Cat. No. I570-E1-02

OMRON

USER'S MANUAL

SYSDRIVE MX2 SERIES

Multi-function Compact Inverter

To: All Customers

August 2010
OMRON Corporation
Automation Systems HQ

SYSDRIVE MX2 Series User's Manual Notification of Additional Information

Cat. No. I570-E1-02

Thank you for supporting OMRON and OMRON products.
It was discovered that the following information is missing from the *SYSDRIVE MX2 Series User's Manual*. We sincerely apologize for this oversight.
Please mark your manuals so that the corrections are noted on the pages concerned, and then securely add any required pages from this *Notification* to the rear of the manual.

■ Applicable Manual

- This *Notification* applies to the *SYSDRIVE MX2 Series Multi-function Compact Inverter User's Manual* that was issued in March 2010 (Cat. No. I570-E1-02).

1. Relevant location: Page 2-8, Digital Specifications in *Control Circuit Terminals*

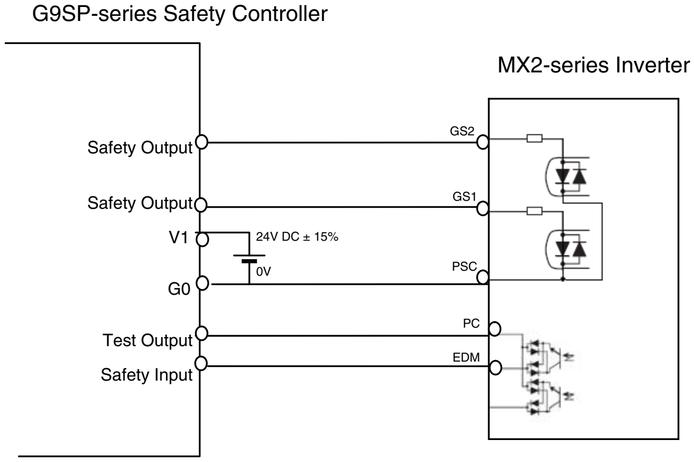
■ Additional Information

Digital	Input	Contact	S7/EB S6 S5/TH S4/GS2 S3/GS1 S2 S1	Multi-function input terminal	Select 7 functions from among 59, and allocate them to terminals S1 through S7/EB. Both sink and source logics are supported. For details, refer to "Connection to Programmable Controller (PLC)" on page 2-22.	Voltage between each input and PSC ON voltage: 18 V min. OFF voltage: 3 V max. Allowable max. voltage: 27 VDC Load current: 5 mA (at 24 V) Internal resistance: 4.7 kΩ
			S4/GS2 S3/GS1	Safety input	Enabled when the safety function selector switch is turned ON. For details, refer to "Safety Function" on page 5-170.	

2. Relevant location: Page 5-172, *Wiring Example*

■ Additional Information

When using the EDM function, we recommend that you use the following wiring example to connect to the Safety Controller.



When connecting to more that one Safety Controller or when connecting to other safety devices, use the above diagram for reference and make sure that the devices are used within their operating ratings.

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August 2010
OMRON Corporation
Automation Systems HQ

SYSDRIVE MX2 Series User's Manual Notification of Additional Information

Cat. No. I570-E1-02

Thank you for supporting OMRON and OMRON products.
The SYSDRIVE MX2 Series Multi-function Compact Inverters have been certified for additional international safety standards. Please mark your manuals so that the corrections are noted on the pages concerned, and then securely add any required pages from this *Notification* to the rear of the manual.

■ Applicable Manual

This *Notification* applies to the *SYSDRIVE MX2 Series Multi-function Compact Inverter User's Manual* that was issued in March 2010 (Cat. No. I570-E1-02).

1. Relevant location: Page 1-2, *International Standards*

■ Additional Information

International Standards (EC Directives and UL/cUL Standards)

The 3G3MX2 Inverter meets the EC Directives and UL/cUL standard requirements for worldwide use.

Classification		Applicable standard
EC Directives	EMC directive	EN61800-3: 2004
	Low-voltage directive	EN61800-5-1: 2003
UL/cUL Standards		UL508C

↓

International Standards

The 3G3MX2-series Inverters meet the following international standards

Classification		Applicable standard
EC Directives	Machinery Directive 2006/94/EC	EN ISO13849-1:2008 PLd EN 61800-5-2 EN 60204-1
	Low-voltage directive	EN 61800-5-1
	EMC directive	EN 61800-3
UL		UL508C
		CSA-C22.2 No. 14

Safety functions are supported.
The 3G3MX2-series Inverters meet requirements for IEC 60204-1 Stop Category 0 operation and ISO 13849-1 Performance Level PLd of the Machinery Directive.
For details, refer to *5-13 Safety Function* on page 5-170.

