OMRON

High-function General-purpose Inverter

RX Series Type V1

User's Manual

3G3RX-□□□□□-V1

I578-E1-02

Introduction

Thank you for purchasing the High-function General-purpose Inverter (Model: 3G3RX-☐-V1).

This manual describes the installation and wiring methods of the 3G3RX-V1 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: 3G3RX-☐-V1).

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 Configuration

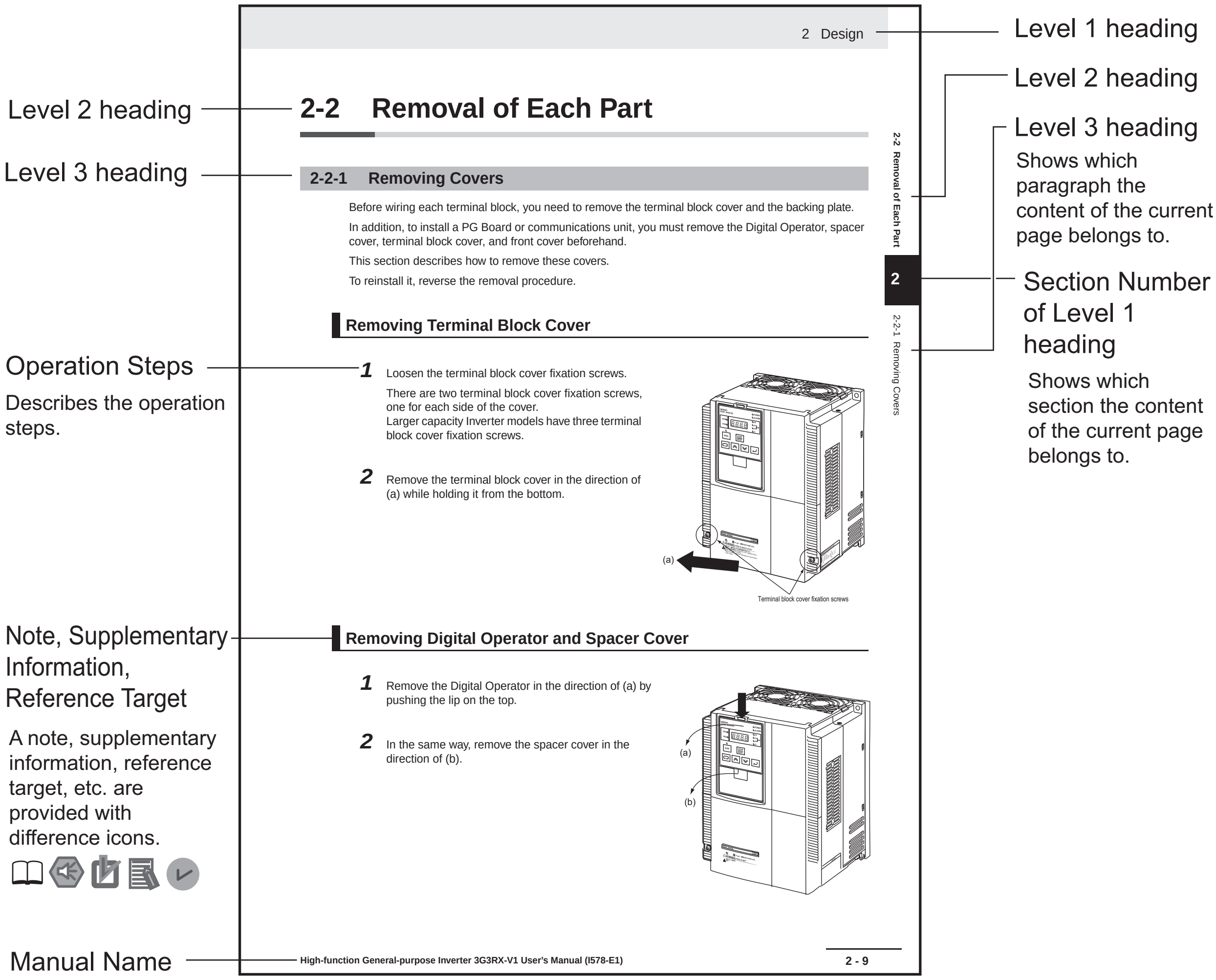
This manual is compiled section by section for user's convenience as follows.

Section/Title		Outline
Section 1	Overview	This section provides the features of this product, specifications, external dimensions, and part names.
Section 2	Design	This section describes the installation and wiring methods for this product.
Section 3	Operation and Test Run	This section describes the part names and key operation of the Digital Operator, and the operation method of this product as well as the test run procedure.
Section 4	Parameter List	This section provides lists of parameters for setting various functions of this product.
Section 5	Basic Settings	This section describes the basic functions, such as the Run command.
Section 6	Vector Control	This section describes the applied functions, such as vector control.
Section 7	Detailed Functions	This section describes the details of functions not described in *Section 5* or *Section 6*.
Section 8	Communications Functions	This section describes the general-purpose serial communications functions (RS-485 communication).
Section 9	Overview of DriveProgramming	This section describes the features of the DriveProgramming.
Section 10	Troubleshooting	This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles.
Section 11	Maintenance and Inspection	This section describes the maintenance and periodical inspection items.
Section 12	Options	This section describes the specifications and external dimension of peripheral equipment.
Appendices		This section provides information on the capacitor life curve and the life alarm output.

Manual Structure

Page Structure and Symbol Icons

The following page structure and symbol icons are used in this manual.



Note The above page is only a sample for illustrative purposes. It is not the actual content of the 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.

Sections in this Manual

1 Overview

2 Design

3 Operation and Test Run

4 Parameter List

5 Basic Settings

6 Vector Control

7 Detailed Functions

8 Communications Functions

9 Overview of DriveProgramming

10 Troubleshooting

11 Maintenance and Inspection

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Terms and Conditions Agreement

Warranty, Limitations of Liability

Warranties

Exclusive Warranty

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

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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 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.

Safety Precautions

To ensure that the High-function General-purpose Inverter (Model: 3G3RX-☐-V1) 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.

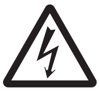
Indications and Meanings of Safety Information

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: 3G3RX-☐-V1). The information provided here is vital to safety. Strictly observe the precautions provided.

Meanings of Signal Words

⚠ WARNING	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.
⚠ 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. 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. 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.”
	● 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 “general compulsory items.”
	● 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.”

⚠ 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), 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 10 minutes 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.

⚠ Caution

	Do not connect resistors to the terminals (+1, P/+2, 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.

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.
- If a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur. Perform the operation after enough confirmation.
- When using DriveProgramming, confirm that the program data is downloaded normally before starting operation.

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 DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.
- 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 a check that the clock data returns to the initial setting and stopping the inverter or programs. When the LCD Digital Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock command.

Maintenance and Inspection

- Be sure to confirm safety before conducting maintenance, inspection or parts replacement.
- The capacitor service life is influenced 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 as the product, you need to replace the capacitor.
- When disposing of LCD digital operators and wasted 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 www.dtsc.ca.gov/hazardouswaste/perchlorate

The 3G3AX-OP05 has the lithium primary battery (with more than 6 ppb of perchlorate).
Label or mark the above display on the exterior of all outer shipping packages of your products when exporting your products which the 3G3AX-OP05 are installed to the State of California, USA.

- 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 Digital Operator can not be recognized due to the service life, replace the LCD Digital 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.

Restart Selection Function

- Do not come close to the machine when using the Restart Selection function (b001, b008) because the machine may abruptly start when stopped by an alarm.
- Be sure to confirm the RUN signal is turned off before resetting the alarm because the machine may abruptly start.

Deceleration Stop Function

Do not come close to the machine when selecting reset in the Deceleration Stop Function (b050) because the machine may abruptly start after the power is turned on.

Operation Stop Command

- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- When checking a signal during 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.

Maintenance and Parts Replacement

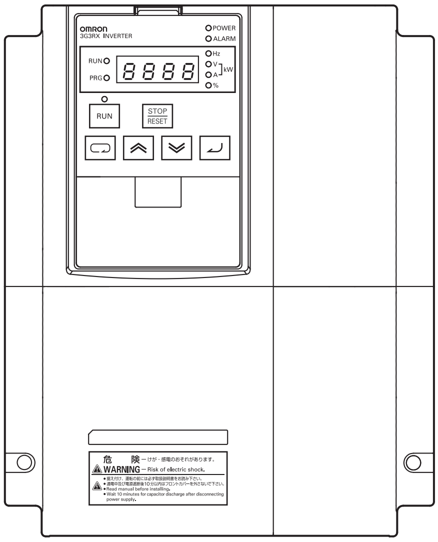
- Inverters contain components and will operate properly only when each component operates normally. Some of the electrical components require maintenance depending on application conditions. Periodic inspection and replacement are necessary to ensure proper long-term operation of Inverters. (Quoted from The Recommendation for Periodic Maintenance of a General-purpose Inverter published by JEMA.)
- When a cooling fan reaches the end of its service life, replace it.

Product Disposal

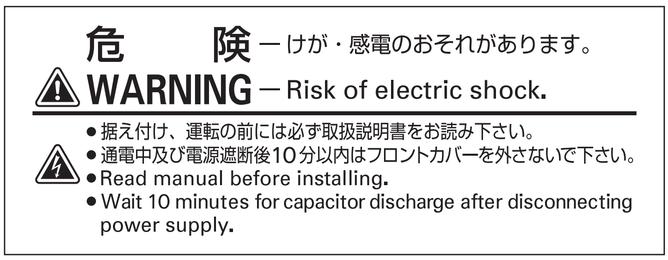
Comply with the local ordinance and regulations when disposing of the product.

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



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.

EC Directives and UL/cUL Standards

The 3G3RX-V1 Series complies as standard with both the EC Directives and UL/cUL Standards.

Standard		Applicable Standard
EC Directives	EMC Directive	EN61800-3
	Low Voltage Directive	EN61800-5-1
UL/cUL Standards		UL 508C

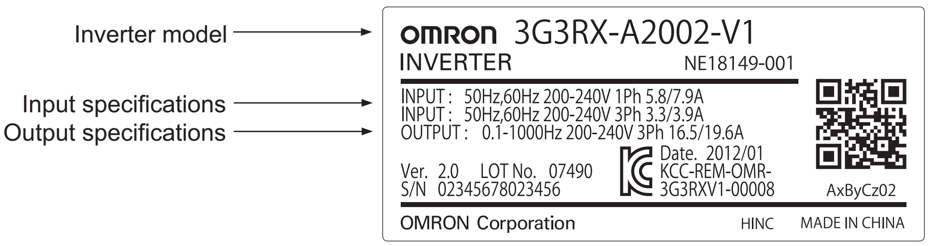
Items to Check after Unpacking

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

3 G 3 R X - A 2 0 5 5 - V 1

Maximum applicable motor capacity

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

Voltage class

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

Enclosure rating

A	Panel-mounting (IP20) or closed wall-mounting models
B	Panel-mounting (IP00)

Checking the Accessories

The instruction manual is the only accessory included in the High-function General-purpose Inverter (Model: 3G3RX-☐-V1).

Mounting screws and other necessary parts must be provided by the user.

Related Manuals

Please see the manuals below for related product information.

Name	Catalog No.
Regenerative Braking Unit 3G3AX-RBU User's Manual	I563
Encorder Feedback Board 3G3AX-PG User's Manual	I564
CX-Drive Operation Manual	W453
LCD Digital Operator 3G3AX-OP05 User's Manual	I579
DriveProgramming User's Manual	I580
MX2/RX Series EtherCAT® Communication Unit User's Manual	I574
MX2/RX Series CompoNet™ Communications Unit User's Manual	I582
MX2/RX Series DeviceNet™ Communications Unit User's Manual	I581

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.

Example

Cat.No. I578-E1-02

Revision code

Revision code	Revision date	Revised Content
01	November 2012	Original production
02	March 2015	• Added explanations. • Corrected mistakes.

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1

Overview

This section provides an overview of the 3G3RX-V1 Series features, standard specifications, and external dimensions by inverter capacity. It also shows the differences of this inverter from the conventional inverter for those who use the previous model.

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1-1 Overview of Functions

The High-function General-purpose Inverter (Model: 3G3RX-☐-V1) is a human- and environmental-friendly inverter suitable for a variety of applications. It provides various features, such as convenient functions intended for ease of use, network support, and diverse I/O.

In addition, the 3G3RX-V1 Series complies as standard with both the EC Directives and UL/cUL Standards. You can use this product as a world standard inverter.

1-1-1 Features of 3G3RX-V1 Series Inverter

The 3G3RX-V1 Series Inverter has the following features.

Enhanced Application Support

The 3G3RX-V1 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.

● Addition of the dual rating function (heavy load and light load)

In addition to the conventional heavy load mode, the 3G3RX-V1 Series Inverter newly has the light load mode to provide the dual rating function.

The light load mode is available for a fan, pump, or other device that operates at the rated motor torque or less in a normal state. Setting the light load mode causes the rated current of the inverter to increase, enabling the inverter to drive a motor that is one size larger in capacity.

However, pay attention to when selecting an inverter because the overload capacity decreases to 1 minute, 120% of the rated current.

Precautions for Correct Use

Switching between the heavy load mode and the light load mode changes the setting ranges and default data of the related parameters. Refer to *5-2-2 Heavy Load/Light Load Selection* on page 5-12 for details.

● Implementation of the programming function

The 3G3RX-V1 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 “DriveProgramming User’s Manual (I580)”.

Implementation of the vector control functions

With sensorless vector control, the inverter realizes a high starting torque at 200% of the motor rating in 0.3 Hz.

With 0-Hz sensorless vector control, the inverter can also output a high starting torque at 150% of the motor rating in even lower frequencies.

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

- Sensorless vector control
- 0-Hz sensorless vector control
- Sensor vector control

Availability of position control by the feedback

The inverter can realize accurate position control by feeding back the load-side position information, just like a servo system. It is effective to save costs for the whole system because the position control system with a motor over 15 kW is available, and also 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 the process control 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.

Ease of Use

The 3G3RX-V1 Series Inverter contributes to the reduction of man-hours in all phases of inverter-related work: from wiring, parameter setting, operation, through to maintenance.

● Removable Digital Operator as standard equipment

This inverter has a removable Digital Operator as standard equipment.

By connecting the optional special cable, it is possible to operate the Digital Operator at hand or install it to the front face of the control panel. This is convenient during setup or maintenance operation.

The operability of the keys and the method to initialize parameters were changed to the same as those for the 3G3MX2 Series.

● Addition of the initial screen automatic return function

The inverter newly has the “initial screen automatic return function” which automatically switches the screen to the initial screen if the Digital Operator is not operated for 10 minutes.

● 5-line LCD Digital Operator

This inverter supports the newly released LCD Digital Operator 3G3AX-OP05 with the 5-line display capability. The LCD Digital Operator can display four monitor functions or parameter settings in the selected language (currently English only), which effectively improves the readability of the device status and other information.

In addition, the LCD Digital Operator can store up to four sets of inverter parameter setting data, or a single set of inverter parameter setting data and a single DriveProgramming program in its internal memory. This saves time when you set the same parameter or write the same program to more than one inverter.

● Removable control terminal block

The removable control circuit terminal block enables you to replace an Unit with wiring connected, which facilitates the maintenance and inspection of the inverter.

● Emergency shutoff function

This function enables to shut off output by the hardware without the software, which can provide more reliable emergency shutoff operation.

● Modbus communication function as standard

The inverter has the RS485 communications circuit and the Modbus communication protocol as standard.

You can use Modbus communication to control and monitor the inverter status, or read and write various parameter settings.

● Change of default parameter setting

The default parameter settings of the conventional 3G3RX Series Inverter were reviewed and were changed according to the user’s usage. Some functions are enabled by default for reducing the workload of the user.

The default parameter settings changed in the 3G3RX-V1 Series are shown in *Section 4 Parameter List*. Check if these are appropriate for your application.

● Simplified parameter setting by user parameters

This inverter provides User Selection 1 to 12 (U001 to U012) as user parameters. You can register parameters that are frequently used to simplify the parameter setting and adjustment.

It is also possible to automatically register changed parameters as user parameters.

● Open field network

Installing any of the following optional communications units enables the inverter to support the corresponding open network.

It means that the host of each communications unit can perform the inverter operations, stop control, status monitor, and functions to read and write various parameter settings.

- EtherCAT Communications Unit (Model: 3G3AX-RX-ECT)
- CompoNet Communications Unit (Model: 3G3AX-RX-CRT-E)
- DeviceNet Communications Unit (Model: 3G3AX-RX-DRT-E)

Environmental Consideration

OMRON gives consideration to not only the inverter, but also the service life and energy efficiency of the connected motor.

This inverter, as a standard product, complies with the RoHS directive and international standards to realize an environmental-friendly inverter.

● Measures against noise and harmonic interference for peripheral protection

The inverter has the built-in EMC noise filter as standard as a measure against noise for compliance with the EMC directive.

● Long life design

The inverter has a design life of 10 years through the use of long-life pars 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 pump.

● Compliance with safety standards

The inverter complies as standard with the EC Directives and UL/cUL Standards.

● Complies with RoHS Directive

This inverter, as a standard product, complies with the RoHS Directive that restricts the use of six hazardous substances.

1-1-2 Classes of 3G3RX-V1 Series Inverter

There are two voltage classes for 3G3RX-V1 Series Inverters: 3-phase 200 VAC and 3-phase 400 VAC.

The applicable motor capacity is 0.4 to 132 kW.

All models comply as standard with the EC Directives and UL/cUL Standards.

Rated voltage	Enclosure rating	Max. applicable motor capacity	Model
3-phase 200 VAC	IP20	0.4 kW	3G3RX-A2004-V1
		0.75 kW	3G3RX-A2007-V1
		1.5 kW	3G3RX-A2015-V1
		2.2 kW	3G3RX-A2022-V1
		3.7 kW	3G3RX-A2037-V1
		5.5 kW	3G3RX-A2055-V1
		7.5 kW	3G3RX-A2075-V1
		11 kW	3G3RX-A2110-V1
		15 kW	3G3RX-A2150-V1
		18.5 kW	3G3RX-A2185-V1
		22 kW	3G3RX-A2220-V1
		30 kW	3G3RX-A2300-V1
		37 kW	3G3RX-A2370-V1
		45 kW	3G3RX-A2450-V1
		55 kW	3G3RX-A2550-V1
3-phase 400 VAC	IP20	0.4 kW	3G3RX-A4004-V1
		0.75 kW	3G3RX-A4007-V1
		1.5 kW	3G3RX-A4015-V1
		2.2 kW	3G3RX-A4022-V1
		3.7 kW	3G3RX-A4037-V1
		5.5 kW	3G3RX-A4055-V1
		7.5 kW	3G3RX-A4075-V1
		11 kW	3G3RX-A4110-V1
		15 kW	3G3RX-A4150-V1
		18.5 kW	3G3RX-A4185-V1
		22 kW	3G3RX-A4220-V1
		30 kW	3G3RX-A4300-V1
		37 kW	3G3RX-A4370-V1
		45 kW	3G3RX-A4450-V1
		55 kW	3G3RX-A4550-V1
	IP00	75 kW	3G3RX-B4750-V1
		90 kW	3G3RX-B4900-V1
		110 kW	3G3RX-B411K-V1
		132 kW	3G3RX-B413K-V1

Checking the Model

3 G 3 R X – A 2 0 5 5 – V 1

Maximum applicable motor capacity

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

Voltage class

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

Enclosure rating

A	Panel-mounting (IP20) or closed wall-mounting models
B	Panel-mounting (IP00)

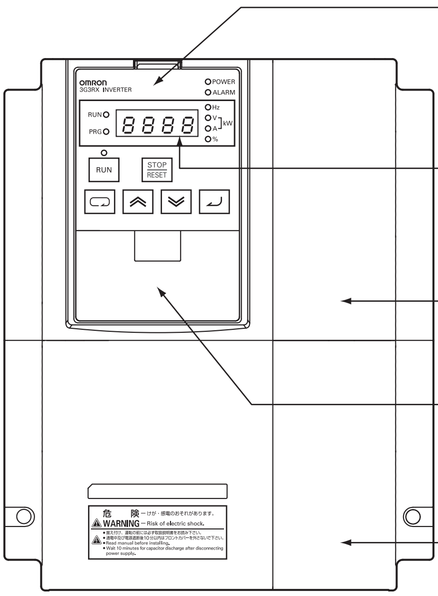
1-1-3 Compliance with International Standards (EC Directives and UL/cUL Standards)

The 3G3RX-V1 Series complies as standard with both the EC Directives and UL/cUL Standards. You can use this product as a world standard inverter.

Standard		Applicable Standard
EC Directives	EMC Directive	EN61800-3
	Low Voltage Directive	EN61800-5-1
UL/cUL Standards		UL 508C

1-2 Appearance and Part Names

The following shows the front view when the product is unpacked (an example of 3G3RX-A2055-V1/A2075-V1/A2110-V1/A4055-V1/A4075-V1/A4110-V1).



Digital Operator
Use this to set parameters, view various monitor data, run/stop the inverter, etc.

Data Display
This displays the frequency reference value, output frequency, parameter set value, or other relevant data.

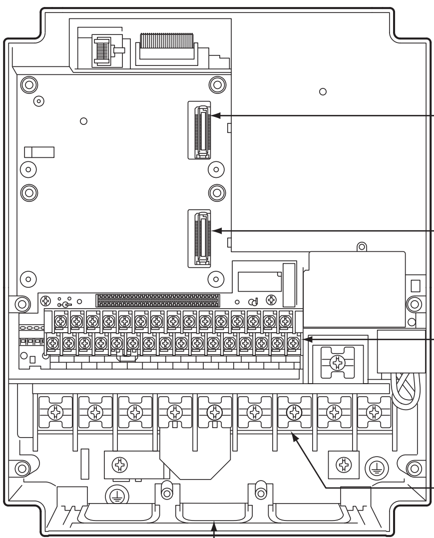
Front Cover
Remove this to mount option boards.

Spacer Cover
Remove this to mount optional units or 5-line LCD Digital Operator.

Terminal Block Cover
Remove this when connecting cables to each terminal block.

Open the terminal block cover to wire the main circuit terminal block and the control circuit terminal block.

Moreover, you can open the front cover to mount option boards.



Connector for mounting option board 1
Use this to connect an option board.

Connector for mounting option board 2
Use this to connect an option board or communications unit.

Control circuit terminal block
Use this to connect various digital/analog I/O signals for inverter control.

Main circuit terminal block
Use this to connect the inverter main power supply, motor, braking resistor, and other devices.

Backing plate
Cut off the cutout portions of this plate to connect power supply lines, signal lines, etc.

1-3 Specifications

1-3-1 Standard Specifications

3-phase 200-V Class

CT: Heavy load mode, VT: Light load mode

Item			Model (3G3RX)							
			A2004-V1	A2007-V1	A2015-V1	A2022-V1	A2037-V1	A2055-V1	A2075-V1	A2110-V1
Maximum applicable motor capacity [kW]		CT	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
		VT	0.75	1.5	2.2	3.7	5.5	7.5	11	15
Rated output capacity [kVA]	200 V	CT	1.0	1.7	2.5	3.6	5.7	8.3	11.0	15.9
		VT	1.2	2.1	3.2	4.1	6.7	10.3	15.2	20.0
	240 V	CT	1.2	2.0	3.1	4.3	6.8	9.9	13.3	19.1
		VT	1.5	2.6	3.9	4.9	8.1	12.4	18.2	24.1
Rated input voltage			3-phase: 200 V –15% to 240 V 10%, 50/60 Hz ±5%							
Rated input current [A]		CT	3.3	5.5	8.3	12	18	26	35	51
		VT	3.9	7.2	10.8	13.9	23	37	48	64
Rated output voltage			3-phase: 200 to 240 V (Cannot exceed that of incoming voltage)							
Rated output current [A]		CT	3.0	5.0	7.5	10.5	16.5	24	32	46
		VT	3.7	6.3	9.4	12	19.6	30	44	58
EMC noise filter			Built-in (EMC Directive EN61800-3 Category C3)							
Weight [kg]			3.5	3.5	3.5	3.5	3.5	6	6	6
Braking	Regenerative braking		Built-in braking resistor circuit (Discharge resistor separately mounted)							
	Minimum connection resistance [Ω]		50	50	35	35	35	16	10	10
Maximum leakage current [mA]	EMC filter enabled		2.5					48		
	EMC filter disabled		0.1							

Item			Model (3G3RX)						
			A2150-V1	A2185-V1	A2220-V1	A2300-V1	A2370-V1	A2450-V1	A2550-V1
Maximum applicable motor capacity [kW]		CT	15	18.5	22	30	37	45	55
		VT	18.5	22	30	37	45	55	75
Rated input capacity [kVA]	200 V	CT	22.1	26.3	32.9	41.9	50.2	63.0	76.2
		VT	25.2	29.4	39.1	48.5	58.5	72.7	93.5
	240 V	CT	26.6	31.5	39.4	50.2	60.2	75.6	91.4
		VT	30.3	35.3	46.9	58.1	70.2	87.2	112.2
Rated input voltage			3-phase: 200 V –15% to 240 V 10%, 50/60 Hz ±5%						
Rated input current [A]		CT	70	84	105	133	160	200	242
		VT	80	94	120	150	186	240	280
Rated output voltage			3-phase: 200 to 240 V (Cannot exceed that of incoming voltage)						
Rated output current [A]		CT	64	76	95	121	145	182	220
		VT	73	85	113	140	169	210	270
EMC noise filter			Built-in (EMC Directive EN61800-3 Category C3)						
Weight [kg]			14	14	14	22	30	30	43
Braking	Regenerative braking		Built-in braking resistor circuit (discharge resistor separately mounted)			Regenerative braking unit separately mounted			
	Minimum connection resistance [Ω]		7.5	7.5	5	–			
Maximum leakage current [mA]	EMC filter enabled		23						
	EMC filter disabled		0.1						

3-phase 400-V Class

CT: Heavy load mode, VT: Light load mode

Item			Model (3G3RX)										
			A4004-V1	A4007-V1	A4015-V1	A4022-V1	A4037-V1	A4055-V1	A4075-V1	A4110-V1	A4150-V1	A4185-V1	A4220-V1
Maximum applicable motor capacity [kW]		CT	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
		VT	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30
Rated output capacity [kVA]	400 V	CT	1.0	1.7	2.6	3.6	6.2	9.6	13.1	17.3	22.1	26.3	33.2
		VT	1.3	2.1	3.3	4.6	7.6	11.0	15.2	20.0	25.6	29.7	39.4
	480 V	CT	1.2	2.0	3.1	4.4	7.4	11.6	15.7	20.7	26.6	31.5	39.9
		VT	1.5	2.5	3.9	5.5	9.2	13.3	18.2	24.1	30.7	35.7	47.3
Rated input voltage			3-phase: 380 V –15% to 480 V 10%, 50/60 Hz ±5%										
Rated input current [A]		CT	1.8	2.8	4.2	5.8	9.8	15	21	28	35	42	53
		VT	2.1	4.3	5.9	8.1	13.3	20	24	32	41	47	63
Rated output voltage			3-phase: 380 to 480 V (Cannot exceed that of incoming voltage)										
Rated output current [A]		CT	1.5	2.5	3.8	5.3	9.0	14	19	25	32	38	48
		VT	1.9	3.1	4.8	6.7	11.1	16	22	29	37	43	57
EMC noise filter			Built-in (EMC Directive EN61800-3 Category C3)										
Weight [kg]			3.5	3.5	3.5	3.5	3.5	6	6	6	14	14	14
Braking	Regenerative braking		Built-in braking resistor circuit (Discharge resistor separately mounted)										
	Minimum connection resistance [Ω]		100	100	100	100	70	70	35	35	24	24	20
Maximum leakage current [mA]	EMC filter enabled		5					95			56		
	EMC filter disabled		0.2										

Item			Model (3G3RX)							
			A4300-V1	A4370-V1	A4450-V1	A4550-V1	A4750-V1	B4900-V1	B411K-V1	B413K-V1
Maximum applicable motor capacity [kW]		CT	30	37	45	55	75	90	110	132
		VT	37	45	55	75	90	110	132	160
Rated output capacity [kVA]	400 V	CT	40.1	51.9	63.0	77.5	103.2	121.9	150.3	180.1
		VT	48.4	58.8	72.7	93.5	110.8	135	159.3	200.9
	480 V	CT	48.2	62.3	75.6	93.1	123.8	146.3	180.4	216.1
		VT	58.1	70.6	87.2	112.2	133	162.1	191.2	241.1
Rated input voltage			3-phase: 380 V –15% to 480 V 10%, 50/60 Hz ±5%							
Rated input current [A]		CT	64	83	100	121	164	194	239	286
		VT	77	94	116	149	176	199	253	300
Rated output voltage			3-phase: 380 to 480 V (Cannot exceed that of incoming voltage)							
Rated output current [A]		CT	58	75	91	112	149	176	217	260
		VT	70	85	105	135	160	195	230	290
EMC noise filter			Built-in (EMC Directive EN61800-3 Category 3)							
Weight [kg]			22	30	30	30	55	55	70	70
Braking	Regenerative braking		Regenerative braking unit separately mounted							
	Minimum connection resistance [Ω]		–							
Maximum leakage current [mA]	EMC filter enabled		56				0.2 (No enabled/disabled setting available)			
	EMC filter disabled		0.2							

Common Specifications

Item		Specifications	
Enclosure rating		IP20 (0.4 to 55 kW) IP00 (75 to 132 kW)	
Control method		Phase-to-phase sinusoidal modulation PWM	
Output frequency range		0.1 to 400 Hz	
Frequency precision		Digital command: ±0.01% of the maximum frequency, Analog command: ±0.2% of the maximum frequency (25±10°C)	
Frequency resolution		Digital setting: 0.01 Hz Analog setting: Maximum frequency/4000 (Terminal FV: 12 bits/0 to 10 V), (Terminal FE: 12 bits/–10 to 10 V), (Terminal FI: 12 bits/0 to 20 mA)	
Voltage/Frequency characteristics		Heavy load (CT): V/f characteristics (constant torque, reduced torque, free V/f setting), sensorless vector control, 0-Hz sensorless vector control, sensor vector control Light load (VT): V/f characteristics (constant torque, reduced torque, free V/f setting), sensorless vector control	
Overload current rating		Heavy load (CT): 150%/60 s, 200%/3 s (180%/3 s for 75 kW or more) Light load (VT): 120%/60 s, 150%/5 s	
Instantaneous overcurrent protection		200% of heavy load rating (CT) value	
Acceleration/Deceleration time		0.01 to 3600.0 s (line/curve setting)	
Speed fluctuation		Heavy load (CT): ±0.5% [*1 *2] Light load (VT): ±0.5% [*1]	
Carrier frequency change range		<For 0.4 to 55 kW> Heavy load (CT): 0.5 to 15 kHz Light load (VT): 0.5 to 12 kHz	<For 75 to 132 kW> Heavy load (CT): 0.5 to 10 kHz Light load (VT): 0.5 to 8 kHz
Starting torque	Sensorless vector control	<For 0.4 to 55 kW> Heavy load (CT): 200%/0.3 Hz [*1] Light load (VT): 150%/0.5 Hz [*1]	<For 75 to 132 kW> Heavy load (CT): 180%/0.3 Hz [*1] Light load (VT): 120%/0.5 Hz [*1]
	0-Hz sensorless vector control	<For 0.4 to 55 kW> Heavy load (CT): 150%/Torque at 0 Hz [*3] Light load (VT): No function available	<For 75 to 132 kW> Heavy load (CT): 130%/Torque at 0 Hz [*3] Light load (VT): No function available
DC injection braking		Operates when the starting frequency is lower than that in deceleration via the STOP command, when the frequency reference is lower than the operation frequency, or via an external input (braking power, time, and frequency are adjustable)	
Protective functions		Overcurrent protection, Overvoltage protection, Undervoltage protection, Electronic thermal protection, Temperature error protection, Momentary power interruption/Power interruption protection, Input phase loss protection, Braking resistor overload protection, Ground-fault current detection at power-on, USP error, External trip, Emergency shutoff trip, CT error, Communication error, Option error, etc.	

Item			Specifications
Input signal	Frequency settings	Standard Digital Operator	Setting via ⋀ / ⋁ keys
		External signal *4	0 to 10 VDC, –10 to 10 VDC (Input impedance: 10 kΩ), 4 to 20 mA (Input impedance: 100 Ω)
		External port	Setting through RS485 communications
	Forward or Reverse operation /Stop	Standard Digital Operator	RUN/STOP (Forward/reverse switched via parameter settings)
		External signal	Forward/Stop (Reverse/Stop available at the time of multi-functional input terminal allocation), 3-wire input available (at the time of control circuit terminal block allocation)
		External port	Setting through RS485 communications
	Multi-function input *5		8 terminals, NO/NC switchable, sink/source logic switchable Heavy load (CT): 8 functions can be selected from among 72 Light load (VT): 8 functions can be selected from among 57
	Thermistor input terminal		1 terminal (Positive/Negative temperature coefficient of resistance element switchable)
Output signal	Multi-function output *5		5 open collector output terminals: NO/NC switchable, sink/source logic switchable 1 relay (SPDT contact) output terminal: NO/NC switchable Heavy load (CT): 6 functions can be selected from among 55 Light load (VT): 6 functions can be selected from among 51
	Multi-function monitor output terminal		Analog voltage output (0 to 10 V) *6 , Analog current output (0 to 20 mA) *6 , pulse train output (maximum frequency 3.6 kHz)
Display monitor			Output frequency, Output current, Output torque, Frequency conversion value, Trip history, I/O terminal status, Electric power, etc.
Other functions			<Heavy load (CT)> V/f free setting (7), Upper/lower frequency limit, Frequency jump, Curve acceleration/deceleration, Manual torque boost level/break, Energy-saving operation, Analog meter adjustment, Starting frequency, Carrier frequency adjustment, Electronic thermal function (free setting available), External start/end (frequency/rate), Analog input selection, Trip retry, Restart during momentary power interruption, Various signal outputs, Reduced voltage startup, Overload limit, Initialization value setting, Automatic deceleration at power-off, AVR function, Automatic acceleration/deceleration, Auto tuning (Online/Offline) <Light load (VT)> V/f free setting (7), Upper/lower frequency limit, Frequency jump, Curve acceleration/deceleration, Manual torque boost level/break, Energy-saving operation, Analog meter adjustment, Starting frequency, Carrier frequency adjustment, Electronic thermal function (free setting available), External start/end (frequency/rate), Analog input selection, Trip retry, Restart during momentary power interruption, Various signal outputs, Reduced voltage startup, Overload limit, Initialization value setting, Automatic deceleration at power-off, AVR function, Auto tuning (Online/Offline)
Operating environment	Operating ambient temperature		Heavy load (CT): –10 to 50 °C Light load (VT): –10 to 40 °C
	Storage ambient temperature		–20 to 65 °C
	Operating ambient humidity		20% to 90% (with no condensation)
	Vibration resistance *7		5.9 m/s^2 (0.6 G), 10 to 55 Hz (0.4 to 22 kW) 2.94 m/s^2 (0.3 G), 10 to 55 Hz (30 to 132 kW)
	Location		At a maximum altitude of 1,000 m (without corrosive gases or dust)*8

Item		Specifications
Options	PG Board	3G3AX-PG01 for sensor vector control
	EtherCAT Communications Unit	3G3AX-RX-ECT
	CompoNet Communications Unit	3G3AX-RX-CRT-E
	DeviceNet Communications Unit	3G3AX-RX-DRT-E
Other options		Braking resistor, AC reactor, DC reactor, Digital Operator, Digital Operator cables, Noise filter, Regenerative braking unit, etc.

*1. Applicable in the sensorless vector control

*2. Applicable in the 0-Hz sensorless vector control

*3. Applicable in the 0 Hz sensorless vector control when using a motor one size smaller in capacity than the inverter

*4. The maximum frequency is set to 9.8 V for a voltage input of 0 to 10 VDC and to 19.8 mA for an current input of 4 to 20 mA, respectively. If this causes any inconvenience, change the default data.

*5. In the VT mode, the available functions are limited compared with the CT mode. The default data and setting range of some functions also differ.

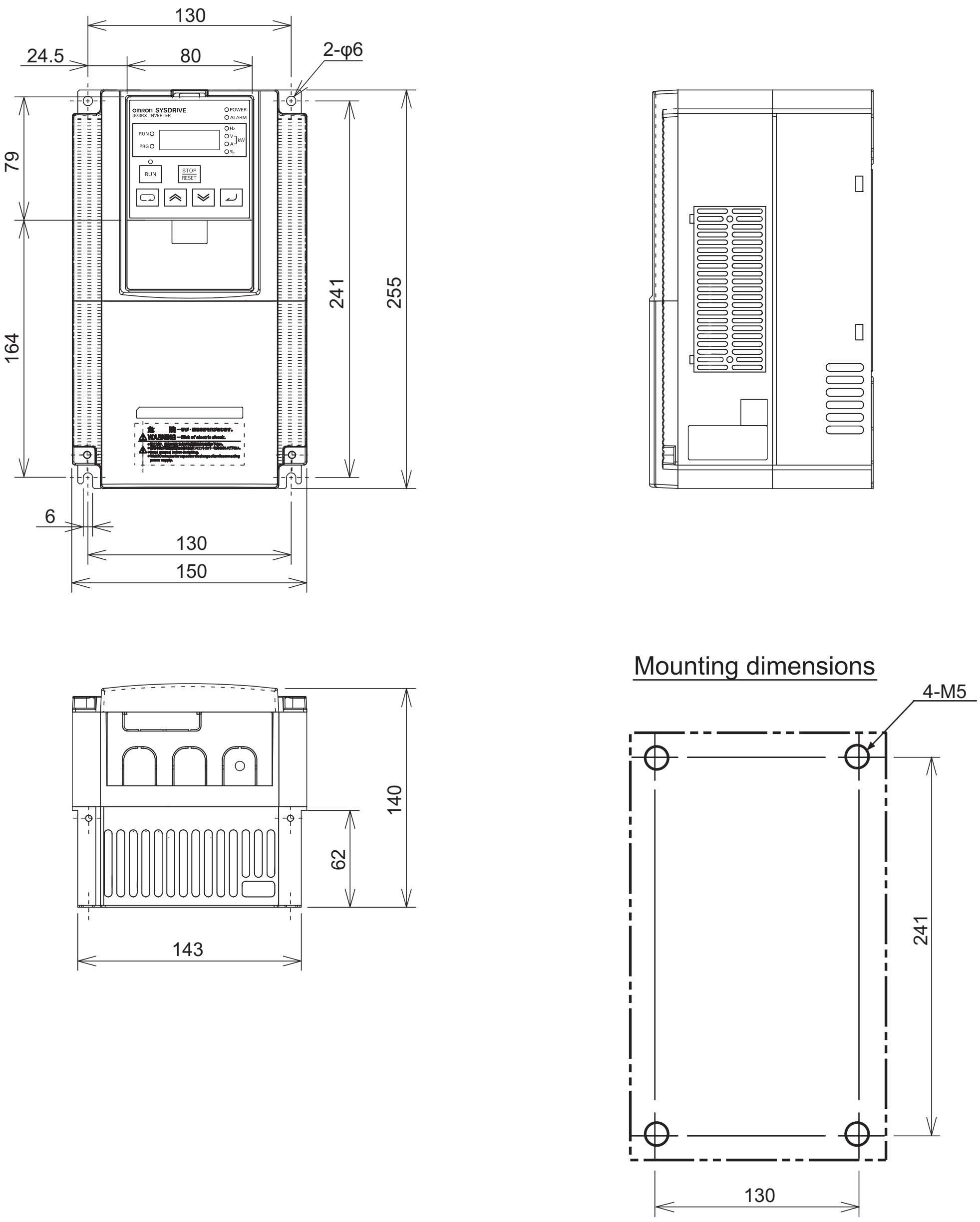
*6. The analog voltage and current values for the multi-function monitor output terminals show values that can only be used as a guide for analog meter connection. The maximum output value may differ slightly from 10 V or 20 mA due to the variability of the analog output circuit. If this causes any inconvenience, refer to *AM/AMI Gain Setting* on page 7-144 to adjust the default data.

*7. Complies with the test method specified in JIS C60068-2-6: 2010 (IEC 60068-2-6: 2007).

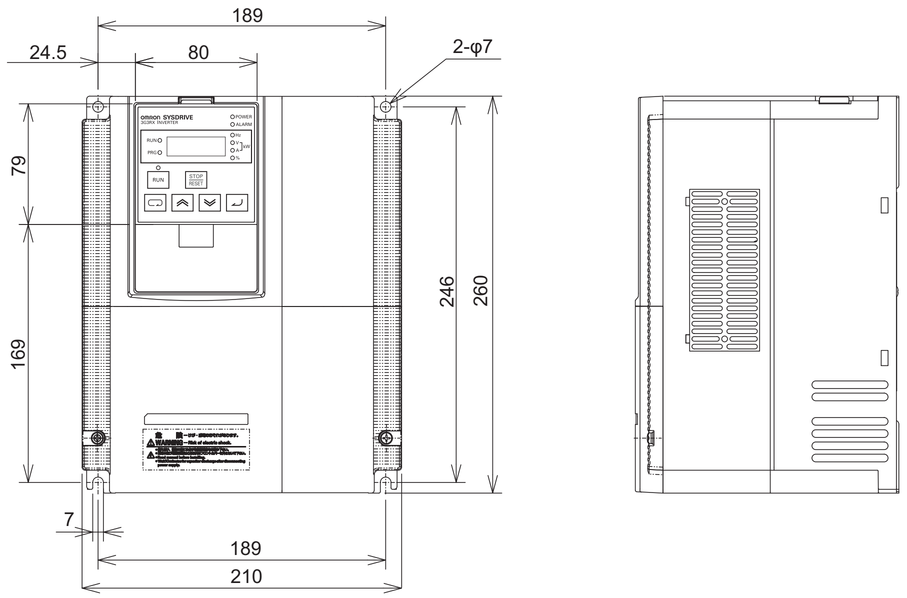
*8. If the altitude is higher than 1,000 m, reduce the amount of heat generation because air density decreases by 1% with the increasing altitude by 100 m. For switching devices such as IGBTs, the amount of heat generation is proportional to the current flowing in the device and the applied voltage. Therefore, reduce the value of the rated current by 1% with the increasing altitude by 100 m to use a standard inverter. However, this is applicable to an altitude of 2,500 m or lower.

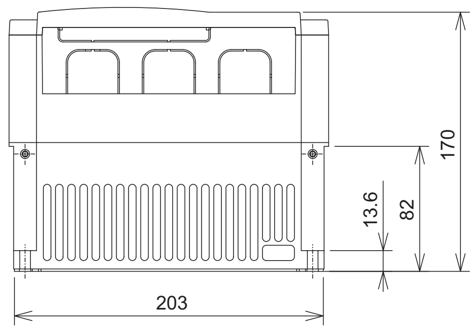
1-3-2 External Dimensions

- **3G3RX-A2004-V1/A2007-V1/A2015-V1/A2022-V1/A2037-V1/A4004-V1/A4007-V1/A4015-V1/A4022-V1/A4037-V1**

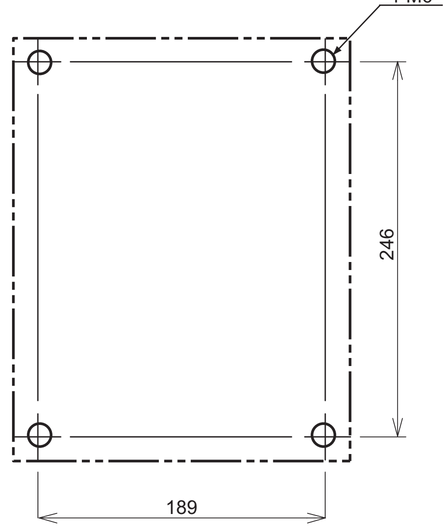


- **3G3RX-A2055-V1/A2075-V1/A2110-V1/A4055-V1/A4075-V1/A4110-V1**

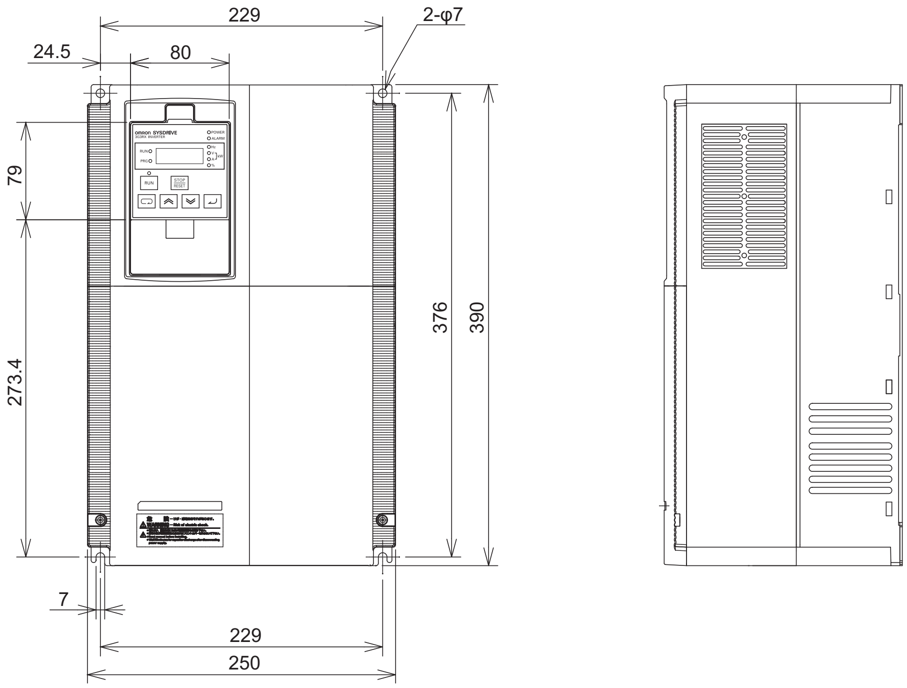


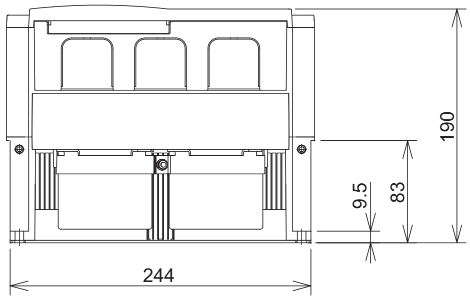


Mounting dimensions



- **3G3RX-A2150-V1/A2185-V1/A2220-V1/A4150-V1/A4185-V1/A4220-V1**





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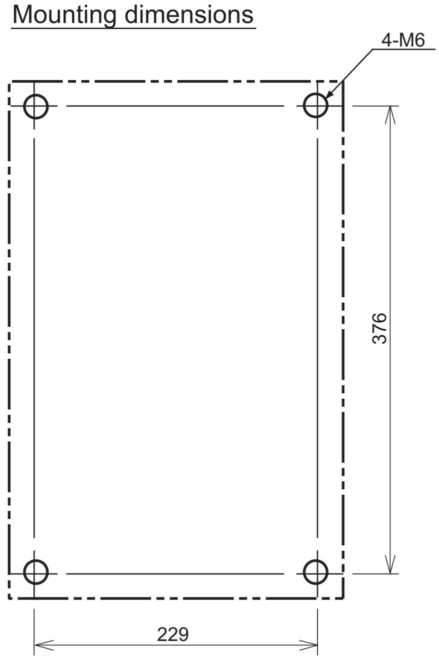
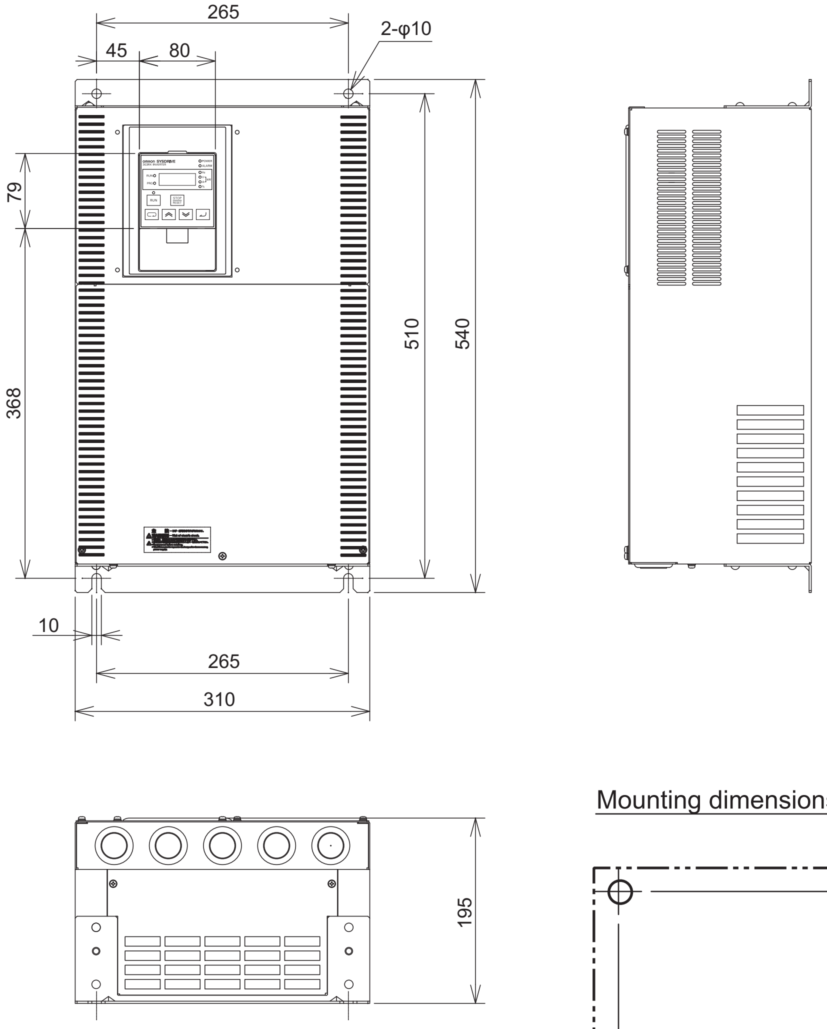


- **3G3RX-A2300-V1/A4300-V1**



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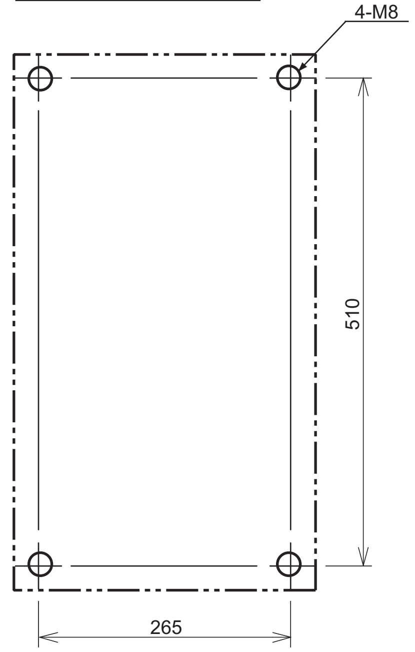
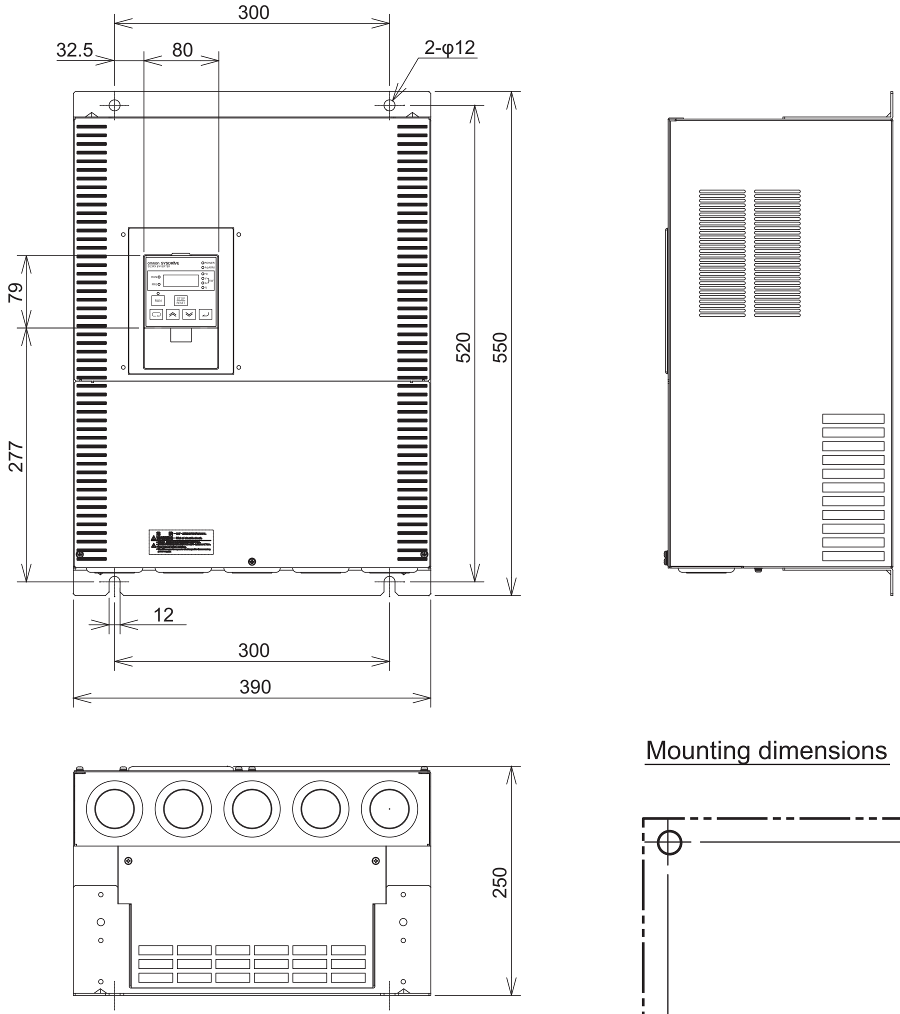
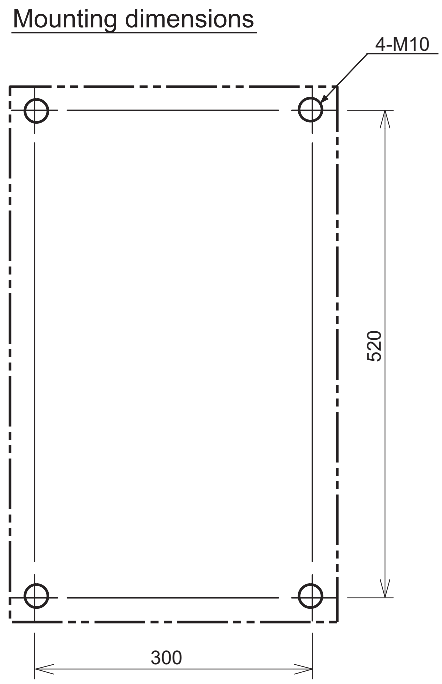
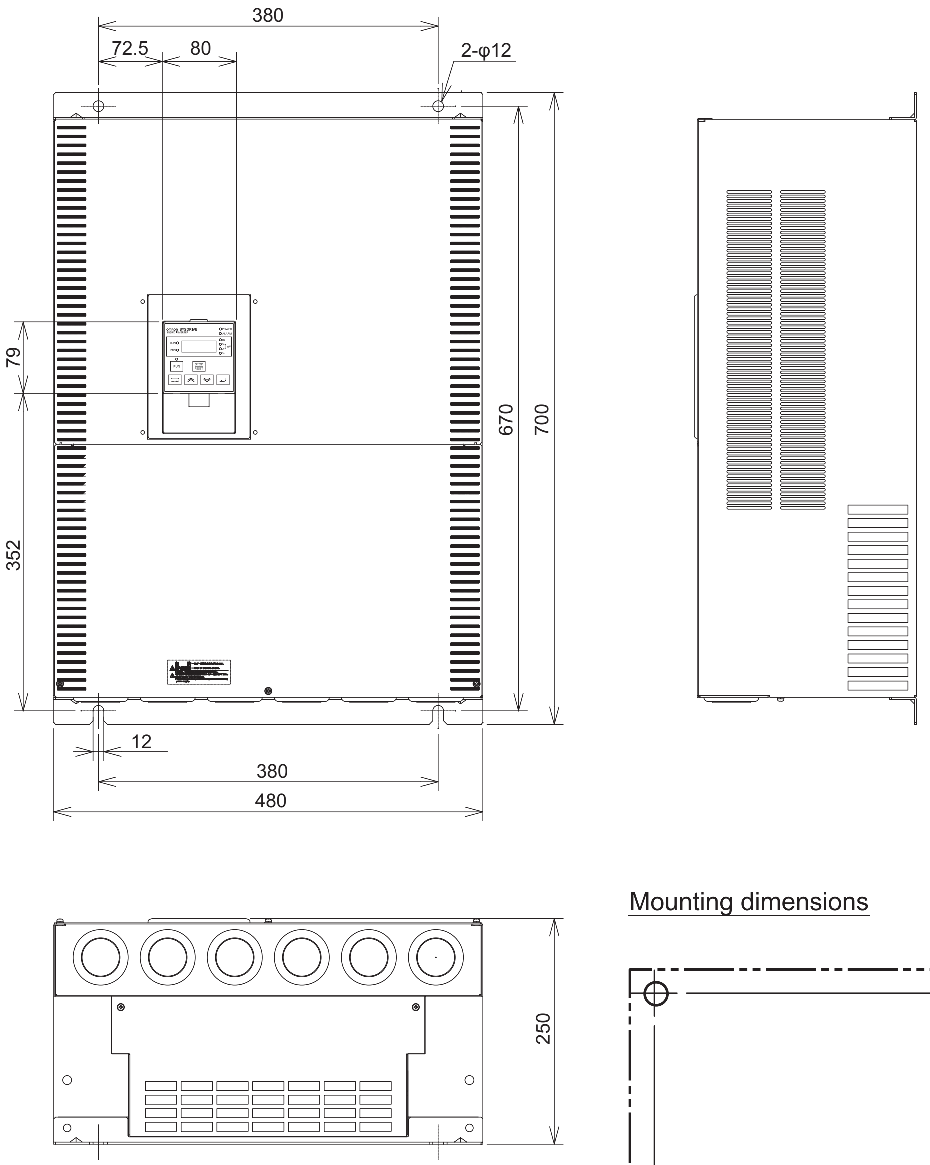


- **3G3RX-A2370-V1/A2450-V1/A4370-V1/A4450-V1/A4550-V1**

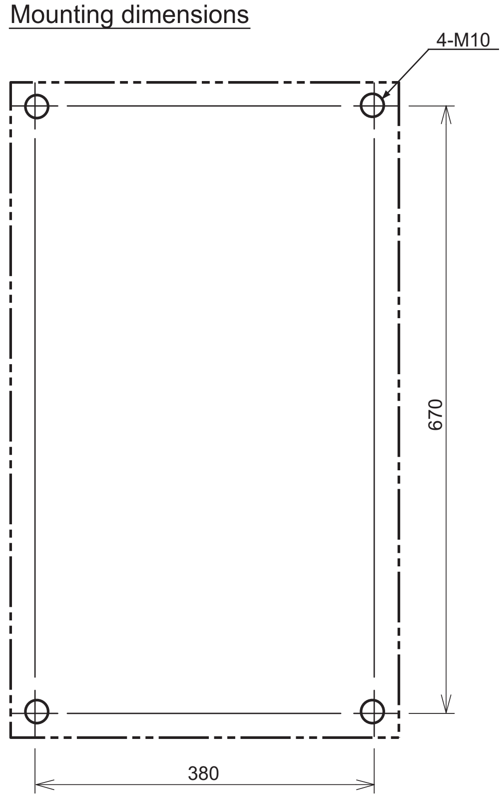




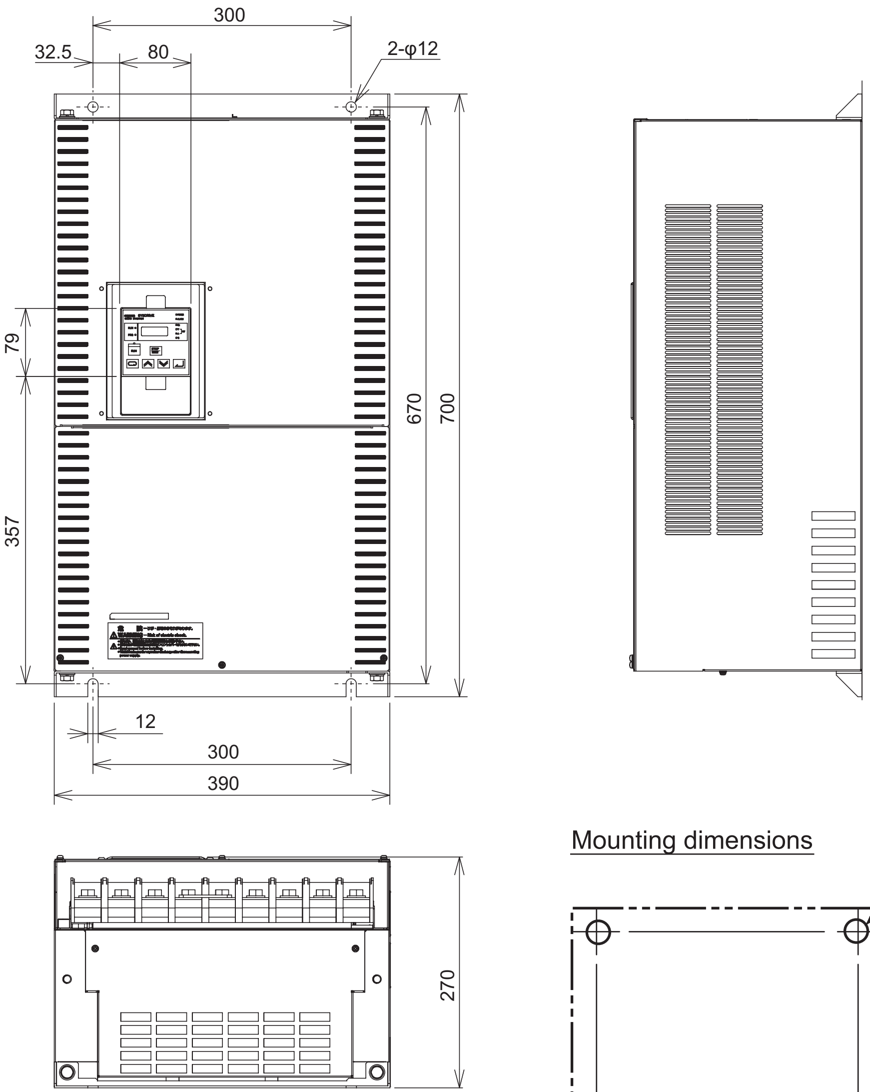
- **3G3RX-A2550-V1**

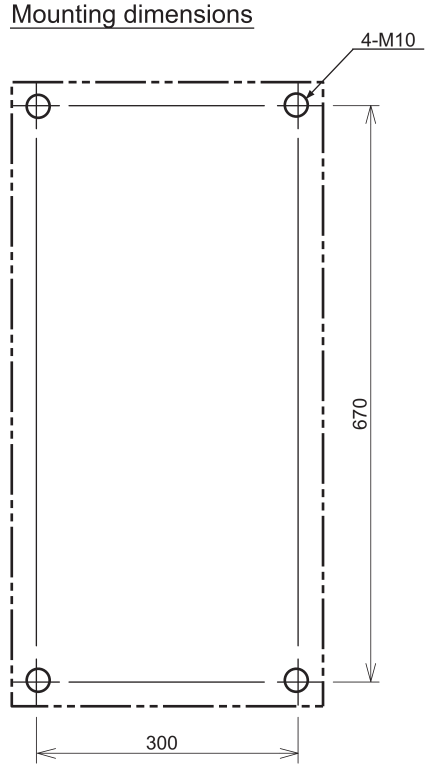


Mounting dimensions

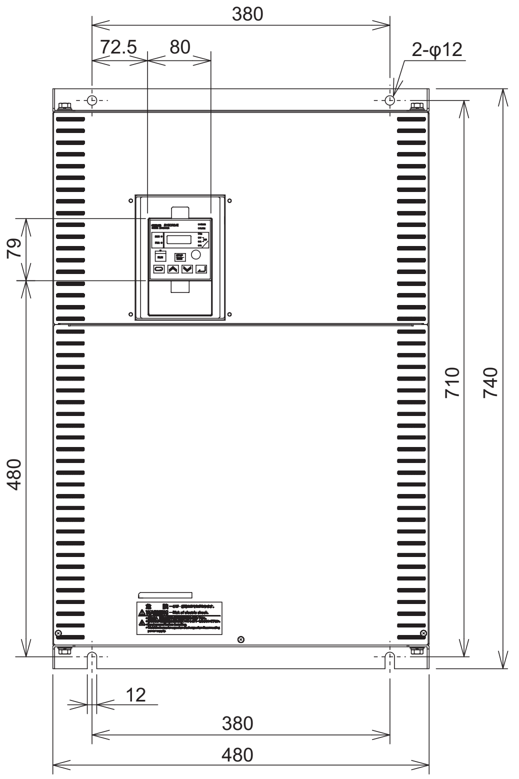


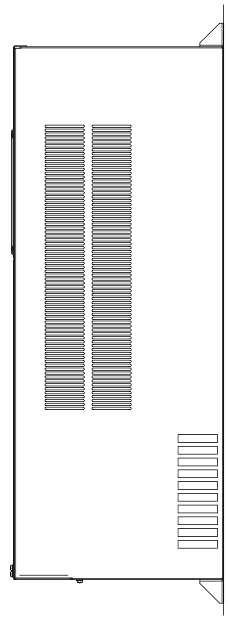
- **3G3RX-B4750-V1/B4900-V1**

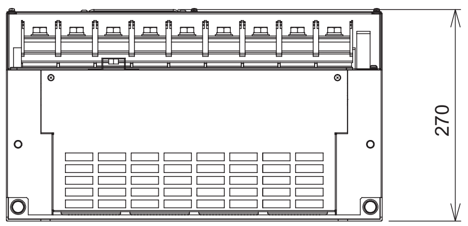




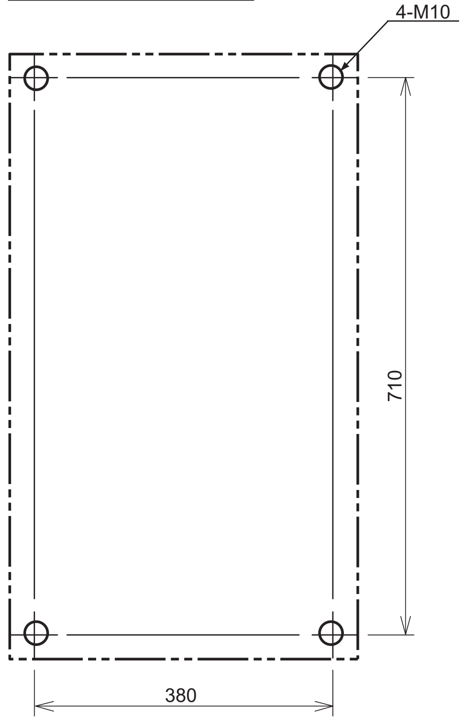
● **3G3RX-B411K-V1/B413K-V1**



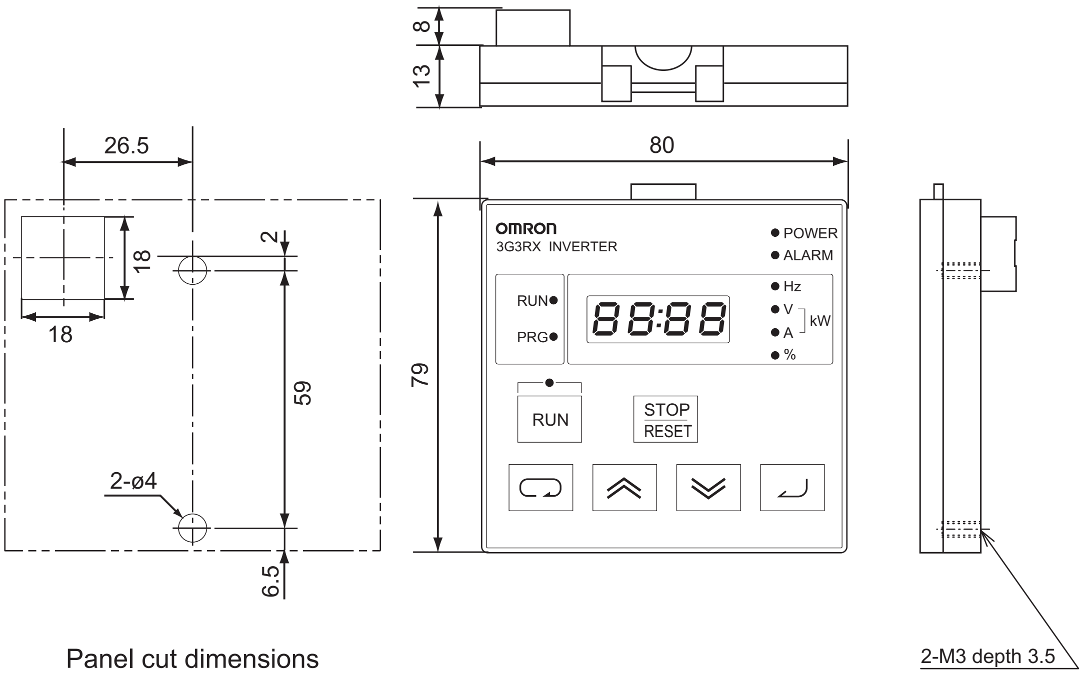




Mounting dimensions



● Built-in LED Digital Operator



Panel cut dimensions

1-4 Restrictions

Restriction on Light Load Mode

Selecting the light load mode disables the following controls.

- 0-Hz sensorless vector control
- Sensor vector control

Therefore, functions associated with these controls such as position and torque control functions are unavailable.

In addition, switching from the heavy load mode to the light load mode causes the rated current and overload detection level of the inverter to be changed, which also changes the default data and setting ranges of some parameters accordingly.

Check the ambient environment; the operating ambient temperature for the light mode is –10 to 40°C.

Limitation on 0-Hz Sensorless Vector Control

When 0-Hz sensorless 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.

Limitation on RS485 Communications

When the inverter is used with any of the following communications units, the inverter's RS485 communications function cannot be used due to conflict in command system information. Control the inverter from the host of each communications unit.

- EtherCAT Communications Unit (Model: 3G3AX-RX-ECT)
- CompoNet Communications Unit (Model: 3G3AX-RX-CRT-E)
- DeviceNet Communications Unit (Model: 3G3AX-RX-DRT-E)

Limitation on Built-in EMC Filter

If the EMC filter that is built into this inverter is used, a stand-alone inverter complies with the EMC directives (EN61800-3 Category C3) required by CE standards.

However, if any of the following communications units is used, the optional EMC Noise Filter (upcoming product) is required.

- EtherCAT Communications Unit (Model: 3G3AX-RX-ECT)
- CompoNet Communications Unit (Model: 3G3AX-RX-CRT-E)
- DeviceNet Communications Unit (Model: 3G3AX-RX-DRT-E)

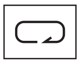
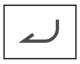
1-5 Comparison with Previous Model

The following describes the changes and additions from the conventional 3G3RX Series.

Use this information when replacing the previous model.

Change in Colors of Digital Operator Keys

The color scheme for Digital Operator keys was reviewed thoroughly based on a global concept that "run- and start-related keys are green" and "stop-related keys are red." As a result, the key colors were changed as shown below.

Key	Name	Previous model	3G3RX Type V1
RUN	RUN key	Gray	Green
STOP/RESET	STOP/RESET key	Yellow	Red
	Mode key	Blue	Blue (No change)
	Enter key	Yellow	Yellow (No change)
	Increment key	Green	Gray
	Decrement key	Green	Gray

Changes in Operation and Initialization Methods from Previous Model

The inverter operation and parameter initialization methods are simplified according to the 3G3MX2 Series.

For details, refer to *3-1-2 Key Operation Method* on page 3-6.

● Elimination of the top display layer (complete display of each function mode)

The top display layer in the operation (A- - -) was eliminated, although the concept of the function modes remains as before.

● Change of scroll behavior in each function mode

The parameter numbers loop in each function mode when scrolled.

● Functions of Mode key and Enter key

The functions of the Mode key and the Enter key were changed as follows for consistency and simplicity in operation.

- Mode key (or ESC key): Moves to the upper display layer (without entering the data).
- Enter key: Moves to the lower display layer, or enters the last data and returns to the upper display layer.

● Parameter Initialization method

Parameter initialization is performed by the parmeter setting without the complicated key operation (simultaneous press of three keys).

Change of Default Parameter Setting

The default parameter settings of the conventional 3G3RX Series Inverter were reviewed and were changed according to the user's usage. Some functions are enabled by default for reducing the workload of the user.

The default parameter settings changed in the 3G3RX-V1 Series are shown in *Section 4 Parameter List*. Check if these are appropriate for your application.

No.	Parameter name	Default setting change		No.	Parameter name	Default setting change	
		Conventional	3G3RX-V1			Conventional	3G3RX-V1
F002	1st Acceleration Time 1	30.00	10.00	A097	Acceleration Pattern Selection	00	01
F202	2nd Acceleration Time 1	30.00	10.00	A098	Deceleration Pattern Selection	00	01
F302	3rd Acceleration Time 1	30.00	10.00	A150	EL-S Shape Acceleration Curve Ratio 1	25	10
F003	1st Deceleration Time 1	30.00	10.00	A151	EL-S Shape Acceleration Curve Ratio 2	25	10
F203	2nd Deceleration Time 1	30.00	10.00	A152	EL-S Shape Deceleration Curve Ratio 1	25	10
F303	3rd Deceleration Time 1	30.00	10.00	A153	EL-S Shape Deceleration Curve Ratio 2	25	10
A039	Jogging Stop Selection	00	04	b006	Input Phase Loss Protection Selection	00	01
A041	1st Torque Boost Selection	00	01	b037	Display Selection	04	00
A241	2nd Torque Boost Selection	00	01	b082	Starting Frequency	0.50	1.50
A047	1st Automatic Torque Boost Slip Compensation Gain	100	0	b130	Overvoltage Suppression Function Selection During Deceleration	00	01
A247	2nd Automatic Torque Boost Slip Compensation Gain	100	0	C071	Communication Speed Selection (Baud Rate Selection)	04	05
A092	1st Acceleration Time 2	30.00	10.00	C073	Communication Bit Length Selection	7	8
A292	2nd Acceleration Time 2	30.00	10.00	C102	Reset Selection	00	02
A392	3rd Acceleration Time 2	30.00	10.00	P070	Origin Search Mode 1 Frequency	0.00	5.00
A093	1st Deceleration Time 2	30.00	10.00	P071	Origin Search Mode 2 Frequency	0.00	5.00
A293	2nd Deceleration Time 2	30.00	10.00				
A393	3rd Deceleration Time 2	30.00	10.00				

Change in Byte Order of Read/Write Function for Multiple Coils in Modbus Communication

For Modbus communication, the inverter provides the function to read and write multiple coils for the control of control I/O.

This function was changed to use the same byte order as that of the 3G3MX2 Series when transferring data over 1 byte. Previously the byte with the largest coil number was the first to be processed, however, in the 3G3RX-V1 Series the byte with the smallest coil number is the first. This enables the use of programs created via Modbus communication for both models.

Addition of the Dual Rating Function (Heavy Load and Light Load)

In addition to the conventional heavy load mode, the 3G3RX-V1 Series Inverter newly has the light load mode to provide the dual rating function.

The light load mode is available for a fan, pump, or other device that operates at the rated motor torque or less in a normal state. Setting the light load mode causes the rated current of the inverter to increase, enabling the inverter to drive a motor that is one size larger in capacity.

However, pay attention to when selecting an inverter because the overload capacity decreases to 1 minute, 120% of the rated current.

Precautions for Correct Use

Switching between the heavy load mode and the light load mode changes the setting ranges and default data of the related parameters. Refer to *5-2-2 Heavy Load/Light Load Selection* on page 5-12 for details.

Implementation of the Programming Function

The 3G3RX-V1 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 “DriveProgramming User’s Manual (I580)”.

5-line LCD Digital Operator

This inverter supports the newly released LCD Digital Operator 3G3AX-OP05 with the 5-line display capability. The LCD Digital Operator can display four monitor functions or parameter settings in the selected language (currently English only), which effectively improves the readability of the device status and other information.

In addition, the LCD Digital Operator can store up to four sets of inverter parameter setting data, or a single set of inverter parameter setting data and a single DriveProgramming program in its internal memory. This saves time when you set the same parameter or write the same program to more than one inverter.

DI Board Not Supported

The 3G3RX-V1 Series Inverter does not support the OMRON DI Board (Model: 3G3AX-DI01).

Do not connect the DI Board (Model: 3G3AX-DI01).

2

Design

This section describes the installation and wiring methods.

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2-1-2 Installation Environment 2-4
2-2 Removal of Each Part 2-9
2-2-1 Removing Covers 2-9
2-2-2 Terminal Blocks 2-11
2-2-3 Preparing Backing Plate 2-13
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2-3-11 Reference Manuals for Options 2-60

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 the slide switch (SW1), install/remove the Digital Operator and optional devices, or replace the cooling fan 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)

Caution	
	Do not connect resistors to the terminals (+1, P/+2, 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 and 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 overheating is detected in the braking resistor and 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.

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 power 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.

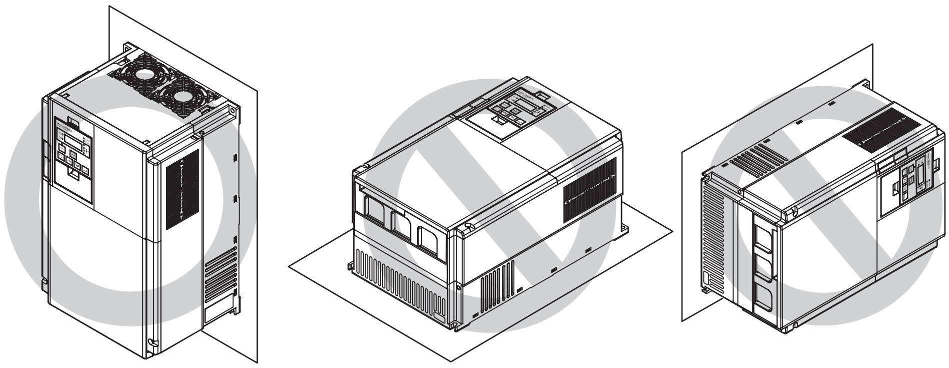
  Locations close to power lines.
- If a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur. Perform the operation after enough confirmation.
- When using the DriveProgramming, confirm that the program data is downloaded normally before starting operation.

2-1 Installation

2-1-1 Inverter Installation

Mount the 3G3RX-V1 Series Inverter vertically on a wall with the product's longer sides upright.

The material of the wall must be noninflammable such as a metal plate.



For the mounting dimensions, refer to *1-3-2 External Dimensions* on page 1-14.

2-1-2 Installation Environment

Operating Environment Conditions

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

Rating	Operating ambient temperature	Operating ambient humidity
Heavy load mode	–10 to 50°C	20% to 90% (with no condensation)
Light load mode	–10 to 40°C	20% to 90% (with no condensation)

- Avoid installing the inverter in a dirty environment subject to oil mist, dust, or other airborne particles. Install the inverter in a clean place, or in a full-enclosure type panel.
- Take measures during installation and operation to prevent foreign objects such as metal particles, oil, and water from entering the inverter.

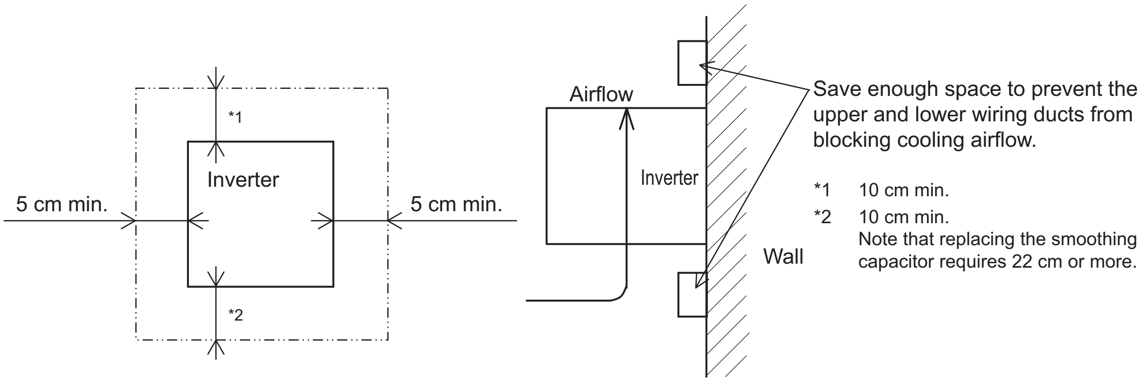
Installation Conditions

Keep the inverter clear of heating elements such as a braking resistor or reactor.

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 dispersion from inside the inverter, provide the clearance specified in the figure below during installation.

Do not install more than one inverter side by side without clearance.

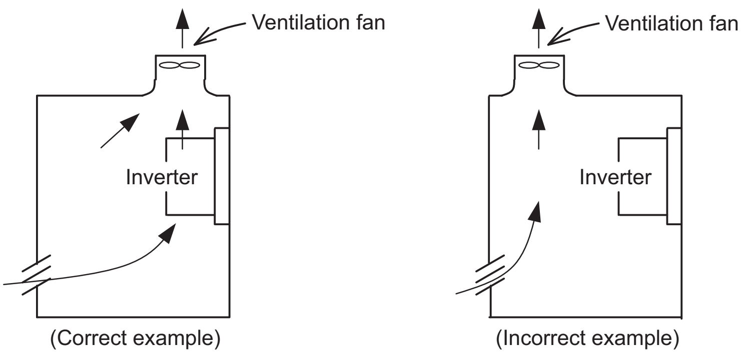


Ambient Temperature Control

To ensure reliable operation, use the inverter in an environment subject to minimal temperature rise as much as possible.

If you install a ventilation fan in a control panel where several inverters are installed, be careful about the layout of the inverters and the air intake and ventilation apertures.

Remember that poor air circulation around inverters causes an internal temperature rise, which may inversely affect the internal components of the inverters.



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 complete. Using the inverter with the cover placed results in poor ventilation, which causes the inverter to overheat.

Loss according to the Inverter Capacity

For the calculation of heat radiation from a cabinet, the following table shows the amount of heat generation (loss) according to the inverter capacity.

Voltage	200-V class/400-V class					
Capacity [kW]	Heavy load			Light load		
	Loss at 70% load [W]	Loss at 100% load [W]	Efficiency at rated output [%]	Loss at 70% load [W]	Loss at 100% load [W]	Efficiency at rated output [%]
0.4	64	70	85.1	76	88	89.5
0.75	76	88	89.5	102	125	92.3
1.5	102	125	92.3	127	160	93.2
2.2	127	160	93.2	179	235	94.0
3.7	179	235	94.0	242	325	94.4
5.5	242	325	94.4	312	425	94.6
7.5	312	425	94.6	435	600	94.8
11	435	600	94.8	575	800	94.9
15	575	800	94.9	698	975	95.0
18.5	698	975	95.0	820	1,150	95.0
22	820	1,150	95.0	1,100	1,550	95.0
30	1,100	1,550	95.0	1,345	1,900	95.1
37	1,345	1,900	95.1	1,625	2,300	95.1
45	1,625	2,300	95.1	1,975	2,800	95.1
55	1,975	2,800	95.1	2,675	3,800	95.2
75	2,675	3,800	95.2	3,375	4,800	95.2
90	3,375	4,800	95.2	3,900	5,550	95.2
110	3,900	5,550	95.2	4,670	6,650	95.2
132	4,670	6,650	95.2	5,660	8,060	95.2

Derating of Rated Output Current

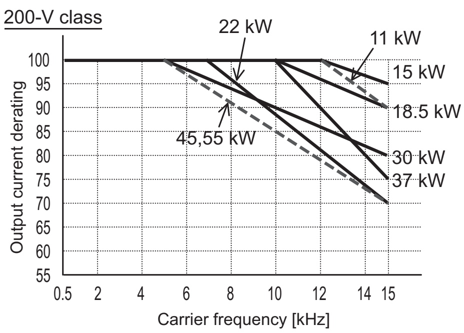
The table below shows the derating specifications for the rated output current of the 3G3RX-V1 Series Inverter.

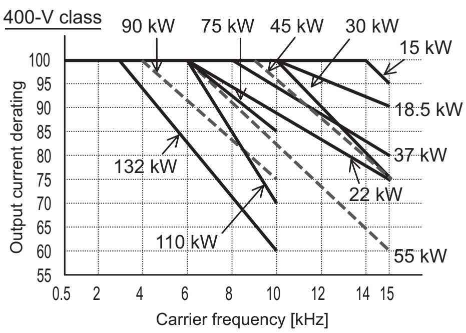
Make sure that you use the correct data. The derating value differs between the heavy load mode and the light load mode.

- Necessity of derating (Yes/No): Shows whether derating is necessary.
- Max. carrier frequency fc: Shows the maximum carrier frequency for which derating is not necessary.
- Derating at fc = ** kHz: Shows the rated output current reduction rate when the carrier frequency is set to ** kHz.

● Derating at the heavy load

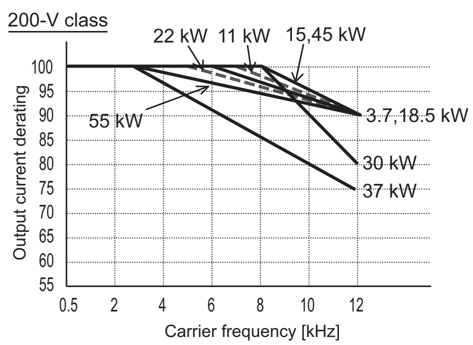
Voltage	200-V class			400-V class		
Capacity [kW]	Heavy load mode			Heavy load mode		
	Necessity of derating	Max. carrier frequency fc [kHz]	Derating at fc = 15 kHz	Necessity of derating	Max. carrier frequency fc [kHz]	Derating at fc = 15 kHz (10 kHz for 75 kW or more)
0.4	No	15	100%	No	15	100%
0.75	No	15	100%	No	15	100%
1.5	No	15	100%	No	15	100%
2.2	No	15	100%	No	15	100%
3.7	No	15	100%	No	15	100%
5.5	No	15	100%	No	15	100%
7.5	No	15	100%	No	15	100%
11	Yes	12	90% (41.4 A max.)	No	15	100%
15	Yes	12	95% (60.8 A max.)	Yes	14	95% (30.4 A max.)
18.5	Yes	10	90% (68.4 A max.)	Yes	10	90% (34.2 A max.)
22	Yes	7	70% (66.5 A max.)	Yes	6	75% (36.0 A max.)
30	Yes	5	80% (96.8 A max.)	Yes	10	75% (43.5 A max.)
37	Yes	10	75% (108.7 A max.)	Yes	8	80% (60.0 A max.)
45	Yes	5	70% (127.4 A max.)	Yes	9	75% (68.2 A max.)
55	Yes	5	70% (154.0 A max.)	Yes	6	60% (67.2 A max.)
75	–	–	–	Yes	6	85% (126.7 A max.)
90	–	–	–	Yes	4	75% (132.0 A max.)
110	–	–	–	Yes	6	70% (151.9 A max.)
132	–	–	–	Yes	3	60% (156.0 A max.)

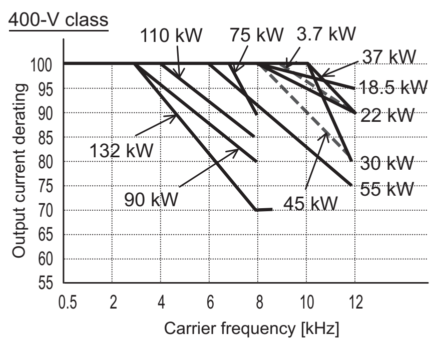




● Derating at the light load

Voltage	200-V class			400-V class		
Capacity [kW]	Light load mode			Light load mode		
	Necessity of derating	Max. carrier frequency fc [kHz]	Derating at fc = 12 kHz	Necessity of derating	Max. carrier frequency fc [kHz]	Derating at fc = 12 kHz (8 kHz for 75 kW or more)
0.4	No	12	100%	No	12	100%
0.75	No	12	100%	No	12	100%
1.5	No	12	100%	No	12	100%
2.2	No	12	100%	No	12	100%
3.7	Yes	6	90% (17.6 A max.)	Yes	10	90% (9.9 A max.)
5.5	No	12	100%	No	12	100%
7.5	No	12	100%	No	12	100%
11	Yes	7	90% (52.2 A max.)	No	12	100%
15	Yes	8	90% (65.7 A max.)	No	12	100%
18.5	Yes	6	90% (76.5 A max.)	Yes	8	95% (40.8 A max.)
22	Yes	5	90% (101.7 A max.)	Yes	8	90% (51.3 A max.)
30	Yes	8	80% (112.0 A max.)	Yes	10	80% (56.0 A max.)
37	Yes	3	75% (126.7 A max.)	Yes	9	90% (76.5 A max.)
45	Yes	8	90% (189.0 A max.)	Yes	8	80% (84.0 A max.)
55	Yes	3	90% (243.0 A max.)	Yes	6	75% (101.2 A max.)
75	–	–	–	Yes	7	90% (144.0 A max.)
90	–	–	–	Yes	3	80% (156.0 A max.)
110	–	–	–	Yes	4	85% (195.5 A max.)
132	–	–	–	Yes	3	70% (203.0 A max.)





2-2 Removal of Each Part

2-2-1 Removing Covers

Before wiring each terminal block, you need to remove the terminal block cover and the backing plate.

In addition, to install a PG Board or communications unit, you must remove the Digital Operator, spacer cover, terminal block cover, and front cover beforehand.

This section describes how to remove these covers.

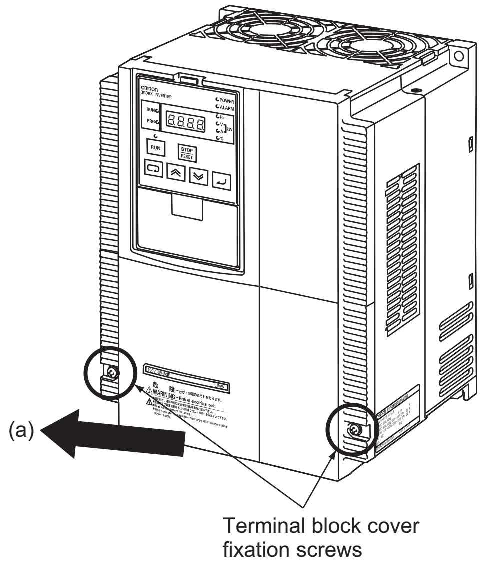
To reinstall it, reverse the removal procedure.

Removing Terminal Block Cover

1 **Loosen the terminal block cover fixation screws.**

There are two terminal block cover fixation screws, one for each side of the cover.
Larger capacity inverter models have three terminal block cover fixation screws.

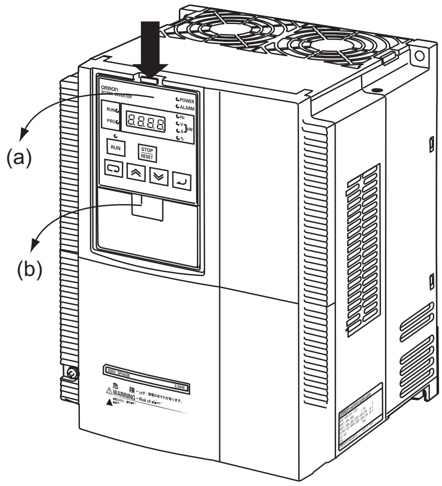
2 **Remove the terminal block cover in the direction of (a) while holding it from the bottom.**



Removing Digital Operator and Spacer Cover

1 **Remove the Digital Operator in the direction of (a) by pushing the lip on the top.**

2 **In the same way, remove the spacer cover in the direction of (b).**

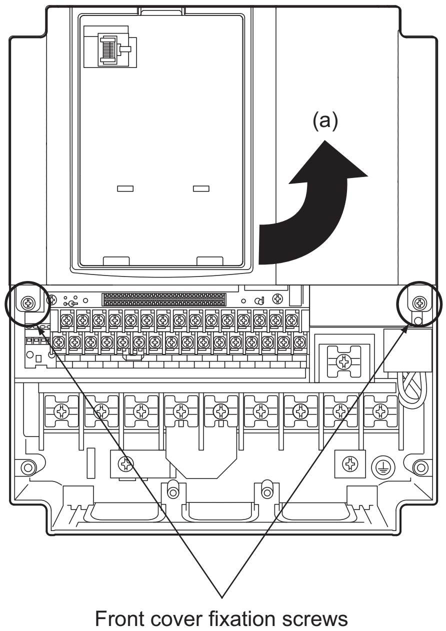


Removing Front Cover

1 **After removing the terminal block cover, Digital Operator, and spacer cover, loosen the front cover fixation screws.**

There are two front cover fixation screws, one for each side of the cover.

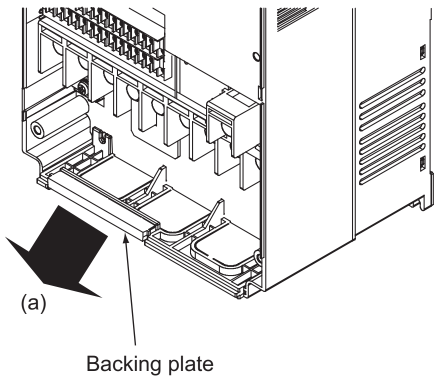
2 **Remove the front cover in the direction of (a) while holding it from the bottom.**



Removing Backing Plate

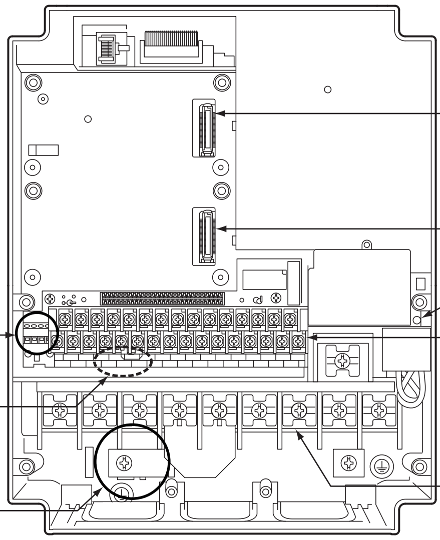
After removing the terminal block cover, pull out the backing plate in the direction of (a).

For how to cut the backing plate, refer to *2-2-3 Preparing Backing Plate* on page 2-13.



2-2-2 Terminal Blocks

Before wiring each terminal block, remove the terminal block cover and the backing plate.



Name	Description
Control circuit terminal block	The terminal block for connecting various digital/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.
Mounting position of option board 1	The position where the option board (PG Board) is mounted.
Mounting position of option board 2	The position where the option board (communications unit) is mounted.
Ground terminal with short-circuit bar for switching EMC filter function	The ground terminal with a short-circuit bar for switching the filter function for compliance with the EMC Directives required by EC Directive.
RS485 communications terminal block	The communications terminal for RS485 communications between the inverter and external control equipment.
Charge indicator	Lights up even after power supply shutoff if the main circuit DC voltage (between the P/+2 terminal and N/– terminal) is approximately 45 V or higher. Make sure the charge indicator is not lit before wiring etc.
Slide switch SW1	Enables or disables the emergency shutoff function.

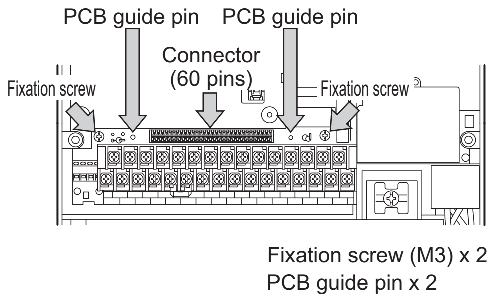
Removing Control Circuit Terminal Block

The following is the procedure for removing the control circuit terminal block.

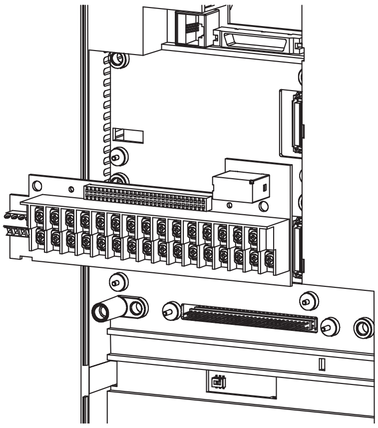
To reinstall it, reverse the removal procedure.

1 **Loosen the control circuit terminal block fixation screws.**

There are two control circuit terminal block fixation screws, one for each side of the terminal block.



2 **Pull the control circuit terminal block PCB straight forward to remove it.**



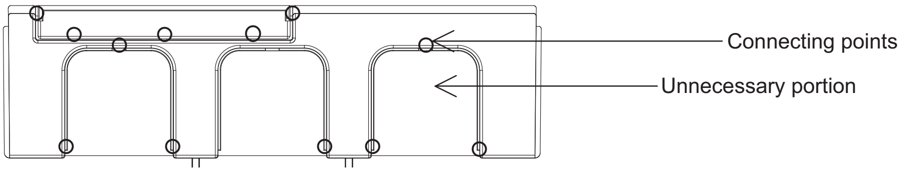
Precautions for Correct Use

Pull the control circuit terminal block PCB slowly. At this time, be careful not to bend or break the connector pins and the PCB guide pins.

2-2-3 Preparing Backing Plate

Inverter with 22 kW or Lower Capacity

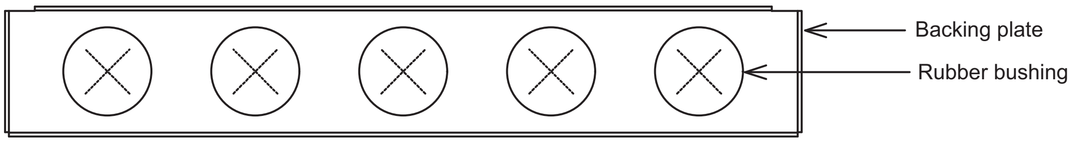
When wiring cables, cut the points between the backing plate and unnecessary portions with nippers or a wire cutter, and remove.



Inverter with 30 kW or Higher Capacity

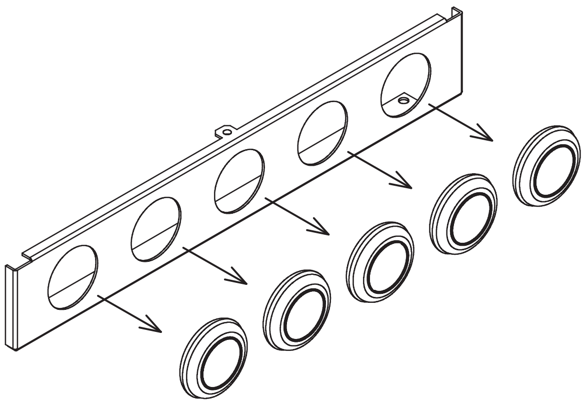
- **For connection without any cable conduit**

Make an X-cut in each rubber bushing of the backing plate with nippers or a wire cutter, and insert a cable.



- **For connection with a cable conduit**

Remove the rubber bushing from each portion where you connect the cable conduit.

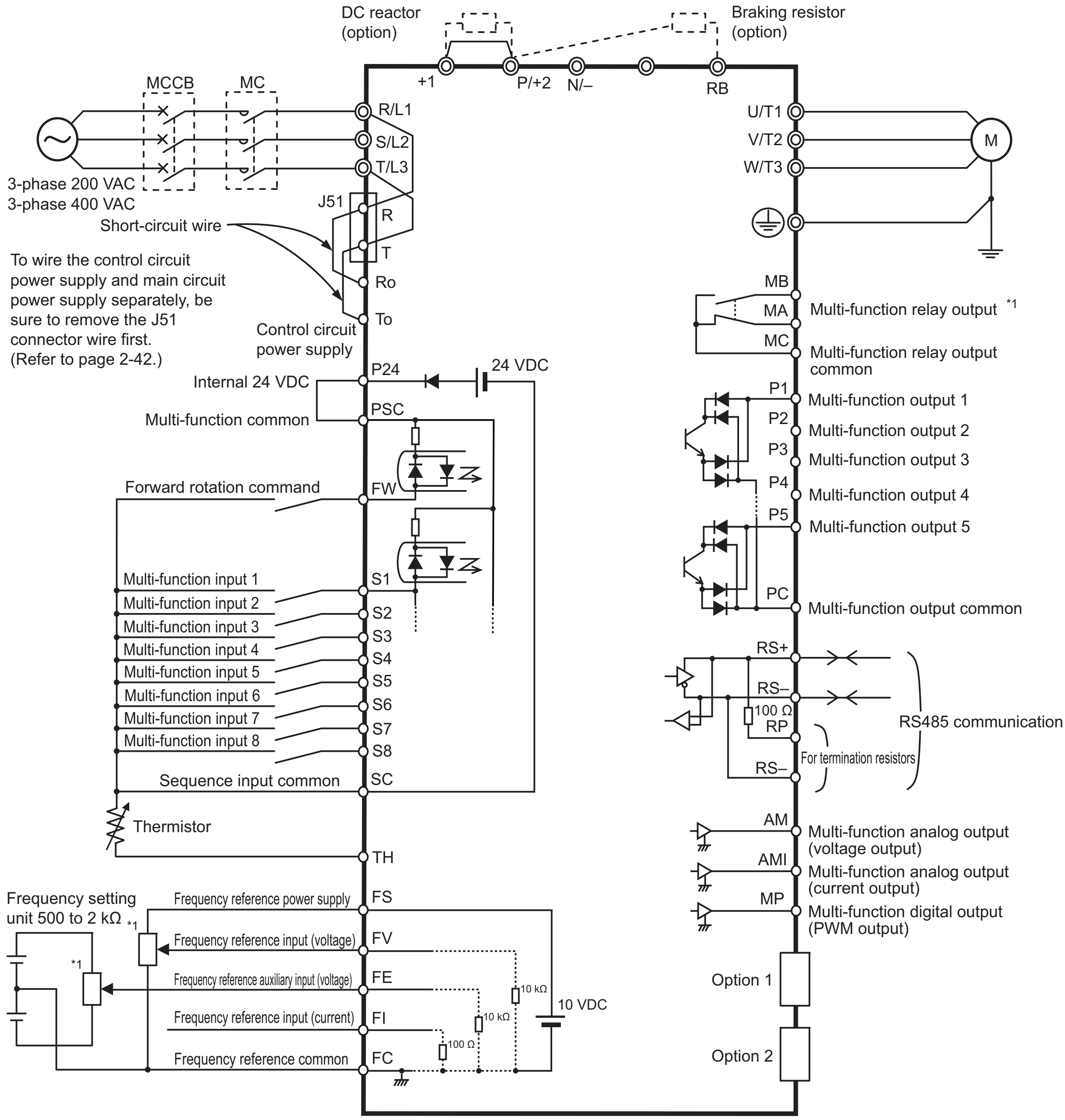


Precautions for Safe Use

Do not remove the rubber bushing unless you connect a cable conduit. Doing so may result in 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

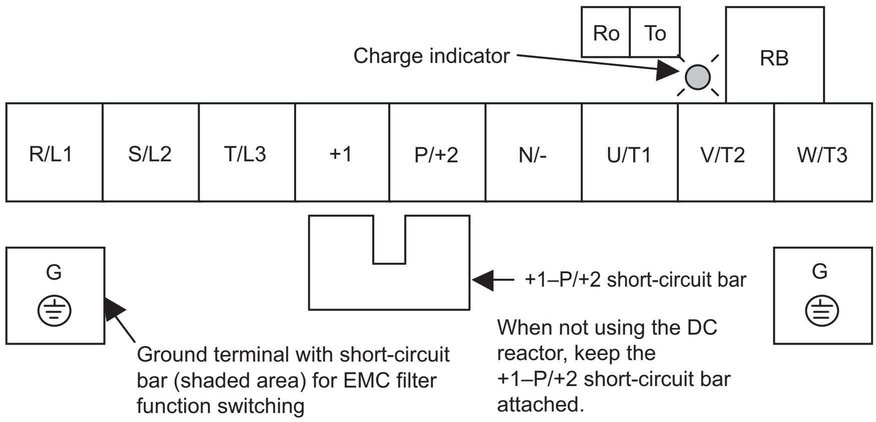


*1 Variable volume adjuster (2 kΩ 1/4 W or larger recommended)

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

The table below shows the arrangement of the main circuit terminal block and description of each terminal.

Main Circuit Terminal Block



Terminal symbol	Terminal name	Description
R/L1 S/L2 T/L3	Main power supply input terminal	Connect the input power supply. 200-V class: 170 to 264 VAC, 50/60 Hz ±5% 400-V class: 323 to 528 VAC, 50/60 Hz ±5%
U/T1 V/T2 W/T3	Inverter output terminal	Connect a 3-phase motor. The maximum output voltage depends on the input power supply voltage. 200-V class: 170 to 264 VAC 400-V class: 323 to 528 VAC
+1 P/+2	External DC reactor terminal	Remove the short-circuit bar between the terminals +1 and P/+2, and connect the optional power factor improvement DC reactor.
P/+2 RB	Braking resistor connection terminal	Connect optional external braking resistors. The terminal RB is provided for the inverters with 22 kW or lower capacity.
P/+2 N/–	Regenerative braking unit connection terminal	Connect optional regenerative braking units.
G ⏚	Ground terminal	The inverter's ground terminal. Connect this terminal to the ground. Class D (200-V class), Class C (400-V class)
Ro To	Control circuit power supply terminal	Power supply terminals for inverter control circuit.

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

The table below shows the arrangement of the control circuit terminal block, and description and specifications of each terminal.

Control Circuit Terminal Block

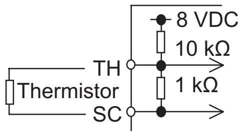
	FS	FE	AM	MP	TH	FW	S8	SC	S5	S3	S1	P4	P3	P1	MA
FC	FV	FI	AMI	P24	PSC	SC	S7	S6	S4	S2	P5	PC	P2	MC	MB

Terminal screw size M3

Terminal		Terminal symbol	Terminal name	Description	Specifications
Analog	Frequency reference input	FS	Frequency reference power supply output	10 VDC power supply for the terminal FV.	Allowable load current: 20 mA max.
		FV	Frequency reference input (Voltage reference)	0 to 10 VDC analog input. By default, this is set so that the frequency reaches the maximum at 9.8 V (Adjustable in A012/A014). This terminal is enabled when Frequency Reference Selection (A001) is set to 01 (Terminal).	Input impedance: 10 kΩ Allowable input voltage range: –0.3 to 12 VDC
		FE	Auxiliary frequency reference input (Voltage reference)	–10 to 10 VDC analog input. By default, this is set so that the frequency reaches the maximum at 9.8 V (Adjustable in A112/A114). Setting these parameters adds the terminal FE signal to the frequency reference signal at the terminal FV or FI. It is also possible to input the frequency reference independently to the terminal FE.	Input impedance: 10 kΩ Allowable input voltage range: 0 to ±12 VDC
		FI	Frequency reference input (Current reference)	4 to 20 mA analog DC input. By default, this is set so that the frequency reaches the maximum at 19.8 mA (Adjustable in A102/A104). By default, the terminal FI signal is added to the frequency reference signal at the terminal FV. If any of the multi-function input terminals is set to AT, this terminal is enabled only when the AT terminal is ON.	Input impedance: 100 Ω Max. allowable current: 24 mA
		FC	Frequency reference common	Common terminal for the frequency setting signals (FV, FE and FI) and the analog output terminals (AM and AMI). Do not connect this terminal to the ground.	–

Terminal		Terminal symbol	Terminal name	Description	Specifications
Analog	Monitor output	AM	Multi-function analog output (Voltage)	This terminal outputs a signal selected from the “0 to 10 VDC Voltage Output” monitor items: Output frequency, Output current, Output torque (with/without sign), Output voltage, Input power, Electronic thermal load rate, LAD frequency, Motor temperature, and Fin temperature.	Max. allowable current: 2 mA
		AMI	Multi-function analog output (Current)	This terminal outputs a signal selected from the “4 to 20 mA DC Current Output” monitor items: Output frequency, Output current, Output torque (without sign), Output voltage, Input power, Electronic thermal load rate, LAD frequency, Motor temperature, and Fin temperature.	Allowable load impedance: 250 Ω max.
Digital (contact)	Monitor output	MP	Multi-function digital output	This terminal outputs a signal selected from the “0 to 10 VDC Voltage Output (PWM)” monitor items: Output frequency, Output current, Output torque (without sign), Output voltage, Input power, Electronic thermal load rate, LAD frequency, Motor temperature, Fin temperature, Digital output frequency, and Digital current monitor. “Digital output frequency” and “Digital current monitor” output a frequency at a pulse of 0/10 VDC pulse voltage and with a duty ratio of 50%.	Max. allowable current: 1.2 mA Max. frequency: 3.6 kHz
	Power supply	P24	Internal 24 VDC	24-VDC power supply for contact input signal. When the source logic is selected, this terminal functions as the contact input common terminal.	Max. allowable output current: 100 mA
		SC	Sequence input common	Common terminal for the interface power supply terminal P24, thermistor input terminal TH , and digital monitor terminal MP. When the sink logic is selected, this terminal functions as the contact input common terminal. Do not connect this terminal to the ground.	–

<table>
<tr><th colspan="3">Terminal</th><th>Terminal symbol</th><th>Terminal name</th><th>Description</th><th>Specifications</th></tr>
<tr><td rowspan="18">Digital (contact)</td><td rowspan="10">Contact input</td><td>RUN command</td><td>FW</td><td>Forward RUN command terminal</td><td>When the FW signal is ON, the motor runs forward. When it is OFF, the motor decelerates and stops.</td><td rowspan="9">[Contact input ON condition]
Voltage between each input terminal and the terminal PSC: 18 VDC or more
Input impedance between each input terminal and the terminal PSC: 4.7 kΩ
Max. allowable voltage: Voltage between each input terminal and the terminal PSC: 27 VDC
Load current at 27 VDC power supply voltage: Approx. 5.6 mA</td></tr>
<tr><td rowspan="9">Function, switching, etc.</td><td>S1</td><td rowspan="8">Multi-function input</td><td rowspan="8">Select 8 functions from among the 70 functions and allocate them to terminals S1 to S8.</td></tr>
<tr><td>S2</td></tr>
<tr><td>S3</td></tr>
<tr><td>S4</td></tr>
<tr><td>S5</td></tr>
<tr><td>S6</td></tr>
<tr><td>S7</td></tr>
<tr><td>S8</td></tr>
<tr><td>PSC</td><td>Multi-function input common</td><td>The sink and source logics for contact input can be switched by connecting a short-circuit bar on the control terminal block.
• Short-circuiting P24 and SC: Sink logic
• Short-circuiting SC and PSC: Source logic
To activate contact input via an external power supply, remove the short-circuit bar and connect terminal PSC to the external interface circuit.</td><td>–</td></tr>
<tr><td rowspan="6">Open collector output</td><td rowspan="6">Status, factor, etc.</td><td>P1</td><td rowspan="5">Multi-function output</td><td rowspan="5">Select five functions from among 52 functions, and allocate them to terminals P1 through P5.
When an alarm code is selected in C062, terminals P1 to P3, or terminals P1 to P4 always output an alarm factor code (e.g. inverter trip).
The signal between each terminal and PC always corresponds to the sink or source logic.</td><td rowspan="5">Between each terminal and PC
Voltage drop at power-on: 4 V max.
Max. allowable voltage: 27 VDC
Max. allowable current: 50 mA</td></tr>
<tr><td>P2</td></tr>
<tr><td>P3</td></tr>
<tr><td>P4</td></tr>
<tr><td>P5</td></tr>
<tr><td>PC</td><td>Multi-function output common</td><td>Common terminal for multi-function output terminals P1 to P5.</td><td>–</td></tr>
<tr><td rowspan="2">Relay output</td><td rowspan="2">Status, alarm, etc.</td><td>MA
MB</td><td>Multi-function relay output</td><td rowspan="2">Select the desired function from among 52 functions, and allocate it to these terminals.
SPDT contact output.
By factory default, Multi-function Relay Output (MA, MB) Operation Selection (C036) is set at NC contact between MA and MC, and NO contact between MB and MC.</td><td rowspan="2">Max. contact capacity
Between MA and MC
• 250 VAC: 2 A (Resistance)/0.2 A (Induction)
• 30 VDC: 8 A (Resistance)/0.6 A (Induction)
Between MB and MC
• 250 VAC: 1 A (Resistance)/0.2 A (Induction)
• 30 VDC: 1 A (Resistance)/0.2 A (Induction)
Min. contact capacity
• 100 VAC, 10 mA
• 5 VDC, 100 mA</td></tr>
<tr><td>MC</td><td>Multi-function relay output common</td></tr>
</table>

Terminal			Terminal symbol	Terminal name	Description	Specifications
Analog	Analog input	Sensor	TH	External thermistor input terminal	Connect an external thermistor to this terminal, to cause the inverter to trip when a temperature error occurs. The terminal SC functions as the common terminal. [Recommended thermistor characteristics] Allowable rated power: 100 mW min. Impedance at temperature error: 3 kΩ Temperature error detection level is adjustable between 0 and 9999 Ω.	Allowable input voltage range: 0 to 8 VDC [Input circuit] 

Precautions for Correct Use

The relay output terminals are allocated to 05 (AL: Alarm output) by default. However, the relay output status of the inverter when the input power supply is OFF is different from the previous model (3G3☐V Series).

The table below shows the relationship between the relay output status when the inverter input power supply is ON/OFF and the Multi-function Relay Output (MA, MB) Operation Selection (C036) setting. Select the parameter setting appropriate to the sequence of your inverter according to this table.

Setting in C036	Input power supply	Inverter status	Relay output status	
			Between MA and MC	Between MB and MC
00	ON	Normal	Open	Closed
		Alarm output	Closed	Open
	OFF	–	Open	Closed
01 (Default data)	ON	Normal	Closed	Open
		Alarm output	Open	Closed
	OFF	–	Open	Closed

Note Set C036 to 00 to have the same relay output status as with the previous model (3G3☐V Series).

RS-485 Communications Terminal Block

The table below shows the arrangement of the RS485 communications terminal block and description of each terminal.

RS+	RS–	RP	RS–

Terminal			Terminal symbol	Terminal name	Description	Specifications
Communication function	Communications	Signal	RS+	RS485 communications send/receive terminal, positive side	Positive side send/receive signal for RS485 communications.	Conform to RS485 signal level
			RS–	RS485 communications send/receive terminal, negative side	Negative-side send/receive signal for RS485 communications.	
	Termination	Termination	RP	Terminating Resistor enable terminal	The RP terminal is used to enable the built-in Terminating Resistor.	100 Ω
			RS–	RS485 communications send/receive terminal, negative side (for Terminating Resistor connection)	Connect this terminal to the negative side RS485 communications send/receive terminal (for Termination Resistor connection) to enable the built-in Terminating Resistor.	

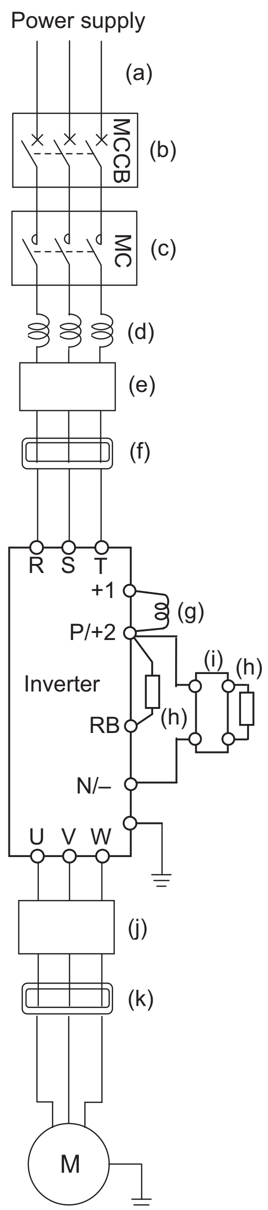
2-3-4 Wiring for Main Circuit Terminals

Precautions for Safe Use

- Before wiring, make sure that the charge indicator is not lit.
- Once the power supply is turned on, the capacitor in the inverter remains charged with a high voltage for a while after the power supply is shut off regardless of whether the inverter operates or not, which is dangerous.
- If you change cable connections after the power supply is shut off, wait for at least 10 minutes and, before wiring, check with a circuit tester etc. to be sure that there is no residual voltage between terminals P/+2 and N/–.

Main Circuit Configuration Diagram

The diagram below shows the configuration of the inverter main circuit. The function of each peripheral component is also described.

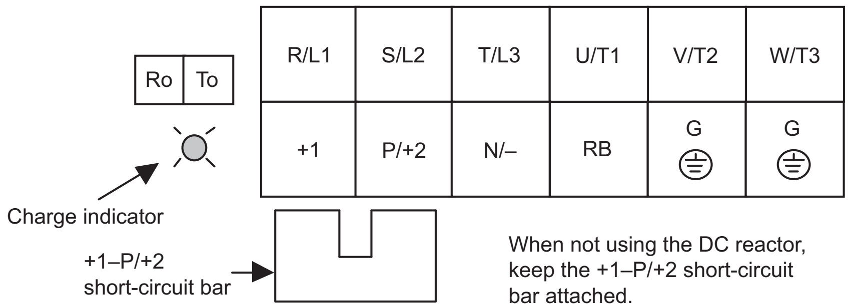


Name	Function
(a) (b) (c)	Refer to *Recommended Cable Size, Wiring Device, and Crimp Terminal* on page 2-26.
(d) AC reactor	This is used as a harmonic suppression measure. It also helps improve the power factor. The AC reactor is used when the power supply voltage unbalance factor is 3% or more, the inverter capacity is 500 kVA or more, or rapid change in the power supply voltage occurs to reduce its effect.
(e) Input noise filter	This filter reduces the conductive noise generated in the inverter and transmitted via wires. Connect it to the primary side (input side) of the inverter.
(f) Radio noise filter	The inverter in operation may cause noise through the power supply wiring etc., which could affect radio receivers or other equipment nearby. This filter reduces such noise (radiated noise).
(g) DC reactor	This reactor helps suppress harmonics generated by the inverter.
(h) Braking Resistor (i) Regenerative braking unit	These are used to increase the inverter's braking torque in applications where the signal turns ON/OFF frequently in a repetitive manner or where the speed of a load with a large moment of inertia is decelerated.
(j) Output noise filter	This filter is installed between the inverter and the motor to reduce the radiated noise emitted from cables. It is used to reduce radio and television interference and prevent meter and sensor malfunction.
(k) Radio noise filter	This filter is used to reduce noise generated on the input or output side of the inverter.

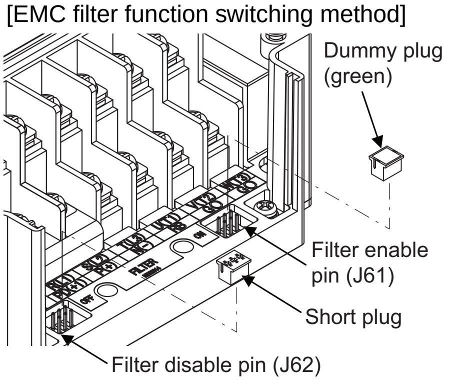
Arrangement of Main Circuit Terminals

The arrangement of the inverter main circuit terminals is shown below.

Terminal arrangement | **Applicable model**



[EMC filter function switching method]



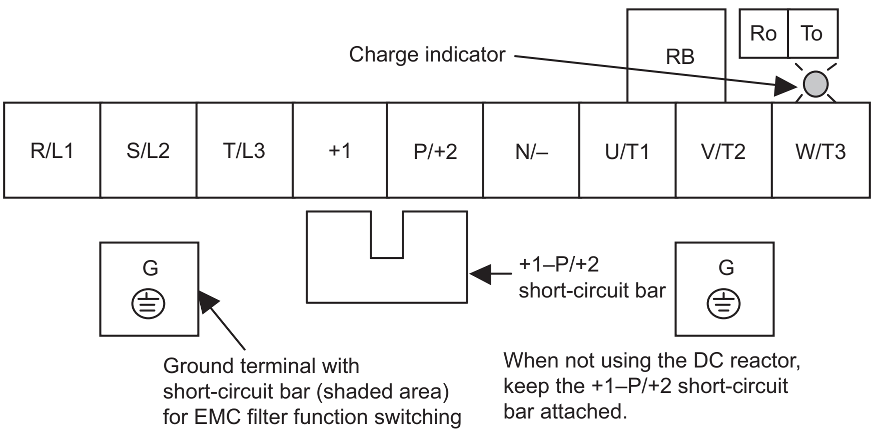
In order to enable the EMC filter function, set up the plug inserted into the filter enable pin (J61) and filter disable pin (J62) as shown in the table below. Confirm that electrical power is disconnected before performing this setup. Not doing so may result in electric shock. Also, use with the plug inserted.

	Filter enable pin (J61)	Filter disable pin (J62)
EMC filter disabled (factory setting)	Dummy plug (green)	Short plug
EMC filter enabled	Short plug	Dummy plug (green)

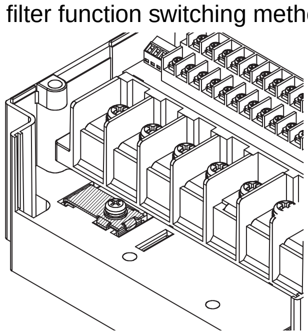
Applicable model:

3G3RX-A2004-V1 to A2037-V1
3G3RX-A4004-V1 to A4037-V1

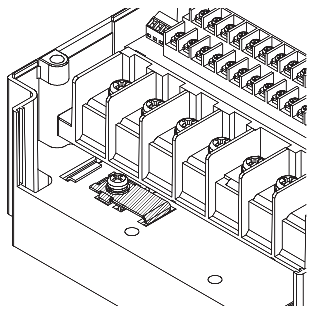
Ro, To: M4
Ground terminal: M4
Others: M4



[EMC filter function switching method]



EMC filter enabled



EMC filter disabled (factory setting)

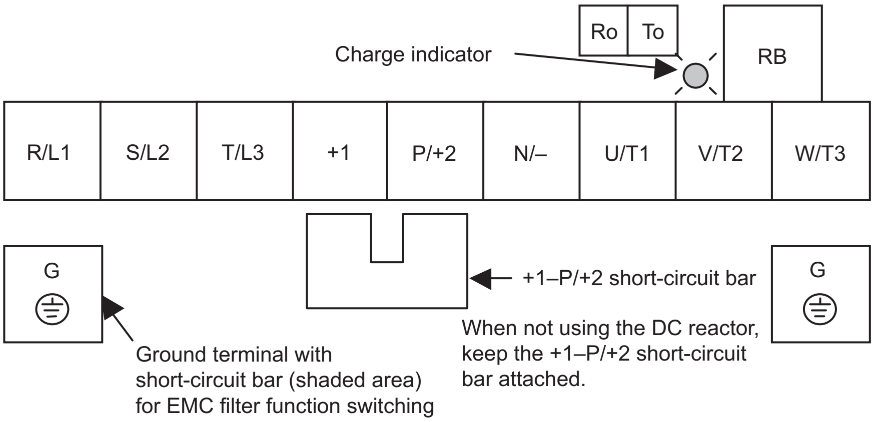
Applicable model:

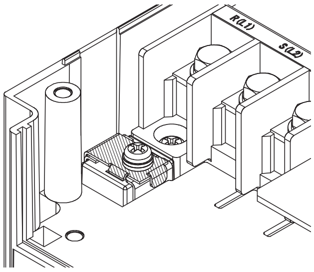
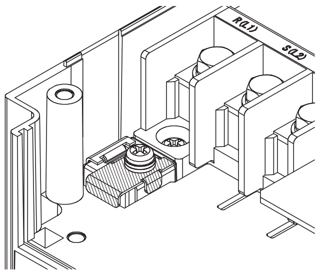
3G3RX-A2055-V1, A2075-V1
3G3RX-A4055-V1, A4075-V1

Ro, To: M4
Ground terminal: M5
Others: M5

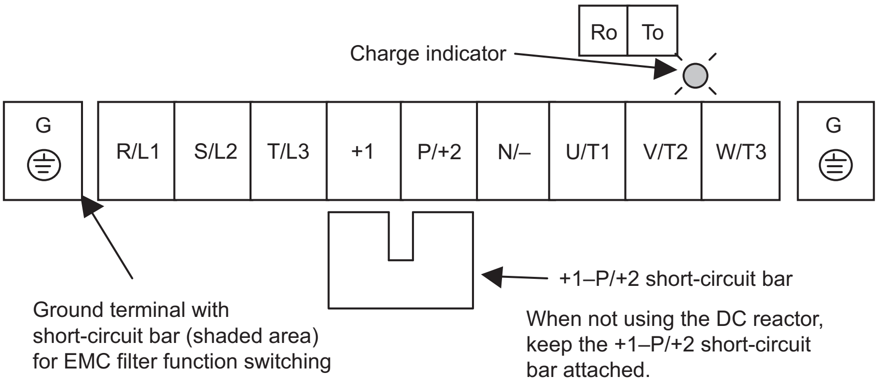
3G3RX-A2110-V1
3G3RX-A4110-V1

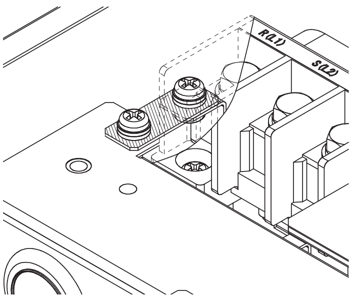
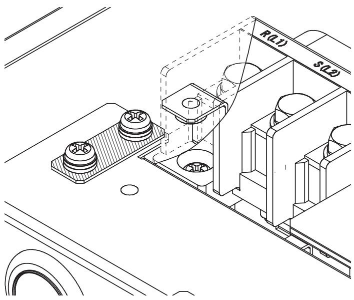
Ro, To: M4
Ground terminal: M5
Others: M6

<table>
<tr><th>Terminal arrangement</th><th>Applicable model</th></tr>
<tr><td rowspan="2">

[EMC filter function switching method]

EMC filter enabled

EMC filter disabled (factory setting)</td>
<td>3G3RX-A2150-V1 to A2185-V1
3G3RX-A4150-V1 to A4220-V1

Ro, To: M4
Ground terminal: M6
Others: M6</td></tr>
<tr><td>3G3RX-A2220-V1

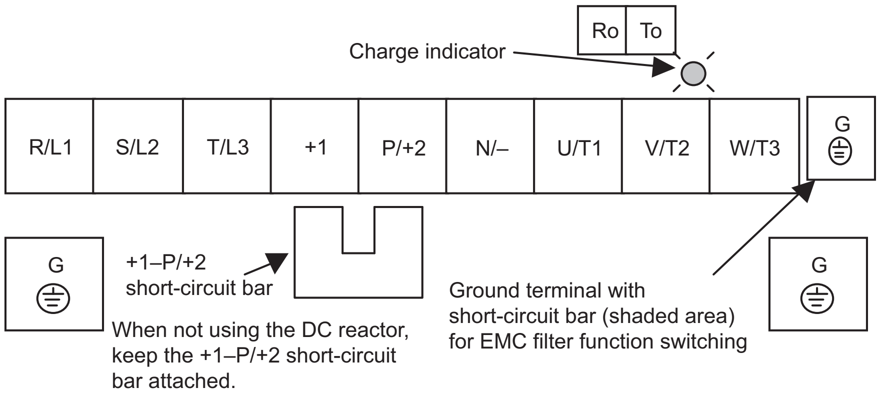
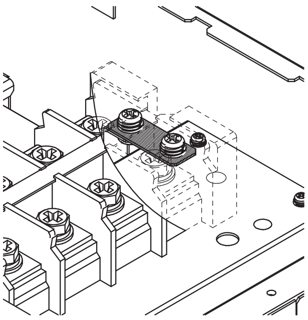
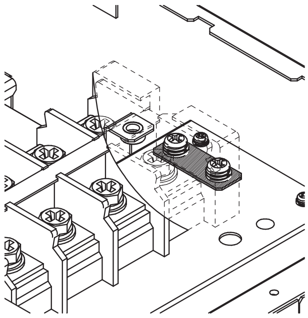
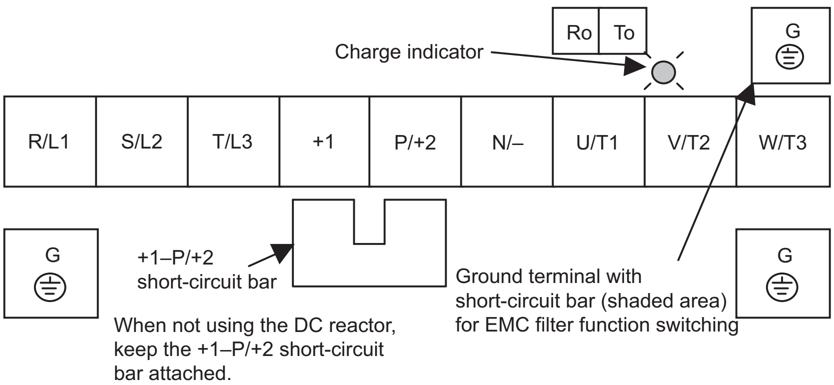
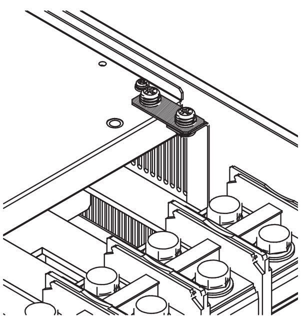
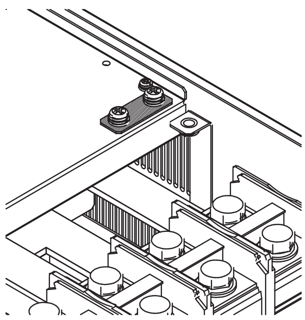
Ro, To: M4
Ground terminal: M6
Others: M8</td></tr>
<tr><td rowspan="3">

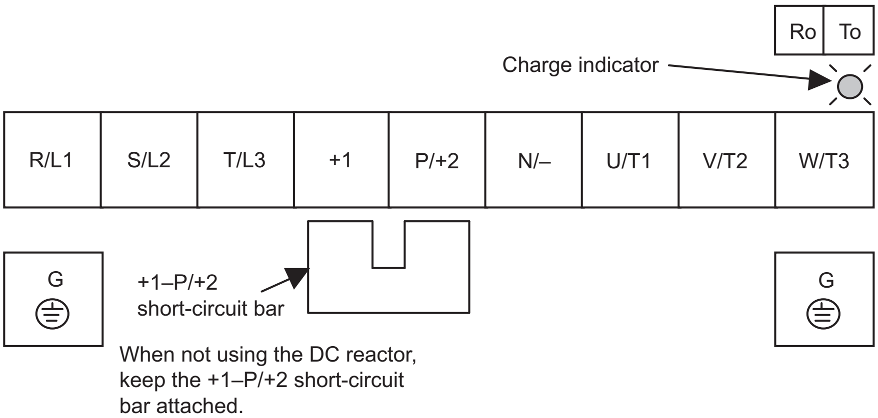
[EMC filter function switching method]

EMC filter enabled

EMC filter disabled (factory setting)</td>
<td>3G3RX-A2300-V1

Ro, To: M4
Ground terminal: M6
Others: M8</td></tr>
<tr><td>3G3RX-A4300-V1

Ro, To: M4
Ground terminal: M6
Others: M6</td></tr>
<tr><td>3G3RX-A2370-V1
3G3RX-A4370-V1

Ro, To: M4
Ground terminal: M8
Others: M8</td></tr>
</table>

Terminal arrangement	Applicable model
 [EMC filter function switching method]  EMC filter enabled  EMC filter disabled (factory setting)	3G3RX-A2450-V1 3G3RX-A4450-V1 3G3RX-A4550-V1 Ro, To: M4 Ground terminal: M8 Others: M8
 [EMC filter function switching method]  EMC filter enabled  EMC filter disabled (factory setting)	3G3RX-A2550-V1 Ro, To: M4 Ground terminal: M8 Others: M10

Terminal arrangement	Applicable model
	3G3RX-B4750-V1 3G3RX-B4900-V1 3G3RX-B411K-V1 3G3RX-B413K-V1 Ro, To: M4 Ground terminal: M8 Others: M10

Recommended Cable Size, Wiring Device, and Crimp Terminal

For inverter wiring, crimp terminal, and terminal screw tightening torque, refer to the table below.

● 200-V class

Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Power cable [mm^2] R, S, T, U, V, W, +1, P/+2, N/–	Ground cable [mm^2]	External braking resistor between +1 and RB [mm^2]	Terminal screw size	Crimp terminal	Tightening torque [N·m]	Molded case circuit breaker (MCCB)
3G3RX-A2004-V1	Heavy load	0.4	3.3	1.25	1.25	1.25	M4	1.25-4	1.2 (1.8 max.)	5 A
	Light load	0.75	3.9	1.25	1.25	1.25		1.25-4		10 A
3G3RX-A2007-V1	Heavy load	0.75	5.5	1.25	1.25	1.25	M4	1.25-4	1.2 (1.8 max.)	10 A
	Light load	1.5	7.2	2	2	2		2-4		15 A
3G3RX-A2015-V1	Heavy load	1.5	8.3	2	2	2	M4	2-4	1.2 (1.8 max.)	15 A
	Light load	2.2	10.8	2	2	2		2-4		20 A
3G3RX-A2022-V1	Heavy load	2.2	12	2	2	2	M4	2-4	1.2 (1.8 max.)	20 A
	Light load	3.7	13.9	3.5	3.5	3.5		3.5-4		30 A
3G3RX-A2037-V1	Heavy load	3.7	18	3.5	3.5	3.5	M4	3.5-4	1.2 (1.8 max.)	30 A
	Light load	5.5	23	5.5	5.5	5.5		R5.5-4		50 A
3G3RX-A2055-V1	Heavy load	5.5	26	5.5	5.5	5.5	M5	R5.5-5	2.4 (4.0 max.)	50 A
	Light load	7.5	37	8	8	8		R8-5		60 A
3G3RX-A2075-V1	Heavy load	7.5	35	8	8	8	M5	R8-5	2.4 (4.0 max.)	60 A
	Light load	11	48	14	14	14		R14-5		75 A
3G3RX-A2110-V1	Heavy load	11	51	14	14	14	M6	R14-6	4.0 (4.4 max.)	75 A
	Light load	15	64	22	22	14		R22-6		100 A
3G3RX-A2150-V1	Heavy load	15	70	22	22	22	M6	22-6	4.5 (4.9 max.)	100 A
	Light load	18.5	80	30	22	22		38-6		100 A
3G3RX-A2185-V1	Heavy load	18.5	84	30	22	30	M6	38-6	4.5 (4.9 max.)	100 A
	Light load	22	94	38	30	30		38-6		150 A

Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Power cable [mm²] R, S, T, U, V, W, +1, P/+2, N/–	Ground cable [mm²]	External braking resistor between +1 and RB [mm²]	Terminal screw size	Crimp terminal	Tightening torque [N·m]	Molded case circuit breaker (MCCB)
3G3RX-A2220-V1	Heavy load	22	105	38	30	38	M8	38-8	8.1 (8.8 max.)	150 A
	Light load	30	120	60 (22 × 2)	30	38		R60-8		200 A
3G3RX-A2300-V1	Heavy load	30	133	60 (22 × 2)	30	–	M8	60-8	8.1 (8.8 max.)	200 A
	Light load	37	150	100 (38 × 2)	38	–		100-8		225 A
3G3RX-A2370-V1	Heavy load	37	160	100 (38 × 2)	38	–	M8 *1	100-8	8.1 (20.0 max.)	225 A
	Light load	45	186	100 (38 × 2)	38	–		100-8		225 A
3G3RX-A2450-V1	Heavy load	45	200	100 (38 × 2)	38	–	M8 *1	100-8	8.1 (20.0 max.)	225 A
	Light load	55	240	150 (60 × 2)	60	–		150-8		350 A
3G3RX-A2550-V1	Heavy load	55	242	150 (60 × 2)	60	–	M10	150-10	20.0 (22.0 max.)	350 A
	Light load	75	280	150 (60 × 2)	80	–		R150-10		350 A

*1 When the cable is connected without using the crimp terminal (as bare wires), use the square washer included with the product.

Note The wire size is based on HIV wire (with a heat resistance of 75°C).

● 400-V class

Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Power cable [mm^2] R, S, T, U, V, W, +1, P/+2, N/–	Ground cable [mm^2]	External braking resistor between +1 and RB [mm^2]	Terminal screw size	Crimp terminal	Tightening torque [N·m]	Molded case circuit breaker (MCCB)
3G3RX-A4004-V1	Heavy load	0.4	1.8	1.25	1.25	1.25	M4	1.25-4	1.2 (1.8 max.)	5 A
	Light load	0.75	2.1	1.25	1.25	1.25		1.25-4		5 A
3G3RX-A4007-V1	Heavy load	0.75	2.8	1.25	1.25	1.25	M4	1.25-4	1.2 (1.8 max.)	5 A
	Light load	1.5	4.3	2	2	2		2-4		10 A
3G3RX-A4015-V1	Heavy load	1.5	4.2	2	2	2	M4	2-4	1.2 (1.8 max.)	10 A
	Light load	2.2	5.9	2	2	2		2-4		10 A
3G3RX-A4022-V1	Heavy load	2.2	5.8	2	2	2	M4	2-4	1.2 (1.8 max.)	10 A
	Light load	3.7	8.1	2	2	2		2-4		15 A
3G3RX-A4037-V1	Heavy load	3.7	9.8	2	2	2	M4	2-4	1.2 (1.8 max.)	15 A
	Light load	5.5	13.3	3.5	3.5	3.5		R2-4		30 A
3G3RX-A4055-V1	Heavy load	5.5	15	3.5	3.5	3.5	M5	R2-5	2.4 (4.0 max.)	30 A
	Light load	7.5	20	3.5	3.5	3.5		3.5-5		30 A
3G3RX-A4075-V1	Heavy load	7.5	21	3.5	3.5	3.5	M5	3.5-5	2.4 (4.0 max.)	30 A
	Light load	11	24	5.5	5.5	5.5		R5.5-5		50 A
3G3RX-A4110-V1	Heavy load	11	28	5.5	5.5	5.5	M6	R5.5-6	4.0 (4.4 max.)	50 A
	Light load	15	32	8	8	5.5		R8-6		60 A
3G3RX-A4150-V1	Heavy load	15	35	8	8	8	M6	8-6	4.5 (4.9 max.)	60 A
	Light load	18.5	41	14	14	8		R14-6		60 A
3G3RX-A4185-V1	Heavy load	18.5	42	14	14	14	M6	14-6	4.5 (4.9 max.)	60 A
	Light load	22	47	14	14	14		R14-6		75 A
3G3RX-A4220-V1	Heavy load	22	53	14	14	14	M6	14-6	4.5 (4.9 max.)	75 A
	Light load	30	63	22	22	14		R22-6		100 A
3G3RX-A4300-V1	Heavy load	30	64	22	22	–	M6	22-6	4.5 (4.9 max.)	100 A
	Light load	37	77	38	22	–		38-6		100 A

Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Power cable [mm²] R, S, T, U, V, W, +1, P/+2, N/–	Ground cable [mm²]	External braking resistor between +1 and RB [mm²]	Terminal screw size	Crimp terminal	Tightening torque [N·m]	Molded case circuit breaker (MCCB)
3G3RX-A4370-V1	Heavy load	37	83	38	22	–	M8 *1	38-8	8.1 (20.0 max.)	100 A
	Light load	45	94	38	22	–		R38-8		150 A
3G3RX-A4450-V1	Heavy load	45	100	38	22	–	M8 *1	38-8	8.1 (20.0 max.)	150 A
	Light load	55	116	60	30	–		R60-8		175 A
3G3RX-A4550-V1	Heavy load	55	121	60	30	–	M8 *1	R60-8	8.1 (22.0 max.)	175 A
	Light load	75	149	100 (38 × 2)	38	–		100-8		225 A
3G3RX-B4750-V1	Heavy load	75	164	100 (38 × 2)	38	–	M10 *1	100-10	20.0 (22.0 max.)	225 A
	Light load	90	176	100 (38 × 2)	38	–		R100-10		225 A
3G3RX-B4900-V1	Heavy load	90	194	100 (38 × 2)	38	–	M10 *1	100-10	20.0 (22.0 max.)	225 A
	Light load	110	199	150 (60 × 2)	60	–		R150-10		350 A
3G3RX-B411K-V1	Heavy load	110	239	150 (60 × 2)	60	–	M10 *1	150-10	20.0 (35.0 max.)	350 A
	Light load	132	253	80 × 2	80	–		80-10		350 A
3G3RX-B413K-V1	Heavy load	132	286	80 × 2	80	–	M10 *1	80-10	20.0 (35.0 max.)	350 A
	Light load	160	300	100 × 2	80	–		R100-10		350 A

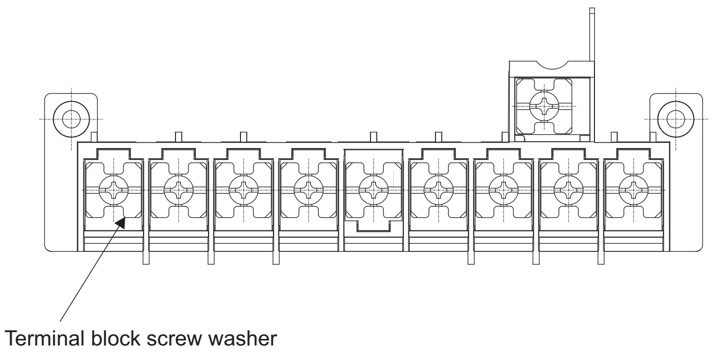
*1 When the cable is connected without using the crimp terminal (as bare wires), use the square washer included with the product.

Note The wire size is based on HIV wire (with a heat resistance of 75°C).

Installing Main Circuit Terminal Block Screws

For the 3G3RX-A2055-V1/A2075-V1/A4055-V1/A4075-V1, be sure to install the main circuit terminal block washers with their recessed portions aligned vertically, as shown below.

Not doing so may result in a contact failure or fire.
(Applicable terminals: R/L1, S/L2, T/L3, +1, P/+2, N/–, U/T1, V/T2, W/T3, RB)



Wiring for Main Power Supply Input Terminals (R/L1, S/L2, T/L3)

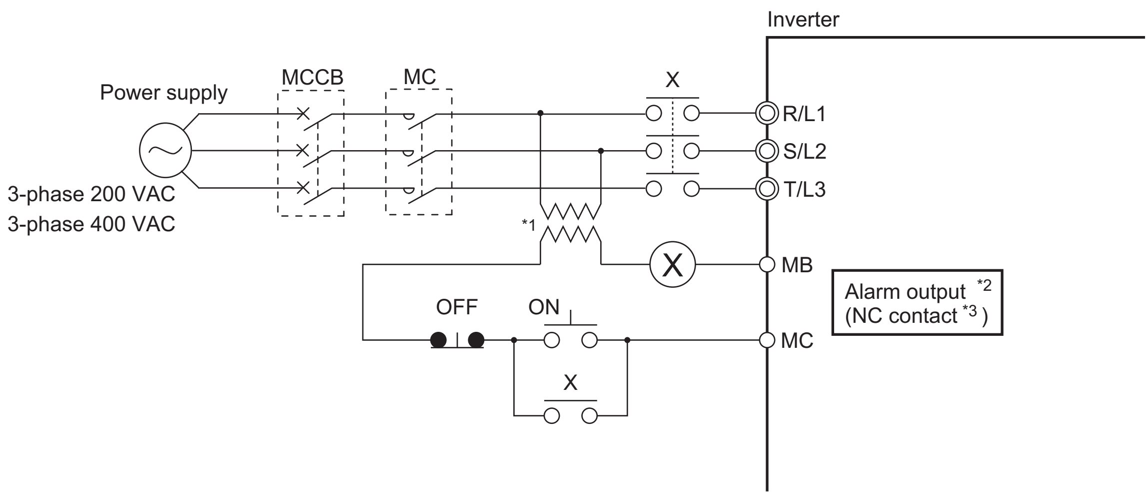
The following describes the wiring for the main power supply input terminals and for peripheral equipment.

● Installing molded case circuit breaker

If the inverter's protective function is activated, the inverter internal circuit may be damaged depending on the condition.

Be sure to connect the main power supply input terminals (R/L1, S/L2, T/L3) to the power supply via a molded case circuit-breaker (MCCB) according to each inverter.

- When using multiple inverters, install one MCCB per inverter.
- Determine the capacity of the MCCB according to the Molded case circuit breaker (MCCB) value shown in the previous table.
- Determine the time characteristic of the MCCB upon due consideration of the time characteristic of the inverter's overheat protection function (150% of the rated output current for 1 min).
- In applications where one MCCB is shared with multiple inverters or other equipment, construct a sequence that turns OFF the power supply via the alarm output signal, as shown in the figure below.



*1. For 400-V class inverters, connect a 400/200-V transformer.
*2. Set the Multi-function Relay Output (MA, MB) Function Selection (C026) to 05 (AL: Alarm output).
*3. Set the Multi-function Relay Output (MA, MB) Operation Selection (C036) to 00 (NC contact between MB and MC).

Installing earth leakage breaker

When selecting the earth leakage breaker to use between the power supply and the main power supply input terminals (R/L1, S/L2, T/L3), consider 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, an earth leakage breaker to use in the power input section must be dedicated for the inverter, which removes high-frequency leakage current and detects only the leakage current in a frequency range that is dangerous to the human body.

- Select a special earth leakage breaker for the inverter with a sensitivity current rating of 10 mA or higher per inverter.
- If you use a general earth leakage breaker (which detects high-frequency leakage current), select one with a sensitivity current rating of 200 mA or higher per inverter and an operation time of 0.1 s or longer.

Leakage current from EMC noise filter

The EMC noise filter is designed to comply with European CE standards.

Specifically, it is designed to meet the neutral-point grounding requirement of the European power supply specifications.

Therefore, using the EMC noise filter with the phase S grounding causes an increase of leakage current.

For use with the phase S grounding, it is recommended to use the Input Noise Filter (Model: 3G3AX-NFI).

- Check the maximum leakage current value in the standard built-in EMC filter specifications for 3G3RX Series.
- Check also the maximum leakage current value in the optional external EMC noise filter specifications.

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.

Use the RUN 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. Doing so may result in an inverter damage.

● 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.

3-phase 200-V class		3-phase 400-V class	
3G3RX-□-V1	**Inrush current value (A0-P)**	**3G3RX-□-V1**	**Inrush current value (A0-P)**
A2004 to A2037	17	A4004 to A4037	15
A2055 to A2110	40	A4055 to A4110	29
A2150 to A2370	48	A4150 to A4370	34
A2450, A2550	87	A4450, A4550	57
		B4750, B4900	113
		B411L, B413K	226

● 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 an inverter damage.

Be sure to check the wiring for the 3-phase power supply before using the inverter. Note that the inverter operates without detecting a phase loss if it occurs in the phase S as shown below.

Phase loss	State
Phase R	The inverter does not operate.
Phase T	
Phase S	The inverter operates independently. Under this state, the inverter may cause an undervoltage or overvoltage trip, or could be damaged.

Precautions for Safe Use

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

Be sure to check the precautions provided in the *Precautions for Safe Use* on page 2-3.

● 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 inverter capacity and, at the same time, 500 kVA or more.
- Rapid change in the power supply voltage occurs.

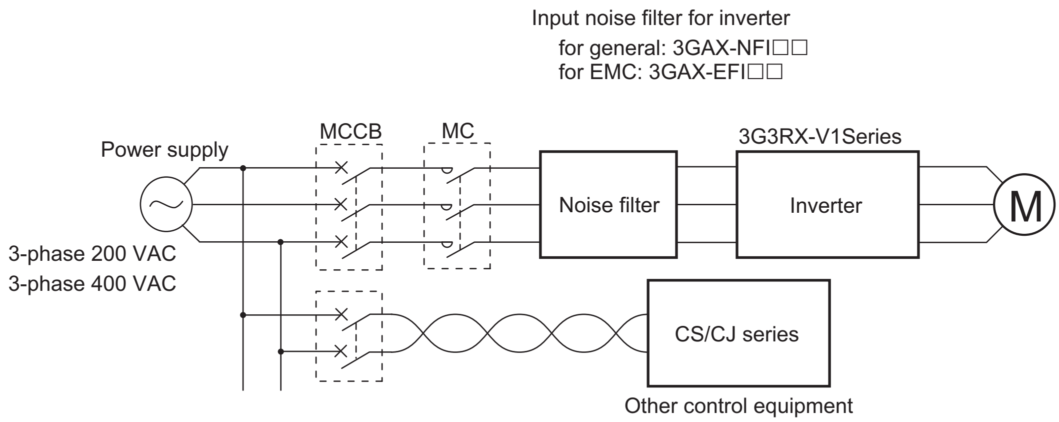
  Example. When the phase advance capacitor is turned on/off, the inverter may detect an overvoltage or the rectifier may be damaged.

- **Installing input surge absorber**

When using an inductive load (such as a magnetic contactor, magnetic relay, magnetic valve, solenoid, or electromagnetic brake), 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.



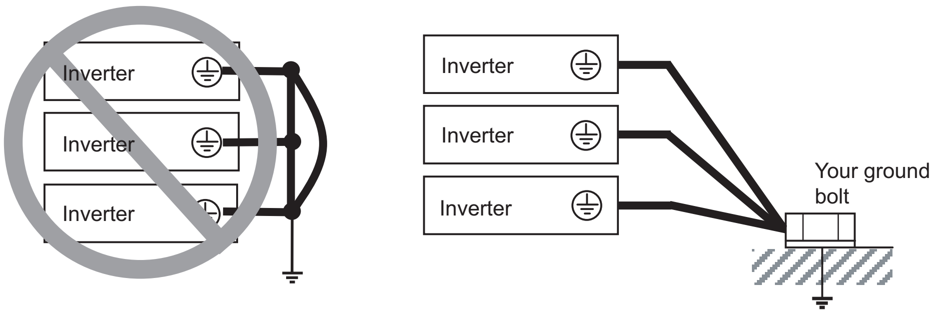
Wiring for Ground Terminal (G⏚)

To prevent electric shock, be sure to ground the inverter and the motor.

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 several inverters are connected, the ground cable must not be connected across several inverters or looped. Otherwise, the inverters and peripheral control equipment may malfunction.



Harmonic Current Measures and DC/AC Reactor Wiring (+1, P/2)

In recent years, there is an increasing concern about harmonic currents generated from industrial machinery.

The following provides an overview of harmonics and measures against harmonics implemented in this inverter.

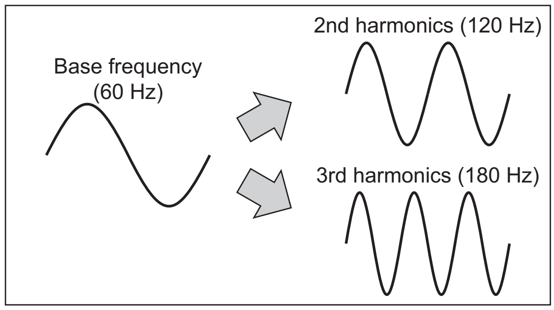
● Harmonics

The voltage or current whose frequency is an integral multiple of certain standard frequency (base frequency) is called a harmonic.

If a commercial power supply frequency of 60 Hz (50 Hz) is the reference frequency, the harmonics of that signal is:

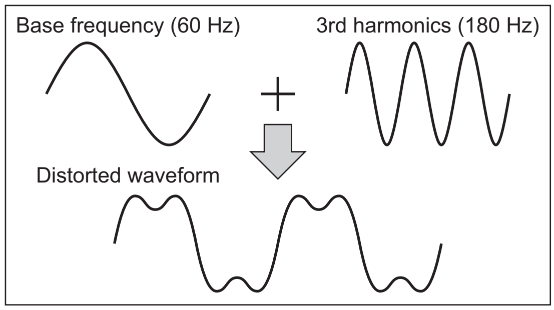
x2 = 120 Hz (100 Hz),

x3 = 180 Hz (150 Hz), and so on.



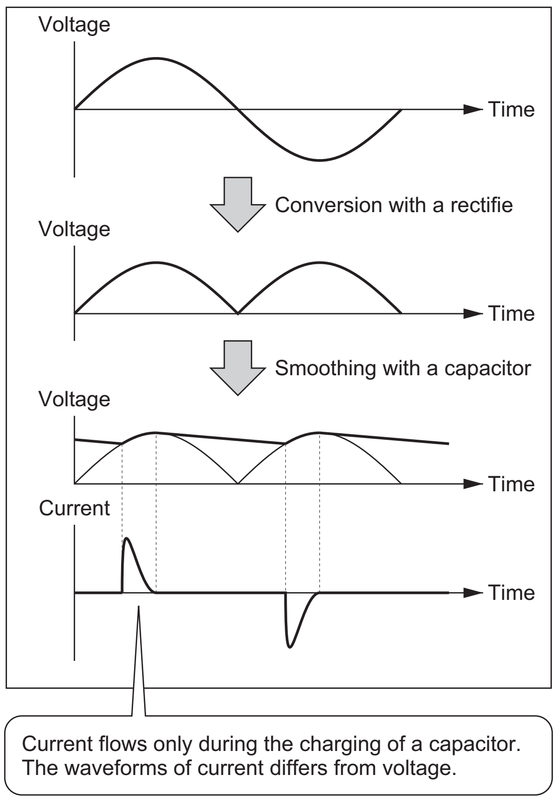
● Reason why harmonics cause problems

As the number of harmonics increases, the waveform of the commercial supply has more distortion. This distortion causes the malfunction of the connected equipment or leads to 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.
- This 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 a 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.

Do not touch the interior of the inverter during inverter opertaion. Doing so may result in electric shock or burn injury.

By factory default, a short-circuit bar is connected between the terminals +1 and –P/+2. Before connecting the DC reactor, remove this short-circuit bar.

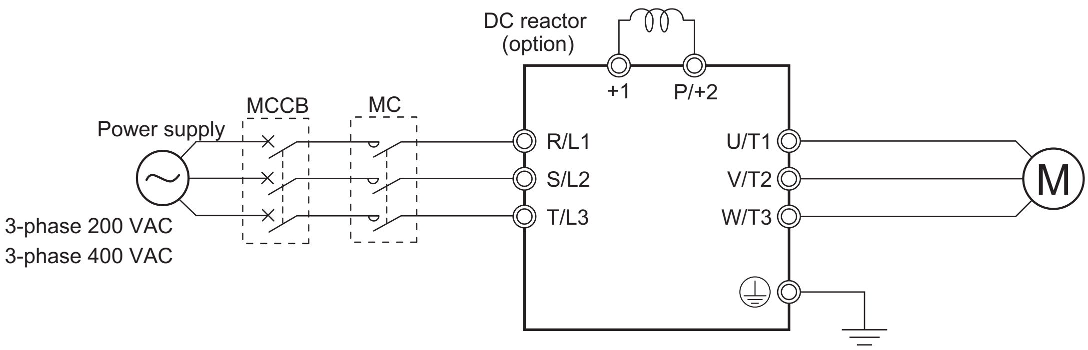
Note that the length of the DC reactor connection cable must be 5 m or shorter.

Remove the short-circuit bar only if you connect the DC reactor for use.

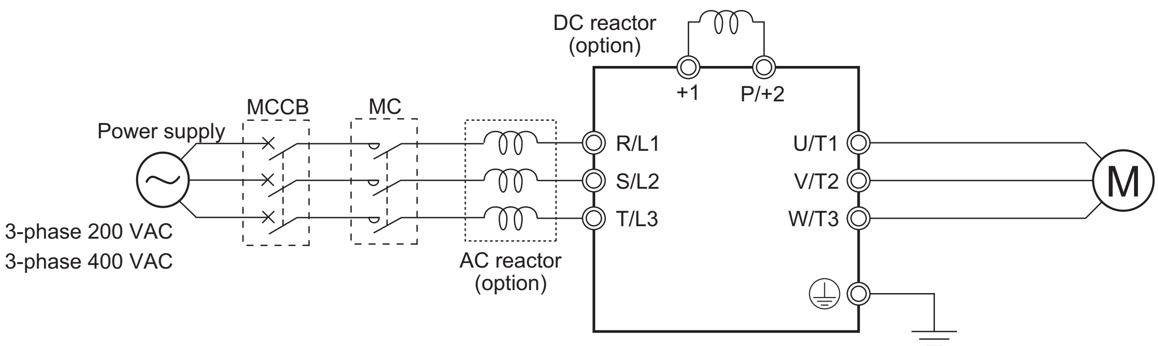
If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

Wiring method

With DC reactor



With DC reactor and AC reactor



Effect of reactors

Through the use of the DC/AC reactor, the rate of harmonic current occurrences can be reduced as shown in the table of typical examples below.

Measure against harmonics	Harmonic current occurrence rate [%]							
	5th	7th	11th	13th	17th	19th	23rd	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 a DC reactor and evaluate its effect. Then, if further reduction is required, add an AC reactor.

To implement harmonic countermeasures 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 have multiple inverters and use the AC reactor, 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/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 switch 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.

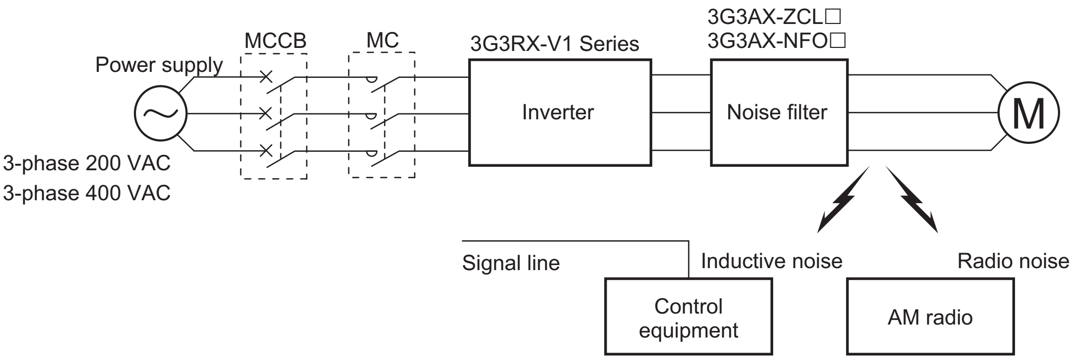
● Precautions for connecting more than one motors to inverter's output terminals

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

- Make sure that the 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 Electronic Thermal Level to the rated output current of the inverter.

● Installing output noise filter

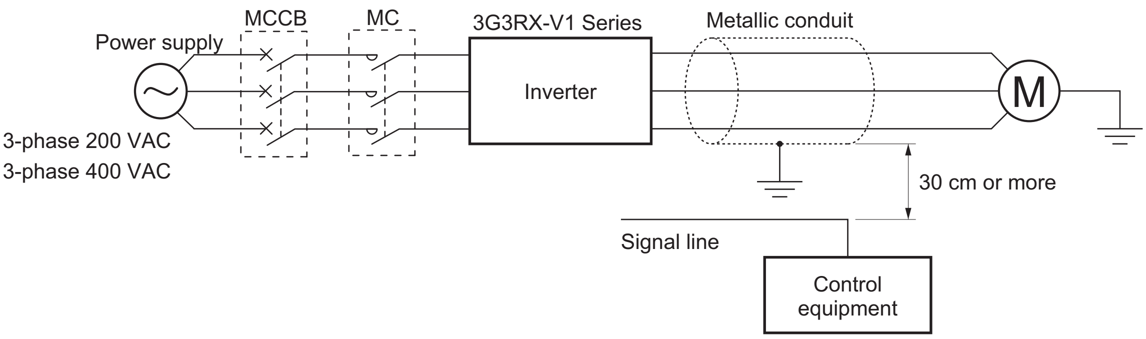
Connecting a noise filter to the output side of the inverter enables the reduction of radio noise and inductive noise.



Noise	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

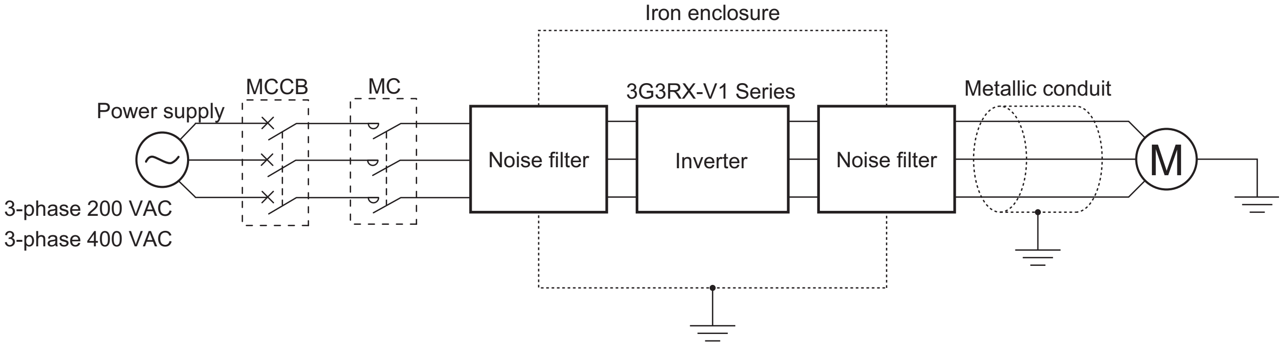
In addition to the noise filter described above, you can suppress the inductive noise produced on the output side by connecting a bundle of wires through a grounded metal conduit. Simply moving the conduit 30 cm away from signal lines also helps the reduction of inductive noise.



● Measures against radio noise

Besides the I/O wires, radio noise is radiated from the inverter itself. 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 cables are 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 inverter motor. Dedicated inverter motors 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. 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 on 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 are such as 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 max.	100 m max.	Over 100 m
Carrier frequency	10 kHz max.	5 kHz max.	2.5 kHz

External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)

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

● 200/400-V class models with 22 kW or lower capacity

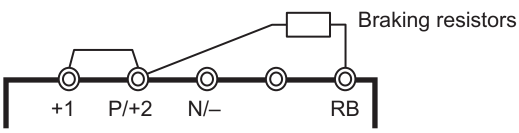
The models have a built-in regenerative braking circuit.

To improve the braking capacity, connect the optional external braking resistor to these terminals (P/+2, 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 minimum connection resistance value specified in the standard specifications table. Doing so may result in damage to the regenerative braking circuit.
- 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.

- Wiring diagram



● 200/400-V class models with 30 kW or higher capacity

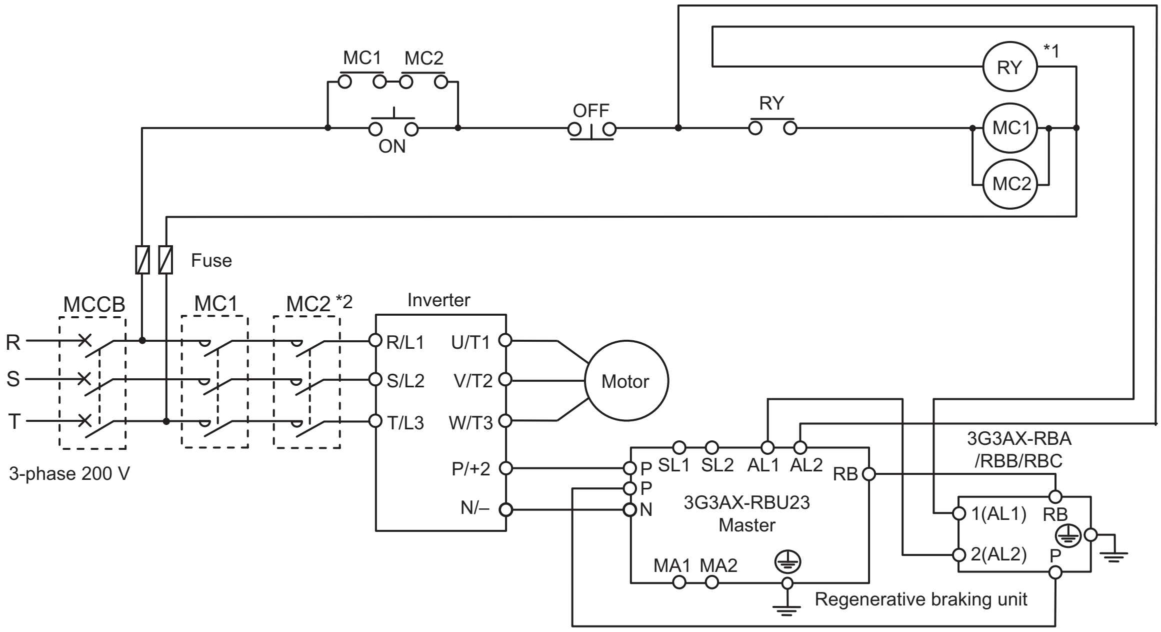
These models have no built-in regenerative braking circuit.

