00
AJ-21	-	PID3 enable	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-	00
AJ-22	-	PID3 deviation inverse	00: Disabled 01: Enabled	-	00
AJ-23	-	PID3 unit selection	0 to 58 Refer to *Unit Options* on page 15-115.	-	01
AJ-24	Yes	PID3 scale adjustment (at 0%)	-10000 to 10000	1	0
AJ-25	Yes	PID3 scale adjustment (at 100%)	-10000 to 10000	1	10000
AJ-26	Yes	PID3 scale adjustment (point position)	00: 0000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	-	02

Code	Change during operation	Name	Range of data	Unit	Default
AJ-27	-	Input source selection of Set-point for PID3	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-	07
AJ-30	Yes	Set-point setting for PID3	0.00 to 100.00 The display range can be changed arbitrarily by setting (AJ-24), (AJ-25), and (AJ-26).	Unit differs depending on the AJ-23 and AJ-26 settings.	0.00
AJ-32	-	Input source selection of Process data for PID3	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	02
AJ-33	Yes	PID3 proportional gain	0.0 to 100.0	0.1	1.0
AJ-34	Yes	PID3 integral time constant	0.0 to 3600.0	0.1 s	1.0
AJ-35	Yes	PID3 derivative gain	0.00 to 100.00	0.01 s	0.00
AJ-36	Yes	PID3 output range	0.00 to 100.00	0.01%	0.00
AJ-37	Yes	PID3 Deviation over level	0.00 to 100.00	0.01%	3.00
AJ-38	Yes	PID3 Feedback compare signal turn-off level	0.00 to 100.00	0.01%	100.00
AJ-39	Yes	PID3 Feedback compare signal turn-on level	0.00 to 100.00	0.01%	0.00
AJ-41	-	PID4 enable	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-	00

Code	Change during operation	Name	Range of data	Unit	Default
AJ-42	-	PID4 deviation inverse	00: Disabled 01: Enabled	-	00
AJ-43	-	PID4 unit selection	0 to 58 Refer to *Unit Options* on page 15-115.	-	01
AJ-44	Yes	PID4 scale adjustment (at 0%)	-10000 to 10000	1	0
AJ-45	Yes	PID4 scale adjustment (at 100%)	-10000 to 10000	1	10000
AJ-46	Yes	PID4 scale adjustment (point position)	00: 0000. 01: 0000.0 02: 000.00 03: 00.000 04: 0.0000	-	02
AJ-47	-	Input source selection of Set-point for PID4	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-	07
AJ-50	Yes	Set-point setting for PID4	0.00 to 100.00 The display range can be changed arbitrarily by setting (AJ-44), (AJ-45), and (AJ-46).	Unit differs depending on the AJ-43 and AJ-46 settings.	0.00
AJ-52	-	Input source selection of Process data for PID4	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	02

Code	Change during operation	Name	Range of data	Unit	Default
AJ-53	Yes	PID4 proportional gain	0.0 to 100.0	0.1	1.0
AJ-54	Yes	PID4 integral time constant	0.0 to 3600.0	0.1 s	1.0
AJ-55	Yes	PID4 derivative gain	0.00 to 100.00	0.01 s	0.00
AJ-56	Yes	PID4 output range	0.00 to 100.00	0.01%	0.00
AJ-57	Yes	PID4 Deviation over level	0.00 to 100.00	0.01%	3.00
AJ-58	Yes	PID4 Feedback compare signal turn-off level	0.00 to 100.00	0.01%	100.00
AJ-59	Yes	PID4 Feedback compare signal turn-on level	0.00 to 100.00	0.01%	0.00

15-3-2 Parameter (Code B)

Code	Change during operation	Name	Data range	Unit	Default
bA101	-	Frequency limit selection, 1st-motor	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	00
bA102	Yes	Upper Frequency limit, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
bA103	Yes	Lower Frequency limit, 1st-motor	0.00 to 590.00	0.01 Hz	0.00

Code	Change during operation	Name	Data range	Unit	Default
bA110	-	Torque limit selection, 1st-motor	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3	-	07
bA111	-	Torque limit parameter mode selection, 1st-motor	00: Four quadrant specific 01: [TRQ] terminal switch	-	00
bA112	Yes	Torque limit 1 (Forward driving), 1st-motor	0.0 to 500.0	0.1%	150.0
bA113	Yes	Torque limit 2 (Reverse regenerative), 1st-motor		0.1%	150.0
bA114	Yes	Torque limit 3 (Reverse driving), 1st-motor		0.1%	150.0
bA115	Yes	Torque limit 4 (Forward regenerative), 1st-motor		0.1%	150.0
bA116	-	Torque limit LADSTOP selection, 1st-motor	00: Disabled 01: Enabled	-	00
bA120	-	Over current suppress enable, 1st-motor	00: Disabled 01: Enabled	-	1
bA121	-	Over current suppress Level, 1st-motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.8 × Inverter rated current
bA122	-	Overload restriction 1 mode selection, 1st-motor	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/ Increase speed at regeneration	-	01
bA123	Yes	Overload restriction 1 active level, 1st-motor	(0.2 to 2.0) × Inverter rated current*1	0.1 A	1.5 × Inverter rated current
bA124	Yes	Overload restriction 1 action time, 1st-motor	0.10 to 3600.00	0.01 s	1.00
bA126	-	Overload restriction 2 mode selection, 1st-motor	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/ Increase speed at regeneration	-	01
bA127	Yes	Overload restriction 2 active level, 1st-motor	(0.2 to 2.0) × Inverter rated current*1	0.1 A	1.5 × Inverter rated current

Code	Change during operation	Name	Data range	Unit	Default
bA128	Yes	Overload restriction 2 Action time, 1st-motor	0.10 to 3600.00	0.01 s	1.00
bA-30	-	Deceleration-stop at power failure	00: Disabled 01: Enabled: deceleration stop 02: Enabled: no recovery 03: Enabled with recovery	-	00
bA-31	Yes	Decel-stop at power failure starting voltage	200 V class: 0.0 to 410.0 400 V class: 0.0 to 820.0	0.1 VDC	220 V class: 200.0 400 V class: 440.0
bA-32	Yes	Decel-stop at power failure control target level	200 V class: 0.0 to 410.0 400 V class: 0.0 to 820.0	0.1 VDC	200 V class: 360.0 400 V class: 720.0
bA-34	Yes	Decel-stop at power failure deceleration time	0.01 to 3600.00	0.01 s	1.00
bA-36	Yes	Decel-stop at power failure freq. width at deceleration start	0.00 to 10.00	0.01 Hz	0.00
bA-37	Yes	Decel-stop at power failure DC-bus voltage constant control P-gain	0.00 to 5.00	0.01	0.20
bA-38	Yes	Decel-stop at power failure DC-bus voltage constant control I-gain	0.00 to 150.00	0.01 s	1.00
bA140	Yes	Over-voltage suppression enable, 1st-motor	00: Disabled 01: DC voltage constant deceleration 02: Acceleration only at deceleration 03: Acceleration at constant speed/deceleration	-	00
bA141	Yes	Over-voltage suppression active level, 1st-motor	200 V class: 330.0 to 400.0 400 V class: 660.0 to 800.0	0.1 VDC	200 V class: 380.0 400 V class: 760.0
bA142	Yes	Over-voltage suppression action time, 1st-motor	0.00 to 3600.00	0.01 s	1.00
bA144	Yes	DC bus constant control proportional gain, 1st-motor	0.00 to 5.00	0.01	0.20
bA145	Yes	DC bus constant control integral gain, 1st-motor	0.00 to 150.00	0.01 s	1.00

Code	Change during operation	Name	Data range	Unit	Default
bA146	Yes	Over magnetization deceleration function selection, 1st-motor	00: Disabled 01: Regular operation 02: Operation only at deceleration 03: Level mode 04: Level mode only at deceleration	-	02
bA147	Yes	Over magnetization output filter time constant, 1st_motor	0.00 to 1.00	0.01 s	0.30
bA148	Yes	Over magnetization voltage gain, 1st_motor	50 to 400	1%	100
bA149	Yes	Over magnetization level setting, 1st_motor	200 V class: 330.0 to 400.0 400 V class: 660.0 to 800.0	0.1 VDC	200 V class: 360.0 400 V class: 720.0
bA-60	Yes	Dynamic brake usage rate	0.0 to 10.0 × ((bA-63) / minimum resistance)^2 *2	0.1%	10.0
bA-61	-	Dynamic brake selection	00: Disabled 01: Enabled: disabled at stop 02: Enabled: enabled at stop	-	00
bA-62	-	Dynamic brake active level	200 V class: 330.0 to 400.0 400 V class: 660.0 to 800.0	0.1 VDC	200 V class: 360.0 400 V class: 720.0
bA-63	-	Dynamic brake resister value	Minimum resistance to 600.0	0.1Ω	Minimum resistance value*2
bA-70	Yes	Cooling FAN control method selection	00: Always ON 01: ON during operation 02: Temperature dependent	-	00
bA-71	-	Cooling FAN accumulation running time clear selection	00: Disabled 01: Clear	-	00

Code	Change during operation	Name	Data range	Unit	Default
bA201	-	Frequency limit selection, 2nd motor	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-	00
bA202	Yes	Upper frequency limit, 2nd motor	0.00 to 590.00	0.01 Hz	0.00
bA203	Yes	Lower frequency limit, 2nd motor	0.00 to 590.00	0.01 Hz	0.00
bA210	-	Torque limit selection, 2nd-motor	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3	-	07
bA211	-	Torque limit parameter mode selection, 2nd-motor	00: Four quadrant specific 01: [TRQ] terminal switch	-	00
bA212	Yes	Torque limit 1 (Forward driving), 2nd-motor	0.0 to 500.0	0.1%	150.0
bA213	Yes	Torque limit 2 (Reverse regenerative), 2nd-motor		0.1%	150.0
bA214	Yes	Torque limit 3 (Reverse driving), 2nd-motor		0.1%	150.0
bA215	Yes	Torque limit 4 (Forward regenerative), 2nd motor		0.1%	150.0
bA216	-	Torque limit LADSTOP selection, 1st-motor	00: Disabled 01: Enabled	-	00
bA220	-	Over current suppress enable, 2nd-motor	00: Disabled 01: Enabled	-	1
bA221	-	Over current suppress Level, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.8 × Inverter rated current

Code	Change during operation	Name	Data range	Unit	Default
bA222	-	Overload restriction 1 mode selection, 2nd-motor	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/ Increase speed at regeneration	-	01
bA223	Yes	Overload restriction 1 active level, 2nd-motor	(0.2 to 2.0) × Inverter rated current*1	0.1 A	1.5 × Inverter rated current
bA224	Yes	Overload restriction 1 action time, 2nd-motor	0.10 to 3600.00	0.01 s	1
bA226	-	Overload restriction 2 mode selection, 2nd-motor	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/ Increase speed at regeneration	-	01
bA227	Yes	Overload restriction 2 active level, 2nd-motor	(0.2 to 2.0) × Inverter rated current*1	0.1 A	1.5 × Inverter rated current
bA228	Yes	Overload restriction 2 action time, 2nd-motor	0.10 to 3600.00	0.01 s	1.00
bA240	Yes	Over-voltage suppression enable, 2nd-motor	00: Disabled 01: DC voltage constant deceleration 02: Acceleration only at deceleration 03: Acceleration at constant speed/ deceleration	-	00
bA241	Yes	Over-voltage suppression active level, 2nd-motor	200 V class: 330.0 to 400.0 400 V class: 660.0 to 800.0	0.1 VDC	200 V class: 380.0 400 V class: 760.0
bA242	Yes	Over-voltage suppression action time, 2nd-motor	0.00 to 3600.00	0.01 s	1.00
bA244	Yes	DC bus constant control proportional gain, 2nd-motor	0.00 to 5.00	0.01	0.20
bA245	Yes	DC bus constant control integral gain, 2nd-motor	0.00 to 150.00	0.01 s	1.00
bA246	Yes	Over magnetization function selection, 2nd-motor	00: Disabled 01: Regular operation 02: Operation only at deceleration 03: Level mode 04: Level mode only at deceleration	-	02
bA247	Yes	Over magnetization output filter time constant, 2nd-motor	0.00 to 1.00	0.01 s	0.30

Code	Change during operation	Name	Data range	Unit	Default
bA248	Yes	Over magnetization voltage gain, 2nd-motor	50 to 400	1%	100
bA249	Yes	Over magnetization level setting, 2nd-motor	200 V class: 330.0 to 400.0 400 V class: 660.0 to 800.0	0.1 VDC	200 V class: 360.0 400 V class: 720.0

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V (When you operate with CX-Drive,
   set **Resister data selection**(CF-11) to *00: A, V*.
   Otherwise **Resister data selection** (CF-11) is not set to *00: A, V* the data cannot be set or displayed correctly.)
2. Modbus： The current and the voltage vary depending on the setting of **Resister data selection**(CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V.
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio).
3. DriveProgramming: 0.01 (Rated ratio)

*2. Minimum resistance values vary in inverter model.