Introduction

Thank you for choosing the multi-function Inverter 3G3MX2. This User's Manual (hereinafter called "this manual") describes the parameter setting methods required for installation/wiring and operation of the 3G3MX2 model, as well as troubleshooting and inspection methods.

- This manual should be delivered to the actual end user of the product.
- After reading this manual, keep it handy for future reference.
- This manual describes the specifications and functions of the product as well as the relations between them. You should assume that anything not described in this manual is not possible with the product.
- Intended readers
  This manual is intended for those with knowledge of the workings of electricity (qualified electric engineers or the equivalent), and also in charge of:
  - Introducing the control equipment
  - Designing the control system
  - Installing and/or connecting the control equipment
  - Field management

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY
OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON. OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY
OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY. In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted. IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE
OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products. At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use. The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products: • Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual. • Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations. • Systems, machines, and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to the products. NEVER USE THE PRODUCTS 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 PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS
OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

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 model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS
Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA
Performance data given in this manual 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 users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS
The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Safety Precautions

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 3G3MX2 Inverter.
The information provided here is vital to safety. Strictly observe the precautions provided.

Meanings of Signal Words

WARNING	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Alert Symbols in this Document

	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.
	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 block cover during the power supply and 10 minutes after the power shutoff. Doing so may result in a serious injury due to an electric shock.
	Do not operate the Digital 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 has been 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 shutoff function is activated.
	Do not change wiring, slide switches, or optional devices while power is being supplied. Always turn off the power supply to the Inverter before changing wiring, changing the slide switches, or attaching/removing options.
	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 shutoff. 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 overheating 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 this 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.

Transporting, 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 terminal block cover, but hold by the fins during transportation.
- 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.

Main Circuit Power Supply

- Confirm that the rated input voltage of the Inverter is the same as AC power supply voltage.

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.

Maintenance and Inspection

- Be sure to confirm safety before conducting maintenance, inspection or parts replacement.
- The life of the capacitor depends on ambient temperatures. Refer to the diagram of product life specified in the manual. When the capacitor stops operating at the end of the product's life, the Inverter must be replaced.

Precautions for Correct Use

Installation

- Mount the product vertically on a wall with the product's longer sides upright.
  The material of the wall has to be nonflammable such as a metal plate.

Restart after Trip

- Do not come close to the machine when using the Restart During Momentary Power Interruption function 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.

Operation Stop Command

- Provide a separate emergency stop switch because the STOP key on the Digital 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

- The Inverter consists of many parts, and these parts must operate properly in order to make full use of the designed functions of the Inverter. Among the electronic components, there are some that require maintenance depending on their usage conditions. In order to keep the Inverter operating normally over a long period of time, it is necessary to perform periodic inspections and replace parts according to their service life.

Product Disposal

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

Warning Labels

Warning labels are located on the Inverter as shown in the following illustration.
Be sure to follow the instructions.

Warning Description

危　険 ー けが・感電のおそれがあります。

WARNING ー Risk of electric shock.

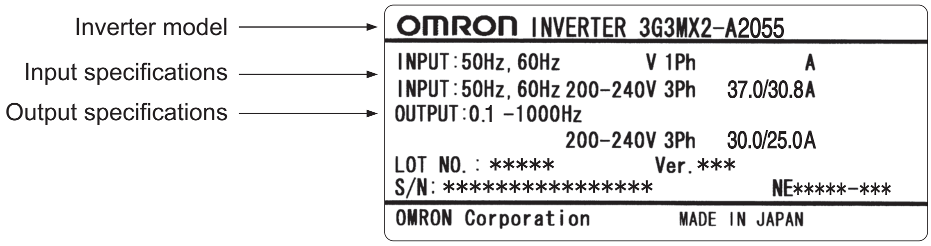
- 据え付け、運転の前には必ず取扱説明書をお読み下さい。
- 通電中及び電源遮断後10分以内はフロントカバーを外さないで下さい。
- Read manual before installing.
- Wait 10 minutes for capacitor discharge after disconnecting power supply.

Checking Before Unpacking

Checking the Product

On delivery, be sure to check that the delivered product is the Inverter 3G3MX2 model that you ordered.
Should you find any problems with the product, immediately contact your nearest local sales representative or OMRON sales office.