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/+2, N/–).

Precautions for Safe Use

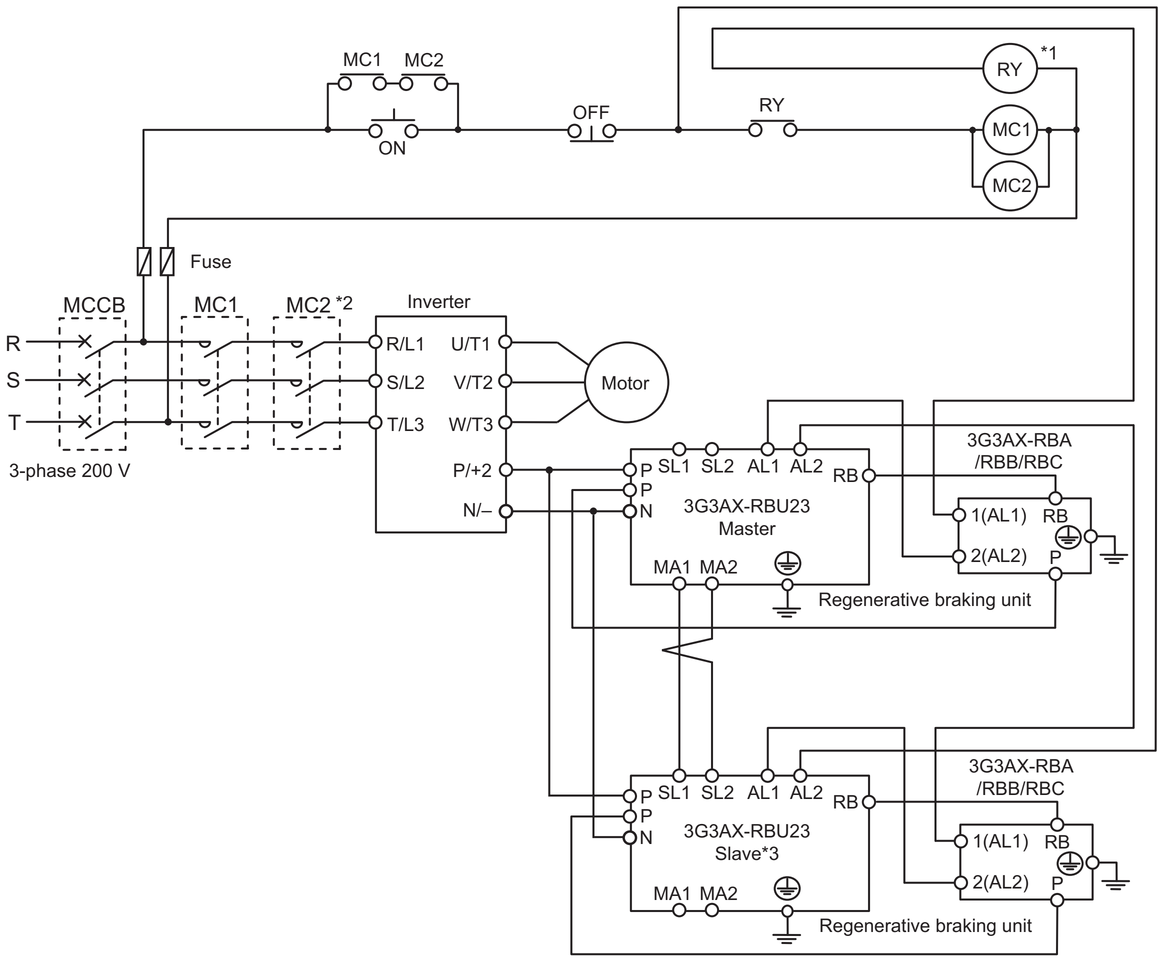
- Be sure to install a circuit that detects overheating of the regenerative braking unit(s) and braking resistor(s) via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the connection resistance 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)



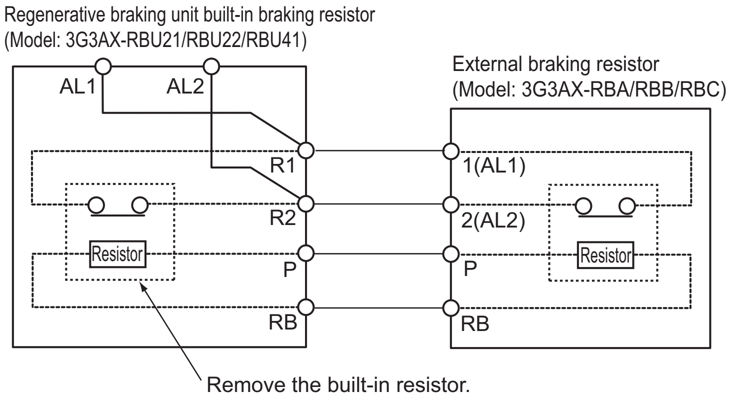
*1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.
*2. MC1 and MC2 are used not only to provide redundancy, but also to meet safety standards.
*3. You need to set DIP switch to regenerative braking unit as a slave, and wire terminal SL1 and SL2.

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 resistor from the Regenerative Braking Unit Built-in Braking Resistor (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.

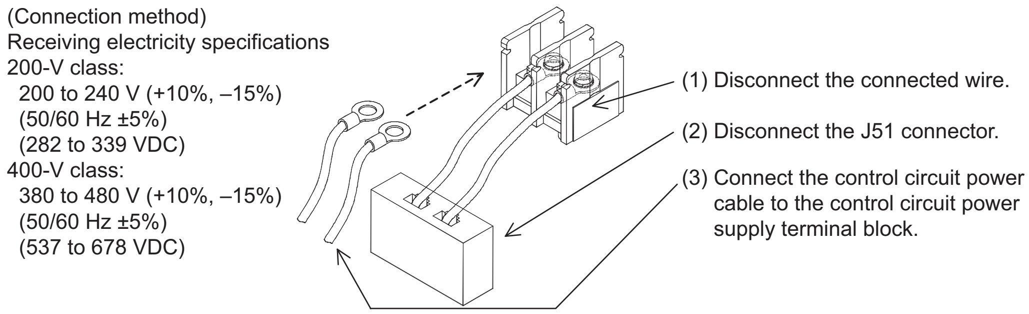


Connection for Separating Inverter Control Circuit Power Supply from Main Power Supply

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 alarm signal cannot be retained.

If the alarm signal must be retained, use control circuit power supply terminals Ro and To.

Connect control circuit power supply terminals Ro and To with the primary circuit of the magnetic contactor according to the following procedure.



Precautions for Correct Use

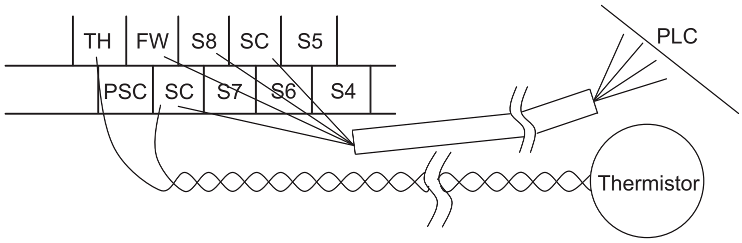
To separate the control circuit power supply (Ro, To) from the main circuit power supply (R, S, T), observe the following instructions:

- For wiring between terminals Ro and To (terminal screw size: M4), use a cable of 1.25 mm^2 or more.
- Connect a 3 A fuse to the control circuit power supply cable.
- If the control circuit power supply (Ro, To) is turned on before the main circuit power supply (R, S, T), ground fault detection at power-on is disabled.
- To use a DC power supply for the control circuit power supply (Ro, To), set the Multi-function Output Operation Selection (C031 to C036) for the multi-function output terminals (P1 to P5) and relay output terminals (MA, MB, MC) to 00. If the Multi-function Output Operation Selection is set to 01, the output signal may chatter when the DC power supply is turned off.
- For the terminals Ro and To, the tightening torque should be as follows.
  M4: 1.2 N·m (1.4 N·m max.)

2-3-5 Wiring for Control Circuit Terminals

Wiring for Control Circuit Terminals

- The terminals FC and SC 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 these common terminals via external equipment.
  When finished wiring, check the external equipment ground conditions.
- For wiring to the control circuit terminals, use twisted-pair shielded cables (recommended diameter: 0.75 mm^2). Connect the sheathed shielded cable to each common terminal.
- Twist a cable connected to the terminal TH (thermistor input) with a cable of the terminal SC individually, and separate them from other SC common 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.



- To use a relay for a multi-function output terminal, connect a surge-absorbing diode in parallel with the coil.
- 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. For wiring instructions, refer to *Precaution for Wiring Control Circuit Terminals* on page 2-47.
- The control circuit connection cables should be 20 m or shorter.
- 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 the analog power supply terminals FS and FC and/or the interface power supply terminals P24 and SC. Doing so may result in failure of the inverter.
- After wiring, lightly pull the wire to confirm that it is connected properly.

Arrangement of Control Circuit Terminal

The arrangement of the control circuit terminal block is shown below.

	FS	FE	AM	MP	TH	FW	S8	SC	S5	S3	S1	P4	P3	P1	MA
FC	FV	FI	AMI	P24	PSC	SC	S7	S6	S4	S2	P5	PC	P2	MC	MB

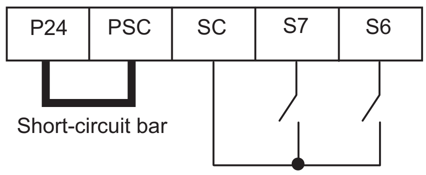
Terminal screw size M3 Tightening torque 0.7 N·m (0.8 max.)

Changing Input Control Logic

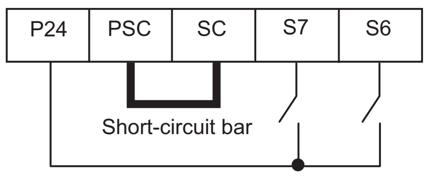
By factory default, the terminal FW and the multi-function input terminal are set to sink logic (NPN).

To change the input control logic to source logic (PNP), remove the short-circuit bar between the terminals P24 and PSC on the control circuit terminal block, and connect it between the terminals PSC and SC.

(a) Sink logic



(b) Source logic



Multi-function Input Terminals and Programmable Controller Connection

- **Sink logic**

<table>
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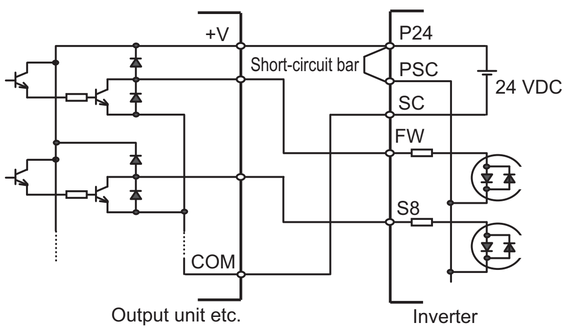
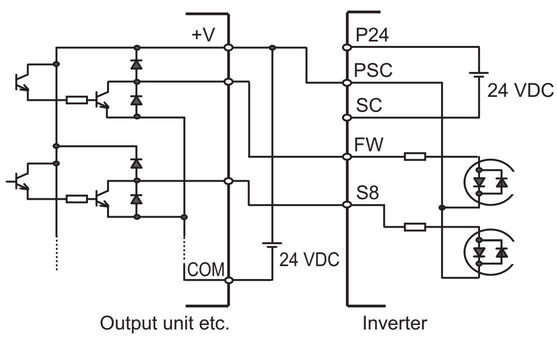
(Remove the short-circuit bar from the control terminal block)</th></tr>
<tr><td>
</td><td>
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● Source logic

<table>
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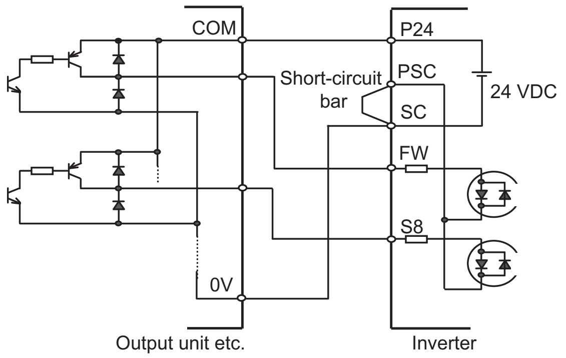
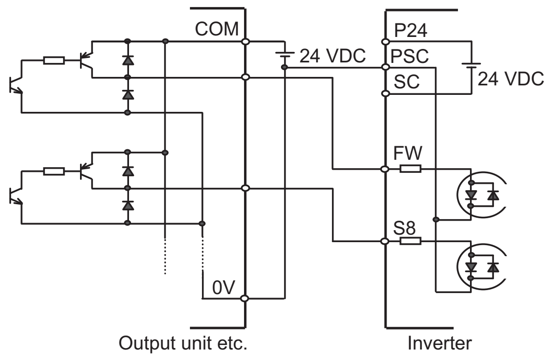
(Remove the short-circuit bar from the control terminal block)</th></tr>
<tr><td>
</td><td>
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● No-voltage switch

<table>
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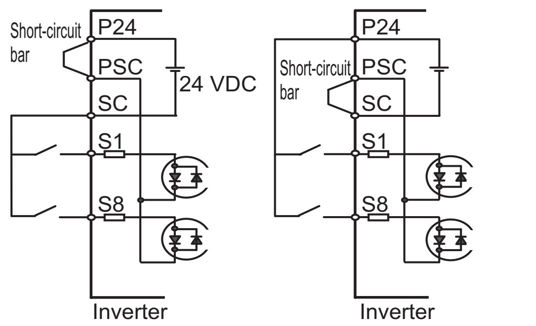
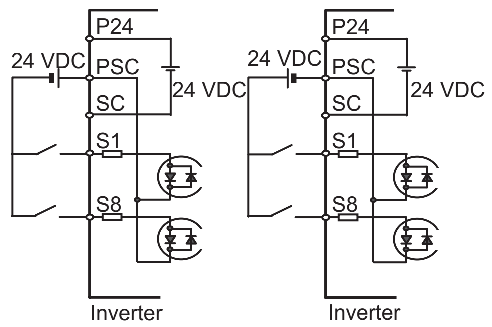
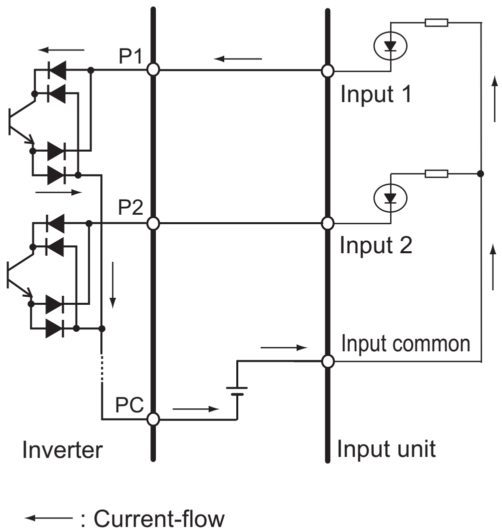
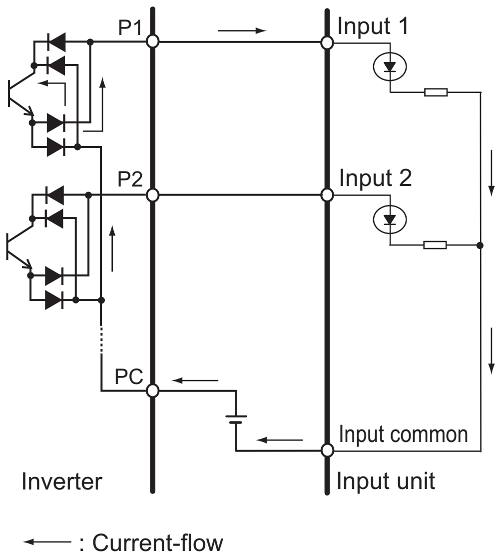
(Remove the short-circuit bar from the control terminal block)</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Multi-function Output Terminals and Programmable Controller Connection

● Sink logic



● Source logic

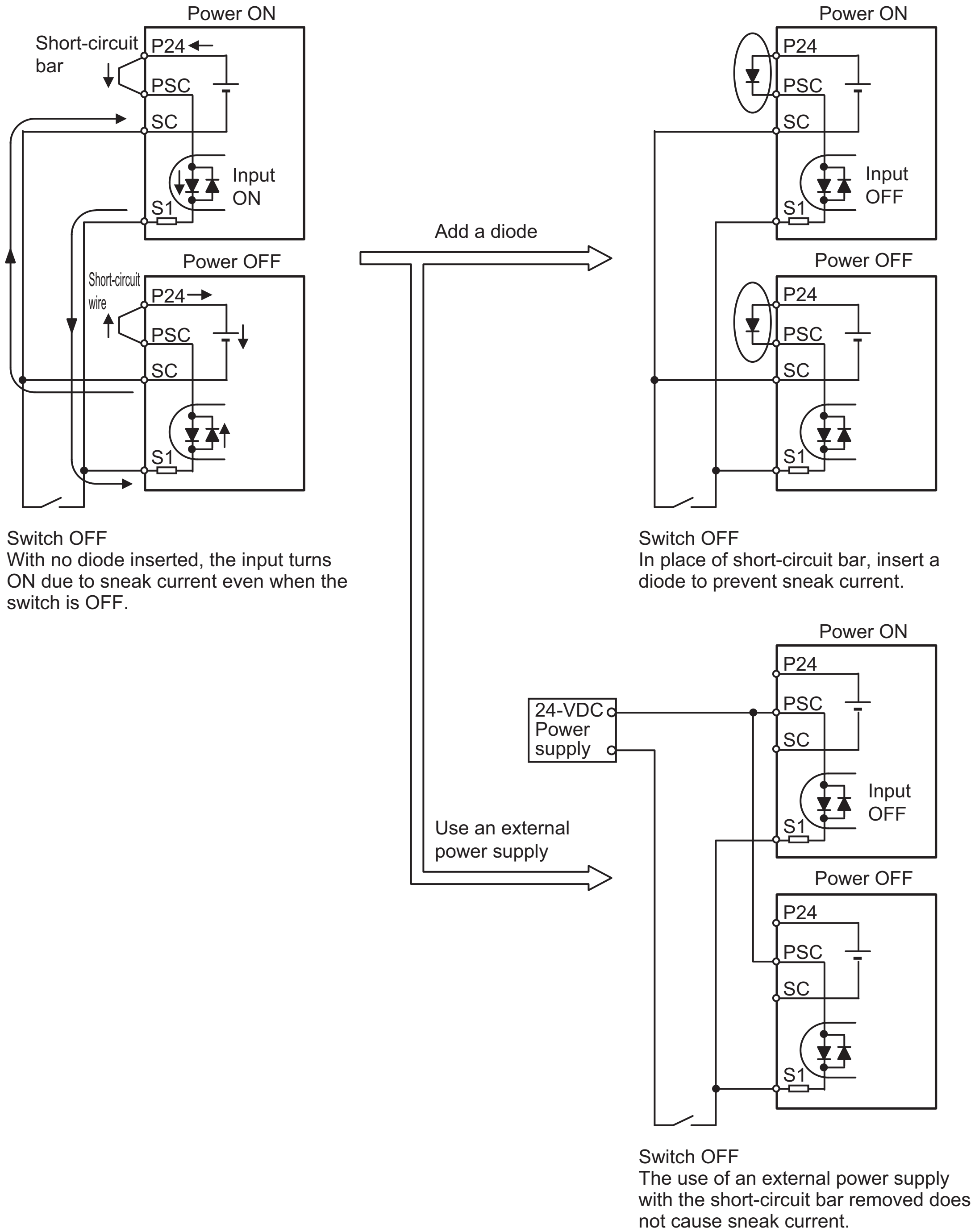


Precaution for Wiring Control Circuit Terminals

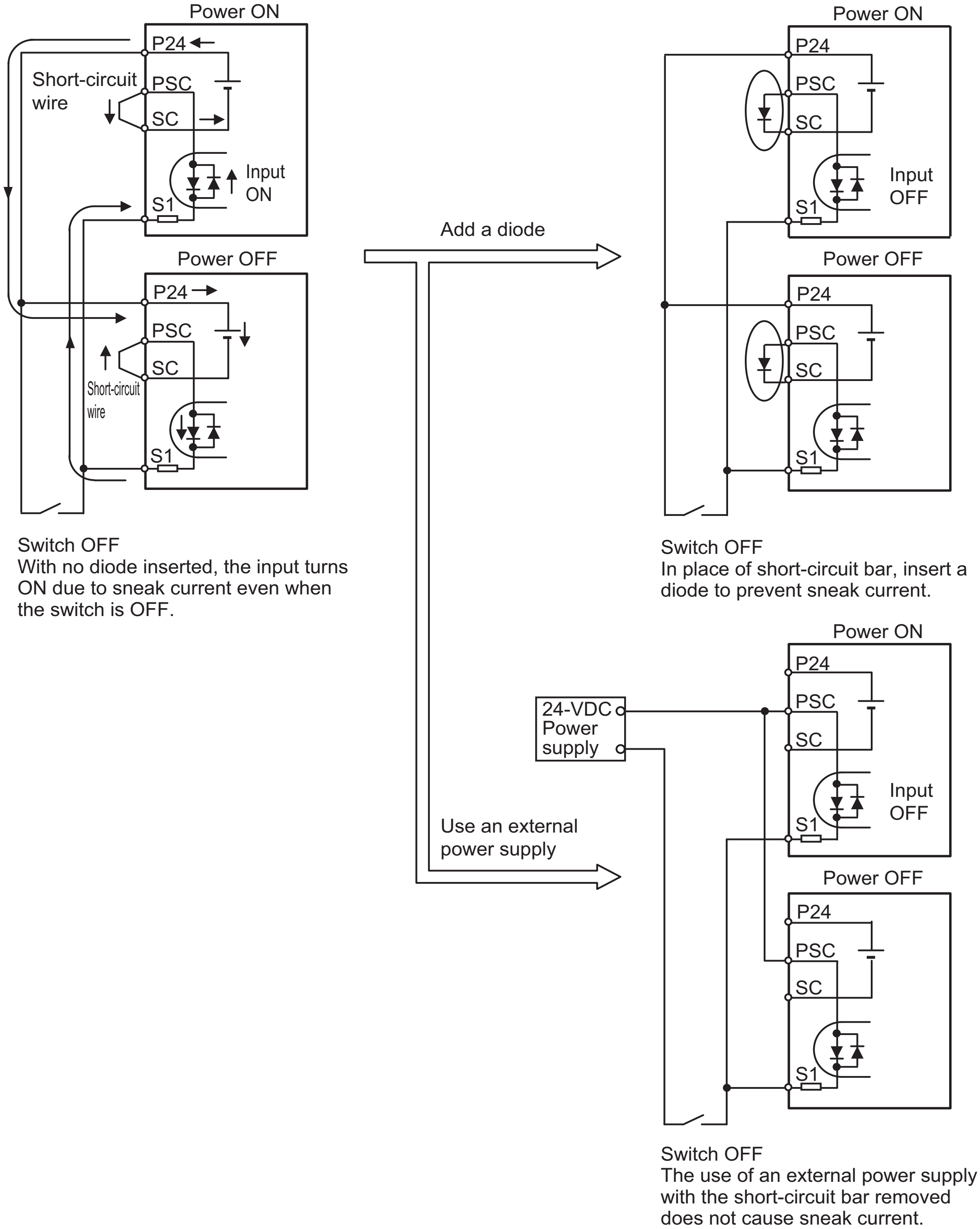
● Precaution for using more than one inverter

If more than one inverter uses a common input (such as a switch), and their power-on timing is different, a sneak current will flow in the circuit as shown below. This may cause the inverters to falsely recognize the input signal is ON even if it is OFF. If this occurs, insert a diode (rating: 50 V/0.1 A) in the position shown in the diagram or redesign the circuit to use an external power supply to prevent sneak current.

● For sink logic



● For source logic



2-3-6 Wiring for PG Board

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

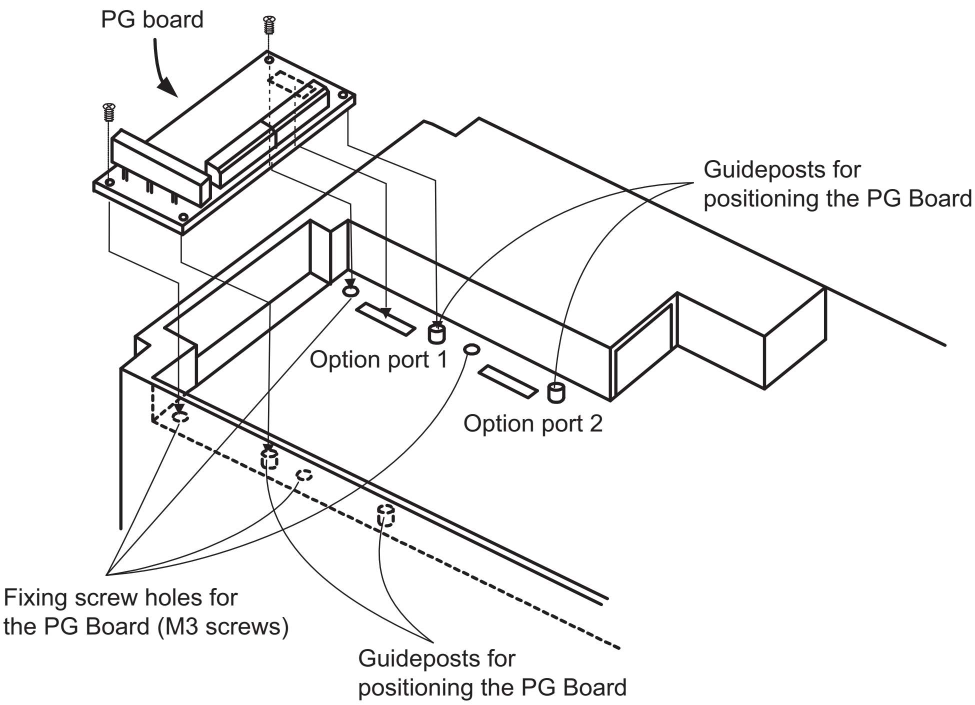
For details on the PG Board, refer to PG Board 3G3AX-PG☐☐ User's Manual (I564).

PG Board Mounting

The PG Board can be mounted on the option port 1 or 2. Securely mount the PG Board as shown below.

Place the four holes in the corners of the PG Board; two holes on the guideposts and the other two on the screw holes. Put the connector at the back of the PG Board on the option port 1 or 2 correctly.

Then, tighten the two fixing screws for the PG Board securely.

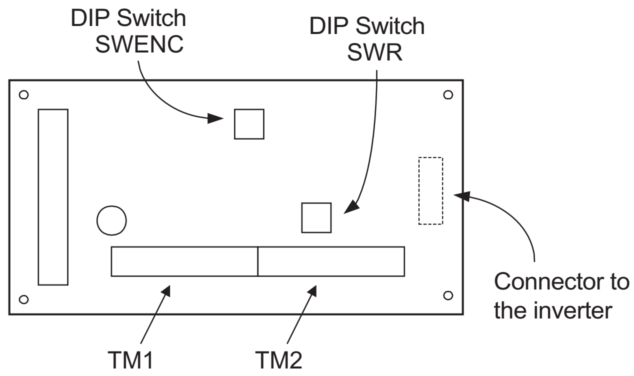


Precautions for Correct Use

To mount the PG Board, be sure to tightly fix it with the two provided fixing screws after putting in place the connector securely. Otherwise, the inverter cannot operate properly.

Terminal Arrangement on PG Board

The arrangement of the terminals on the PG Board is shown below.



TM1 Terminal arrangement

EP5	EG5	EAP	EAN	EBP	EBN	EZP	EZN

TM2 Terminal arrangement

SAP	SAN	SBP	SBN	AP	AN	BP	BN

● Input terminals

Terminal symbol	Terminal name	Functional description	Electrical specifications
SAP SAN SBP SBN	Pulse train position command input	• Pulse Train Input Selection (P013) *1 Mode 0: 90°phase difference pulse train Mode 1: Forward/Reverse command + pulse train Mode 2: Forward command + Reverse pulse train • Use the DIP switches on the PG Board to enable/disable the built-in terminating resistor (150 Ω).	Line-driver input 5-VDC receiver input (RS-422 compliant)
EAP EAN EBP EBN EZP EZN	Encoder signal input	A/B/Z: Encoder signal input	Photocoupler input (5 VDC line-driver output type rotary encoders supported)

*1. Select the pulse train mode with the inverter parameter P013.

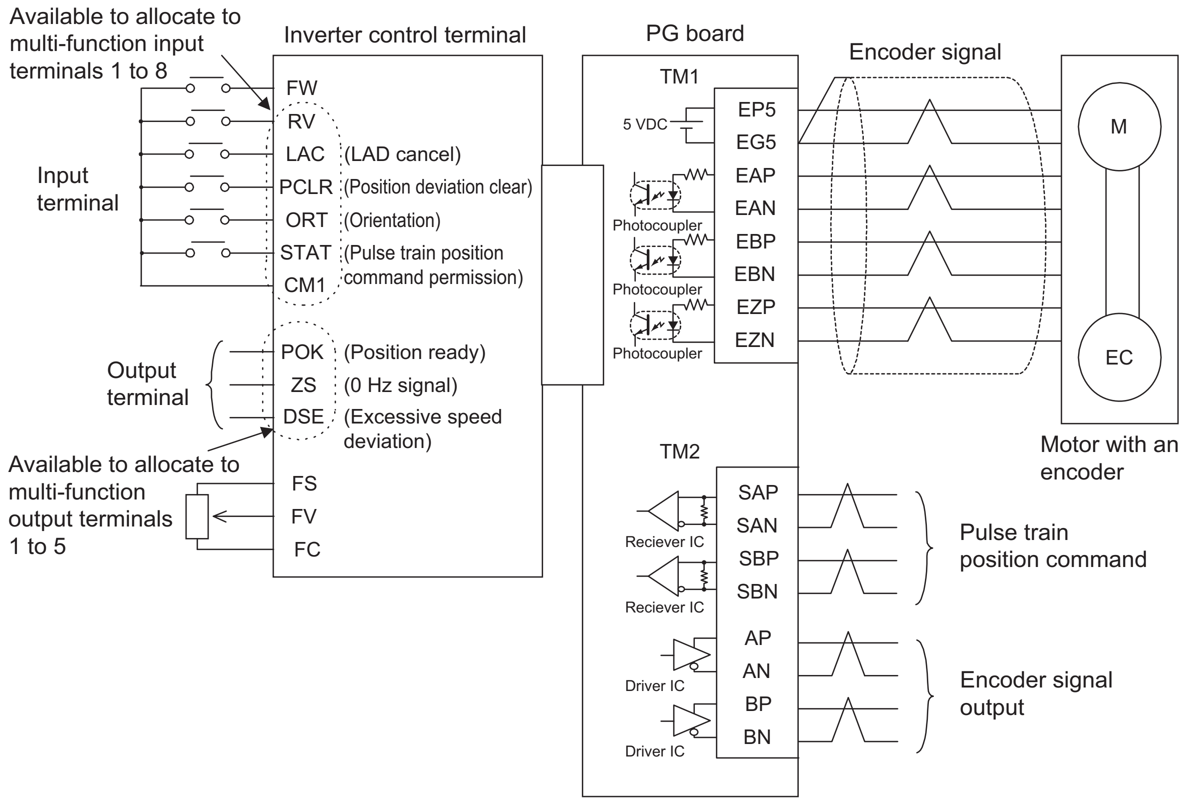
● Output terminal

Terminal symbol	Terminal name	Functional description	Electrical specifications
AP AN BP BN	Encoder signal output	Output pulses in a ratio 1 to 1 to encode input pulses.	5 VDC line-driver output (RS-422 compliant)
EP5 EG5 (Common)	Encoder power supply	+5 VDC power supply	150 mA max.

DIP switch name	Switch No.	Description		Default data
SWENC	1	ON	Disconnection detection enabled when the encoder phase A/B is not connected	OFF
		OFF	Disconnection detection disabled when the encoder phase A/B is not connected	
	2	ON	Disconnection detection enabled when the encoder phase Z is not connected	OFF
		OFF	Disconnection detection disabled when the encoder phase Z is not connected	
SWR*1	1	ON	Built-in terminating resistor between SAP and SAN enabled (150 Ω)	OFF
		OFF	Built-in terminating resistor between SAP and SAN disabled	
	2	ON	Built-in terminating resistor between SBP and SBN enabled (150 Ω)	OFF
		OFF	Built-in terminating resistor between SBP and SBN disabled	

*1. To input the pulse train position command into more than one inverter, set the DIP switches SWR1 and SWR2 to ON only one inverter that is farthest from the master.

Wiring for PG Board



Disconnection Detection Function of PG Board

The encoder input terminals (EAP/EAN/EBP/EBN/EZP/EZN) have a function that detects disconnection when no encoder is connected.

When no encoder is connected, set both of the DIP switches SWENC1 and 2 to OFF to disable the disconnection detection function.

When connecting an encoder without the phase Z signal, set the DIP switch SWENC2 to OFF to disable the disconnection detection for the phase Z.

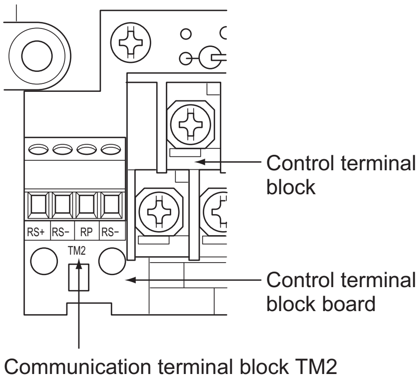
2-3-7 Wiring for RS485 Communications Terminals

The 3G3RX-V1 Series 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 and the ASCII format.

This section describes the wiring procedure for the RS485 communications terminal block and the installation of the terminating resistor.

Wiring for RS485 Communications Terminal Block



Terminal symbol	Terminal name	Function
RS+	RS485 communications send/receive terminal, positive side	Positive-side send/receive terminal signal for RS485 communications.
RS–	RS485 communications send/receive terminal, negative side	Negative-side send/receive terminal signal for RS485 communications.
RP	Terminating Resistor enable terminal	The RP terminal is used to enable the built-in Terminating Resistor (100 Ω). Connect the negative-side RS485 communications send/receive terminal (for Termination Resistor connection) with the terminal RP to enable the built-in Terminating Resistor.
RS–	RS485 communications send/receive terminal, negative side (for Terminating Resistor connection)	

Wire size and tightening torque

Screw size	Tightening torque [N·m]	Wire type	Wire size [mm^2]
M2	0.22 to 0.25	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)
		Stranded wire with ferrule	0.25 to 0.5 (Example: PC-1.25 F-7 from JST Mfg. Co., Ltd.)

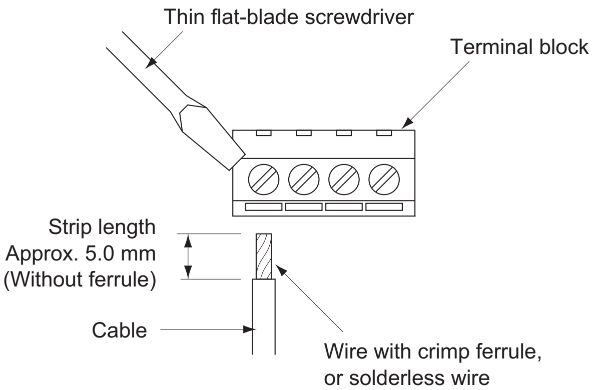
● Wiring method

(1) Loosen the terminal screw with a thin flat-blade screwdriver.

(2) Insert the wire through the bottom of the terminal block.

(3) Tighten the terminal screw securely.

Be sure to tighten the terminal screws to the tightening torque specified in the table on the previous page.



Precautions for Correct Use

- Separate signal lines for control from the main circuit cable and other power supply/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 cable to the terminal FC (frequency reference common) of the 3G3RX-V1 Series . Do not connect it to the controller.
- Insulate the cable shields with tape or some other means to prevent them from contact with other signal lines or equipment.
- Tightening the screws to an excessive tightening torque may result in damage to the terminals. Tightening them with a weak torque may also cause a malfunction or short-circuit.

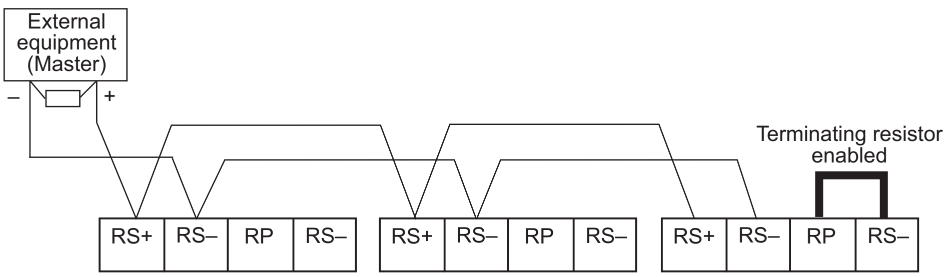
Terminating Resistor Installation

Connect each inverter in series as shown below.

Because a terminating resistor must be installed at each end of communications wiring, enable the terminating resistor only for the terminal inverter.

Use the terminating resistor even if you have only one inverter connected.

For this inverter, shorting the terminals RP and RS– enables the built-in terminating resistor (100 Ω).

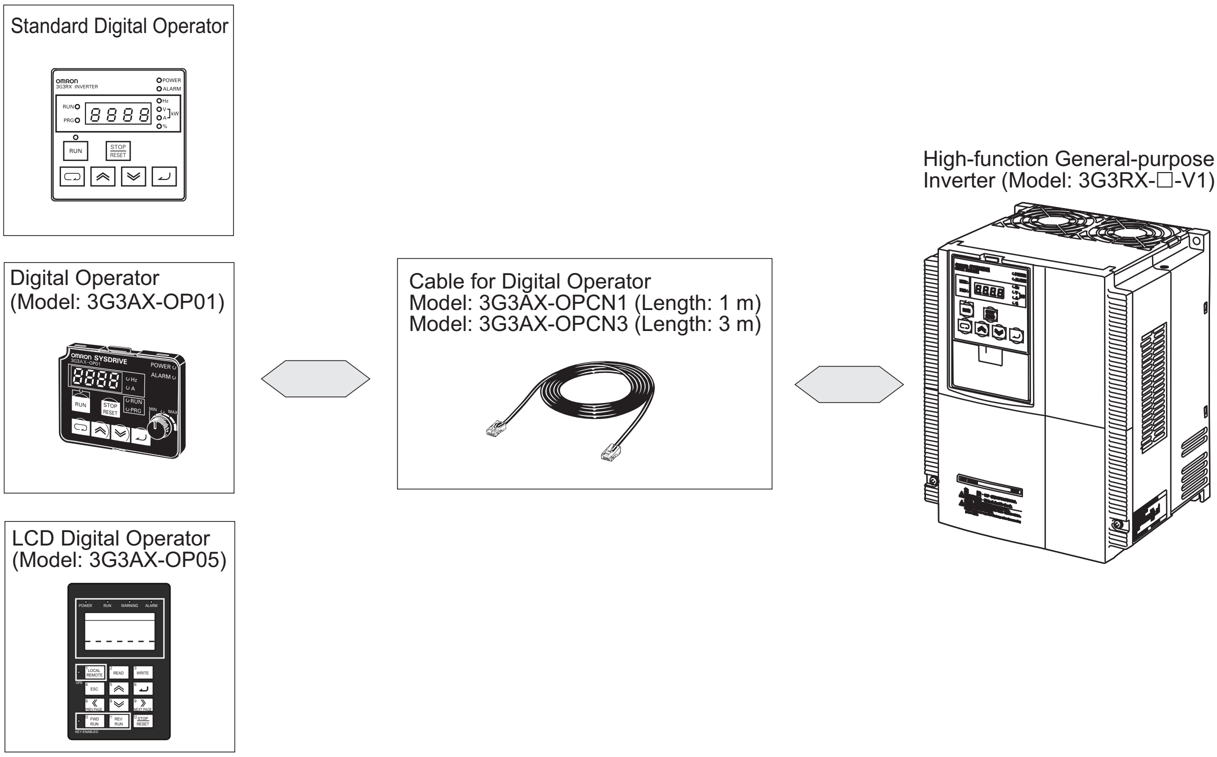


2-3-8 Wiring for Digital Operator

In addition to the standard Digital Operator, this inverter can be operated via the optional Digital Operator (Model: 3G3AX-OP01) or LCD Digital Operator (Model: 3G3AX-OP05).

To use these options with the standard Digital Operator removed from the inverter, you need the optional Digital Operator Cable (Model: 3G3AX-OPCN1 (1 m)/3G3AX-OPCN3 (3 m)).

Note that the maximum length of these optional cables is 3 m. Exceeding 3 m may result in malfunction.



For details on the LCD Digital Operator, refer to the LCD Digital Operator 3G3AX-OP05 User’s Manual (I579).

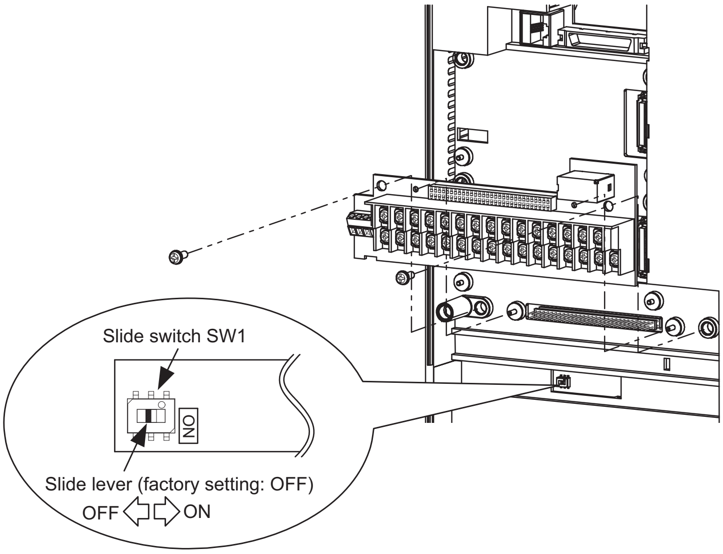
2-3-9 Wiring for Emergency Shutoff Function

Slide Switch (SW1) Setting

The built-in slide switch is used to enable or disable the emergency shutoff function.
This function is disabled by factory default.

For the location of the slide switch, refer to the figure below.

For how to remove the control circuit terminal block, refer to *Removing Control Circuit Terminal Block* on page 2-12.



Emergency Shutoff Function

This function is intended to shut off the inverter output (stop switching the main element) via only the multi-function input terminal of the hardware circuit without use of the built-in CPU software.

To enable this function, set the slide switch SW1 lever in the inverter to ON. By factory default, slide switch SW1 is OFF (function disabled).

When this function is enabled, the multi-function input terminals S1 and S3 are dedicated for this function. No other function can be allocated to these terminals. If another function is allocated, it is automatically disabled, and terminals S1 and S3 are changed to the emergency shutoff terminals.

Special function of multi-function input terminal S1 when SW1 is ON	Reset signal (RS)/NO contact (Fixed) This signal is used to reset the inverter, and to reset the emergency shutoff trip (E37.*).
Special function of multi-function input terminal S3 when SW1 is ON	Emergency shutoff signal (EMR)/NC contact (Fixed) This signal is used to turn off the inverter output without using the built-in CPU. With this signal input, the inverter activates an emergency shutoff trip (E37.*).

Precautions for Correct Use

- Although this function stops switching of the main element, the circuit is not electrically shut off. While the power supply is ON, do not touch the inverter terminals and power cable (e.g. motor cable). Doing so may result in electric shock, injury, or ground fault.
- Before operating slide switch SW1, make sure that the input power supply is OFF.
- If multi-function input terminal S3 is not connected or disconnected, or if the signal logic does not match, the inverter activates an emergency shutoff trip (E37.*). After checking the cable connection and the signal logic, input the reset signal (RS).
  Note that emergency shutoff trip (E37.*) can be reset only by the reset signal (RS) via multi-function input terminal S1 and cannot be reset with the Digital Operator.

The slide switch SW1 setting and the status of the multi-function input terminals S1 and S3 are shown below.

Slide switch SW1 setting and status of multi-function input terminals S1 and S3								
Slide switch (SW1) setting	**Multi-function input terminal S1**				**Multi-function input terminal S3**			
	Multi-function Input S1 Selection (C001)		**Multi-function Input S1 Operation Selection (C011) *1**		**Multi-function Input S3 Selection (C003)**		**Multi-function Input S3 Operation Selection (C013) *2**	
SW1 "OFF" Emergency shutoff: Disabled (Factory default)	[Can be selected randomly] *4		[Can be selected randomly] *4		[Can be selected randomly] *4		[Can be selected randomly] *4	
	Factory default	01: RV	Factory default	00: NO	Factory default	12: EXT	Factory default	00: NO
SW1 "ON" Emergency shutoff: Enabled *5	Automatic allocation to multi-function input terminals S1 and S3, and the input terminal with "18 (RS)" setting *3							
	Fixed function (Cannot be changed)	18: RS	Fixed function (Cannot be changed)	00: NO	Fixed function (Cannot be changed)	64: EMR	Fixed function (Cannot be changed)	01: NC
SW1 "ON," then "OFF" Emergency shutoff: Disabled *3 *5	[Can be selected randomly] *4		[Can be selected randomly] *4		[Can be selected randomly] *4		[Can be selected randomly] *4	
	Holds setting while SW1 is ON	18: RS	Holds setting while SW1 is ON	00: NO	Emergency shutoff function: Reset	no (No allocation)	Holds setting while SW1 is ON	01: NC

*1 When the Multi-function Input S1 Selection (C001) is set to 18 (RS), C011 is fixed to 00 (NO).

*2 When the Multi-function Input S3 Selection (C003) is set to 64 (EMR), C013 is fixed to 01 (NC).

*3 If the switch SW1 is turned ON with a Multi-function Input terminal other than S1 and S3 set to 18 (RS), the function to prevent duplicated allocation is activated and automatically changes this Input Selection setting to no (No allocation). If this occurs, just turning the switch SW1 back to OFF does not restore the previous setting. Re-allocate the terminal function.

Example: When the Multi-function Input S2 Selection (C002) is allocated to 18 (RS), if the switch SW1 is turned ON, the C002 setting is changed to no (No allocation), and the Multi-function Input S1 Selection (C001) is allocated to 18 (RS).
Then, even if the switch SW1 is turned back to OFF, the Multi-function Input S2 Selection (C002) setting is no (No allocation) and the Multi-function Input S1 Selection (C001) is 18 (RS).

*4 Multi-function Input Selection parameters cannot be set to 64 (EMR) via the Digital Operator. This function is allocated automatically when the slide switch SW1 is turned ON.

*5 Once the slide switch SW1 is turned ON, turning OFF SW1 does not restore the previous allocations for the multi-function input terminal S1/S3. Allocate the terminal function again.

2-3-10 Conformance to EC Directives

This section provides conditions that must be met for compliance with European EC Directives.
Take measures to meet the conditions shown here for the entire system as well as peripheral equipment.
For the system that incorporates this inverter, perform the final compliance verification separately on the whole system.

Applicable Standards

The 3G3RX-V1 Series complies with the following standards.

Standard	Applicable standard
EMC Directive	EN61800-3
Low-voltage Directive	EN61800-5-1

Concepts of Compliance

● EMC Directive

OMRON products are the electrical devices incorporated and used in various machines or manufacturing equipment. For this reason, OMRON makes efforts to manufacture products that meet the related EMC standards so that the machines or equipment in which they are incorporated can easily comply with the EMC standards.

The 3G3RX-V1 Series Inverter complies with the EMC Directive EN61800-3 when installed and wired to equipment according to the methods described below. However, your machines and equipment vary in type, and in addition, EMC performance depends on the configuration, wiring, and location of the device or control panel in which EC Directive compliant products are incorporated. This does not allow OMRON to verify the compliance under your usage conditions. Please perform the final verification on the EMC compliance of your machines or the entire system at your own responsibility.

This is a Class A product designed for industrial environments. Use in residential area may cause radio interference, in which case the user may be required to take adequate measures to reduce interference.

● Built-in EMC noise filter

The EMC noise filter that is built into the 3G3RX-V1 Series complies with EN61800-3 Category C3.

● Other EMC noise filters

Refer to the table below. These filters are effective for improving of EMC conditions.
When setting the light load mode, select the maximum applicable motor capacity for the light load mode.

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

Wiring for power supply

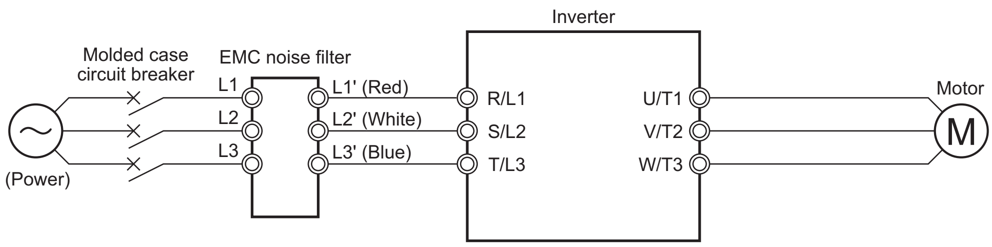
Keep the ground cable as short as possible.

Place the inverter and the noise filter on the same earth (ground) plate.

Always connect the power supply input terminals (R/L1, S/L2, T/L3) of the inverter to the power supply via an EMC noise filter.

Keep the cable between the inverter and the EMC noise filter as short as possible (40 cm maximum).

Connection Example



Wiring between inverter and motor

When connecting a motor to the inverter, be sure to use shield braided cables.

Keep the cables as short as possible.

Measures against noise

- For the power supply lines of the inverter, use a shield braided cable with a minimum cable length, and connect 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. Keep the cable as short as possible at a length 20 m or less, with the cable shield grounded. Installing a clamp filter 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.

Low-voltage Directive

The 3G3RX-V1 Series Inverter complies with the EMC Directive EN61800-5-1 when installed with a molded case circuit-breaker (MCCB) and wired according to the specified wiring method.

- The 3G3RX-V1 Series Inverter is an open type device. Be sure to install it inside the control panel.
- The power supply and voltage (SELV) with reinforced or double insulation should be used for wiring to the control circuit terminals.
- To satisfy requirements of the LVD (Low Voltage Directive), the inverter must be protected with a molded case circuit breaker (MCCB) in case a short-circuiting accident occurs. Be sure to install a molded case circuit breaker (MCCB) on the power supply side of the inverter.
- Use one molded case circuit breaker (MCCB) per inverter.
- Use the crimp terminal with an insulation sleeve to connect to the main circuit terminals.
- For 400-V class inverters, the ground terminal must be connected to the neutral point of a power supply.

2-3-11 Reference Manuals for Options

This section provides an outline of options and peripheral equipment used with this inverter and information on their reference manual.

Regenerative Braking Unit (Model: 3G3AX-RBU□□)

This option is used in conjunction with a braking resistor to shorten the motor deceleration time.

Name	Catalog No.
Regenerative Braking Unit 3G3AX-RBU□□ User's Manual	I563

PG Board (Model: 3G3AX-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.

Name	Catalog No.
Encoder Feedback Board 3G3AX-PG□□ User's Manual	I564

LCD Digital Operator (Model: 3G3AX-OP05)

This is a Digital Operator with the 5-line display capability.

Name	Catalog No.
LCD Digital Operator 3G3AX-OP05 User's Manual	I579

CX-Drive

This optional support tool enables you to edit inverter parameter data and monitor the status of the inverter.

Name	Catalog No.
CX-Drive Operation Manual	W453

DriveProgramming

This option enables a stand-alone inverter to perform simple sequence control.

Name	Catalog No.
DriveProgramming User's Manual	I580

3

Operation and Test Run

This section describes the operations of the Digital Operator and this product as well as the test run procedure.

3-1 Operation of Digital Operator **3-4**
3-1-1 Part Names and Descriptions 3-4
3-1-2 Key Operation Method 3-6
3-2 Overview of LCD Digital Operator **3-15**
3-3 Connections and Functions of CX-Drive **3-16**
3-3-1 CX-Drive Connection Method 3-16
3-3-2 Outline of CX-Drive 3-20
3-4 Flow of Test Run **3-24**
3-5 Test Run Procedure **3-25**

WARNING	
	Do not change wiring and slide switches (SW1), 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.
	Do not remove the terminal cover during the power supply and 10 minutes 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.

Caution	
	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.

Precautions for Safe Use

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 a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur. Perform the operation after enough confirmation.
- When using DriveProgramming, confirm that the program data is downloaded normally before starting the operation.

Precautions for Correct Use

Restart Selection Function

- Do not come close to the machine when using the Restart Selection function (b001, b008) because the machine may abruptly start when stopped by an alarm.
- Be sure to confirm the RUN signal has turned OFF before resetting the alarm because the machine may abruptly start.

Deceleration Stop Function

- Do not come close to the machine when selecting reset in the Deceleration Stop Function (b050) because the machine may abruptly start after the power is turned on.

Operation Stop Command

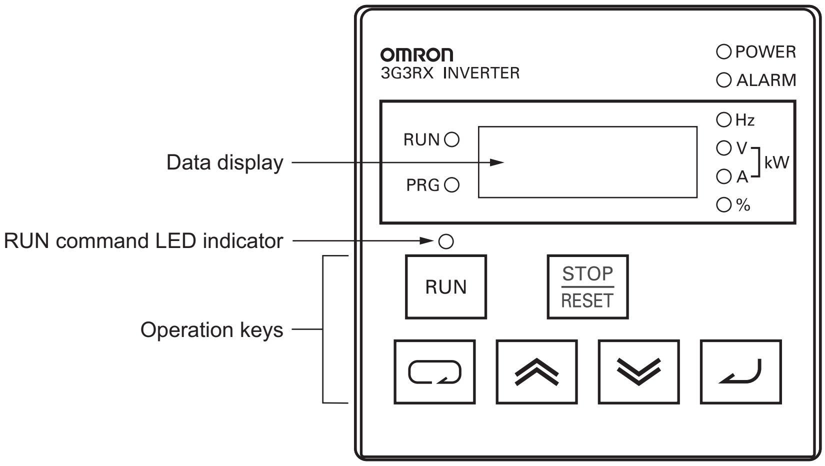
- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- When checking a signal during the power supply and the voltage is erroneously applied to the control input terminals, the motor may start abruptly. Be sure to confirm safety before checking a signal.

3-1 Operation of Digital Operator

The Digital Operator is a display operation panel equipped as standard on the 3G3RX-V1 Series Inverter.

3-1-1 Part Names and Descriptions

The table below shows the name and function of each part of the Digital Operator.



Part	Name	Function
○ POWER	POWER LED	Lights (green) when the power is supplied to the control circuit.
○ ALARM	ALARM LED	Lights (red) when the inverter is in a trip error state. For how to reset a trip error state, refer to *How to Reset a Trip State* on page 10-3.
RUN ○	RUN LED	Lights (green) during operation.
PRG ○	Program LED	Lights (green) when the set value for the selected function is displayed on the data display. Blinks if the set value is invalid (during warning). Refer to *10-2 Warning Function* on page 10-12.
8.8.8.8.	Data display	Displays the frequency reference value, output current value or set value, or other relevant data.
○ Hz ○ V, ○ A (kW) ○ %	Data display LED	Lights (green) according to the content of the data display. Hz: Frequency, V: Voltage, A: Current, kW: Power, %: Rate
○	RUN command LED indicator	Lights (green) when the RUN command source is set to the Digital Operator. This indicates that the RUN key of the Digital Operator is enabled.
RUN	RUN key	Starts inverter operation. Operation via the Digital Operator is enabled and the RUN command is selected. Check that the RUN command LED indicator is lit.
STOP/RESET	STOP/RESET key	Stops the inverter. The STOP/RESET key is enabled by factory setting even when the RUN command source is not set to the Digital Operator. This key can be disabled by setting the STOP Key Selection (b087). When the inverter is in a trip error state, if you press this key, the trip error state is reset.

Part	Name	Function
	Mode key	When parameter is displayed: Moves to the beginning of the next function mode. When data is displayed: Cancels the setting and returns to the parameter display. In individual input mode: Moves the blinking position one digit to the left, if not located at the left end. At the left end, cancels the input data and returns to the previous display. Regardless of the display, if you press the Mode key for 3 seconds or more, the data of Output Frequency Monitor (d001) is displayed.
	Enter key	When parameter is displayed: Switches to the data display. When data is displayed: Enters and stores the set value (into the EEPROM) and returns to the parameter display. In individual input mode: Enters the value in the blinking position and moves it one digit to the right.
	Increment key	Increases the parameter number or the set data value. Press and hold the key to quickly increase the number or value. Press the increment key and the decrement key simultaneously to enter the individual input mode, where you can edit the value in each digit independently.
	Decrement key	Decreases the parameter number or the set data value. Press and hold the key to quickly decrease the number or value. Press the increment key and the decrement key simultaneously to enter the individual input mode, where you can edit the value in each digit independently.

Precautions for Correct Use

- The color scheme of the Digital Operator keys was changed.
  Operate the keys correctly according to the following information on the displays and colors.

Key	Name	Previous model	3G3RX-V1
RUN	RUN key	Gray	Green
STOP/RESET	STOP/RESET key	Yellow	Red
	Mode key	Blue	Blue (No change)
	Enter key	Yellow	Yellow (No change)
	Increment key	Green	Gray
	Decrement key	Green	Gray

- Install or remove the Digital Operator with the power supply shut off.
  Not doing so may result in failure.

3-1-2 Key Operation Method

This section explains how to use the Digital Operator keys in a typical operation (when the Display Selection is “Complete display”) and in the extended function mode U as operation examples.

This operation will be the same even if you select a different setting in the Display Mode (b037), although the number of parameters that you will see on the display differs.

Precautions for Correct Use

- You can change the parameter display on the Digital Operator by the Display Selection (b037). For details, refer to *Display Selection* on page 7-78.
- In the 3G3RX-V1, the factory setting for the Display Selection (b037) is “Complete display,” which was changed from the conventional default “Basic display.” You can see and set all parameters when you turn on the power supply for the first time.

Additional Information

- You can set the initial screen displayed after turning on the power supply by the Initial Screen Selection (b038). For details, refer to *Initial Screen Selection (Initial Screen after Power-on)* on page 7-81.
- You can display only the parameters registered as user parameters. It is also possible to automatically register changed parameters, or directly set specific parameters. For details, refer to *User Parameter Automatic Setting Function* on page 7-81.

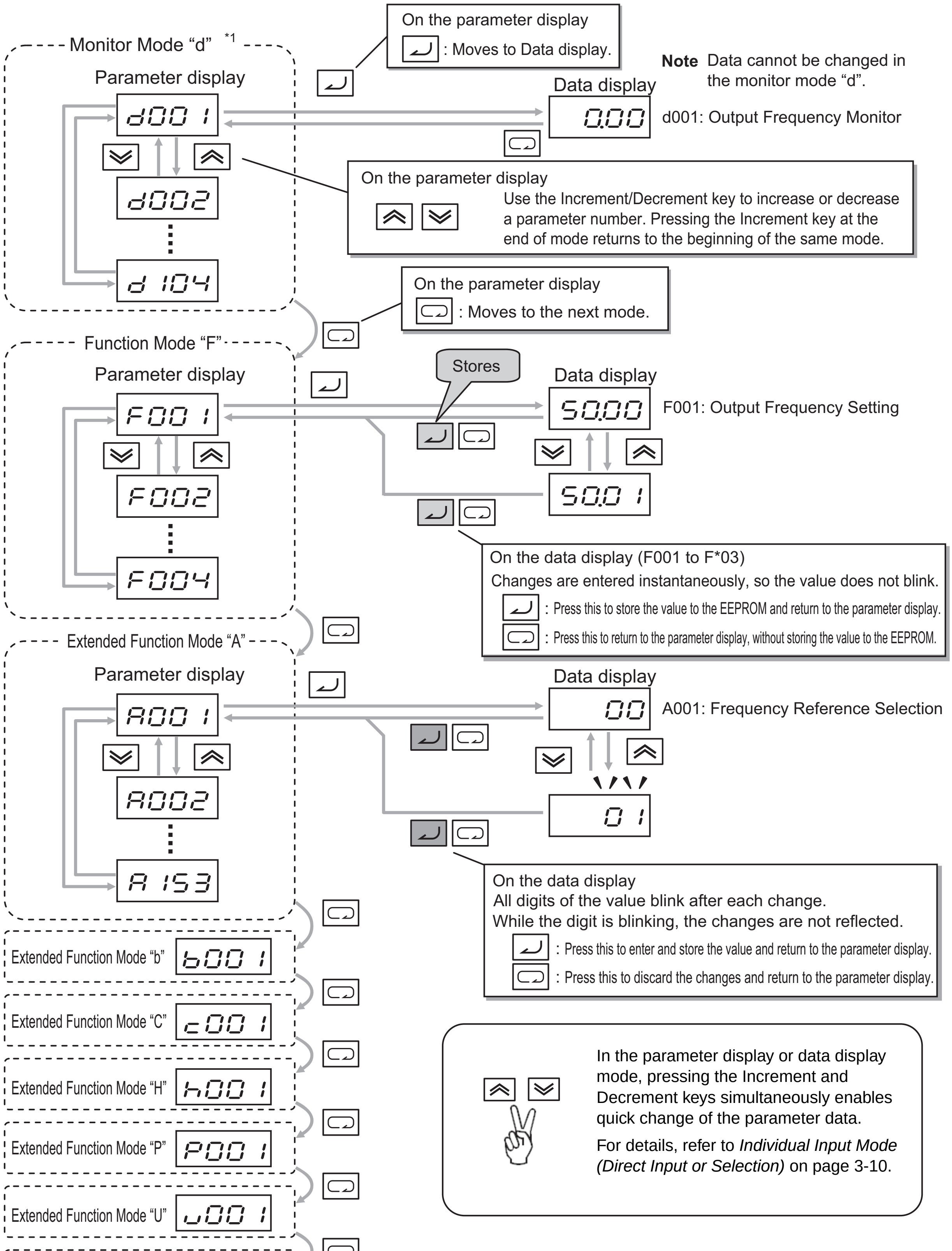
Item	Parameter No.	Data	Description
Display Selection	b037	00	Complete display (Factory setting)
		01	Individual display of functions
		02	User setting
		03	Data comparison display
		04	Basic display
Initial Screen Selection (Initial screen after power-on)	b038	000	Screen on which the Enter key is pressed last
		001 to 060	d001 to d060 (001: Factory setting)
		201	F001
		202	Do not set.
User Parameter Automatic Setting Function	b039	00	Disabled (Factory setting)
		01	Enabled

Additional Information

Regardless of the display mode of the Digital Operator, if you press the Mode key for 3 seconds or more, the data of Output Frequency Monitor (d001) is displayed. However, the Digital Operator continues to display the function group parameters in sequence as the normal operation if you press the Mode key for less than 3 seconds. (Example: A001 → F001 → b001 → C001 ... (after 3 s) “500” appears)

Transition of Parameter Display

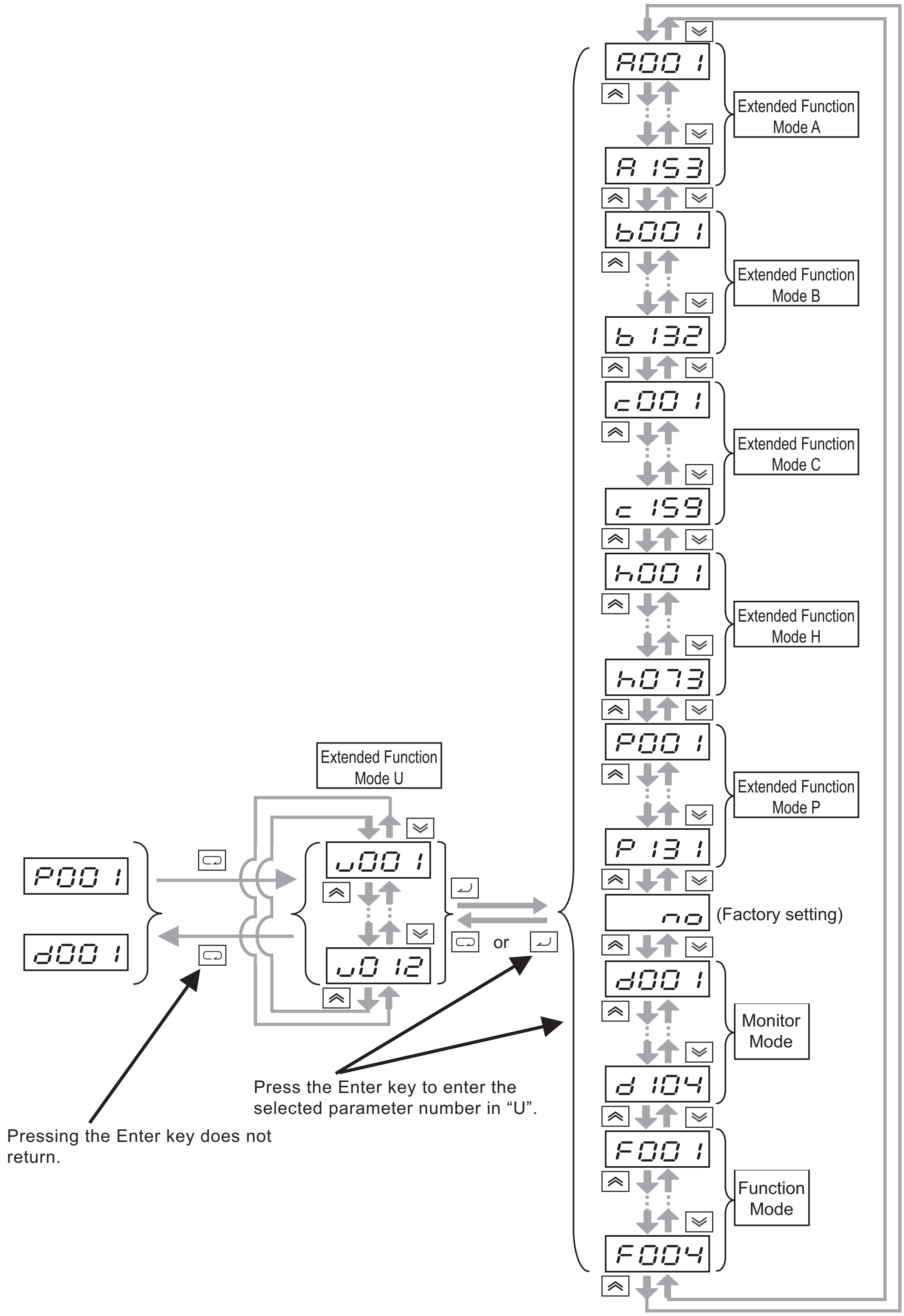
The following figure shows how to operate the Digital Operator to reach the intended parameter display.



*1 Data cannot be changed in the monitor mode “d”.
*2 After the extended function mode “U”, returns to the monitor mode “d”.

Transition of Parameter Display and Key Operation in Function Group U

In the extended function mode U, you can operate the Digital Operator in the same way as in other modes. However, do not be confused although each parameter number is displayed again for the set value.
Press the Enter key to enter the selected parameter number. Then the display returns to the parameter display in the extended function mode U.
To display only the user set parameters, set the Display Selection (b037) to 02 (User setting).



Parameter Initialization

You can initialize the changed parameters and also clear the fault monitor data.

As a measure to prevent inadvertent parameter initialization, the inverter is designed to force the user to set several parameters to execute initialization.

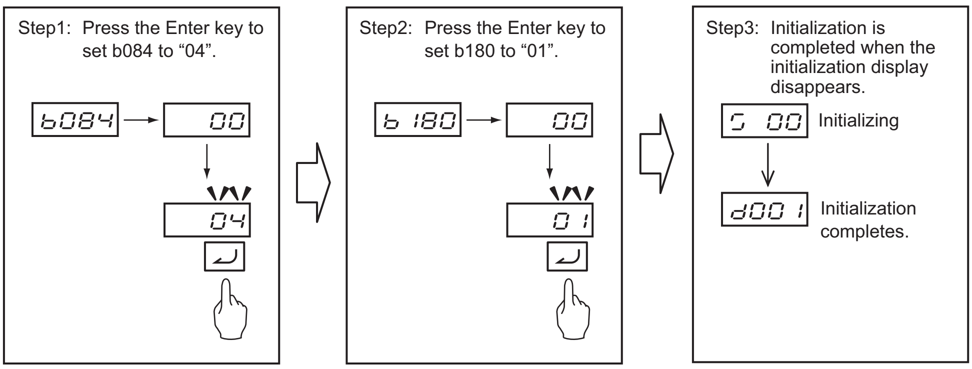
For details on parameter initialization, refer to *5-1 Parameter Display and Parameter Initialization* on page 5-3.

Precautions for Correct Use

- The following parameters are not initialized: the settings of the DriveProgramming User Parameters U00 to U31 (P100 to P131), Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Initialization Data Selection (b085), Heavy Load/Light Load Selection (b049), Thermistor Adjustment (C085), and analog adjustment parameters (C081 to C083, C121 to C123).
- The inverter does not display the initialization-related parameters depending on the Display Selection (b037) setting. If they are not displayed, change b037 to 00 (Complete display).
- When the Soft Lock Selection (b031) is set to prohibit changes of the parameter settings, the parameter initialization function does not work. Disable the soft lock function before attempting parameter initialization.
- The 3G3RX-V1 Inverter does not support the conventional initialization which is performed by pressing multiple keys simultaneously.
- Remember that it is impossible to undo the initialization once you press the Enter key  to execute parameter initialization, with the Initialization Execution (b180) set to 01.

The following figure shows the steps of complete parameter initialization.

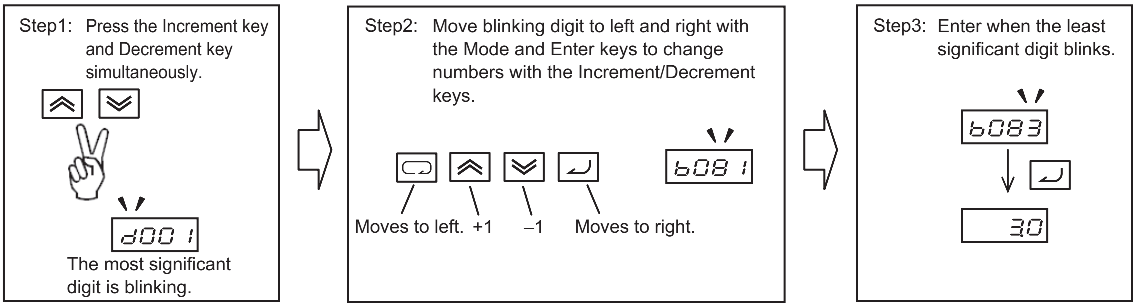
Complete initialization means to clear the Fault Monitor and DriveProgramming application data, as well as the parameter data.



Individual Input Mode (Direct Input or Selection)

If the parameter number or data is far away from the current value on the display, using the individual input mode is efficient for changing the parameter data.

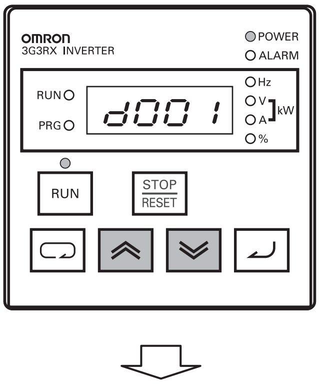
In the individual input mode, you can change the parameter number or data by selecting and entering a value digit by digit.



The following is an example of changing the monitor mode parameter number d001 on the display to the extended function parameter number A029.

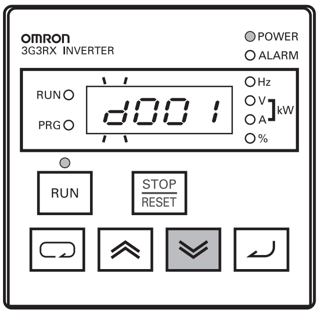
(1) Display the monitor mode parameter number.

(“d001” is displayed.)



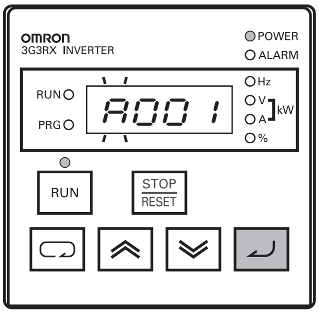
Press and simultaneously.

(2) Change to the extended function mode.



- In the left-end digit (4th digit), “d” starts blinking.
- Press twice.
  (“A001” is displayed.)

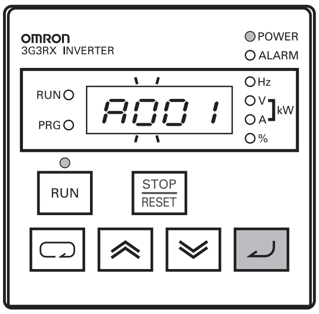
Note If you press when the left-end digit is blinking, the selected value is canceled and it returns to the display on which you pressed and simultaneously.



- In the left-end digit, “A” is blinking.
- Press to enter the value blinking in the digit.
  (“A” is entered.)

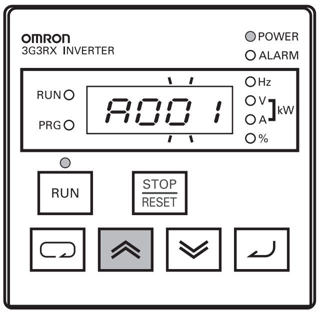
Note If you press when the digit is blinking, the blink returns to the digit in which you entered the previous value.

(3) Change the 3rd digit of the extended function parameter number.

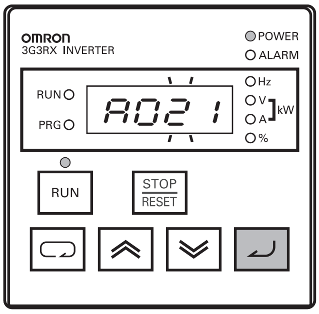


- In the 3rd digit, “0” is blinking.
- This “0” in the 3rd digit need not be changed, so press to enter “0”.

(4) Change the 2nd digit of the extended function parameter number.



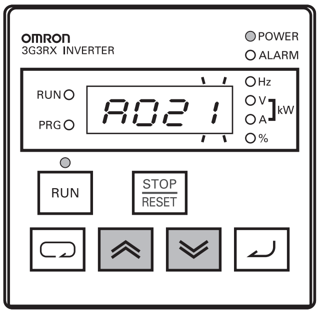
- In the 2nd digit, “0” is blinking.
- Press twice.
(“A021” is displayed.)



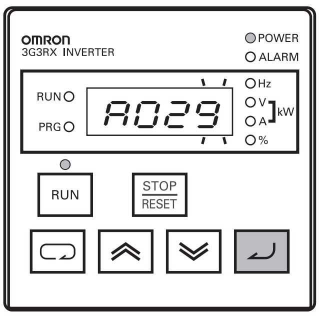
- In the 2nd digit, “2” is blinking.
- Press to enter the value blinking in the digit.
(“2” is entered.)

Note If you press when the digit is blinking, the blink returns to the digit in which you entered the previous value.

(5) Change the 1st digit of the extended function parameter number.

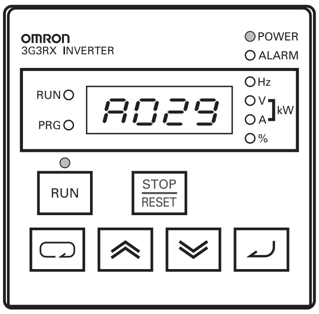


- In the 1st digit, “1” is blinking.
- Press 8 times, or press twice.
(“A029” is displayed.)



- In the 1st digit, “9” is blinking.
- Press to enter the value blinking in the digit.
(“9” is entered.)

(6) The extended function parameter number setting is completed.



- The parameter number “A029” is selected.

Precautions for Correct Use

If the set parameter number is not listed in the Parameter List, or if the parameter number is hidden in the Display Selection setting, “A” in the left-end digit (4th digit) is blinking again. Refer to *Display Selection* on page 7-78 to check the parameter number and set it again.

(7) Press (Enter key) to display the parameter setting; press / (Increment/Decrement key) to change the data; and press (Enter key) again to enter the new setting.

To change the parameter setting, follow the steps (1) to (6) in a similar manner.

Returning Display to d001

Regardless of the display mode of the Digital Operator, if you press (Mode key) for 3 seconds or more, the data of Output Frequency Monitor (d001) is displayed. However, the Digital Operator continues to display the function mode and extended function mode in sequence as the normal operation if you press the Mode key for less than 3 seconds.

Changes in Operation Method from Previous Model

For the 3G3RX-V1, the operation method was changed from the conventional 3G3RX Series.

The following table shows the changes and simplified operation method according to the 3G3MX2 Series.

● Elimination of the top display layer (overall display of each function mode)

The top display layer in the operation A--- was eliminated, although the concept of the function modes remains as before.

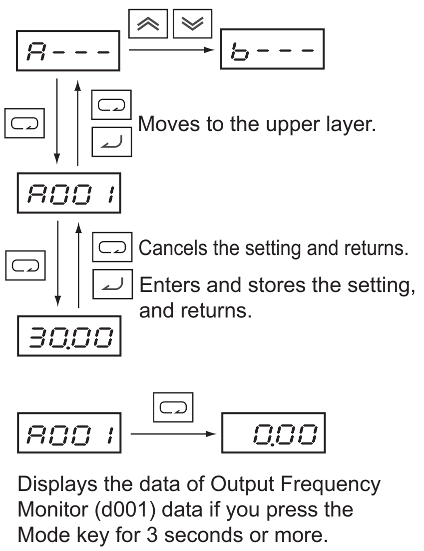
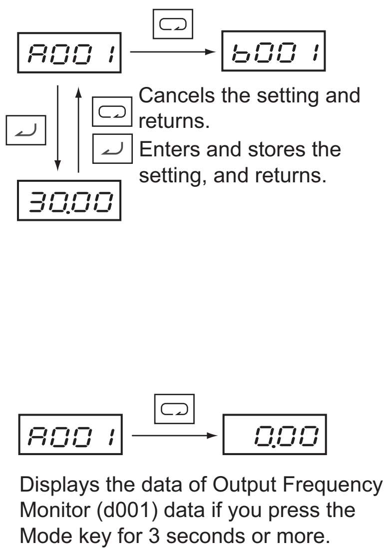
● Change of scroll behavior in each function mode

The parameter numbers loop in each function mode when scrolled.

In the previous model, when the highest parameter number in a function mode appears, the display switches to display the first parameter number in the next function mode.

● Functions of Mode key and Enter key

The functions of the Mode key and the Enter key were changed as follows for consistency and simplicity in operation.

Name	Previous model 3G3RX Series	This model 3G3RX-V1
Enter key	• Moves to the upper layer. • Enters and stores the setting, and returns to the parameter display.	• Moves to the data display. • Enters and stores the setting, and returns to the parameter display.
Mode key	• Moves to the upper layer. • Moves to the parameter display. • Moves to the data display. • Cancels the setting and returns to the parameter display. • Displays the data of Output Frequency Monitor (d001) if you press the Mode key for 3 seconds or more.	• Moves to the beginning of the next function mode. • Cancels the setting and returns to the parameter display. • Displays the data of Output Frequency Monitor (d001) if you press the Mode key for 3 seconds or more.
Difference in key operation		

3-2 Overview of LCD Digital Operator

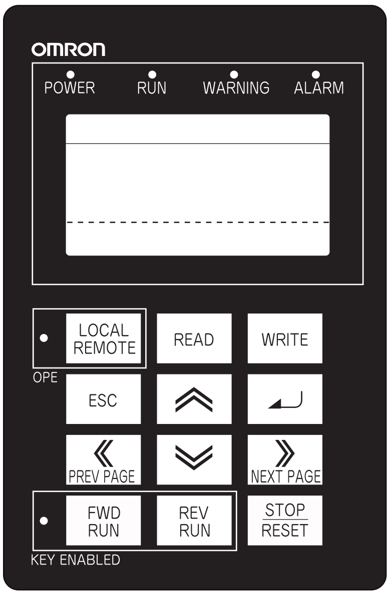
The LCD Digital Operator (Model: 3G3AX-OP05) is an optional Digital Operator with a 5-line LCD screen.

This LCD Digital Operator is newly supported in the 3G3RX-V1 Series and cannot be used with the previous model.

- The LCD Digital Operator can display up to four monitor functions or parameter settings in the selected language (currently English only).
- Similar to the standard LED Digital Operator, the LCD Digital Operator supports the starting/stopping of the inverter, parameter setting, monitor checking, trip error/warning data checking, and other operations.
- The LCD Digital Operator can store up to four sets of inverter parameter setting data, or a single set of inverter parameter setting data and a single DriveProgramming program in its internal memory.
- The LCD Digital Operator supports all read/write of inverter parameters and DriveProgramming program data. However, it can write parameter data to only the same model and the same version of inverters.
- The LCD Digital Operator has a capability to verify the parameter data stored in it and that stored inside the inverter.
- The LCD Digital Operator can be mounted directly on the inverter. The use of the Digital Operator Cable not only extends its application to handy operation but also enables panel-mounting.

Install or remove the Digital Operator with the power supply shut off. Not doing so may result in failure.

For details on the functions of the LCD Digital Operator, refer to “LCD Digital Operator 3G3AX-OP05 User’s Manual (I579)”.



3-3 Connections and Functions of CX-Drive

The inverter/Servo support tool CX-Drive is support software to edit the inverter parameter settings.

Installing the OMRON CX-One software on your PC also installs the CX-Drive simultaneously.

The 3G3RX-V1 Series Inverter is supported in the following or higher versions of the CX-Drive product:

- CX-One: Ver. 4.23
- CX-Drive: Ver. 2.7

This section describes how to connect the CX-Drive to an inverter and provides an overview of its functions.

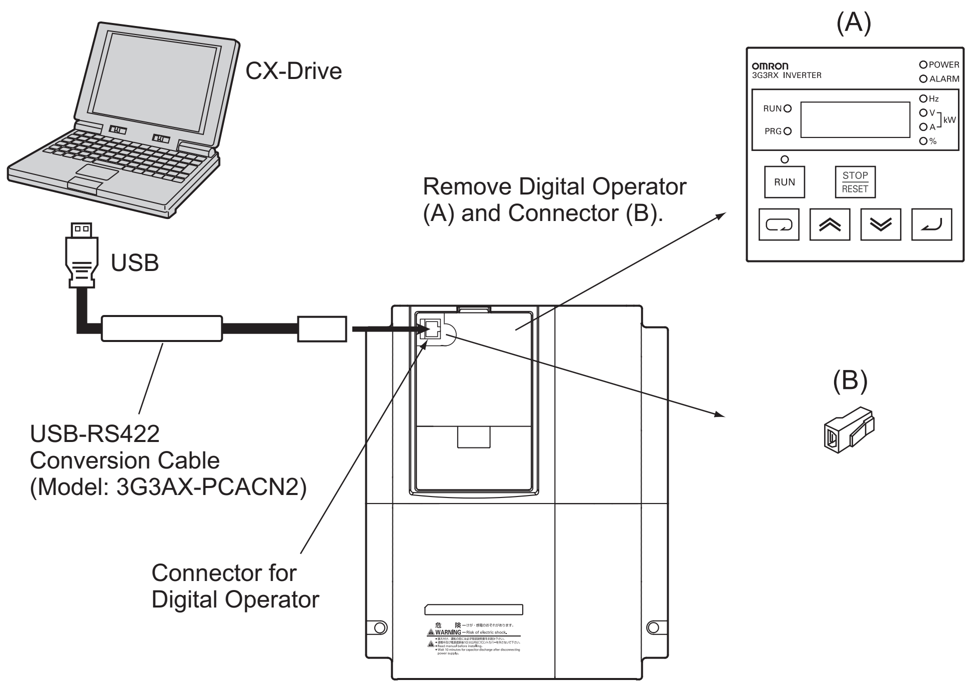
For details on the functions of the CX-Drive, refer to "CX-Drive Operation Manual (W453)".

3-3-1 CX-Drive Connection Method

The following figure shows how to connect the 3G3RX-V1 Series with the 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 Procedure

There are two methods to connect the CX-Drive with the inverter.

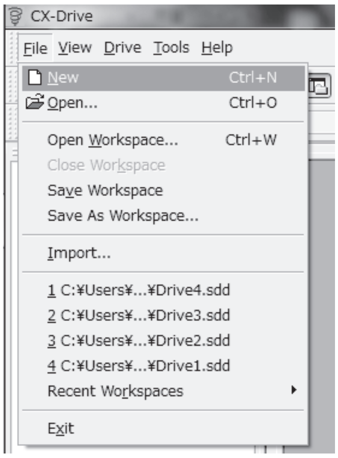
The step-by-step procedure for each method is provided below.

● Connecting by registering inverter connection method beforehand

Create a new inverter project, set the connecting method, and connect with the inverter.

Follow the steps below.

1 **Start the CX-Drive and, from the [File] menu, select [New].**

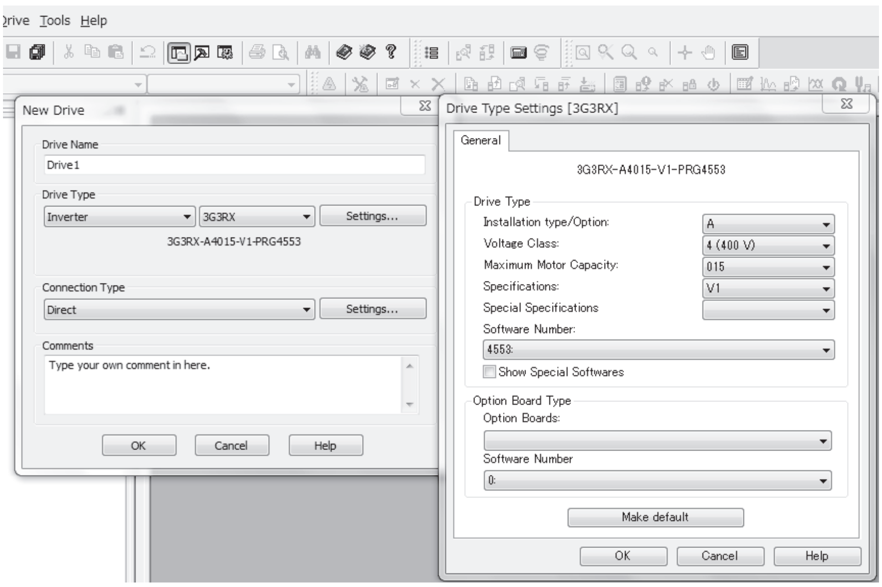


2 **In the [New Drive] window, set the drive type of the target inverter.**

Under [Drive Type], select the inverter series name and click the [Settings] button to the right.

In the [Drive Type Settings] window, set the Installation Type/Option, Voltage Class, and Maximum Motor Capacity and select [V1] in Specifications.

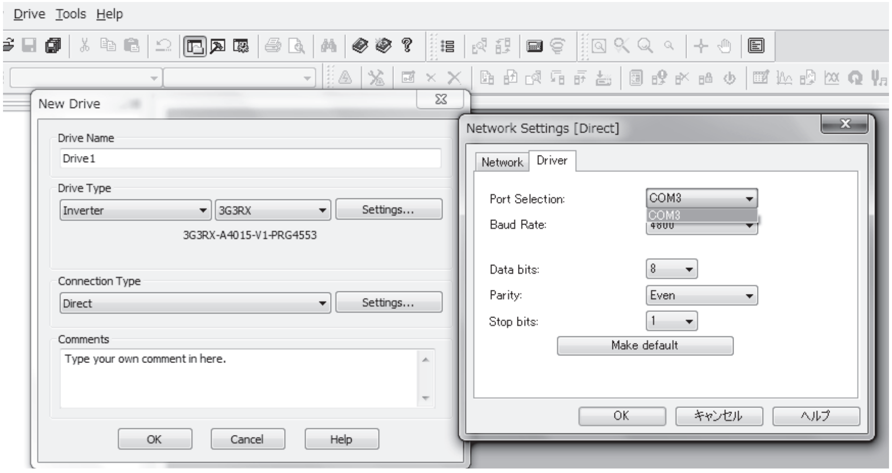
After setting these items, click the [OK] button to close the [Drive Type Settings] window.



3 **In the [New Drive] window, set the type of connection to the inverter.**

Under [Connection Type], select [Direct] and click the [Settings] button to the right.

On the [Driver] tab, set the Port Selection to the port name of the computer on which the CX-Drive is installed Data bits to 8, Parity to Even, and Stop bits to 1.



4 **After setting these items, click the [OK] button and close all windows.**

The new project is registered in the workspace.

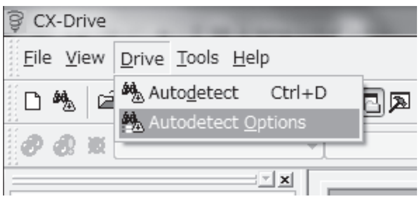
Click the [] (Work Online) icon to connect to the inverter.

● Automatically detecting the connected inverter

Set the [Autodetect Options] in the CX-Drive and use the Autodetect function to automatically connect to the inverter.

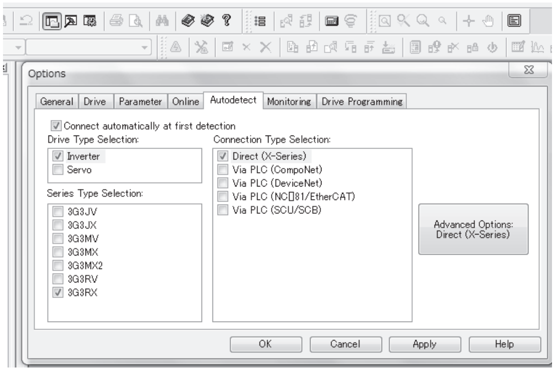
Follow the steps below.

1 **Start the CX-Drive and, from the [Drive] menu, select [Autodetect Options] to open the Options window.**



2 **On the [Autodetect] tab, under [Drive Type Selection], check the [Inverter] box.**

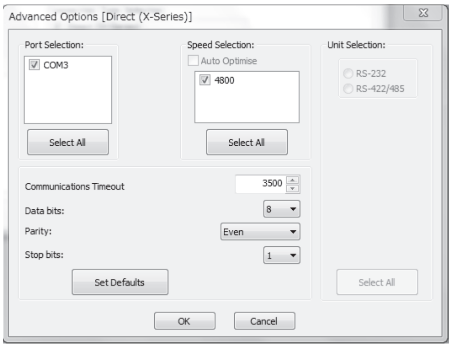
Then, under [Connection Type Selection], check the [Direct] box and click the [Advanced Options: Direct] button to the right.



Additional Information

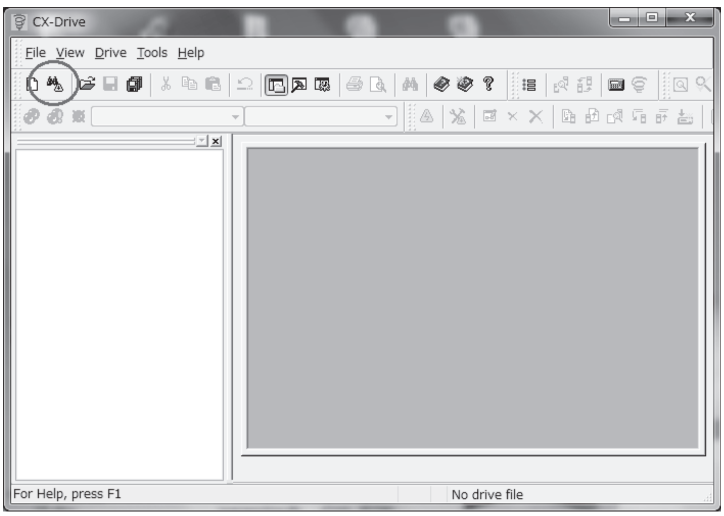
For the reduction of the automatic search time, deselect unnecessary check boxes to narrow down the scope of autodetection.

3 **In the [Advanced Options [Direct (X-Series)]] window, set communications options.**



4 **After setting communications options, click the [OK] button and close all windows. Then, click [Autodetect].**

The Autodetect function starts to create new drive projects automatically.



3-3-2 Outline of CX-Drive

The Inverter/Servo support tool CX-Drive enables you to edit inverter parameters and monitor the inverter status.

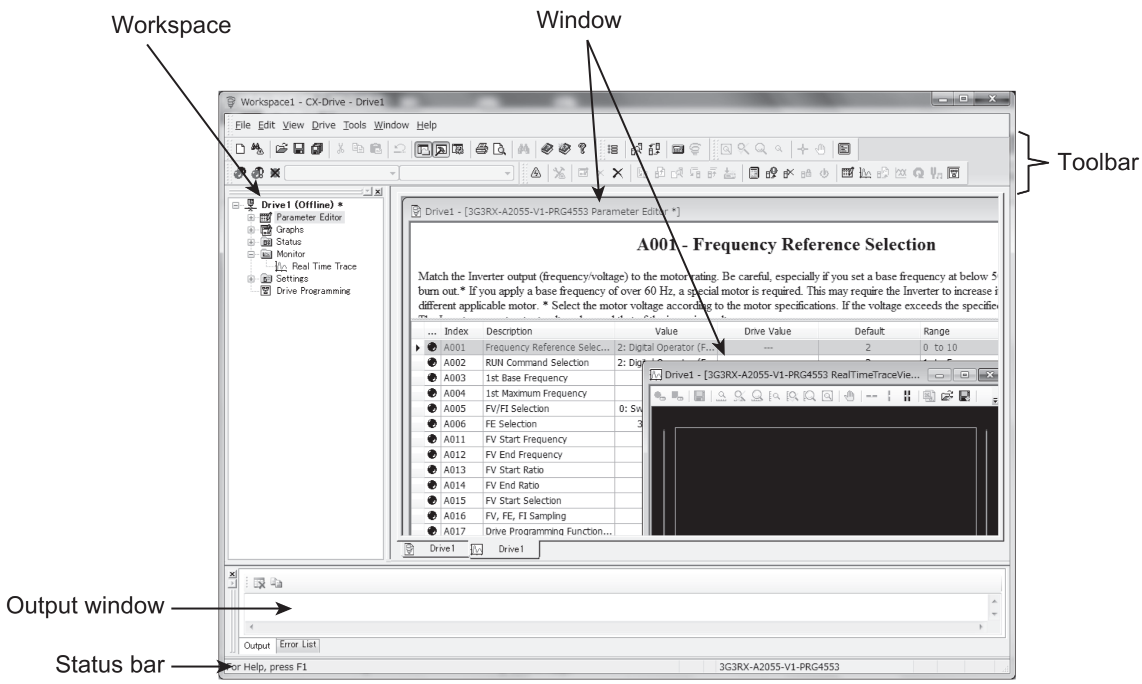
This section provides a functional outline of CX-Drive.

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 and, in the [Online] tab, deselect the [Check Drive Software Compatibility] check box. This allows CX-Drive to connect to the inverter 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.

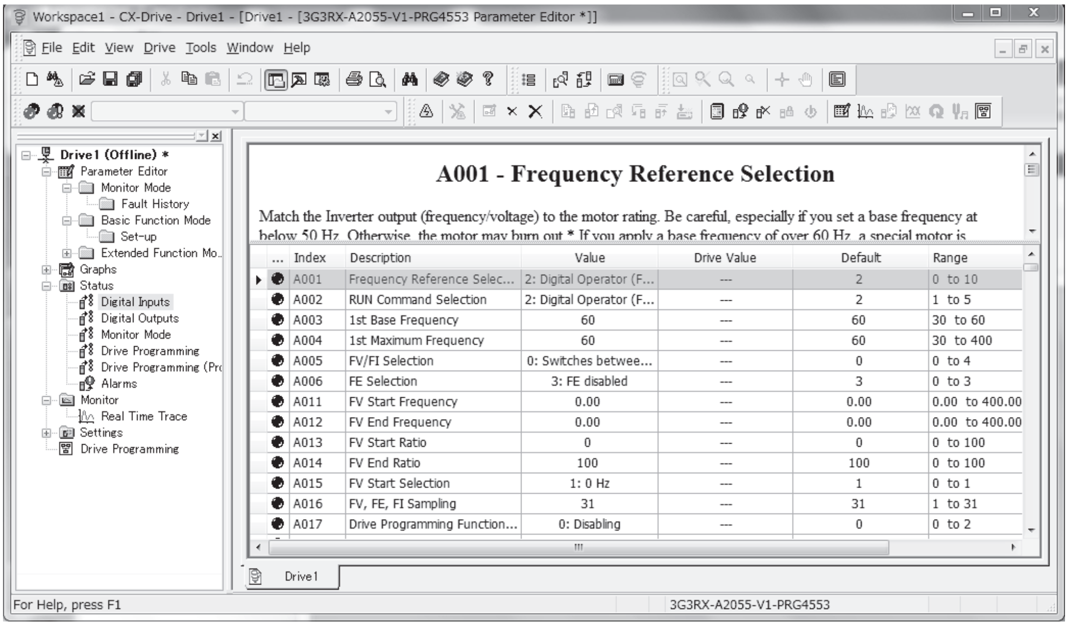
Editing Device Parameters Using CX-Drive

Double-clicking [Parameter Editor] in the project opens a window in which all inverter parameters are listed (in ascending order).

You can edit inverter parameters in this window.

To upload/download inverter parameters, use the [Transfer] buttons 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, icons that represent the status of parameter data are displayed: Not default, Not default and different from the inverter, or Invalid. You can display only parameters with the same icon.
- You can select specific parameters and transfer data for only those selected parameters to the inverter.

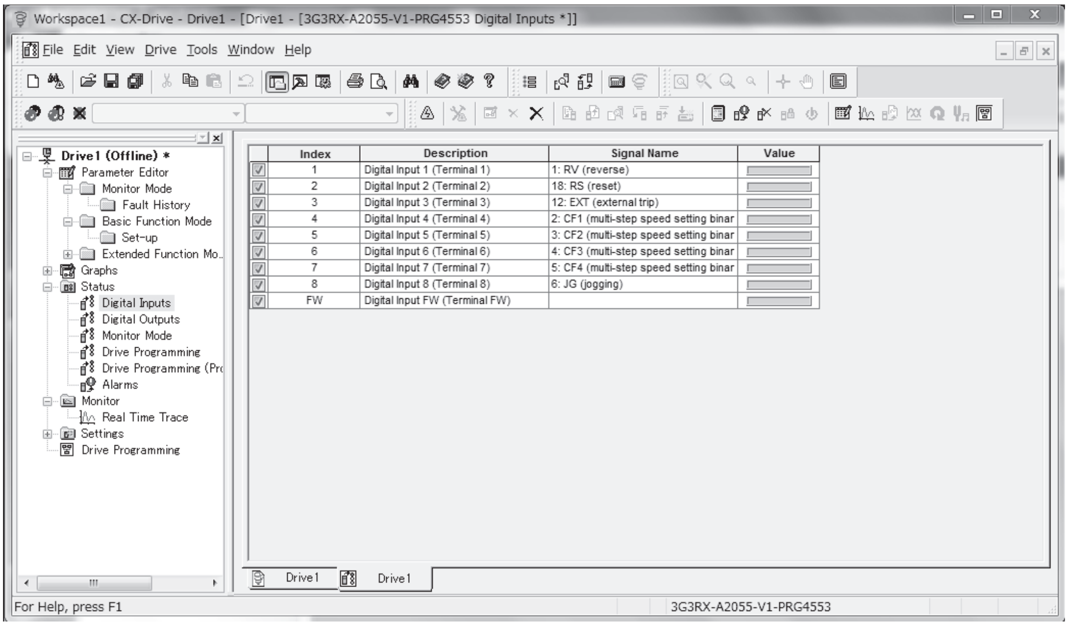


Status Function of CX-Drive

Open the Status folder in the project and double-click the status information.

The window corresponding to the selected status information opens.

Status icon category	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.

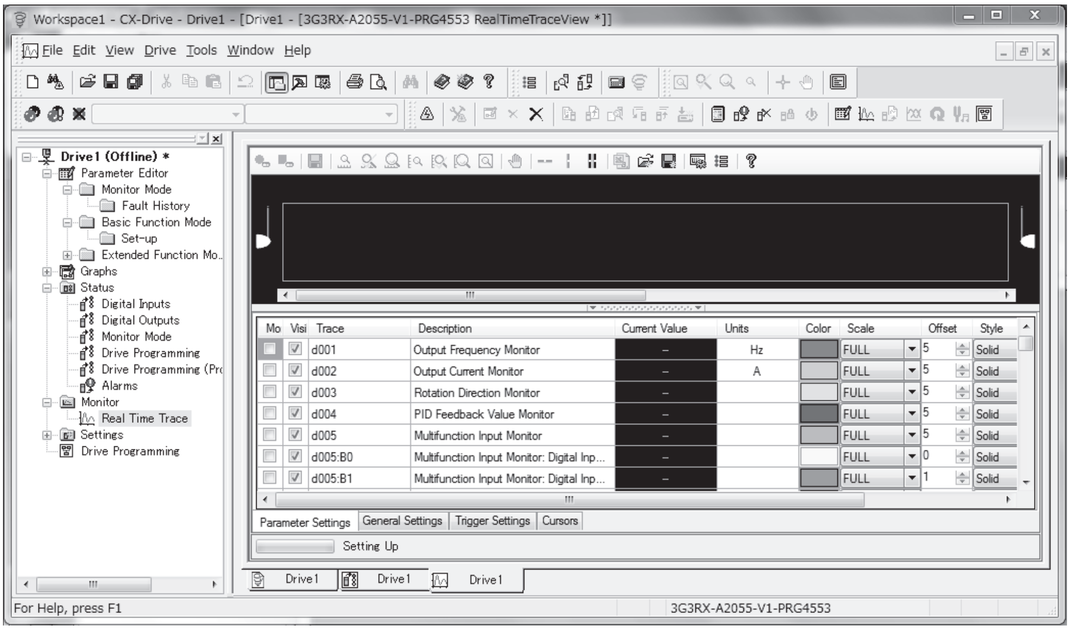


Monitor Function of CX-Drive

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.



3-4 Flow of Test Run

Perform a test run of the inverter according to the following flow.

Item	Description	Reference
Installation	Install the inverter according to the installation conditions.	Section 2, 2-1
Wiring and connections	Connect the inverter to the power supply and peripheral equipment.	Section 2, 2-3
Power-on	Check the points mentioned in the next page before turning on the power supply.	Section 2, 2-3
Display status checks	Check that there is no error in the Inverter.	Section 10
Parameter Initialization	Initialize the inverter parameters.	Section 5, 5-1
Parameter setting	Set the parameters required for the test run.	Section 5, 5-3, 5-4
No-load run	Run the motor with no-load via the Digital Operator.	Section 3, 3-1
Load run	Run the motor via Digital Operator, with the mechanical system connected.	Section 3, 3-1
Operation	Basic settings (operation with the basic settings required to operate and stop the inverter.)	Section 5
	Vector control (operation the inveter with the vector control and other functions.)	Section 6

3-5 Test Run Procedure

The following describes the test run procedure.

Installation

Check that the inverter meets the installation conditions.

For details on installing the inverter, refer to *2-1 Installation* on page 2-4.

Wiring and Connections

Select peripheral equipment according to the specifications and wire the cables securely.

For details on wiring the inverter, refer to *2-3 Wiring* on page 2-14.

Power-on

● Points to be checked before turning ON the power

Check that the power supply voltage is appropriate and that the power supply input terminals (R/L1, S/L2, T/L3) are securely wired. The power supply voltage of the 3G3RX-V1 Series Inverter is as follows.

Model	Power supply voltage
3G3RX-A2□-V1 (IP20)	3-phase 200 to 240 VAC
3G3RX-A4□-V1 (IP20)	3-phase 400 to 480 VAC
3G3RX-B4□-V1 (IP00)	3-phase 400 to 480 VAC

Check that the motor is securely connected to the motor output terminals (U/T1, V/T2, W/T3).

Check that the controller is securely connected to the control circuit terminals. In addition, turn off the control terminals.

Set the motor in a no-load state (not connected to the mechanical system).

● Power-on

If no problem is found in above checks, turn on the power supply.

Display Status Checks

If no problem is found at power-on, the display status will be as follows.

Name	Display status
POWER LED	Lit
ALARM LED	Not lit
RUN LED	Not lit (Lit during RUN)
RUN command LED indicator	Lit
Data display LED (Hz)	Lit
Data display	Displays d001 setting.

If any problem is found, the display status will be as follows.

Take countermeasures according to *Section 10 Troubleshooting*.

Name	Display status
POWER LED	Lit
ALARM LED	Lit
RUN LED	Not lit
RUN command LED indicator	Lit
Data display LED (Hz)	Lit
Data display	Displays error code such as E01. (Displayed error code differs depending on error condition.)

Parameter Initialization

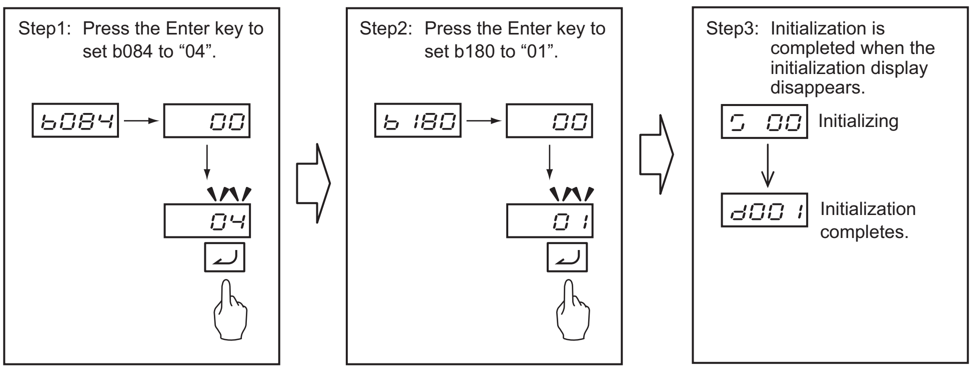
You can initialize the changed parameters and also clear the fault monitor data.

As a measure to prevent inadvertent parameter initialization, the inverter is designed to force the user to set several parameters to execute initialization.

The following figure shows the steps of complete parameter initialization.

Complete initialization means to clear the Fault Monitor and DriveProgramming application data, as well as the parameter data.

For details on parameter initialization, refer to *5-1 Parameter Display and Parameter Initialization* on page 5-3.



Precautions for Correct Use

- The following parameters are not initialized: the settings of the DriveProgramming User Parameters U00 to U31 (P100 to P131), Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Initialization Data Selection (b085), Heavy Load/Light Load Selection (b049), Thermistor Adjustment (C085), and analog adjustment parameters (C081 to C083, C121 to C123).
- The inverter does not display the initialization-related parameters depending on the Display Selection (b037) setting. If they are not displayed, change b037 to 00 (Complete display).
- When the Soft Lock Selection (b031) is set to prohibit changes of the parameter settings, the parameter initialization function does not work. Disable the soft lock function before attempting parameter initialization.
- The 3G3RX-V1 Inverter does not support the conventional initialization which is performed by pressing multiple keys simultaneously.
- Remember that it is impossible to undo the initialization once you press the Enter key to execute parameter initialization, with the Initialization Execution (b180) set to 01.

Parameter Setting

To operate the inverter, two commands are required: the RUN command and the frequency reference.

First, set the sources of these commands in the Frequency Reference Selection (A001) and RUN Command Selection (A002). For Test Run, set these parameter to 02 (Digital Operator) to operate the inverter via the Digital Operator.

Next, set the 1st Motor Capacity (H003) and the 1st Motor Pole Number (H004). These values are used as the reference values for the automatic torque boost, motor protection, and torque limit functions.

Then, in the 1st Electronic Thermal Level (b012), set the rated current of your motor.

Set the value correctly according to the motor.

Parameter No.	Function name	Set value	Default data	Unit
A001	Frequency Reference Selection	02: Digital Operator	02	–
A002	RUN Command Selection	02: Digital Operator	02	–
H003	1st Motor Capacity	0.20 to 160.0	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
b012	1st Electronic Thermal Level	0.2 x Rated current to 1.0 x Rated current	Rated current	A
b087	STOP Key Selection	00 to 02	00	–

Precautions for Correct Use

The STOP/RESET key on the Digital Operator is enabled when the STOP Key Selection parameter is set to Enabled. Make sure that this parameter is set correctly, although the STOP/RESET key is set to Enabled by default.

No-load Run

Rotate the motor with no-load (in a state not connected to the mechanical system) via the Digital Operator.

● Forward/reverse rotation via Digital Operator

Follow the steps below to run the motor in the forward or reverse rotation.

(1) Set the Output Frequency Setting/Monitor (F001).

It is recommended to initially set this to approximately 10 Hz or slower for safety reasons (Factory settings: F001 = 6.0).

(2) Set the RUN Direction Selection (F004).

In the RUN Direction Selection (F004), select 00 (Forward) or 01 (Reverse).

Display the Output Frequency Monitor (d001) on the Digital Operator and press the Enter key.

Make sure that the displayed value is 0.00 (Hz).

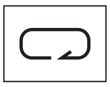
(3) Press the RUN key.

The motor starts rotating with the RUN LED lit.

(4) Check that there is no problem with the output frequency, motor rotation direction or inveter operation displayed on the Digital Operator.

For the rotation direction of motor, refer to the explanation for the RUN Direction Monitor (d003).

Parameter No.	Function name	Data range	Default data	Unit
F001	Output Frequency Setting/Monitor	0.0 Starting Frequency to 1st Maximum Frequency	6.0	Hz
F004	RUN Direction Selection	00: Forward 01: Reverse	00	–
d001	Output Frequency Monitor	0.00 to 99.9 100.0 to 400.0	–	Hz
d003	RUN Direction Monitor	F: Forward o: Stop r: Reverse	–	–

Key	Data display example	Description
	0.00	Press the Mode key for 1 s or more to display the d001 data “0.00”.
RUN	6.0	Press the RUN key. The RUN command LED indicator lights and the frequency reference monitor value is displayed on the data display.

● Stopping motor

After running the motor with no-load in the forward or reverse rotation, press the STOP/RESET key STOP RESET. The motor stops rotating.

Load Run

If no problem is found during no-load run, connect the mechanical system and run the inverter with load via the Digital Operator.

● Mechanical system connection

Make sure that the motor has stopped completely before connecting the mechanical system.

Then, connect the mechanical system with the motor shaft securely to prevent the screws from loosening.

● Operation via digital operator

In case of abnormal inverter run, be prepared to press the STOP/RESET key STOP/RESET on the Digital Operator.

In the same way as you did during no-load run, stop the machine via the Digital Operator.

● RUN mode checks

Start with a low speed and, while checking that the machine moves smoothly in a correct direction, increase the Output Frequency Setting/Monitor (F001) value.

Check that there is no mechanical vibration and noise by varying the Output Frequency Setting/Monitor (F001) and RUN Direction Selection (F004) settings.

Also, check, using the Output Current Monitor (d002) and DC Voltage Monitor (d102), that the current/voltage is still far from the value at which a trip error occurs.

Operation

To operate the inverter with only basic parameters, refer to *Section 5 Basic Settings*.

To use applied functions such as the sensorless vector control, sensor vector control, speed control, torque control, and position control modes, in addition to *Section 5 Basic Settings*. refer to *Section 6 Vector Control*.

4

Parameter List

This section describes the parameters used with this inverter.

4-1 Monitor Mode 4-2

4-1-1 Group d 4-2

4-2 Basic Function Mode 4-5

4-2-1 Group F: Basic Function Parameters 4-5

4-3 Extended Function Mode 4-6

4-3-1 Group A: Standard Function Parameters 4-7

4-3-2 Group b: Detailed Function Parameters 4-19

4-3-3 Group C: Multi-function Terminal Function Parameters 4-28

4-3-4 Group H: Motor Control Parameters 4-39

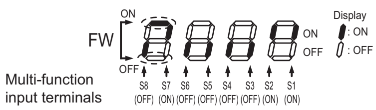
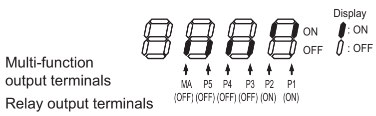
4-3-5 Group P: Option Parameters 4-42

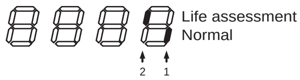
4-3-6 Group U: User Setting Display Parameters 4-49

4-1 Monitor Mode

The inverter by default displays the content of the parameter d001at power-on. To monitor the desired parameter, change the setting in the Initial Screen Selection (b038).

4-1-1 Group d

Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
				Normal	b031 = 10		
d001	Output Frequency Monitor	0.00 to 99.99 100.0 to 400.0	–	Enabled	Enabled	Hz	7-2
d002	Output Current Monitor	0.0 to 999.9 1000. to 9999.	–	–	–	A	7-2
d003	RUN Direction Monitor	F: Forward o: Stop r: Reverse	–	–	–	–	7-2
d004	PID Feedback Value Monitor	0.00 to 99.99 100.0 to 999.9 1000. to 9999. 1000 to 9999 (10000 to 99990) Γ100 to Γ999 (100000 to 999000) (Enabled when the PID function is selected)	–	–	–	–	7-3
d005	Multi-function Input Monitor		–	–	–	–	7-3
d006	Multi-function Output Monitor		–	–	–	–	7-4
d007	Output Frequency Monitor (After Conversion)	0.00 to 99.99 100.0 to 999.9 1000. to 9999. 1000 to 3996 (10000 to 39960) [Output Frequency (d001) x Frequency Conversion Factor (b086)]	–	Enabled	Enabled	–	7-4
d008	Real Frequency Monitor	0.00 to 99.99 (Forward) 100.0 to 400.0 (Forward) –99.9 to –00.0 (Reverse) –400. to –100. (Reverse)	–	–	–	Hz	7-5
d009	Torque Reference Monitor	–200. to 200.	–	–	–	%	7-5
d010	Torque Bias Monitor	–200. to 200.	–	–	–	%	7-5
d012	Output Torque Monitor	–200. to 200.	–	–	–	%	7-6
d013	Output Voltage Monitor	0.0 to 600.0	–	–	–	V	7-6

Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
				Normal	b031 = 10		
d014	Input Power Monitor	0.0 to 999.9	–	–	–	kW	7-6
d015	Integrated Power Monitor	0. to 9999. 1000 to 9999 (10000 to 99990) Γ100 to Γ999 (100000 to 999000)	–	–	–	kWh	7-7
d016	Total RUN Time Monitor	0. to 9999. 1000 to 9999 (10000 to 99990) Γ100 to Γ999 (100000 to 999000)	–	–	–	h	7-7
d017	Total Power ON Time Monitor	0. to 9999. 1000 to 9999 (10000 to 99990) Γ100 to Γ999 (100000 to 999000)	–	–	–	h	7-8
d018	Fin Temperature Monitor	–020.0 to 200.0	–	–	–	°C	7-8
d019	Motor Temperature Monitor	–020.0 to 200.0	–	–	–	°C	7-8
d022	Life Assessment Monitor	 1: Main circuit board capacitor 2: Cooling fan rotation speed reduced	–	–	–	–	7-8
d023	Program Counter (DriveProgramming)	0 to 1024	–	–	–	–	7-9
d024	Program Number Monitor (DriveProgramming)	0000 to 9999	–	–	–	–	7-9
d025	User Monitor 0 (DriveProgramming)	–2147483647 to 2147483647 (Displays DriveProgramming execution result)	–	–	–	–	7-9
d026	User Monitor 1 (DriveProgramming)	–2147483647 to 2147483647 (Displays DriveProgramming execution result)	–	–	–	–	
d027	User Monitor 2 (DriveProgramming)	–2147483647 to 2147483647 (Displays DriveProgramming execution result)	–	–	–	–	
d028	Pulse Counter Monitor	0 to 2147483647 (Displays MSB 4 digits)	–	–	–	–	7-10
d029	Position Command Monitor	–268435455 to 268435455 (P012 = “02”) –1073741823 to 1073741823 (P012 = “03”) Displays MSB 4 digits (1 digit for “–”)	–	–	–	–	7-10
d030	Current Position Monitor	–268435455 to 268435455 (P012 = “02”) –1073741823 to 1073741823 (P012 = “03”) Displays MSB 4 digits (1 digit for “–”)	–	–	–	–	7-10

Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
				Normal	b031 = 10		
d031 *1	Current Time Monitor	mm/dd hh: mm (Month/Day and Hours/Minutes, 12 characters)	–	–	–	–	7-11
d060	Inverter Mode Monitor	Displays currently set mode I-C: IM motor heavy load I-V: IM motor light load	–	–	–	–	7-11
d080	Fault Counter	0. to 9999. 1000 to 6553 (10000 to 65530)	–	–	–	time	7-11
d081	Fault Monitor 1 (Latest)	Error code (Fault factor) • Output frequency [Hz] • Output current [A] • P-N voltage [V] • RUN time [h] • Power ON time [h]	–	–	–	–	7-12
d082	Fault Monitor 2		–	–	–	–	
d083	Fault Monitor 3		–	–	–	–	
d084	Fault Monitor 4		–	–	–	–	
d085	Fault Monitor 5		–	–	–	–	
d086	Fault Monitor 6		–	–	–	–	
d090	Warning Monitor	Warning code	–	–	–	–	7-12
d102	DC Voltage Monitor	0.0 to 999.9	–	–	–	V	7-13
d103	Regenerative Braking Load Rate Monitor	0.0 to 100.0	–	–	–	%	7-13
d104	Electronic Thermal Load Rate Monitor	0.0 to 100.0	–	–	–	%	7-13

*1 This can be displayed when the LCD Digital Operator is used.

Description for Data Range

Data range	Description
0.00 to 99.99	Displays in increments of 0.01.
0.0 to 999.9	Displays in increments of 0.1.
0. to 9999.	Displays in increments of 1.
1000 to 9999 (10000 to 99990)	Displays in increments of 10.
Γ100 to Γ999 (100000 to 999000)	Displays in increments of 1000.

Display of MSB 4 Digits

Data	Display
1230000	1230
–1230000	–123

4-2 Basic Function Mode

The table below lists the basic function mode parameters.

4-2-1 Group F: Basic Function Parameters

Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
				Normal	b031 = 10		
F001	Output Frequency Setting/Monitor	0.0/Starting frequency to 1st/2nd/3rd max. frequency 0.0 to 100.0 (PID function enabled)	–	Enabled	Enabled	Hz	7-14
F002	1st Acceleration Time 1	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.0 *1	Enabled	Enabled	s	7-15
F202	2nd Acceleration Time 1		10.0 *1	Enabled	Enabled	s	
F302	3rd Acceleration Time 1		10.0 *1	Enabled	Enabled	s	
F003	1st Deceleration Time 1	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.0 *1	Enabled	Enabled	s	
F203	2nd Deceleration Time 1		10.0 *1	Enabled	Enabled	s	
F303	3rd Deceleration Time 1		10.0 *1	Enabled	Enabled	s	
F004	RUN Direction Selection	00: Forward 01: Reverse	00	Disabled	Disabled	–	7-16

*1 The default data was changed from the previous model.

Description for Data Range

Data range	Description
0.00 to 99.99	Displays in increments of 0.01.
0.0 to 999.9	Displays in increments of 0.1.
0. to 9999.	Displays in increments of 1.
1000 to 9999 (10000 to 99990)	Displays in increments of 10.
Γ100 to Γ999 (100000 to 999000)	Displays in increments of 1000.

4-3 Extended Function Mode

In the extended function mode, inverter parameters are categorized in five groups: A, b, C, H, and P.

This section provides the parameter list for each group.

Note that the parameters displayed on the Digital Operator depend on the setting in the Display Selection (b037). To display all parameters, set this parameter to 00 (Complete display).

Precautions for Correct Use

- You can change the parameter display on the Digital Operator by the Display Selection (b037). For details, refer to *Display Selection* on page 7-78.
- In the 3G3RX-V1, the factory setting for the Display Selection (b037) is “Complete display,” which was changed from the conventional default “Basic display.” You can see and set all parameters when you turn on the power supply for the first time.

Additional Information

- You can set the initial screen displayed after turning on the power supply by the Initial Screen Selection (b038). For details, refer to *Initial Screen Selection (Initial Screen after Power-on)* on page 7-81.
- You can display only the parameters registered as user parameters. It is also possible to automatically register changed parameters, or directly set specific parameters. For details, refer to *User Parameter Automatic Setting Function* on page 7-81.

4-3-1 Group A: Standard Function Parameters

	Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Basic Settings	A001	Frequency Reference Selection	00: Digital Operator (Volume adjuster) (Enabled when 3G3AX-OP01 is connected) 01: Control circuit terminal block (Analog input) 02: Digital Operator (F001) 03: Modbus communication 04: Option 1 05: Option 2 06: Pulse train frequency 07: DriveProgramming 10: Operation function output	02	Disabled	Disabled	–	7-17
	A002	RUN Command Selection	01: Control circuit terminal block 02: Digital Operator 03: Modbus communication 04: Option 1 05: Option 2	02	Disabled	Disabled	–	7-18
	A003	1st Base Frequency	30. to 1st Maximum Frequency (A004)	60.	Disabled	Disabled	Hz	7-19
	A203	2nd Base Frequency	30. to 2nd Maximum Frequency (A204)	60.				
	A303	3rd Base Frequency	30. to 3rd Maximum Frequency (A304)	60.				
	A004	1st Maximum Frequency	30. to 400.	60.	Disabled	Disabled	Hz	7-19
	A204	2nd Maximum Frequency	30. to 400.	60.				
	A304	3rd Maximum Frequency	30. to 400.	60.				

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Analog input, others	A005	FV/FI Selection	00: Switching between FV (Voltage) and FI (Current) via terminal AT 02: Switching between FV and volume adjuster via terminal AT 03: Switching between FI and volume adjuster via terminal AT 04: Switching between FE and volume adjuster via terminal AT	00	Disabled	Disabled	–	7-21
	A006	FE Selection	00: FE only 01: FV/FI auxiliary frequency reference (not reversible) 02: FV/FI auxiliary frequency reference (reversible) 03: FE disabled	03	Disabled	Disabled	–	
	A011	FV Start Frequency *1	0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	7-24
	A012	FV End Frequency *1	0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	
	A013	FV Start Ratio	0. to FV End Ratio (A014)	0.	Disabled	Enabled	%	
	A014	FV End Ratio	FV Start Ratio (A013) to 100.	100.	Disabled	Enabled	%	
	A015	FV Start Selection	00: FV Start Frequency (A011) 01: 0 Hz	01	Disabled	Enabled	–	
	A016	Analog Input Filter	1. to 30. (x 2 ms) 31. : With 500 ms filter ±0.1 Hz hysteresis	31.	Disabled	Enabled	–	7-26
	A017	DriveProgramming Function Selection	00: Disabled 01: Enabled (Start/stop via multi-function input PRG terminal) 02: Enabled (Start/stop via power on/off)	00	Disabled	Disabled	–	7-26

*1 The inverter operates at 0 to 9.8 V when A011and A012 are set to 0.00.

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Multi-step speed, jogging	A019	Multi-step Speed Selection	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	00	Disabled	Disabled	–	7-26
	A020	1st Multi-step Speed Reference 0	0.00 Starting Frequency (b082) to 1st Maximum Frequency (A004)	6.00	Enabled	Enabled	Hz	
	A220	2nd Multi-step Speed Reference 0	0.00 Starting Frequency (b082) to 2nd Maximum Frequency (A204)	6.00	Enabled	Enabled	Hz	
	A320	3rd Multi-step Speed Reference 0	0.00 Starting Frequency (b082) to 3rd Maximum Frequency (A304)	6.00	Enabled	Enabled	Hz	
	A021	Multi-step Speed Reference 1	0.00 Starting Frequency (b082) to 1st/2nd/3rd Maximum Frequency (A004/A204/A304)	0.00	Enabled	Enabled	Hz	
	A022	Multi-step Speed Reference 2		0.00				
	A023	Multi-step Speed Reference 3		0.00				
	A024	Multi-step Speed Reference 4		0.00				
	A025	Multi-step Speed Reference 5		0.00				
	A026	Multi-step Speed Reference 6		0.00				
	A027	Multi-step Speed Reference 7		0.00				
	A028	Multi-step Speed Reference 8		0.00				
	A029	Multi-step Speed Reference 9		0.00				
	A030	Multi-step Speed Reference 10		0.00				
	A031	Multi-step Speed Reference 11		0.00				
	A032	Multi-step Speed Reference 12		0.00				
	A033	Multi-step Speed Reference 13	0.00 Starting Frequency (b082) to 1st/2nd/3rd Maximum Frequency (A004/A204/A304)	0.00	Enabled	Enabled	Hz	
	A034	Multi-step Speed Reference 14		0.00				
	A035	Multi-step Speed Reference 15		0.00				
	A038	Jogging Frequency	0.00 Starting Frequency to 9.99	6.00	Enabled	Enabled	Hz	7-30

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Multi-step speed, jogging	A039	Jogging Stop Selection	00: Free running during jogging stop/Disabled during operation 01: Deceleration stop during jogging stop/Disabled during operation 02: DC injection braking during jogging stop/Disabled during operation 03: Free running during jogging stop/Enabled during operation 04: Deceleration stop during jogging stop/Enabled during operation 05: DC injection braking during jogging stop/Enabled during operation	04 *1	Disabled	Enabled	–	7-30

*1 The default data was changed from the previous model.

<table>
<tr><th colspan="2" rowspan="2">Parameter No.</th><th rowspan="2">Function name</th><th colspan="2" rowspan="2">Monitor or data range</th><th rowspan="2">Default data</th><th colspan="2">Changes during operation</th><th rowspan="2">Unit</th><th rowspan="2">Page</th></tr>
<tr><th>Normal</th><th>b031 = 10</th></tr>
<tr><td rowspan="10">V/f characteristics</td><td>A041</td><td>1st Torque Boost Selection</td><td colspan="2">00: Manual torque boost
01: Automatic torque boost</td><td>01 *1</td><td rowspan="2">Disabled</td><td rowspan="2">Disabled</td><td rowspan="2">–</td><td rowspan="8">7-31</td></tr>
<tr><td>A241</td><td>2nd Torque Boost Selection</td><td colspan="2">00: Manual torque boost
01: Automatic torque boost</td><td>01 *1</td></tr>
<tr><td>A042</td><td>1st Manual Torque Boost Voltage</td><td colspan="2">0.0 to 20.0
(Percentage of Motor Rated Voltage Selection (A082))</td><td>1.0</td><td rowspan="3">Enabled</td><td rowspan="3">Enabled</td><td rowspan="3">%</td></tr>
<tr><td>A242</td><td>2nd Manual Torque Boost Voltage</td><td colspan="2">0.0 to 20.0
(Percentage of Motor Rated Voltage Selection (A082))</td><td>1.0</td></tr>
<tr><td>A342</td><td>3rd Manual Torque Boost Voltage</td><td colspan="2">0.0 to 20.0
(Percentage of Motor Rated Voltage Selection (A082))</td><td>1.0</td></tr>
<tr><td>A043</td><td>1st Manual Torque Boost Frequency</td><td colspan="2">0.0 to 50.0
(Percentage of 1st Base Frequency (A003))</td><td>5.0</td><td rowspan="3">Enabled</td><td rowspan="3">Enabled</td><td rowspan="3">%</td></tr>
<tr><td>A243</td><td>2nd Manual Torque Boost Frequency</td><td colspan="2">0.0 to 50.0
(Percentage of 2nd Base Frequency (A203))</td><td>5.0</td></tr>
<tr><td>A343</td><td>3rd Manual Torque Boost Frequency</td><td colspan="2">0.0 to 50.0
(Percentage of 3rd Base Frequency (A303))</td><td>5.0</td></tr>
<tr><td rowspan="2">A044</td><td rowspan="2">1st Control Method</td><td>Heavy load (CT)</td><td>00: Constant torque characteristics (VC)
01: Reduced torque characteristics (VP 1.7th power (VC at low speed))
02: Free V/f setting
03: Sensorless vector control (SLV)
04: 0-Hz sensorless vector control
05: Sensor vector control (V2)</td><td>00</td><td rowspan="2">Disabled</td><td rowspan="2">Disabled</td><td rowspan="2">–</td><td rowspan="2">7-34</td></tr>
<tr><td>Light load (VT)</td><td>00: Constant torque characteristics (VC)
01: Reduced torque characteristics (VP 1.7th power (VC at low speed))
02: Free V/f setting
03: Sensorless vector control (SLV)</td><td>00</td></tr>
</table>

*1 The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation		Unit	Page
						Normal	b031 = 10		
V/f characteristics	A244	2nd Control Method	Heavy load (CT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control (SLV) 04: 0-Hz sensorless vector control	00	Disabled	Disabled	–	7-34
			Light load (VT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control (SLV)	00				
	A344	3rd Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed))		00				
	A045	Output Voltage Gain	20. to 100.		100.	Enabled	Enabled	%	7-38
	A046	1st Automatic Torque Boost Voltage Compensation Gain	0. to 255.		100.	Enabled	Enabled	–	5-65
	A246	2nd Automatic Torque Boost Voltage Compensation Gain	0. to 255.		100.				
	A047	1st Automatic Torque Boost Slip Compensation Gain	0. to 255.		0. *1	Enabled	Enabled	–	
	A247	2nd Automatic Torque Boost Slip Compensation Gain	0. to 255.		0. *1				

*1 The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation: Normal	Changes during operation: b031 = 10	Unit	Page
DC injection braking	A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)		00	Disabled	Enabled	–	7-38
	A052	DC Injection Braking Frequency	0.00 to 99.99 100.0 to 400.0		0.50	Disabled	Enabled	Hz	
	A053	DC Injection Braking Delay Time	0.0 to 5.0		0.0	Disabled	Enabled	s	
	A054	DC Injection Braking Power	Heavy load (CT)	0. to 100. (0.4 to 55 kW)	50	Disabled	Enabled	%	
				0. to 80. (75 to 132 kW)	40	Disabled	Enabled	%	
			Light load (VT)	0. to 70. (0.4 to 55 kW)	50	Disabled	Enabled	%	
				0. to 50. (75 to 132 kW)	40	Disabled	Enabled	%	
	A055	DC Injection Braking Time	0.0 to 60.0		0.5	Disabled	Enabled	s	
	A056	DC Injection Braking Edge/Level Selection	00: Edge operation 01: Level operation		01	Disabled	Enabled	–	
	A057	Startup DC Injection Braking Power	Heavy load (CT)	0. to 100. (0.4 to 55 kW)	0.	Disabled	Enabled	%	
				0. to 80. (75 to 132 kW)	0.	Disabled	Enabled	%	
			Light load (VT)	0. to 70. (0.4 to 55 kW)	0.	Disabled	Enabled	%	
				0. to 50. (75 to 132 kW)	0.	Disabled	Enabled	%	
	A058	Startup DC Injection Braking Time	0.0 to 60.0		0.0	Disabled	Enabled	s	
	A059	DC Injection Braking Carrier Frequency	Heavy load (CT)	0.5 to 15.0 (0.4 to 55 kW)	5.0	Disabled	Enabled	kHz	
				0.5 to 10.0 (75 to 132 kW)	3.0	Disabled	Disabled	kHz	
			Light load (VT)	0.5 to 12.0 (0.4 to 55 kW)	3.0	Disabled	Enabled	kHz	
				0.5 to 8.0 (75 to 132 kW)	3.0	Disabled	Disabled	kHz	

	Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Upper/Lower limit, jump	A061	1st Frequency Upper Limit	0.00: Disabled (Function not active) 1st Frequency Lower Limit (A062) to 1st Maximum Frequency (A004)	0.00	Disabled	Enabled	Hz	7-42
	A261	2nd Frequency Upper Limit	0.00: Disabled (Function not active) 2nd Frequency Lower Limit (A262) to 2nd Maximum Frequency (A204)	0.00				
	A062	1st Frequency Lower Limit	0.00: Disabled (Function not active) Starting Frequency (b082) to 1st Frequency Upper Limit (A061)	0.00	Disabled	Enabled	Hz	
	A262	2nd Frequency Lower Limit	0.00: Disabled (Function not active) Starting Frequency (b082) to 2nd Frequency Upper Limit (A261)	0.00				
	A063	Jump Frequency 1	0.00: Disabled (Function not active) 0.01 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	7-44
	A064	Jump Frequency Width 1	0.0 to 10.0	0.50				
	A065	Jump Frequency 2	0.00: Disabled (Function not active) 0.01 to 99.99 100.0 to 400.0	0.00				
	A066	Jump Frequency Width 2	0.0 to 10.0	0.50				
	A067	Jump Frequency 3	0.00: Disabled (Function not active) 0.01 to 99.99 100.0 to 400.0	0.00				
	A068	Jump Frequency Width 3	0.0 to 10.0	0.50				
	A069	Acceleration Stop Frequency	0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	7-45
	A070	Acceleration Stop Time	0.0 to 60.0	0.0	Disabled	Enabled	s	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
PID Braking	A071	PID Selection	00: Disabled 01: Enabled 02: Reverse output enabled	00	Disabled	Enabled	–	7-45
	A072	PID P Gain	0.2 to 5.0	1.0	Enabled	Enabled	–	
	A073	PID I Gain	0.0 to 999.9 1000. to 3600.	1.0	Enabled	Enabled	s	
	A074	PID D Gain	0.00 to 99.99 100.0	0.00	Enabled	Enabled	s	
	A075	PID Scale	0.01 to 99.99	1.00	Disabled	Enabled	time	
	A076	PID Feedback Selection	00: FI (Current) 01: FV (Voltage) 02: Modbus communication 03: Pulse train frequency 10: Operation function output	00	Disabled	Enabled	–	
	A077	PID Deviation Reverse Output	00: Disabled (Deviation = Target value – Feedback value) 01: Enabled (Deviation = Feedback value – Target value)	00	Disabled	Enabled	–	
	A078	PID Variable Range Limit	0.0: Disabled 0.1 to 100.0	0.0	Disabled	Enabled	%	
	A079	PID Feedforward Selection	00: Disabled 01: FV (Voltage) 02: FI (Current) 03: FE (Voltage)	00	Disabled	Enabled	–	
AVR	A081	AVR Selection	00: Always ON 01: Always OFF 02: OFF during deceleration	02	Disabled	Disabled	–	7-51
	A082	Motor Rated Voltage Selection	200-V class: 200/215/220/230/240 400-V class: 380/400/415/440/460/480	200/400	Disabled	Disabled	V	

	Parameter No.	Function name	Monitor or data range		Default data	Changes during operation		Unit	Page
						Normal	b031 = 10		
RUN mode, Acceleration/Deceleration function	A085	Operation Mode Selection	Heavy load (CT)	00: Normal operation 01: Energy-saving operation 02: Automatic operation	00	Disabled	Disabled	–	7-53
			Light load (VT)	00: Normal operation 01: Energy-saving operation	00	Disabled	Disabled	–	
	A086	Energy-saving Response/ Accuracy Adjustment	0.0 to 100.0		50.0	Enabled	Enabled	–	
	A092	1st Acceleration Time 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.		10.0 *1	Enabled	Enabled	s	7-55
	A292	2nd Acceleration Time 2			10.0 *1				
	A392	3rd Acceleration Time 2			10.0 *1				
	A093	1st Deceleration Time 2			10.0 *1				
	A293	2nd Deceleration Time 2			10.0 *1				
	A393	3rd Deceleration Time 2			10.0 *1				
	A094	1st 2-step Acceleration/ Deceleration Selection	00: 2CH terminal (Switched by multi-function Input: “09”) 01: Switched by setting (A095/A295/A096/A296) 02: Switched only during forward/reverse switching		00	Disabled	Disabled	–	
	A294	2nd 2-step Acceleration/ Deceleration Selection			00				
	A095	1st 2-step Acceleration Frequency	0.00 to 99.9 100.0 to 400.0		0.00	Disabled	Disabled	Hz	
	A295	2nd 2-step Acceleration Frequency			0.00				
	A096	1st 2-step Deceleration Frequency			0.00	Disabled	Disabled	Hz	
	A296	2nd 2-step Deceleration Frequency			0.00				
	A097	Acceleration Pattern Selection	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve		01 *1	Disabled	Disabled	–	7-57
	A098	Deceleration Pattern Selection			01 *1	Disabled	Disabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
External frequency adjustment	A101	FI Start Frequency *2	0.00 to 99.9 100.0 to 400.0	0.00	Disabled	Enabled	Hz	7-24
	A102	FI End Frequency *2		0.00	Disabled	Enabled	Hz	
	A103	FI Start Ratio	0. to FI End Ratio (A104)	20.	Disabled	Enabled	%	
	A104	FI End Ratio	FV Start Ratio (A103) to 100.	100.	Disabled	Enabled	%	
	A105	FI Start Selection	00: Use FI Start Frequency (A101) 01: 0 Hz	00	Disabled	Enabled	–	
	A111	FE Start Frequency *3	–400. to –100. –99.9 to –00.0 0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	7-25
	A112	FE End Frequency *3		0.00	Disabled	Enabled	Hz	
	A113	FE Start Ratio	–100. to FE End Ratio (A114)	–100.	Disabled	Enabled	%	
	A114	FE End Ratio	FE Start Ratio (A113) to 100.	100.	Disabled	Enabled	%	
Acceleration/ Deceleration	A131	Acceleration Curve Parameter	01 (Small curve) to 10 (Large curve)	02	Disabled	Enabled	–	7-57
	A132	Deceleration Curve Parameter		02	Disabled	Enabled	–	

*1 The default data was changed from the previous model.

*2 The inverter operates at 4 to 19.8 mA when A101 and A102 are set to 0.00.

*3 The inverter operates at –9.8 to 9.8 V when A111 and A112 are set to 0.00.

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Calculation frequency	A141	Calculation Frequency Selection 1	00: Digital Operator 01: Digital Operator (Volume adjuster) *1 02: Input FV (Voltage) 03: Input FI (Current) 04: Modbus communication 05: Option 1 06: Option 2 07: Pulse train frequency	02	Disabled	Enabled	–	7-59
	A142	Calculation Frequency Selection 2		03	Disabled	Enabled	–	
	A143	Calculation Function Operator Selection	00: Addition (A141 + A142) 01: Subtraction (A141 – A142) 02: Multiplication (A141 x A142)	00	Disabled	Enabled	–	
	A145	Frequency Addition Amount Setting	0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	7-60
	A146	Frequency Addition Sign Selection	00: Frequency reference + A145 01: Frequency reference – A145	00	Disabled	Enabled	–	
Acceleration/Deceleration	A150	EL-S Shape Acceleration Curve Ratio 1	0. to 50.	10. *2	Disabled	Disabled	%	7-57
	A151	EL-S Shape Acceleration Curve Ratio 2	0. to 50.	10. *2	Disabled	Disabled	%	
	A152	EL-S Shape Deceleration Curve Ratio 1	0. to 50.	10. *2	Disabled	Disabled	%	
	A153	EL-S Shape Deceleration Curve Ratio 2	0. to 50.	10. *2	Disabled	Disabled	%	

*1 This setting is enabled when the 3G3AX-OP01 is connected.

*2 The default data was changed from the previous model.

4-3-2 Group b: Detailed Function Parameters

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Momentary power interruption/Trip restart	b001	Power Interruption/Under voltage Restart Selection	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	00	Disabled	Enabled	–	7-61
	b002	Allowable Power Interruption Time	0.3 to 25.0	1.0	Disabled	Enabled	s	
	b003	Restart Standby Time	0.3 to 100.0	1.0	Disabled	Enabled	s	
	b004	Power Interruption/Under voltage Trip Selection During Stop	00: Disabled 01: Enabled 02: Disabled during stop and deceleration stop	00	Disabled	Enabled	–	
	b005	Power Interruption Restart Count	00: 16 times 01: No limit	00	Disabled	Enabled	–	
	b006	Input Phase Loss Protection Selection	00: Disabled 01: Enabled	01 *1	Disabled	Enabled	–	7-65
	b007	Frequency Matching Lower Limit Frequency	0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	7-61
	b008	Overvoltage/Over current Restart Selection	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	00	Disabled	Enabled	–	
	b009	Undervoltage Restart Count	00: 16 times 01: No limit	00	Disabled	Enabled	–	
	b010	Overvoltage/Over current Restart Count	1 to 3	3	Disabled	Enabled	time	
	b011	Overvoltage/Over current Restart Standby Time	0.3 to 100.0	1.0	Disabled	Enabled	s	

*1 The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Electronic thermal	b012	1st Electronic Thermal Level	0.20 x Rated current to 1.00 x Rated current	Rated current value	Disabled	Enabled	A	7-66
	b212	2nd Electronic Thermal Level						
	b312	3rd Electronic Thermal Level						
	b013	1st Electronic Thermal Characteristics Selection	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	00	Disabled	Enabled	–	
	b213	2nd Electronic Thermal Characteristics Selection						
	b313	3rd Electronic Thermal Characteristics Selection						
	b015	Free-electronic Thermal Frequency 1	0: Disabled 0. to Free-electronic Thermal Frequency 2	0.	Disabled	Enabled	Hz	
	b016	Free-electronic Thermal Current 1	0.00 to Rated current	0.00	Disabled	Enabled	A	
	b017	Free-electronic Thermal Frequency 2	0: Disabled Free-electronic Thermal Frequency 1 to Free-electronic Thermal Frequency 3	0.	Disabled	Enabled	Hz	
	b018	Free-electronic Thermal Current 2	0.00 to Rated current	0.00	Disabled	Enabled	A	
	b019	Free-electronic Thermal Frequency 3	0: Disabled Free-electronic Thermal Frequency 2. to 400.	0.	Disabled	Enabled	Hz	
	b020	Free-electronic Thermal Current 3	0.00 to Rated current	0.00	Disabled	Enabled	A	

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation		Unit	Page
						Normal	b031 = 10		
Overload limit, overcurrent protection	b021	Overload Limit Selection	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)		01	Disabled	Enabled	–	7-72
	b022	Overload Limit Level	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)	Rated current value x 1.5	Disabled	Enabled	A	
				0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)					
			Light load (VT)	0.20 x Rated current to 1.50 x Rated current	Rated current value x 1.2	Disabled	Enabled	A	
	b023	Overload Limit Parameter	0.10 to 30.00		1.00	Disabled	Enabled	s	
	b024	Overload Limit Selection 2	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)		01	Disabled	Enabled	–	
	b025	Overload Limit Level 2	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)	Rated current value x 1.5	Disabled	Enabled	A	
				0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)					
			Light load (VT)	0.20 x Rated current to 1.50 x Rated current	Rated current value x 1.2	Disabled	Enabled	A	
	b026	Overload Limit Parameter 2	0.10 to 30.00		1.00	Disabled	Enabled	s	
	b027	Overcurrent Suppression Selection	00: Disabled 01: Enabled		01	Disabled	Enabled	–	7-75
	b028	Frequency Pull-in Restart Level	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)	Rated current value	Disabled	Enabled	A	7-98
				0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)					
			Light load (VT)	0.20 x Rated current to 1.50 x Rated current	Rated current value	Disabled	Enabled	A	
	b029	Frequency Pull-in Restart Parameter	0.10 to 30.00		0.50	Disabled	Enabled	s	
	b030	Starting Frequency Selection at Frequency Pull-in Restart	00: Frequency at shutoff 01: Max. frequency 02: Set frequency (Reference frequency)		00	Disabled	Enabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Lock	b031	Soft Lock Selection	00: Data other than b031 cannot be changed when terminal SFT is ON. 01: Data other than b031 and the set frequency cannot be changed when terminal SFT is ON. 02: Data other than b031 cannot be changed. 03: Data other than b031 and the specified frequency parameter cannot be changed. 10: Data can be changed during RUN.	01	Disabled	Enabled	–	7-75
Others	b034	RUN Time/Power ON Time Detection Level	0: Disabled (Function not active) 1. to 9999. (0 to 9999) 1000 to 6553 (10000 to 65530)	0.	Disabled	Enabled	10 h	7-76
	b035	RUN Direction Limit Selection	00: No direction limit 01: Only Forward enabled (Reverse limited) 02: Only Reverse enabled (Forward limited)	00	Disabled	Disabled	–	7-77
	b036	Reduced Voltage Startup Selection	0 (Reduced voltage startup time: small) to 255 (Reduced voltage startup time: large)	6	Disabled	Enabled	–	7-77
	b037	Display Selection	00: Complete display 01: Individual display of functions 02: User setting + b037 03: Data comparison display 04: Basic display	00 *1	Disabled	Enabled	–	7-78
	b038	Initial Screen Selection	000: Screen on which the Enter key was last pressed 001 to 010: d001 to d010 012 to 019: d012 to d019 022 to 030: d022 to d030 060: d060 201: F001 202: Do not set.	001	Disabled	Enabled	–	7-81
	b039	User Parameter Automatic Setting Function	00: Disabled 01: Enabled	00	Disabled	Enabled	–	7-81

*1 The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation		Unit	Page
						Normal	b031 = 10		
Torque limit	b040	Torque Limit Selection	00: Four-quadrant separate setting (b041 to b044) 01: Terminal switching 02: Analog voltage input 03: Option 1 04: Option 2		00	Disabled	Enabled	–	7-82
	b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW) 0. to 180. (75 to 132 kW) no: Torque limit disabled	150.	Disabled	Enabled	%	
			Light load (VT)	0. to 150. no: Torque limit disabled	120.	Disabled	Enabled	%	
	b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW) 0. to 180. (75 to 132 kW) no: Torque limit disabled	150.	Disabled	Enabled	%	
			Light load (VT)	0. to 150. (0.4 to 132 kW) no: Torque limit disabled	120.	Disabled	Enabled	%	
	b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW) 0. to 180. (75 to 132 kW) no: Torque limit disabled	150.	Disabled	Enabled	%	
			Light load (VT)	0. to 150. (0.4 to 132 kW) no: Torque limit disabled	120.	Disabled	Enabled	%	
	b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW) 0. to 180. (75 to 132 kW) no: Torque limit disabled	150.	Disabled	Enabled	%	
			Light load (VT)	0. to 150. (0.4 to 132 kW) no: Torque limit disabled	120.	Disabled	Enabled	%	
	b045	Torque LADSTOP Selection	00: Disabled 01: Enabled		00	Disabled	Enabled	–	7-83
Others	b046	Reverse Rotation Prevention Selection	00: Disabled 01: Enabled		00	Disabled	Enabled	–	7-83
	b049	Heavy Load/Light Load Selection	00: Heavy load mode 01: Light load mode		00	Disabled	Disabled	–	7-83
	b050	Deceleration Stop Selection on Power Interruption	00: Disabled 01: Enabled (deceleration stop) 02: Enabled (Constant voltage, without recovery) 03: Enabled (Constant voltage, with recovery)		00	Disabled	Disabled	–	7-88
	b051	Starting Voltage on Power Interruption	0.0 to 999.9 1000.		220.0/ 440.0	Disabled	Disabled	V	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Others	b052	Deceleration Hold Level on Power Interruption	0.0 to 999.9 1000.	360.0/ 720.0	Disabled	Disabled	V	7-88
	b053	Deceleration Time on Power Interruption	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	1.00	Disabled	Disabled	s	
	b054	Deceleration Starting Width on Power Interruption	0.00 to 10.00	0.00	Disabled	Disabled	Hz	
	b055	Proportional Gain on Power Interruption	0.00 to 2.55	0.20	Enabled	Enabled	–	
	b056	Integral Time on Power Interruption	0.000 to 9.999 10.00 to 65.53	0.100	Enabled	Enabled	s	
	b060	Window Comparator FV Upper Limit Level	Set the upper limit level. Setting range: 0 to 100 Minimum value: Lower limit level + Hysteresis width x 2	100.	Enabled	Enabled	%	7-92
	b061	Window Comparator FV Lower Limit Level	Set the lower limit level. Setting range: 0. to 100. Maximum value: Upper limit level – Hysteresis width x 2	0.	Enabled	Enabled	%	
	b062	Window Comparator FV Hysteresis Width	Set the hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Maximum value: (Upper limit level – Lower limit level) / 2	0.	Enabled	Enabled	%	
	b063	Window Comparator FI Upper Limit Level	Set the upper limit level. Setting range: 0. to 100. Lower limit: Lower limit level + Hysteresis width x 2	100.	Enabled	Enabled	%	
	b064	Window Comparator FI Lower Limit Level	Set the lower limit level. Setting range: 0. to 100. Maximum value: Upper limit level – Hysteresis width x 2	0.	Enabled	Enabled	%	
	b065	Window Comparator FI Hysteresis Width	Set a hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Maximum value: (Upper limit level – Lower limit level) / 2	0.	Enabled	Enabled	%	
	b066	Window Comparator FE Upper Limit Level	Set the upper limit level. Setting range: –100. to 100. Minimum value: Lower limit level + Hysteresis width x 2	100.	Enabled	Enabled	%	
	b067	Window Comparator FE Lower Limit Level	Set the lower limit level. Setting range: –100. to 100. Maximum value: Upper limit level – Hysteresis width x 2	–100.	Enabled	Enabled	%	

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation		Unit	Page
						Normal	b031 = 10		
Others	b068	Window Comparator FE Hysteresis Width	Set the hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Maximum value: (Upper limit level – Lower limit level) / 2		0.	Enabled	Enabled	%	7-92
	b070	Analog Operation Level at FV Disconnection	0. to 100. no: Ignored		no	Disabled	Enabled	–	
	b071	Analog Operation Level at FI Disconnection	0. to 100. no: Ignored		no	Disabled	Enabled	–	
	b072	Analog Operation Level at FE Disconnection	–100. to 100. no: Ignored		no	Disabled	Enabled	–	
	b078	Integrated Power Clear	Cleared by pressing Enter key after changing to 01		00	Enabled	Enabled	–	7-7
	b079	Integrated Power Display Scale	1. to 1000.		1.	Enabled	Enabled	–	
	b082	Starting Frequency	0.10 to 9.99		1.5 *1	Disabled	Enabled	Hz	7-94
	b083	Carrier Frequency *2	Heavy load (CT)	0.5 to 15.0 (0.4 to 55 kW)	5.0	Disabled	Disabled	kHz	7-94
				0.5 to 10.0 (75 to 132 kW)	3.0	Disabled	Disabled	kHz	
			Light load (VT)	0.5 to 12.0 (0.4 to 55 kW)	3.0	Disabled	Disabled	kHz	
				0.5 to 8.0 (75 to 132 kW)	3.0	Disabled	Disabled	kHz	
	b084	Initialization Selection	00: Initialization disabled 01: Clear fault monitor 02: Initialize data 03: Clear fault monitor + initialize data 04: Clear fault monitor + initialize data + Clear DriveProgramming		00	Disabled	Disabled	–	7-95
	b085	Initialization Data Selection	00 *3		00	Disabled	Disabled	–	
	b086	Frequency Conversion Coefficient	0.1 to 99.9		1.0	Enabled	Enabled	–	7-4
	b087	STOP Key Selection	00: Enabled 01: Disabled 02: Only RESET enabled		00	Disabled	Enabled	–	7-97
	b088	Free-run Stop Selection	00: 0 Hz-restart 01: Frequency matching restart 02: Frequency pull-in restart		00	Disabled	Enabled	–	7-98
	b089	Automatic Carrier Reduction	00: Disabled 01: Enabled, dependent on the current		00	Disabled	Disabled	–	7-100
	b090	Usage Rate of Regenerative Braking *4	0.0: Disabled (Function not active) 0.1 to 100.0		0.0	Disabled	Enabled	%	7-101
	b091	Stop Selection	00: Deceleration stop 01: Free-run stop		00	Disabled	Enabled	–	7-97

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Others	b092	Cooling Fan Operation	00: Always enabled 01: Enabled only during RUN (including 5 minutes after power on/stop)	01	Disabled	Enabled	–	7-103
	b095	Regenerative Braking Selection *5	00: Disabled (Function not active) 01: Enabled (Disabled during stop) 02: Enabled (Enabled during stop)	00	Disabled	Enabled	–	7-101
	b096	Regenerative Braking ON Level	200-V class: 330 to 380 200-V class: 660 to 760	360./720.	Disabled	Enabled	V	
	b098	Thermistor Selection	00: Disabled (Function not active) 01: PTC enabled 02: NTC enabled	00	Disabled	Enabled	–	7-103
	b099	Thermistor Error Level	0. to 9999.	3000.	Disabled	Enabled	Ω	

*1 The default data was changed from the previous model.

*2 Check the derating of the inverter rated output current when you change the default data.

*3 Do not change this setting.

*4 Set Regenerative Braking Selection (b095) simultaneously.

*5 Set Usage Rate of Regenerative Braking (b090) simultaneously.

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
V/f free setting	b100	Free V/f Frequency 1	0: Disabled (Function not active) 1. to Free V/f Frequency 2	0.	Disabled	Disabled	Hz	7-36
	b101	Free V/f Voltage 1	0.0 to 800.0	0.0	Disabled	Disabled	V	
	b102	Free V/f Frequency 2	0: Disabled (Function not active) Free V/f Frequency 1 to Free V/f Frequency 3	0.	Disabled	Disabled	Hz	
	b103	Free V/f Voltage 2	0.0 to 800.0	0.0	Disabled	Disabled	V	
	b104	Free V/f Frequency 3	0: Disabled (Function not active) Free V/f Frequency 2 to Free V/f Frequency 4	0.	Disabled	Disabled	Hz	
	b105	Free V/f Voltage 3	0.0 to 800.0	0.0	Disabled	Disabled	V	
	b106	Free V/f Frequency 4	0: Disabled (Function not active) Free V/f Frequency 3 to Free V/f Frequency 5	0.	Disabled	Disabled	Hz	
	b107	Free V/f Voltage 4	0.0 to 800.0	0.0	Disabled	Disabled	V	
	b108	Free V/f Frequency 5	0: Disabled (Function not active) Free V/f Frequency 4 to Free V/f Frequency 6	0.	Disabled	Disabled	Hz	
	b109	Free V/f Voltage 5	0.0 to 800.0	0.0	Disabled	Disabled	V	
	b110	Free V/f Frequency 6	0: Disabled (Function not active) Free V/f Frequency 5 to Free V/f Frequency 7	0.	Disabled	Disabled	Hz	
	b111	Free V/f Voltage 6	0.0 to 800.0	0.0	Disabled	Disabled	V	
	b112	Free V/f Frequency 7	0: Disabled (Function not active) Free V/f Frequency 6 to 400.	0.	Disabled	Disabled	Hz	
	b113	Free V/f Voltage 7	0.0 to 800.0	0.0	Disabled	Disabled	V	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Others	b120	Brake Control Function Selection	00: Disabled 01: Enabled	00	Disabled	Enabled	–	7-104
	b121	Brake Release Wait Time	0.00 to 5.00	0.00	Disabled	Enabled	s	
	b122	Acceleration Wait Time on Brake Control	0.00 to 5.00	0.00	Disabled	Enabled	s	
	b123	Stop Wait Time on Brake Control	0.00 to 5.00	0.00	Disabled	Enabled	s	
	b124	Brake Error Detection Time	0.00 to 5.00	0.00	Disabled	Enabled	s	
	b125	Brake Release Frequency	0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	
	b126	Brake Release Current	0.00 to 2.00 x Rated current (0.4 to 55 kW) 0.00 to 1.80 x Rated current (75 to 132 kW)	Rated current value	Disabled	Enabled	–	
	b127	Brake Force Frequency	0.00 to 99.99 100.0 to 400.0	0.00	Disabled	Enabled	Hz	
	b130	Overvoltage Suppression Function Selection During Deceleration	00: Disabled 01: Enabled (DC voltage kept constant) 02: Enabled (Acceleration enabled)	01 *1	Disabled	Enabled	–	7-106
	b131	Overvoltage Suppression Level During Deceleration	200-V class: 330 to 390 400-V class: 660 to 780	380./760.	Disabled	Enabled	V	
	b132	Overvoltage Suppression Parameter During Deceleration	0.10 to 30.00	1.00	Disabled	Enabled	s	
	b133	Overvoltage Suppression Proportional Gain During Deceleration	0.00 to 2.55	0.50	Enabled	Enabled	–	
	b134	Overvoltage Suppression Integral Time During Deceleration	0.000 to 9.999 10.00 to 65.53	0.060	Enabled	Enabled	s	
	b164	Initial Screen Automatic Return Function	00: Disabled 01: Enabled	00	Enabled	Enabled	–	7-107
	b166	Data Read/Write Selection	00: R/W OK 01: R/W protected	00	Enabled	Enabled	–	7-76
	b180	Initialization Execution	00: Function is disabled 01: Execute initialization	00	Disabled	Disabled	–	7-95

*1 The default data was changed from the previous model.

4-3-3 Group C: Multi-function Terminal Function Parameters

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Multi-function input terminals	C001	Multi-function Input S1 Selection *1	01: RV (Reverse) 02: CF1 (Multi-step speed setting binary 1) 03: CF2 (Multi-step speed setting binary 2) 04: CF3 (Multi-step speed setting binary 3) 05: CF4 (Multi-step speed setting binary 4) 06: JG (Jogging) 07: DB (External DC injection braking) 08: SET (2nd control) 09: 2CH (2-step acceleration/deceleration) 11: FRS (Free-run stop) 12: EXT (External trip) 13: USP (Power recovery restart prevention function) 14: CS (Commercial switch) 15: SFT (Soft lock) 16: AT (Analog input switching) 17: SET3 (3rd control) 18: RS (Reset) 20: STA (3-wire start) 21: STP (3-wire stop) 22: F/R (3-wire forward/reverse) 23: PID (PID disabled) 24: PIDC (PID integral reset) 26: CAS (Control gain switching) 27: UP (Remote operation accelerated) 28: DWN (Remote operation decelerated) 29: UDC (Remote data clear) 31: OPE (Forced operator function) 32: SF1 (Multi-step speed setting bit 1) 33: SF2 (Multi-step speed setting bit 2) 34: SF3 (Multi-step speed setting bit 3) 35: SF4 (Multi-step speed setting bit 4) 36: SF5 (Multi-step speed setting bit 5) 37: SF6 (Multi-step speed setting bit 6) 38: SF7 (Multi-step speed setting bit 7) 39: OLR (Overload limit switching) 40: TL (Torque limit enabled/disabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2) 43: PPI (P/PI switching) 44: BOK (Brake confirmation) 45: ORT (Orientation) 46: LAC (LAD cancel) 47: PCLR (Position deviation clear) 48: STAT (Pulse train position command input permission) 50: ADD (Set frequency A145 addition) 51: F-TM: (Forced terminal block) 52: ATR (Torque command input permission) 53: KHC (Integrated power clear) 54: SON (Servo ON) 55: FOC (Preliminary excitation)	01	Disabled	Enabled	–	5-51
	C002	Multi-function Input S2 Selection		18				
	C003	Multi-function Input S3 Selection *1		12				
	C004	Multi-function Input S4 Selection		02				
	C005	Multi-function Input S5 Selection		03				
	C006	Multi-function Input S6 Selection		04				

*1 When the emergency shutoff function is enabled (SW1 = ON), the C001 and C003 data are force-rewritten with 18 (RS) and 64 (EMR), respectively. 64 cannot be set by the user. If you turn ON and then OFF the slide switch SW1, C003 is set to no (No allocation).

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Multi-function input terminals	C007	Multi-function Input S7 Selection	56: MI1 (General-purpose input 1) 57: MI2 (General-purpose input 2) 58: MI3 (General-purpose input 3) 59: MI4 (General-purpose input 4) 60: MI5 (General-purpose input 5) 61: MI6 (General-purpose input 6) 62: MI7 (General-purpose input 7) 63: MI8 (General-purpose input 8) 65: AHD (Analog command held) 66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3) 69: ORL (Zero return limit signal) 70: ORG (Zero return startup signal) 71: FOT (Forward driving stop) 72: ROT (Reverse driving stop) 73: SPD (Speed/Position switching) 74: PCNT (Pulse counter) 75: PCC (Pulse counter clear) 82: PRG (DriveProgramming start) no: NO (No allocation)	05	Disabled	Enabled	–	5-51
	C008	Multi-function Input S8 Selection		06				
	C011	Multi-function Input S1 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00	Disabled	Enabled	–	5-52
	C012	Multi-function Input S2 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				
	C013	Multi-function Input S3 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				
	C014	Multi-function Input S4 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				
	C015	Multi-function Input S5 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				
	C016	Multi-function Input S6 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				
	C017	Multi-function Input S7 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				
	C018	Multi-function Input S8 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				
	C019	Forward RUN Command FW Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00				

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Multi-function output terminals	C021	Multi-function Output P1 Selection	00: RUN (Signal during RUN) 01: FA1 (Constant speed arrival signal) 02: FA2 (Set frequency exceeded signal) 03: OL (Overload warning) 04: OD (Excessive PID deviation) 05: AL (Alarm signal) 06: FA3 (Set-frequency only signal) 07: OTQ (Overtorque/Undertorque signal) 08: IP (Signal during momentary power interruption) 09: UV (Signal during undervoltage) 10: TRQ (Torque limit) 11: RNT (RUN time over) 12: ONT (Power ON time over) 13: THM (Electronic thermal warning) 19: BRK (Brake release) 20: BER (Brake error) 21: ZS (0 Hz detection signal) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 24: FA4 (Set frequency exceeded signal 2) 25: FA5 (Set-frequency only signal 2) 26: OL2 (Overload warning 2) 27: FVDc (Analog FV disconnection detection) 28: FIDc (Analog FI disconnection detection) 29: FEDc (Analog FE disconnection detection) 31: FBV (PID feedback comparison signal) 32: NDc (Communications disconnection detection) 33: LOG1 (Logic operation output 1) 34: LOG2 (Logic operation output 2) 35: LOG3 (Logic operation output 3) 36: LOG4 (Logic operation output 4) 37: LOG5 (Logic operation output 5) 38: LOG6 (Logic operation output 6) 39: WAC (Capacitor life warning signal) 40: WAF (Cooling fan life warning signal) 41: FR (Starting contact signal) 42: OHF (Cooling fin overheat warning) 43: LOC (Low current signal) 44: MO1 (General-purpose output 1) 45: MO2 (General-purpose output 2) 46: MO3 (General-purpose output 3) 47: MO4 (General-purpose output 4) 48: MO5 (General-purpose output 5) 49: MO6 (General-purpose output 6) 50: IRDY (Operation ready) 51: FWR (Forward run signal) 52: RVR (Reverse run signal) 53: MJA (Fatal fault signal) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 56: WCFE (Window comparator FE) 63: OPO (Option) no: NO (No allocation)	00	Disabled	Enabled	–	5-59
	C022	Multi-function Output P2 Selection		01				
	C023	Multi-function Output P3 Selection		03				
	C024	Multi-function Output P4 Selection		07				
	C025	Multi-function Output P5 Selection		40				
	C026	Multi-function Relay Output (MA, MB) Function Selection		05				

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation		Unit	Page
						Normal	b031 = 10		
Analog monitor	C027	MP Selection	00: Output frequency 01: Output current 02: Output torque (Only in the heavy load mode) 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 09: Motor temperature 10: Cooling fin temperature 12: DriveProgramming (YA (0)) 19: Option 1 20: Option 2		00	Disabled	Enabled	–	7-140
	C028	AM Selection	00: Output frequency 01: Output current 02: Output torque (Only in the heavy load mode) 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 09: Motor temperature 10: Cooling fin temperature 11: Output torque (signed) (Only in the heavy load mode) 13: DriveProgramming (YA (1)) 19: Option 1 20: Option 2		00	00	Disabled	–	7-142
	C029	AMI Selection	00: Output frequency 01: Output current 02: Output torque 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 09: Motor temperature 10: Cooling fin temperature 14: DriveProgramming (YA (2))		00	00	Disabled	–	
	C030	Digital Current Monitor Reference Value	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (Current value at digital current monitor output 1,440 Hz)	Rated current value	Enabled	Enabled	A	7-141
			Light load (VT)	0.20 x Rated current to 1.50 x Rated current	Rated current value	Enabled	Enabled	A	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Multi-function output terminals	C031	Multi-function Output P1 Operation Selection	00: NO (NO contact at MA; NC contact at MB) 01: NC (NC contact at MA; NO contact at MB)	00	Disabled	Enabled	–	5-60
	C032	Multi-function Output P2 Operation Selection	00: NO (NO contact at MA; NC contact at MB) 01: NC (NC contact at MA; NO contact at MB)	00				
	C033	Multi-function Output P3 Operation Selection	00: NO (NO contact at MA; NC contact at MB) 01: NC (NC contact at MA; NO contact at MB)	00				
	C034	Multi-function Output P4 Operation Selection	00: NO (NO contact at MA; NC contact at MB) 01: NC (NC contact at MA; NO contact at MB)	00				
	C035	Multi-function Output P5 Operation Selection	00: NO (NO contact at MA; NC contact at MB) 01: NC (NC contact at MA; NO contact at MB)	00				
	C036	Multi-function Relay Output (MA, MB) Operation Selection	00: NO contact between MA and MC, NC contact between MB and MC 01: NC contact between MA and MC, NO contact between MB and MC	01				

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation: Normal	Changes during operation: b031 = 10	Unit	Page
Level and output terminal status	C038	Low Current Signal Output Mode	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed		01	Disabled	Enabled	–	7-136
	C039	Low Current Detection Level	Heavy load (CT)	0.00 to 2.00 x Rated current (0.4 to 55 kW)	Rated current value	Enabled	Enabled	A	
				0.00 to 1.80 x Rated current (75 to 132 kW)	Rated current value				
			Light load (VT)	0.00 to 1.50 x Rated current	Rated current value	Enabled	Enabled	A	
	C040	Overload Warning Signal Output Mode Selection	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed		01	Disabled	Enabled	–	7-74
	C041	Overload Warning Level	0.0: Disabled		–	Enabled	Enabled	A	
			Heavy load (CT)	0.00 to 2.00 x Rated current (0.4 to 55 kW)	Rated current value				
				0.00 to 1.80 x Rated current (75 to 132 kW)	Rated current value				
			Light load (VT)	0.00 to 1.50 x Rated current	Rated current value	Enabled	Enabled	A	
	C042	Arrival Frequency During Acceleration 1	0.00: Does not output arrival signal during acceleration 0.01 to 99.99 100.0 to 400.0		0.00	Disabled	Enabled	Hz	7-127
	C043	Arrival Frequency During Deceleration 1	0.00: Does not output arrival signal during deceleration 0.01 to 99.99 100.0 to 400.0		0.00	Disabled	Enabled	Hz	

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation		Unit	Page
						Normal	b031 = 10		
Level and output terminal status	C044	PID Deviation Excessive Level	0.0 to 100.0		3.0	Disabled	Enabled	%	7-45
	C045	Arrival Frequency During Acceleration 2	0.00 to 99.99 100.0 to 400.0		0.00	Disabled	Enabled	Hz	7-127
	C046	Arrival Frequency During Deceleration 2	0.00 to 99.99 100.0 to 400.0		0.00	Disabled	Enabled	Hz	
	C052	Feedback Comparison Signal Off Level	0.0 to 100.0		100.0	Disabled	Enabled	%	7-45
	C053	Feedback Comparison Signal On Level	0.0 to 100.0		0.0	Disabled	Enabled	%	
	C055	Overtorque Level (Forward Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	100.	Disabled	Enabled	%	7-129
				0. to 180. (75 to 132 kW)	100.				
			Light load (VT)	0. to 150.	100.	Disabled	Enabled	%	
	C056	Overtorque Level (Reverse Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	100.	Disabled	Enabled	%	
				0. to 180. (75 to 132 kW)	100.				
			Light load (VT)	0. to 150.	100.	Disabled	Enabled	%	
	C057	Overtorque Level (Reverse Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	100.	Disabled	Enabled	%	
				0. to 180. (75 to 132 kW)	100.				
			Light load (VT)	0. to 150.	100.	Disabled	Enabled	%	
	C058	Overtorque Level (Forward Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	100.	Disabled	Enabled	%	
				0. to 180. (75 to 132 kW)	100.				
			Light load (VT)	0. to 150.	100.	Disabled	Enabled	%	
	C061	Electronic Thermal Warning Level	0. to 100.		80.	Disabled	Enabled	%	7-71
	C062	Alarm Code Selection	00: Disabled 01: 3 bits 02: 4 bits		00	Disabled	Enabled	–	7-130
	C063	0 Hz Detection Level	0.00 to 99.99 100.0		0.00	Disabled	Enabled	Hz	7-130
	C064	Cooling Fin Overheat Warning Level	0. to 200.		120.	Disabled	Enabled	°C	7-135

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Communications function	C071	Communication Speed Selection (Baud Rate Selection)	02: Loop-back test 03: 2,400 bps 04: 4,800 bps 05: 9,600 bps 06: 19,200 bps	05 *1	Disabled	Enabled	–	8-4
	C072	Communication Station No. Selection	1. to 32.	1.	Disabled	Enabled	–	
	C073	Communication Bit Length Selection	7: 7 bits 8: 8 bits	8 *1	Disabled	Enabled	–	
	C074	Communication Parity Selection	00: No parity 01: Even parity 02: Odd parity	00	Disabled	Enabled	–	
	C075	Communication Stop Bit Selection	1: 1 bit 2: 2 bits	1	Disabled	Enabled	–	
	C076	Operation Selection on Communication Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	02	Disabled	Enabled	–	
	C077	Communication Error Timeout Time	0.00: Disabled (Function not active) 0.01 to 99.99	0.00	Disabled	Enabled	s	
	C078	Communication Wait Time	0. to 1000.	0.	Disabled	Enabled	ms	
	C079	Communication Method Selection	00: ASCII 01: Modbus	01	Disabled	Enabled	–	
Adjustment	C081	FV Adjustment	0. to 9999. 1000 to 6553 (10000 to 65535)	Factory setting	Enabled	Enabled	–	7-24
	C082	FI Adjustment	0. to 9999. 1000 to 6553 (10000 to 65535)	Factory setting	Enabled	Enabled	–	
	C083	FE Adjustment	0. to 9999. 1000 to 6553 (10000 to 65535)	Factory setting	Enabled	Enabled	–	
	C085	Thermistor Adjustment	0.0 to 999.9 1000.	Factory setting	Enabled	Enabled	–	7-103
Others	C091	Debug Mode Selection *2	Use “00.”	00	Disabled	Disabled	–	–
	C101	UP/DWN Storage Selection	00: Do not store frequency data 01: Store frequency data	00	Disabled	Enabled	–	7-119
	C102	Reset Selection	00: Trip reset at power-on 01: Trip reset at power-off 02: Enabled only during trip (Reset at power-on) 03: Trip reset only	02 *1	Enabled	Enabled	–	7-115
	C103	Reset Restart Selection	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00	Disabled	Enabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation: Normal	Changes during operation: b031 = 10	Unit	Page
Meter adjustment	C105	MP Gain Setting	50. to 200.	100.	Enabled	Enabled	%	7-141
	C106	AM Gain Setting	50. to 200.	100.	Enabled	Enabled	%	7-144
	C107	AMI Gain Setting	50. to 200.	100.	Enabled	Enabled	%	
	C109	AM Bias Setting	0. to 100.	0.	Enabled	Enabled	%	
	C110	AMI Bias Setting	0. to 100.	20.	Enabled	Enabled	%	

*1 The default data was changed from the previous model.