Code	Change during operation	Name	Data range	Unit	Default
bb101	Yes	Carrier speed setting, 1st-motor	Normal Duty (ND) 0.5 to 16.0 Low Duty (LD) 0.5 to 12.0 Very Low Duty (VLD) 0.5 to 10.0*1	0.1 kHz	2.0
bb102	-	Sprinkle carrier pattern selection, 1st-motor	00: Disabled 01: Pattern 1 enabled 02: Pattern 2 enabled 03: Pattern 3 enabled	-	00
bb103	Yes	Automatic-carrier reduction selection, 1st-motor	00: Disabled 01: Enabled: current 02: Enabled: temperature	-	00
bb-10	-	Automatic error reset selection	00: Disabled 01: Enabled with operation command OFF 02: Enable after the setting time	-	00
bb-11	-	Alarm signal selection at Automatic error reset is active	00: Output 01: Not output	-	00
bb-12	-	Automatic error reset wait time	0 to 600	1 s	2
bb-13	-	Automatic error reset number	0 to 10	1	3
bb-20	-	The number of retries after instantaneous power failure	0 to 16 / ∞(255)	1	0
bb-21	-	The number of retries after under voltage	0 to 16 / ∞(255)	1	0
bb-22	-	The number of retries after over current	0 to 5	1	0
bb-23	-	The number of retries after over-voltage	0 to 5	1	0
bb-24	-	Selection of restart mode @Instantaneous power failure/ under-voltage trip	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-	01
bb-25	-	Allowable under-voltage power failure time	0.3 to 25.0	0.1 s	1.0
bb-26	-	Retry wait time before motor restart	0.3 to 100.0	0.1 s	0.3
bb-27	-	Instantaneous power failure/under-voltage trip alarm enable	00: Disabled 01: Enabled at stop 02: Disabled at stop and deceleration stop	-	00

Code	Change during operation	Name	Data range	Unit	Default
bb-28	-	Selection of restart mode @over-current	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-	01
bb-29	-	Wait time of restart @over-current	0.3 to 100.0	0.1 s	0.3
bb-30	-	Selection of restart mode @over-voltage	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-	01
bb-31	-	Wait time of restart @over-voltage	0.3 to 100.0	0.1 s	0.3
bb-40	Yes	Restart mode after FRS release	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed*2	-	00
bb-41	Yes	Restart mode after RS release	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed*2	-	00
bb-42	Yes	Restart frequency threshold	0.00 to 590.00	0.01 Hz	0.00
bb-43	Yes	Restart level of Active frequency matching	(0.0 to 2.0) × Inverter rated current*3	0.1 A	1.0 × Inverter rated current
bb-44	Yes	Restart constant (speed) of Active frequency matching	0.10 to 30.00	0.01 s	0.5
bb-45	Yes	Restart constant (Voltage) of Active frequency matching	0.10 to 30.00	0.01 s	0.5
bb-46	Yes	OC-supress level of Active frequency matching	(0.0 to 2.0) × Inverter rated current*3	0.1 A	1.0 × Inverter rated current
bb-47	Yes	Restart speed selection of Active frequency matching	00: Cutoff frequency 01: Maximum frequency 02: Setting frequency	-	00
bb160	-	Over current detection level, 1st-motor	(0.2 to 2.2) x Inverter ND rated current*3	0.1 A	2.2 × Inverter ND rated current
bb-61	Yes	Power supply over voltage selection	00: Warning 01: Error	-	00

Code	Change during operation	Name	Data range	Unit	Default
bb-62	Yes	Power supply over voltage level setting	200 V class: 300.0 to 410.0 400 V class: 600.0 to 820.0	0.1 VDC	200 V class: 390.0 400 V class: 780.0
bb-64	-	Ground fault selection	00: Disabled 01: Enabled	-	01
bb-65	Yes	Input phase loss enable	00: Disabled 01: Enabled	-	00
bb-66	Yes	Output phase loss enable	00: Disabled 01: Enabled	-	00
bb-67	Yes	Output phase loss detection sensitivity	1 to 100	1%	10
bb-70	Yes	Thermistor error level	0 to 10000	1Ω	3000
bb-80	Yes	Over speed detection level	0.0 to 150.0	0.10%	135.0
bb-81	Yes	Over speed detection time	0.0 to 5.0	0.1 s	0.5
bb-82	-	Speed deviation error mode selection	00: Warning 01: Error	-	00
bb-83	-	Speed deviation error detection level	0.0 to 100.0	0.10%	15.0
bb-84	-	Speed deviation error detection time	0.0 to 5.0	0.1 s	0.5
bb-85	-	Position deviation error mode selection	00: Warning 01: Error	-	00
bb-86	-	Position deviation error detection level	0 to 65535	1 × 100 pls	4096
bb-87	-	Position deviation error detection time	0.0 to 5.0	0.1 s	0.5
bb201	Yes	Carrier speed setting, 2nd-motor	Normal Duty (ND) 0.5 to 16.0 Low Duty (LD) 0.5 to 12.0 Very Low Duty (VLD) 0.5 to 10.0*1	0.1 kHz	2.0
bb202	-	Sprinkle carrier pattern selection, 2nd-motor	00: Disabled 01: Pattern 1 enabled 02: Pattern 2 enabled 03: Pattern 3 enabled	-	00
bb203	Yes	Automatic-carrier reduction selection, 2nd-motor	00: Disabled 01: Enabled: current 02: Enabled: temperature	-	00
bb260	-	Over current detection level, 2nd-motor	(0.2 to 2.2) x Inverter ND rated current*3	0.1 A	2.2 × Inverter ND rated current

*1. 3G3RX2-B4750 to 3G3RX2-B413K should be as follows.

- **Load type selection** (Ub-03) is set to *02: ND*: 0.5 to 10.0 kHz
- **Load type selection** (Ub-03) is set to *00: VLD* or *01: LD*: 0.5 to 8.0 kHz

*2. The feedback input to input terminals A and B and the feedback input to option cassette RX2-PG are necessary.

*3. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V
   When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A,V*, units are 0.1A and 0.1V.
   When **Resister data selection** (CF-11) is not set to *00: A,V*, the data cannot be set or displayed correctly.
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection**(CF-11).
   When **Resister data selection** (CF-11) is set to *00: A, V*, units are 0.1A and 0.1V.
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01%.
3. DriveProgramming: 0.01 (Rated ratio)

Code	Change during operation	Name	Data range	Unit	Default
bC110	Yes	Electronic thermal level setting, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
bC111	Yes	Electronic thermal characteristic selection, 1st-motor	00: Reduction characteristics 01: Constant torque characteristics 02: Arbitrary setting	-	01*2
bC112	Yes	Electronic thermal Subtraction function enable, 1st-motor	00: Disabled 01: Enabled	-	01
bC113	Yes	Electronic thermal Subtraction time, 1st-motor	1 to 1000	1 s	600
bC-14	Yes	Electronic thermal counter memory selection at Power-off	00: Disabled 01: Enabled	-	01
bC120	Yes	Free electronic thermal frequency-1, 1st-motor	0.00 to**Free electronic thermal frequency-2, 1st-motor**(bC122)	0.01 Hz	0.00
bC121	Yes	Free electronic thermal current-1, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	0.0
bC122	Yes	Free electronic thermal frequency-2, 1st-motor	**Free electronic thermal frequency-1, 1st-motor**(bC120) to**Free electronic thermal frequency-3, 1st-motor**(bC124)	0.01 Hz	0.00
bC123	Yes	Free electronic thermal current-2, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	0.0
bC124	Yes	Free electronic thermal frequency-3, 1st-motor	**Free electronic thermal frequency-2, 1st-motor**(bC122) to 590.00	0.01 Hz	0.00
bC125	Yes	Free electronic thermal current-3, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	0.0
bC210	Yes	Electronic thermal level setting, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
bC211	Yes	Electronic thermal characteristic selection, 2nd-motor	00: Reduction characteristics 01: Constant torque characteristics 02: Arbitrary setting	-	01*2
bC212	Yes	Electronic thermal Subtraction function enable, 2nd-motor	00: Disabled 01: Enabled	-	01
bC213	Yes	Electronic thermal Subtraction time, 2nd-motor	1 to 1000	1 s	600
bC220	Yes	Free electronic thermal frequency-1, 2nd-motor	0.00 to**Free electronic thermal frequency-2, 2nd-motor**(bC222)	0.01 Hz	0.00
bC221	Yes	Free electronic thermal current-1, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	0.0

Code	Change during operation	Name	Data range	Unit	Default
bC222	Yes	Free electronic thermal frequency-2, 2nd-motor	**Free electronic thermal frequency-1, 2nd-motor**(bC220) to**Free electronic thermal frequency-3, 2nd-motor** (bC224)	0.01 Hz	0.00
bC223	Yes	Free electronic thermal current-2, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	0.0
bC224	Yes	Free electronic thermal frequency-3, 2nd-motor	**Free electronic thermal frequency-2, 2nd-motor**(bC222) to 590.00	0.01 Hz	0.00
bC225	Yes	Free electronic thermal current-3, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	0.1 A	0.0

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V
   When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*, units are 0.1A and 0.1V.
   When **Resister data selection**(CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.
2. Modbus:
   The current and the voltage vary depending on the setting of **Resister data selection** (CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V.
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio).
3. DriveProgramming: 0.01 (Rated ratio)

*2. The default when **Initialize Data selection** (Ub-02) is set to*01: Mode 1*.

Code	Change during operation	Name	Data range	Unit	Default
bd-01	-	STO input display selection	00: With indication 01: Without indication 02: Trip	-	00
bd-02	-	STO input change time	0.00 to 60.00	0.01 s	1
bd-03	-	Display selection at STO input change time	00: With indication 01: Without indication	-	00
bd-04	-	Action selection after STO input change time	00: Retain only the condition 01: Disabled 02: Trip	-	00

15-3-3 Parameter (Code C)

Code	Change during operation	Name	Data range	Unit	Default
CA-01	Yes	Input terminal [1] function	Refer to *List of Input Terminal Functions* on page 15-81.	-	028
CA-02	Yes	Input terminal [2] function		-	015
CA-03	Yes	Input terminal [3] function		-	029
CA-04	Yes	Input terminal [4] function		-	032
CA-05	Yes	Input terminal [5] function		-	031
CA-06	Yes	Input terminal [6] function		-	003
CA-07	Yes	Input terminal [7] function		-	004
CA-08	Yes	Input terminal [8] function		-	002
CA-09	Yes	Input terminal [9] function		-	001
CA-10	Yes	Input terminal [A] function		-	033
CA-11	Yes	Input terminal [B] function		-	034

Code	Change during operation	Name	Data range	Unit	Default
CA-21	Yes	Input terminal [1] a/b(NO/NC)	00: Normally open: NO 01: Normally closed: NC	-	00
CA-22	Yes	Input terminal [2] a/b(NO/NC)		-	00
CA-23	Yes	Input terminal [3] a/b(NO/NC)		-	00
CA-24	Yes	Input terminal [4] a/b(NO/NC)		-	00
CA-25	Yes	Input terminal [5] a/b(NO/NC)		-	00
CA-26	Yes	Input terminal [6] a/b(NO/NC)		-	00
CA-27	Yes	Input terminal [7] a/b(NO/NC)		-	00
CA-28	Yes	Input terminal [8] a/b(NO/NC)		-	00
CA-29	Yes	Input terminal [9] a/b(NO/NC)		-	00
CA-30	Yes	Input terminal [A] a/b(NO/NC)		-	00
CA-31	Yes	Input terminal [B] a/b(NO/NC)		-	00
CA-41	Yes	Input terminal [1] response time	0 to 400	1 ms	2
CA-42	Yes	Input terminal [2] response time		1 ms	2
CA-43	Yes	Input terminal [3] response time		1 ms	2
CA-44	Yes	Input terminal [4] response time		1 ms	2
CA-45	Yes	Input terminal [5] response time		1 ms	2
CA-46	Yes	Input terminal [6] response time		1 ms	2
CA-47	Yes	Input terminal [7] response time		1 ms	2
CA-48	Yes	Input terminal [8] response time		1 ms	2
CA-49	Yes	Input terminal [9] response time		1 ms	2
CA-50	Yes	Input terminal [A] response time		1 ms	2
CA-51	Yes	Input terminal [B] response time		1 ms	2
CA-55	Yes	Multistage input determination time	0 to 2000	1 ms	0

Code	Change during operation	Name	Data range	Unit	Default
CA-60	Yes	FUP / FDN overwrite target selection	00: Frequency command 01: PID1	-	00
CA-61	Yes	FUP / FDN data save enable	00: Not save 01: Save	-	00
CA-62	Yes	FUP / FDN UDC selection	00: 0 Hz 01: Saved data	-	00
CA-64	Yes	Acceleration time setting for FUP / FDN function	0.00 to 3600.00	0.01 s	30.00
CA-66	Yes	Deceleration time setting for FUP / FDN function	0.00 to 3600.00	0.01 s	30.00
CA-70	Yes	Speed reference source selection at [F-OP] is active	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-	01
CA-71	Yes	RUN command source selection at [F-OP] is active	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-	00
CA-72	-	Reset mode selection	00: ON to Release Trip 01: OFF to Release Trip 02: On to Release at Trip 03: OFF to Release at Trip	-	00
CA-81	-	Encoder constant setting	32 to 65535	1 pls	1024
CA-82	-	Encoder position selection	00: Phase-A is leading 01: Phase-B is leading	-	00
CA-83	-	Motor gear ratio Numerator	1 to 10000	1	1
CA-84	-	Motor gear ratio Denominator	1 to 10000	1	1
CA-90	-	Pulse train detection (internal) control terminal [A] [B]	00: Disabled 01: Frequency command 02: Speed feedback 03: Pulse count	-	00

Code	Change during operation	Name	Data range	Unit	Default
CA-91	-	Mode selection of pulse train input	00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string	-	00
CA-92	Yes	Pulse train frequency Scale	0.05 to 32.00	0.01 kHz	25.00
CA-93	Yes	Pulse train frequency Filter time constant	0.01 to 2.00	0.01 s	0.10
CA-94	Yes	Pulse train frequency Bias value	-100.0 to 100.0	0.1%	0.0
CA-95	Yes	Pulse train frequency High Limit	0.0 to 100.0	0.1%	100.00
CA-96	Yes	Pulse train frequency detection low level	0.0 to 100.0	0.1%	0.0
CA-97	Yes	Comparing match output ON-level for Pulse count	0 to 65535	1	0
CA-98	Yes	Comparing match output OFF-level for Pulse count	0 to 65535	1	0
CA-99	Yes	Comparing match output Maximum value for Pulse count	0 to 65535	1	0

Code	Change during operation	Name	Data range	Unit	Default
Cb-01	Yes	Filter time constant of Terminal [Ai1]	1 to 500	1 ms	16
Cb-03	Yes	Start value of Terminal [Ai1]	0.00 to 100.00	0.01%	0.00
Cb-04	Yes	End value of Terminal [Ai1]	0.00 to 100.00	0.01%	100.00
Cb-05	Yes	Start rate of Terminal [Ai1]	0.0 to **End rate of Terminal [Ai1]** (Cb-06)	0.1%	0.0
Cb-06	Yes	End rate of Terminal [Ai1]	**Start rate of Terminal [Ai1]** (Cb-05) to 100.0	0.1%	100.0
Cb-07	Yes	Start point selection of Terminal [Ai1]	00: Start amount 01: 0%	-	01
Cb-11	Yes	Filter time constant of Terminal [Ai2]	1 to 500	1 ms	16
Cb-13	Yes	Start value of Terminal [Ai2]	0.00 to 100.00	0.01%	0.00
Cb-14	Yes	End value of Terminal [Ai2]	0.00 to 100.00	0.01%	100.00
Cb-15	Yes	Start rate of Terminal [Ai2]	0.0 to **End rate of Terminal [Ai2]** (Cb-16)	0.1%	20.0
Cb-16	Yes	End rate of Terminal [Ai2]	**Start rate of Terminal [Ai2]** (Cb-15) to 100.0	0.1%	100.0
Cb-17	Yes	Start point selection of Terminal [Ai2]	00: Start amount 01: 0%	-	01
Cb-21	Yes	Filter time constant of Terminal [Ai3]	1 to 500	1 ms	16
Cb-22	-	Terminal [Ai3] selection	00: Single 01: Added to Ai1 / Ai2: with reversibility 02: Added to Ai1 / Ai2: without reversibility	-	00
Cb-23	Yes	Start value of Terminal [Ai3]	-100.00 to 100.00	0.01%	-100.00
Cb-24	Yes	End value of Terminal [Ai3]	-100.00 to 100.00	0.01%	100.00
Cb-25	Yes	Start rate of Terminal [Ai3]	-100.0 to **End rate of Terminal [Ai3]** (Cb-26)	0.1%	-100.00
Cb-26	Yes	End rate of Terminal [Ai3]	**Start rate of Terminal [Ai3]** (Cb-25) to 100.0	0.1%	100.00
Cb-30	-	[Ai1] Voltage / Current zero-gain adjustment	-100.00 to 100.00	0.01%	0.00
Cb-31	-	[Ai1] Voltage / Current gain adjustment	0.00 to 200.00	0.01%	100.00
Cb-32	-	[Ai2] Voltage / Current zero-gain adjustment	-100.00 to 100.00	0.01%	0.00