Checking the Nameplate



Checking the Model

3 G 3 M X 2 - A 2 0 5 5

Maximum applicable motor capacity (CT rating)

001	0.1 kW
002	0.2 kW
004	0.4 kW
007	0.75 kW
015	1.5 kW
022	2.2 kW
030	3.0 kW
037	3.7 kW
040	4.0 kW
055	5.5 kW
075	7.5 kW
110	11 kW
150	15 kW

Voltage class

B	1-phase 200 V AC (200 V class)
2	3-phase 200 V AC (200 V class)
4	3-phase 400 V AC (400 V class)

Enclosure rating

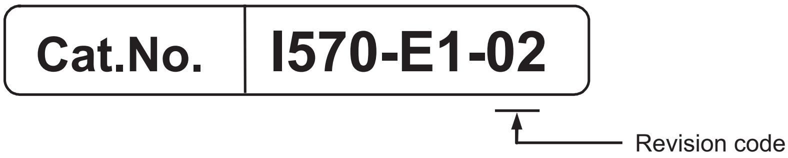
A	Panel-mounting (IP10 min.) or closed wall-mounting models

Checking the Accessories

Note that Instruction manual is the only accessory included with the 3G3MX2 model.
Mounting screws and other necessary parts must be provided by the user.

Revision History

A manual revision code appears as a suffix to the catalog number located at the lower left of the front and back covers.



Revision code	Revision date	Changes and revision pages
01	September 2009	First printing
02	March 2010	Revised information on the simple position control function and revised/corrected manual contents.

About This Manual

This User's Manual is compiled chapter by chapter for user's convenience as follows.
Understanding the following configuration ensures more effective use of the product.

		Overview
Chapter 1	Overview	Describes features and names of parts.
Chapter 2	Design	Provides external dimensions, installation dimensions, peripheral device design/selection instructions, and other information necessary for design.
Chapter 3	Operation	Describes names of parts, the Inverter's operations, including how to use the keys on the Digital Operator, and the monitor function.
Chapter 4	Parameter List	List of parameters set via Digital Operator.
Chapter 5	Functions	Describes the functions of the Inverter.
Chapter 6	Communication Function	Describes the Modbus-RTU communication.
Chapter 7	Maintenance Operations	Describes the causes and their countermeasures if the Inverter fails, including the solutions to possible troubles (troubleshooting).
Chapter 8	Inspection and Maintenance	Describes items for periodical inspection and/or maintenance for the Inverter.
Chapter 9	Specifications	Provides Inverter specifications, as well as the specifications and dimensions of peripheral devices.
Appendix		Describes the derating chart, capacitor life curve, compliance with international standards and index.

Contents

Contents

1

Overview

Describes the features, operating procedures, performance specifications and other aspects of this Unit.

1-1 Functions

3G3MX2 Inverter Models

Rated voltage	Enclosure ratings	Max. applicable motor capacity		Model
		CT: Heavy load	VT: Light load	
3-phase 200 VAC	IP20	0.1kW	0.2 kW	3G3MX2-A2001
		0.2 kW	0.4 kW	3G3MX2-A2002
		0.4 kW	0.75 kW	3G3MX2-A2004
		0.75 kW	1.1 kW	3G3MX2-A2007
		1.5 kW	2.2 kW	3G3MX2-A2015
		2.2 kW	3.0 kW	3G3MX2-A2022
		3.7 kW	5.5 kW	3G3MX2-A2037
		5.5 kW	7.5 kW	3G3MX2-A2055
		7.5 kW	11 kW	3G3MX2-A2075
		11 kW	15 kW	3G3MX2-A2110
		15 kW	18.5 kW	3G3MX2-A2150
3-phase 400 VAC	IP20	0.4 kW	0.75 kW	3G3MX2-A4004
		0.75 kW	1.5 kW	3G3MX2-A4007
		1.5 kW	2.2 kW	3G3MX2-A4015
		2.2 kW	3.0 kW	3G3MX2-A4022
		3.0 kW	4.0 kW	3G3MX2-A4030
		4.0 kW	5.5 kW	3G3MX2-A4040
		5.5 kW	7.5 kW	3G3MX2-A4055
		7.5 kW	11 kW	3G3MX2-A4075
		11 kW	15 kW	3G3MX2-A4110
		15 kW	18.5 kW	3G3MX2-A4150
1-phase 200 V AC	IP20	0.1 kW	0.2 kW	3G3MX2-AB001
		0.2 kW	0.4 kW	3G3MX2-AB002
		0.4 kW	0.55 kW	3G3MX2-AB004
		0.75 kW	1.1 kW	3G3MX2-AB007
		1.5 kW	2.2 kW	3G3MX2-AB015
		2.2 kW	3.0 kW	3G3MX2-AB022

International Standards (EC Directives and UL/cUL Standards)

The 3G3MX2 Inverter meets the EC Directives and UL/cUL standard requirements for worldwide use.