*2 Do not set.

Parameter No.		Function name	Monitor or data range		Default data	Changes during operation: Normal	Changes during operation: b031 = 10	Unit	Page
Terminal	C111	Overload Warning Level 2	0.0: Disabled		Rated current value	Enabled	Enabled	A	7-74
			Heavy load (CT)	0.00 to 2.00 x Rated current (0.4 to 55 kW)					
				0.00 to 1.80 x Rated current (75 to 132 kW)					
			Light load (VT)	0.00 to 1.50 x Rated current (0.4 to 132 kW)	Rated current value	Enabled	Enabled	A	
Adjustment	C121	FV Zero Adjustment	0. to 9999. 1000 to 6553 (10000 to 65535)		Factory default	Enabled	Enabled	–	7-24
	C122	FI Zero Adjustment	0. to 9999. 1000 to 6553 (10000 to 65535)		Factory default	Enabled	Enabled	–	
	C123	FE Zero Adjustment	0. to 9999. 1000 to 6553 (10000 to 65535)		Factory default	Enabled	Enabled	–	
Output terminal operation function	C130	Multi-function Output P1 ON Delay Time	0.0 to 100.0		0.0	Disabled	Enabled	s	5-60
	C131	Multi-function Output P1 OFF Delay Time	0.0 to 100.0		0.0				
	C132	Multi-function Output P2 ON Delay Time	0.0 to 100.0		0.0				
	C133	Multi-function Output P2 OFF Delay Time	0.0 to 100.0		0.0				
	C134	Multi-function Output P3 ON Delay Time	0.0 to 100.0		0.0				
	C135	Multi-function Output P3 OFF Delay Time	0.0 to 100.0		0.0				
	C136	Multi-function Output P4 ON Delay Time	0.0 to 100.0		0.0				
	C137	Multi-function Output P4 OFF Delay Time	0.0 to 100.0		0.0				
	C138	Multi-function Output P5 ON Delay Time	0.0 to 100.0		0.0				

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation Normal	Changes during operation b031 = 10	Unit	Page
Output terminal operation function	C139	Multi-function Output P5 OFF Delay Time	0.0 to 100.0	0.0	Disabled	Enabled	s	5-60
	C140	Multi-function Relay Output ON Delay Time	0.0 to 100.0	0.0				
	C141	Multi-function Relay Output OFF Delay Time	0.0 to 100.0	0.0				
	C142	Logic Output Signal 1 Selection 1	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00	Disabled	Enabled	–	7-132
	C143	Logic Output Signal 1 Selection 2	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C144	Logic Output Signal 1 Operator Selection	00: AND 01: OR 02: XOR	00				
	C145	Logic Output Signal 2 Selection 1	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C146	Logic Output Signal 2 Selection 2	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C147	Logic Output Signal 2 Operator Selection	00: AND 01: OR 02: XOR	00				
	C148	Logic Output Signal 3 Selection 1	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C149	Logic Output Signal 3 Selection 2	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C150	Logic Output Signal 3 Operator Selection	00: AND 01: OR 02: XOR	00				
	C151	Logic Output Signal 4 Selection 1	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C152	Logic Output Signal 4 Selection 2	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Output terminal operation function	C153	Logic Output Signal 4 Operator Selection	00: AND 01: OR 02: XOR	00	Disabled	Enabled	–	7-132
	C154	Logic Output Signal 5 Selection 1	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C155	Logic Output Signal 5 Selection 2	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C156	Logic Output Signal 5 Operator Selection	00: AND 01: OR 02: XOR	00				
	C157	Logic Output Signal 6 Selection 1	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C158	Logic Output Signal 6 Selection 2	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00				
	C159	Logic Output Signal 6 Operator Selection	00: AND 01: OR 02: XOR	00				
Input terminal response	C160	Multi-function Input S1 Response Time	0. to 200. (x 2 ms)*1	1.	Disabled	Enabled	ms	7-140
	C161	Multi-function Input S2 Response Time	0. to 200. (x 2 ms)*1	1.				
	C162	Multi-function Input S3 Response Time	0. to 200. (x 2 ms)*1	1.				
	C163	Multi-function Input S4 Response Time	0. to 200. (x 2 ms)*1	1.				
	C164	Multi-function Input S5 Response Time	0. to 200. (x 2 ms)*1	1.				
	C165	Multi-function Input S6 Response Time	0. to 200. (x 2 ms)*1	1.				
	C166	Multi-function Input S7 Response Time	0. to 200. (x 2 ms)*1	1.				
	C167	Multi-function Input S8 Response Time	0. to 200. (x 2 ms)*1	1.				
	C168	Forward RUN Command FW Response Time	0. to 200. (x 2 ms)*1	1.				
Others	C169	Multi-step Speed/Position Determination Time	0. to 200. (x 10 ms)*1	0.	Disabled	Enabled	ms	6-40

*1 When 0 is set, the response time is 2 ms.

4-3-4 Group H: Motor Control Parameters

	Parameter No.	Function name	Monitor or data range	Default data	Changes during operation: Normal	Changes during operation: b031 = 10	Unit	Page
Control parameters	H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00	Disabled	Disabled	–	6-5
	H002	1st Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	Disabled	Disabled	–	
	H202	2nd Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	Disabled	Disabled	–	
	H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/ 1.5/2.2/3.0/3.7/4.0/5.5/7.5/ 11.0/15.0/18.5/22/30/37/45/55/75/ 90/110/132	Maximum applicable motor capacity	Disabled	Disabled	kW	
	H203	2nd Motor Capacity			Disabled	Disabled		
	H004	1st Motor Pole Number	2/4/6/8/10	4	Disabled	Disabled	pole	
	H204	2nd Motor Pole Number		4	Disabled	Disabled		
	H005	1st Speed Response	0.001 to 9.999 10.00 to 80.00 (10.000 to 80.000)	1.590	Enabled	Enabled	–	6-27
	H205	2nd Speed Response		1.590				
	H006	1st Stabilization Parameter	0. to 255.	100.	Enabled	Enabled	–	7-146
	H206	2nd Stabilization Parameter		100.				
	H306	3rd Stabilization Parameter		100.				
	H020	1st Motor Parameter R1	0.001 to 9.999 10.00 to 65.53	Depends on the motor capacity.	Disabled	Disabled	Ω	6-11
	H220	2nd Motor Parameter R1		Depends on the motor capacity.				
	H021	1st Motor Parameter R2	0.001 to 9.999 10.00 to 65.53	Depends on the motor capacity.	Disabled	Disabled	Ω	
	H221	2nd Motor Parameter R2		Depends on the motor capacity.				
	H022	1st Motor Parameter L	0.01 to 99.99 100.0 to 655.3	Depends on the motor capacity.	Disabled	Disabled	mH	
	H222	2nd Motor Parameter L		Depends on the motor capacity.				
	H023	1st Motor Parameter Io	0.01 to 99.99 100.0 to 655.3	Depends on the motor capacity.	Disabled	Disabled	A	
	H223	2nd Motor Parameter Io		Depends on the motor capacity.				

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Control parameters	H024	1st Motor Parameter J	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Depends on the motor capacity.	Disabled	Disabled	kg/m^2	6-11
	H224	2nd Motor Parameter J		Depends on the motor capacity.				
	H030	1st Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Depends on the motor capacity.	Disabled	Disabled	Ω	6-5
	H230	2nd Motor Parameter R1 (Auto-tuning Data)		Depends on the motor capacity.				
	H031	1st Motor Parameter R2 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Depends on the motor capacity.	Disabled	Disabled	Ω	
	H231	2nd Motor Parameter R2 (Auto-tuning Data)		Depends on the motor capacity.				
	H032	1st Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Depends on the motor capacity.	Disabled	Disabled	mH	
	H232	2nd Motor Parameter L (Auto-tuning Data)		Depends on the motor capacity.				
	H033	1st Motor Parameter Io (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Depends on the motor capacity.	Disabled	Disabled	A	
	H233	2nd Motor Parameter Io (Auto-tuning Data)		Depends on the motor capacity.				
	H034	1st Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Depends on the motor capacity.	Disabled	Disabled	kg/m^2	
	H234	2nd Motor Parameter J (Auto-tuning Data)		Depends on the motor capacity.				
	H050	1st PI Proportional Gain	0.0 to 999.9 1000.	100.0	Enabled	Enabled	–	6-27
	H250	2nd PI Proportional Gain		100.0				
	H051	1st PI Integral Gain	0.0 to 999.9 1000.	100.0	Enabled	Enabled	–	6-28
	H251	2nd PI Integral Gain		100.0				
	H052	1st P Proportional Gain	0.01 to 10.00	1.00	Enabled	Enabled	–	
	H252	2nd P Proportional Gain		1.00				
	H060	1st Limit at 0 Hz	0.0 to 100.0	100.0	Enabled	Enabled	%	6-4
	H260	2nd Limit at 0 Hz		100.0				

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Control parameters	H061	1st Boost Amount at SLV Startup, 0 Hz	0. to 50.	50.	Enabled	Enabled	%	6-4
	H261	2nd Boost Amount at SLV Startup, 0 Hz		50.				
	H070	For PI Proportional Gain Switching	0.0 to 999.9 1000.	100.0	Enabled	Enabled	–	6-29
	H071	For PI Integral Gain Switching	0.0 to 999.9 1000.	100.0	Enabled	Enabled	–	
	H072	For P Proportional Gain Switching	0.00 to 10.00	1.00	Enabled	Enabled	–	
	H073	Gain Switching Time	0. to 9999.	100.	Enabled	Enabled	ms	

4-3-5 Group P: Option Parameters

	Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Options	P001	Operation Selection on Option 1 Error	00: Trip 01: Continues operation	00	Disabled	Enabled	–	7-147
	P002	Operation Selection on Option 2 Error	00: Trip 01: Continues operation	00	Disabled	Enabled	–	
	P011	Number of Encoder Pulses	128. to 9999. 1000 to 6553 (10000 to 65535)	1024.	Disabled	Disabled	pulse	6-17
	P012	V2 Control Mode Selection	00: ASR (Speed control mode) 01: APR (Pulse train position control mode) 02: APR2 (Absolute position control mode) 03: HAPR (High-resolution absolute position control mode)	00	Disabled	Disabled	–	6-15
	P013	Pulse Train Input Selection	00: Mode 0 01: Mode 1 02: Mode 2	00	Disabled	Disabled	–	6-34
	P014	Orientation Stop Position	0. to 4095.	0.	Disabled	Enabled	–	6-53
	P015	Orientation Speed Setting	Starting Frequency (b082) to 1st Maximum Frequency (A004) (Upper limit: 120.0)	5.00	Disabled	Enabled	Hz	
	P016	Orientation Direction Setting	00: Forward side 01: Reverse side	00	Disabled	Disabled	–	
	P017	Positioning Completion Range Setting	0. to 9999. 1000 (10000)	5.	Disabled	Enabled	pulse	6-34
	P018	Positioning Completion Delay Time Setting	0.00 to 9.99	0.00	Disabled	Enabled	s	
	P019	Electronic Gear Position Selection	00: Position feedback side (FB) 01: Position command side (REF)	00	Disabled	Enabled	–	
	P020	Electronic Gear Ratio Numerator	0. to 9999.	1.	Enabled	Enabled	–	
	P021	Electronic Gear Ratio Denominator	0. to 9999.	1.	Enabled	Enabled	–	
	P022	Position Control Feedforward Gain	0.00 to 99.99 100.0 to 655.3	0.00	Enabled	Enabled	–	
	P023	Position Loop Gain	0.00 to 99.99 100.0	0.50	Enabled	Enabled	rad/s	
	P024	Position Bias Amount	–204 (–2048.) –999. to 2048.	0.	Enabled	Enabled	–	
	P025	Secondary Resistance Compensation Selection	00: Disabled 01: Enabled	00	Disabled	Enabled	–	7-147
	P026	Overspeed Error Detection Level	0.0 to 150.0	135.0	Disabled	Enabled	%	7-83

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Options	P027	Speed Deviation Excessive Level	0.00 to 99.99 100.0 to 120.0	7.50	Disabled	Enabled	Hz	6-17
	P028	Motor Gear Ratio Numerator	1. to 9999.	1.	Disabled	Enabled	–	6-17
	P029	Motor Gear Ratio Denominator	1. to 9999.	1.	Disabled	Enabled	–	
	P031	Acceleration/ Deceleration Time Input Type	00: Digital Operator 01: Option 1 02: Option 2 03: DriveProgramming	00	Disabled	Disabled	–	5-35
	P032	Orientation Stop Position Input Type	00: Digital Operator 01: Option 1 02: Option 2	00	Disabled	Enabled	–	7-83
	P033	Torque Reference Input Selection	00: Terminal FV 01: Terminal FI 02: Terminal FE 03: Digital Operator 06: Option	00	Disabled	Disabled	–	6-56
	P034	Torque Reference Setting	0. to 200. (0.4 to 55 kW) 0. to 180. (75 to 132 kW)	0.	Enabled	Enabled	%	
	P035	Polarity Selection at Torque Reference via FE	00: Signed 01: Depends on the RUN direction	00	Disabled	Enabled	–	
	P036	Torque Bias Mode	00: None 01: Digital Operator 02: Terminal FE	00	Disabled	Enabled	–	
	P037	Torque Bias Value	–200. to 200. (0.4 to 55 kW) –180. to 180. (75 to 132 kW)	0.	Enabled	Enabled	%	
	P038	Torque Bias Polarity Selection	00: Signed 01: Depends on the RUN direction	00	Disabled	Disabled	–	
	P039	Speed Limit Value in Torque Control (Forward)	0.00 to 1st Maximum Frequency (A004)	0.00	Disabled	Enabled	Hz	
	P040	Speed Limit Value in Torque Control (Reverse)	0.00 to 1st Maximum Frequency (A004)	0.00	Disabled	Enabled	Hz	
	P044	Communications Error Detection Timer Setting	0.00 to 99.99	1.00	Disabled	Disabled	s	7-147
	P045	Operation Selection at Host Communications Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00	Disabled	Disabled	–	
	P046	Assembly Instance Number	0 to 20	1	Disabled	Disabled	–	
	P048	Operation Selection at Idle Mode Detection	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00	Disabled	Disabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Options	P049	Number of Poles for Rotation Speed Setting	0/2/4/8/10/12/14/16/18/20/22/24/26/28/30/32/34/36/38	0	Disabled	Disabled	–	7-147
	P055	Pulse Train Frequency Scale	1.0 to 50.0	25.0	Disabled	Enabled	kHz	7-47
	P056	Pulse Train Frequency Filter Time Parameter	0.01 to 2.00	0.10	Disabled	Enabled	s	5-24
	P057	Pulse Train Frequency Bias Amount	–100. to 100.	0	Disabled	Enabled	%	
	P058	Pulse Train Frequency Limit	0. to 100.	100.	Disabled	Enabled	%	
	P060	Multi-step Position Command 0	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0	Enabled	Enabled	–	6-40
	P061	Multi-step Position Command 1	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0				
	P062	Multi-step Position Command 2	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0				
	P063	Multi-step Position Command 3	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0				
	P064	Multi-step Position Command 4	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0				
	P065	Multi-step Position Command 5	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0				
	P066	Multi-step Position Command 6	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0				
	P067	Multi-step Position Command 7	Position range specification (reverse side) to Position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	0				
	P068	Origin Search Mode	00: Origin search mode 1 01: Origin search mode 2 02: Origin search mode 3	00				
	P069	Origin Search Direction Selection	00: Forward side 01: Reverse side	00				

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Options	P070	Origin Search Mode 1 Frequency	0.00 to 10.00	5.00 *1	Enabled	Enabled	Hz	6-40
	P071	Origin Search Mode 2 Frequency	0.00 to 99.99 100.0 to 1st Maximum Frequency (A004)	5.00 *1	Enabled	Enabled	Hz	
	P072	Position Limit Setting (Forward Side)	0 to 268435455 (When P012 = 02) 0 to 1073741823 (When P012 = 03) (Displays MSB 4 digits)	268435355	Enabled	Enabled	–	
	P073	Position Limit Setting (Reverse Side)	–268435455 to 0 (When P012 = 02) –1073741823 to 0 (When P012 = 03) Displays MSB 4 digits (1 digit for "–")	–268435455	Enabled	Enabled	–	
	P074	Teaching Selection	00: Multi-step Position Command 0 (P060) 01: Multi-step Position Command 1 (P061) 02: Multi-step Position Command 2 (P062) 03: Multi-step Position Command 3 (P063) 04: Multi-step Position Command 4 (P064) 05: Multi-step Position Command 5 (P065) 06: Multi-step Position Command 6 (P066) 07: Multi-step Position Command 7 (P067)	00	Enabled	Enabled	–	
	P100	DriveProgramming User Parameter U00	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	7-148
	P101	DriveProgramming User Parameter U01	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P102	DriveProgramming User Parameter U02	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P103	DriveProgramming User Parameter U03	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P104	DriveProgramming User Parameter U04	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P105	DriveProgramming User Parameter U05	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	

*1 The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Options	P106	DriveProgramming User Parameter U06	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	7-148
	P107	DriveProgramming User Parameter U07	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P108	DriveProgramming User Parameter U08	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P109	DriveProgramming User Parameter U09	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P110	DriveProgramming User Parameter U10	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P111	DriveProgramming User Parameter U11	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P112	DriveProgramming User Parameter U12	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P113	DriveProgramming User Parameter U13	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P114	DriveProgramming User Parameter U14	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P115	DriveProgramming User Parameter U15	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P116	DriveProgramming User Parameter U16	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P117	DriveProgramming User Parameter U17	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P118	DriveProgramming User Parameter U18	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P119	DriveProgramming User Parameter U19	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P120	DriveProgramming User Parameter U20	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P121	DriveProgramming User Parameter U21	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P122	DriveProgramming User Parameter U22	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P123	DriveProgramming User Parameter U23	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Options	P124	DriveProgramming User Parameter U24	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	7-148
	P125	DriveProgramming User Parameter U25	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P126	DriveProgramming User Parameter U26	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P127	DriveProgramming User Parameter U27	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P128	DriveProgramming User Parameter U28	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P129	DriveProgramming User Parameter U29	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P130	DriveProgramming User Parameter U30	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P131	DriveProgramming User Parameter U31	0. to 9999. 1000 to 65535 (10000 to 65535)	0.	Enabled	Enabled	–	
	P160	Option I/F Flexible Format Output Register 1	0000 to FFFF	0000	Enabled	Enabled	–	7-147
	P161	Option I/F Flexible Format Output Register 2	0000 to FFFF	0000	Enabled	Enabled	–	
	P162	Option I/F Flexible Format Output Register 3	0000 to FFFF	0000	Enabled	Enabled	–	
	P163	Option I/F Flexible Format Output Register 4	0000 to FFFF	0000	Enabled	Enabled	–	
	P164	Option I/F Flexible Format Output Register 5	0000 to FFFF	0000	Enabled	Enabled	–	
	P165	Option I/F Flexible Format Output Register 6	0000 to FFFF	0000	Enabled	Enabled	–	
	P166	Option I/F Flexible Format Output Register 7	0000 to FFFF	0000	Enabled	Enabled	–	
	P167	Option I/F Flexible Format Output Register 8	0000 to FFFF	0000	Enabled	Enabled	–	
	P168	Option I/F Flexible Format Output Register 9	0000 to FFFF	0000	Enabled	Enabled	–	
	P169	Option I/F Flexible Format Output Register 10	0000 to FFFF	0000	Enabled	Enabled	–	
	P170	Option I/F Flexible Format Input Register 1	0000 to FFFF	0000	Enabled	Enabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
Options	P171	Option I/F Flexible Format Input Register 2	0000 to FFFF	0000	Enabled	Enabled	–	7-147
	P172	Option I/F Flexible Format Input Register 3	0000 to FFFF	0000	Enabled	Enabled	–	
	P173	Option I/F Flexible Format Input Register 4	0000 to FFFF	0000	Enabled	Enabled	–	
	P174	Option I/F Flexible Format Input Register 5	0000 to FFFF	0000	Enabled	Enabled	–	
	P175	Option I/F Flexible Format Input Register 6	0000 to FFFF	0000	Enabled	Enabled	–	
	P176	Option I/F Flexible Format Input Register 7	0000 to FFFF	0000	Enabled	Enabled	–	
	P177	Option I/F Flexible Format Input Register 8	0000 to FFFF	0000	Enabled	Enabled	–	
	P178	Option I/F Flexible Format Input Register 9	0000 to FFFF	0000	Enabled	Enabled	–	
	P179	Option I/F Flexible Format Input Register 10	0000 to FFFF	0000	Enabled	Enabled	–	
	P180	Not used *1	Use default data.	0.	–	–	–	–
	P181	Not used *1	Use default data.	00	–	–	–	–
	P182	Not used *1	Use default data.	00	–	–	–	–
	P185	Not used *1	Use default data.	0.	–	–	–	–
	P186	Not used *1	Use default data.	06	–	–	–	–
	P190	CompoNet Node Address	0 to 63	0	Disabled	Disabled	–	7-147
	P192	DeviceNet MAC ID	0 to 63	63	Disabled	Disabled	–	7-147
	P195	Not used *1	Use default data.	00	–	–	–	–
	P196	Not used *1	Use default data.	21 hex	–	–	–	–

*1 Do not set.

4-3-6 Group U: User Setting Display Parameters

	Parameter No.	Function name	Monitor or data range	Default data	Changes during operation		Unit	Page
					Normal	b031 = 10		
User parameter	U001	User Selection 1	no: No registration d001 to P196: Select the parameter number you want to display.	no	Enabled	Enabled	–	7-149
	U002	User Selection 2	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U003	User Selection 3	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U004	User Selection 4	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U005	User Selection 5	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U006	User Selection 6	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U007	User Selection 7	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U008	User Selection 8	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U009	User Selection 9	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U010	User Selection 10	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U011	User Selection 11	no: No registration d001 to P196: Select the parameter number you want to display.	no				
	U012	User Selection 12	no: No registration d001 to P196: Select the parameter number you want to display.	no				

5

Basic Settings

This section describes the basic parameter settings.

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5-1 Parameter Display and Parameter Initialization

5-1-1 Display Selection

- You can select the parameters to be displayed on the Digital Operator.
- To display all parameters, set the Display Selection to 00 (Complete display).

Parameter No.	Function name	Data	Default data	Unit
b037	Display Selection	00: Complete display 01: Individual display of functions 02: User setting + b037 03: Data comparison display 04: Basic display	00 *1	–
U001 to U012	User Selection 1 to User Selection 12	no: No registration d001 to P196: Select the parameter number you want to display.	no	–

*1. The default data was changed from the previous model.

Complete Display (b037 = 00)

Displays all inverter parameters.

Individual Display of Functions (b037 = 01)

If a specific function is not selected, its related parameter is not displayed.

For details on the display conditions, refer to the following table.

No.	Display condition	Parameters displayed when display condition is met
1	A001 = 01	A005, A006, A011 to A016, A101, A102 A111 to A114, C081 to C083, C121 to C123
2	A001 = 10	A141 to A143
3	A002 = 01, 03, 04, 05	b087
4	A017 = 01	d025 to d027, P100 to P131 P100 to P131 cannot be used.
5	A041 = 01	A046, A047
6	A044 = 00, 01	A041, A042, A043
7	A044 = 03, 04, 05	H002, H005, H050
8	A044 = 04	H060, H061
9	A044 = 03, 04, 05, and H002 = 00	H020 to H024
10	A044 = 03, 04, 05, and H002 = 01, 02	H030 to H034
11	Either A044 or A244, or both of them are 03, 04, 05.	d008 to d010, d012, b040 to b046, H001, H070 to H073
12	Either A044 or A244, or both of them are 02.	b100 to b113
13	A051 = 01, 02	A052, A056 to A058
14	A051 = 01, 02	A053 to A055, A059

No.	Display condition	Parameters displayed when display condition is met
15	A071 = 01, 02	d004, A005, A006, A011 to A016, A072 to A078 A101, A102, A111 to A114, C044, C052, C053, C081 to C083, C121 to C123
16	A076 = 10	A141 to A143
17	A094 = 01, 02	A095, A096
18	A097 = 01, 02, 03, 04	A131
19	A097 = 01, 02, 03, 04	A132
20	One or more of b012, b212, or b312 are 02.	b015 to b020
21	b021 = 01, 02, 03	b022, b023
22	b024 = 01, 02, 03	b025, b026
23	b050 = 01	b051 to b054
24	b095 = 01, 02	b090, b096
25	b098 = 01, 02	b099, C085
26	b120 = 01	b121 to b127
27	One of C001 to C008 is 05 and A019 = 00.	A028 to A035
28	One of C001 to C008 is 06.	A038, A039
29	One of C001 to C008 is 07.	A053 to A055, A059
30	One of C001 to C008 is 08.	F202, F203, A203, A204, A220, A244, A246, A247, A261, A262, A292, A293, A294, b212, b213, H203, H204, H206
31	One of C001 to C008 is 08 and A041 = 01.	A246, A247
32	One of C001 to C008 is 08 and A244 = 00 or 01.	A241, A242, A243
33	One of C001 to C008 is 08 and A244 = 03 or 04.	H202, H205, H250, H251, H252
34	One of C001 to C008 is 08 and A244 = 04.	H260, H261
35	One of C001 to C008 is 08 and A244 = 03 or 04 and H202 = 00.	H220 to H224
36	One of C001 to C008 is 08 and A244 = 03 or 04 and H202 = 01 or 02.	H230 to H234
37	One of C001 to C008 is 08 and A094 = 01 or 02.	A295, A296
38	One of C001 to C008 is 11.	b088
39	One of C001 to C008 is 17.	F302, F303, A303, A304, A320, A342, A343, A392, A393, b312, b313, H306
40	One of C001 to C008 is 18.	C102
41	One of C001 to C008 is 27, 28, or 29.	C101
42	One of C021 to C026 is 03.	C040, C041
43	One of C021 to C026 is 26.	C040, C111
44	One of C021 to C026 is 02 or 06.	C042, C043
45	One of C021 to C026 is 07.	C055 to C058
46	One of C021 to C026 is 21.	C063
47	One of C021 to C026 is 24 or 25.	C045, C046
48	One of C021 to C026 is 33.	C142 to C144
49	One of C021 to C026 is 34.	C145 to C147
50	One of C021 to C026 is 35.	C148 to C150
51	One of C021 to C026 is 36.	C151 to C153
52	One of C021 to C026 is 37.	C154 to C156
53	One of C021 to C026 is 38.	C157 to C159
54	One of C021 to C026 is 42.	C064

User Setting (b037 = 02)

- Displays only the parameters set in U001 to U012.
- In addition to U001 to U012, the parameter d001, F001, and b037 are displayed.

Data Comparison Display (b037 = 03)

- Displays only the changed parameters from the factory default settings.
  However, the parameters for analog input adjustment (C081 to C083, C121 to C123) and Thermistor Adjustment (C085) are not displayed.
- All monitor display parameters (d***) and F001 will be always displayed.

Basic Display (b037 = 04)

- Displays only the basic parameters.
- When this setting is enabled, the following parameters are displayed.

No.	Parameter No.	Function name	No.	Parameter No.	Function name
1	d001	Output Frequency Monitor	18	A044	1st Control Method
2	d002	Output Current Monitor	19	A045	Output Voltage Gain
3	d003	RUN Direction Monitor	20	A085	Operation Mode Selection
4	d004	PID Feedback Value Monitor	21	b001	Power Interruption/Undervoltage Restart Selection
5	F001	Output Frequency Setting/Monitor	22	b002	Allowable Power Interruption Time
6	F002	1st Acceleration Time 1	23	b008	Overvoltage/Overcurrent Restart Selection
7	F003	1st Deceleration Time 1	24	b011	Overvoltage/Overcurrent Restart Standby Time
8	F004	RUN Direction Selection	25	b037	Display Selection
9	A001	Frequency Reference Selection	26	b083	Carrier Frequency
10	A002	RUN Command Selection	27	b084	Initialization Selection
11	A003	1st Base Frequency	28	b130	Overvoltage Suppression Function Selection During Deceleration
12	A004	1st Maximum Frequency	29	b131	Overvoltage Suppression Level During Deceleration
13	A005	FV/FI Selection	30	b180	Initialization Execution
14	A020	1st Multi-step Speed Reference 0	31	C021	Multi-function Output P1 Selection
15	A021	Multi-step Speed Reference 1	32	C022	Multi-function Output P2 Selection
16	A022	Multi-step Speed Reference 2	33	C036	Multi-function Relay Output (MA, MB) Operation Selection
17	A023	Multi-step Speed Reference 3			
Related functions		U001 to U012			

5-1-2 Parameter Initialization

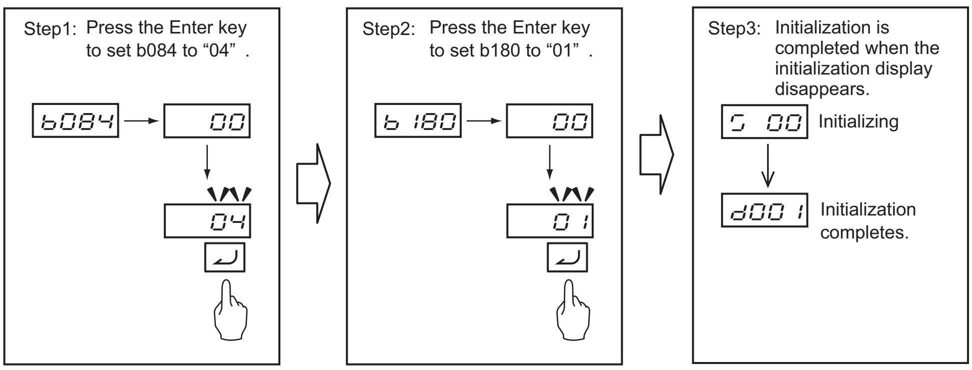
- The parameter initialization function restores the changed parameters to the factory default settings.
- It also can clear the fault monitor data.
- As a measure to prevent inadvertent parameter initialization, you need to set several parameters to execute initialization.
- The following parameters are not initialized: the settings of the DriveProgramming User Parameters U00 to U31 (P100 to P131), Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Initialization Data Selection (b085), Heavy Load/Light Load Selection (b049), analog adjustment parameters (C081 to C083, C121 to C123), and Thermistor Adjustment (C085).
- If you use the 3G3RX-V1 Series Inverter for the first time or newly configure settings, execute 04 (Clear fault monitor + initialize data + Clear DriveProgramming) in b084.
- Remember that you cannot restore the initialized data to the previous settings once you execute parameter initialization.

Parameter No.	Function name	Data	Default data	Unit
b084	Initialization Selection	00: Initialization disabled 01: Clear fault monitor 02: Initialize data 03: Clear fault monitor + initialize data 04: Clear fault monitor + initialize data + Clear DriveProgramming	00	–
b085	Initialization Data Selection	00: Do not change.	00	–
b180	Initialization Execution	00: Function disabled 01: Execute initialization	00	–

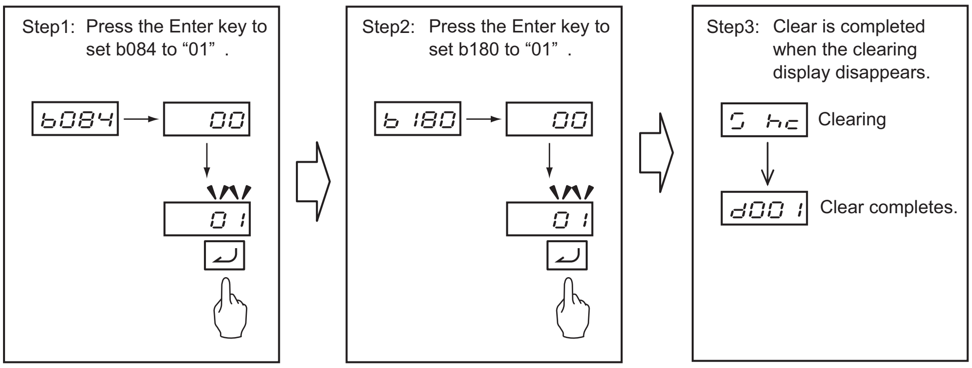
Precautions for Correct Use

- Remember that it is impossible to undo the initialization once you press the Enter key to execute parameter initialization, with the Initialization Execution (b180) set to 01.
- The 3G3RX-V1 Inverter does not support the conventional initialization which is performed by pressing multiple keys simultaneously.

Initializing the Parameter Settings (Clear Fault Monitor + Initialize Data + Clear DriveProgramming)



Clearing Fault Monitor Data



Precautions for Correct Use

- As a measure to prevent inadvertent parameter initialization, the Initialization Selection (b084) and Initialization Execution (b180) settings are designed to be reset to 00 when the initialization is completed or after power cycle. Be sure to set these parameters each time when you need to initialize the parameter settings.
- The following parameters are not initialized: the settings of the DriveProgramming User Parameters U00 to U31 (P100 to P131), Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Initialization Data Selection (b085), Heavy Load/Light Load Selection (b049), analog adjustment parameters (C081 to C083, C121 to C123), and Thermistor Adjustment (C085).
- Remember that you cannot restore the initialized data to the previous settings once you execute parameter initialization.

Switching among 1st, 2nd, and 3rd Controls

- The 3G3RX-V1 Series Inverter provides three controls that can be switched as required.
- With a single motor, only the 1st control is used normally.
  However, even with a single motor, you can use the 2nd or 3rd control to configure the settings suitable for your application.
- The 2nd or 3rd control is allocated in the 200s or 300s parameter number respectively.
- For parameters with the 2nd and 3rd controls, the display changes in the order of the 1st control, the 2nd control, and the 3rd control. Therefore, when using the Digital Operator, the displayed parameter number can change to the 200s and then the 300s.

For the explanation of the 2nd/3rd control, refer to *2nd/3rd Control Functions* on page 7-111.

5-2 V/f Control Settings

5-2-1 Control Method (V/f Characteristics)

- V/f control is the control mode used for the conventional general-purpose inverter and can be used easily.
- You can set the following V/f (output voltage/output frequency) characteristics.

Parameter No.	Function name	Data		Default data	Unit
A044	1st Control Method	Heavy load (CT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control (SLV) *1 04: 0-Hz sensorless vector control *1 05: Sensor vector control (V2) *2	00	–
		Light load (VT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control (SLV)	00	
A244	2nd Control Method *3	Heavy load (CT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control (SLV) *1 04: 0-Hz sensorless vector control *1	00	
		Light load (VT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control (SLV)	00	
A344	3rd Control Method *3	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed))			

*1. Refer to *6-2 Sensorless Vector Control* on page 6-4 .

*2. Refer to *6-3 Sensor Vector Control* on page 6-15.

*3. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

Constant Torque Characteristics (VC)

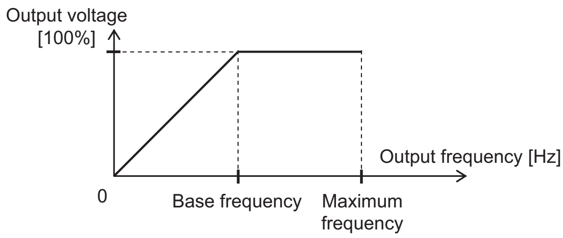
This setting is suitable for cart, conveyor, overhead traveling crane, and other applications where a constant torque is required, independent of the motor rotation speed.

The output voltage is generated in proportion to the output frequency to realize the output of a constant torque.

However, the output voltage is proportional from 0 Hz to the base frequency, it is constant independent of the frequency, from the base frequency to the maximum frequency.

For the base frequency, set the rated frequency of the motor.

For the maximum frequency, set the highest frequency required for your application, within the maximum frequency of the motor.

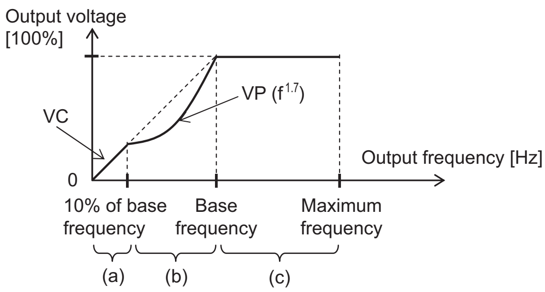


Reduced Torque Characteristics (VP 1.7th Power (VC at low speed))

This setting is suitable for fan, pump, and other applications that do not require large torque at low speeds.

It provides high efficiency, reduced noise, and vibration, because the output voltage is reduced in the low speed range.

In the low speed range at 10% of the base frequency or less, the setting provides constant torque characteristics (VC) to secure a sufficient starting torque.



Range (a): Constant torque characteristics are provided from 0 Hz to 10% of the base frequency. (Example) If the base frequency is 60 Hz, the setting provides constant torque characteristics from 0 to 6 Hz.

Range (b): Reduced torque characteristics are provided from 10% to 100% of the base frequency. The inverter outputs voltage based on a curve of the 1.7th power of the frequency.

Range (c): Constant voltage characteristics are provided from the base frequency to the maximum frequency.

Free V/f Setting

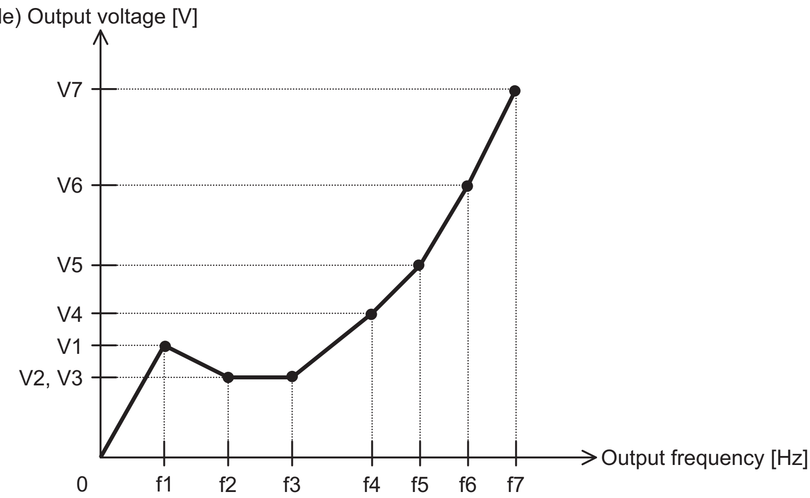
- The free V/f setting function is suitable for the applications below.
  The output voltage of the inverter can be adjusted according to your application.

Application	Adjustment method
Motor integrated with a brake (that uses a shared power supply for the motor and the brake)	If the motor and the brake share the same power supply, a large voltage is required at low frequencies to release the brake. The release timing of the brake can be adjusted by setting the frequency at which you want to release the brake and adjusting the voltage at that frequency.
Applications subject to significant load variation at different motor speeds	When the load value changes significantly depending on the motor speed (frequency), the output torque of the inverter can be adjusted by setting the frequency at which the load value becomes large and adjusting the voltage at that frequency.

- In the free V/f setting, you can configure the desired V/f characteristics by setting the voltage and frequency values at 7 points in the parameters b100 to b113.
- The set values of the Free V/f Frequency 1 to 7 must satisfy the following relationship:
  1 ≤ 2 ≤ 3 ≤ 4 ≤ 5 ≤ 6 ≤ 7.
- All of the default data are set to 0 Hz. Start by setting the Free V/f Frequency 7 (b112) and Free V/f Voltage 7 (b113).You cannot operate the inverter with the factory default settings.
- If the free V/f settings are enabled, the Torque Boost Selection (A041/A241), Base Frequency (A003/A203/A303), and Maximum Frequency (A004/A204/A304) functions are disabled. The Free V/f Frequency 7 data is regarded as the maximum frequency.

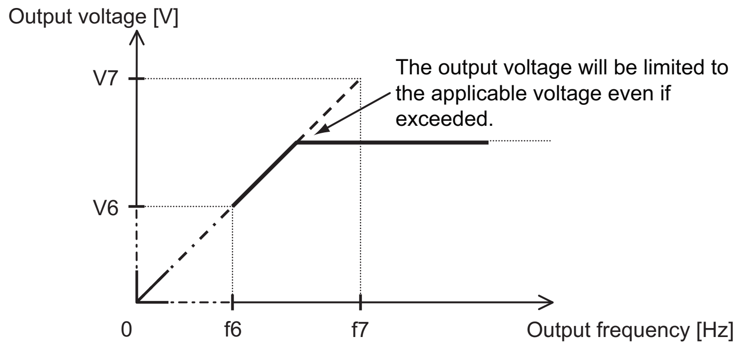
Parameter No.	Function name	Data	Description	Default data	Unit
b100	Free V/f Frequency 1 (f1)	0. : Disabled 1. to Free V/f Frequency 2	Set the frequency at each break point.	0	Hz
b102	Free V/f Frequency 2 (f2)	0. : Disabled Free V/f Frequency 1 to Free V/f Frequency 3			
b104	Free V/f Frequency 3 (f3)	0. : Disabled Free V/f Frequency 2 to Free V/f Frequency 4			
b106	Free V/f Frequency 4 (f4)	0. : Disabled Free V/f Frequency 3 to Free V/f Frequency 5			
b108	Free V/f Frequency 5 (f5)	0. : Disabled Free V/f Frequency 4 to Free V/f Frequency 6			
b110	Free V/f Frequency 6 (f6)	0. : Disabled Free V/f Frequency 5 to Free V/f Frequency 7			
b112	Free V/f Frequency 7 (f7)	0. : Disabled Free V/f Frequency 6 to 400.			

Parameter No.	Function name	Data	Description	Default data	Unit
b101	Free V/f Voltage 1 (V1)	0. to 800.0	Set the voltage at each break point.	0.0	V
b103	Free V/f Voltage 2 (V2)				
b105	Free V/f Voltage 3 (V3)				
b107	Free V/f Voltage 4 (V4)				
b109	Free V/f Voltage 5 (V5)				
b111	Free V/f Voltage 6 (V6)				
b113	Free V/f Voltage 7 (V7)				
Related functions		A044, A244, A344			



Precautions for Correct Use

Even if the Free V/f Voltage 1 to 7 are set to 800 V, the inverter cannot produce output voltage higher than the input voltage or the value of the Motor Rated Voltage Selection (A082).
Be sure to check that the output characteristic setting is proper. An improper setting causes overcurrent during acceleration or deceleration, or vibration of the motor and/or machine.



5-2-2 Heavy Load/Light Load Selection

The 3G3RX-V1 Series Inverter supports dual load ratings (heavy load mode and light load mode).

This enables the efficient utilization of the inverter according to your application.

- According to your application, select one of the two modes: heavy load mode and light load mode.
- The heavy load mode provides the same load rating as the conventional 3G3RX Series Inverter. This means that the overload capacity is 150% of the rated current of the inverter for 1 minute.
- For loads (such as fan and pumps) that do not require frequent use of the inverter above the rated torque, you can select the light load mode.
  Setting the light load mode causes the rated current of the inverter to increase, which enables the inverter to drive a motor, one size larger in capacity. However, the overload capacity is 120% of the rated current of the inverter for 1 minute.
- Use the Heavy Load/Light Load Selection (b049) to switch between the heavy load mode and the light load mode.
  It is not necessary to cycle the power supply after changing this setting.

Parameter No.	Function name	Data	Default data	Unit
b049	Heavy Load/Light Load Selection	00: Heavy load mode (CT) 01: Light load mode (VT)	00	–

The characteristics in the heavy load mode and the light load mode are as shown below.

Item	Heavy load (CT)	Light load (VT)
Feature	Loads that require a high torque during acceleration/deceleration etc.	Loads that do not require frequent use of the inverter above rated torque
Application	Elevator, crane, conveyor, etc.	Fan, pump, air conditioner, etc.
Rated current (Example)	3.0 A (3-phase 200-V, 0.4-kW inverter)	3.7 A (3-phase 200-V, 0.4-kW inverter)
Overload current rating	150%, 60 s	120%, 60 s

Changing the Heavy Load/Light Load Selection (b049) setting switches the setting ranges and default data of some parameters.

Doing so also causes some parameter settings to be initialized at the same time.

For these parameters, you must set data again after changing the b049 setting even if you configured them beforehand.

- Changing from heavy load mode to light load mode:
  Basically causes the parameter settings to be initialized. For details, refer to the Initialization at mode switching column in the following table.
- Changing from light load mode to heavy load mode:
  Basically does NOT cause the parameter settings to be initialized. For details, refer to the Initialization at mode switching column in the following table.

● Parameters whose Setting Ranges and Default Settings are Switched between Heavy Load and Light Load Mode

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Parameter name</th><th colspan="2">Setting range</th><th colspan="2">Default data</th><th colspan="2">Initialization at mode switching</th></tr>
<tr><th>Heavy load (CT)</th><th>Light load (VT)</th><th>Heavy load (CT)</th><th>Light load (VT)</th><th>Heavy to Light</th><th>Light to Heavy</th></tr>
<tr><td>A044</td><td>1st Control Method</td><td>00: Constant torque characteristics
01: Reduced torque characteristics
02: Free V/f setting
03: Sensorless vector control
04: 0-Hz sensorless vector control
05: Sensor vector control</td><td>00: Constant torque characteristics
01: Reduced torque characteristics
02: Free V/f setting
03: Sensorless vector control</td><td>00</td><td>No switching</td><td rowspan="2">Enabled</td><td rowspan="2">Disabled</td></tr>
<tr><td>A244</td><td>2nd Control Method</td><td>00: Constant torque characteristics
01: Reduced torque characteristics
02: Free V/f setting
03: Sensorless vector control
04: 0-Hz sensorless vector control</td><td>00: Constant torque characteristics
01: Reduced torque characteristics
02: Free V/f setting
03: Sensorless vector control</td><td>00</td><td>No switching</td></tr>
<tr><td>A054</td><td>DC Injection Braking Power</td><td rowspan="2">Percentage of heavy-load rated current
0. to 100.[%] (0. to 80.[%])</td><td rowspan="2">Percentage of light-load rated current
0. to 70.[%] (0. to 50.[%])</td><td>50.[%] (40.[%])</td><td>No switching</td><td rowspan="2">Enabled</td><td rowspan="2">Disabled</td></tr>
<tr><td>A057</td><td>Startup DC Injection Braking Power</td><td>0.[%]</td><td>No switching</td></tr>
<tr><td>A059</td><td>DC Injection Braking Carrier Frequency</td><td>0.5 to 15.0 [kHz] (0.5 to 10.0 [kHz])</td><td>0.5 to 12.0 [kHz] (0.5 to 8.0 [kHz])</td><td>5.0 [kHz] (3.0 [kHz])</td><td>3.0 [kHz] (3.0 [kHz])</td><td>Enabled</td><td>Disabled</td></tr>
<tr><td>A085</td><td>Operation Mode Selection</td><td>00: Normal operation
01: Energy-saving operation
02: Automatic operation</td><td>00: Normal operation
01: Energy-saving operation</td><td>00</td><td>No switching</td><td>Enabled</td><td>Disabled</td></tr>
<tr><td>b012</td><td>1st Electronic Thermal Level</td><td rowspan="3">0.20 x Heavy-load rated current to 1.00 x Heavy-load rated current [A]</td><td rowspan="3">0.20 x Light-load rated current to 1.00 x Light-load rated current [A]</td><td rowspan="3">Heavy-load rated current [A]</td><td rowspan="3">Light-load rated current [A]</td><td rowspan="3">Conversion *1</td><td rowspan="3">Conversion *1</td></tr>
<tr><td>b212</td><td>2nd Electronic Thermal Level</td></tr>
<tr><td>b312</td><td>3rd Electronic Thermal Level</td></tr>
<tr><td>b016</td><td>Free-electronic Thermal Current 1</td><td rowspan="3">0.00 x Heavy-load rated current to 1.00 x Heavy-load rated current [A]</td><td rowspan="3">0.00 x Light-load rated current to 1.00 x Light-load rated current [A]</td><td rowspan="3">0.00 [A]</td><td rowspan="3">No switching</td><td rowspan="3">Disabled</td><td rowspan="3">Disabled</td></tr>
<tr><td>b018</td><td>Free-electronic Thermal Current 2</td></tr>
<tr><td>b020</td><td>Free-electronic Thermal Current 3</td></tr>
</table>

No.	Parameter name	Setting range		Default data		Initialization at mode switching	
		Heavy load (CT)	Light load (VT)	Heavy load (CT)	Light load (VT)	Heavy to Light	Light to Heavy
b022	Overload Limit Level	0.20 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.20 x Heavy-load rated current to 1.80 x Heavy-load rated current [A]	0.20 x Light-load rated current to 1.50 x Light-load rated current [A] (0.20 x Light-load rated current to 1.50 x Light-load rated current [A])	1.50 x Heavy-load rated current [A]	1.20 x Light-load rated current [A]	Enabled	Conversion *1
b025	Overload Limit Level 2						
b028	Frequency Pull-in Restart Level	0.20 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.20 x Heavy-load rated current to 1.80 x Heavy-load rated current [A])	0.20 x Light-load rated current to 1.50 x Light-load rated current [A] (0.20 x Light-load rated current to 1.50 x Light-load rated current [A])	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion *1
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	Percentage of heavy-load rated current 0. to 200.[%] (0. to 180.[%]) no: Function disabled	Percentage of light-load rated current 0. to 150.[%] (0. to 150.[%]) no: Function disabled	150.[%]	120.[%]	Enabled	Disabled
b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)						
b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)						
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)						
b083	Carrier Frequency	0.5 to 15.0 [kHz] (0.5 to 10.0 [kHz])	0.5 to 12.0 [kHz] (0.5 to 8.0 [kHz])	5.0 [kHz] (3.0 [kHz])	3.0 [kHz] (3.0 [kHz])	Enabled	Disabled
C030	Digital Current Monitor Reference Value	0.20 x Heavy-load rated current to 2.00 x Heavy-load rated current [A]	0.20 x Light-load rated current to 1.50 x Light-load rated current [A]	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion *1
C039	Low Current Detection Level	0.00 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.00 x Heavy-load rated current to 1.80 x Heavy-load rated current [A])	0.00 x Light-load rated current to 1.50 x Light-load rated current [A] (0.00 x Light-load rated current to 1.50 x Light-load rated current [A])	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion *1
C041	Overload Warning Level	0.00 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.00 x Heavy-load rated current to 1.80 x Heavy-load rated current [A]) 0.00: Function disabled	0.00 x Light-load rated current to 1.50 x Light-load rated current [A] (0.00 x Light-load rated current to 1.50 x Light-load rated current [A]) 0.00: Function disabled	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion *1

No.	Parameter name	Setting range		Default data		Initialization at mode switching	
		Heavy load (CT)	Light load (VT)	Heavy load (CT)	Light load (VT)	Heavy to Light	Light to Heavy
C055	Overtorque Level (Forward Power Running)	Percentage of heavy-load rated current 0. to 200.[%] (0. to 180.[%])	Percentage of light-load rated current 0. to 150.[%] (0. to 150.[%])	100.[%]	100.[%]	Enabled	Disabled
C056	Overtorque Level (Reverse Regeneration)						
C057	Overtorque Level (Reverse Power Running)						
C058	Overtorque Level (Forward Regeneration)						
C111	Overload Warning Level 2	0.00 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.00 x Heavy-load rated current to 1.80 x Heavy-load rated current [A]) 0.00: Function disabled	0.00 x Light-load rated current to 1.50 x Light-load rated current [A] (0.00 x Light-load rated current to 1.50 x Light-load rated current [A]) 0.00: Function disabled	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion *1
H003	1st Motor Capacity	0.1 to 132 [kW] Setting in steps *2	No switching	Heavy-load rated capacity [kW]	Light-load rated capacity [kW]	Disabled	Disabled
H203	2nd Motor Capacity						

*1. Conversion: The current value will be converted at the ratio of the rated current for the heavy load/light load mode.

(Example) If you change from a light load mode setting of 5 A (rated current: 10 A) to the heavy load mode (rated current: 8 A), the current value will be converted as follows: Rated current 8A x 50% (5 A/10 A) = 4 A.

*2. Setting in steps: 0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132 [kW] can be selected.

Note For each parameter in the above table, the values enclosed in parentheses ( ) represent the setting range/default data for high-capacity type (75 to 132 kW) inverters.
Without parentheses ( ), the parameter has the same setting range/default data regardless of the inverter capacity.

In the light load mode, 0-Hz sensorless vector control, sensor vector control and brake control are disabled. Therefore, the following parameters and function options are not displayed.

Parameter No.	Function name	Parameter No.	Function name
d008	Real Frequency Monitor	P024	Position Bias Amount
d009	Torque Reference Monitor	P026	Overspeed Error Detection Level
d010	Torque Bias Monitor	P027	Speed Deviation Excessive Level
d029	Position Command Monitor	P028	Motor Gear Ratio Numerator
d030	Current Position Monitor	P029	Motor Gear Ratio Denominator
b120	Brake Control Function Selection	P032	Orientation Stop Position Input Type
b121	Brake Release Wait Time	P033	Torque Reference Input Selection
b122	Acceleration Wait Time on Brake Control	P034	Torque Reference Setting
b123	Stop Wait Time on Brake Control	P035	Polarity Selection at Torque Reference via FE
b124	Brake Error Detection Time	P036	Torque Bias Mode
b125	Brake Release Frequency	P037	Torque Bias Value
b126	Brake Release Current	P038	Torque Bias Polarity Selection
b127	Brake Force Frequency	P039	Speed Limit Value in Torque Control (Forward)
H060	1st Limit at 0 Hz	P040	Speed Limit Value in Torque Control (Reverse)
H260	2nd Limit at 0 Hz	P060	Multi-step Position Command 0
H061	1st Boost Amount at SLV Startup, 0 Hz	P061	Multi-step Position Command 1
H261	2nd Boost Amount at SLV Startup, 0 Hz	P062	Multi-step Position Command 2
P011	Number of Encoder Pulses	P063	Multi-step Position Command 3
P012	V2 Control Mode Selection	P064	Multi-step Position Command 4
P013	Pulse Train Input Selection	P065	Multi-step Position Command 5
P014	Orientation Stop Position	P066	Multi-step Position Command 6
P015	Orientation Speed Setting	P067	Multi-step Position Command 7
P016	Orientation Direction Setting	P068	Origin Search Mode
P017	Positioning Completion Range Setting	P069	Origin Search Direction Selection
P018	Positioning Completion Delay Time Setting	P070	Origin Search Mode 1 Frequency
P019	Electronic Gear Position Selection	P071	Origin Search Mode 2 Frequency
P020	Electronic Gear Ratio Numerator	P072	Position Limit Setting (Forward Side)
P021	Electronic Gear Ratio Denominator	P073	Position Limit Setting (Reverse Side)
P022	Position Control Feedforward Gain	P074	Teaching Selection
P023	Position Loop Gain		

Similarly, in the light load mode, the following function options are not displayed.

Function options for Multi-function Input S1 to S8 Selection (C001 to C008)	
44: BOK	Brake confirmation
45: ORT	Orientation
47: PCLR	Position deviation clear
48: STAT	Pulse train position command input permission
52: ATR	Torque command input permission
54: SON	Servo ON
55: FOC	Preliminary excitation
66: CP1	Position command selection 1
67: CP2	Position command selection 2
68: CP3	Position command selection 3
69: ORL	Zero return limit signal
70: ORG	Zero return startup signal
71: FOT	Forward driving stop
72: ROT	Reverse driving stop
73: SPD	Speed/Position switching

Function options for Multi-function Output P1 to P5 Selection/ Multi-function Relay Output (MA, MB) Function Selection (C021 to C026)	
19: BRK	Brake release
20: BER	Brake error
22: DSE	Excessive speed deviation
23: POK	Position ready

5-3 Motor Parameter Settings

5-3-1 Motor Capacity/Pole Number Selection

Set the following parameters according to your motor.

Parameter No.	Function name	Data	Default data	Unit
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H203	2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
H204	2nd Motor Pole Number	2/4/6/8/10	4	pole

5-3-2 Electronic Thermal Function

The electronic thermal function prevents the motor from overloading and burning.

Set the rated current value of your motor in the Electronic Thermal Level parameters.

In the Electronic Thermal Characteristics Selection parameters, set the motor torque characteristics as follows, according to the motor specifications.

Characteristics	Description
Reduced torque characteristics	Use this setting for general-purpose motors. In an air-cooled motor that uses the rear fan coupled directly to the motor shaft, the cooling effect degrades as the motor rotation speed decreases. This characteristics setting enables overload detection that takes into account such degradation of the cooling effect at low speeds.
Constant torque characteristics	Use this setting for dedicated inverter motors. Dedicated inverter motors are designed to prevent degradation of the cooling effect that arises as the motor speed changes. This characteristics setting provides overload detection independent of the motor rotation speed.

Precautions for Correct Use

- You cannot disable the electronic thermal function because it also provides overload protection for the inverter.
- To connect several motors to a single inverter, set the Electronic Thermal Level to the rated output current of the inverter and install a thermal relay etc. for each motor.
- Before setting the electronic thermal function, set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) correctly according to your motor.

Parameter No.	Function name	Data	Default data	Unit
b012	1st Electronic Thermal Level	0.20 x Rated current to 1.00 x Rated current *1 *2	Rated current of inverter	A
b212	2nd Electronic Thermal Level *1			
b312	3rd Electronic Thermal Level *1			
b013	1st Electronic Thermal Characteristics Selection	00: Reduced torque characteristics (for general-purpose motor) 01: Constant torque characteristics (for dedicated inverter motor) 02: Free setting (Select 00 or 01 according to your motor.)	00	–
b213	2nd Electronic Thermal Characteristics Selection *1			
b313	3rd Electronic Thermal Characteristics Selection *1			

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2. Set according to the rated current of your motor.

Additional Information

- To check the status of the electronic thermal function, use the Electronic Thermal Load Rate Monitor (d104). An overload trip (E05) error will occur if the value reaches approximately 100%.
- This inverter has the free-electronic thermal function. This function enables you to change the overload detection characteristics of the electronic thermal function according to the motor specifications, if they are not applicable to the overload characteristics of your motor.
  For details, refer to the Free-electronic Thermal Function section in *7-4 Detailed Functions (Group b)* on page 7-61.
- The electronic thermal function can output a warning signal before the inverter is stopped by an overload detection.
  The use of a warning signal is effective to reduce the system down time because it enables you to solve problems previously.
  For details, refer to the Electronic Thermal Function section in *7-5 Multi-function Terminal Functions (Group C)* on page 7-108 .

Electronic Thermal Characteristics

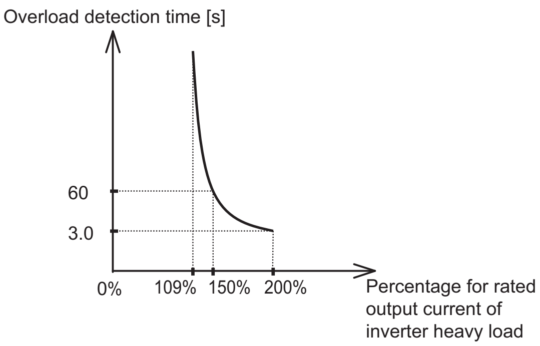
The electronic thermal function enables you to change the overload detection characteristics by setting the 1st/2nd/3rd Electronic Thermal Characteristics Selection (b013/b213/b313) according to the motor in use.

This section first describes the basic electronic thermal characteristics and then provides the details of individual detection characteristics.

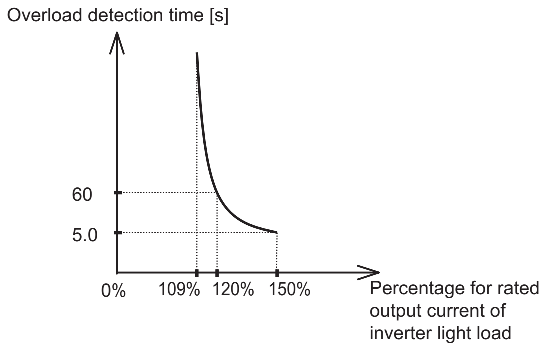
● Basic Characteristics

The electronic thermal characteristics differ between the heavy load mode and the light load mode. In addition, because the electronic thermal characteristics are different at 75 kW or higher, this inverter has four basic characteristics as follows.

Basic Characteristics in Heavy Load Mode

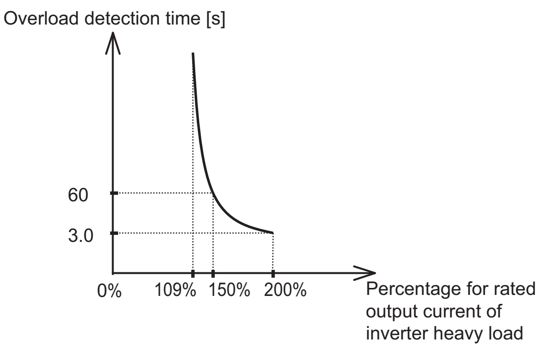


Basic Characteristics in Light Load Mode

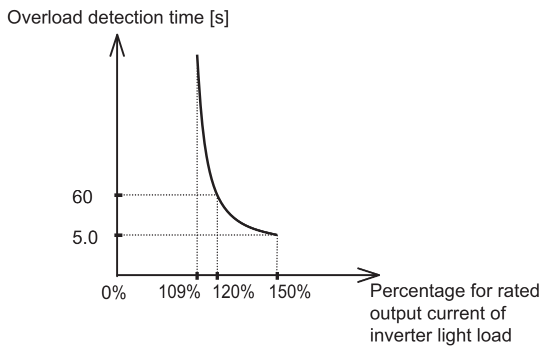


The basic electronic thermal characteristics of four different inverters (Model: 3G3RX-A4750-V1 to B413K-V1) are as follows.

Basic Characteristics in Heavy Load Mode



Basic Characteristics in Light Load Mode



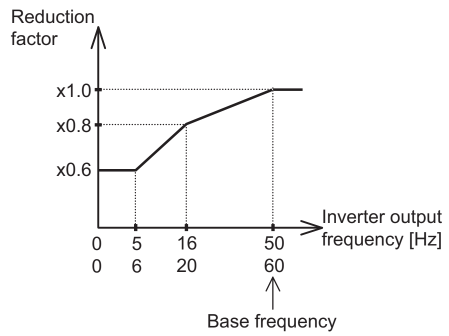
Reduced Torque Characteristics

Use the reduced torque characteristics setting for general-purpose (standard) motors.

In an air-cooled motor that uses the rear fan coupled directly to the motor shaft, the cooling effect degrades as the motor rotation speed decreases.

This characteristics setting enables overload detection that takes into account such degradation of the cooling effect at low speeds.

Reduction Factor Characteristics



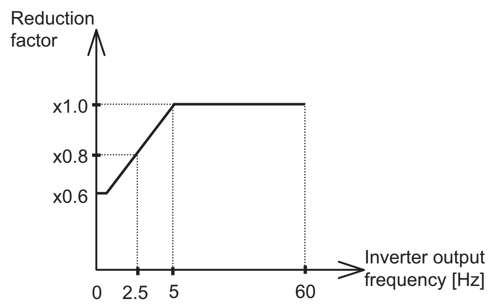
Constant Torque Characteristics

Use the reduced torque characteristics setting for dedicated inverter motors.

Dedicated inverter motors are designed to prevent degradation of the cooling effect that arises as the motor speed changes, except at 5 Hz or less.

For constant torque characteristics, the reduction factor is defined only for frequencies of 5 Hz or less.

Reduction Factor Characteristics

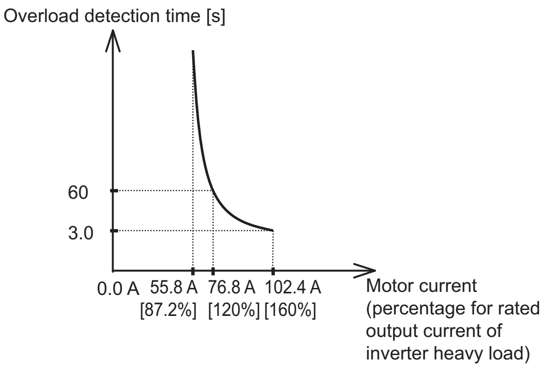


Examples of Actual Electronic Thermal Characteristics

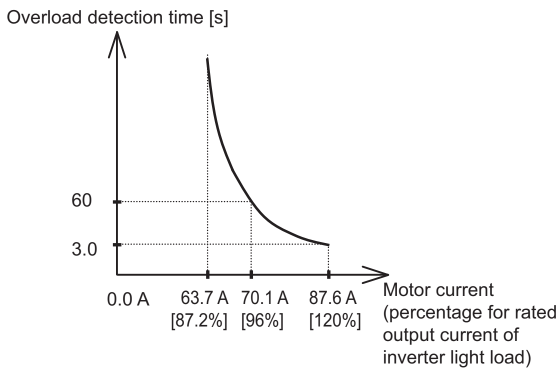
Electronic thermal characteristics are as shown in the graphs below under the following four conditions.

- The inverter (Model: G3RX-A2150-V1) is used. (Rated output current: 64 A in the heavy load mode, 73 A in the light load mode)
  1st Electronic Thermal Level (b012) is set to 64 A in the heavy load mode, and 73 A in the light load mode.
- 1st Electronic Thermal Characteristics Selection (b013) is set to 00 (Reduced torque characteristics).
- 1st Base Frequency (A003) is set to 60 Hz.
- While the output frequency is output at 20 Hz. (Reduction factor: x0.8)

Basic Characteristics in Heavy Load Mode



Basic Characteristics in Light Load Mode



Base Frequency and Maximum Frequency of Motor

For the configuration of the V/f control characteristics to output to the motor, set the base frequency and maximum frequency of your motor.

For the base frequency, set the rated frequency of the motor (the frequency put on the motor rating nameplate).

For the maximum frequency, set the highest frequency required for your application.

However, do not exceed the maximum rotation speed of the motor.

Parameter No.	Function name	Data	Default data	Unit
A003	1st Base Frequency	30. to 1st Maximum Frequency (A004)	60.	Hz
A203	2nd Base Frequency *1	30. to 2nd Maximum Frequency (A204)	60.	Hz
A303	3rd Base Frequency *1	30. to 3rd Maximum Frequency (A304)	60.	Hz
A004	1st Maximum Frequency	30. to 400.	60.	Hz
A204	2nd Maximum Frequency *1	30. to 400.	60.	Hz
A304	3rd Maximum Frequency *1	30. to 400.	60.	Hz

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

5-4 RUN Command Settings

5-4-1 RUN Command Selection

Select the input method for the RUN command.

Parameter No.	Function name	Data	Default data	Unit
A002	RUN Command Selection	01: Control circuit terminal block 02: Digital Operator (F001) 03: Modbus communication 04: Option 1 05: Option 2	02	–
Related functions		F004, C001 to C008, C019		

Below are the details of the parameter settings.

Data	RUN command source
01	Inputs the RUN command via the ON/OFF of the FW/RV signal allocated to the control circuit terminal block. It will be regarded as the STOP command if both the forward and reverse commands are input simultaneously.
02	Inputs the RUN command via the RUN key and the STOP/RESET key on the Digital Operator or LCD Digital Operator.
03	Inputs the RUN command via Modbus communication.
04	Inputs the RUN command via the option board mounted on the option port 1.
05	Inputs the RUN command via the option board mounted on the option port 2.

5-5 Frequency Reference Settings

5-5-1 Frequency Reference Selection

- Select the input method for the frequency reference.
- When the multi-step speed reference function is used (by setting the multi-function input terminals for the Multi-step Speed Reference 0 to 15), the value set in A001 is effective only for the Frequency Reference 0.
  The values set in the Frequency Reference 1 to 15 have priority over the value set in A001.

Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	00: Digital Operator (Volume adjuster) *1 01: Control circuit terminal block (Analog input) 02: Digital Operator (F001) 03: Modbus communication 04: Option 1 05: Option 2 06: Pulse train frequency 07: DriveProgramming 10: Operation function output	02	–
Related functions		A005, A141 to A143, A145, A146		

*1 This setting is enabled when the 3G3AX-OP01 is connected.

Below are the details of the parameter data.

Data	Frequency reference source
00	Sets the frequency reference via the volume adjuster on the external Digital Operator (3G3AX-OP01).
01	Sets the frequency reference via the control circuit terminal block (analog input signals). (FV-FC, FI-FC, FE-FC)
02	Sets the frequency reference via the Digital Operator or LCD Digital Operator. (Output Frequency Setting: F001)
03	Sets the frequency reference via Modbus communication.
04	Sets the frequency reference via the option board mounted on the option port 1.
05	Sets the frequency reference via the option board mounted on the option port 2.
06	Sets the frequency reference as a pulse train via the 3G3AX-PG01.*1
07	Sets the frequency reference via the DriveProgramming.*2
10	Sets the calculation result of the frequency operation function as the frequency reference.*3

*1 Refer to *6-2 Sensorless Vector Control* on page 6-4 .

*2 Refer to “DriveProgramming User’s Manual (I580)”.

*3 Refer to *Calculation Frequency Function* on page 7-59.

Precautions for Correct Use

The Output Frequency Setting/Monitor (F001) shows the frequency reference configured in the internal memory (RAM).

F001 displays the frequency reference value selected at that time.

If you change the frequency reference value displayed in F001 and save it (by pressing the Enter key), the data will be stored with the frequency reference selected at that time.

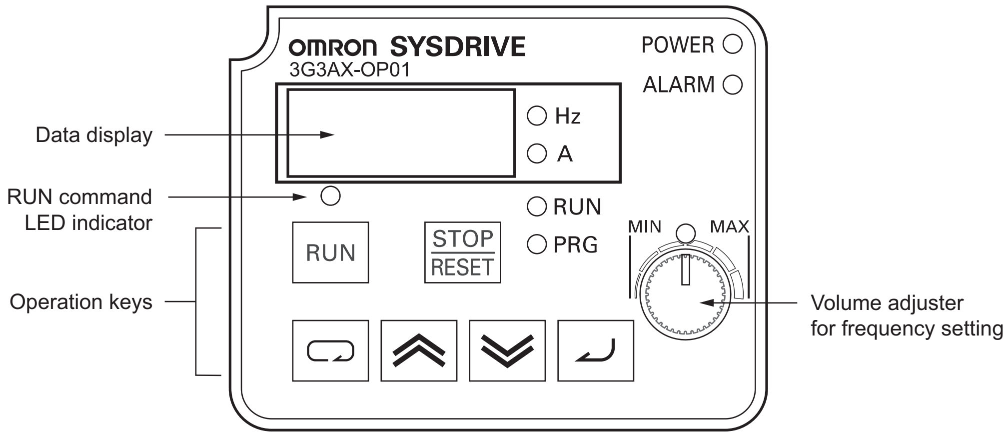
- For the frequency reference 0, the data will be stored with the 1st Multi-step Speed Reference 0 (A020)/2nd Multi-step Speed Reference 0 (A220)/3rd Multi-step Speed Reference 0 (A320) according to the 1st/2nd/3rd Control Method selection.
- For the multi-step speed reference 1 to 15, the data will be stored with the corresponding Multi-step Speed Reference 1 to 15 (A021 to A035).

* The frequency reference selection of Digital Operator (Volume adjuster), Control terminal block (Analog input), Modbus communication, Options, DriveProgramming, and Operation function output cannot be changed in F001.

The frequency reference methods that are used generally are shown below.

Using Digital Operator (Volume Adjuster)

Set the frequency reference via the volume adjuster for frequency setting on the Digital Operator (Model: 3G3AX-OP01).

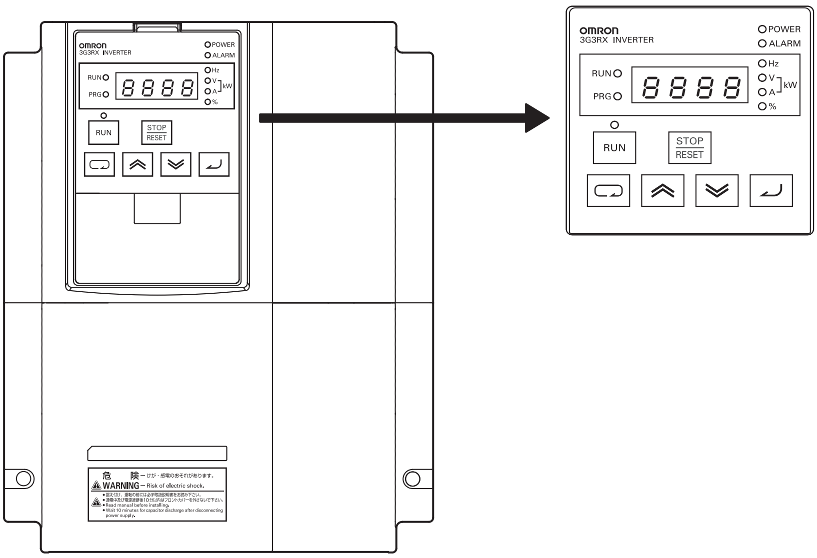


Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	00: Digital Operator (Volume adjuster) *1	02	–

*1 This setting is enabled when the 3G3AX-OP01 is connected.

Using Digital Operator

Set a frequency reference in the Output Frequency Setting/Monitor (F001) or 1st/2nd/3rd Multi-step Speed Reference 0 (A020/A220/A320) via the built-in digital operator or the optional LCD Digital Operator.



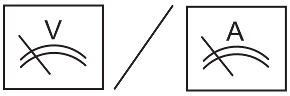
Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	02: Digital Operator (F001)	02	–

Using an Analog Voltage Input or Analog Current Input

To use an analog voltage input or analog current input to set the inverter frequency reference, set the parameters as follows.

This enables the frequency reference input (voltage reference) or frequency reference input (current directive) terminal.

If inputs are made to both the frequency reference input (voltage reference) and frequency reference input (current reference) terminals, the sum of the two analog input values will be set as the inverter frequency reference.



- Frequency reference input (Voltage reference), between terminal FV and FC: 0 to 10 VDC
- Frequency reference input (Current reference), between terminal FI and FC: 4 to 20 mA

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection *1	00: Switching between FV and FI via terminal AT	00	–
A006	FE Selection	03: FE disabled	03	–
C001 to C008	Multi-function Input S1 to S8 Selection	Do not set C001 to C008 to 16 (Terminal AT: Analog input switching).	–	–

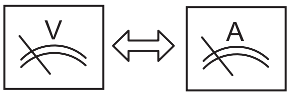
*1 If C001 to C008 is not set to 16 (AT), FV input and FI input reference values will be added according to the 01 to 03 setting.

Using an Analog Voltage Input or Analog Current Input by Switching

To switch between analog voltage and analog current inputs to set the frequency reference, set the parameters as follows.

This enables switching between the frequency reference input (voltage reference) and frequency reference input (current reference) terminals.

To switch between these analog input signals, use the terminal AT (Analog input switching) allocated to a multi-function input terminal.



- Frequency reference input (Voltage reference), between terminal FV and FC: 0 to 9.8 VDC
- Frequency reference input (Current reference), between terminal FI and FC: 4 to 19.8 mA

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection *1	00: Switching between FV and FI via terminal AT	00	–
A006	FE Selection	03: FE disabled	03	–
C001 to C008	Multi-function Input S1 to S8 Selection	16: Terminal AT (Analog input switching)	–	–

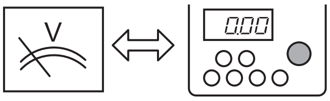
*1 When the terminal AT is ON, the frequency reference input (current reference) terminal is enabled.

Using Two Analog Voltage Inputs by Switching

To switch between two analog voltage inputs to set the frequency reference, set the parameters as follows.

This enables switching between the frequency reference input (voltage reference) terminal and auxiliary frequency reference input (voltag reference) terminal.

To switch between these analog input signals, use the terminal AT (Analog input switching) allocated to a multi-function input terminal.



- Frequency reference input (Voltage reference), between terminal FV and FC: 0 to 9.8 VDC
- Auxiliary frequency reference input (Voltage reference), between terminal FE and FC: –9.8 to 9.8 VDC

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection *1	01: Switching between FV and FE via terminal AT	00	–
A006	FE Selection	Select one of the following settings. 00: FE only 03: FE disabled	03	–
C001 to C008	Multi-function Input S1 to S8 Selection	16: Terminal AT (Analog input switching)	–	–

*1 When the terminal AT is ON, the auxiliary frequency reference input (voltage reference) terminal is enabled.

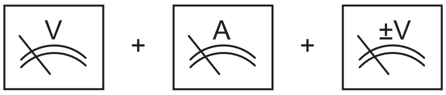
Using Sum of Multiple Analog Inputs

To use a sum of multiple analog inputs to set the frequency reference, set the parameters as follows.

This enables the sum of three analog inputs to the frequency reference input (voltage reference), frequency reference input (current reference), and auxiliary frequency reference input (Voltage reference) terminals to be set as the frequency reference inverter.

In the FE Selection (A006), set the operation to be performed if the sum of these three analog inputs is negative.

- 01: FV/FI auxiliary frequency reference (not reversible)
  The frequency is limited to 0 Hz, and the motor does not rotate in reverse direction to the RUN command.
- 02: FV/FI auxiliary frequency reference (reversible)
  The motor rotates in a reverse direction to the RUN command.



- Frequency reference input (Voltage reference), between terminal FV and FC: 0 to 9.8 VDC
- Frequency reference input (Current reference), between terminal FI and FC: 4 to 19.8 mA
- Auxiliary frequency reference input (Voltage reference), between terminal FE and FC: –9.8 to 9.8 VDC

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection*1	00: Switches between FV and FI via terminal AT	00	–
A006	FE Selection	01: FV/FI auxiliary frequency reference (Not reversible) 02: FV/FI auxiliary frequency reference (Reversible)	03	–
C001 to C008	Multi-function Input S1 to S8 Selection	Do not set C001 to C008 to 16 (Terminal AT: Analog input switching).	–	–

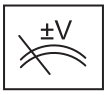
*1 If C001 to C008 is not set to 16 (AT), FV input and FI input reference values will be added according to the 01 to 03 setting.

Using a Positive/Negative Analog Voltage Input

To use a positive/negative analog voltage input to set the frequency reference of inverter, set the parameters as follows.

This enables inputs to the auxiliary frequency reference input (voltage reference) terminal only.

If a negative voltage is input to the auxiliary frequency reference input (voltage reference) terminal, the motor will rotate in a reverse direction to the RUN command.



- Auxiliary frequency reference input (Voltage reference), between terminal FE and FC: –9.8 to 9.8 VDC

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection *1	Ignores the set data in A005.	00	–
A006	FE Selection	00: FE only (Reversible)	03	–
C001 to C008	Multi-function Input S1 to S8 Selection	Do not set C001 to C008 to 16 (Terminal AT: Analog input switching).	–	–

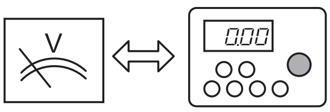
*1 If C001 to C008 is not set to 16 (AT), FV input and FI input reference values will be added according to the 01 to 03 setting.

Using an Analog Voltage Input or Volume Adjuster by Switching

To use an analog voltage input and the volume adjuster on the Digital Operator (Model: 3G3AX-OP01) to set the frequency reference, set the following parameters.

This enables switching between the frequency reference input (voltage reference) and the volume adjuster on the 3G3AX-OP01.

To switch the reference input, use the terminal AT (Analog input switching) allocated to a multi-function input terminal.



- Auxiliary frequency reference input (Voltage reference), between terminal FE and FC: –9.8 to 9.8 VDC
- Volume adjuster on Digital Operator (Model: 3G3AX-OP01)

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

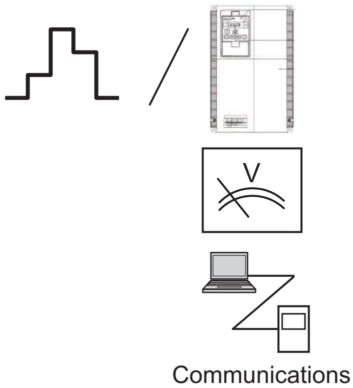
Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection	02: Switches between FV and volume adjuster via terminal AT (Enabled only when 3G3AX-OP01 is used)	00	–
A006	FE Selection	03: FE disabled	03	–
C001 to C008	Multi-function Input S1 to S8 Selection	16: Terminal AT (Analog input switching) *1	–	–

*1 When the terminal AT is ON, the volume adjuster on the 3G3AX-OP01 is enabled.

Using Multi-step Speed Reference

Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 02 to 05 or 21 to 38 (Multi-step speed) and turn ON that terminal. This enables the inverter to perform multi-step speed operation, independent of Frequency Reference Selection (A001) settings.

The frequency depends on the value set in the Multi-step Speed Reference 1 to 15 (A021 to A035). However, at the 0th speed where multi-step input signals are all OFF, the frequency depends on the Frequency Reference Selection (A001) setting.



Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	02: Digital Operator (F001) *1	02	–
A019	Multi-step Speed Selection	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	00	–
C001 to C008	Multi-function Input S1 to S8 Selection	02 to 05: CF1 to CF4 Binary 15-step	–	–
		32 to 38: SF1 to SF7 Bit 7-step		
A020	1st Multi-step Speed Reference 0 *1	0.00 Starting Frequency to 1st Maximum Frequency		
A220	2nd Multi-step Speed Reference 0 *2	0.00 Starting Frequency to 2nd Maximum Frequency	6.0	Hz
A320	3rd Multi-step Speed Reference 0 *2	0.00 Starting Frequency to 3rd Maximum Frequency		
A021 to A035	Multi-step Speed Reference 1 to Multi-step Speed Reference 15	0.00 Starting Frequency to 1st Maximum Frequency	0.0	Hz

*1. Only the frequency reference at the 0th speed depends on the Frequency Reference Selection (A001) setting.

*2. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input Terminal S1 to S8 Selection parameter (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

5-5-2 Frequency Limit

- Use this function to set the upper and lower limits of the output frequency. The set limits will be applied if the input frequency reference is beyond the upper/lower limit(s).
- Set the upper limit first. Be sure that the value set in the 1st/2nd Frequency Upper Limit (A061/A261) must be larger than the value set in the 1st/2nd Frequency Lower Limit (A062/A262).
- Set the upper and lower limit values so that they do not exceed the 1st/2nd/3rd Maximum Frequency (A004/A204/A304).
- Set the Output Frequency Setting/Monitor (F001) and the Multi-step Speed Reference 1 to 15 (A021 to A035) within the upper and lower limit settings.
- The upper/lower limit setting is disabled when 0 Hz is set.
- These functions are disabled when the 3rd control is selected.

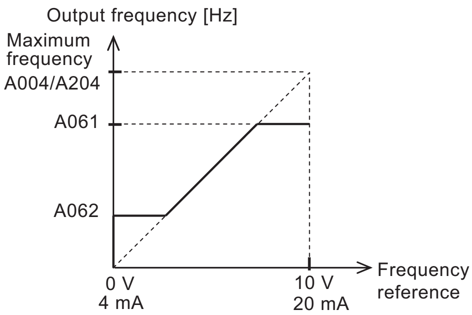
Parameter No.	Function name	Data	Default data	Unit
A061	1st Frequency Upper Limit	0.00: Disabled (Function not active) 1st Frequency Lower Limit to 1st Maximum Frequency	0.00	Hz
A261	2nd Frequency Upper Limit *1	0.00: Disabled (Function not active) 2nd Frequency Lower Limit to 2nd Maximum Frequency		
A062	1st Frequency Lower Limit	0.00: Disabled (Function not active) Starting Frequency to 1st Frequency Upper Limit		
A262	2nd Frequency Lower Limit *1	0.00: Disabled (Function not active) Starting Frequency to 2nd Frequency Upper Limit		
Related functions		C001 to C008		

*1. To enable the switching to the 2nd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) and turn ON that terminal.

When Using FV-FC, FI-FC

Setting the lower limit causes the inverter to output the frequency set in the 1st/2nd Frequency Lower Limit (A062/A262) when 0 V (4 mA) is input to the frequency reference.

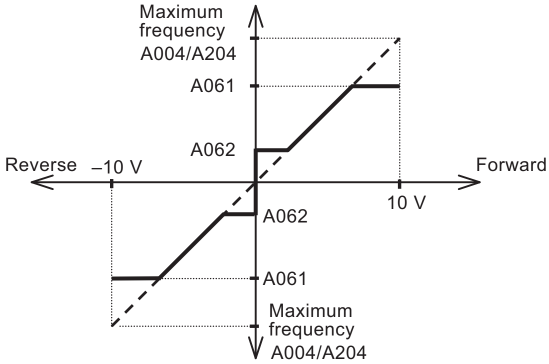
The graph below shows the FV/FI characteristics with the default analog input adjustment function settings (FV: A012 to A015, FI: A101 to A105).



When Using FE-FC

When an input is made to FE with the lower limit set, the rotation frequency at 0 V is fixed to the forward-side lower limit (A062/A262) or the reverse-side lower limit setting (A062/A262), as shown below.

The graph below shows the FE characteristics with the default analog adjustment function settings (FE: A111 to A114).



- RUN Command Selection (A002) = 01 (Control circuit terminal block)

Terminal	Rotation when FE = 0 V
FW (ON)	A062 (Forward side)
RV (ON)	A062 (Reverse side)

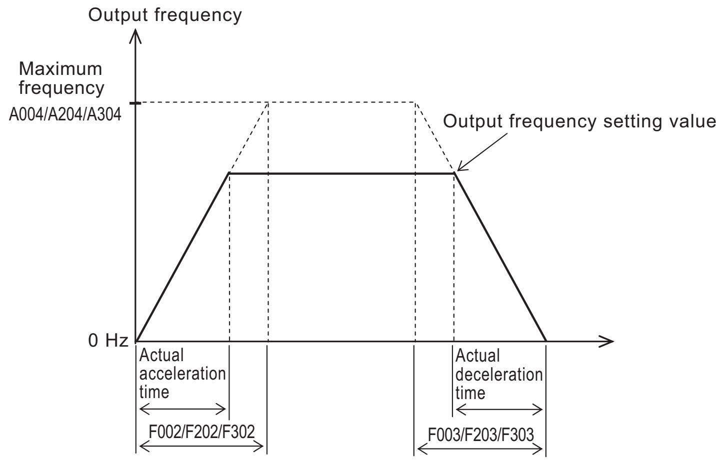
- RUN Command Selection (A002) = 02 (Digital Operator)

RUN Direction Selection (F004)	Rotation when FE = 0 V
00: Forward	A062 (Forward side)
01: Reverse	A062 (Reverse side)

5-6 Acceleration/Deceleration Time Settings

5-6-1 Acceleration/Deceleration Time Settings

- Set the motor acceleration/deceleration time. To accelerate/decelerate slowly, set a large value. To accelerate/decelerate quickly, set a small value.
- The set time here indicates the acceleration/deceleration time from 0 Hz to the maximum frequency. The actual acceleration/deceleration time varies depending on the frequency reference value.



- The acceleration/deceleration time settings will be ignored and the output frequency will instantaneously follow the reference frequency if you allocate the LAD cancel (LAC) function to one of the multi-function input terminals and turn ON the signal for that terminal.
- To enable the switching to the 1st/2nd/3rd Acceleration Time and to the 1st/2nd/3rd Deceleration Time, allocate one of the Multi-function Input S1 to S8 Selection to 08 (SET) or 17 (SET3) and turn ON that terminal. For multi-function input selection, refer to *Multi-function Input Selection* on page 7-108.
- The Acceleration/Deceleration Time Input Type (P031) sets the input type of the acceleration/deceleration type.
  Select 00 (Digital Operator) to input via an inverter parameter or 03 (DriveProgramming) to input via the DriveProgramming function. Note that 00 (Option 1) and 02 (Option 2) settings are disabled.
- The actual motor acceleration/deceleration time cannot be set shorter than the minimum acceleration/deceleration time, which is determined by the mechanical inertia moment and the motor torque. Setting a time shorter than the minimum acceleration/deceleration time may cause an overcurrent/overvoltage trip error.
- These acceleration/deceleration pattern settings are effective also for frequency reference input via analog input terminals.

Parameter No.	Function name	Data	Default data	Unit
F002	1st Acceleration Time 1	Acceleration time from 0 to maximum frequency 0.01 to 99.99 100.0 to 99.99 1000 to 3600	10.00 *2	s
F202	2nd Acceleration Time 1 *1			
F302	3rd Acceleration Time 1 *1			
F003	1st Deceleration Time 1	Deceleration time from maximum frequency to 0 0.01 to 99.99 100.0 to 99.99 1000 to 3600	10.00 *2	s
F203	2nd Deceleration Time 1 *1			
F303	3rd Deceleration Time 1 *1			
P031	Acceleration/Deceleration Time Input Type	00: Digital Operator 01: Option 1 02: Option 2 03: DriveProgramming	00	–
Related functions		A004, A204, A304, C001 to C008		

*1 To enable the switching to the 2nd Acceleration Time 1/3rd Acceleration Time 1 and to the 2nd Deceleration Time 1/3rd Deceleration Time 1, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2 The default data was changed from the previous model.

Additional Information

- If a short deceleration time is set, the amount of regeneration fed back during deceleration becomes large. If the amount of regeneration exceeds the amount allowable for the inverter, the deceleration time will be extended according to the Overvoltage Suppression Function Selection During Deceleration (b130) setting, or an overvoltage will occur. In such a case, use the regenerative braking function.
- For the regenerative braking function, refer to *5-12-2 Regenerative Braking Function* on page 5-70.

5-6-2 Acceleration/Deceleration Pattern

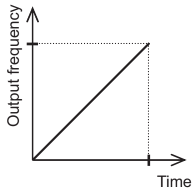
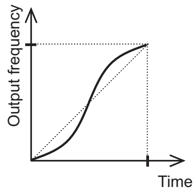
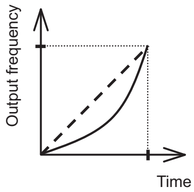
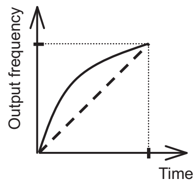
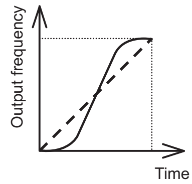
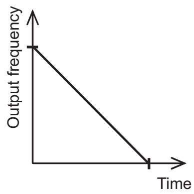
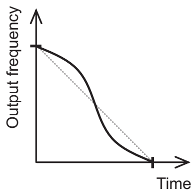
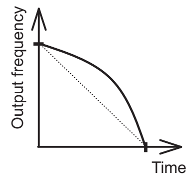
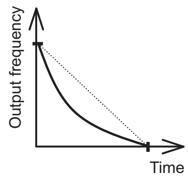
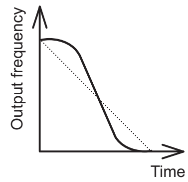
- Use this function to set the acceleration/deceleration pattern for each system.
- Select the acceleration and deceleration patterns in the Acceleration Pattern Selection (A097) and Deceleration Pattern Selection (A098), respectively.
- The acceleration pattern and the deceleration pattern can be set independently.
- These acceleration/deceleration pattern settings are effective also for frequency reference via analog input terminals.

<table>
<tr><th>Parameter No.</th><th>Function name</th><th>Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>A097</td><td>Acceleration Pattern Selection</td><td rowspan="2">00: Line
01: S-shape curve
02: U-shape curve
03: Inverted U-shape curve
04: EL-S-shape curve</td><td rowspan="2">01 *1</td><td rowspan="2">–</td></tr>
<tr><td>A098</td><td>Deceleration Pattern Selection</td></tr>
<tr><td>A131</td><td>Acceleration Curve Parameter</td><td rowspan="2">01 (Small curve) to 10 (Large curve)</td><td rowspan="2">02</td><td rowspan="2">–</td></tr>
<tr><td>A132</td><td>Deceleration Curve Parameter</td></tr>
<tr><td>A150</td><td>EL-S Shape Acceleration Curve Ratio 1</td><td rowspan="2">0. to 50.</td><td rowspan="2">10 *1</td><td rowspan="2">%</td></tr>
<tr><td>A151</td><td>EL-S Shape Acceleration Curve Ratio 2</td></tr>
<tr><td>A152</td><td>EL-S Shape Deceleration Curve Ratio 1</td><td rowspan="2">0. to 50.</td><td rowspan="2">10 *1</td><td rowspan="2">%</td></tr>
<tr><td>A153</td><td>EL-S Shape Deceleration Curve Ratio 2</td></tr>
</table>

*1.The default data was changed from the previous model.

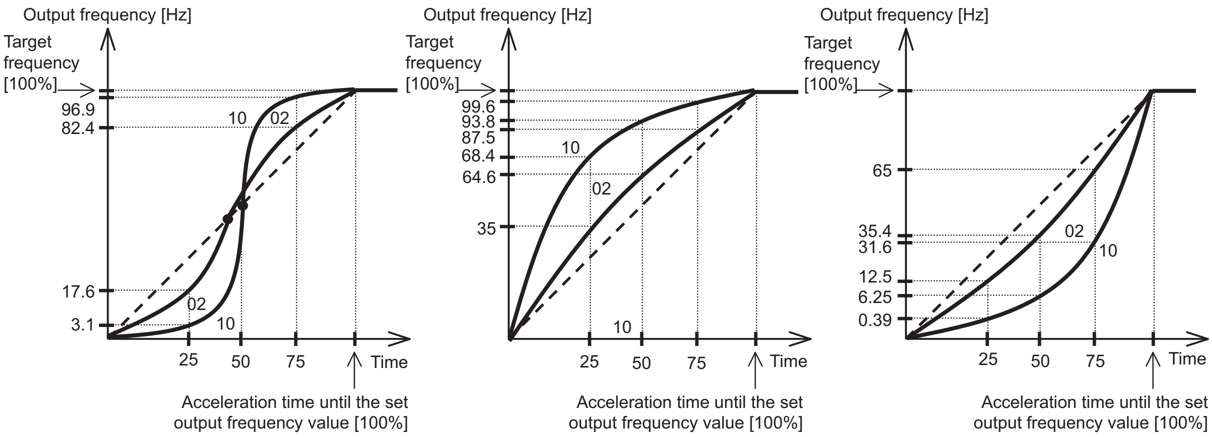
Pattern Selection

Select an acceleration/deceleration pattern with reference to the following table.

Parameter No.	Set value				
	00	**01**	**02**	**03**	**04**
	Line	**S shape**	**U shape**	**Inverted U shape**	**EL-S shape**
A097 (Acceleration)					
A098 (Deceleration)					
Description	The motor accelerates/ decelerates linearly until the set output frequency value is reached.	This pattern is effective to prevent the collapse of load on an elevator, conveyor, etc.	These patterns are effective for tension control and roll-break prevention applications for winding equipment etc.		Provides shockless start/stop as with the S shape, but the intermediate section is linear.

Pattern Curve Parameter (Curve Factor)

Use the following graphs to determine the curve factor.

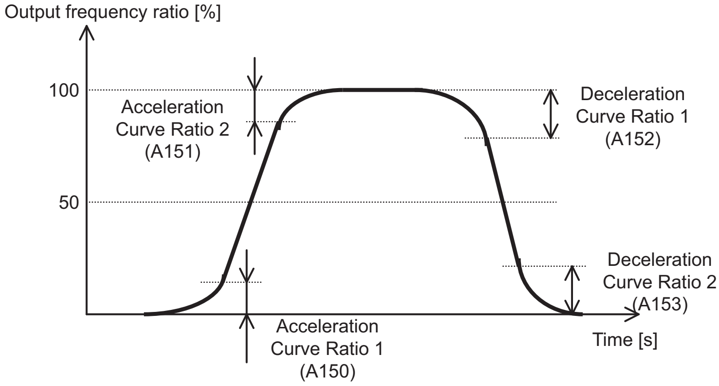


- The S-shape pattern has a portion where acceleration/deceleration time is faster in the middle of the curve.
- If the LAD cancel (LAC) function is allocated to a multi-function input terminal and that terminal turns ON, the acceleration/deceleration pattern is ignored and the output frequency follows the reference frequency instantaneously.

EL-S-shape Curve Ratio

With the EL-S-shape pattern, you can set the EL-S Shape Acceleration/Deceleration Curve Ratio parameters (A151 to A153) independently.

Setting all of these parameters to 50 [%] is equivalent to selecting the S-shape pattern.



5-6-3 Automatic Optimum Acceleration/Deceleration

- The automatic acceleration/deceleration function eliminates the need for acceleration/deceleration settings for inverter operation.
- To use this function, set the Operation Mode Selection (A085) to 02 (Automatic operation).
- Although, conventionally, the user had to set an inverter acceleration/deceleration time depending on the load conditions etc., this function can automatically adjust the acceleration/deceleration time to make full use of the inverter’s capacity.
- The acceleration time is the time during which the motor accelerates at the current value within the setting in the Overload Limit Level (b022) if the overload limit function is enabled, or at approximately 150% or less of the rated current of the inverter if the overload limit function is disabled, respectively. The deceleration time is the time during which the motor decelerates at a current value of approximately 150% or less, or at a DC current of approximately 370 V or less (for 200-V class) or at approximately 740 V or less (for 400-V class) in the inverter.
  Thus, the function automatically sets the acceleration/deceleration time by responding in real time to changes in the load and inertia.

Parameter No.	Function name	Data		Default data	Unit
A085	Operation Mode Selection	Heavy load (CT)	00: Normal operation 01: Energy-saving operation 02: Automatic operation	00	–
		Light load (VT)	00: Normal operation 01: Energy-saving operation		
Related functions		A044, A244, A344, b021, b024, b022, b025			

Precautions for Correct Use

- This function is not intended for machines that require a constant acceleration/deceleration time. The acceleration/deceleration time changes based on the size of the load and inertia.
- If the inertia of the machine is more than approximately 20 times that of the motor shaft, a trip error may occur. In this case, deal with the trip error instead of using the automatic optimum acceleration/deceleration function.
- The automatic optimum acceleration/deceleration setting is enabled in the V/f control mode only. In other words, the inverter performs normal operation in other operation modes.
- When the automatic operation mode is selected, jogging operation will be performed with automatic acceleration enabled, which is different from normal jogging operation.
- Repeating the automatic optimum acceleration/deceleration function frequently may cause overloading because the motor is accelerated/decelerated at 150% of the rated current of the inverter.
- When the internal braking circuit or an external regenerative braking unit is used separately, the motor cannot decelerate based on the internal DC voltage. In this case, do not use the automatic optimum acceleration/deceleration function.
- When using a smaller motor in capacity than the inverter, set the Overload Limit Selection (b021) to Enabled and the Overload Limit Level (b022) to 150% of the rated current of the motor.

5-6-4 2-step Acceleration/Deceleration Function

- Use this function to switch between two acceleration/deceleration time settings or change the acceleration/deceleration time on the way during acceleration/deceleration.
- The acceleration/deceleration time switching method can be selected from the following three.
  - Switching via a multi-function input
  - Automatic switching at a specified frequency
  - Automatic switching via forward/reverse switching

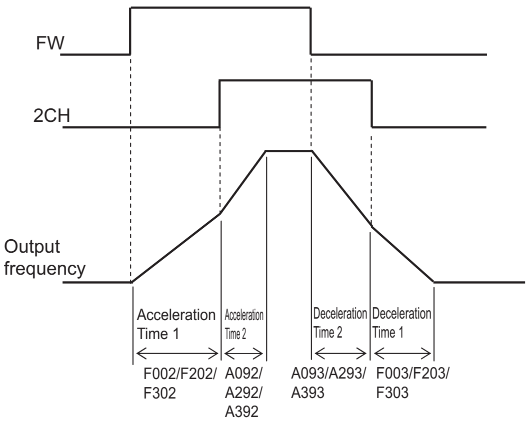
  Note that, automatic switching to 2-step acceleration/deceleration is disabled when the 3rd control function is selected.
- To switch via a multi-function input terminal, set one of C001 to C008 to 09 (2CH).

Parameter No.	Function name	Data	Default data	Unit
A092	1st Acceleration Time 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 *2	s
A292	2nd Acceleration Time 2 *1			
A392	3rd Acceleration Time 2 * 1			
A093	1st Deceleration Time 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 *2	s
A293	2nd Deceleration Time 2 *1			
A393	3rd Deceleration Time 2 *1			
A094	1st 2-step Acceleration/Deceleration Selection	00: Switched via 2CH terminal (multi-function input set to 09) (Example 1) 01: Switched via setting (Example 2) 02: Switched only during forward/reverse switching (Example 3)	00	–
A294	2nd 2-step Acceleration/Deceleration Selection *1			
A095	1st 2-step Acceleration Frequency	0.00 to 99.99	0.00	Hz
A295	2nd 2-step Acceleration Frequency *1	100.0 to 400.0		
A096	1st 2-step Deceleration Frequency	0.00 to 99.99	0.00	Hz
A296	2nd 2-step Deceleration Frequency *1	100.0 to 400.0		
Related functions		F002, F202, F302, F003, F203, F303, C001 to C008		

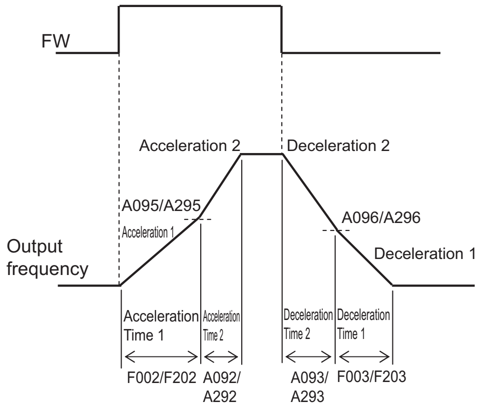
*1 To enable the switching to the 2nd Acceleration Time 1/3rd Acceleration Time 1 and to the 2nd Deceleration Time 1/3rd Deceleration Time 1, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2 The default data was changed from the previous model.

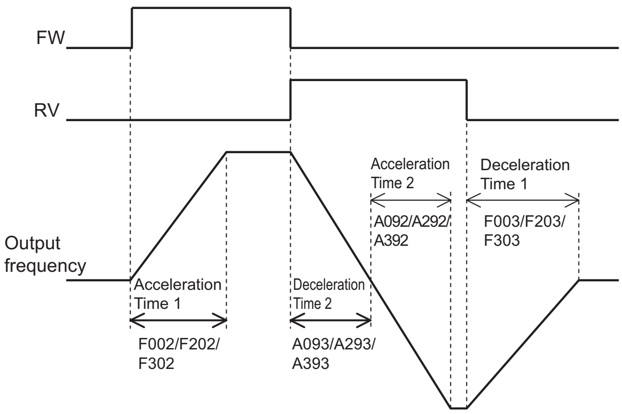
(Example 1) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 00 (Switched by 2CH terminal)



(Example 2) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 01 (Switched by setting)



(Example 3) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 02 (Switched only during forward/reverse switching)



5-7 Stop Method Settings

5-7-1 Stop Selection

- Select whether the motor is stopped by a deceleration stop according to the deceleration time setting or a free-run stop, when the STOP command is input via the Digital Operator or the control circuit terminal block.
- If the RUN command is input again during free run, the inverter will restart according to the Free-run Stop Selection (b088) setting.

Parameter No.	Function name	Data	Default data	Unit
b091	Stop Selection	00: Deceleration stop 01: Free-run stop	00	–

5-7-2 Free-run Stop Selection

- Free-run stop is a method of shutting off the inverter output to stop the motor rotation.
  Executing the free-run stop function causes the motor to fall a free-run state, in which it decelerates due to the load and friction forces exerted on the motor and/or machine and comes to a stop.
- In the Free-run Stop Selection (b088), set how to restart the motor rotating in a free-run state after the execution of the free-run stop.
- The Free-run Stop Selection (b088) setting is enabled for the following cases.

  When Stop Selection (b091) is set to 01 (Free-run stop)

  Restarting the motor in a free-run stop state when the When Stop Selection (b091) is set to 01 (Free-run stop) causes the motor to restart according to the Free-run Stop Selection (b088) setting.

  When free-run stop (FRS) function is used via a multi-function input terminal

  Setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 11 (FRS) and turning ON the corresponding input terminal causes the motor to fall in a free-run stop state (with the inverter output shut off).
  Then, when the FRS terminal turns OFF, the motor restarts according to the Free-run Stop Selection (b088) setting.
  However, the motor does not restart when the RUN Command Selection (A002) is set to 02 (Digital Operator).
- Set the Free-run Stop Selection (b088) as follows.

  00: 0-Hz restart

  Forces the inverter to restart at 0 Hz. Note that the inverter restarts suddenly while in a free-run state. Use this setting if the motor stops shortly due to the load.

  01: Frequency matching restart

  Causes the inverter to restart by recognizing the frequency from the voltage between the motor terminals during free-run stop and adjusting to it. The inverter restarts at 0 Hz if it cannot fully recognize the voltage between the motor terminals.

  Use this setting if the inverter is in a free-run stop for a few seconds.

  02: Frequency pull-in restart

  Causes the inverter to restart by outputting the starting frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030) to the motor in a free-run stop state and re-accelerating when the Frequency Pull-in Restart Level (b028) is reached.

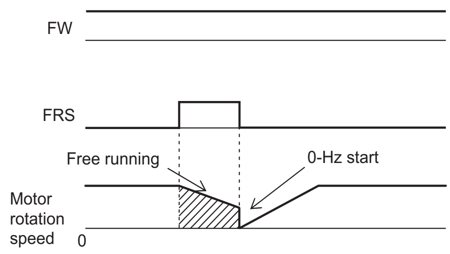
This enables a smooth restart independent of the voltage between motor terminals.

Use this setting when the inverter is in free-run state for a long time due to a large load inertia.

- When the Frequency Matching Lower Limit Frequency (b007) is set, executing the frequency pull-in restart function causes the inverter to restart at 0 Hz if the set frequency or less is detected.
- Immediately after a free-run stop, a large residual voltage remains between motor terminals. If the inverter restarts the output, an overcurrent may occur. To circumvent this, set the Restart Standby Time (b003) to a large value (at least 0.3 s).
- While in a free-run stop state, the motor is not subject to external influence because the inverter output is shut off.
  Even if the motor is stopped by an external brake or the effect of other equipment, the inverter can still be used without detecting any overcurrent.
  However, if the motor in a free-run state is rotated externally, the regenerated energy may be fed back to the inverter. In this case, use the regenerative braking function.
- The examples below assume that you are using the FRS terminal.
  Consider that, when the motor is in a free-run stop state, restarting of the inverter occurs in the same timing as when the FRS terminal turns OFF.

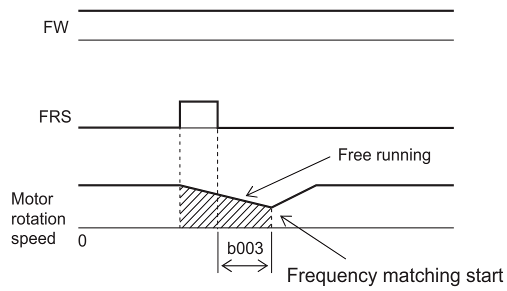
<table>
<tr><th>Parameter No.</th><th>Function name</th><th colspan="2">Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>b088</td><td>Free-run Stop Selection</td><td colspan="2">00: 0-Hz restart
01: Frequency matching restart
02: Frequency pull-in restart</td><td>00</td><td>–</td></tr>
<tr><td>b003</td><td>Restart Standby Time</td><td colspan="2">0.3 to 100.0</td><td>1.0</td><td>s</td></tr>
<tr><td>b007</td><td>Frequency Matching Lower Limit Frequency</td><td colspan="2">0.00 to 99.99
100.0 to 400.0</td><td>0.00</td><td>Hz</td></tr>
<tr><td rowspan="3">b028</td><td rowspan="3">Frequency Pull-in Restart Level</td><td rowspan="2">Heavy load (CT)</td><td>0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)</td><td rowspan="3">Rated current value</td><td rowspan="3">A</td></tr>
<tr><td>0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)</td></tr>
<tr><td>Light load (VT)</td><td>0.20 x Rated current to 1.50 x Rated current</td></tr>
<tr><td>b029</td><td>Frequency Pull-in Restart Parameter</td><td colspan="2">0.10 to 30.00</td><td>0.50</td><td>s</td></tr>
<tr><td>b030</td><td>Starting Frequency Selection at Frequency Pull-in Restart</td><td colspan="2">00: Frequency at shutoff
01: Max. frequency
02: Set frequency</td><td>00</td><td>–</td></tr>
</table>

(Example 1) 0-Hz restart (b088 = 00)



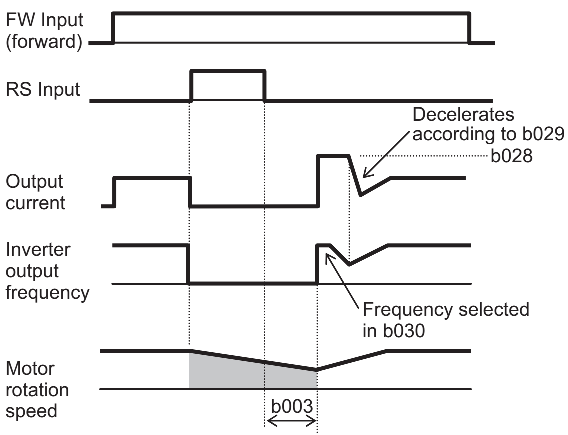
- The inverter restarts at 0 Hz independent of the motor rotation speed. The restart standby time setting will be ignored during 0-Hz restart.
- If the inverter starts at 0 Hz at a high motor rotation speed, an overcurrent trip may occur.

(Example 2) Frequency matching start (b088 = 01)



- When the restart standby time elapses after the FRS terminal is turned OFF, the inverter pulls in the motor frequency to execute the frequency matching restart function without stopping the motor rotation. If an overcurrent trip occurs during a frequency matching restart, increase the restart standby time.
- Even when the Free-run Stop Selection is set to 01 (Frequency matching start), the inverter may restart at 0 Hz in the following cases.
  - The output frequency is equal to or lower than 1/2 of the base frequency.
  - The motor induction voltage decays quickly.
  - The inverter recognizes that the detected frequency is equal to or less than the value set in the Frequency Matching Lower Limit Frequency (b007).

(Example 3) Frequency pull-in restart (b088 = 02)



- When the set Restart Standby Time (b003) elapses, the inverter starts output at the frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030). Then, the inverter decelerates the motor according to the Frequency Pull-in Restart Parameter (b029) setting, while suppressing the output current to the value set in the Frequency Pull-in Restart Level (b028).
- When the current decreases to or below the Frequency Pull-in Restart Level (b028), the inverter accelerates the motor again to return to the original frequency.
- If an overcurrent trip occurs with this method, reduce the Frequency Pull-in Restart Level (b028).

5-7-3 STOP Key Selection

- Enable/disable the STOP/RESET key on the Digital Operator or LCD Digital Operator.
- This setting is enabled when the RUN Command Selection (A002) is not set to 02 (Digital Operator). However, when the RUN Command Selection (A002) is set to 02 (Digital Operator), the STOP/RESET key is enabled independent of this setting.

Parameter No.	Function name	Data	Default data	Unit
b087	STOP Key Selection	00: Enabled 01: Disabled 02: Only RESET enabled	00	–

Data	STOP command via STOP/RESET key on Digital Operator	Trip reset via STOP/RESET key on Digital Operator
00	Enabled	Enabled
01	Disabled	Disabled
02	Disabled	Enabled

Precautions for Safe Use

The STOP/RESET key on the Digital Operator or LCD Digital Operator is enabled only when the STOP Key Selection parameter is set to Enabled.

Be sure to provide a separate emergency stop switch.

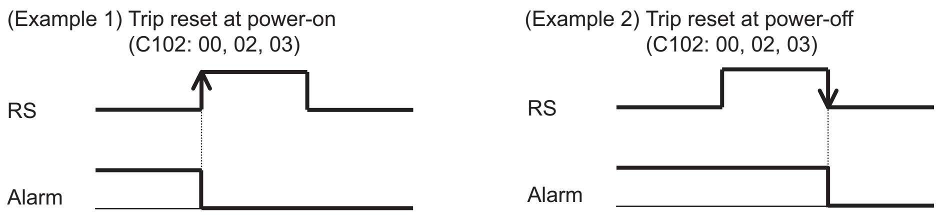
5-8 Reset Method Settings

5-8-1 Reset

- Use the reset function to reset the trip status of the inverter. This function is used also when the inverter operates normally to shut off the inverter output.
  To disable the reset function when the inverter operates normally, set the Reset Selection (C102) to 02 (Enabled only during trip) or 03 (Trip reset only).
- If the reset signal is input to the inverter, calculated electronic thermal function data, calculated regenerative braking usage rate data, multi-function pulse counter/current position counter data, and internal counter data used for the Teaching Selection (P074) and protective function are cleared. To prevent these data from being cleared, set the Reset Selection (C102) to 03 (Trip reset only).
- Setting the STOP Key Selection (b087) to 00 (Enabled) or 02 (Only RESET enabled) enables the input of the reset signal via the STOP/RESET key on the Digital Operator.
- To input the reset signal via the control circuit terminal block, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 18 (RS: Reset).
- The terminal RS (Reset) only supports NO (normally open contact) as the input method. The Multi-function Input S1 to S8 Operation Selection (C011 to C018) cannot be set to 01 (NC: Normally closed contact). Be sure to set the NO contact.
  In addition, selecting the Reset Selection (C102) is set to 02 (Trip reset at power-off) enables the reset function to be activated at the falling edge of the signal.
- In the Reset Restart Selection (C103), select the restart method after reset is executed.
  However, when the Reset Selection (C102) is set to 03 (Trip reset only), or when the Reset Restart Selection (C103) is set to 00 (0-Hz restart), the inverter does not restart.

Parameter No.	Function name	Data	Default data	Unit
C102	Reset Selection	00: Trip reset at power-on (Example 1) 01: Trip reset at power-off (Example 2) 02: Enabled only during trip (Reset at power-on) (Example 1) 03: Trip reset only (Example 1)	02 *1	–
C103	Reset Restart Selection	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00	–

*1. The default data was changed from the previous model.



Precautions for Correct Use

The reset function clears calculated electronic thermal function data, calculated regenerative braking usage rate data, and other data.

Therefore, if the reset function is often used, the motor overload protection and braking resistor overheat protection cannot be performed properly.

If you need to execute the reset function more than once, provide a few minutes of interval between each execution.

To shut off the inverter output, use the free-run stop function, instead of the reset function.

5-8-2 Restart after Resetting

- In the Reset Restart Selection (C103), select the restart method after trip reset is executed.
- To reset via the control circuit terminal block, set the Multi-function Input S1 to S8 Selection (C008) to 18 (RS: Reset).
- After the reset signal is input and the motor falls in a free-run state, a large residual voltage remains between motor terminals.
  If the inverter restarts the output, an overcurrent may occur.
  To circumvent this, set the Restart Standby Time (b003) to a large value (at least 0.3 s).

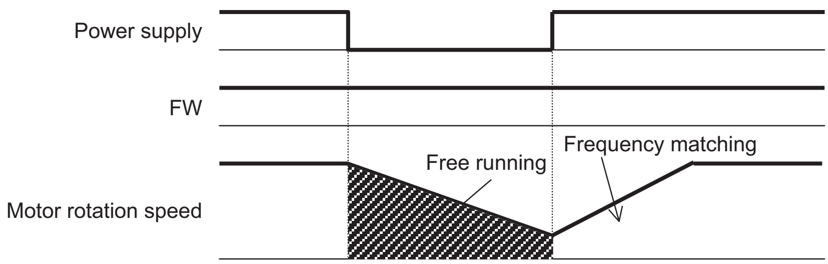
<table>
<tr><th>Parameter No.</th><th>Function name</th><th colspan="2">Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>b003</td><td>Restart Standby Time</td><td colspan="2">0.3 to 100.0</td><td>1.0</td><td>s</td></tr>
<tr><td>b007</td><td>Frequency Matching Lower Limit Frequency</td><td colspan="2">0.00 to 99.99
100.0 to 400.0</td><td>0.00</td><td>Hz</td></tr>
<tr><td rowspan="3">b028</td><td rowspan="3">Frequency Pull-in Restart Level</td><td rowspan="2">Heavy load (CT)</td><td>0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)</td><td rowspan="3">Rated current value</td><td rowspan="3">A</td></tr>
<tr><td>0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)</td></tr>
<tr><td>Light load (VT)</td><td>0.20 x Rated current to 1.50 x Rated current</td></tr>
<tr><td>b029</td><td>Frequency Pull-in Restart Parameter</td><td colspan="2">0.10 to 30.00</td><td>0.50</td><td>s</td></tr>
<tr><td>b030</td><td>Starting Frequency Selection at Frequency Pull-in Restart</td><td colspan="2">00: Frequency at shutoff
01: Max. frequency
02: Set frequency</td><td>00</td><td>–</td></tr>
<tr><td>C103</td><td>Reset Restart Selection</td><td colspan="2">00: 0-Hz restart
01: Frequency matching restart (Example 1)
02: Frequency pull-in restart (Example 2)</td><td>00</td><td>–</td></tr>
</table>

(Example 1) Frequency matching restart

Setting Reset Restart Selection (C103) to 01 (Frequency matching restart) causes the inverter to perform frequency matching restart also after the power supply is turned off and then on again.

Also, when it is set to 00 (0-Hz restart), the Restart Standby Time (b003) will be ignored. However, even when the Setting Reset Restart Selection is set to 01 (Frequency matching start), the inverter may restart at 0 Hz in the following cases.

- The output frequency is equal to or lower than 1/2 of the base frequency.
- The motor induction voltage decreases quickly.
- The inverter recognizes that the detected frequency is equal to or less than the value set in the Frequency Matching Lower Limit Frequency (b007).



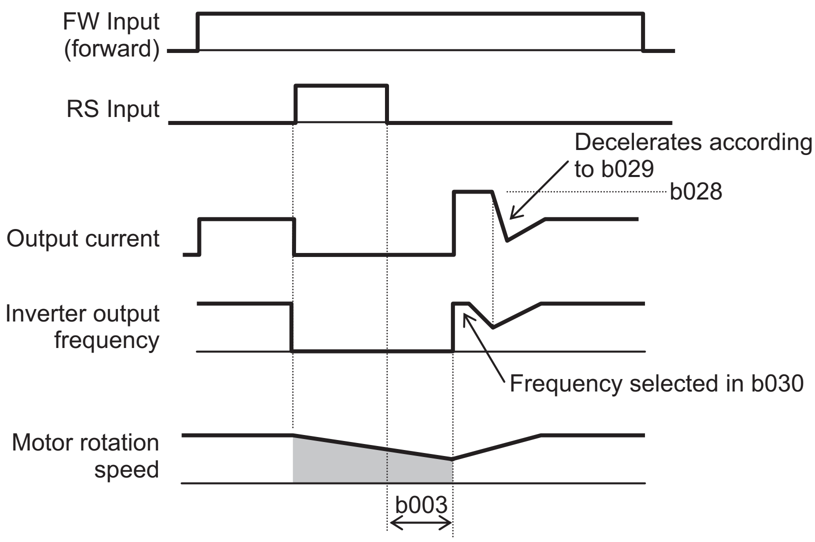
(Example 2) Frequency pull-in restart

When the set Restart Standby Time (b003) elapses, the inverter starts output at the frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030).

Then, the inverter decelerates the motor according to the Frequency Pull-in Restart Parameter (b029) setting, while suppressing the output current to the value set in the Frequency Pull-in Restart Level (b028).

When the current decreases to or below the Frequency Pull-in Restart Level (b028), the inverter accelerates the motor again to return to the original frequency.

If this method causes an overcurrent trip, decrease the value set in the Frequency Pull-in Restart Level (b028).



Additional Information

- If the reset signal is input during the restart standby time, the frequency at shutoff value stored in the inverter will be cleared, resulting in a 0-Hz start.
- The details of the Starting Frequency Selection at Frequency Pull-in Restart (b030) are shown below.

Set value	Description	Explanation
00	Frequency at shutoff	Executes pull-in restart at frequency at which inverter output is shut off.
01	Maximum frequency	Executes pull-in restart at maximum frequency.
02	Set frequency	Executes pull-in restart at reference frequency at which inverter operates normally.

5-9 Multi-function Input Settings

5-9-1 Multi-function Input Selection

- You can allocate any of the following functions to the multi-function input terminals S1 to S8 to use them.
  To do so, set the Multi-function Input S1 to S8 Selection (C001 to C008) according to the table below.
- Do not allocate the same function to more than one multi-function input terminal. If you allocate the same function to two or more multi-function input terminals by mistake, the function will be set only for the terminal to which you allocated the function last and the terminal to which the function is allocated previously will be reset to 255 (no: No allocation).
- This section describes seven types of primary functions. For other functions, refer to *7-5 Multi-function Terminal Functions (Group C)* on page 7-108.

Parameter No.	Data	Function name	Reference item	Page
Multi-function Input S1 to S8 Selection (C001 to C008)	01	RV: Reverse	Reverse run command	5-52
	02	CF1: Multi-step speed setting binary 1	Multi-step speed operation function	5-53
	03	CF2: Multi-step speed setting binary 2		
	04	CF3: Multi-step speed setting binary 3		
	05	CF4: Multi-step speed setting binary 4		
	06	JG: Jogging	Jogging operation function	5-56
	09	2CH: 2-step acceleration/deceleration	2-step acceleration/deceleration function	5-57
	18	RS: Reset	Reset	5-57
	20	STA: 3-wire start	3-wire input function	5-58
	21	STP: 3-wire stop		
	22	F/R: 3-wire forward/reverse		
	32	SF1: Multi-step speed setting bit 1	Multi-step speed operation function	5-53
	33	SF2: Multi-step speed setting bit 2		
	34	SF3: Multi-step speed setting bit 3		
	35	SF4: Multi-step speed setting bit 4		
	36	SF5: Multi-step speed setting bit 5		
	37	SF6: Multi-step speed setting bit 6		
	38	SF7: Multi-step speed setting bit 7		

5-9-2 Multi-function Input Operation Selection

The multi-function input terminals can be set to either NO (Normally open contact) or NC (Normally closed contact) individually.

Parameter No.	Function name	Data	Default data	Unit
C011	Multi-function Input S1 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact) • Each multi-function input terminal S1 to S8 and the terminal FW can be set individually to either an NO (Normally open contact) or NC (Normally closed contact) input terminal. *1 • The terminal allocated to 18 (RS: Reset) cannot be set to NC contact. Be sure to set NO contact.	00	–
C012	Multi-function Input S2 Operation Selection			
C013	Multi-function Input S3 Operation Selection			
C014	Multi-function Input S4 Operation Selection			
C015	Multi-function Input S5 Operation Selection			
C016	Multi-function Input S6 Operation Selection			
C017	Multi-function Input S7 Operation Selection			
C018	Multi-function Input S8 Operation Selection			
C019	Forward RUN Command FW Operation Selection		00	–
Related functions		C001 to C008		

*1 NO contact: ON when closed, OFF when open
NC contact: ON when open, OFF when closed

5-9-3 Input Terminal Response Time

- Set the response time for each multi-function input S1 to S8 terminal and the forward RUN command terminal FW independently.
  This function is effective for removing noise caused by chattering etc.
- If the terminal input becomes unstable because of chattering, increase the set value.
  However, increasing the set value results in a slow response. The setting range is 0 to 200, which provides a response time of approximately 2 to 400 ms.

Parameter No.	Function name	Data	Default data	Unit
C160 to C167	Multi-function Input S1 to S8 Response Time	0. to 200. (x 2 ms) *1	1	ms
C168	Forward RUN Command FW Response Time			

*1 When 0 is set, the response time is 2 ms.

5-9-4 Reverse Command (RV)

To execute the reverse command, set the Multi-function Input S1 to S8 Selection (C008) to 01 (RV).
To execute the RUN command via the control circuit terminal block, set the RUN Command Selection (A002) to 01 (Control circuit terminal block).

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	01: RV (Reverse)	–	–

5-9-5 Multi-step Speed Operation Function

- Use this function to switch the frequency reference set in the Multi-step Speed Reference 0 to 15 based on the combination of inputs to multi-function input terminals.
- For multi-step speed operation, you can select either 4-terminal binary operation (in 16 steps maximum) or 7-terminal bit operation (in 8 steps maximum).

Parameter No.	Function name	Data	Default data	Unit
A019	Multi-step Speed Selection	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	00	–
A020	1st Multi-step Speed Reference 0	0.00 Starting Frequency (b082) to 1st Maximum Frequency (A004)	6.0	Hz
A220	2nd Multi-step Speed Reference 0 *1	0.00 Starting Frequency (b082) to 2nd Maximum Frequency (A204)		
A320	3rd Multi-step Speed Reference 0 *1	0.00 Starting Frequency (b082) to 3rd Maximum Frequency (A304)		
A021	Multi-step Speed Reference 1	0.00 Starting Frequency (b082) to 1st/2nd/3rd Maximum Frequency (A004/204/304)	0.0	
A022	Multi-step Speed Reference 2			
A023	Multi-step Speed Reference 3			
A024	Multi-step Speed Reference 4			
A025	Multi-step Speed Reference 5			
A026	Multi-step Speed Reference 6			
A027	Multi-step Speed Reference 7			
A028	Multi-step Speed Reference 8			
A029	Multi-step Speed Reference 9			
A030	Multi-step Speed Reference 10			
A031	Multi-step Speed Reference 11			
A032	Multi-step Speed Reference 12			
A033	Multi-step Speed Reference 13			
A034	Multi-step Speed Reference 14			
A035	Multi-step Speed Reference 15			

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

Precautions for Correct Use

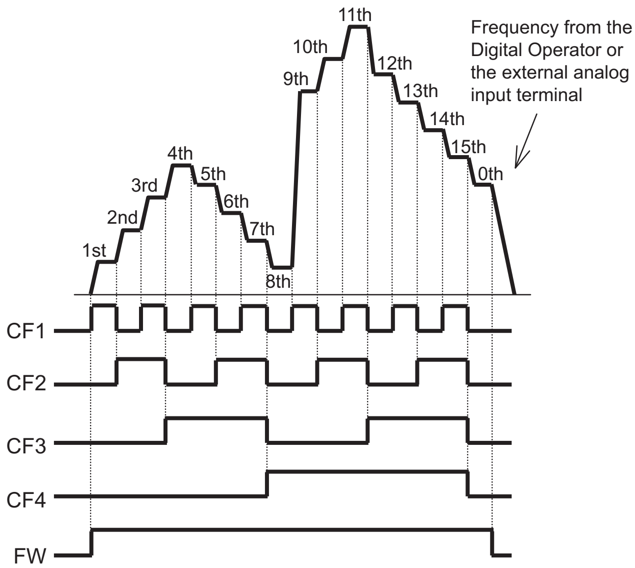
For the Multi-step Speed Reference 0, set the Frequency Reference Selection (A001). To enable the 1st/2nd/3rd frequency reference 0 setting, set A001 to 02 (Digital Operator: F001).

Binary Operation

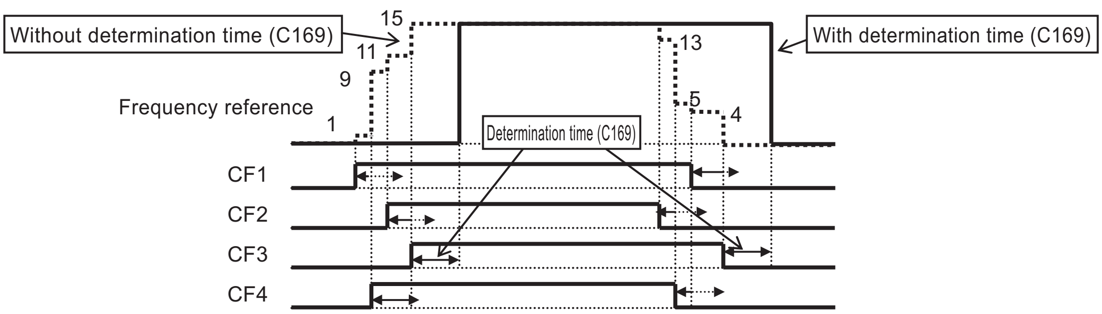
- Setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 02 (CF1) to 05 (CF4) enables the selection of the Multi-step Speed Reference 0 to 15.
- Use the Multi-step Speed Reference 1 to 15 (A021 to A035) to set the frequency for the 1st to 15th multi-step speeds.
- For the Multi-step Speed Reference 0, set the Frequency Reference Selection (A001).
  To enable the 1st/2nd/3rd frequency reference 0 setting, set A001 to 02 (Digital Operator: F001).
  If this parameter is set to 01 (Control circuit terminal block: Analog input), the frequency reference for the Multi-step Speed Reference 0 is set via analog input.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	02: CF1 (Multi-step speed setting binary 1)	–	–
		03: CF2 (Multi-step speed setting binary 2)	–	–
		04: CF3 (Multi-step speed setting binary 3)	–	–
		05: CF4 (Multi-step speed setting binary 4)	–	–

Multi-step speed	CF4	CF3	CF2	CF1
0th	OFF	OFF	OFF	OFF
1st				ON
2nd			ON	OFF
3rd				ON
4th		ON	OFF	OFF
5th				ON
6th			ON	OFF
7th				ON
8th	ON	OFF	OFF	OFF
9th				ON
10th			ON	OFF
11th				ON
12th		ON	OFF	OFF
13th				ON
14th			ON	OFF
15th				ON



- For multi-step speed binary operation, the wait time until the inverter recognizes terminal input can be set in the Multi-step Speed/Position Determination Time (C169). This prevents the transitional status before terminal input is recognized from being accepted.
- Input data will be determined if it remains unchanged for the time set in the Multi-step Speed/Position Determination Time (C169). Note that setting a long determination time results in a slow input response.



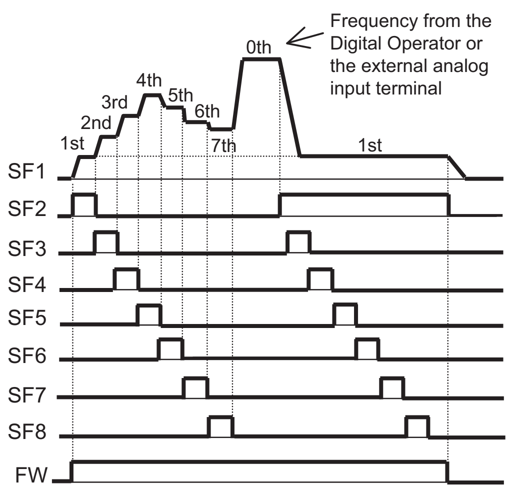
Bit Operation

- Setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 32 (SF1) to 38 (SF7) enables the selection of the 0th to 7th multi-step speed.
- Use the Multi-step Speed Reference 1 to 7 (A021 to A027) to set the frequency for SF1 to SF7.
- For the Multi-step Speed Reference 0, set the Frequency Reference Selection (A001).
  To enable the 1st/2nd/3rd frequency reference 0 setting, set A001 to 02 (Digital Operator: F001).
  If this parameter is set to 01 (Control circuit terminal block: Analog input), the frequency reference for the Multi-step Speed Reference 0 is set via analog input.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	32: SF1 (Multi-step speed setting bit 1)	–	–
		33: SF2 (Multi-step speed setting bit 2)	–	–
		34: SF3 (Multi-step speed setting bit 3)	–	–
		35: SF4 (Multi-step speed setting bit 4)	–	–
		36: SF5 (Multi-step speed setting bit 5)	–	–
		37: SF6 (Multi-step speed setting bit 6)	–	–
		38: SF7 (Multi-step speed setting bit 7)	–	–

Multi-step speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1
0th	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1st	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	ON
2nd	Disabled	Disabled	Disabled	Disabled	Disabled	ON	OFF
3rd	Disabled	Disabled	Disabled	Disabled	ON	OFF	OFF
4th	Disabled	Disabled	Disabled	ON	OFF	OFF	OFF
5th	Disabled	Disabled	ON	OFF	OFF	OFF	OFF
6th	Disabled	ON	OFF	OFF	OFF	OFF	OFF
7th	ON	OFF	OFF	OFF	OFF	OFF	OFF

Note When several terminals simultaneously turn ON, priority is given to the terminal with the smallest number.
"Disabled" in the above table indicates that speed is selected regardless of ON/OFF status.



5-9-6 Jogging (JG)

- When the jogging function is enabled, jogging operation starts when the RUN command is input.
- To enable the jogging function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 06 (JG: Jogging).
- Set the frequency reference for jogging operation in the Jogging Frequency (A038).
  Because, in jogging operation, the frequency reference is output instantaneously without acceleration time, setting a high jogging frequency value may cause an overload or trip error. Be sure to set a frequency value that does not cause a trip error.
- Use the Jogging Stop Selection (A039) to set the jogging stop method and whether to enable or disable the jogging function during operation.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	06: JG (Jogging)	–	–
A038	Jogging Frequency	0.00 Starting Frequency to 9.99	6.00	Hz
A039	Jogging Stop Selection	00: Free running during jogging stop/Disabled during operation 01: Deceleration stop during jogging stop/Disabled during operation 02: DC injection braking on jogging stop/Disabled in operation * 03: Free running during jogging stop/Enabled during operation 04: Deceleration stop during jogging stop/Enabled during operation 05: DC injection braking on jogging stop/Enabled in operation *1	00	–

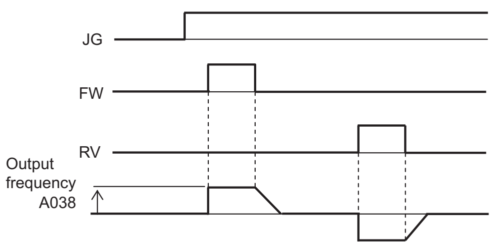
*1.If the Jogging Stop Selection(A039) is set to 02 or 05, set the DC Injection Braking Selection (A051).

● Disabled during Operation

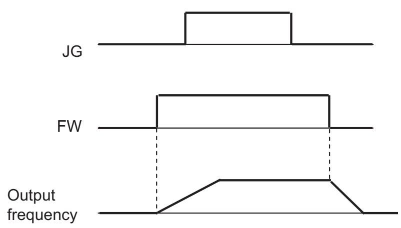
To perform jogging operation, turn ON the JG terminal and then turn ON the FW or RV terminal.

When the Jogging Stop Selection (A039) is set to 00, 01, or 02, jogging operation will not occur if the FW signal turns ON first.

Jogging Operation Enabled



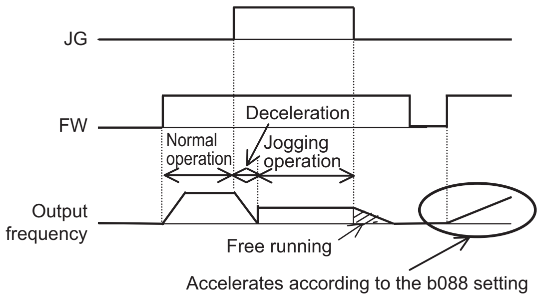
Jogging Operation Disabled



Enabled during Operation

When the Jogging Stop Selection (A039) is set to 03, 04, or 05, jogging operation will occur even if the FW signal turns ON first.

However, if the JG signal turns OFF first, the motor will make a free-run stop.



5-9-7 2-step Acceleration/Deceleration (2CH)

- Use this function to change the acceleration/deceleration time on the way during acceleration/deceleration.
- Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 09 (2CH).
- For the 2-step acceleration/deceleration function, refer to *5-6 Acceleration/Deceleration Time Settings* on page 5-35.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	09: 2CH (2-step acceleration/deceleration)	–	–

5-9-8 Reset (RS)

- This function resets an inverter trip error.
- Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 18 (RS).
- For the reset function, refer to *5-8 Reset Method Settings* on page 5-47.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	18: RS (Reset)	–	–

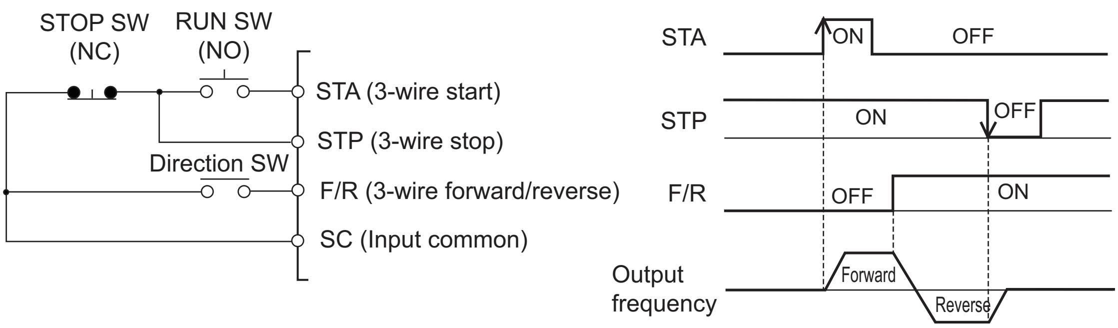
5-9-9 3-wire Input Function (STA, STP, F/R)

- Use this function to start and stop the inverter via an automatic reset contact such as a pushbutton switch.
- Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 20 (STA), 21 (STP), and 22 (F/R).
- Set the RUN Command Selection (A002) to 01 (Control circuit terminal block).
- Allocating the terminal STP disables the terminals FW and RV.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	20: STA (3-wire start) 21: STP (3-wire stop) 22: F/R (3-wire forward/reverse)	–	–

Data	Symbol	Function name	Status	Description
20	STA	3-wire start	ON	Start via automatic reset contact
			OFF	Independent of motor operation
21	STP	3-wire stop	ON	Motor operation enabled
			OFF	Stop via automatic reset contact
22	F/R	3-wire forward/reverse	ON	Reverse
			OFF	Forward
Required setting		A002 = 01		

- The operation timing is as follows.



5-10 Multi-function Output Settings

5-10-1 Multi-function Output Selection

- Use this function to allocate the functions listed below to the multi-function output P1 to P5 terminals and the multi-function relay output (MA, MB) terminals.
- The multi-function output P1 to P5 terminals are for open collector output and the multi-function relay output (MA, MB) terminals are for relay output.
- Set the desired function in the Multi-function Output P1 Selection (C021 to C025) and the Multi-function Relay Output (MA, MB) Function Selection (C026).
- If the alarm code output function is enabled in Alarm Code Selection (C062) (*Alarm Code Output (AC0 to AC3)* on page 7-130), some multi-function output settings to select alarm code output are disabled.
  When C062 is set to 01 (3 bits), the output terminals P1 to P3 are used for alarm code output; when C062 is set to 02 (4 bits), the output terminals P1 to P4 are used for alarm code output.
- This section describes seven types of primary functions. For other functions, refer to *7-5 Multi-function Terminal Functions (Group C)* on page 7-108.

Parameter No.	Data	Function name	Reference item	Page
C021 to C025, C026	00	RUN: During RUN signal	During RUN signal	5-61
	01	FA1: Constant speed arrival signal	Frequency arrival signal	5-61
	05	AL: Alarm signal	Alarm signal	5-62
	21	ZS: 0-Hz detection signal	0-Hz detection signal	5-63
	50	IRDY: Operation ready	Operation ready signal	5-63
	51	FWR: Forward run signal	Forward run signal	5-64
	52	RVR: Reverse run signal	Reverse run signal	5-64

5-10-2 Multi-function Output Operation Selection

- Set the multi-function output P1 to P5 terminals and the multi-function relay output (MA, MB) terminal to either NO (Normally open contact) or NC (Normally closed contact) individually.

Parameter No.	Function name	Data	Default data	Unit
C031	Multi-function Output P1 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00	–
C032	Multi-function Output P2 Operation Selection			
C033	Multi-function Output P3 Operation Selection			
C034	Multi-function Output P4 Operation Selection			
C035	Multi-function Output P5 Operation Selection			
C036	Multi-function Relay Output (MA, MB) Operation Selection	00: NO contact between MA and MC, NC contact between MB and MC 01: NC contact between MA and MC, NO contact between MB and MC	01	–

5-10-3 Multi-function Output ON/OFF Delay Time

- Each multi-function output terminal can be allocated with the ON/OFF delay time.
- All output signals turn ON/OFF immediately when the set conditions are satisfied. Depending on the selected signal, chattering may occur. In such a case, use this function to hold or delay the signal.
- Set the parameter for each output terminal. For the output terminal, multi-function output terminals P1 to P5 and a multi-function relay output (MA, MB) terminal are provided. For the output terminals and the corresponding parameters, refer to the table below.

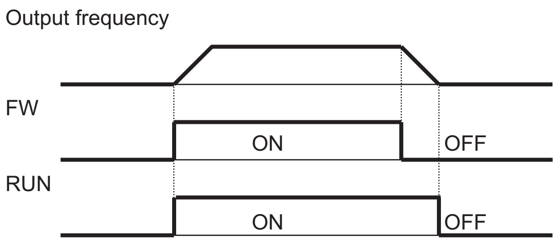
Parameter No.	Function name	Data	Default data	Unit
C130	Multi-function Output P1 ON Delay Time	0.0 to 100.0	0.0	s
C132	Multi-function Output P2 ON Delay Time			
C134	Multi-function Output P3 ON Delay Time			
C136	Multi-function Output P4 ON Delay Time			
C138	Multi-function Output P5 ON Delay Time			
C140	Multi-function Relay Output ON Delay Time			
C131	Multi-function Output P1 OFF Delay Time	0.0 to 100.0	0.0	s
C133	Multi-function Output P2 OFF Delay Time			
C135	Multi-function Output P3 OFF Delay Time			
C137	Multi-function Output P4 OFF Delay Time			
C139	Multi-function Output P5 OFF Delay Time			
C141	Multi-function Relay Output OFF Delay Time			

5-10-4 Signal during RUN (RUN)

- The RUN signal is output during inverter operation.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 00 (RUN).
- The RUN signal is also output when DC injection braking is active.
- The RUN signal is output even when the inverter does not output because the frequency reference is 0 Hz, as long as the RUN command is ON.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	00: RUN (Signal during RUN)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

The timing diagram is as follows.
The inverter outputs the RUN signal until the motor is stopped even if the RUN command (FW) turns OFF.

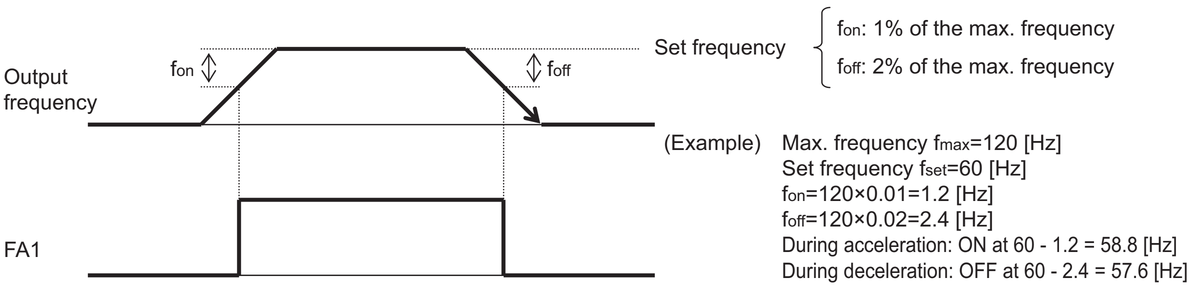


5-10-5 Constant Speed Arrival Signal (FA1)

- This signal will be output when the output frequency reaches the set frequency reference.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 01 (FA1).
- The hysteresis of this frequency arrival signal is calculated as follows.

ON : Set frequency – 1% of maximum frequency) [Hz]
OFF : Set frequency – 2% of maximum frequency) [Hz]

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	01: FA1 (Constant speed arrival signal)	–	–
C026	Multi-function Relay Output (MA,MB) Function Selection		05	–



5-10-6 Alarm Signal (AL)

- If an overcurrent, overvoltage, or some other error occurs, the inverter shuts off its output and generates an alarm signal. This is called a “trip.”
- A trip state can be cancelled by resetting the inverter, by which the alarm signal also turns OFF. To reset the inverter, press the STOP/RESET key on the Digital Operator or turn ON the reset terminal. However, you may not be able to reset some trip factors by using these methods. In such cases, cycle the power supply.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 05 (AL). By default, the Multi-function Relay Output (MA, MB) Function Selection (C026) is set to 05 (AL: Alarm signal).

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	05: AL (Alarm signal)	–	–
C026	Multi-function Relay Output (MA,MB) Function Selection		05	–

The alarm signal will be output as shown below. You can change whether the inverter outputs an alarm when it recognizes the power supply OFF status by using the combination of the Multi-function Output P1 to P5 Operation Selection and Multi-function Relay Output (MA, MB) Operation Selection (C031 to C036).

Precautions for Correct Use

The relay output terminals are allocated to 05 (AL: Alarm output) by default. However, the relay output status of the inverter when the input power supply is OFF is different from the previous model (3G3☐V Series).

The table below shows the relationship between the relay output status when the inverter input power supply is ON/OFF and the Multi-function Relay Output (MA, MB) Operation Selection (C036) setting. Select the parameter setting appropriate to the sequence of your inverter according to this table.

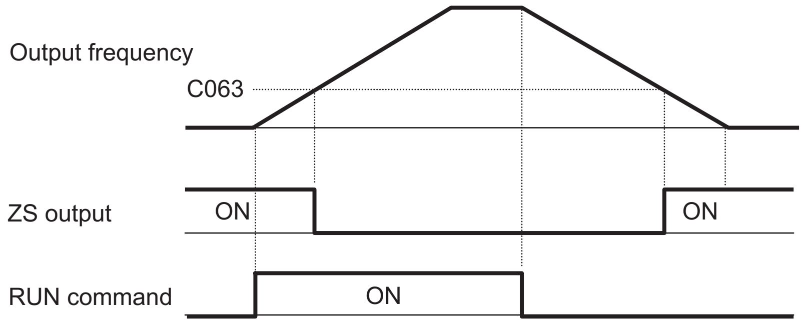
Setting in C036	Input power supply	Inverter status	Relay output status	
			Between MA and MC	Between MB and MC
00	ON	Normal	Open	Closed
		Alarm output	Closed	Open
	OFF	–	Open	Closed
01 (Default data)	ON	Normal	Closed	Open
		Alarm output	Open	Closed
	OFF	–	Open	Closed

Note Set C036 to 00 to have the same relay output status as with the previous model (3G3☐V Series).

5-10-7 0-Hz Detection Signal (ZS)

- Use this function to output a detection signal when the output frequency of the inverter falls below the 0 Hz Detection Level (C063).
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 21 (ZS) to enable this function.
- This function works upon the inverter output frequency when the control method is set to Constant torque characteristics, Reduced torque characteristics, Free V/f setting, Sensorless vector control, or 0-Hz sensorless vector control, or upon the motor rotation frequency when the control method is set to Sensor vector control.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	21: ZS (0-Hz detection signal)	–	–
C026	Multi-function Relay Output (MA,MB) Function Selection		05	
C063	0 Hz Detection Level	0.00 to 99.99 100.0	0.00	Hz
Related functions		A044, A244, A344		



5-10-8 Operation Ready (IRDY)

- This signal will be output when the inverter becomes ready to run (ready to accept the RUN command).
- When this command is not output, the inverter does not recognize the RUN command even if it is input.
- If this signal is not output, check if the input power supply voltage (R, S, T) is within the specified range.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 50 (IRDY) to enable this function.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	50: IRDY (Operation ready)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

5-10-9 Forward Run Signal (FWR)

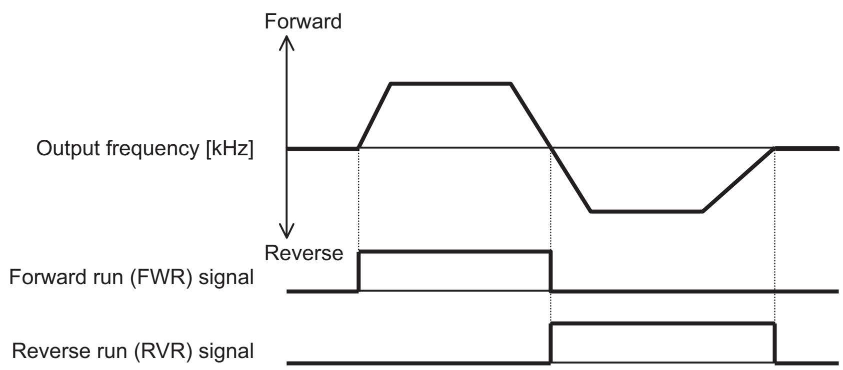
- This signal is output while the inverter performs the forward operation.
- While the inverter performs the reverse operation or when stopped, this signal is not output.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 51 (FWR) to enable this function.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	51: FWR (Forward run signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

5-10-10 Reverse Run Signal (RVR)

- This signal is output while the inverter performs the reverse operation.
- While the inverter performs the forward operation or when stopped, this signal is not output.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 52 (RVR) to enable this function.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	52: RVR (Reverse run signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	



5-11 Torque Boost Function Settings

5-11-1 Torque Boost

- Use the torque boost function to adjust the output torque if it is not sufficient at low speeds.
- This inverter provides two torque boost options: Manual torque boost for manual adjustment and Automatic torque boost for automatic adjustment.
- By factory default, the Automatic torque boost option is selected.

Parameter No.	Function name	Data	Default data	Unit
A041	1st Torque Boost Selection	00: Manual torque boost 01: Automatic torque boost	01 *3	–
A241	2nd Torque Boost Selection *1			
A042	1st Manual Torque Boost Voltage	0.0 to 20.0 *2	1.0	%
A242	2nd Manual Torque Boost Voltage *1			
A342	3rd Manual Torque Boost Voltage *1			
A043	1st Manual Torque Boost Frequency	0.0 to 50.0	5.0	%
A243	2nd Manual Torque Boost Frequency *1			
A343	3rd Manual Torque Boost Frequency *1			
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H203	2nd Motor Capacity *1			
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
H204	2nd Motor Pole Number *1			
A046	1st Automatic Torque Boost Voltage Compensation Gain	0. to 255.	100.	%
A246	2nd Automatic Torque Boost Voltage Compensation Gain			
A047	1st Automatic Torque Boost Slip Compensation Gain	0. to 255.	0. *3	
A247	2nd Automatic Torque Boost Slip Compensation Gain			

*1 To enable the switching to the 2nd Acceleration Time 1/3rd Acceleration Time 1 and to the 2nd Deceleration Time 1/3rd Deceleration Time 1, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2 Set data as a percentage of Motor Rated Voltage Selection (A082).

*3 The default data was changed from the previous model.

Automatic Torque Boost

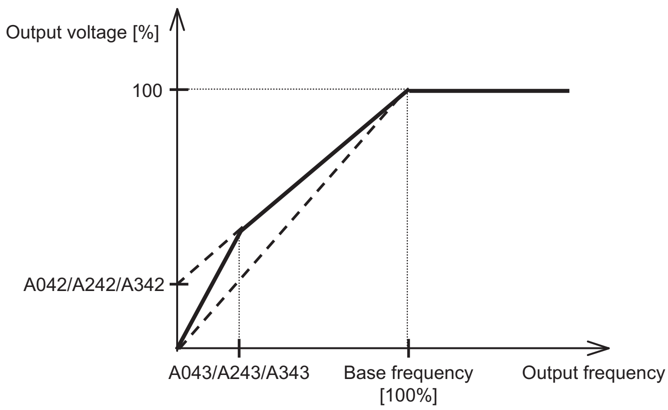
- In the 3G3RX-V1 Series Inverter, the automatic torque boost function is enabled by default (A041/A241 = 01).
  With this setting, the inverter adjusts the output voltage automatically, depending on the load condition. However, the actual control must be provided in conjunction with the manual torque boost function.
- To use the automatic torque boost function effectively, set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) correctly according to your motor.
- To avoid possible overcurrent trip during deceleration, set the AVR Selection (A081) to 00 (Always ON).
- To enable the slip compensation function in addition to the voltage compensation provided by the automatic torque boost function, set the 1st/2nd Automatic Torque Boost Slip Compensation Gain (A047/A247) to 100%.
- If the automatic torque boost does not provide the intended performance characteristics, adjust each adjustment item shown in the following table.

Phenomenon	Adjustment method	Adjustment item
Torque is insufficient at low speeds. (Motor does not rotating at low speeds.)	(1) Gradually increase the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(2) Set the Automatic Torque Boost Slip Compensation Gain to 100. Then, increase the set value gradually.	A047/A247
	(3) Gradually increase the Manual Torque Boost Voltage.	A042/A242
	(4) Decrease the Carrier Frequency.	b083
Overcurrent trip occurs when load is applied.	(1) Gradually decrease the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(2) Set the Automatic Torque Boost Slip Compensation Gain to 100. Then, decrease the set value gradually.	A047/A247
	(3) Gradually decrease the Manual Torque Boost Voltage.	A042/A242
	(4) Gradually decrease the Overload Limit Parameter.	b023/b026

Phenomenon	Adjustment method	Adjustment item
Rotation speed decreases when load is applied.	Gradually increase the Automatic Torque Boost Slip Compensation Gain.	A047/A247
Rotation speed increases when load is applied.	Gradually decrease the Automatic Torque Boost Slip Compensation Gain.	A047/A247

Manual Torque Boost

- The manual torque boost function sets the starting voltage for the output voltage of the inverter. The automatic torque boost function starts the adjustment of the output voltage and the output frequency from the value set in the manual torque boost function.
- When the automatic torque boost function is enabled, normally it is not necessary to adjust the manual torque boost function.
  Adjust it when the automatic torque boost function is disabled or if the motor stalls at low speeds.
- Set the 1st/2nd/3rd Manual Torque Boost Frequency (A043/A243/A343) appropriate to the rotation speed that provides the required output torque.
  While observing the movement of the load, adjust the 1st/2nd/3rd Manual Torque Boost Voltage (A042/A242/A342) at which the motor speed does not decrease. Check the output current of the inverter and adjust it to 150% of the rated current of the motor or less.
- Set A042/A242/A342 as 100% of the Motor Rated Voltage Selection (A082) value.
  The set data is defined as a voltage equivalent to V/f characteristics at 0 Hz.
- Set A043/A243/A343 as 100% of the 1st/2nd/3rd Base Frequency (A003/A203/A303) value.
- Setting the manual torque boost voltage data too high may cause motor overexcitation. Although an overexcited motor can still produce torque output, it is inefficient and causes overload or overcurrent conditions easily. Check the output current of the inverter and adjust it to 150% of the rated current of the motor or less.



5-12 Measures against Overvoltage

5-12-1 Overvoltage Suppression Function during Deceleration

- Use this function to prevent overvoltage trip caused by the regenerative energy from the motor during deceleration.
- Enable or disable the function in the Overvoltage Suppression Function Selection During Deceleration (b130).
- If the Overvoltage Suppression Function Selection During Deceleration (b130) is set to 01 (Enabled: DC voltage constant control), the inverter automatically decelerates while keeping the main circuit DC voltage rise due to deceleration start at the Overvoltage Suppression Level During Deceleration (b131).
- If the Overvoltage Suppression Function Selection During Deceleration (b130) is set to 02 (Enabled: acceleration enabled), the inverter starts accelerating according to the Overvoltage Suppression Parameter During Deceleration (b132) setting when the main circuit DC voltage increases due to the start of deceleration to exceed the Overvoltage Suppression Level During Deceleration (b131). After that, when the main circuit DC voltage falls below the value set in b131, the inverter starts deceleration again.
- To use this function, set the Usage Rate of Regenerative Braking (b090) and the Regenerative Braking Selection (b095) to 0.0 (Disabled).

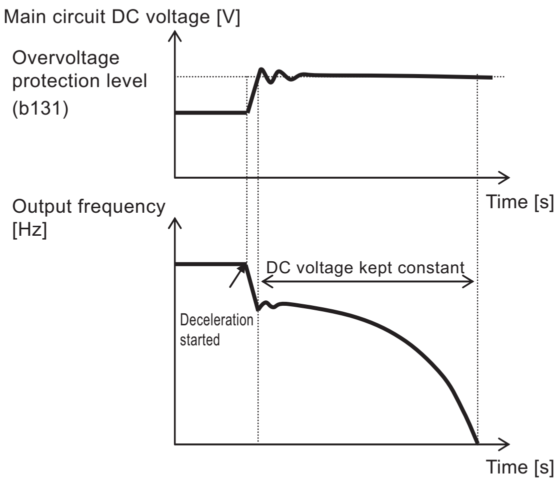
Parameter No.	Function name	Data	Default data	Unit
b130	Overvoltage Suppression Function Selection During Deceleration	00: Disabled 01: Enabled (DC voltage kept constant) (Example 1) *1 02: Enabled (Acceleration enabled) (Example 2)	01 *3	–
b131	Overvoltage Suppression Level During Deceleration *2	200-V class: 330 to 390 400-V class: 660 to 780	380/760	V
b132	Overvoltage Suppression Parameter During Deceleration	0.10 to 30.00: Set the acceleration rate applied when this function is enabled.	1.00	s
b133	Overvoltage Suppression Proportional Gain During Deceleration	0.00 to 2.55: Proportional gain for DC voltage constant control (b130 = 01 only)	0.50	–
b134	Overvoltage Suppression Integral Time During Deceleration	0.000 to 9.999/10.00 to 65.53: Integral time when DC voltage is kept constant (b130 = 01 only)	0.060	s

*1 When b130 is set to 01, PI control works to keep the internal DC voltage constant.
Although increasing the Overvoltage Suppression Proportional Gain During Deceleration (b133) provides a faster response, setting it to an excessive large value may cause an overcurrent trip.
Increasing the Overvoltage Suppression Integral Time During Deceleration (b134) also provides a faster response, but setting it to an excessive small value may cause an overcurrent trip.

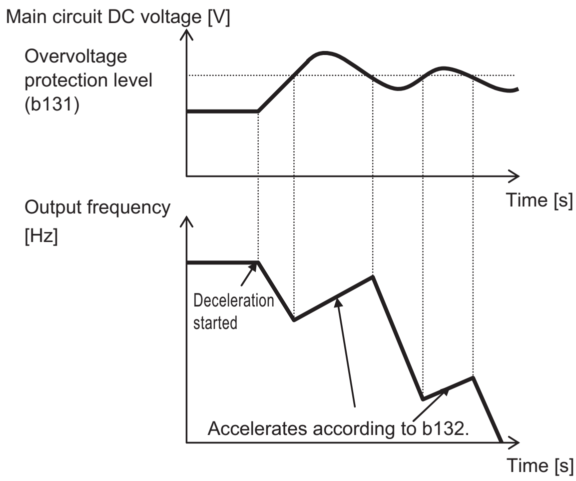
*2 If b131 is set to a value less than the input voltage, the inverter may not be able to stop the motor. Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.

*3 The default data was changed from the previous model.

(Example 1) When DC voltage is kept constant (b130 = 01)



(Example 2) When acceleration is enabled (b130 = 02)

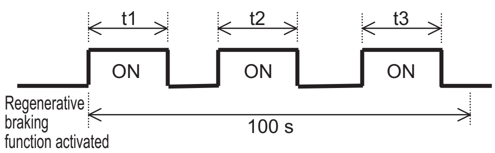


Precautions for Correct Use

- When the overvoltage suppression function during deceleration function is enabled, the actual deceleration time is longer than the set time.
  If the motor load inertia is considerably large, the motor may take a long time to stop.
  To shorten the time until the motor stops, change to the deceleration stop method according to *5-12-2 Regenerative Braking Function* on page 5-70.
- Setting the Overvoltage Suppression Level During Deceleration (b131) to a value less than the input power supply voltage prevents deceleration.
  Be sure to set this to a value higher than the input power supply voltage multiplied by the square root of 2.
  Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.
- Even when the overvoltage suppression function during deceleration function is enabled, rapid deceleration may cause a trip error if the motor cannot respond in time.
  In this case, change to the deceleration stop method according to *5-12-2 Regenerative Braking Function* on page 5-70.