Code	Change during operation	Name	Data range	Unit	Default
Cb-33	-	[Ai2] Voltage / Current gain adjustment	0.00 to 200.00	0.01%	100.00
Cb-34	-	[Ai3] Voltage / Current zero-gain adjustment	-100.00 to 100.00	0.01%	0.00
Cb-35	-	[Ai3] Voltage gain adjustment	0.00 to 200.00	0.01%	100.00
Cb-40	Yes	Thermistor selection	00: Disabled 01: PTC resistance value enabled 02: NTC resistance value enabled	-	00
Cb-41	-	Thermistor gain adjustment	0.0 to 1000.0	0.1	100.0
Cb-51 to Cb-57	-	Reserved	-	-	-

Code	Change during operation	Name	Data range	Unit	Default
CC-01	Yes	Output terminal [11] function	Refer to *List of Output Terminal Functions* on page 15-83.	-	001
CC-02	Yes	Output terminal [12] function		-	002
CC-03	Yes	Output terminal [13] function		-	003
CC-04	Yes	Output terminal [14] function		-	007
CC-05	Yes	Output terminal [15] function		-	035
CC-06	Yes	Relay output terminal [16] function		-	000
CC-07	Yes	Relay output terminal [AL] function		-	017
CC-11	Yes	Output terminal [11] a/b(NO/NC)	00: Normally open: NO 01: Normally closed: NC	-	0
CC-12	Yes	Output terminal [12] a/b(NO/NC)		-	0
CC-13	Yes	Output terminal [13] a/b(NO/NC)		-	0
CC-14	Yes	Output terminal [14] a/b(NO/NC)		-	0
CC-15	Yes	Output terminal [15] a/b(NO/NC)		-	0
CC-16	Yes	Output terminal [16] a/b(NO/NC)		-	0
CC-17	Yes	Output terminal [AL] a/b(NO/NC)		-	1

Code	Change during operation	Name	Data range	Unit	Default
CC-20	Yes	Output terminal [11] on-delay time	0 to 10000	0.01 s	0.00
CC-21	Yes	Output terminal [11] off-delay time		0.01 s	0.00
CC-22	Yes	Output terminal [12] on-delay time		0.01 s	0.00
CC-23	Yes	Output terminal [12] off-delay time		0.01 s	0.00
CC-24	Yes	Output terminal [13] on-delay time		0.01 s	0.00
CC-25	Yes	Output terminal [13] off-delay time		0.01 s	0.00
CC-26	Yes	Output terminal [14] on-delay time		0.01 s	0.00
CC-27	Yes	Output terminal [14]		0.01 s	0.00
CC-28	Yes	Output terminal [15] on-delay time		0.01 s	0.00
CC-29	Yes	Output terminal [15] off-delay time		0.01 s	0.00
CC-30	Yes	Output terminal [16] on-delay time		0.01 s	0.00
CC-31	Yes	Output terminal [16] off-delay time		0.01 s	0.00
CC-32	Yes	Output relay [AL] on-delay time		0.01 s	0.00
CC-33	Yes	Output relay [AL] off-delay time		0.01 s	0.00
CC-40	Yes	Logical calculation target 1 selection of LOG1	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-	0
CC-41	Yes	Logical calculation target 2 selection of LOG1		-	0
CC-42	Yes	Logical calculation symbol selection of LOG1	00: AND 01: OR 02: XOR	-	00
CC-43	Yes	Logical calculation target 1 selection of LOG2	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-	0
CC-44	Yes	Logical calculation target 2 selection of LOG2		-	0
CC-45	Yes	Logical calculation symbol selection of LOG2	00: AND 01: OR 02: XOR	-	00
CC-46	Yes	Logical calculation target 1 selection of LOG3	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-	0
CC-47	Yes	Logical calculation target 2 selection of LOG3		-	0

Code	Change during operation	Name	Data range	Unit	Default
CC-48	Yes	Logical calculation symbol selection of LOG3	00: AND 01: OR 02: XOR	-	00
CC-49	Yes	Logical calculation target 1 selection of LOG4	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-	0
CC-50	Yes	Logical calculation target 2 selection of LOG4		-	0
CC-51	Yes	Logical calculation symbol selection of LOG4	00: AND 01: OR 02: XOR	-	00
CC-52	Yes	Logical calculation target 1 selection of LOG5	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-	0
CC-53	Yes	Logical calculation target 2 selection of LOG5		-	0
CC-54	Yes	Logical calculation symbol selection of LOG5	00: AND 01: OR 02: XOR	-	00
CC-55	Yes	Logical calculation target 1 selection of LOG6	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-	0
CC-56	Yes	Logical calculation target 2 selection of LOG6		-	0
CC-57	Yes	Logical calculation symbol selection of LOG6	00: AND 01: OR 02: XOR	-	00
CC-58	Yes	Logical calculation target 1 selection of LOG7	Refer to *List of Output Terminal Functions* on page 15-83. [62: LOG1] to [68: LOG7] cannot be selected.	-	0
CC-59	Yes	Logical calculation target 2 selection of LOG7		-	0
CC-60	Yes	Logical calculation symbol selection of LOG7	00: AND 01: OR 02: XOR	-	00

Code	Change during operation	Name	Data range	Unit	Default
Cd-01	-	[FM] monitor output wave form selection	00: PWM 01: Frequency	-	00
Cd-02	-	[FM] monitor output base frequency (at PWM output)	0 to 3600	1 Hz	2880
Cd-03	Yes	[FM] monitor output selection	Refer to *List of Output Monitor Functions* on page 15-85.	1	(dA-01)
Cd-04	Yes	[Ao1] monitor output selection	Refer to *List of Output Monitor Functions* on page 15-85.	1	(dA-01)
Cd-05	Yes	[Ao2] monitor output selection	Refer to *List of Output Monitor Functions* on page 15-85.	1	(dA-01)
Cd-10	-	Analog monitor adjust mode enable	00: Disabled 01: Enabled	-	00
Cd-11	-	Filter time constant of [FM]monitor	1 to 500	1 ms	100
Cd-12	-	[FM] Data type selection	00: Absolute value 01: with sign	-	00
Cd-13	Yes	[FM] monitor bias adjustment	-100.0 to 100.0	0.10%	0.0
Cd-14	Yes	[FM] monitor gain adjustment	-1000.0 to 1000.0	0.10%	100.0
Cd-15	Yes	Output level setting at [FM] monitor adjust mode	-100.0 to 100.0	0.10%	100.0
Cd-21	-	Filter time constant of [Ao1] monitor	1 to 500	1 ms	100
Cd-22	-	[Ao1] Data type selection	00: Absolute value 01: with sign	-	00
Cd-23	Yes	[Ao1] monitor bias adjustment	-100.0 to 100.0	0.10%	0.0
Cd-24	Yes	[Ao1] monitor gain adjustment	-1000.0 to 1000.0	0.10%	100.0
Cd-25	Yes	Output level setting at [Ao1] monitor adjust mode	-100.0 to 100.0	0.10%	100.0
Cd-31	-	Filter time constant of [Ao2] monitor	1 to 500	1 ms	100
Cd-32	-	[Ao2] Data type selection	00: Absolute value 01: with sign	-	0
Cd-33	Yes	[Ao2] monitor bias adjustment	-100.0 to 100.0	0.10%	20.0
Cd-34	Yes	[Ao2] monitor gain adjustment	-1000.0 to 1000.0	0.10%	80.0
Cd-35	Yes	Output level setting at [Ao2] monitor adjust mode	-100.0 to 100.0	0.10%	100.0

Code	Change during operation	Name	Data range	Unit	Default
CE101	Yes	Low current signal output mode selection, 1st motor	00: During acceleration / deceleration, at constant speed 01: Only at constant speed	-	01
CE102	Yes	Low current detection level 1, 1st motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
CE103	Yes	Low current detection level 2, 1st motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
CE105	Yes	Over current signal output mode selection, 1st motor	00: During acceleration/deceleration, at constant speed 01: Only at constant speed	-	01
CE106	Yes	Over current detection level 1, 1st motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
CE107	Yes	Over current detection level 2, 1st motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
CE-10	Yes	Arrival frequency setting during acceleration 1	0.00 to 590.00	0.01 Hz	0.00
CE-11	Yes	Arrival frequency setting during deceleration 1		0.01 Hz	0.00
CE-12	Yes	Arrival frequency setting during acceleration 2		0.01 Hz	0.00
CE-13	Yes	Arrival frequency setting during deceleration 2		0.01 Hz	0.00
CE120	Yes	Over torque level (Forward driving), 1st motor	0.0 to 500.0	0.10%	100.0
CE121	Yes	Over torque level (Reverse regenerative), 1st motor		0.10%	100.0
CE122	Yes	Over torque level (Reverse driving), 1st motor		0.10%	100.0
CE123	Yes	Over torque level (Forward regenerative), 1st motor		0.10%	100.0
CE-30	Yes	Electronic thermal warning level (MTR)	0.00 to 100.00	0.01%	80.0
CE-31	Yes	Electronic thermal warning level (CTL)	0.00 to 100.00	0.01%	80.0
CE-33	Yes	Zero speed detection level	0.00 to 100.00	0.01 Hz	0.50
CE-34	Yes	Cooling FAN over-heat warning level	0 to 200	1℃	120

Code	Change during operation	Name	Data range	Unit	Default
CE-36	Yes	Accum.RUN (RNT) / Accum.Power-on (ONT) time setting	0 to 100000	1 hr	0
CE-40	Yes	Window comparator for [Ai1] higher level	0 to 100	1%	100
CE-41	Yes	Window comparator for [Ai1] lower level	0 to 100	1%	0
CE-42	Yes	Window comparator for [Ai1] hysteresis width	0 to 10	1%	0
CE-43	Yes	Window comparator for [Ai2] higher level	0 to 100	1%	100
CE-44	Yes	Window comparator for [Ai2] lower level	0 to 100	1%	0
CE-45	Yes	Window comparator for [Ai2] hysteresis width	0 to 10	1%	0
CE-46	Yes	Window comparator for [Ai3] higher level	-100 to 100	1%	100
CE-47	Yes	Window comparator for [Ai3] lower level	-100 to 100	1%	-100
CE-48	Yes	Window comparator for [Ai3] hysteresis width	0 to 10	1%	0
CE-50	Yes	Operation level at [Ai1] disconnection	0 to 100	1%	0
CE-51	Yes	Operation level selection at [Ai1] disconnection	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-	00
CE-52	Yes	Operation level at [Ai2] disconnection	0 to 100	1%	0
CE-53	Yes	Operation level selection at [Ai2] disconnection	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-	00
CE-54	Yes	Operation level at [Ai3] disconnection	-100 to 100	1%	0
CE-55	Yes	Operation level selection at [Ai3] disconnection	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-	00
CE201	Yes	Low current signal output mode selection, 2nd-motor	00: During acceleration/deceleration, at constant speed 01: Only at constant speed	-	01
CE202	Yes	Low current detection level 1, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
CE203	Yes	Low current detection level 2, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current

Code	Change during operation	Name	Data range	Unit	Default
CE205	Yes	Over current signal output mode selection, 2nd-motor	00: During acceleration / deceleration, at constant speed 01: Only at constant speed	-	1
CE206	Yes	Over current detection level 1, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
CE207	Yes	Over current detection level 2, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	0.1 A	1.0 × Inverter rated current
CE220	Yes	Over torque level (Forward driving), 2nd-motor	0.0 to 500.0	0.10%	100.0
CE221	Yes	Over torque level (Reverse regenerative), 2nd-motor		0.10%	100.0
CE222	Yes	Over torque level (Reverse driving), 2nd-motor		0.10%	100.0
CE223	Yes	Over torque level (Forward regenerative), 2nd motor		0.10%	100.0

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V
   (When you operate with CX-Drive, set **Resister data selection**(CF-11) to *00: A, V*.
   When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.)
2. Modbus： The current and the voltage vary depending on the setting of **Resister data selection**(CF-11).
   When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1 A and 0.1 V
   When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01 (Rated ratio)

Code	Change during operation	Name	Data range	Unit	Default
CF-01	-	RS485 communication baud rate selection	03: 2400 bps 04: 4800 bps 05: 9600 bps 06: 19.2 kbps 07: 38.4 kbps 08: 57.6 kbps 09: 76.8 kbps 10: 115.2 kbps	-	05
CF-02	Yes	RS485 communication Node allocation	1 to 247	1	1
CF-03	Yes	RS485 communication parity selection	00: Without parity 01: Even number parity 02: Odd number parity	-	00
CF-04	Yes	RS485 communication stop-bit selection	01: 1 bit 02: 2 bit	-	01
CF-05	Yes	RS485 communication error selection	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-	02
CF-06	Yes	RS485 communication timeout setting	0.00 to 100.00 (0: Disable Communication Timeout)	0.01 s	0.00
CF-07	Yes	RS485 communication wait time setting	0 to 1000	1 ms	2
CF-08	Yes	RS485 communication mode selection	01: Modbus-RTU 02: EzCOM 03: EzCOM management	-	01
CF-11	-	Resister data selection	00: A, V 01: %	-	00
CF-20	-	EzCOM Start node No.	01 to 08	1	1
CF-21	-	EzCOM End node No.	01 to 08	1	1
CF-22	-	EzCOM Start method selection	00: ECOM terminal 01: Modbus spec	-	00
CF-23	Yes	EzCOM data size	01 to 05	1	5
CF-24	Yes	EzCOM destination address 1	1 to 247	1	1
CF-25	Yes	EzCOM destination resister 1	0000 to FFFF	1	0
CF-26	Yes	EzCOM source resister 1	0000 to FFFF	1	0
CF-27	Yes	EzCOM destination address 2	1 to 247	1	2
CF-28	Yes	EzCOM destination resister 2	0000 to FFFF	1	0
CF-29	Yes	EzCOM source resister 2	0000 to FFFF	1	0
CF-30	Yes	EzCOM destination address 3	1 to 247	1	3

Code	Change during operation	Name	Data range	Unit	Default
CF-31	Yes	EzCOM destination resister 3	0000 to FFFF	1	0
CF-32	Yes	EzCOM source resister 3	0000 to FFFF	1	0
CF-33	Yes	EzCOM destination address 4	1 to 247	1	4
CF-34	Yes	EzCOM destination resister 4	0000 to FFFF	1	0
CF-35	Yes	EzCOM source resister 4	0000 to FFFF	1	0
CF-36	Yes	EzCOM destination address 5	1 to 247	1	5
CF-37	Yes	EzCOM destination resister 5	0000 to FFFF	1	0
CF-38	Yes	EzCOM source resister 5	0000 to FFFF	1	0
CF-50	Yes	USB communication Node allocation	1 to 247	1	1