Classification		Applicable standard
EC Directives	EMC directive	EN61800-3: 2004
	Low-voltage directive	EN61800-5-1: 2003
UL/cUL Standards		UL508C

High-performance, Multi-function Compact Inverter Supporting Wide-ranging Applications

Powerful Torque Ideal for a Variety of Applications

High starting torque

With the sensorless vector control and auto-tuning functions, this Unit ensures high starting torque of 200% at 0.5 Hz.

Note. The frame may have to be raised depending on the condition.

Overload limit/Overcurrent Suppression function

(1) The Inverter monitors the motor current during acceleration or constant speed operation in order to lower output frequency automatically.
(2) This function suppresses significant change in current caused by rapid acceleration, etc. Acceleration will be suppressed temporarily if the output current reaches approx. 180% of the rated current during acceleration.

Various Applications

Safety Function

Conforming to stop category 0 under IEC60204-1 and the ISO13849-1: 2006 (PLd) standard (certification pending)

Simple Position Control Function

(1) Comes standard with the pulse input functions.
(2) Supporting simple positioning to a maximum of 8 points by setting the position command, speed reference and acceleration/deceleration time to parameters.

Comes Standard with RS-485 (Modbus-RTU)

(1) Comes standard with the Modbus-RTU communication function to communicate with, and also read/write various parameters from/to, the host equipment.
Broadcasting from the host equipment is also supported.

(2) Transfer Speed: Supporting speeds up to 115.2 kbps
(3) Co-inverter communication is also supported.

Side-by-Side (Zero Clearance) Installation

Since the Inverter can be installed with its right or left face contacting a wall or other structure, the installation space can be reduced.

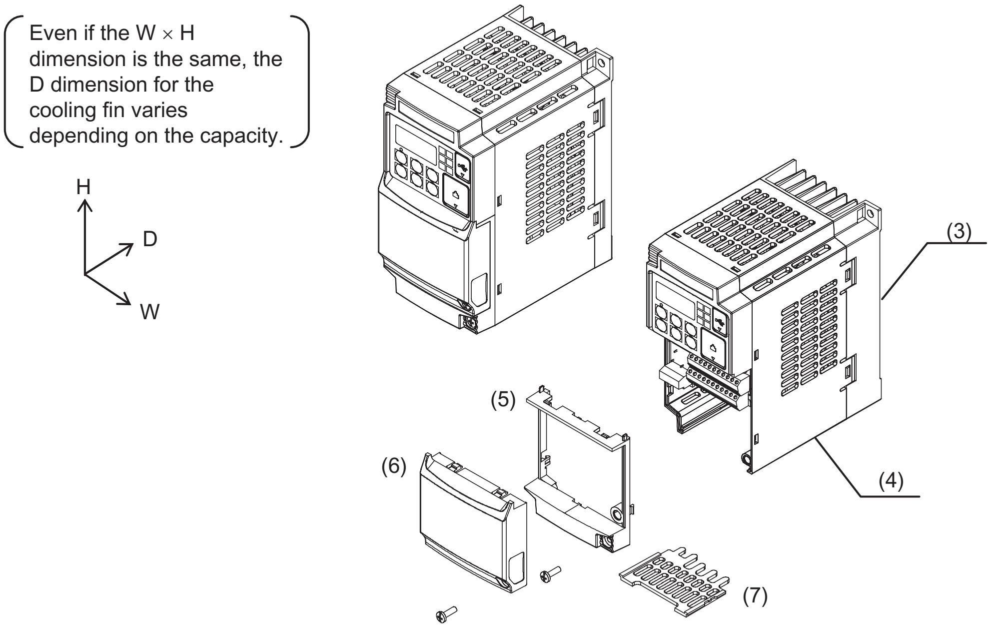
Note. The carrier frequency, etc. must be derated depending on the model.