5-12-2 Regenerative Braking Function

- When decelerating, generating downward movement, or being rotated by an external load (that is, when the output torque direction and the rotation direction are opposite), the motor serves as a generator and the regenerated energy is fed back to the inverter.
  However, 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.
- The regenerative braking function uses the built-in or an external regenerative braking circuit to decrease the internal DC voltage of the inverter by converting the regenerated energy from the motor into heat via external braking resistors.
- Connect external braking resistors or external regenerative braking units according to the description of External Braking Resistor Connection Terminal or Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-20.
  The regenerative braking function is enabled only when the inverter is connected with external braking resistors or external regenerative braking units.
- The following models have a built-in regenerative braking circuit. Connect external braking resistors only.
  [200-V class] 3G3RX-A2004-V1 (0.4 kW) to 3G3RX-A2220-V1 (22 kW)
  [400-V class] 3G3RX-A4004-V1 (0.4 kW) to 3G3RX-A4220-V1 (22 kW)
- To use models other than the above or process a very large amount of regenerative energy, you need to use regenerative braking units.
- To use the built-in regenerative braking function of the inverter, set the Regenerative Braking Selection (b095) to 01 or 02 (Enabled).
  Normally, this parameter is set to 01 (Enabled: Disabled during stop).
  At this time, set the usage condition (%) of the braking resistor in use in the Usage Rate of Regenerative Braking (b090).
  Note that the regenerative braking function is enabled only when both b090 and b095 are set.
- For the Regenerative Braking ON Level (b096), you need not change the default data normally. This parameter is used for adjusting the level at which the regenerative braking function according to the input power supply voltage.
- External regenerative braking units are processed on the external regenerative braking unit side. Therefore, set the Regenerative Braking Selection (b095) to 00 (Disabled). In this case, the b090 and b096 settings are ignored.
- To this function, set the Overvoltage Suppression Function Selection During Deceleration (b130) to 00 (Disabled).

Parameter No.	Function name	Data	Default data	Unit
b090	Usage Rate of Regenerative Braking	0.0: Regenerative braking not active 0.1 to 100.0 Set the usage rate of the regenerative braking function in units of 0.1%. Exceeding the set usage rate causes a trip error.  Usage rate [%] = $\frac{(t1 + t2 + t3)}{100\ s} \times 100$	0.0	%
b095	Regenerative Braking Selection	00: Disabled 01: Enabled (Disabled during stop) 02: Enabled (Enabled during stop)	00	–

Parameter No.	Function name	Data	Default data	Unit
b096	Regenerative Braking ON Level	200-V class: 330 to 380 VDC *1	200-V class: 360 V	V
		400-V class: 660 to 760 VDC *1	400-V class: 720 V	

*1.Regenerative Braking ON Level refers to the voltage setting for the internal converter (DC unit) of the inverter.

Precautions for Correct Use

- To use the built-in regenerative braking function of the inverter, be sure to set both the Usage Rate of Regenerative Braking (b090) and the regenerative Braking Selection (b095). Otherwise, the function cannot work.
- Setting the Regenerative Braking ON Level (b096) to the input power supply voltage or lower causes the built-in regenerative braking function to be always active, which results in overheating or burning of the braking resistor. Be sure to set this to a value higher than the input power supply voltage multiplied by the square root of 2.
  Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.
- To use the regenerative braking function, connect external braking resistor(s) or external regenerative braking unit(s) according to the description of External Braking Resistor Connection Terminal/Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-20.
  Be sure to install a circuit that detects overheating of the braking resistor(s) and the regenerative braking unit(s) via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.

6

Vector Control

This section describes the vector control.

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6

6-1 Overview of Vector Control

Induction motors have a characteristic that their output torque and rotation speed change depending on the load.

The vector control function enables to output the output torque and rotation speed of induction motors as the target values.

It calculates the output voltage and frequency of the inverter based on vector operations considering with phases such as the current, voltage, and magnetic flux inside the motor.

The 3G3RX-V1 Series Inverter provides three types of vector controls as described below.

Use an appropriate control mode according to the torque and speed accuracy required by the load.

Sensorless Vector Control

The 3G3RX-V1 Series Inverter’s sensorless vector control provides a high starting torque of 200% at 0.3 Hz.

It estimates the motor rotation speed based on the output current and voltage of the inverter to enable such a high torque even at low speeds.

In addition to sensorless vector control, the inverter also provides the auto-tuning function (motor rotation/no motor rotation).

The auto-tuning function enables you to set motor parameters without use of speed sensors (PG), so you can easily use the sensorless vector control for your system.

Compared with conventional V/f control, sensorless vector control provides improved motor speed accuracy (±0.5% maximum) and torque characteristics in the range of low to high speed.

0-Hz Sensorless Vector Control

The 3G3RX-V1 Series Inverter’s 0-Hz sensorless vector control is designed to achieve a high starting torque output of 150% especially in a 0-Hz range.

It is suitable particularly for elevating applications such as a crane and hoist that requires a high torque at low frequencies when the brake is released.

Because of a high torque at 0 Hz, timing and other adjustments of the brake are fairly easy.

To use this control, however, use an inverter that is one size larger in capacity than the motor.

It is required to use an inverter that is one size larger in capacity than the motor to supply a sufficient current at low speeds without error detection such as overcurrent, overvoltage and overload.

Sensor Vector Control

Using sensor vector control with a speed sensor (PG) realizes even more accurate speed and torque control.

Sensor vector control provides the following control modes.

● Speed control

Sensor vector control, when enabled, automatically uses a speed sensor (PG) as the source of speed feedback to configure a speed control loop.

It provides speed control at an accuracy of ±0.5 % or less as long as the resolution of the speed sensor (PG) is sufficient.

This enables the accurate monitoring and follow-up of the line speed in winding control, tension control, or other applications.

● Position control

In the position control, a speed sensor (PG) can be used as the source of position feedback to configure a position control loop.

Similar to ordinary servo systems, it realizes a positioning accuracy corresponding to the resolution of the speed sensor in use. The Positioning Completion Range Setting (P017) is set to ±5 pulses by default.

The position control mode includes position control functions such as “pulse train position control” under which the position is controlled based on the pulse input and “absolute position control” under which the position is controlled to the position reference set inside the inverter.

● Torque control

Sensor vector control supports the direct control of the motor output torque, which is suitable for press control and press-fit control applications. It also includes the torque limit function that controls the torque to the torque limit value or less while providing the speed control or position control function.

6-2 Sensorless Vector Control

6-2-1 Sensorless Vector Control Parameter Settings

- Set the 1st/2nd Control Method (A044/A244) to 03 (Sensorless vector control).
- Set the 1st/2nd Motor Capacity (H003/H203) and the 1st Motor Pole Number (H004/H204) according to your motor.
- In the 1st/2nd Base Frequency (A003/A203), set the rated frequency of the motor. In the Motor Rated Voltage Selection (A082), set the rated voltage of the motor.
- To use this function, be sure to set the motor parameters appropriately according to *6-2-3 Auto-tuning of Motor Parameters* on page 6-5.

Parameter No.	Function name	Data	Default data	Unit
A044/A244	1st/2nd Control Method *1	03: Sensorless vector control *2	00	–
H003/H203	1st/2nd Motor Capacity	0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8/10	4	pole
A003/A203	1st/2nd Base Frequency	30. to 1st/2nd Maximum Frequency (A004/A204)	60	Hz
A082	Motor Rated Voltage Selection	200-V class: 200 V/215 V/220 V/230 V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	V

*1. To enable the switching to the 2nd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) and turn ON that terminal.

*2. Sensorless vector control can be selected for the 1st/2nd control only.

6-2-2 0-Hz Sensorless Vector Control Parameter Settings

- Set the 1st/2nd Control Method (A044/A244) to 04 (0-Hz sensorless vector control).
- Set the 1st/2nd Motor Capacity (H003/H203) and the 1st Motor Pole Number (H004/H204) according to your motor.
- In the 1st/2nd Base Frequency (A003/A203), set the rated frequency of the motor. In the Motor Rated Voltage Selection (A082), set the rated voltage of the motor.
- To use this function, be sure to set the motor parameters appropriately according to *6-3-4 Auto-tuning of Motor Parameters* on page 6-18.
- Use the 1st/2nd Limit at 0 Hz (H060/H260) to set the current under constant current control in a 0-Hz range (approximately 3.0 Hz or less). Set this as a percentage of the rated current of the inverter.
- In the 1st Boost Amount at SLV Startup, 0 Hz (H061/H261), set the amount of current boost during startup. Set this as a percentage of the rated current of the inverter. The value set here will be added to the value set in the 1st Limit at 0 Hz (H060/H260) during startup only.
- 0-Hz sensorless vector control cannot be used in the light load mode. Be sure to set the Heavy Load/Light Load Selection (b049) to 00 (Heavy load mode).

Parameter No.	Function name	Data	Default data	Unit
A044/A244	1st/2nd Control Method [*1]	04: 0-Hz sensorless vector control	00	–
H003/H203	1st/2nd Motor Capacity	0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8/10	4	pole
A003/A203	1st/2nd Base Frequency	30. to 1st/2nd Maximum Frequency (A004/A204)	60	Hz
A082	Motor Rated Voltage Selection	200-V class: 200 V/215 V/220 V/230 V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	V
b049	Heavy Load/Light Load Selection	00: Heavy load mode (CT) 01: Light load mode (VT)	00	
H060/H260	1st/2 Limit at 0 Hz	0.0 to 100.0	100.0	%
H061/H261	1st/2nd Boost Amount at SLV Startup, 0 Hz	0. to 50.	50.	

*1. To enable the switching to the 2nd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) and turn ON that terminal.

6-2-3 Auto-tuning of Motor Parameters

- Use this function to measure and automatically set the motor parameters required for the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control.
- To use the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control method, perform offline auto-tuning to measure the motor parameter values.
- The offline auto-tuning function is applicable to the 1st and 2nd control methods only. It cannot be used for the 3rd control method.
- The measured motor parameter values will be set as 50-Hz data for one phase in 3-phase Y-connection.

Parameter No.	Function name	Data	Default data	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00	–
H002/H202	1st/2nd Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–
H003/H203	1st/2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8/10	4	pole

Parameter No.	Function name	Data	Default data	Unit
H030/H230	1st/2nd Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	O
H031/H231	1st/2nd Motor Parameter R2 (Auto-tuning Data)			
H032/H232	1st/2nd Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		mH
H033/H233	1st/2nd Motor Parameter lo (Auto-tuning Data)			A
H034/H234	1st/2nd Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kg/m^2
A003/A203	1st/2nd Base Frequency	30. to 1st/2nd Maximum Frequency (A004/A204)	60	Hz
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–
A082	Motor Rated Voltage Selection	200-V class: 200/215/220/230/240	200	V
		400-V class: 380/400/415/440/460/480	400	

Offline Auto-Tuning Steps

Offline auto-tuning consists of the following five steps:

- Presetting of parameters
- Selection of motor rotation during auto-tuning
- Auto-tuning
- Operations after auto-tuning
- Operations in case of error

1 Presetting of parameters

(1) Set the 1st Motor Capacity (H003) and the 1st Motor Pole Number (H004) according to your motor.

(2) Set the 1st Base Frequency (A003) to the rated frequency of the motor and the Motor Rated Voltage Selection (A082) to the rated voltage of the motor.

(3) Change the DC Injection Braking Selection (A051) from 01 (Enabled) to 00 (Disabled).

If the DC Injection Braking Selection (A051) is set to 01 (Enabled), change it to 00 (Disabled). If it is set to enabled, auto-tuning will not complete.

(4) Set the Output Voltage Gain (A045) to 100%.

This parameter is set to 100% by default. Restore it to 100% if the data is different.

(5) Make sure that the torque reference input permission terminal (52: ATR) is OFF.

Correct measurement is not possible when the terminal is ON.

Parameter No.	Function name	Data	Default data	Unit
H003/H203	1st/2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8/10	4	pole
A003/A203	1st/2nd Base Frequency	30. to 1st/2nd Maximum Frequency (A004/A204)	60	Hz
A045	Output Voltage Gain	20. to 100.	100.	%
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–
A082	Motor Rated Voltage Selection	200-V class: 200 V/215 V/220 V/230 V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	

2 Selection of motor rotation during auto-tuning

In the Auto-tuning Selection (H001), select whether the motor rotates during auto-tuning.

Set value	Description
01	The motor does not rotate during auto-tuning.
02	The motor rotates during auto-tuning.

Motor rotation selection	Description
Motor does not rotate (01)	Measures motor parameter values without rotating the motor. Use this setting if you do not rotate the motor. Because the motor does not rotate, the Motor Parameter Io (No-load current) and Motor Parameter J (Moment of inertia) values cannot be measured.
Motor rotates (02)	Measures motor parameter values with the motor rotating. Use this setting if you can rotate the motor without any problem.

Parameter No.	Function name	Data	Default data	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00	–

3 Auto-tuning

(1) After presetting of parameters, set the Auto-tuning Selection (H001) to 01 (Enabled: No motor rotation) or 02 (Enabled: Motor rotation).

(2) Turn ON the RUN command.
Turning ON the RUN command starts automatic operation in the following procedure.

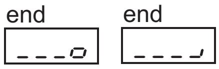
1) **1st AC excitation (Motor does not rotate.)**
↓
2) **2nd AC excitation (Motor does not rotate.)**
↓
3) **1st DC excitation (Motor does not rotate.)**
↓
4) **V/f operation (Motor accelerates up to 80% of base frequency.)**
↓
5) **SLV operation (Motor accelerates up to X% of base frequency.)**
↓
6) **2nd DC excitation (Motor does not rotate.)**
↓
7) **Auto-tuning result is displayed.**

Note 1 Steps 4 and 5 will be skipped in auto-tuning without motor rotation (H001 = 01).

2 The motor speed X in step 5 is given as follows, where T is the acceleration or deceleration time in step 4, whichever is greater.
T ≤ 0 < 50 s: X = 40%
0 s ≤ T ≤ 100 s: X = 20%
100 s ≤ T: X = 10%

3 The auto-tuning result will be displayed as follows.

Normal end   Abnormal end



If auto-tuning is aborted by an error, retry it.
To clear the above display, press the STOP/RESET key.

Precautions for Correct Use

- Even if you set H001 to 01 (Auto-tuning without motor rotation), the motor may rotate slightly.
- To perform auto-tuning for a motor one size smaller in capacity than the inverter, enable the overload limit function and set the overload limit level to 150% of the rated current of the motor.
- If the Overvoltage Suppression Integral Time During Deceleration (b134) is set too small, an Overvoltage trip (E07) may occur during auto-tuning. In this case, increase the b134 value and retry auto-tuning.
- Make sure the following points before starting auto-tuning with motor rotation enabled.

There is no problem even if the motor accelerates up to approximately 80% of the base frequency.
The motor is not driven by external equipment.
The brake is released.
During auto-tuning, the inverter does not provide full output torque, which could result in a slip-and-fall accident in elevating or other applications. To prevent this, remove the motor from the load and perform the auto-tuning with the single motor. In this case, because the moment of inertia J is given for the single motor, calculate the motor-shaft conversion of the moment of inertia of the load machine and add it to this value.
In applications such as an elevator or ball screw where the amount of motor shaft rotation is limited, the motor may rotate over the allowable rotation amount, which may result in a mechanical damage. Be sure to set H001 to 01 (Enabled: No motor rotation).
If the Motor Parameter Io (No-load current) value is unknown, measure in advance the no-load current value at 50 Hz under V/f control and set it in H033/H233 before auto-tuning.

4 **Operations after auto-tuning**

- After normal completion of auto-tuning, set the 1st Motor Parameter selection (H002) to 01 (Auto-tuning).
  This enables the 1st/2nd motor parameters (H030 to H034/H230 to H234) set by the auto-tuning function.
- At the end of auto-tuning, the inverter automatically resets the Auto-tuning Selection (H001) to 00 (Disabled).
  To retry auto-tuning, set H001 again to enable auto-tuning.
- During auto-tuning without motor rotation, the Motor Parameter Io (No-load current) and Motor Parameter J (Moment of inertia J) values are not measured. Set the following parameters at the end of auto-tuning.

1st/2nd Motor Parameter Io (H033/H233):	Measure and set the no-load current of the single motor at 50 Hz in advance. Alternatively, check the no-load current of the motor at 50 Hz with the motor manufacturer and set it.
1st/2nd Motor Parameter J (H034/H234):	Calculate and set the motor-shaft conversion of the moment of inertia of the load machine.

Precautions for Correct Use

- To operate the inverter with the auto-tuned data after normal completion of auto-tuning, be sure to change the 1st Motor Parameter selection (H002) setting to 01.
- Adjust the DC Injection Braking Selection (A051) and Output Voltage Gain (A045) values according to the user environment.

Parameter No.	Function name	Data	Default data	Unit
H002/H202	1st/2nd Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–
H030/H230	1st/2nd Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H031/H231	1st/2nd Motor Parameter R2 (Auto-tuning Data)			
H032/H232	1st/2nd Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		mH
H033/H233	1st/2nd Motor Parameter Io (Auto-tuning Data)			A
H034/H234	1st/2nd Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kg/m^2
A045	Output Voltage Gain	20. to 100.	100.	%
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–

5 **Operations in case of error**

If auto-tuning is aborted by an error, review the preset parameters and check the rated motor torque ratio of the inverter to that of the motor. If the load is too heavy, disconnect the load and retry auto-tuning.

If the error persists or auto-tuning is still aborted, enter the motor parameter values directly.

For details, refer to *6-2-4 Motor Parameter Settings* on page 6-11.

Precautions for Correct Use

- If a trip error occurs during auto-tuning, the auto-tuning process will be force-terminated. In this case, the inverter displays the alarm code for the trip error in preference to the abort display. Check the cause of the trip error.
- If the auto-tuning process does not terminate, press the STOP/RESET key. Then, the process will be force-terminated. Review the preset parameters and retry auto-tuning.
- If the auto-tuning process is terminated by STOP command input by pressing the STOP key or by turning OFF the RUN command, the parameters for auto-tuning may be left in the inverter.
- When the control method is set to Free V/f setting, starting offline auto-tuning causes the inverter to terminate the process with the abort display.

Online Auto-Tuning Function

- The performance of sensorless vector control is sufficiently provided by simply executing offline auto-tuning.
- However, motor parameter values change with time due to a temperature rise in the motor and many other aspects. To compensate for such changes in the motor parameter values to perform more stable operation with less speed changes, use the online auto-tuning function.
- The online auto-tuning function, measures the motor parameter values each time the inverter stops the operation and applies them to the motor parameters used for sensorless vector control.
- This function is applicable to the 1st and 2nd control methods only. It cannot be used for the 3rd control method.

Parameter No.	Function name	Data	Default data	Unit
H002/H202	1st/2nd Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–

Note the following points before using this function.

- Before using the online auto-tuning function, be sure to perform offline auto-tuning. The data required for online auto-tuning is calculated during offline auto-tuning.
- The online auto-tuning function will be activated for up to 5 seconds after the motor stops. (The inverter executes DC excitation once for tuning the Motor Parameters R1 and R2, this result is not displayed, however). If the RUN command is input during this period, the online auto-tuning process will be aborted at that point because the RUN command is given priority. (In this case, the tuning result will not be reflected.)
- If the DC injection braking on jogging stop function is enabled, online auto-tuning will start after DC injection braking is completed.
- When the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 54 (SON) or 55 (FOC), the online auto-tuning function is not performed.

- **Operating Procedure**

1 **Set the 1st Motor Parameter selection (H002) to 02 (Online auto-tuning enabled).**

The Auto-tuning Selection (H001) must be set to 00 (Disabled).

2 **Input the RUN command.**

The inverter will perform online auto-tuning automatically during the stop.

Secondary Resistance Compensation Function (Temperature Compensation)

- This function provides compensation for suppressing the variation of the rotation speed due to temperature changes in the motor. It is enabled when sensorless vector control, 0-Hz sensorless vector control, or sensor vector control is selected as the control method. Use the thermistor PB-41E (from SHIBAURA ELECTRONICS).
- To use this function, set the Thermistor Selection (b098) to 02 (NTC). Other thermistor settings do not provide correct temperature detection.

Parameter No.	Function name	Data	Default data	Unit
P025	Secondary Resistance Compensation Selection	00: Disabled 01: Enabled	00	–

6-2-4 Motor Parameter Settings

- To use the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control method, you need to set the motor parameters. Normally, perform offline auto-tuning to determine the motor parameter values.
- Set the motor parameters manually if the offline auto-tuning process is aborted, for example, if the inverter does not reach 50% of the rated current during auto-tuning.
- Set the 1st/2nd Motor Parameter selection (H002/H202) to 00 (Standard motor parameter). By default, the inverter is set to use the motor parameter values for typical general-purpose motors. To maximize the performance of the vector control, adjust each parameter value according to your motor.
- Obtain the motor's datasheet from the motor manufacturer to set the motor parameters.

  The following values must be set as 50-Hz data for one phase in 3-phase Y-connection.

Winding resistance on primary side of motor:	Set the wiring resistance (in Ω) on the primary side of the motor for one phase in Y-connection.
Winding resistance on secondary side of motor:	Set the wiring resistance (in Ω) on the secondary side of the motor for one phase in Y-connection.
Motor leakage inductance:	Set the motor leakage inductance (in mH) in Y-connection.
Motor no-load current:	Set the no-load current of the motor, or set the current value measured when the motor rotates with no load at 50 Hz.
Moment of inertia:	Add the moment of inertia of the motor and that of the load and set the motor-shaft conversion of the sum.

- For the 3rd control, the motor parameter values set for the 1st control will be used.

Parameter No.	Function name	Data	Default data	Unit
A044/A244	1st/2nd Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics [*1] 02: Free V/f setting [*2] 03: Sensorless vector control [*2] 04: 0-Hz sensorless vector control [*2] 05: Sensor vector control (V2)[*2]	00	–
H002/H202	1st/2nd Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–
H003/H203	1st/2nd Motor Capacity	0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8/10	4	pole
H020/H220	1st/2nd Motor Parameter R1 (Winding resistance on primary side)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H021/H221	1st/2nd Motor Parameter R2 (Winding resistance on secondary side)			
H022/H222	1st/2nd Motor Parameter L (Leakage inductance)	0.01 to 99.99 100.0 to 655.3		mH
H023/H223	1st/2nd Motor Parameter Io (No-load current)	0.01 to 99.99 100.0 to 655.3		A
H024/H224	1st/2nd Motor Parameter J (Moment of inertia)	0.001 to 9.999 [*3] 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kg/m^2

*1. VP 1.7th Power (VC at low speed).

*2. Although the 1st Control Method (A044) can be set to any of 00 to 05, the 2nd Control Method (A244) can be set to 00 to 04 and the 3rd Control Method (A344) can be set to 00 to 01 only. In the light load mode, this parameter cannot be set to 04 or 05.

*3. For the Moment of Inertia J, set the motor conversion value. The larger the J value, the higher the response speed, which results in a steep torque rise; the smaller the J value, the lower the response speed, which results in gradual torque rise. After setting the J value, adjust the response speed in the 1st/2nd Speed Response (H005/H205).

Precautions for Correct Use

Under sensorless vector control, 0-Hz sensorless vector control, or sensor vector control, because of its control characteristics, the inverter may output a rotation signal opposite to the RUN command direction at low speeds. If allowing the motors to rotate in the opposite rotation may pose a risk of mechanical damage or any other problem, set the Reverse Rotation Prevention Selection (b046) to 01 (Enabled). (Refer to *Reverse Rotation Prevention Function* on page 7-83).

6-2-5 Adjustment for Sensorless Vector Control

- To use the sensorless vector control method, perform offline auto-tuning.
  If you cannot perform offline auto-tuning, set the motor parameters appropriately according to *6-2-4 Motor Parameter Settings* on page 6-11.
- The inverter may not provide sufficient performance characteristics if your motor is two or more sizes smaller than the maximum applicable motor capacity. This is because the inverter requires a current accuracy of at least 50% of the rated current.
- If the sensorless vector control method does not provide the intended performance characteristics, adjust the appropriate motor parameter depending on the phenomenon, as shown in the following table.

Operation status	Phenomenon	Adjustment method	Adjustment item
Power running	Actual motor speed is lower than target speed.	Increase the Motor Parameter R2 value gradually, up to 120% of the set value.	H021/H221/ H031/H231
	Actual motor speed is higher than target speed.	Decrease the Motor Parameter R2 value gradually, up to 80% of the set value.	H021/H221/ H031/H231
Regeneration	Torque is insufficient at low frequencies (at 1 to 3 Hz).	Increase the Motor Parameter R1 value gradually, up to 120% of the set value.	H020/H220/ H030/H230
		Increase the Motor Parameter Io value gradually, up to 120% of the set value.	H023/H223/ H033/H233
During startup	Shock occurs during startup.	Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H224/ H034/H234
During deceleration	Motor is hunting.	Decrease the Speed Response value.	H005/H205
		Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H224/ H034/H234
During torque limit	Torque becomes insufficient at low frequencies when torque limit is enabled.	Set the Overload Limit Level to a value lower than the Torque Limit.	b021/ b041 to b044
Low-frequency operation	Rotation is unstable.	Increase the Motor Parameter J value, relative to the set value.	H024/H224/ H034/H234

Precautions for Correct Use

- Be sure to set the Carrier Frequency (b083) to 2.1 kHz or higher. The inverter will not operate normally at 2.1 Hz or lower.
- To use a motor one size smaller in capacity than the inverter, set the Torque Limit 1 to 4 (b041 to b044) to the value calculated by using the following formula. Be sure that the value α is not more than 200%. Otherwise, the motor may burn out.

  α = Torque Limit set value x (Inverter capacity) / (Motor capacity)

  Example
  To result in α = 200% when the inverter capacity is 0.75 kW and the motor capacity is 0.4 kW, according to the above formula, the Torque Limit set value (b041 to b044) can be calculated as follows: α x (Motor capacity) / (Inverter capacity) = 200% x (0.4 kW) / (0.75 kW) = 106%.

6-2-6 Adjustment for 0 Hz Sensorless Vector Control

- To use the 0-Hz sensorless vector control method, perform offline auto-tuning. If you cannot perform offline auto-tuning, set the motor parameters appropriately according to *6-2-4 Motor Parameter Settings* on page 6-11.
- The inverter may not provide sufficient performance characteristics if your motor is two or more sizes smaller than the maximum applicable motor capacity. This is because the inverter requires a current accuracy of at least 50% of the rated current.
- If the sensorless vector control method does not provide the intended performance characteristics, adjust the appropriate motor parameter depending on the phenomenon, as shown in the following table.

Operation status	Phenomenon	Adjustment method	Adjustment item
Power running	Actual motor speed is lower than target speed.	Increase the Motor Parameter R2 value gradually, up to 120% of the set value.	H021/H221/ H031/H231
	Actual motor speed is higher than target speed.	Decrease the Motor Parameter R2 value gradually, up to 80% of the set value.	H021/H221/ H031/H231
Regeneration	Torque is insufficient at low frequencies (at 1 to 3 Hz).	Increase the Motor Parameter R1 value gradually, up to 120% of the set value.	H020/H220/ H030/H230
		Increase the Motor Parameter Io value gradually, up to 120% of the set value.	H023/H223/ H033/H233
During startup	Shock occurs during startup.	Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H224/ H034/H234
During low-speed startup	Workpiece falls when brake is released during low-speed startup.	Increase the Limit at 0 Hz value, up to 150% of the rated current of the inverter. If the workpiece falls only at the moment when the brake is released, increase the Boost Amount at SLV Startup value.	H060/H260 H061/H261
During deceleration	Motor is hunting.	Decrease the Speed Response value.	H005/H205
		Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H224/ H034/H234
Immediately after deceleration	Overcurrent or overvoltage protection error occurs.	Decrease the Motor Parameter Io value gradually, up to 80% of the set value.	H023/H223/ H033/H233
		Set the AVR Selection (A081) value to 00 (Always ON) or 01 (Always OFF).	A081
Low-frequency operation	Rotation is unstable.	Increase the Motor Parameter J value, relative to the set value.	H024/H224/ H034/H234

Precautions for Correct Use

- Be sure to set the Carrier Frequency (b083) to 2.1 kHz or higher. The inverter will not operate normally at 2.1 Hz or lower.
- To use a motor one size smaller in capacity than the inverter, set the Torque Limit 1 to 4 (b041 to b044) to the value calculated by using the following formula. Be sure that the value α is not more than 200%. Otherwise, the motor may burn out.

  α = Torque Limit set value x (Inverter capacity) / (Motor capacity)

  Example
  To result in α = 200% when the inverter capacity is 0.75 kW and the motor capacity is 0.4 kW, according to the above formula, the Torque Limit set value (b041 to b044) can be calculated as follows: α x (Motor capacity) / (Inverter capacity) = 200% x (0.4 kW) / (0.75 kW) = 106%.

6-3 Sensor Vector Control

Follow the steps below to set the sensor vector control function.

- Sensor vector control parameter settings
- PG Board settings
- Auto-tuning
- Adjustment

6-3-1 Sensor Vector Control Parameter Settings

- Set the 1st Control Method (A044) to 05 (Sensor vector control).
- Set the 1st Motor Capacity (H003) and the 1st/ Motor Pole Number (H004) according to your motor.
- In the 1st Base Frequency (A003), set the rated frequency of the motor. In the Motor Rated Voltage Selection (A082), set the rated voltage of the motor.
- Sensor vector control can be used only for the 1st control method.
- Sensor vector control cannot be used in the light load mode.
- In the V2 Control Mode Selection (P012), set the control method used for sensor vector control. You can select speed control, position control, etc.

Parameter No.	Function name	Data	Default data	Unit
A044	1st Control Method	05: Sensor vector control (V2) *1	00	–
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
A003	1st Base Frequency	30. to 1st Maximum Frequency (A004)	60	Hz
A082	Motor Rated Voltage Selection	200-V class: 200V/215V/220V/230V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	
b049	Heavy Load/Light Load Selection	00: Heavy load mode (CT) 01: Light load mode (VT)	00	–
P012	V2 Control Mode Selection	00: ASR (Speed control mode) 01: APR (Pulse train position control mode) 02: APR2 (Absolute position control mode) 03: HAPR (High-resolution absolute position control mode)	00	–

*1. Sensor vector control can be selected only for the 1st control method.

6-3-2 Overview of PG Board

The PG Board 3G3AX-PG01 enables the inverter capture the feedback signal from an encoder.

In addition, the use of the PG Board enables the following controls.

- Sensor vector control
- Pulse train frequency input (Frequency Reference Selection (A001) = 06)

The PG Board has the following functions.

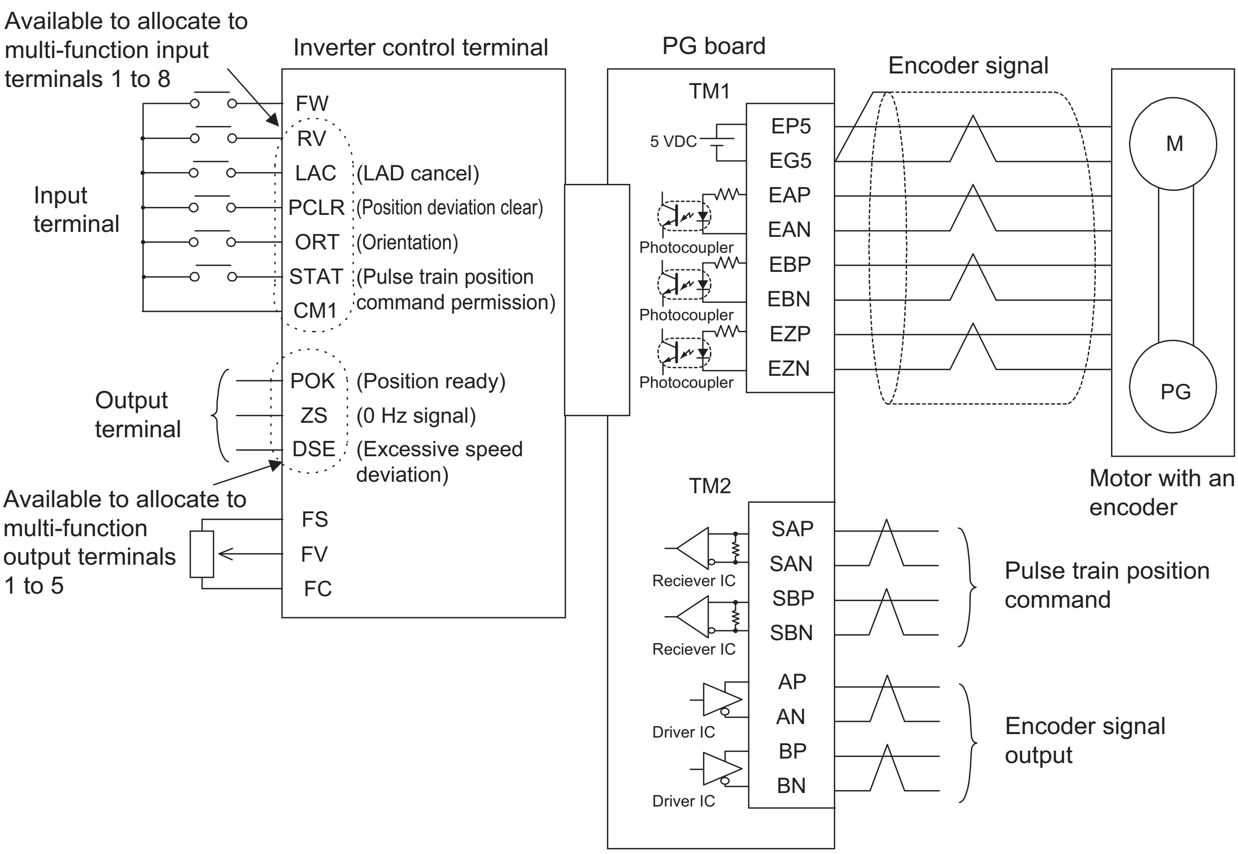
- Encoder feedback pulse input
- Pulse train command input (Frequency reference or Position command)
- Encoder feedback pulse output

To confirm that the encoder is wired correctly, once set the 1st Control Method (A044) to 00 (Constant torque characteristics), start inverter operation, and check the rotation direction in the Real Frequency Monitor (d008).

The encoder is wired correctly if the monitor displays a positive value for the Forward command and a negative value the Reverse command.

Additional Information

- The inverter supports line driver encoders only. Open collector type encoders are not supported.
- The PG Board (Model: 3G3AX-PG01) has a built-in power supply for encoder use.
  Power supply specifications: +5 VDC, 150 mA maximum.



6-3-3 PG Board Function Settings

- Set the number of actual encoder pulses in the Number of Encoder Pulses (P011). In P011, set the number of pulses (after x1 multiplication).
- Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 22 (DSE) to output the excessive speed deviation signal.
- In the Speed Deviation Excessive Level (P027), set the level of excessive deviation. The DSE signal turns ON when the deviation between the real frequency and the reference frequency becomes equal to or greater than the P027 value. However, the inverter does not detect this as a trip error.

Parameter No.	Function name	Data	Default data	Unit
P011	Number of Encoder Pulses	128 to 9999. 1000 to 6553 (10000 to 65535): Set the number of actual encoder pulses.	1024	pulse
P027	Speed Deviation Excessive Level	0.00 to 99.99, 100.0 to 120.0: DSE signal output level	7.50	Hz
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
C021 to C025	Multi-function Output P1 to P5 Selection	22: DSE (Excessive speed deviation)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

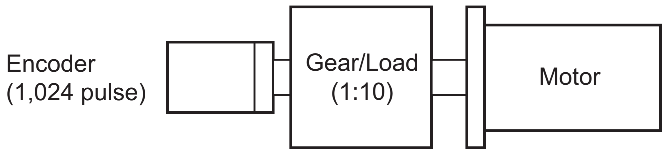
Motor Gear Ratio Setting Function

- Use this function for equipment that cannot be directly coupled to the encoder motor shaft, which uses a reduction gear system between the motor and the encoder.
- Set the number of actual encoder pulses in the Number of Encoder Pulses (P011).
- In the Motor Gear Ratio Numerator/Denominator (P028/P029), set the reduction ratio of the motor to the encoder.
  These settings convert the set number of encoder pulses into the motor-shaft conversion and generate the resulting number of pulses in the inverter.
  This allows the inverter to detect the speed/position based on the motor-shaft conversion number of encoder pulses.

Parameter No.	Function name	Data	Default data	Unit
P011	Number of Encoder Pulses	128. to 9999. 1000 to 6553 (10000 to 65535) Set the number of actual encoder pulses.	1024.	pulse
P028	Motor Gear Ratio Numerator	0. to 9999 Set the rotation ratio of the motor to the encoder.	1.	–
P029	Motor Gear Ratio Denominator			

Note Be sure to set the numerator and the denominator so that the following condition is met: $1/50 \le N/D \le 20$.
(N: Motor gear ratio numerator, D: Motor gear ratio denominator)

Example



For a motor-to-encoder reduction ratio of 1 to 10, set the following parameters values.

- Number of Encoder Pulses (P011): 1,024
- Motor Gear Ratio Numerator (P028): 1
- Motor Gear Ratio Denominator (P029): 10

6-3-4 Auto-tuning of Motor Parameters

- Use this function to measure and automatically set the motor parameters required for the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control.
- To use the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control method, perform offline auto-tuning to measure the motor parameter values.
- If an Encoder disconnection (E60. ☐/ E70. ☐) or Overspeed (E61. ☐/E71. ☐) error occurs, check the encoder wiring and the parameter settings for the PG Board.
- Sensor vector control can be used only for the 1st control method.
- The measured motor parameter values will be set as 50-Hz data for one phase in 3-phase Y-connection.

Parameter No.	Function name	Data	Default data	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00	–
H002	1st Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
H030	1st Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H031	1st Motor Parameter R2 (Auto-tuning Data)			
H032	1st Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		mH
H033	1st Motor Parameter Io (Auto-tuning Data)			A
H034	1st Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kg/m^2
A003	1st Base Frequency	30. to 1st/2nd Maximum Frequency (A004, A204)	60	Hz

Parameter No.	Function name	Data	Default data	Unit
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–
A082	Motor Rated Voltage Selection	200-V class: 200V/215V/220V/230V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	V

Offline Auto-Tuning Steps

Offline auto-tuning consists of the following five steps:

- Presetting of parameters
- Selection of motor rotation during auto-tuning
- Auto-tuning
- Operations after auto-tuning
- Operations in case of error

1 Presetting of parameters

(1) Set the 1st Motor Capacity (H003) and the 1st Motor Pole Number (H004) according to your motor.

(2) Set the 1st Base Frequency (A003) to the rated frequency of the motor and the Motor Rated Voltage Selection (A082) to the rated voltage of the motor.

(3) Change the DC Injection Braking Selection (A051) from 01 (Enabled) to 00 (Disabled).

If the DC Injection Braking Selection (A051) is set to 01 (Enabled), change it to 00 (Disabled). If it is set to enabled, auto-tuning will not complete.

(4) Set the Output Voltage Gain (A045) to 100%.

This parameter is set to 100% by default. Restore it to 100% if the data is different.

(5) Make sure that the torque reference input permission terminal (52: ATR) is OFF.

Correct measurement is not possible when the terminal is ON.

Parameter No.	Function name	Data	Default data	Unit
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
A003	1st Base Frequency	30. to 1st/2nd Maximum Frequency (A004, A204)	60	Hz
A045	Output Voltage Gain	20. to 100.	100.	%
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–
A082	Motor Rated Voltage Selection	200-V class: 200V/215V/220V/230V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	V

2 Selection of motor rotation during auto-tuning

In the Auto-tuning Selection (H001), select whether the motor rotates during auto-tuning.

Set value	Description
01	The motor does not rotate during auto-tuning.
02	The motor rotates during auto-tuning.

Motor rotation selection	Description
Motor does not rotate (01)	Measures motor parameter values without rotating the motor. Use this setting if you do not rotate the motor. Because the motor does not rotate, the Motor Parameter Io (No-load current) and Motor Parameter J (Moment of inertia) values cannot be measured.
Motor rotates (02)	Measures motor parameter values with the motor rotating. Use this setting if you can rotate the motor without any problem.

Parameter No.	Function name	Data	Default data	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00	–

3 Auto-tuning

(1) After presetting of parameters, set the Auto-tuning Selection (H001) to 01 (Enabled: No motor rotation) or 02 (Enabled: Motor rotation).

(2) Turn ON the RUN command.
Turning ON the RUN command starts automatic operation in the following procedure.

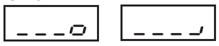
1) 1st AC excitation (Motor does not rotate.)
↓
2) 2nd AC excitation (Motor does not rotate.)
↓
3) 1st DC excitation (Motor does not rotate.)
↓
4) V/f operation (Motor accelerates up to 80% of base frequency.)
↓
5) SLV operation (Motor accelerates up to X% of base frequency.)
↓
6) 2nd DC excitation (Motor does not rotate.)
↓
7) Auto-tuning result is displayed.

Note 1 Steps 4 and 5 will be skipped in auto-tuning without motor rotation (H001 = 01).

2 The motor speed X in step 5 is given as follows, where T is the acceleration or deceleration time in step 4, whichever is greater.
T ≤ 0 < 50 s: X = 40%
0 s ≤ T ≤ 100 s: X = 20%
100 s ≤ T: X = 10%

3 The auto-tuning result will be displayed as follows.

Normal end   Abnormal end



If auto-tuning is aborted by an error, retry it.
To clear the above display, press the STOP/RESET key.

Precautions for Correct Use

- Even if you set H001 to 01 (Auto-tuning without motor rotation), the motor may rotate slightly.
- To perform auto-tuning for a motor one size smaller in capacity than the inverter, enable the overload limit function and set the overload limit level to 150% of the rated current of the motor.
- If the Overvoltage Suppression Integral Time During Deceleration (b134) is set too small, an Overvoltage trip (E07) may occur during auto-tuning. In this case, increase the b134 value and retry auto-tuning.
- Make sure the following points before starting auto-tuning with motor rotation enabled.

There is no problem even if the motor accelerates up to approximately 80% of the base frequency.
The motor is not driven by external equipment.
The brake is released.
During auto-tuning, the inverter does not provide full output torque, which could result in a slip-and-fall accident in elevating or other applications. To prevent this, remove the motor from the load and perform the auto-tuning with the single motor. In this case, because the moment of inertia J is given for the single motor, calculate the motor-shaft conversion of the moment of inertia of the load machine and add it to this value.
In applications such as an elevator or ball screw where the amount of motor shaft rotation is limited, the motor may rotate over the allowable rotation amount, which may result in a mechanical damage. Be sure to set H001 to 01 (Enabled: No motor rotation).
If the Motor Parameter Io (No-load current) value is unknown, measure in advance the no-load current value at 50 Hz under V/f control and set it in H033/H233 before auto-tuning.

4 Operations after auto-tuning

- After normal completion of auto-tuning, set the 1st Motor Parameter selection (H002) to 01 (Auto-tuning).
  This enables the 1st motor parameters (H030 to H034) set by the auto-tuning function.
- At the end of auto-tuning, the inverter automatically resets the Auto-tuning Selection (H001) to 00 (Disabled).
  To retry auto-tuning, set H001 again to enable auto-tuning.
- During auto-tuning without motor rotation, the Motor Parameter Io (No-load current) and Motor Parameter J (Moment of inertia J) values are not measured. Set the following parameters at the end of auto-tuning.

1st Motor Parameter Io (H033):	Measure and set the no-load current of the single motor at 50 Hz in advance. Alternatively, check the no-load current of the motor at 50 Hz with the motor manufacturer and set it.
1st Motor Parameter J (H034):	Calculate and set the motor-shaft conversion of the moment of inertia of the load machine.

Precautions for Correct Use

- To operate the inverter with the auto-tuned data after normal completion of auto-tuning, be sure to change the 1st Motor Parameter selection (H002) setting to 01.
- Adjust the DC Injection Braking Selection (A051) and Output Voltage Gain (A045) values according to the user environment.

Parameter No.	Function name	Data	Default data	Unit
H002	1st Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–
H030	1st Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H031	1st Motor Parameter R2 (Auto-tuning Data)			
H032	1st Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		mH
H033	1st Motor Parameter Io (Auto-tuning Data)			A
H034	1st Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kg/m^2
A045	Output Voltage Gain	20. to 100.	100.	%
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–

5 Operations in case of error

If auto-tuning is aborted by an error, review the preset parameters and check the rated motor torque ratio of the inverter to that of the motor. If the load is too heavy, disconnect the load and retry auto-tuning.

If the error persists or auto-tuning is still aborted, enter the motor parameter values directly.

For details, refer to *6-3-5 Motor Parameter Settings* on page 6-24.

Precautions for Correct Use

- If a trip error occurs during auto-tuning, the auto-tuning process will be force-terminated. In this case, the inverter displays the alarm code for the trip error in preference to the abort display. Check the cause of the trip error.
- If the auto-tuning process does not terminate, press the STOP/RESET key. Then, the process will be force-terminated. Review the preset parameters and retry auto-tuning.
- If the auto-tuning process is terminated by STOP command input by pressing the STOP key or by turning OFF the RUN command, the parameters for auto-tuning may be left in the inverter.
- When the control method is set to Free V/f setting, starting offline auto-tuning causes the inverter to terminate the process with the abort display.

Online Auto-Tuning Function

- The performance of sensorless vector control is sufficiently provided by simply executing offline auto-tuning.
- However, motor parameter values change with time due to a temperature rise in the motor and many other aspects. To compensate for such changes in the motor parameter values to perform more stable operation with less torque changes, use the online auto-tuning function.
- The online auto-tuning function, measures the motor parameter values each time the inverter stops the operation and applies them to the motor parameters used for sensor vector control.
- Sensor vector control can be used only for the 1st control method.

Parameter No.	Function name	Data	Default data	Unit
H002	1st Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–

Note the following points before using this function.

- Before using the online auto-tuning function, be sure to perform offline auto-tuning. The data required for online auto-tuning is calculated during offline auto-tuning.
- The online auto-tuning function will be activated for up to 5 seconds after the motor stops. (The inverter executes DC excitation once for tuning the Motor Parameters R1 and R2, this result is not displayed, however). If the RUN command is input during this period, the online auto-tuning process will be aborted at that point because the RUN command is given priority. (In this case, the tuning result will not be reflected.)
- If the DC injection braking on jogging stop function is enabled, online auto-tuning will start after DC injection braking is completed.
- When the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 54 (SON) or 55 (FOC), the online auto-tuning function is not performed.

● Operating Procedure

1 **Set the 1st Motor Parameter selection (H002) to 02 (Online auto-tuning enabled).**

The Auto-tuning Selection (H001) must be set to 00 (Disabled).

2 **Input the RUN command.**

The inverter will perform online auto-tuning automatically during the stop.

Secondary Resistance Compensation Function (Temperature Compensation)

- This function provides compensation for suppressing the variation of the rotation speed due to temperature changes in the motor. It is enabled when sensorless vector control, 0-Hz sensorless vector control, or sensor vector control is selected as the control method. Use the thermistor PB-41E (from SHIBAURA ELECTRONICS).
- To use this function, set the Thermistor Selection (b098) to 02 (NTC). Other thermistor settings do not provide correct temperature detection.

Parameter No.	Function name	Data	Default data	Unit
P025	Secondary Resistance Compensation Selection	00: Disabled 01: Enabled	00	–

6-3-5 Motor Parameter Settings

- To use the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control method, you need to set the motor parameters. Normally, perform offline auto-tuning to determine the motor parameter values.
- Set the motor parameters manually if the offline auto-tuning process is aborted, for example, if the inverter does not reach 50% of the rated current during auto-tuning.
- Set the 1st Motor Parameter selection (H002) to 00 (Standard motor parameter).
  By default, the inverter is set to use the motor parameter values for typical general-purpose motors. To maximize the performance of the vector control, adjust each parameter value according to your motor.
- Obtain the motor’s datasheet from the motor manufacturer to set the motor parameters.

  The following values must be set as 50-Hz data for one phase in 3-phase Y-connection.

Winding resistance on primary side of motor:	Set the wiring resistance (in Ω) on the primary side of the motor for one phase in Y-connection.
Winding resistance on secondary side of motor:	Set the wiring resistance (in Ω) on the secondary side of the motor for one phase in Y-connection.
Motor leakage inductance:	Set the motor leakage inductance (in mH) in Y-connection.
Motor no-load current:	Set the no-load current of the motor, or set the current value measured when the motor rotates with no load at 50 Hz.
Moment of inertia:	Add the moment of inertia of the motor and that of the load and set the motor-shaft conversion of the sum.

Parameter No.	Function name	Data	Default data	Unit
A044	1st Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control 04: 0-Hz sensorless vector control 05: Sensor vector control (V2)	00	–
H002	1st Motor Parameter selection	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	00	–
H003	1st Motor Capacity	0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
H020	1st Motor Parameter R1 (Winding resistance on primary side)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H021	1st Motor Parameter R2 (Winding resistance on secondary side)			
H022	1st Motor Parameter L (Leakage inductance)	0.01 to 99.99 100.0 to 655.3		mH
H023	1st Motor Parameter Io (No-load current)	0.01 to 99.99 100.0 to 655.3		A
H024	1st Motor Parameter J (Moment of inertia)	0.001 to 9.999 *1 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kg/m^2

*1. For the Moment of Inertia J, set the motor conversion value. The larger the J value, the higher the response speed, which results in a steep torque rise; the smaller the J value, the lower the response speed, which results in gradual torque rise. After setting the J value, adjust the response speed in the 1st/2nd Speed Response (H005/H205).

Precautions for Correct Use

Under sensorless vector control, 0-Hz sensorless vector control, or sensor vector control, because of its control characteristics, the inverter may output a rotation signal opposite to the RUN command direction at low speeds. If allowing the motors to rotate in the opposite rotation may pose a risk of mechanical damage or any other problem, set the Reverse Rotation Prevention Selection (b046) to 01 (Enabled). (Refer to *Reverse Rotation Prevention Function* on page 7-83).

6-3-6 Adjustment for Sensor Vector Control (Speed Control)

- To use the sensor vector control method, perform offline auto-tuning.
  If you cannot perform offline auto-tuning, set the motor parameters appropriately according to *6-3-5 Motor Parameter Settings* on page 6-24.
- After completion of auto-tuning, set the V2 Control Mode Selection (P012) to 00 (Speed control) to adjust the motor parameter values.
- The inverter may not provide sufficient performance characteristics if you motor is two or more sizes smaller than the maximum applicable motor capacity.
- If acceleration is abnormal, or if an Encoder disconnection (E60. ☐/ E70. ☐) or Overspeed (E61. ☐/E71. ☐) error occurs, check the encoder wiring and the parameter settings for the PG Board.
- If sensor vector control cannot provide the desired characteristics, adjust the motor parameters depending on the phenomena, as shown in the table below.

Operation status	Phenomenon	Adjustment method	Adjustment item
During startup	Shock occurs during startup.	Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H034
During deceleration	Motor is hunting.	Decrease the Speed Response value.	H005
		Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H034
During torque limit	Torque becomes insufficient at low frequencies when torque limit is enabled.	Set the Overload Limit Level to a value lower than the Torque Limit.	b021/ b041 to b044
Low-frequency operation	Rotation is unstable.	Increase the Motor Parameter J value, relative to the set value.	H024/H034

Precautions for Correct Use

- Be sure to set the Carrier Frequency (b083) to 2.1 kHz or higher. The inverter will not operate normally at 2.1 Hz or lower.
- To use a motor one size smaller in capacity than the inverter, set the Torque Limit 1 to 4 (b041 to b044) to the value calculated by using the following formula. Be sure that the value α is not more than 200%. Otherwise, the motor may burn out.

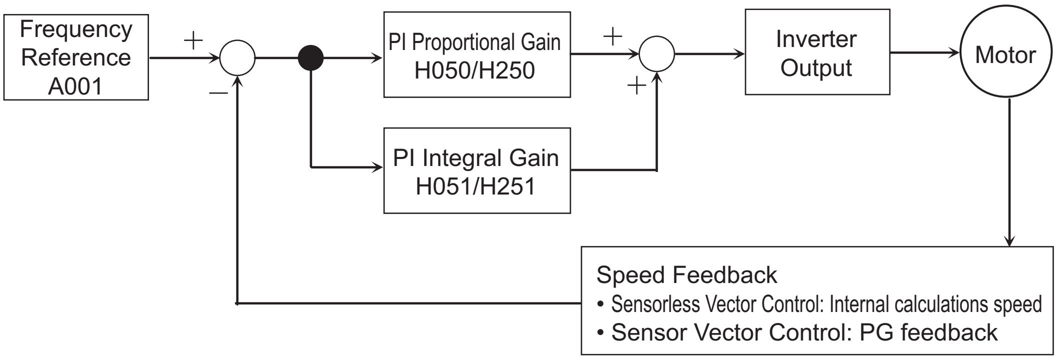
  α = Torque Limit set value x (Inverter capacity) / (Motor capacity)

  Example
  To result in α = 200% when the inverter capacity is 0.75 kW and the motor capacity is 0.4 kW, according to the above formula, the Torque Limit set value (b041 to b044) can be calculated as follows: α x (Motor capacity) / (Inverter capacity) = 200% x (0.4 kW) / (0.75 kW) = 106%.

6-4 Speed Control

Sensorless vector control, 0-Hz sensorless vector control, or Sensor vector control, when enabled, configures a speed control loop inside the inverter.
By configuring a speed control loop, it improves the accuracy of speed control.
To improve the responsiveness in load operation, adjust the following speed control loop gain parameters.

Parameter No.	Function name	Data	Default data	Unit
A044/A244	1st/2nd Control Method	03: Sensorless vector control 04: 0-Hz sensorless vector control 05: Sensor vector control (V2)	00	–
P012	V2 Control Mode Selection	00: ASR (Speed control mode)		



6-4-1 Speed Control Gain Parameters

Configure the speed control loop gain parameters to improve the responsiveness in load operation. Adjust the following gain parameters while repeating a typical application operation and, when you are sure that the responsiveness has improved, fix the settings.

- If vibration or hunting occurs before adjusting the 1st/2nd PI Proportional Gain (H050/H250) or 1st/2nd PI Integral Gain (H051/H251) value, gradually decrease the 1st/2nd Speed Response (H005/H205) value to improve the condition.
- Gradually increase the 1st/2nd PI Proportional Gain (H050/H250) value to make sure that the speed responsiveness has improved.
- Next, gradually increase the 1st/2nd PI Integral Gain (H051/H251) value to make sure that a sufficient holding force is obtained during stop.
- If vibration or overshooting/undershooting occurs, decrease the PI Integral Gain value to improve the condition.
- If adjusting the PI Proportional Gain and PI Integral Gain settings still does not provide sufficient responsiveness, gradually increase the 1st/2nd Speed Response (H005/H205) to improve the condition. If vibration or hunting occurs as you improve the speed responsiveness, further adjustment is difficult. Restore the previous setting.

Parameter No.	Function name	Data	Default data	Unit
H005/H205	1st/2nd Speed Response	0.001 to 9.999 10.00 to 80.00 (10.000 to 80.000)	1.590	–
H050/H250	1st/2nd PI Proportional Gain	0.0 to 999.9, 1000.	100.0	–
H051/H251	1st/2nd PI Integral Gain	0.0 to 999.9, 1000.	100.0	–

Precautions for Correct Use

Before adjusting these parameters, adjust the motor parameters with no load. For details, refer to *6-2-3 Auto-tuning of Motor Parameters* on page 6-5.

6-4-2 P/PI Switching Function

- This function is enabled when sensorless vector control, 0-Hz sensorless vector control, or sensor vector control is selected as the control method.
- It enables the control gain setting for the speed control loop to be switched from normally used proportional integral (PI) control to proportional (P) control.
- Switching to proportional (P) control lowers the overall speed control loop gain level and is an effective method to reduce vibration etc.
  It is used in the following cases.

Equipment generates a large friction force and a torque equivalent to that friction force is produced during stop, resulting in an overload. Switch the control method to proportional (P) control. By doing so, the torque during stop will decrease, preventing overloading.
Equipment has low machine rigidity and is likely to cause vibration. Switch the control method to proportional (P) control in a state where vibration is likely to occur. This prevents vibration.
If two axes are coupled, switch the control method for one axis to proportional (P) control to keep balance with the other.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	43: PPI (P/PI switching)	–	–
H050/H250	1st/2nd PI Proportional Gain	0.0 to 999.9, 1000.	100.0	–
H051/H251	1st/2nd PI Integral Gain	0.0 to 999.9, 1000.	100.0	–
H052/H252	1st/2nd P Proportional Gain	0.01 to 10.00	1.00	–

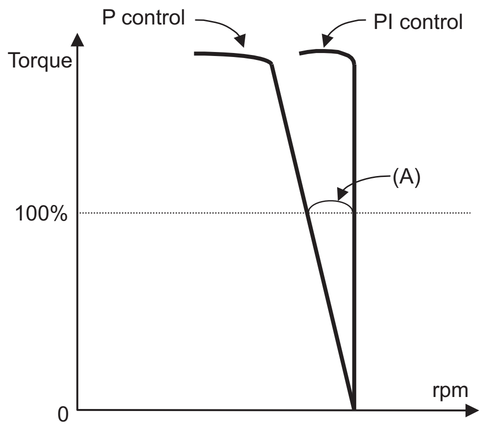
Note 1 Sensorless vector control and 0-Hz sensorless vector control can be selected for the 1st/2nd control.
2 Sensor vector control can be selected for the 1st control.

- When the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 43 (PPI: P/PI switching), turning OFF/ON the signal switches the control method as follows.

OFF	Proportional integral control
ON	Proportional control

- When the Multi-function Input S1 to S8 Selection (C001 to C008) is not set to 43 (PPI: P/PI switching), the inverter provides proportional integral control.

Normally, for speed control, the inverter uses the proportional integral (PI) control method, which controls so that the difference between the frequency reference and the actual rotation speed becomes 0. However, in order to drive a single load with more than one motor, proportional (P) control may be used. To switch to proportional (P) control, allocate the P/PI switching function to one of the multi-function input S1 to S8 via the Digital Operator and turn ON the terminal. Then, set the KPP value in the 1st P Proportional Gain (H052) to enable proportional control.



The relationship between the KPP value and speed change ratio is expressed broadly in the following formula:

$$\text{(Speed change ratio)} = \frac{10}{\text{(KPP set value)}} \quad [\%]$$

The relationship between speed change ratio and speed error is expressed broadly in the following formula:

$$\text{(Speed change ratio)} = \frac{\text{Speed error at rated torque [A]}}{\text{Synchronous rpm at base frequency}} \times 100\ [\%]$$

6-4-3 Control Gain Switching Function

- This function is enabled when sensorless vector control, 0-Hz sensorless vector control, or sensor vector control is selected as the control method.
- It provides two speed control loop gain settings, which can be switched as required.
  For example, switch the gain setting according to the load condition in the following cases.

When using two control gain settings to switch between a low-level gain that does not cause vibration during stop and a high-level gain that provides higher responsiveness for high-speed operation
When the applied load (inertia) changes to a large extent and requires the control gain to be switched between the high-load and low-load settings

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	26: CAS (Control gain switching)	–	–
H050/H250	1st/2nd PI Proportional Gain	0.0 to 999.9, 1000.	100.0	–
H051/H251	1st/2nd PI Integral Gain	0.0 to 999.9, 1000.	100.0	–
H052/H252	1st/2nd P Proportional Gain	0.01 to 10.00	1.00	–
H070	For PI Proportional Gain Switching	0.0 to 999.9, 1000.	100.0	–
H071	For PI Integral Gain Switching	0.0 to 999.9, 1000.	100.0	–
H072	For P Proportional Gain Switching	0.0 to 10.00	1.00	–
H073	Gain Switching Time	0. to 9999.: Gain switching taper time	100.	ms

Note 1 Sensorless vector control and 0-Hz sensorless vector control can be selected for the 1st/2nd control.

2 Sensor vector control can be selected for the 1st control.

- When the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 26 (CAS: Control gain switching), turning OFF/ON the signal switches the control method as follows.

OFF	H050/H250/H051/H251/H052/H252
ON	H070/H071/H072

- When the Multi-function Input S1 to S8 Selection (C001 to C008) is not set to 26 (CAS: Control gain switching), the inverter uses the same parameter settings as when the signal is OFF.

6-4-4 Torque Bias Function Settings

- This function applies bias to the torque reference output from the speed control loop and is enabled when sensor vector control is selected.
  It is useful when the inverter needs to output a sufficient torque to ensure smooth release/hold of the brake in elevating axis.

Parameter No.	Function name	Data	Default data	Unit
P036	Torque Bias Mode	00: None 01: Set via the Digital Operator (P037) 02: Set via terminal FE *1	00	–
P037	Torque Bias Value	–200 to 200. (04 to 55 kW) –180 to 180. (75 to 132 kW) Enabled when P036 = 01	0.	%
P038	Torque Bias Polarity Selection *2	00: Signed 01: Depends on the RUN direction	00	–
Related functions		d010		

*1. When the torque bias function is allocated to the terminal FE, the inverter recognizes –10 to 10 V as –200 to 200% (for 0.4 to 55 kW) and as –180 to 180% (for 75 to 132 kW), respectively.

*2. When P038 = 00 (Signed): The torque increases in the forward direction when the torque bias signal is positive (+) and in the reverse direction when negative (–), independent of the RUN direction.
When P038 = 01 (Depends on the RUN direction): The torque bias signal sign (+/–) and the direction in which the torque bias function operates change depending on the RUN command direction.

Forward command	Torque bias value increases in forward direction when torque bias value is positive (+).
Reverse command	Torque bias value increases in reverse direction when torque bias value is positive (+).

6-5 Torque Limit Function

6-5-1 Torque Limit Function Settings

- Use the torque limit function to limit the output torque of motor.
  This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control).

Parameter No.	Function name	Data		Default data	Unit
A044	1st Control Method	Heavy load (CT)	03: Sensorless vector control (SLV) 04: 0-Hz sensorless vector control 05: Sensor vector control (V2)	00	–
		Light load (VT)	03: Sensorless vector control (SLV)	00	
A244	2nd Control Method	Heavy load (CT)	03: Sensorless vector control (SLV) 04: 0-Hz sensorless vector control	00	
		Light load (VT)	03: Sensorless vector control (SLV)	00	
b040	Torque Limit Selection	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Option 1 04: Option 2		00	–
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150.	120.	%
			no: Torque limit disabled		
b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150. (0.4 to 132 kW)	120.	%
			no: Torque limit disabled		
b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150. (0.4 to 132 kW)	120.	%
			no: Torque limit disabled		

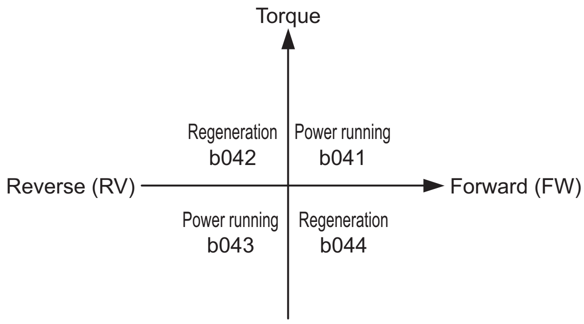
Parameter No.	Function name	Data		Default data	Unit
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150. (0.4 to 132 kW)	120.	%
			no: Torque limit disabled		
C001 to C008	Multi-function Input S1 to S8 Selection	40: Torque limit enabled 41: Torque limit switching 1 42: Torque limit switching 2		–	–
C021 to C025	Multi-function Output P1 to P5 Selection	10: Torque limit		–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			–	–

- The Torque Limit Selection (b040) provides four modes as shown below.

Mode	Description
Four-quadrant separate setting mode	Use this mode to set the four-quadrant (Forward Power Running, Reverse Regeneration, Reverse Power Running, and Forward Regeneration) torque limits in Torque Limit 1 to 4 (b041 to b044).
Terminal switching mode	Use this mode to switch the Torque Limit 1 to 4 (b041 to b044) setting based on the combination of the torque limit switching functions 1 and 2 (TRQ1 and TRQ2) allocated to multi-function input terminals. The selected torque limit value is enabled for all RUN modes.
Analog input mode	Use this mode to set the torque limit value based on the voltage applied to the terminal FE of the control terminal block. 0 to 10 V corresponds to the torque limit value of 0% to 200%. The selected torque limit values are effective for all RUN modes.
Option (option 1, option 2) mode	Use this mode to set the torque limit value from optional equipment. At present, OMRON provides no options that support this mode.

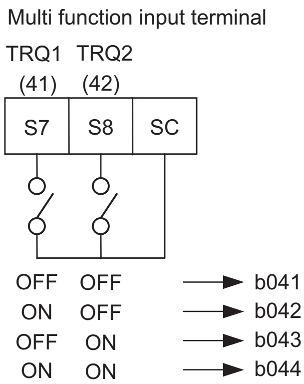
- When the Torque limit enabled (TL) function is allocated to one of the multi-function input terminals, the torque limit function set in the Torque Limit Selection (b040) is enabled only when the terminal TL is ON.
  When this terminal is OFF, the torque limit setting is disabled and the inverter uses the maximum value as the torque limit value.
  When the Torque limit enabled (TL) function is not allocated to one of the multi-function input terminals, the torque limit function set in the Torque Limit Selection (b040) is always enabled.
- This function regards the torque limit value when the inverter outputs the maximum potential current as 200%.
  To convert to the rated motor torque ratio from this value, use the following formula:
  Rated motor torque ratio = Set value x Rated motor current / Rated output current of inverter

- The following figure shows the Torque Limit 1 to 4 (b041 to b044) when the Torque Limit Selection (b040) is set to 00 (Four-quadrant separate setting).



- When the Torque Limit Selection (b040) is set to 01 (Terminal switching), the Torque Limit 1 to 4 (b041 to b044) switched by the torque limit switching 1 and 2 functions allocated to two of the multi-function input terminals are defined as follows.

Example. When TRQ1 (torque limit switching 1) and TRQ2 (torque limit switching 2) are allocated to multi-function input terminals S7 and S8, respectively (C007 =41, C008 =42)



- To use the torque limit function in a low speed range, also use the overload limit function.

6-5-2 Torque LADSTOP Function Settings

- Use this function to stop temporarily the frequency acceleration/deceleration function (LAD) when the torque limit function is activated.
  The torque limit function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control, or 05 (Sensor vector control).
  LAD functions to calculate transient frequency reference value to enable the motor to reach the reference frequency in the set acceleration/deceleration time.
- This function stops temporarily the frequency reference at the transient value calculated by LAD when it reaches the torque limit and restarts at that frequency when the torque limit is reset.
  This enables the motor to run smoothly after the reset of the torque limit, which prevents overloading.

Parameter No.	Function name	Data	Default data	Unit
b045	Torque LADSTOP Selection	00: Disabled 01: Enabled	00	–

6-6 Pulse Train Position Control Mode

6-6-1 Pulse Train Position Control Mode Settings

- To use this function, set the 1st Control Method (A044) to 05 (Sensor vector control) and the V2 Control Mode Selection (P012) to 01 (Pulse train position control).

Under sensor vector control, select the heavy load mode (b049 = 00).
Sensor vector control can be selected only for the 1st control.

- Select the input mode for the pulse train position command in the Pulse Train Input Selection (P013).
- Set the positioning completion signal that determines the completion of position control.
  Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 23 (POK: Position ready).
  The position completion signal will be output when the current position reaches the target position range set in the Positioning Completion Range Setting (P017). In the Positioning Completion Delay Time Setting (P018), set the time until the signal is stabilized depending on your application.

Parameter No.	Function name	Data	Default data	Unit
P012	V2 Control Mode Selection	01: APR (Pulse train position control mode)	00	–
P013	Pulse Train Input Selection	00: Mode 0 (90°phase difference pulse train) 01: Mode 1 (Forward/Reverse command + pulse train) 02: Mode 2 (Forward/pulse train + Reverse pulse train)	00	–
P017	Positioning Completion Range Setting	0. to 9999., 1000 (10000): Set as a value equivalent to encoder resolution x4.	5.	pulse
P018	Positioning Completion Delay Time Setting	0.00 to 9.99	0.00	s
P019	Electronic Gear Position Selection	00: FB (Position feedback side) 01: REF (Position command side)	00	–
P020	Electronic Gear Ratio Numerator	1. to 9999.	1.	–
P021	Electronic Gear Ratio Denominator	1. to 9999.	1.	–
P022	Position Control Feedforward Gain	0.00 to 99.99, 100.0 to 655.3	0.00	–
P023	Position Loop Gain	0.00 to 99.99, 100.0	0.50	rad/s
P024	Position Bias Amount	–204 (–2048), –999. to 2048.	0.	–
C001 to C008	Multi-function Input S1 to S8 Selection	47: PCLR (Position deviation clear) 48: STAT (Pulse train position command input permission)	–	–
C021 to C025	Multi-function Output P1 to P5 Selection	23: POK (Position ready)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

Precautions for Correct Use

To provide pulse train position control via an OMRON Programmable Controller, use the Position Control Unit (Model: CJ1W-NC☐3☐/CS1W-NC☐3☐).

After connecting the unit, set the Pulse Train Input Selection (P013) to 01 (Mode 1: Forward/Reverse command + pulse train) on the inverter and then perform the pulse/direction output setting on the Position Control Unit.

Note that setting P013 to 02 (Mode 2: Forward/pulse train + Reverse pulse train) cannot establish connection.

The frequency reference for the pulse train position control mode is calculated from the following formula:

$$\text{Frequency reference [Hz]} = \frac{6.4 \times P \times Kv}{ENC} \times \frac{\Delta P}{255}$$

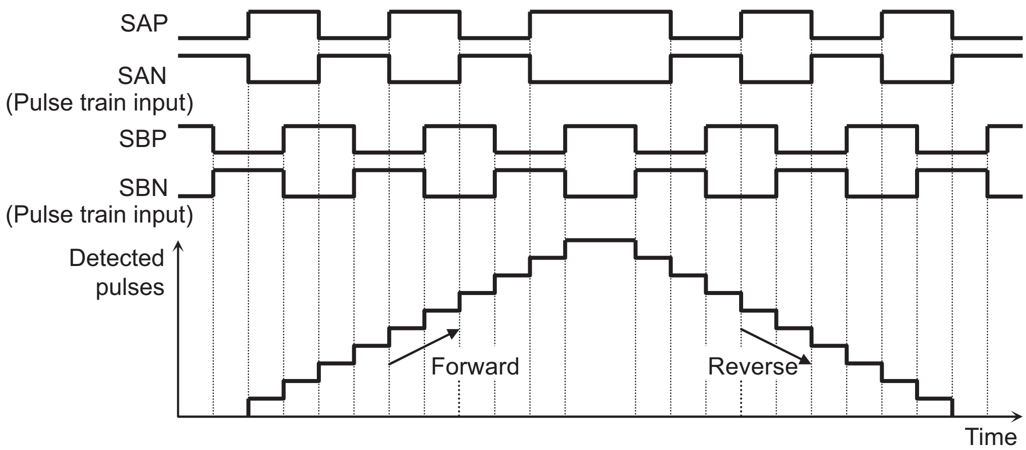
P:	Number of motor poles
Kv:	Position loop gain
ENC:	Number of encoder pulses
⊿P:	Position deviation

In the position control mode, the acceleration/deceleration time settings are disabled. (The state will be the LAD cancel automatically.)

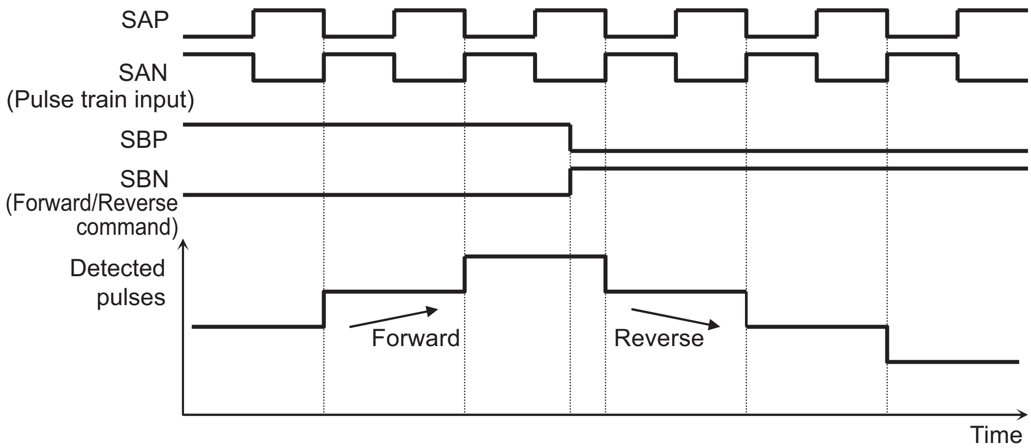
The higher the position loop-back gain, the shorter the acceleration/deceleration time.

For details on the pulse train input mode, refer to the following figures.

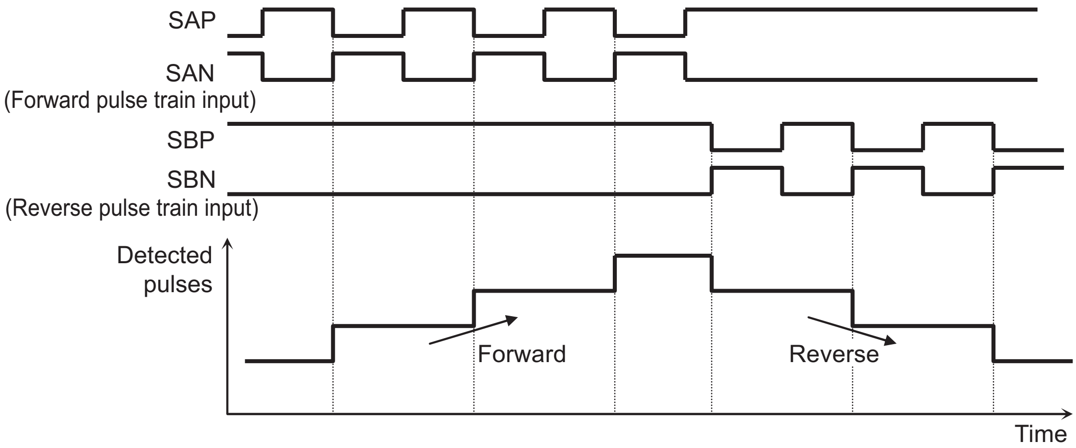
- Mode 0: 90°phase difference pulse train



- Mode 1: Forward/Reverse command + pulse train



• Mode 2: Forward/pulse train + Reverse pulse train



Note 1 To input a forward or reverse pulse train, the other pulse train input must be kept in a High state. When the other pulse train input in a Low state, pulse train input will not be recognized because it is judged as disconnected.

2 With the Position Control Unit (Model: CJ1W-NC□3□/CS1W-NC□3□), the inverter cannot establish connection in Mode 2.

6-6-2 Electronic Gear Function

Use this function to set the gain for the position command or position feedback side. You can adjust the main/sub motor rotation ratio, particularly for synchronous operation.

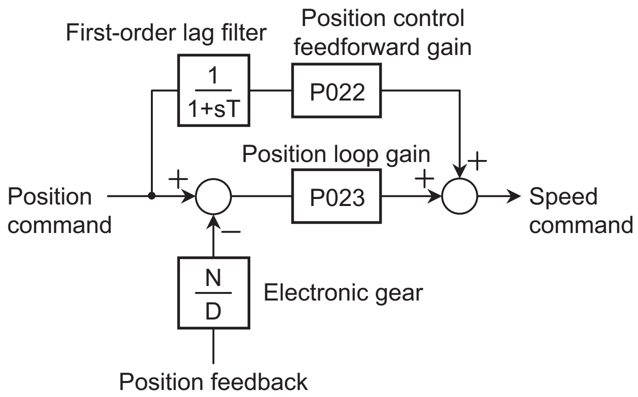
Parameter No.	Function name	Data	Default data	Unit
P019	Electronic Gear Position Selection	00: FB (Feedback side) 01: REF (Command side)	00	–
P020	Electronic Gear Ratio Numerator *1	1. to 9999.	1.	–
P021	Electronic Gear Ratio Denominator *1	1. to 9999.	1.	–
P022	Position Control Feed forward Gain *2	0.00 to 99.99, 100.0 to 655.3	0.00	–
P023	Position Loop Gain*3	0.00 to 99.99, 100.0	0.50	rad/s

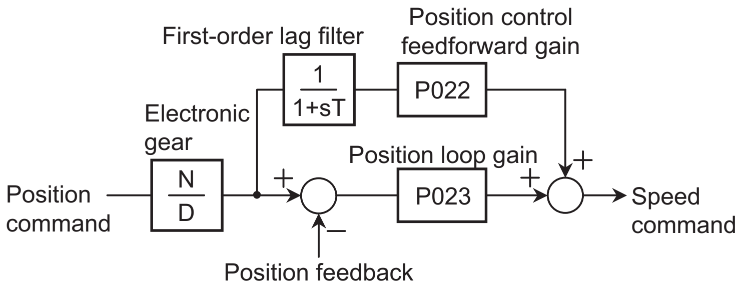
*1. Be sure to set the numerator and the denominator so that the following condition is met: 1/50 ≤ N/D ≤ 20.
N: Electronic Gear Ratio Numerator (P020), D: Electronic Gear Ratio Denominator (P021)

*2. It is recommended to start position control feedforward gain adjustment with P022 set to 2.00. To reduce the position deviation between the main and sub motors, increase the feedforward gain. If motor hunting occurs, reduce the feedforward gain.

*3. It is recommended to start position loop gain adjustment with P023 set to 2.00. To increase the positioning accuracy and the holding power, increase the position loop gain. If the position loop gain is set too high and causes hunting, decrease the position loop gain.

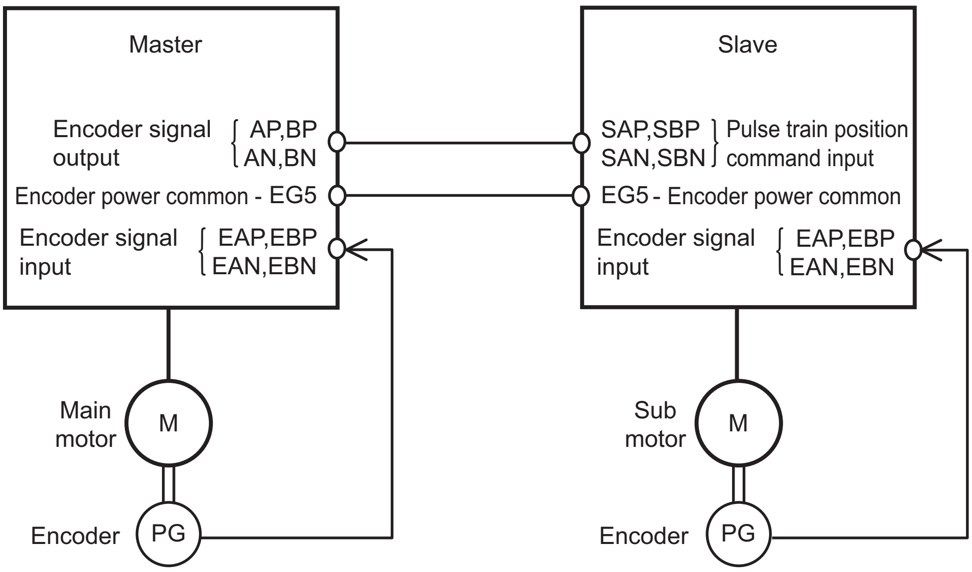
Below are the block diagrams of the electronic gear function.

<table>
<tr><th>Setting in P019</th><th>Description</th></tr>
<tr><td>00 (FB)</td><td>


</td></tr>
<tr><td>01 (REF)</td><td>


</td></tr>
</table>

Example: Synchronous Operation



The inverter (master) on the main motor side can be set to either the speed control or pulse train position control mode.

The inverter (slave) on the sub motor side must be set to the pulse train position control mode.

Setting Example

Item	Setting
Main motor	Number of encoder pulses = 1,024
Sub motor	Number of encoder pulses = 3,000
Ratio of main motor rpm	to sub motor rpm = 2:1

To operate the inverter under the above conditions, set the following data on the slave inverter.

Item	Setting
Pulse Train Input Selection (P013)	00 (90°phase difference pulse train)
Electronic Gear Position Selection (P019)	01 (REF)
Electronic Gear Ratio Numerator (P020)	3,000
Electronic Gear Ratio Denominator (P021)	1,024 × 2 = 2,048

The following shows an example of the ratio of the slave rpm to the master rpm according to the P019 to P021 settings.

It assumes that the same number of encoder pulses (1,024 pulses) is set on both inverters.

Electronic Gear Position Selection (P019)	REF (Position command side)	REF (Position command side)	FB (Position feedback side)	FB (Position feedback side)
Electronic Gear Ratio Numerator (P020)	1,024	2,048	1,024	2,048
Electronic Gear Ratio Denominator (P021)	2,048	1,024	2,048	1,024
Slave rpm/Master rpm	1/2	2	2	1/2

6-6-3 Position Bias Function

- Use this function to shift the origin position by adding the value set in the Position Bias Amount (P024) to the value of the origin determined through origin search (encoder Z-phase detection) operation in the pulse train position control mode.
- This function is useful for shifting the mechanical system origin to an application-specific origin, adjusting the phase of synchronization points during synchronous operation, and so on.
- Set an addition value in the Position Bias Amount (P024). A positive value adds the value in the forward direction.

Parameter No.	Function name	Data	Default data	Unit
P024	Position Bias Amount	–204 to –100 (–2048 to –1000), –999. to 2048	0.	–

Note The current value at completion of origin search operation, etc. can be preset.

6-6-4 Speed Bias Function

- Use this function to apply speed command bias to the speed command in the pulse train position control mode.
- It adds the set speed command bias value at the start of the positioning process to enable quick startup.
- Clear the speed command bias amount before the positioning process is completed.
  If the speed bias amount is added during stop, the stop position will be misaligned accordingly.
- Set the bias amount in the Frequency Addition Amount Setting (A145) and the frequency addition sign in the Frequency Addition Sign Selection (A146).
- Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 50 (ADD: Frequency addition).
  The set bias value will be added to the speed command while the terminal ADD is ON.

Parameter No.	Function name	Data	Default data	Unit
A145	Frequency Addition Amount Setting	0.00 to 99.99 100.0 to 400.0	0.00	–
A146	Frequency Addition Sign Selection	00: Add A145 value to output frequency. 01: Subtract A145 value from output frequency.	00	–
C001 to C008	Multi-function Input S1 to S8 Selection	50: ADD (Set frequency A145 addition)	–	–

6-7 Absolute Position/High-resolution Absolute Position Control Mode

6-7-1 Absolute Position/High-resolution Absolute Position Control Mode Parameter Settings

- To use the absolute position control mode, set the 1st Control Method (A044) to 05 (Sensor vector control) and the V2 Control Mode Selection (P012) to 02 (APR2: Absolute position control mode).
- When the V2 Control Mode Selection (P012) is set to 03 (HAPR: High-resolution absolute position control mode), the current position is controlled based on the quadrupled (x4) pulse count used in internal calculations. Set the Multi-step Position Command/Position Limit Setting to a quadruple precision.
- Using the combination of the multi-step input terminals enables switching among eight position command settings.
- Origin search can be performed in different frequencies, either at a low speed (Mode 1) or at a high speed (Mode 2, 3). The orientation function is disabled during origin search operation. For the orientation function, refer to *6-8 Orientation Function* on page 6-53.
- The teaching function allows you to set the position command while operating the machine.
- Allocating one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 73 (SPD: Speed/Position switching) enables the switching between speed control and position control via the corresponding terminal.
- For the position command or other data with many digits, only the four most significant bits (MSBs) will be displayed. It is recommended to use the CX-Drive for setting these parameters.

Parameter No.	Function name	Data	Default data	Unit
A044	1st Control Method	05: Sensor vector control (V2) *1	00	–
P012	V2 Control Mode Selection	02: APR2 (Absolute position control mode) 03: HAPR (High-resolution absolute position control mode)	00	–
P023	Position Loop Gain	0.00 to 99.99, 100.0	0.50	rad/s
P060	Multi-step Position Command 0	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4digit (1 digit for "–")	00	–
P061	Multi-step Position Command 1	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	00	–
P062	Multi-step Position Command 2	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	00	–
P063	Multi-step Position Command 3	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	00	–
P064	Multi-step Position Command 4	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	00	–
P065	Multi-step Position Command 5	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4 digits (1 digit for "–")	00	–

Parameter No.	Function name	Data	Default data	Unit
P066	Multi-step Position Command 6	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4 digits (1 digit for “–”)	00	–
P067	Multi-step Position Command 7	Position range specification (reverse side) to position range specification (forward side) Displays MSB 4 digits (1 digit for “–”)	00	–
P068	Origin Search Mode	00: Origin search mode 1 01: Origin search mode 2 02: Origin search mode 3	00	–
P069	Origin Search Direction Selection	00: Forward side 01: Reverse side	00	–
P070	Origin Search Mode 1 Frequency	0.00 to 10.00	5.00	Hz
P071	Origin Search Mode 2 Frequency	.00 to 99.99/100.0 to 400.0	5.00	Hz
P072	Position Limit Setting (Forward Side)	0 to 268435456: When P012 = 02 0 to 1073741823: When P012 = 03 Displays MSB 4 digits (1 digit for “–”)	268435455	–
P073	Position Limit Setting (Reverse Side)	268435456 to 0: When P012 = 02 –1073741823 to 0: When P012 = 03 Displays MSB 4 digits (1 digit for “–”)	–268435455	–
P074	Teaching Selection	00: Multi-step Position Command 0 (P060) 01: Multi-step Position Command 1 (P061) 02: Multi-step Position Command 2 (P062) 03: Multi-step Position Command 3 (P063) 04: Multi-step Position Command 4 (P064) 05: Multi-step Position Command 5 (P065) 06: Multi-step Position Command 6 (P066) 07: Multi-step Position Command 7 (P067)	00	–
C169	Multi-step Speed/Position Determination Time	0 to 200. (x 10 ms)	0	ms
d029	Position Command Monitor	–268435455 to 268435455 (P012 = 02) –1073741823 to 1073741823 (P012 = 03) (Displays MSB 4 digits including “–”)	–	–

*1 Under sensor vector control, select the heavy load mode (b049 = 00).

Parameter No.	Function name	Data	Default data	Unit
d030	Current Position Monitor	–268435455 to 268435455 (P012 = 02) –1073741823 to 1073741823 (P012 = 03) (Displays MSB 4 digits including "–")	–	–
C001 to C008	Multi-function Input S1 to S8 Selection	45: ORT (Orientation) 54: SON (Servo ON) 66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3) 69: ORL (Zero return limit signal) 70: ORG (Zero return startup signal) 71: FOT (Forward driving stop) 72: ROT (Reverse driving stop) 73: SPD (Speed/Position switching)	–	–
C021 to C025	Multi-function Output P1 to P5 Selection	22: DSE (Excessive speed deviation) 23: POK (Reverse driving stop)		
C026	Multi-function Relay Output (MA, MB) Function Selection			
C102	Reset Selection	03: Trip reset only *2	02	–

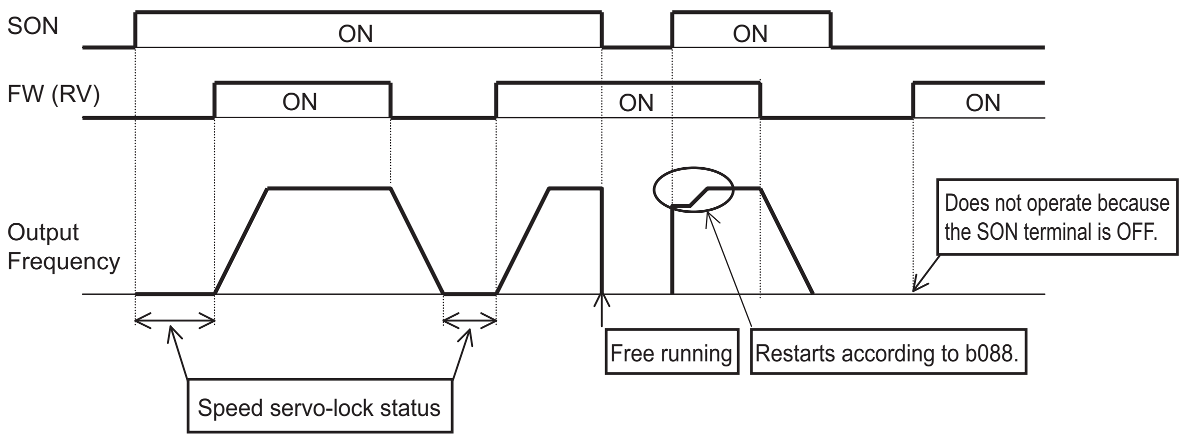
*2 The reset function does not initialize the internal data including position control settings.

6-7-2 Operation Sequences

Servo ON Function

- This function is enabled when the 1st Control Method (A044) is set to 05 (Sensor vector control) to set the motor shaft in a speed servo lock state.
  Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 54 (SON: Servo ON).
  Once the SON function is allocated, the inverter does not accept the RUN command unless the SON terminal turns ON.
  If the SON terminal turns OFF during operation, the inverter will fall in a free-run state. In this case, turning ON the SON terminal again causes the inverter to restart according to the Free-run Stop Selection (b088) setting.
- Do not set the Multi-function Input S1 to S8 Selection (C001 to C008) to 55 (FOC: Preliminary excitation).

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	54: SON (Servo ON) 55: FOC (Preliminary excitation)	–	–
b088	Free-run Stop Selection	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00	–



Precautions for Correct Use

Inputting the servo ON (SON) signal causes the motor shaft to be locked in a speed servo lock state.

However, because this is not the position servo lock function, the stop position will be misaligned when the speed is offset.

To prevent this misalignment of the stop position, input the RUN command (FW or RW) to set the motor shaft in a position servo lock state. Follow the steps below to control the stop position.

(1) After inputting the servo ON (SON) signal, perform origin search operation. Unless you perform origin search operation, the position in which the power supply is turned ON will be the origin (position 0).

(2) Set the Multi-step Position Command 0 (P060) to 0 and, with the Multi-step Position Command 0 selected, input the RUN command (FW or RV).

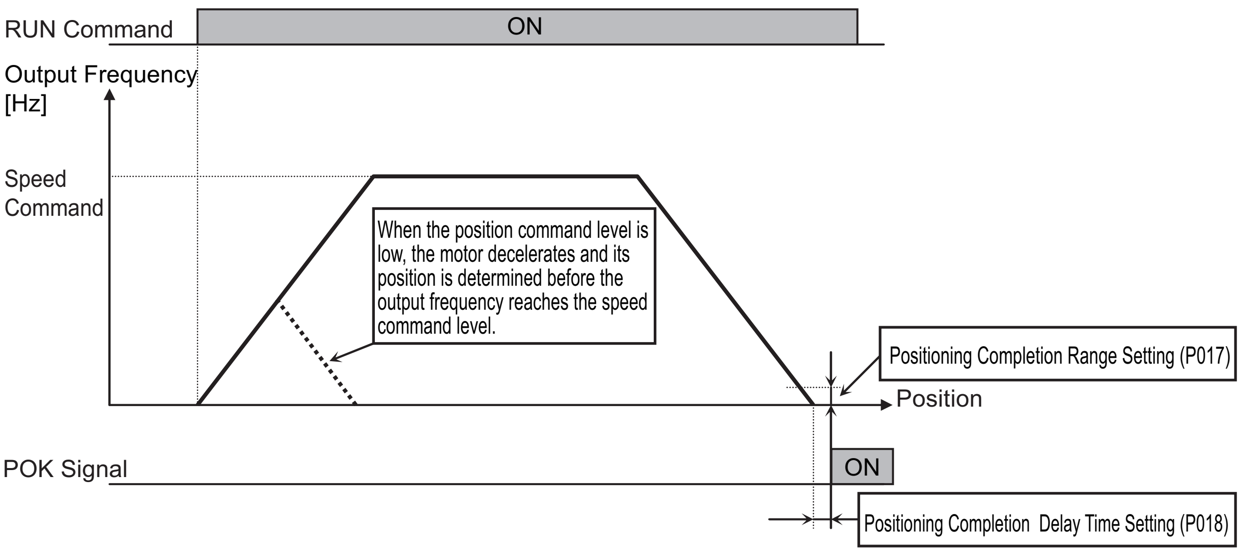
(3) The inverter will move the motor to the next target position in the timing based on the multi-step position switching function (CP1/CP2/CP3) described later. When you change the position command selection 1 to 3 set in C001 to C008, the inverter moves the motor to the next target position at that time. The RUN command (FW or RV) must be input constantly.

(4) Subsequently, the servo ON (SON) and RUN command (FW or RV) signals will be controlled to turn ON/OFF in the same timing.

Inverter Operation in Absolute Position/High-resolution Absolute Position Control Mode

In the absolute position control mode/high-resolution absolute position control mode, the inverter moves the motor to the target position according to the Acceleration Time or Deceleration Time parameter settings and then falls in a position servo lock state.

The servo lock state will be maintained until the RUN command turns OFF.



- Under absolute position control, the inverter operates according to the frequency reference and acceleration/deceleration command settings selected for the RUN command.
- If the position command has a small value, the inverter may perform positioning before the speed command value is reached.

- In the absolute position control mode, the direction of RUN command (FW or RV) does not mean the rotating direction. It serves as a start or stop signal. The motor rotates in the forward or reverse direction based on whether the result of the subtraction, Target position – Current position, is a positive or negative value, respectively.
- Unless you perform origin search operation, the position in which the power supply is turned ON will be regarded as the origin (position 0).
- If the position command value is 0, the inverter will be in a positioning completed state immediately when the RUN command turns ON.
- Set the Reset Selection (C102) to 03 (Trip reset only).

Additional Information

When the Reset Selection (C102) is not set to 03, turning ON the reset terminal (or RESET key) of the inverter causes the current position counter to be cleared. In this case, perform origin search operation again.

- When the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 47 (PCLR: Position deviation clear), turning ON the terminal PCLR causes the current position counter to be cleared. This also clears the internal position deviation counter simultaneously.
- In the absolute position/high-resolution absolute position control mode, 52 (ATR: Torque reference input permission) is disabled, so torque control does not function.
- In the absolute position/high-resolution absolute position control mode, 48 (STAT: Pulse train position command input permission) is disabled, so pulse train position control does not function.
- In the absolute position/high-resolution absolute position control mode, the orientation function is disabled. However, the terminal ORT is used for teaching, as described later.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	47: PCLR (Position deviation clear) 48: STAT (Pulse train position command input permission) 52: ATR (Torque reference input permission)	–	–
C102	Reset Selection	03: Trip reset only *1	02	–

*1 The reset function does not initialize the internal data including position control settings.

Multi-step Position Switching Function (CP1/CP2/CP3)

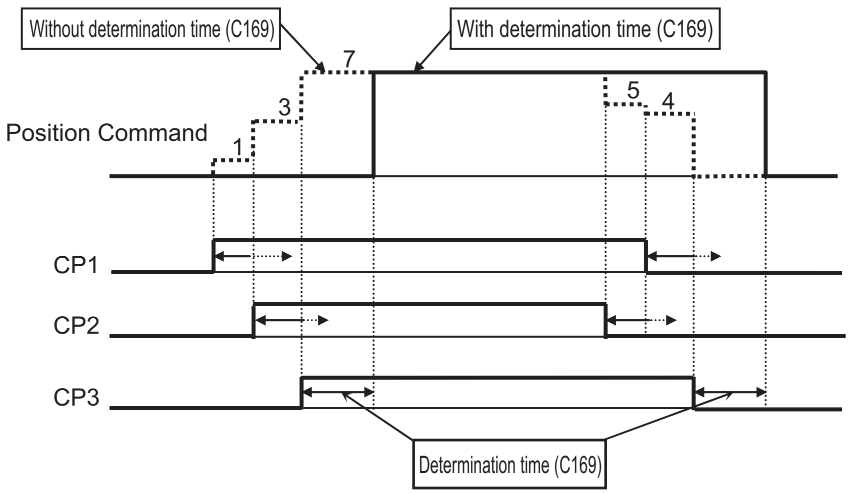
- Setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 66 (CP1: Position command selection 1) to 68 (CP3: Position command selection 3) enables the selection of the Multi-step Position Command 0 to 7.
- Set the position commands in the Multi-step Position Command 0 to 7 (P060 to P067).
- If the multi-step position switching function is not allocated, the Multi-step Position Command 0 (P060) is used as the position command.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	66: Position command selection 1 67: Position command selection 2 68: Position command selection 3	–	–

Position command	CP3	CP2	CP1
Multi-step Position Command 0 (P060)	0	0	0
Multi-step Position Command 1 (P061)	0	0	1
Multi-step Position Command 2 (P062)	0	1	0
Multi-step Position Command 3 (P063)	0	1	1
Multi-step Position Command 4 (P064)	1	0	0
Multi-step Position Command 5 (P065)	1	0	1
Multi-step Position Command 6 (P066)	1	1	0
Multi-step Position Command 7 (P067)	1	1	1

For multi-step position command input, the wait time until the inverter determines the input terminal can be set. This prevents the transitional status before terminal input is recognized from being accepted as an input.

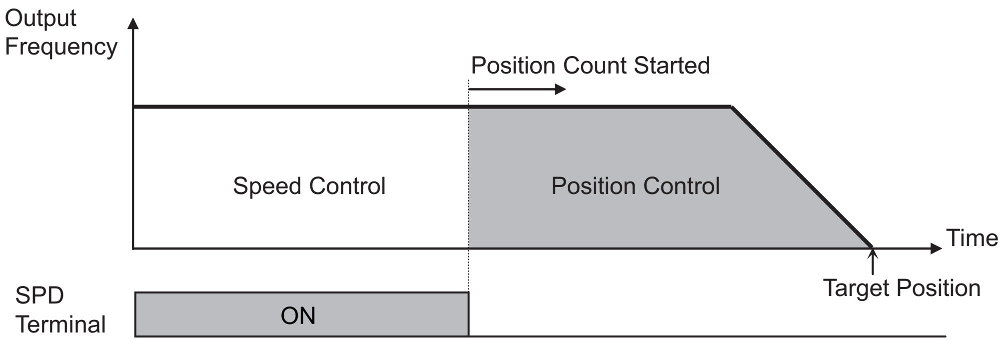
Set this wait time in the Multi-step Speed/Position Determination Time (C169). Input data will be determined as the final data if it remains unchanged for the time set in the Multi-step Speed/Position Determination Time (C169). Note that setting a long determination time results in a slow input response.



Speed/Position Switching Function (SPD)

- Use this function to switch between speed control and position control.
- Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 73 (SPD: Speed/Position switching).
- While the SPD terminal is ON, the current position counter value remains 0. From the moment when the terminal SPD turns OFF during operation, the inverter starts position control (which is referred to as “speed/position switching”).
- When the Multi-step Position Command 0 to 7 (P060 to P067) is set to 0, the inverter starts stopping immediately when the terminal SPD turns OFF.
  Hunting may occur depending on the Position Loop Gain setting.
- While the terminal SPD is ON, the inverter operates the motor in the direction based on the RUN command. Be sure to set the RUN command so that the inverter operates the motor in the same direction at the speed/position switching.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	73: SPD (Speed/Position switching)	–	–



6-7-3 Origin Search Function

In the Origin Search Mode (P068), select one of the three origin search modes. When origin search is completed, a new origin is established with the Current Position Monitor (d030) cleared (= 0).
Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 54 (SON: Servo ON) and turn ON that terminal SON. Then, start the origin search operation.

Set the origin search direction in the Origin Search Direction Selection (P069).

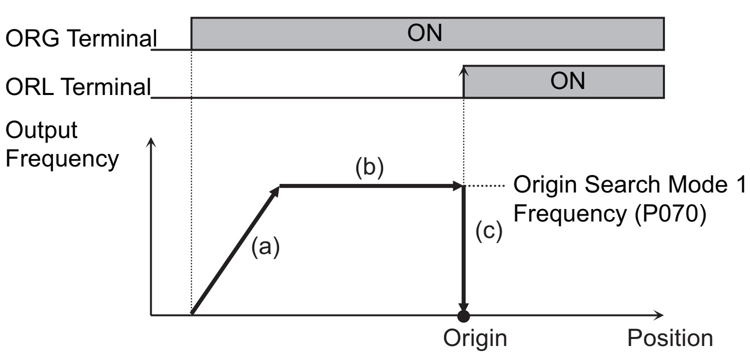
Unless you perform origin search operation, the position in which the power supply is turned ON will be used as the origin for position control.

Parameter No.	Function name	Data	Default data	Unit
P068	Origin Search Mode	00: Origin search mode 1 01: Origin search mode 2 02: Origin search mode 3	00	–
P069	Origin Search Direction Selection	00: Forward side 01: Reverse side	00	–
P070	Origin Search Mode 1 Frequency	0.00 to 10.00	5.00 *2	Hz
P071	Origin Search Mode 2 Frequency	0.00 to 1st Maximum Frequency (A004)	5.00 *2	Hz
C001 to C008	Multi-function Input S1 to S8 Selection	69: ORL (Zero return limit signal) 70: ORG (Zero return startup signal)	–	–
C102	Reset Selection	03: Trip reset only *1	02	–
d030	Current Position Monitor	–268435455 to 268435455 (P012 = 02) –1073741823 to 1073741823 (P012 = 03) Displays MSB 4digits (1digit for “–”)	–	–

*1 The reset function does not initialize the internal data including position control settings.

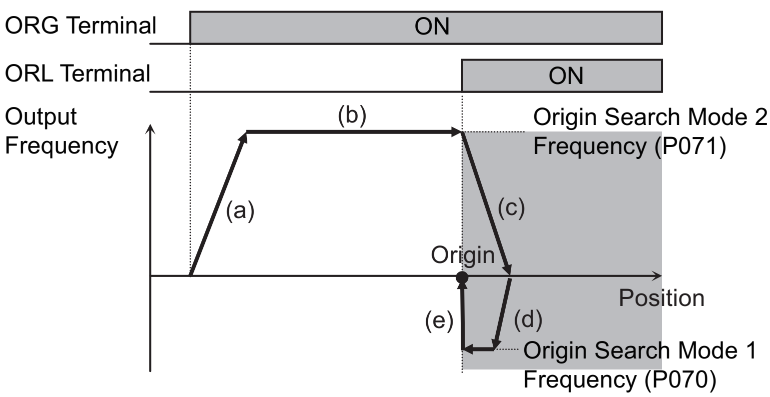
*2 The default data was changed from the previous model.

● Low-speed Origin Search (P068 = 00: Origin Search Mode 1)



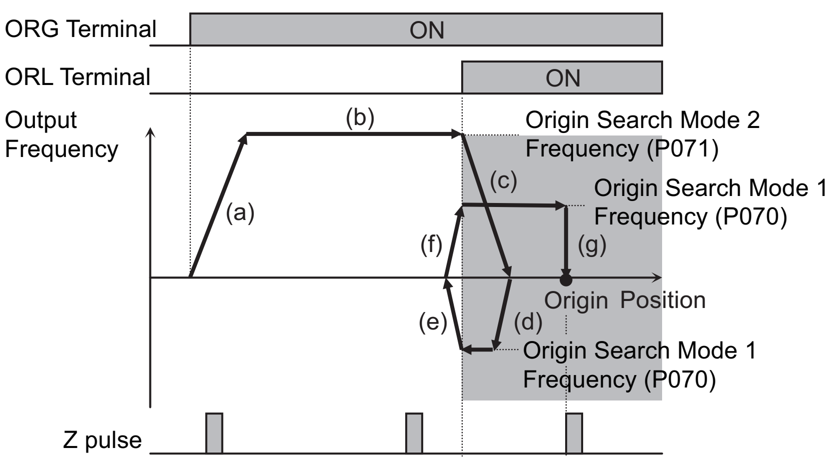
(a) Accelerates to Origin Search Mode 1 Frequency according to Acceleration Time settings.
(b) Runs at Origin Search Mode 1 Frequency.
(c) Performs positioning when ORL signal is input.

● High-speed Origin Search 1 (P068 = 01: Origin Search Mode 2)



(a) Accelerates to Origin Search Mode 2 Frequency according to Acceleration Time settings.
(b) Runs at Origin Search Mode 2 Frequency.
(c) Starts deceleration when ORL signal turns ON.
(d) Runs in reverse at Origin Search Mode 1 Frequency.
(e) Performs positioning when the ORL signal turns OFF.

● High-speed Origin Search 2 (P068 = 02: Origin Search Mode 3)



(a) Accelerates to Origin Search Mode 2 Frequency according to Acceleration Time settings.
(b) Runs at Origin Search Mode 2 Frequency.
(c) Starts deceleration when ORL signal turns ON.
(d) Runs in reverse at Origin Search Mode 1 Frequency.
(e) Starts deceleration when ORL signal turns OFF.
(f) Runs forward at Origin Search Mode 1 Frequency.
(g) Performs positioning to first Z-pulse position after ORL signal turns ON.

6-7-4 Teaching Function

- Use this function to start/stop the motor at the desired position and store that position as position command data in the specified position command area.
- Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 45 (ORT: Orientation).
- When the V2 Control Mode Selection (P012) is set to 02 (Absolute position control mode) or 03 (HAPR: High resolution absolute position control mode), the terminal ORT serves as the teaching terminal, instead of the orientation terminal.

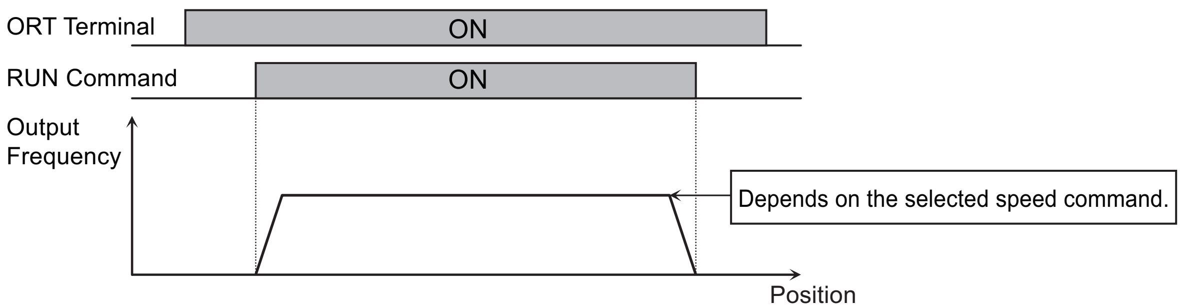
Parameter No.	Function name	Data	Default data	Unit
P012	V2 Control Mode Selection	02: APR2 (Absolute position control mode) 03: HAPR (High resolution absolute position control mode)	00	–
P074	Teaching Selection	00: Multi-step Position Command 0 (P060) 01: Multi-step Position Command 1 (P061) 02: Multi-step Position Command 2 (P062) 03: Multi-step Position Command 3 (P063) 04: Multi-step Position Command 4 (P064) 05: Multi-step Position Command 5 (P065) 06: Multi-step Position Command 6 (P066) 07: Multi-step Position Command 7 (P067)	00	–
C001 to C008	Multi-function Input S1 to S8 Selection	45: ORT (Orientation)	–	–

● Teaching Procedure

1 **In the Teaching Selection (P074), select the position command you want to set.**

2 **Move the workpiece.**

Input the RUN command with the terminal ORT ON. At this time, the inverter operates according to the selected speed command and acceleration/deceleration time settings selected for the RUN command.



Precautions for Correct Use

The teaching function is available as long as the power is supplied to the power supply input terminals Ro and To of the inverter control circuit. Because the current position counter is always active, you can perform teaching by moving the workpiece via external equipment etc. At this time, make sure that the power supply to the terminals (R/L1, S/L2, T/L3) of the inverter drive circuit is shut off, or that the motor output terminals (U/T1, V/T2, W/T3) of the inverter is disconnected from the motor. Not doing so may result in injury and/or damage to the equipment.

3 **When the workpiece reached the target position, (with the PRG indicator lit,) press the Enter key on the Digital Operator.**

4 **The current position is set in the position command source set in the Teaching Selection (P074). Note that the P074 setting is not stored. It will be reset to 00 when the power supply is turned off or when the inverter is reset.**

Value set in P074	Position command allocated
00	P060: Multi-step Position Command 0
01	P061: Multi-step Position Command 1
02	P062: Multi-step Position Command 2
03	P063: Multi-step Position Command 3
04	P064: Multi-step Position Command 4
05	P065: Multi-step Position Command 5
06	P066: Multi-step Position Command 6
07	P067: Multi-step Position Command 7

6-7-5 Forward/Reverse Driving Stop and Position Limit Setting Functions

Forward/Reverse Driving Stop Function (FOT/ROT)

- This function uses the limit switches installed at both machine edges of equipment to suppress movement out of its allowable operating range.
- With the torque limit set to 10%, the movement on the forward side is suppressed when the terminal FOT turns ON and the movement on the reverse side is suppressed when the terminal ROT turns ON. At both ends of the machine edge, provide a mechanical mechanism such as a stopper.
- To use this function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 71 (FOT: Forward driving stop) and 72 (ROT: Reverse driving stop) and connect the limit switches.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	71: FOT (Forward driving stop) 72: ROT (Reverse driving stop)	–	–

Position Limit Setting Function

- Set the forward/reverse position limit of the control range in the Position Limit Setting (Forward Side) (P072)/Position Limit Setting (Reverse Side) (P073). If the current position counter exceeds the set value, a Position control range error (E63.*/E73.*) will occur, which causes the inverter to fall into a free-run state.
- The multi-step position command set in the Multi-step Position Command 0 to 7 (P060 to P067) is subject to these upper limit settings.
  You cannot set a position command value over the position limit setting.

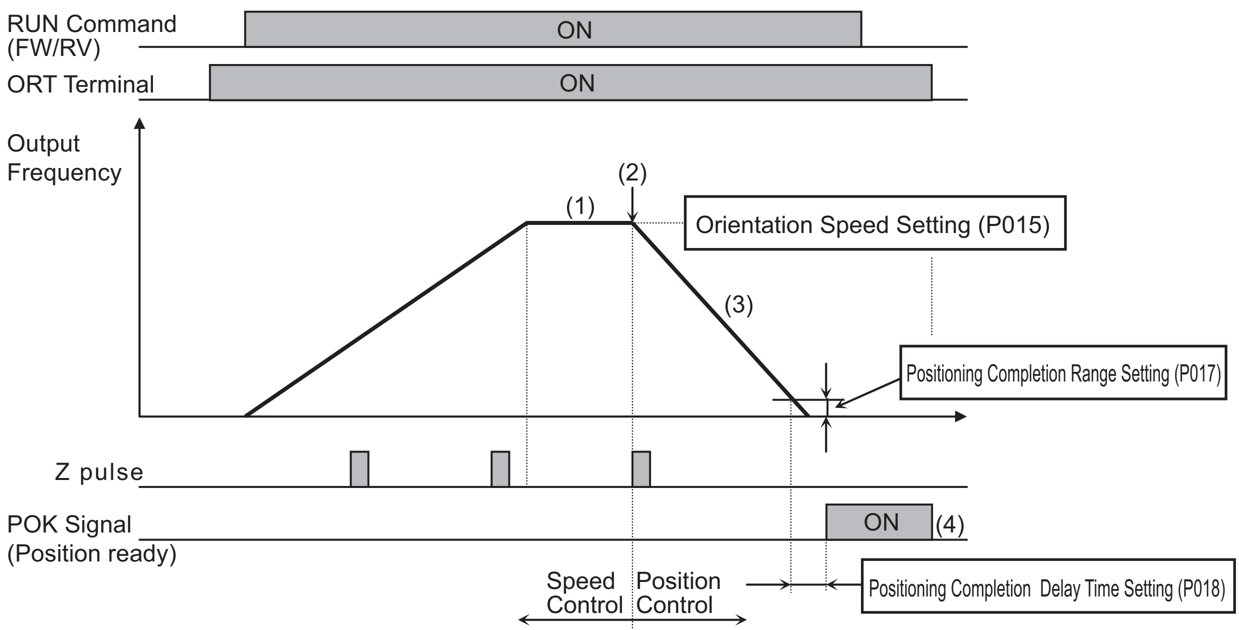
Parameter No.	Function name	Data	Default data	Unit
P072	Position Limit Setting (Forward Side)	0 to 268435455 (When P012 = 02) 0 to 1073741823 (When P012 = 03) (Displays MSB 4 digits)	268435455	–
P073	Position Limit Setting (Reverse Side)	–268435455 to 0 (When P012 = 02) –1073741823 to 0 (When P012 = 03) Displays MSB 4digit (1 digit for “–”)	–268435455	–

6-8 Orientation Function

6-8-1 Orientation Function Parameter Settings

- Use this function to stop the motor at any point in one rotation. It is useful for applications such as tool change on the main spindle of a machine tool.
- To use this function, set the 1st Control Method (A044) to 05 (Sensor vector control) and the V2 Control Mode Selection (P012) to 00 (Speed control mode) or 01 (Pulse train position control mode).
- As the reference signal for positioning, the function uses the phase-Z pulse signal (one rotation position signal). Input a phase-Z pulse between the terminals EZP and EZN of the PG Board (Model: 3G3AX-PG01).
- Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 45 (ORT: Orientation).

Parameter No.	Function name	Data	Default data	Unit
P011	Number of Encoder Pulses	128. to 9999., 1000 to 6553 (10000 to 65530)	1024.	pulse
P014	Orientation Stop Position	0. to 4095.	0.	–
P015	Orientation Speed Setting	0.00 to 99.99, 100.0 to 120.0	5.00	Hz
P016	Orientation Direction Setting	00: Forward side 01: Reverse side	00	–
P017	Positioning Completion Range Setting	0. to 9999., 1000 (10000)	5.	pulse
P018	Positioning Completion Delay Time Setting	0.00 to 9.99	0.00	s
P023	Position Loop Gain	0.00 to 99.99, 100.0	0.50	rad/s
C001 to C008	Multi-function Input S1 to S8 Selection	45: ORT (Orientation)	–	
C021 to C025	Multi-function Output P1 to P5 Selection	23: POK (Position ready)	–	
C026	Multi-function Relay Output (MA, MB) Function Selection	23: POK (Position ready)	05	



(1) Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 45 (ORT: Orientation) and turn ON that terminal. In this state, turning ON the RUN command causes the inverter to accelerate to the speed set in the Orientation Speed Setting (P015) and perform constant speed operation.
If the terminal ORT turns ON when the RUN command is input, the inverter changes to operation speed after input of the ORT signal.

(2) After the orientation speed is reached, the inverter switches to the position control mode when the first phase-Z pulse is detected.

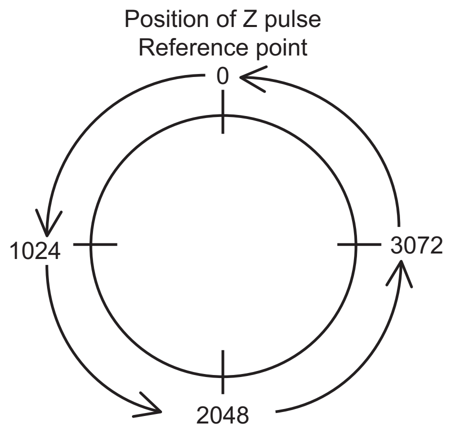
(3) When the Orientation Direction Setting (P016) is set to 00 (Forward side), the inverter controls the position to the target value of “Orientation Stop Position (P014) + 1 rotation”; When the Orientation Direction Setting (P016) is set to 01 (Reverse side), the inverter controls the position to the target value of “Orientation Stop Position (P014) + 2 rotations” (instead of rotating the motor in reverse).
At this time, regardless of the Deceleration Time value, the deceleration time decreases as the Position Loop Gain (P023) increases.

(4) When the time set in the Positioning Completion Delay Time Setting (P018) elapsed after the number of remaining pulses reached the Positioning Completion Range Setting (P017), the inverter outputs the POK signal. The POK output continues until the ORT signal turns OFF.
After completion of positioning, the inverter remains in a servo lock state until the RUN command turns OFF.

Precautions for Correct Use

- Do not set the Orientation Speed Setting to a high frequency value because the inverter decelerates and completes positioning within 2 rotations. Decelerating to stop in approximately 1 to 2 rotations causes a rapid movement, having a large impact on the equipment. In addition, it is more likely to cause an inverter trip error.
- The Orientation Stop Position is defined as 4,096 (0 to 4,095) divisions of one forward rotation from the reference point. The number of divisions is fixed to 4,096, regardless of the number of encoder pulses.
  The reference point is a point where the pulse signal is input between the terminals EZP and EZN of the PG Board. The location of the target stop position is as shown below (in the case of positive-phase connection).

  Motor shaft viewed from motor shaft load side



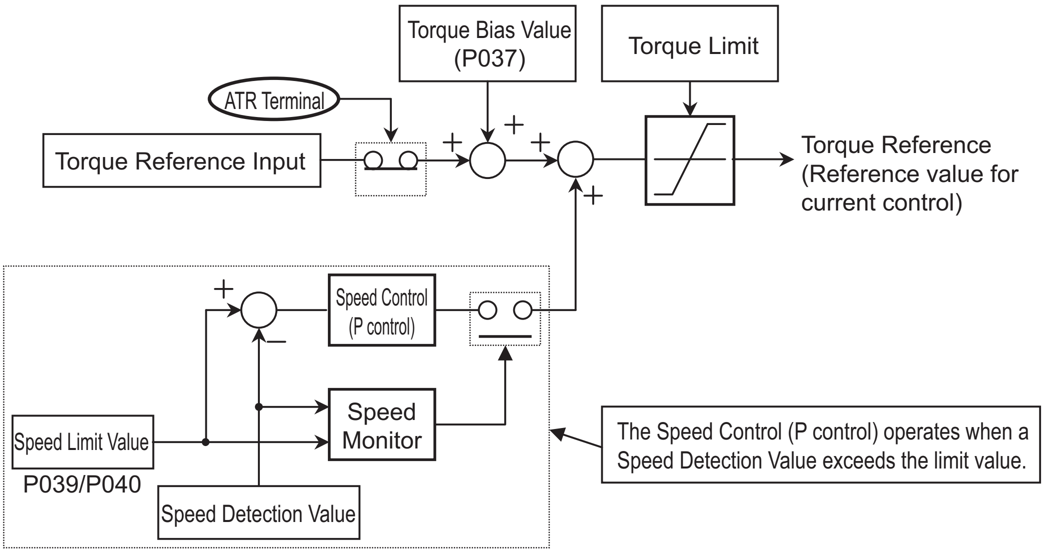
6-9 Torque Control

6-9-1 Torque Control Parameter Settings

- The inverter also provides torque control, in addition to speed control and pulse train position control.
- To use this function, set the 1st Control Method (A044) to 05 (Sensor vector control) and the V2 Control Mode Selection (P012) to 00 (Speed control mode).
- To use torque control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 52 (ATR: Torque command input permission). The torque reference input is enabled when the terminal ATR is ON.
- In the Torque Reference Input Selection (P033), select whether to input the torque reference via an analog input terminal or the Digital Operator.
- Because, under torque control, the speed of the inverter is determined by the balance between torque and load, set the Speed Limit Value in Torque Control (Forward/Reverse) (P039/P040) to prevent the inverter from going out of control.

Parameter No.	Function name	Data	Default data	Unit
P033	Torque Reference Input Selection	00: Terminal FV 01: Terminal FI 02: Terminal FE 03: Digital Operator	00	–
P034	Torque Reference Setting	0. to 200. (0.4 to 55 kW) 0. to 180. (75 to 132 kW) Torque reference when P033 = 03	0.	%
P035	Polarity Selection at Torque Reference via FE	00: Signed 01: Depends on the RUN direction	00	–
P036	Torque Bias Mode	00: None 01: Digital Operator 02: Terminal FE	00	–
P037	Torque Bias Value	–200. to 200. (0.4 to 55 kW) –180. to 180. (75 to 132 kW) Enabled when P036 = 01	0.	%
P038	Torque Bias Polarity Selection	00: Signed 01: Depends on the RUN direction	00	–
P039	Speed Limit Value in Torque Control (Forward)	0.00 to 1st Maximum Frequency (A004)	0.00	Hz
P040	Speed Limit Value in Torque Control (Reverse)	0.00 to 1st Maximum Frequency (A004)	0.00	Hz
C001 to C008	Multi-function Input S1 to S8 Selection	52: ATR (Torque command input permission)	–	–
Related functions	d009, d010, d012			

- **Control Block Diagram**



7

Detailed Functions

This section describes each function (parameter) in detail.

7-1 Monitor Mode (Group d) 7-2
7-2 Basic Functions (Group F) 7-14
7-3 Basic Functions (Group A) 7-17
7-4 Detailed Functions (Group b) 7-61
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7-6 Motor Parameters (Group H) 7-145
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7-8 User Setting Display Functions (Group U) 7-149

7-1 Monitor Mode (Group d)

This section describes the output frequency, trip monitor, and other monitor function of the inverter.

Output Frequency Monitor [d001]

Use this function to display the output frequency of the inverter. The value is 0.00 when the inverter is stopped.

The data display LED “Hz” is lit while the value of d001 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d001	Output Frequency Monitor	0.00 to 99.99 (Displayed in increments of 0.01 Hz) 100.0 to 400.0 (Displayed in increments of 0.1 Hz)	–	Hz

Precautions for Correct Use

- If the Digital Operator is used to set output reference, only during operation, you can change the Output Frequency Setting/Monitor (F001) setting by entering new data in the Output Frequency Monitor (After Conversion) (d007) using the Increment/Decrement key.
- The new Output Frequency Monitor (d001) value is reflected on the Output Frequency Setting/Monitor (F001) setting and stored to the EEPROM when you press the Enter key.

Output Current Monitor [d002]

Use this function to display the output current value of the inverter. The value is 0.0 when the inverter is stopped.

The data display LED “A” is lit while the value of d002 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d002	Output Current Monitor	0.0 to 999.9 (Displayed in increments of 0.1A) 1000. to 9999. (Displayed in increments of 1A)	–	A

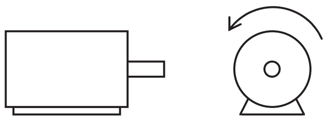
RUN Direction Monitor [d003]

Use this function to display the RUN direction of the inverter.

The RUN LED is lit during inverter operation (in the forward/reverse direction).

Parameter No.	Function name	Data	Default data	Unit
d003	RUN Direction Monitor	F: Forward o: Stop r: Reverse	–	–

Generally, the forward rotation is defined as the direction in which the motor rotates counterclockwise when viewed from the shaft.



Forward

PID Feedback Value Monitor [d004]

Use this function to display the PID feedback value when the PID Selection (A071) is set to 01 (Enabled) or 02 (Reverse output enabled).

The monitor value can be converted by setting the PID Scale (A075) as follows.

d004 = PID Feedback value [%] x PID Scale (A075)

The value of A075 can be set to 0.01 to 99.99 (in increments of 0.01).

Parameter No.	Function name	Data	Default data	Unit
d004	PID Feedback Value Monitor	0.00 to 99.99 (Displayed in increments of 0.01) 100.0 to 999.9 (Displayed in increments of 0.1) 1000. to 9999. (Displayed in increments of 1) 1000 to 9999 (10000 to 99990) (Displayed in increments of 10) Γ100 to Γ999 (100000 to 999000) (Displayed in increments of 1000, enabled when the PID function is selected)	–	–

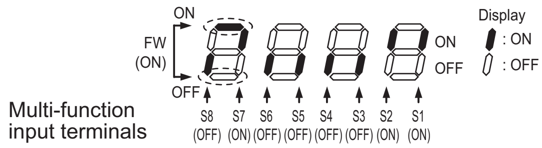
Multi-function Input Monitor [d005]

Use this function to display the input status of each multi-function input terminal, based on whether the corresponding 7-segment LED is lit or not lit.

The terminal for which the built-in CPU detected the input of a signal is indicated as ON.

Note that this is not affected by the NO/NC contact setting.

(Example)
FW and Multi-function input terminals S7, S2, S1: ON
Multi-function input terminals S8, S6, S5, S4, S3: OFF



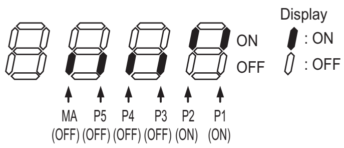
Multi-function Output Monitor [d006]

Use this function to display the output status of each multi-function output terminal, based on whether the corresponding 7-segment LED is lit or not lit.

Each LED shows the output status detected by the built-in CPU. It is not the status of the control circuit terminals.

Note that this is not affected by the NO/NC contact setting.

(Example)
Multi-function relay output terminal MA: OFF
Multi-function output terminals P1, P2: ON
Multi-function output terminals P3, P4, P5: OFF



Output Frequency Monitor (After Conversion) [d007]

Use this function to display the output frequency value that is converted based on the Frequency Conversion Coefficient (b086).

This parameter is useful when you want to view the output frequency in a different display unit, for example to monitor the motor rotation speed.

d007 = Output Frequency Monitor (d001) x Frequency Conversion Coefficient (b086)

(Example) To monitor the rotation speed of a 4-pole motor:
Motor rotation speed N [min-1] = (120 x f [Hz])/P [pole] = f [Hz] x 30
Therefore, if the Frequency Conversion Coefficient (b086) is set to 30.0, at 60 Hz, the value of this parameter will be: 60 x 30.0 = 1800.

Parameter No.	Function name	Data	Default data	Unit
d007	Output Frequency Monitor (After Conversion)	0.00 to 99.99 (Displayed in increments of 0.01) 100.0 to 999.9 (Displayed in increments of 0.1) 1000. to 9999. (Displayed in increments of 1) 1000 to 3996 (10000 to 39960) (Displayed in increments of 10)	–	–
b086	Frequency Conversion Coefficient	0.1 to 99.9	1.0	–

Precautions for Correct Use

- If the Digital Operator is used to set output reference, only during operation, you can change the Output Frequency Setting/Monitor (F001) setting by entering new data in the Output Frequency Monitor (After Conversion) (d007) using the Increment/Decrement key.
- The new Output Frequency Monitor (d007) value is reflected on the Output Frequency Setting/Monitor (F001) setting and stored to the EEPROM when you press the Enter key.

Real Frequency Monitor [d008]

Use this function to display the real frequency of the motor when a motor with an encoder is connected to a load and the PG Board (Model: 3G3AX-PG01) is used. This parameter does not depend on the control method setting.

Parameter No.	Function name	Data	Default data	Unit
d008	Real Frequency Monitor	0.00 to 99.99: During forward run (Displayed in increments of 0.01Hz) 100.0 to 400.0: During forward run (Displayed in increments of 0.1Hz) –99.9 to –0.0: During reverse run (Displayed in increments of 0.1Hz) –400 to –100: During reverse run (Displayed in increments of 1 Hz)	–	Hz

Note 1 Set the Number of Encoder Pulses (P011) and the 1st/2nd Motor Pole Number (H004/H204) correctly.

2 This parameter does not depend on the 1st Control Method (A044).

Torque Reference Monitor [d009]

Use this function to display the torque command value that is currently input when torque control is selected for sensor vector control.

The data display LED “%” is lit while the value of d009 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d009	Torque Reference Monitor	–200. to 200. (Displayed in increments of 1%)	–	%

Torque Bias Monitor [d010]

Use this function to display the current torque bias amount setting when sensor vector control is selected.

The data display LED “%” is lit while the value of d010 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d010	Torque Bias Monitor	–200. to 200. (Displayed in increments of 1%)	–	%

Output Torque Monitor [d012]

Use this function to display the estimated output torque value of the inverter.

The data display LED “%” is lit while the value of d012 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d012	Output Torque Monitor	–200. to 200. (Displayed in increments of 1%)	–	%

Precautions for Correct Use

This parameter value can be displayed only when the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control mode is selected.

Output Voltage Monitor [d013]

Use this function to display the output voltage of the inverter.

The data display LED “V” is lit while the value of d013 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d013	Output Voltage Monitor	0.0 to 600.0 (Displayed in increments of 0.1 V)	–	V

Precautions for Correct Use

Set the Motor Rated Voltage Selection (A082) correctly to obtain a correct parameter value.

Input Power Monitor [d014]

Use this function to display the input power (instantaneous value) of the inverter.

The data display LED “kW” (“V” and “A”) is lit while the value of d014 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d014	Input Power Monitor	0.0 to 999.9 (Displayed in increments of 0.1 kW)	–	kW

Integrated Power Monitor [d015]

Use this function to display the integrated power (integrated input power value) of the inverter.

The monitor value can be converted and displayed with a different scale factor by setting the Integrated Power Display Scale (b079)

d015 = Calculated input power value [kWh]/Integrated Power Display Scale (b079)

(Example) With the Integrated Power Display Scale (b079) set to 100, the actual integrated power is 100,000 [kWh] when the displayed value is 1,000.

To clear the integrated power value, set the Integrated Power Clear (b078) to 01.
It is also possible to clear the integrated power value via terminal input, if you allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 53 (KHC: Integrated power clear).
When the Integrated Power Display Scale (b079) is set to 1,000, an integrate power value of up to 999,000,000 [kWh] can be displayed.

Parameter No.	Function name	Data	Default data	Unit
d015	Integrated Power Monitor	0.0 to 999.9 (Displayed in increments of 1 kWh/(Value set in b079)) 1000. to 9999. (Displayed in increments of 1 kWh/ (Value set in b079)) 1000 to 9999 (10000 to 99990) (Displayed in increments of 1 kWh/(Value set in b079)) Γ100 to Γ999 (100000 to 999000) (Displayed in increments of 1 kWh/(Value set in b079))	–	kWh
b078	Integrated Power Clear	00: Normal 01: Execute Integrated Power Clear. (Reset from 01 to 00 after execution.)	00	–
b079	Integrated Power Display Scale	1. to 1000.	1.	–
C001 to C008	Multi-function Input S1 to S8 Selection	53: KHC (Integrated power clear)	–	–

Total RUN Time Monitor [d016]

Use this function to display the total RUN time of the inverter.

Parameter No.	Function name	Data	Default data	Unit
d016	Total RUN Time Monitor	0. to 9999. (Displayed in increments of 1 hour) 1000 to 9999 (10000 to 99990) (Displayed in increments of 10 hours) Γ100 to Γ999 (100000 to 999000) (Displayed in increments of 1,000 hours)	–	h

Total Power ON Time Monitor [d017]

Use this function to display the total power ON time of the inverter.

Parameter No.	Function name	Data	Default data	Unit
d017	Total Power ON Time Monitor	0. to 9999. (Displayed in increments of 1 hour) 1000 to 9999 (10000 to 99990) (Displayed in increments of 10 hours) Γ100 to Γ999 (100000 to 999000) (Displayed in increments of 1,000 hours)	–	h

Fin Temperature Monitor [d018]

Use this function to display the temperature of the cooling fin that is built into the inverter.

Parameter No.	Function name	Data	Default data	Unit
d018	Fin Temperature Monitor	–20.0 to 200.0: (Displayed in increments of 0.1°C)	–	°C

Motor Temperature Monitor [d019]

Use this function to display the temperature of the thermistor connected between the control circuit terminals TH and SC.

Use the thermistor PB-41E (manufactured by Shibaura Electronics Co., Ltd.).

Set the Thermistor Selection (b098) to 02 (NTC enabled).

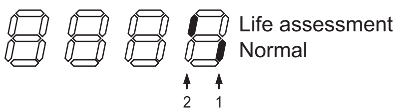
Parameter No.	Function name	Data	Default data	Unit
d019	Motor Temperature Monitor	–20.0 to 200.0 (Displayed in increments of 0.1°C)	–	°C

Life Assessment Monitor [d022]

Use this function to display the output status of each multi-function output terminal, based on whether the corresponding 7-segment LED is lit or not lit.

This parameter can be set to display either of the following two:

- Life expectancy of main circuit board capacitor: 1
- Life expectancy of cooling fan: 2



Precautions for Correct Use

- The inverter calculates the capacitor life once every 10 minutes. If the power supply is turned on/off more frequently than this cycle, the inverter cannot evaluate the capacitor life successfully.
- If the Cooling Fan Operation (b092) is set to 01, the rotation speed of the cooling fan will be evaluated as normal while the cooling fan is stopped.

Program Counter (DriveProgramming) [d023]

Use this function to display the line number of the program that is executed while a DriveProgramming function is active.

For details, refer to “DriveProgramming User’s Manual (I580)”.

Parameter No.	Function name	Data	Default data	Unit
d023	Program Counter	0 to 1024 (Displayed in increments of 1)	–	–

Program Number Monitor (DriveProgramming) [d024]

Use this function to display the program number of the downloaded DriveProgramming program.

However, you need to set a program number during programming.

For details, refer to “DriveProgramming User’s Manual (I580)”.

Parameter No.	Function name	Data	Default data	Unit
d024	Program Number Monitor	0000 to 9999 (Displayed in increments of 1)	–	–

User Monitor 0 to 2 (DriveProgramming) [d025 to d027]

Use these functions to monitor the result of the calculation performed in the DriveProgramming program.

For details, refer to “DriveProgramming User’s Manual (I580)”.

Parameter No.	Function name	Data	Default data	Unit
d025	User Monitor 0	–2147483647 to 2147483647 (Displays MSB 4digits of DriveProgramming execution result)	–	–
d026	User Monitor 1			
d027	User Monitor 2			

Pulse Counter Monitor [d028]

Use this function to monitor the total pulse count of the pulse counter (74: PCNT), which is allocated to one of the Multi-function Input S1 to S8 Selection (C001 to C008).

Parameter No.	Function name	Data	Default data	Unit
d028	Pulse Counter Monitor	0 to 2147483647 (Displays MSB 4 digits)	–	–

Position Command Monitor (Absolute Position Control Mode) [d029]

Use this function to monitor the position command value in the absolute position control mode.

Parameter No.	Function name	Data	Default data	Unit
d029	Position Command Monitor	–268435455 to 268435455 (P012 = 02) –1073741823 to 1073741823 (P012 = 03) Displays MSB 4digit (1 digit for "–")	–	–

Precautions for Correct Use

- This monitor value is displayed only when the V2 Control Mode Selection (P012) is set to 02 or 03 in the sensor vector control mode.
- When the V2 Control Mode Selection (P012) is set to 03 (High-resolution absolute position control mode), the current position is controlled based on the quadrupled (x4) pulse count used in internal calculations.

Current Position Monitor (Absolute Position Control Mode) [d030]

Use this function to monitor the position command value in the absolute position control mode.

Parameter No.	Function name	Data	Default data	Unit
d030	Current Position Monitor	–268435455 to 268435455 (P012 = 02) –1073741823 to 1073741823 (P012 = 03) Displays MSB 4digit (1 digit for "–")	–	–

Precautions for Correct Use

- This monitor value is displayed only when the V2 Control Mode Selection (P012) is set to 02 or 03 in the sensor vector control mode.
- When the V2 Control Mode Selection (P012) is set to 03 (High-resolution absolute position control mode), the current position is controlled based on the quadrupled (x4) pulse count used in internal calculations.

Current Time Monitor [d031]

Use this function to monitor the current time only when the inverter is connected with the optional LCD Digital Operator (Model: 3G3AX-OP05).

This monitor function is not available with the built-in Digital Operator.

Parameter No.	Function name	Data	Default data	Unit
d031	Current Time Monitor	mm/dd hh:mm (Month/Day and Hours/ Minutes, 12 characters)	–	–

(Example)
"05/28 10:16" means May 28, 10 o'clock and 16 minutes.

Inverter Mode Monitor [d060]

Use this function to display the current inverter mode.

Parameter No.	Function name	Data	Default data	Unit
d060	Inverter Mode Monitor	I-C: IM motor heavy load I-V: IM motor light load	–	–

Fault Counter [d080]

Use this function to display the number of inverter trips.

This count value will be saved to the inverter's EEPROM when the power supply is turned OFF.

Parameter No.	Function name	Data	Default data	Unit
d080	Fault Counter	0. to 9999. (Displayed in increments of 1 time) 1000 to 6553 (Displayed in increments of 10 times)	–	time

Fault Monitor 1 to 6 [d081 to 086]

Use these functions to display the fault history of up to the last six faults.

To display the latest fault history, set the Fault Monitor 1 (d081).

<Displayed Items>

(a) Error code (Fault factor) (Displayed in E01 to E79.)*

(b) Output frequency at the trip [Hz]

(c) Output current at the trip [A]

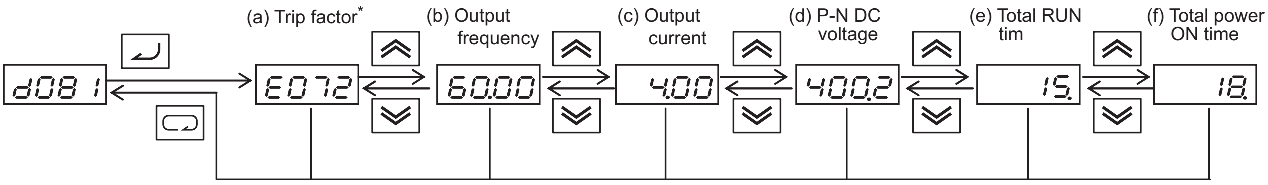
(d) DC voltage between P and N on main circuit at the trip [V]

(e) Total RUN time of inverter before the trip [h]

(f) Total power ON time of inverter before the trip [h]

Note Refer to *10-1-2 Alarm Code List* on page 10-3.

<Trip Monitor Display Sequence>



* Displays ---- if there is no trip.

Warning Monitor [d090]

Use this function to display a warning code if any inconsistency is found among the set data.

The program LED “PRG” remains lit during the warning, until the inconsistent data is corrected.

For details on the warning display, refer to *10-2 Warning Function* on page 10-12.

DC Voltage Monitor [d102]

Use this function to display the inverter DC voltage called “P-N voltage” (the DC voltage between the P/+2 and N/– terminals of the inverter.)

During operation, the monitor value changes according to the actual DC voltage of the inverter.

Parameter No.	Function name	Data	Default data	Unit
d102	DC Voltage Monitor	0.0 to 999.0 (Displayed in increments of 0.1 V)	–	V

Regenerative Braking Load Rate Monitor [d103]

Use this function to display the regenerative braking load rate. If this monitor value exceeds the value set in the Usage Rate of Regenerative Braking (b090), the inverter will cause a trip with the alarm code E06 (Braking resistor overload protection).

Parameter No.	Function name	Data	Default data	Unit
d103	Regenerative Braking Load Rate Monitor	0.0 to 100.0 (Displayed in increments of 0.1%)	–	%

Electronic Thermal Load Rate Monitor [d104]

Use this function to display the electronic thermal load rate. If this monitor value exceeds 100%, the inverter will cause a trip with the alarm code E05 (Overload protection).

Parameter No.	Function name	Data	Default data	Unit
d104	Electronic Thermal Load Rate Monitor	0.0 to 100.0 (Displayed in increments of 0.1%)	–	%

7-2 Basic Functions (Group F)

This section describes the output frequency setting, acceleration/deceleration time, and other basic parameters.

Output Frequency Setting/Monitor

- Use these parameters to set the output frequency of the inverter.
- F001 can be used to set the output frequency only when the Frequency Reference Selection (A001) is set to 02 (Digital Operator). For other frequency setting methods, refer to *Frequency Reference Selection* on page 7-17. F001 functions as the frequency reference monitor when A001 is set to other than 02.
- Setting a frequency in F001 automatically configures the 1st Multi-step Speed Reference 0 (A020) to the same value.
  To configure the 2nd/3rd control, set the 2nd Multi-step Speed Reference 0 (A220)/3rd Multi-step Speed Reference 0 (A320), or set F001 with the SET/SET3 terminal turned ON.
  To use the SET/SET3 terminal, allocate one of the Multi-function Input S1 to S8 Selection to 08 (SET)/17 (SET3).
- If the output frequency is used as the PID target value, it will be displayed as a percentage [%]. In this case, 100% is the maximum frequency.

Parameter No.	Function name	Data	Default data	Unit
F001	Output Frequency Setting/Monitor	0.0/Starting frequency to 1st/2nd/3rd Maximum Frequency 0.0 to 100.0 (PID function enabled)	–	Hz
A020	1st Multi-step Speed Reference 0		6.0	
A220	2nd Multi-step Speed Reference 0[*1]			
A320	3rd Multi-step Speed Reference 0[*1]			
A001	Frequency Reference Selection	00: Digital Operator (Volume adjuster) 01: Control circuit terminal block (Analog input) 02: Digital Operator (F001) 03: Modbus communication 04: Option 1 05: Option 2 06: Pulse train frequency 07: DriveProgramming 10: Operation function output	02	–
Related functions		C001 to C008		

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

Precautions for Correct Use

The Output Frequency Setting/Monitor (F001) shows the frequency reference configured in the internal memory (RAM).

F001 displays the frequency reference value selected at that time.

If you change the frequency reference value displayed in F001 and save it (by pressing the Enter key), the data will be stored with the frequency reference selected at that time.

- For the multi-step speed reference 0, the data will be stored with the 1st Multi-step Speed Reference 0 (A020)/2nd Multi-step Speed Reference 0 (A220)/3rd Multi-step Speed Reference 0 (A320) according to the 1st/2nd/3rd Control Method selection.
- For the multi-step speed reference 1 to 15, the data will be stored with the corresponding Multi-step Speed Reference 1 to 15 (A021 to A035).

* The frequency reference selection of Digital Operator (Volume adjuster), Control terminal block (Analog input), Modbus communication, Options, DriveProgramming, and Calculation function output cannot be changed in F001.

Acceleration/Deceleration Time Settings

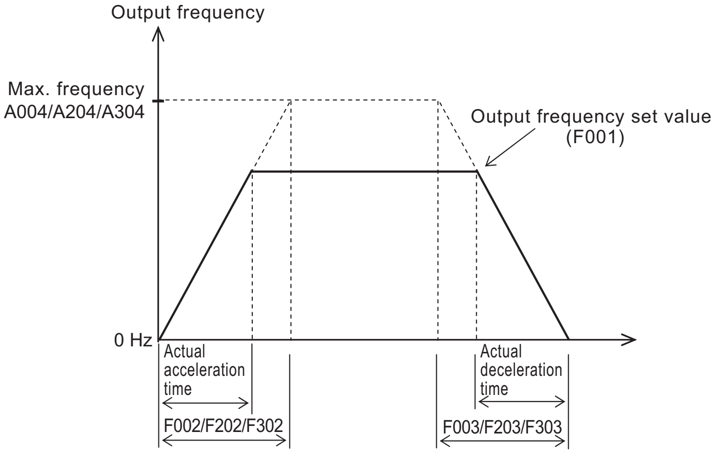
- Set the motor acceleration/deceleration time. To accelerate/decelerate slowly, set a large value. To accelerate/decelerate quickly, set a small value.
- The acceleration/deceleration time settings will be ignored and the output frequency will instantaneously follow the reference frequency if you allocate the LAD cancel (LAC) function to one of the multi-function input terminals and turn ON the signal for that terminal.
- To enable the switching to the 1st/2nd/3rd Acceleration Time and to the 1st/2nd/3rd Deceleration Time, allocate one of the Multi-function Input S1 to S8 Selection to 08 (SET) or 17 (SET3) and turn ON the terminal SET/SET3. For the multi-function input terminals, refer to *Multi-function Input Selection* on page 7-108.
- Set the Acceleration/Deceleration Time Input Type (P031) to 00 (Digital Operator), 01 (Option board 1), 02 (Option board 2), or 03 (DriveProgramming) to select the desired input type.

Parameter No.	Function name	Data	Default data	Unit
F002	1st Acceleration Time 1	Acceleration time from 0 to maximum frequency 0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00*2	s
F202	2nd Acceleration Time 1*1			
F302	3rd Acceleration Time 1*1			
F003	1st Deceleration Time 1	Deceleration time from maximum frequency to 0 0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00*2	s
F203	2nd Deceleration Time 1*1			
F303	3rd Deceleration Time 1*1			
P031	Acceleration/Deceleration Time Input Type	00: Digital Operator 01: Option 1 02: Option 2 03: DriveProgramming	00	–
Related functions		A004, A204, A304, C001 to C008		

*1. To enable the switching to the 2nd Acceleration Time 1/3rd Acceleration Time 1 and to the 2nd Deceleration Time 1/3rd Deceleration Time 1, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2. The default data was changed from the previous model.

- The set time here indicates the acceleration/deceleration time from 0 Hz to the maximum frequency.
- Depending on the maximum frequency and output frequency settings, the actual acceleration/deceleration time may be shorter than the set acceleration/deceleration time, as shown below.



- The actual motor acceleration/deceleration time cannot be set shorter than the minimum acceleration/deceleration time, which is determined by the mechanical inertia moment and the motor torque. Setting a time shorter than the minimum acceleration/deceleration time may cause an overcurrent/overvoltage trip error.

Acceleration Time T_S

$$T_S = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_S - T_L)}$$

Deceleration Time T_S

$$T_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$$

J_L : Inertia moment of the load converted to the motor shaft [kg·m²]
J_M : Inertia moment of the motor [kg·m²]
N_M : Motor rotation speed [r/min]
T_S : Max. acceleration torque with the Inverter driving [N·m]
T_B : Max. deceleration torque with the Inverter driving [N·m]
T_L : Required driving torque [N·m]

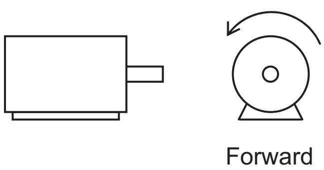
- If a shorter acceleration/deceleration time is required, use the regenerative braking function.

RUN Direction Selection

- Select the rotation direction when the RUN command is executed via the Digital Operator.
- This setting is disabled when the RUN command is input via the control circuit terminal block.

Parameter No.	Function name	Data	Default data	Unit
F004	RUN Direction Selection	00: Forward 01: Reverse	00	–

Generally, the forward rotation is defined as the direction in which the motor rotates counterclockwise when viewed from the shaft.



7-3 Basic Functions (Group A)

This section describes the Frequency Reference Selection, RUN Command Selection, and other basic parameters commonly used for the inverter.

Frequency Reference Selection

- Select the frequency reference selection method.
- When the multi-step speed reference function is used (by setting the multi-function input terminals for the Multi-step Speed Reference 0 to 15), the value set in A001 is effective only for the Multi-step Speed Reference 0.
  The values set in the Multi-step Speed Reference 1 to 15 have priority over the value set in A001.

Parameter No.	Function name	Data	Default data	Unit
A001	Frequency Reference Selection	00: Digital Operator (Volume adjuster) (Enabled when 3G3AX-OP01 is connected) 01: Control circuit terminal block (Analog input) 02: Digital Operator (F001) 03: Modbus communication 04: Option 1 05: Option 2 06: Pulse train frequency 07: DriveProgramming 10: Operation function output	02	–
Related functions		A005, A141 to A143, A145, A146		

Below are the details of the parameter data.

Data	Frequency reference source
00	Sets the frequency via the volume adjuster on the external Digital Operator (Model: 3G3AX-OP01).
01	Sets the frequency via the control circuit terminal block (analog input signals). (FV-FC, FI-FC, FE-FC)
02	Sets the frequency via the Digital Operator or LCD Digital Operator. (Output Frequency Setting: F001)
03	Sets the frequency via Modbus communication.
04	Sets the frequency via the option board mounted on the option port 1.
05	Sets the frequency via the option board mounted on the option port 2.
06	Sets the frequency as a pulse train via the 3G3AX-PG01.*1
07	Sets the frequency via the DriveProgramming.*2
10	Sets the calculation result of the frequency operation function as the frequency reference.*3

*1 Refer to *6-2 Sensorless Vector Control* on page 6-4.

*2 Refer to the “DriveProgramming User’s Manual (I580)”.

*3 Refer to *Calculation Frequency Function* on page 7-59.

Precautions for Correct Use

The Output Frequency Setting/Monitor (F001) shows the frequency reference configured in the internal memory (RAM).

F001 displays the frequency reference value selected at that time.

If you change the frequency reference value displayed in F001 and save it (by pressing the Enter key), the data will be stored with the frequency reference selected at that time.

- For the multi-step speed reference 0, the data will be stored with the 1st Multi-step Speed Reference 0 (A020)/2nd Multi-step Speed Reference 0 (A220)/3rd Multi-step Speed Reference 0 (A320) according to the 1st/2nd/3rd Control Method selection.
- For the multi-step speed reference 1 to 15, the data will be stored with the corresponding Multi-step Speed Reference 1 to 15 (A021 to A035).

* The frequency reference selection of Digital Operator (Volume adjuster), Control terminal block (Analog input), Modbus communication, Options, DriveProgramming, and Operation function output cannot be changed in F001.

RUN Command Selection

Select the RUN/STOP command selection method.

Parameter No.	Function name	Data	Default data	Unit
A002	RUN Command Selection	01: Control circuit terminal block 02: Digital Operator 03: Modbus communication 04: Option 1 05: Option 2	02	–
Related functions		F004, C001 to C008, C019		

Below are the details of the parameter data.

Data	Frequency reference source
01	Inputs the RUN command via the ON/OFF of the FW/RV signal allocated to the control circuit terminal block. It will be regarded as the STOP command if both the forward and reverse commands are input simultaneously.
02	Inputs the RUN command via the RUN key and the STOP/RESET key on the Digital Operator or LCD Digital Operator.
03	Inputs the RUN command via Modbus communication.
04	Inputs the RUN command via the option board mounted on the option port 1.
05	Inputs the RUN command via the option board mounted on the option port 2.

Base Frequency

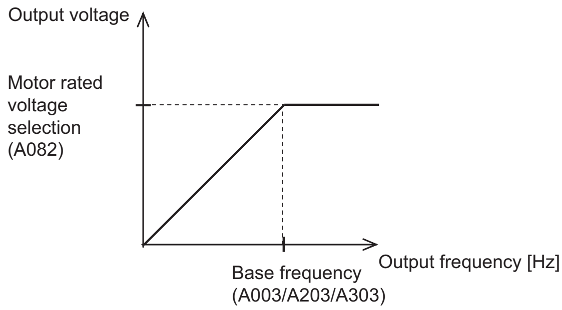
Set the inverter output (frequency and voltage) according to the motor rating. Note in particular that setting the base frequency to lower than 50 Hz may cause motor burnout.

Be sure to set the rated frequency of the motor.

Parameter No.	Function name	Data	Default data	Unit
A003	1st Base Frequency	30. to 1st Maximum Frequency (A004)		
A203	2nd Base Frequency*1	30. to 2nd Maximum Frequency (A204)	60.	Hz
A303	3rd Base Frequency*1	30. to 3rd Maximum Frequency (A304)		
Related functions		A004, A204, A304, A081, A082		

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

- In the Base Frequency (A003/A203/A303) and Motor Rated Voltage Selection (A082), set the inverter output (frequency and voltage) to the motor rating.

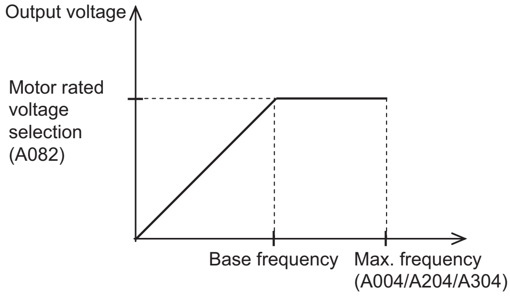


- Setting the base frequency to 60 Hz or higher is regarded as a special motor setting. This may require the use of a larger inverter capacity because the maximum applicable motor for the inverter is different.
- Set the Motor Rated Voltage Selection (A082) according to the motor specifications. Note in particular that setting the parameter to a value higher than specified in the motor specifications may cause motor burnout.

Maximum Frequency

- Set the maximum output frequency.
- The value set here is defined as the maximum value for external analog input (frequency reference) (for example, 10 V if the setting range is 0 to 10 V).
- The maximum output voltage of the inverter from the base frequency to the maximum frequency is the voltage set in the Motor Rated Voltage Selection (A082).
- The inverter cannot produce output voltage over the incoming voltage.

- Set the maximum frequency to the maximum motor rotation speed or lower.



Parameter No.	Function name	Data	Default data	Unit
A004	1st Maximum Frequency	30. to 400.	60.	Hz
A204	2nd Maximum Frequency*1	30. to 400.		
A304	3rd Maximum Frequency*1	30. to 400.		
Related functions		A003, A203, A303, A081, A082		

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

Analog Input (FV, FE, FI)

The inverter has the following three types of external analog input terminals.

By default, these analog input terminals are set to reach the maximum frequency at 9.8 V or 19.8 mA.

- FV-FC terminal: 0 to 10 V (Voltage input)
- FI-FC terminal: 4 to 20 mA (Current input)
- FE-FC terminal: –10 to 10 V (Voltage input)

Parameter No.	Function name	Data	Default data	Unit
A005	FV/FI Selection	00: Switching between FV (Voltage) and FI (Current) via terminal AT 01: Switching between FV and FE via terminal AT 02: Switching between FV and volume adjuster via terminal AT*1 03: Switching between FI and volume adjuster via terminal AT*1 04: Switching between FE and volume adjuster via terminal AT*1	00	–
A006	FE Selection	00: FE only 01: FV/FI auxiliary frequency reference (Not reversible) 02: FV/FI auxiliary frequency reference (Reversible) 03: FE disabled	03	–
Related functions		A005, A006, C001 to C008, C081, C082		

*1. The volume adjuster is enabled only when the 3G3AX-OP01 is connected.

- Note the following when setting these parameters. The judgment on the frequency reference and reversibility will be made based on conditions that 16 (AT: analog input switching) is allocated to any of the multi-function input terminals and the combination of the values set in A005 and A006.
- When reversibility is enabled, the motor will rotate in the reverse direction if the sum of the main frequency reference and the auxiliary frequency reference is less than 0 (that is, analog input is negative) even when the FW (Forward) terminal is ON.
  Also, even when the FE terminal is not connected, the motor may also rotate in the reverse direction if the voltage is unstable at around 0 V, which may result in a prolonged acceleration time or other phenomenon.

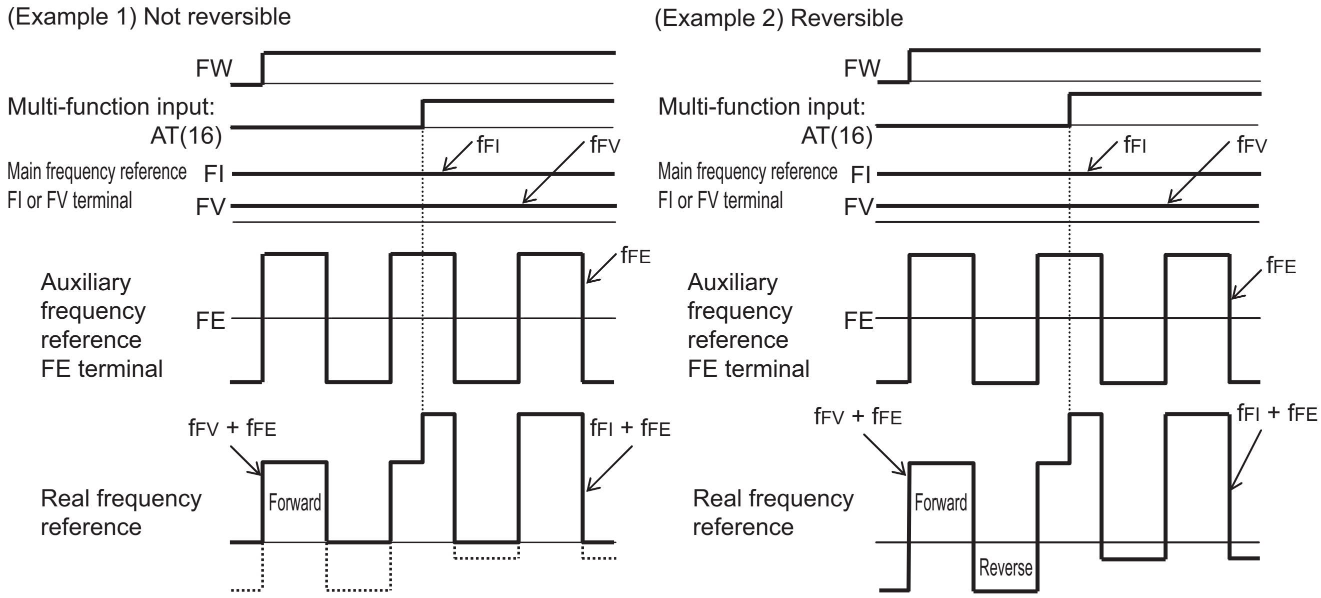
- When 16 (AT: analog input switching) is allocated to a multi-function input terminal

Setting in A005	Setting in A006	Multi-function input 16: Terminal AT (Analog input switching)	Frequency reference input terminal	Auxiliary frequency reference input terminal	Reversibility Enabled/ Disabled
00	00 or 03	OFF	FV-FC	Disabled	Disabled
		ON	FI-FC	Disabled	Disabled
	01 (Example 1)	OFF	FV-FC	FE-FC	Disabled
		ON	FI-FC	FE-FC	Disabled
	02 (Example 2)	OFF	FV-FC	FE-FC	Enabled
		ON	FI-FC	FE-FC	Enabled
01	00 or 03	OFF	FV-FC	Disabled	Disabled
		ON	FE-FC	Disabled	Enabled
	01 (Example 1)	OFF	FV-FC	FE-FC	Disabled
		ON	FE-FC	Disabled	Enabled
	02 (Example 2)	OFF	FV-FC	FE-FC	Enabled
		ON	FE-FC	Disabled	Enabled
02	00 or 03	OFF	FV-FC	Disabled	Disabled
		ON	Volume adjuster	Disabled	Disabled
	01 (Example 1)	OFF	FV-FC	FE-FC	Disabled
		ON	Volume adjuster	Disabled	Disabled
	02 (Example 2)	OFF	FV-FC	FE-FC	Enabled
		ON	Volume adjuster	Disabled	Disabled
03	00 or 03	OFF	FI-FC	Disabled	Disabled
		ON	Volume adjuster	Disabled	Disabled
	01 (Example 1)	OFF	FI-FC	FE-FC	Disabled
		ON	Volume adjuster	Disabled	Disabled
	02 (Example 2)	OFF	FI-FC	FE-FC	Enabled
		ON	Volume adjuster	Disabled	Disabled
04	00 or 03	OFF	FE-FC	Disabled	Enabled
		ON	Volume adjuster	Disabled	Disabled
	01 (Example 1)	OFF	FE-FC	Disabled	Enabled
		ON	Volume adjuster	Disabled	Disabled
	02 (Example 2)	OFF	FI-FC	Disabled	Enabled
		ON	Volume adjuster	Disabled	Disabled

- When 16 (AT: analog input switching) is not allocated to a multi-function input terminal

  If any of Multi-function Input Selection parameters is not set to 16 (AT), the input values of FV (voltage input) and FI (current input) will be added. Therefore, the operations are as follows.

Setting in A005	Setting in A006	Multi-function input 16: Terminal AT (Analog input switching)	Frequency reference input terminal	Auxiliary frequency reference input terminal	Reversibility Enabled/ Disabled
Disabled	00	–	FE-FC	Disabled	Enabled
	01	–	Sum of FV-FC and FI-FC	FE-FC	Disabled
	02	–	Sum of FV-FC and FI-FC	FE-FC	Enabled
	03	–	Sum of FV-FC and FI-FC	Disabled	Disabled



Analog Input (Voltage or Current) Adjustment

Set the following external analog input (frequency reference):

- FV-FC terminal: 0 to 10 V (Voltage input)
- FI-FC terminal: 4 to 20 mA (Current input)
- FE-FC terminal: –10 to 10 V (Voltage input)

And the output frequency for the volume adjuster on the Digital Operator.

By default, each analog input is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Adjustments for FV-FC Terminals

Parameter No.	Function name	Data	Default data	Unit
A011	FV Start Frequency	0.00 to 99.99, 100.00 to 400.00 (Set start and end frequencies.)*1	0.00	Hz
A012	FV End Frequency			
A013	FV Start Ratio	0. to FV end ratio (Set a start ratio relative to an external frequency reference of 0 to 10 V)	0.	%
A014*2	FV End Ratio	FV Start Ratio to 100. (Set an end ratio relative to an external frequency reference of 0 to 10 V)	100.	
A015	FV Start Selection	00: Use FV Start Frequency (A011) 01: 0 Hz	01	–
Related functions		A005, A006, C001 to C008, C081, C082		

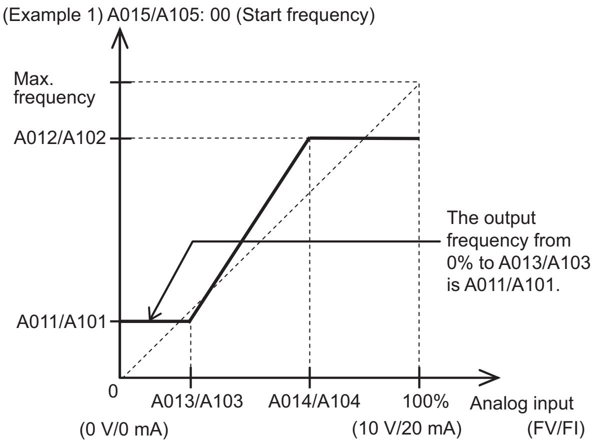
*1. The inverter operates at 0 to 10 V when both A011 and A012 are set to 0.00.

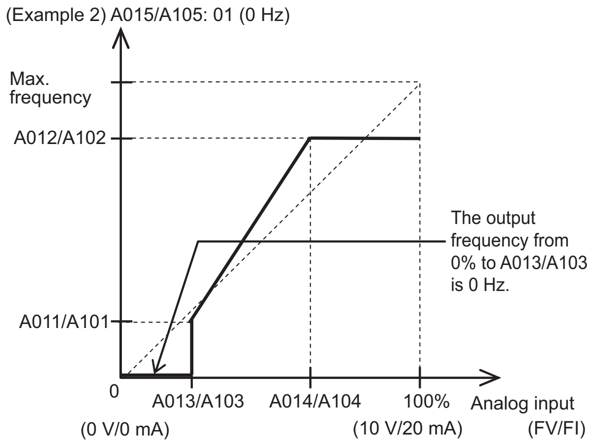
*2. To supply an input voltage of 0 to 5 V between the FV and FC terminals, set A014 to 50%.

Adjustments for FI-FC Terminals

Parameter No.	Function name	Data	Default data	Unit
A101	FI Start Frequency	0.00 to 99.99, 100.00 to 400.00 (Set start and end frequencies.)*1	0.00	Hz
A102	FI End Frequency			
A103	FI Start Ratio	0. to FI End Ratio (Set a start ratio relative to an external frequency reference of 4 to 20 mA)	20.	%
A104	FI End Ratio	FI Start Ratio to 100. (Set an end ratio relative to an external frequency reference of 4 to 20 mA)	100.	
A105	FI Start Selection	00: Use FI Start Frequency (A101) 01: 0 Hz	00	–
Related functions		A005, A006, C001 to C008, C081, C082		

*1. The inverter operates at 0 to 10 V when both A101 and A102 are set to 0.00.





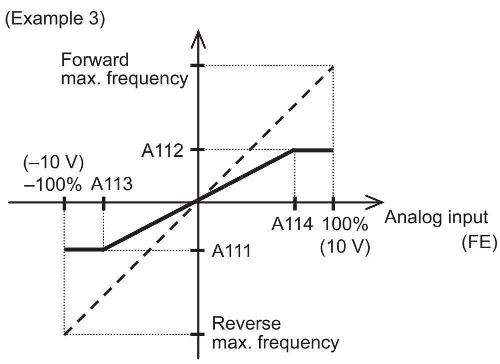
Adjustments for FE-FC Terminals

Parameter No.	Function name	Data	Default data	Unit
A111	FE Start Frequency	–400. to –100. –99.9 to –00.0 0.00 to 99.99 100. to 400. (Set start and end frequencies.)*1	0.00	Hz
A112	FE End Frequency			
A113	FE Start Ratio	–100. to FE End Ratio (Set a start ratio relative to an external frequency reference of –10 to 10 V)*2	0.	%
A114	FE End Ratio	FE Start Ratio to 100. (Set an end ratio relative to an external frequency reference of –10 to 10 V)*2	100.	
Related functions		A005, A006, C001 to C008, C081, C082		

*1. The inverter operates at –10 to 10 V when both A111 and A112 are set to 0.00.

*2. The ratio relative to an external frequency reference of –10 to 10 V is as follows.
- –10 to 0 V: –100% to 0%
- 0 to 10 V: 0% to 100%

For example, to use an external frequency reference of –5 to 5 V between the FE and FC terminals, set A113 to –50% and A114 to 50%.



Analog Input Filter

- Set the built-in filter applied to the frequency setting signals via external voltage/current input.
- This function is effective for removing noise in the frequency setting circuit.
- Set a larger data value if stable operation cannot be secured because of noise.
  However, setting a large data value results in a slow response. The filter time constant is a set value of 1. to 30 (x 2 ms).
- When set to 31., the parameter applies a filter time constant of 500 ms and a hysteresis of ±0.1 Hz (factory setting).

Parameter No.	Function name	Data	Default data	Unit
A016	Analog Input Filter	1. to 30.(x 2 ms) 31. (500-ms filter with ±0.1-Hz hysteresis)	31.	time
Related functions		A011 to A016, C001 to C008		

DriveProgramming Function Selection

Enable or disable the DriveProgramming function.

For details, refer to “DriveProgramming User’s Manual (I580)”.