List of Input Terminal Functions

Function No.	Abbreviation	Function name
000	-	Without allocation
001	FW	Normal rotation
002	RV	Reverse rotation
003	CF1	Multistage speed 1
004	CF2	Multistage speed 2
005	CF3	Multistage speed 3
006	CF4	Multistage speed 4
007	SF1	Multistage speed bit 1
008	SF2	Multistage speed bit 2
009	SF3	Multistage speed bit 3
010	SF4	Multistage speed bit 4
011	SF5	Multistage speed bit 5
012	SF6	Multistage speed bit 6
013	SF7	Multistage speed bit 7
014	ADD	Addition of frequency
015	SCHG	Switching of command
016	STA	3-wire starting up
017	STP	3-wire stopping
018	F/R	3-wire normal and reverse
019	AHD	Retention of analog command
020	FUP	Acceleration through remote operation
021	FDN	Deceleration through remote operation
022	UDC	Clearing of remote operation data
023	F-OP	Forced switching of command

Function No.	Abbreviation	Function name
024	SET	Second control
028	RS	Reset
029	JG	Jogging
030	DB	Braking with external direct current
031	2CH	2-step acceleration/deceleration
032	FRS	Free-run stop
033	EXT	External abnormality
034	USP	Prevention of power restoration restarting
035	CS	Commercial switch
036	SFT	Soft lock
037	BOK	Brake check
038	OLR	Switching of overload limit
039	KHC	Clearing of integrated input power
040	OKHC	Clearing of integrated output power
041	PID	PID1 disabled
042	PIDC	Resetting of PID1 integration
043	PID2	PID2 disabled
044	PIDC2	Resetting of PID2 integration
045	PID3	PID3 disabled
046	PIDC3	Resetting of PID3 integration
047	PID4	PID4 disabled
048	PIDC4	Resetting of PID4 integration
051	SVC1	PID1 Multi stage set-point 1 setting
052	SVC2	PID1 Multi stage set-point 2 setting
053	SVC3	PID1 Multi stage set-point 3 setting
054	SVC4	PID1 Multi stage set-point 4 setting
055	PRO	Switching of PID gain
056	PIO1	Switching of PID output
057	PIO2	Switching of PID output 2
058	SLEP	Satisfaction of SLEEP condition
059	WAKE	Satisfaction of WAKE condition
060	TL	Validation of torque limit
061	TRQ1	Torque limit switchover 1
062	TRQ2	Torque limit switchover 2
063	PPI	PPI control switch
064	CAS	Control gain switch
065	SON	Servo-on
066	FOC	Auxiliary excitation
067	ATR	Validation of torque control
068	TBS	Validation of torque bias
069	ORT	Orientation
071	LAC	Cancellation of LAD
072	PCLR	Clearing of positional deviation
073	STAT	Permission to inputting of Pulse string position command
074	PUP	Addition of positional bias
075	PDN	Subtraction of positional bias
076	CP1	Positional command selection 1

Function No.	Abbreviation	Function name
077	CP2	Positional command selection 2
078	CP3	Positional command selection 3
079	CP4	Positional command selection 4
080	ORL	Origin limit signal
081	ORG	Return-to-origin start up signal
082	FOT	Stopping of normal rotation driving
083	ROT	Stopping of reverse rotation driving
084	SPD	Switching of speed position
085	PSET	Presetting of positional data
086	MI1	General purpose input 1
087	MI2	General purpose input 2
088	MI3	General purpose input 3
089	MI4	General purpose input 4
090	MI5	General purpose input 5
091	MI6	General purpose input 6
092	MI7	General purpose input 7
093	MI8	General purpose input 8
094	MI9	General purpose input 9
095	MI10	General purpose input 10
096	MI11	General purpose input 11
097	PCC	Clearing of pulse counter
098	ECOM	Starting up of EzCOM
099	PRG	Starting of EzSQ program
100	HLD	Stopping of acceleration/deceleration
101	REN	Operation permission signal
102	DISP	Fixation of display
103	PLA	Pulse string input A
104	PLB	Pulse string input B
105	EMF	Emergency forced operation
107	COK	Contactor check signal
109	PLZ	Pulse string input Z
110	TCH	Teaching signal

List of Output Terminal Functions

Function No.	Abbreviation	Function Name
000	-	Without allocation
001	RUN	During operation
002	FA1	When the constant speed is attained
003	FA2	Equal to or above the set frequency
004	FA3	Set frequency match
005	FA4	Equal to or above the set frequency 2
006	FA5	Set frequency match 2
007	IRDY	Operation ready completion
008	FWR	During normal rotation operation
009	RVR	During reverse rotation operation

Function No.	Abbreviation	Function Name
010	FREF	Frequency command panel
011	REF	Operation command panel
012	SETM	Second control under selection
016	OPO	Optional output
017	AL	Alarm signal
018	MJA	Severe failure signal
019	OTQ	Over torque
020	IP	During instantaneous power failure
021	UV	Under insufficient voltage
022	TRQ	During torque limitation
023	IPS	During power failure deceleration
024	RNT	RUN time elapsed
025	ONT	Power ON time elapsed
026	THM	Electronic thermal warning (Motor)
027	THC	Electronic thermal warning (Inverter)
029	WAC	Capacitor life advance notice
030	WAF	Fan life advance notice
031	FR	Operation command signal
032	OHF	Cooling fin heating advance notice
033	LOC	Low current signal
034	LOC2	Low current signal 2
035	OL	Overload advance notice
036	OL2	Overload advance notice 2
037	BRK	Brake release
038	BER	Brake abnormality
039	CON	Contactor control
040	ZS	0 Hz detection signal
041	DSE	Excessive speed deviation
042	PDD	Excessive positional deviation
043	POK	Positioning completed
044	PCMP	Pulse count compare-match output
045	OD	PID excessive deviation
046	FBV	PID feedback comparison
047	OD2	PID2 excessive deviation
048	FBV2	PID2 feedback comparison
049	NDc	Communication disconnection
050	Ai1Dc	Analog disconnection Ai1
051	Ai2Dc	Analog disconnection Ai2
052	Ai3Dc	Analog disconnection Ai3
056	WCAi1	Window comparator Ai1
057	WCAi2	Window comparator Ai2
058	WCAi3	Window comparator Ai3
062	LOG1	Result of logical operation 1
063	LOG2	Result of logical operation 2
064	LOG3	Result of logical operation 3
065	LOG4	Result of logical operation 4
066	LOG5	Result of logical operation 5

Function No.	Abbreviation	Function Name
067	LOG6	Result of logical operation 6
068	LOG7	Result of logical operation 7
069	MO1	General purpose output 1
070	MO2	General purpose output 2
071	MO3	General purpose output 3
072	MO4	General purpose output 4
073	MO5	General purpose output 5
074	MO6	General purpose output 6
075	MO7	General purpose output 7
076	EMFC	Forced operation in process signal
077	EMBP	During-bypass-mode signal
080	LBK	LCD operator battery insufficient
081	OVS	Excessive voltage of accepted power
084	AC0	Alarm code bit 0
085	AC1	Alarm code bit 1
086	AC2	Alarm code bit 2
087	AC3	Alarm code bit 3
089	OD3	PID3 excessive deviation
090	FBV3	PID3 feedback comparison
091	OD4	PID4 excessive deviation
092	FBV4	PID4 feedback comparison
093	SSE	PID soft start abnormality
053 - 055		Reserved
059 - 061		Reserved

List of Output Monitor Functions

Register No.	Modbus No.	Monitor No.	Function
0 to 65535 (Register No. of d and F code)			
10001	2711 hex	dA-01	Output Frequency Monitor
10002	2712 hex	dA-02	Output Current Monitor
10004	2714 hex	dA-04	Frequency command after calculation
10008	2718 hex	dA-08	Speed Detection Value Monitor
10012	271C hex	dA-12	Output frequency monitor (with sign)
10014	271E hex	dA-14	Frequency upper limit monitor
10016	271F hex	dA-15	Torque command monitor after calculation
10017	2720 hex	dA-16	Torque limit monitor
10018	2721 hex	dA-17	Output torque monitor
10020	2722 hex	dA-18	Output Voltage Monitor
10030	272E hex	dA-30	Input Power Monitor
10034	2732 hex	dA-34	Output Power Monitor
10038	2736 hex	dA-38	Motor temperature monitor
10040	2738 hex	dA-40	DC voltage monitor
10041	2739 hex	dA-41	BRD load factor monitor
10042	273A hex	dA-42	Electronic thermal duty ratio monitor MTR

Register No. 0 to 65535 (Register No. of d and F code)	Modbus No.	Monitor No.	Function
10043	273B hex	dA-43	Electronic thermal duty ratio monitor CTL
10061	274D hex	dA-61	Analog input [Ai1] monitor
10062	274E hex	dA-62	Analog input [Ai2] monitor
10063	274F hex	dA-63	Analog input [Ai3] monitor
10070	2756 hex	dA-70	Pulse string input monitor main body
10071	2757 hex	dA-71	Pulse string input monitor option
10118	2786 hex	db-18	Analog output monitor YA0
10119	2787 hex	db-19	Analog output monitor YA1
10120	2788 hex	db-20	Analog output monitor YA2
10130	2792 hex	db-30	PID1 feedback data 1 monitor
10132	2794 hex	db-32	PID1 feedback data 2 monitor
10134	2796 hex	db-34	PID1 feedback data 3 monitor
10136	2798 hex	db-36	PID2 feedback data monitor
10138	279A hex	db-38	PID3 feedback data monitor
10140	279C hex	db-40	PID4 feedback data monitor
10142	279E hex	db-42	PID1 target value monitor after calculation
10144	27A0 hex	db-44	PID1 feedback data
10150	27A6 hex	db-50	PID1 output monitor
10151	27A7 hex	db-51	PID1 deviation monitor
10152	27A8 hex	db-52	PID1 deviation 1 monitor
10153	27A9 hex	db-53	PID1 deviation 2 monitor
10154	27AA hex	db-54	PID1 deviation 3 monitor
10155	27AB hex	db-55	PID2 output monitor
10156	27AC hex	db-56	PID2 deviation monitor
10157	27AD hex	db-57	PID3 output monitor
10158	27AE hex	db-58	PID3 deviation monitor
10159	27AF hex	db-59	PID4 output monitor
10160	27B0 hex	db-60	PID4 deviation monitor
10164	27B4 hex	db-64	PID feed-forward monitor
10215	27E7 hex	dC-15	Cooling Fin Temperature Monitor
11001	2AF9 hex	FA-01	Main Speed reference monitor
11002	2AFA hex	FA-02	Sub speed reference
11015	2B07 hex	FA-15	Torque reference monitor
11016	2B08 hex	FA-16	Torque bias monitor
11030	2B16 hex	FA-30	PID1 Set Value 1 monitor
11032	2B18 hex	FA-32	PID1 Set Value 2 monitor
11034	2B1A hex	FA-34	PID1 Set Value 3 monitor
11036	2B1C hex	FA-36	PID2 Set Value monitor
11038	2B1E hex	FA-38	PID3 Set Value monitor
11040	2B20 hex	FA-40	PID4 Set Value monitor

15-3-4 Parameter (Code H)

Code	Change during operation	Name	Data range	Unit	Default
HA-01	-	Auto-tuning selection	00: Disabled 01: Non-rotation 02: Rotation 03: IVMS	-	00
HA-02	-	RUN command selection at Auto-tuning	00: RUN key on LCD operator 01: (AA111)/(AA211)	-	00
HA-03	-	Online auto-tuning selection	00: Disabled 01: Enabled	-	00
HA110	Yes	Stabilization constant, 1st-motor	0 to 1000	1%	100
HA115	Yes	Speed response for Async.M, 1st-motor	0 to 1000	1%	100
HA120	Yes	ASR gain switching mode selection, 1st-motor	00: [CAS] terminal 01: setting switch	-	00
HA121	Yes	ASR gain switching time setting, 1st-motor	0 to 10000	1 ms	100
HA122	Yes	ASR gain mapping intermediate speed 1, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
HA123	Yes	ASR gain mapping intermediate speed 2, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
HA124	Yes	ASR gain mapping Maximum speed, 1st-motor	0.00 to 590.00	0.01 Hz	0.00
HA125	Yes	ASR gain mapping P-gain 1, 1st-motor	0.0 to 1000.0	0.1%	100.0
HA126	Yes	ASR gain mapping I-gain 1, 1st-motor		0.1%	100.0
HA127	Yes	ASR gain mapping P-gain 1 at P-control, 1st-motor		0.1%	100.0
HA128	Yes	ASR gain mapping P-gain 2, 1st-motor		0.1%	100.0
HA129	Yes	ASR gain mapping I-gain 2, 1st-motor		0.1%	100.0
HA130	Yes	ASR gain mapping P-gain 2 at P-control, 1st-motor		0.1%	100.0
HA131	Yes	ASR gain mapping P-gain 3, 1st-motor		0.1%	100.0
HA132	Yes	ASR gain mapping I-gain 3, 1st-motor		0.1%	100.0
HA133	Yes	ASR gain mapping P-gain 4, 1st-motor		0.1%	100.0
HA134	Yes	ASR gain mapping I-gain 4, 1st-motor		0.1%	100.0
HA210	Yes	Stabilization constant, 2nd-motor	0 to 1000	1%	100

Code	Change during operation	Name	Data range	Unit	Default
HA215	Yes	Speed response for Async.M, 2nd-motor	0 to 1000	1%	100
HA220	Yes	ASR gain switching mode selection, 2nd-motor	00: [CAS] terminal 01: setting switch	1	0
HA221	Yes	ASR gain switching time setting, 2nd-motor	0 to 10000	1 ms	100
HA222	Yes	ASR gain mapping intermidiate speed 1, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
HA223	Yes	ASR gain mapping intermidiate speed 2, 2nd-motor	0.00 to 590.00	0.01 Hz	100.00
HA224	Yes	ASR gain mapping Maximum speed, 2nd-motor	0.00 to 590.00	0.01 Hz	0.00
HA225	Yes	ASR gain mapping P-gain 1, 2nd-motor	0.0 to 1000.0	0.1%	100.0
HA226	Yes	ASR gain mapping I-gain 1, 2nd-motor		0.1%	100.0
HA227	Yes	ASR gain mapping P-gain 1 at P-control, 2nd-motor		0.1%	100.0
HA228	Yes	ASR gain mapping P-gain 2, 2nd-motor		0.1%	100.0
HA229	Yes	ASR gain mapping I-gain 2, 2nd-motor		0.1%	100.0
HA230	Yes	ASR gain mapping P-gain 2 at P-control, 2nd-motor		0.1%	100.0
HA231	Yes	ASR gain mapping P-gain 3, 2nd-motor		0.1%	100.0
HA232	Yes	ASR gain mapping I-gain 3, 2nd-motor		0.1%	100.0
HA233	Yes	ASR gain mapping P-gain 4, 2nd-motor		0.1%	100.0
HA234	Yes	ASR gain mapping I-gain 4, 2nd-motor		0.1%	100.0

Code	Change during operation	Name	Data range	Unit	Default
Hb102	-	Async.Motor capacity setting, 1st-motor	0.01 to 160.00	0.01 kW	Varies depending on inverter models and settings of load rating.
Hb103	-	Async.Motor poles setting, 1st-motor	2 to 48	1 Pole	4
Hb104	-	Async.Motor Base frequency setting, 1st-motor	10.00 to 590.00	0.01 Hz	50.00*1
Hb105	-	Async.Motor Maximum frequency setting, 1st-motor	10.00 to 590.00	0.01 Hz	50.00*1
Hb106	-	Async.Motor rated voltage, 1st-motor	1 to 1000	1 V	200 V: 230 400 V: 400 *1
Hb108	-	Async.Motor rated current, 1st-motor	0.01 to 10000.00	0.01 A	Varies depending on inverter models and settings of load rating.
Hb110	-	Async.Motor constant R1, 1st-motor	0.000001 to 1000.000000	0.000001Ω	Varies depending on inverter models and settings of load rating.
Hb112	-	Async.Motor constant R2, 1st-motor	0.000001 to 1000.000000	0.000001Ω	Varies depending on inverter models and settings of load rating.