Parameter No.	Function name	Data	Default data	Unit
A017	DriveProgramming Function Selection	00: Disabled 01: Enabled (Start/Stop via multi-function input terminal (S1 to S8) 02: Enabled (Start/Stop via power on/off)	00	–
Related functions		P100 to P131		

Multi-step Speed Operation Function

- Use this function to set several speed reference values in the Multi-step Speed Reference 0 to 15 and switch the speed among those settings via terminal input.
- For the Multi-step Speed Reference 0, set the Frequency Reference Selection (A001).
  To enable the 1st/2nd/3rd frequency reference 0 setting, set A001 to 02 (Digital Operator: F001).
  If this parameter is set to 01 (Control circuit terminal block: Analog input), the frequency reference for the Multi-step Speed Reference 0 is set via analog input.
- For multi-step speed operation, you can select either 4-terminal binary operation (in 16 steps max.) or 7-terminal bit operation (in 8 steps max.).

Parameter No.	Function name	Data	Default data	Unit
A019	Multi-step Speed Selection	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	00	–
A020	1st Multi-step Speed Reference 0	0.00 Starting Frequency (b082) to 1st Maximum Frequency (A004)	6.0	Hz
A220	2nd Multi-step Speed Reference 0*1	0.00 Starting Frequency (b082) to 2nd Maximum Frequency (A204)		
A320	3rd Multi-step Speed Reference 0*1	0.00 Starting Frequency (b082) to 3rd Maximum Frequency (A304)		
A021	Multi-step Speed Reference 1	0.00 Starting Frequency (b082) to 1st/2nd/3rd Maximum Frequency (A004/A204/A304)	0.0	
A022	Multi-step Speed Reference 2			
A023	Multi-step Speed Reference 3			
A024	Multi-step Speed Reference 4			
A025	Multi-step Speed Reference 5			
A026	Multi-step Speed Reference 6			
A027	Multi-step Speed Reference 7			
A028	Multi-step Speed Reference 8			
A029	Multi-step Speed Reference 9			
A030	Multi-step Speed Reference 10			
A031	Multi-step Speed Reference 11			
A032	Multi-step Speed Reference 12			
A033	Multi-step Speed Reference 13			
A034	Multi-step Speed Reference 14			
A035	Multi-step Speed Reference 15			

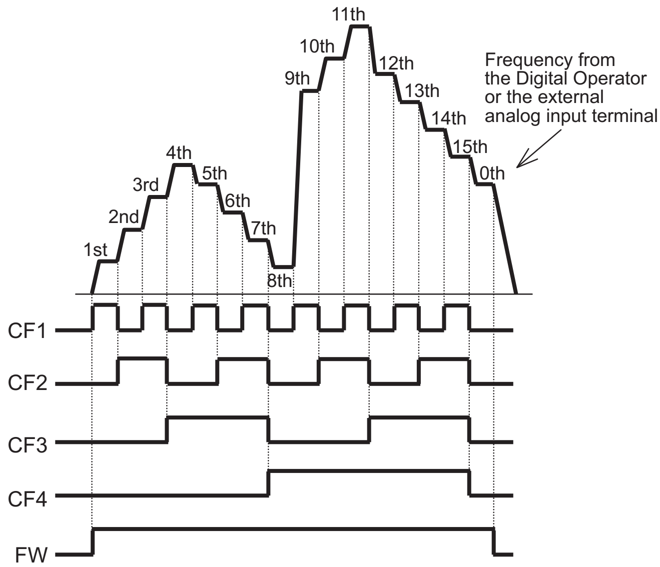
*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

Binary Operation

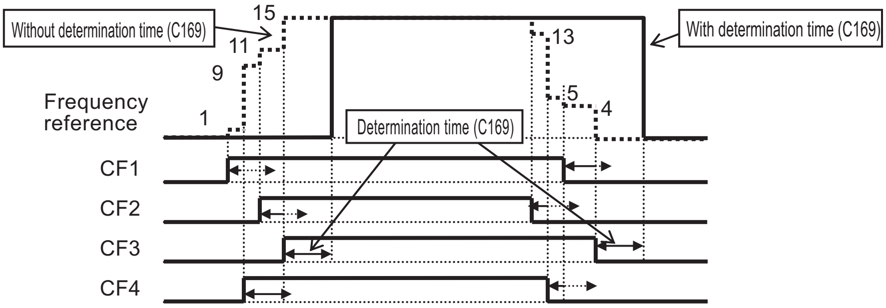
- Setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 02 (CF1) to 05 (CF4) enables the selection of the Multi-step Speed Reference 0 to 15.
- Use the Multi-step Speed Reference 1 to 15 (A021 to A035) to set the frequency for the 1st to 15th multi-step speeds.
- For the Multi-step Speed Reference 0, set the Frequency Reference Selection (A001).
  To enable the 1st/2nd/3rd Multi-step Speed Reference 0 setting, set A001 to 02 (Digital Operator: F001).
  If this parameter is set to 01 (Control circuit terminal block: Analog input), the frequency reference for the Multi-step Speed Reference 0 is set via analog input.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	02: CF1 (Multi-step speed setting binary 1) 03: CF2 (Multi-step speed setting binary 2) 04: CF3 (Multi-step speed setting binary 3) 05: CF4 (Multi-step speed setting binary 4)	–	–

Multi-step speed	CF4	CF3	CF2	CF1
0th	OFF	OFF	OFF	OFF
1st				ON
2nd			ON	OFF
3rd				ON
4th		ON	OFF	OFF
5th				ON
6th			ON	OFF
7th				ON
8th	ON	OFF	OFF	OFF
9th				ON
10th			ON	OFF
11th				ON
12th		ON	OFF	OFF
13th				ON
14th			ON	OFF
15th				ON



- For multi-step speed binary operation, the wait time until the inverter recognizes terminal input can be set in the Multi-step Speed/Position Determination Time (C169). This prevents the transitional status before terminal input is recognized from being accepted as an input.
- Input data will be determined if it remains unchanged for the time set in the Multi-step Speed/Position Determination Time (C169). Note that setting a long determination time results in a slow input response.



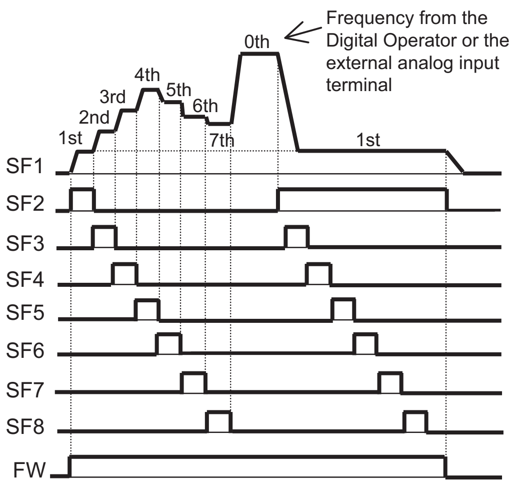
Bit Operation

- Setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 32 (SF1) to 38 (SF7) enables the selection of the Multi-step Speed Reference 0 to 7.
- Use the Multi-step Speed Reference 1 to 7 (A021 to A027) to set the frequency for SF1 to SF7.
- For the Multi-step Speed Reference 0, set the Frequency Reference Selection (A001).
  To enable the 1st/2nd/3rd Multi-step Speed Reference 0 setting, set A001 to 02 (Digital Operator: F001).
  If this parameter is set to 01 (Control circuit terminal block: Analog input), the frequency reference for the Multi-step Speed Reference 0 is set via analog input.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	32: SF1 (Multi-step speed setting bit 1) 33: SF2 (Multi-step speed setting bit 2) 34: SF3 (Multi-step speed setting bit 3) 35: SF4 (Multi-step speed setting bit 4) 36: SF5 (Multi-step speed setting bit 5) 37: SF6 (Multi-step speed setting bit 6) 38: SF7 (Multi-step speed setting bit 7)	–	–

Multi-step speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1
0th	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1st	×	×	×	×	×	×	ON
2nd	×	×	×	×	×	ON	OFF
3rd	×	×	×	×	ON	OFF	OFF
4th	×	×	×	ON	OFF	OFF	OFF
5th	×	×	ON	OFF	OFF	OFF	OFF
6th	×	ON	OFF	OFF	OFF	OFF	OFF
7th	ON	OFF	OFF	OFF	OFF	OFF	OFF

- When several terminals simultaneously turn ON, the bit with the smallest number has priority.
  In the above table, x indicates that a speed is selected regardless of the ON/OFF status of the bit.



7-3 Basic Functions (Group A)

7

Jogging Operation Function (JG)

- When the jogging function is enabled, jogging operation starts when the RUN command is input.
- To enable the jogging function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 06 (JG: Jogging).
- Set the frequency reference for jogging operation in the Jogging Frequency (A038).
  Because, in jogging operation, the frequency reference is output instantaneously without acceleration time, setting a high jogging frequency value may cause an overload or trip error. Be sure to set a frequency value that does not cause a trip error.
- Use the Jogging Stop Selection (A039) to set the jogging stop method and whether to enable or disable the jogging function during operation.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	06: JG (Jogging)	–	–
A038	Jogging Frequency	0.00, Starting Frequency (b082) to 9.99	6.00	Hz
A039	Jogging Stop Selection	00: Free-run stop/Disabled in operation 01: Deceleration stop/Disabled in operation 02: DC injection braking stop/Disabled in operation*1 03: Free-run stop/Enabled in operation 04: Deceleration stop/Enabled in operation 05: DC injection braking stop/Enabled in operation*1	04*2	–

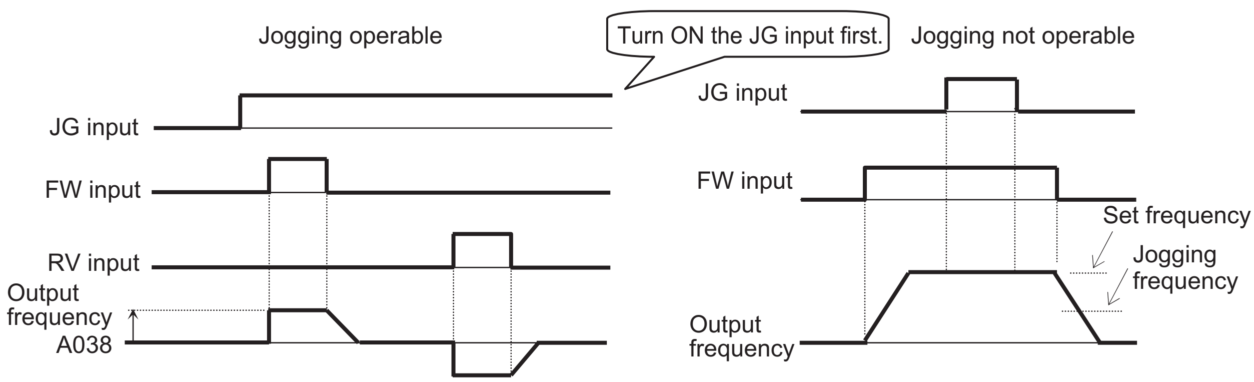
*1. If the Jogging Stop Selection(A039) is set to 02 or 05, set the DC Injection Braking Selection (A051).

*2. The default data was changed from the previous model.

Disabled during Operation

To perform jogging operation, turn ON the JG terminal and then turn ON the FW or RV terminal.

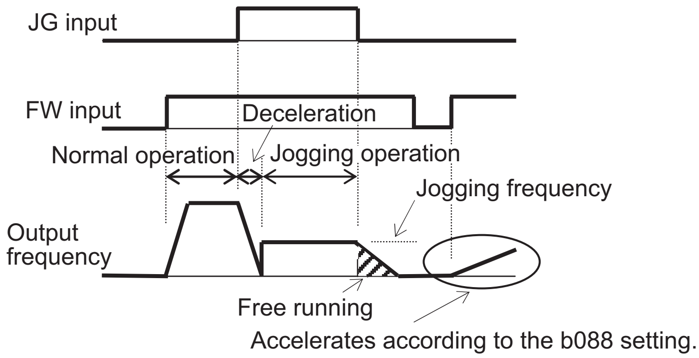
When the Jogging Stop Selection (A039) is set to 00, 01, or 02, jogging operation will not occur if the FW signal turns ON first.



Enabled during Operation

When the Jogging Stop Selection (A039) is set to 03, 04, or 05, jogging operation will occur even if the FW signal turns ON first.

However, if the JG signal turns OFF first, the motor will make a free-run stop.



Torque Boost

- The torque boost function compensates for the voltage drop caused by the primary resistance in the motor or by wiring to suppress torque reduction at a low speed range.
- To select Automatic torque boost in the 1st/2nd Torque Boost Selection(A041/A241), set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) according to your motor.
- By factory setting, the automatic torque boost option is selected.

Parameter No.	Function name	Data	Default data	Unit
A041	1st Torque Boost Selection	00: Manual torque boost 01: Automatic torque boost	01[*2]	–
A241	2nd Torque Boost Selection[*1]			
A042	1st Manual Torque Boost Voltage	0.0 to 20.0 (Percentage of Motor Rated Voltage Selection (A082))	1.0	%
A242	2nd Manual Torque Boost Voltage[*1]			
A342	3rd Manual Torque Boost Voltage[*1]			
A043	1st Manual Torque Boost Frequency	0.0 to 50.0 (Percentage of Base Frequency (A003/A203/A303))	5.0	%
A243	2nd Manual Torque Boost Frequency[*1]			
A343	3rd Manual Torque Boost Frequency[*1]			
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H203	2nd Motor Capacity[*1]			
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
H204	2nd Motor Pole Number[*1]			

Parameter No.	Function name	Data	Default data	Unit
A046	1st Automatic Torque Boost Voltage Compensation Gain	0. to 255.	100.	%
A246	2nd Automatic Torque Boost Voltage Compensation Gain			
A047	1st Automatic Torque Boost Slip Compensation Gain	0. to 255.	0. *2	
A247	2nd Automatic Torque Boost Slip Compensation Gain			

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2. The default data was changed from the previous model.

Automatic Torque Boost

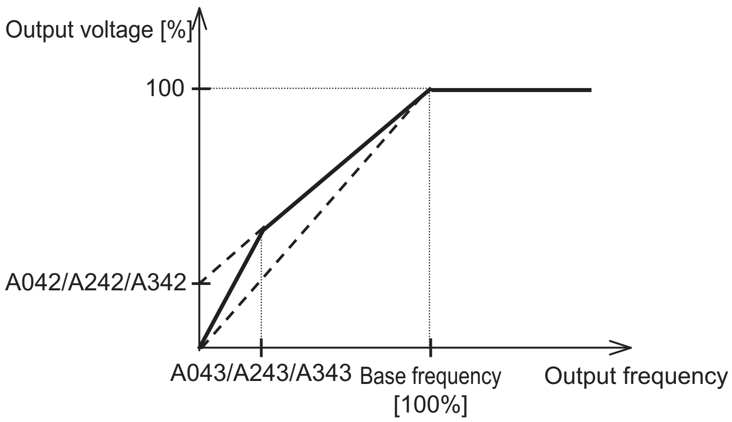
- In the 3G3RX-V1 Series Inverter, the default data for the 1st/2nd Torque Boost Selection (A041/A241) was changed to 01 to enable the automatic torque boost function.
- The automatic torque boost function adds the voltage automatically calculated from the output current to the output voltage set for the manual torque boost function to increase the output torque.
- To use the automatic torque boost function effectively, set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) correctly according to your motor.
- To avoid possible overcurrent trip during deceleration, set the AVR Selection (A081) to 00 (Always ON).
- To enable the slip compensation function in addition to the voltage compensation provided by the automatic torque boost function, set the 1st/2nd Automatic Torque Boost Slip Compensation Gain (A047/A247) to 100%.
- If the automatic torque boost does not provide the intended performance characteristics, adjust each adjustment item shown in the following table.

Phenomenon	Adjustment method	Adjustment item
Insufficient torque at low speeds (Motor does not run at low speeds.)	(1) Gradually increase the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(2) Set the Automatic Torque Boost Slip Compensation Gain to 100. Then, increase the set value gradually.	A047/A247
	(3) Gradually increase the Manual Torque Boost Voltage.	A042/A242
	(4) Decrease the Carrier Frequency.	b083
Overcurrent trip occurs when load is applied.	(1) Gradually decrease the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(2) Set the Automatic Torque Boost Slip Compensation Gain to 100. Then, decrease the set value gradually.	A047/A247
	(3) Gradually decrease the Manual Torque Boost Voltage.	A042/A242
	(4) Gradually decrease the Overload Limit Parameter.	b023/b026

Phenomenon	Adjustment method	Adjustment item
Rotation speed decreases when load is applied.	Gradually increase the Automatic Torque Boost Slip Compensation Gain.	A047/A247
Rotation speed increases when load is applied.	Gradually decrease the Automatic Torque Boost Slip Compensation Gain.	A047/A247

Manual Torque Boost

- The manual torque boost function sets the starting voltage for the output voltage of the inverter. The automatic torque boost function starts the adjustment of the output voltage and the output frequency from the value set in the manual torque boost function.
- When the automatic torque boost function is enabled, normally it is not necessary to adjust the manual torque boost function.
  Adjust it when the automatic boost function is disabled or if the motor stalls at low speeds.
- Set the 1st/2nd/3rd Manual Torque Boost Frequency (A043/A243/A343) appropriate to the rotation speed that provides the required output torque. While observing the movement of the load, adjust the 1st/2nd/3rd Manual Torque Boost Voltage (A042/A242/A342) at which the motor speed does not decrease. Check the output current of the inverter and adjust it to 150% of the rated current of the motor or less.
- Set A042/A242/A342 as a percentage of the Motor Rated Voltage Selection (A082) value.
  The set data is defined as a voltage equivalent to V/f Characteristics at 0 Hz.
- Set A043/A243/A343 as a percentage of the 1st/2nd/3rd Base Frequency (A003/A203/A303) value.
- Setting the Manual Torque Boost Voltage data too high may cause motor overexcitation.
  Although an overexcited motor can still produce torque output, it is inefficient and causes overload or overcurrent conditions easily. Check the output current of the inverter and adjust it to 150% of the rated current of the motor or less.



Control Method (V/f Characteristics)

You can set the following V/f (output voltage/output frequency) characteristics.

Parameter No.	Function name	Data		Default data	Unit
A044	1st Control Method	Heavy load (CT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control (SLV)[*2] 04: 0-Hz sensorless vector control[*2] 05: Sensor vector control (V2)[*3]	00	–
		Light load (VT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control (SLV)[*2]	00	
A244	2nd Control Method[*1]	Heavy load (CT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control (SLV)[*2] 04: 0-Hz sensorless vector control[*2]	00	
		Light load (VT)	00: Constant torque characteristics (VC) 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control (SLV)[*2]	00	
A344	3rd Control Method[*1]	00: Constant torque characteristics 01: Reduced torque characteristics		00	–

*1 To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2 Refer to *6-2 Sensorless Vector Control* on page 6-4.

*3 Refer to *6-3 Sensor Vector Control* on page 6-15.

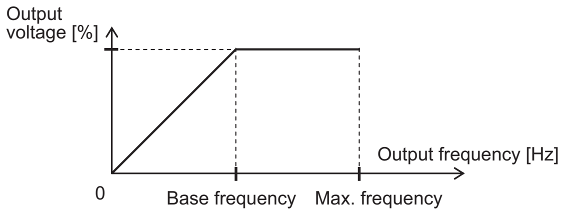
Constant Torque Characteristics (VC)

This setting is suitable for cart, conveyor, overhead traveling crane, and other applications where a constant torque is required, independent of the motor rotation speed.

The output voltage is generated in proportion to the output frequency to realize the output of a constant torque.

However, the output voltage is proportional from 0 Hz to the base frequency, it is constant independent of the frequency, from the base frequency to the maximum frequency.

For the base frequency, set the rated frequency of the motor. For the maximum frequency, set the highest frequency required for your application, within the maximum frequency of the motor.

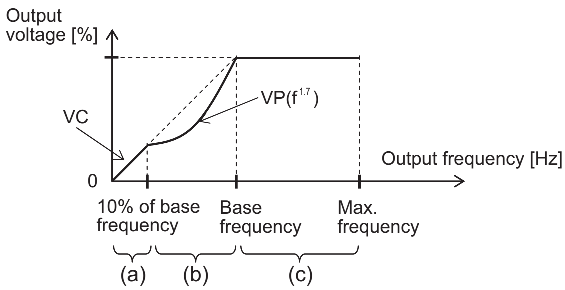


Reduced Torque Characteristics (VP 1.7th Power (VC at Low Speed))

This setting is suitable for fan, pump, and other applications that do not require large torque at low speeds.

It provides high efficiency, reduced noise, and vibration, because the output voltage is reduced in the low speed range.

In only the low speed range at 10% of the base frequency or less, the setting provides constant torque characteristics (VC) to secure a sufficient starting torque.



Range (a):
Constant torque characteristics are provided from 0 Hz to 10% of the base frequency.
(Example) If the base frequency is 60 Hz, the setting provides constant torque characteristics from 0 to 6 Hz.

Range (b):
Reduced torque characteristics are provided from 10% to 100% of the base frequency.
The inverter outputs voltage based on a curve of the 1.7th power of the frequency.

Range (c):
Constant voltage characteristics are provided from the base frequency to the maximum frequency.

Free V/f Setting

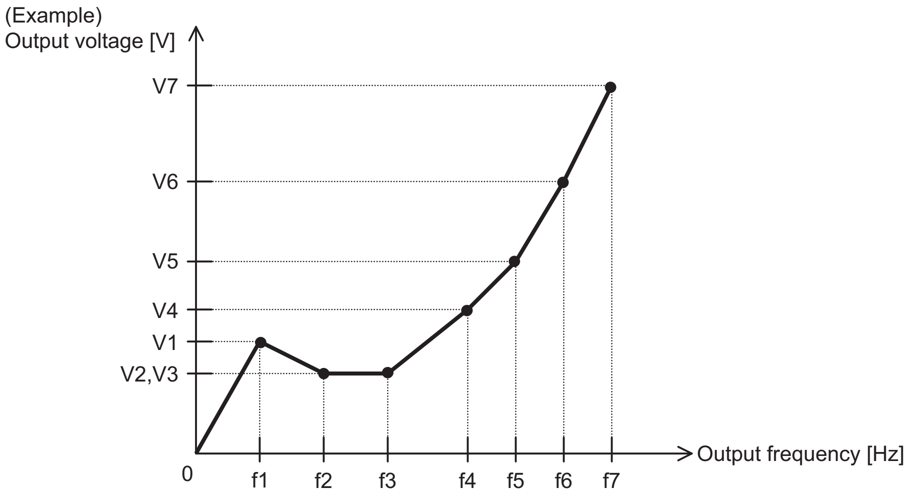
- The free V/f setting function is suitable for the applications below.
- The output voltage of the inverter can be adjusted according to your application.

Application	Adjustment method
Motor integrated with a brake (that uses a shared power supply for the motor and the brake)	If the motor and the brake share the same power supply, a large voltage is required at low frequencies to release the brake. The release timing of the brake can be adjusted by setting the frequency at which you want to release the brake and adjusting the voltage at that frequency.
Applications subject to significant load variation at different motor speeds	When the load value changes significantly depending on the motor speed, the output torque of the inverter can be adjusted by setting the frequency at which the load value becomes large and adjusting the voltage at that frequency.

- In the free V/f setting, you can configure the desired V/f characteristics by setting the voltage and frequency values at 7 points in the parameters b100 to b113.
- The set values of the Free V/f Frequency 1 to 7 must satisfy the following relationship: 1 ≤ 2 ≤ 3 ≤ 4 ≤ 5 ≤ 6 ≤ 7.
  All of the default data are set to 0 Hz. Start by setting the Free V/f Frequency 7 (b112). You cannot operate the inverter with the factory default settings.
- If the free V/f settings are enabled, the 1st/2nd Torque Boost Selection (A041/A241), 1st/2nd/3rd Base Frequency (A003/A203/A303), and 1st/2nd/3rd Maximum Frequency (A004/A204/A304) functions are disabled. The Free V/f Frequency 7 data is regarded as the maximum frequency.

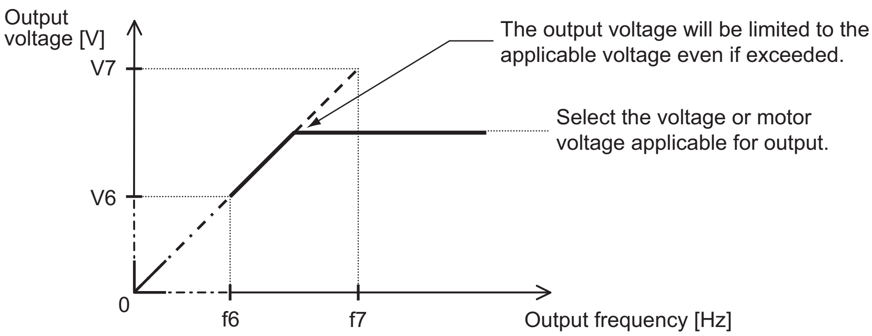
Parameter No.	Function name	Data	Description	Default data	Unit
b100	Free V/f Frequency 1 (f1)	0. Disabled 1. to Free V/f Frequency 2	Set the frequency at each break point.	0	Hz
b102	Free V/f Frequency 2 (f2)	0. Disabled Free V/f Frequency 1 to Free V/f Frequency 3			
b104	Free V/f Frequency 3 (f3)	0. Disabled Free V/f Frequency 2 to Free V/f Frequency 4			
b106	Free V/f Frequency 4 (f4)	0. Disabled Free V/f Frequency 3 to Free V/f Frequency 5			
b108	Free V/f Frequency 5 (f5)	0. Disabled Free V/f Frequency 4 to Free V/f Frequency 6			
b110	Free V/f Frequency 6 (f6)	0. Disabled Free V/f Frequency 5 to Free V/f Frequency 7			
b112	Free V/f Frequency 7 (f7)	0. Disabled Free V/f Frequency 6 to 400.			

Parameter No.	Function name	Data	Description	Default data	Unit
b101	Free V/f Voltage 1 (V1)	0.0 to 800.0	Set the voltage at each break point.	0.0	V
b103	Free V/f Voltage 2 (V2)				
b105	Free V/f Voltage 3 (V3)				
b107	Free V/f Voltage 4 (V4)				
b109	Free V/f Voltage 5 (V5)				
b111	Free V/f Voltage 6 (V6)				
b113	Free V/f Voltage 7 (V7)				
Related functions		A044, A244, A344			



Precautions for Correct Use

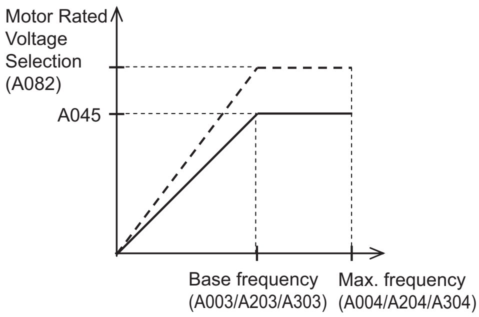
Even if the Free V/f Voltage 1 to 7 are set to 800 V, the inverter cannot produce output voltage higher than the input voltage or the value of the Motor Rated Voltage Selection (A082).
Be sure to check that the output characteristic setting is proper. An improper setting causes overcurrent during acceleration or deceleration, or vibration of the motor and/or machine.



Output Voltage Gain

- Use this function to adjust the inverter output voltage as 100% of the voltage set in the Motor Rated Voltage Selection (A082).
- You can avoid motor hunting by decreasing the value set in the Output Voltage Gain.

Parameter No.	Function name	Data	Default data	Unit
A045	Output Voltage Gain	20. to 100.	100.	%
Related functions		A082		



DC Injection Braking

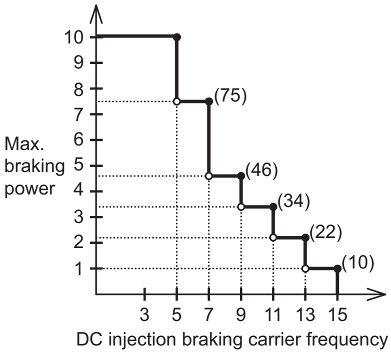
- Use this function to apply DC injection braking to the motor according to the load.
- Two types of DC injection braking are available: via a multifunction input terminal that is allocated to 07: DB (External DC injection braking), and automatic application at the time when the motor is started or stopped.
  Note, however that the use of DC injection braking may not be able to stop the motor due to the moment of inertia of the motor load.

Parameter No.	Function name	Data		Default data	Unit
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)		00	–
A052	DC Injection Braking Frequency	0.00 to 99.99 100.0 to 400.0		0.50	Hz
A053	DC Injection Braking Delay Time	0.0 to 5.0		0.0	s
A054	DC Injection Braking Power	Heavy load (CT)	0. to 100. (0.4 to 55 kW)	50	%
			0. to 80. (75 to 132 kW)	40	
		Light load (VT)	0. to 70. (0.4 to 55 kW)	50	
			0. to 50. (75 to 132 kW)	40	
A055	DC Injection Braking Time	0.0 to 60.0		0.5	s
A056	DC Injection Braking Edge/Level Selection	00: Edge operation 01: Level operation		01	–
A057	Startup DC Injection Braking Power	Heavy load (CT)	0. to 100. (0.4 to 55 kW)	0.	%
			0. to 80. (75 to 132 kW)	0.	
		Light load (VT)	0. to 70. (0.4 to 55 kW)	0.	
			0. to 50. (75 to 132 kW)	0.	
A058	Startup DC Injection Braking Time	0.0 to 60.0		0.0	s

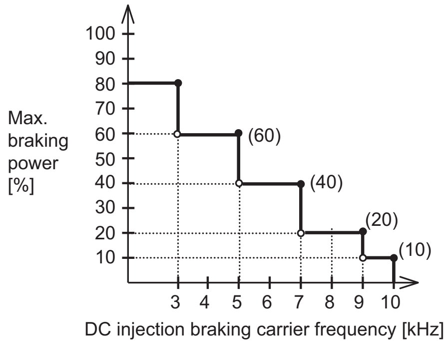
Parameter No.	Function name	Data		Default data	Unit
A059	DC Injection Braking Carrier Frequency	Heavy load (CT)	0.5 to 15.0 (0.4 to 55 kW)	5.0	kHz
			0.5 to 10.0 (75 to 132 kW)	3.0	
		Light load (VT)	0.5 to 12.0 (0.4 to 55 kW)	3.0	
			0.5 to 8.0 (75 to 132 kW)	3.0	

DC Injection Braking Carrier Frequency

The carrier frequency for DC injection braking can be set in the DC Injection Braking Carrier Frequency (A059). Note, however, that setting a 5 kHz or higher frequency automatically reduces the upper limit of the braking power. Refer to the following figure.



DC Injection Braking Power Limit (55 kW max.)



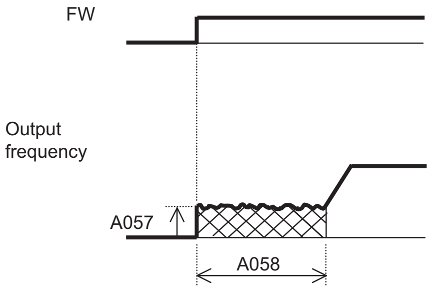
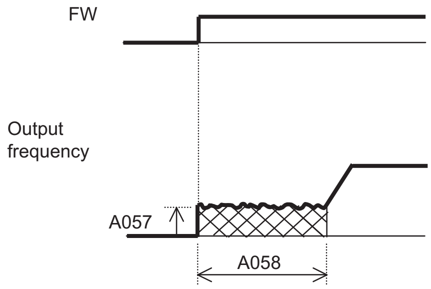
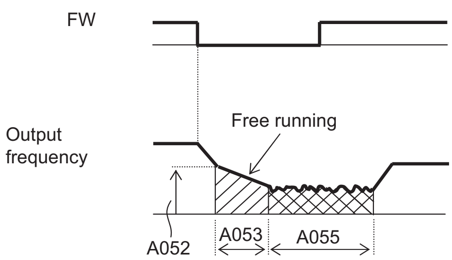
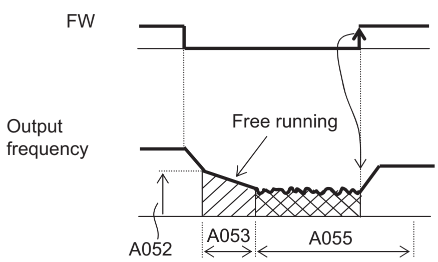
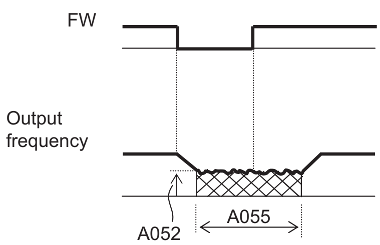
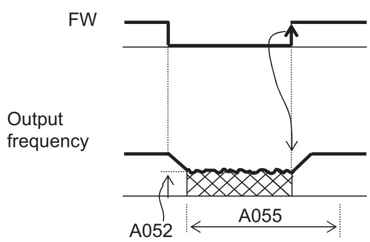
DC Injection Braking Power Limit (75 to 132 kW)

DC Injection Braking (A051 = 01)

- DC injection braking can be applied without terminal operation during startup/stop of the inverter. To enable the DC injection braking function, set the DC Injection Braking Selection (A051) to 01.
- Set the DC injection braking power during startup in the Startup DC Injection Braking Power (A057) and, regardless of the edge/level operation selection, the DC injection braking time during start up in the Startup DC Injection Braking Time (A058). (Example 4-a, 4-b.)
- In the DC Injection Braking Power (A054), set the DC injection braking power other than during startup.
- In the DC Injection Braking Frequency (A052), set the frequency at which you want to start DC injection braking.
- When the DC Injection Braking Delay Time (A053) is set, turning OFF the RUN command (FW) causes the inverter to shut off its output when the frequency reaches the value set in A052 and remain in a free-run state during the time set in A053. After the expiration of the time set in A053, the inverter starts DC injection braking.
- DC injection braking works differently between edge and level operations, when the RUN command is switched from STOP to RUN.

Edge operation:
The inverter performs DC injection braking for the time set in the DC Injection Braking Time (A055), which is given priority. Once the RUN command (FW) turns OFF, the inverter applies DC injection braking for the time set in A055 when the output frequency reaches the value set in A052. Even if the RUN command is turned ON while DC injection braking is active, the inverter continues to apply DC injection braking during the time set in A055. (Example 5-a, 6-a)

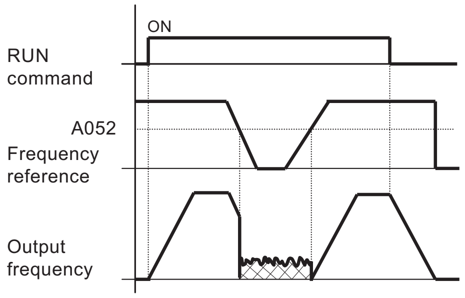
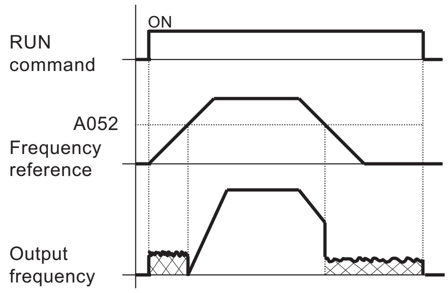
Level operation:
The inverter ignores the DC Injection Braking Time (A055) setting and shifts to normal operation by the RUN command that is priority given. If the RUN command is turned ON while DC injection braking is active, the inverter returns to normal operation with the time set in A055 ignored. (Example 5-b, 6-b)

<table>
<tr><th>(a) Edge operation</th><th>(b) Level operation</th></tr>
<tr><td>(i) During startup (Example 4-a)

</td><td>(i) During startup (Example 4-b)

</td></tr>
<tr><td>(ii) During stop (Example 5-a)

</td><td>(ii) During stop (Example 5-b)

</td></tr>
<tr><td>(iii) During stop (Example 6-a)

</td><td>(iii) During stop (Example 6-b)

</td></tr>
</table>

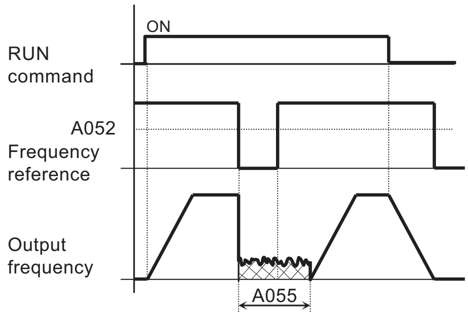
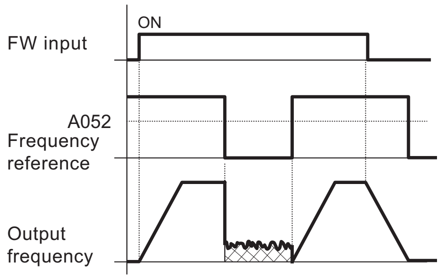
DC Injection Braking (Operates Only at Set Frequency) (A051 = 02)

- Use this setting to apply DC injection braking with the setting of the DC Injection Braking Power (A054), if the frequency reference falls to or below the value set in the DC Injection Braking Frequency (A052) with the RUN command ON.
- Selecting this setting disables the DC injection braking applied during startup/stop and the multi-function input terminal allocated to 07: DB (External DC injection braking).
- DC injection braking starts when the frequency reference falls to or below the DC Injection Braking Frequency (A052). (Example 7-a)
- When the reference frequency becomes 2 Hz higher than the value set in the DC Injection Braking Frequency (A052), the inverter releases DC injection braking and returns to normal output. (Example 7-a)

- If the reference frequency is 0 during startup via analog input etc., the inverter starts operating with DC injection braking. (Example 7-b)
  If the RUN command turns ON when the frequency reference is higher than the DC Injection Braking Frequency (A052), the inverter starts operating with normal output. (Example 7-a)

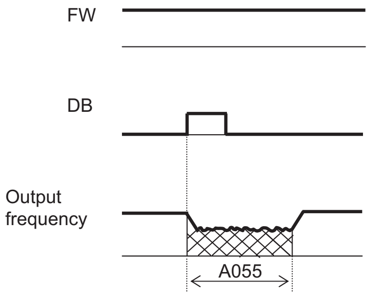
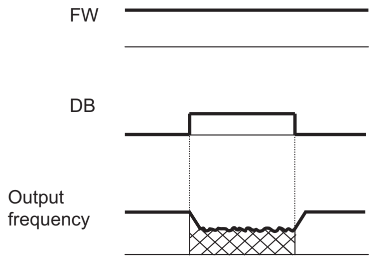
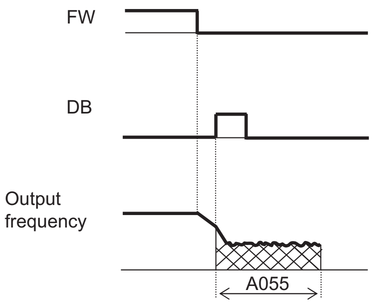
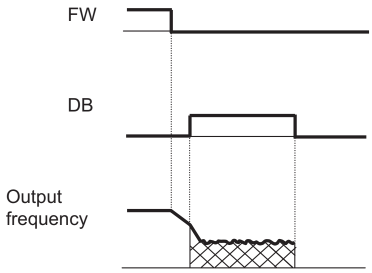
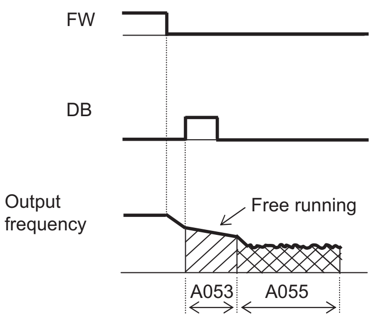
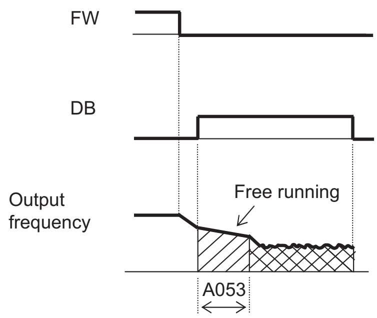
(Example 7-a)	(Example 7-b)
	

- The inverter behaves differently when returning to normal operation depending on the value set in the DC Injection Braking Edge/Level Selection (A056).

(a) Edge operation (A056= 00)	(b) Level operation (A056= 01)
	

External DC Injection Braking

- Allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 07 (DB: External DC injection braking).
- DC injection braking is applied by turning ON/OFF the DB terminal, independent of the DC Injection Braking Selection (A051).
- In the DC Injection Braking Power (A054), set the strength or weakness of the DC injection braking power.
- When the DC Injection Braking Delay Time (A053) is set, the inverter shuts off its output and remains in a free-run state during the set time. After the expiration of the set time, the inverter starts DC injection braking.
- Set the DC injection time via the DC Injection Braking Time (A055) or the DB terminal, while taking into account the heat generation of the motor.
- Select the operation in the DC Injection Braking Edge/Level Selection (A056) and configure the required settings according to your system.

(a) Edge operation (A056 = 00)	(b) Level operation (A056 = 01)
(Example 1-a) 	(Example 1-b) 
(Example 2-a) 	(Example 2-b) 
(Example 3-a) 	(Example 3-b) 

Frequency Limit

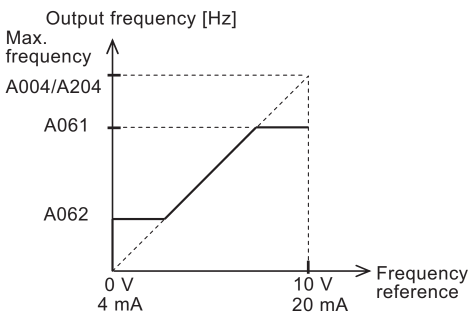
- Use this function to set the upper and lower limits of the output frequency. The set limits will be applied if the input frequency reference is beyond the upper/lower limit(s).
- Set the upper limit first. Be sure that the value set in the 1st/2nd Frequency Upper Limit (A061/A261) must be larger than the value set in the 1st/2nd Frequency Lower Limit (A062/A262).
- Set the upper and lower limit values so that they do not exceed the 1st/2nd/3rd Maximum Frequency (A004/A204/A304).
- Set the Output Frequency Setting/Monitor (F001) and the Multi-step Speed Reference 1 to 15 (A021 to A035) whithin the upper and lower limit settings.
- The upper/lower limit setting is disabled when 0 Hz is set.
- These functions are disabled when the 3rd control is selected.

Parameter No.	Function name	Data	Default data	Unit
A061	1st Frequency Upper Limit	0.00: Disabled (Function not active) 1st Frequency Lower Limit to 1st Maximum Frequency	0.00	Hz
A261	2nd Frequency Upper Limit*1	0.00: Disabled (Function not active) 2nd Frequency Lower Limit to 2nd Maximum Frequency		
A062	1st Frequency Lower Limit	0.00: Disabled (Function not active) Starting Frequency to 1st Frequency Upper Limit		
A262	2nd Frequency Lower Limit*1	0.00: Disabled (Function not active) Starting Frequency to 2nd Frequency Upper Limit		

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

When Using FV-FC and FI-FC

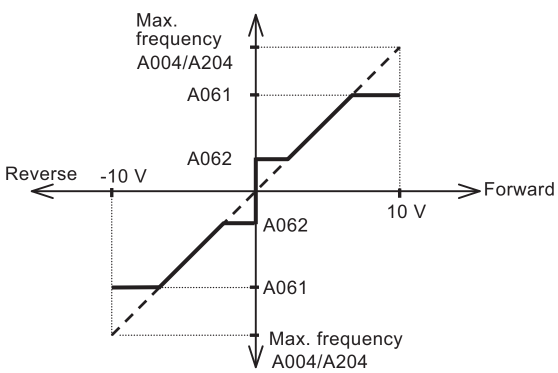
- Setting the lower limit causes the inverter to output the frequency set in the 1st/2nd Frequency Lower Limit (A062/A262) when 0 V or 4 mA is input to the frequency reference via analog input.



Note: The analog frequency reference (FV, FI) shows characteristics with the default data.

When Using FE-FC

- When a frequency is input to the auxiliary frequency reference input (voltage reference) terminal FE via positive/negative analog input, the lower limit on the forward/reverse side is judged as follows.



- When RUN Command Selection (A002) is set to 01 (Control circuit terminal block)

Terminal	Rotation when FE = 0 V
FW (ON)	A062 (Forward side)
RV (ON)	A062 (Reverse side)

- When RUN Command Selection (A002) is set to 02 (Digital Operator)

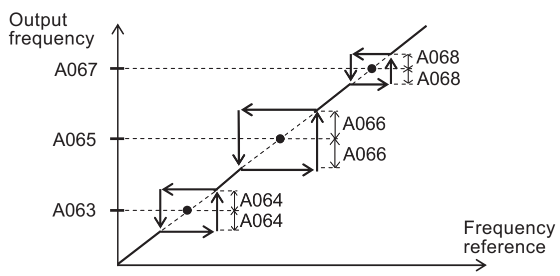
RUN Direction Selection (F004) setting	Rotation when FE = 0 V
00: Forward	A062 (Forward side)
01: Reverse	A062 (Reverse side)

Frequency Jump Function

Use the frequency jump function to avoid the resonant point of the load machine during operation.

Parameter No.	Function name	Data	Default data	Unit
A063	Jump Frequency 1	0.00: Disabled (Function not active) 0.01 to 99.99 100.0 to 400.0	0.00	Hz
A065	Jump Frequency 2			
A067	Jump Frequency 3			
A064	Jump Frequency Width 1	0.00 to 10.00	0.50	
A066	Jump Frequency Width 2			
A068	Jump Frequency Width 3			
Related functions		C001 to C008		

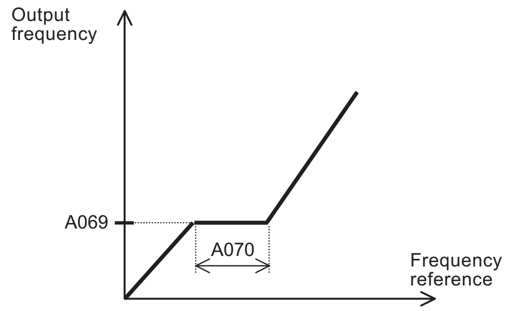
- In the Jump Frequency 1 to 3 (A063/A065/A067), set the center of the jump-target frequency range.
- In the Jump Frequency Width 1 to 3 (A064/A066/A068) set 1/2 of the width of the jump-target frequency range.
- When a jump frequency is set, the output frequency is the upper/lower-limit frequency of the set jump frequency range, avoiding frequencies within that range.
- The output frequency changes continuously according to the acceleration/deceleration time settings during acceleration/deceleration.
- You can set up to three jump frequency ranges.



Acceleration Stop Function

- If the moment of inertia of a load machine is large, use this function to delay the acceleration of the motor until the amount of motor slip during startup becomes small.
  This function is useful if the inverter cannot start the motor or detects an overcurrent during startup.
- It works for all acceleration patterns at any time, independent of the Acceleration Pattern Selection (A097) setting.

Parameter No.	Function name	Data	Default data	Unit
A069	Acceleration Stop Frequency	0.00 to 99.99 100.0 to 400.0	0.00	Hz
A070	Acceleration Stop Time	0.0 to 60.0	0.0	s



PID Function

Use this function to control the flow rate, air volume, pressure, and other processes.

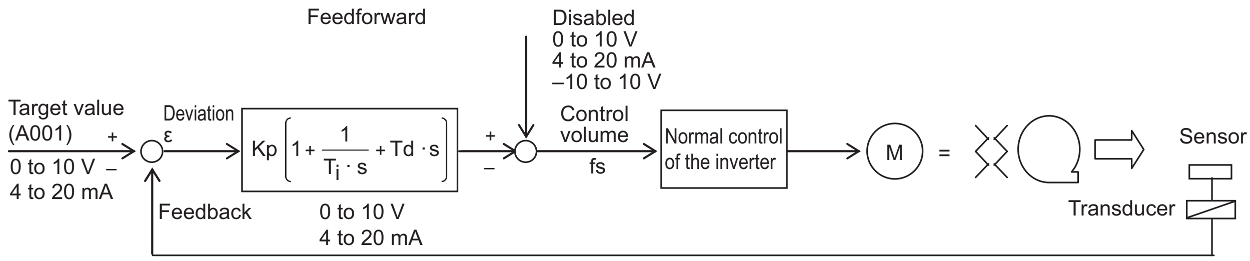
Parameter No.	Function name	Data	Default data	Unit
A071	PID Selection	00: Disabled 01: Enabled (Reverse output disabled) 02: Enabled (Reverse output enabled)	00	–
A072	PID P Gain	0.2 to 5.0	1.0	–
A073	PID I Gain	0.0 to 999.9 1000. to 3600.	1.0	s
A074	PID D Gain	0.00 to 99.99 100.0	0.00	s
A075	PID Scale	0.01 to 99.99	1.00	time
A076	PID Feedback Selection	00: FI (Current) 01: FV (Voltage) 02: Modbus communication 03: Pulse train frequency 10: Operation function output	00	–
A077	PID Deviation Reverse Output	00: Disabled 01: Enabled	00	–
A078	PID Variable Range Limit	0.0: Disabled 0.1 to 100.0	0.0	%
A079	PID Feedforward Selection	00: Disabled 01: FV (Voltage) 02: FI (Current) 03: FE (Voltage)	00	–

Parameter No.	Function name	Data	Default data	Unit
C044	PID Deviation Excessive Level	0.0 to 100.0	3.0	%
C052	Feedback Comparison Signal Off Level	0.0 to 100.0	100.0	
C053	Feedback Comparison Signal On Level	0.0 to 100.0	0.0	
Related functions		d004, A001, A005, A006, C001 to C008, C021 to C025		

- To use this function, set A071 to 01 (Enabled: Reverse output disabled) or 02 (Enabled: Reverse output enabled).
- The PID function can be disabled during PID operation via external signal input. To use this function, allocate one of the multi-function input terminals to 23 (PID: PID disabled). This causes the PID function to be disabled while the PID terminal is ON and the inverter generates a normal output.
- Using PID control ensures the feedback value to match the set target value. Specifically, you can install a flow-rate, air-volume, or pressure feedback sensor and control its feedback value to the intended target value.

Basic Structure of PID Control

The basic configuration of a control system using the PID function is as shown in the block diagram below.

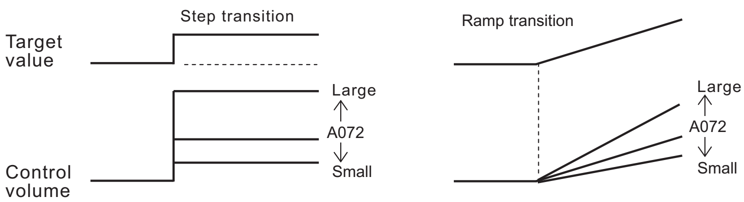


Kp: Proportional gain (A072: PID P gain) Ti: Integral time (A073: PID I gain)
Td: Derivative time (A074: PID D gain) s: Operator ε: Deviation

PID Operation

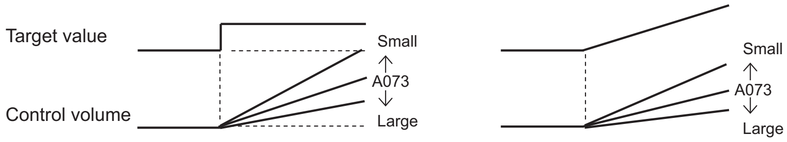
(1) P Operation

In this operation, the control volume is proportional to the deviation (difference between the target value and the current value).



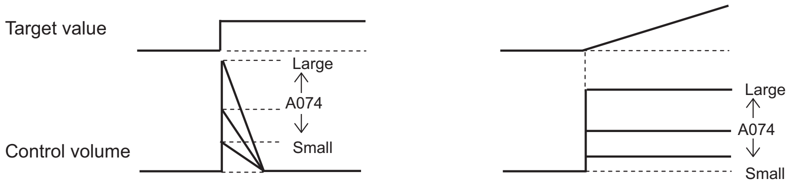
(2) I Operation

In this operation, the control volume is proportional to the time integral value of the deviation. The P operation is less effective as the current value approaches the target value due to smaller deviation, taking a long time to reach the target value. The I operation compensates this disadvantage.



(3) D Operation

In this operation, the control volume is proportional to the percentage of change in the deviation. Because using only the PI operation is time-consuming, the D operation is used to effectively compensate for the disadvantage in responsiveness.



The PI operation is the combination of the P and I operations; the PD operation is the combination the P and D operations; the PID operation is the combination of the P, I, and D operations.

Feedback Selection and Target Value Setting

- Select the terminals used to input the feedback signal in PID Feedback Selection (A076).
- For the target value, the frequency reference selection method depends on the Frequency Reference Selection (A001) setting. When A001 is set to 01 (Terminal), the FV/FI Selection (A005) setting is disabled.
- When you select analog input terminals for the PID feedback function and set A001 to 01 (Terminal), the PID target value is selected based on the value set in the FE Selection (A006) set value, as shown in the following table.
- Be sure that the input terminal setting for the target value and that for the feedback signal do not overlap.

PID Feedback Selection (A076)		PID target value			
		A006 = 00	A006 = 01	A006 = 02	A006 = 03
00 (FI-FC)		FV + FE (Not reversible)		FV + FE (Reversible)	FV
01 (FV-FC)		FI + FE (Not reversible)		FI + FE (Reversible)	FI
10 (Calculation result)	FI included in operands	FV + FE (Not reversible)		FV + FE (Reversible)	FV
	FV included in operands	FI + FE (Not reversible)		FI + FE (Reversible)	FI
	FI and FV are operands	FE (Reversible)			

- To use the PID feedback function via RS485 communications, transfer data as described below.

<Modbus (C078 = 01)>
Write data in the holding register address 0006 hex. (100% = 10,000)

Register No.	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
0006hex	PID feedback	–	R/W	0 to 10000	0.01 [%]

Precautions for Correct Use

Although the PID feedback function supports reading/writing of data, you can write data only when PID Feedback Selection is set to Modbus communication. You cannot write data with other settings.

<ASCII (C078 = 00)>
Transfer data using the command 01. To transfer the feedback data, set the most significant byte of the frequency data to 1.

(Example)
To send 5 Hz:
Transmission data is "Set value x 100" and has 6 bytes: 000500
Set the most significant byte to 1: 100500
Convert it to ASCII: 31 30 30 35 30 30

Precautions for Correct Use

Note that, in the ASCII method, the set value is frequency [Hz].

- When the PID Feedback Selection (A076) is set to 03 (Pulse train input), the pulse train frequency input to the PG Board (Model: 3G3AX-PG01) will be fed back.
  The feedback value is the result of percentage conversion, as 100% of the frequency set in the Pulse Train Frequency Scale (P055).

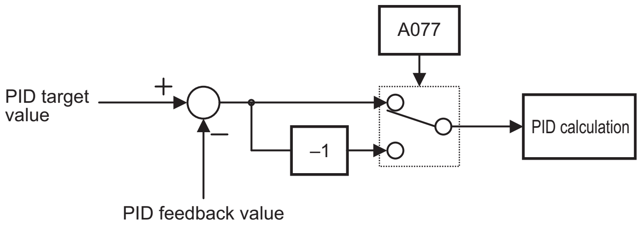
Feedforward Selection

- Select the terminals used to input the feedforward signal in the PID Feedforward Selection (A079).
- The A079 setting will be used "as is" even if the terminal selected in A079 overlap with the terminal selected for the target/feedback value.
- If A079 is set to Disabled, feedforward control will not be performed.
- Feedforward control is effective for tension control applications, where the tension is controlled according to the line speed. In this case, the line speed is input as the feedforward signal.

PID Deviation Reverse Output

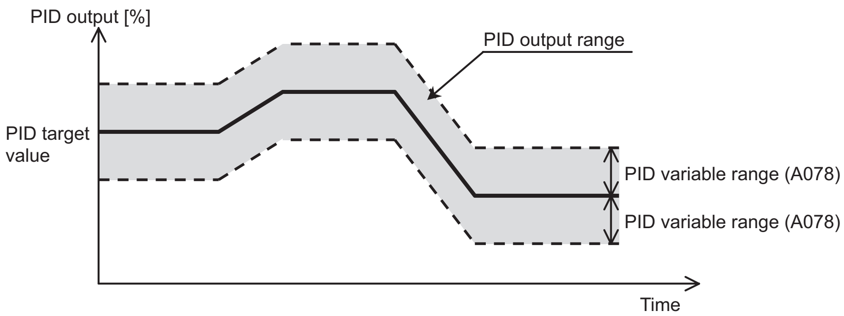
Depending on the system configuration, sensor characteristics, etc., the polarity of deviation between the target and feedback values may not match the inverter's command. In this case, you can invert the deviation polarity by setting the PID Deviation Reverse Output (A077) to 01.

(Example)
To control a refrigerator compressor
If you are using a temperature sensor designed for use in a temperature range of 0 to 100°C at 0 to 10 V and the target and current temperatures are 5°C and 10°C, respectively, the inverter attempts to reduce the frequency under normal PID control since the feedback value is larger than the target value. In this case, set A077 to 01. Then, the inverter attempts to increase the frequency.



PID Variable Range Limit

- This function limits the PID output to within the variable range defined based on the target value.
- To use this function, set the PID Variable Range Limit (A078) with the maximum frequency defined as 100%. Then, the output frequency will be limited to within a range of "Target value ±A078."
- This function is disabled when A078 is set to 0.0.



PID Reverse Output

- Under normal PID control, the frequency reference to the inverter will be limited to 0 Hz if the result of PID operation is a negative value. However, when the PID Selection (A071) is set to 02 (Reverse output enabled), reverse output is enabled for the inverter if the result of PID operation is a negative value.
- When A071 is set to 02, the PID Variable Range Limit (A078) and the PID disabled function allocated to any multi-function input terminal are disabled.

PID Gain Adjustment

If PID control does not provide a stable response, adjust the appropriate gain setting according to the table below.

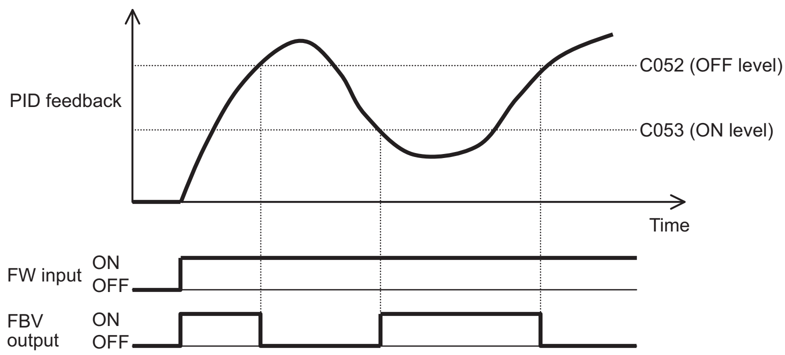
Changes in target value are not reflected quickly on feedback value.	Increase PID P Gain (A072).
Changes are reflected quickly on feedback value, but not stable.	Decrease PID P Gain (A072).
Target and feedback values do not match quickly.	Decrease PID I Gain (A073).
Feedback value fluctuates unstably.	Increase PID I Gain (A073).
Increasing PID P Gain does not improve response speed.	Increase PID D Gain (A074).
Increasing PID P Gain results in fluctuating and unstable feedback value.	Decrease PID D Gain (A074).

PID Deviation Excessive Level Detection (OD)

- You can set the PID Deviation Excessive Level (C044) for PID control. This enables the inverter to output a control signal from the multi-function output terminal to which the function is allocated when the deviation reaches the value set in C044.
- The setting range for C044 is 0 to 100. Set this with the maximum target value defined as 100%.
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 04 (OD).

Feedback Comparison Signal

- The inverter can be configured to output a control signal from the multi-function output terminal to which the function is allocated when the PID feedback value falls out of the setting range.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 31 (FBV).



PID Feedback Value Monitor (d004)

- Use this parameter to monitor the PID feedback value.
- The monitor value is displayed as a product of the feedback value and the PID Scale (A075).
  PID Feedback Value Monitor (d004) = Feedback value [%] x PID Scale (A075)

PID Integral Reset (PIDC)

- Use this function to clear the integral value of PID operation.
- Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 24 (PIDC).
- The integral value is cleared every time the PIDC terminal is turned ON.
  Never turn ON the PIDC terminal during PID operation. Doing so may cause an overcurrent trip.
  Be sure to disable PID operation before you turn ON the PIDC terminal.

AVR (Automatic Voltage Regulator) Function

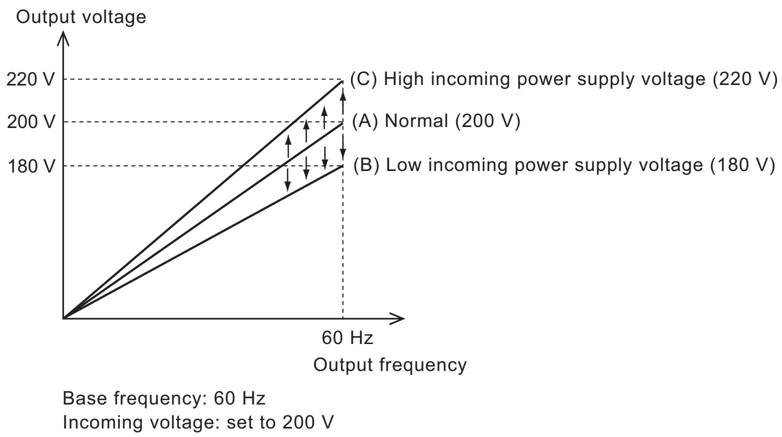
- Low input power supply voltage causes the inverter to produce a low output voltage, which in turn causes a low motor torque.
  This function corrects the output voltage to the motor even when the input power supply voltage to the inverter fluctuates, ensuring a reliable operation.
- In the AVR Selection (A081), select whether to enable or disable this function.
- The inverter will output voltage to the motor according to the value set in the Motor Rated Voltage Selection (A082). Note, however, that the inverter cannot output voltage exceeding the incoming voltage to the inverter.
- To avoid possible overcurrent tripping during deceleration, set the AVR Selection (A081) to 00 (Always ON).

Parameter No.	Function name	Data	Default data	Unit
A081	AVR Selection	00: Always ON 01: Always OFF 02: OFF during deceleration	02	–
A082	Motor Rated Voltage Selection	200-V class: 200 V/215 V/220 V/230 V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	
Related functions		d004, A001, A005		

The details of the AVR Selection (A081) are as follows.

Parameter No.	Data	Description	Remarks
A081	00	Always ON	Function enabled during acceleration, constant speed, and deceleration.
	01	Always OFF	Function disabled during acceleration, constant speed, and deceleration.
	02	OFF during deceleration	Function disabled only during deceleration to increase motor loss, whereby reducing regenerated energy to Inverter.

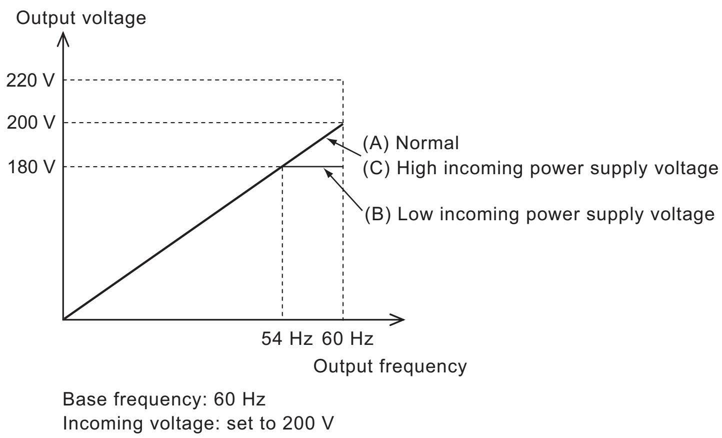
(Example 1) AVR = OFF



If the incoming voltage fluctuates, the output voltage also fluctuates.

In particular, low incoming voltage causes a low motor torque.

(Example 2) AVR = ON



The output voltage is controlled to a constant level even when the incoming voltage fluctuates.

However, if the incoming voltage is low, the motor toque may decrease as the value approaches the base frequency because the inverter cannot output voltage exceeding the incoming voltage.

Automatic Energy-saving Operation Function

- This function automatically adjusts the inverter output power during constant speed operation to the minimum level.
  It is suitable for fan, pump, or other load that has reduced torque characteristics.

Parameter No.	Function name	Data		Default data	Unit
A085	Operation Mode Selection	Heavy load (CT)	00: Normal operation 01: Energy-saving operation 02: Automatic operation	00	–
		Light load (VT)	00: Normal operation 01: Energy-saving operation	00	
A086	Energy-saving Response/Accuracy Adjustment	0.0 to 100.0		50	%

- To perform energy-saving operation using this function, set the Operation Mode Selection (A085) to 01 (Energy-saving operation).
  You can adjust the response and accuracy of the function in the Energy-saving Response/Accuracy Adjustment (A086).
- Because this function controls the output power moderately, it may cause the motor to stall if a rapid load variation such as an impact load occurs, which may result in an overcurrent trip.

Parameter No.	Function name	Data	Response	Accuracy
A086	Energy-saving Response/Accuracy Adjustment	0 ↕ 100	Slow ↕ Fast	High ↕ Low

Automatic Optimum Acceleration/Deceleration

- The automatic acceleration/deceleration function eliminates the need for acceleration/deceleration settings for Inverter operation.
- To use this function, set the Operation Mode Selection (A085) to 02 (Automatic operation).
- Although, conventionally, the user had to set an inverter acceleration/deceleration time depending on the load conditions etc., this function can automatically adjust the acceleration/deceleration time to make full use of the inverter's capacity.
- The acceleration time is the time during which the motor accelerates at the current value within the setting in the Overload Limit Level (b022) if the overload limit function is enabled, or at approximately 150% or less of the rated current of the inverter if the overload limit function is disabled, respectively.
- The deceleration time is the time during which the motor decelerates at a current value of approximately 150% or less, or at a DC voltage of 370 V or less (for 200-V class) or at 740 V or less (for 400-V class) in the inverter.
- To ensure stable operation, set the Overload Limit Level (b022) to 150% of the rated current of your motor.

Thus, the function automatically sets the acceleration/deceleration time by responding in real time to changes in the load and inertia.

Parameter No.	Function name	Data		Default data	Unit
A085	Operation Mode Selection	Heavy load (CT)	00: Normal operation 01: Energy-saving operation 02: Automatic operation	00	–
		Light load (VT)	00: Normal operation 01: Energy-saving operation	00	
Related functions		A044, A244, A344, b021, b024, b022, b025			

Precautions for Correct Use

- This function is not intended for machines that require a constant acceleration/deceleration time. The acceleration/deceleration time changes constantly based on the size of the load and inertia.
- If the inertia of the machine is more than approximately 20 times that of the motor shaft, a trip error may occur. In this case, deal with the trip error instead of using the automatic optimum acceleration/deceleration function.
- The automatic optimum acceleration/deceleration setting is enabled in the V/f control mode only. In other words, the inverter performs normal operation in other operation modes.
- When the automatic operation mode is selected, jogging operation will be carried out with automatic acceleration enabled, which is different from normal jogging operation.
- Repeating the automatic optimum acceleration/deceleration function frequently may cause overloading because the motor is accelerated/decelerated at 150% of the rated current of the inverter.
- When the internal braking circuit or an external regenerative braking unit is used, the motor cannot decelerate based on the internal DC voltage. In this case, do not use the automatic optimum acceleration/deceleration function.
- When using a smaller motor in capacity than the inverter, set the Overload Limit Selection (b021) to Enabled and the Overload Limit Level (b022) to 150% of the rated current of the motor.

2-step Acceleration/Deceleration Function

- Use this function to switch between two acceleration/deceleration time settings or change the acceleration/deceleration time on the way during acceleration/deceleration.
- The acceleration/deceleration time switching method can be selected from the following three.

Switching via a multi-function input terminal
Automatic switching at a specific frequency
Automatic switching only during forward/reverse switching

Note that, automatic switching to 2-step acceleration/deceleration is disabled when the 3rd control method is selected.

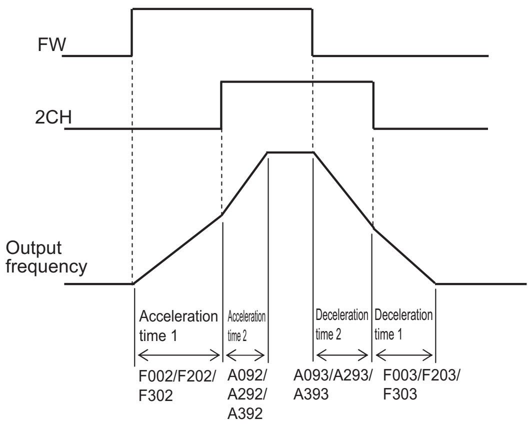
- To switch via a multi-function input terminal, set one of C001 to C008 to 09 (2CH).

Parameter No.	Function name	Data	Default data	Unit
A092	1st Acceleration Time 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00*2	s
A292	2nd Acceleration Time 2*1			
A392	3rd Acceleration Time 2*1			
A093	1st Deceleration Time 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00*2	s
A293	2nd Deceleration Time 2*1			
A393	3rd Deceleration Time 2*1			
A094	1st 2-step Acceleration/Deceleration Selection	00: Switched via 2CH terminal (Example 1) 01: Switched via setting (Example 2) 02: Switched only during forward/reverse switching (Example 3)	00	–
A294	2nd 2-step Acceleration/Deceleration Selection*1			
A095	1st 2-step Acceleration Frequency	0.00 to 99.99 100.0 to 400.0	0.00	Hz
A295	2nd 2-step Acceleration Frequency*1			
A096	1st 2-step Deceleration Frequency	0.00 to 99.99 100.0 to 400.0	0.00	Hz
A296	2nd 2-step Deceleration Frequency*1			
Related functions		F002, F202, F302, F003, F203, F303, C001 to C008		

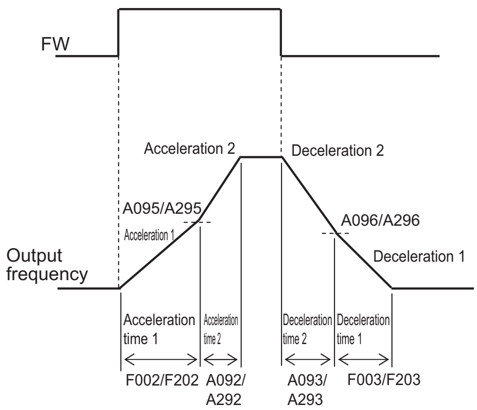
*1 To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2 The default data was changed from the previous model.

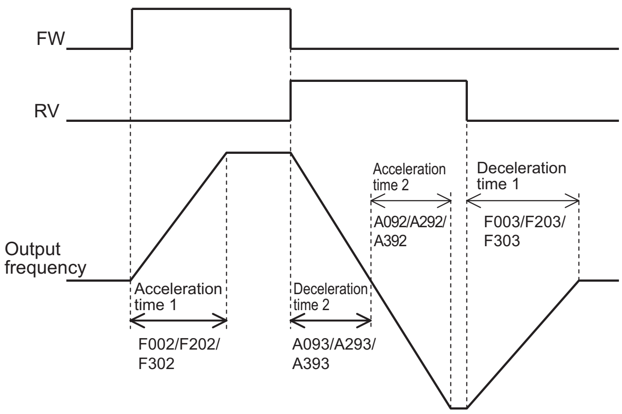
(Example 1) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 00 (Switched via terminal 2CH)



(Example 2) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 01 (Switched by setting)



(Example 3) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 02 (Switched only during forward/reverse switching)



Acceleration/Deceleration Pattern

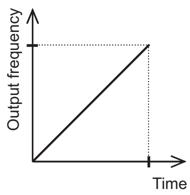
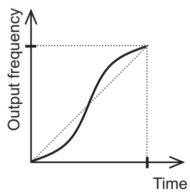
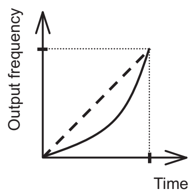
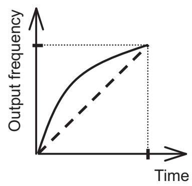
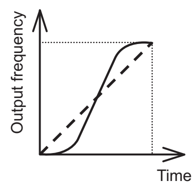
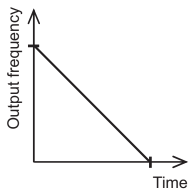
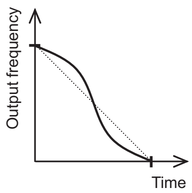
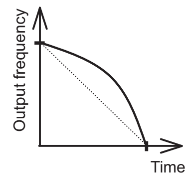
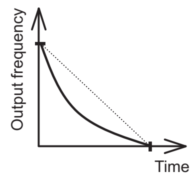
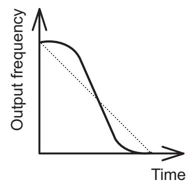
- Use this function to set the acceleration/deceleration pattern for each system.
- Select the acceleration/deceleration pattern in the Acceleration Pattern Selection (A097)/ Deceleration Pattern Selection (A098).
- The acceleration pattern and the deceleration pattern can be set independently.
- These acceleration/deceleration pattern settings are effective also for frequency reference via analog input terminals.

Parameter No.	Function name	Data	Default data	Unit
A097	Acceleration Pattern Selection	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	01[*1]	–
A098	Deceleration Pattern Selection			
A131	Acceleration Curve Parameter	01 (Small curve) to 10 (Large curve)	02	–
A132	Deceleration Curve Parameter			
A150	EL-S Shape Acceleration Curve Ratio 1	0. to 50.	10[*1]	%
A151	EL-S Shape Acceleration Curve Ratio 2			
A152	EL-S Shape Deceleration Curve Ratio 1	0. to 50.	10[*1]	%
A153	EL-S Shape Deceleration Curve Ratio 2			

*1 The default data was changed from the previous model.

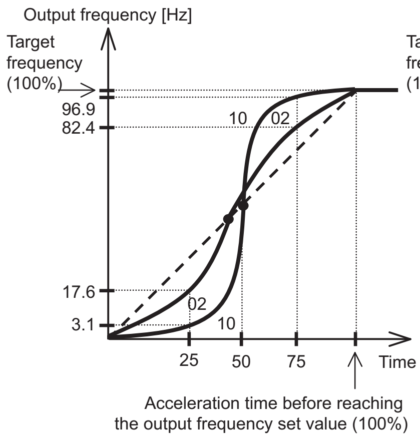
Pattern Selection

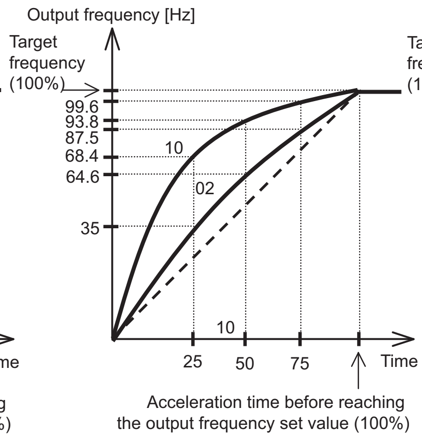
Select the acceleration/deceleration pattern according to the following table.

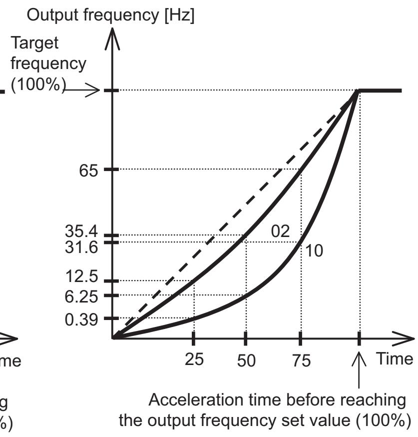
Parameter No.	Set value				
	00	01	02	03	04
	Line	S shape	U shape	Inverted U shape	EL-S shape
A097 (Acceleration)					
A098 (Deceleration)					
Description	The motor accelerates/ decelerates linearly until the set output frequency value is reached.	This pattern is effective to prevent the collapse of load on an elevator, conveyor, etc.	These patterns are effective for tension control and roll-break prevention applications for winding equipment etc.		This pattern, with a linear portion in the middle of the curve, provides shockless start/stop as with the S-shape pattern.

Pattern Curve Parameter (Curve Factor)

Use the following graphs to determine the curve factor.





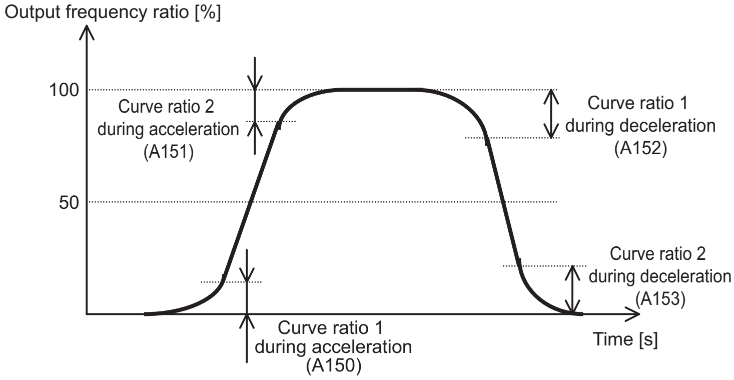


- The S-shape pattern has a portion where acceleration/deceleration time is faster in the middle of the curve.
- If the LAD cancel (LAC) function is allocated to a multi-function input terminal and that terminal turns ON, the acceleration/deceleration pattern is ignored and the output frequency follows the reference frequency instantaneously.

EL-S-shape Curve Ratio

With the EL-S-shape pattern, you can set the EL-S Shape Acceleration/Deceleration Curve Ratio parameters (A151 to A153).

Setting all of these parameters to 50 [%] is equivalent to selecting the S-shape pattern.



Calculation Frequency Function

- The calculation frequency function enables the use of calculation results from two analog input channels for the frequency reference and the PID feedback value.

Parameter No.	Function name	Data	Default data	Unit
A141	Calculation Frequency Selection 1	00: Digital Operator (F001) 01: Digital Operator (Volume adjuster) (Enabled when 3G3AX-OP01 is connected) 02: Input FV (Voltage) 03: Input FI (Current) 04: Modbus communication 05: Option 1 06: Option 2 07: Pulse train frequency	02	–
A142	Calculation Frequency Selection 2		03	–
A143	Calculation Function Operator Selection	00: Addition (A141 + A142) 01: Subtraction (A141 – A142) 02: Multiplication (A141 x A142)	00	–
Related functions		A001 = 10, A076 = 10		

Precautions for Correct Use

When this function is enabled, the Multi-function Input S1 to S8 Selection (C001 to C008) cannot be set to 27, 28, or 29 to enable the UP/DWN function. In addition, the frequency settings of the Output Frequency Monitor (d001), Output Frequency Monitor (After Conversion) (d007), and Output Frequency Setting/Monitor (F001) cannot be changed via the Digital Operator keys.

A141 and A142 can have the same setting.

- To use this function for the frequency reference, set the Frequency Reference Selection (A001) to 10 (Operation function output).
- To use this function for the PID feedback value, set the PID Feedback Selection (A076) to 10 (Operation function output).

Frequency Addition Function

- Use this function to add or subtract the value set in the Frequency Addition Amount Setting (A145) to the selected frequency reference value.
- To use this function, allocate one of the multi-function input terminals to 50 (ADD).
  The value set in A145 will be added or subtracted when the ADD terminal is ON.

Parameter No.	Function name	Data	Default data	Unit
A145	Frequency Addition Amount Setting	0.00 to 99.99 100.0 to 400.0	0.00	Hz
A146	Frequency Addition Sign Selection	00: Frequency reference + A145 01: Frequency reference – A145	00	–

Precautions for Correct Use

- If the +/– sign in front of the frequency reference changes (from “–” to “+” or “+” to “–”) as a result of operation, the rotation direction of the motor will be reversed.
- When the PID function is used, this function is enabled for the PID target value. (Note that A145 is displayed in % (in increments of 0.01%).)

7-4 Detailed Functions (Group b)

This section describes the detailed function parameters associated with operation or protection.

Restart during Power Interruption, Undervoltage/Overvoltage, Overcurrent

Restart during Power Interruption, Undervoltage/Overvoltage, Overcurrent

- The Power Interruption/Undervoltage Restart Selection (b001) can be used to select whether the inverter trips or restarts if a momentary power interruption or undervoltage occurs.
- The Overvoltage/Overcurrent Restart Selection (b008) can be used select whether the inverter trips or restarts if an overvoltage or overcurrent occurs.
- When the Power Interruption/Undervoltage Restart Selection (b001) is set to one of the restart options, the inverter repeats restart operation for the number of times set in the Power Interruption Restart Count (b005) in the event of a power interruption, or for the number of times set in the Undervoltage Restart Count (b009) in the event of an undervoltage, and then trips.
  When b009 is set to No limit, the inverter does not trip.
- When the Overvoltage/Overcurrent Restart Selection (b008) is set to one of the restart options, the inverter repeats restart operation for the number of times set in the Overvoltage/Overcurrent Restart Count (b010) in the event of an overvoltage or overcurrent and then trip.
- In the Power Interruption/Undervoltage Trip Selection During Stop (b004), select conditions of the inverter judges the occurrence of a power interruption or undervoltage during stop as a trip cause.
- The Power Interruption/Undervoltage Restart Selection (b001) and Overvoltage/Overcurrent Restart Selection (b008) provide restart options that you can select according to your system (0-Hz restart/Frequency matching restart/Trip after frequency matching deceleration stop/Frequency pull-in restart).
- If the inverter is in an undervoltage state continuously for 40 seconds during restart operation, an Undervoltage protection (E09) trip will occur.

Parameter No.	Function name	Data	Default data	Unit
b001	Power Interruption/ Undervoltage Restart Selection*1*2	00: Trip 01: 0-Hz restart 02: Frequency matching restart (Example 1)*3 03: Trip after frequency matching deceleration stop*3*4 04: Frequency pull-in restart (Example 1)*3	00	–
b002	Allowable Power Interruption Time	0.3 to 25.0	1.0	–
b003	Restart Standby Time	0.3 to 100.0	1.0	s
b004	Power Interruption/ Undervoltage Trip Selection During Stop*1*5	00: Disabled 01: Enabled 02: Disabled during stop and deceleration stop	00	–
b005	Power Interruption Restart Count	00: 16 times 01: No limit	00	–
b007	Frequency Matching Lower Limit Frequency	0.00 to 99.99 100.0 to 400.0 (Examples 3 and 4)	0.00	Hz

<table>
<tr><th>Parameter No.</th><th>Function name</th><th colspan="2">Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>b008</td><td>Overvoltage/ Overcurrent Restart Selection*6</td><td colspan="2">00: Trip
01: 0-Hz restart
02: Frequency matching restart
03: Trip after frequency matching deceleration stop
04: Frequency pull-in restart</td><td>00</td><td>–</td></tr>
<tr><td>b009</td><td>Undervoltage Restart Count</td><td colspan="2">00: 16 times
01: No limit</td><td>00</td><td>–</td></tr>
<tr><td>b010</td><td>Overvoltage/ Overcurrent Restart Count</td><td colspan="2">1 to 3 (times)*7</td><td>3</td><td>time</td></tr>
<tr><td>b011</td><td>Overvoltage/ Overcurrent Restart Standby Time</td><td colspan="2">0.3 to 100.0</td><td>1.0</td><td>s</td></tr>
<tr><td rowspan="3">b028</td><td rowspan="3">Frequency Pull-in Restart Level</td><td rowspan="2">Heavy load (CT)</td><td>0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)</td><td rowspan="3">Rated current value</td><td rowspan="3">A</td></tr>
<tr><td>0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)</td></tr>
<tr><td>Light load (VT)</td><td>0.20 x Rated current to 1.50 x Rated current</td></tr>
<tr><td>b029</td><td>Frequency Pull-in Restart Parameter</td><td colspan="2">0.10 to 30.00</td><td>0.50</td><td>s</td></tr>
<tr><td>b030</td><td>Starting Frequency Selection at Frequency Pull-in Restart</td><td colspan="2">00: Frequency at shutoff
01: Max. frequency
02: Set frequency</td><td>00</td><td>–</td></tr>
<tr><td colspan="2">Related functions</td><td colspan="4">C021 to C025, C026</td></tr>
</table>

*1. Even when the Power Interruption/Undervoltage Restart Selection (b001) is set to 01 to 03 (a restart option) or the Power Interruption/Undervoltage Trip Selection During Stop (b004) is set to 00 or 02 (a disabled option), the inverter will trip if the actual power interruption time exceeds the Allowable Power Interruption Time. (Example 2)

*2. Even when an restart option is selected, the inverter will trip if it is in an undervoltage state continuously for 40 seconds or more.

*3. The inverter may restart at 0 Hz in any of the following cases:

- The output frequency is equal to or lower than 1/2 of the base frequency.
- The motor induction voltage decreases quickly.
- The inverter recognizes that the frequency is equal to or less than the value set in the Frequency Matching Lower Limit Frequency (b007).

*4. If an overvoltage, overcurrent, or other trip occurs during deceleration, the motor will fall in a free-run state with a power interruption protection (E16) error. In this case, increase the deceleration time.

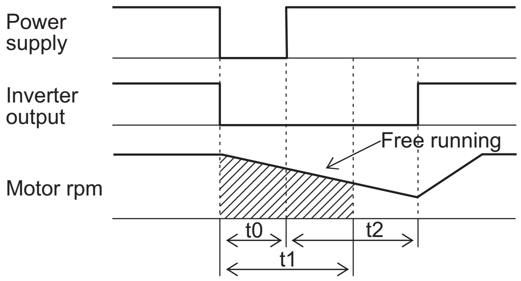
*5. When the control power supply terminals Ro-To are supplied with direct current (P-N), the inverter may detect an undervoltage during power supply shutoff and then trip. If this causes any problem with your system, set the Power Interruption/Undervoltage Trip Selection During Stop (b004) to 00 or 02 (a disabled option).

*6. Note that selecting a restart option may cause the inverter to restart suddenly when the power supply is turned on or an alarm is reset.

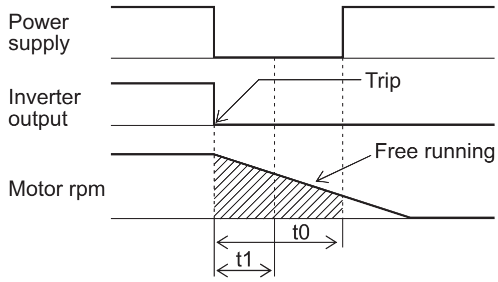
*7. Even when you selected to restart the inverter during a trip, unless the trip factor is removed, the inverter will trip when the Restart Standby Time (b003) elapses. In this case, increase the restart standby time.

- Below is the timing charts for different cases when the Power Interruption/Undervoltage Restart Selection (b001) is set to 02.
  Note, however, that, regardless of the parameter setting, the inverter will be in the initial power ON state if the internal DC power is completely discharged.
  t0: Power interruption time
  t1: Allowable Power Interruption Time (b002)
  t2: Restart Standby Time (b003)

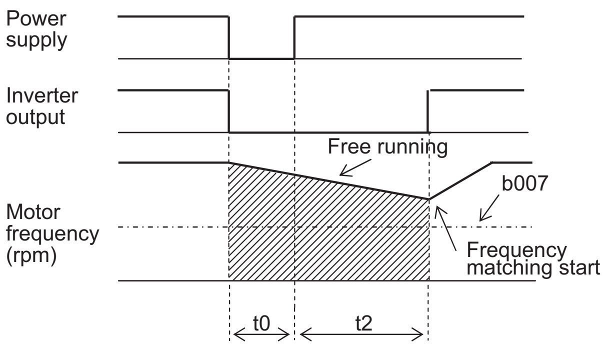
(Example 1)
Duration of power interruption < Allowable Power Interruption Time (b002)



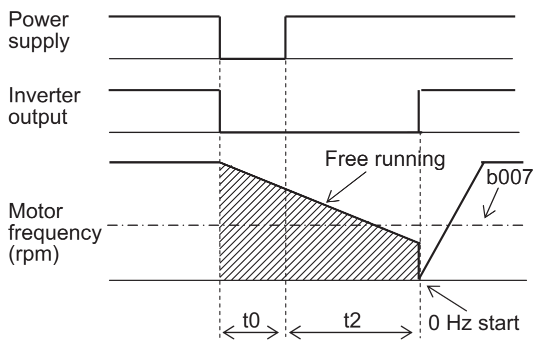
(Example 2)
Duration of power interruption > Allowable Power Interruption Time (b002)



(Example 3)
Motor frequency (rpm) > Frequency Matching Lower Limit Frequency (b007)



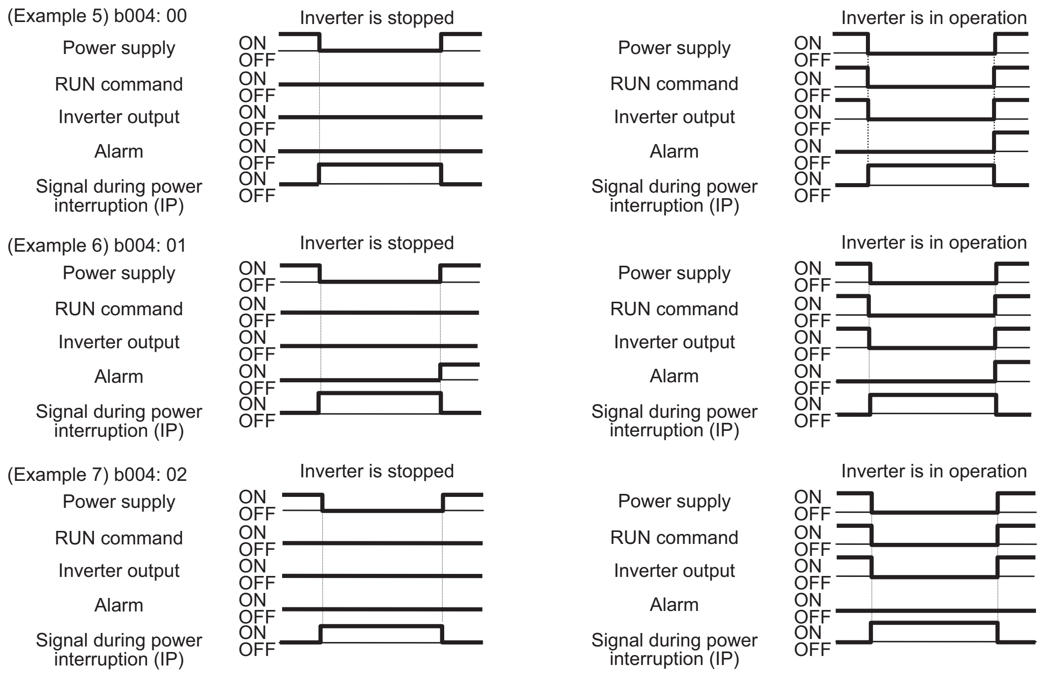
(Example 4)
Motor frequency (rpm) < Frequency Matching Lower Limit Frequency (b007)



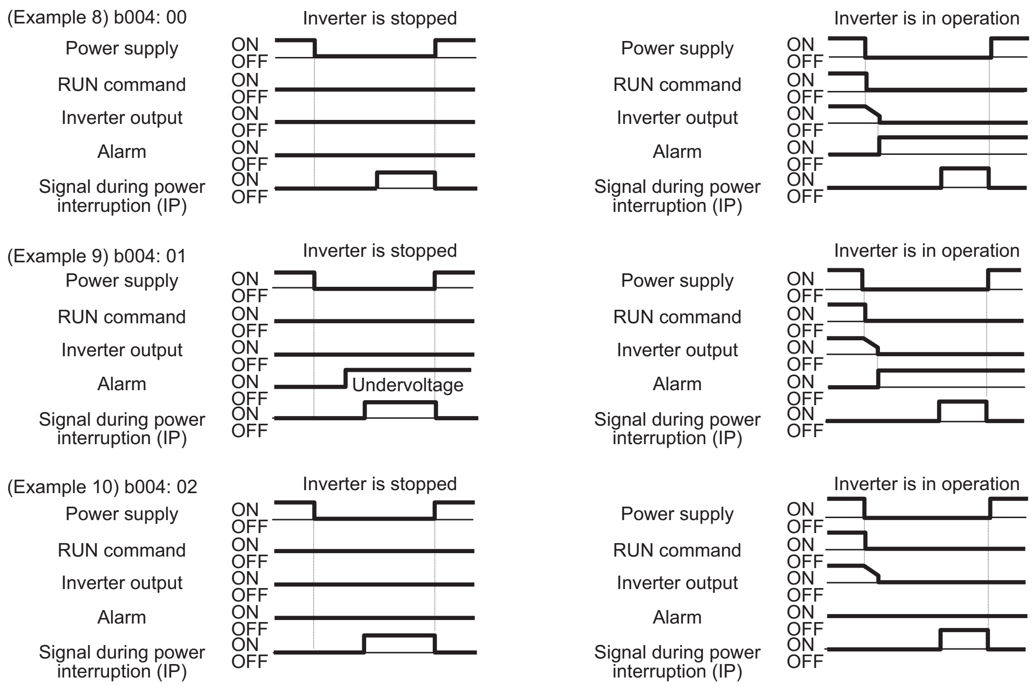
Alarm Output for Power Interruption/Undervoltage during Stop

- In the Power Interruption/Undervoltage Trip Selection During Stop (b004), select conditions of the inverter judges the occurrence of a power interruption or undervoltage as a trip cause.
- If the inverter judges this as a trip, it outputs an alarm. This alarm output will continue while the inverter's control power supply is ON.

- Alarm output during normal power input (Examples 5 to 7)



- Alarm output when direct current (P-N) is supplied to control power supply terminals Ro-To (Examples 8 to 10)



Note To output an alarm, allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 08 (IP: During power interruption signal) or 09 (UV: During undervoltage signal).

Restart Options

- The inverter provides the following restart options. Select one that is suited to your application.

  [00: 0-Hz restart]
  Forces the inverter to restart at 0 Hz. Note that the inverter restarts suddenly while in a free-run state.
  Use this setting if the motor stops shortly due to the load.

  [01: Frequency matching restart]
  Causes the inverter to restart by recognizing the frequency from the voltage between the motor terminals during free-run stop and adjusting to it. The inverter restarts at 0 Hz if it cannot fully recognize the voltage between the motor terminals.
  Use this setting if the inverter is in a free-run stop for a few seconds.

  [02: Frequency pull-in restart]
  Causes the inverter to restart by outputting the starting frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030) to the motor in a free-run stop state and re-accelerating when the Frequency Pull-in Restart Level (b028) is reached.
  This enables a smooth restart independent of the voltage between motor terminals.
  Use this setting when the inverter is in free-run state for a long time due to a large load inertia.
- For restart operation examples, refer to *5-8-2 Restart after Resetting* on page 5-48.

Input Power Supply Phase Loss Protection Selection

Use this function to cause the inverter to trip when a phase loss is detected in the inverter input power supply.

Parameter No.	Function name	Data	Default data	Unit
b006	Input Phase Loss Protection Selection	00: Disabled 01: Enabled	01*1	–

*1 The default data was changed from the previous model.

Note The inverter will trip if it is in a phase-loss state for approximately 1 s or more (due to the Input phase loss protection (E24) error).

A phase loss will cause the following, which may result in an inverter malfunction.

- The ripple current in the main capacitor will increase, which remarkably reduces the life expectancy of the inverter.
- Under a loaded condition, the inverter's internal converter may be damaged.

Electronic Thermal Function

- The electronic thermal function prevents the motor from overloading and burning.
- Before setting the electronic thermal function, set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) according to your motor. This switches the parameters that can be set.
- Set the rated current of your motor in the 1st/2nd/3rd Electronic Thermal Level (b012/b212/b312) and, in the 1st/2nd/3rd Electronic Thermal Characteristics Selection (b013/b213/b313), set the motor torque characteristics as follows, according to the motor specifications.

Characteristics	Description
Reduced torque characteristics	Use this setting for general-purpose motors. In an air-cooled motor that uses the rear fan coupled directly to the motor shaft, the cooling effect degrades as the motor rotation speed decreases. This characteristics setting enables overload detection that takes into account such degradation of the cooling effect at low speeds.
Constant torque characteristics	Use this setting for dedicated Inverter motors. Dedicated Inverter motors are designed to prevent degradation of the cooling effect that arises as the motor speed increases. This characteristics setting provides overload detection independent of the motor rotation speed.

- The electronic thermal function can be to output an electronic thermal warning before the inverter detects an overload.
- To check the status of the electronic thermal function, use the Electronic Thermal Load Rate Monitor (d104).
  An Overload trip (E05) error will occur if the value reaches approximately 100%.

Precautions for Correct Use

- You cannot disable the electronic thermal function because it also provides overload protection for the inverter.
- To connect several motors to a single Inverter, set the Electronic Thermal Level to the rated output current of the inverter and install a thermal relay etc. for each motor.
- When the 1st/2nd/3rd Electronic Thermal Characteristics Selection (b013/b213/b313) is set to 02 (Free setting), you need to set a frequency value in the Free-electronic Thermal Frequency 1 to 3. Otherwise, a warning will occur.

Parameter No.	Function name	Data	Default data	Unit
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H203	2nd Motor Capacity*1	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8/10	4	pole
H204	2nd Motor Pole Number*1	2/4/6/8/10	4	pole
b012	1st Electronic Thermal Level	0.20 x Rated current to 1.00 x Rated current (Set to match the rated current of your motor.) *2	Rated current of Inverter	A
b212	2nd Electronic Thermal Level*1			
b312	3rd Electronic Thermal Level*1			

Parameter No.	Function name	Data	Default data	Unit
b013	1st Electronic Thermal Characteristics Selection	00: Reduced torque characteristics (for general-purpose motor) 01: Constant torque characteristics (for dedicated Inverter motor) 02: Free setting (Select 00 or 01 according to your motor.)	00	–
b213	2nd Electronic Thermal Characteristics Selection*1			
b313	3rd Electronic Thermal Characteristics Selection*1			
b015	Free-electronic Thermal Frequency 1	0. to Free-electronic Thermal Frequency 2*3	0.	Hz
b017	Free-electronic Thermal Frequency 2	Free-electronic Thermal Frequency 1 to Free-electronic Thermal Frequency*3		
b019	Free-electronic Thermal Frequency 3	Free-electronic Thermal Frequency 2 to 400*3		
b016	Free-electronic Thermal Current 1	0.00 to Rated current (Set to match the rated current of your motor.)	0.00	A
b018	Free-electronic Thermal Current 2			
b020	Free-electronic Thermal Current 3			
C061	Electronic Thermal Warning Level	0. to 100. *4	80	%

*1. To enable the switching to the 2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON that terminal.

*2. You cannot disable the electronic thermal function because it also serves as a thermal for not only the motor, but also the inverter.
Setting the Electronic Thermal Level to the maximum value is equivalent to disabling it.

*3. Setting the Free-electronic Thermal Frequency to 0 causes a warning (120).

*4. Set this value as a percentage of the integrated electronic thermal value. Take into consideration that an Overload trip (E05) error occurs when the integrated electronic thermal value reaches 100%.
This integrated electronic thermal value can be checked with the Electronic Thermal Load Rate Monitor (d104).

Electronic Thermal Characteristics

The electronic thermal function enables you to change the overload detection characteristics by setting the 1st/2nd/3rd Electronic Thermal Characteristics Selection (b013/b213/b313) according to the motor in use.

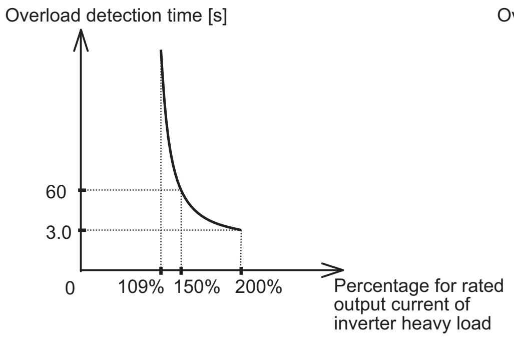
This section first describes the basic electronic thermal characteristics and then provides the details of individual detection characteristics.

● Basic Characteristics

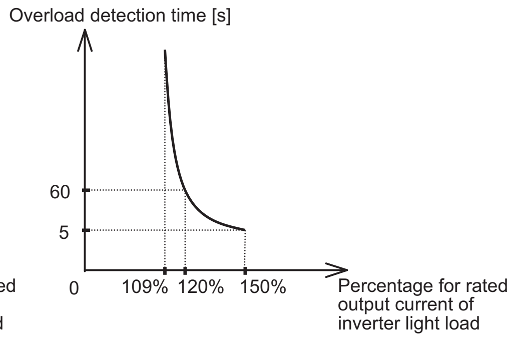
The electronic thermal characteristics differ between the heavy load mode and the light load mode. In addition, because the electronic thermal characteristics are different at 75 kW or higher, this inverter has four basic characteristics as follows.

Basic characteristics of 3G3RX-A2004-V1 to A2550-V1, 4004-V1 to A4550-V1

Basic characteristics of the heavy load mode

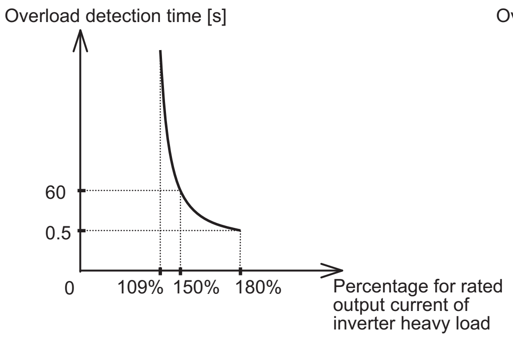


Basic characteristics of the light load mode

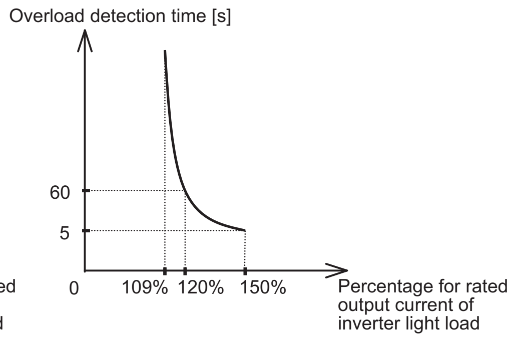


Basic characteristics of 3G3RX-A4750-V1 to A413K-V1

Basic characteristics of the heavy load mode



Basic characteristics of the light load mode



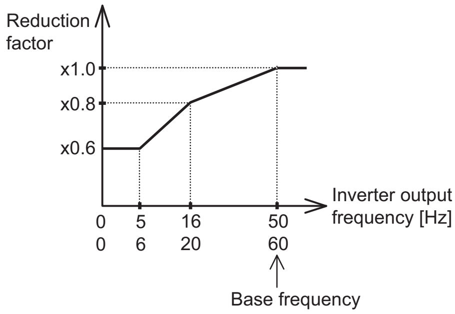
● Reduced torque characteristics

Use the reduced torque characteristics setting for general-purpose (standard) motors.

In an air-cooled motor that uses the fan coupled directly to the motor shaft, the cooling effect degrades as the motor rotation speed decreases.

This characteristics setting enables overload detection that takes into account such degradation of the cooling effect at low speeds.

Reduction Factor Characteristics



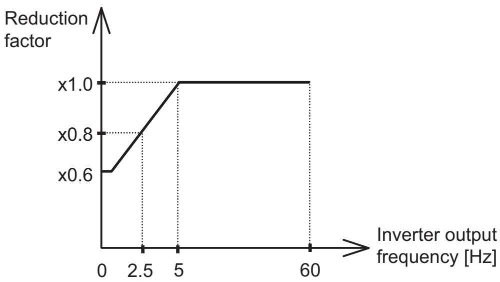
● Constant torque characteristics

Use the constant torque characteristics setting for dedicated Inverter motors.

Dedicated Inverter motors are designed to prevent degradation of the cooling effect that arises as the motor speed increases, except at 5 Hz or less.

For constant torque characteristics, the reduction factor is defined only for frequencies of 5 Hz or less.

Reduction Factor Characteristics

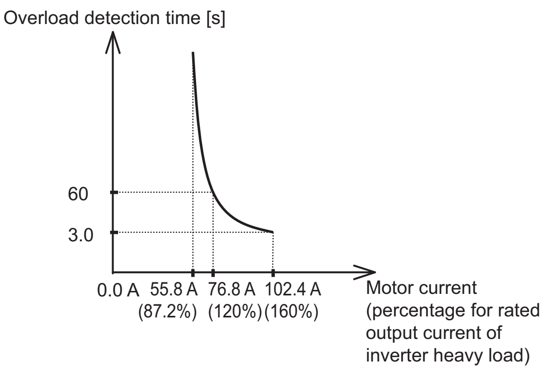


Examples of Actual Electronic Thermal Characteristics

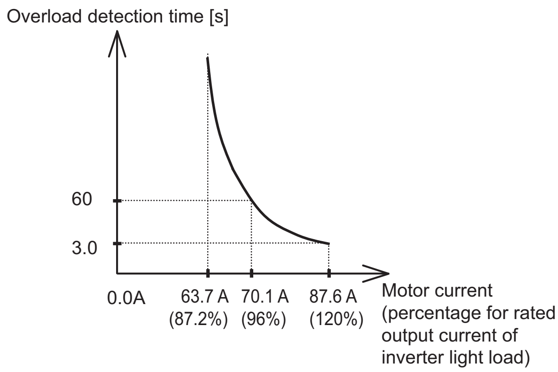
Electronic thermal characteristics are as shown in the graphs below under the following four conditions.

- The inverter (Model: G3RX-A2150-V1) is used. (Rated output current: 64 A in the heavy load mode, 73 A in the light load mode) 1st Electronic Thermal Level (b012) is set to 64 A in the heavy load mode, and 73 A in the light load mode.
- 1st Electronic Thermal Characteristics Selection (b013) is set to 00 (Reduced torque characteristics).
- 1st Base Frequency (A003) is set to 60 Hz.
- While the output frequency is output at 20 Hz. (Reduction factor: x 0.8)

Basic Characteristics in Heavy Load Mode



Basic Characteristics in Light Load Mode



Free-electronic Thermal Function

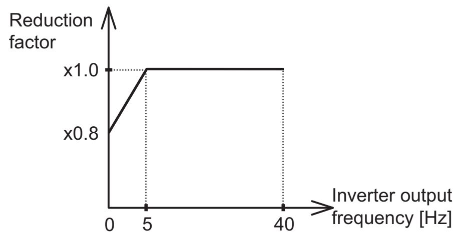
- The free-electronic thermal function enables you to change the electronic thermal characteristics according to the motor or load in use.
- Set the desired electronic thermal characteristics in the Free-electronic Thermal Frequency 1 to 3 (b015/b017/b019) and the Free-electronic Thermal Current 1 to 3 (b016/b018/b020).
- Set the 1st/2nd/3rd Electronic Thermal Characteristics Selection (b013/b213/b313) to 02 (Free setting).

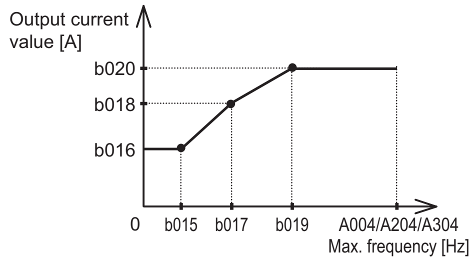
Parameter No.	Function name	Data	Default data	Unit
b015	Free-electronic Thermal Frequency 1	0. : Disabled 1. to Free-electronic Thermal Frequency 2*1	0.	Hz
b017	Free-electronic Thermal Frequency 2	0. : Disabled Free-electronic Thermal Frequency 1 to Free-electronic Thermal Frequency 3*1		
b019	Free-electronic Thermal Frequency 3	0. : Disabled Free-electronic Thermal Frequency 2 to 400*1		
b016	Free-electronic Thermal Current 1	0.00 to Rated current (Set to match the rated current of your motor.)	0.00	A
b018	Free-electronic Thermal Current 2			
b020	Free-electronic Thermal Current 3			

*1. Setting the Free-electronic Thermal Frequency to 0 causes a warning (120).

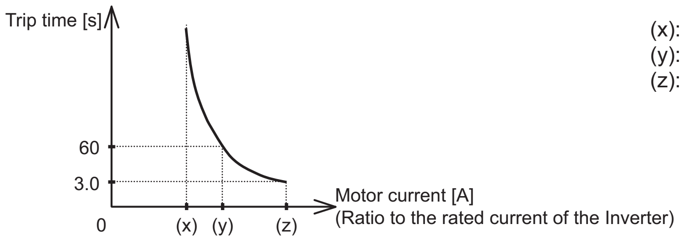
(Example) Examples of Free-Electronic Thermal Characteristics

- Start by setting the Free-electronic Thermal Frequency 3 and the Free-electronic Thermal Current 3.
- The reduction factor for frequencies of 5 Hz or less is defined independent of that for the free-electronic thermal function.
  The actual reduction factor will be multiplied by the Free-electronic Thermal Current settings.





(Example) Output frequency = b017



(x): (b018/Rated current) ×109%
(y): (b018/Rated current) ×150%
(z): (b018/Rated current) ×200%

Electronic Thermal Warning Function

- The electronic thermal function can be to output an electronic thermal warning before the inverter detects an overload.
  This output not only allows the prior recognition of an overload condition, but also can be used as a timing signal to improve that overloaded condition.
- In the Electronic Thermal Warning Level (C061), set the level at which a warning is output.
  Set this value as a percentage of the integrated electronic thermal value. Take into consideration that an overload error is detected when the integrated electronic thermal value reaches 100%.
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 13 (THM: Electronic thermal warning).

Parameter No.	Function name	Data	Default data	Unit
C061	Electronic Thermal Warning Level	0. to 100.	80	%
C021 to C025	Multi-function Output P1 to P5 Selection	13: THM (Electronic thermal warning)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

7-4 Detailed Functions (Group b)

7

Overload Limit and Overload Warning Functions

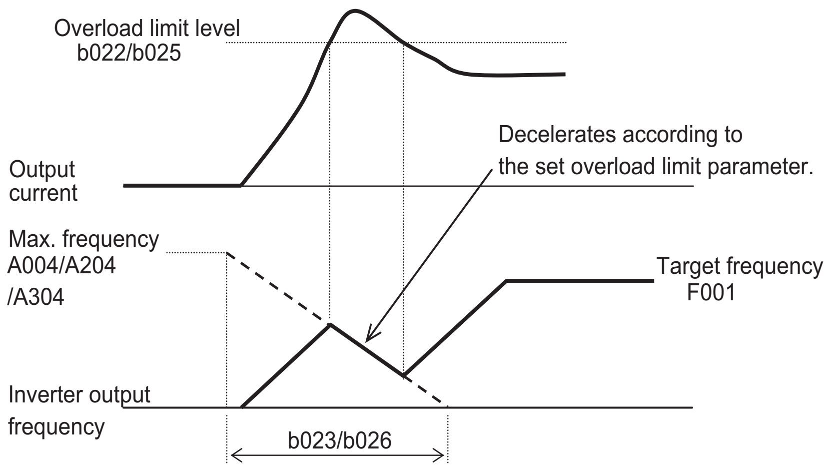
If the load value changes rapidly during acceleration and constant speed operation, the motor may stall (or step out), causing overload or overcurrent. This section describes the function that helps prevent the motor from stalling.

Overload Limit Function

- To enable the overload limit function, set the Overload Limit Selection/Overload Limit Selection 2 (b021/b024) to 01 to 03.
- The inverter monitors the motor current during acceleration or constant speed operation and, if the Overload Limit Level/Overload Limit Level 2 (b022/b025) is reached, decreases the output frequency automatically according to the Overload Limit Parameter/Overload Limit Parameter 2 (b023/b026).
- This function prevents the motor from stalling during acceleration under heavy load conditions or during constant speed operation subject to rapid load fluctuations.
- You can have two different overload limit function settings and switch between them by setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 39 (OLR: Overload limit switching).
- Set the Overload Limit Level/Overload Limit Level 2 (b022/b025) to 150% of the rated current of your motor.
- In the Overload Limit Parameter/Overload Limit Parameter 2 (b023/b026), set the time during which the motor automatically decelerates from the maximum frequency to 0 Hz during automatic deceleration.
- When this function is enabled, the acceleration time will be longer than the set time.
- When the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control), the frequency will be accelerated when the following conditions are met.
  - Overload Limit Selection/Overload Limit Selection 2 (b021/b024) is set to 03 (Enabled during acceleration/constant speed (Accelerated during regeneration)).
  - A current exceeding the Overload Limit Level/Overload Limit Level 2 (b022/b025) flows during regenerative operation.
- Because this function causes automatic deceleration even during acceleration, if the value set in the Overload Limit Parameter/Overload Limit Parameter 2 (b023/b026) is too small, an overvoltage may occur due to the regenerative energy from the motor.
  In this case, use the regenerative braking function.
- If this function is activated during acceleration to prevent the target frequency from being attained, make the following adjustments.
  - Increase the acceleration time. (Refer to *Acceleration/Deceleration Time Settings* on page 7-15.)
  - Increase the torque boost value. (Refer to *Torque Boost* on page 7-31.)
  - Increase the Overload Limit Level/Overload Limit Level 2 (b022/b025).

Parameter No.	Function name	Data	Default data	Unit
b021	Overload Limit Selection	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration/constant speed (Accelerated during regeneration)	01	–
b024	Overload Limit Selection 2			

Parameter No.	Function name	Data		Default data	Unit
b022	Overload Limit Level	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)	Rated current x 1.5	A
b025	Overload Limit Level 2		0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)		
		Light load (VT)	0.20 x Rated current to 1.50 x Rated current	Rated current x 1.2	
b023	Overload Limit Parameter	0.10 to 30.00		1.0	s
b026	Overload Limit Parameter 2				
Related functions		C001 to C008, C021 to C025, C026			



Precautions for Correct Use

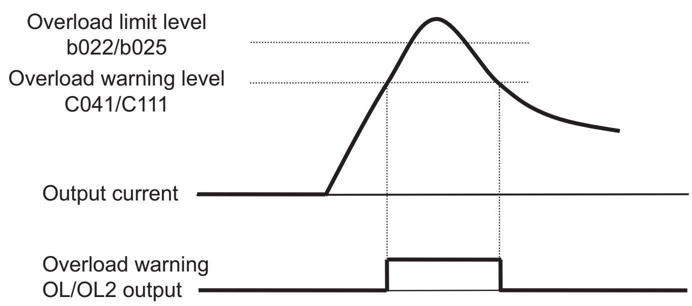
If the set overload limit level is reached during acceleration, the inverter decreases the output frequency according to the overload limit parameter.

This decrease in the frequency causes the motor decelerate, which may results in an overvoltage.

Overload Warning Function

- The overload warning function can be set so that the inverter outputs an overload warning if the load is too large, before it causes an overload trip.
  This helps prevent mechanical damage to transfer machines etc. due to overweighed loading, or stoppage of transfer lines due to an overload.
- Setting the Multi-function Output P1 to P5 Selection (C021 to C025), or the Multi-function Relay Output (MA, MB) Function Selection (C026), to 03 (OL: Overload warning) or 26 (OL2: Overload warning 2) enables the inverter to output two types of overload warning signals.

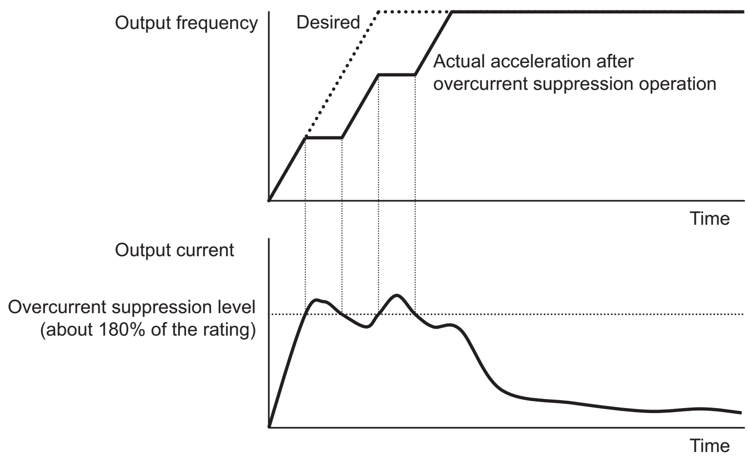
Parameter No.	Function name	Data		Default data	Unit
C040	Overload Warning Signal Output Mode Selection	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed		01	–
C041	Overload Warning Level	Heavy load (CT)	0.00: Function disabled 0.01 x Rated current to 2.00 x Rated current (0.4 to 55 kW) 0.01 x Rated current to 1.80 x Rated current (75 to 132 kW)	Heavy load Rated current [A]	A
		Light load (VT)	0.00: Function disabled 0.01 x Rated current to 1.50 x Rated current (0.4 to 55 kW) 0.01 x Rated current to 1.50 x Rated current (75 to 132 kW)	Light load Rated current [A]	A
C111	Overload Warning Level 2	Heavy load (CT)	0.00: Function disabled 0.01 x Rated current to 2.00 x Rated current (0.4 to 55 kW) 0.01 x Rated current to 1.80 x Rated current (75 to 132 kW)	Heavy load Rated current [A]	A
		Light load (VT)	0.00: Function disabled 0.01 x Rated current to 1.50 x Rated current (0.4 to 55 kW) 0.01 x Rated current to 1.50 x Rated current (75 to 132 kW)	Light load Rated current [A]	A
Related functions		C001 to C008, C021 to C025, C026			



Overcurrent Suppression Selection

- This function suppresses the overcurrent caused by a steep current increase during rapid acceleration.
- Enable or disable the function in the Overcurrent Suppression Selection (b027).

Parameter No.	Function name	Data	Default data	Unit
b027	Overcurrent Suppression Selection	00: Disabled 01: Enabled	01	–



Parameter Write Protection

This section describes the functions you can use to protect Inverter parameter settings from rewriting.

Soft Lock Function

- Use the soft lock function to set whether to enable or disable the writing of parameter data. This helps prevent data rewriting due to erroneous operation.
- In the Soft Lock Selection (b031), select to which parameter data you want to apply the soft lock.
- To control the soft lock function via a multi-function input terminal, set the Multi-function Input S1 to S8 Selection to 15 (SFT: Soft lock).
- Setting the Soft Lock Selection (b031) to 10 (Data can be changed during RUN) enables to change parameter data, which is marked with under “Changes during operation” in Section 4 Parameter List, during operation.
  Note that only this setting is provided for disabling, instead of enabling, the parameter lock function.

Parameter No.	Function name	Data	Default data	Unit
b031	Soft Lock Selection	00: Data other than b031 cannot be changed when terminal SFT is ON. 01: Data other than b031 and set frequency cannot be changed when terminal SFT is ON. 02: Data other than b031 cannot be changed. 03: Data other than b031 and set frequency cannot be changed. 10: Data can be changed during RUN.	01	–
Related functions		C001 to C008, SFT input		

Data Read/Write Selection

The optional LCD Digital Operator provides the function to read and write all inverter parameters.

In the Data Read/Write Selection (b166), you can set the parameter to protect data from the all Read/Write operations via the LCD Digital Operator.

Parameter No.	Function name	Data	Default data	Unit
b166	Data Read/Write Selection	00: R/W OK 01: R/W protected	00	–

RUN Time/Power ON Time Detection Level

- If the total RUN time or power ON time of the inverter exceeds the RUN Time/Power ON Time Detection Level (b034), the inverter will output a RUN time over (RNT) or Power ON time over (ONT) signal.

Parameter No.	Function name	Data	Default data	Unit
b034	RUN Time/Power ON Time Detection Level	0.: Function disabled 1. to 9999. (1 to 9999) 1000 to 6553 (10000 to 65530)	0	10 h

RUN Time Over (RNT)

- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 11 (RNT).
- Set the RUN Time/Power ON Time Detection Level (b034).

Power ON Time Over (ONT)

- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 12 (ONT).
- Set the RUN Time/Power ON Time Detection Level (b034).

RUN Direction Limit Selection

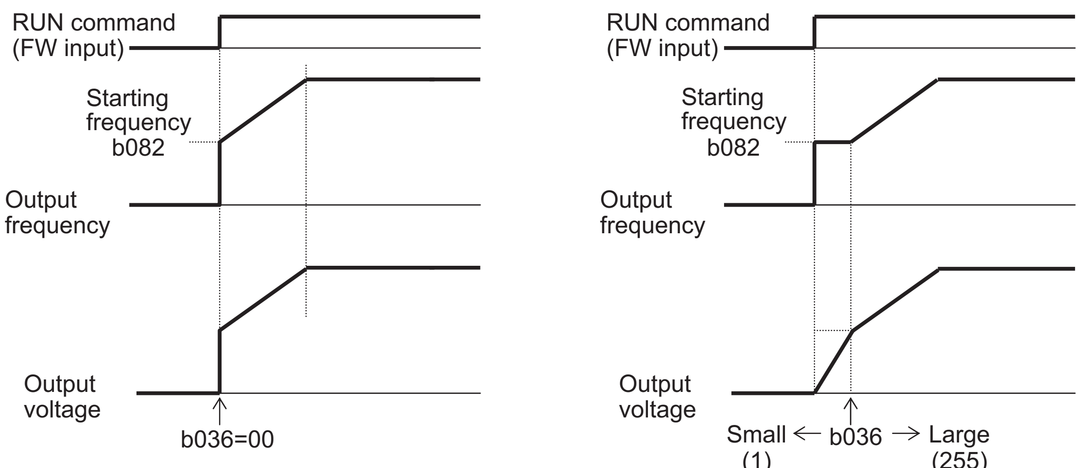
- Use this function to limit the RUN direction of the motor.
- This function is effective for all settings provided in the RUN Command Selection (A002).
- When the inverter receives a RUN command input with the RUN direction limit function enabled, is displayed on the Digital Operator.

Parameter No.	Function name	Data	Default data	Unit
b035	RUN Direction Limit Selection	00: No direction limit 01: Forward only (Reverse limited) 02: Reverse only (Forward limited)	00	–

Reduced Voltage Startup Selection

- Use this function to increase the voltage slowly during motor startup.
- To increase the torque during startup etc., decrease the value set in the Reduced Voltage Startup Selection (b036). Note, however, that setting a small value could trigger a full-voltage start, causing an overcurrent trip easily.

Parameter No.	Function name	Data	Default data	Unit
b036	Reduced Voltage Startup Selection	0: Reduced voltage startup disabled 1 (Reduced voltage startup time: small) to 255 (Reduced voltage startup time: large) 1: Short (Approx. 6 ms) ↕ ↕ 255: Long (Approx. 1.53 s)	6	–



Reduced voltage startup disabled

Reduced voltage startup enabled

Display Selection

- Use this function to set the parameters displayed on the Digital Operator.
- To display all parameters, set this parameter to 00 (Complete display).

Parameter No.	Function name	Data	Default data	Unit
b037	Display Selection	00: Complete display 01: Individual display of functions 02: User setting + b037 03: Data comparison display 04: Basic display	00*1	–
U001 to U012	User Selection 1 to User Selection 12	no: No allocation d001 to P196: Select the parameter number you want to display.	no	–

*1. The default data was changed from the previous model.

Complete Display (b037 = 00)

- Displays all Inverter parameters.

Individual Display of Functions (b037 = 01)

- If a specific function is not selected, its related parameter is not displayed.
- For details on the display conditions, refer to the following table.

No.	Display condition	Parameters displayed when display condition is met
1	A001 = 01	A005, A006, A011 to A016, A101, A102 A111 to A114, C081 to C083, C121 to C123
2	A001 = 10	A141 to A143
3	A002 = 01, 03, 04, 05	b087
4	A017 = 01	d025 to d027, P100 to P131 P100 to P131 cannot be used.
5	A041 = 01	A046, A047
6	A044 = 00, 01	A041, A042, A043
7	A044 = 03, 04, 05	H002, H005, H050
8	A044 = 04	H060, H061
9	A044 = 03, 04, 05, and H002 = 00	H020 to H024
10	A044 = 03, 04, 05, and H002 = 01, 02	H030 to H034
11	Either A044 or A244, or both of them are 03, 04, 05.	d008 to d010, d012, b040 to b046, H001, H070 to H073
12	Either A044 or A244, or both of them are 02.	b100 to b113
13	A051 = 01, 02	A052, A056 to A058
14	A051 = 01, 02	A053 to A055, A059
15	A071 = 01, 02	d004, A005, A006, A011 to A016, A072 to A078 A101, A102, A111 to A114, C044, C052, C053, C081 to C083, C121 to C123
16	A076 = 10	A141 to A143
17	A094 = 01, 02	A095, A096

No.	Display condition	Parameters displayed when display condition is met
18	A097 = 01, 02, 03, 04	A131
19	A097 = 01, 02, 03, 04	A132
20	One or more of b012, b212, or b312 are 02.	b015 to b020
21	b021 = 01, 02, 03	b022, b023
22	b024 = 01, 02, 03	b025, b026
23	b050 = 01	b051 to b054
24	b095 = 01, 02	b090, b096
25	b098 = 01, 02	b099, C085
26	b120 = 01	b121 to b127
27	One of C001 to C008 is 05 and A019 = 00.	A028 to A035
28	One of C001 to C008 is 06.	A038, A039
29	One of C001 to C008 is 07.	A053 to A055, A059
30	One of C001 to C008 is 08.	F202, F203, A203, A204, A220, A244, A246, A247, A261, A262, A292, A293, A294, b212, b213, H203, H204, H206
31	One of C001 to C008 is 08 and A041 = 01.	A246, A247
32	One of C001 to C008 is 08 and A244 = 00 or 01.	A241, A242, A243
33	One of C001 to C008 is 08 and A244 = 03 or 04.	H202, H205, H250, H251, H252
34	One of C001 to C008 is 08 and A244 = 04.	H260, H261
35	One of C001 to C008 is 08 and A244 = 03 or 04 and H202 = 00.	H220 to H224
36	One of C001 to C008 is 08 and A244 = 03 or 04 and H202 = 01 or 02.	H230 to H234
37	One of C001 to C008 is 08 and A094 = 01 or 02.	A295, A296
38	One of C001 to C008 is 11.	b088
39	One of C001 to C008 is 17.	F302, F303, A303, A304, A320, A342, A343, A392, A393, b312, b313, H306
40	One of C001 to C008 is 18.	C102
41	One of C001 to C008 is 27, 28, or 29.	C101
42	One of C021 to C026 is 03.	C040, C041
43	One of C021 to C026 is 26.	C040, C111
44	One of C021 to C026 is 02 or 06.	C042, C043
45	One of C021 to C026 is 07.	C055 to C058
46	One of C021 to C026 is 21.	C063
47	One of C021 to C026 is 24 or 25.	C045, C046
48	One of C021 to C026 is 33.	C142 to C144
49	One of C021 to C026 is 34.	C145 to C147
50	One of C021 to C026 is 35.	C148 to C150
51	One of C021 to C026 is 36.	C151 to C153
52	One of C021 to C026 is 37.	C154 to C156
53	One of C021 to C026 is 38.	C157 to C159
54	One of C021 to C026 is 42.	C064

User Setting (b037 = 02)

- Displays only the parameters set U001 to U012.
- In addition to U001 to U012, d001, F001, and b037 are displayed.

Data Comparison Display (b037 = 03)

- Displays only the changed parameters from the factory default settings.
  However, the parameters for analog input adjustment (C081 to C083, C121 to C123) and Thermistor Adjustment (C085) are not displayed.
- All monitor display parameters (d***) and F001 will be always displayed.

Basic Display (b037 = 04)

- Displays only the basic parameters.
- When this setting is enabled, the following parameters are displayed.

No.	Parameter No.	Function name	No.	Parameter No.	Function name
1	d001	Output Frequency Monitor	18	A044	1st Control Method
2	d002	Output Current Monitor	19	A045	Output Voltage Gain
3	d003	RUN Direction Monitor	20	A085	Operation Mode Selection
4	d004	PID Feedback Value Monitor	21	b001	Power Interruption/ Undervoltage Restart Selection
5	F001	Output Frequency Setting/ Monitor	22	b002	Allowable Power Interruption Time
6	F002	1st Acceleration Time 1	23	b008	Overvoltage/Overcurrent Restart Selection
7	F003	1st Deceleration Time 1	24	b011	Overvoltage/Overcurrent Restart Standby Time
8	F004	RUN Direction Selection	25	b037	Display Selection
9	A001	Frequency Reference Selection	26	b083	Carrier Frequency
10	A002	RUN Command Selection	27	b084	Initialization Selection
11	A003	1st Base Frequency	28	b130	Overvoltage Suppression Function Selection During Deceleration
12	A004	1st Maximum Frequency	29	b131	Overvoltage Suppression Level During Deceleration
13	A005	FV/FI Selection	30	b180	Initialization Execution
14	A020	1st Multi-step Speed Reference 0	31	C021	Multi-function Output P1 Selection
15	A021	Multi-step Speed Reference 1	32	C022	Multi-function Output P2 Selection
16	A022	Multi-step Speed Reference 2	33	C036	Multi-function Relay Output (MA, MB) Function Selection
17	A023	Multi-step Speed Reference 3			
Related functions		U001 to U012			

Initial Screen Selection (Initial Screen after Power-on)

Use the Initial Screen Selection parameter to select from the following the screen that appears on the Digital Operator at power-ON.

By factory default, this is set to 001 (d001).

Parameter No.	Function name	Data	Default data	Unit
b038	Initial Screen Selection	000: Screen on which the Enter key was last pressed 001 to 060: d001 to d060 201: F001 202: Do not set.	001	–

User Parameter Automatic Setting Function

- Setting the User Parameter Automatic Setting Function (b039) to 01 (Enabled) causes the inverter to store automatically the parameters whose data have been changed in an ascending order from U001 to U012. This function is useful to keep track of changes made to the default data.
- Parameter changes are stored when the Enter key is pressed. This is also true for the monitor functions (d***).
- U001 stores the most recent parameter data; U012 stores the oldest.
- The same parameter will be stored only once. In addition, attempting to store more than 12 user parameter data results in erasing the data from the oldest (U012).

Parameter No.	Function name	Data	Default data	Unit
b039	User Parameter Automatic Setting Function	00: Disabled 01: Enabled	00	–
Related functions		U001 to U012		

Torque Limit Function

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control). It is used to set the upper limit of the motor output torque.
- For details on the torque limit function, refer to *6-5-1 Torque Limit Function Settings* on page 6-31.

Parameter No.	Function name	Data		Default data	Unit
b040	Torque Limit Selection		00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Option 1 04: Option 2	00	–
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150.	120.	%
			no: Torque limit disabled		
b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150. (0.4 to 132 kW)	120.	%
			no: Torque limit disabled		
b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150. (0.4 to 132 kW)	120.	%
			no: Torque limit disabled		
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	Heavy load (CT)	0. to 200. (0.4 to 55 kW)	150.	%
			0. to 180. (75 to 132 kW)		
			no: Torque limit disabled		
		Light load (VT)	0. to 150. (0.4 to 132 kW)	120.	%
			no: Torque limit disabled		

Reverse Rotation Prevention Function

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control).
- Because of its control characteristics, the inverter may output a rotation signal opposite to the RUN command direction at low speeds. If allowing the motors to rotate in the opposite rotation may pose a risk of mechanical damage or any other problem, set the Reverse Rotation Prevention Selection (b046) to 01 (Enabled).

Parameter No.	Function name	Data	Default data	Unit
A044	1st Control Method	03: Sensorless vector control 04: 0-Hz sensorless vector control 05: Sensor vector control (V2)	00	–
A244	2nd Control Method			
b046	Reverse Rotation Prevention Selection	00: Disabled 01: Enabled	00	–

Torque LADSTOP Function

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control). It functions to stop temporarily the frequency acceleration/deceleration function (LAD) when the torque limit function is activated.
- For the torque LADSTOP function, refer to *6-5-1 Torque Limit Function Settings* on page 6-31.

Parameter No.	Function name	Data	Default data	Unit
b045	Torque LADSTOP Selection	00: Disabled 01: Enabled	00	–

Heavy Load/Light Load Selection

The 3G3RX-V1 Series Inverter supports dual load ratings (heavy load mode and light load mode). This enables the efficient utilization of the inverter according to your application.

- According to your application, select one of the two modes: heavy load mode and light load mode.
- The heavy load mode provides the same load rating as the conventional 3G3RX Series Inverter. This means that the overload capacity is 150% of the rated current of the inverter for 1 minute.
- For loads (such as fan and pumps) that do not require frequent use of the inverter above the rated torque, you can select the light load mode.
  Setting the light load mode causes the rated current of the inverter to increase, which enables the inverter to drive a motor, one size larger in capacity. However, the overload capacity is 120% of the rated current of the inverter for 1 minute.
- Use the Heavy Load/Light Load Selection (b049) to switch between the heavy load mode and the light load mode.
  It is not necessary to cycle the power supply after changing this setting.

Parameter No.	Function name	Data	Default data	Unit
b049	Heavy Load/Light Load Selection	00: Heavy load mode (CT) 01: Light load mode (VT)	00	–

The characteristics in the heavy load mode and the light load mode are as shown below.

Item	Heavy load (CT)	Light load (VT)
Feature	Loads that require a high torque during startup, acceleration/deceleration etc.	Loads that do not require frequent use of the inverter above rated torque
Application	Elevator, crane, conveyor, etc.	Fan, pump, air conditioner, etc.
Rated current (Example)	3.0 A (3-phase 200 V, 0.4-kW Inverter)	3.7 A (3-phase 200 V, 0.4-kW Inverter)
Overload current rating	150%, 60 s	120%, 60 s

Changing the Heavy Load/Light Load Selection (b049) setting switches the setting ranges and default data of some parameters.

Doing so also causes some parameter settings to be initialized at the same time.

For these parameters, you need to set data again after changing the b049 setting even if you configured them beforehand.

- Changing from heavy load mode to light load mode:
  Basically causes the parameter settings to be initialized. For details, refer to the Initialization at mode switching column in the following table.
- Changing from light load mode to heavy load mode:
  Basically does NOT cause the parameter settings to be initialized. For details, refer to the Initialization at mode switching column in the following table.

No.	Parameter name	Setting range		Default data		Initialization at mode switching	
		Heavy load (CT)	Light load (VT)	Heavy load (CT)	Light load (VT)	Heavy to Light	Light to Heavy
A044	1st Control Method	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control 04: 0-Hz sensorless vector control 05: Sensor vector control	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	00	No switching	Enabled	Disabled
A244	2nd Control Method	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control 04: 0-Hz sensorless vector control	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	00	No switching		
A054	DC Injection Braking Power	Percentage of heavy-load rated current 0. to 100. [%] (0. to 80. [%])	Percentage of light-load rated current 0. to 70. [%] (0. to 50. [%])	50. [%] (40. [%])	No switching	Enabled	Disabled
A057	Startup DC Injection Braking Power			0. [%]	No switching		
A059	DC Injection Braking Carrier Frequency	0.5 to 15.0 [kHz] (0.5 to 10.0 [kHz])	0.5 to 12.0 [kHz] (0.5 to 8.0 [kHz])	5.0 [kHz] (3.0 [kHz])	3.0 [kHz] (3.0 [kHz])	Enabled	Disabled
A085	Operation Mode Selection	00: Normal operation 01: Energy-saving operation 02: Automatic operation	00: Normal operation 01: Energy-saving operation	00	No switching	Enabled	Disabled

No.	Parameter name	Setting range		Default data		Initialization at mode switching	
		Heavy load (CT)	Light load (VT)	Heavy load (CT)	Light load (VT)	Heavy to Light	Light to Heavy
b012	1st Electronic Thermal Level	0.20 x Heavy-load rated current to 1.00 x Heavy-load rated current [A]	0.20 x Light-load rated current to 1.00 x Light-load rated current [A]	Heavy-load rated current [A]	Light-load rated current [A]	Conversion*1	Conversion*1
b212	2nd Electronic Thermal Level						
b312	3rd Electronic Thermal Level						
b016	Free-electronic Thermal Current 1	0.00 x Heavy-load rated current to 1.00 x Heavy-load rated current [A]	0.00 x Light-load rated current to 1.00 x Light-load rated current [A]	0.00 [A]	No switching	Disabled	Disabled
b018	Free-electronic Thermal Current 2						
b020	Free-electronic Thermal Current 3						
b022	Overload Limit Level	0.20 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.20 x Heavy-load rated current to 1.80 x Heavy-load rated current [A])	0.20 x Light-load rated current to 1.50 x Light-load rated current [A] (0.20 x Light-load rated current to 1.50 x Light-load rated current [A])	1.50× Heavy-load rated current [A]	1.20× Light-load rated current [A]	Enabled	Conversion*1
b025	Overload Limit Level 2						
b028	Frequency Pull-in Restart Level	0.20 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.20 x Heavy-load rated current to 1.80 x Heavy-load rated current [A])	0.2 x Light-load rated current to 1.50 x Light-load rated current [A] (0.20 x Light-load rated current to 1.50 x Light-load rated current [A])	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion*1
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	Percentage of heavy-load rated current 0. to 200. [%] (0. to 180. [%]) no: Function disabled	Percentage of light-load rated current 0. to 150. [%] (0. to 150. [%]) no: Function disabled	150. [%]	120. [%]	Enabled	Disabled
b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)						
b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)						
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)						
b083	Carrier Frequency	0.5 to 15.0 [kHz] (0.5 to 10.0 [kHz])	0.5 to 12.0 [kHz] (0.5 to 8.0 [kHz])	5.0 [kHz] (3.0 [kHz])	3.0 [kHz] (3.0 [kHz])	Enabled	Disabled
C030	Digital Current Monitor Reference Value	0.20 x Heavy-load rated current to 2.00 x Heavy-load rated current [A]	0.20 x Light-load rated current to 1.50 x Light-load rated current [A]	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion*1

No.	Parameter name	Setting range		Default data		Initialization at mode switching	
		Heavy load (CT)	Light load (VT)	Heavy load (CT)	Light load (VT)	Heavy to Light	Light to Heavy
C039	Low Current Detection Level	0.00 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.00 x Heavy-load rated current to 1.80 x Heavy-load rated current [A])	0.00 x Light-load rated current to 1.50 x Light-load rated current [A] (0.00 x Light-load rated current to 1.50 x Light-load rated current [A])	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion*1
C041	Overload Warning Level	0.00 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.00 x Heavy-load rated current to 1.80 x Heavy-load rated current [A]) 0.00: Function disabled	0.00 x Light-load rated current to 1.50 x Light-load rated current [A] (0.00 x Light-load rated current to 1.50 x Light-load rated current [A]) 0.00: Function disabled	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion*1
C055	Overtorque Level (Forward Power Running)	Percentage of heavy-load rated current 0. to 200. [%] (0. to 180. [%])	Percentage of light-load rated current 0. to 150. [%] (0. to 150. [%])	100. [%]	100. [%]	Enabled	Disabled
C056	Overtorque Level (Reverse Regeneration)						
C057	Overtorque Level (Reverse Power Running)						
C058	Overtorque Level (Forward Regeneration)						
C111	Overload Warning Level 2	0.00 x Heavy-load rated current to 2.00 x Heavy-load rated current [A] (0.00 x Heavy-load rated current to 1.80 x Heavy-load rated current [A]) 0.00: Function disabled	0.00 x Light-load rated current to 1.50 x Light-load rated current [A] (0.00 x Light-load rated current to 1.50 x Light-load rated current [A]) 0.00: Function disabled	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion*1
H003	1st Motor Capacity	0.2 to 160 [kW]*2 Setting in steps	No switching	Heavy-load rated capacity [kW]	Light-load rated capacity [kW]	Disabled	Disabled
H203	2nd Motor Capacity						

*1. Conversion: The current value will be converted at the ratio of the rated current for the heavy load/light load mode.
(Example) If you change from a light load mode setting of 5A (rated current: 10A) to the heavy load mode (rated current: 8A), the current value will be converted as follows: Rated current 8A x 50% (5A/10A) = 4A.

*2. Setting in steps: 0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/37/45/55/75/90/110/132/160 [kW] can be selected.

Note For each parameter in the above table, the values enclosed in parentheses ( ) represent the setting range/default data for high-capacity type (75 to 132 kW) Inverters.
Without parentheses ( ), the parameter has the same setting range/default data regardless of the inverter capacity.

In the light load mode, 0-Hz sensorless vector control, sensor vector control and brake control are disabled.

Therefore, the following parameters and function options are not displayed.

Parameter No.	Function name	Parameter No.	Function name
d008	Real Frequency Monitor	P024	Position Bias Amount
d009	Torque Reference Monitor	P026	Overspeed Error Detection Level
d010	Torque Bias Monitor	P027	Speed Deviation Excessive Level
d029	Position Command Monitor	P028	Motor Gear Ratio Numerator
d030	Current Position Monitor	P029	Motor Gear Ratio Denominator
b120	Brake Control Function Selection	P032	Orientation Stop Position Input Type
b121	Brake Release Wait Time	P033	Torque Reference Input Selection
b122	Acceleration Wait Time on Brake Control	P034	Torque Reference Setting
b123	Stop Wait Time on Brake Control	P035	Polarity Selection at Torque Reference via FE
b124	Brake Error Detection Time	P036	Torque Bias Mode
b125	Brake Release Frequency	P037	Torque Bias Value
b126	Brake Release Current	P038	Torque Bias Polarity Selection
b127	Brake Force Frequency	P039	Speed Limit Value in Torque Control (Forward)
H060	1st Limit at 0 Hz	P040	Speed Limit Value in Torque Control (Reverse)
H260	2nd Limit at 0 Hz	P060	Multi-step Position Command 0
H061	1st Boost Amount at SLV Startup, 0 Hz	P061	Multi-step Position Command 1
H261	2nd Boost Amount at SLV Startup, 0 Hz	P062	Multi-step Position Command 2
P011	Number of Encoder Pulses	P063	Multi-step Position Command 3
P012	V2 Control Mode Selection	P064	Multi-step Position Command 4
P013	Pulse Train Input Selection	P065	Multi-step Position Command 5
P014	Orientation Stop Position	P066	Multi-step Position Command 6
P015	Orientation Speed Setting	P067	Multi-step Position Command 7
P016	Orientation Direction Setting	P068	Origin Search Mode
P017	Positioning Completion Range Setting	P069	Origin Search Direction Selection
P018	Positioning Completion Delay Time Setting	P070	Origin Search Mode 1 Frequency
P019	Electronic Gear Position Selection	P071	Origin Search Mode 2 Frequency
P020	Electronic Gear Ratio Numerator	P072	Position Limit Setting (Forward Side)
P021	Electronic Gear Ratio Denominator	P073	Position Limit Setting (Reverse Side)
P022	Position Control Feedforward Gain	P074	Teaching Selection
P023	Position Loop Gain		

Function options for Multi-function Input S1 to S8 Selection (C001 to C008)	
44: BOK	Brake confirmation
45: ORT	Orientation
47: PCLR	Position deviation clear
48: STAT	Pulse train position command permission
52: ATR	Torque command input permission
54: SON	Servo ON
55: FOC	Preliminary excitation
66: CP1	Position command selection 1
67: CP2	Position command selection 2
68: CP3	Position command selection 3
69: ORL	Zero return limit signal
70: ORG	Zero return startup signal
71: FOT	Forward driving stop
72: ROT	Reverse driving stop
73: SPD	Speed/Position switching

Function options for Multi-function Output P1 to P5 Selection/Multi-function Relay Output (MA, MB) Function Selection (C021 to C026)	
19: BRK	Brake release
20: BER	Brake error
22: DSE	Excessive speed deviation
23: POK	Position ready

Deceleration Stop on Power Interruption Function

- If the inverter detects a power supply shutoff during operation, this function causes the motor to stop after deceleration so that the internal DC voltage of the inverter is maintained at the Deceleration Hold Level on Power Interruption (b052).
- This function can be enabled in three ways in the Deceleration Stop Selection on Power Interruption (b050).
- This function does not reset until the motor stops running. To restart the inverter after power recovery with this function activated, turn ON the STOP command input (to turn OFF the RUN command) and then turn ON the RUN command input again.

Parameter No.	Function name	Data	Default data	Unit
b050	Deceleration Stop Selection on Power Interruption	00: Disabled 01: Enabled (deceleration stop) 02: Enabled (Constant voltage, without recovery) 03: Enabled (Constant voltage, with recovery)	00	–
b051	Starting Voltage on Power Interruption	0.0 to 999.9 1000.	220/440	V
b052	Deceleration Hold Level on Power Interruption	0.0 to 999.9 1000.	360/720	V

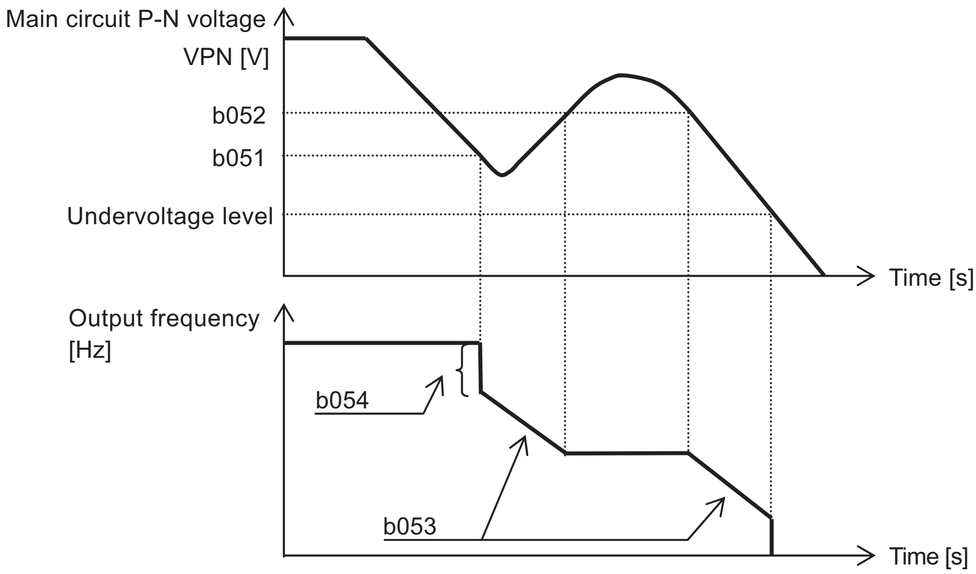
Parameter No.	Function name	Data	Default data	Unit
b053	Deceleration Time on Power Interruption	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	1.00	s
b054	Deceleration Starting Width on Power Interruption	0.00 to 10.00	0.00	Hz
b055	Proportional Gain on Power Interruption	0.00 to 2.55: Proportional gain for DC voltage constant control (b050 = 02, 03 only)	0.20	–
b056	Integral Time on Power Interruption	0.000 to 9.999/10.00 to 65.53: Integral time when DC voltage is kept constant (b050 = 02, 03 only)	0.100	s

Deceleration Stop on Power Interruption: b050 = 01 (Deceleration Stop)

- If a power supply shutoff or undervoltage is detected during operation, the function causes the inverter to stop after deceleration so that the internal DC power of the inverter does not exceed the Deceleration Hold Level on Power Interruption (b052).
- To use this function, remove the J51 connector cable connected between the terminals Ro and To and connect the main circuit terminals P and N to Ro and To via cables, respectively.
  The cable size should be 0.75 mm^2 or larger.
- If, after a power supply shutoff is detected during operation, the internal DC power of the inverter falls to or below the Starting Voltage on Power Interruption (b051), the inverter will decrease the frequency to the value set in the Deceleration Starting Width on Power Interruption (b054)
  and then cause the motor to decelerate according to the Deceleration Time on Power Interruption (b053).
- The motor will stop decelerating if, due to the regenerative energy produced during deceleration, the internal DC power of the inverter rises to or above the Deceleration Hold Level on Power Interruption (b052) and start decelerating again if it falls to or below the value set in b052.

Precautions for Correct Use

- Be sure to set the Deceleration Hold Level on Power Interruption (b052) to a value higher than the input power supply voltage multiplied by the square root of 2. Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class. If it is set to a value less than the input power supply voltage multiplied by the square root of 2, the motor will remain in a deceleration stop state even after the power is restored and cannot decelerate. (Neither the RUN command and the frequency reference do not accept input until the operation completes after a deceleration stop.)
- If the value set in the Deceleration Hold Level on Power Interruption (b052) is less than the value set in the Starting Voltage on Power Interruption (b051), the inverter will ignore the b052 setting and run according to the b051 setting.
- This function will not reset until the motor decelerates and stops running. To restart the inverter after power recovery with this function activated, after the motor stops, turn ON the RUN command input again.
- If the value set in the Deceleration Starting Width on Power Interruption (b054) is too large, the motor may decelerate rapidly, causing an overcurrent. If an overcurrent occurs, decrease the b054 value.
- If the Deceleration Starting Width on Power Interruption (b054) is too small or if the Deceleration Time on Power Interruption (b053) is too long, there will be a shortage of the regenerative energy, causing the internal DC power voltage of inverter to drop, which in turn causes an undervoltage. Should an undervoltage occur, increase the b054 value or decrease the b053 value.



Deceleration Stop on Power Interruption: b050 = 02 (Without Recovery), b050 = 03 (With Recovery)

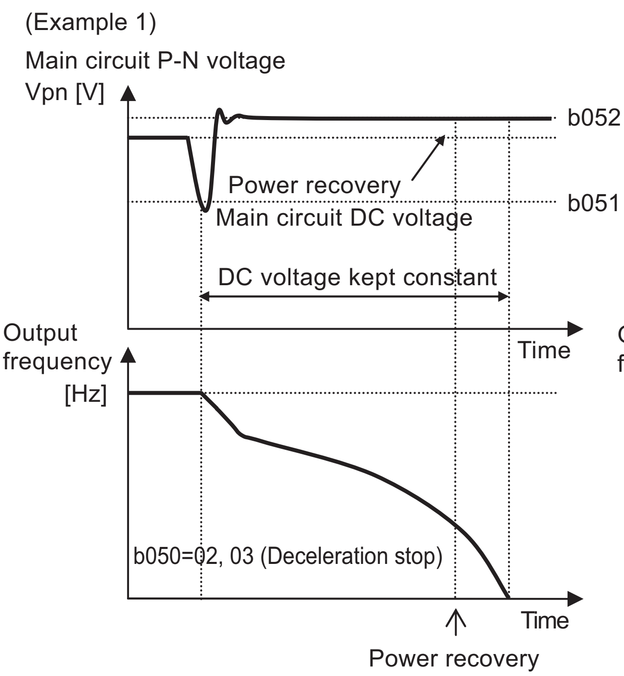
- If a power supply shutoff or undervoltage is detected during operation, the function causes the inverter to stop after deceleration so that the internal DC power of the inverter does not exceed the Deceleration Hold Level on Power Interruption (b052).
- To use this function, remove the J51 connector cable connected between the terminals Ro and To and connect the main circuit terminals P and N to Ro and To via cables, respectively. The cable size should be 0.75 mm^2 or larger.
- If, after a power supply shutoff or undervoltage is detected during operation, the internal DC power of the inverter falls to or below the Starting Voltage on Power Interruption (b051), the inverter will start decelerating the motor so that the internal DC power of the inverter does not exceed the Deceleration Hold Level on Power Interruption (b052) under PI control.
- In case of a short momentary power interruption, the inverter can operate continuously without shutting off its output.
  However, if an undervoltage occurs during deceleration after an momentary power interruption, the inverter will shut off its output immediately to terminate this function. The subsequent operation when the power is restored after a momentary power interruption depends on the Power Interruption/Undervoltage Restart Selection (b001) setting.
- If, after this function is activated, the power is recovered before another momentary power interruption is detected, the inverter can return to normal operation. In this case, the subsequent operation varies depending on the Deceleration Stop Selection on Power Interruption (b050) and Deceleration Hold Level on Power Interruption (b052) settings.

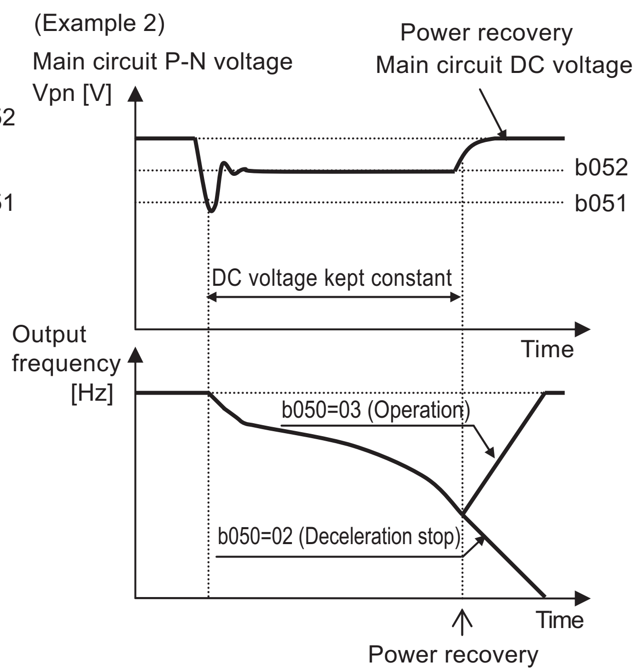
b050	b052	Operation
02: (without recovery)	b052 > Main circuit DC voltage at incoming voltage recovery	Deceleration stop (DC voltage constant control) (Example 1)
	b052 < Main circuit DC voltage at incoming voltage recovery	Deceleration stop (Normal operation) (Example 2)
03: (with recovery)	b052 > Main circuit DC voltage at incoming voltage recovery	Deceleration stop (DC voltage constant control) (Example 1)
	b052 < Main circuit DC voltage at incoming voltage recovery	Operation (Normal operation) (Example 2)

- If this function is activated, the inverter will force the motor to stop even when the RUN command input is ON.
  To restart the inverter, make sure that the power is recovered and then input the RUN command again.
- If the inverter stops operating due to an undervoltage when the deceleration stop on power interruption function is used to execute a deceleration stop, set the Proportional Gain on Power Interruption (b055) to a large value and the Integral Time on Power Interruption (b056) to a small value.
- Setting the Proportional Gain on Power Interruption (b055) value too large, or setting the Integral Time on Power Interruption (b056) value too small, may cause the deceleration time to fluctuate widely, which may result in trip.
  If this occurs, adjust by first increasing the value set in b056 and then decreasing the value set in b055.

Precautions for Correct Use

- The Starting Voltage on Power Interruption (b051) and the Deceleration Hold Level on Power Interruption (b052) must be set to the undervoltage detection level (200-V class: 210 V, 400-V class: 410 V) or higher. This function will be disabled if these parameter settings are lower than the undervoltage detection level.
- To ensure that this function operates in a stable manner, set these parameters as follows:
  Starting Voltage on Power Interruption (b051) < Deceleration Hold Level on Power Interruption (b052)





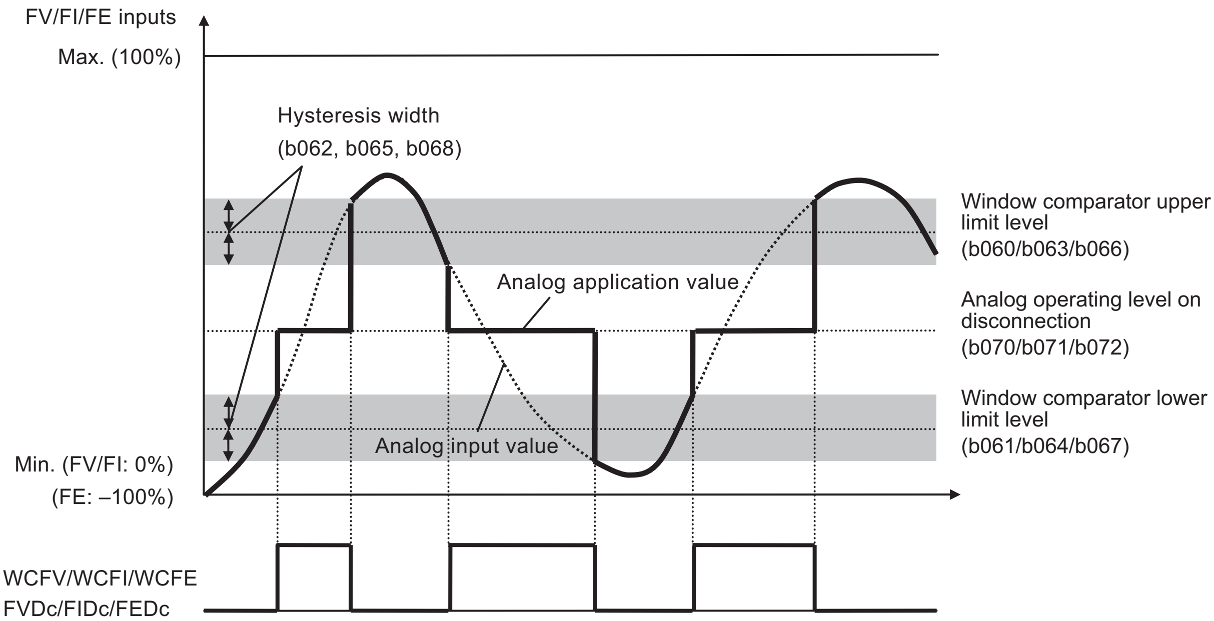
Window Comparator (Disconnection Detection FVDc/FIDc/FEDc)

- The window comparator function generates an output when the FV/FI/FV2 analog input value is between the set upper limit and lower limit levels, enabling the analog input monitoring at the desired level to detect a disconnection etc.
- The hysteresis width is provided for the window comparator upper/lower limit level setting.
- You can set upper and lower limit levels and a hysteresis width independently for analog input terminals FV, FI, and FE.
- The analog input value used when the WCFV/WCFI/WCFE signal is output from an analog output terminal can be fixed to any value. Set the Analog Operation Level at FV/FI/FE Disconnection (b070/b071/b072). When set to no, the analog input value will be used “as is.”
- The multi-function output signal FVDc/FIDc/FEDc will be output in the same way as the WCFV/WCFI/WCFE signal, respectively.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	27: FVDc (Analog FV disconnection detection) 28: FIDc (Analog FI disconnection detection) 29: FEDc (Analog FE disconnection detection) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 56: WCFE (Window comparator FE)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	
b060	Window Comparator FV Upper Limit Level	Set the upper limit level. Setting range: 0. to 100. Minimum value: Lower limit level + Hysteresis width x 2	100.	%
b061	Window Comparator FV Lower Limit Level	Set the lower limit level. Setting range: 0. to 100. Maximum value: Upper limit level – Hysteresis width x 2	0.	
b062	Window Comparator FV Hysteresis Width	Set the hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Maximum value: (Upper limit level – Lower limit level)/2		
b063	Window Comparator FI Upper Limit Level	Set the upper limit level. Setting range: 0. to 100. Lower limit: Lower limit level + Hysteresis width x 2	100.	
b064	Window Comparator FI Lower Limit Level	Set the lower limit level. Setting range: 0. to 100. Maximum value: Upper limit level – Hysteresis width x 2	0.	
b065	Window Comparator FI Hysteresis Width	Set the hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Maximum value: (Upper limit level – Lower limit level)/2		

Parameter No.	Function name	Data	Default data	Unit
b066	Window Comparator FE Upper Limit Level	Set the upper limit level. Setting range: –100. to 100. Minimum value: Lower limit level + Hysteresis width x 2	100.	%
b067	Window Comparator FE Lower Limit Level	Set the lower limit level. Setting range: –100. to 100. Maximum value: Upper limit level – Hysteresis width x 2	–100.	
b068	Window Comparator FE Hysteresis Width	Set the hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Maximum value: (Upper limit level – Lower limit level)/2	0.	
b070	Analog Operation Level at FV Disconnection	0. to 100. no (Ignored)	no	–
b071	Analog Operation Level at FI Disconnection			
b072	Analog Operation Level at FE Disconnection	–100. to 100. no (Ignored)		

Note The upper and lower limit level settings for the window comparator function are independent of the external frequency start/end settings. Set the voltage between 0 and 10 V or between –10 and 10 V; the current as a percentage of 0 to 20 mA.



Additional Information

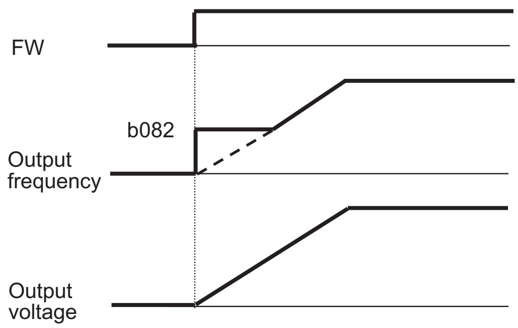
To use this function for disconnection detection, set the disconnection detection level to the same value as the window comparator upper limit level (so that the inverter uses the frequency range above the upper limit value and detects a disconnection if the frequency falls to or below the upper limit value.)

Starting Frequency

- Set the frequency at which the inverter starts to output when the RUN signal turns ON.
- Normally, you need not adjust the Starting Frequency (b082). Decrease the default data if control must be provided at less than 1.5 Hz.
- Setting the Starting Frequency (b082) too high may trigger the overload limit function or result in an overcurrent.
- This function is disabled when the 1st Control Method (A044) is set to 04 (0SLV: 0-Hz sensorless vector control) or 05 (V2: Sensor vector control).

Parameter No.	Function name	Data	Default data	Unit
b082	Starting Frequency	0.10 to 9.99	1.5*1	Hz

*1. The default data was changed from the previous model.



Carrier Frequency

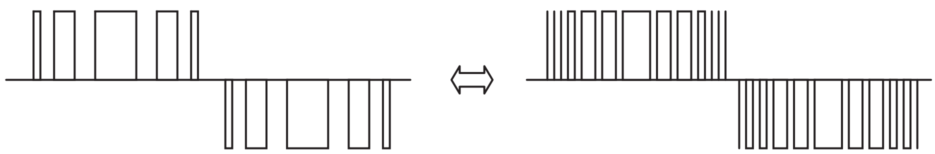
- Set the carrier frequency at which the inverter generates a PWM output.
- Set a higher carrier frequency value to reduce the metallic sound generated by the motor.
- However, setting the carrier frequency too high may require derating (a limitation) at inverter rated output current because of the increase in the amount of heat generation in the inverter.
  For the relationship between the carrier frequency and derating, refer to *Derating of Rated Output Current* on page 2-6.

Parameter No.	Function name	Data		Default data	Unit
b083	Carrier Frequency*1	Heavy load (CT)	0.5 to 15.0 (0.4 to 55 kW)	5.0	Hz
			0.5 to 10.0 (75 to 132 kW)	3.0	
		Light load (VT)	0.5 to 12.0 (0.4 to 55 kW)	3.0	
			0.5 to 8.0 (75 to 132 kW)	3.0	

*1. This parameter requires derating.

- Use the following information as a guide if the carrier frequency must be adjusted.

Carrier frequency setting	Low	High	Explanation
Metallic sound from motor	Large	Small	High carrier frequencies produce a high tone sound, which is difficult to be heard by human ears.
Electrical noise and high-frequency leakage current	Small	Large	High carrier frequencies results in an increase in the number of ON/OFF times, having a larger impact accordingly.
Output torque	Slight increase	Slight decrease	Carrier frequency has little effect on output torque.



Parameter Initialization

- The parameter initialization function restores the changed parameters to the factory default settings.
- It also can clear the fault monitor data.
- As a measure to prevent inadvertent parameter initialization, the inverter is designed to force the user to set several parameters to execute initialization.
- The following parameters are not initialized: the settings of the DriveProgramming User Parameters U00 to U31 (P100 to P131), Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Initialization Data Selection (b085), Heavy Load/Light Load Selection (b049), Thermistor Adjustment (C085), and analog adjustment parameters (C081 to C083, C121 to C123).
- If you use the 3G3RX-V1 Series Inverter for the first time or newly configure settings, execute 04 (Clear fault monitor + initialize data + Clear DriveProgramming) in b084.
- Remember that you cannot restore the initialized data to the previous settings once you execute parameter initialization.

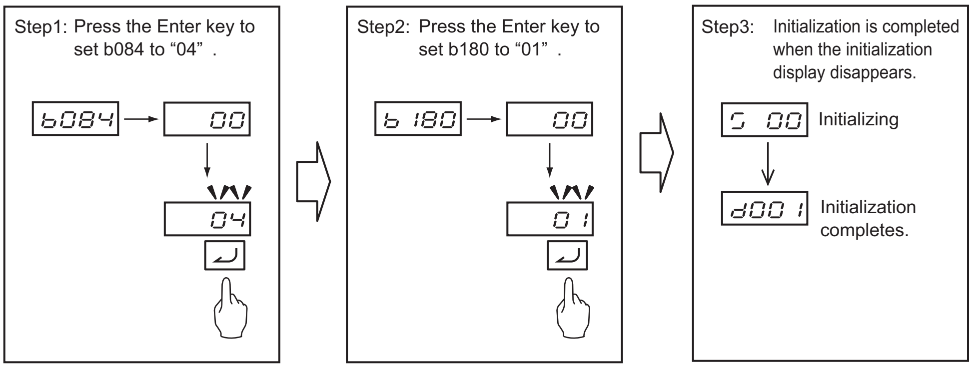
Parameter No.	Function name	Data	Default data	Unit
b084	Initialization Selection	00: Initialization disabled 01: Clear fault monitor 02: Initialize data 03: Clear fault monitor + initialize data 04: Clear fault monitor + initialize data + Clear DriveProgramming	00	–
b085	Initialization Data Selection	00: Do not change.	00	–
b180	Initialization Execution*1	00: Function disabled 01: Execute initialization	00	–

*1.Remember that it is impossible to undo the initialization once you press the Enter key ( ) to execute parameter initialization, with the Initialization Execution (b180) set to 01.