Code	Change during operation	Name	Data range	Unit	Default
Hb114	-	Async.Motor constant L, 1st-motor	0.000001 to 1000.000000	0.000001 mH	Varies depending on inverter models and settings of load rating.
Hb116	-	Async.Motor constant Io, 1st-motor	0.01 to 10000.00	0.01 A	Varies depending on inverter models and settings of load rating.
Hb118	-	Async.Motor constant J, 1st-motor	0.00001 to 10000.00000	0.00001 kg·m^2	Varies depending on inverter models and settings of load rating.
Hb130	-	Minimum frequency adjustment, 1st-motor	0.10 to 10.00	0.01 Hz	0.50
Hb131	Yes	Reduced voltage start time setting, 1st-motor	0 to 2000	1 ms	36
Hb140	-	Manual torque boost operational mode selection, 1st-motor	00: Disabled 01: Always enabled 02: Enabled only for forward revolution 03: Enabled only for reverse revolution	-	01
Hb141	Yes	Manual torque boost value, 1st-motor	0.0 to 20.0	0.1%	0.0
Hb142	Yes	Manual torque boost Peak speed, 1st-motor	0.0 to 50.0	0.1%	0.0
Hb145	-	Eco drive enable, 1st-motor	00: Disabled 01: Enabled	-	00
Hb146	Yes	Eco drive response adjustment, 1st-motor	0 to 100	1%	50
Hb150	-	Free-V / f frequency 1 setting, 1st-motor	0.00 to **Free-V / f frequency 2 setting, 1st-motor** (Hb152)	0.01 Hz	0.00

Code	Change during operation	Name	Data range	Unit	Default
Hb151	-	Free-V / f Voltage 1 setting, 1st-motor	0.0 to 1000.0	0.1 V	0.0
Hb152	-	Free-V / f frequency 2 setting, 1st-motor	**Free-V / f frequency 1 setting, 1st-motor** (Hb150) to **Free-V / f frequency 3 setting, 1st-motor** (Hb154)	0.01 Hz	0.00
Hb153	-	Free-V / f Voltage 2 setting, 1st-motor	0.0 to 1000.0	0.1 V	0.0
Hb154	-	Free-V / f frequency 3 setting, 1st-motor	**Free-V / f frequency 2 setting, 1st-motor** (Hb152) to **Free-V / f frequency 4 setting, 1st-motor**(Hb156)	0.01 Hz	0.00
Hb155	-	Free-V / f Voltage 3 setting, 1st-motor	0.0 to 1000.0	0.1 V	0.0
Hb156	-	Free-V / f frequency 4 setting, 1st-motor	**Free-V / f frequency 3 setting, 1st-motor** (Hb154) to **Free-V / f frequency 5 setting, 1st-motor** (Hb158)	0.01 Hz	0.00
Hb157	-	Free-V / f Voltage 4 setting, 1st-motor	0.0 to 1000.0	0.1 V	0.0
Hb158	-	Free-V / f frequency 5 setting, 1st-motor	**Free-V / f frequency 4 setting, 1st-motor** (Hb156) to **Free-V / f frequency 6 setting, 1st-motor** (Hb160)	0.01 Hz	0.00
Hb159	-	Free-V / f Voltage 5 setting, 1st-motor	0.0 to 1000.0	0.1 V	0.0
Hb160	-	Free-V / f frequency 6 setting, 1st-motor	**Free-V / f frequency 5 setting, 1st-motor** (Hb158) to **Free-V / f frequency 7 setting, 1st-motor** (Hb162)	0.01 Hz	0.00
Hb161	-	Free-V / f Voltage 6 setting, 1st-motor	0.0 to 1000.0	0.1 V	0.0
Hb162	-	Free-V / f frequency 7 setting, 1st-motor	**Free-V / f frequency 6 setting, 1st-motor** (Hb160) to **Async.Motor Base frequency setting, 1st-motor** (Hb104)	0.01 Hz	0.00
Hb163	-	Free-V / f Voltage 7 setting, 1st-motor	0.0 to 1000.0	0.1 V	0.0
Hb170	Yes	Slip Compensation P-gain with encoder, 1st-motor	0 to 1000	1%	100
Hb171	Yes	Slip Compensation I-gain with encoder, 1st-motor	0 to 1000	1%	100
Hb180	Yes	Output voltage gain, 1st-motor	0 to 255	1%	100

Code	Change during operation	Name	Data range	Unit	Default
Hb202	-	Async.Motor capacity setting, 2nd-motor	0.01 to 160.00	0.01 kW	Varies depending on inverter models and settings of load rating.
Hb203	-	Async.Motor poles setting, 2nd-motor	2 to 48	1	4
Hb204	-	Async.Motor Base frequency setting, 2nd-motor	10.00 to 590.00	0.01 Hz	50.00*1
Hb205	-	Async.Motor Maximum frequency setting, 2nd-motor	10.00 to 590.00	0.01 Hz	50.00*1
Hb206	-	Async.Motor rated voltage, 2nd-motor	1 to 1000	1 V	200V: 230 400V: 400 *1
Hb208	-	Async.Motor rated current, 2nd-motor	0.01 to 10000.00	0.01 A	Varies depending on inverter models and settings of load rating.
Hb210	-	Async.Motor constant R1, 2nd-motor	0.000001 to 1000.000000	0.000001Ω	Varies depending on inverter models and settings of load rating.
Hb212	-	Async.Motor constant R2, 2nd-motor	0.000001 to 1000.000000	0.000001Ω	Varies depending on inverter models and settings of load rating.

Code	Change during operation	Name	Data range	Unit	Default
Hb214	-	Async.Motor constant L, 2nd-motor	0.000001 to 1000.000000	0.000001 mH	Varies depending on inverter models and settings of load rating.
Hb216	-	Async.Motor constant Io, 2nd-motor	0.01 to 10000.00	0.01 A	Varies depending on inverter models and settings of load rating.
Hb218	-	Async.Motor constant J, 2nd-motor	0.00001 to 10000.00000	0.00001 $kg \cdot m^2$	Varies depending on inverter models and settings of load rating.
Hb230	-	Minimum frequency adjustment, 2nd-motor	0.10 to 10.00	0.01 Hz	0.50
Hb231	Yes	Reduced voltage start time setting, 2nd-motor	0 to 2000	1 ms	36
Hb240	-	Manual torque boost operational mode selection, 2nd-motor	00: Disabled 01: Always enabled 02: Enabled only for forward revolution 03: Enabled only for reverse revolution	-	01
Hb241	Yes	Manual torque boost value, 2nd-motor	0.0 to 20.0	0.1%	0.0
Hb242	Yes	Manual torque boost Peak speed, 2nd-motor	0.0 to 50.0	0.1%	0.0
	-	Eco drive enable, 2nd-motor	00: Disabled 01: Enabled	-	00
Hb246	Yes	Eco drive response adjustment, 2nd-motor	0 to 100	1%	50
Hb250	-	Free-V / f frequency 1 setting, 2nd-motor	0.00 to **Free-V / f frequency 2 setting, 2nd-motor** (Hb252)	0.01 Hz	0.00

Code	Change during operation	Name	Data range	Unit	Default
Hb251	-	Free-V / f Voltage 1 setting, 2nd-motor	0.0 to 1000.0	0.1 V	0.0
Hb252	-	Free-V / f frequency 2 setting, 2nd-motor	**Free-V / f frequency 1 setting, 2nd-motor** (Hb250) to **Free-V / f frequency 3 setting, 2nd-motor** (Hb254)	0.01 Hz	0.00
Hb253	-	Free-V / f Voltage 2 setting, 2nd-motor	0.0 to 1000.0	0.1 V	0.0
Hb254	-	Free-V / f frequency 3 setting, 2nd-motor	**Free-V / f frequency 2 setting, 2nd-motor** (Hb252) to **Free-V / f frequency 4 setting, 2nd-motor** (Hb256)	0.01 Hz	0.00
Hb255	-	Free-V / f Voltage 3 setting, 2nd-motor	0.0 to 1000.0	0.1 V	0.0
Hb256	-	Free-V / f frequency 4 setting, 2nd-motor	**Free-V / f frequency 3 setting, 2nd-motor** (Hb254) to **Free-V / f frequency 5 setting, 2nd-motor** (Hb258)	0.01 Hz	0.00
Hb257	-	Free-V / f Voltage 4 setting, 2nd-motor	0.0 to 1000.0	0.1 V	0.0
Hb258	-	Free-V / f frequency 5 setting, 2nd-motor	**Free-V / f frequency 4 setting, 2nd-motor** (Hb256) to **Free-V / f frequency 6 setting, 2nd-motor** (Hb260)	0.01 Hz	0.00
Hb259	-	Free-V / f Voltage 5 setting, 2nd-motor	0.0 to 1000.0	0.1 V	0.0
Hb260	-	Free-V / f frequency 6 setting, 2nd-motor	**Free-V / f frequency 5 setting, 2nd-motor** (Hb258) to **Free-V / f frequency 7 setting, 2nd-motor** (Hb262)	0.01 Hz	0.00
Hb261	-	Free-V / f Voltage 6 setting, 2nd-motor	0.0 to 1000.0	0.1 V	0.0
Hb262	-	Free-V / f frequency 7 setting, 2nd-motor	**Free-V / f frequency 6 setting, 2nd-motor** (Hb260) to **Async.Motor Base frequency setting, 2nd-motor** (Hb204)	0.01 Hz	0.00
Hb263	-	Free-V / f Voltage 7 setting, 2nd-motor	0.0 to 1000.0	0.1 V	0.0
Hb270	Yes	Slip Compensation P-gain with encoder, 2nd-motor	0 to 1000	1%	100
Hb271	Yes	Slip Compensation I-gain with encoder, 2nd-motor	0 to 1000	1%	100
Hb280	Yes	Output voltage gain, 2nd-motor (V / f)	0 to 255	1%	100

*1. The default when **Initialize Data selection** (Ub-02) is set to *01: Mode 1*.

Code	Change during operation	Name	Data range	Unit	Default
HC101	Yes	Automatic torque boost voltage compensation gain, 1st-motor	0 to 255	1%	100
HC102	Yes	Automatic torque boost slip compensation gain, 1st-motor	0 to 255	1%	100
HC110	Yes	Zero speed area limit for Async.M-0SLV, 1st-motor	0 to 100	1%	80
HC111	Yes	Boost value at start for Async.M-SLV/IM-CLV, 1st-motor	0 to 50	1%	0
HC112	Yes	Boost value at start for Async.M-0SLV, 1st-motor	0 to 50	1%	10
HC113	-	Secondary resistance correction,1st-motor (IM-SLV, IM-0Hz-SLV, IM-CLV)	00: Disabled 01: Enabled	-	00
HC114	Yes	Counter direction run protection selection, 1st-motor (IM-SLV, IM-0Hz-SLV, IM-CLV)	00: Disabled 01: Enabled	-	00
HC120	Yes	Torque current reference filter time constant, 1stmotor (IM- SLV, IM-0Hz-SLV, IM-CLV, SM-CLV)	0 to 100	1 ms	2
HC121	Yes	Speed feedforward compensation gain, 1st-motor (IM-SLV, IM-0Hz-SLV, IM-CLV, SM-CLV)	0 to 1000	1%	0
HC201	Yes	Automatic torque boost voltage compensation gain, 2nd-motor	0 to 255	1%	100
HC202	Yes	Automatic torque boost slip compensation gain, 2nd-motor	0 to 255	1%	100
HC210	Yes	Zero speed area limit for Async.M-0SLV, 2nd-motor	0 to 100	1%	80
HC211	Yes	Boost value at start for Async.M-SLV/IM-CLV, 2nd-motor	0 to 50	1%	0
HC212	Yes	Boost value at start for Async.M-0SLV, 2nd-motor	0 to 50	1%	10
HC213	-	Secondary resistance correction, 2nd-motor (IM-SLV, IM-0Hz-SLV, IM-CLV)	00: Disabled 01: Enabled	-	00

Code	Change during operation	Name	Data range	Unit	Default
HC214	Yes	Counter direction run protection selection, 2nd-motor (IM-SLV, IM-0Hz-SLV, IM-CLV)	00: Disabled 01: Enabled	-	00
HC220	Yes	Torque current reference filter time constant, 2ndmotor (IM-SLV, IM-0Hz-SLV, IM-CLV, SM-CLV)	0 to 100	1 ms	2
HC221	Yes	Speed feedforward compensation gain, 2nd-motor (IM-SLV, IM-0Hz-SLV, IM-CLV, SM-CLV)	0 to 1000	1%	0

Code	Change during operation	Name	Data range	Unit	Default
Hd102	-	Sync.Motor capacity setting, 1st-motor	0.01 to 160.00	0.01 kW	Varies depending on inverter models and settings of load rating.
Hd103	-	Sync.Motor poles setting, 1st-motor	2 to 48	1 Pole	Varies depending on inverter models and settings of load rating.
Hd104	-	Sync.Base frequency setting, 1st-motor	10.00 to 590.00	0.01 Hz	Varies depending on inverter models and settings of load rating.
Hd105	-	Sync.Maximum frequency setting, 1st-motor	10.00 to 590.00	0.01 Hz	Varies depending on inverter models and settings of load rating.
Hd106	-	Sync.Motor rated voltage, 1st-motor	1 to 1000	1 V	Varies depending on inverter models and settings of load rating.

Code	Change during operation	Name	Data range	Unit	Default
Hd108	-	Sync.Motor rated current, 1st-motor	0.01 to 10000.00	0.01 A	Varies depending on inverter models and settings of load rating.
Hd110	-	Sync.Motor constant R, 1st-motor	0.000001 to 1000.000000	0.000001Ω	Varies depending on inverter models and settings of load rating.
Hd112	-	Sync.Motor constant Ld, 1st-motor	0.000001 to 1000.000000	0.000001 mH	Varies depending on inverter models and settings of load rating.
Hd114	-	Sync.Motor constant Lq, 1st-motor	0.000001 to 1000.000000	0.000001 mH	Varies depending on inverter models and settings of load rating.
Hd116	-	Sync.Motor constant Ke, 1st-motor	0.1 to 100000.0	0.1 mVs/rad	Varies depending on inverter models and settings of load rating.

Code	Change during operation	Name	Data range	Unit	Default
Hd118	-	Sync.Motor constant J, 1st-motor	0.00001 to 10000.00000	0.00001kg・m^2	Varies depending on inverter models and settings of load rating.
Hd130	Yes	Minimum Frequency for Sync.M-SLV, 1st-motor	0 to 50	1%	8
Hd131	Yes	No-Load current for Sync.M-SLV, 1st-motor	0 to 100	1%	10
Hd132	-	Starting Method for Sync.M, 1st-motor	00: Position estimation disabled 01: Position estimation enabled	-	00
Hd133	-	IMPE 0V wait number for Sync.M, 1st-motor	0 to 255	1	10
Hd134	-	IMPE detect wait number for Sync.M, 1st-motor	0 to 255	1	10
Hd135	-	IMPE detect number for Sync.M, 1st-motor	0 to 255	1	30
Hd136	-	IMPE voltage gain for Sync.M, 1st-motor	0 to 200	1%	100
Hd137	-	IMPE Mg-pole position offset, 1st-motor	0 to 359	1 deg	0
Hd-41	Yes	Carrier frequency at IVMS	0.5 to 16.0	0.1 kHz	2.0
Hd-42	Yes	Filter gain of current detection at IVMS	0 to 1000	1	100
Hd-43	-	Open phase voltage detection gain	00: Gain 0 01: Gain 1 02: Gain 2 03: Gain 3	-	00
Hd-44	Yes	Open phase switching threshold compensation	00: Disabled 01: Enabled	-	01
Hd-45	Yes	P-Gain for speed control, SM(PMM)-IVMS	0 to 1000	1	100
Hd-46	Yes	I-Gain for speed control, SM(PMM)-IVMS	0 to 10000	1	100
Hd-47	Yes	Wait time for open phase switching, SM(PMM)-IVMS	0 to 1000	1	15
Hd-48	Yes	Limitation of decision about the drive direction, SM(PMM)-IVMS	00: Disabled 01: Enabled	-	01
Hd-49	Yes	Open phase voltage detection timing adjustment, SM(PMM)-IVMS	0 to 1000	1	10

Code	Change during operation	Name	Data range	Unit	Default
Hd-50	Yes	Minimum pulse width adjustment, SM(PMM)-IVMS	0 to 1000	1	100
Hd-51	Yes	IVMS Current Limit for threshold	0 to 255	1	100
Hd-52	Yes	IVMS Threshold Gain	0 to 255	1	100
Hd-58	Yes	IVMS Carrier frequency start/end point	0 to 50	1%	5
Hd202	-	Sync.Motor capacity setting, 2nd-motor	0.01 to 160.00	0.01 kW	Varies depending on inverter models and settings of load rating.
Hd203	-	Sync.Motor poles setting, 2nd-motor	2 to 48	1	Varies depending on inverter models and settings of load rating.
Hd204	-	Sync.Base frequency setting, 2nd-motor	10.00 to 590.00	0.01 Hz	Varies depending on inverter models and settings of load rating.
Hd205	-	Sync.Maximum frequency setting, 2nd-motor	10.00 to 590.00	0.01 Hz	Varies depending on inverter models and settings of load rating.

Code	Change during operation	Name	Data range	Unit	Default
Hd206	-	Sync.Motor rated voltage, 2nd-motor	1 to 1000	1 V	Varies depending on inverter models and settings of load rating.
Hd208	-	Sync.Motor rated current, 2nd-motor	0.01 to 10000.00	0.01 A	Varies depending on inverter models and settings of load rating.
Hd210	-	Sync.Motor constant R, 2nd-motor	0.000001 to 1000.000000	0.000001 Ω	Varies depending on inverter models and settings of load rating.
Hd212	-	Sync.Motor constant Ld, 2nd-motor	0.000001 to 1000.000000	0.000001 mH	Varies depending on inverter models and settings of load rating.
Hd214	-	Sync.Motor constant Lq, 2nd-motor	0.000001 to 1000.000000	0.000001 mH	Varies depending on inverter models and settings of load rating.

Code	Change during operation	Name	Data range	Unit	Default
Hd216	-	Sync.Motor constant Ke, 2nd-motor	0.1 to 100000.0	0.1 mVs/rad	Varies depending on inverter models and settings of load rating.
Hd218	-	Sync.Motor constant J, 2nd-motor	0.00001 to 10000.00000	0.00001 kg・m^2	Varies depending on inverter models and settings of load rating.
Hd230	Yes	Minimum Frequency for Sync.M-SLV, 2nd-motor	0 to 50	1%	8
Hd231	Yes	No-Load current for Sync.M-SLV, 2nd-motor	0 to 100	1%	10
Hd232	-	Starting Method for Sync.M, 2nd-motor (SM-SLV, SM-IVMS, SM-CLV)	00: Position estimation disabled 01: Position estimation enabled	-	0
Hd233	-	IMPE 0V wait number for Sync.M, 2nd-motor	0 to 255	1	10
Hd234	-	IMPE detect wait number for Sync.M, 2nd-motor	0 to 255	1	10
Hd235	-	IMPE detect number for Sync.M, 2nd-motor	0 to 255	1	30
Hd236	-	IMPE voltage gain for Sync.M, 2nd-motor	0 to 200	1%	100
Hd237	-	IMPE Mg-pole position offset, 2nd-motor	0 to 359	1 deg	0

15-3-5 Parameter (Code o)

Code	Change during operation	Name	Data range	Unit	Default
oA-10	Yes	Operation mode on option card error (SLOT-1)	00: Error 01: Continue operation	-	00

Code	Change during operation	Name	Data range	Unit	Default
oA-11	Yes	Communication Watch Dog Timer	0.00 to 100.00	0.01 s	0.00
oA-12	-	Action selection at communication error	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-	01
oA-13	-	Run command enable option during the option card (SLOT-1) start-up	00: Operation command disabled 01: Operation command enabled	-	00
oA-20	Yes	Operation mode on option card error (SLOT-2)	00: Error 01: Continue operation	-	00
oA-21	Yes	Communication Watch Dog Timer	0.00 to 100.00	0.01 s	1.00
oA-22	-	Action selection at communication error	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-	01
oA-23	-	Run command enable option during the option card (SLOT-2) start-up	00: Operation command disabled 01: Operation command enabled	-	00
oA-30	Yes	Operation mode on option card error (SLOT-3)	00: Error 01: Continue operation	-	00
oA-31	Yes	Communication Watch Dog Timer	0.00 to 100.00	0.01 s	1.00
oA-32	-	Action selection at communication error	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-	01
oA-33	-	Run command enable option during the option card (SLOT-3) start-up	00: Operation command disabled 01: Operation command enabled	-	00

Code	Change during operation	Name	Data range	Unit	Default
ob-01	-	Encoder constant setting (Option)	32 to 65535	1 pls	1024
ob-02	-	Encoder position selection (Option)	00: Phase-A is leading 01: Phase-B is leading	-	00
ob-03	-	Motor gear ratio Numerator (Option)	1 to 10000	1	1
ob-04	-	Motor gear ratio Denominator (Option)	1 to 10000	1	1
ob-10	-	Pulse train detection (option) terminal	00: Command 01: Pulse string position command	-	00
ob-11	-	Mode selection of pulse train input	00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string	-	01
ob-12	Yes	Pulse train frequency Scale	0.05 to 200.00	0.01 kHz	25
ob-13	Yes	Pulse train frequency Filter time constant	0.01 to 2.00	0.01 s	0.1
ob-14	Yes	Pulse train frequency Bias value	-100.0 to 100.0	0.1%	0.0
ob-15	Yes	Pulse train frequency High Limit	0.0 to 100.0	0.1%	100.0
ob-16	Yes	Pulse train frequency detection low level	0.0 to 100.0	0.1%	0.0

Code	Change during operation	Name	Data range	Unit	Default
oC-01 to oC-28	-	Reserved	-	-	-
oE-01 to oE-70	-	Reserved	-	-	-
oH-01 to oH-34	-	Reserved	-	-	-
oJ-01 to oJ-60	-	Reserved	-	-	-
oL-01 to oL-76	-	Reserved	-	-	-

15-3-6 Parameter (Code P)

Code	Change during operation	Name	Data range	Unit	Default
PA-01	-	Mode selection for Emergency-force drive	00: Disabled 01: Enabled	-	00
PA-02	-	Frequency reference setting at Emergency-force drive	0.00 to 590.00	0.01 Hz	0.00
PA-03	-	Direction command at Emergency-force drive	00: Normal rotation 01: Reverse rotation	-	00
PA-04	-	Commercial power supply bypass function selection	00: Disabled 01: Enabled	-	00
PA-05	-	Delay time of Bypass function	0.0 to 1000.0	0.1 s	5.0
PA-20	-	Simulation mode enable	00: Disabled 01: Enabled	-	00
PA-21	-	Error code selection for Alarm test	0 to 255	1	0

Code	Change during operation	Name	Data range	Unit	Default
PA-22	Yes	Output current monitor optional output enable	00: Disabled 01: Enabled: parameter setting (PA-23) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-	01
PA-23	Yes	Output current monitor optional output value setting	(0.0 to 3.0) × Inverter rated current*1	0.1 A	0.0
PA-24	Yes	DC-bus voltage monitor optional output enable	00: Disabled 01: Enabled: parameter setting (PA-25) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-	01
PA-25	Yes	DC-bus voltage monitor optional value output	200 V class: 0.0 to 450.0 400 V class: 0.0 to 900.0	0.1 VDC	200 V class: 270.0 400 V class: 540.0
PA-26	Yes	Output voltage monitor optional output enable	00: Disabled 01: Enabled: parameter setting (PA-27) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-	01
PA-27	Yes	Output voltage monitor optional output value setting	200V class: 0.0 to 300.0 400V class: 0.0 to 600.0	0.1 V	0.0
PA-28	Yes	Output torque monitor optional output enable	00: Disabled 01: Enabled: parameter setting (PA-29) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-	01
PA-29	Yes	Output torque monitor optional output value setting	-500.0 to 500.0	0.1%	0.0

Code	Change during operation	Name	Data range	Unit	Default
PA-30	Yes	Start with frequency matching optional Setting enable	00: Disabled 01: Enabled: parameter setting (PA-31) 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-	01
PA-31	Yes	Start with frequency matching optional value setting	0.00 to 590.00	0.01 Hz	0.00

*1. For the current and voltage related parameters, the values and units that can be used will differ depending on the setting method.

1. Operator or CX-Drive: 0.1 A or 0.1 V (When you operate with CX-Drive, set **Resister data selection** (CF-11) to *00: A, V*. When **Resister data selection** (CF-11) is not set to *00: A, V*, the data cannot be set or displayed correctly.)
2. Modbus: The current and the voltage vary depending on the setting of **Resister data selection** (CF-11). When **Resister data selection** (CF-11) is set to *00: A,V*, units are 0.1A and 0.1V When **Resister data selection** (CF-11) is set to *01: %*, unit is 0.01% (Rated ratio)
3. DriveProgramming: 0.01% (Rated ratio)

15-3-7 Parameter (Code U)

Code	Change during operation	Name	Data range	Unit	Default
UA-01	-	Password input for display selection	-	-	0
UA-02	-	Soft-lock password input	-	-	0
UA-10	-	Display restriction selection	00: Full display 01: By function 02: User setting 03: Data comparison display 04: Only monitor display	-	00
UA-12	Yes	Accumulation input power monitor clear	00: Disabled 01: Clear	-	00
UA-13	Yes	Display gain for Accumulation input power monitor	1 to 1000	1	1
UA-14	Yes	Accumulation output power monitor clear	00: Disabled 01: Clear	-	00
UA-15	Yes	Display gain for Accumulation output power monitor	1 to 1000	1	1

Code	Change during operation	Name	Data range	Unit	Default
UA-16	Yes	Soft Lock selection	00: [SFT] terminal 01: Always enabled	-	00
UA-17	Yes	Soft Lock target selection	00: All data cannot be changed 01: Data other than set frequency cannot be changed	-	00
UA-18	-	Data R/W selection	00: R/W enabled 01: R/W disabled	-	00
UA-19	-	Low battery warning enable	00: Disabled 01: Warning 02: Error	-	00
UA-20	-	Action selection at Keypad disconnection	00: Error 01: Error after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-	02
UA-21	-	2nd-motor parameter display selection	00: Not display 01: Display	-	01
UA-22	-	Option parameter display selection	00: Not display 01: Display	-	01
UA-30	-	User parameter auto setting function enable	00: Disabled 01: Enabled	-	00
UA-31	Yes	User parameter 1 selection	no/***** (select a parameter)	1	no
UA-32	Yes	User parameter 2 selection		1	no
UA-33	Yes	User parameter 3 selection		1	no
UA-34	Yes	User parameter 4 selection		1	no
UA-35	Yes	User parameter 5 selection		1	no
UA-36	Yes	User parameter 6 selection		1	no
UA-37	Yes	User parameter 7 selection		1	no
UA-38	Yes	User parameter 8 selection		1	no
UA-39	Yes	User parameter 9 selection		1	no
UA-40	Yes	User parameter 10 selection		1	no

Code	Change during operation	Name	Data range	Unit	Default
UA-41	Yes	User parameter 11 selection	no/***** (select a parameter)	1	no
UA-42	Yes	User parameter 12 selection		1	no
UA-43	Yes	User parameter 13 selection		1	no
UA-44	Yes	User parameter 14 selection		1	no
UA-45	Yes	User parameter 15 selection		1	no
UA-46	Yes	User parameter 16 selection		1	no
UA-47	Yes	User parameter 17 selection		1	no
UA-48	Yes	User parameter 18 selection		1	no
UA-49	Yes	User parameter 19 selection		1	no
UA-50	Yes	User parameter 20 selection		1	no
UA-51	Yes	User parameter 21 selection	no/***** (select a parameter)	1	no
UA-52	Yes	User parameter 22 selection		1	no
UA-53	Yes	User parameter 23 selection		1	no
UA-54	Yes	User parameter 24 selection		1	no
UA-55	Yes	User parameter 25 selection		1	no
UA-56	Yes	User parameter 26 selection		1	no
UA-57	Yes	User parameter 27 selection		1	no
UA-58	Yes	User parameter 28 selection		1	no
UA-59	Yes	User parameter 29 selection		1	no
UA-60	Yes	User parameter 30 selection		1	no
UA-61	Yes	User parameter 31 selection	no/***** (select a parameter)	1	no
UA-62	Yes	User parameter 32 selection		1	no
UA-90 to UA-94	-	Reserved	-	-	-