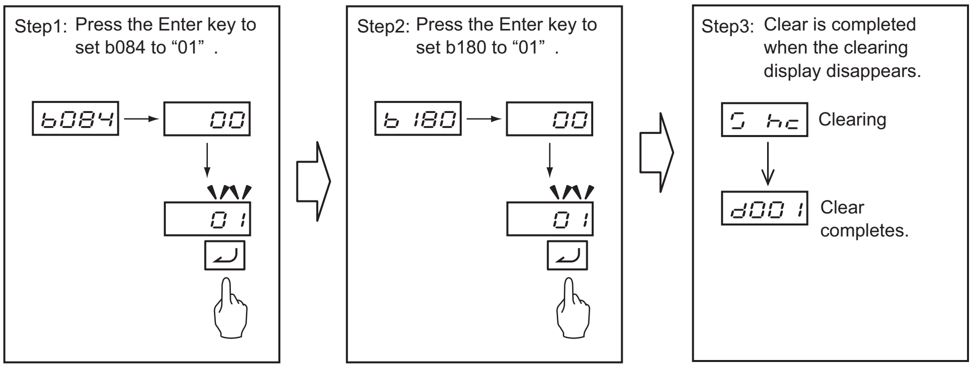
Precautions for Correct Use

The 3G3RX-V1 Series Inverter does not support the conventional initialization which is performed by pressing multiple keys simultaneously.

Initializing the Parameter Settings (Clear Fault Monitor + Initialize Data + Clear DriveProgramming)



Clearing Fault Monitor Methods



Precautions for Correct Use

- As a measure to prevent inadvertent parameter initialization, the Initialization Selection (b084) and Initialization Execution (b180) settings are designed to be reset to 00 when the initialization is completed or after power cycle. Be sure to set these parameters each time when you need to initialize the parameter settings.
- The following parameters are not initialized: the settings of the DriveProgramming User Parameters U00 to U31 (P100 to P131), Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Initialization Data Selection (b085), Heavy Load/Light Load Selection (b049), Thermistor Adjustment (C085), and analog adjustment parameters (C081 to C083, C121 to C123).
- Remember that you cannot restore the initialized data to the previous settings once you execute parameter initialization.

STOP Key Selection

- Enable/disable the STOP/RESET key on the Digital Operator or LCD Digital Operator.
- This setting is enabled when the RUN Command Selection (A002) is not set to 02 (Digital Operator). However, when the RUN Command Selection (A002) is set to 02 (Digital Operator), the STOP/RESET key is enabled independent of this setting.

Parameter No.	Function name	Data	Default data	Unit
b087	STOP Key Selection	00: Enabled 01: Disabled 02: Only RESET enabled	00	–

Data	STOP command via STOP/RESET key on Digital Operator	Trip reset operation via STOP/RESET key on Digital Operator
00	Enabled	Enabled
01	Disabled	Disabled
02	Disabled	Enabled

Precautions for Safe Use

- The STOP/RESET key on the Digital Operator or LCD Digital Operator is enabled only when the STOP Key Selection parameter is set to Enabled. Be sure to provide a separate emergency stop switch.

Stop Selection

- Select whether the motor is stopped by a deceleration stop according to the deceleration time setting or a free-run stop, when the STOP command is input via the Digital Operator or the control circuit terminal block.
- If the RUN command is input again during free run, the inverter will restart according to the Free-run Stop Selection (b088) setting. (Refer to *Free-run Stop Selection* on page 7-98.)

Parameter No.	Function name	Data	Default data	Unit
b091	Stop Selection	00: Deceleration stop 01: Free-run stop	00	–

Free-run Stop Selection

- Free-run stop is a method of shutting off the inverter output to stop the motor rotation.
  Executing the free-run stop function causes the motor to fall a free-run state, in which it decelerates due to the load and friction forces exerted on the motor and/or machine and comes to a stop.
- In the Free-run Stop Selection (b088), set how to restart the motor rotating in a free-run state after the execution of the free-run stop.
- The Free-run Stop Selection (b088) setting is enabled for the following cases.

  [When Stop Selection (b091) is set to 01 (Free-run stop)]
  Restarting the motor in a free-run stop state when the Stop Selection (b091) is set to 01 (Free-run stop) causes the motor to restart according to the Free-run Stop Selection (b088) setting.

  [When free-run stop (FRS) function is used via a multi-function input terminal]
  Setting the Multi-function Input S1 to S8 Selection (C001 to C008) to 11 (FRS) and turning ON the corresponding input terminal causes the motor to fall in a free-run stop state (with the inverter output shut off).
  Then, when the FRS terminal turns OFF, the motor restarts according to the Free-run Stop Selection (b088) setting.
  However, the motor does not restart when the RUN Command Selection (A002) is set to 02 (Digital Operator).
- Set the Free-run Stop Selection (b088) as follows.

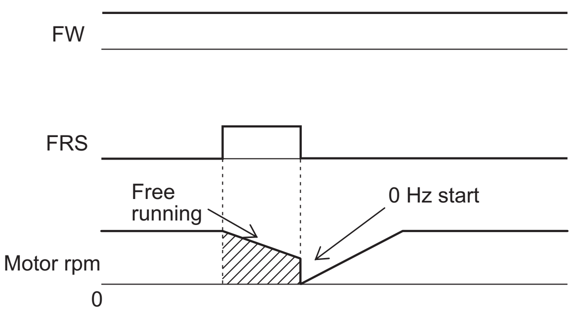
  [00: 0-Hz restart]
  Forces the inverter to restart at 0 Hz. Note that the inverter restarts suddenly while in a free-run state. Use this setting if the motor stops shortly due to the load.

  [01: Frequency matching restart]
  Causes the inverter to restart by recognizing the frequency from the voltage between the motor terminals during free-run stop and adjusting to it. The inverter restarts at 0 Hz if it cannot fully recognize the voltage between the motor terminals.
  Use this setting if the inverter is in a free-run stop for a few seconds.

  [02: Frequency pull-in restart]
  Causes the inverter to restart by outputting the starting frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030) to the motor in a free-run stop state and re-accelerating when the Frequency Pull-in Restart Level (b028) is reached.
  This enables a smooth restart independent of the voltage between motor terminals.
  Use this setting when the inverter is in free-run state for a long time due to a large load inertia.
- When the Frequency Matching Lower Limit Frequency (b007) is set, executing the frequency pull-in restart function causes the inverter to restart at 0 Hz if the set frequency or less is detected.
- Immediately after a free-run stop, a large residual voltage remains between motor terminals. If the inverter restarts the output, an overcurrent may occur. To circumvent this, set the Restart Standby Time (b003) to a large value (at least 0.3 s).
- While in a free-run stop state, the motor is not subject to external influence because the inverter output is shut off.
  Even if the motor is stopped by an external brake or the effect of other equipment, the inverter can still be used without detecting any overcurrent.
  However, if the motor in a free-run state is rotated externally, the regenerated energy may be fed back to the inverter. In this case, use the regenerative braking function.
- The examples below assume that you are using the FRS terminal.
  Consider that, when the motor is in a free-run stop state, restarting of the inverter occurs in the same timing as when the FRS terminal turns OFF.

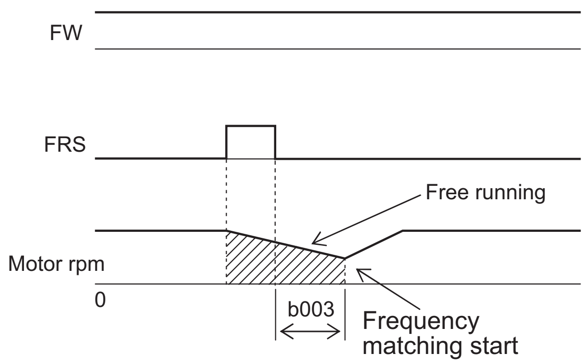
Parameter No.	Function name	Data		Default data	Unit
b088	Free-run Stop Selection	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart		00	–
b003	Restart Standby Time	0.3 to 100.0		1.0	Hz
b007	Frequency Matching Lower Limit Frequency	0.00 to 99.99 100.0 to 400.0		0.00	s
b028	Frequency Pull-in Restart Level	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)	Rated current value	A
			0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)		
		Light load (VT)	0.20 x Rated current to 1.50 x Rated current	Rated current value	
b029	Frequency Pull-in Restart Parameter	0.10 to 30.00		0.50	s
b030	Starting Frequency Selection at Frequency Pull-in Restart	00: Frequency at shutoff		00	–

(Example 1) 0-Hz restart (b088 = 00)



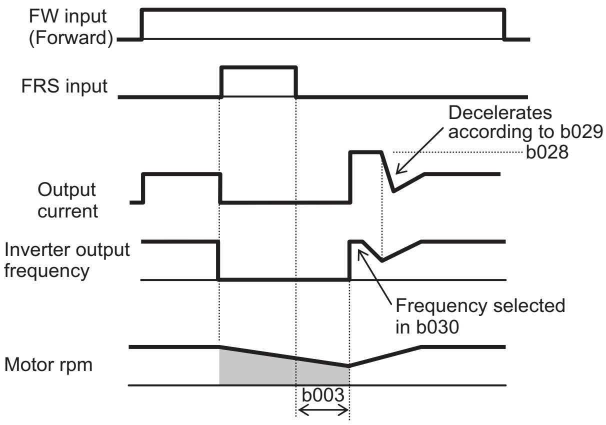
- The inverter restarts at 0 Hz independent of the motor rotation speed.
  The Restart Standby Time setting will be ignored during 0-Hz restart.
- If the inverter starts at 0 Hz at a high motor rotation speed, an overcurrent trip may occur.

(Example 2) Frequency matching restart (b088 = 01)



- When the restart standby time elapses after the FRS terminal is turned OFF, the inverter pulls in the motor frequency to execute the frequency matching restart function without stopping the motor rotation. If an overcurrent trip occurs during a frequency matching restart, increase the restart standby time.
- Even when the Free-run Stop Selection is set to 01 (Frequency matching start), the inverter may restart at 0 Hz in the following cases.
  - The output frequency is equal to or lower than 1/2 of the base frequency.
  - The motor induction voltage decreases quickly.
  - The inverter recognizes that the detected frequency is equal to or less than the value set in the Frequency Matching Lower Limit Frequency (b007).

(Example 3) Frequency pull-in restart (b088 = 02)



- When the set Restart Standby Time (b003) elapses, the inverter starts to output at the frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030).
- Then, the inverter decelerates the motor according to the Frequency Pull-in Restart Parameter (b029) setting, while suppressing the output current to the value set in the Frequency Pull-in Restart Level (b028).
- When the current decreases to or below the Frequency Pull-in Restart Level (b028), the inverter accelerates the motor again to return to the original frequency.
- If this method causes an overcurrent trip, decrease the value set in the Frequency Pull-in Restart Level (b028).

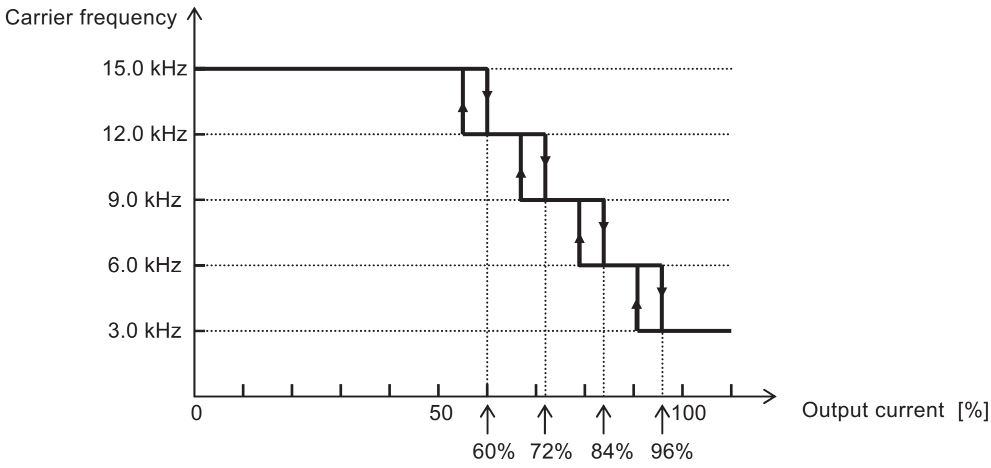
Automatic Carrier Frequency Reduction Function

- Use this function to reduce the carrier frequency automatically as the output current increases.
- To enable this function, set the Automatic Carrier Reduction (b089) to 01 (Enable).

Parameter No.	Function name	Data	Default data	Unit
b089	Automatic Carrier Reduction	00: Disabled 01: Enabled, dependent on the current	00	–

- When the output current exceeds 60%, 72%, 84%, and 96% of the rated current, this function reduces the carrier frequency to 12, 9, 6, and 3 kHz, respectively.
  The normal carrier frequency will be restored when the output current exceeds the carrier reduction start level –5% (Reset level).

Carrier reduction start level (Reset level)	Reduced carrier frequency (kHz)
Less than 60% of rated current	15.0
60% (55%) of rated current	12.0
72% (67%) of rated current	9.0
84% (79%) of rated current	6.0
96% (91%) of rated current	3.0



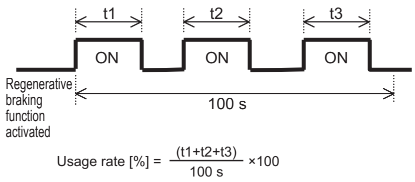
- The carrier frequency reduction rate is 2 kHz per second.
- The upper limit of the carrier frequency range in which this function operates is the value set in the Carrier Frequency (b083); the lower limit of the carrier frequency range is 3 kHz.

Note This function is disabled when the Carrier Frequency (b083) is set to 3 kHz or less, independent of the b089 setting.

Regenerative Braking Function

- When decelerating, generating downward movement, or being rotated by an external load (that is, when the output torque direction and the rotation direction are opposite), the motor serves as a generator and the regenerated energy is fed back to the inverter.
  However, 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.
- The regenerative braking function uses the built-in or an external regenerative braking circuit to decrease the internal DC voltage of the inverter by converting the regenerated energy from the motor into heat via external braking resistors.
- Connect external braking resistors or external regenerative braking units according to the description of External Braking Resistor Connection Terminal/Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-20.
  The regenerative braking function is enabled only when the inverter is connected with external braking resistors/external regenerative braking units.
- The following models have a built-in regenerative braking circuit. Connect external braking resistors only.
  [200-V class] 3G3RX-A2004-V1 (0.4 kW) to 3G3RX-A2220-V1 (22 kW)
  [400-V class] 3G3RX-A4004-V1 (0.4 kW) to 3G3RX-A4220-V1 (22 kW)
- To use models other than the above or process a very large amount of regenerative energy, you need to use regenerative braking units.
- To use the built-in regenerative braking function of the inverter, set the Regenerative Braking Selection (b095) to 01 or 02 (Enabled).
  Normally, this parameter is set to 01 (Enabled: Disabled during stop).
  At this time, set the usage condition [%] of the braking resistor in use in the Usage Rate of Regenerative Braking (b090).
  Note that the regenerative braking function is enabled only when both b090 and b095 are set.
- For the Regenerative Braking ON Level (b096), you need not change the default data normally.
  This parameter is used for adjusting the level at which the regenerative braking function operates according to the input power supply voltage.
- External regenerative braking units are processed on the external regenerative braking unit side.
  Therefore, set the Regenerative Braking Selection (b095) to 00 (Disabled). In this case, the b090 and b096 settings are ignored.

- To this function, set the Overvoltage Suppression Function Selection During Deceleration (b130) to 00 (Disabled).

Parameter No.	Function name	Data	Default data	Unit
b090	Usage Rate of Regenerative Braking	0.0: Regenerative braking not active 0.1 to 100.0 Set the usage rate of the regenerative braking function in units of 0.1%. Exceeding the set usage rate causes a trip error. 	0.0	%
b095	Regenerative Braking Selection	00: Disabled 01: Enabled (Disabled during stop) 02: Enabled (Enabled during stop)	00	–
b096	Regenerative Braking ON Level	200-V class: 330 to 380 VDC*1	200-V class: 360 V	V
		400-V class: 660 to 760 VDC*1	400-V class: 720 V	

*1. Regenerative Braking ON Level refers to the voltage setting for the internal converter (DC unit) of the inverter. Normally, use the default data.

Precautions for Correct Use

- To use the built-in regenerative braking function of the inverter, be sure to set both the Usage Rate of Regenerative Braking (b090) and the Regenerative Braking Selection (b095). Otherwise, the function cannot work.
- Setting the Regenerative Braking ON Level (b096) to the input power supply voltage or lower causes the built-in regenerative braking function to be always active, which results in overheating or burning of the braking resistor. Be sure to set this to a value higher than the input power supply voltage multiplied by the square root of 2. Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.
- To use the regenerative braking function, connect external braking resistor(s) or external regenerative braking unit(s) according to the description of External Braking Resistor Connection Terminal/Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-20. Be sure to install a circuit that detects overheating of the braking resistor(s) and the regenerative braking unit(s) via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.

Cooling Fan Control

Select whether to enable the inverter's built-in cooling fan constantly or only during inverter operation.

Parameter No.	Function name	Data	Default data	Unit
b092	Cooling Fan Operation	00: Always enabled 01: Enabled only during RUN (Operates for 5 minutes after power on and after stop.)	01	–

Precautions for Correct Use

If a power interruption or power shutoff occurs when the cooling fan is operating, the cooling fan will stop temporarily and, when the power supply is restored, restart automatically.

External Thermistor (TH)

- You can provide thermal protection for external equipment such as a motor by connecting the thermistor installed on it to the inverter.
- To do so, set the following functions according to the specifications of the thermistor.

Parameter No.	Function name	Data	Default data	Unit
b098	Thermistor Selection	00: Disabled 01: PTC enabled (Positive temperature coefficient resistor element) 02: NTC enabled (Negative temperature coefficient resistor element)	00	–
b099	Thermistor Error Level	0. to 9999.	3000.	O
C085	Thermistor Adjustment	0.0 to 999.9 1000.	Factory setting	–

Precautions for Correct Use

- Setting the Thermistor Selection (b098) to 01 or 02 (Enable) when the inverter is not connected to any external thermistor causes a trip.
- Connect an external thermistor between the control terminals TH and SC.
- To use this function, keep the wiring distance between the motor and the inverter at 20 m or shorter. Since the current flowing through the thermistor is weak, take measures, such as isolating the thermistor cable, to prevent noise due to the motor current.

Brake Control Function

Use this function to control the external brake used in an elevating system etc. from the inverter.

The brake control function can be used independent of the 1st/2nd/3rd Control Method (A044/A244/A344) selection. When the Brake Control Function Selection (b120) is set to 01 (Enabled), the inverter operates as follows.

(1) When the RUN command is input, the inverter starts to output and accelerates to the Brake Release Frequency (b125).

(2) After reaching the Brake Release Frequency, the inverter outputs the brake release signal (BRK) when the Brake Release Wait Time (b121) elapses. However, if the output current of the inverter is less than the Brake Release Current (b126), the inverter trips and outputs the brake error signal (BER) instead of the brake release signal.

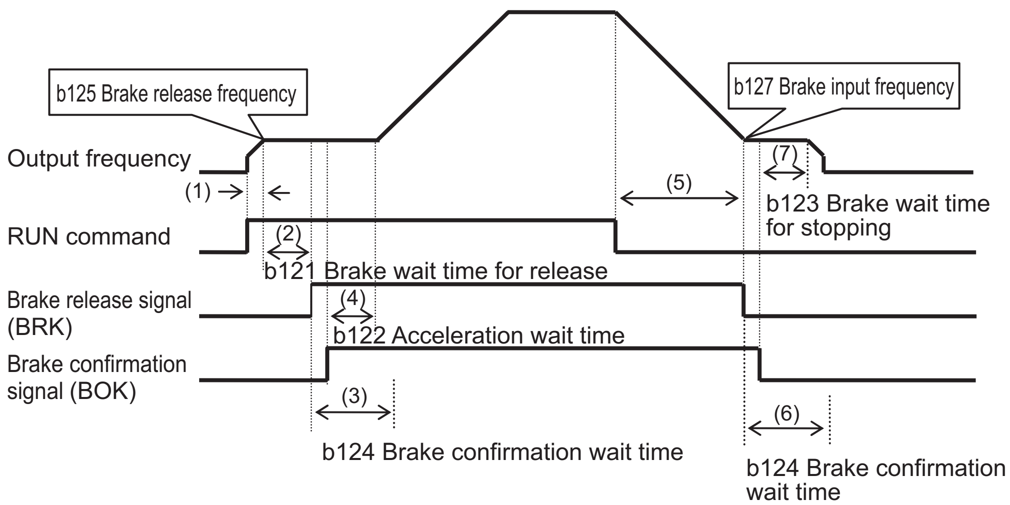
(3) If the brake confirmation signal (BOK) is allocated to a multi-function input terminal (if the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 44), after the brake release signal is output, the inverter waits for the brake confirmation signal during the Brake Error Detection Time(b124) without starting acceleration. If the brake confirmation signal does not turn ON within the period set in b124, the inverter outputs the brake error signal (BER) and trips. If the brake confirmation signal is not allocated to any multi-function input terminal, the Brake Error Detection Time (b124) setting is disabled and the inverter proceeds to step (4) after the brake release signal is output.

(4) After the brake confirmation signal is input (or after the brake release signal is output if BOK is not selected), the inverter restarts acceleration up to the set frequency after the period set in the Acceleration Wait Time on Brake Control (b122) elapses.

(5) After the RUN command is turned OFF, the inverter decelerates to the Brake Force Frequency (b127) and turns OFF the brake release signal (BRK).

(6) If the brake confirmation signal (BOK) is allocated to a multi-function input terminal (if the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 44), after the brake release signal turns OFF, the inverter waits for the brake confirmation signal during the Brake Error Detection Time (b124) without starting deceleration. If the brake confirmation signal does not turn OFF within the period set in b124, the inverter outputs the brake error signal (BER) and trips. If the brake confirmation signal is not allocated to any multi-function input terminal, the Brake Error Detection Time (b124) setting is disabled and the inverter proceeds to step (7) after the brake release signal turns OFF.

(7) After the brake confirmation signal turns OFF (or after the brake release signal turns OFF if BOK is not selected), the inverter restarts deceleration down to 0 Hz after the period set in the Stop Wait Time on Brake Control (b123) elapses.



Precautions for Correct Use

The above operation chart applies to a case where 44: BOK (Brake confirmation signal) is allocated to one of the Multi-function Input S1 to S8 Selection (C001 to C008). If BOK is not selected, the Acceleration Wait Time on Brake Control (b122) starts when the brake release signal turns ON and the Stop Wait Time on Brake Control (b123) starts when the brake release signal turns OFF.

- To use the brake control function, allocate the following functions to multi-function I/O terminals, as required.

(1) To input a brake release signal from an external brake to the inverter, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 44: BOK (Brake confirmation signal).

(2) To release a brake, allocate one of the multi-function output terminals P1 to P5 (C021 to C025) to 19: BRK (Brake release signal). Also, to use a brake error output signal, allocate one of them to 20: BER (Brake error).

- When using the brake control function, it is recommended to use sensorless vector control (A044 = 03), 0-Hz sensorless vector control (A044 = 04), or Sensor vector control (A044 = 05), which generates a high torque during startup.

Parameter No.	Function name	Data	Default data	Unit
b120	Brake Control Function Selection	00: Disabled 01: Enabled	00	–
b121	Brake Release Wait Time	0.00 to 5.00: Set the time required for the output current to reach the brake release current after reaching the brake release frequency.	0.00	s
b122	Acceleration Wait Time on Brake Control	0.00 to 5.00: Set the mechanical delay time from when the brake release signal is output until the brake is released.	0.00	s
b123	Stop Wait Time on Brake Control	0.00 to 5.00: Set the mechanical delay time from when the brake release signal turns OFF until the brake is applied.	0.00	s
b124	Brake Error Detection Time	0.00 to 5.00: Set this to longer than the time from when the release signal is output until the release completion signal output by the brake is input to the inverter.	0.00	s
b125	Brake Release Frequency	0.00 to 99.99/100.0 to 400.0 [Hz]: Set the frequency at which the brake release signal is output. *1	0.00	Hz
b126	Brake Release Current	0.0 to 2.00 x Rated current (0.4 to 55 kW)*2 0.0 to 1.80 x Rated current (75 to 132 kW)*2	Rated current value	–
b127	Brake Force Frequency	0.00 to 99.99/100.0 to 400.0: Set the frequency at which the brake is closed during stop.*1	0.00	Hz
Related functions		C001 to C008, C021 to C025		

*1. Set this to a value larger than the Starting Frequency (b082).

*2. If the set value is too low, the inverter may not output a sufficient torque when the brake is released.

In the following cases, the inverter trips and outputs the brake error signal (BER). (Brake error: E36)

- The output current remains lower than the brake release current when the Brake Release Wait Time (b121) has elapsed.
- If the brake confirmation signal (BOK) is used, this error is detected when:
  - The brake confirmation signal did not turn ON within the Brake Error Detection Time (b124) during acceleration.
  - The brake confirmation signal did not turn ON within the Brake Error Detection Time (b124) during deceleration.
  - The brake confirmation signal turned OFF although the brake release signal is output.

Overvoltage Suppression Function during Deceleration

- Use this function to prevent overvoltage trip caused by the regenerative energy from the motor during deceleration.
- Enable or disable the function in the Overvoltage Suppression Function Selection During Deceleration (b130).
- If the Overvoltage Suppression Function Selection During Deceleration (b130) is set to 01 (Enabled: DC voltage constant control), the inverter decelerates automatically so that the increase in the main circuit DC voltage due to the start of deceleration is maintained to the Overvoltage Suppression Level During Deceleration (b131).
- If the Overvoltage Suppression Function Selection During Deceleration (b130) is set to 02 (Enabled: acceleration enabled), the inverter starts accelerating according to the Overvoltage Suppression Parameter During Deceleration (b132) setting when the main circuit DC voltage increases due to the start of deceleration to exceed the Overvoltage Suppression Level During Deceleration (b131). After that, when the main circuit DC voltage falls below the value set in b131, the inverter restrats deceleration.
- To use this function, set the Usage Rate of Regenerative Braking (b090) to 0.0 (Disabled) and the Regenerative Braking Selection (b095) to 00 (Disabled).

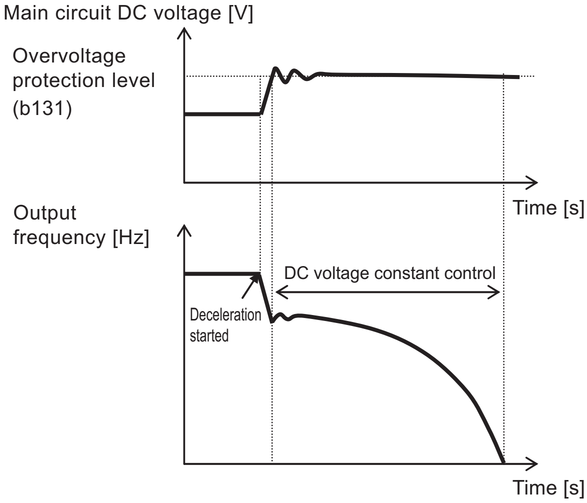
Parameter No.	Function name	Data	Default data	Unit
b130	Overvoltage Suppression Function Selection During Deceleration	00: Disabled 01: Enabled (DC voltage constant control) (Example 1)*1 02: Enabled (Acceleration enabled) (Example 2)	01*3	–
b131	Overvoltage Suppression Level During Deceleration*2	200-V class: 330 to 390 400-V class: 660 to 780	380/760	V
b132	Overvoltage Suppression Parameter During Deceleration	0.10 to 30.00: Set the acceleration rate applied when this function is enabled.	1.00	s
b133	Overvoltage Suppression Proportional Gain During Deceleration	0.00 to 2.55: Proportional gain for DC voltage constant control (b130 = 01 only)	0.50	–
b134	Overvoltage Suppression Integral Time During Deceleration	0.000 to 9.999/10.00 to 65.53: Integral time for DC voltage constant control (b130 = 01 only)	0.060	s

*1 When b130 is set to 01, PI control works to keep the internal DC voltage constant. Although increasing the Overvoltage Suppression Proportional Gain During Deceleration (b133) provides a faster response, setting it to an excessive large value may cause an overcurrent trip. Increasing the Overvoltage Suppression Integral Time During Deceleration (b134) also provides a faster response, but setting it to an excessive small value may cause an overcurrent trip.

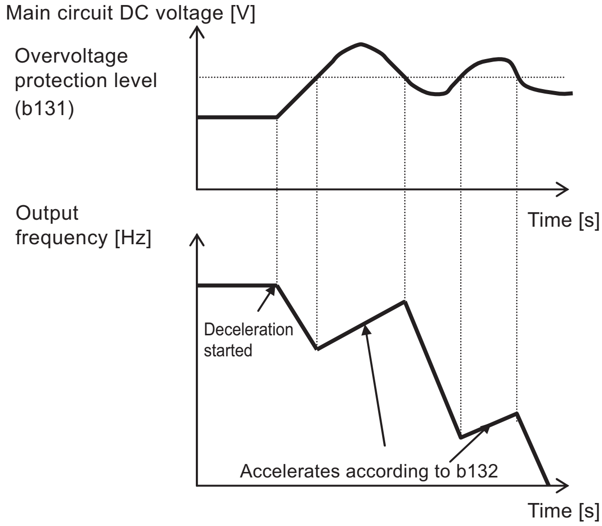
*2 If b131 is set to a value less than the incoming voltage, the inverter may not be able to stop the motor. Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.

*3 The default data was changed from the previous model.

(Example 1) When DC voltage is kept constant (b130 = 01)



(Example 2) Before acceleration starts (b130 = 02)



Precautions for Correct Use

- When the Overvoltage Suppression Function during Deceleration function is enabled, the actual deceleration time is longer than the set time.
  If the motor load inertia is considerably large, the motor may take a long time to stop.
  To shorten the time until the motor stops, change to the deceleration stop method according to *5-12-2 Regenerative Braking Function* on page 5-70.
- Setting the Overvoltage Suppression Level During Deceleration (b131) to a value less than the input power supply voltage prevents deceleration.
  Be sure to set this to a value higher than the input power supply voltage multiplied by the square root of 2.
  Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.
- Even when the Overvoltage Suppression Function during Deceleration function is enabled, rapid deceleration may cause a trip error if the motor cannot respond in time.
  In this case, change to the deceleration stop method according to *5-12-2 Regenerative Braking Function* on page 5-70.

Initial Screen Automatic Return Function

To enable this function, set the Initial Screen Automatic Return Function (b164) to 01 (Enabled). When enabled, the function will automatically switch the display to the initial screen set in the Initial Screen Selection (b038) if the Digital Operator is not operated for 10 minutes.

Parameter No.	Function name	Data	Default data	Unit
b164	Initial Screen Automatic Return Function	00: Automatic return disabled 01: Automatic return enabled	00	–

7-5 Multi-function Terminal Functions (Group C)

This section describes the multi-function input selection and other function parameters related to the I/O signals of the inverter.

Multi-function Input Selection

- You can allocate any of the following functions to the multi-function input terminals S1 to S8 to use them. To do so, set the Multi-function Input S1 to S8 Selection (C001 to C008) according to the table below.
- Do not allocate the same function to more than one multi-function input terminal. If you allocate the same function to two or more multi-function input terminals by mistake, the function will be set only for the terminal to which you allocated the function last and the terminal to which the function is allocated previously will be reset to 255 (no: No allocation).
- When the emergency shutoff function is enabled (SW1 = ON), the Multi-function Input S1 Selection (C001) and Multi-function Input S3 Selection (C003) data will be force-rewritten with 18 (RS) and 64 (EMR), respectively. “64 (EMR)” cannot be set via the Digital Operator. In addition, if you turn ON and then OFF the switch SW1, the Multi-function Input S3 Selection (C003) will be set to 255 (no: No allocation).

Parameter No.	Data	Function name	Reference item	Page
Multi-function Input S1 to S8 Selection C001 to C008	01	RV: Reverse	RUN Command Selection	5-23
	02	CF1: Multi-step speed setting binary 1	Multi-step Speed Operation Function	5-53
	03	CF2: Multi-step speed setting binary 2		
	04	CF3: Multi-step speed setting binary 3		
	05	CF4: Multi-step speed setting binary 4		
	06	JG: Jogging	Jogging operation function	5-56
	07	DB: External DC injection braking	External DC injection braking	7-38
	08	SET: 2nd control	2nd control function	5-8
	09	2CH: 2-step acceleration/ deceleration	2-step Acceleration/Deceleration Function	5-41
	11	FRS: Free-run stop	Free-run Stop Selection	5-43
	12	EXT: External trip	External trip	7-112
	13	USP: Power recovery restart prevention function	Power Recovery Restart Prevention Function	7-112
	14	CS: Commercial switch	Commercial switching	7-113
	15	SFT: Soft lock	Soft Lock Function	7-75
	16	AT: Analog input switch	Analog Input (FV, FI, FE)	5-27
	17	SET3: 3rd control	3rd control function	7-111
	18	RS: Reset	Reset	7-115
	20	STA: 3-wire start	3-wire input function	5-58
	21	STP: 3-wire stop		
	22	F/R: 3-wire forward/reverse		
	23	PID: PID disabled	PID Function	7-45
	24	PIDC: PID integral reset		
	26	CAS: Control gain switching	Control gain switching function	6-29
	27	UP: Remote operation accelerated	Up/Down function	7-119
	28	DWN: Remote operation decelerated		
	29	UDC: Remote data clear		
	31	OPE: Forced operator function	Forced Digital Operator function	7-120

Parameter No.	Data	Function name	Reference item	Page
Multi-function Input S1 to S8 Selection C001 to C008	32	SF1: Multi-step speed setting bit 1	Multi-step Speed Operation Function	5-53
	33	SF2: Multi-step speed setting bit 2		
	34	SF3: Multi-step speed setting bit 3		
	35	SF4: Multi-step speed setting bit 4		
	36	SF5: Multi-step speed setting bit 5		
	37	SF6: Multi-step speed setting bit 6		
	38	SF7: Multi-step speed setting bit 7		
	39	OLR: Overload limit switching	Overload Limit/Overload Warning	7-72
	40	TL: Torque limit enabled/disabled	Torque Limit Function	7-82
	41	TRQ1: Torque limit switching 1		
	42	TRQ2: Torque limit switching 2		
	43	PPI: P/PI switching	P/PI switching	6-28
	44	BOK: Brake confirmation	Brake Control Function	7-104
	45	ORT: Orientation	Orientation Function	6-53
	46	LAC: LAD cancel	LAD Cancel Function	7-15
	47	PCLR: Position deviation clear	V2 Control Mode Selection	6-15
	48	STAT: Pulse train position command permission		
	50	ADD: Set frequency A145 addition	Frequency Addition Function	7-60
	51	F-TM: Forced terminal block	Forced Terminal Block Function (F-TM)	7-121
	52	ATR: Torque command input permission	Torque Control	6-56
	53	KHC: Integrated power clear	Integrated Power Monitor	7-7
	54	SON: Servo ON	Servo ON Function	6-43
	55	FOC: Preliminary excitation	Preliminary Excitation Function (FOC)	7-122
	56	MI1: General-purpose input 1	DriveProgramming Function	7-26
	57	MI2: General-purpose input 2		
	58	MI3: General-purpose input 3		
	59	MI4: General-purpose input 4		
	60	MI5: General-purpose input 5		
	61	MI6: General-purpose input 6		
	62	MI7: General-purpose input 7		
	63	MI8: General-purpose input 8		
	65	AHD: Analog command held	Analog Command Hold Function	7-122
	66	CP1:Position command selection 1	Absolute Position/High-resolution Absolute Position Control Mode	6-40
	67	CP2: Position command selection 2		
	68	CP3: Position command selection 3		
	69	ORL: Zero return limit signal		
	70	ORG: Zero return startup signal		
	71	FOT: Forward driving stop		
	72	ROT: Reverse driving stop		
	73	SPD: Speed/Position switching		
	74	PCNT: Pulse counter	Multi-function Pulse Counter	7-123
	75	PCC: Pulse counter clear		
	82	PRG: DriveProgramming start	DriveProgramming Function	7-26
	no	NO: No allocation	–	–

Multi-function Input Operation Selection

- The multi-function input terminals can be set to either NO (Normally open contact) or NC (Normally closed contact) individually.

<table>
<tr><th>Parameter No.</th><th>Function name</th><th>Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>C011</td><td>Multi-function Input S1 Operation Selection</td><td rowspan="9">00: NO (Normally open contact)
01: NC (Normally closed contact)
• Each multi-function input terminal S1 to S8 and the terminal FW can be set individually to either an NO contact or NC contact input terminal.
NO contact: ON when closed, OFF when open
NC contact: ON when open, OFF when closed
• The terminal allocated to 18 (RS: Reset) cannot be set to NC contact. Be sure to set NO contact.</td><td rowspan="8">00</td><td rowspan="8">–</td></tr>
<tr><td>C012</td><td>Multi-function Input S2 Operation Selection</td></tr>
<tr><td>C013</td><td>Multi-function Input S3 Operation Selection</td></tr>
<tr><td>C014</td><td>Multi-function Input S4 Operation Selection</td></tr>
<tr><td>C015</td><td>Multi-function Input S5 Operation Selection</td></tr>
<tr><td>C016</td><td>Multi-function Input S6 Operation Selection</td></tr>
<tr><td>C017</td><td>Multi-function Input S7 Operation Selection</td></tr>
<tr><td>C018</td><td>Multi-function Input S8 Operation Selection</td></tr>
<tr><td>C019</td><td>Forward RUN Command FW Operation Selection</td><td>00</td><td>–</td></tr>
<tr><td colspan="2">Related functions</td><td colspan="3">C001 to C008</td></tr>
</table>

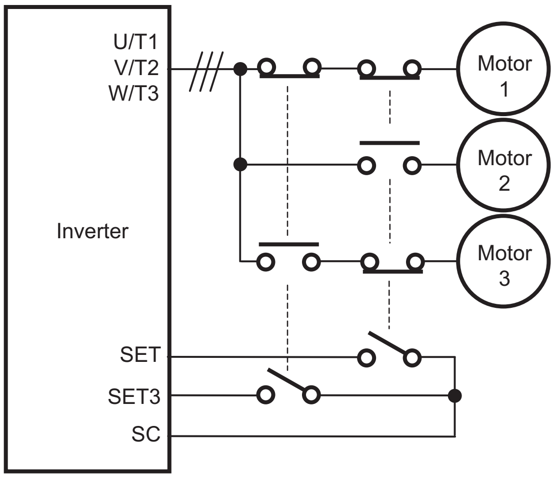
2nd/3rd Control Functions

- Use this function to control three motors by switching.
- To switch among three motors, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON/OFF the terminal SET or SET3.

The functions that support switching of motor via the SET/SET3 terminal are as follows.

F002/F202/F302*1:	1st/2nd/3rd	Acceleration Time 1
F003/F203/F303*1:	1st/2nd/3rd	Deceleration Time 1
A003/A203/A303:	1st/2nd/3rd	Base Frequency
A004/A204/A304:	1st/2nd/3rd	Maximum Frequency
A020/A220/A320*1:	1st/2nd/3rd	Multi-step Speed Reference 0
A041/A241:	1st/2nd	Torque Boost Selection
A042/A242/A342*1:	1st/2nd/3rd	Manual Torque Boost Voltage
A043/A243/A343*1:	1st/2nd/3rd	Manual Torque Boost Frequency
A044/A244/A344:	1st/2nd/3rd	Control Method
A046/A246*1:	1st/2nd	Automatic Torque Boost Voltage Compensation Gain
A047/A247*1:	1st/2nd	Automatic Torque Boost Slip Compensation Gain
A061/A261*1:	1st/2nd	Frequency Upper Limit
A062/A262*1:	1st/2nd	Frequency Lower Limit
A092/A292/A392*1:	1st/2nd/3rd	Acceleration Time 2
A093/A293/A393*1:	1st/2nd/3rd	Deceleration Time 2
A094/A294:	1st/2nd	2-step Acceleration/Deceleration Selection
A095/A295:	1st/2nd	2-step Acceleration Frequency
A096/A296:	1st/2nd	2-step Deceleration Frequency
b012/b212/b312*1:	1st/2nd/3rd	Electronic Thermal Level
b013/b213/b313*1:	1st/2nd/3rd	Electronic Thermal Characteristics Selection
H002/H202:	1st/2nd	Motor Parameter selection
H003/H203:	1st/2nd	Motor Capacity
H004/H204:	1st/2nd	Motor Pole Number
H005/H205*1:	1st/2nd	Speed Response
H006/H206/H306*1:	1st/2nd/3rd	Stabilization Parameter
H020/H220:	1st/2nd	Motor Parameter R1
H021/H221:	1st/2nd	Motor Parameter R2
H022/H222:	1st/2nd	Motor Parameter L
H023/H223:	1st/2nd	Motor Parameter Io
H024/H224:	1st/2nd	Motor Parameter J
H030/H230:	1st/2nd	Motor Parameter R1 (Auto-tuning Data)
H031/H231:	1st/2nd	Motor Parameter R2 (Auto-tuning Data)
H032/H232:	1st/2nd	Motor Parameter L (Auto-tuning Data)
H033/H233:	1st/2nd	Motor Parameter Io (Auto-tuning Data)
H034/H234:	1st/2nd	Motor Parameter J (Auto-tuning Data)
H050/H250*:	1st/2nd	PI Proportional Gain
H051/H251*:	1st/2nd	PI Integral Gain
H052/H252*:	1st/2nd	P Proportional Gain
H060/H260*:	1st/2nd	Limit at 0 Hz

*1 *: For these parameters, data can be changed during operation.



Precautions for Correct Use

It is not possible to distinguish among the 1st/2nd/3rd control functions on the Digital Operator display. Check the ON/OFF status of each terminal to determine which control function is enabled.

When the terminals SET and SET3 are both ON, SET is given priority, which means that the 2nd control function is enabled.

During operation, you cannot switch among the 1st, 2nd, and 3rd control functions. Switching is possible only during stop.

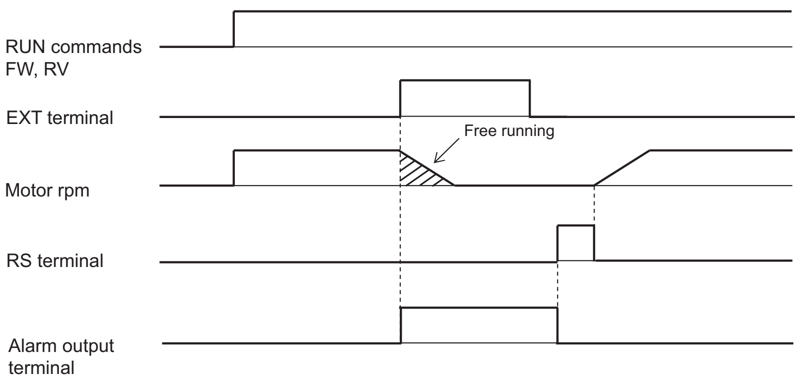
External Trip (EXT)

Use this parameter to have the inverter trip via an error (trip) signal generated by a peripheral system. To do so, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 12 (EXT).

Data	Symbol	Function name	Status	Description
12	EXT	External trip	ON	Shuts off output to set motor in a free-run state.
			OFF	Motor is in normal operation.

Note Do not turn ON the terminal EXT after turning off the power supply. Otherwise, the inverter may not store the error status correctly.

- When the EXT terminal turns ON, the inverter trips with the alarm code E12 displayed and stops output.
- Once the inverter trips with the alarm code E12 displayed, the trip status will not be reset even if the error signal is reset from external equipment (the terminal EXT is turned OFF).
- In this case, perform the reset operation or turn off and then the power supply again to reset the trip.



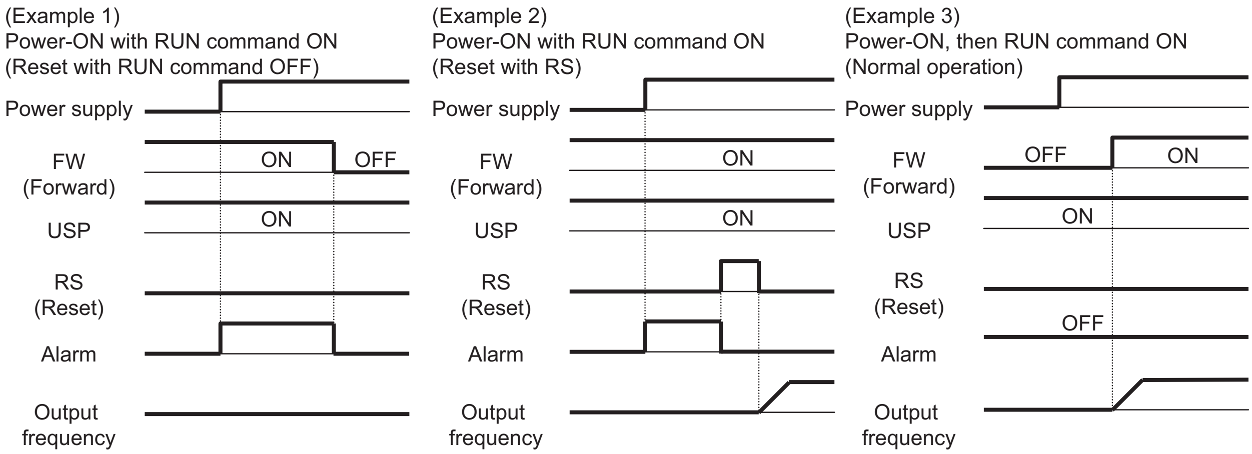
Power Recovery Restart Prevention Function (USP)

Use this function to cause the inverter to trip with the alarm code E13 displayed, if the power supply is turned on with the RUN command input in the inverter.

Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 13 (USP).

Data	Symbol	Function name	Status	Description
13	USP	Power recovery restart prevention function	ON	Disables restart of Inverter with RUN command input at power-on.
			OFF	Enables restart of Inverter with RUN command input at power-on.

- To reset a trip, perform the reset operation, or turn OFF the RUN command. (Example 1)
- If a trip is reset with the RUN command input, the inverter starts operating immediately after the trip is reset. (Example 2)
- If the RUN command turns ON after the power supply is turned on, the inverter operates normally. (Example 3)
- The following shows how the power recovery restart prevention function works.



Commercial Switch (CS)

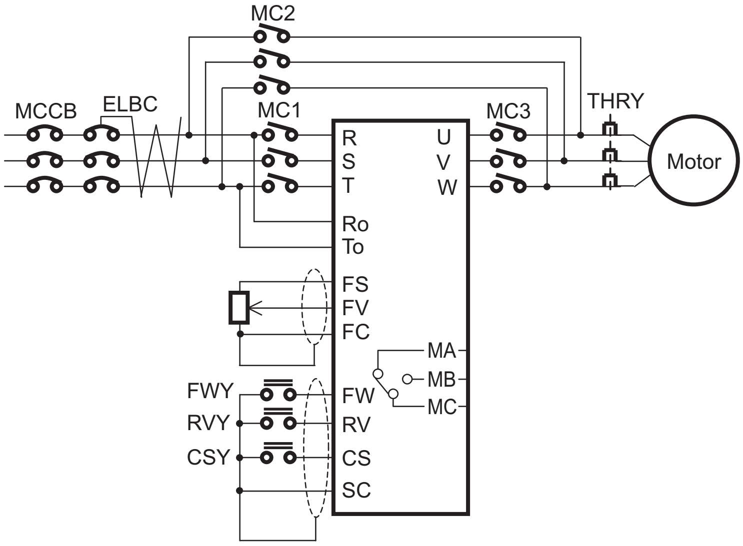
- Use this function to drive a system subject to a large load inertia moment during acceleration and deceleration with the inverter and during constant speed operation with a commercial power supply, respectively.
- Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 14 (CS).
- When the terminal CS turns ON with the RUN command input, the inverter shuts off its output. Be sure that the output is maintained while the motor sequence is switched.
- When the terminal CS is turned from ON to OFF with the RUN command ON, after expiration of the Restart Standby Time (b003), the inverter accelerates at the frequency according to the rotation speed of the motor in a free-run state (“frequency matching restart”). However, the inverter may restart at 0 Hz in any of the following cases:

The motor rotation speed is equal to or lower than 1/2 of the base rotation speed.
The motor induction voltage decreases quickly.

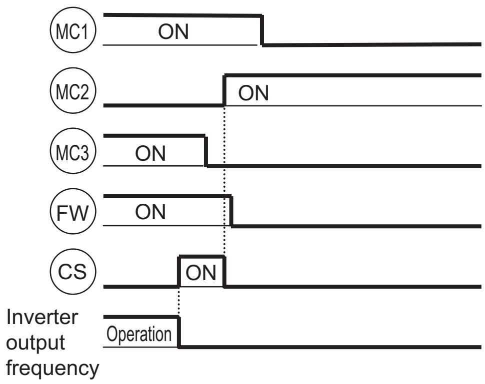
- When the Frequency Matching Lower Limit Frequency (b007) is set, the inverter may restart at 0 Hz if the motor rotation speed decreases to the set frequency. (Refer to page 7-63.)

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	14: CS (Commercial switch)	–	–

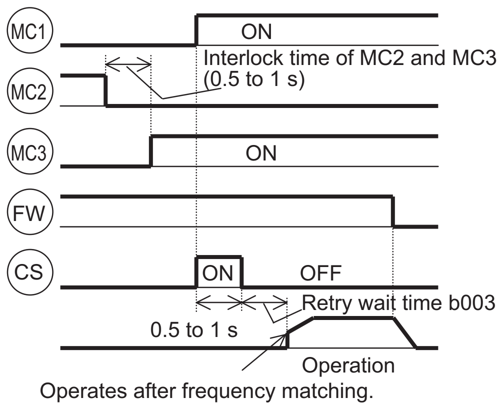
Connection and timing diagrams for commercial switching operation



Inverter-to-Commercial
switching operation timing diagram



Commercial-to-Inverter
switching operation timing diagram



- Make sure that MC3 and MC2 are mechanically interlocked. Not doing so may result in damage to the inverter.
- If the earth leakage breaker (ELB) trips due to a ground fault, the commercial power supply circuit does not work as well. If necessary, provide a backup power supply circuit separate from the commercial circuit.
- If an overcurrent trip occurs during frequency matching, increase the Restart Standby Time (b003).
- For commercial switching operation, refer to the above Connection and timing diagrams for commercial switching operation.
- For FWY, RVY, and CSY, use low-voltage relays. Use the above timing sequence diagrams for reference.
- The inverter can be set up to restart automatically at power-on. In this case, the terminal CS is not required. For details, refer to *Reset (RS)* on page 7-115.

Reset (RS)

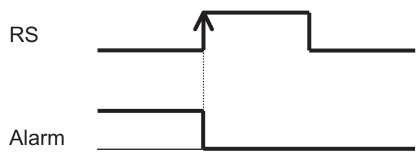
- Use the reset function to reset the trip status of the inverter. This function is used also when the inverter operates normally to shut off the inverter output.
  To disable the reset function when the inverter operates normally, set the Reset Selection (C102) to 02 (Enabled only during trip) or 03 (Trip reset only).
- If the reset signal is input to the inverter, calculated electronic thermal function data, calculated regenerative braking usage rate data, multi-function pulse counter/current position counter data, and internal counter data used for the Teaching Selection (P074) and protective function are cleared.
  To prevent these data from being cleared, set the Reset Selection (C102) to 03 (Trip reset only).
- Setting the STOP Key Selection (b087) to 00 (Enabled) or 02 (Only RESET enabled) enables the input of the reset signal via the STOP/RESET key on the Digital Operator.
- To input the reset signal via the control circuit terminal block, set the Multi-function Input S1 to S8 Selection (C008) to 18 (RS: Reset).
- The terminal RS (Reset) only supports NO (normally open contact) as the input method.
  Therefore, the Multi-function Input S1 to S8 Operation Selection (C011 to C018) cannot be set to 01 (NC: Normally closed contact). Be sure to set NO contact.
  In addition, setting the Reset Selection (C102) to 02 (Trip reset at power-off) enables the reset function to be activated at the falling edge of the signal.
- In the Reset Restart Selection (C103), select the restart method after reset is executed.
  Setting C103 to 01 (Frequency matching restart) causes the inverter to perform frequency matching restart also after the power supply is turned off and then on again.
  However, when the Reset Selection (C102) is set to 03 (Trip reset only), or when the Reset Restart Selection (C103) is set to 00 (0-Hz restart), the inverter does not restart.

Parameter No.	Function name	Data		Default data	Unit
b003	Restart Standby Time	0.3 to 100.0		1.0	s
b007	Frequency Matching Lower Limit Frequency	0.00 to 99.99 100.0 to 400.0		0.00	Hz
b028	Frequency Pull-in Restart Level	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (0.4 to 55 kW)	Rated current value	A
			0.20 x Rated current to 1.80 x Rated current (75 to 132 kW)		
		Light load (VT)	0.20 x Rated current to 1.50 x Rated current	Rated current value	
b029	Frequency Pull-in Restart Parameter	0.10 to 30.00		0.50	s
b030	Starting Frequency Selection at Frequency Pull-in Restart	00: Frequency at shutoff 01: Max. frequency 02: Set frequency		00	–
C102	Reset Selection	00: Trip reset at power-on (Example 1) 01: Trip reset at power-off (Example 2) 02: Enabled only during trip (Reset at power-on) (Example 1) 03: Trip reset only (Example 1)		02	–
C103	Reset Restart Selection	00: 0-Hz restart 01: Frequency matching restart (Example 3) 02: Frequency pull-in restart (Example 4)		00	–
C001 to C008	Multi-function Input S1 to S8 Selection	18: RS (reset)		–	–

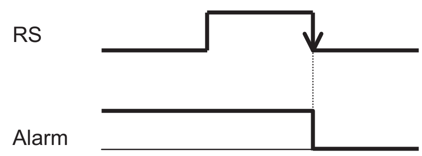
Precautions for Correct Use

The reset function clears calculated electronic thermal function data, calculated regenerative braking usage rate data, and other data. Therefore, if the reset function is often used, the motor overload protection and braking resistor overheat protection cannot be performed properly. If you need to execute the reset function more than once, provide a few minutes of interval between each execution. To shut off the inverter output, use the free-run stop function, instead of the reset function.

(Example 1)Trip reset at power-on
(C102 = 00, 02, 03)



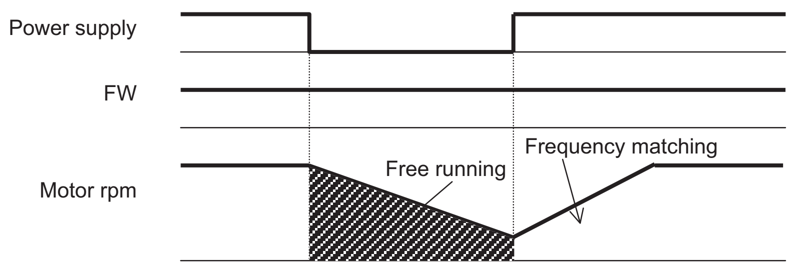
(Example 2)Trip reset at power-off
(C102 = 01)



(Example 3) Frequency matching restart

Setting Reset Restart Selection (C103) to 01 (Frequency matching restart) causes the inverter to perform frequency matching restart also after the power supply is turned off and then on again. Also, when it is set to 00 (0-Hz restart), the Restart Standby Time (b003) will be ignored. However, even when the Free-run Stop Selection is set to 01 (Frequency matching start), the inverter may restart at 0 Hz in the following cases.

The output frequency is equal to or lower than 1/2 of the base frequency.
The motor induction voltage decreases quickly.
The inverter recognizes that the detected frequency is equal to or less than the value set in the Frequency Matching Lower Limit Frequency (b007).



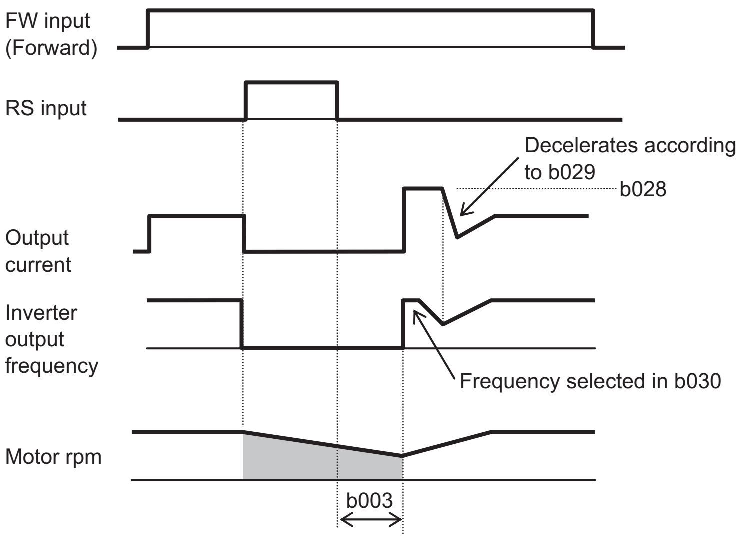
(Example 4) Frequency pull-in restart

When the set Restart Standby Time (b003) elapses, the inverter starts to output at the frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030).

Then, the inverter decelerates the motor according to the Frequency Pull-in Restart Parameter (b029) setting, while suppressing the output current to the value set in the Frequency Pull-in Restart Level (b028).

When the current decreases to or below the Frequency Pull-in Restart Level (b028), the inverter accelerates the motor again to return to the original frequency.

If this method causes an overcurrent trip, decrease the value set in the Frequency Pull-in Restart Level (b028).



Additional Information

If the reset signal is input during the restart standby time, the “frequency at shutoff” value stored in the inverter will be cleared, which results in a 0-Hz start.

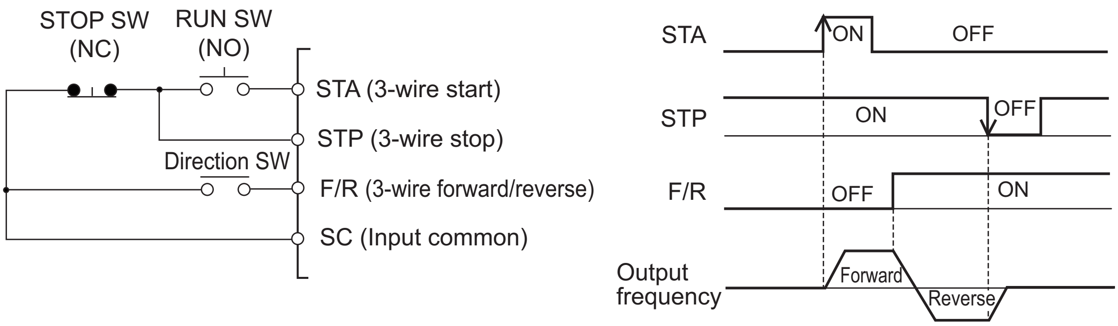
3-wire Input Function (STA, STP, F/R)

- Use this function to start and stop the inverter via an automatic reset contact such as a pushbutton switch.
- Set the Multi-function Input S1 to S8 Selection (C001 to C008) to 20 (STA), 21 (STP), and 22 (F/R).
- Set the RUN Command Selection (A002) to 01 (Control circuit terminal block).
- Allocating the terminal STP disables the terminals FW and RV.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	20: STA (3-wire start) 21: STP (3-wire stop) 22: F/R (3-wire forward/reverse)	–	–

Data	Symbol	Function name	Status	Description
20	STA	3-wire start	ON	Start via automatic reset contact
			OFF	Independent of motor operation
21	STP	3-wire stop	ON	Motor operation enabled
			OFF	Stop via automatic reset contact
22	F/R	3-wire forward/reverse	ON	Reverse
			OFF	Forward
Required setting		A002 = 01		

- The operation timing is as follows.



Control Gain Switching Function (CAS)

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control). It provides two sets of gain and time constant settings for the speed control system (proportional, integral), which can be selected for use.
- For the control gain switching function, refer to *6-4-3 Control Gain Switching Function* on page 6-29.

Parameter No.	Function name	Data	Default data	Unit
A044	1st Control Method	03: Sensorless vector control (Only in the heavy load mode) 04: 0-Hz sensorless vector control 05: Sensor vector control (V2)	00	–
A244	2nd Control Method			
C001 to C008	Multi-function Input S1 to S8 Selection	26: CAS (Control gain switching)	–	–
H005	1st Speed Response	0.001 to 9.999/10.00 to 80.00 (10.000 to 80.000)	1.590	–
H205	2nd Speed Response			
H050	1st PI Proportional Gain	0.0 to 999.9 1000.	100.0	%
H250	2nd PI Proportional Gain			
H051	1st PI Integral Gain	0.0 to 999.9 1000.	100.0	
H251	2nd PI Integral Gain			
H052	1st P Proportional Gain	0.01 to 10.00	1.00	–
H252	2nd P Proportional Gain			
H070	For PI Proportional Gain Switching	0.0 to 999.9 1000.	100.0	%
H071	For PI Integral Gain Switching	0.0 to 999.9 1000.	100.0	
H072	For P Proportional Gain Switching	0.00 to 10.00	1.00	–
H073	Gain Switching Time	0. to 9999.	1.00	ms

Up/Down Function (UP, DWN, UDC)

- Use this function to change the inverter output frequency via the multi-function input terminals UP and DWN.
- Set the Multi-function Input terminals S1 to S8 Selection (C001 to C008) to 27 (UP) and 28 (DWN).
- This function is enabled only when the Frequency Reference Selection (A001) is set to 01 or 02. However, the setting 01 (Terminal) is effective only for multi-step speed operation.
  It is not effective when using an external analog input for the frequency reference or when setting the jogging operation frequency.
- The acceleration/deceleration time when the UP/DWN terminal is ON depends on the F002, F003/F202, F203/F302, and F303 settings. To enable the switching to the 1st/2nd/3rd control, allocate one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 08 (SET) or 17 (SET3) and turn ON the terminal SET/SET3.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	27: UP (Remote operation acceleration) 28: DWN (Remote operation deceleration) 29: UDC (Remote data clear)	–	–

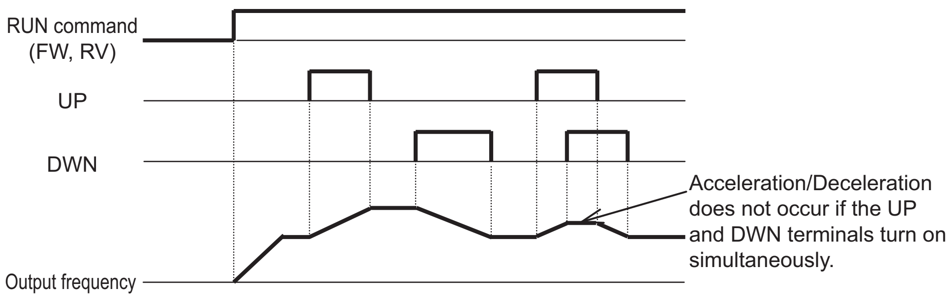
Data	Symbol	Function name	Status	Description
27	UP	Remote operation acceleration	ON	Accelerates from the current speed during the signal input period.
			OFF	Keeps the current speed.
28	DWN	Remote operation deceleration	ON	Decelerates from the current speed during the signal input period.
			OFF	Keeps the current speed.
29	UDC	Remote data clear	ON	Clears the stored UP/DWN speed.
			OFF	Keeps the stored UP/DWN speed unchanged.

Precautions for Correct Use

Do not turn ON/OFF the terminal UP/DWN after turning off the power supply. Otherwise, the inverter may not store data normally.

- The set frequency value after UP/DWN adjustment can be stored. Select whether to store the setting in the UP/DWN Storage Selection (C101).
  The set frequency value after adjustment will be stored when the power supply is turned off.
  Until stored, you can clear the set frequency value after adjustment and restore the value before adjustment.
  To clear the frequency reference value adjusted via UP/DWN, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 29 (UDC) and turn ON/OFF the terminal UDC.

Parameter No.	Data	Description
C101 (UP/DWN Storage Selection)	00	Do not store the frequency reference adjusted via UP/DWN. Turn off and then on the power supply to restore the set value before UP/DWN adjustment.
	01	Stores the frequency reference adjusted via UP/DWN. Turn off and then on the power supply to keep the set value after UP/DWN adjustment.



Forced Operator Function (OPE)

- Use this function when the Digital Operator is not selected as the frequency reference/RUN command source to force enable operation via the Digital Operator by turning ON/OFF the multi-function input terminal to which the function is allocated.
- To allocate this function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 31 (OPE).
- When the forced operator function is allocated to a multi-function input terminal, the inverter accepts the frequency reference source and RUN command via the sources selected in A001 and A002 if the signal is OFF and via the Digital Operator if the signal is ON.
- If you switch on/off this function during operation, the RUN command will be reset to stop the inverter output. In this case, to ensure safety, once turn OFF the RUN command from the selected command source and input it again before resuming operation.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	31: OPE (Forced Operator)	–	–

Data	Symbol	Function name	Status	Description
31	OPE	Forced Operator	ON	Accepts command from Digital Operator preferentially, independent of A001 and A002.
			OFF	Accepts command from source selected in A001 and A002.
Related parameters		A001, A002		

P/PI Switching Function (PPI)

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control). It allows the control method in the speed control system to be switched between the proportional integral control and the proportional control.
- For the P/PI switching function, refer to *6-4-2 P/PI Switching Function* on page 6-28.

Parameter No.	Function name	Data	Default data	Unit
A044	1st Control Method	03: Sensorless vector control (Only in the heavy load mode) 04: 0-Hz sensorless vector control 05: Sensor vector control (V2)	00	–
A244	2nd Control Method			
C001 to C008	Multi-function Input S1 to S8 Selection	43: PPI (P/PI switching)	–	–
H005	1st Speed Response	0.001 to 9.999/10.00 to 80.00 (10.000 to 80.000)	1.590	–
H205	2nd Speed Response			
H050	1st PI Proportional Gain	0.0 to 999.9 1000.	100.0	%
H250	2nd PI Proportional Gain			
H051	1st PI Integral Gain	0.0 to 999.9 1000.	100.0	
H251	2nd PI Integral Gain			
H052	1st P Proportional Gain	0.01 to 10.00	1.00	–
H252	2nd P Proportional Gain			

Forced Terminal Block Function (F-TM)

- Use this function when the control circuit terminal block is not selected as the frequency reference/RUN command source to force enable operation via the terminal block by turning ON/OFF the multi-function input terminal to which the function is allocated.
- To allocate this function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 51 (F-TM).
- When the forced terminal block function is allocated to a multi-function input terminal, the inverter accepts the frequency reference source and RUN command via the sources selected in A001 and A002 if the signal is OFF and via the control circuit terminal block if the signal is ON.
- The forced operator function (C001 to C008 = 31: OPE) has priority to this function if both signals turn ON simultaneously.

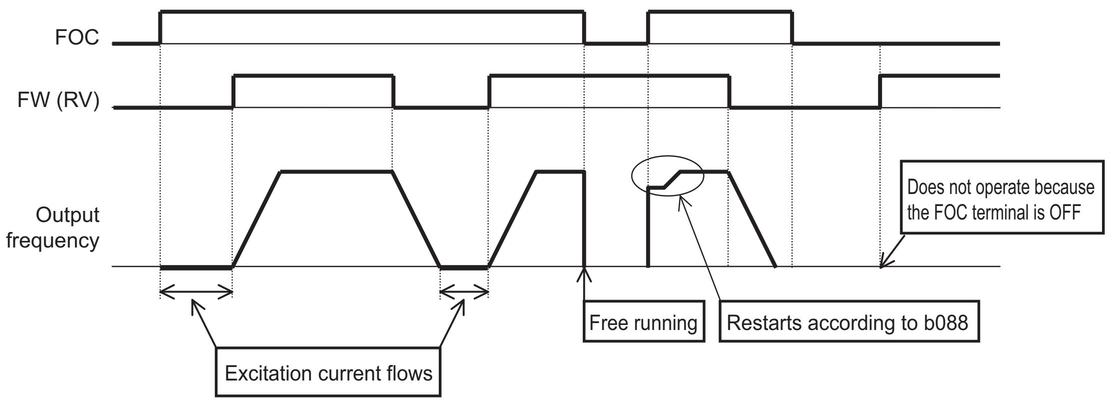
Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	51: F-TM (Forced terminal block)	–	–

Data	Symbol	Function name	Description
51	F-TM	Multi-function Input Selection	Forced terminal block
Related parameters		A001, A002	

Preliminary Excitation Function (FOC)

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control). It supplies a flow of excitation current to the selected input terminal to establish the magnetic flux in advance.
- In addition to establishing the magnetic flux in advance, this function improves the torque responsiveness during startup and therefore is useful for applications such as the elevating axis.
- To allocate this function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 55 (FOC).
- Once the FOC function is allocated, the inverter does not accept the RUN command unless the terminal FOC turns ON.
- If the terminal FOC is turned OFF during operation, the inverter will fall in a free-run state. In this case, turning ON the terminal FOC again causes the inverter to restart according to the Free-run Stop Selection (b088) setting.

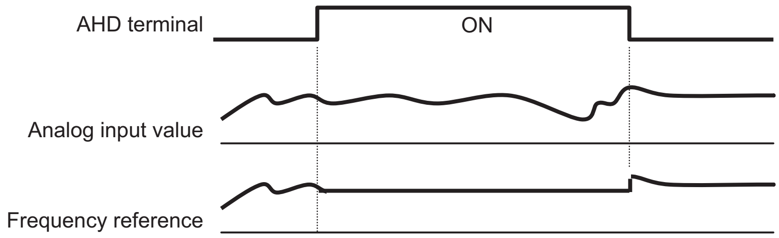
Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	55: FOC (Preliminary excitation)	–	–
Related functions		A044/A244		



Analog Command Hold Function (AHD)

- This function causes the inverter to hold the result of external analog input to the terminal AHD while it is ON.
- To allocate this function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 65 (AHD).
- While the terminal AHD is ON, you can use the UP/DWN function using the analog signal held by this function as a reference value.
- Setting the UP/DWN Storage Selection (C101) to 01 enables the inverter to store the UP/DWN result.
- If the power supply is turned on, or if the terminal RS (C001 to C008 = 18) turns from ON to OFF, with the terminal AHD ON, the last held data is available.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	65: AHD (Analog command held)	–	–
Related functions		C101		



Precautions for Correct Use

- If you switch the control via the terminal SET/SET3 (C001 to C008 = 08/17) with the terminal AHD ON, the set frequency remains "as is." To switch the control function, turn OFF the terminal AHD and have the inverter hold the signal again.
- Frequent use of this function could shorten the life expectancy of the internal storage element.

Multi-function Pulse Counter (PCNT, PCC)

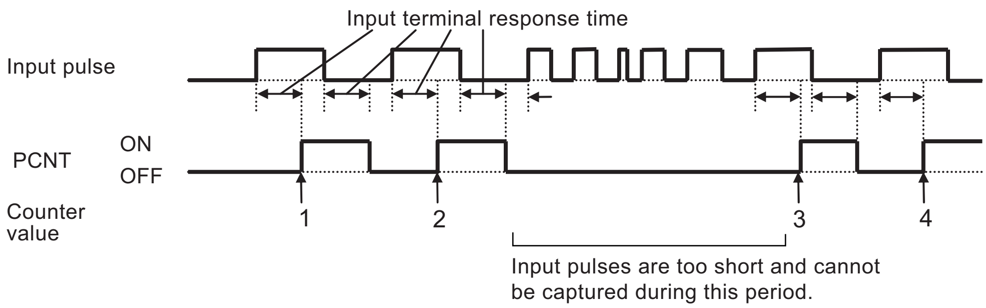
- Use this function to capture pulses from a pulse train input via one of the multi-function input terminals.
- You can monitor the captured pulses as the total count in the Pulse Counter Monitor (d028).
- To use this function, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 74 (PCNT) or 75 (PCC).
- The total count value cannot be stored. It will be reset to zero when the power supply is turned off and then on again or when the inverter is reset.
- To clear the total count value, turn ON the terminal to which PCC (pulse counter clear) is allocated.

Parameter No.	Function name	Data	Default data	Unit
C001 to C008	Multi-function Input S1 to S8 Selection	74: PCNT (Pulse counter) 75: PCC (Pulse counter clear)	–	–
Related functions		d028		

- The resolution of the input pulse frequency can be obtained from the formula shown below. Note, however, that this applies to pulse input with a duty ratio of 50%.
  The inverter cannot capture input pulses at frequencies higher than the specified resolution. It is recommended that you use a frequency resolution of 100 Hz or less.
  For details on input terminal response, refer to *Input Terminal Response Time* on page 7-140.

(Example) Input terminal response time = 1, Frequency resolution = 125 Hz

Frequency resolution [Hz] = 250/(Input terminal response time set values C160 to C168 + 1)



Multi-function Output Selection

- Use this function to allocate the functions listed below to the multi-function output P1 to P5 terminals and the multi-function relay output (MA, MB) terminals.
- The multi-function output P1 to P5 terminals are for open collector output and the multi-function relay output (MA, MB) terminals are for relay output.
- Set the desired function in the Multi-function Output P1 to P5 Selection (C021 to C025) and the Multi-function Relay Output (MA, MB) Function Selection (C026).
- These output terminals can be set to either NO (Normally open contact) or NC (Normally closed contact) in the Multi-function Output P1 to P5 Operation Selection (C031 to C035) and the Multi-function Relay Output (MA, MB) Operation Selection (C036) independently.
- If the alarm code output function is enabled in Alarm Code Selection (C062) (*Alarm Code Output (AC0 to AC3)* on page 7-130), some multi-function output settings are disabled.
  When C062 is set to 01 (3 bits), the output terminals P1 to P3 are used for alarm code output; when C062 is set to 02 (4 bits), the output terminals P1 to P4 are used for alarm code output.

Parameter No.	Data	Function name	Reference item	Page
C021 to C025, C026	00	RUN: Signal during RUN	Signal during RUN	5-61
	01	FA1: Constant speed arrival signal	Frequency Arrival Signal	5-61
	02	FA2: Set frequency exceeded signal		
	03	OL: Overload warning	Overload Limit/Overload Warning	7-72
	04	OD: Excessive PID deviation	PID Function	7-45
	05	AL: Alarm signal	–	–
	06	FA3: Set-frequency only signal	Frequency Arrival Signal	7-127
	07	OTQ: Overtorque/Undertorque signal	Overtorque (OTQ)	7-129
	08	IP: Signal during power interruption	Alarm Output for Power Interruption/Undervoltage during Stop	7-64
	09	UV: Signal during undervoltage		
	10	TRQ: Torque limit	Torque Limit Function	7-82
	11	RNT: RUN time over	RUN time over (RNT)	7-76
	12	ONT: Power ON time over	Power ON time over (ONT)	7-76
	13	THM: Electronic thermal warning	Electronic Thermal Function	5-18
	19	BRK: Brake release	Brake Control Function	7-104
	20	BER: Brake error		
	21	ZS: 0 Hz detection signal	0-Hz Detection Signal	5-63
	22	DSE: Excessive speed deviation	V2 Control Mode Selection	6-15
	23	POK: Position ready	Orientation Function	6-53
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	26	OL2: Overload warning 2	Overload Limit/Overload Warning	7-72
	27	FVDc: Analog FV disconnection detection	Window Comparator (Disconnection Detection FVDc/FIDc/FEDc)	7-92
	28	FIDc: Analog FI disconnection detection		
	29	FEDc: Analog FE disconnection detection		
	31	FBV: PID feedback comparison signal	PID Function	7-45
	32	NDc: Communications disconnection detection	Network Error	–

Parameter No.	Data	Function name	Reference item	Page
C021 to C025, C026	33	LOG1: Logic operation output 1	Logic Output Signal Operator	7-132
	34	LOG2: Logic operation output 2		
	35	LOG3: Logic operation output 3		
	36	LOG4: Logic operation output 4		
	37	LOG5: Logic operation output 5		
	38	LOG6: Logic operation output 6		
	39	WAC: Capacitor life warning signal	Capacitor Life Warning Signal	7-134
	40	WAF: Cooling fan life warning signal	Cooling Fan Speed Drop Signal	7-134
	41	FR: Starting contact signal	Starting Contact Signal	7-135
	42	OHF: Cooling fin overheat warning	Cooling Fin Overheat Warning	7-135
	43	LOC: Low current signal	Light Load Detection Signal	–
	44	MO1: General-purpose output 1	DriveProgramming Function	7-26
	45	MO2: General-purpose output 2		
	46	MO3: General-purpose output 3		
	47	MO4: General-purpose output 4		
	48	MO5: General-purpose output 5		
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	50	IRDY: Operation ready	Operation Ready Signal	5-63
	51	FWR: Forward run signal	During Forward Run Signal	5-64
	52	RVR: Reverse run signal	During Reverse Run Signal	5-64
	53	MJA: Fatal fault signal	Fatal Fault Signal	7-138
	54	WCFV: Window comparator FV	Window Comparator (Disconnection Detection FVDc/FIDc/FEDc)	7-92
	55	WCFI: Window comparator FI		
	56	WCFE: Window comparator FE		
	63	OPO: Option	–	–
	no	NO: No allocation	–	–

Multi-function Output Operation Selection

- Set the multi-function output P1 to P5 terminals and the multi-function relay output (MA, MB) terminal to output specifications either of NO (Normally open contact) or NC (Normally closed contact) individually.
- The multi-function output P1 to P5 terminals are for open collector output.

Parameter No.	Function name	Data	Default data	Unit
C031	Multi-function Output P1 Operation Selection	00: NO (Normally open contact) 01: NC (Normally closed contact)	00	–
C032	Multi-function Output P2 Operation Selection			
C033	Multi-function Output P3 Operation Selection			
C034	Multi-function Output P4 Operation Selection			
C035	Multi-function Output P5 Operation Selection			
C036	Multi-function Relay Output (MA, MB) Function Selection	00: NO contact between MA and MC, NC contact between MB and MC 01: NC contact between MA and MC, NO contact between MB and MC	01	–

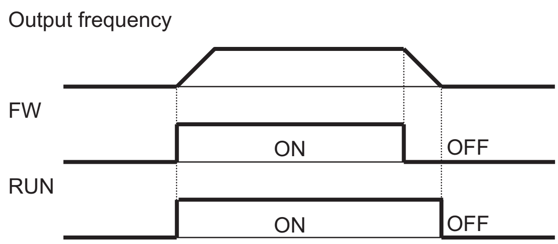
Signal during RUN (RUN)

- The RUN signal is output from the multi-function output P1 to P5 terminals and the multi-function relay output (MA, MB) terminal during operation.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 00 (RUN).
- This signal is also output when DC injection braking is active.
- The RUN signal is output even when the inverter does not output because the frequency reference is 0 Hz, as long as the RUN command is ON.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	00: RUN (Signal during RUN)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

The timing diagram is as follows.

The inverter outputs the RUN signal until the motor is stopped even if the RUN command (FW) turns OFF.



Frequency Arrival Signal (FA1 to FA5)

- These frequency arrival signals will be output when the output frequency reaches the set level.
- In applications such as an elevator, use this signal for applying the brake. To release the brake, use the overtorque (OTQ) signal (C021 to C025, C026 = 07).
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 01 (FA1: Constant speed arrival signal), 02 (FA2: Set frequency exceeded signal), 06 (FA3: Set-frequency only signal), 24 (FA4: Set frequency exceeded signal 2), or 25 (FA5: Set-frequency only signal 2) to allocate the desired signal.
- Below is the hysteresis of the frequency arrival signal:
  ON: Set frequency – 1% of maximum frequency [Hz]
  OFF: Set frequency – 2% of maximum frequency [Hz]

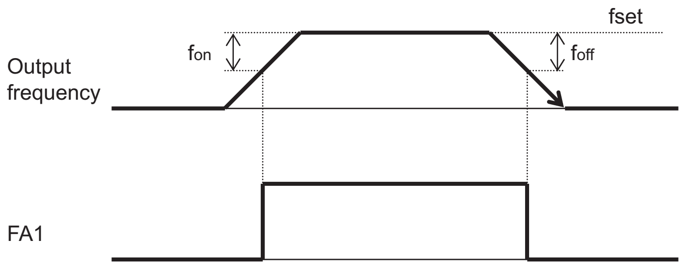
  However, when the above parameter is set to 06 (FA3) or 25 (FA5), the hysteresis during acceleration is:
  ON: Set frequency – 1% of maximum frequency [Hz]
  OFF: Set frequency + 2% of maximum frequency [Hz]

  And the hysteresis during deceleration is:
  ON: Set frequency + 1% of maximum frequency [Hz]
  OFF: Set frequency – 2% of maximum frequency [Hz]

<table>
<tr><th>Parameter No.</th><th>Function name</th><th>Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>C021 to C025</td><td>Multi-function Output P1 to P5 Selection</td><td rowspan="2">01: FA1 (Constant speed arrival signal)
02: FA2 (Set frequency exceeded signal)
06: FA3 (Set-frequency only signal)
24: FA4 (Set frequency exceeded signal 2)
25: FA5 (Set-frequency only signal 2)</td><td>–</td><td>–</td></tr>
<tr><td>C026</td><td>Multi-function Relay Output (MA, MB) Function Selection</td><td>05</td><td>–</td></tr>
<tr><td>C042</td><td>Arrival Frequency During Acceleration 1</td><td rowspan="2">0.00: Does not output arrival signal during acceleration
0.00 to 99.99
100.0 to 400.0</td><td rowspan="2">0.00</td><td rowspan="4">Hz</td></tr>
<tr><td>C045</td><td>Arrival Frequency During Acceleration 2</td></tr>
<tr><td>C043</td><td>Arrival Frequency During Deceleration 1</td><td rowspan="2">0.00: Does not output arrival signal during deceleration
0.00 to 99.99
100.0 to 400.0</td><td rowspan="2">0.00</td></tr>
<tr><td>C046</td><td>Arrival Frequency During Deceleration 2</td></tr>
</table>

Constant Speed Arrival Signal (01: FA1)

- This signal will be output when the frequency reaches the level set in the frequency settings (F001, A020, A220, and A320) or the multi-step speed settings (A021 to A035).
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 01 (FA1).



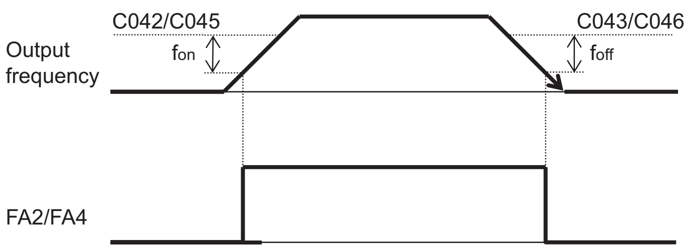
f_{on}: 1% of the max. frequency

f_{off}: 2% of the max. frequency

(Example)
Max. frequency f_{max}=120 [Hz]
Set frequency f_{set}=60 [Hz]
Hysteresis at power ON:
f_{on}=120×0.01=1.2 [Hz]
Hysteresis at power OFF:
f_{off}=120×0.02=2.4 [Hz]
During acceleration: ON at 60 - 1.2 = 58.8 [Hz]
During deceleration: OFF at 60 - 2.4 = 57.6 [Hz]

Set Frequency Exceeded Signal (02: FA2, 24: FA4)

- FA2 will be output when the output frequency exceed the Arrival Frequency During Acceleration/Deceleration 1 (C042/C043); FA4 will be output when the output frequency exceed the Arrival Frequency During Acceleration/Deceleration 2 (C045/C046).
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 02 (FA2) or 24 (FA4) to allocate the desired signal.

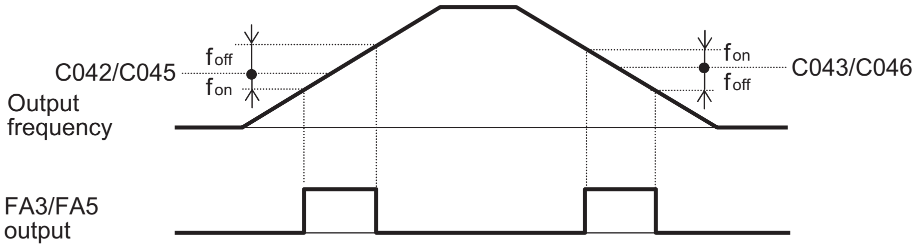


f_{on}: 1% of the max. frequency

f_{off}: 2% of the max. frequency

Set-frequency Only Signal (06: FA3, 25: FA5)

- FA3 will be output only when the output frequency exceed the Arrival Frequency During Acceleration/Deceleration 1 (C042/C043); FA5 will be output when the output frequency exceed the Arrival Frequency During Acceleration/Deceleration 2 (C045/C046).
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 06 (FA3) or 25 (FA5) to allocate the desired signal.



Overtorque (OTQ)

Use this function to detect that the estimated motor output torque value has exceeded the set level and output the overtorque signal.

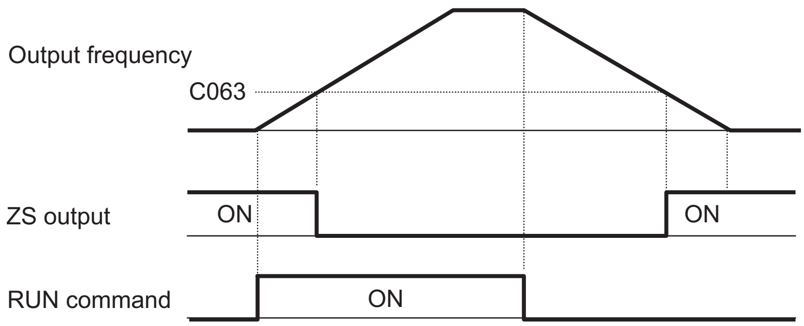
- To enable this function, set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 07 (Overtorque signal).
- This function is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), 04 (0-Hz sensorless vector control), or 05 (Sensor vector control). Note that the output will be unstable with other settings.
- In applications such as an elevator, use this signal for releasing the brake. To apply the brake, use the frequency arrival signals.

Parameter No.	Function name	Data		Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	07: OTQ (Overtorque/Undertorque signal)		–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			05	
C055	Overtorque Level (Forward Power Running)	Heavy load (CT)	0. to 200. (0.4 to 55 kW) 0. to 180. (75 to 132 kW)	100.	%
C056	Overtorque Level (Reverse Regeneration)				
C057	Overtorque Level (Reverse Power Running)	Light load (VT)	0. to 150.	100.	%
C058	Overtorque Level (Forward Regeneration)				
Related functions			A044, A244, A344, C063		

0-Hz Detection Signal (ZS)

- Use this function to output a detection signal when the output frequency of the inverter falls below the 0 Hz Detection Level (C063).
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 21 (ZS) to enable this function.
- This function works upon the inverter output frequency when the control method is set to Constant torque characteristics, Special reduced torque characteristics, Free V/f setting, Sensorless vector control, or 0-Hz sensorless vector control, or upon the motor rotation frequency when the control method is set to Sensor vector control.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	21: ZS (0-Hz detection signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	
C063	0 Hz Detection Level	0.00 to 99.99 100.0 Set a frequency to be detected as 0 Hz.	0.00	Hz
Related functions		A044, A244, A344		



Alarm Code Output (AC0 to AC3)

Use this function to output the inverter trip factor as a 3-bit or 4-bit code signal.

Parameter No.	Function name	Data	Default data	Unit
C062	Alarm Code Selection	00: Disabled 01: 3 bits 02: 4 bits	00	–

- When the Alarm Code Selection (C062) is set to 01 (3 bits) or 02 (4 bits), the multi-function output terminals P1 to P3 or P1 to P4 are used forcedly for alarm code output. The following table shows the alarm codes that will be output.

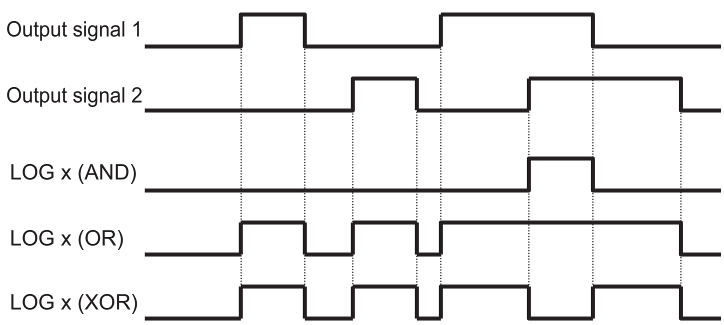
Multi-function output terminals				With 4-bit code selected		With 3-bit code selected	
P4	P3	P2	P1	Factor code	Trip data	Factor code	Trip data
AC3	AC2	AC1	AC0				
0	0	0	0	Normal	Normal	Normal	Normal
0	0	0	1	E01 to E03, E04	Overcurrent protection	E01 to E03, E04	Overcurrent protection
0	0	1	0	E05, E38	Overload protection Overload protection in a low speed range	E05	Overload protection
0	0	1	1	E07, E15	Overvoltage/Incoming overvoltage protection	E07, E15	Overvoltage/Incoming overvoltage protection
0	1	0	0	E09	Undervoltage protection	E09	Undervoltage protection
0	1	0	1	E16	Power interruption protection	E16	Power interruption protection
0	1	1	0	E30	IGBT error	E30	IGBT error
0	1	1	1	E06	Braking resistor overload protection	–	Other errors
1	0	0	0	E08, E11, E23, E25	EEPROM error, CPU error, GA communication error, Main circuit error	–	–
1	0	0	1	E10	CT error	–	–
1	0	1	0	E12, E13, E35, E36	External trip, USP error, Thermistor error, Brake error	–	–
1	1	0	0	E14	Ground protection	–	–
1	1	0	1	E20	Temperature error due to cooling fin speed drop		
1	1	0	1	E21	Temperature error	–	–
1	1	1	0	E24	Input phase loss protection	–	–
1	1	1	1	E50 to E79	Network error, Option 1/2 error 0 to 9	–	–

Logic Output Signal Operator (LOG1 to LOG3)

- Use these signals to have the inverter internally perform logical operations with output signals.
- All output signals can be used as operands.
  However, the logic operation outputs, LOG1 to LOG6, OPO, and no (No allocation) (C021 to C025, C026 = 33 to 38, 63, 255), cannot be used as operands.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	33: LOG1 (Logic operation output 1 (C142, C143, C144)) 34: LOG2 (Logic operation output 2 (C145, C146, C147)) 35: LOG3 (Logic operation output 3 (C148, C149, C150)) 36: LOG4 (Logic operation output 4 (C151, C152, C153)) 37: LOG5 (Logic operation output 5 (C154, C155, C156)) 38: LOG6 (Logic operation output 6 (C157, C158, C159))	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–
C142/C145/ C148/C151/ C154/C157	Logic Output Signal 1 Selection 1 to Logic Output Signal 6 Selection 1	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00	–
C143/C146/ C149/C152/ C155/C158	Logic Output Signal 1 Selection 2 to Logic Output Signal 6 Selection 2	Same as options for C021 to C026 (33 (LOG1), 34 (LOG2), 35 (LOG3), 36 (LOG4), 37 (LOG5), 38 (LOG6), 63 (OPO), and no (NO) cannot be selected)	00	–
C144/C147/ C150/C153/ C156/C159	Logic Output Signal 1 Operator Selection to Logic Output Signal 6 Operator Selection	00: AND 01: OR 02: XOR	00	–

- Three operators, AND, OR, and XOR, are available.



- The required parameters vary depending on the selected logic operation output.
  Use the following table as a reference to set the necessary parameters.

Selected signal	Operand 1 selection	Operand 2 selection	Operator selection
33: LOG1 (Logic operation output 1)	C142	C143	C144
34: LOG2 (Logic operation output 2)	C145	C146	C147
35: LOG3 (Logic operation output 3)	C148	C149	C150
36: LOG4 (Logic operation output 4)	C151	C152	C153
37: LOG5 (Logic operation output 5)	C154	C155	C156
38: LOG6 (Logic operation output 6)	C157	C158	C159

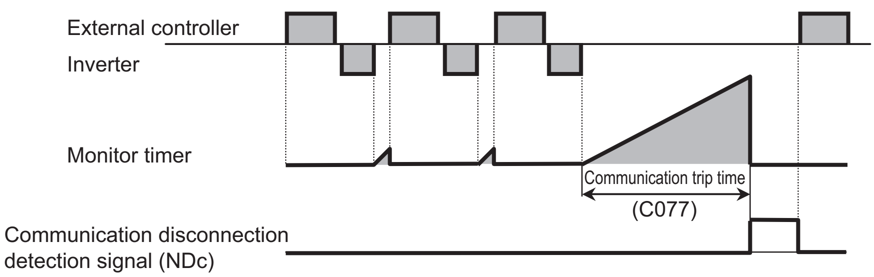
(Example) To output the result of the AND operation between RUN (During RUN signal: 00) and FA2 (Set frequency exceeded signal: 02) to the multi-function output terminal P2 as a logic output operation 1 (LOG1) terminal (C022 = 33)

Item	Setting
Multi-function Output P2 Selection (C022)	33: LOG1
Logic Output Signal 1 Selection 1 (C142)	00: RUN
Logic Output Signal 1 Selection 2 (C143)	02: FA2
Logic Output Signal 1 Operator Selection (C144)	00: AND

Communication Disconnection Detection Signal (NDc)

- This signal is enabled only when Modbus communication is selected for RS485 communications.
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 32 (NDc) to allocate the desired signal.
- If a reception timeout error occurs, this signal is output until the next data is received.
- Set the time until the reception timeout in the Communication Error Timeout Time (C077).
- For details, refer to *Section 8 Communications Functions*.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	32: NDc (Communications disconnection detection)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	
C077	Communication Error Timeout Time	0.00: Timeout disabled 0.01 to 99.99	0.00	s



Capacitor Life Warning Signal (WAC)

- Use this signal to determines the life expectancy of the capacitor on the option board based on the inverter's internal temperature and conduction time.
- The status of this signal can be monitored in the Life Assessment Monitor (d022).
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 39 (WAC) to allocate the desired signal.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	39: WAC (Capacitor life warning signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

Cooling Fan Life Warning Signal (WAF)

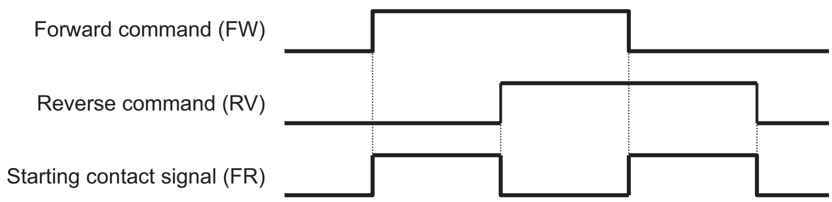
- This signal will be output when the rotation speed of the inverter's built-in cooling fan decreases to 75% or less.
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 40 (WAF) to allocate the desired signal.
- When the Cooling Fan Operation (b092) is set to 01 (Enabled only during RUN (including 5 minutes after power on/stop)), this signal will not be output while the fan is stopped.
- If this signal is output, check the cooling fan for clogging etc.
- The status of this signal can be monitored in the Life Assessment Monitor (d022).

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	40: WAF (Cooling fan life warning signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	
Related functions		b092, d022		

Starting Contact Signal (FR)

- The starting contact signal will be output while the inverter is ready to accept the RUN command.
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 41 (FR) to allocate the desired signal.
- The output is enabled independent of the RUN Command Selection (A002).
- The inverter will stop if both the FW and RV signals are input simultaneously.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	41: FR (Starting contact signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	



Cooling Fin Overheat Warning (OHF)

- This function monitors the temperature of the cooling fin located inside the inverter and outputs a signal if the temperature is at or higher than the Cooling Fin Overheat Warning Level (C064).
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 42 (OHF) to allocate the desired signal.

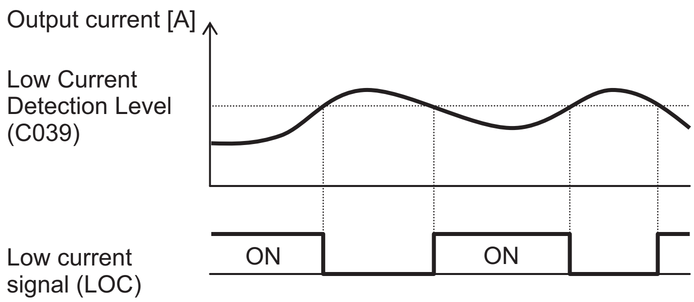
Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	42: OHF (Cooling fin overheat warning)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	
C064	Cooling Fin Overheat Warning Level	0. to 200. Set the temperature at which to the overheat warning signal is output.	120	°C

Low Current Signal (LOC)

- This signal will be output when the output current falls to or below the Low Current Detection Level (C039).
- In the Low Current Signal Output Mode (C038), select whether to enable the function during acceleration and constant speed or only during constant speed.
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 43 (LOC) to enable this function.

Parameter No.	Function name	Data		Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	43: LOC (Low current signal)		–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			05	
C038	Low Current Signal Output Mode	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed*1		01	–
C039	Low Current Detection Level	Heavy load (CT)	0.00 to 2.00 x Rated current (0.4 to 55 kW)	Rated current value	A
			0.00 to 1.80 x Rated current (75 to 132 kW)		
		Light load (VT)	0.00 to 1.50 x Rated current	Rated current value	A

*1. When the Frequency Reference Selection (A001) is set to 01 (Control circuit terminal block), the signal may not be judged as a constant speed depending on the sampling condition. In this case, set C038 to 00 (Enabled during acceleration/deceleration and constant speed) or increase the value set in the Analog Input Filter (A016).



Operation Ready Signal (IRDY)

- This signal will be output when the inverter becomes ready to accept the RUN command or ready to run.
- When this command is not output, the inverter does not recognize the RUN command even if it is input.
- If this signal is not output, check if the input power supply voltage (R, S, T) is within the specified range.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 50 (IRDY) to enable this function.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	50: IRDY (Operation ready)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

Forward Run Signal (FWR)

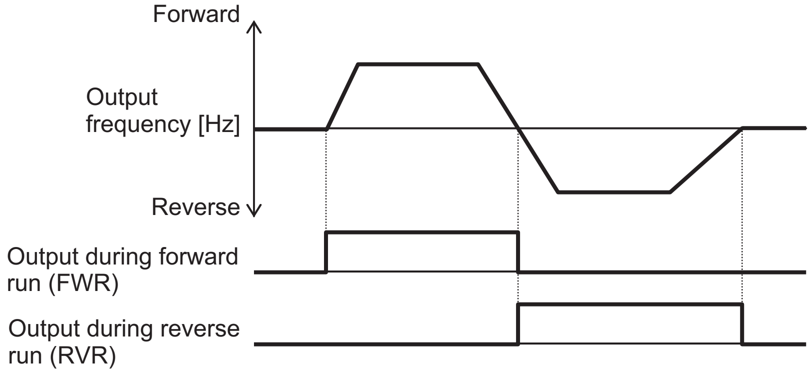
- This signal is output while the inverter performs the forward operation.
- This signal is OFF while the inverter performs the reverse operation or stopped.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 51 (FWR) to enable this function.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	51: FWR (Forward run signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

Reverse Run Signal (RVR)

- This signal is output while the inverter performs the reverse operation.
- This signal is OFF while the inverter performs the forward operation or stopped.
- Allocate one of the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 52 (RVR) to enable this function.

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	52: RVR (Reverse run signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	



Fatal Fault Signal (MJA)

- This signal will be output if any of the following trips occurs. It is different from the alarm signal AL (C021 to C025, C026 = 05) that will be output for all trips.
- This signal coverts the trips caused by a hardware failure.
- Set the Multi-function Output P1 to P5 Selection (C021 to C025) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 53 (MJA) to enable this function.

No.	Error code	Description
1	E10.*	CT error
2	E11.*	CPU error
3	E14.*	Ground protection
4	E20.*	Temperature error due to cooling fin stop
5	E23.*	Gate array communications error
6	E25.*	Main circuit error

Parameter No.	Function name	Data	Default data	Unit
C021 to C025	Multi-function Output P1 to P5 Selection	53: MJA (Fatal fault signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

Multi-function Output ON/OFF Delay Time

- Each multi-function output terminal can be allocated with the ON/OFF delay time.
- All output signals turn ON/OFF immediately when the set conditions are satisfied.
  However, depending on the selected signal, chattering may occur. In such a case, use this function to hold or delay the signal.
- Set the ON/OFF delay parameter for a total of the six output terminals: multi-function output terminals P1 to P5 and one relay output (MA, MB) terminal.
  The correspondence between each output terminal and the related ON/OFF delay parameter is shown in the table below.

Output terminal	ON delay time	OFF delay time
P1	C130	C131
P2	C132	C133
P3	C134	C135
P4	C136	C137
P5	C138	C139
Relay (MA, MB)	C140	C141

Parameter No.	Function name	Data	Default data	Unit
C130	Multi-function Output P1 ON Delay Time	0.0 to 100.0	0.0	s
C132	Multi-function Output P2 ON Delay Time			
C134	Multi-function Output P3 ON Delay Time			
C136	Multi-function Output P4 ON Delay Time			
C138	Multi-function Output P5 ON Delay Time			
C140	Multi-function Relay Output ON Delay Time			
C131	Multi-function Output P1 OFF Delay Time	0.0 to 100.0	0.0	s
C133	Multi-function Output P2 OFF Delay Time			
C135	Multi-function Output P3 OFF Delay Time			
C137	Multi-function Output P4 OFF Delay Time			
C139	Multi-function Output P5 OFF Delay Time			
C141	Multi-function Relay Output OFF Delay Time			

Input Terminal Response Time

- Set the response time for each multi-function input S1 to S8 terminal and the forward RUN command terminal FW independently.
  This function is effective for removing noise caused by chattering etc.
- If stable terminal input is not possible due to chattering, increase the set value.
  However, increasing the set value results in a slow response. The setting range is 0 to 200, which provides a response time of approximately 2 to 400 ms.

Parameter No.	Function name	Data	Default data	Unit
C160 to C167	Multi-function Input S1 to S8 Response Time	0. to 200. (x 2 ms)*1	1.	ms
C168	Forward RUN Command FW Response Time			

*1. When 0 is set, the response time is 2 ms.

Digital MP Terminal

- The digital terminal MP on the control circuit terminal block enables the monitoring of the output frequency and the output current.
- The terminal MP provides 10-VDC pulse output or PWM output.

MP Selection

- Select the signal you want to output from the following table.
- When this parameter is set to 03 (Digital output frequency) or 08 (Digital current monitor), the terminal provides pulse output.
- For pulse output signals, use a digital frequency counter.
  For other output signals, use an analog meter.

Parameter No.	Data	Description	PWM/ pulse	Full-scale value
C027	00	Output frequency*1	PWM	0 to Maximum frequency [Hz]*2
	01	Output current	PWM	0% to 200%
	02	Output torque (Only in the heavy load mode)*3	PWM	0% to 200%
	03	Digital output frequency*4	pulse	0 to Maximum frequency [Hz]
	04	Output voltage	PWM	0% to 100%
	05	Input power	PWM	0% to 200%
	06	Electronic thermal load rate	PWM	0% to 100%
	07	LAD frequency*1	PWM	0 to Maximum frequency [Hz]
	08	Digital current monitor	pulse	*5
	09	Motor temperature	PWM	0 to 200°C (0°C output at 0°C or lower)
	10	Cooling fin temperature	PWM	0 to 200°C (0°C output at 0°C or lower)
	12	DriveProgramming (YA(0))*6	PWM	0% to 100%
	19	Option 1	PWM	–
	20	Option 2	PWM	–

*1. 00 (Output frequency) represents a frequency value that takes into account the aspects of vector control compensation (such as sensorless vector control) and even stabilization control.
07 (LAD frequency) represents the frequency commanded by the inverter and is equivalent of the Output Frequency Monitor (d001) value.

*2. When Sensor vector control is selected (A044 = 05), the real frequency (detected frequency) will be displayed.

*3. This signal will be output only when Sensorless vector control, 0-Hz sensorless vector control, or Sensor vector control is selected in *Control Method (V/f Characteristics)* on page 7-34.

*4. When the Frequency Conversion Coefficient (b086) is set, the Digital output frequency signal will be converted into a gain value. Refer to *Output Frequency Monitor (After Conversion) [d007]* on page 7-4.

*5. For the digital current monitor function, refer to *MP Gain Setting* on page 7-141 in the next section.

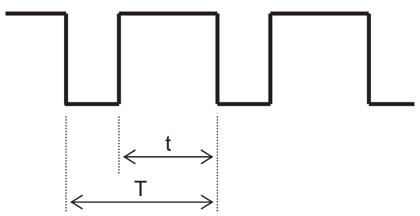
*6. For functional details, refer to “DriveProgramming User’s Manual (I580)”.

MP Gain Setting

The MP Gain Setting (C105) is available for setting the output gain only when an signal that provides PWM output is selected in the MP Selection (C027).
When the MP Selection (C027) is set to 08 (Digital current monitor), you can set the output pulse in the Digital Current Monitor Reference Value (C030). Then, the C030 value will be output as a 1440-Hz pulse.

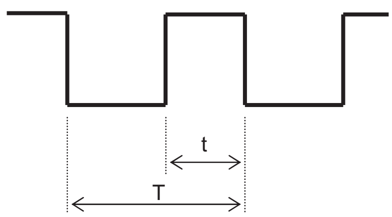
Parameter No.	Function name	Data		Default data	Unit
C105	MP Gain Setting	50. to 200.		100	%
C030	Digital Current Monitor Reference Value	Heavy load (CT)	0.20 x Rated current to 2.00 x Rated current (Current value at digital current monitor output 1440 Hz)	Rated current	A
		Light load (VT)	0.20 x Rated current to 1.50 x Rated current (Current value at digital current monitor output 1440 Hz)	Rated current	A
Related functions		C027, b081			

(Example 1) PWM output



Cycle T: Constant (6.4 ms)
Duty ratio t/T: Variable

(Example 2) Pulse output



Cycle T: Variable
Duty ratio t/T: Fixed to 1/2

Analog Output AM/AMI Terminals

- The digital terminal AM/AMI on the control circuit terminal block enables the monitoring of the output frequency and the output current.
  The terminal AM provides an analog output of 0 to 10 V.
  The terminal AMI provides an analog output of 0 to 20 mA. By default, this terminal is set to provide an analog output of 4 to 20 mA.

AM/AMI Selection

Select the signal you want to output from the following table.

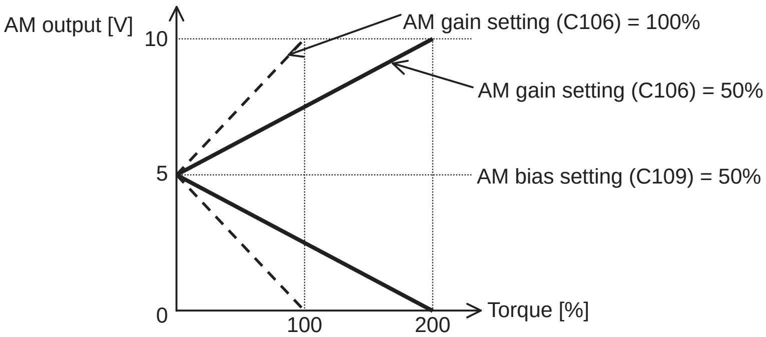
Parameter No.	Function name	Data	Description	Full-scale value
C028/C029	AM Selection/ AMI Selection	00	Output frequency*1	0 to Maximum frequency (Hz) *2
		01	Output current	0% to 200%
		02	Output torque*3	0% to 200%
		04	Output voltage	0% to 100%
		05	Input power	0% to 200%
		06	Electronic thermal load rate	0% to 100%
		07	LAD frequency*1	0 to Maximum frequency [Hz]
		09	Motor temperature	0 to 200°C (0°C output at 0°C or lower)
		10	Cooling fin temperature	0 to 200°C (0°C output at 0°C or lower)
		11	Output torque (signed)*3 AM output only	0% to 200%*4 (C028 only)
		13	DriveProgramming (YA(1))*5 AM output only	0% to 100% (C028 only)
		14	DriveProgramming (YA(2))*5 AM output only	0% to 100% (C029 only)
		19	Option 1	–
		20	Option 2	–

*1. 00 (Output frequency) represents a frequency value that takes into account the aspects of vector control compensation (such as sensorless vector control) and even stabilization control.
07 (LAD frequency) represents the frequency commanded by the inverter and is equivalent of the Output Frequency Monitor (d001) value.

*2. When Sensor vector control is selected (A044 = 05), the real frequency (detected frequency) will be displayed.

*3. This signal will be output only when Sensorless vector control, 0-Hz sensorless vector control, or Sensor vector control is selected in *Control Method (V/f Characteristics)* on page 7-34.

*4. The specifications of the output torque (signed) are as follows.



In the above example,
· When AM Gain Setting (C106) = 100%, AM output = 10 V at torque output of 100%, and
· When AM Gain Setting (C106) = 50%, AM output = 7.5 V at torque output of 100%.

*5. For functional details, refer to “DriveProgramming User’s Manual (I580)”.

Torque Monitor Function

This function allows you to monitor an estimated motor output torque, when Sensorless vector control, 0-Hz sensorless vector control, or Sensor vector control is selected as the control method.

Parameter No.	Function name	Data	Default data	Unit
A044/A244/ A344	1st/2nd/3rd Control Method	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control*1 04: 0-Hz sensorless vector control*1 05: Sensor vector control (V2)*1	00	–
C027/C028/ C029	MP Selection/ AM Selection/ AMI Selection	(Heavy load mode only) 02: Output torque 11: Output torque (signed) (C028 only)	00	–
H003/H203	1st/2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/ 3.7/4.0/5.5/7.5/11.0/15.0/18.5/22/30/ 37/45/55/75/90/110/132	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8/10	4	poles

*1. The 1st Control Method (A044) can be set to 00 to 05; the 2nd Control Method (A244) can be set to 00 to 04; the 3rd Control Method (A344) can be set to 00 to 01.
When the Heavy Load/Light Load Selection (b049) is set to 01 (Light load mode), this parameter cannot be set to 04 or 05.

- To monitor the motor output torque via the Digital Operator, set the Output Torque Monitor (d012). To monitor the motor output torque as a signal from the control circuit terminal block, refer to the *Digital MP Terminal* on page 7-140 or *Analog Output AM/AMI Terminals* on page 7-142 section.
- When the 1st/2nd Control Method (A044/A244) is set to 00 (Constant torque characteristics), 01 (Reduced torque characteristics), or 02 (Free V/f setting), this function is disabled. Note that the output signal to the display or the control circuit terminal block will be indefinite. This function shows the output torque during synchronous rotation at the rated frequency equivalent to the rated motor output as 100%.
- Since this function estimates the output torque based on the motor current, the accuracy is approximately 20% when a motor with the same output capacity as the inverter is used.

AM/AMI Gain Setting

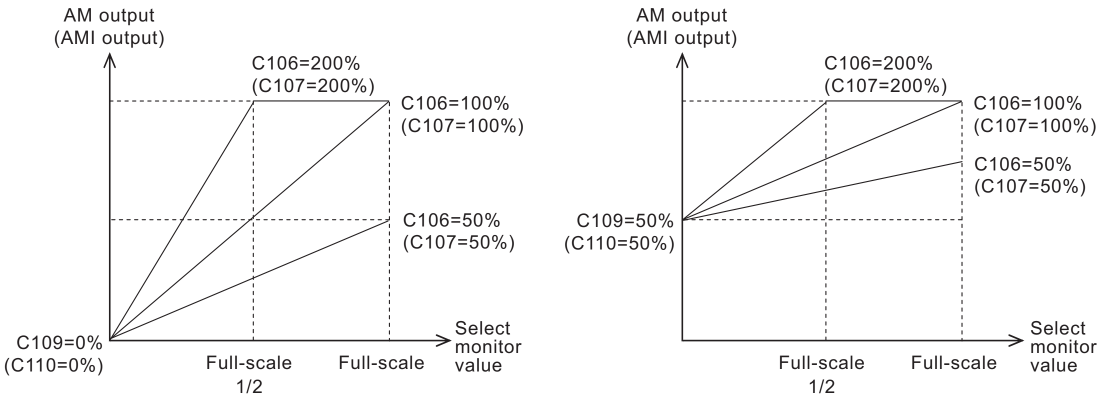
- Use these parameters to set the output gain of the inverter according to the meter connected to the terminal AM/AMI.

Parameter No.	Function name	Data	Default data	Unit
C106	AM Gain Setting	50. to 200. Set AM monitor gain.	100.	%
C107	AMI Gain Setting	50. to 200. Set AMI monitor gain.		
C109	AM Bias Setting	0. to 100. Set AM monitor offset.	0.	
C110	AMI Bias Setting	0. to 100. Set AMI monitor offset.	20.	

(Example) If AMI provides an output of 4 to 20 mA: C110 = 4 ÷ 20 = 20 [%] (Default data)

The relationship between the AM Gain Setting (C106) and the AM Bias Setting (C109) when there values are changed is as follows.

- C109 = 0 (Offset 0%)
- C109 = 50 (Offset 50%)



Note The relationship between the AMI Gain Setting (C106) and the AMI Bias Setting (C110) is similar to this.

7-6 Motor Parameters (Group H)

This section describes the motor parameters and the related functions including the auto-tuning function.

Offline Auto-Tuning Function

- Use this function to measure and automatically set the motor parameter data required for the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control.
- To use the sensorless vector control, 0-Hz sensorless vector control, or sensor vector control method using a motor whose motor parameter data is unknown, perform offline auto-tuning to measure the motor parameter values.
- Before using the online auto-tuning function, be sure to perform offline auto-tuning.
- This function is applicable to the 1st and 2nd control methods only. It cannot be used for the 3rd control method.
- For the offline auto-tuning function, refer to *6-2 Sensorless Vector Control* on page 6-4.

Online Auto-Tuning Function

- Online auto-tuning adjusts the motor parameter values according to changes such as a temperature rise in the motor, thus ensuring stable operation.
- This function is applicable to the 1st and 2nd control methods only. It cannot be used for the 3rd control method.
- For the online auto tuning function, refer to *6-2 Sensorless Vector Control* on page 6-4.

Motor Parameter Selection

- Set the motor parameters according to your motor.
- To use two or more motors using a single Inverter in the constant torque characteristics, special reduced torque characteristics, or free V/f setting control mode, calculate the total capacity of the motors and select the closest value in the Motor Capacity setting.
- Using the automatic torque boost function with improper motor parameter settings may result in torque reduction or motor hunting.
- For motor parameters, refer to *6-2 Sensorless Vector Control* on page 6-4.

Stabilization Parameters

- Use this function to stabilize the motor in hunting.
- If the motor is hunting, check first whether the 1st/2nd Motor Capacity (H003/H203) and 1st/2nd Motor Pole Number (H004/H204) settings match your motor and, if they do not, match them.
  If the motor's primary resistance is smaller than that of the standard motor, increase the value set in the 1st/2nd/3rd Stabilization Parameter (H006/H206/H306) gradually. To drive a motor with a capacity larger than the rated capacity of the inverter, reduce the set value.
- To suppress hunting, you can try the following methods as alternatives to this function.

Method	Reference
Decrease the Carrier Frequency (b083).	*Carrier Frequency* on page 7-94
Decrease the Output Voltage Gain (A045).	*Output Voltage Gain* on page 7-38

<table>
<tr><th>Parameter No.</th><th>Function name</th><th colspan="2">Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>H006/H206/
H306</td><td>1st/2nd/3rd Stabilization Parameter</td><td colspan="2">0. to 255.</td><td>100.</td><td>–</td></tr>
<tr><td>A045</td><td>Output Voltage Gain</td><td colspan="2">20. to 100.</td><td>100</td><td>%</td></tr>
<tr><td rowspan="4">b083</td><td rowspan="4">Carrier Frequency</td><td rowspan="2">Heavy load (CT)</td><td>0.5 to 15.0
(0.4 to 55 kW)</td><td>5.0</td><td rowspan="4">Hz</td></tr>
<tr><td>0.5 to 10.0
(75 to 132 kW)</td><td>3.0</td></tr>
<tr><td rowspan="2">Light load (VT)</td><td>0.5 to 12.0
(0.4 to 55 kW)</td><td>3.0</td></tr>
<tr><td>0.5 to 8.0
(75 to 132 kW)</td><td>3.0</td></tr>
</table>

7-7 Option Functions (Group P)

For the functions available when using the optional PG Board (Model: 3G3AX-PG01), refer to *6-2 Sensorless Vector Control* on page 6-4 to *6-9 Torque Control* on page 6-56.

Operation Selection on Option Error

Select whether to have the inverter trip or continue operation with the error from the option unit ignored, if an option error occurs.

Parameter No.	Function name	Data	Default data	Unit
P001	Operation Selection on Option 1 Error	00: Trip 01: Continues operation	00	–
P002	Operation Selection on Option 2 Error			

Secondary Resistance Compensation Function (Temperature Compensation)

- This function provides compensation for suppressing the variation of the rotation speed due to temperature changes in the motor when Sensorless vector control, 0-Hz sensorless vector control, or Sensor vector control is selected as the control method.
- Use the thermistor PB-41E (from SHIBAURA ELECTRONICS).
- To use this function, set the Thermistor Selection (b098) to 02 (NTC). Other thermistor settings do not provide correct temperature detection.

Parameter No.	Function name	Data	Default data	Unit
P025	Secondary Resistance Compensation Selection	00: None 01: Enabled	00	–

Communications Option Function

- Use this function when using a communications unit to communicate with optional equipment.
- For details of parameters, refer to the following manuals.
  - EtherCAT Communication Unit User's Manual (I574)
  - CompoNet Communications Unit User's Manual (I582)
  - DeviceNet Communications Unit User's Manual (I581)
- Set the network slave address in the DeviceNet MAC ID (P192) or CompoNet Node Address (P190).
- In the Assembly Instance Number (P046), set the remote I/O function of the communications unit.
- If you select the flexible format for the remote I/O function, use the following parameters to configure the interface for the remote I/O function.
  - Option I/F Flexible Format Output Register 1 to 10 (P160 to P169)
  - Option I/F Flexible Format Input Register 1 to 10 (P170 to P179)
- To command the inverter frequency reference as a rotation speed, set the number of motor poles in the Number of Poles for Rotation Speed Setting (P049).
- In the Communications Error Detection Timer Setting (P044), set the function for monitoring the data communications between the inverter and the communications unit.
- In the Operation Selection at Host Communications Error (P045), set how the inverter should operate if an error etc. occurs in the host network.

- In the Operation Selection at Idle Mode Detection (P048), set how the inverter should operate when the network is in the Idle (communications standby) mode.

Parameter No.	Function name	Data	Default data	Unit
P044	Communications Error Detection Timer Setting	0.00 to 99.9	1.00	s
P045	Operation Selection at Host Communications Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00	–
P046	Assembly Instance Number	00 to 20	01	–
P048	Operation Selection at Idle Mode Detection	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00	–
P049	Number of Poles for Rotation Speed Setting	0/2/4/8/10/12/14/16/18/20/22/24/26/28/30/32/34/36/38	0	–
P160 to P169	Option I/F Flexible Format Output Register 1 to 10	0000 to FFFF	0000	–
P170 to P179	Option I/F Flexible Format Input Register 1 to 10	0000 to FFFF	0000	–
P190	CompoNet Node Address	0 to 63	00	–
P192	DeviceNet MAC ID	0 to 63	63	–

DriveProgramming User Parameters

- Use these parameters to set user-defined values available with the DriveProgramming function.
- Changes made to DriveProgramming User Parameters via the Digital Operator are reflected on the user variables (U00 to U31) used in the program.
- For details, refer to “DriveProgramming User’s Manual (I580)”.

Parameter No.	Function name	Data	Default data	Unit
P100 to P131	DriveProgramming User Parameter U00 to U31	0. to 9999. 1000 to 6553 (10000 to 65535)	0.	–

7-8 User Setting Display Functions (Group U)

This section describes the user setting display functions.

User Parameter Setting Functions

In the User Selection 1 to 12 (U001 to U012), register up to 12 user parameters you want to display.

When registration is done, set the Display Selection to 02 (User setting). After that, you will see only the functions registered with U001 to U012, in addition to d001, F001, and b037.

Parameter No.	Function name	Data	Default data	Unit
U001 to U012	User Selection 1 to 12	no: No registration d001 to P196: Register the parameter numbers you want to display	no	–
b037	Display Selection	02: User setting	00	–

8

Communications Functions

This section describes the communications functions.

8-1 Communication Specifications 8-2
8-2 Modbus Method 8-6
8-3 Explanation of Each Function Code 8-10
8-4 Saving a Change to Holding Register (Enter Command) 8-20
8-5 Modbus Communication Register Number List 8-22
8-5-1 Coil Number List 8-22
8-5-2 Monitor Function/Enter Command Register List 8-27
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8-5-5 2nd Control Register Number List 8-71
8-5-6 3rd Control Register Number List 8-75
8-6 ASCII Method 8-77
8-6-1 Communications Procedure 8-77
8-6-2 Communications Commands 8-78

8-1 Communication Specifications

The 3G3RX-V1 Series has an RS485 communications capability that enables the inverter to communicate with an external controller from its communications terminal block TM2 on the control terminal block PCB.

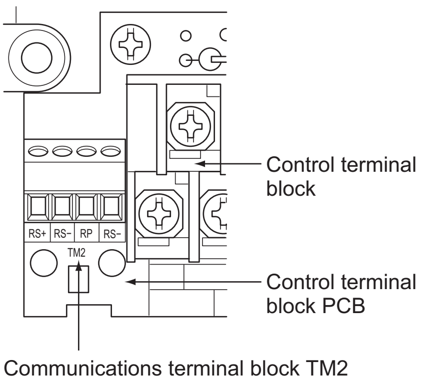
Communications Specifications

Item	ASCII format	Modbus format	Remarks
Transmission speed	2,400/4,800/9,600/19,200 bps		Selectable via Digital Operator
Communications method	Half-duplex communications		
Synchronous system	Start-stop synchronous system		
Transmission code	ASCII code	Binary	
Transmission mode	Transmission starts with Least Significant Bit (LSB first)		
Compatible interface	RS485		
Data bit length	7 or 8 bits	8 bits	Selectable via Digital Operator
Parity	No/Even/Odd		Selectable via Digital Operator
Stop bit length	1 or 2 bits		Selectable via Digital Operator
Startup method	One-side start using host command		
Wait time	10 to 1,000 [ms]	0 to 1,000 [ms]	Selectable via Digital Operator
Connection form	1:N (N = 32 max.)		Station No. selectable via Digital Operator
Error check	Overrun/Framing/BCC/ Vertical parity/Horizontal parity	Overrun/Framing/CRC-16/ Horizontal parity	

RS485 Port Specifications and Connections

The RS485 communications function uses the communications terminal block TM2 located on the left side of the control terminal block.

Wire the RS485 communications terminal block as follows.



Terminal symbol	Terminal name	Description
RS+	RS485 communications port	RS485 communications send/receive terminal, positive side
RS–		RS485 communications send/receive terminal, negative side
RP	Terminating Resistor enable terminal	Use these terminals to enable the built-in terminating resistor for the RS485 communications port. The terminating resistor is enabled when shorted. (Built-in terminating resistor value: 100 Ω)
RS–	RS485 communications send/receive terminal, negative side (for Terminating Resistor connection)	

The wire size and tightening torque recommended for the communications terminal block TM2 are as follows.

Screw size	Tightening torque [N·m]	Wire type	Wire size [mm^2]
M2	0.22 to 0.25	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)
		Stranded wire with ferrule	0.25 to 0.5 (Example: PC-1.25 F7 from JST Mfg. Co., Ltd.)

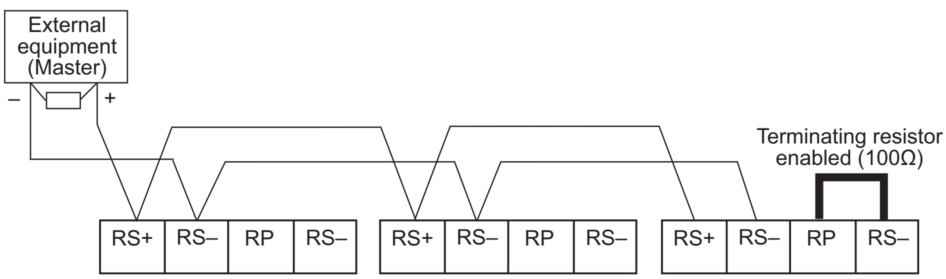
Connections

Connect the inverters parallel to each other as shown below. For termination, enable the terminating resistor only for the terminal Inverter.

Use the terminating resistor even if you have only one Inverter connected.

Selecting a terminating resistor that matches the cable impedance improves the terminating effect.

For the 3G3RX-V1 Series Inverter, shorting the RP and RS terminals enables the built-in terminating resistor (100 Ω).



Settings

To configure the 3G3RX-V1 Series Inverter for RS485 communications, the following settings are required.

Parameter No.	Function name	Data	Default data	Unit
C071	Communication Speed Selection (Baud Rate Selection)	02: Loop-back test 03: 2,400 bps 04: 4,800 bps 05: 9,600 bps 06: 19,200 bps	05 *2	–
C072	Communication Station No. Selection	1. to 32.: Allocate each inverter's station number. Set station numbers to control several inverters simultaneously.	1.	–
C073	Communication Bit Length Selection	7: 7 bits 8: 8 bits	8 *2	–
C074	Communication Parity Selection	00: No parity 01: Even 02: Odd	00	–
C075	Communication Stop Bit Selection	1: 1 bit 2: 2 bits	1	–
C076	Operation Selection on Communication Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	02	–
C077	Communication Error Timeout Time	0.00: Function disabled 0.01 to 99.99: Length of time to occurrence of a communications timeout	0.00	s
C078	Communication Wait Time	0. to 1000. : Time to wait for response from the inverter	0.	ms
C079	Communication Method Selection	00: ASCII 01: Modbus *1	01	–
Related functions		A001, A002		

*1 When the Communication Method Selection (C079) is set to 01 (Modbus), the Communication Bit Length Selection (C073) is disabled.

*2 The default data was changed from the previous model.

Communications Test Mode

Use the communication test mode to check the RS485 communications line (hardware).

Communications Test Procedure

(1) To perform a loop-back test, disconnect the cables from the communications terminal block TM2.

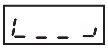
(2) Set the following parameters via the Digital Operator.

- Communication Method Selection (C079): 00 (ASCII) or 01 (Modbus)
- Communication Speed Selection (Baud Rate Selection) (C071): 02 (Loop-back test)

(3) Turn off and then on the inverter again.

The test starts.

After completion of the test, the Digital Operator displays the following result:

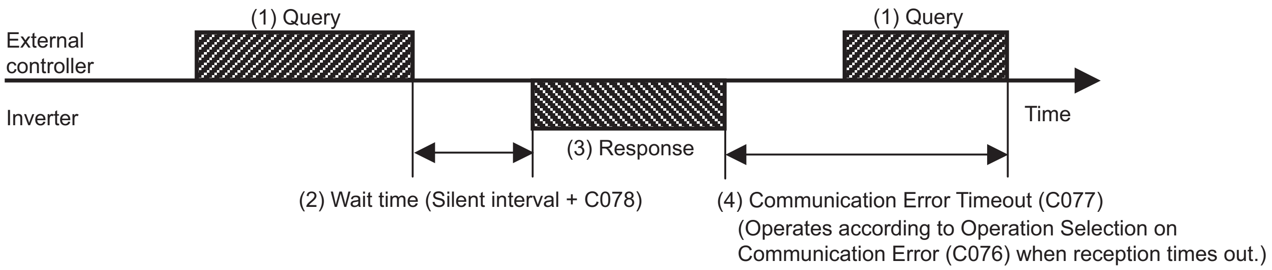
- Normal 
- Error 

(4) Press the RESET button on the Digital Operator to display the normal setting screen and restore the parameters that you changed in Step 2 to the previous settings.

8-2 Modbus Method

Communications Procedure

The inverter communicates with an external controller as follows.



(1) Frame (Query) that is sent from the external control device to the inverter

(2) After receiving a query frame, the inverter waits for the total time of the Silent Interval and the Communication Wait Time (C078), before returning a response.
Silent Interval
The wait time that is specified on Modbus communication; its data length is 3.5 characters (3.5 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 control device. The inverter judges it as a communications error if it receives no response within the Communication Error Timeout Time (C077).
Then, the inverter operates according the Operation Selection on Communication Error (C076), while waiting for the reception of the first data again.
The monitoring of the Communication Error Timeout Time 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 data	Unit
C076	Operation Selection on Communication Error	00: Trip (Trip after receiving timeout (E41)) 01: Trip after deceleration stop (Deceleration stop after receiving timeout, Trip after stop (E41)) 02: Ignore (No trip and no alarm output) 03: Free-run stop (Free-run stop after receiving timeout. No trip and no alarm output) 04: Deceleration stop (Deceleration stop after receiving timeout. No trip and no alarm output)	02	–
C077	Communication Error Timeout Time	0.00: Function disabled 0.01 to 99.99: Length of time to occurrence of a communications timeout	0.00	–
C078	Communication Wait Time	0. to 1000.: Wait time until response starts after receiving is completed (excluding silent interval)	0.	–

Query Frame Configuration

The format of a query frame (command) is as follows.

Header (Silent interval)
Slave address
Function code
Data
Error check
Trailer (Silent interval)

<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.
- The 3G3RX-V1 Series Inverter supports the following function codes.

Function Code

Function code	Function	Maximum number of data bytes per message	Maximum number of coils/registers per message
01 hex	Read coil status	4	32 coils (in bits)
03 hex	Read from holding register	8	4 registers (in bytes)
05 hex	Write to coil	2	1 coil (in bits)
06 hex	Write to holding register	2	1 register (in bytes)
08 hex	Loop-back test	–	–
0F hex	Write to multiple coils	4	32 coils (in bits)
10 hex	Write to multiple registers	8	4 registers (in bytes)

<Data>

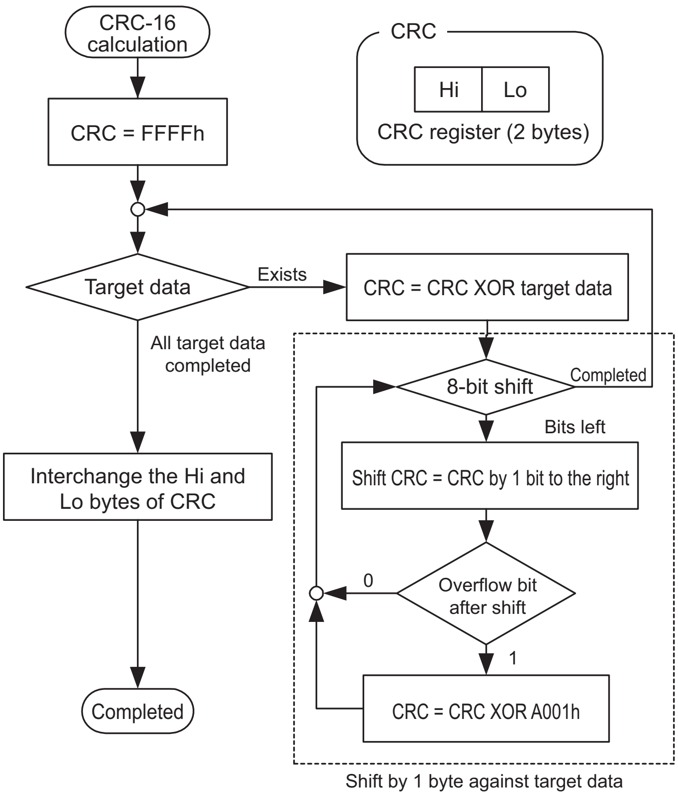
- This sends the function command.
- The data format differs depending on the function code.
- The 3G3RX-V1 Series supports the following data formats used in Modbus communication.

Data name	Description
Coil	Binary data (1 bit) that can be referenced or changed.
Holding register	16-bit data that can be referenced to or changed.

<Error Check>

- In Modbus communication, 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 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 the Communication Wait Time (C078).

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 the Communication Wait Time (C078).
- 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/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/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 exceptional 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.
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 command 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).

<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).

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.

8-3 Explanation of Each Function Code

Read Coil Status [01 hex]

Reads the coil status (ON/OFF).

Precautions for Correct Use

In the 3G3RX-V1 Series Inverter, Read Coil Status function of Modbus communication was changed to use the same byte order as that of the 3G3MX2 Series when transferring data over 1 byte.

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>To read data from multi-function input terminals S1 to S6 of the inverter with slave address 8.</u>

The status of each multi-function input terminal is as follows.

Item	Data					
Multi-function input terminal	S1	S2	S3	S4	S5	S6
Coil number	0007 hex	0008 hex	0009 hex	000A hex	000B hex	000C hex
Terminal status	ON	ON	ON	OFF	ON	OFF

Coil numbers 000D hex and 000E 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	06	
5	Number of coils (MSB) *3	00	
6	Number of coils (LSB) *3	06	
7	CRC-16 (MSB)	5C	
8	CRC-16 (LSB)	90	

Response

No.	Field name	Example [hex]	Remarks
1	Slave address	08	
2	Function code	01	
3	Number of data bytes	01	
4	Coil data *4	17	17 hex = 0 0 0 1 0 1 1 1 Input terminal S6 Input terminal S1
5	CRC-16 (MSB)	12	
6	CRC-16 (LSB)	1A	

*1 Broadcasting cannot be performed.

*2 Note that the coil start number is 0006, which is 1 less than the coil number 0007.

*3 If the number of coils to be read is set to 0 or more than 32, an error code (3 hex) will be returned.

*4 Data as much as the number of data bytes will be transferred.

The data received in a response shows the status for coil numbers 0007 hex to 000E hex (multi-function input terminal S1 to S8).

Therefore, the received data “17 hex = 00010111 binary” can be read from the LSB that shows the status of coil number 0007 hex, as follows:

Coil No.	000E hex	000D hex	000C hex	000B hex	000A hex	0009 hex	0008 hex	0007 hex
Coil status	OFF	OFF	OFF	ON	OFF	ON	ON	ON
Multi-function input terminal	S8	S7	S6	S5	S4	S3	S2	S1

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 the “Exception Response” section.

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

To read past trip data from the inverter with slave address 5.

The inverter status for the past three trips is as follows.

Item	Previous factor	Previous inverter status
3G3RX-V1 command	d081	d081
Holding register number	0012 hex	0013 hex
Trip factor (MSB)	Overvoltage (E07)	During deceleration (02)

Query

No.	Field name	Example [hex]	Remarks
1	Slave address *1	05	
2	Function code	03	
3	Register start number (MSB) *2	00	(Register address) = (Register number) – 1
4	Register start number (LSB) *2	11	
5	Number of holding registers (MSB)	00	2 registers
6	Number of holding registers (LSB)	02	
7	CRC-16 (MSB)	95	
8	CRC-16 (LSB)	8A	

Response

No.	Field name	Example [hex]	Remarks
1	Slave address	05	
2	Function code	03	
3	Number of data bytes *3	04	
4	Register start number (MSB)	00	0007 hex → 07 decimal → E07 (Factor: Overvoltage)
5	Register start number (LSB)	07	
6	Register start number +1 (MSB)	00	0002 hex → 2 (Inverter status: During deceleration)
7	Register start number +1 (LSB)	02	
8	CRC-16 (MSB)	36	
9	CRC-16 (LSB)	37	

*1 Broadcasting cannot be performed.

*2 Note that the register start number is 0011 hex, which is 1 less than the register number 0012 hex.

*3 Data as much as the number of data bytes will be transferred. In this example, the inverter sends back 4 bytes of data from two holding registers.

If the Read from Holding Register function is executed normally, refer to the “Exception Response” section.

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

<u>To issue the RUN command to the inverter with slave address 10.</u>

To operate the inverter, you need to set A002 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 to ON: FF00 hex
6	Written data (LSB)	00	
7	CRC-16 (MSB)	8D	
8	CRC-16 (LSB)	41	

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

*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.

If the Write to Coil function is not executed normally, refer to the “Exception Response” section.

Write to Holding Register [06 hex]

Writes data to the specified holding register.

Example

To write 50 Hz to the inverter with slave address 5 as the 1st Base Frequency (A003) value.

Because the holding register 1203 hex for the 1st Base Frequency (A003) has a data resolution of 1 Hz, to set 50 Hz, set the written data to 50 (0032 hex).

Query

No.	Field name	Example [hex]	Remarks
1	Slave address *1	05	
2	Function code	06	
3	Register start number (MSB) *2	12	(Register address) = (Register number) – 1
4	Register start number (LSB) *2	02	
5	Written data (MSB)	00	0032 hex → 50 decimal → 50 Hz
6	Written data (LSB)	32	
7	CRC-16 (MSB)	AD	
8	CRC-16 (LSB)	23	

Response

No.	Field name	Example [hex]
1	Slave address	05
2	Function code	06
3	Register start number (MSB)	12
4	Register start number (LSB)	02
5	Written data (MSB)	00
6	Written data (LSB)	32
7	CRC-16 (MSB)	AD
8	CRC-16 (LSB)	23

*1 During a broadcast, no response will be sent back.

*2 Note that the register start number is 1202 hex, which is 1 less than the register number 1203 hex.

Note that, except for F001, changing the parameter value on the data display does not update the displayed data realtime.

To view the updated value, once return to the parameter display and then display the data again.

If the Write to Holding Register function is executed normally, refer to the “Exception Response” section.

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

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
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

In the 3G3RX-V1 Series Inverter, the Write to Multiple Coils function of Modbus communication was changed to use the same byte order as that of the 3G3MX2 Series when transferring data over 1 byte. 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	(Padding data)

- 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	(Padding data)

- 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 000E hex.

Example

<u>To change the status of multi-function input terminals S1 to S6 of the inverter with slave address 5.</u>

Change the ON/OFF status of the multi-function input terminal as shown in the following table.

Item	Data					
Multi-function input terminal	S1	S2	S3	S4	S5	S6
Coil number	0007 hex	0008 hex	0009 hex	000A hex	000B hex	000C 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	06	
5	Number of coils (MSB)	00	
6	Number of coils (LSB)	06	
7	Number of bytes *3	02	
8	Change data (MSB) *3	17	17 hex = 0 0 0 1 0 1 1 1 Input terminal S6 Input terminal S1
9	Change data (LSB) *3	00	
10	CRC-16 (MSB)	DB	
11	CRC-16 (LSB)	3E	

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)	06
5	Number of coils (MSB)	00
6	Number of coils (LSB)	06
7	CRC-16 (MSB)	34
8	CRC-16 (LSB)	4C

*1 During a broadcast, no response will be sent back.

*2 Note that the coil start number is 0006, which is 1 less than the coil number 0007.

*3 Since the change 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.

A multi-function 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 the “Exception Response” section.

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 the 1st Acceleration Time 1 (F002) value.

Because the holding registers 1103 hex to 1104 hex for the 1st Acceleration Time 1 (F002) has a data resolution of 0.01 seconds, to set 3,000 seconds, set the written 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	11	(Register address) = (Register number) – 1
4	Register start address (LSB) *2	02	
5	Number of holding registers (MSB)	00	
6	Number of holding registers (LSB)	02	
7	Number of bytes *3	04	
8	Written data 1 (MSB)	00	000493E0 hex → 300000 decimal → 3,000.00 s
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	

Response

No.	Field name	Example [hex]
1	Slave address	01
2	Function code	10
3	Register start address (MSB)	11
4	Register start address (LSB)	02
5	Number of holding registers (MSB)	00
6	Number of holding registers (LSB)	02
7	CRC-16 (MSB)	E5
8	CRC-16 (LSB)	34

*1 During a broadcast, no response will be sent back.

*2 Note that the register start address is 1102 hex, which is 1 less than the register number 1103 hex.

*3 This is not the number of holding registers, but the number of bytes to be changed actually.

If the Write to Holding Register function is not executed normally, refer to the “Exception Response” section.

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
Exception code
Error check

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. A 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	Explanation
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: • Inverter is in a communications busy state. • Function attempts to change a register that cannot be changed during RUN. • Function attempts to issue the Enter command 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).

8-4 Saving a Change to Holding Register (Enter Command)

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 command according to the following procedure. In addition, after changing a control parameter, you need to recalculate the motor parameters. In this case, also use the Enter command to execute recalculation.

How to Issue Enter Command

Use the Write to Holding Register (06 hex) command to write data to the holding register for the Enter command (0900 hex). Below are the values to be written to the holding register (0900 hex).

Set value	Description
0000	Motor parameter recalculation
0001	Set value storage
0002 to FFFF	Motor parameter recalculation and Set value storage

Note After changing any of the parameters shown below, you must recalculate the motor parameters. To recalculate the motor parameters, write 0000 hex or 0002 hex to the holding register for the Enter command.

The list of parameters that require the motor parameter recalculation

Parameter No.	Item	Parameter No.	Item
A003/A203/A303	Base Frequency	H003/H203	Motor Capacity
A004/A204/A304	Maximum Frequency	H004/H204	Motor Pole Number
A044/A244/A344	Control Method	H005/H205	Speed Response
A082	Motor Rated Voltage Selection	H020/H220 to H024/H224	Various motor parameters
b112	Free V/f Frequency 7	H030/H230 to H034/H234	Various motor parameters (Auto-tuning)
H002/H202	Motor parameter selection	–	–

Precautions for Correct Use

- After receiving the Enter command, 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 command is frequently used.

Example

To issue the Enter command (storing set value) for the inverter with slave address 8.

Query

No.	Field name	Example [hex]	Remarks
1	Slave address *1	08	
2	Function code	06	
3	Register start address (MSB) *2	08	(Register address) = (Register number) – 1
4	Register start address (LSB) *2	FF	
5	Written data (MSB)	00	
6	Written data (LSB)	01	
7	CRC-16 (MSB)	7A	
8	CRC-16 (LSB)	C3	

Response

No.	Field name	Example [hex]
1	Slave address	08
2	Function code	06
3	Coil address (MSB)	08
4	Coil address (LSB)	FF
5	Written data (MSB)	00
6	Written data (LSB)	01
7	CRC-16 (MSB)	7A
8	CRC-16 (LSB)	C3

*1 During a broadcast, no response will be sent back.

*2 Note that the register start address is 08FF hex, which is 1 less than the register number 0900 hex.

8-5 Modbus Communication Register Number List

8-5-1 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 header shows the coil number used inside the inverter.
  Use this coil number when setting communications or other options for the inverter.
- The "Modbus coil spec. No." in the table header 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	Description
0000 hex	–	Not used	–	–
0001 hex	0000 hex	RUN command	R/W	1: Run 0: Stop (Enabled when A002 = 03)
0002 hex	0001 hex	Rotation direction command	R/W	1: Reverse 0: Forward (Enabled when A002 = 03)
0003 hex	0002 hex	External trip (EXT)	R/W	1: Trip
0004 hex	0003 hex	Trip reset (RS)	R/W	1: Reset
0005 hex	–	Not used	–	–
0006 hex	–	Not used	–	–
0007 hex	0006 hex	Multi-function input terminal S1	R/W	1: ON 0: OFF *1
0008 hex	0007 hex	Multi-function input terminal S2	R/W	1: ON 0: OFF *1
0009 hex	0008 hex	Multi-function input terminal S3	R/W	1: ON 0: OFF *1
000A hex	0009 hex	Multi-function input terminal S4	R/W	1: ON 0: OFF *1

*1 Normally, this is ON when the control circuit terminal block input or the coil is ON.
In this case, however, priority for the multi-function input terminals is given to the control circuit terminal block.
If the ON status of a coil cannot be reset from the master due to communications disconnection, turning the control circuit terminal block from ON to OFF switches the coil to the OFF status.

Coil No.	Modbus coil spec. No.	Item	R/W	Description
000B hex	000A hex	Multi-function input terminal S5	R/W	1: ON 0: OFF *1
000C hex	000B hex	Multi-function input terminal S6	R/W	1: ON 0: OFF *1
000D hex	000C hex	Multi-function input terminal S7	R/W	1: ON 0: OFF *1
000E hex	000D hex	Multi-function input terminal S8	R/W	1: ON 0: OFF *1
000F hex	000E hex	Operation status	R	1: Run 0: Stop (Interlocked with d003)
0010 hex	000F hex	RUN direction	R	1: Reverse 0: Forward (Interlocked with d003)
0011 hex	0010 hex	Inverter ready	R	1: Ready 0: Not ready
0012 hex	–	Not used	–	–
0013 hex	0012 hex	RUN (Signal during RUN)	R	1: During RUN 0: Normal
0014 hex	0013 hex	FA1 (Constant speed arrival signal)	R	1: ON 0: OFF
0015 hex	0014 hex	FA2 (Set frequency exceeded signal)	R	1: ON 0: OFF
0016 hex	0015 hex	OL (Overload warning)	R	1: ON 0: OFF
0017 hex	0016 hex	OD (Excessive PID deviation)	R	1: ON 0: OFF
0018 hex	0017 hex	AL (Alarm signal)	R	1: ON 0: OFF
0019 hex	0018 hex	FA3 (Set-frequency only signal)	R	1: ON 0: OFF
001A hex	0019 hex	OTQ (Overtorque/Undertorque signal)	R	1: ON 0: OFF
001B hex	001A hex	IP (Signal during power interruption)	R	1: ON 0: OFF
001C hex	001B hex	UV (Signal during undervoltage)	R	1: ON 0: OFF
001D hex	001C hex	TRQ (Torque limit)	R	1: ON 0: OFF
001E hex	001D hex	RNT (RUN time over)	R	1: ON 0: OFF

*1 Normally, this is ON when the control circuit terminal block input or the coil is ON.
In this case, however, priority for the multi-function input terminals is given to the control circuit terminal block.
If the ON status of a coil cannot be reset from the master due to communications disconnection, turning the control circuit terminal block from ON to OFF switches the coil to the OFF status.

Coil No.	Modbus coil spec. No.	Item	R/W	Description
001F hex	001E hex	ONT (Power ON time over)	R	1: ON 0: OFF
0020 hex	001F hex	THM (Electronic thermal warning)	R	1: ON 0: OFF
0021 hex	–	Not used	–	–
0022 hex	–	Not used	–	–
0023 hex	–	Not used	–	–
0024 hex	–	Not used	–	–
0025 hex	–	Not used	–	–
0026 hex	0025 hex	BRK (Brake release)	R	1: ON 0: OFF
0027 hex	0026 hex	BER (Brake error)	R	1: ON 0: OFF
0028 hex	0027 hex	ZS (0-Hz detection signal)	R	1: ON 0: OFF
0029 hex	0028 hex	DSE (Excessive speed deviation)	R	1: ON 0: OFF
002A hex	0029 hex	POK (Position ready)	R	1: ON 0: OFF
002B hex	002A hex	FA4 (Set frequency exceeded signal 2)	R	1: ON 0: OFF
002C hex	002B hex	FA5 (Set-frequency only signal 2)	R	1: ON 0: OFF
002D hex	002C hex	OL2 (Overload warning 2)	R	1: ON 0: OFF
002E hex	002D hex	FVDc (Analog FV disconnection detection)	R	1: ON 0: OFF
002F hex	002E hex	FIDc (Analog FI disconnection detection)	R	1: ON 0: OFF
0030 hex	002F hex	FEDc (Analog FE disconnection detection)	R	1: ON 0: OFF
0031 hex	–	Not used	–	–
0032 hex	0031 hex	FBV (PID feedback comparison signal)	R	1: ON 0: OFF
0033 hex	0032 hex	NDc (Communications disconnection detection)	R	1: ON 0: OFF
0034 hex	0033 hex	LOG1 (Logic operation output 1)	R	1: ON 0: OFF
0035 hex	0034 hex	LOG2 (Logic operation output 2)	R	1: ON 0: OFF
0036 hex	0035 hex	LOG3 (Logic operation output 3)	R	1: ON 0: OFF
0037 hex	0036 hex	LOG4 (Logic operation output 4)	R	1: ON 0: OFF
0038 hex	0037 hex	LOG5 (Logic operation output 5)	R	1: ON 0: OFF

Coil No.	Modbus coil spec. No.	Item	R/W	Description
0039 hex	0038 hex	LOG6 (Logic operation output 6)	R	1: ON 0: OFF
003A hex	0039 hex	WAC (Capacitor life warning signal)	R	1: ON 0: OFF
003B hex	003A hex	WAF (Cooling fan life warning signal)	R	1: ON 0: OFF
003C hex	003B hex	FR (Starting contact signal)	R	1: ON 0: OFF
003D hex	003C hex	OHF (Cooling fin overheat warning)	R	1: ON 0: OFF
003E hex	003D hex	LOC (Low current signal)	R	1: ON 0: OFF
003F hex	003E hex	MO1 (General-purpose output 1)	R	1: ON 0: OFF
0040 hex	003F hex	MO2 (General-purpose output 2)	R	1: ON 0: OFF
0041 hex	0040 hex	MO3 (General-purpose output 3)	R	1: ON 0: OFF
0042 hex	0041 hex	MO4 (General-purpose output 4)	R	1: ON 0: OFF
0043 hex	0042 hex	MO5 (General-purpose output 5)	R	1: ON 0: OFF
0044 hex	0043 hex	MO6 (General-purpose output 6)	R	1: ON 0: OFF
0045 hex	0044 hex	IRDY (Operation ready)	R	1: ON 0: OFF
0046 hex	0045 hex	FWR (Forward run signal)	R	1: ON 0: OFF
0047 hex	0046 hex	RVR (Reverse run signal)	R	1: ON 0: OFF
0048 hex	0047 hex	MJA (Fatal fault signal)	R	1: ON 0: OFF
0049 hex	0048 hex	During data write	R	1: Writing 0: Normal

Coil No.	Modbus coil spec. No.	Item	R/W	Description
004A hex	0049 hex	CRC error	R	1: Error 0: No error *1
004B hex	004A hex	Overrun error	R	1: Error 0: No error *1
004C hex	004B hex	Framing error	R	1: Error 0: No error *1
004D hex	004C hex	Parity error	R	1: Error 0: No error *1
004E hex	004D hex	Checksum error	R	1: Error 0: No error *1
004F hex	–	Not used	–	
0050 hex	004F hex	WCFV (Window Comparator FV)	–	1: ON 0: OFF
0051 hex	0050 hex	WCFI (Window Comparator FI)	–	1: ON 0: OFF
0052 hex	0051 hex	WCFE (Window Comparator FE)	–	1: ON 0: OFF
0053 to 0058 hex	0052 to 0057 hex	(Reserved)	–	–
005 9hex to	0058 hex to	Not used	R	–

*1 The content of communication error is held until a fault reset is input. Fault reset can be executed during operation.

8-5-2 Monitor Function/Enter Command Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter. Use this register number when setting communications or other options for the inverter.
- The “Modbus register spec. No.” in the table header 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 No.	R/W	Monitor or setting data	Resolution
0001 hex	0000 hex	Output Frequency Setting/Monitor	F001 (HIGH)	R/W	0 to 40000 (Enabled when A001 = 03)	0.01 [Hz]
0002 hex	0001 hex		F001 (LOW)	R/W		
0003 hex	0002 hex	Inverter status A	–	R	0: Initial status 1: – 2: Stop 3: RUN 4: Free-run stop 5: Jogging 6: DC injection braking 7: Retry 8: Trip 9: During UV	–
0004 hex	0003 hex	Inverter Status B	–	R	0: During stop 1: During RUN 2: During trip	–

Note 1 The inverter’s rated current is 1,000.

2 When the set value is 10,000 (100.0 s) or more, the value in the second decimal place is ignored.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0005 hex	0004 hex	Inverter Status C	–	R	0: – 1: Stop 2: Deceleration 3: Constant speed 4: Acceleration 5: Forward 6: Reverse 7: Forward to reverse 8: Reverse to forward 9: Forward run start 10: Reverse run start	–
0006 hex	0005 hex	PID Feedback Value Monitor	–	R/W	0 to 10000	0.01 [%]
0007 hex to 0010 hex	–	Not used	–	–	–	–
0011 hex	0010 hex	Fault Counter	d080	R	0 to 65530	1 [time]
0012 hex	0011 hex	Fault Monitor 1 Factor	d081	R	Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0013 hex	0012 hex	Fault Monitor 1 Inverter Status			Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0014 hex	0013 hex	Fault Monitor 1 Output Frequency (HIGH)			0 to 40000	0.01 [Hz]
0015 hex	0014 hex	Fault Monitor 1 Output Frequency (LOW)				
0016 hex	0015 hex	Fault Monitor 1 Output Current			Output current value at the time of trip	0.1 [A]
0017 hex	0016 hex	Fault Monitor 1 Main Circuit DC Voltage			DC input voltage at the time of trip	1 [V]
0018 hex	0017 hex	Fault Monitor 1 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0019 hex	0018 hex	Fault Monitor 1 Total RUN Time (LOW)				
001A hex	0019 hex	Fault Monitor 1 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
001B hex	001A hex	Fault Monitor 1 Total Power ON Time (LOW)				

Note 1 The inverter's rated current is 1,000.

2 When the set value is 10,000 (100.0 s) or more, the value in the second decimal place is ignored.

3 The PID Feedback Value Monitor function (Register No.: 0006 hex) can be written only when the PID Feedback Selection (A076) is set to 02 (Modbus communication).

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
001C hex	001B hex	Fault Monitor 2 Factor	d082	R	Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
001D hex	001C hex	Fault Monitor 2 Inverter Status			Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
001E hex	001D hex	Fault Monitor 2 Output Frequency (HIGH)			0 to 40000	0.01 [Hz]
001F hex	001E hex	Fault Monitor 2 Output Frequency (LOW)				
0020 hex	001F hex	Fault Monitor 2 Output Current			Output current value at the time of trip	0.1 [A]
0021 hex	0020 hex	Fault Monitor 2 Main Circuit DC Voltage			DC input voltage at the time of trip	1 [V]
0022 hex	0021 hex	Fault Monitor 2 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0023 hex	0022 hex	Fault Monitor 2 Total RUN Time (LOW)				
0024 hex	0023 hex	Fault Monitor 2 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
0025 hex	0024 hex	Fault Monitor 2 Total Power ON Time (LOW)				
0026 hex	0025 hex	Fault Monitor 3 Factor	d083	R	Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0027 hex	0026 hex	Fault Monitor 3 Inverter Status			Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0028 hex	0027 hex	Fault Monitor 3 Output Frequency (HIGH)			0 to 40000	0.01 [Hz]
0029 hex	0028 hex	Fault Monitor 3 Output Frequency (LOW)				
002A hex	0029 hex	Fault Monitor 3 Output Current			Output current value at the time of trip	0.1 [A]
002B hex	002A hex	Fault Monitor 3 Main Circuit DC Voltage			DC input voltage at the time of trip	1 [V]
002C hex	002B hex	Fault Monitor 3 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
002D hex	002C hex	Fault Monitor 3 Total RUN Time (LOW)				
002E hex	002D hex	Fault Monitor 3 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
002F hex	002E hex	Fault Monitor 3 Total Power ON Time (LOW)				

Note 1 The inverter's rated current is 1,000.

2 When the set value is 10,000 (100.0 s) or more, the value in the second decimal place is ignored.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0030 hex	002F hex	Fault Monitor 4 Factor	d084	R	Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0031 hex	0030 hex	Fault Monitor 4 Inverter Status			Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0032 hex	0031 hex	Fault Monitor 4 Output Frequency (HIGH)			0 to 40000	0.01 [Hz]
0033 hex	0032 hex	Fault Monitor 4 Output Frequency (LOW)				
0034 hex	0033 hex	Fault Monitor 4 Output Current			Output current value at the time of trip	0.1 [A]
0035 hex	0034 hex	Fault Monitor 4 Main Circuit DC Voltage			DC input voltage at the time of trip	1 [V]
0036 hex	0035 hex	Fault Monitor 4 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0037 hex	0036 hex	Fault Monitor 4 Total RUN Time (LOW)				
0038 hex	0037 hex	Fault Monitor 4 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
0039 hex	0038 hex	Fault Monitor 4 Total Power ON Time (LOW)				
003A hex	0039 hex	Fault Monitor 5 Factor	d085	R	Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
003B hex	003A hex	Fault Monitor 5 Inverter Status			Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
003C hex	003B hex	Fault Monitor 5 Output Frequency (HIGH)			0 to 40000	0.01 [Hz]
003D hex	003C hex	Fault Monitor 5 Output Frequency (LOW)				
003E hex	003D hex	Fault Monitor 5 Output Current			Output current value at the time of trip	0.1 [A]
003F hex	003E hex	Fault Monitor 5 Main Circuit DC Voltage			DC input voltage at the time of trip	1 [V]
0040 hex	003F hex	Fault Monitor 5 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0041 hex	0040 hex	Fault Monitor 5 Total RUN Time (LOW)				
0042 hex	0041 hex	Fault Monitor 5 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
0043 hex	0042 hex	Fault Monitor 5 Total Power ON Time (LOW)				

Note 1 The inverter's rated current is 1,000.

2 When the set value is 10,000 (100.0 s) or more, the value in the second decimal place is ignored.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0044 hex	0043 hex	Fault Monitor 6 Factor	d086	R	Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0045 hex	0044 hex	Fault Monitor 6 Inverter Status			Refer to *Inverter Fault Monitor Factor List* on page 8-34.	–
0046 hex	0045 hex	Fault Monitor 6 Output Frequency (HIGH)			0 to 40000	0.01 [Hz]
0047 hex	0046 hex	Fault Monitor 6 Output Frequency (LOW)				
0048 hex	0047 hex	Fault Monitor 6 Output Current			Output current value at the time of trip	0.1 [A]
0049 hex	0048 hex	Fault Monitor 6 Main Circuit DC Voltage			DC input voltage at the time of trip	1 [V]
004A hex	0049 hex	Fault Monitor 6 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
004B hex	004A hex	Fault Monitor 6 Total RUN Time (LOW)				
004C hex	004B hex	Fault Monitor 6 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
004D hex	004C hex	Fault Monitor 6 Total Power ON Time (LOW)				
004E hex	004D hex	Warning Monitor	d090	R	Warning code	–
004F to 0050 hex	004E to 004F hex	Not used	–	–		–
0051 hex	0050 hex	Fault Monitor 1 Detection Year	d081	R	Year in which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0052 hex	0051 hex	Fault Monitor 1 Detection Date	d081	R	Date (month and day) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0053 hex	0052 hex	Fault Monitor 1 Detection Time	d081	R	Time (o'clock and minutes) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0054 to 0055 hex	0053 to 0054 hex	Not used	–	–		–
0056 hex	0055 hex	Fault Monitor 2 Detection Year	d082	R	Year in which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0057 hex	0056 hex	Fault Monitor 2 Detection Date	d082	R	Date (month and day) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0058 hex	0057 hex	Fault Monitor 2 Detection Time	d082	R	Time (o'clock and minutes) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0059 to 005A hex	0058 to 0059 hex	Not used	–	–		–
005B hex	005A hex	Fault Monitor 3 Detection Year	d083	R	Year in which error was detected (Enabled when LCD Digital Operator is connected)	BCD
005C hex	005B hex	Fault Monitor 3 Detection Date	d083	R	Date (month and day) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
005D hex	005C hex	Fault Monitor 3 Detection Time	d083	R	Time (o'clock and minutes) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
005E to 005F hex	005D to 005E hex	Not used	–	–		–
0060 hex	005F hex	Fault Monitor 4 Detection Year	d084	R	Year in which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0061 hex	0060 hex	Fault Monitor 4 Detection Date	d084	R	Date (month and day) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0062 hex	0061 hex	Fault Monitor 4 Detection Time	d084	R	Time (o'clock and minutes) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0063 to 0064 hex	0062 to 0063 hex	Not used	–	–		–
0065 hex	0064 hex	Fault Monitor 5 Detection Year	d085	R	Year in which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0066 hex	0065 hex	Fault Monitor 5 Detection Date	d085	R	Date (month and day) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0067 hex	0066 hex	Fault Monitor 5 Detection Time	d085	R	Time (o'clock and minutes) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
0068 to 0069 hex	0067 to 0068 hex	Not used	–	–		–

Note 1 The inverter's rated current is 1,000.

2 When the set value is 10,000 (100.0 s) or more, the value in the second decimal place is ignored.

3 The time information used for register No. 0051 hex to 006C hex is enabled when the LCD Operator is connected.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
006A hex	0069 hex	Fault Monitor 6 Detection Year	d086	R	Year in which error was detected (Enabled when LCD Digital Operator is connected)	BCD
006B hex	006A hex	Fault Monitor 6 Detection Date	d086	R	Date (month and day) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
006C hex	006B hex	Fault Monitor 6 Detection Time	d086	R	Time (o'clock and minutes) at which error was detected (Enabled when LCD Digital Operator is connected)	BCD
006D to 08FF hex	006C to 08FE hex	Not used	–	–		–
0900 hex	08FF hex	Enter command (Write to EEPROM)	–	W	0000: Motor parameter recalculation 0001: Set value storage in EEPROM Other: Motor parameter recalculation and Set value storage in EEPROM	–
0901 to 1000 hex	0900 to 0FFF hex	Not used	–	–		–

Note 1 The inverter's rated current is 1,000.