Code	Change during operation	Name	Data range	Unit	Default
Ub-01	-	Initialize Mode selection	00: Disabled 01: Trip history 02: Parameter initialization 03: Trip history + parameters 04: Trip history + parameters + DriveProgramming 05: Other than terminal function 06: Other than communication function 07: Other than terminal & communication functions 08: Only DriveProgramming	-	00
Ub-02	-	Initialize Data selection	00: Mode 0 01: Mode 1 02: Mode 2 03: Mode 3	-	01
Ub-03	-	Load type selection	00: VLD 01: LD 02: ND	-	02
Ub-05	-	Initialize Enable	00: Disabled 01: Start initialization	-	00

Code	Change during operation	Name	Data range	Unit	Default
UC-01	Yes	Debug mode enable	(do not change)	1	0

Code	Change during operation	Name	Data range	Unit	Default
Ud-01 to Ud-60	-	Reserved	-	-	-

Code	Change during operation	Name	Data range	Unit	Default
UE-01	-	EzSQ operation cycle	00: 1ms 01: 2ms	-	00
UE-02	Yes	EzSQ function enable	00: Disabled 01: [PRG] terminal 02: Always	-	00
UE-10	Yes	EzSQ user parameter U (00)	0 to 65535	1	0
UE-11	Yes	EzSQ user parameter U (01)	0 to 65535	1	0
UE-12	Yes	EzSQ user parameter U (02)	0 to 65535	1	0
UE-13	Yes	EzSQ user parameter U (03)	0 to 65535	1	0
UE-14	Yes	EzSQ user parameter U (04)	0 to 65535	1	0
UE-15	Yes	EzSQ user parameter U (05)	0 to 65535	1	0
UE-16	Yes	EzSQ user parameter U (06)	0 to 65535	1	0
UE-17	Yes	EzSQ user parameter U (07)	0 to 65535	1	0
UE-18	Yes	EzSQ user parameter U (08)	0 to 65535	1	0
UE-19	Yes	EzSQ user parameter U (09)	0 to 65535	1	0
UE-20	Yes	EzSQ user parameter U (10)	0 to 65535	1	0
UE-21	Yes	EzSQ user parameter U (11)	0 to 65535	1	0
UE-22	Yes	EzSQ user parameter U (12)	0 to 65535	1	0
UE-23	Yes	EzSQ user parameter U (13)	0 to 65535	1	0
UE-24	Yes	EzSQ user parameter U (14)	0 to 65535	1	0
UE-25	Yes	EzSQ user parameter U (15)	0 to 65535	1	0
UE-26	Yes	EzSQ user parameter U (16)	0 to 65535	1	0
UE-27	Yes	EzSQ user parameter U (17)	0 to 65535	1	0
UE-28	Yes	EzSQ user parameter U (18)	0 to 65535	1	0
UE-29	Yes	EzSQ user parameter U (19)	0 to 65535	1	0
UE-30	Yes	EzSQ user parameter U (20)	0 to 65535	1	0
UE-31	Yes	EzSQ user parameter U (21)	0 to 65535	1	0
UE-32	Yes	EzSQ user parameter U (22)	0 to 65535	1	0
UE-33	Yes	EzSQ user parameter U (23)	0 to 65535	1	0
UE-34	Yes	EzSQ user parameter U (24)	0 to 65535	1	0
UE-35	Yes	EzSQ user parameter U (25)	0 to 65535	1	0
UE-36	Yes	EzSQ user parameter U (26)	0 to 65535	1	0
UE-37	Yes	EzSQ user parameter U (27)	0 to 65535	1	0
UE-38	Yes	EzSQ user parameter U (28)	0 to 65535	1	0
UE-39	Yes	EzSQ user parameter U (29)	0 to 65535	1	0
UE-40	Yes	EzSQ user parameter U (30)	0 to 65535	1	0
UE-41	Yes	EzSQ user parameter U (31)	0 to 65535	1	0
UE-42	Yes	EzSQ user parameter U (32)	0 to 65535	1	0
UE-43	Yes	EzSQ user parameter U (33)	0 to 65535	1	0
UE-44	Yes	EzSQ user parameter U (34)	0 to 65535	1	0
UE-45	Yes	EzSQ user parameter U (35)	0 to 65535	1	0
UE-46	Yes	EzSQ user parameter U (36)	0 to 65535	1	0
UE-47	Yes	EzSQ user parameter U (37)	0 to 65535	1	0
UE-48	Yes	EzSQ user parameter U (38)	0 to 65535	1	0

Code	Change during operation	Name	Data range	Unit	Default
UE-49	Yes	EzSQ user parameter U (39)	0 to 65535	1	0
UE-50	Yes	EzSQ user parameter U (40)	0 to 65535	1	0
UE-51	Yes	EzSQ user parameter U (41)	0 to 65535	1	0
UE-52	Yes	EzSQ user parameter U (42)	0 to 65535	1	0
UE-53	Yes	EzSQ user parameter U (43)	0 to 65535	1	0
UE-54	Yes	EzSQ user parameter U (44)	0 to 65535	1	0
UE-55	Yes	EzSQ user parameter U (45)	0 to 65535	1	0
UE-56	Yes	EzSQ user parameter U (46)	0 to 65535	1	0
UE-57	Yes	EzSQ user parameter U (47)	0 to 65535	1	0
UE-58	Yes	EzSQ user parameter U (48)	0 to 65535	1	0
UE-59	Yes	EzSQ user parameter U (49)	0 to 65535	1	0
UE-60	Yes	EzSQ user parameter U (50)	0 to 65535	1	0
UE-61	Yes	EzSQ user parameter U (51)	0 to 65535	1	0
UE-62	Yes	EzSQ user parameter U (52)	0 to 65535	1	0
UE-63	Yes	EzSQ user parameter U (53)	0 to 65535	1	0
UE-64	Yes	EzSQ user parameter U (54)	0 to 65535	1	0
UE-65	Yes	EzSQ user parameter U (55)	0 to 65535	1	0
UE-66	Yes	EzSQ user parameter U (56)	0 to 65535	1	0
UE-67	Yes	EzSQ user parameter U (57)	0 to 65535	1	0
UE-68	Yes	EzSQ user parameter U (58)	0 to 65535	1	0
UE-69	Yes	EzSQ user parameter U (59)	0 to 65535	1	0
UE-70	Yes	EzSQ user parameter U (60)	0 to 65535	1	0
UE-71	Yes	EzSQ user parameter U (61)	0 to 65535	1	0
UE-72	Yes	EzSQ user parameter U (62)	0 to 65535	1	0
UE-73	Yes	EzSQ user parameter U (63)	0 to 65535	1	0

Code	Change during operation	Name	Data range	Unit	Default
UF-02	Yes	EzSQ user parameter UL (00)	-2147483647 to 2147483647	1	0
UF-04	Yes	EzSQ user parameter UL (01)		1	0
UF-06	Yes	EzSQ user parameter UL (02)		1	0
UF-08	Yes	EzSQ user parameter UL (03)		1	0
UF-10	Yes	EzSQ user parameter UL (04)		1	0
UF-12	Yes	EzSQ user parameter UL (05)		1	0
UF-14	Yes	EzSQ user parameter UL (06)		1	0
UF-16	Yes	EzSQ user parameter UL (07)		1	0
UF-18	Yes	EzSQ user parameter UL (08)		1	0
UF-20	Yes	EzSQ user parameter UL (09)		1	0
UF-22	Yes	EzSQ user parameter UL (10)		1	0
UF-24	Yes	EzSQ user parameter UL (11)		1	0
UF-26	Yes	EzSQ user parameter UL (12)		1	0
UF-28	Yes	EzSQ user parameter UL (13)		1	0
UF-30	Yes	EzSQ user parameter UL (14)		1	0
UF-32	Yes	EzSQ user parameter UL (15)		1	0

Unit Options

No.	Unit	No.	Unit
00	non	31	cm
01	%	32	°F
02	A	33	l/s
03	Hz	34	l/min
04	V	35	l/h
05	kW	36	m^3/s
06	W	37	m^3/min
07	hr	38	m^3/h

08	s	39	kg/s
09	kHz	40	kg/min
10	ohm	41	kg/h
11	mA	42	t/min
12	ms	43	t/h
13	P	44	gal/s
14	kgm^2	45	gal/min
15	pls	46	gal/h
16	mH	47	ft^3/s
17	Vdc	48	ft^3/min
18	°C	49	ft^3/h
19	kWh	50	lb/s
20	mF	51	lb/min
21	mVs/rad	52	lb/h
22	Nm	53	mbar
23	min^{-1}	54	bar
24	m/s	55	Pa
25	m/min	56	kPa
26	m/h	57	PSI
27	ft/s	58	mm
28	ft/min	-	-
29	ft/h	-	-
30	m	-	-

A

Appendix

A

A-1 Overview of Inverter Selection

A-1-1 Motor Capacity Selection

Before selecting an inverter, first select a motor.
In selecting the motor, calculate the load inertia appropriate to the application, and then calculate the required capacity and torque.

Simplified Selection Method (Required Output Calculation)

This method of calculation helps you select a motor by calculating the output (kW) required by the motor to maintain its steady rotations. To use this method for motor selection, make allowance for the calculated result because it does not include acceleration/deceleration and other transient state calculations.
Simplified selection is suitable for applications that continue to be in a constant state, such as fans, conveyors, and mixers.

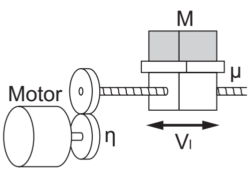
Additional Information

Simplified selection cannot be used for the following applications. For these applications, use the detailed selection method.

- Those requiring rapid startup (acceleration).
- Those that frequently repeat run and stop.
- Those that have a large inertia at power transfer.
- Those that have an inefficient power transfer part.

● For Linear Motion

Steady power P_0 (kW) is calculated as follows.



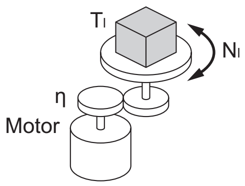
$$P0\,[\text{kW}] = \frac{\mu \cdot Mg \cdot V_l}{60 \cdot \eta} \times 10^{-3}$$

μ : Friction coefficient
M : Mass of linear motion part [kg]
g : Acceleration of gravity (g ≈ 9.8 [m/s^2])
V_l : Speed of linear motion part [m/min]
η : Efficiency of transfer part (η ≤ 1)

Note The same calculation formula is also applicable for belt conveyors.

● For Rotation Motion

Steady power P_0 (kW) is calculated as follows.



$$P0\,[\text{kW}] = \frac{2\pi \cdot T_l \cdot N_l}{60 \cdot \eta} \times 10^{-3}$$

T_l : Load torque (Load shaft) [N·m]
N_l : Rotation speed of load shaft [r/min]
η : Efficiency of transfer part (η ≤ 1)

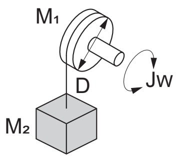
Detailed Selection Method (RMS Calculation)

This method helps you select a motor by calculating the effective torque and maximum torque values required to achieve a certain pattern of operation for the application. You can select the optimal motor for a particular operation pattern.

● Calculation of Load Inertia and Motor-shaft Conversion Inertia

According to the type of power transmission system, the inertia of all parts is calculated and converted to the inertia of the motor shaft.

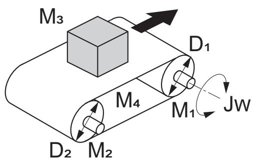
- Hoist application example



$$
\begin{aligned}
Jw\ [kg{\cdot}m^2] &= J_1 + J_2 \\
&= \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4} \right) \times 10^{-6}
\end{aligned}
$$

Jw : Shaft conversion inertia [kg·m^2]
J_1 : Inertia of cylinder (Shaft conversion) [kg·m^2]
J_2 : Inertia of workpiece (Shaft conversion) [kg·m^2]
M_1 : Mass of cylinder [kg]
M_2 : Mass of workpiece [kg]
D : Diameter of cylinder [mm]

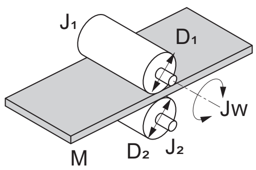
- Conveyor application example



$$
\begin{aligned}
Jw\ [kg{\cdot}m^2] &= J_1 + J_2 + J_3 + J_4 \\
&= \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} \cdot \frac{D_1^2}{D_2^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4} \right) \times 10^{-6}
\end{aligned}
$$

Jw : Shaft conversion inertia (Cylinder-1-shaft conversion) [kg·m^2]
J_1 : Inertia of cylinder 1 (Cylinder-1-shaft conversion) [kg·m^2]
J_2 : Inertia of cylinder 2 (Cylinder-1-shaft conversion) [kg·m^2]
J_3 : Inertia of workpiece (Cylinder-1-shaft conversion) [kg·m^2]
J_4 : Inertia of belt (Cylinder-1-shaft conversion) [kg·m^2]
M_1 : Mass of cylinder 1 [kg]
M_2 : Mass of cylinder 2 [kg]
M_3 : Mass of workpiece [kg]
M_4 : Mass of belt [kg]
D_1 : Diameter of cylinder 1 [mm]
D_2 : Diameter of cylinder 2 [mm]

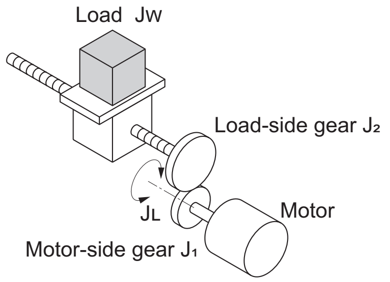
- Roller application example



$$
Jw\ [kg{\cdot}m^2] = J_1 + \left(\frac{D_1^2}{D_2^2} \right) J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6}
$$

Jw : Shaft conversion inertia (Roller-1-shaft conversion) [kg·m^2]
J_1 : Inertia of roller 1 (Roller-1-shaft conversion) [kg·m^2]
J_2 : Inertia of roller 2 (Roller-2-shaft conversion) [kg·m^2]
M : Mass of workpiece [kg]
D_1 : Diameter of roller 1 [mm]
D_2 : Diameter of roller 2 [mm]

- Example of conversion into motor-shaft inertia



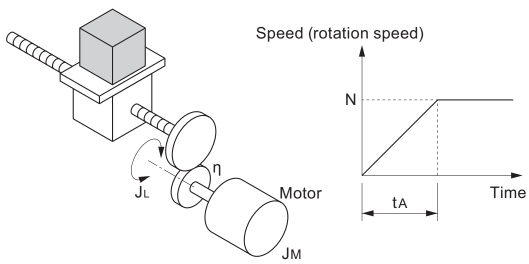
$$J_L\,[\mathrm{kg \cdot m^2}] = J_1 + G^2 (J_2 + J_W)$$

J_L : Motor-shaft conversion inertia [$\mathrm{kg \cdot m^2}$]
J_W : Load inertia (Load-side gear-shaft conversion) [$\mathrm{kg \cdot m^2}$]
J_1 : Inertia of motor-side gear [$\mathrm{kg \cdot m^2}$]
J_2 : Inertia of load-side gear [$\mathrm{kg \cdot m^2}$]
Z_1 : Number of motor-side gear teeth
Z_2 : Number of load-side gear teeth
G : Gear ratio (Speed reduction ratio) = Z_1 / Z_2

● Calculation of Motor-shaft Conversion Torque and Effective Torque

Calculate the acceleration torque from the motor-shaft conversion load inertia, the motor-rotor inertia, and the acceleration. In addition, the load torque is calculated from the external force (gravity and tensile force) and frictional force applied to the load.
These are combined to calculate the torque required for the motor.

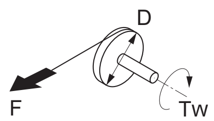
- Calculation of acceleration torque (T_A)



$$T_A[\mathrm{N \cdot m}] = \frac{2\pi \cdot N}{60 \cdot t_A}\left(J_M + \frac{J_L}{\eta}\right)$$

T_A : Acceleration torque [$\mathrm{N \cdot m}$]
J_L : Motor-shaft conversion load inertia [$\mathrm{kg \cdot m^2}$]
J_M : Motor-rotor inertia [$\mathrm{kg \cdot m^2}$]
η : Efficiency of transfer part ($\eta \leqq 1$)
t_A : Acceleration time [s]
N : Motor rotation speed [r/min]

- Calculation of motor-shaft conversion load torque (T_L)

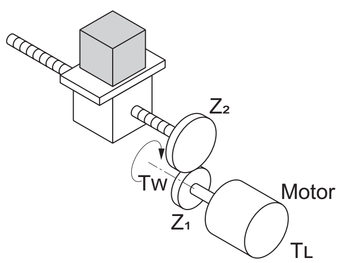


$$T_W\,[\mathrm{N \cdot m}] = F \cdot \frac{D}{2} \times 10^{-3}$$

T_W : Load torque (Load-shaft conversion) [$\mathrm{N \cdot m}$]
F : External force [N]
D : Diameter of cylinder [mm]

Generally, the friction force can be calculated as:
$F = \mu Mg$ [N], where

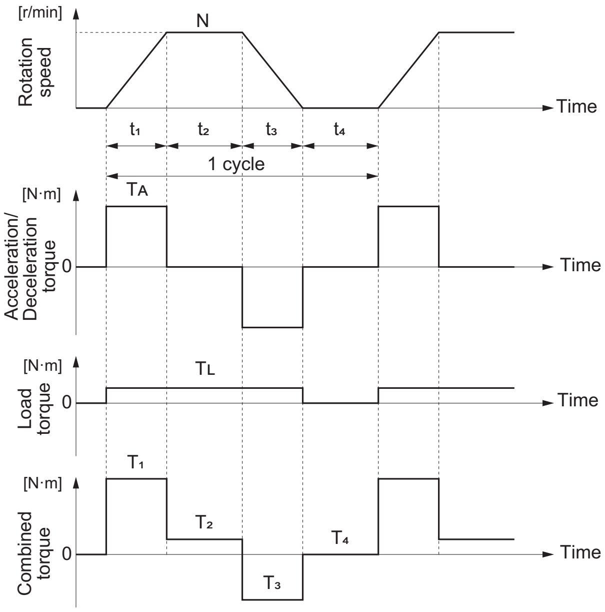
μ : Coefficient of friction
M : Mass of motion part [kg]
g : Acceleration of gravity ($g \approx 9.8$ [$\mathrm{m/s^2}$])



$$T_L\,[\mathrm{N \cdot m}] = T_W \cdot \frac{G}{\eta}$$

T_L : Motor-shaft conversion load torque [$\mathrm{N \cdot m}$]
T_W : Load torque (Load-shaft conversion) [$\mathrm{N \cdot m}$]
Z_1 : Number of motor-side gear teeth
Z_2 : Number of load-side gear teeth
G : Gear ratio (Speed reduction ratio) = Z_1 / Z_2

- Calculation of combined torque and effective torque



- Effective torque (T_{RMS})

$$T_{RMS}\ [\text{N·m}] = \sqrt{\frac{\Sigma\,(T_i^{\,2} \cdot t_i)}{\Sigma t_i}}$$

$$= \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3 + T_4^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

- Maximum torque (T_{MAX})

$$T_{MAX}\ [\text{N·m}] = T_1 = T_A + T_L$$

Motor Selection

Select the motor capacity from the above calculation results and the following formula.
Select the larger of the two calculated values as the motor capacity.
Also, when selecting a motor, take into consideration the errors in calculation and modeling. Select a motor whose capacity is at least approximately 20% larger.

- Motor capacity conversion to effective torque

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{RMS} \cdot N}{60} \times 10^{-3}$$

N : Maximum rotation speed [r/min]

- Motor capacity required for maximum torque output

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{MAX} \cdot N}{60 \times 1.5} \times 10^{-3}$$

N : Maximum rotation speed [r/min]

Note The maximum torque of the motor is calculated as 150% of the rated torque.

A-1-2 Inverter Capacity Selection

Select an inverter that can be used with the motor selected as a result of the motor selection. Basically, select an inverter with the maximum applicable motor capacity that matches the selected motor capacity.
After selecting an inverter, check whether it meets the both of the following conditions. If not, select an inverter that has a one class larger capacity and check again.

Rated motor current ≤ Rated output current of inverter
Continuous maximum torque output time of application ≤ 1 minute

Note 1. In the light load mode, the overload capacity of the inverter is 150% of the rated torque for 5 seconds. Use the 5-seconds rating when determining the maximum continuous torque.
Note 2. If you want to use 0-Hz sensorless vector control, or if you need a holding torque at a rotation speed of 0 (r/min), or if you frequently require 150% of the rated torque or more, use an inverter with a one class larger capacity than the one selected by the above method.

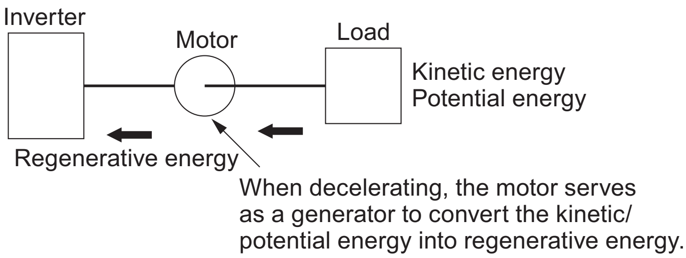
A-1-3 Overview of Braking Resistor Selection

Requirement of Braking Resistor

If the regenerative energy generated in deceleration or descent in an application is too great, the main circuit voltage in the inverter may increase, which results in damage to the inverter.
Normally, the inverter has a built-in overvoltage protection function, which detects an overvoltage (OV) in the main circuit to prevent inverter damage. However, because it detects a fault to cause the motor to stop, stable and continuous operation will be disturbed.
Therefore, you need to use one or more braking resistors/ regenerative braking units to absorb this regenerative energy outside the inverter.

● What is Regenerative Energy?

The load connected to the motor has kinetic energy when it is rotating and potential energy when it is subject to gravity. When the motor decelerates or if the load is reduced, the energy is returned to the inverter. This phenomenon is known as regeneration, and that energy is called regenerative energy.



● How to prevent main circuit over-voltage (OV) from occurring without the use of braking resistors

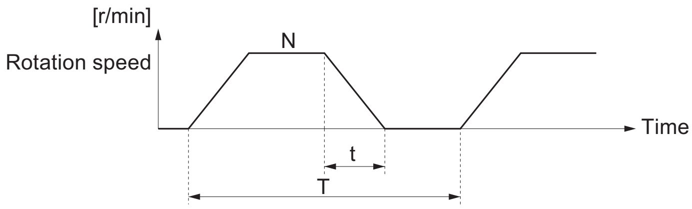
The following methods can be used to prevent main circuit over-voltage (OV) from occurring without connecting a braking resistor.

Since these methods prolong the deceleration time, check that the selected method will not cause application problems.

- Enable the over-voltage suppression function during deceleration
  The Overvoltage suppression function during deceleration is enabled by factory default. It automatically increases the deceleration time to prevent the occurrence of an over-voltage in the main circuit.
- Set a longer deceleration time
  Increase the deceleration time to prevent the occurrence of an over-voltage in the main circuit. This decreases the amount of regenerative energy per unit of time.
- Select free-run stop
  This prevents the regenerative energy from being fed back to the inverter.

Simplified Braking Resistor Selection

This is a simple method to select an appropriate braking resistor based on the percentage of the time in which regenerative energy is produced in a normal operation pattern.



Usage rate [%ED] = 100 × t / T   t : Deceleration time (regenerative time) [s]
T : 1cycle operation time [s]

● For Models With Built-in Regenerative Braking Circuit

(3G3RX2 200 V with a capacity of 22 kW or lower, 400 V with a capacity of 37 kW or lower)
Select a braking resistor based on the usage rate calculated from the operation pattern.
Connect a braking resistor suitable for your inverter according to the braking resistor list provided in the inverter manual / catalog.

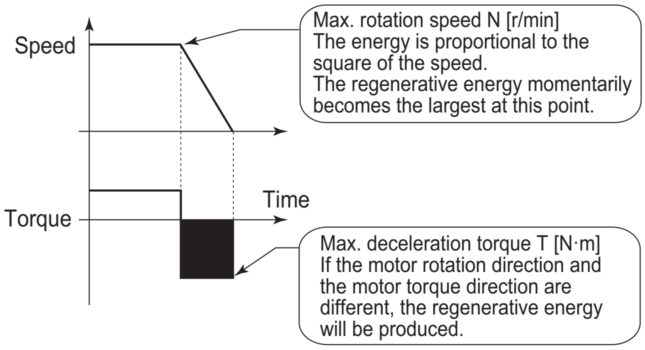
● For Models Without Built-in Regenerative Braking Circuit

(3G3RX2 200 V with a capacity of 30 kW or higher, 400 V with a capacity of 45 kW or higher)
Select a regenerative braking unit and a braking resistor.
A list of regenerative braking units and braking resistors is provided in the instruction manual / catalog. Connect the regenerative braking unit / braking resistor that matches the inverter you are using.

Detailed Braking Resistor Selection

If the usage rate exceeds 10% ED when using the simplified braking resistor selection method, or if a very large braking torque is required, select by calculating the regenerative energy.

● Calculation of Required Braking Resistance



Resistance of braking resistor : $R \leq \dfrac{60 \times V^2}{2\pi \cdot (T - 0.2 \times T_m) \cdot N}$

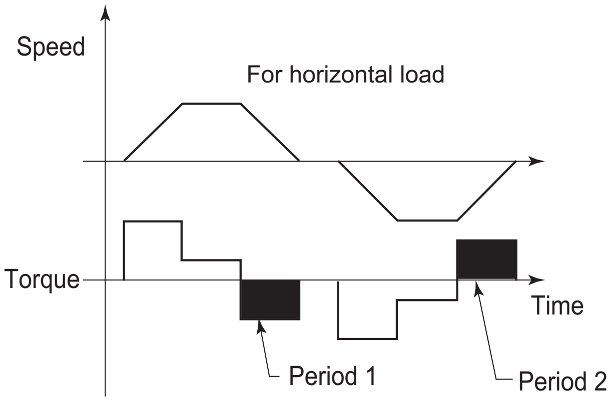
V : 200-V class inverter 362.5 [V]
400-V class inverter 725 [V]
T : Maximum braking torque [N·m]
T_m : Motor rating torque [N·m]
N : Maximum rotation speed [r/min]

Note The braking torque calculation is described in section on inverter capacity selection. Calculate it based on the motor capacity selection.

● Calculation of Average Regenerative Energy

Regenerative energy is produced when the motor rotation direction and the torque direction are opposite.

Use the following formula to calculate the regenerative energy for each period in a cycle.



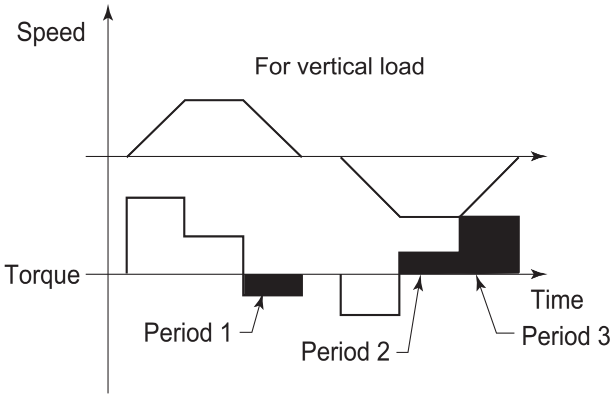
$P_i = N \times T \times t \times 1.047 \times 10^{-1}$

P_i : Regenerative energy in Period i [J]
N : Motor rotation speed [r/min]
When the number of rotations changes, take an average value.

ex. For linear deceleration
$(N_{max}+N_{min})/2$

T : Deceleration torque [N·m]
t : Deceleration time [s]

The average regenerative energy is calculated by adding all the regenerative energies of each section of one cycle and dividing by the time of one cycle as shown below.



$$\text{Average regenerative energy [W]} = \frac{(P_1 + P_2 + \cdots + P_i)\ [J]}{1\ \text{cycle time [s]}}$$

Note 1. Speed is indicated as positive in the forward rotation direction, and torque is indicated as torque in the forward rotation direction.
Note 2. The braking torque calculation is described in section on inverter capacity selection. Calculate it based on the motor capacity selection.

● Braking Resistor Selection

Select a braking resistor from the calculated braking resistance value and average regenerative energy.

Calculated braking resistance value ≥ braking resistor resistance value ≥ minimum resistance value
Average regenerative energy ≤ resistance capacity of braking resistor

Note 1. This is the resistance value that can be connected to the resistance connection terminal of the regenerative braking unit or inverter. Connecting a resistor below the minimum connectable resistance of the inverter or regenerative braking unit will damage the internal braking transistor. If the required braking resistance value is less than the minimum connectable resistance value, increase the capacity of the inverter and change to an inverter or regenerative braking unit with the minimum connectable resistance value below the required braking resistance value.
Note 2. In the case of a regenerative braking unit, two or more units can be operated in parallel. The braking resistance value when operating with two or more units is as follows.

Braking resistance value (Ω) = (required braking resistance value calculated above) x (number of units used)

Note 3. Be sure to make an allowance for the resistance capacity of the braking resistor. The braking resistor may become hot.
Consider a margin of about 20% or more when calculating.

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