2 When the set value is 10,000 (100.0 s) or more, the value in the second decimal place is ignored.

3 The time information used for register No. 0051 hex to 006C hex is enabled when the LCD Operator is connected.

Inverter Fault Monitor Factor List

Fault monitor factor			Fault monitor Inverter status		
Name	**Code**	**Actual data**	**Name**	**Code**	**Actual data**
No trip factor	0	0 hex	During reset	0	0 hex
Overcurrent protection during constant speed	1	1 hex	During stop	1	1 hex
Overcurrent protection during deceleration	2	2 hex	During deceleration	2	2 hex
Overcurrent protection during acceleration	3	3 hex	During constant speed	3	3 hex
Overcurrent protection during stop	4	4 hex	During acceleration	4	4 hex
Overload protection	5	5 hex	Operates at frequency = 0	5	5 hex
Braking resistor overload protection	6	6 hex	During startup	6	6 hex
Overvoltage protection	7	7 hex	During DB	7	7 hex
EEPROM error	8	8 hex	During overload limit	8	8 hex
Undervoltage protection	9	9 hex	During SON/FOC	9	9 hex
CT error	10	A hex			
CPU error	11	B hex			
External trip	12	C hex			
USP error	13	D hex			
Ground protection	14	E hex			
Incoming overvoltage protection	15	F hex			
Power interruption protection	16	10 hex			
Power module abnormal temperature (during FAN stop)	20	14 hex			
Power module abnormal temperature	21	15 hex			
Gate array communications error	23	17 hex			
Input phase loss protection	24	18 hex			
Main circuit error	25	19 hex			
IGBT error	30	1E hex			
Thermistor error	35	23 hex			
Brake error addition	36	24 hex			
Emergency shutoff error	37	25 hex			
Low-speed-range electronic thermal	38	26 hex			
Option 1 error 0 to 9	60 to 69	3C to 45 hex			
Option 2 error 0 to 9	70 to 79	46 to 4F hex			

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1001 hex	1000 hex	Output Frequency Monitor	d001 (HIGH)	R	0 to 40000	0.01 [Hz]
1002 hex	1001 hex		d001 (LOW)			
1003 hex	1002 hex	Output Current Monitor	d002	R	0 to 9999	0.1 [A]
1004 hex	1003 hex	RUN Direction Monitor	d003	R	0: Stop 1: Forward 2: Reverse	–
1005 hex	1004 hex	PID Feedback Value Monitor	d004 (HIGH)	R	0 to 9990	0.1 [%]
1006 hex	1005 hex		d004 (LOW)			
1007 hex	1006 hex	Multi-function Input Monitor	d005	R	2^0 (Terminal S1) to 2^7 (Terminal S8) 2^8 (Terminal FW)	–
1008 hex	1007 hex	Multi-function Output Monitor	d006	R	2^0 (Terminal P1) to 2^4 (Terminal P5) 2^6 (Relay terminal)	–
1009 hex	1008 hex	Output frequency monitor (After conversion)	d007 (HIGH)	R	0 to 3996000	0.01
100A hex	1009 hex		d007 (LOW)			
100B hex	100A hex	Real Frequency Monitor	d008 (HIGH)	R	–40000 to 40000	0.01 [Hz]
100C hex	100B hex		d008 (LOW)	R		
100D hex	100C hex	Torque Reference Monitor	d009	R	–200 to 200	1 [%]
100E hex	100D hex	Torque Bias Monitor	d010	R	–200 to 200	1 [%]
100F hex	–	Not used	–	–	–	–
1010 hex	100F hex	Output Torque Monitor	d012	R	–200 to 200	1 [%]
1011 hex	1010 hex	Output Voltage Monitor	d013	R	0 to 6000	0.1 [V]
1012 hex	1011 hex	Input Power Monitor	d014	R	0 to 9999	0.1 [kW]
1013 hex	1012 hex	Integrated Power Monitor	d015 (HIGH)	R	0 to 9999999	0.1 [kW]
1014 hex	1013 hex		d015 (LOW)			
1015 hex	1014 hex	Total RUN Time Monitor	d016 (HIGH)	R	0 to 999900	0.1 [h]
1016 hex	1015 hex		d016 (LOW)			
1017 hex	1016 hex	Total Power ON Time Monitor	d017 (HIGH)	R	0 to 999900	1 [h]
1018 hex	1017 hex		d017 (LOW)			
1019 hex	1018 hex	Fin Temperature Monitor	d018	R	–200 to 2000	0.1 [°C]
101A hex	1019 hex	Motor Temperature Monitor	d019	R	–200 to 2000	0.1 [°C]
101B hex	–	Not used	–	–	–	–
101C hex	–					

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
101D hex	101C hex	Life Assessment Monitor	d022	R	2^0: Capacitor on main circuit board 2^1: Cooling fan rotation speed reduced	–
101E to 1023 hex	–	Not used	–	–	–	–
1024 hex	1023 hex	LAD frequency	d101 (HIGH)	R	0 to 400000	0.001 [Hz]
1025 hex	1024 hex		d101 (LOW)			
1026 hex	1025 hex	DC Voltage Monitor	d102	R	0 to 9999	0.1 [V]
1027 hex	1026 hex	Regenerative Braking Load Rate Monitor	d103	R	0 to 1000	0.1 [%]
1028 hex	1027 hex	Electronic Thermal Load Rate Monitor	d104	R	0 to 1000	0.1 [%]
1029 to 102D hex	– –	Not used	–	–	–	–
102E hex	102D hex	User Monitor 0 (DriveProgramming)	d025 (HIGH)	R	–2147483647 to 2147483647	1
102F hex	102E hex		d025 (LOW)			
1030 hex	102F hex	User Monitor 1 (DriveProgramming)	d026 (HIGH)	R	–2147483647 to 2147483647	1
1031 hex	1030 hex		d026 (LOW)			
1032 hex	1031 hex	User Monitor 2 (DriveProgramming)	d027 (HIGH)	R	–2147483647 to 2147483647	1
1033 hex	1032 hex		d027 (LOW)			
1034 hex	1033 hex	Pulse Counter Monitor	d028 (HIGH)	R/W	0 to 2147483647	1
1035 hex	1034 hex		d028 (LOW)	R/W		
1036 hex	1035 hex	Position Command Monitor	d029 (HIGH)	R	–2147483647 to 2147483647	1
1037 hex	1036 hex		d029 (LOW)	R		
1038 hex	1037 hex	Current Position Monitor	d030 (HIGH)	R	–2147483647 to 2147483647	1
1039 hex	1038 hex		d030 (LOW)	R		
103A to 1102 hex	–	Not used	–	–	–	–

8-5-3 Group F Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter. Use this register number when setting communications or other options for the inverter.
- The “Modbus register spec. No.” in the table header 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 No.	R/W	Monitor or setting data	Resolution
1103 hex	1102 hex	1st Acceleration Time 1	F002 (HIGH)	R/W	1 to 360000	0.01 [s]
1104 hex	1103 hex		F002 (LOW)			
1105 hex	1104 hex	1st Deceleration Time 1	F003 (HIGH)	R/W	1 to 360000	0.01 [s]
1106 hex	1105 hex		F003 (LOW)			
1107 hex	1106 hex	RUN Direction Selection	F004	R/W	0: Forward 1: Reverse	–
1108 to 1200 hex	–	Not used	–	–		–

8-5-4 Group A/b/C/H/P Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter. Use this register number when setting communications or other options for the inverter.
- The “Modbus register spec. No.” in the table header 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 No.	R/W	Monitor or setting data	Resolution
1201 hex	1200 hex	Frequency Reference Selection	A001	R/W	0: Digital Operator (Volume adjuster) 1: Control Circuit Terminal Block 2: Digital Operator (F001) 3: Modbus communication 4: Option 1 5: Option 2 6: Pulse train frequency 7: DriveProgramming 10: Operation function output	–
1202 hex	1201 hex	RUN Command Selection	A002	R/W	1: Control Circuit Terminal Block 2: Digital Operator (F001) 3: Modbus communication 4: Option 1 5: Option 2	–
1203 hex	1202 hex	1st Base Frequency	A003	R/W	30 to Max. frequency	1 [Hz]
1204 hex	1203 hex	1st Maximum Frequency	A004	R/W	30 to 400	1 [Hz]
1205 hex	1204 hex	FV/FI Selection	A005	R/W	0: Switching between FV (voltage) and FI (current) 1: Switching between FV and FE 2: Switching between FV and volume adjuster via terminal AT 3: Switching between FI and volume adjuster via terminal AT 4: Switching between FE and volume adjuster via terminal AT	–
1206 hex	1205 hex	FE Selection	A006	R/W	0: FE only 1: FV/FI auxiliary frequency reference (Not reversible) 2: FV/FI auxiliary frequency reference (Reversible) 3: FE disabled	–
1207 to 120A hex	–	Not used	–	–	–	–
120B hex	120A hex	FV Start Frequency	A011 (HIGH)	R/W	0 to 40000	0.01 [Hz]
120C hex	120B hex		A011 (LOW)			

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
120D hex	120C hex	FV End Frequency	A012 (HIGH)	R/W	0 to 40000	0.01 [Hz]
120E hex	120D hex		A012 (LOW)			
120F hex	120E hex	FV Start Ratio	A013	R/W	0 to FV End Ratio	1 [%]
1210 hex	120F hex	FV End Ratio	A014	R/W	FV Start Ratio to 100	1 [%]
1211 hex	1210 hex	FV Start Selection	A015	R/W	0: Start frequency (A011) 1: 0 Hz	–
1212 hex	1211 hex	Analog Input Filter	A016	R/W	1. to 30. (×2 ms) 31. (500-ms filter with ±0.1–Hz hysteresis)	1
1213 hex	1212 hex	DriveProgramming Function Selection	A017	–	0: Disabled 1: Enabled (Start/stop via multi-function input terminal (S1 to S8)) 2: Enabled (Start/stop via power on/off)	–
1214 hex	–	Not used	–	–	–	–
1215 hex	1214 hex	Multi-step Speed Selection	A019	R/W	0: Binary (16-step selection with 4 terminals) 1: Bit (8-step selection with 7 terminals)	–
1216 hex	1215 hex	1st Multi-step Speed Reference 0	A020 (HIGH)	R/W	0 Starting Frequency to 1st Maximum Frequency	0.01 [Hz]
1217 hex	1216 hex		A020 (LOW)	R/W		
1218 hex	1217 hex	Multi-step Speed Reference 1	A021 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1219 hex	1218 hex		A021 (LOW)	R/W		
121A hex	1219 hex	Multi-step Speed Reference 2	A022 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
121B hex	121A hex		A022 (LOW)	R/W		
121C hex	121B hex	Multi-step Speed Reference 3	A023 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
121D hex	121C hex		A023 (LOW)	R/W		
121E hex	121D hex	Multi-step Speed Reference 4	A024 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
121F hex	121E hex		A024 (LOW)	R/W		
1220 hex	121F hex	Multi-step Speed Reference 5	A025 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1221 hex	1220 hex		A025 (LOW)	R/W		
1222 hex	1221 hex	Multi-step Speed Reference 6	A026 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1223 hex	1222 hex		A026 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1224 hex	1223 hex	Multi-step Speed Reference 7	A027 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1225 hex	1224 hex		A027 (LOW)	R/W		
1226 hex	1225 hex	Multi-step Speed Reference 8	A028 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1227 hex	1226 hex		A028 (LOW)	R/W		
1228 hex	1227 hex	Multi-step Speed Reference 9	A029 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1229 hex	1228 hex		A029 (LOW)	R/W		
122A hex	1229 hex	Multi-step Speed Reference 10	A030 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
122B hex	122A hex		A030 (LOW)	R/W		
122C hex	122B hex	Multi-step Speed Reference 11	A031 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
122D hex	122C hex		A031 (LOW)	R/W		
122E hex	122D hex	Multi-step Speed Reference 12	A032 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
122F hex	122E hex		A032 (LOW)	R/W		
1230 hex	122F hex	Multi-step Speed Reference 13	A033 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1231 hex	1230 hex		A033 (LOW)	R/W		
1232 hex	1231 hex	Multi-step Speed Reference 14	A034 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1233 hex	1232 hex		A034 (LOW)	R/W		
1234 hex	1233 hex	Multi-step Speed Reference 15	A035 (HIGH)	R/W	0 Starting frequency to Max. frequency	0.01 [Hz]
1235 hex	1234 hex		A035 (LOW)	R/W		
1236 hex	–	Not used	–	–	–	–
1237 hex	–	Not used	–	–	–	–
1238 hex	1237 hex	Jogging Frequency	A038	R/W	Starting Frequency to 999	0.01 [Hz]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1239 hex	1238 hex	Jogging Stop Selection	A039	R/W	00: Free-run stop/Disabled in operation 01: Deceleration stop/Disabled in operation 02: DC injection braking stop/Disabled in operation 03: Free-run stop/Enabled in operation 04: Deceleration stop/Enabled in operation 05: DC injection braking stop/Enabled in operation	–
123A hex	–	Not used	–	–	–	–
123B hex	123A hex	1st Torque Boost Selection	A041	R/W	0: Manual torque boost 1: Automatic torque boost	–
123C hex	123B hex	1st Manual Torque Boost Voltage	A042	R/W	0 to 200	0.1 [%]
123D hex	123C hex	1st Manual Torque Boost Frequency	A043	R/W	0 to 500	0.1 [%]
123E hex	123D hex	1st Control Method	A044	R/W	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control 04: 0-Hz sensorless vector control 05: Sensor vector control (V2) (04 and 05 only in the heavy load mode)	–
123F hex	123E hex	Output Voltage Gain	A045	R/W	20 to 100	1 [%]
1240 hex	123F hex	1st Automatic Torque Boost Voltage Compensation Gain	A046	R/W	0 to 255	1 [%]
1241 hex	1240 hex	1st Automatic Torque Boost Slip Compensation Gain	A047	R/W	0 to 255	1 [%]
1242 to 1244 hex	–	Not used	–	–	–	–
1245 hex	1244 hex	DC Injection Braking Selection	A051	R/W	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	–
1246 hex	1245 hex	DC Injection Braking Frequency	A052	R/W	0 to 40000	0.01 [Hz]
1247 hex	1246 hex	DC Injection Braking Delay Time	A053	R/W	0 to 50	0.1 [s]
1248 hex	1247 hex	DC Injection Braking Power	A054	R/W	0 to 100 (0.4 to 55 kW) 0 to 80 (75 to 132 kW) (In the light mode) 0 to 70 (0.4 to 55 kW) 0 to 50 (75 to 132 kW)	1 [%]
1249 hex	1248 hex	DC Injection Braking Time	A055	R/W	0 to 600	0.1 [s]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
124A hex	1249 hex	DC Injection Braking Edge/Level Selection	A056	R/W	00: Edge operation 01: Level operation	–
124B hex	124A hex	Startup DC Injection Braking Power	A057	R/W	0 to 100 (0.4 to 55 kW) 0 to 80 (75 to 132 kW) (In the light mode) 0 to 70 (0.4 to 55 kW) 0 to 50 (75 to 132 kW)	1 [%]
124C hex	124B hex	Startup DC Injection Braking Time	A058	R/W	0 to 600	0.1 [s]
124D hex	124C hex	DC Injection Braking Carrier Frequency	A059	R/W	5 to 150 (0.4 to 55 kW) 5 to 100 (75 to 132 kW) (In the light mode) 5 to 120 (0.4 to 55 kW) 5 to 80 (95 to 132 kW)	0.01 [Hz]
124E hex	–	Not used	–	–	–	–
124F hex	124E hex	1st Frequency Upper Limit	A061 (HIGH)	R/W	0 Frequency Lower Limit to Max. Frequency	0.01 [Hz]
1250 hex	124F hex		A061 (LOW)	R/W		
1251 hex	1250 hex	1st Frequency Lower Limit	A062 (HIGH)	R/W	0 Starting Frequency to Frequency Upper Limit	0.01 [Hz]
1252 hex	1251 hex		A062 (LOW)	R/W		
1253 hex	1252 hex	Jump Frequency 1	A063 (HIGH)	R/W	0 to 40000	0.01 [Hz]
1254 hex	1253 hex		A063 (LOW)	R/W		
1255 hex	1254 hex	Jump Frequency Width 1	A064	R/W	0 to 1000	0.01 [Hz]
1256 hex	1255 hex	Jump Frequency 2	A065 (HIGH)	R/W	0 to 40000	0.01 [Hz]
1257 hex	1256 hex		A065 (LOW)	R/W		
1258 hex	1257 hex	Jump Frequency Width 2	A066	R/W	0 to 1000	0.01 [Hz]
1259 hex	1258 hex	Jump Frequency 3	A067 (HIGH)	R/W	0 to 40000	0.01 [Hz]
125A hex	1259 hex		A067 (LOW)	R/W		
125B hex	125A hex	Jump Frequency Width 3	A068	R/W	0 to 1000	0.01 [Hz]
125C hex	125B hex	Acceleration Stop Frequency	A069 (HIGH)	R/W	0 to 40000	0.01 [Hz]
125D hex	125C hex		A069 (LOW)	R/W		
125E hex	125D hex	Acceleration Stop Time	A070	R/W	0 to 600	0.1 [s]
125F hex	125E hex	PID Selection	A071	R/W	00: Disabled 01: Enabled 02: Reverse output enabled	–
1260 hex	125F hex	PID P Gain	A072	R/W	2 to 50	0.1
1261 hex	1260 hex	PID I Gain	A073	R/W	0 to 36000	0.1 [s]
1262 hex	1261 hex	PID D Gain	A074	R/W	0 to 10000	0.01 [s]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1263 hex	1262 hex	PID Scale	A075	R/W	1 to 9999	0.01
1264 hex	1263 hex	PID Feedback Selection	A076	R/W	00: FI (Current) 01: FV (Voltage) 02: Modbus communication 10: Operation function output	–
1265 hex	1264 hex	PID Deviation Reverse Output	A077	R/W	00: Disabled 01: Enabled	–
1266 hex	1265 hex	PID Variable Range Limit	A078	R/W	0 to 1000	0.1 [s]
1267 hex	1266 hex	PID Feedforward Selection	A079	R/W	00: Disabled 01: FV (Voltage) 02: FI (Current) 03: FE (Voltage)	–
1268 hex	–	Not used	–	–	–	–
1269 hex	1268 hex	AVR Selection	A081	R/W	00: Always ON 01: Always OFF 02: OFF during deceleration	–
126A hex	1269 hex	Motor Rated Voltage Selection	A082	R/W	200-V class: 00(200) 01(215) 02(220) 03(230) 04(240) 400-V class: 05(380) 06(400) 07(415) 08(440) 09(460) 10(480)	–
126B hex	–	Not used	–	–	–	–
126C hex	–	Not used	–	–	–	–
126D hex	126C hex	Operation Mode Selection	A085	R/W	00: Normal operation 01: Energy-saving operation 02: Automatic operation (only in the heavy load mode)	–
126E hex	126D hex	Energy-saving Response/Accuracy Adjustment	A086	R/W	0 to 1000	0.1 [%]
126F to 1273 hex	–	Not used	–	–	–	–
1274 hex	126F to 1273 hex	1st Acceleration Time 2	A092 (HIGH)	R/W	1 to 360000	0.01 [s]
1275 hex	1274 hex		A092 (LOW)	R/W		
1276 hex	1275 hex	1st Deceleration Time 2	A093 (HIGH)	R/W	1 to 360000	0.01 [s]
1277 hex	1276 hex		A093 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1278 hex	1277 hex	1st 2-step Acceleration/Deceleration Selection	A094	R/W	0: Switched via terminal 2CH 1: Switched by setting 2: Switched only during forward/reverse switching	–
1279 hex	1278 hex	1st 2-step Acceleration Frequency	A095 (HIGH)	R/W	0 to 40000	0.01 [Hz]
127A hex	1279 hex		A095 (LOW)	R/W		
127B hex	127A hex	1st 2-step Deceleration Frequency	A096 (HIGH)	R/W	0 to 40000	0.01 [Hz]
127C hex	127B hex		A096 (LOW)	R/W		
127D hex	127C hex	Acceleration Pattern Selection	A097	R/W	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	–
127E hex	127D hex	Deceleration Pattern Selection	A098	R/W	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	–
127F hex	–	Not used	–	–	–	–
1280 hex	–	Not used	–	–	–	–
1281 hex	1280 hex	FI Start Frequency	A101 (HIGH)	R/W	0 to 40000	0.01 [Hz]
1282 hex	1281 hex		A101 (LOW)	R/W		
1283 hex	1282 hex	FI End Frequency	A102 (HIGH)	R/W	0 to 40000	0.01 [Hz]
1284 hex	1283 hex		A102 (LOW)	R/W		
1285 hex	1284 hex	FI Start Ratio	A103	R/W	0 to FI End Ratio	1 [%]
1286 hex	1285 hex	FI End Ratio	A104	R/W	FI Start Ratio to 100	1 [%]
1287 hex	1286 hex	FI Start Selection	A105	R/W	00: Use FI Start Frequency (A101) 01: 0 Hz	–
1288 to 128C hex	–	Not used	–	–	–	–
128D hex	128C hex	FE Start Frequency	A111 (HIGH)	R/W	–40000 to 40000	0.01 [Hz]
128E hex	128D hex		A111 (LOW)	R/W		
128F hex	128E hex	FE End Frequency	A112 (HIGH)	R/W	–40000 to 40000	0.01 [Hz]
1290 hex	128F hex		A112 (LOW)	R/W		
1291 hex	1290 hex	FE Start Ratio	A113	R/W	–100 to FE End Ratio	1 [%]
1292 hex	1291 hex	FE End Ratio	A114	R/W	FE Start Ratio to 100	1 [%]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1293 to 12A4 hex	–	Not used	–	–	–	–
12A5 hex	12A4 hex	Acceleration Curve Parameter	A131	R/W	01 (Small curve) to 10 (Large curve)	–
12A6 hex	12A5 hex	Deceleration Curve Parameter	A132	R/W	01 (Small curve) to 10 (Large curve)	–
12A7 to 12AE hex	–	Not used	–	–	–	–
12AF hex	12AE hex	Calculation Frequency Selection 1	A141	R/W	00: Digital Operator 01: Digital Operator (Volume adjuster) 02: Input FV (Voltage) 03: Input FI (Current) 04: Modbus communication 05: Option 1 06: Option 2 07: Pulse train frequency	–
12B0 hex	12AF hex	Calculation Frequency Selection 2	A142	R/W	00: Digital Operator 01: Digital Operator (Volume adjuster) 02: Input FV (Voltage) 03: Input FI (Current) 04: Modbus communication 05: Option 1 06: Option 2 07: Pulse train frequency	–
12B1 hex	12B0 hex	Calculation Function Operator Selection	A143	R/W	00: Addition (A141 + A142) 01: Subtraction (A141 – A142) 02: Multiplication (A141 x A142)	–
12B2 hex	–	Not used	–	–	–	–
12B3 hex	12B2 hex	Frequency Addition Amount Setting	A145 (HIGH)	R/W	0 to 40000	0.01 [Hz]
12B4 hex	12B3 hex		A145 (LOW)	R/W		
12B5 hex	12B4 hex	Frequency Addition Sign Selection	A146	R/W	00: Frequency reference + A145 01: Frequency reference – A145	–
12B6 to 12B8 hex	–	Not used	–	–	–	–
12B9 hex	12B8 hex	EL-S Shape Acceleration Curve Ratio 1	A150	R/W	0 to 50	1 [%]
12BA hex	12B9 hex	EL-S Shape Acceleration Curve Ratio 2	A151	R/W	0 to 50	1 [%]
12BB hex	12BA hex	EL-S Shape Deceleration Curve Ratio 1	A152	R/W	0 to 50	1 [%]
12BC hex	12BB hex	EL-S Shape Deceleration Curve Ratio 2	A153	R/W	0 to 50	1 [%]
12BD to 1300 hex	–	Not used	–	–	–	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1301 hex	1300 hex	Power Interruption/Undervoltage Restart Selection	b001	R/W	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	–
1302 hex	1301 hex	Allowable Power Interruption Time	b002	R/W	3 to 250	0.1 [s]
1303 hex	1302 hex	Restart Standby Time	b003	R/W	3 to 1000	0.1 [s]
1304 hex	1303 hex	Power Interruption/Undervoltage Trip Selection During Stop	b004	R/W	00: Disabled 01: Enabled 02: Disabled during stop and deceleration stop	–
1305 hex	1304 hex	Power Interruption Restart Count	b005	R/W	00: 16 times 01: No limit	–
1306 hex	1305 hex	Input Phase Loss Protection Selection	b006	R/W	00: Disabled 01: Enabled	–
1307 hex	1306 hex	Frequency Matching Lower Limit Frequency	b007 (HIGH)	R/W	0 to 40000	0.01 [Hz]
1308 hex	1307 hex		b007 (LOW)	R/W		
1309 hex	1308 hex	Overvoltage/Overcurrent Restart Selection	b008	R/W	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	–
130A hex	1309 hex	Undervoltage Restart Count	b009	R/W	00: 16 times 01: No limit	–
130B hex	130A hex	Overvoltage/Overcurrent Restart Count	b010	R/W	1 to 3	–
130C hex	130B hex	Overvoltage/Overcurrent Restart Standby Time	b011	R/W	3 to 1000	0.1 [s]
130D hex	130C hex	1st Electronic Thermal Level	b012	R/W	200 to 1000	0.1 [%]
130E hex	130D hex	1st Electronic Thermal Characteristics Selection	b013	R/W	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–
130F hex	–	Not used	–	–	–	–
1310 hex	130F hex	Free-electronic Thermal Frequency 1	b015	R/W	0 to Free-electronic Thermal Frequency 2	1 [Hz]
1311 hex	1310 hex	Free-electronic Thermal Current 1	b016	R/W	0 to Rated current	0.1 [A]
1312 hex	1311 hex	Free-electronic Thermal Frequency 2	b017	R/W	Free-electronic Thermal Frequency 1 to Free-electronic Thermal Frequency 3	1 [Hz]
1313 hex	1312 hex	Free-electronic Thermal Current 2	b018	R/W	0 to Rated current	0.1 [A]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1314 hex	1313 hex	Free-electronic Thermal Frequency 3	b019	R/W	Free-electronic Thermal Frequency 2 to 400	1 [Hz]
1315 hex	1314 hex	Free-electronic Thermal Current 3	b020	R/W	0 to Rated current	0.1 [A]
1316 hex	1315 hex	Overload Limit Selection	b021	R/W	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)	–
1317 hex	1316 hex	Overload Limit Level	b022	R/W	200 to 2000 (0.4 to 55 kW) 200 to 1800 (75 to 132 kW) (In the light mode) 200 to 1500 (0.4 to 132 kW)	0.1 [%]
1318 hex	1317 hex	Overload Limit Parameter	b023	R/W	10 to 3000	0.01 [s]
1319 hex	1318 hex	Overload Limit Selection 2	b024	R/W	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)	–
131A hex	1319 hex	Overload Limit Level 2	b025	R/W	200 to 2000 (0.4 to 55 kW) 200 to 1800 (75 to 132 kW) (In the light mode) 200 to 1500 (0.4 to 132 kW)	0.1 [%]
131B hex	131A hex	Overload Limit Parameter 2	b026	R/W	10 to 3000	0.01 [s]
131C hex	131B hex	Overcurrent Suppression Selection	b027	R/W	00: Disabled 01: Enabled	–
131D hex	131C hex	Frequency Pull-in Restart Level	b028	R/W	200 to 2000 (0.4 to 55 kW) 200 to 1800 (75 to 132 kW) (In the light mode) 200 to 1500 (0.4 to 132 kW)	0.1 [%]
131E hex	131D hex	Frequency Pull-in Restart Parameter	b029	R/W	10 to 3000	0.01 [s]
131F hex	131E hex	Starting Frequency Selection at Frequency Pull-in Restart	b030	R/W	00: Frequency at interruption 01: Max. frequency 02: Set frequency	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1320 hex	131F hex	Soft Lock Selection	b031	R/W	00: Data other than b031 cannot be changed when terminal SFT is ON. 01: Data other than b031 and set frequency cannot be changed when terminal SFT is ON. 02: Data other than b031 cannot be changed. 03: Data other than b031 and the specified frequency parameter cannot be changed. 10: Data can be changed during RUN.	–
1321 hex	–	Not used	–	–	–	–
1322 hex	–	Not used	–	–	–	–
1323 hex	1322 hex	RUN Time/Power ON Time Detection Level	b034 (HIGH)	R/W	0 to 65535	1 [10 h]
1324 hex	1323 hex		b034 (LOW)	R/W		
1325 hex	1324 hex	RUN Direction Limit Selection	b035	R/W	00: No direction limit 01: Forward only (Reverse limited) 02: Reverse only (Forward limited)	–
1326 hex	1325 hex	Reduced Voltage Startup Selection	b036	R/W	0: (Reduced voltage startup time: Short) to 255: (Reduced voltage startup time: Long)	–
1327 hex	1326 hex	Display Selection	b037	R/W	00: Complete display 01: Individual display of functions 02: User setting + b037 03: Data comparison display 04: Basic display	–
1328 hex	1327 hex	Initial Screen Selection	b038	R/W	00: Screen on which the Enter key was last pressed 001 to 060: (d001 to d060) 201: F001 202: Do not set.	–
1329 hex	1328 hex	User Parameter Automatic Setting Function	b039	R/W	00: Disabled 01: Enabled	–
132A hex	1329 hex	Torque Limit Selection	b040	R/W	00: Four-quadrant separate setting 01: Terminal switching 02: Analog Input 03: Option 1 04: Option 2	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
132B hex	132A hex	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	b041	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) 255 (no) (In the light mode) 0 to 150 255 (no)	1 [%]
132C hex	132B hex	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	b042	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) 255 (no) (In the light mode) 0 to 150 255 (no)	1 [%]
132D hex	132C hex	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	b043	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) 255 (no) (In the light mode) 0 to 150 255 (no)	1 [%]
132E hex	132D hex	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	b044	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) 255 (no) (In the light mode) 0 to 150 255 (no)	1 [%]
132F hex	132E hex	Torque LADSTOP Selection	b045	R/W	00: Disabled 01: Enabled	–
1330 hex	132F hex	Reverse Rotation Prevention Selection	b046	R/W	00: Disabled 01: Enabled	–
1331 to 1332 hex	–	Not used	–	–	–	–
1333 hex	1332 hex	Heavy Load/Light Load Selection	b049	R/W	00: Heavy load mode 01: Light load mode	–
1334 hex	1333 hex	Deceleration Stop Selection on Power Interruption	b050	R/W	00: Disabled 01: Enabled (Deceleration stop) 02: Enabled (Constant voltage, without recovery) 03: Enabled (Constant voltage, with recovery)	–
1335 hex	1334 hex	Starting Voltage on Power Interruption	b051	R/W	0 to 10000	0.1 [V]
1336 hex	1335 hex	Deceleration Hold Level on Power Interruption	b052	R/W	0 to 10000	0.1 [V]
1337 hex	1336 hex	Deceleration Time on Power Interruption	b053 (HIGH)	R/W	0 to 360000	0.01 [s]
1338 hex	1337 hex		b053 (LOW)	R/W		
1339 hex	1338 hex	Deceleration Starting Width on Power Interruption	b054	R/W	0 to 1000	0.01 [Hz]
133A hex	1339 hex	Proportional Gain on Power Interruption	b055	R/W	0 to 255	0.01
133B hex	133A hex	Integral Time on Power Interruption	b056	R/W	0 to 65535	0.001 [s]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
133C to 133E hex	–	Not used	–	–	–	–
133F hex	133E hex	Window Comparator FV Upper Limit Level	b060	R/W	Set an upper limit level. Setting range: 0 to 100 Lower limit: Lower limit level + Hysteresis width x 2	1 [%]
1340 hex	133F hex	Window Comparator FV Lower Limit Level	b061	R/W	Set a lower limit level. Setting range: 0 to 100 Upper limit: Upper limit level - Hysteresis width x 2	1 [%]
1341 hex	1340 hex	Window Comparator FV Hysteresis Width	b062	R/W	Set a hysteresis width for the upper and lower limit levels. Setting range: 0 to 10 Upper limit: (Upper limit level – Lower limit level) / 2	1 [%]
1342 hex	1341 hex	Window Comparator FI Upper Limit Level	b063	R/W	Set an upper limit level. Setting range: 0 to 100 Lower limit: Lower limit level + Hysteresis width x 2	1 [%]
1343 hex	1342 hex	Window Comparator FI Lower Limit Level	b064	R/W	Set a lower limit level. Setting range: 0 to 100 Upper limit: Upper limit level - Hysteresis width x 2	1 [%]
1344 hex	1343 hex	Window Comparator FI Hysteresis Width	b065	R/W	Set a hysteresis width for the upper and lower limit levels. Setting range: 0 to 10 Upper limit: (Upper limit level – Lower limit level) / 2	1 [%]
1345 hex	1344 hex	Window Comparator FE Upper Limit Level	b066	R/W	Set an upper limit level. Setting range: –100 to 100 Lower limit: Lower limit level + Hysteresis width x 2	1 [%]
1346 hex	1345 hex	Window Comparator FE Lower Limit Level	b067	R/W	Set a lower limit level. Setting range: –100 to 100 Upper limit: Upper limit level - Hysteresis width x 2	1 [%]
1347 hex	1346 hex	Window Comparator FE Hysteresis Width	b068	R/W	Set a hysteresis width for the upper and lower limit levels. Setting range: 0 to 10 Upper limit: (Upper limit level – Lower limit level) / 2	1 [%]
1348 hex	–	Not used	–	–	–	–
1349 hex	1348 hex	Analog Operation Level at FV Disconnection	b070	R/W	0 to 100 255 (no)	1 [%]
134A hex	1349 hex	Analog Operation Level at FI Disconnection	b071	R/W	0 to 100 255 (no)	1 [%]
134B hex	134A hex	Analog Operation Level at FE Disconnection	b072	R/W	–100 to 100 127 (no)	1 [%]
134C to 1350 hex	–	Not used	–	–	–	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1351 hex	1350hex	Integrated Power Clear	b078	R/W	Clear by writing 1	–
1352 hex	1351 hex	Integrated Power Display Scale	b079	R/W	1 to 1000	1
1353 hex	–	Not used	–	–	–	–
1354 hex	–	Not used	–	–	–	–
1355 hex	1354 hex	Starting Frequency	b082	R/W	10 to 999	0.01 [Hz]
1356 hex	1355 hex	Carrier Frequency	b083	R/W	5 to 150 (0.4 to 55 kW) 5 to 100 (75 to 132 kW) (In the light mode) 5 to 120 (0.4 to 55 kW) 5 to 80 (75 to 132 kW)	0.1 [kHz]
1357 hex	1356 hex	Initialization Selection	b084	R/W	00: Initialization disabled 01: Clear fault monitor 02: Initialize data 03: Clear fault monitor + Initialize data 04: Clear fault monitor + Initialize data + Clear DriveProgramming	–
1358 hex	1357 hex	Initialization Data Selection	b085	R/W	Do not change.	–
1359 hex	1358 hex	Frequency Conversion Coefficient	b086	R/W	1 to 999	0.1
135A hex	1359 hex	STOP Key Selection	b087	R/W	00: Enabled 01: Disabled 02: Only RESET enabled	–
135B hex	135A hex	Free-run Stop Selection	b088	R/W	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–
135C hex	135B hex	Automatic Carrier Reduction	b089	R/W	00: Disabled 01: Enabled, dependent on the current	–
135D hex	135C hex	Usage Rate of Regenerative Braking	b090	R/W	0 to 1000	0.1 [%]
135E hex	135D hex	Stop Selection	b091	R/W	00: Deceleration stop 01: Free-run stop	–
135F hex	135E hex	Cooling Fan Operation	b092	R/W	00: Always enabled 01: Enabled only during RUN (including 5 minutes after power on/stop)	–
1360 hex	–	Not used	–	–	–	–
1361 hex	–	Not used	–	–	–	–
1362 hex	1361 hex	Regenerative Braking Selection	b095	R/W	00: Disabled 01: Enabled (Disabled during stop) 02: Enabled (Also during stop)	–
1363 hex	1362 hex	Regenerative Braking ON Level	b096	R/W	200-V class: 330 to 380 400-V class: 660 to 760	1 [V]
1364 hex	–	Not used	–	–	–	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1365 hex	1364 hex	Thermistor Selection	b098	R/W	00: Disabled 01: PTC enabled 02: NTC enabled	–
1366 hex	1365 hex	Thermistor Error Level	b099	R/W	0 to 9999	1 [Ω]
1367 hex	1366 hex	Free V/f Frequency 1	b100	R/W	0 to Free V/f Frequency 2	1 [Hz]
1368 hex	1367 hex	Free V/f Voltage 1	b101	R/W	0 to 8000	0.1 [V]
1369 hex	1368 hex	Free V/f Frequency 2	b102	R/W	Free V/f Frequency 1 to Free V/f Frequency 3	1 [Hz]
136A hex	1369 hex	Free V/f Voltage 2	b103	R/W	0 to 8000	0.1 [V]
136B hex	136A hex	Free V/f Frequency 3	b104	R/W	Free V/f Frequency 2 to Free V/f Frequency 4	1 [Hz]
136C hex	136B hex	Free V/f Voltage 3	b105	R/W	0 to 8000	0.1 [V]
136D hex	136C hex	Free V/f Frequency 4	b106	R/W	Free V/f Frequency 3 to Free V/f Frequency 5	1 [Hz]
136E hex	136D hex	Free V/f Voltage 4	b107	R/W	0 to 8000	0.1 [V]
136F hex	136E hex	Free V/f Frequency 5	b108	R/W	Free V/f Frequency 4 to Free V/f Frequency 6	1 [Hz]
1370 hex	136F hex	Free V/f Voltage 5	b109	R/W	0 to 8000	0.1 [V]
1371 hex	1370 hex	Free V/f Frequency 6	b110	R/W	Free V/f Frequency 5 to Free V/f Frequency 7	1 [Hz]
1372 hex	1371 hex	Free V/f Voltage 6	b111	R/W	0 to 8000	0.1 [V]
1373 hex	1372 hex	Free V/f Frequency 7	b112	R/W	Free V/f Frequency 6 to 400	1 [Hz]
1374 hex	1373 hex	Free V/f Voltage 7	b113	R/W	0 to 8000	0.1 [V]
1375 to 137A hex	–	Not used	–	–	–	–
137B hex	137A hex	Brake Control Function Selection	b120	R/W	00: Disabled 01: Enabled	–
137C hex	137B hex	Brake Release Wait Time	b121	R/W	0 to 500	0.01 [s]
137D hex	137C hex	Acceleration Wait Time on Brake Control	b122	R/W	0 to 500	0.01 [s]
137E hex	137D hex	Stop Wait Time on Brake Control	b123	R/W	0 to 500	0.01 [s]
137F hex	137E hex	Brake Error Detection Time	b124	R/W	0 to 500	0.01 [s]
1380 hex	137F hex	Brake Release Frequency	b125	R/W	0 to 40000	0.01 [Hz]
1381 hex	1380 hex	Brake Release Current	b126	R/W	0 to 2000 (0.4 to 55 kW) 0 to 1800 (75 to 132 kW)	0.1 [%]
1382 hex	1381 hex	Brake Force Frequency	b127	R/W	0 to 40000	0.01 [Hz]
1383 hex	–	Not used	–	–	–	–
1384 hex	–	Not used	–	–	–	–
1385 hex	1384 hex	Overvoltage Suppression Function Selection During Deceleration	b130	R/W	00: Disabled 01: Enabled (DC voltage kept constant) 02: Enabled (Acceleration enabled)	–
1386 hex	1385 hex	Overvoltage Suppression Level During Deceleration	b131	R/W	200-V class: 330 to 390 400-V class: 660 to 780	1 [V]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1387 hex	1386 hex	Overvoltage Suppression Parameter During Deceleration	b132	R/W	10 to 3000	0.01 [s]
1388 hex	1387 hex	Overvoltage Suppression Proportional Gain During Deceleration	b133	R/W	0 to 255	0.01
1389 hex	1388 hex	Overvoltage Suppression Integral Time During Deceleration	b134	R/W	0 to 65535	0.001 [s]
138A to 13A6 hex	–	Not used	–	–	–	–
13A7 hex	13A6 hex	Initial Screen Automatic Return Function	b164	R/W	0: Disabled 1: Enabled	–
13A8 hex	–	Not used	–	–		–
13A9 hex	13A8 hex	Data Read/Write Selection	b166	R/W	00: R/W OK 01: R/W protected	–
13AA to 13B6 hex	–	Not used	–	–		–
13B7 hex	13B6	Initialization Execution	b180	R/W	00: Function is disabled 01: Execute initialization	–
13B8 to 1400 hex	–	Not used	–	–		–

<table>
<tr><th>Register No.</th><th>Modbus register spec. No.</th><th>Function name</th><th>Parameter No.</th><th>R/W</th><th>Monitor or setting data</th><th>Resolution</th></tr>
<tr><td>1401 hex</td><td>1400 hex</td><td>Multi-function Input S1 Selection</td><td>C001</td><td>R/W</td><td rowspan="8">01: RV (Reverse)
02: CF1 (Multi-step speed setting binary 1)
03: CF2 (Multi-step speed setting binary 2)
04: CF3 (Multi-step speed setting binary 3)
05: CF4 (Multi-step speed setting binary 4)
06: JG (Jogging)
07: DB (External DC injection braking)
08: SET (2nd control)
09: 2CH (2-step acceleration/deceleration)
11: FRS (Free-run stop)
12: EXT (External trip)
13: USP (Power recovery restart prevention function)
14: CS (Commercial switch)
15: SFT (Soft lock)
16: AT (Analog input switching)
17: SET3 (3rd control)
18: RS (Reset)
20: STA (3-wire start)
21: STP (3-wire stop)
22: FR (3-wire forward/reverse)
23: PID (PID disabled)
24: PIDC (PID integral reset)
26: CAS (Control gain switching)
27: UP (Remote operation accelerated)
28: DWN (Remote operation decelerated)
29: UDC (Remote data clear)
31: OPE (Forced operator function)
32: SF1 (Multi-step speed setting bit 1)
33: SF2 (Multi-step speed setting bit 2)
34: SF3 (Multi-step speed setting bit 3)
35: SF4 (Multi-step speed setting bit 4)
36: SF5 (Multi-step speed setting bit 5)
37: SF6 (Multi-step speed setting bit 6)
38: SF7 (Multi-step speed setting bit 7)
39: OLR (Overload limit switching)
40: TL (Torque limit enabled/disabled)
41: TRQ1 (Torque limit switching 1)
42: TRQ2 (Torque limit switching 2)
43: PPI (P/PI switching)
44: BOK (Brake confirmation)
45: ORT (Orientation)
46: LAC (LAD cancel)
47: PCLR (Position deviation clear)
48: STAT: Pulse train position command permission
50: ADD (Set frequency A145 addition)
51: F-TM (Forced terminal block)
52: ATR (Torque command input permission)
53: KHC (Integrated power clear)
54: SON (Servo ON)
55: FOC (Preliminary excitation)
56: MI1 (General-purpose input 1)
57: MI2 (General-purpose input 2)
58: MI3 (General-purpose input 3)
59: MI4 (General-purpose input 4)
60: MI5 (General-purpose input 5)
61: MI6 (General-purpose input 6)
62: MI7 (General-purpose input 7)
63: MI8 (General-purpose input 8)
65: AHD (Analog command held)
66: CP1 (Position command selection 1)
67: CP2 (Position command selection 2)
68: CP3 (Position command selection 3)
69: ORL (Zero return limit signal)
70: ORG (Zero return startup signal)
71: FOT (Forward driving stop)
72: ROT (Reverse driving stop)
73: SPD (Speed/Position switching)
74: PCNT (Pulse counter)
75: PCC (Pulse counter clear)
82: PRG (DriveProgramming start)
255: no (No allocation)</td><td>–</td></tr>
<tr><td>1402 hex</td><td>1401 hex</td><td>Multi-function Input S2 Selection</td><td>C002</td><td>R/W</td><td>–</td></tr>
<tr><td>1403 hex</td><td>1402 hex</td><td>Multi-function Input S3 Selection</td><td>C003</td><td>R/W</td><td>–</td></tr>
<tr><td>1404 hex</td><td>1403 hex</td><td>Multi-function Input S4 Selection</td><td>C004</td><td>R/W</td><td>–</td></tr>
<tr><td>1405 hex</td><td>1404 hex</td><td>Multi-function Input S5 Selection</td><td>C005</td><td>R/W</td><td>–</td></tr>
<tr><td>1406 hex</td><td>1405 hex</td><td>Multi-function Input S6 Selection</td><td>C006</td><td>R/W</td><td>–</td></tr>
<tr><td>1407 hex</td><td>1406 hex</td><td>Multi-function Input S7 Selection</td><td>C007</td><td>R/W</td><td>–</td></tr>
<tr><td>1408 hex</td><td>1407 hex</td><td>Multi-function Input S8 Selection</td><td>C008</td><td>R/W</td><td>–</td></tr>
</table>

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1409 hex	–	Not used	–	–	–	–
140A hex	–	Not used	–	–	–	–
140B hex	140A hex	Multi-function Input S1 Operation Selection	C011	R/W	00: NO (Normally open contact) 01: NC (Normally closed contact)	–
140C hex	140B hex	Multi-function Input S2 Operation Selection	C012	R/W		–
140D hex	140C hex	Multi-function Input S3 Operation Selection	C013	R/W		–
140E hex	140D hex	Multi-function Input S4 Operation Selection	C014	R/W		–
140F hex	140E hex	Multi-function Input S5 Operation Selection	C015	R/W		–
1410 hex	140F hex	Multi-function Input S6 Operation Selection	C016	R/W		–
1411 hex	1410 hex	Multi-function Input S7 Operation Selection	C017	R/W		–
1412 hex	1411 hex	Multi-function Input S8 Operation Selection	C018	R/W		–
1413 hex	1412 hex	Forward RUN Command FW Operation Selection	C019	R/W		–
1414 hex	–	Not used	–	–	–	–

<table>
<tr><th>Register No.</th><th>Modbus register spec. No.</th><th>Function name</th><th>Parameter No.</th><th>R/W</th><th>Monitor or setting data</th><th>Resolution</th></tr>
<tr><td>1415 hex</td><td>1414 hex</td><td>Multi-function Output P1 Selection</td><td>C021</td><td>R/W</td><td rowspan="6">00: RUN (Signal during RUN)
01: FA1 (Constant speed arrival signal)
02: FA2 (Set frequency exceeded signal)
03: OL (Overload warning)
04: OD (Excessive PID deviation)
05: AL (Alarm signal)
06: FA3 (Set-frequency only signal)
07: OTQ (Overtorque/Undertorque signal)
08: IP (Signal during power interruption)
09: UV (Signal during undervoltage)
10: TRQ (Torque limit)
11: RNT (RUN time over)
12: ONT (Power ON time over)
13: THM (Electronic thermal warning)
19: BRK (Brake release)
20: BER (Brake error)
21: ZS (0-Hz detection signal)
22: DSE (Excessive speed deviation)
23: POK (Position ready)
24: FA4 (Set frequency exceeded signal 2)
25: FA5 (Set-frequency only signal 2)
26: OL2 (Overload warning 2)
27: FVDc (Analog FV disconnection detection)
28: FIDc (Analog F disconnection detection)
29: FEDc (Analog FE disconnection detection)
31: FBV (PID feedback comparison signal)
32: NDc (Communications disconnection detection)
33: LOG1 (Logic operation output 1)
34: LOG2 (Logic operation output 2)
35: LOG3 (Logic operation output 3)
36: LOG4 (Logic operation output 4)
37: LOG5 (Logic operation output 5)
38: LOG6 (Logic operation output 6)
39: WAC (Capacitor life warning signal)
40: WAF (Cooling fan life warning signal)
41: FR (Starting contact signal)
42: OHF (Cooling fin overheat warning)
43: LOC (Low current signal)
44: MO1 (General-purpose output 1)
45: MO2 (General-purpose output 2)
46: MO3 (General-purpose output 3)
47: MO4 (General-purpose output 4)
48: MO5 (General-purpose output 5)
49: MO6 (General-purpose output 6)
50: IRDY (Operation ready)
51: FWR (Forward run signal)
52: RVR (Reverse run signal)
53: MJA (Fatal fault signal)
54: WCFV (Window comparator FV)
55: WCFI (Window comparator FI)
56: WCFE (Window comparator FE)
63: OPO (Option)
255: no (No allocation)
(When an alarm code is selected in C062, multi-function output terminals P1 to P3 or P1 to P4 are force-set to output an alarm code (AC0 to AC2 or AC0 to AC3).)</td><td>–</td></tr>
<tr><td>1416 hex</td><td>1415 hex</td><td>Multi-function OutputP2 Selection</td><td>C022</td><td>R/W</td><td>–</td></tr>
<tr><td>1417 hex</td><td>1416 hex</td><td>Multi-function OutputP3 Selection</td><td>C023</td><td>R/W</td><td>–</td></tr>
<tr><td>1418 hex</td><td>1417 hex</td><td>Multi-function OutputP4 Selection</td><td>C024</td><td>R/W</td><td>–</td></tr>
<tr><td>1419 hex</td><td>1418 hex</td><td>Multi-function OutputP5 Selection</td><td>C025</td><td>R/W</td><td>–</td></tr>
<tr><td>141A hex</td><td>1419 hex</td><td>Multi-function Relay Output (MA, MB) Function Selection</td><td>C026</td><td>R/W</td><td>–</td></tr>
</table>

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
141B hex	141A hex	MP Selection	C027	R/W	00: Output frequency 01: Output current 02: Output torque (only in the heavy load mode) 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 09: Motor temperature 10: Cooling fin temperature 12: DriveProgramming (YA (0)) 19: Option 1 20: Option 2	–
141C hex	141B hex	AM Selection	C028	R/W	00: Output frequency 01: Output current 02: Output torque (only in the heavy load mode) 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 09: Motor temperature 10: Cooling fin temperature 11: Output torque (signed) (only in the heavy load mode) 13: DriveProgramming (YA (1)) 19: Option 1 20: Option 2	–
141D hex	141C hex	AMI Selection	C029	R/W	00: Output frequency 01: Output current 02: Output torque (only in the heavy load mode) 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 09: Motor temperature 10: Cooling fin temperature 14: DriveProgramming (YA (2))	–
141E hex	141D hex	Digital Current Monitor Reference Value	C030	R/W	200 to 2000 (In the light mode) 200 to 1500	0.1 [%]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
141F hex	141E hex	Multi-function Output P1 Operation Selection	C031	R/W	00: NO (NO contact at MA; NC contact at MB) 01: NC (NC contact at MA; NO contact at MB)	–
1420 hex	141F hex	Multi-function Output P2 Operation Selection	C032	R/W		–
1421 hex	1420 hex	Multi-function Output P3 Operation Selection	C033	R/W		–
1422 hex	1421 hex	Multi-function Output P4 Operation Selection	C034	R/W		–
1423 hex	1422 hex	Multi-function Output P5 Operation Selection	C035	R/W		–
1424 hex	1423 hex	Multi-function relay Output (MA, MB) Operation Selection	C036	R/W		–
1425 hex	–	Not used	–	–	–	–
1426 hex	1425 hex	Low Current Signal Output Mode	C038	R/W	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed	–
1427 hex	1426 hex	Low Current Detection Level	C039	R/W	0 to 2000 (0.4 to 55 kW) 0 to 1800 (75 to 132 kW) (In the light mode) 0 to 1500	0.1 [%]
1428 hex	1427 hex	Overload Warning Signal Output Mode Selection	C040	R/W	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed	–
1429 hex	1428 hex	Overload Warning Level	C041	R/W	0: Function not active 0 to 2000 (0.4 to 55 kW) 0 to 1800 (75 to 132 kW) (In the light mode) 0 to 1500	0.1 [%]
142A hex	1429 hex	Arrival Frequency During Acceleration 1	C042 (HIGH)	R/W	0 to 40000	0.01 [Hz]
142B hex	142A hex		C042 (LOW)	R/W		
142C hex	142B hex	Arrival Frequency During Deceleration 1	C043 (HIGH)	R/W	0 to 40000	0.01 [Hz]
142D hex	142C hex		C043 (LOW)	R/W		
142E hex	142D hex	PID Deviation Excessive Level	C044	R/W	0 to 1000	0.1 [%]
142F hex	142E hex	Arrival Frequency During Acceleration 2	C045 (HIGH)	R/W	0 to 40000	0.01 [Hz]
1430 hex	142F hex		C045 (LOW)	R/W		
1431 hex	1430 hex	Arrival Frequency During Deceleration 2	C046 (HIGH)	R/W	0 to 40000	0.01 [Hz]
1432 hex	1431 hex		C046 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1433 to 1437 hex	–	Not used	–	–	–	–
1438 hex	1437 hex	Feedback Comparison Signal Off Level	C052	R/W	0 to 1000	0.1 [%]
1439 hex	1438 hex	Feedback Comparison Signal On Level	C053	R/W	0 to 1000	0.1 [%]
143A hex	–	Not used	–	–	–	–
143B hex	143A hex	Overtorque Level (Forward Power Running)	C055	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) (In the light mode) 0 to 150	1 [%]
143C hex	143B hex	Overtorque Level (Reverse Regeneration)	C056	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) (In the light mode) 0 to 150	1 [%]
143D hex	143C hex	Overtorque Level (Reverse Power Running)	C057	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) (In the light mode) 0 to 150	1 [%]
143E hex	143D hex	Overtorque Level (Forward Regeneration)	C058	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW) (In the light mode) 0 to 150	1 [%]
143F hex	–	Not used	–	–	–	–
1440 hex	–	Not used	–	–	–	–
1441 hex	1440 hex	Electronic Thermal Warning Level	C061	R/W	0 to 100	1 [%]
1442 hex	1441 hex	Alarm Code Selection	C062	R/W	00: Disabled 01: 3 bits 02: 4 bits	–
1443 hex	1442 hex	0 Hz Detection Level	C063	R/W	0 to 10000	0.01 [Hz]
1444 hex	1443 hex	Cooling Fin Overheat Warning Level	C064	R/W	0 to 200	1 [°C]
1445 to 144A hex	–	Not used	–	–	–	–
144B hex	144A hex	Communication Speed Selection (Baud Rate Selection)	C071	R/W	02: Loop-back test 03: 2400 bps 04: 4800 bps 05: 9600 bps 06: 19200 bps	–
144C hex	144B hex	Communication Station No. Selection	C072	R/W	1 to 32	–
144D hex	144C hex	Communication Bit Length Selection	C073	R/W	7: 7 bits 8: 8 bits	–
144E hex	144D hex	Communication Parity Selection	C074	R/W	00: No parity 01: Even parity 02: Odd parity	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
144F hex	144E hex	Communication Stop Bit Selection	C075	R/W	1: 1 bit 2: 2 bits	–
1450 hex	144F hex	Operation Selection on Communication Error	C076	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–
1451 hex	1450 hex	Communication Error Timeout Time	C077	R/W	0 to 9999	0.01 [s]
1452 hex	1451 hex	Communication Wait Time	C078	R/W	0 to 1000	1 [ms]
1453 hex	1452 hex	Communication Method Selection	C079	R/W	00: ASCII 01: Modbus	–
1454 hex	–	Not used	–	–	–	–
1455 hex	1454 hex	FV Adjustment	C081	R/W	0 to 65530	1
1456 hex	1455 hex	FI Adjustment	C082	R/W	0 to 65530	1
1457 hex	1456 hex	FE Adjustment	C083	R/W	0 to 65530	1
1458 hex	–	Not used	–	–	–	–
1459 hex	1458 hex	Thermistor Adjustment	C085	R/W	0 to 10000	0.1
145A to 145E hex	–	Not used	–	–	–	–
145F hex	145E hex	Debug mode selection	C091	R	00 (Do not change.)	–
1460 to 1468 hex	–	Not used	–	–	–	–
1469 hex	1468 hex	UP/DWN Storage Selection	C101	R/W	00: Do not store frequency data 01: Store frequency data	–
146A hex	1469 hex	Reset Selection	C102	R/W	00: Trip reset at power-on 01: Trip reset at power-off 02: Enabled only during trip (Reset at power-on) 03: Trip reset only	–
146B hex	146A hex	Reset Restart Selection	C103	R/W	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–
146C hex	–	Not used	–	–	–	–
146D hex	146C hex	MP Gain Setting	C105	R/W	50 to 200	1 [%]
146E hex	146D hex	AM Gain Setting	C106	R/W	50 to 200	1 [%]
146F hex	146E hex	AMI Gain Setting	C107	R/W	50 to 200	1 [%]
1470 hex	–	Not used	–	–	–	–
1471 hex	1470 hex	AM Bias Setting	C109	R/W	0 to 100	1 [%]
1472 hex	1471 hex	AMI Bias Setting	C110	R/W	0 to 100	1 [%]
1473 hex	1472 hex	Overload Warning Level 2	C111	R/W	0: Function not active 0 to 2000 (0.4 to 55 kW) 0 to 1800 (75 to 132 kW) (In the light mode) 0 to 1500	0.1 [%]
1474 to 147C hex	–	Not used	–	–	–	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
147D hex	147C hex	FV Zero Adjustment	C121	R/W	0 to 65530	1
147E hex	147D hex	FI Zero Adjustment	C122	R/W	0 to 65530	1
147F hex	147E hex	FE Zero Adjustment	C123	R/W	0 to 65530	1
1480 to 1485 hex	–	Not used	–	–	–	–
1486 hex	1485 hex	Multi-function Output P1 ON Delay Time	C130	R/W	0 to 1000	0.1 [s]
1487 hex	1486 hex	Multi-function Output P1 OFF Delay Time	C131	R/W		0.1 [s]
1488 hex	1487 hex	Multi-function Output P2 ON Delay Time	C132	R/W		0.1 [s]
1489 hex	1488 hex	Multi-function Output P2 OFF Delay Time	C133	R/W		0.1 [s]
148A hex	1489 hex	Multi-function Output P3 ON Delay Time	C134	R/W		0.1 [s]
148B hex	148A hex	Multi-function Output P3 OFF Delay Time	C135	R/W		0.1 [s]
148C hex	148B hex	Multi-function Output P4 ON Delay Time	C136	R/W		0.1 [s]
148D hex	148C hex	Multi-function Output P4 OFF Delay Time	C137	R/W		0.1 [s]
148E hex	148D hex	Multi-function Output P5 ON Delay Time	C138	R/W		0.1 [s]
148F hex	148E hex	Multi-function Output P5 OFF Delay Time	C139	R/W		0.1 [s]
1490 hex	148F hex	Multi-function Relay Output ON Delay Time	C140	R/W		0.1 [s]
1491 hex	1490 hex	Multi-function Relay Output OFF Delay Time	C141	R/W		0.1 [s]
1492 hex	1491 hex	Logic Output Signal 1 Selection 1	C142	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
1493 hex	1492 hex	Logic Output Signal 1 Selection 2	C143	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
1494 hex	1493 hex	Logic Output Signal 1 Operator Selection	C144	R/W	00: AND 01: OR 02: XOR	–
1495 hex	1494 hex	Logic Output Signal 2 Selection 1	C145	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
1496 hex	1495 hex	Logic Output Signal 2 Selection 2	C146	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
1497 hex	1496 hex	Logic Output Signal 2 Operator Selection	C147	R/W	00: AND 01: OR 02: XOR	–
1498 hex	1497 hex	Logic Output Signal 3 Selection 1	C148	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
1499 hex	1498 hex	Logic Output Signal 3 Selection 2	C149	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
149A hex	1499 hex	Logic Output Signal 3 Operator Selection	C150	R/W	00: AND 01: OR 02: XOR	–
149B hex	149A hex	Logic Output Signal 4 Selection 1	C151	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
149C hex	149B hex	Logic Output Signal 4 Selection 2	C152	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
149D hex	149C hex	Logic Output Signal 4 Operator Selection	C153	R/W	00: AND 01: OR 02: XOR	–
149E hex	149D hex	Logic Output Signal 5 Selection 1	C154	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
149F hex	149E hex	Logic Output Signal 5 Selection 2	C155	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
14A0 hex	149F hex	Logic Output Signal 5 Operator Selection	C156	R/W	00: AND 01: OR 02: XOR	–
14A1 hex	14A0 hex	Logic Output Signal 6 Selection 1	C157	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
14A2 hex	14A1 hex	Logic Output Signal 6 Selection 2	C158	R/W	Same as C021 to C026 (except LOG1 to 6, OPO, no)	–
14A3 hex	14A2 hex	Logic Output Signal 6 Operator Selection	C159	R/W	00: AND 01: OR 02: XOR	–
14A4 hex	14A3 hex	Multi-function Input S1 Response Time	C160	R/W	0 to 200 (x 2 ms)	1
14A5 hex	14A4 hex	Multi-function Input S2 Response Time	C161	R/W	0 to 200 (x 2 ms)	1
14A6 hex	14A5 hex	Multi-function Input S3 Response Time	C162	R/W	0 to 200 (x 2 ms)	1
14A7 hex	14A6 hex	Multi-function Input S4 Response Time	C163	R/W	0 to 200 (x 2 ms)	1
14A8 hex	14A7 hex	Multi-function Input S5 Response Time	C164	R/W	0 to 200 (x 2 ms)	1
14A9 hex	14A8 hex	Multi-function Input S6 Response Time	C165	R/W	0 to 200 (x 2 ms)	1
14AA hex	14A9 hex	Multi-function Input S7 Response Time	C166	R/W	0 to 200 (x 2 ms)	1
14AB hex	14AA hex	Multi-function Input S8 Response Time	C167	R/W	0 to 200 (x 2 ms)	1
14AC hex	14AB hex	Forward RUN Command FW Response Time	C168	R/W	0 to 200 (x 2 ms)	1
14AD hex	14AC hex	Multi-step Speed/Position Determination Time	C169	R/W	0 to 200 (x 2 ms)	1
14AE to 1500 hex	–	Not used	–	–	–	–
1501 hex	1500 hex	Auto-tuning Selection	H001	R/W	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1502 hex	1501 hex	1st Motor Parameter selection	H002	R/W	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning data (Online auto-tuning enabled)	–
1503 hex	1502 hex	1st Motor Capacity	H003	R/W	Refer to page 8-70.	–
1504 hex	1503 hex	1st Motor Pole Number	H004	R/W	00: 2P 01: 4P 02: 6P 03: 8P 04: 10P	–
1505 hex	1504 hex	1st Speed Response	H005 (HIGH)	R/W	0 to 80000	0.001
1506 hex	1505 hex		H005 (LOW)	R/W		
1507 hex	1506 hex	1st Stabilization Parameter	H006	R/W	0 to 255	1
1508 to 1514 hex	–	Not used	–	–	–	–
1515 hex	1514 hex	1st Motor Parameter R1	H020 (HIGH)	R/W	1 to 65535	0.001 [Ω]
1516 hex	1515 hex		H020 (LOW)	R/W		
1517 hex	1516 hex	1st Motor Parameter R2	H021 (HIGH)	R/W	1 to 65535	0.001 [Ω]
1518 hex	1517 hex		H021 (LOW)	R/W		
1519 hex	1518 hex	1st Motor Parameter L	H022 (HIGH)	R/W	1 to 65535	0.01 [mH]
151A hex	1519 hex		H022 (LOW)	R/W		
151B hex	151A hex	1st Motor Parameter Io	H023 (HIGH)	R/W	1 to 65535	0.01 [A]
151C hex	151B hex		H023 (LOW)	R/W		
151D hex	151C hex	1st Motor Parameter J	H024 (HIGH)	R/W	1 to 9999000	0.001 [kg/m^2]
151E hex	151D hex		H024 (LOW)	R/W		
151F to 1523 hex	–	Not used	–	–	–	–
1524 hex	1523 hex	1st Motor Parameter R1 (Auto-tuning Data)	H030 (HIGH)	R/W	1 to 65535	0.001 [Ω]
1525 hex	1524 hex		H030 (LOW)	R/W		
1526 hex	1525 hex	1st Motor Parameter R2 (Auto-tuning Data)	H031 (HIGH)	R/W	1 to 65535	0.001 [Ω]
1527 hex	1526 hex		H031 (LOW)	R/W		
1528 hex	1527 hex	1st Motor Parameter L (Auto-tuning Data)	H032 (HIGH)	R/W	1 to 65535	0.01 [mH]
1529 hex	1528 hex		H032 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
152A hex	1529 hex	1st Motor Parameter Io (Auto-tuning Data)	H033 (HIGH)	R/W	1 to 65535	0.01 [A]
152B hex	152A hex		H033 (LOW)	R/W		
152C hex	152B hex	1st Motor Parameter J (Auto-tuning Data)	H034 (HIGH)	R/W	1 to 9999000	0.001 [kg/m^2]
152D hex	152C hex		H034 (LOW)	R/W		
152E to 153C hex	–	Not used	–	–	–	–
153D hex	153C hex	1st PI Proportional Gain	H050	R/W	0 to 10000	0.1 [%]
153E hex	153D hex	1st PI Integral Gain	H051	R/W	0 to 10000	0.1 [%]
153F hex	153E hex	1st P Proportional Gain	H052	R/W	0 to 1000	0.01
1540 to 1546 hex	–	Not used	–	–	–	–
1547 hex	1546 hex	1st Limit at 0 Hz	H060	R/W	0 to 1000	0.1 [%]
1548 hex	1547 hex	1st Boost Amount at SLV Startup, 0 Hz	H061	R/W	0 to 50	1 [%]
1549 to 1550 hex	–	Not used	–	–	–	–
1551 hex	1550 hex	For PI Proportional Gain Switching	H070	R/W	0 to 10000	0.1 [%]
1552 hex	1551 hex	For PI Integral Gain Switching	H071	R/W	0 to 10000	0.1 [%]
1553 hex	1552 hex	For P Proportional Gain Switching	H072	R/W	0 to 1000	0.01
1554 hex	1553 hex	Gain Switching Time	H073	R/W	0 to 9999	1 [ms]
1555 to 1600 hex	–	Not used	–	–	–	–
1601 hex	1600 hex	Operation Selection on Option 1 Error	P001	R/W	00: Trip 01: Continues operation	–
1602 hex	1601 hex	Operation Selection on Option 2 Error	P002	R/W	00: Trip 01: Continues operation	–
1603 to 160A hex	1602 hex	Not used	–	–	–	–
160B hex	160A hex	Number of Encoder Pulses	P011	R/W	128 to 65535	1
160C hex	160B hex	V2 Control Mode Selection	P012	R/W	00: ASR (Speed control mode) 01: APR (Pulse train position control mode) 02: APR2 (Absolute position control mode) 03: HAPR (High-resolution absolute position control mode)	–
160D hex	160C hex	Pulse Train Input Selection	P013	R/W	00: Mode 0 01: Mode 1 02: Mode 2	–
160E hex	160D hex	Orientation Stop Position	P014	R/W	0 to 4095	1
160F hex	160E hex	Orientation Speed Setting	P015	R/W	Starting Frequency to 1st Maximum Frequency (Upper limit 12000)	0.01 [Hz]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1610 hex	160F hex	Orientation Direction Setting	P016	R/W	00: Forward 01: Reverse	–
1611 hex	1610 hex	Positioning Completion Range Setting	P017	R/W	0 to 10000	1
1612 hex	1611 hex	Positioning Completion Delay Time Setting	P018	R/W	0 to 999	0.01 [s]
1613 hex	1612 hex	Electronic Gear Position Selection	P019	R/W	00: Position feedback side (FB) 01: Position command side (REF)	–
1614 hex	1613 hex	Electronic Gear Ratio Numerator	P020	R/W	1 to 9999	–
1615 hex	1614 hex	Electronic Gear Ratio Denominator	P021	R/W	1 to 9999	–
1616 hex	1615 hex	Position Control Feedforward Gain	P022	R/W	0 to 65535	0.01
1617 hex	1616 hex	Position Loop Gain	P023	R/W	0 to 10000	0.01
1618 hex	1617 hex	Position Bias Amount	P024	R/W	–2048 to 2048	–
1619 hex	1618 hex	Secondary Resistance Compensation Selection	P025	R/W	00: Disabled 01: Enabled	–
161A hex	1619 hex	Overspeed Error Detection Level	P026	R/W	0 to 1500	0.1 [%]
161B hex	161A hex	Speed Deviation Excessive Level	P027	R/W	0 to 12000	0.01 [Hz]
161C hex	161B hex	Motor Gear Ratio Numerator	P028	R/W	1 to 9999	1
161D hex	161C hex	Motor Gear Ratio Denominator	P029	R/W	1 to 9999	1
161E hex	–	Not used	–	–	–	–
161F hex	161E hex	Acceleration/Deceleration Time Input Type	P031	R/W	00: Digital Operator 01: Option 1 02: Option 2 03: DriveProgramming	–
1620 hex	161F hex	Orientation Stop Position Input Type	P032	R/W	00: Digital Operator 01: Option 1 02: Option 2	–
1621 hex	1620 hex	Torque Reference Input Selection	P033	R/W	00: Terminal FV 01: Terminal FI 02: Terminal FE 03: Digital Operator 06: Option 1 07: Option 2	–
1622 hex	1621 hex	Torque Reference Setting	P034	R/W	0 to 200 (0.4 to 55 kW) 0 to 180 (75 to 132 kW)	1 [%]
1623 hex	1622 hex	Polarity Selection at Torque Reference via FE	P035	R/W	00: As per sign 01: Depends on the RUN direction	–
1624 hex	1623 hex	Torque Bias Mode	P036	R/W	00: None 01: Digital Operator 02: Terminal FE	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1625 hex	1624 hex	Torque Bias Value	P037	R/W	–200 to 200 (0.4 to 55 kW) –180 to 180 (75 to 132 kW)	1 [%]
1626 hex	1625 hex	Torque Bias Polarity Selection	P038	R/W	00: As per sign 01: Depends on the RUN direction	–
1627 hex	1626 hex	Speed Limit Value in Torque Control (Forward)	P039 (HIGH)	R/W	0 to 1st Maximum Frequency	0.01 [Hz]
1628 hex	1627 hex		P039 (LOW)	R/W		
1629 hex	1628 hex	Speed Limit Value in Torque Control (Reverse)	P040 (HIGH)	R/W	0 to 1st Maximum Frequency	0.01 [Hz]
162A hex	1629 hex		P040 (LOW)	R/W		
162B hex	–	Not used	–	–	–	–
162C hex	–	Not used	–	–	–	–
162D hex	–	Not used	–	–	–	–
162E hex	162D hex	Communications Error Detection Timer Setting	P044	R/W	0 to 9999	0.01 [s]
162F hex	162E hex	Operation Selection at Host Communications Error	P045	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run 04: Deceleration stop	–
1630 hex	162F hex	Assembly Instance Number	P046	R/W	0 to 20	–
1631 hex	–	Not used	–	–	–	–
1632 hex	1631 hex	Operation Selection at Idle Mode Detection	P048	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–
1633 hex	1632 hex	Number of Poles for Rotation Speed Setting	P049	R/W	0: 0P 1: 2P 2: 4P 3: 6P 4: 8P 5: 10P 6: 12P 7: 14P 8: 16P 9: 18P 10: 20P 11: 22P 12: 24P 13: 26P 14: 28P 15: 30P 16: 32P 17: 34P 18: 36P 19: 38P	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1634 to 1638 hex	1633 hex	Not used	–	–	–	–
1639 hex	1638 hex	Pulse Train Frequency Scale	P055	R/W	10 to 500 * Input frequency at maximum frequency	0.1 [kHz]
163A hex	1639 hex	Pulse Train Frequency Filter Time Parameter	P056	R/W	1 to 200	0.01 [s]
163B hex	163A hex	Pulse Train Frequency Bias Amount	P057	R/W	–100 to 100	1 [%]
163C hex	163B hex	Pulse Train Frequency Limit	P058	R/W	0 to 100	1 [%]
163D hex	163C hex	Not used	–	–	–	–
163E hex	163D hex	Multi-step Position Command 0	P060 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
163F hex	163E hex		P060 (LOW)	R/W		
1640 hex	163F hex	Multi-step Position Command 1	P061 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
1641 hex	1640 hex		P061 (LOW)	R/W		
1642 hex	1641 hex	Multi-step Position Command 2	P062 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
1643 hex	1642 hex		P062 (LOW)	R/W		
1644 hex	1643 hex	Multi-step Position Command 3	P063 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
1645 hex	1644 hex		P063 (LOW)	R/W		
1646 hex	1645 hex	Multi-step Position Command 4	P064 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
1647 hex	1646 hex		P064 (LOW)	R/W		
1648 hex	1647 hex	Multi-step Position Command 5	P065 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
1649 hex	1648 hex		P065 (LOW)	R/W		
164A hex	1649 hex	Multi-step Position Command 6	P066 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
164B hex	164A hex		P066 (LOW)	R/W		
164C hex	164B hex	Multi-step Position Command 7	P067 (HIGH)	R/W	Position range specification (reverse side) to position range specification (forward side)	1
164D hex	164C hex		P067 (LOW)	R/W		
164E hex	164D hex	Origin Search Mode	P068	R/W	00: Origin search mode 1 01: Origin search mode 2 02: Origin search mode 3	–

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
164F hex	164E hex	Origin Search Direction Selection	P069	R/W	0: Forward side 1: Reverse side	–
1650 hex	164F hex	Origin Search Mode 1 Frequency	P070	R/W	0 to 1000	0.01 [Hz]
1651 hex	1650 hex	Origin Search Mode 2 Frequency	P071	R/W	0 to 40000	0.01 [Hz]
1652 hex	1651 hex	Position Limit Setting (Forward Side)	P072 (HIGH)	R/W	0 to 268435455 (When P012 = 2) 0 to 1073741823 (When P012 = 3)	1
1653 hex	1652 hex		P072 (LOW)	R/W		
1654 hex	1653 hex	Position Limit Setting (Reverse Side)	P073 (HIGH)	R/W	–268435455 to 0 (When P012 = 2) –1073741823 to 0 (When P012 = 3)	1
1655 hex	1654 hex		P073 (LOW)	R/W		
1656 to 1665 hex	–	Not used	–	–	–	–
1666 hex	1665 hex	DriveProgramming User Parameter U00	P100	R/W	0 to 65535	1
1667 hex	1666 hex	DriveProgramming User Parameter U01	P101	R/W	0 to 65535	1
1668 hex	1667 hex	DriveProgramming User Parameter U02	P102	R/W	0 to 65535	1
1669 hex	1668 hex	DriveProgramming User Parameter U03	P103	R/W	0 to 65535	1
166A hex	1669 hex	DriveProgramming User Parameter U04	P104	R/W	0 to 65535	1
166B hex	166A hex	DriveProgramming User Parameter U05	P105	R/W	0 to 65535	1
166C hex	166B hex	DriveProgramming User Parameter U06	P106	R/W	0 to 65535	1
166D hex	166C hex	DriveProgramming User Parameter U07	P107	R/W	0 to 65535	1
166E hex	166D hex	DriveProgramming User Parameter U08	P108	R/W	0 to 65535	1
166F hex	167E hex	DriveProgramming User Parameter U09	P109	R/W	0 to 65535	1
1670 hex	167F hex	DriveProgramming User Parameter U10	P110	R/W	0 to 65535	1
1671 hex	1670 hex	DriveProgramming User Parameter U11	P111	R/W	0 to 65535	1
1672 hex	1671 hex	DriveProgramming User Parameter U12	P112	R/W	0 to 65535	1
1673 hex	1672 hex	DriveProgramming User Parameter U13	P113	R/W	0 to 65535	1
1674 hex	1673 hex	DriveProgramming User Parameter U14	P114	R/W	0 to 65535	1
1675 hex	1674 hex	DriveProgramming User Parameter U15	P115	R/W	0 to 65535	1
1676 hex	1675 hex	DriveProgramming User Parameter U16	P116	R/W	0 to 65535	1

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
1677 hex	1676 hex	DriveProgramming User Parameter U17	P117	R/W	0 to 65535	1
1678 hex	1677 hex	DriveProgramming User Parameter U18	P118	R/W	0 to 65535	1
1679 hex	1678 hex	DriveProgramming User Parameter U19	P119	R/W	0 to 65535	1
167A hex	1679 hex	DriveProgramming User Parameter U20	P120	R/W	0 to 65535	1
167B hex	167A hex	DriveProgramming User Parameter U21	P121	R/W	0 to 65535	1
167C hex	167B hex	DriveProgramming User Parameter U22	P122	R/W	0 to 65535	1
167D hex	167C hex	DriveProgramming User Parameter U23	P123	R/W	0 to 65535	1
167E hex	167D hex	DriveProgramming User Parameter U24	P124	R/W	0 to 65535	1
167F hex	167E hex	DriveProgramming User Parameter U25	P125	R/W	0 to 65535	1
1680 hex	168F hex	DriveProgramming User Parameter U26	P126	R/W	0 to 65535	1
1681 hex	1680 hex	DriveProgramming User Parameter U27	P127	R/W	0 to 65535	1
1682 hex	1681 hex	DriveProgramming User Parameter U28	P128	R/W	0 to 65535	1
1683 hex	1682 hex	DriveProgramming User Parameter U29	P129	R/W	0 to 65535	1
1684 hex	1683 hex	DriveProgramming User Parameter U30	P130	R/W	0 to 65535	1
1685 hex	1684 hex	DriveProgramming User Parameter U31	P131	R/W	0 to 65535	1
1686 to 16A1 hex	1685 to 16A0 hex	Not used	–	–	–	–
16A2 hex	16A1 hex	Option I/F Flexible Format Output Register 1	P160	R/W	0000 to FFFF hex	1
16A3 hex	16A2 hex	Option I/F Flexible Format Output Register 2	P161	R/W	0000 to FFFF hex	1
16A4 hex	16A3 hex	Option I/F Flexible Format Output Register 3	P162	R/W	0000 to FFFF hex	1
16A5 hex	16A4 hex	Option I/F Flexible Format Output Register 4	P163	R/W	0000 to FFFF hex	1
16A6 hex	16A5 hex	Option I/F Flexible Format Output Register 5	P164	R/W	0000 to FFFF hex	1
16A7 hex	16A6 hex	Option I/F Flexible Format Output Register 6	P165	R/W	0000 to FFFF hex	1
16A8 hex	16A7 hex	Option I/F Flexible Format Output Register 7	P166	R/W	0000 to FFFF hex	1
16A9 hex	16A8 hex	Option I/F Flexible Format Output Register 8	P167	R/W	0000 to FFFF hex	1
16AA hex	16A9 hex	Option I/F Flexible Format Output Register 9	P168	R/W	0000 to FFFF hex	1
16AB hex	16AA hex	Option I/F Flexible Format Output Register 10	P169	R/W	0000 to FFFF hex	1

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
16AC hex	16AB hex	Option I/F Flexible Format Input Register 1	P170	R/W	0000 to FFFF hex	1
16AD hex	16AC hex	Option I/F Flexible Format Input Register 2	P171	R/W	0000 to FFFF hex	1
16AE hex	16AD hex	Option I/F Flexible Format Input Register 3	P172	R/W	0000 to FFFF hex	1
16AF hex	16AE hex	Option I/F Flexible Format Input Register 4	P173	R/W	0000 to FFFF hex	1
16B0 hex	16BF hex	Option I/F Flexible Format Input Register 5	P174	R/W	0000 to FFFF hex	1
16B1 hex	16B0 hex	Option I/F Flexible Format Input Register 6	P175	R/W	0000 to FFFF hex	1
16B2 hex	16B1 hex	Option I/F Flexible Format Input Register 7	P176	R/W	0000 to FFFF hex	1
16B3 hex	16B2 hex	Option I/F Flexible Format Input Register 8	P177	R/W	0000 to FFFF hex	1
16B4 hex	16B3 hex	Option I/F Flexible Format Input Register 9	P178	R/W	0000 to FFFF hex	1
16B5 hex	16B4 hex	Option I/F Flexible Format Input Register 10	P179	R/W	0000 to FFFF hex	1
16B6 hex	16B5 hex	Not used	P180	–	Use default data. * Do not set.	–
16B7 hex	16B6 hex	Not used	P181	–	Use default data. * Do not set.	–
16B8 hex	16B7 hex	Not used	P182	–	Use default data. * Do not set.	–
16B9 hex	16B8 hex	Not used	–	–		–
16BA hex	16B9 hex	Not used	–	–		–
16BB hex	16BA hex	Not used	P185	–	Use default data. * Do not set.	–
16BC hex	16BB hex	Not used	P186	–	Use default data. * Do not set.	–
16BD to 16BF hex	16BC to 16BE hex	Not used	–	–		–
16C0 hex	16BF hex	CompoNet Node Address	P190	R/W	0 to 63	1
16C1 hex	16C0 hex	Not used	–	–		–
16C2 hex	16C1 hex	DeviceNet MAC ID	P192	R/W	0 to 63	1
16C3 to 2102 hex	16C2 to 2101 hex	Not used	–	–		

* The 1st Motor Capacity (H003) takes the following code data.

Code data	00	01	02	03	04	05	06	07	08	09	10
Motor capacity [kW]	0.2	–	0.4	–	0.75	–	1.5	2.2	–	3.7	–
Code data	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Motor capacity [kW]	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Code data	**22**	**23**	**24**	**25**	**26**						
Motor capacity [kW]	90	110	132	150	160						

8-5-5 2nd Control Register Number List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter. Use this register number when setting communications or other options for the inverter.
- The “Modbus register spec. No.” in the table header 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.

● Group F

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2103 hex	2102 hex	2nd Acceleration Time 1	F202 (HIGH)	R/W	1 to 360000	0.01 [s]
2104 hex	2103 hex		F202 (LOW)	R/W		
2105 hex	2104 hex	2nd Deceleration Time 1	F203 (HIGH)	R/W	1 to 360000	0.01 [s]
2106 hex	2105 hex		F203 (LOW)	R/W		
2107 to 2202 hex	–	Not used	–	–	–	–

● Group A/b/C/H/P

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2203 hex	2202 hex	2nd Base Frequency	A203	R/W	30 to 2nd Maximum Frequency	1 [Hz]
2204 hex	2203 hex	2nd Maximum Frequency	A204	R/W	30 to 400	1 [Hz]
2205 to 2215 hex	–	Not used	–	–	–	–
2216 hex	2215 hex	2nd Multi-step Speed Reference 0	A220 (HIGH)	R/W	0 Starting Frequency to 2nd Maximum Frequency	0.01 [Hz]
2217 hex	2216 hex		A220 (LOW)	R/W		
2218 to 223A hex	–	Not used	–	–	–	–
223B hex	223A hex	2nd Torque Boost Selection	A241	R/W	00: Manual torque boost 01: Automatic torque boost	–
223C hex	223B hex	2nd Manual Torque Boost Voltage	A242	R/W	0 to 200	0.1 [%]
223D hex	223C hex	2nd Manual Torque Boost Frequency	A243	R/W	0 to 500	0.1 [%]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
223E hex	223D hex	2nd Control Method	A244	R/W	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control 04: 0-Hz sensorless vector control (only in the heavy load mode)	–
223F hex	–	Not used	–	–	–	–
2240 hex	223F hex	2nd Automatic Torque Boost Voltage Compensation Gain	A246	R/W	0 to 255	1
2241 hex	2240 hex	2nd Automatic Torque Boost Slip Compensation Gain	A247	R/W	0 to 255	1
2242 to 224E hex	–	Not used	–	–	–	–
224F hex	224E hex	2nd Frequency Upper Limit	A261 (HIGH)	R/W	0 2nd Frequency Lower Limit to 2nd Maximum Frequency	0.01 [Hz]
2250 hex	224F hex		A261 (LOW)	R/W		
2251 hex	2250 hex	2nd Frequency Lower Limit	A262 (HIGH)	R/W	0 Starting Frequency to 2nd Frequency Upper Limit	0.01 [Hz]
2252 hex	2251 hex		A262 (LOW)	R/W		
2253 to 226E hex	–	Not used	–	–	–	–
226F hex	226E hex	2nd Acceleration Time 2	A292 (HIGH)	R/W	1 to 360000	0.01 [s]
2270 hex	226F hex		A292 (LOW)	R/W		
2271 hex	2270 hex	2nd Deceleration Time 2	A293 (HIGH)	R/W	1 to 360000	0.01 [s]
2272 hex	2271 hex		A293 (LOW)	R/W		
2273 hex	2272 hex	2nd 2-step Acceleration/Deceleration Selection	A294	R/W	00: Switched via terminal 2CH 01: Switched by setting 02: Switched only during forward/reverse switching	–
2274 hex	2273 hex	2nd 2-step Acceleration Frequency	A295 (HIGH)	R/W	0 to 40000	0.01 [Hz]
2275 hex	2274 hex		A295 (LOW)	R/W		
2276 hex	2275 hex	2nd 2-step Deceleration Frequency	A296 (HIGH)	R/W	0 to 40000	0.01 [Hz]
2277 hex	2276 hex		A296 (LOW)	R/W		
2278 to 230B hex	–	Not used	–	–	–	–
230C hex	230B hex	2nd Electronic Thermal Level	b212	R/W	200 to 1000	0.1 [%]

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
230D hex	230C hex	2nd Electronic Thermal Characteristics Selection	b213	R/W	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–
230E to 2501 hex	–	Not used	–	–	–	–
2502 hex	2501 hex	2nd Motor Parameter selection	H202	R/W	00: Standard motor parameter 01: Auto-tuning 02: Auto-tuning (Online auto-tuning enabled)	–
2503 hex	2502 hex	2nd Motor Capacity	H203	R/W	Refer to page 8-74.	–
2504 hex	2503 hex	2nd Motor Pole Number	H204	R/W	0: 2P 1: 4P 2: 6P 3: 8P 4: 10P	–
2505 hex	2504 hex	2nd Speed Response	H205 (HIGH)	R/W	1 to 80000	0.001
2506 hex	2505 hex		H205 (LOW)	R/W		
2507 hex	2506 hex	2nd Stabilization Parameter	H206	R/W	0 to 255	1
2508 to 2514 hex	–	Not used	–	–	–	–
2515 hex	2514 hex	2nd Motor Parameter R1	H220 (HIGH)	R/W	1 to 65535	0.001 [Ω]
2516 hex	2515 hex		H220 (LOW)	R/W		
2517 hex	2516 hex	2nd Motor Parameter R2	H221 (HIGH)	R/W	1 to 65535	0.001 [Ω]
2518 hex	2517 hex		H221 (LOW)	R/W		
2519 hex	2518 hex	2nd Motor Parameter L	H222 (HIGH)	R/W	1 to 65535	0.01 [mH]
251A hex	2519 hex		H222 (LOW)	R/W		
251B hex	251A hex	2nd Motor Parameter Io	H223 (HIGH)	R/W	1 to 65535	0.01 [A]
251C hex	251B hex		H223 (LOW)	R/W		
251D hex	251C hex	2nd Motor Parameter J	H224 (HIGH)	R/W	1 to 9999000	0.001 [kg/m^2]
251E hex	251D hex		H224 (LOW)	R/W		
251F to 2523 hex	–	Not used	–	–	–	–
2524 hex	2523 hex	2nd Motor Parameter R1 (Auto-tuning Data)	H230 (HIGH)	R/W	1 to 65535	0.001 [Ω]
2525 hex	2524 hex		H230 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2526 hex	2525 hex	2nd Motor Parameter R2 (Auto-tuning Data)	H231 (HIGH)	R/W	1 to 65535	0.001 [Ω]
2527 hex	2526 hex		H231 (LOW)	R/W		
2528 hex	2527 hex	2nd Motor Parameter L (Auto-tuning Data)	H232 (HIGH)	R/W	1 to 65535	0.01 [mH]
2529 hex	2528 hex		H232 (LOW)	R/W		
252A hex	2529 hex	2nd Motor Parameter Io (Auto-tuning Data)	H233 (HIGH)	R/W	1 to 65535	0.01 [A]
252B hex	252A hex		H233 (LOW)	R/W		
252C hex	252B hex	2nd Motor Parameter J (Auto-tuning Data)	H234 (HIGH)	R/W	1 to 9999000	0.001 [kg/m^2]
252D hex	252C hex		H234 (LOW)	R/W		
252E to 253C hex	–	Not used	–	–	–	–
253D hex	253C hex	2nd PI Proportional Gain	H250	R/W	0 to 10000	0.1 [%]
253E hex	253D hex	2nd PI Integral Gain	H251	R/W	0 to 10000	0.1 [%]
253F hex	253E hex	2nd P Proportional Gain	H252	R/W	0 to 1000	0.01
2540 to 2546 hex	–	Not used	–	–	–	–
2547 hex	2546 hex	2nd Limit at 0 Hz	H260	R/W	0 to 1000	0.1 [%]
2548 hex	2547 hex	2nd Boost Amount at SLV Startup, 0 Hz	H261	R/W	0 to 50	1 [%]
2549 to 3102 hex	–	Not used	–	–	–	–

* The 2nd Motor Capacity (H203) takes the following code data.

Code data	00	01	02	03	04	05	06	07	08	09	10
Motor capacity [kW]	0.2	–	0.4	–	0.75	–	1.5	2.2	–	3.7	–
Code data	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Motor capacity [kW]	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Code data	**22**	**23**	**24**								
Motor capacity [kW]	90	110	132								

8-5-6 3rd Control Register Number List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter. Use this register number when setting communications or other options for the inverter.
- The “Modbus register spec. No.” in the table header 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.

● Group F

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3103 hex	3102 hex	3rd Acceleration Time 1	F302 (HIGH)	R/W	1 to 360000	0.01 [s]
3104 hex	3103 hex		F302 (LOW)	R/W		
3105 hex	3104 hex	3rd Deceleration Time 1	F303 (HIGH)	R/W	1 to 360000	0.01 [s]
3106 hex	3105 hex		F303 (LOW)	R/W		
3107 to 3202 hex	–	Not used	–	–	–	–

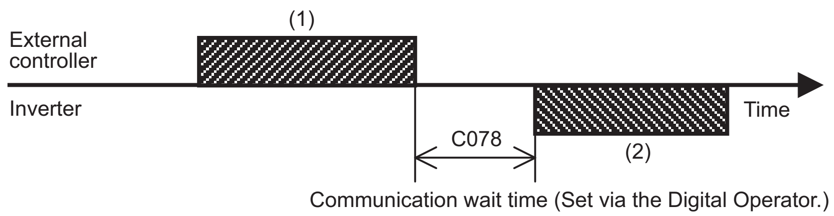
● Group A/b/C/H/P

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3203 hex	3202 hex	3rd Base Frequency	A303	R/W	30 to 3rd Maximum Frequency	1 [Hz]
3204 hex	3203 hex	3rd Maximum Frequency	A304	R/W	30 to 400	1 [Hz]
3205 to 3215 hex	–	Not used	–	–	–	–
3216 hex	3215 hex	3rd Multi-step Speed Reference 0	A320 (HIGH)	R/W	0 Starting Frequency to 3rd Maximum Frequency	0.01 [Hz]
3217 hex	3216 hex		A320 (LOW)	R/W		
3218 to 323B hex	–	Not used	–	–	–	–
323C hex	323B hex	3rd Manual Torque Boost Voltage	A342	R/W	0 to 200	0.1 [%]
323D hex	323C hex	3rd Manual Torque Boost Frequency	A343	R/W	0 to 500	0.1 [%]
323E hex	323D hex	3rd Control Method	A344	R/W	00: Constant torque characteristics 01: Reduced torque characteristics	–
323F to 326C hex	–	Not used	–	–	–	–
326D hex	326C hex	3rd Acceleration Time 2	A392 (HIGH)	R/W	1 to 360000	0.01 [s]
326E hex	326D hex		A392 (LOW)	R/W		
326F hex	326E hex	3rd Deceleration Time 2	A393 (HIGH)	R/W	1 to 360000	0.01 [s]
3270 hex	326F hex		A393 (LOW)	R/W		
3271 to 330B hex	–	Not used	–	–	–	–
330C hex	330B hex	3rd Electronic Thermal Level	b312	R/W	200 to 1000	0.1 [%]
330D hex	330C hex	3rd Electronic Thermal Characteristics Selection	b313	R/W	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–
330E to 3506 hex	–	Not used	–	–	–	–
3507 hex	3506 hex	3rd Stabilization Parameter	H306	R/W	0 to 255	1
3508 hex to	–	Not used	–	–	–	–

8-6 ASCII Method

8-6-1 Communications Procedure

The inverter communicates with an external controller as follows.



(1): Frame that is sent from external controller to Inverter

(2): Frame that is sent back from Inverter to external controller

Frame (2) will be output as a response from the inverter after it receives frame (1) and is not an active output.

Each frame format (command) is shown below. For each command, refer to the next section.

Command List

Command	Description	Broadcast to all stations	Remarks
00	Inputs forward/reverse/stop command.	Enabled	
01	Sets frequency reference.	Enabled	
02	Sets multi-function input terminal status.	Enabled	
03	Reads all monitor data.	Disabled	
04	Reads the inverter status.	Disabled	
05	Reads the trip data.	Disabled	
06	Reads a parameter setting.	Disabled	
07	Sets a parameter value.	Enabled	
08	Restores all parameters to the default data.	Enabled	b084 must be set to 01 or 02. (The trip data will be cleared.)
09	Checks if a set value can be stored in EEPROM.	Disabled	
0A	Stores a set value in EEPROM.	Enabled	
0B	Recalculates internal parameters.	Enabled	

8-6-2 Communications Commands

This section describes each command.

Command 00

Inputs forward/reverse/stop command. (To use this command, set the RUN Command Selection (A002) to 03 (RS485).)

- Transmission Frame

Frame format

STX	Station No.	Command	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32, and FF (Broadcast to all stations)
Command	Transmission command	2 bytes	00
Data	Transmission data	1 byte	Set the transmission data as shown below.*
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

* Set one of the following set values to Data.

Data	Description
0	Stop command
1	Forward command
2	Reverse command

Example. To send the forward command to station 01

(STX)|01|00|1|(BCC)|(CR) ASCII conversion 02|30 31|30 30|31|33 30|0D

- Response frame

  Normal response: Refer to page 8-92

  Error response: Refer to page 8-93

Command 01

Sets frequency reference. (To use this command, set the Frequency Reference Selection (A001) to 03 (RS485).)

- Transmission Frame

Frame format

STX	Station No.	Command	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32, and FF (Broadcast to all stations)
Command	Transmission command	2 bytes	01
Data	Transmission data (Decimal ASCII code)	6 bytes	*
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

* To set 5 Hz for station 01

(STX)|01|01|000500|(BCC)|(CR)
ASCII conversion 02|30 31|30 31|30 30 30 35 30 30|30 35|0D

Note Data is 100 times the set value.

Example. 5 [Hz] → 500 → 000500 ASCII conversion 30 30 30 35 30 30

Note To use Data as the PID control feedback data, set its MSB to 1.

Example. 5 [%] → 500 → 100500 ASCII conversion 31 30 30 35 30 30

- Response frame

Normal response: Refer to page 8-92

Error response: Refer to page 8-93

Command 02

Sets multi-function input terminal status.

- Transmission Frame

Frame format

STX	Station No.	Command	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32, and FF (Broadcast to all stations)
Command	Transmission command	2 bytes	02
Data	Transmission data	16 bytes	*(Refer to the next page.)
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

* Multi-function terminal setting data (hexadecimal) and descriptions
(For details, refer to *Multi-function Input Selection* on page 7-108.)

Data [hex]	Description	Data [hex]	Description
0000000000000001	FW : Forward	0000000100000000	SF1 : Multi-step speed setting bit 1
0000000000000002	RV : Reverse	0000000200000000	SF2 : Multi-step speed setting bit 2
0000000000000004	CF1 : Multi-step speed setting binary 1	0000000400000000	SF3 : Multi-step speed setting bit 3
0000000000000008	CF2 : Multi-step speed setting binary 2	0000000800000000	SF4 : Multi-step speed setting bit 4
0000000000000010	CF3 : Multi-step speed setting binary 3	0000001000000000	SF5 : Multi-step speed setting bit 5
0000000000000020	CF4 : Multi-step speed setting binary 4	0000002000000000	SF6 : Multi-step speed setting bit 6
0000000000000040	JG : Jogging	0000004000000000	SF7 : Multi-step speed setting bit 7
0000000000000080	DB : External DC injection braking	0000008000000000	OLR : Overload limit switching
0000000000000100	SET : 2nd control	0000010000000000	TL : Torque limit enabled/disabled
0000000000000200	2CH : 2-step acceleration/deceleration	0000020000000000	TRQ1: Torque limit switching 1
0000000000000400	–	0000040000000000	TRQ2: Torque limit switching 2
0000000000000800	FRS : Free-run stop	0000080000000000	PPI : P/PI switching
0000000000001000	EXT : External trip	0000100000000000	BOK : Brake confirmation
0000000000002000	USP : Power recovery restart prevention	0000200000000000	ORT : Orientation
0000000000004000	CS : Commercial switch	0000400000000000	LAC : LAD cancel
0000000000008000	SFT : Soft lock	0000800000000000	PCLR: Position deviation clear
0000000000010000	AT : Analog input switching	0001000000000000	STAT: Pulse train position command permission
0000000000020000	SET3: 3rd control	0002000000000000	–
0000000000040000	RS : Reset	0004000000000000	ADD : Set frequency addition
0000000000080000	–	0008000000000000	F-TM: Forced terminal
0000000000100000	STA : 3-wire start	0010000000000000	ATR : Torque command input permission
0000000000200000	STP : 3-wire stop	0020000000000000	KHC : Integrated power clear
0000000000400000	F/R : 3-wire forward/reverse	0040000000000000	SON : Servo ON
0000000000800000	PID : PID enabled/disabled	0080000000000000	FOC : Preliminary excitation
0000000001000000	PIDC: PID integral reset	0100000000000000	MI1 : Not used
0000000002000000	–	0200000000000000	MI2 : Not used
0000000004000000	CAS : Control gain switching	0400000000000000	MI3 : Not used
0000000008000000	UP : Remote operation acceleration	0800000000000000	MI4 : Not used
0000000010000000	DWN: Remote operation deceleration	1000000000000000	MI5 : Not used
0000000020000000	UDC : Remote data clear	2000000000000000	MI6 : Not used
0000000040000000	–	4000000000000000	MI7 : Not used
0000000080000000	OPE : Forced Operator	8000000000000000	MI8 : Not used

* Multi-function terminal setting data (hexadecimal) and descriptions for 12 commands
(For details, refer to *Brake Control Function* on page 7-104.)

Data [hex]	Description	Data [hex]	Description
0000000000000001	–	0000000100000000	–
0000000000000002	AHD: Analog command held	0000000200000000	–
0000000000000004	CP1: Position command selection 1	0000000400000000	–
0000000000000008	CP2: Position command selection 2	0000000800000000	–
0000000000000010	CP3: Position command selection 3	0000001000000000	–
0000000000000020	ORL: Zero return limit signal	0000002000000000	–
0000000000000040	ORG: Zero return startup signal	0000004000000000	–
0000000000000080	FOT: Forward driving stop	0000008000000000	–
0000000000000100	ROT: Reverse driving stop	0000010000000000	–
0000000000000200	SPD: Speed/Position switching	0000020000000000	–
0000000000000400	PCNT: Pulse counter	0000040000000000	–
0000000000000800	PCC: Pulse counter clear	0000080000000000	–
0000000000001000	–	0000100000000000	–
0000000000002000	–	0000200000000000	–
0000000000004000	–	0000400000000000	–
0000000000008000	–	0000800000000000	–
0000000000010000	–	0001000000000000	–
0000000000020000	–	0002000000000000	–
0000000000040000	–	0004000000000000	–
0000000000080000	–	0008000000000000	–
0000000000100000	–	0010000000000000	–
0000000000200000	–	0020000000000000	–
0000000000400000	–	0040000000000000	–
0000000000800000	–	0080000000000000	–
0000000001000000	–	0100000000000000	–
0000000002000000	–	0200000000000000	–
0000000004000000	–	0400000000000000	–
0000000008000000	–	0800000000000000	–
0000000010000000	–	1000000000000000	–
0000000020000000	–	2000000000000000	–
0000000040000000	–	4000000000000000	–
0000000080000000	–	8000000000000000	–

Example. To activate the inverter settings, Forward, Multi-step speed 1, and Multi-step speed 2, for station 01, the contents of data are as follows:
0x0000000000000001 + 0x0000000000000004 + 0x0000000000000008
= 0x000000000000000D
Therefore, the transmission frame format is:
(STX)|01|02|000000000000000D|(BCC)|(CR)

- Response frame

  Positive response: Refer to page 8-92

  Negative response: Refer to page 8-93

Command 03

Reads all monitor data.

- Transmission Frame

Frame format

STX	Station No.	Command	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Command	Transmission command	2 bytes	03
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

- Response frame

Frame format

STX	Station No.	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Data	Data	104 bytes	* (Refer to the next page.)
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

* Monitor values

Monitor item	Unit	Magnification	Data size	Description	
Output frequency	Hz	× 100	8 bytes	Decimal ASCII code	
Output current	A	× 10	8 bytes	Decimal ASCII code	
Rotation direction	–	–	8 bytes	0: Stop, 1: Forward, 2: Reverse	
PID feedback monitor	%	× 100	8 bytes	Decimal ASCII code	
Multi-function input monitor	–	–	8 bytes	Refer to *1.	
Multi-function output monitor	–	–	8 bytes	Refer to *2.	→
Frequency conversion monitor	–	× 100	8 bytes	Decimal ASCII code	MSB LSB
Output torque	%	× 1	8 bytes	Decimal ASCII code	←
Output voltage monitor	V	× 10	8 bytes	Decimal ASCII code	
Power monitor	kW	× 10	8 bytes	Decimal ASCII code	
–	–	–	8 bytes	“00000000” is stored. (Preliminary data storage area)	
RUN time monitor	h	× 1	8 bytes	Decimal ASCII code	
ON time monitor	h	× 1	8 bytes	Decimal ASCII code	

*1 Multi-function Input Monitor

Item	Data
S1 terminal	00,000,001
S2 terminal	00,000,002
S3 terminal	00,000,004
S4 terminal	00,000,008
S5 terminal	00,000,010
S6 terminal	00,000,020
S7 terminal	00,000,040
S8 terminal	00,000,080
FW terminal	00,000,100

*2 Multi-function Output Monitor

Item	Data
P1 terminal	00,000,001
P2 terminal	00,000,002
P3 terminal	00,000,004
P4 terminal	00,000,008
P5 terminal	00,000,010
Relay terminal	00,000,020

Command 04

Reads inverter status.

- Transmission Frame

Frame format

STX	Station No.	Command	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Command	Transmission command	2 bytes	04
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

- Response frame

Frame format

STX	Station No.	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Data	Data	8 bytes	*(Refer to the next page.)
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

* Inverter status data consists of the following three elements (A, B, and C).

Data

Status A	Status B	Status C	00 (Reserved)

Inverter status A

Code	Status
00	Initial status
01	–
02	During stop
03	During RUN
04	During FRS
05	During JG
06	During DB
07	During retry
08	During trip
09	During UV

Inverter status B

Code	Status
00	During stop
01	During RUN
02	During trip

Inverter status C

Code	Status
00	–
01	Stop
02	Deceleration
03	Constant speed
04	Acceleration
05	Forward
06	Reverse
07	Forward to reverse
08	Reverse to forward
09	Forward run start
10	Reverse run start

Command 05

Reads a trip data.

- Transmission Frame

Frame format

STX	Station No.	Command	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Command	Transmission command	2 bytes	05
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

- Response frame

Frame format

STX	Station No.	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Data	Each monitor's data at the time of trip	440 bytes	*
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to (page 8-94).)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

* Data (Each monitor data during trip) stores the past six trip data, together with the total trip count (8 bytes).

Total count	Trip data 1	......	Trip data 6

Monitor item	Unit	Magnification	Data size	Remarks	
Trip factor	–	–	8 bytes	Code display	
Inverter status A	–	–	8 bytes		
Inverter status B	–	–	8 bytes	Refer to Command 04.	
Inverter status C	–	–	8 bytes		→ MSB
Output frequency	Hz	×10	8 bytes	Decimal ASCII code	
Total RUN time	h	×1	8 bytes	Decimal ASCII code	LSB ←
Output current	A	×10	8 bytes	Decimal ASCII code	
DC voltage	V	×10	8 bytes	Decimal ASCII code	
Power ON time	h	×1	8 bytes	Decimal ASCII code	

Command 06

Reads a parameter setting.

- Transmission Frame

Frame format

STX	Station No.	Command	Parameter	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Command	Transmission command	2 bytes	06
Parameter	Parameter number for data	4 bytes	*1
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

*1 All parameters can be read, except for F001 and U001 to U012.

- Response frame

Positive response

Frame format

STX	Station No.	ACK	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
ACK	Control code (ACKnowledge)	1 byte	ACK (0x06)
Data	Data (Decimal ASCII code)	8 bytes	*(Refer to the next page.)
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

* If Data is a selection parameter value, the corresponding code data will be sent/received.
For example, the code data for the data set in the 1st/2nd Motor Capacity (H003/H203) are as follows.

Code data	00	01	02	03	04	05	06	07	08	09	10
Domestic (b085 = 00, 02)	0.2 kW	–	0.4	–	0.75	–	1.5	2.2	–	3.7	–
Code data	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Domestic (b085 = 00, 02)	5.5 kW	7.5	11	15	18.5	22	30	37	45	55	75
Code data	**22**	**23**	**24**	**25**	**26**						
Domestic (b085 = 00, 02)	90 kW	110	132	150	160						

- If Data is a numeric value, refer to the function code list.

Example. When the 1st Acceleration Time 1 (F002) is set to 30.00 s, Data is 3000.

Negative response: Refer to page 8-93

Command 07

Sets a parameter value.

- Transmission Frame

Frame format

STX	Station No.	Command	Parameter	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32, FF (Broadcast to all stations)
Command	Transmission command	2 bytes	07
Parameter	Parameter number for data	4 bytes	*1
Data	Parameter data (Decimal ASCII code)	8 bytes	*2
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

*1. Parameter can be one of the following parameter groups:
Group F (excluding F001), Group A, Group B, Group C, Group H, Group P (For F001, use command 01.)

*2. Refer to command 06.

- Response frame

Positive response: Refer to page 8-92

Negative response: Refer to page 8-93

Command 08

Restores all parameters to the default data.

The function of this command depends on the value set in the Initialization Selection (b084). If b084 is set to 00, the trip data will be cleared.

- Transmission Frame

Frame format

STX	Station No.	Command	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32, FF (Broadcast to all stations)
Command	Transmission command	2 bytes	08
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

- Response frame

Positive response: Refer to page 8-92

Negative response: Refer to page 8-93

Command 09

Checks if a set value can be stored in EEPROM.

- Transmission Frame

Frame format

STX	Station No.	Command	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Command	Transmission command	2 bytes	09
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

- Response frame

Frame format

STX	Station No.	ACK	Data	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
ACK	Control code (ACKnowledge)	1 byte	ACK (0x06)
Data	Data	2 bytes	01: Enabled
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

Negative response: Refer to page 8-93

Command 0A

Stores a set value in EEPROM.

- Transmission Frame

Frame format

STX	Station No.	Command	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Command	Transmission command	2 bytes	0A
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

- Response frame

Positive response: Refer to page 8-92

Negative response: Refer to page 8-93

Command 0B

Recalculates internal parameters.

The recalculation is required if the base frequency or motor parameters (H***) are changed via RS485 communications.

- Transmission Frame

Frame format

STX	Station No.	Command	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
Command	Transmission command	2 bytes	0B
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

- Response frame

Positive response: Refer to page 8-92

Negative response: Refer to page 8-93

Positive and Negative Responses

<Positive Response>

- Response frame

Frame format

STX	Station No.	ACK	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
ACK	Control code (ACKnowledge)	1 byte	ACK (0x06)
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

<Negative Response>

- Response frame

Frame format

STX	Station No.	NAK	Error code	BCC	CR

	Description	Data size	Setting
STX	Control code (Start of Text)	1 byte	STX (0x02)
Station No.	Station No. of target Inverter	2 bytes	01 to 32
NAK	Control code (Negative AcKnowledge)	1 byte	NAK (0x15)
Error code	Communications error status	2 bytes	*1
BCC	Block check code	2 bytes	Exclusive OR of frame segments from Station No. to Data (Refer to page 8-94.)
CR	Control code (Carriage Return)	1 byte	CR (0x0D)

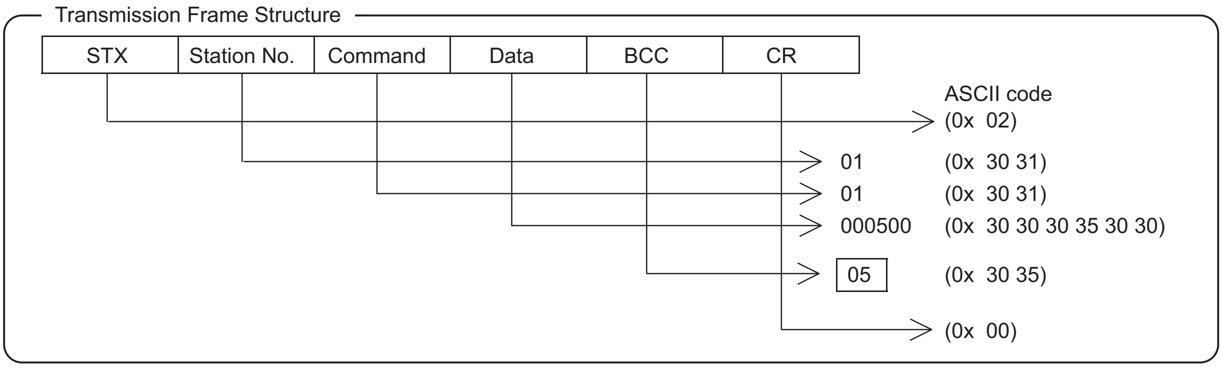
*1 Error Code List

Error code	Description
01 H	Parity error
02 H	Checksum error
03 H	Framing error
04 H	Overrun error
05 H	Protocol error
06 H	ASCII code error
07 H	Receiving buffer overrun error
08 H	Receiving timeout error
–	–
–	–
11 H	Command invalid error
12 H	–
13 H	Execution disabled error
14 H	–
15 H	–
16 H	Parameter invalid error
17 H	–

During a broadcast to all stations, the inverter sends back no response.

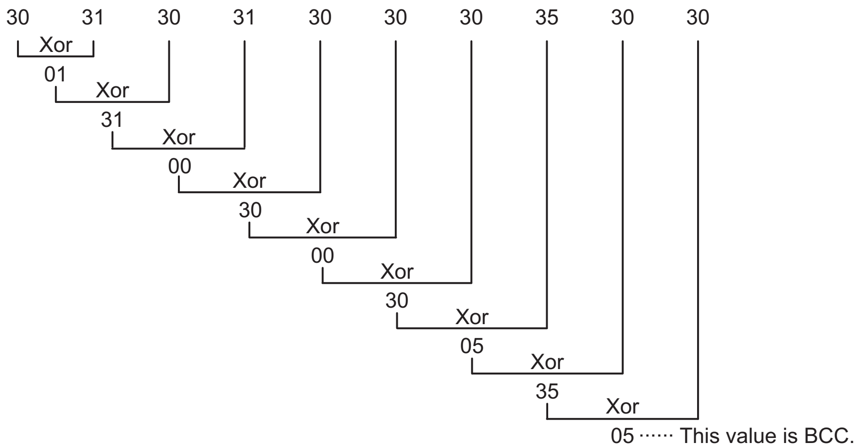
BCC (Block Check Code) Calculation Method

Example. To set the frequency reference to 5 Hz by using command 01 (Target station No. = 01)



To calculate BCC, convert the frame segments from Station No. to Data into ASCII code and then perform exclusive OR (XOR) operation byte by byte.

In the case of the above transmission frame, BCC is calculated as follows.



ASCII Code Conversion Table

Text data	ASCII code	Text data	ASCII code
STX	2	A	41
ACK	6	B	42
CR	0D	C	43
NAK	15	D	44
0	30	E	45
1	31	F	46
2	32	H	48
3	33	P	50
4	34	b	62
5	35		
6	36		
7	37		
8	38		
9	39		

9

Overview of DriveProgramming

This section describes the features of the DriveProgramming.

9-1 Overview of DriveProgramming 9-2

9-1 Overview of DriveProgramming

The 3G3RX-V1 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.
- User programs can be executed externally by the ON/OFF signal input via a multi-function input terminal.
- The user programs can be used to read and write functions allocated to the multi-function input and output terminals.
- The Digital 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 (P100 to P131), 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 Digital Operator enables the control of the inverter by using the LCD Digital Operator’s clock command.

Precautions for Safe Use

- If the clock command is used in the DriveProgramming, an unexpected operation may occur due to weak battery of the LCD Digital Operator. Take measures such as detecting a weak battery by a check that the clock data returns to the initial setting and stopping the inverter or programs. When the LCD Digital Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock command.
- If the DriveProgramming stops during multi-function 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.

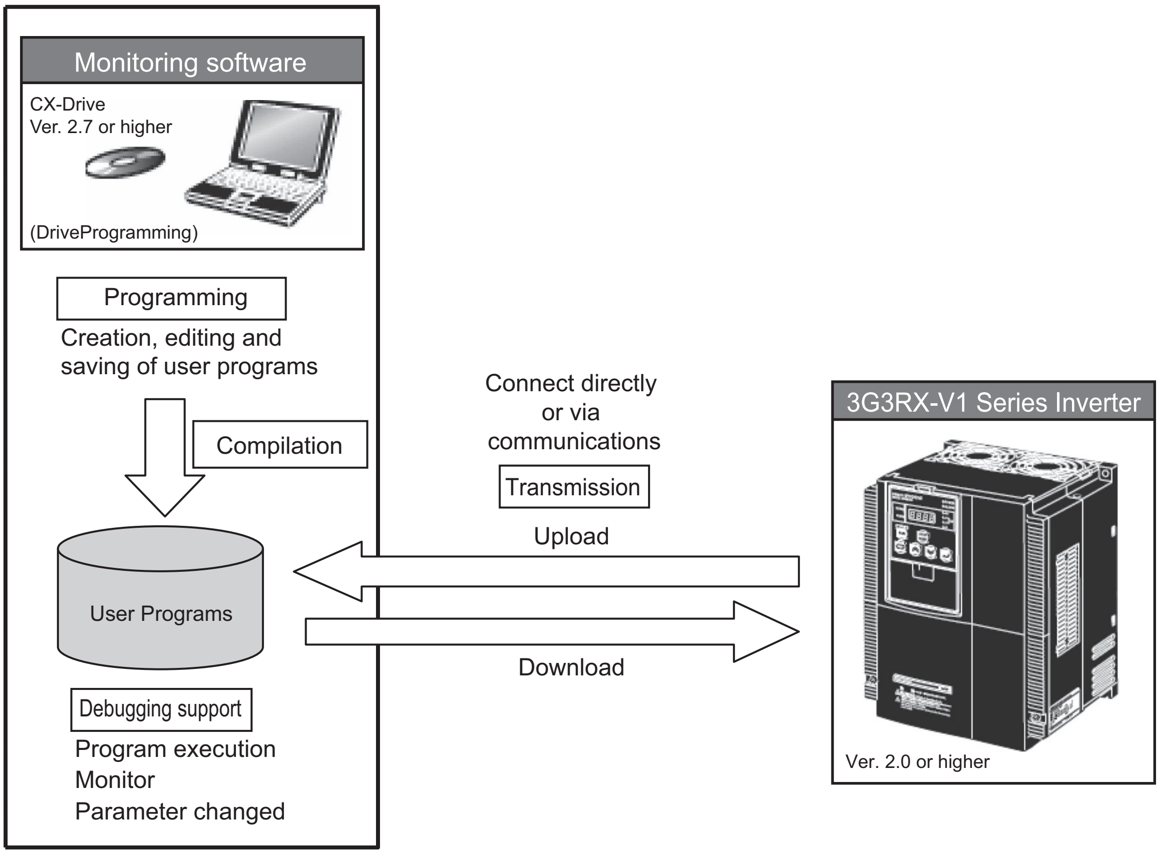
Item		Specifications
Program specifications	Programming language	Flowchart and text language method
	Input device	Windows computer (The supported operating systems are Windows XP SP3, Windows Vista, and Windows 7.)
	Program capacity	1024 steps max.: 6 KB (1024 steps max. for a total of 5 tasks)
	Programming 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: 2 ms/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 “DriveProgramming User’s Manual (I580)”.


Monitoring software
CX-Drive
Ver. 2.7 or higher
(DriveProgramming)
Programming
Creation, editing and saving of user programs
Compilation
User Programs
Debugging support
Program execution
Monitor
Parameter changed
Connect directly or via communications
Transmission
Upload
Download
3G3RX-V1 Series Inverter
Ver. 2.0 or higher

10

Troubleshooting

This section describes how to analyze the cause and take countermeasures based on the alarm code, and how to check when a trip error occurs.

10-1 Alarm Codes and Remedies **10-2**
- 10-1-1 Alarm Display 10-2
- 10-1-2 Alarm Code List 10-3
- 10-1-3 Option Board Protective Function List 10-9

10-2 Warning Function **10-12**

10-3 Other Indications on Digital Operator **10-14**

10-4 Troubleshooting **10-15**

10-1 Alarm Codes and Remedies

This section describes how to deal with troubles that may occur after the start of the inverter operation.

10-1-1 Alarm Display

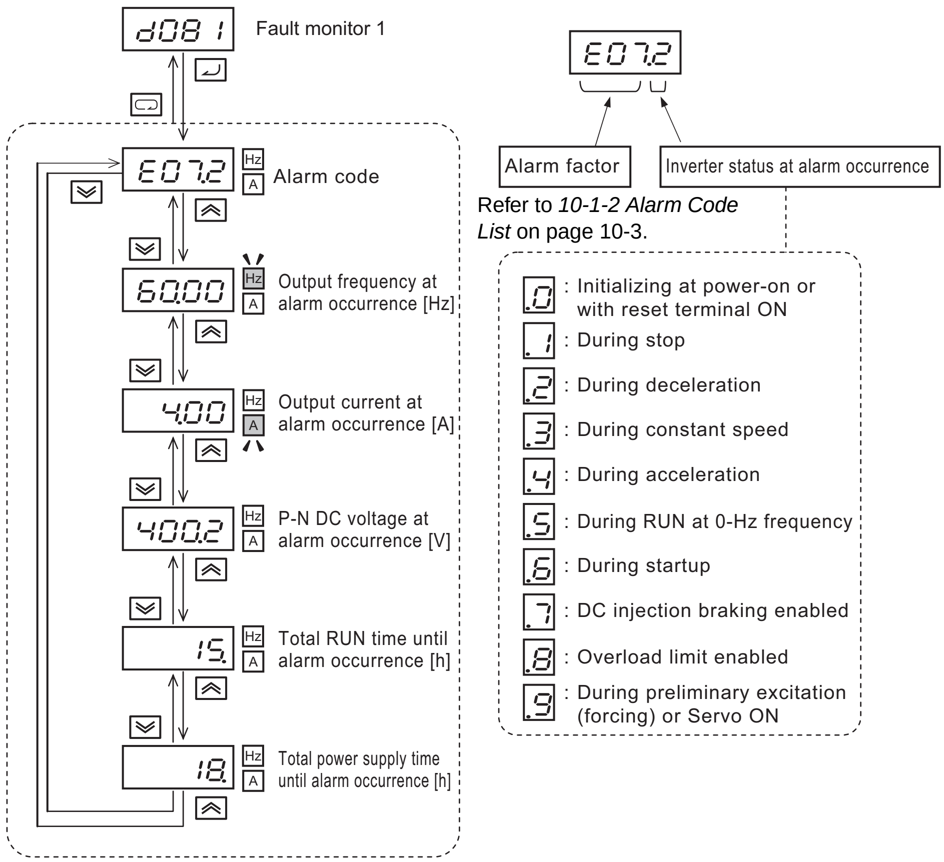
If an error occurs, the inverter shuts off its output (“trip”), turns ON the ALARM LED, and displays an alarm code. With the alarm code displayed, you can press the Increment key to view the detailed information such as the output frequency, current, and DC voltage when the alarm signal was output.

After checking the RUN command and other signals, you can reset the alarm.

Before resetting the alarm, be sure to investigate the cause of the trip and remove the trip factor(s) according to the displayed alarm code.

Fault Monitor Display

Use the Fault Monitor 1 to 6 (d081 to d086) to check the current alarm, as well as the past alarms. The Fault Monitor 1 (d081) displays information on the last alarm.



Precautions for Correct Use

The status information displayed on the inverter in the event of an alarm may not match the apparent operation of the motor.
For example, under PID control or in applications where the frequency is input via the analog signal, the inverter may accelerate and decelerate slightly in a repetitive manner due to fluctuation of the analog signal etc. even though the motor may appear to rotate at a constant speed.

How to Reset a Trip State

The inverter in a trip state can be reset in either of the following two methods.

- Press the STOP/RESET key on the Digital Operator or LCD Digital Operator.
  This key can be used to reset a trip error when the STOP Key Selection (b087) is set to 00 (Enabled) or 02 (Only RESET enabled).
- Input the reset signal via the control circuit terminal block.
  Set one of the Multi-function Input S1 to S8 Selection (C001 to C008) to 18 (RS: Reset).

  The above reset methods may not be effective depending on the trip factor.
  In such cases, cycle the power supply.

10-1-2 Alarm Code List

<table>
<tr><th>Name</th><th colspan="2">Description</th><th>Alarm code on Digital Operator</th><th>Check and remedy</th></tr>
<tr><td rowspan="4">Overcurrent protection</td><td rowspan="4">If the motor is restrained or rapidly accelerated or decelerated, a large current will flow through the inverter, which will result in a fault. Therefore, if the current exceeding the specified level flows, the inverter shuts off its output and displays an alarm.
This protection function detects an overcurrent through the AC current detector (CT: current transformer).
The protection circuit is activated at approximately 220% of the inverter rated output current, causing a trip.</td><td>During constant speed</td><td>E01.□</td><td>Is there any rapid load fluctuation? (Eliminate load fluctuation.)
Is there any output short-circuit? (Check the output wires.)
Is there any ground fault? (Check the output wires and the motor.)</td></tr>
<tr><td>During deceleration</td><td>E02.□</td><td>Is there any rapid deceleration? (Increase the deceleration time.)</td></tr>
<tr><td>During acceleration</td><td>E03.□</td><td>Is there any rapid acceleration? (Increase the acceleration time.)
Is the motor locked? (Check the motor and wires.)
Is the torque boost too high? (Decrease the torque boost setting.)</td></tr>
<tr><td>Others</td><td>E04.□</td><td>Is the DC injection braking power too high? (Decrease the braking power level.)
Is there any CT fault? (Replace or repair the CT.)</td></tr>
</table>

Name	Description	Alarm code on Digital Operator	Check and remedy
Overload protection*1	This function monitors the inverter output current and, if the built-in electronic thermal function detects a motor overload, causes the inverter to shut off the output and display an alarm . The inverter trips depending on the electronic thermal function settings.	E05.□	Is the load too heavy? (Reduce the load rate.) Is the thermal level correct? (Adjust the thermal level to an appropriate level.)*2
Braking resistor overload protection	This function causes the inverter to shut off its output and display an alarm if the usage rate of the regenerative braking circuit exceeds the value set in b090.	E06.□	Is there any rapid deceleration? (Increase the deceleration time.) Is the operation cycle frequent? (Increase the operation cycle time.) Is the usage rate setting of the regenerative braking function too low? (Set it to an appropriate level.)*3
Overvoltage protection	Extremely high DC voltage between P/+2 and N/– may result in a fault. This function therefore causes the inverter to shut off its output and display an alarm if the DC voltage between P/+2 and N/– exceeds the specified level due to regenerative energy from the motor or an increase in the incoming voltage during operation. The inverter trips when the DC voltage between P/+2 and N/– reaches approximately 400 VDC for 200-V class, and 800 VDC for 400-V class.	E07.□	Is there any rapid deceleration? (Increase the deceleration time.) Is there any ground fault? (Check the output wires and the motor.) Is the motor rotated from the load side? (Reduce the amount of regenerative energy.)
EEPROM error*4 *5	The inverter shuts off the output and displays an alarm if an error occurs in the built-in EEPROM due to external noise or abnormal temperature rise.*6	E08.□	Is there any large noise source around? (Take measures against noise.) Is the cooling efficiency reduced? (Check the fin for clogging and clean it.) (Replace the cooling fan.)

*1. The inverter will not accept the reset command until approximately 10 seconds after the occurrence of a trip (specifically, after activation of the protection function).

*2. The electronic thermal function is likely to work at 5 Hz or lower. Therefore, if the load inertial moment is large, the overload protect function will be activated during acceleration to prevent the inverter from accelerating further. In this case, increase the torque boost or take other measures for adjustment.

*3. Pay attention to the allowable power of the resistor.

*4. The reset operation is not accepted if an EEPROM error occurs. Turn off the power supply once. If E08 is displayed when turning on the power supply again, it is possible that the memory element is broken or the parameters are not stored correctly. Perform user initialization to reset the parameter settings.

*5. If this occurs, the inverter will not accept the reset operation via the terminal RS or the STOP/RESET key. Turn off the power supply once.

*6. This may result in a CPU error.

Name	Description	Alarm code on Digital Operator	Check and remedy
Undervoltage	The inverter shuts off its output if the incoming voltage drops below the specified level and the control circuit fails to work properly. The inverter trips when the DC voltage between P and N decreases to approximately 175 VDC for 200-V class, and 345 VDC for 400-V class.	E09.□	Is the power supply voltage decreased? (Check the power supply.) Is the power supply capacity sufficient? (Check the power supply.) Is the thyristor broken? (Check the thyristor.)
Current detector error	The inverter shuts off its output if an error occurs in the current detector (CT) built into the inverter. The inverter trips if the CT output is approximately 0.6 V or more when the power is turned on.	E10.□	The inverter has a defect. (Repair it.)
CPU error*1	The inverter shuts off its output and displays an alarm if a malfunction or error occurs in the internal CPU. *2	E11.□	Is there any large noise source around? (Take measures against noise.) The inverter has a defect. (Repair it.)
External trip	If an error occurs in the external equipment or device, the inverter captures the signal from that equipment or device and shuts of its output. (This alarm is enabled when the external trip function is selected.)	E12.□	Is there any error in the external equipment when the external trip function is selected? (Reset the external equipment error.)
USP error	This alarm appears when the power supply is turned on with the RUN signal input into the inverter. (This alarm is enabled when the USP function is selected.)	E13.□	When the USP function was selected, did you turn on the power supply with the RUN signal input into the inverter? (Cancel the RUN command and turn on the power supply again.)
Ground protection*3	This protects the inverter if a ground fault is detected between the inverter output unit and the motor when the power supply is turned on. This function does not work when a residual voltage remains in the motor.	E14.□	Is there any ground fault? (Check the output wires and the motor.) Is there any fault in the inverter itself? (Disconnect the output wires to check it.) Is there any fault in the main circuit? (Check and repair the main circuit.)*4
Incoming overvoltage protection	This alarm appears if the incoming voltage continues to be higher than the specification value for 100 seconds while the inverter is stopped. The inverter trips when the main circuit DC voltage reaches approximately 390 VDC for 200-V class, and 780 VDC for 400-V class.	E15.□	Is the incoming voltage high when the inverter is stopped? (Lower the incoming voltage; suppress the power supply fluctuation; install the AC reactor in the input power circuit.)

Name	Description	Alarm code on Digital Operator	Check and remedy
Momentary power interruption protection	The inverter shuts off its output if a momentary power interruption occurs for 15 ms or more. If the shutoff time is long, it is normally recognized as a power shutoff. Note that, when the power interruption restart function is enabled, the inverter restarts after power recovery if the RUN command input remains.	E16.□	Is the power supply voltage decreased? (Restore the power supply.) Is there a contact failure on the MCCB and/or MC? (Replace the MCCB and/or MC.)
Temperature error due to cooling fin speed drop	This alarm appears if a decrease of the cooling fan rotation speed is detected when a temperature error occurs.	E20.□	Is the cooling efficiency reduced? (Replace the cooling fan.) Is there any clogging in the fin? (Clean the fin.)
Temperature error	The inverter shuts off its output if the temperature rises in the main circuit due to such as a high ambient temperature.	E21.□	Did you install the inverter vertically? (Check the installation.) Is the ambient temperature high? (Decrease the ambient temperature.)

*1. If this occurs, the inverter will not accept the reset operation via the terminal RS or the STOP/RESET key. Turn off the power supply once.

*2. If the inverter reads an abnormal value from the EEPROM, a CPU error may occur.

*3. If this occurs, the inverter will not accept the reset operation via the Digital Operator. Be sure to reset it via the terminal RS.

*4. Refer to *Section 11 Maintenance and Inspection*.

Name	Description	Alarm code on Digital Operator	Check and remedy
Gate array communications error	The inverter trips when a fault is detected in communications between the built-in CPU and the gate array.	E23.□	Is there any large noise source around? (Take measures against noise.) Is the cable disconnected? (Check the connector.)
Input phase loss protection	This causes the inverter to trip to prevent inverter damage due to input phase loss when the Input Phase Loss Protection Selection (b006) is set to 01 (Enabled). The inverter trips when the phase loss time is approximately 1 second or more.	E24.□	Is there any input power supply phase loss? (Check the input wiring.) Is there a contact failure on the MCB and/or Mg? (Replace the MCB and/or Mg.)
Main circuit error*1	The inverter trips if the gate array cannot confirm whether the IGBT is ON or OFF due to a malfunction by noise in the signal, load short-circuit, or broken main element, etc.	E25.□	Is there any large noise source around? (Take measures against noise.) Is the main element damaged? Is there any output short-circuit? (Check the Servo Drive.) The inverter has a defect. (Repair it.)

Name	Description	Alarm code on Digital Operator	Check and remedy
Servo Drive error	The inverter shuts off its output to protect the main element if a momentary overcurrent, temperature error in the main element, or drop in the main element driving power supply occurs. Retry operation cannot be performed after this trip.	E30.□	Is there any output short-circuit? (Check the output wires.) Is there any ground fault? (Check the output wires and the motor.) Is the main element damaged? (Check the Servo Drive.) Is there any clogging in the fin? (Clean the fin.)
Thermistor error	The inverter shuts off its output if it detects an abnormal motor temperature rise from the thermistor resistance value inside the motor connected to the terminal TH.	E35.□	Is the motor temperature too high? (Check the motor temperature.) Is there any damage to the thermistor inside the motor? (Check the thermistor.) Is there any noise in the thermistor signal? (Separate the wiring.)
Brake error	This alarm appears when the Brake Control Function Selection (b120) is set to 01 (Enabled), if the inverter cannot recognize the brake ON/OFF status within the Brake Error Detection Time (b124) after it outputs the brake release signal.	E36.□	Is the brake ON/OFF function working? (Check the brake.) Is the time set in b124 too short? (Increase the b124 value.) Is the brake confirmation signal input? (Check the wiring.)
Emergency shutoff*2	The inverter shuts off the hardware output and displays an alarm if the terminal EMR (S3) turns ON with SW1 on the logic board ON.	E37.□	Is there any error in the external equipment when the emergency shutoff function is selected? (Correct the external equipment error.)
Overload protection in low speed range	The inverter shuts off its output if the inverter built-in electronic thermal function detects an overload in the lowest speed range of 0.2 Hz maximum (2nd Electronic Thermal Level). (However, a higher frequency may remain displayed in the Fault Monitor.)	E38.□	Is the load too heavy? (Reduce the load rate.)
Modbus communication (Modbus error)	This alarm appears if the timeout occurs due to disconnection during Modbus communication.	E41.□	Is the communication speed correct? Is the wiring distance appropriate? (Check the connection.)

*1. If this occurs, the inverter will not accept the reset operation via the terminal RS or the STOP/RESET key. Turn off the power supply once.

*2. If this occurs, the inverter will not accept the reset operation via the Digital Operator. Be sure to reset it via the terminal RS.

Name	Description	Alarm code on Digital Operator	Check and remedy
DriveProgramming Invalid command	The terminal PRG was turned ON although no program was downloaded into the inverter.	E43.□	Upload the program and check if it actually exists in the inverter. Then, create the program again and download it to the inverter.
DriveProgramming nesting count error	A subroutine, or a For-Next loop statement, is nested exceeding eight levels.	E44.□	Upload a program and check the number of nesting levels in it. Then, correct the program so that it has a nesting of eight levels or less and download it to the inverter.
DriveProgramming command error 1	• The jump destination of a "goto" command points to a command that terminates a "for" or other loop. • The variable U(ii), which is referenced through another variable, could not be found. • An arithmetic instruction results in the following error: Overflow, underflow, or division by zero • The "ChgParam" command results in the following error: · Reference to a parameter that does not exist · Writing of a value exceeding the setting range · Change to a parameter value that cannot be updated during inverter opertaion · Change to a parameter value that is protected against update by the Soft Lock Selection (b031) setting	E45.□	Upload the program and check if it causes any of the errors listed on the left. Then, correct the program and download it to the inverter. Or check and correct the inverter settings to prevent errors listed on the left.
DriveProgramming user trip 0 to 9	The "trip" command of the DriveProgramming was executed. The "trip" command generates a trip in the program.	E50.□ to E59.□	Check and remove the trip factor(s).
Option 1 error	The inverter detects an error in the option board mounted on option port 1.	E60.□ to E69.□	Is the option board securely mounted? (Check the mounting condition.)
Option 2 error	The inverter detects an error in the option board mounted on option port 2.	E70.□ to E79.□	Is the option board securely mounted? (Check the mounting condition.)

10-1-3 Option Board Protective Function List

E6*.☐ (OP1-*) appears when the option board is mounted on option port 1 (Digital Operator connecter side), and E7*.☐ (OP2-*) appears when it is mounted on option port 2 (control circuit terminal block side).

Protective Function Display when PG Board (Model: 3G3AX-PG01) is Mounted

Name	Description	Alarm code on Digital Operator
Encoder disconnection	The inverter shuts off its output and displays an alarm if the encoder wiring disconnection or connection failure is detected, when the encoder is damaged, or when an encoder except for line driver output is used.	E60.☐, E70.☐
Overspeed	The inverter shuts off its output and displays an alarm if the motor rotation speed reaches or exceeds the 1st Maximum Frequency (A004) × the Overspeed Error Detection Level (P026).	E61.☐, E71.☐
Positioning error	The inverter shuts off its the output and displays an alarm if the current position deviation from the position reference value reaches or exceeds 1,000,000 pulses during position control.	E62.☐, E72.☐
Position control range trip	The inverter shuts off its output and displays an alarm if the current position exceeds the value set in the Position Limit Setting (Forward Side) (P072) Position Limit Setting (Reverse Side) (P073) during absolute position control.	E63.☐, E73.☐
3G3AX-PG01 connection error	The inverter shuts off its output and displays an alarm if a PG board connection (mounting) failure is detected.	E69.☐, E79.☐

● Function List for the DIP Switches on PG Board (Model: 3G3AX-PG01)

Use the DIP switches on the PG Board to enable/disable the encoder disconnection detection function and terminating resistor.

DIP switch	Switch No.	Description	
SWENC	1	ON	Disconnection detection enabled when encoder phase A/B is not connected
		OFF	Disconnection detection disabled when encoder phase A/B is not connected
	2	ON	Disconnection detection enabled when encoder phase Z is not connected
		OFF	Disconnection detection disabled when encoder phase Z is not connected
SWR	1	ON	Terminating resistor between SAP and SAN (150 Ω) enabled
		OFF	Terminating resistor between SAP and SAN disabled
	2	ON	Terminating resistor between SBP and SBN (150 Ω) enabled
		OFF	Terminating resistor between SBP and SBN disabled

Additional Information

Refer to the “Encorder Feedback Board 3G3AX-PG User’s Manual (I564)”.

Protective Function Display when EtherCAT Communications Unit (Model: 3G3AX-RX-ECT) is Mounted

Description	Alarm code on Digital Operator
When an unrecoverable error is detected in the option board, a trip is generated for the inverter.	E70.☐
A trip occurs when a timeout is generated in communication between the inverter and option board.	E79.☐

Additional Information

Refer to the “MX2/RX Series EtherCAT Communication Unit User’s Manual (I574)”.

Protective Function Display when CompoNet Communications Unit (Model: 3G3AX-RX-CRT-E) is Mounted

Description	Alarm code on Digital Operator
This alarm appears if a fatal fault occurs on the communications unit when the power supply is ON or during opertaion.	E70.☐
This alarm appears if an overlapping node address is found.	E71.☐
This alarm appears if the inverter trips due to an external fault (EXT) detected via the fieldbus connection.	E72.☐
This alarm appears if a communications idle error or communications timeout error is detected in the RUN mode.	E73.☐
This alarm appears if a setting error is detected in any of the parameters P160 to P167 and P170 to P179.	E74.☐
This alarm appears if the inverter settings are not compatible with the communications unit.	E75.☐
This alarm appears if an option connection error or a fatal fault is detected when the communications unit operates.	E79.☐

Additional Information

Refer to the “MX2/RX Series CompoNet Communications Unit User’s Manual (I582)”.

Protective Function Display when DeviceNet Communications Unit (Model: 3G3AX-RX-DRT-E) is Mounted

Description	Alarm code on Digital Operator
This alarm appears if a fatal fault occurs on the communications unit when the power supply is ON or during opertaion.	E70.☐
This alarm appears if an overlapping node address is found.	E71.☐
This alarm appears if the inverter trips due to an external fault (EXT) detected via the fieldbus connection.	E72.☐
This alarm appears if a communications idle error, communications timeout error, or network power supply error is detected in the RUN mode.	E73.☐
This alarm appears if a setting error is detected in any of the parameters P160 to P167 and P170 to P179.	E74.☐
This alarm appears if the inverter settings are not compatible with the communications unit.	E75.☐
This alarm appears if an option connection error or a fatal fault is detected when the communications unit operates.	E79.☐

Additional Information

Refer to the “MX2/RX Series DeviceNet Communications Unit User’s Manual (I581)”.

10-2 Warning Function

The following table shows the relationship between the displayed warning code and the parameter correction.

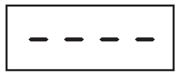
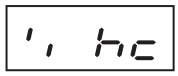
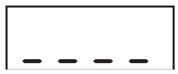
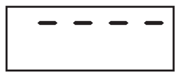
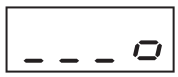
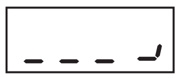
Warning code	Warning display conditions		
W001	1st Frequency Upper Limit (A061)	>	1st Maximum Frequency (A004)
W002	1st Frequency Lower Limit (A062)	>	1st Maximum Frequency (A004)
W005	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	>	1st Maximum Frequency (A004)
W015	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	>	1st Frequency Upper Limit (A061)
W019	1st/2nd Frequency Upper Limit (A061/A261)	<	Orientation Speed Setting (P015)
W025	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	<	1st Frequency Lower Limit (A062)
W029	1st Frequency Lower Limit (A062)	>	Orientation Speed Setting (P015)
W031	1st Frequency Upper Limit (A061)	<	Starting Frequency (b082)
W032	1st Frequency Lower Limit (A062)	<	Starting Frequency (b082)
W035	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	<	Starting Frequency (b082)
W037	Jogging Frequency (A038)	<	Starting Frequency (b082)
W085	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	<>	Jump Frequency 1/2/3 ± Jump Frequency Width 1/2/3 (A063/A065/A067) ± (A064/A066/A068)
W086	Multi-step Speed Reference 1 to 15 (A021 to A035)	<>	Jump Frequency 1/2/3 ± Jump Frequency Width 1/2/3 (A063/A065/A067) ± (A064/A066/A068)
W091	Free V/f Frequency 7 (b112)	<	1st Frequency Upper Limit (A061)
W092	Free V/f Frequency 7 (b112)	<	1st Frequency Lower Limit (A062)
W095	Free V/f Frequency 7 (b112)	<	1st Multi-step Speed Reference 0 (A020)
W201	2nd Frequency Upper Limit (A261)	>	2nd Maximum Frequency (A204)
W202	2nd Frequency Lower Limit (A262)	>	2nd Maximum Frequency (A204)
W205	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	>	2nd Maximum Frequency (A204)
W215	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	>	2nd Frequency Upper Limit (A261)
W225	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	<	2nd Frequency Lower Limit (A262)
W231	2nd Frequency Upper Limit (A261)	<	Starting Frequency (b082)
W232	2nd Frequency Lower Limit (A262)	<	Starting Frequency (b082)
W235	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	<	Starting Frequency (b082)
W285	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	<>	Jump Frequency 1/2/3 ± Jump Frequency Width 1/2/3 (A063/A065/A067) ± (A064/A066/A068)
W291	Free V/f Frequency 7 (b112)	<	2nd Frequency Upper Limit (A261)
W292	Free V/f Frequency 7 (b112)	<	2nd Frequency Lower Limit (A262)
W295	Free V/f Frequency 7 (b112)	<	2nd Multi-step Speed Reference 0 (A220)
W305	Output Frequency Setting/Monitor (F001), 3rd Multi-step Speed Reference 0 (A320)	>	3rd Maximum Frequency (A304)
W335	Output Frequency Setting/Monitor (F001), 3rd Multi-step Speed Reference 0 (A320)	<	Starting Frequency (b082)
W385	Output Frequency Setting/Monitor (F001), 3rd Multi-step Speed Reference 0 (A320)	<>	Jump Frequency 1/2/3 ± Jump Frequency Width 1/2/3 (A063/A065/A067) ± (A064/A066/A068)

Note 1 Modifying a parameter setting causes the base frequency to be rewritten. This may result in motor burnout depending on the value. If a warning occurs, be sure to change the parameter setting to a correct value.

2 The parameter settings will be checked even if the Frequency Reference Selection (A001) is set to other than 02 (Digital Operator).

3 A warning will occur if the frequency set in F001, A020, A220, A320, or A021 to A035 falls within the frequency range set by the Jump Frequency settings.

10-3 Other Indications on Digital Operator

Name	Description	Indication on Digital Operator
During reset	This indication appears when the input terminal allocated to the reset (RS) function is ON, or when a trip state is reset via the STOP/RESET key.	Rotating 
Undervoltage standby	This indication appears when the inverter is in an undervoltage standby state, or when the power supply is shut off.	
Restart during momentary power interruption/Restart on trip	This indication appears while restart operation is in progress.	
RUN command limited	This indication appears when the RUN command is input from the control terminal, with the RUN direction limited by the RUN Direction Limit Selection (b035) setting.	
Setting initialization	This indication appears while the parameter settings are initialized.	
Fault Monitor initialization	This indication appears while the fault monitor data is initialized.	
No data	This indication appears when there is no applicable data. This indicates that the fault monitor has no trip data.	
Communications error	This indication appears if an error occurs between a remote Digital Operator and the inverter.	Blinking 
Auto-tuning OK	This indication appears when auto-tuning is completed normally.	
Auto-tuning NG	This indication appears when auto-tuning is failed.	

10-4 Troubleshooting

If you feel that the inverter operation is strange or that the inverter does not operate as intended, use the following information as a reference, even if the inverter displays no alarm indication.

If the inverter trips with an alarm indication, refer to *10-1 Alarm Codes and Remedies* on page 10-2.

Symptom	Possible cause	Remedy	Reference page
The power supply is not turned on. The POWER LED on the inverter is not lit.	The short-circuit bar between the terminal +1 and P/+2 is removed, or no DC reactor is connected.	Install the short-cut bar, or connect a DC reactor.	2-15
	Input wiring is disconnected.	Check the input wiring.	2-14
The RUN command is input, but the motor does not rotate.	The RUN Command Selection (A002) setting is incorrect.	Set the RUN Command Selection (A002) correctly.	7-18
	The Frequency Reference Selection (A001) setting is incorrect.	Set the Frequency Reference Selection (A001) correctly, then set the frequency according to the selected frequency reference input method.	7-17
	The frequency is set to 0 Hz.	When the Frequency Reference Selection (A001) is set to 01 (Control circuit terminal block), input the analog voltage or current signal corresponding to the frequency to the terminal FV or FI. For details on switching between the analog voltage and current signals, refer to *Output Frequency Setting/Monitor* on page 7-14 and *Frequency Reference Selection* on page 7-17.	7-17
		When the Frequency Reference Selection (A001) is set to 02 (Digital Operator), input the frequency in the Output Frequency Setting/Monitor (A001).	
		Set the frequency according to the Frequency Reference Selection (A001) setting. The input frequency will be displayed in the Output Frequency Setting/Monitor (F001).	
		For the multi-step speed operation, set the frequency to the Multi-step Speed Reference 0 to 15 (A020 to A035, A220).	5-53
	No multi-function input terminal is allocated for the RUN command.	To input the RUN command via a multi-function input terminal, set the Multi-function Input S1 to S8 Selection (C001 to C008) to 01 (RV). To input the RUN command via the 3-wire input method, set them to 20 (STA), 21 (STP), and 22 (F/R).	7-108
	The Multi-function Input S1 to S8 Selection (C001 to C008) is set to 02 (CF1) to 05 (CF4) and that terminal is ON to enable the Multi-step speed setting.	Disable the Multi-step speed setting. When this terminal is ON, multi-step speed operation is enabled, so the motor does not rotate if the frequency values in the Multi-step Speed Reference 1 to 15 (A021 to A035) are 0 (default data).	5-52
	Both the forward and reverse input terminals are ON.	To input the RUN command via the forward/reverse input terminal, turn ON either of them.	5-23
	The RUN Direction Limit Selection (b035) is set to limit the forward or reverse rotation.	Set the RUN Direction Limit Selection (b035) correctly.	7-77
	The input terminal wiring or short-circuit bar connection for the RUN command is incorrect.	Wire correctly. The multi-function input terminal status can be checked in the Multi-function Input Monitor (d005).	2-15

Symptom	Possible cause	Remedy	Reference page
The RUN command is input, but the motor does not rotate.	The analog voltage/current or variable resistor input wiring for the frequency reference is incorrect.	Wire correctly. • For the analog voltage or variable resistor input wiring, measure the voltage between the terminals FC and SC with a tester etc. to check that the voltage is correct. • For the analog current input wiring, with the wires disconnected, measure the current flowing between the power supply and FI terminals with a tester etc. to check that the current is correct.	2-14
	Although the inverter is operated via the Digital Operator, the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 51 (F-TM: Forced terminal block) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	7-108
	Although the inverter is operated via the control circuit terminal block, the Multi-function Input S1 to S8 Selection (C001 to C008) is set to 31 (OPE: Forced operator function) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	7-108
	The inverter trip occurred. The ALARM LED is lit with “Exxx” on the display.	Press the STOP/RESET key to reset the trip and, after determining the cause and taking countermeasures based on the alarm code, restart the inverter.	10-3
	The emergency shutoff function slide switch (SW1) is ON, but the multi-function input terminal S3 (EMR: Emergency shutoff signal) is OFF.	To use the emergency shutoff function with the slide switch SW1 ON, turn ON the multi-function input terminal S3 (EMR: Emergency shutoff signal). To disable the function, set the slide switch SW1 to OFF.	7-108
	The Multi-function Input S1 to S8 Selection (C001 to C008) is set to 18 (RS: Reset), 14 (CS: Commercial switching), or 11 (FRS :Free-run stop) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	7-108
	The wiring from the inverter to the motor, or the internal wiring of the motor, is disconnected.	Check the input wiring.	2-14
	The load is too heavy.	Reduce the load.	–
	The motor brake is applied.	Release the brake.	
The motor rotation speed does not increase.	There is a contact failure for the analog voltage/current or variable resistor input wiring.	Check the input wiring. • For the analog voltage or variable resistor input wiring, measure the voltage between the terminals FC and SC with a tester etc. to check that the voltage is correct. • For the analog current input wiring, with the wires disconnected, measure the current flowing between the power supply and FI terminals with a tester etc. to check that the current is correct.	2-14

Symptom	Possible cause	Remedy	Reference page
The motor rotation speed does not increase.	The overload limit or overcurrent suppression function is active.	Disable the function, or increase the level at which the function is activated.	7-72 7-75
	The 1st/2nd/3rd Maximum Frequency (A004/A204/A304) or the 1st/2nd Frequency Upper Limit (A061/A261) is set too low.	Change the set value.	7-19 7-42
	The set acceleration time is too long.	Decrease the value set in the 1st/2nd/3rd Acceleration Time 1/2 (F002/F202/F302/A092/A292/A392).	7-15
	The Multi-function Input S1 to S8 Selection (C001 to C008) is set to 06 (JG: Jogging) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	7-108
	The Multi-function Input S1 to S8 Selection (C001 to C008) is set to 02 (CF1) to 05 (CF4) and that terminal is ON to enable the Multi-step speed setting.	Disable the Multi-step speed setting. When this terminal is ON, multi-step speed operation is enabled, so the motor rotates according to frequency values set in the Multi-step Speed Reference 1 to 15 (A021 to A035).	7-108
	The load is too heavy.	Reduce the load.	–
	The motor brake is applied.	Release the brake.	
The Output Frequency Setting/Monitor (F001) cannot be set via the Digital Operator.	The Frequency Reference Selection (A001) is set to other than Digital Operator.	Set the Frequency Reference Selection (A001) to 02 (Digital Operator).	7-17
	The Multi-function Input S1 to S8 Selection (C001 to C008) is set to 51 (F-TM: Forced terminal block) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	7-108
The specified parameter does not appear.	The Display Selection (b037) is set to 01 (Individual display of functions), 04 (Basic display), etc.	Set the Display Selection (b037) to 00 (Complete display).	7-78
The parameter settings cannot be changed.	The inverter operates.	Stop the inverter. Then, set the parameters again after the motor stops decelerating. Setting b031 to 10 (Data can be changed during RUN) enables parameter settings to be changed even when the inverter operates.	–
	The soft lock function is enabled.	Disable the soft lock function in the Soft Lock Selection (b031).	7-75
The motor rotates in reverse.	The phase sequence of wiring to the motor is incorrect. (The motor is not designed to rotate forward in the phase sequence: U/T1, V/T2, W/T3.)	Reverse the order of two wires connected to U/T1, V/T2, W/T3, or change the phase sequence to match that of the motor.	2-14
	The 3-wire input function is enabled, but the forward/reverse logic is incorrect.	Check the logic of the F/R (3-wire forward/reverse) signal allocated to a multi-function input terminal (C001 to C008 = 22).	7-108
The motor rotates in reverse when the RUN key is pressed.	The RUN Direction Selection (F004) setting is incorrect.	Set the RUN Direction Selection (F004) correctly.	7-16

Symptom	Possible cause	Remedy	Reference page
An Overvoltage protection alarm (E03) occurs while the inverter operates.	The acceleration time is set too short.	Increase the value set in the 1st/2nd/3rd Acceleration Time 1/2 (F002/F202/F302/A092/A292/A392).	7-15
		Use the Acceleration Stop Frequency (A069) to enable the inverter to stop accelerating temporarily.	
	The load is too heavy.	Reduce the load.	–
		Use the torque boost function to adjust the torque.	5-65
		Set the 1st/2nd Control Method (A044/A244) to 02 (Free V/f setting) to adjust the torque.	7-34
	The Overload Limit Selection (b021)/Overload Limit Selection 2 (b024) is set to 00 (Disabled).	Set the Overload Limit Selection (b021)/Overload Limit Selection 2 (b024) to 01 to 03 to enable the overload limit function.	7-72
	If an overcurrent trip occurs during operation when the overload limit function is enabled, refer to the following information.		
	The Overload Limit Level (b022)/Overload Limit Level 2 (b025) is too high.	Decrease the Overload Limit Level (b022)/Overload Limit Level 2 (b025).	7-72
	The Overload Limit Parameter (b023)/Overload Limit Parameter 2 (b026) value is too small.	Increase the Overload Limit Parameter (b023)/Overload Limit Parameter 2 (b026) value.	
The STOP/RESET key does not function.	The STOP/RESET key is disabled.	Set the STOP Key Selection (b087) correctly.	7-97
	The Overvoltage Suppression Function Selection During Deceleration (b130) is set to 01 or 02 to enable the overvoltage suppression function.	Set the Overvoltage Suppression Function Selection During Deceleration (b130) to 00 (Disabled), or adjust the level and other settings of the function.	5-68
	The Deceleration Stop Selection on Power Interruption (b050) is set to 01, 02, or 03 to enable the deceleration stop on power interruption function.	Set the Deceleration Stop Selection on Power Interruption (b050) to 00 (Disabled), or adjust the level and other settings of the function.	7-88
The motor or machine causes a loud noise.	The carrier frequency is too low.	Increase the Carrier Frequency (b083) value. However, this may increase noise or leakage current from the inverter. In addition, the output current must be derated depending on the mode. For details, refer to *Derating of Rated Output Current* on page 2-6	7-94
	The frequency of the motor in rotation resonates with the machine's natural frequency.	Change the frequency setting. If resonance occurs during acceleration/deceleration, use the Jump Frequency settings (A063 to A068) to avoid the resonance frequency.	7-44
	The motor is overexcited.	Set the 1st/2nd/3rd Base Frequency (A003/A203/A303) and the Motor Rated Voltage Selection (A082) according to the motor ratings. If this does not improve the condition, decrease the Output Voltage Gain (A045) slightly. Or set the 1st/2nd Control Method (A044/A244) to 02 (Free V/f setting) to adjust the torque.	7-19 7-34
An Overload protection alarm occurs.	The electronic thermal level is inappropriate.	Set the 1st Electronic Thermal Level (b012)/1st Electronic Thermal Characteristics Selection (b013) to a correct value.	7-66

Symptom	Possible cause	Remedy	Reference page
An Overvoltage protection alarm (E07) occurs during deceleration.	The set deceleration time is too short.	Increase the value set in the 1st/2nd/3rd Deceleration Time 1/2 (F003/F203/F303/A093/A293/A393).	7-15
	The Overvoltage Suppression Function Selection During Deceleration (b130) is set to 00 (Disabled).	Set the Overvoltage Suppression Function Selection During Deceleration (b130) to 01 or 02 to enable the overvoltage suppression function. However, when this function is enabled, the actual deceleration time may be longer than the set value. For details, refer to *Overvoltage Suppression Function during Deceleration* on page 7-106.	7-106
	If the Overvoltage protection alarm (E07) still occurs during deceleration when the Overvoltage Suppression Function Selection During Deceleration (b130) is set to 01 or 02 (Enabled), refer to the following information.		
	The Overvoltage Suppression Proportional Gain During Deceleration (b133)/Overvoltage Suppression Integral Time During Deceleration (b134) value is inappropriate.	Change the set values. For details, refer to *Overvoltage Suppression Function during Deceleration* on page 7-106.	7-106
	The Overvoltage Suppression Level During Deceleration (b131) is too high.	Decrease the Overvoltage Suppression Level During Deceleration (b131). Note, however, that setting an excessively small value may disable deceleration. Consider that the minimum value is: Incoming voltage x $\sqrt{2}$ x 110%.	
A Thermistor error (E35) occurs.	24-VDC voltage is input to the external thermistor input terminal TH.	Deallocate the external thermistor function from the terminal TH.	2-16
The output frequency is unstable.	The parameter settings are inappropriate.	Change the output frequency value slightly away from the power supply frequency.	7-14
		Change the 1st/2nd/3rd Stabilization Parameter (H006/H206/H306) value.	7-146
	The load changes significantly.	Increase the motor/inverter capacity.	–
	The power supply voltage fluctuates.	Take measure to reduce the fluctuation.	
The output torque is insufficient.	The acceleration/constant speed parameter settings are inappropriate.	Increase the 1st/2nd/3rd Manual Torque Boost Voltage (A042/A242/A342)/1st/2nd/3rd Manual Torque Boost Frequency (A043/A243/A343) value.	7-31
		Set the 1st/2nd Torque Boost Selection (A041/A241) to 01 (Automatic torque boost).	
		Decrease the Carrier Frequency (b083).	7-94
		Set the 1st/2nd Control Method (A044/A244) to 03 (SLV: Sensorless vector control).	7-34
	The 1st/2nd/3rd Deceleration Time 1 (F003/F203/F303)/ 1st/2nd/3rd Deceleration Time 2 (A093/A293/A393) settings are inappropriate.	Increase the value set in the 1st/2nd/3rd Deceleration Time 1/2 (F003/F203/F303/A093/A293/A393).	7-15
		Set the AVR Selection (A081) to 01 or 02 (OFF).	7-51
		Use braking resistors or regenerative braking units.	2-39

11

Maintenance and Inspection

This section describes the maintenance and periodical inspection items.

11-1 Inspection 11-4
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11-3-3 Inverter/Converter Unit Test 11-10
11-3-4 I/O Voltage/Current/Electric Power Measurement Method 11-12

WARNING

	Do not change wiring and the slide switch (SW1), install/remove the Digital Operator and optional devices, or replace the cooling fan while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.
	Do not remove the terminal cover during the power supply and 10 minutes after the power shut off. Doing so may result in a serious injury due to an electric shock.
	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.

Caution

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

Precautions for Safe Use

Maintenance and Inspection

- Be sure to confirm safety before conducting maintenance, inspection or parts replacement.
- The capacitor service life is influenced 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 as the product, you need to replace the capacitor.
- When disposing of LCD digital operators and wasted 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 www.dtsc.ca.gov/hazardouswaste/perchlorate

The 3G3AX-OP05 has the lithium primary battery (with more than 6 ppb of perchlorate). Label or mark the above display on the exterior of all outer shipping packages of your products when exporting your products which the 3G3AX-OP05 are installed to the State of California, USA.

- 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 Digital Operator cannot be recognized due to the service life, replace the LCD digital operator.

Precautions for Correct Use

Operation Stop Command

- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- When checking a signal during 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.

Maintenance and Parts Replacement

- 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. (Quoted from The Recommendation for Periodic Maintenance of a General-purpose Inverter published by JEMA.)
- 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.

11-1 Inspection

11-1-1 Daily Inspection

Check the following during operation.

- The motor operates according to the settings.
- There are no faults in the installation environment.
- There are no faults in the cooling system.
- There are no abnormal vibration and sound.
- There are no abnormal overheat and discoloration.
- There is no abnormal odor.

Check the input voltage of the inverter during operation by using a tester or other measuring equipment.
- There is no frequent power supply voltage fluctuation.
- The line voltage is balanced.

11-1-2 Periodic Inspection

Check the parts that must be checked with the operation stopped, as well as those that require periodic inspection:

- Check for faults in the cooling system: Clean air filter etc.
- Check for loose screws and retightening:
  The screws, bolts, and other tightened parts may become loose due to vibration, temperature change, or other influences. Check carefully and retighten if necessary.
- Check for corrosion or damage to conductors and insulators.
- Measure the insulation resistance.
- Check and replace the cooling fan, smoothing capacitor, and relay.

11-1-3 Inspection Items

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic				
				1 year	2 years			
General	Ambient environment	Check ambient temperature, humidity, and dust.	✓			Refer to *2-1 Installation* on page 2-4.	Ambient temperature: –10 to 50°C, no freezing Operating humidity: 90% max., no condensation	Thermometer, hygrometer, recorder
	Entire system	Check for abnormal vibration and sound.	✓			Perform visual and acoustic inspection.	No faults	
	Power supply voltage	Check main circuit voltage.	✓			Measure line voltage between Inverter main circuit terminals R/L1, S/L2, and T/L3.	Within allowable AC voltage fluctuation range	Tester, digital multimeter
Main circuit	General	Perform megger check (between main circuit terminals and ground terminal).		✓		Disconnect I/O wires from the inverter main circuit terminal block and remove the control terminal block PCB. Then, after removing the short-circuit bar for switching the inverter built-in filter function, measure using a megger the resistance between the ground terminal and the short-circuited terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, P/+2, +1, N/–, and RB.	5 MΩ min.	500-VDC class megger
		Check for loose bolts and screws.		✓		Retighten loose bolts and screws.	No faults	
		Check each part for traces of overheating.		✓		Perform visual inspection.	No faults	

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic: 1 year	Periodic: 2 years			
Main circuit	Conductor/ wire	Check for distorted conductor.		✓		Perform visual inspection.	No faults	
		Check for broken cable sheaths.		✓				
	Terminal block	Check for damage.		✓		Perform visual inspection.	No faults	
	Inverter unit/ Converter unit (including resistors)	Check resistance between terminals.			✓	Disconnect wires from the inverter main circuit terminal block and measure the resistance between the terminals R/L1, S/L2, T/L3 and the terminals P/+2, N/–, and between the terminals U/T1, V/T2, W/T3 and the terminals P/+2, N/– using a tester in the x1 Ω range.	Refer to *11-3-3 Inverter/Converter Unit Test* on page 11-10. Inverter unit replacement interval: 10^6 start-stop cycles*1	Analog tester

*1 The replacement interval (in years or cycles) shown here and the smoothing capacitor life curve provided in Appendix A-1 are based on the expected design life and not guaranteed data.

Note In case that you find any problems during inspection, contact your OMRON sales representative.

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic: 1 year	Periodic: 2 years			
Main circuit	Smoothing capacitor*1	Check that there is no liquid leakage.	✓			Perform visual inspection.	No faults Replacement interval: 10 years*3	Capacity meter
		Check safety valve for protrusion and swelling.	✓					
	Relay	Check for chattering sound during operation.		✓		Perform acoustic inspection.	No faults	
		Check for rough contact surface.		✓		Perform visual inspection.	No faults	

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic 1 year	Periodic 2 years			
Control circuit protection circuit	Operation check	Check output voltage balance between phases during isolated inverter run.		✓		Measure the line voltage between the inverter main circuit terminals U/T1, V/T2, and W/T3.	Phase-to-phase voltage balance 200-V class: 4 V max. 400-V class: 8 V max.	Digital multimeter, rectifier, voltmeter
		Check for defects in protection and display circuits through sequence protection function test.		✓		Simulate the output of the inverter protection circuit to be is shorted or open.	Fault protection functional in sequence	
Cooling system	Cooling fan	Check for abnormal vibration and sound.	✓			Rotate the fan manually with the power off.	Smooth rotation, no faults Replacement interval: 10 years*2 *3	
		Check for loose connections.		✓		Perform visual inspection.		
	Cooling fin	Check for clogging.		✓		Perform visual inspection.	No clogging	
Display	Indicator	Check for blown-out LEDs.	✓			Perform visual inspection.	Indicator lit	
		Clean display surface.		✓		Clean it with a waste cloth.		
	Meter	Check indicated value.	✓			Check the indicated values on panel meters.	Specified value, control value	Voltmeter, ammeter, etc.
Motor	General	Check for abnormal vibration and sound.	✓			Perform acoustic, sensory, and visual inspection.	No faults	
		Check for abnormal odor.	✓			No abnormal odor due to overheating, damage, etc.	No faults	
	Isolation resistance	Perform megger check (between motor terminal block and ground).			✓	Disconnect wires from the inverter main circuit terminals U/T1, V/T2, W/T3 and short-circuit the 3-phase motor wires. Then, using a megger, measure the resistance between each motor wire and the ground terminal.	5 MΩ min.	500-VDC megger

*1. The life of a smoothing capacitor depends on the ambient temperature. For the replacement guideline, refer to *A-1 Smoothing Capacitor Life Curve* on page A-2.

*2. The life of the cooling fan depends on environmental conditions, such as the ambient temperature and/or dust. Check its operation condition in daily inspections.

*3. The replacement interval (in years or cycles) shown here and the smoothing capacitor life curve provided in Appendix A-1 are based on the expected design life and not guaranteed data.

Note In case that you find any problems during inspection, contact your OMRON sales representative.

11-2 Cleaning

Always keep the inverter clean.

Lightly wipe the exterior surfaces of the inverter with a soft cloth moistened with a neutral detergent to remove dirt.

Do not use solutions such as acetone, benzene, toluene, or alcohol for cleaning. Doing so may cause the inverter surfaces to dissolve or its coating to come off.

In particular, do not use any detergent or alcohol to clean the Digital Operator display.

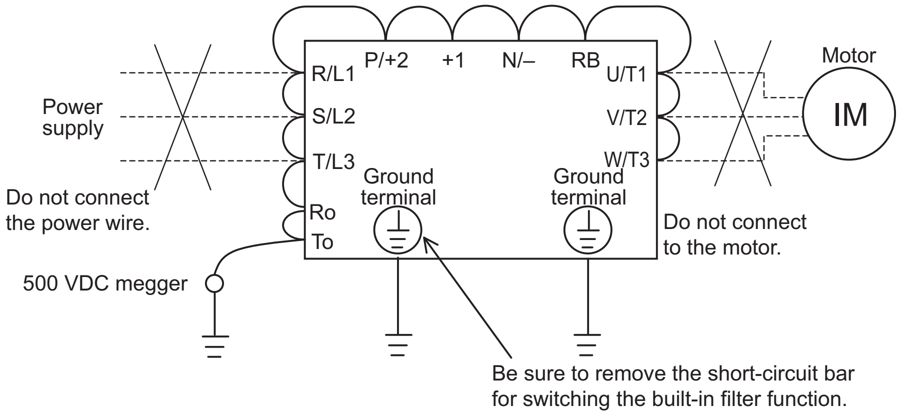
11-3 Test Methods

11-3-1 Megger Test

- Before performing a megger test on external circuits, be sure to disconnect wires from all inverter terminals to prevent the test voltage from being applied to the inverter.
- Use a 500 VDC megger for a megger test.
- For a megger test on the inverter main circuit, remove the short-circuit bar for switching the inverter built-in filter function and then short-circuit the terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, P/+2, +1, N/–, RB, Ro, and To with wires, as shown below.
  After a megger test, remove the short-circuit wires from each terminal and reconnect the short-circuit bar for switching the inverter built-in filter function.
  Note that the terminal RB is provided only for the inverters with a 22 kW or lower capacity.

Precautions for Correct Use

- Use a tester (in a high resistance range) for a power-on test on the control circuit. Do not use a megger or buzzer.
- For the inverter, do not perform a megger test on the control circuit. Perform it only on the main circuit.
- Be sure to remove the short-circuit bar for switching the built-in filter function.



11-3-2 Withstand Voltage Test

Do not conduct a withstand voltage test on any part of the inverter.

Doing this test is dangerous because it may cause damage to or deterioration of the parts inside the inverter.

11-3-3 Inverter/Converter Unit Test

Use the following procedure to check conditions of the inverter and converter units by using a tester.

Preparation

1. **Disconnect the externally connected power supply wires (R/L1, S/L2, T/L3), the motor connection wires (U/T1, V/T2, W/T3), and the regenerative braking resistance (P/+2, RB).**
2. **Have a tester ready. Use the 1 Ω resistance measurement range.**

Test Method

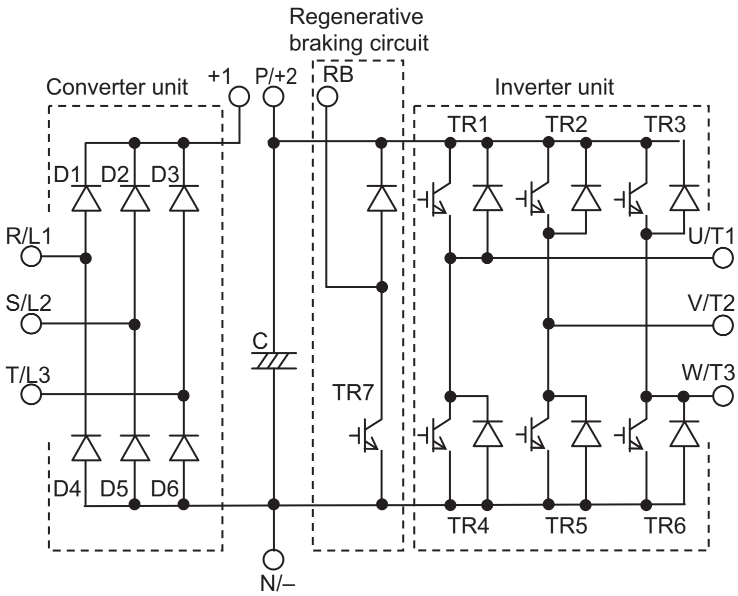
Measure the resistance at the inverter main circuit terminals block R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, RB, P/+2, and N/– by alternating the polarity of the tester to judge the electrical continuity.

Precautions for Correct Use

- Before starting the test, measure the voltage between P/+2 and N/– in the DC voltage range to check that the smoothing capacitor is sufficiently discharged.
- The tester will show nearly infinite resistance if an element has no continuity.
  However, it may not show infinite resistance if a momentary continuity is detected due to the influence of the smoothing capacitor.
  With continuity, an element will show a resistance from a few ohms to several tens of ohms.
  The inverter or converter unit is in good condition if the measured value for each item in the following table is nearly equal, although it does not match exactly because of the element type, tester type, and so on.
- The regenerative braking circuit is provided for Inverters with a capacity of 22 kW or lower.

In case that you find any problems during inspection, contact your OMRON sales representative.

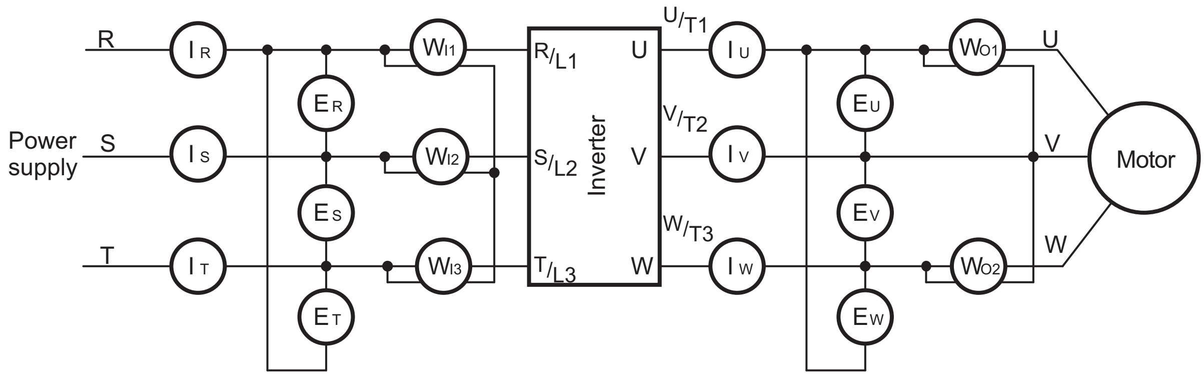
● Converter unit



Measurement point		Tester polarity		Measurement result
		+ (Red)	– (Black)	
Converter unit	D1	R/L1	+1	No continuity
		+1	R/L1	Continuity
	D2	S/L2	+1	No continuity
		+1	S/L2	Continuity
	D3	T/L3	+1	No continuity
		+1	T/L3	Continuity
	D4	R/L1	N/–	Continuity
		N/–	R/L1	No continuity
	D5	S/L2	N/–	Continuity
		N/–	S/L2	No continuity
	D6	T/L3	N/–	Continuity
		N/–	T/L3	No continuity
Inverter unit	TR1	U/T1	P/+2	No continuity
		P/+2	U/T1	Continuity
	TR2	V/T2	P/+2	No continuity
		P/+2	V/T2	Continuity
	TR3	W/T3	P/+2	No continuity
		P/+2	W/T3	Continuity
	TR4	U/T1	N/–	Continuity
		N/–	U/T1	No continuity
	TR5	V/T2	N/–	Continuity
		N/–	V/T2	No continuity
	TR6	W/T3	N/–	Continuity
		N/–	W/T3	No continuity
Regenerative braking unit	TR7	RB	P/+2	No continuity
		P/+2	RB	Continuity
		RB	N/–	No continuity
		N/–	RB	No continuity

11-3-4 I/O Voltage/Current/Electric Power Measurement Method

Measuring instruments commonly used for input/output voltage, current, or electric power measurement are shown below.



Measurement item	Measurement point	Measuring instrument	Remarks	Measurement value reference
Power supply voltage E_{IN}	Between R/L1 and S/L2 (E_R) Between S/L2 and T/L3 (E_R) Between T/L3 and R/L1 (E_R)	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 480 V, 50/60 Hz
Power supply current I_{IN}	Current in R/L1, S/L2 T/L3: (I_R), (I_S), (I_T)	Moving iron ammeter	All effective values	When input current is not balanced: $I_{IN} = (I_R + I_S + I_T) / 3$
Input electric power W_{IN}	Between R/L1 and S/L2 (W_{I1}) Between S/L2 and T/L3 (W_{I2}) Between T/L3 and R/L1 (W_{I3})	Electrodynamic wattmeter	All effective values	Three-wattmeter method (W_{I1}) + (W_{I2}) + (W_{I3})
Input power factor Pf_{IN}	Calculate this from the measured values of power supply voltage E_{IN}, power supply current I_{IN}, and input electric power W_{IN}. $Pf_{IN} = \frac{W_{IN}}{\sqrt{3} \cdot E_{IN} \cdot I_{IN}} \times 100$ [%]			–
Output voltage E_{OUT}	Between U/T1 and V/T2 (E_U) Between V/T2 and W/T3 (E_V) Between W/T3 and U/T1 (E_W)	Refer to the figure on the next page. or rectifier type voltmeter	Effective value of fundamental wave	–

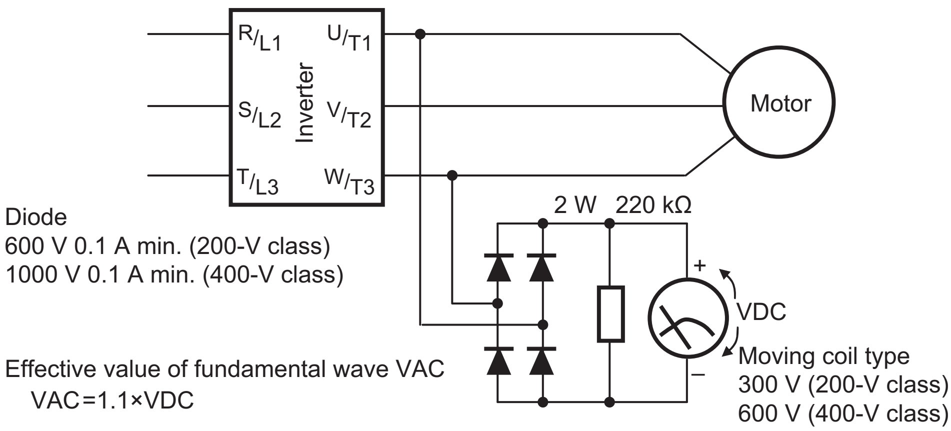
Measurement item	Measurement point	Measuring instrument	Remarks	Measurement value reference
Output current I_{OUT}	Current in U/T1, V/T2, W/T3 (I_U), (I_V), (I_W)	Moving iron ammeter	All effective values	–
Output power W_{OUT}	Between U/T1 and V/T2 (W_{O1}) Between V/T2 and W/T3 (W_{O2})	Electrodynamic wattmeter	All effective values	Two-wattmeter method (or three-wattmeter method) (W_{O1}) + (W_{O2})
Output power factor Pf_{OUT}	Calculate this from the measured values of output voltage E_{OUT}, output current I_{OUT}, and output electric power W_{OUT}. $Pf_{OUT} = \frac{W_{OUT}}{\sqrt{3} \cdot E_{OUT} \cdot I_{OUT}} \times 100$ [%]			–

Note 1 For the output voltage, use a measuring instrument that shows effective values of fundamental wave. For the current and the electric power, use a measuring instrument that shows all effective values.

2 The output waveform of the inverter has a margin of error, especially at low frequencies, because it was generated under PWM control. Note that many general-purpose testers may not be usable due to noise.

3 In case that you find any problems during inspection, contact your OMRON sales representative.

<Output Voltage Measurement Method>



12

Options

This section describes the specifications and external dimension of peripheral equipment.

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12-1 Overview of Optional Equipment

This section provides an overview of the optional equipment available with the 3G3RX-V1 Series Inverter. For details, refer to the manual for each optional product.

12-1-1 Part Names and Descriptions

Regenerative Braking Unit (Model: 3G3AX-RBU□□)/ Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

These products absorb the regenerative energy generated when a load decelerates or an elevating axis descends to prevent overvoltage trip of the inverter.

For details, refer to *External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)* on page 2-39.

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 2-20 and *Harmonic Current Measures and DC/AC Reactor Wiring (+1, P/2)* on page 2-34.

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 2-33.

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 2-37.

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 2-38.

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 *2-3-10 Conformance to EC Directives* on page 2-58.

Digital Operator (Model: 3G3AX-OP01/OP05)/ Digital Operator Cable (Model: 3G3AX-OPCN☐)

In addition to the Digital Operator as standard equipment, the following Digital Operator products are also available.

● Digital Operator (Model: 3G3AX-OP01)

This LED Digital Operator has a volume adjuster for frequency reference adjustment.

● LCD Digital Operator (Model: 3G3AX-OP05)

This Digital Operator can display English characters on its LCD screen. It has a built-in memory device that can store up to four sets of inverter parameter setting data, and can read and write all the inverter parameters.
For details on the 3G3AX-OP05, refer to “LCD Digital Operator 3GAX-OP05 User’s Manual (I579)”.

PG Board (Model: 3G3AX-PG01)

This option board is mounted on the inverter and inputs the signals from the encoder connected to the motor.

This board is indispensable in order to use sensor vector control.

In addition, it is separately implemented with a pulse-train input capability, which enables frequency reference input via pulse train input or position command input under pulse train position control.

For details, refer to “Encorder Feedback Board 3G3AX-PG User’s Manual (I564)”.

EtherCAT Communications Unit (Model: 3G3AX-RX-ECT)

This optional unit can control the inverter via EtherCAT communications.

For details, refer to “MX2/RX Series EtherCAT Communication Unit User's Manual (I574)”.

CompoNet Communications Unit (Model: 3G3AX-RX-CRT-E)

This optional unit can control the inverter via CompoNet communications.

For details, refer to “MX2/RX Series CompoNet Communications Unit User’s Manual (I582)”.

DeviceNet Communications Unit (Model: 3G3AX-RX-DRT-E)

This optional unit can control the inverter via DeviceNet communications.

For details, refer to “MX2/RX Series DeviceNet Communications Unit User’s Manual (I581)”.

12-2 Regenerative Braking Unit (Model: 3G3AX-RBU□□)

12-2-1 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)		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		5 units		
Built-in resistor	Internal resistance	120 W, 180 Ω	120 W, 20 Ω	120 W, 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 approx. 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/s^2 (0.6 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 (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)

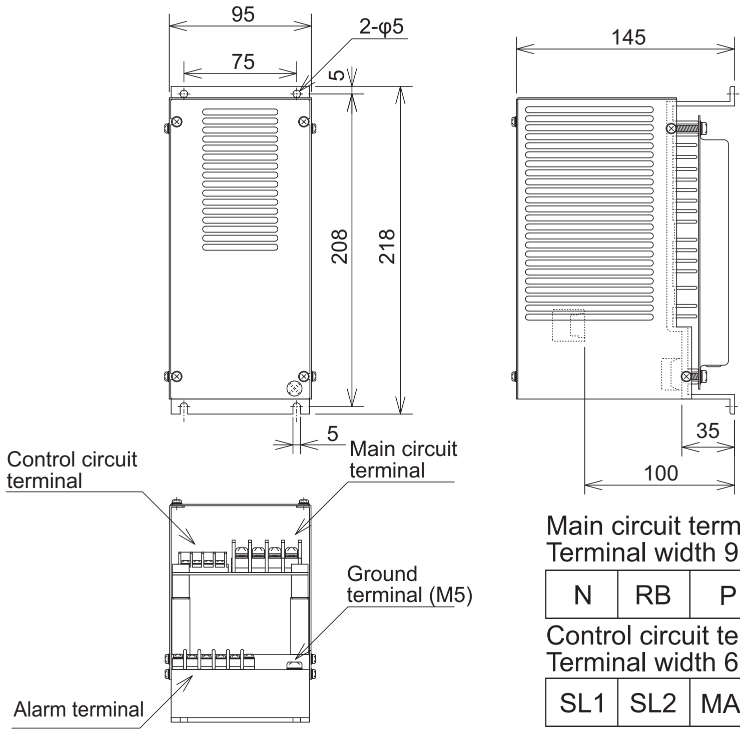
Applicable voltage class		3-phase 200-V class		3-phase 400-V class	
Model		3G3AX-RBU23	3G3AX-RBU24	3G3AX-RBU42*1	3G3AX-RBU43*1
Connection resistance	Continuous operation	6 Ω min.	4 Ω min.	24 Ω min.	12 Ω min.
	Short-time operation/ Allowable operation cycle/ Allowable continuous ON time	4 Ω min. Cycle 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 3A (R load) 36 VDC 2A (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.

12-2-2 External Dimensions

3G3AX-RBU21/RBU22/RBU41



Main circuit terminal
Terminal width 9, M4 screw

N	RB	P	P

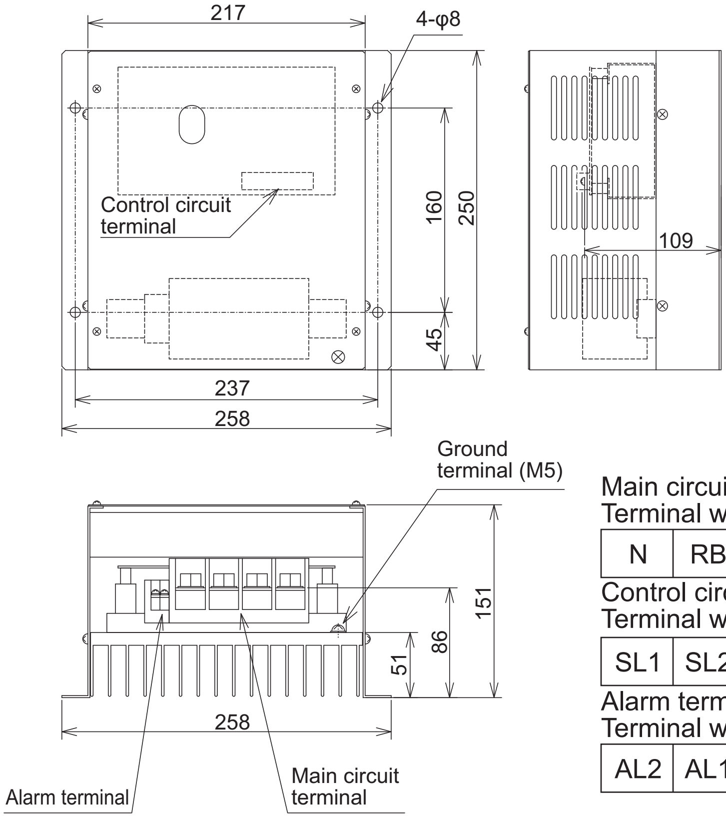
Control circuit terminal
Terminal width 6, M3 screw

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

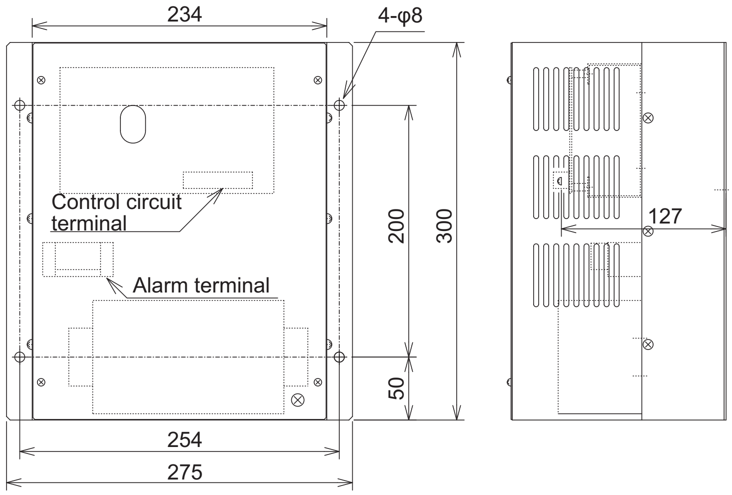
Control circuit terminal
Terminal width 6.4, M3 screw

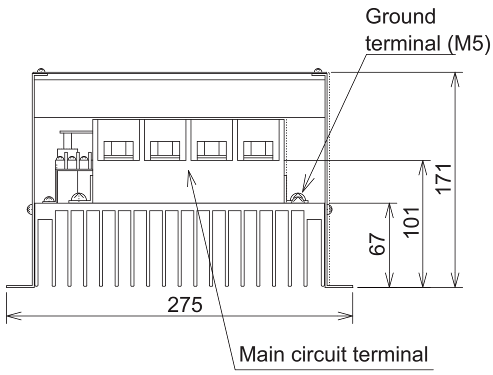
SL1	SL2	MA1	MA2

Alarm terminal
Terminal width 5.9, M3 screw

AL2	AL1

3G3AX-RBU24





Main circuit terminal
Terminal width 33, M10 screw

N	RB	P	P

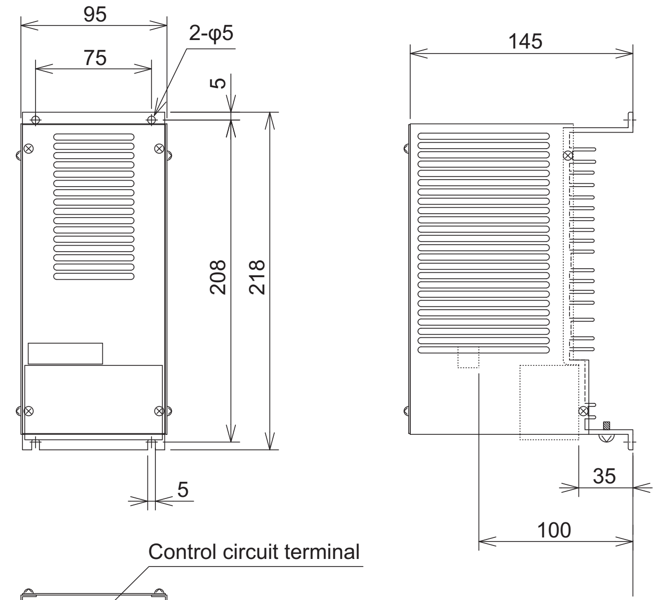
Control circuit terminal
Terminal width 6.4, M3 screw

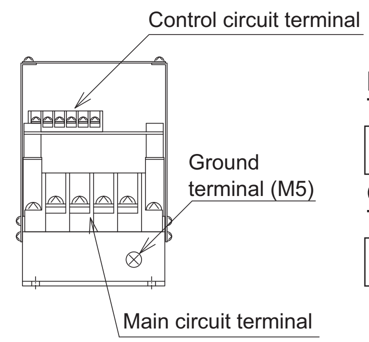
SL1	SL2	MA1	MA2

Alarm terminal
Terminal width 7.5, M3 screw

AL2	AL1

3G3AX-RBU42





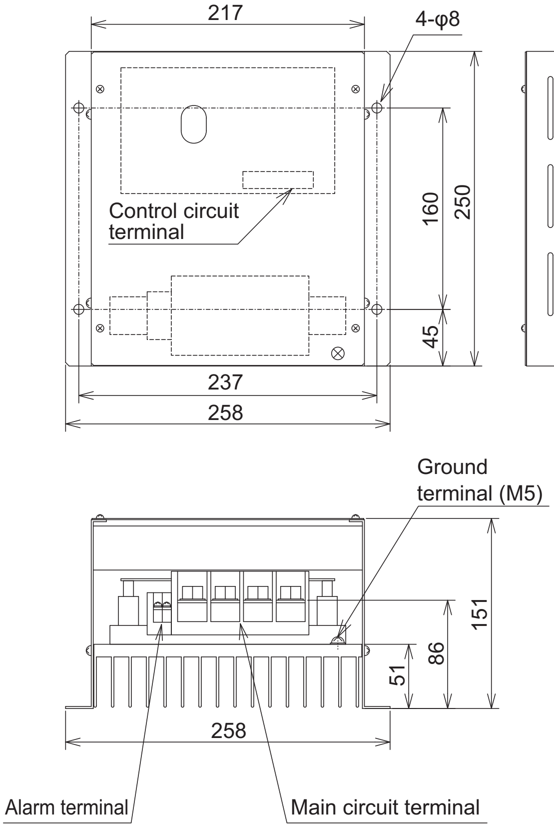
Main circuit terminal
Terminal width 13, M5 screw

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

12-2-3 Connection Examples

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)* on page 2-39 in this manual.

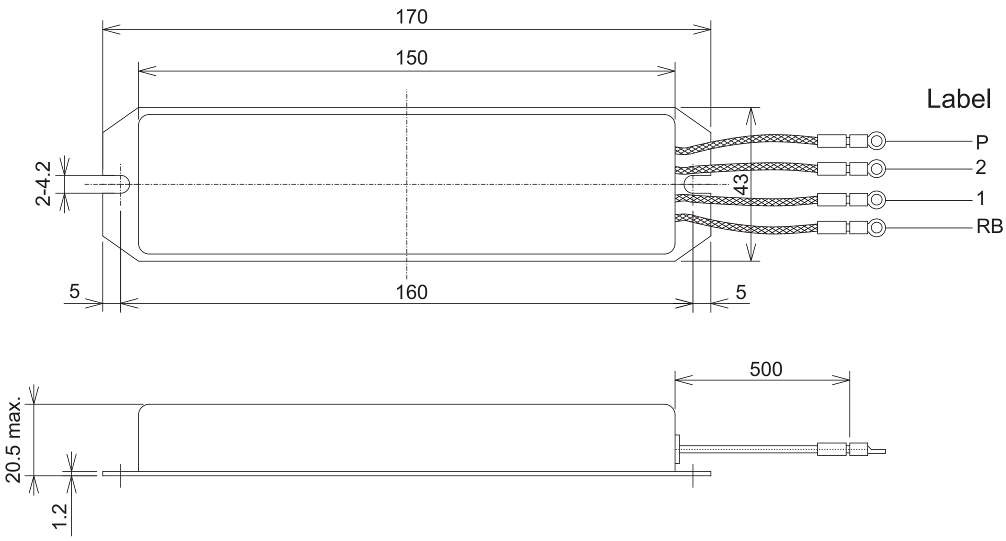
12-3 Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

12-3-1 Specifications

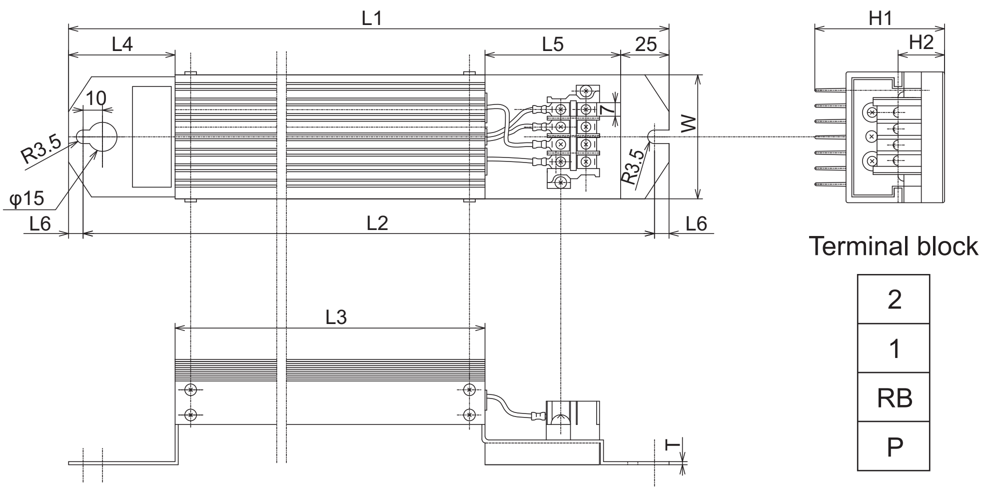
<table>
<tr><th colspan="2" rowspan="2">Model</th><th colspan="4">Compact type
(Model: 3G3AX-RBA□□□□)</th><th colspan="4">Standard type
(Model: 3G3AX-RBB□□□□)</th><th colspan="3">Medium capacity type
(Model: 3G3AX-RBC□□□□)</th></tr>
<tr><th>1201</th><th>1202</th><th>1203</th><th>1204</th><th>2001</th><th>2002</th><th>3001</th><th>4001</th><th>4001</th><th>6001</th><th>12001</th></tr>
<tr><td rowspan="2">Resistance</td><td>Capacity</td><td colspan="4">120 W</td><td colspan="2">200 W</td><td>300 W</td><td>400 W</td><td>400 W</td><td>600 W</td><td>1200 W</td></tr>
<tr><td>Resistance [Ω]</td><td>180</td><td>100</td><td>50</td><td>35</td><td>180</td><td>100</td><td>50</td><td>35</td><td>50</td><td>35</td><td>17</td></tr>
<tr><td colspan="2">Allowable braking frequency [%]</td><td>5</td><td>2.5</td><td>1.5</td><td>1.0</td><td>10</td><td>7.5</td><td>7.5</td><td>7.5</td><td colspan="3">10</td></tr>
<tr><td colspan="2">Allowable continuous braking time [s]</td><td>20</td><td>12</td><td>5</td><td>3</td><td colspan="3">30</td><td>20</td><td colspan="3">10</td></tr>
<tr><td colspan="2">Weight [kg]</td><td colspan="4">0.27</td><td colspan="2">0.97</td><td>1.68</td><td>2.85</td><td>2.5</td><td>3.6</td><td>6.5</td></tr>
<tr><td colspan="2">Error detection function</td><td colspan="8">Built-in thermal (Contact capacity: 240 VAC 2A max., minimum current: 5 mA)
Normally ON (NC contact)
Built-in thermal fuse (No resetting)</td><td colspan="3">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)</td></tr>
<tr><td rowspan="6">General specifications</td><td>Operating ambient temperature</td><td colspan="11">–10 to 50°C</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="11">–20 to 65°C</td></tr>
<tr><td>Operating ambient humidity</td><td colspan="11">20% to 90% (with no condensation)</td></tr>
<tr><td>Vibration resistance</td><td colspan="11">5.9 m/s^2 (0.6 G) 10 to 55 Hz</td></tr>
<tr><td>Location</td><td colspan="11">At a maximum altitude of 1,000 m (without corrosive gases or dust)</td></tr>
<tr><td>Cooling method</td><td colspan="11">Self-cooling</td></tr>
</table>

12-3-2 External Dimensions

3G3AX-RBA□□□□

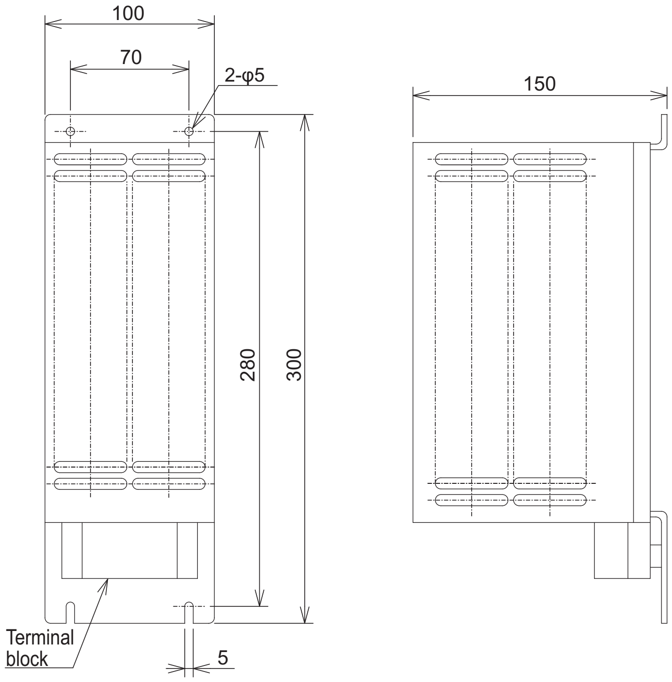


3G3AX-RBB□□□□



Model	Rated capacity [W]	Resistance [Ω]	Dimensions [mm]										Weight [kg]	Terminal screw
			L1	L2	L3	L4	L5	L6	H1	H2	W	T		
3G3AX-RBB2001	200	180	310	295	160	55	70	7.5	67	12	64	1.6	0.97	M3.5
3G3AX-RBB2002	200	100	310	295	160	55	70	7.5	67	12	64	1.6	0.97	
3G3AX-RBB3001	300	50	470	455	320	55	70	7.5	67	12	64	1.6	1.68	
3G3AX-RBB4001	400	35	435	422	300	50	60	6.5	94	15	76	2	2.85	

3G3AX-RBC4001

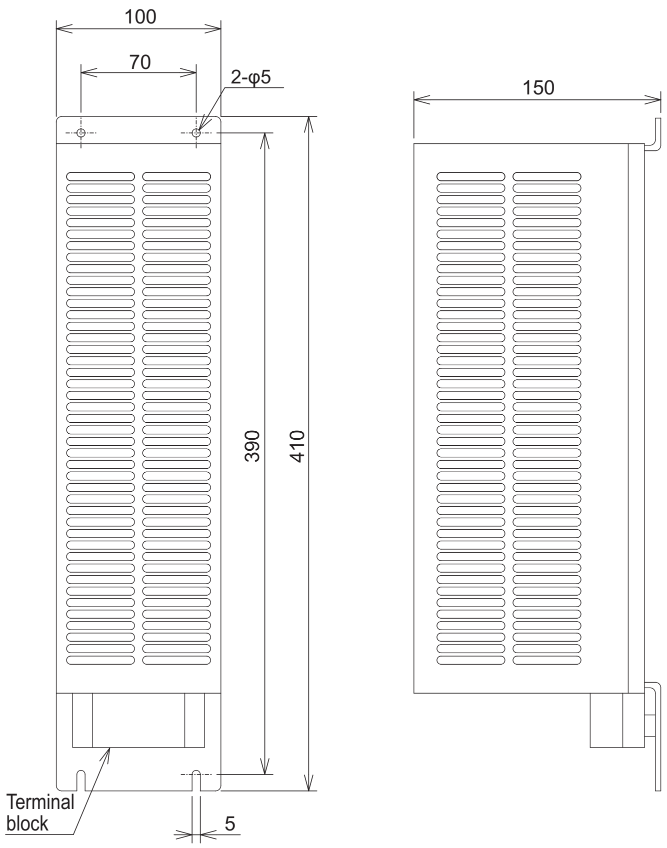


Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

3G3AX-RBC6001

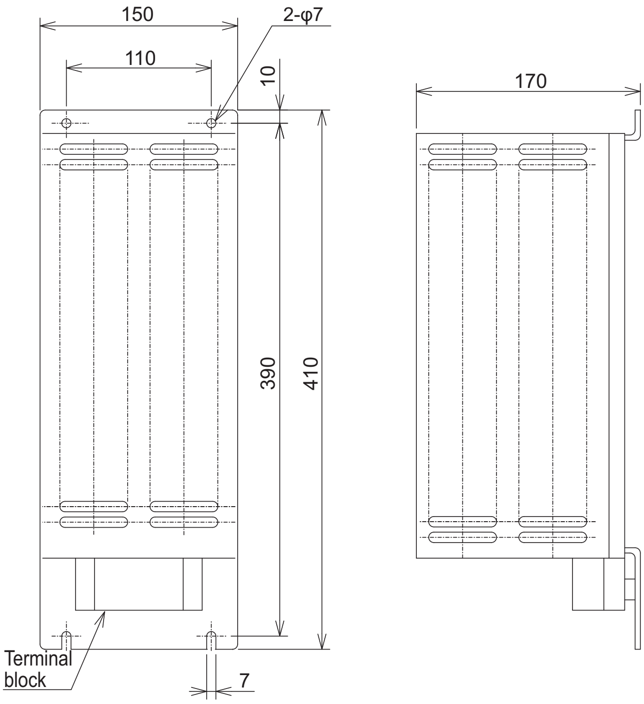


Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

3G3AX-RBC12001



Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

12-3-3 Connection Example

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)* on page 2-39 in this manual.

12-4 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 *Braking Resistor Selection* on page A-8.

- Inverter:
  Select the model of your inverter.
  However, the table below assumes that your inverter is used in the heavy load mode and connected to a single motor with the same capacity.
  Therefore, in the light load mode, a motor with the same capacity means a motor that is one size larger in capacity than the inverter and the converted braking torque decreases accordingly.
- 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.
- 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 below.
- 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).

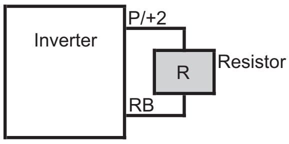
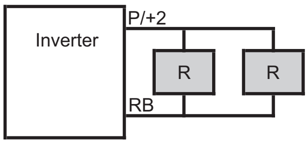
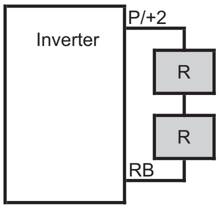
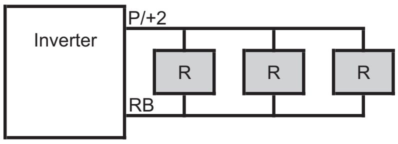
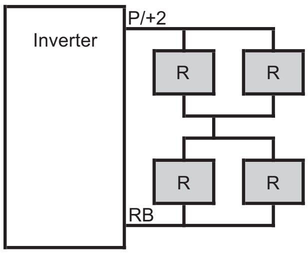
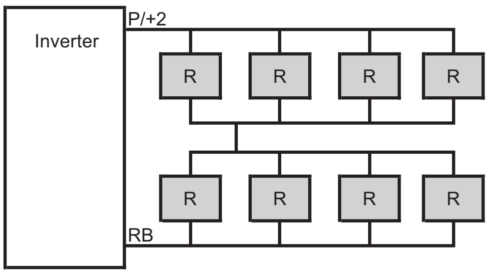
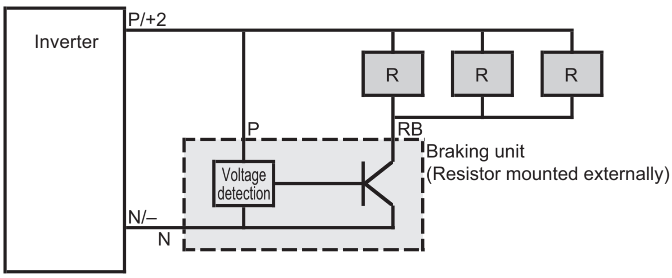
Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
200-V class	0.4	3G3RX-A2004-V1	3%	220%	Built into unit	–	3G3AX-RBA1201	1	1	20	50
			10.0%	220%		–	3G3AX-RBB2001	1	1	30	50
	0.75	3G3RX-A2007-V1	3.0%	120%	Built into unit	–	3G3AX-RBA1201	1	1	20	50
			10.0%	120%		–	3G3AX-RBB2001	1	1	30	50
	1.5	3G3RX-A2015-V1	2.5%	110%	Built into unit	–	3G3AX-RBA1202	1	1	12	35
			10.0%	215%		–	3G3AX-RBC4001	1	1	10	35
	2.2	3G3RX-A2022-V1	3.0%	150%	Built into unit	–	3G3AX-RBB3001	1	1	30	35
			10.0%	150%		–	3G3AX-RBC4001	1	1	10	35

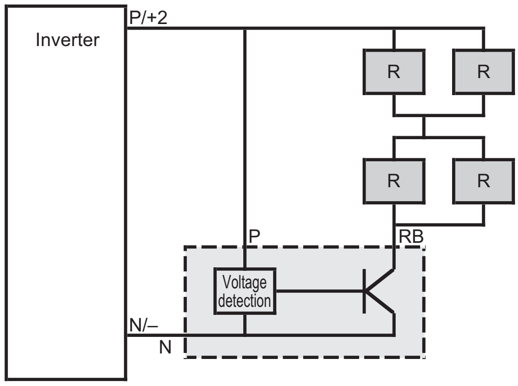
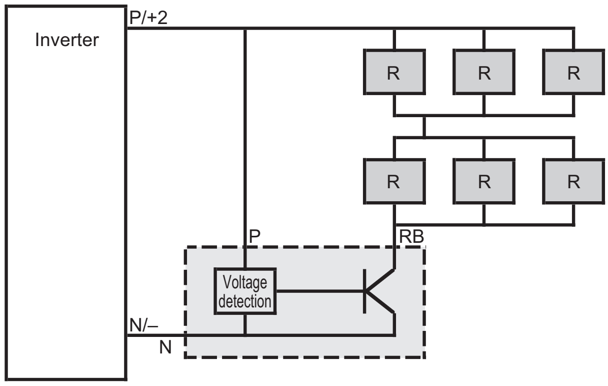
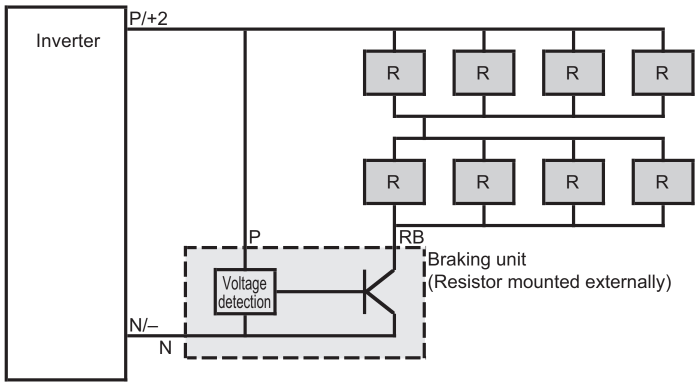
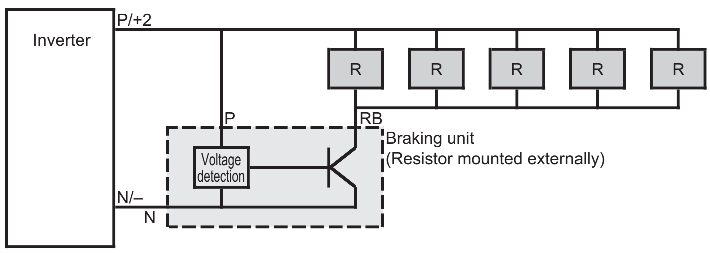
Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
200-V class	3.7	3G3RX-A2037-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	1	1	20	35
			10.0%	125%		–	3G3AX-RBC6001	1	1	10	35
	5.5	3G3RX-A2055-V1	3%	120%	Built into unit	–	3G3AX-RBB3001	2	2	30	16
			10.0%	120%		–	3G3AX-RBC4001	2	2	10	16
	7.5	3G3RX-A2075-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	2	2	20	10
			10.0%	125%		–	3G3AX-RBC6001	2	2	10	10
	11	3G3RX-A2110-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	3	4	20	10
			10.0%	125%		–	3G3AX-RBC6001	3	4	10	10
	15	3G3RX-A2150-V1	3.0%	130%	Built into unit	–	3G3AX-RBC12001	2	2	10	7.5
			10.0%	130%		–	3G3AX-RBC12001	2	2	10	7.5
	18.5	3G3RX-A2185-V1	3.0%	105%	Built into unit	–	3G3AX-RBC12001	2	2	10	7.5
			10.0%	105%		–	3G3AX-RBC12001	2	2	10	7.5
	22	3G3RX-A2220-V1	3.0%	130%	Built into unit	–	3G3AX-RBC12001	3	4	10	5
			10.0%	130%		–	3G3AX-RBC12001	3	4	10	5
	30	3G3RX-A2300-V1	3.0%	160%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
			10.0%	160%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
	37	3G3RX-A2370-V1	3.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
			10.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
	45	3G3RX-A2450-V1	3.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	6	12	10	2
			10.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	6	12	10	2
	55	3G3RX-A2550-V1	3.0%	120%	3G3AX-RBU24	1	3G3AX-RBC12001	7	13	10	2
			10.0%	120%	3G3AX-RBU24	1	3G3AX-RBC12001	7	13	10	2

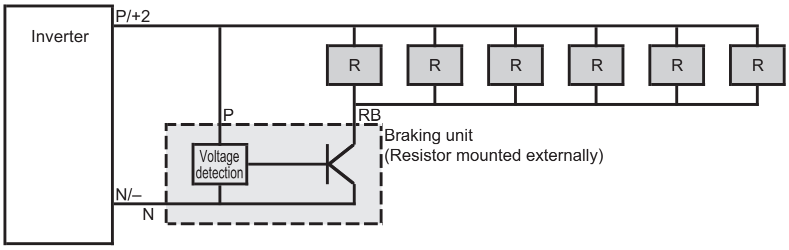
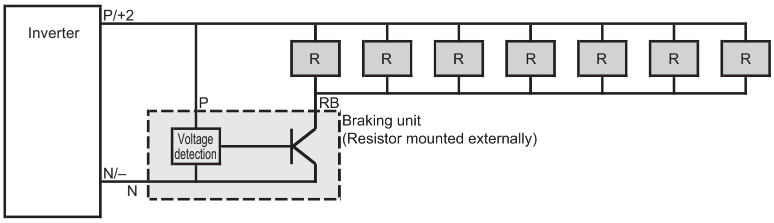
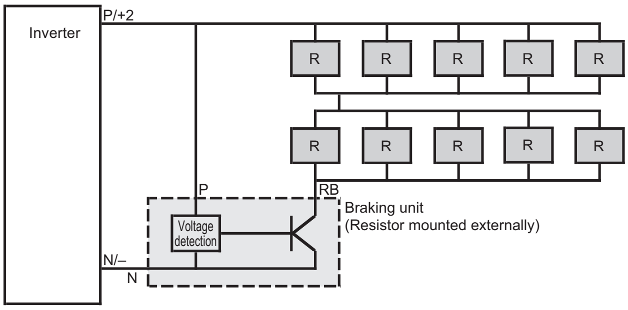
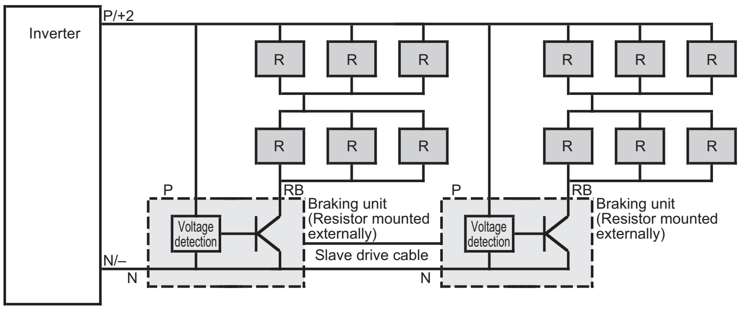
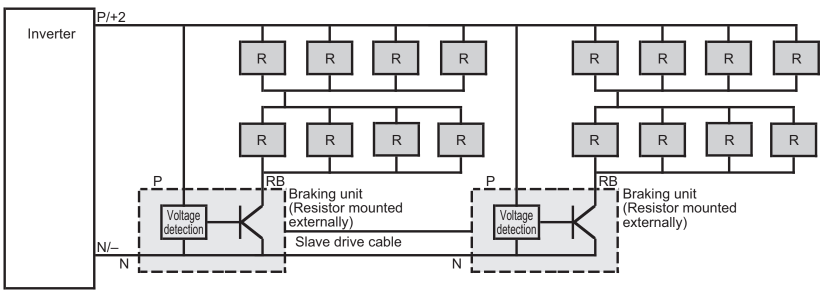
Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
400-V class	0.4	3G3RX-A4004-V1	3.0%	220%	Built into unit	–	3G3AX-RBA1201	2	3	20	100
			10.0%	220%		–	3G3AX-RBB2001	2	3	30	100
	0.75	3G3RX-A4007-V1	3.0%	220%	Built into unit	–	3G3AX-RBA1201	2	3	20	100
			10.0%	220%		–	3G3AX-RBB2001	2	3	30	100
	1.5	3G3RX-A4015-V1	3.0%	120%	Built into unit	–	3G3AX-RBA1201	2	3	20	100
			10.0%	120%		–	3G3AX-RBB2001	2	3	30	100
	2.2	3G3RX-A4022-V1	2.5%	150%	Built into unit	–	3G3AX-RBA1202	2	3	12	100
			10.0%	220%		–	3G3AX-RBC4001	2	3	10	100
	3.7	3G3RX-A4037-V1	3.0%	175%	Built into unit	–	3G3AX-RBB3001	2	3	30	70
			10.0%	175%		–	3G3AX-RBC4001	2	3	10	70
	5.5	3G3RX-A4055-V1	3.0%	120%	Built into unit	–	3G3AX-RBB3001	2	3	30	70
			10.0%	120%		–	3G3AX-RBC4001	2	3	10	70
	7.5	3G3RX-A4075-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	2	3	20	35
			10.0%	125%		–	3G3AX-RBC6001	2	3	10	35
	11	3G3RX-A4110-V1	3.0%	120%	Built into unit	–	3G3AX-RBB3001	4	5	30	35
			10.0%	120%		–	3G3AX-RBC4001	4	5	10	35
	15	3G3RX-A4150-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	4	5	20	24
			10.0%	125%		–	3G3AX-RBC6001	4	5	10	24
	18.5	3G3RX-A4185-V1	3.0%	140%	Built into unit	–	3G3AX-RBB3001	8	6	30	24
			10.0%	140%		–	3G3AX-RBC4001	8	6	10	24
	22	3G3RX-A4220-V1	3.0%	120%	Built into unit	–	3G3AX-RBB3001	8	6	30	20
			10.0%	120%		–	3G3AX-RBC4001	8	6	10	20
	30	3G3RX-A4300-V1	3.0%	130%	3G3AX-RBU42	1	3G3AX-RBC12001	4	8	10	10
			10.0%	130%	3G3AX-RBU42	1	3G3AX-RBC12001	4	8	10	10
	37	3G3RX-A4370-V1	3.0%	155%	3G3AX-RBU43	1	3G3AX-RBC12001	6	9	10	6
			10.0%	155%	3G3AX-RBU43	1	3G3AX-RBC12001	6	9	10	6

Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
400-V class	45	3G3RX-A4450-V1	3.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	6	9	10	6
			10.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	6	9	10	6
	55	3G3RX-A4550-V1	3.0%	140%	3G3AX-RBU43	1	3G3AX-RBC12001	8	10	10	6
			10.0%	140%	3G3AX-RBU43	1	3G3AX-RBC12001	8	10	10	6
	75	3G3RX-A4750-V1	3.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
			10.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
	90	3G3RX-A4900-V1	3.0%	105%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
			10.0%	105%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
	110	3G3RX-A411K-V1	3.0%	105%	3G3AX-RBU43	2	3G3AX-RBC12001	12	15	10	6
			10.0%	105%	3G3AX-RBU43	2	3G3AX-RBC12001	12	15	10	6
	132	3G3RX-A413K-V1	3.0%	115%	3G3AX-RBU43	2	3G3AX-RBC12001	16	16	10	6
			10.0%	115%	3G3AX-RBU43	2	3G3AX-RBC12001	16	16	10	6

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	

12-5 DC Reactor (Model: 3G3AX-DL□□□□)

12-5-1 Specifications

Inverter						DC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
200-V class	0.4	3G3RX-A2004-V1	Heavy load	0.4	3.3	3G3AX-DL2004	10.7	8	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.75	3.9	3G3AX-DL2007	6.75	15		
	0.75	3G3RX-A2007-V1	Heavy load	0.75	5.5					
			Light load	1.5	7.2	3G3AX-DL2015	3.51	25		
	1.5	3G3RX-A2015-V1	Heavy load	1.5	8.3					
			Light load	2.2	10.8	3G3AX-DL2022	2.51	35		
	2.2	3G3RX-A2022-V1	Heavy load	2.2	12					
			Light load	3.7	13.9	3G3AX-DL2037	1.60	45		
	3.7	3G3RX-A2037-V1	Heavy load	3.7	18					
			Light load	5.5	23	3G3AX-DL2055	1.11	55		
	5.5	3G3RX-A2055-V1	Heavy load	5.5	26					
			Light load	7.5	37	3G3AX-DL2075	0.84	95		
	7.5	3G3RX-A2075-V1	Heavy load	7.5	35					
			Light load	11	48	3G3AX-DL2110	0.59	80		
	11	3G3RX-A2110-V1	Heavy load	11	51					
			Light load	15	64	3G3AX-DL2150	0.44	135		
	15	3G3RX-A2150-V1	Heavy load	15	70					
			Light load	18.5	80	3G3AX-DL2220	0.30	200		
	18.5	3G3RX-A2185-V1	Heavy load	18.5	84					
			Light load	22	94					
	22	3G3RX-A2220-V1	Heavy load	22	105					
			Light load	30	120	3G3AX-DL2300	0.23	220		
	30	3G3RX-A2300-V1	Heavy load	30	133					
			Light load	37	150	3G3AX-DL2370	0.19	275		
	37	3G3RX-A2370-V1	Heavy load	37	160					
			Light load	45	186	3G3AX-DL2450	0.16	335		
	45	3G3RX-A2450-V1	Heavy load	45	200					
			Light load	55	240	3G3AX-DL2550	0.13	360		
	55	3G3RX-A2550-V1	Heavy load	55	242					
			Light load	75	280	–	–	–	–	–

<table>
<tr><th colspan="6">Inverter</th><th colspan="5">DC reactor specifications</th></tr>
<tr><th>Voltage class</th><th>Max. applicable motor capacity [kW]</th><th>Model</th><th>Heavy/ Light load mode</th><th>Max. applicable motor capacity [kW]</th><th>Rated input current [A]</th><th>Model</th><th>Inductance [mH]</th><th>Heat generation [W]</th><th>Operating ambient temperature/ humidity</th><th>Location</th></tr>
<tr><td rowspan="30">400-V class</td><td rowspan="2">0.4</td><td rowspan="2">3G3RX-A4004-V1</td><td>Heavy load</td><td>0.4</td><td>1.8</td><td>3G3AX-DL4004</td><td>43.0</td><td>8</td><td rowspan="29">–10 to 50°C
20% to 90%</td><td rowspan="29">At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)</td></tr>
<tr><td>Light load</td><td>0.75</td><td>2.1</td><td rowspan="2">3G3AX-DL4007</td><td rowspan="2">27.0</td><td rowspan="2">15</td></tr>
<tr><td rowspan="2">0.75</td><td rowspan="2">3G3RX-A4007-V1</td><td>Heavy load</td><td>0.75</td><td>2.8</td></tr>
<tr><td>Light load</td><td>1.5</td><td>4.3</td><td rowspan="2">3G3AX-DL4015</td><td rowspan="2">14.0</td><td rowspan="2">25</td></tr>
<tr><td rowspan="2">1.5</td><td rowspan="2">3G3RX-A4015-V1</td><td>Heavy load</td><td>1.5</td><td>4.2</td></tr>
<tr><td>Light load</td><td>2.2</td><td>5.9</td><td rowspan="2">3G3AX-DL4022</td><td rowspan="2">10.1</td><td rowspan="2">35</td></tr>
<tr><td rowspan="2">2.2</td><td rowspan="2">3G3RX-A4022-V1</td><td>Heavy load</td><td>2.2</td><td>5.8</td></tr>
<tr><td>Light load</td><td>3.7</td><td>8.1</td><td rowspan="2">3G3AX-DL4037</td><td rowspan="2">6.4</td><td rowspan="2">45</td></tr>
<tr><td rowspan="2">3.7</td><td rowspan="2">3G3RX-A4037-V1</td><td>Heavy load</td><td>3.7</td><td>9.8</td></tr>
<tr><td>Light load</td><td>5.5</td><td>13.3</td><td rowspan="2">3G3AX-DL4055</td><td rowspan="2">4.41</td><td rowspan="2">55</td></tr>
<tr><td rowspan="2">5.5</td><td rowspan="2">3G3RX-A4055-V1</td><td>Heavy load</td><td>5.5</td><td>15</td></tr>
<tr><td>Light load</td><td>7.5</td><td>20</td><td rowspan="2">3G3AX-DL4075</td><td rowspan="2">3.35</td><td rowspan="2">95</td></tr>
<tr><td rowspan="2">7.5</td><td rowspan="2">3G3RX-A4075-V1</td><td>Heavy load</td><td>7.5</td><td>21</td></tr>
<tr><td>Light load</td><td>11</td><td>24</td><td rowspan="2">3G3AX-DL4110</td><td rowspan="2">2.33</td><td rowspan="2">80</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">3G3RX-A4110-V1</td><td>Heavy load</td><td>11</td><td>28</td></tr>
<tr><td>Light load</td><td>15</td><td>32</td><td rowspan="2">3G3AX-DL4150</td><td rowspan="2">1.75</td><td rowspan="2">135</td></tr>
<tr><td rowspan="2">15</td><td rowspan="2">3G3RX-A4150-V1</td><td>Heavy load</td><td>15</td><td>35</td></tr>
<tr><td>Light load</td><td>18.5</td><td>41</td><td rowspan="4">3G3AX-DL4220</td><td rowspan="4">1.20</td><td rowspan="4">200</td></tr>
<tr><td rowspan="2">18.5</td><td rowspan="2">3G3RX-A4185-V1</td><td>Heavy load</td><td>18.5</td><td>42</td></tr>
<tr><td>Light load</td><td>22</td><td>47</td></tr>
<tr><td rowspan="2">22</td><td rowspan="2">3G3RX-A4220-V1</td><td>Heavy load</td><td>22</td><td>53</td></tr>
<tr><td>Light load</td><td>30</td><td>63</td><td rowspan="2">3G3AX-DL4300</td><td rowspan="2">0.92</td><td rowspan="2">230</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">3G3RX-A4300-V1</td><td>Heavy load</td><td>30</td><td>64</td></tr>
<tr><td>Light load</td><td>37</td><td>77</td><td rowspan="2">3G3AX-DL4370</td><td rowspan="2">0.74</td><td rowspan="2">275</td></tr>
<tr><td rowspan="2">37</td><td rowspan="2">3G3RX-A4370</td><td>Heavy load</td><td>37</td><td>83</td></tr>
<tr><td>Light load</td><td>45</td><td>94</td><td rowspan="2">3G3AX-DL4450</td><td rowspan="2">0.61</td><td rowspan="2">340</td></tr>
<tr><td rowspan="2">45</td><td rowspan="2">3G3RX-A4450</td><td>Heavy load</td><td>45</td><td>100</td></tr>
<tr><td>Light load</td><td>55</td><td>116</td><td rowspan="2">3G3AX-DL4550</td><td rowspan="2">0.5</td><td rowspan="2">400</td></tr>
<tr><td rowspan="2">55</td><td rowspan="2">3G3RX-A4550</td><td>Heavy load</td><td>55</td><td>121</td></tr>
<tr><td>Light load</td><td>75</td><td>149</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
</table>

12-5-2 External Dimensions

Inverter input power supply	Model	Fig. No.	Applicable motor capacity [kW]	Dimensions [mm]									Weight [kg]	Standard applicable wire
				W	D	H	A	B	X	Y	C	K		
3/1-phase 200 VAC	3G3AX-DL2002	Fig. 1	0.2	66	90	98	–	85	56	72	5.2 × 8	M4	0.8	1.25 mm^2 min.
	3G3AX-DL2004		0.4	66	90	98	–	95	56	72	5.2 × 8	M4	1.0	1.25 mm^2 min.
	3G3AX-DL2007		0.75	66	90	98	–	105	56	72	5.2 × 8	M4	1.3	2 mm^2 min.
	3G3AX-DL2015		1.5	66	90	98	–	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL2022		2.2	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL2037		3.7	86	100	118	–	120	71	80	6 × 9	M4	2.6	3.5 mm^2 min.
	3G3AX-DL2055	Fig. 2	5.5	111	100	210	–	110	95	80	7 × 11	M5	3.6	8 mm^2 min.
	3G3AX-DL2075		7.5	111	100	212	–	120	95	80	7 × 11	M6	3.9	14 mm^2 min.
	3G3AX-DL2110		11	146	120	252	–	110	124	96	7 × 11	M6	6.5	22 mm^2 min.
	3G3AX-DL2150		15	146	120	256	–	120	124	96	7 × 11	M8	7.0	38 mm^2 min.
	3G3AX-DL2220	Fig. 3	18.5, 22	120	175	356	140	145	98	151	7 × 11	M8	9.0	60 mm^2 min.
	3G3AX-DL2300		30	120	175	386	155	150	98	151	7 × 11	M8	13.0	38 mm^2 x 2 min.
	3G3AX-DL2370		37	120	175	390	155	150	98	151	7 × 11	M10	13.5	38 mm^2 x 2 min.
	3G3AX-DL2450		45	160	190	420	180	150	120	168	7 × 11	M10	19.0	60 mm^2 x 2 min.
	3G3AX-DL2550		55	160	190	424	180	180	120	168	7 × 11	M12	24.0	80 mm^2 x 2 min.
3-phase 400 VAC	3G3AX-DL4004	Fig. 1	0.4	66	90	98	–	85	56	72	5.2 × 8	M4	0.8	1.25 mm^2 min.
	3G3AX-DL4007		0.75	66	90	98	–	95	56	72	5.2 × 8	M4	1.1	1.25 mm^2 min.
	3G3AX-DL4015		1.5	66	90	98	-–	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL4022		2.2	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL4037		3.7	86	100	116	-–	120	71	80	6 × 9	M4	2.6	2 mm^2 min.
	3G3AX-DL4055		5.5	111	100	138	–	110	95	80	7 × 11	M4	3.6	3.5 mm^2 min.
	3G3AX-DL4075		7.5	111	100	138	–	115	95	80	7 × 11	M4	3.9	3.5 mm^2 min.

Inverter input power supply	Model	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	3G3AX-DL4110	Fig. 2	11	146	120	250	–	105	124	96	7 × 11	M5	5.2	5.5 mm^2 min.
	3G3AX-DL4150		15	146	120	252	–	120	124	96	7 × 11	M6	7.0	14 mm^2 min.
	3G3AX-DL4220	Fig. 3	18.5, 22	120	175	352	140	145	98	151	7 × 11	M6	9.5	22 mm^2 min.
	3G3AX-DL4300		30	120	175	356	140	145	98	151	7 × 11	M8	9.5	30 mm^2 min.
	3G3AX-DL4370		37	120	175	386	155	150	98	151	7 × 11	M8	13.5	38 mm^2 min.
	3G3AX-DL4450		45	160	190	416	180	145	120	168	7 × 11	M8	16.5	60 mm^2 min.
	3G3AX-DL4550		55	160	190	416	190	170	120	168	7 × 11	M8	23.0	38 mm^2 x 2 min.

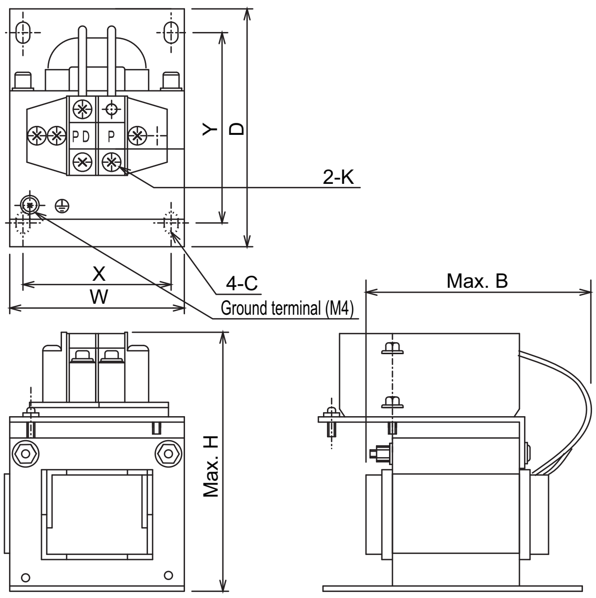


Fig. 1

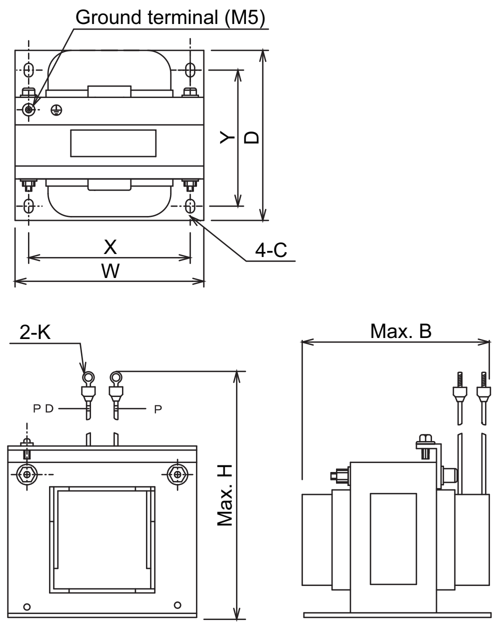


Fig. 2

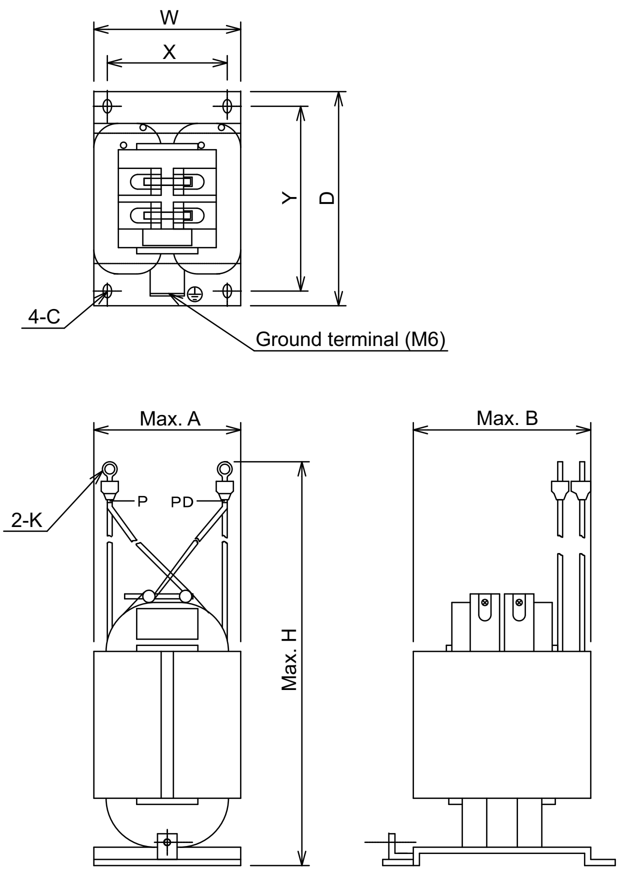
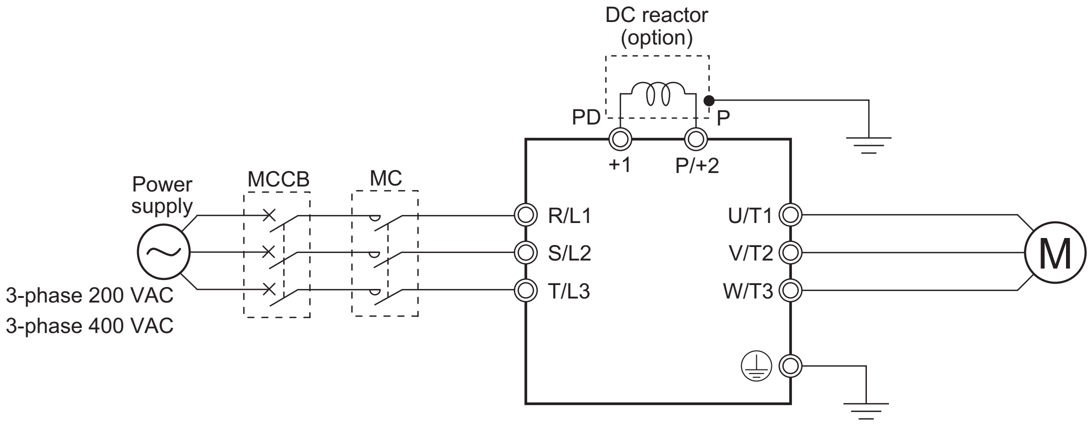


Fig. 3

12-5-3 Connection Examples



DC Reactor Connection Terminals (+1, P/+2)

- 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 +1 and –P/+2. 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.

12-6 AC Reactor (Model: 3G3AX-AL□□□□)

12-6-1 Specifications

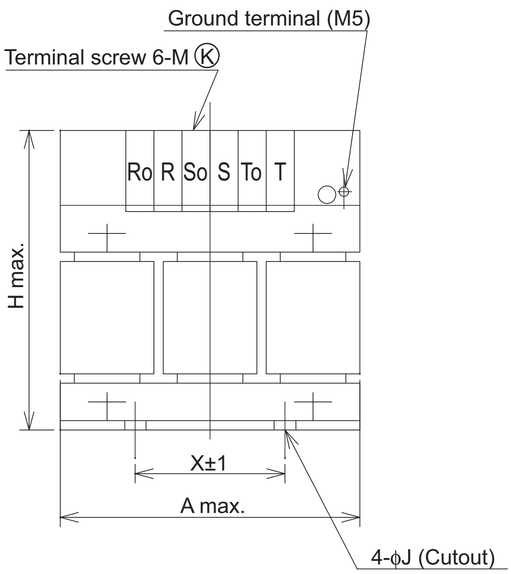
Inverter						AC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
200-V class	0.4	3G3RX-A2004-V1	Heavy load	0.4	3.3	3G3AX-AL2025	2.8	12	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.75	3.9					
	0.75	3G3RX-A2007-V1	Heavy load	0.75	5.5					
			Light load	1.5	7.2					
	1.5	3G3RX-A2015-V1	Heavy load	1.5	8.3					
			Light load	2.2	10.8	3G3AX-AL2055	0.88	25		
	2.2	3G3RX-A2022-V1	Heavy load	2.2	12					
			Light load	3.7	13.9					
	3.7	3G3RX-A2037-V1	Heavy load	3.7	18					
			Light load	5.5	23	3G3AX-AL2110	0.35	50		
	5.5	3G3RX-A2055-V1	Heavy load	5.5	26					
			Light load	7.5	37					
	7.5	3G3RX-A2075-V1	Heavy load	7.5	35					
			Light load	11	48	3G3AX-AL2220	0.18	50		
	11	3G3RX-A2110-V1	Heavy load	11	51					
			Light load	15	64					
	15	3G3RX-A2150-V1	Heavy load	15	70					
		3G3RX-A2150-V1	Light load	18.5	80	3G3AX-AL2330	0.09	85		
	18.5	3G3RX-A2185-V1	Heavy load	18.5	84					
			Light load	22	94					
	22	3G3RX-A2220-V1	Heavy load	22	105					
		3G3RX-A2220-V1	Light load	30	120	3G3AX-AL2500	0.071	95		
	30	3G3RX-A2300-V1	Heavy load	30	133					
			Light load	37	150					
	37	3G3RX-A2370-V1	Heavy load	37	160					
			Light load	45	186	3G3AX-AL2750	0.046	100		
	45	3G3RX-A2450-V1	Heavy load	45	200					
			Light load	55	240					
	55	3G3RX-A2550-V1	Heavy load	55	242					
			Light load	75	280	–	–	–	–	–

Inverter						AC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
400-V class	0.4	3G3RX-A4004-V1	Heavy load	0.4	1.8	3G3AX-AL4025	7.7	12	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.75	2.1					
	0.75	3G3RX-A4007-V1	Heavy load	0.75	2.8					
			Light load	1.5	4.3					
	1.5	3G3RX-A4015-V1	Heavy load	1.5	4.2					
			Light load	2.2	5.9	3G3AX-AL4055	3.5	25		
	2.2	3G3RX-A4022-V1	Heavy load	2.2	5.8					
			Light load	3.7	8.1					
	3.7	3G3RX-A4037-V1	Heavy load	3.7	9.8					
			Light load	5.5	13.3	3G3AX-AL4110	1.3	50		
	5.5	3G3RX-A4055-V1	Heavy load	5.5	15					
			Light load	7.5	20					
	7.5	3G3RX-A4075-V1	Heavy load	7.5	21					
			Light load	11	24	3G3AX-AL4220	0.74	60		
	11	3G3RX-A4110-V1	Heavy load	11	28					
			Light load	15	32					
	15	3G3RX-A4150-V1	Heavy load	15	35					
			Light load	18.5	41	3G3AX-AL4330	0.36	90		
	18.5	3G3RX-A4185-V1	Heavy load	18.5	42					
			Light load	22	47					
	22	3G3RX-A4220-V1	Heavy load	22	53					
			Light load	30	63	3G3AX-AL4500	0.29	95		
	30	3G3RX-A4300-V1	Heavy load	30	64					
			Light load	37	77					
	37	3G3RX-A4370-V1	Heavy load	37	83					
			Light load	45	94	3G3AX-AL4750	0.19	100		
	45	3G3RX-A4450-V1	Heavy load	45	100					
			Light load	55	116					
	55	3G3RX-A4550-V1	Heavy load	55	121					
			Light load	75	149	–	–	–	–	–

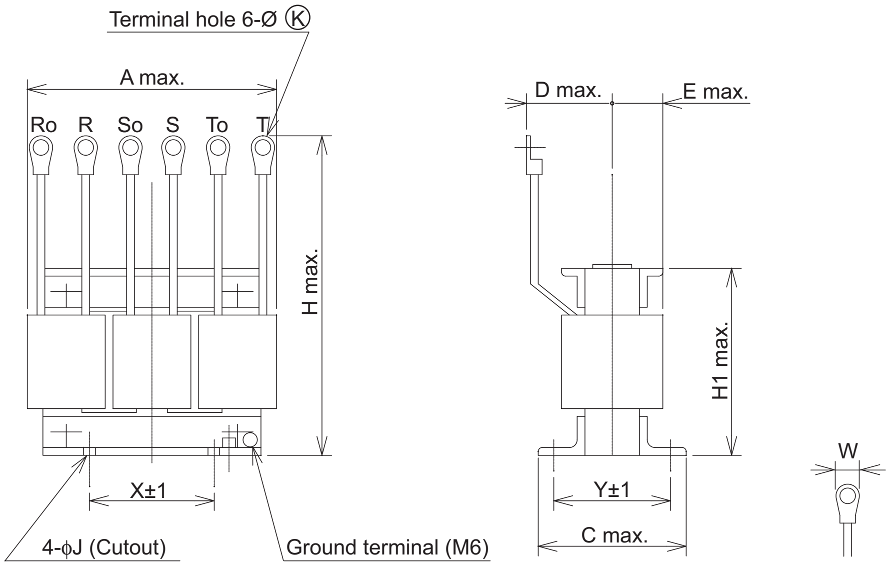
12-6-2 External Dimensions

Inverter input power supply	Model	Applicable motor capacity [kW]	Dimensions [mm]											Weight [kg]
			A	C	D	E	H	H1	X	Y	J	K	W	
3-phase 200 VAC	3G3AX-AL2025	0.2 to 1.5	120	82	60	40	150	94	50	67	6	4.0	9.5	2.8
	3G3AX-AL2055	2.2, 3.7	120	98	60	40	150	94	50	75	6	4.0	9.5	4.0
	3G3AX-AL2110	5.5, 7.5	150	103	70	55	170	108	60	80	6	5.3	12.0	5.0
	3G3AX-AL2220	11, 15	180	113	75	55	190	140	90	90	6	8.4	16.5	10.0
	3G3AX-AL2330	18.5, 22	180	113	85	60	230	140	125	90	6	8.4	22.0	11.0
	3G3AX-AL2500	30, 37	260	113	85	60	290	202	100	90	7	8.4	27.0	19.0
	3G3AX-AL2750	45, 55	260	144	110	80	290	207	125	112	7	8.4	28.5	25.0
3-phase 400 VAC	3G3AX-AL4025	0.4 to 1.5	130	82	60	40	150	94	50	67	6	4	9.5	2.7
	3G3AX-AL4055	2.2, 3.7	130	98	60	40	150	94	50	75	6	5	12.5	4.0
	3G3AX-AL4110	5.5, 7.5	150	116	75	55	170	106	60	98	6	5	12.5	6.0
	3G3AX-AL4220	11, 15	180	103	75	55	190	140	100	80	6	5.3	12.0	10.0
	3G3AX-AL4330	18.5, 22	180	123	85	60	230	140	100	100	6	6.4	16.5	11.5
	3G3AX-AL4500	30, 37	260	113	85	60	290	202	100	90	7	8.4	22.0	19.0
	3G3AX-AL4750	45, 55	260	146	110	80	290	207	125	112	7	8.4	22.0	25.0

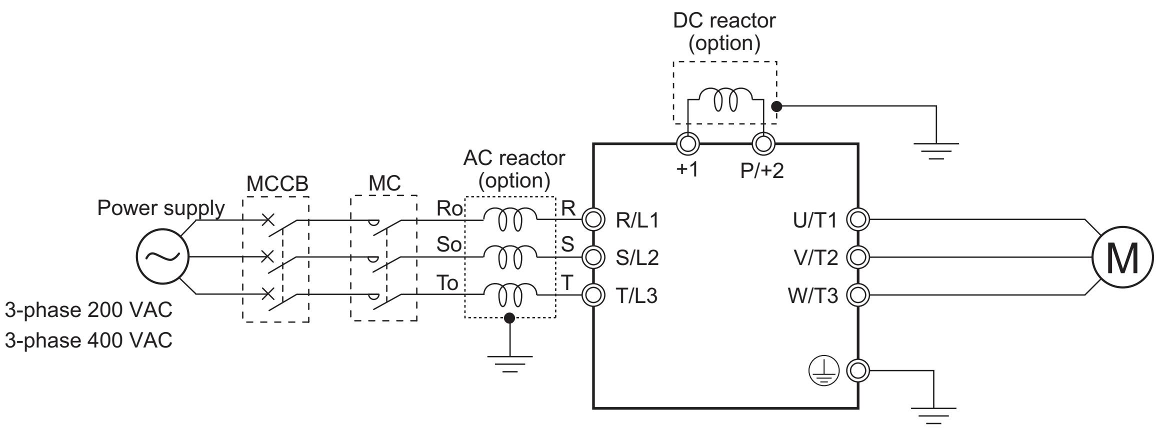
3G3AX-AL2025/AL2055/AL4025/AL4055/AL4110



3G3AX-AL2110/AL2220/AL2330/AL2500/AL2750/AL4220/AL4330/AL4500/AL4750



12-6-3 Connection Examples



12-7 Input Noise Filter (Model: 3G3AX-NFI☐☐)

12-7-1 Specifications

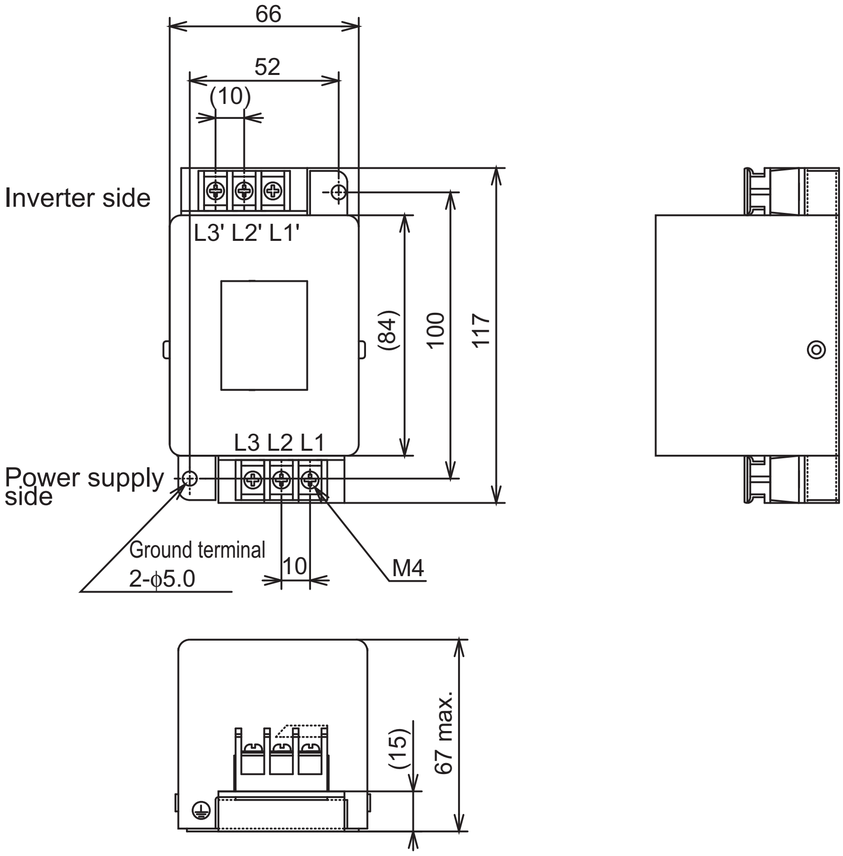
Inverter						Input noise filter specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current (at 50°C)	Heat generation [W]	Leakage current (at 60 Hz)
200-V class	0.4	3G3RX-A2004-V1	Heavy load	0.4	3.3	3G3AX-NFI21	250 VAC +10%	6A	3	1.5 mA max. (250 VAC)
			Light load	0.75	3.9					
	0.75	3G3RX-A2007-V1	Heavy load	0.75	5.5					
			Light load	1.5	7.2	3G3AX-NFI22		10A	4	
	1.5	3G3RX-A2015-V1	Heavy load	1.5	8.3					
			Light load	2.2	10.8	3G3AX-NFI23		20A	6	
	2.2	3G3RX-A2022-V1	Heavy load	2.2	12					
			Light load	3.7	13.9					
	3.7	3G3RX-A2037-V1	Heavy load	3.7	18					
			Light load	5.5	23	3G3AX-NFI24		30A	9	
	5.5	3G3RX-A2055-V1	Heavy load	5.5	26					
			Light load	7.5	37	3G3AX-NFI25		40A	12	
	7.5	3G3RX-A2075-V1	Heavy load	7.5	35					
			Light load	11	48	3G3AX-NFI26		60A	17	
	11	3G3RX-A2110-V1	Heavy load	11	51					
			Light load	15	64	3G3AX-NFI27		80A	21	
	15	3G3RX-A2150-V1	Heavy load	15	70					
			Light load	18.5	80	3G3AX-NFI28		100A	23	
	18.5	3G3RX-A2185-V1	Heavy load	18.5	84					
			Light load	22	94	3G3AX-NFI29		150A	45	
	22	3G3RX-A2220-V1	Heavy load	22	105					
			Light load	30	120					
	30	3G3RX-A2300-V1	Heavy load	30	133					
			Light load	37	150	3G3AX-NFI2A		200A	50	
	37	3G3RX-A2370-V1	Heavy load	37	160					
			Light load	45	186	3G3AX-NFI2B		250A	68	
	45	3G3RX-A2450-V1	Heavy load	45	200					
			Light load	55	240	3G3AX-NFI2C		300A	56	
	55	3G3RX-A2550-V1	Heavy load	55	242					
			Light load	75	280	–	–	–	–	–

Inverter						Input noise filter specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current (at 50°C)	Heat generation [W]	Leakage current (at 60 Hz)
400-V class	0.4	3G3RX-A4004-V1	Heavy load	0.4	1.8	3G3AX-NFI41	480 VAC +10%	7A	2	7.5 mA max. (480 VAC)
			Light load	0.75	2.1					
	0.75	3G3RX-A4007-V1	Heavy load	0.75	2.8					
			Light load	1.5	4.3					
	1.5	3G3RX-A4015-V1	Heavy load	1.5	4.2					
			Light load	2.2	5.9					
	2.2	3G3RX-A4022-V1	Heavy load	2.2	5.8					
			Light load	3.7	8.1	3G3AX-NFI42		10A	4	
	3.7	3G3RX-A4037-V1	Heavy load	3.7	9.8					
			Light load	5.5	13.3	3G3AX-NFI43		20A	6	
	5.5	3G3RX-A4055-V1	Heavy load	5.5	15					
			Light load	7.5	20					
	7.5	3G3RX-A4075-V1	Heavy load	7.5	21					
			Light load	11	24	3G3AX-NFI44		30A	9	
	11	3G3RX-A4110-V1	Heavy load	11	28					
			Light load	15	32	3G3AX-NFI45		40A	12	
	15	3G3RX-A4150-V1	Heavy load	15	35					
			Light load	18.5	41	3G3AX-NFI46		50A	15	
	18.5	3G3RX-A4185-V1	Heavy load	18.5	42					
			Light load	22	47	3G3AX-NFI47		60A	17	
	22	3G3RX-A4220-V1	Heavy load	22	53					
			Light load	30	63	3G3AX-NFI48		80A	21	
	30	3G3RX-A4300-V1	Heavy load	30	64					
			Light load	37	77	3G3AX-NFI49		100A	23	
	37	3G3RX-A4370-V1	Heavy load	37	83					
			Light load	45	94	3G3AX-NFI4A		150A	45	
	45	3G3RX-A4450-V1	Heavy load	45	100					
			Light load	55	116					
	55	3G3RX-A4550-V1	Heavy load	55	121					
			Light load	75	149	–	–	–	–	–

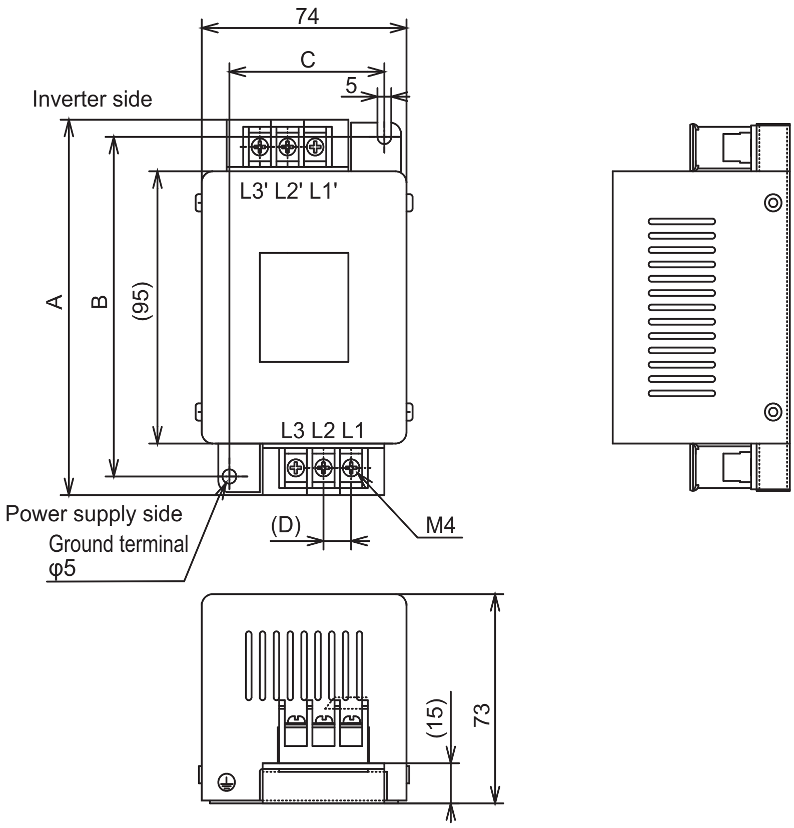
12-7-2 External Dimensions

Model	Case, enclosure rating	Terminal size	Wire diameter	Weight [kg]
G3AX-NFI21	Plastic, IP00	M4	1.25 mm^2	0.5
3G3AX-NFI22	Plastic, IP00	M4	2 mm^2	0.6
3G3AX-NFI23	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
3G3AX-NFI24	Plastic, IP00	M4	5.5 mm^2	0.8
3G3AX-NFI25	Plastic, IP00	M5	8 mm^2	1.4
3G3AX-NFI26	Plastic, IP00	M5	14 mm^2	1.8
3G3AX-NFI27	Metal, IP00	M6	22 mm^2	3.6
3G3AX-NFI28	Metal, IP00	M8	30 mm^2	4.6
3G3AX-NFI29	Metal, IP00	M8	38 mm^2, 60 mm^2	9.0
3G3AX-NFI2A	Metal, IP00	M10	100 mm^2 or 38 mm^2, 2 wires parallel	16
3G3AX-NFI2B	Metal, IP00	M10	100 mm^2 or 38 mm^2, 2 wires parallel	16
3G3AX-NFI2C	Metal, IP00	M10	150 mm^2 or 60 mm^2, 2 wires parallel	23
3G3AX-NFI41	Plastic, IP00	M4	1.25 mm^2, 2 mm^2	0.7
3G3AX-NFI42	Plastic, IP00	M4	2 mm^2	0.7
3G3AX-NFI43	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
3G3AX-NFI44	Plastic, IP00	M4	5.5 mm^2	0.8
3G3AX-NFI45	Plastic, IP00	M5	8 mm^2	1.4
3G3AX-NFI46	Plastic, IP00	M5	14 mm^2	1.6
3G3AX-NFI47	Plastic, IP00	M5	14 mm^2	1.8
3G3AX-NFI48	Metal, IP00	M6	22 mm^2	3.6
3G3AX-NFI49	Metal, IP00	M8	38 mm^2	4.6
3G3AX-NFI4A	Metal, IP00	M8	38 mm^2, 60 mm^2	9.0

3G3AX-NFI21/NFI22

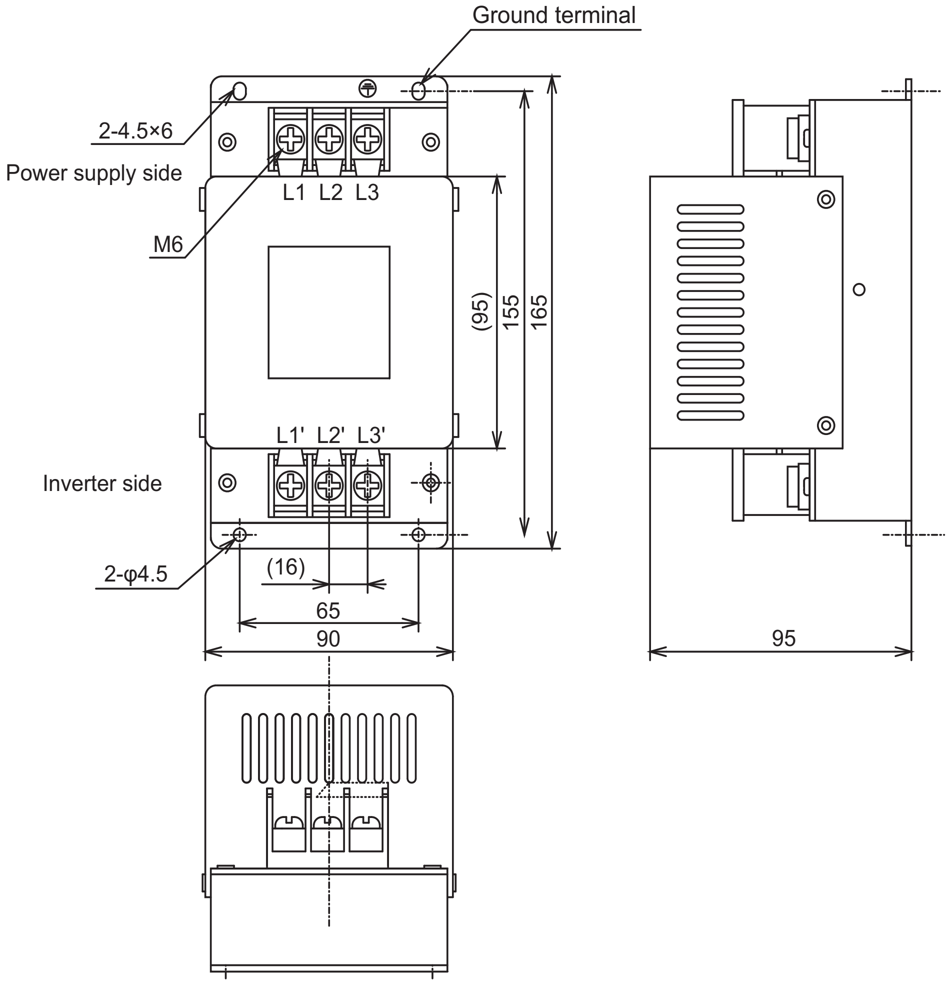


3G3AX-NFI23/NFI24/NFI41/NFI42/NFI43/NFI44

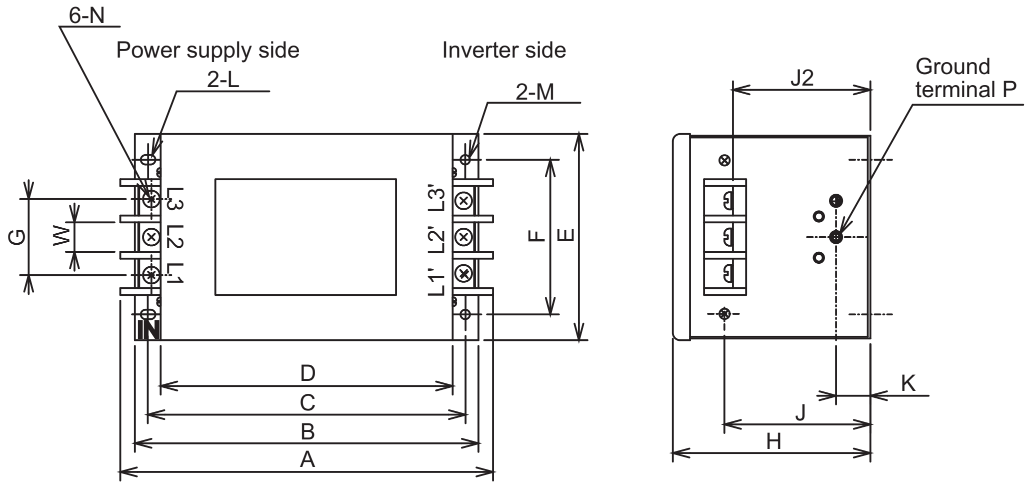


Model	Dimensions [mm]			
	A	B	C	D
3G3AX-NFI23	128	118	56	10
3G3AX-NFI24	144	130	56	11
3G3AX-NFI41	144	130	56	11
3G3AX-NFI42	144	130	56	11
3G3AX-NFI43	144	130	56	11
3G3AX-NFI44	144	130	56	11

3G3AX-NFI25/NFI26/NFI45/NFI46/NFI47

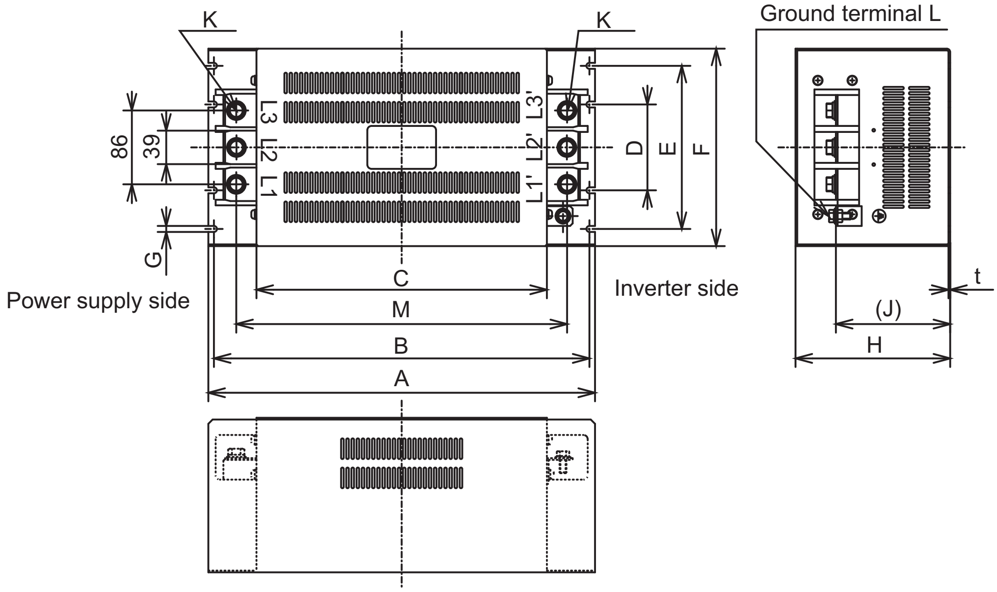


3G3AX-NFI27/NFI28/NFI29/NFI48/NFI49/NFI4A



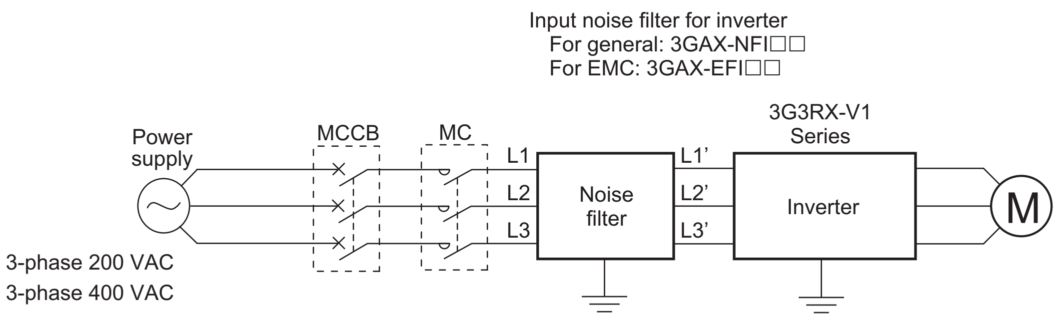
Model	Dimensions [mm]														
	A	B	C	D	E	F	G	H	J	J2	K	L	M	N	P	W
3G3AX-NFI27	217	200	185	170	120	90	44	115	85	82	20	R2.75 Length 7	5.5 dia.	M6	M4	17
3G3AX-NFI28	254	230	215	200	150	120	57	115	80	75	30	R3.75 Length 8	6.5 dia.	M8	M6	23
3G3AX-NFI29	314	300	280	260	200	170	57	130	90	85	35	R3.75 Length 8	6.5 dia.	M8	M6	23
3G3AX-NFI48	217	200	185	170	120	90	44	115	85	85	20	R2.75 Length 7	5.5 dia.	M6	M4	17
3G3AX-NFI49	254	230	215	200	150	120	57	115	80	75	30	R3.75 Length 8	6.5 dia.	M8	M6	23
3G3AX-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	Dimensions [mm]												
	A	B	C	D	E	F	G	H	J	K	L	M	t
3G3AX-NFI2A	450	430	338	100	190	230	7	180	(133)	M10	M8	385	1.0
3G3AX-NFI2B													
3G3AX-NFI2C	500	475	400	–	160	200	12	180	(133)	M10	M8	445	1.2

12-7-3 Connection Examples



12-8 Output Noise Filter (Model: 3G3AX-NFO□□)

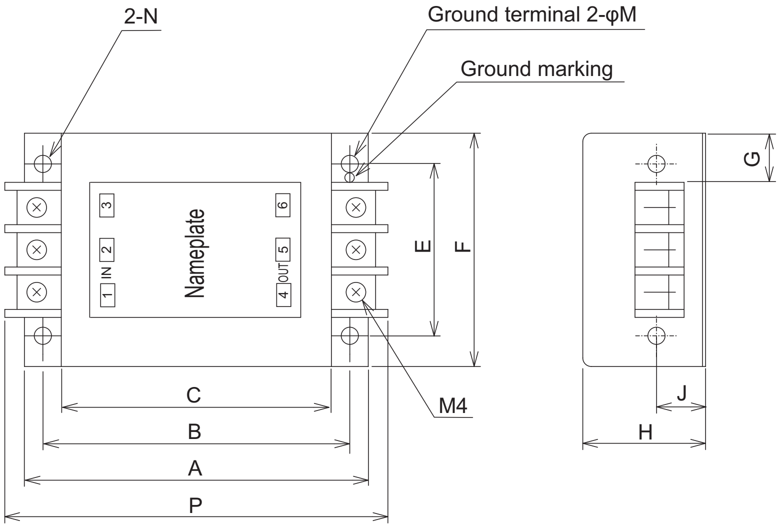
12-8-1 Specifications

<table>
<tr><th colspan="6">Inverter</th><th colspan="4">Output noise filter specifications</th></tr>
<tr><th>Voltage class</th><th>Max. applicable motor capacity [kW]</th><th>Model</th><th>Heavy/ Light load mode</th><th>Max. applicable motor capacity [kW]</th><th>Rated output current [A]</th><th>Model</th><th>Rated voltage</th><th>Rated input current [A]</th><th>Weight [kg]</th></tr>
<tr><td rowspan="26">200-V class</td><td rowspan="2">0.4</td><td rowspan="2">3G3RX-A2004-V1</td><td>Heavy load</td><td>0.4</td><td>3.0</td><td rowspan="3">3G3AX-NFO01</td><td rowspan="25">500 VAC</td><td rowspan="3">6</td><td rowspan="3">0.7</td></tr>
<tr><td>Light load</td><td>0.75</td><td>3.7</td></tr>
<tr><td rowspan="2">0.75</td><td rowspan="2">3G3RX-A2007-V1</td><td>Heavy load</td><td>0.75</td><td>5.0</td></tr>
<tr><td>Light load</td><td>1.5</td><td>6.3</td><td rowspan="4">3G3AX-NFO02</td><td rowspan="4">12</td><td rowspan="4">0.9</td></tr>
<tr><td rowspan="2">1.5</td><td rowspan="2">3G3RX-A2015-V1</td><td>Heavy load</td><td>1.5</td><td>7.5</td></tr>
<tr><td>Light load</td><td>2.2</td><td>9.4</td></tr>
<tr><td rowspan="2">2.2</td><td rowspan="2">3G3RX-A2022-V1</td><td>Heavy load</td><td>2.2</td><td>10.5</td></tr>
<tr><td>Light load</td><td>3.7</td><td>12</td><td rowspan="4">3G3AX-NFO03</td><td rowspan="4">25</td><td rowspan="4">2.1</td></tr>
<tr><td rowspan="2">3.7</td><td rowspan="2">3G3RX-A2037-V1</td><td>Heavy load</td><td>3.7</td><td>16.5</td></tr>
<tr><td>Light load</td><td>5.5</td><td>19.6</td></tr>
<tr><td rowspan="2">5.5</td><td rowspan="2">3G3RX-A2055-V1</td><td>Heavy load</td><td>5.5</td><td>24</td></tr>
<tr><td>Light load</td><td>7.5</td><td>30</td><td rowspan="4">3G3AX-NFO04</td><td rowspan="4">50</td><td rowspan="4">3.7</td></tr>
<tr><td rowspan="2">7.5</td><td rowspan="2">3G3RX-A2075-V1</td><td>Heavy load</td><td>7.5</td><td>32</td></tr>
<tr><td>Light load</td><td>11</td><td>44</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">3G3RX-A2110-V1</td><td>Heavy load</td><td>11</td><td>46</td></tr>
<tr><td>Light load</td><td>15</td><td>58</td><td rowspan="2">3G3AX-NFO05</td><td rowspan="2">75</td><td rowspan="2">5.7</td></tr>
<tr><td rowspan="2">15</td><td rowspan="2">3G3RX-A2150-V1</td><td>Heavy load</td><td>15</td><td>64</td></tr>
<tr><td>Light load</td><td>18.5</td><td>73</td><td rowspan="4">3G3AX-NFO06</td><td rowspan="4">100</td><td rowspan="4">8.4</td></tr>
<tr><td rowspan="2">18.5</td><td rowspan="2">3G3RX-A2185-V1</td><td>Heavy load</td><td>18.5</td><td>76</td></tr>
<tr><td>Light load</td><td>22</td><td>85</td></tr>
<tr><td rowspan="2">22</td><td rowspan="2">3G3RX-A2220-V1</td><td>Heavy load</td><td>22</td><td>95</td></tr>
<tr><td>Light load</td><td>30</td><td>113</td><td rowspan="4">3G3AX-NFO07</td><td rowspan="4">150</td><td rowspan="4">9.0</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">3G3RX-A2300-V1</td><td>Heavy load</td><td>30</td><td>121</td></tr>
<tr><td>Light load</td><td>37</td><td>140</td></tr>
<tr><td rowspan="2">37</td><td rowspan="2">3G3RX-A2370-V1</td><td>Heavy load</td><td>37</td><td>145</td></tr>
<tr><td>Light load</td><td>45</td><td>169</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
</table>

Inverter						Output noise filter specifications			
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated output current [A]	Model	Rated voltage	Rated input current [A]	Weight [kg]
400-V class	0.4	3G3RX-A4004-V1	Heavy load	0.4	1.5	3G3AX-NFO01	500 VAC	6	0.7
			Light load	0.75	1.9				
	0.75	3G3RX-A4007-V1	Heavy load	0.75	2.5				
			Light load	1.5	3.1				
	1.5	3G3RX-A4015-V1	Heavy load	1.5	3.8				
			Light load	2.2	4.8				
	2.2	3G3RX-A4022-V1	Heavy load	2.2	5.3				
			Light load	3.7	6.7	3G3AX-NFO02		12	0.9
	3.7	3G3RX-A4037-V1	Heavy load	3.7	9.0				
			Light load	5.5	11.1	3G3AX-NFO03		25	2.1
	5.5	3G3RX-A4055-V1	Heavy load	5.5	14				
			Light load	7.5	16				
	7.5	3G3RX-A4075-V1	Heavy load	7.5	19				
			Light load	11	22				
	11	3G3RX-A4110-V1	Heavy load	11	25				
			Light load	15	29	3G3AX-NFO04		50	3.7
	15	3G3RX-A4150-V1	Heavy load	15	32				
			Light load	18.5	37				
	18.5	3G3RX-A4185-V1	Heavy load	18.5	38				
			Light load	22	43				
	22	3G3RX-A4220-V1	Heavy load	22	48				
			Light load	30	57	3G3AX-NFO05		75	5.7
	30	3G3RX-A4300-V1	Heavy load	30	58				
			Light load	37	70				
	37	3G3RX-A4370-V1	Heavy load	37	75				
			Light load	45	85	3G3AX-NFO06		100	8.4
	45	3G3RX-A4450-V1	Heavy load	45	91				
			Light load	55	105	3G3AX-NFO07		150	9.0
	55	3G3RX-A4550-V1	Heavy load	55	112				
			Light load	75	135				
	75	3G3RX-A4750-V1	Heavy load	75	149				
			Light load	90	160	–	–	–	–

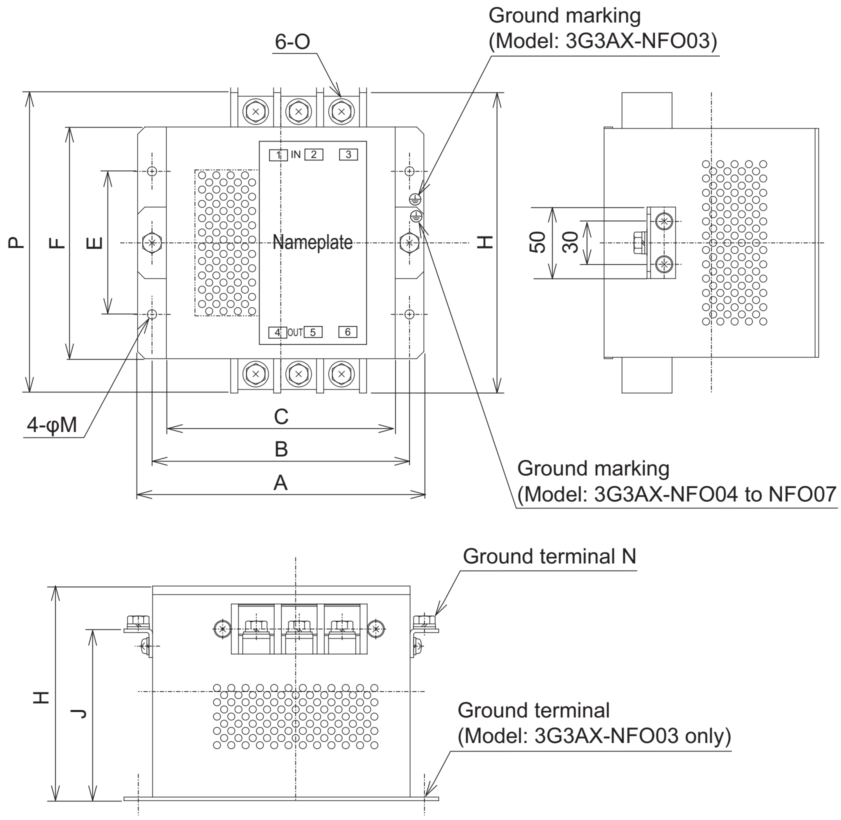
12-8-2 External Dimensions

3G3AX-NFO01/NFO02



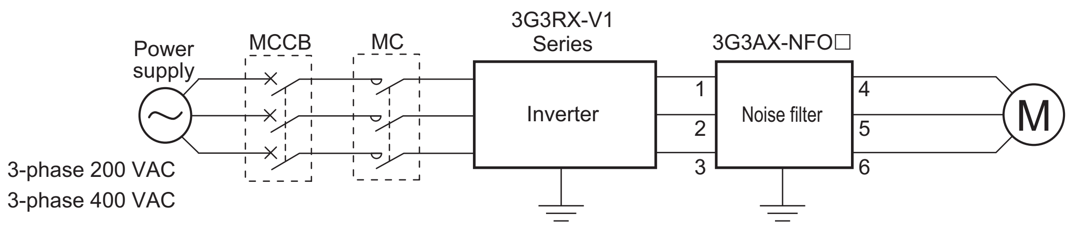
Model	Dimensions [mm]									
	A	B	C	E	F	G	H	J	M	P	N
3G3AX-NFO01	140	125	110	70	95	22	50	20	4.5	156	2-R2.25 Length 6
3G3AX-NFO02	160	145	130	80	110	30	70	25	5.5	176	2-R2.75 Length 7

3G3AX-NFO03/NFO04/NFO05/NFO06/NFO07



Model	Dimensions [mm]									
	A	B	C	E	F	H	J	M	N	O	P
3G3AX-NFO03	160	145	130	80	112	120	–	6.5 dia.	–	M4	154
3G3AX-NFO04	200	180	160	100	162	150	120	6.5 dia.	M5	M5	210
3G3AX-NFO05	220	200	180	100	182	170	140	6.5 dia.	M6	M6	230
3G3AX-NFO06	220	200	180	100	182	170	140	6.5 dia.	M8	M8	237
3G3AX-NFO07	240	220	200	150	202	170	140	6.5 dia.	M8	M8	257

12-8-3 Connection Example



12-9 Radio Noise Filter (Model: 3G3AX-ZCL☐)

12-9-1 Specifications

Select the radio noise filter according to the applicable motor capacity for the heavy/light load mode of the inverter.

3G3AX-ZCL1

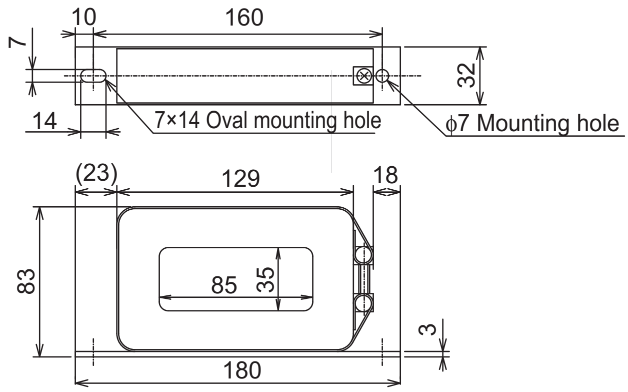
Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.2	1	4	1	4	1	4	1	4
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
2.2	1	4	1	4	1	4	1	4
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

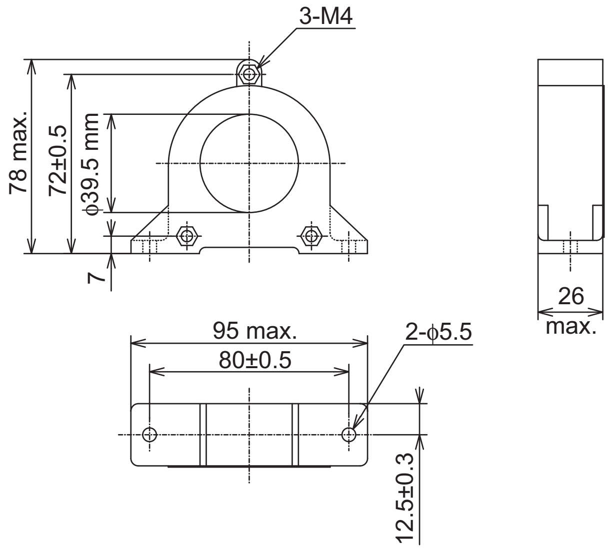
Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.1	1	4	1	4	1	4	1	4
0.2	1	4	1	4	1	4	1	4
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
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
7.5	1	4	1	4	1	4	1	4

12-9-2 External Dimensions

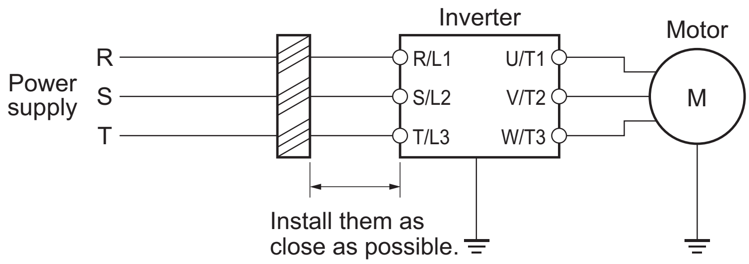
3G3AX-ZCL1



3G3AX-ZCL2



12-9-3 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.

12-10 EMC Noise Filter (Model: 3G3AX-EFI□□)

12-10-1 Specifications

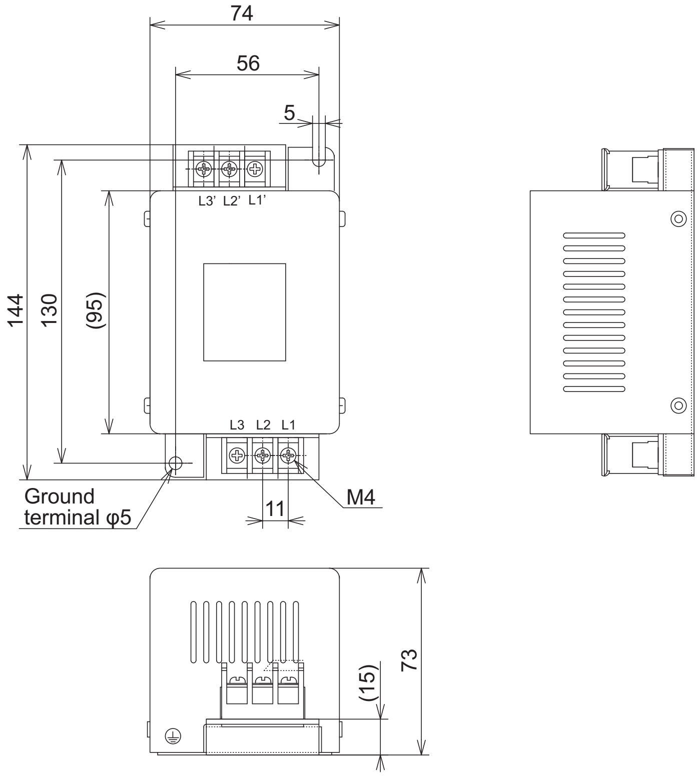
Inverter						EMC noise filter specifications					
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current [A]	Heat generation [W]	Leakage current (at 480 VAC 60 Hz)	Class
200-V class	0.4	3G3RX-A2004-V1	Heavy load	0.4	3.3	3G3AX-EFI41	480 VAC +10%	7	4	150 mA max.	A
			Light load	0.75	3.9						
	0.75	3G3RX-A2007-V1	Heavy load	0.75	5.5						
			Light load	1.5	7.2	3G3AX-EFI42		10	4	150 mA max.	
	1.5	3G3RX-A2015-V1	Heavy load	1.5	8.3						
			Light load	2.2	10.8	3G3AX-EFI43		20	8	170 mA max.	
	2.2	3G3RX-A2022-V1	Heavy load	2.2	12						
			Light load	3.7	13.9						
	3.7	3G3RX-A2037-V1	Heavy load	3.7	18						
			Light load	5.5	23	3G3AX-EFI44		30	9	170 mA max.	
	5.5	3G3RX-A2055-V1	Heavy load	5.5	26						
			Light load	7.5	37	3G3AX-EFI45		40	15	170 mA max.	
	7.5	3G3RX-A2075-V1	Heavy load	7.5	35						
			Light load	11	48	3G3AX-EFI47		60	15	250 mA max.	
	11	3G3RX-A2110-V1	Heavy load	11	51						
			Light load	15	64	3G3AX-EFI48		80	21	250 mA max.	
	15	3G3RX-A2150-V1	Heavy load	15	70						
			Light load	18.5	80	3G3AX-EFI49		100	23	250 mA max.	
	18.5	3G3RX-A2185-V1	Heavy load	18.5	84						
			Light load	22	94	3G3AX-EFI4A		150	45	250 mA max.	
	22	3G3RX-A2220-V1	Heavy load	22	105						
			Light load	30	120						
	30	3G3RX-A2300-V1	Heavy load	30	133						
			Light load	37	150	3G3AX-EFI4B		200	50	250 mA max.	
	37	3G3RX-A2370-V1	Heavy load	37	160						
			Light load	45	186	–	–	–	–	–	–

Inverter						EMC noise filter specifications					
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current [A]	Heat generation [W]	Leakage current (at 480 VAC 60 Hz)	Class
400-V class	0.4	3G3RX-A4004-V1	Heavy load	0.4	1.8	3G3AX-EFI41	480 VAC +10%	7	4	150 mA max.	A
			Light load	0.75	2.1						
	0.75	3G3RX-A4007-V1	Heavy load	0.75	2.8						
			Light load	1.5	4.3						
	1.5	3G3RX-A4015-V1	Heavy load	1.5	4.2						
			Light load	2.2	5.9						
	2.2	3G3RX-A4022-V1	Heavy load	2.2	5.8						
			Light load	3.7	8.1	3G3AX-EFI42		10	4	150 mA max.	
	3.7	3G3RX-A4037-V1	Heavy load	3.7	9.8						
			Light load	5.5	13.3	3G3AX-EFI43		20	8	170 mA max.	
	5.5	3G3RX-A4055-V1	Heavy load	5.5	15						
			Light load	7.5	20						
	7.5	3G3RX-A4075-V1	Heavy load	7.5	21						
			Light load	11	24	3G3AX-EFI44		30	9	170 mA max.	
	11	3G3RX-A4110-V1	Heavy load	11	28						
			Light load	15	32	3G3AX-EFI45		40	15	170 mA max.	
	15	3G3RX-A4150-V1	Heavy load	15	35						
			Light load	18.5	41	3G3AX-EFI46		50	15	250 mA max.	
	18.5	3G3RX-A4185-V1	Heavy load	18.5	42						
			Light load	22	47	3G3AX-EFI47		60	15	250 mA max.	
	22	3G3RX-A4220-V1	Heavy load	22	53						
			Light load	30	63	3G3AX-EFI48		80	21	250 mA max.	
	30	3G3RX-A4300-V1	Heavy load	30	64						
			Light load	37	77	3G3AX-EFI49		100	23	250 mA max.	
	37	3G3RX-A4370-V1	Heavy load	37	83						
			Light load	45	94	3G3AX-EFI4A		150	45	250 mA max.	
	45	3G3RX-A4450-V1	Heavy load	45	100						
			Light load	55	116						
	55	3G3RX-A4550-V1	Heavy load	55	121						
			Light load	75	149	3G3AX-EFI4B		200	50	250 mA max.	
	75	3G3RX-A4750-V1	Heavy load	75	164						
			Light load	90	176						
	90	3G3RX-A4900-V1	Heavy load	90	194						
			Light load	110	199	–	–	–	–	–	–

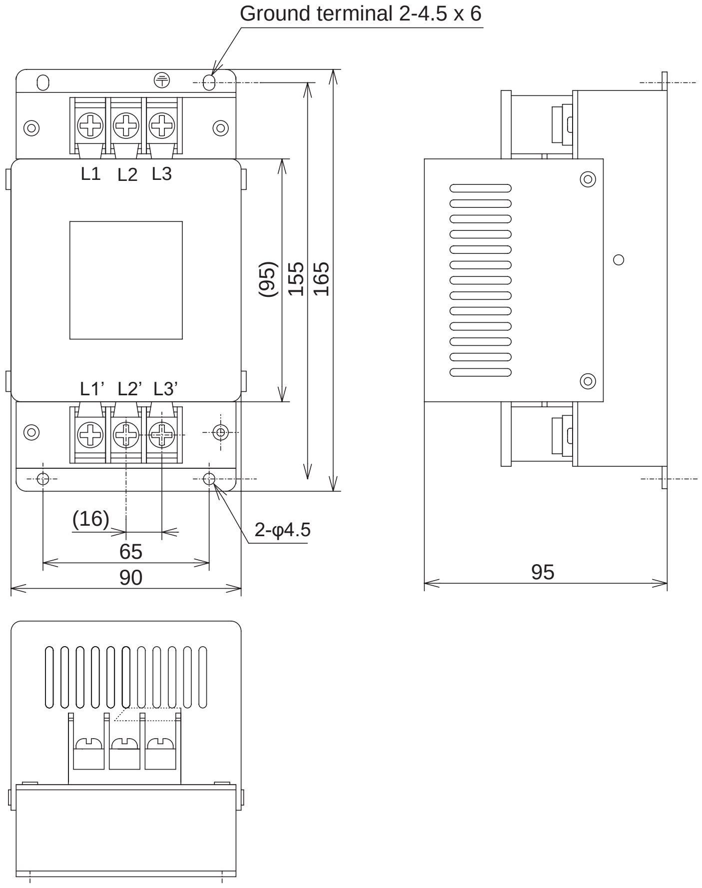
12-10-2 External Dimensions

3G3AX-EFI41/EFI42

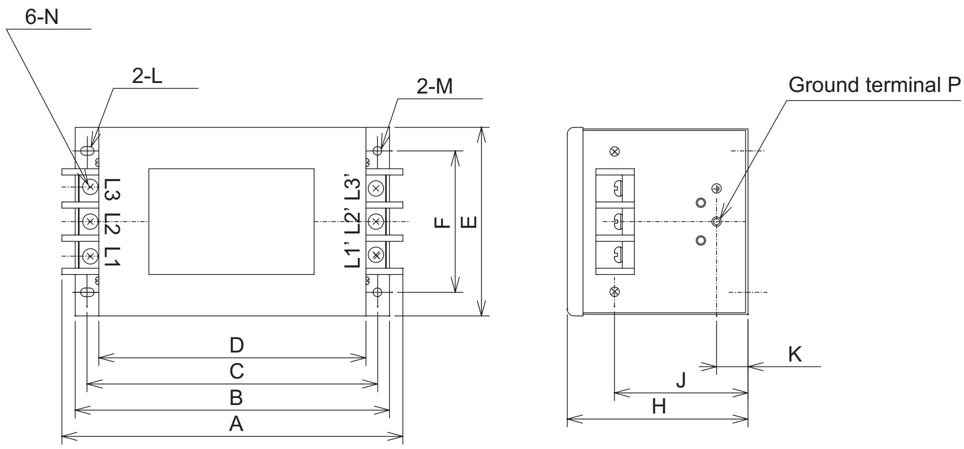
Model	Case, enclosure rating	Screw size	Wire size	Weight [kg]
3G3AX-EFI41	Plastic, IP00	M4	1.25 mm^2, 2 mm^2	0.7
3G3AX-EFI42			2 mm^2	0.7
3G3AX-EFI43		M5	2 mm^2, 3.5 mm^2	1.0
3G3AX-EFI44			5.5 mm^2	1.3
3G3AX-EFI45			8 mm^2	1.4
3G3AX-EFI46	Metal, IP00	M6	14 mm^2	2.9
3G3AX-EFI47			14 mm^2	3.0
3G3AX-EFI48			22 mm^2	3.6
3G3AX-EFI49		M8	30 mm^2, 38 mm^2	4.3
3G3AX-EFI4A			38 mm^2, 60 mm^2	9.0
3G3AX-EFI4B		M10	100 mm^2 or 38 mm^2, 2 wires parallel	16.0



3G3AX-EFI43/EFI44/EFI45

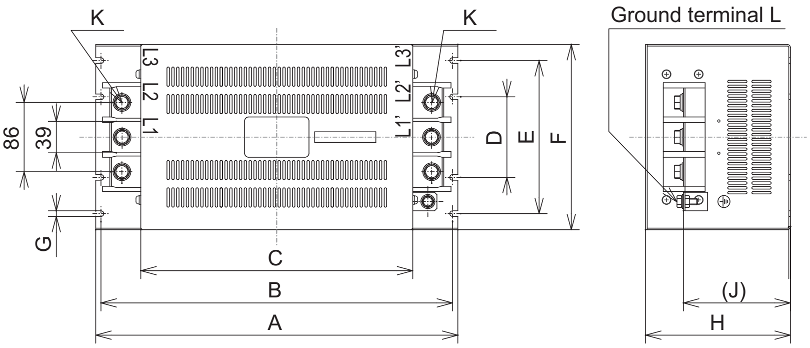


3G3AX-EFI46/EFI47/EFI48/EFI49/EFI4A



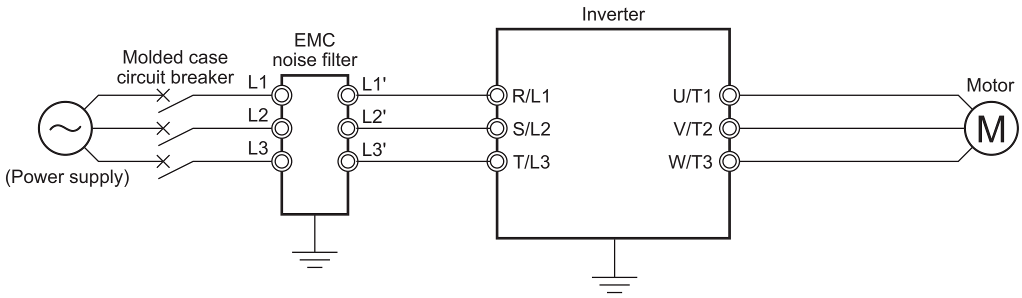
Model	Dimensions [mm]											
	A	B	C	D	E	F	H	J	K	L	M	N	P
3G3AX-EFI46 3G3AX-EFI47 3G3AX-EFI48	217	220	185	170	120	90	115	85	20	R2.75, Length 7	5.5 dia.	M6	M4
3G3AX-EFI49	254	230	215	200	150	120	115	80	30	R3.25, Length 8	6.5 dia.	M8	M6
3G3AX-EFI4A	314	300	280	260	200	170	130	90	35	R3.25, Length 8	6.5 dia.	M8	M6

3G3AX-EFI4B



Model	Dimensions [mm]										
	A	B	C	D	E	F	G	H	J	K	L
3G3AX-EFI4B	450	430	338	100	190	230	7	180	(133)	M10	M8

12-10-3 Connection Example



12-11 Digital Operator (Model: 3G3AX-OP01/OP05)

12-11-1 Specifications

3G3AX-OP01

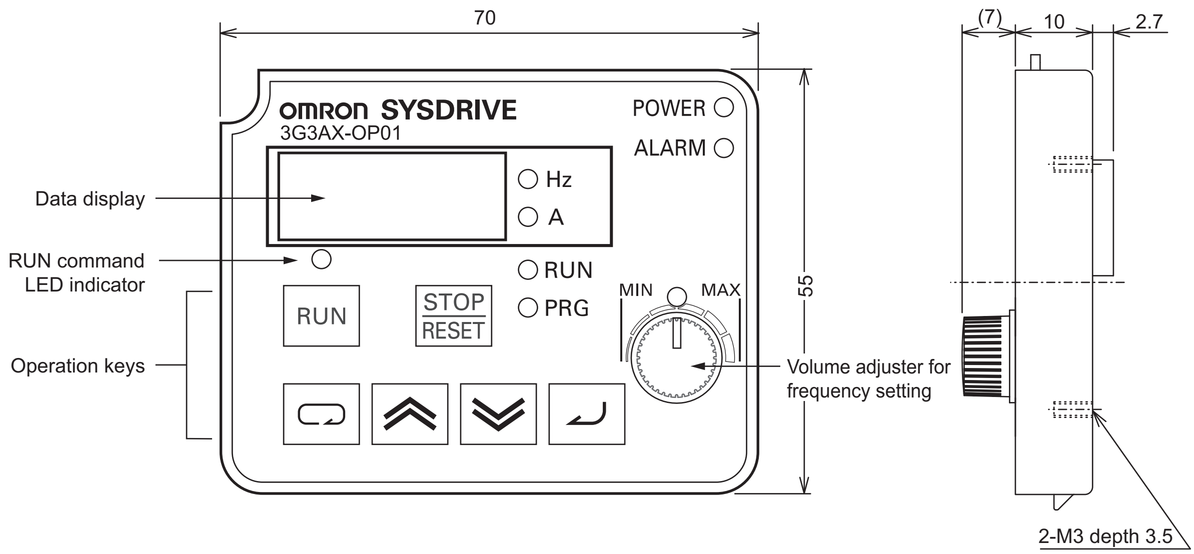
Item	Specifications
Display	LED digital display
External Dimensions	55 x 70 x 10 mm [H x W x D]
Weight	100 g max.
Operating ambient temperature	–10 to 50°C
Operating ambient humidity	20% to 90% (with no condensation)
Storage ambient temperature	–20 to 65°C
Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)
Others	Built-in volume adjuster for frequency setting

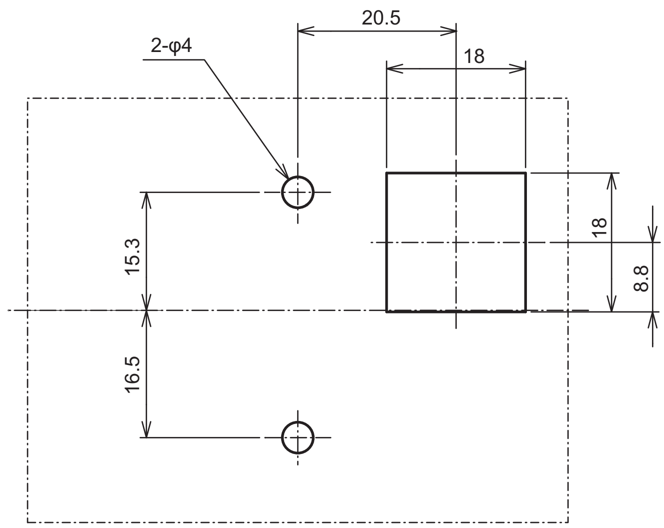
3G3AX-OP05

Item	Specifications
Display	LCD digital display (132 x 64 dots)
Display language	English
External dimensions	123 x 80 x 21 mm [H x W x D]
Weight	100 g max.
Operating ambient temperature	–10 to 50°C
Operating ambient humidity	20% to 90% (with no condensation)
Storage ambient temperature	–20 to 65°C
Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)
Others	• Number of writes to built-in EEPROM during service life: 100,000 times • Battery specifications: Coin type lithium battery CR1220 (Recommended manufacturer: Hitachi Maxell) * When the power supply is OFF, clock data can be backed up for approximately two years (calculated value) if a built-in battery is new. The LCD Digital Operator has a built-in battery for the operation check with shipment. • Clock accuracy: ±1.5 minutes/month

12-11-2 External Dimensions

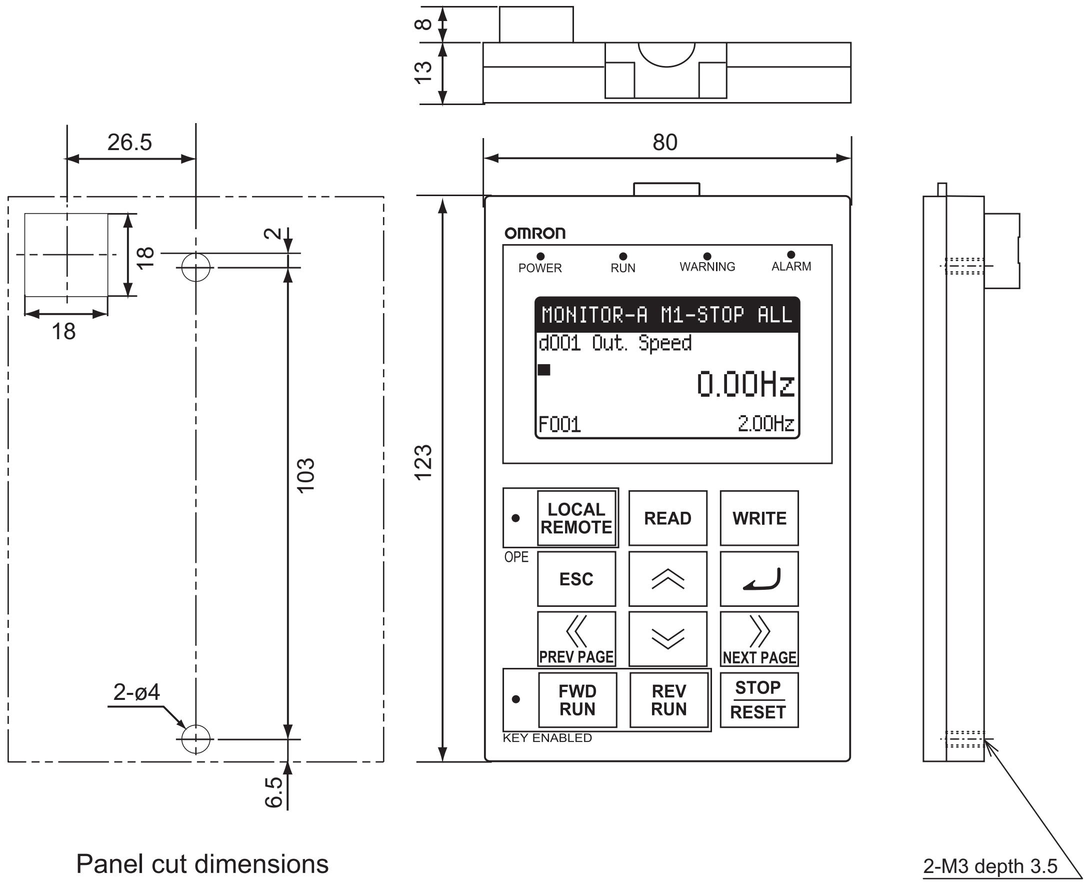
3G3AX-OP01





Panel cut dimensions

3G3AX-OP05


8
13
26.5
80
18
18
2
103
123
2-ø4
6.5
omron
POWER
RUN
WARNING
ALARM
MONITOR-A M1-STOP ALL
d001 Out. Speed
0.00Hz
F001
2.00Hz
LOCAL REMOTE
READ
WRITE
OPE
ESC
PREV PAGE
NEXT PAGE
FWD RUN
REV RUN
STOP RESET
KEY ENABLED
Panel cut dimensions
2-M3 depth 3.5

12-12 Digital Operator Cable (Model: 3G3AX-OPCN☐)

12-12-1 Specifications

Item	Model	
	3G3AX-OPCN1	3G3AX-OPCN3
Connector	RJ45 connector	
Cable	EIA568-compliant cable (UTP category 5)	
Cable length [m]	1	3

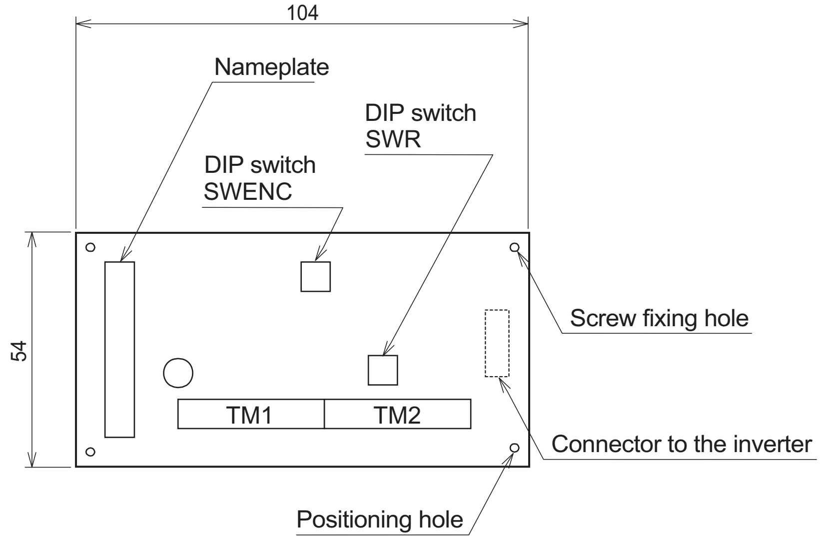
12-13 PG Board (Model: 3G3AX-PG01)

12-13-1 Specifications

Item		Specifications
Speed Control	Encoder feedback	Number of standard encoder pulses: 1024 pulses/rotation Maximum number of input pulses: 100 Kpps
	Speed control method	Proportional integral (PI)/Proportional (P) control
Position control	Position command	• The input mode of the pulse train is one of the following three types, which can be specified as an Inverter setting. Mode 0: 90° phase difference pulse Mode 1: Forward/Reverse signal, pulse train Mode 2: Forward pulse/Reverse pulse • Maximum number of input pulses: 100 Kpps
	Electronic gear	• Pulse ratio A/B (where A and B can take a value between 1 and 9999) • Setting range: 1/50 ≤ A/B ≤ 20
Orientation	Stop position	• 4096 divisions per motor rotation*1
	Speed	• Orientation speed and rotation speed settings available
Protective function		• Encoder cable disconnection protection • Overspeed protection (Overspeed Error Detection Level (P026)) • Positioning error • 3G3AX-PG connection error

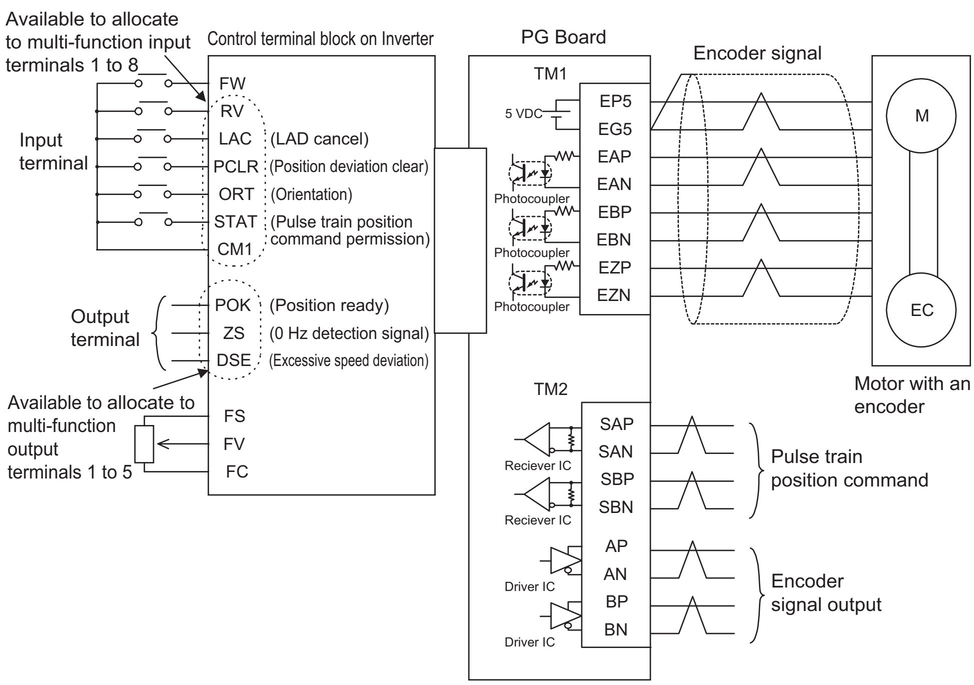
*1. The inverter setting is available.

12-13-2 External Dimensions



TM1, TM2
M2, push-in type
Applicable screwdriver: Flat-blade 0.4 x 2.5
Wire diameter 0.75 mm
Screw tightening torque 0.2 to 0.25 N·m

12-13-3 Connection Examples

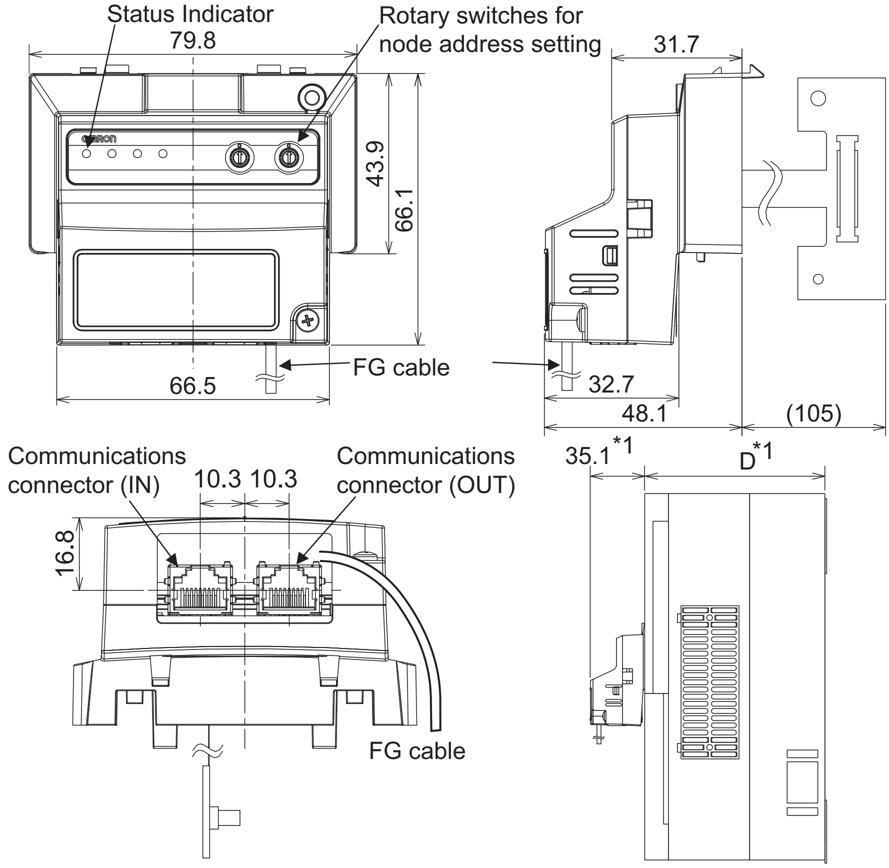


12-14 EtherCAT Communications Unit (Model: 3G3AX-RX-ECT)

12-14-1 Specifications

Item		Specifications
General specifications	Power supply	Supplied from Inverter
	Enclosure rating	Open type (IP20)
	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)
	Weight	100 g max. (Shipping weight: Approx. 200 g)
	EC Directives	EMC Directive: EN61800-3 Low Voltage Directive: EN61800-5-1
	UL/cUL Standards	UL508C
EtherCAT communications specifications	Communications standard	IEC 61158 Type12, IEC 61800-7 CiA 402 drive profile
	Physical layer	100BASE-TX (IEEE802.3)
	Connector	RJ45 x 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 PDO mapping
	Mailbox (CoE)	Emergency messages, SDO requests, SDO responses, and SDO information
	Distributed clock	FreeRun mode (asynchronous)
	LED display	L/A IN (Link/Activity IN) x 1 L/A OUT (Link/Activity OUT) x 1 RUN x 1 ERR x 1
	CiA402 drive profile	Velocity mode

12-14-2 External Dimensions



*1 After the EtherCAT Communication Unit is installed, dimension D of the inverter increases by 35.1 mm. (Dimension D of the inverter varies depending on the capacity. Refer to the manual for the inverter.)

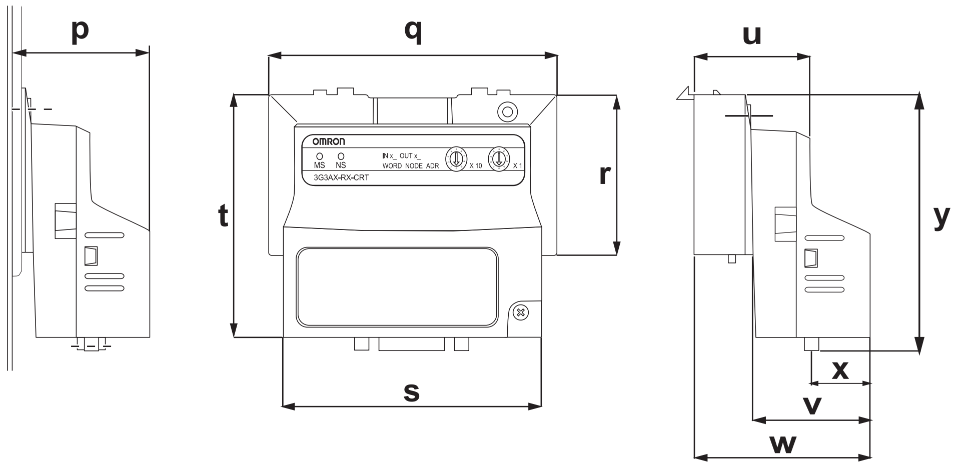
12-15 CompoNet Communications Unit (Model: 3G3AX-RX-CRT-E)

12-15-1 Specifications

Item		Specifications
Mounting	Unit type	RX Series CompoNet Communications Unit
	Model	3G3AX-RX-CRT-E
	Dimensions [Width x Height x Depth]	80 × 67 × 49 mm
	Weight	Approx. 170 g
Environment	Operating ambient temperature	–10 to 50°C (with no freezing or condensation)
	Operating ambient humidity	20% to 90%
	Storage ambient temperature	–20 to 65°C (with no freezing or condensation)
	Vibration resistance	5.9 m/s^2 (0.6 G), 10 to 55 Hz
	Dielectric strength	500 VAC (between isolated circuits)
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)
	Conformance to EMC and electrical safety standards	EN61800-3 Second environment, Category C3
		EN61800-5-1 SELV
	Internal power supply	Supplied from Inverter
	Enclosure rating	IP20
DeviceNet interface	Communications protocol	CompoNet
	Certification	CompoNet conformance test
	CompoNet profile	AC drive (0x02)
	Supported connections	Remote I/O: Master-Slave connection Poll Explicit message Conforming to the CompoNet specifications
	Communications power supply	– (External power supply not required)
	Unit device address range	Node address MAC ID 0 to 63, set via Inverter parameter P190 or rotary switch
	Supported baud rates	4 Mbps, 3 Mbps, 1.5 Mbps, or 93.75 kbps Automatic baud rate detection by Master Unit
DeviceNet configuration	Default connection path	Supported, set via Inverter parameter P046
	Supported assemblies	Basic Speed I/O (Output assembly 20, Input assembly 70) Extended Speed I/O (21, 71) Extended Speed and Torque Control (123, 173) Special I/O (100, 150) Extended Control I/O (101, 151) Extended Control I/O and Multi-function Input Monitor (101, 153) Flexible Format (139, 159) Extended Speed and Acceleration Control (110, 111)*1
	EDS file	Dependent on Inverter model

*1. Use the specified output and input assembly pair.

12-15-2 External Dimensions



Dimensions [mm]									
p*1	q	r	s	t	u	v	w	x	y
35.1	79.8	43.9	66.5	66.1	31.7	32.7	48.1	9.4	68.9

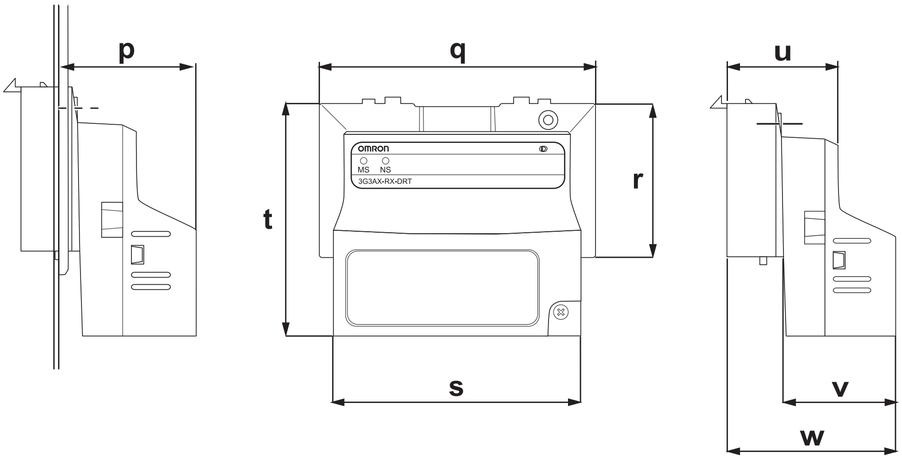
*1. p indicates the depth of the inverter when a CompoNet Communications Unit is installed.

12-16 DeviceNet Communications Unit (Model: 3G3AX-RX-DRT-E)

12-16-1 Specifications

Item		Specifications
Mounting	Unit type	RX Series DeviceNet Communications Unit
	Model	3G3AX-RX-DRT-E
	Dimensions [Width x Height x Depth]	80 × 67 × 49 mm
	Weight	Approx. 170 g
Environment	Operating ambient temperature	–10 to 50°C (with no freezing or condensation)
	Operating ambient humidity	20% to 90%
	Storage ambient temperature	–20 to 65°C (with no freezing or condensation)
	Vibration resistance	5.9 m/s^2 (0.6 G), 10 to 55 Hz
	Dielectric strength	500 VAC (between isolated circuits)
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)
	Conformance to EMC and electrical safety standards	EN61800-3 Second environment, Category C3
		EN61800-5-1 SELV
	Enclosure rating	IP20
DeviceNet interface	Communications protocol	DeviceNet
	Certification	DeviceNet conformance test
	DeviceNet profile	AC drive (0x02)
	Supported connections	Remote I/O: Master-Slave connection Poll Explicit message Conforming to the DeviceNet specifications
	Communications power supply	11 to 25 VDC (50 mA max., 20 mA typ.)
	Unit device address range	Node address MAC ID 0 to 63, set via Inverter parameter P192
	Supported baud rates	125, 250, or500 kbps Automatic baud rate detection by Master Unit
DeviceNet configuration	Default connection path	Supported, set via Inverter parameter P046
	Supported assemblies	Basic Speed I/O (Output assembly 20, Input assembly 70) Extended Speed I/O (21, 71) Extended Speed and Torque Control (123, 173) Special I/O (100, 150) Extended Control I/O (101, 151) Extended Control I/O and Multi-function Input Monitor (101, 153) Flexible Format (139, 159) Extended Speed and Acceleration Control (110, 111) In case the DeviceNet Master Unit is configured using user allocation, only the input/output pairs can be configured.
	EDS file	Dependent on Inverter model

12-16-2 External Dimensions



Dimensions [mm]							
p*1	q	r	s	t	u	v	w
35.1	79.8	43.9	66.5	66.1	31.7	32.7	48.1

*1. p indicates the depth of the RX Inverter when a DeviceNet Communications Unit is installed.

A

Appendices

This section provides information on the capacitor life curve, life warning, and packing dimensions, and as well as an overview of inverter selection.

A

A-1 Smoothing Capacitor Life Curve **A-2**

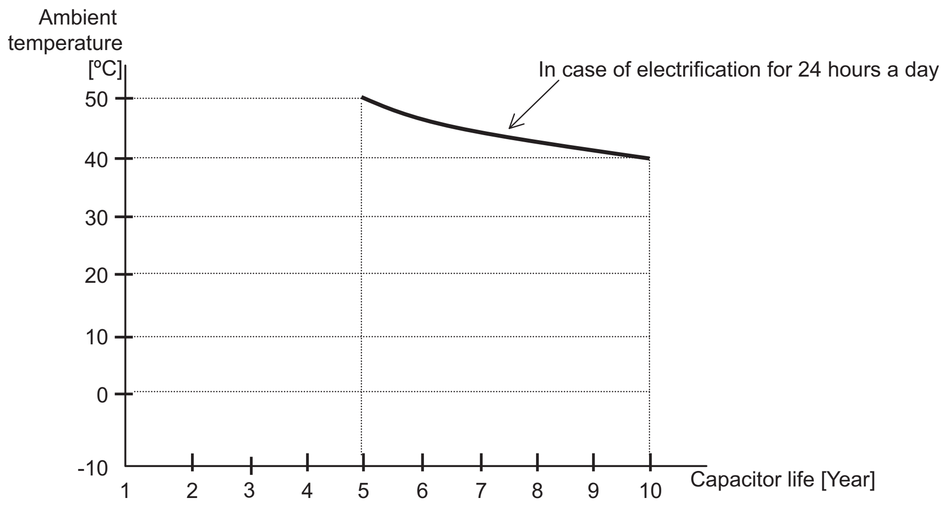
A-2 Life Alarm Output **A-3**

A-3 Packing Dimensions and Weight **A-4**

A-4 Overview of Inverter Selection **A-5**

A-1 Smoothing Capacitor Life Curve

The following graph shows the relationship between the ambient temperature and the life expectancy of the smoothing capacitor that is built into the inverter.



Additional Information

- “Ambient temperature” refers to the temperature measured at a distance of approximately 5 cm from the bottom center of the inverter (atmospheric temperature). It refers to an interior temperature if the inverter is stored in a cabinet.
- The smoothing capacitor has a limited life because it is subjected to chemical reaction inside the part and, as a guide, needs to be replaced once a decade approximately. However, this period is an expected design life, and not the guaranteed value.
  Remember that, if the inverter is used at a high ambient temperature or in a heavy loaded environment, such as at the over-rated current, its life will be significantly shortened.

A-2 Life Alarm Output

The inverter can output an alarm by the self-diagnostic function when the service life of each consumable part incorporated in the inverter such as on-board smoothing capacitors and cooling fans (except for the main circuit smoothing capacitor) comes close to the end. Use this as a guide to know the time for the parts replacement.

For details, refer to *Life Assessment Monitor [d022]* on page 7-8, *Capacitor Life Warning Signal (WAC)* on page 7-134 and *Cooling Fan Life Warning Signal (WAF)* on page 7-134.

Note that this alarm is output by the self-diagnostic function based on the expected design life, not guaranteed value. It has a margin of error depending on your environment or operation conditions.

A-3 Packing Dimensions and Weight

The dimensions, weight, and material of the packing box for the inverter are shown in the table below.

<table>
<tr><th>Rated voltage</th><th>Max. applicable motor capacity</th><th>Model</th><th>Packing box dimensions [W x D x H]</th><th>Weight [kg]</th><th>Packing box material</th></tr>
<tr><td rowspan="15">3-phase 200 VAC</td><td>0.4 kW</td><td>3G3RX-A2004-V1</td><td rowspan="5">345 × 245 × 220</td><td rowspan="5">5</td><td rowspan="14">Cardboard</td></tr>
<tr><td>0.75 kW</td><td>3G3RX-A2007-V1</td></tr>
<tr><td>1.5 kW</td><td>3G3RX-A2015-V1</td></tr>
<tr><td>2.2 kW</td><td>3G3RX-A2022-V1</td></tr>
<tr><td>3.7 kW</td><td>3G3RX-A2037-V1</td></tr>
<tr><td>5.5 kW</td><td>3G3RX-A2055-V1</td><td rowspan="3">355 × 310 × 260</td><td rowspan="3">7</td></tr>
<tr><td>7.5 kW</td><td>3G3RX-A2075-V1</td></tr>
<tr><td>11 kW</td><td>3G3RX-A2110-V1</td></tr>
<tr><td>15 kW</td><td>3G3RX-A2150-V1</td><td rowspan="3">485 × 350 × 290</td><td rowspan="3">17</td></tr>
<tr><td>18.5 kW</td><td>3G3RX-A2185-V1</td></tr>
<tr><td>22 kW</td><td>3G3RX-A2220-V1</td></tr>
<tr><td>30 kW</td><td>3G3RX-A2300-V1</td><td>629 × 402 × 253</td><td>27</td></tr>
<tr><td>37 kW</td><td>3G3RX-A2370-V1</td><td rowspan="2">639 × 482 × 363</td><td>35</td></tr>
<tr><td>45 kW</td><td>3G3RX-A2450-V1</td><td>38</td></tr>
<tr><td>55 kW</td><td>3G3RX-A2550-V1</td><td>880 × 550 × 345</td><td>58</td><td>Wood</td></tr>
<tr><td rowspan="19">3-phase 400 VAC</td><td>0.4 kW</td><td>3G3RX-A4004-V1</td><td rowspan="5">345 × 245 × 220</td><td rowspan="5">5</td><td rowspan="15">Cardboard</td></tr>
<tr><td>0.75 kW</td><td>3G3RX-A4007-V1</td></tr>
<tr><td>1.5 kW</td><td>3G3RX-A4015-V1</td></tr>
<tr><td>2.2 kW</td><td>3G3RX-A4022-V1</td></tr>
<tr><td>3.7 kW</td><td>3G3RX-A4037-V1</td></tr>
<tr><td>5.5 kW</td><td>3G3RX-A4055-V1</td><td rowspan="3">355 × 310 × 260</td><td rowspan="3">7</td></tr>
<tr><td>7.5 kW</td><td>3G3RX-A4075-V1</td></tr>
<tr><td>11 kW</td><td>3G3RX-A4110-V1</td></tr>
<tr><td>15 kW</td><td>3G3RX-A4150-V1</td><td rowspan="3">485 × 350 × 290</td><td rowspan="3">17</td></tr>
<tr><td>18.5 kW</td><td>3G3RX-A4185-V1</td></tr>
<tr><td>22 kW</td><td>3G3RX-A4220-V1</td></tr>
<tr><td>30 kW</td><td>3G3RX-A4300-V1</td><td>629 × 402 × 253</td><td>27</td></tr>
<tr><td>37 kW</td><td>3G3RX-A4370-V1</td><td rowspan="3">639 × 482 × 363</td><td>35</td></tr>
<tr><td>45 kW</td><td>3G3RX-A4450-V1</td><td rowspan="2">38</td></tr>
<tr><td>55 kW</td><td>3G3RX-A4550-V1</td></tr>
<tr><td>75 kW</td><td>3G3RX-B4750-V1</td><td rowspan="2">890 × 470 × 425</td><td rowspan="2">70</td><td rowspan="4">Wood</td></tr>
<tr><td>90 kW</td><td>3G3RX-B4900-V1</td></tr>
<tr><td>110 kW</td><td>3G3RX-B411K-V1</td><td rowspan="2">960 × 590 × 475</td><td rowspan="2">100</td></tr>
<tr><td>132 kW</td><td>3G3RX-B413K-V1</td></tr>
</table>

A-4 Overview of Inverter Selection

Motor Capacity Selection

Before selecting an inverter, first the motor should be chosen. In selecting the motor, calculate the load inertia appropriate to the application, and then calculate the required capacity and torque.

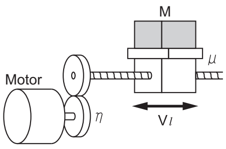
■ Simplified Selection Method (Required Output Calculation)

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. The simplified selection method is suitable for fan, conveyor, mixer, and other applications where a constant state continues for a while.

* The simplified selection method 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 the power transfer part.
- Those that have an inefficient power transfer part.

- For linear motion: Steady power P0 [kW]

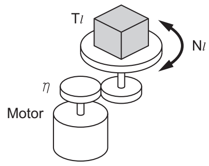


$$P_0\,[\mathrm{kW}] = \frac{\mu \cdot Mg \cdot V_l}{60 \cdot \eta} \times 10^{-3}$$

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 ($\eta \leq 1$)

* The same calculating formula is applicable to belt conveyors.

- For rotation motion: Steady power P0 [kW]



$$P_0\,[\mathrm{kW}] = \frac{2\pi \cdot T_l \cdot N_l}{60 \cdot \eta} \times 10^{-3}$$

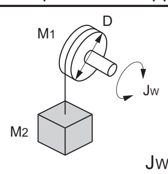
T_l : Load torque (Load shaft) [N·m]
N_l : Rotation speed of load shaft [r/min]
η : Efficiency of transfer part ($\eta \leq 1$)

■ 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. It selects a motor that is optimal for a particular operation pattern.

- Calculation of load inertia and motor-shaft conversion inertia
  Depending on the type of the motor transfer system, calculate the inertia for all parts and convert it into the motor-shaft inertia.

• Example in hoist application

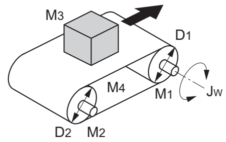


J_W [kg·m^2]

$$= J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4}\right) \times 10^{-6}$$

J_W : Shaft conversion inertia [kg·m^2]
J_1 : Inertia of cylinder (Shaft conversion) [kg·m^2]
J_2 : Inertia of workpiece (Shaft conversion) [k·m^2]
M_1 : Mass of cylinder [kg]
M_2 : Mass of workpiece [kg]
D : Diameter of cylinder [mm]

• Example in conveyor application

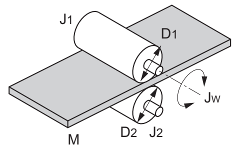


J_W [kg·m^2]

$$= J_1+J_2+J_3+J_4 = \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} \cdot \frac{D_1^2}{D_2^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4}\right) \times 10^{-6}$$

J_W : 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]

• Example in roller application

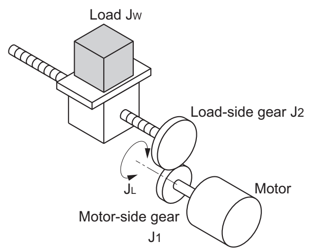


J_W [kg·m^2]

$$= J_1 + \left(\frac{D_1^2}{D_2^2}\right) J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6}$$

J_W : 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



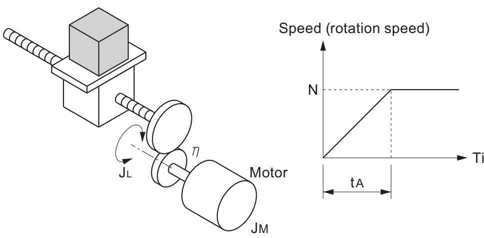
J_L: [kg·m^2]$=J_1+G^2(J_2+J_W)$

J_L : Motor-shaft conversion inertia [kg·m^2]
J_W : Load inertia (Load-side gear-shaft conversion) [kg·m^2]
J_1 : Inertia of motor-side gear [kg·m^2]
J_2 : Inertia of load-side gear [kg·m^2]
Z_1 : Number of motor-side gear teeth
Z_2 : Number of load-side gear teeth
G : Gear ratio (Speed reduction ratio) = Z1 / Z2

- 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. Then, calculate the load torque from the external force (gravity and tension) and friction force applied to the load. Finally, combine these calculation results to calculate the torque required for the motor.

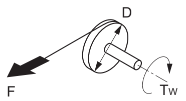
• Calculation of acceleration torque (TA)



$$T_A\,[\mathrm{N\cdot m}] = \frac{2\pi\cdot N}{60\cdot t_A}\left(J_M + \frac{J_L}{\eta}\right)$$

T_A : Acceleration torque [N·m]
J_L : Motor-shaft conversion load inertia [kg·m^2]
J_M : Motor-rotor inertia [kg·m^2]
η : Efficiency of transfer part ($\eta \leq 1$)
t_A : Acceleration time [s]
N : Motor rotation speed [r/min]

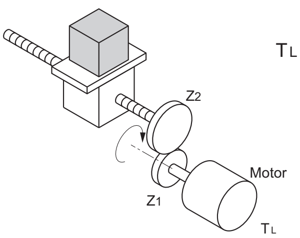
• Calculation of motor-shaft conversion load torque (TL)



$$T_W\,[\mathrm{N\cdot m}] = F\cdot\frac{D}{2}\times 10^{-3}$$

T_W: Load torque (Load-shaft conversion) [N·m]
F : External force [N]
D : Diameter of cylinder [mm]

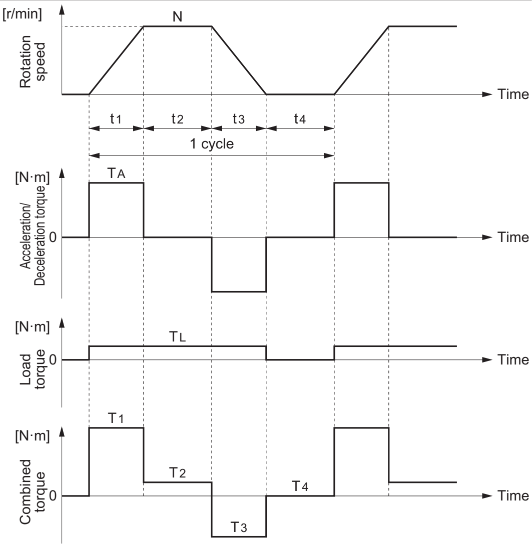
(Generally, the friction force can be calculated as:
F= μMg [N], where
μ : Coefficient of friction
M : Mass of motion part [kg]
g : Acceleration of gravity (g≈9.8 [m/s^2])



$$T_L\,[\mathrm{N\cdot m}] = T_W\cdot\frac{G}{\eta}$$

T_L : Motor-shaft conversion load torque [N·m]
T_W : Load torque (Load-shaft conversion) [N·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} [N·m]

$$= \sqrt{\frac{\sum (T_i{}^2\cdot t_i)}{\sum t_i}}$$

$$= \sqrt{\frac{T_1{}^2\cdot t_1 + T_2{}^2\cdot t_2 + T_3{}^2\cdot t_3 + T_4{}^2\cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

· Maximum torque T_{MAX} [N·m] $= T_1 = T_A + T_L$

- Motor selection

Based on the above calculation results, select the motor capacity by using the following formulae.
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]

* The above calculation formulae assume that the maximum motor toque is 150% of the rated torque.

Inverter Capacity Selection

Select an inverter that can be used with the motor you selected based on the result of motor capacity selection. Basically, select an inverter which fits the maximum applicable motor capacity of the selected motor.
After selecting an inverter, check if 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
Max. continuous torque output time for application ≤ 1 min

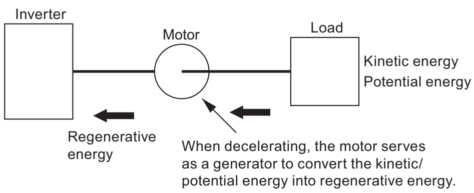
Note 1. In the light load mode, the overload capacity of the inverter is 150% of the rated torque for 5 seconds. Use the 5-seconds rating when determining the maximum continuous torque.
2. If you want to use 0-Hz sensorless vector control, need a holding torque at a rotation speed of 0 (r/min), or frequently 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.

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 (0 V) 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 prevented.
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 a motor has kinetic energy when rotating, and potential energy when it is subject to the gravity. When the motor decelerates, or when the load descends, the energy is fed back to an inverter. This phenomenon is known as regeneration, and the energy is called regenerative energy.



- Preventing an overvoltage (0 V) in main circuit without use of braking resistors
  The following are methods to prevent the occurrence of an overvoltage (0 V) in the main circuit without connection of braking resistors.
  Since these methods prolong the deceleration time, check that the selected method will not cause application problems.

• Enable the Overvoltage 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 overvoltage in the main circuit.

• Set a longer deceleration time

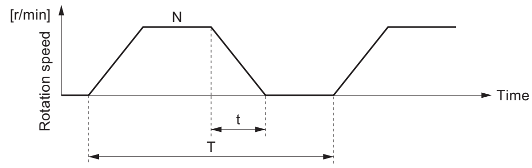
Increase the deceleration time to prevent the occurrence of an overvoltage in the main circuit.
This decreases the amount of regenerative energy per unit time.

• 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 x t/T
t: Deceleration time (regenerative time) [s]
T: 1cycle operation time [s]

- For models with built-in regenerative braking circuit (3G3RX with a capacity of 22 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.

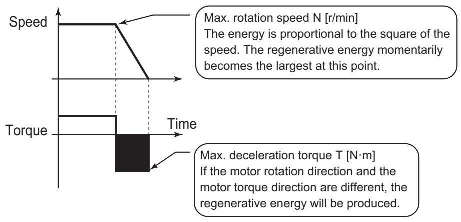
- For models without built-in regenerative braking circuit (3G3RX with a capacity of 30 kW or higher)

Select an appropriate regenerative braking unit and braking resistor.
Connect a regenerative braking unit and braking resistor suitable for your inverter according to the regenerative braking unit/braking resistor list provided in the inverter manual and catalog.

Detailed Braking Resistor Selection

When the usage rate of the braking resistor selected on the previous page exceeds 10% ED, or when an extremely large braking torque is required, use the method below to calculate a regenerative energy and make your selection.

- Calculation of Required Braking Resistance



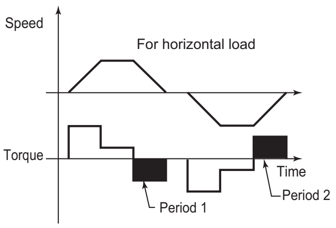
Resistance of braking resistor: $R \leq \dfrac{60 \times V^2}{2\pi \cdot (T - 0.2 \times Tm) \cdot N}$

V : 200-V class inverter 362.5 [V]
400-V class inverter 725 [V]
T : Maximum braking torque [N·m]
Tm : Motor rating torque [N·m]
N : Maximum rotation speed [r/min]

Note: Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

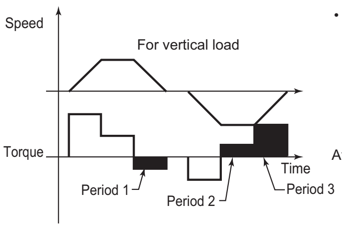
- Calculation of average regenerative energy

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 1 [J] i
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]



- For the average regenerative energy, calculate the time average by adding the regenerative energy for all periods in a cycle and dividing it by the cycle time, as shown below.

Average regenerative energy [W] = $\dfrac{(P1 + P2 + \cdot\cdot\cdot + P\,i)\,[J]}{1 \text{ cycle time [s]}}$

Note)
1. For Speed, the forward rotation direction is indicated as positive. For Torque, the torque in the forward rotation direction is indicated as positive.
2. Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

- Braking Resistor Selection

Select a braking resistor from the required braking resistance and the average regenerative energy on the left.

- Required braking resistance ≥ Resistance of braking resistor ≥ Min. connection resistance of inverter or regenerative braking unit
- Average regenerative energy ≤ Resistance capacity of braking resistor

Note)
1. Connecting a braking resistor whose resistance is less than the minimum connection resistance value of the inverter or regenerative braking unit results in damage to the internal braking transistor. If the required braking resistance is less than the minimum connection resistance, change the inverter or regenerative braking unit to one having a larger capacity and ensure that the required braking resistance is not less than the minimum connection resistance.
2. Two or more regenerative braking units can be connected in parallel. Refer to the following formula to know the braking resistance value in such a case: Braking resistance [ ] = (Required braking resistance calculated as above) x (No. of units)
3. Make allowance for the resistance capacity of the braking resistor. Select a braking resistor whose capacity is at least 20% larger than the calculated value. Otherwise, it may be overheated.

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