Password Function

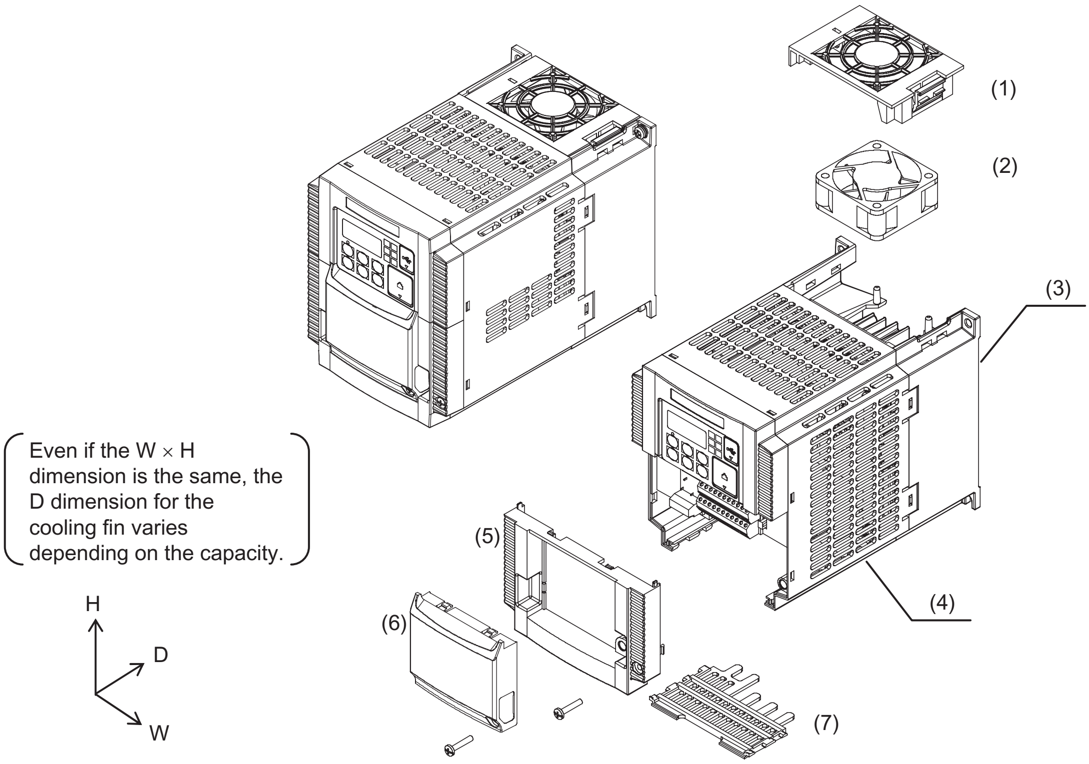
Comes with the password function to prevent reading or changing of parameters without proper access privileges.

1-2 Appearance and Names of Parts

1-phase 200 V 0.1, 0.2, 0.4 kW
3-phase 200 V 0.1, 0.2, 0.4, 0.75 kW



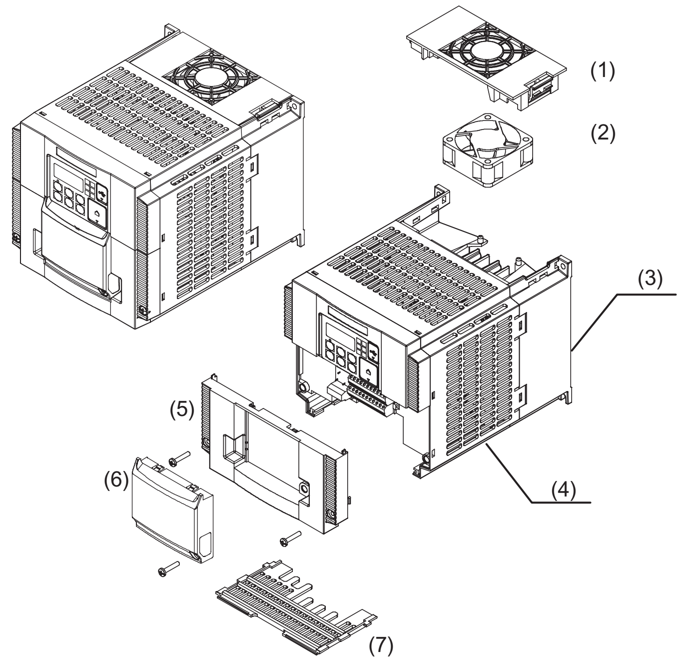
1-phase 200 V 0.75, 1.5, 2.2 kW
3-phase 200 V 1.5, 2.2 kW
3-phase 400 V 0.4, 0.75, 1.5, 2.2, 3.0 kW



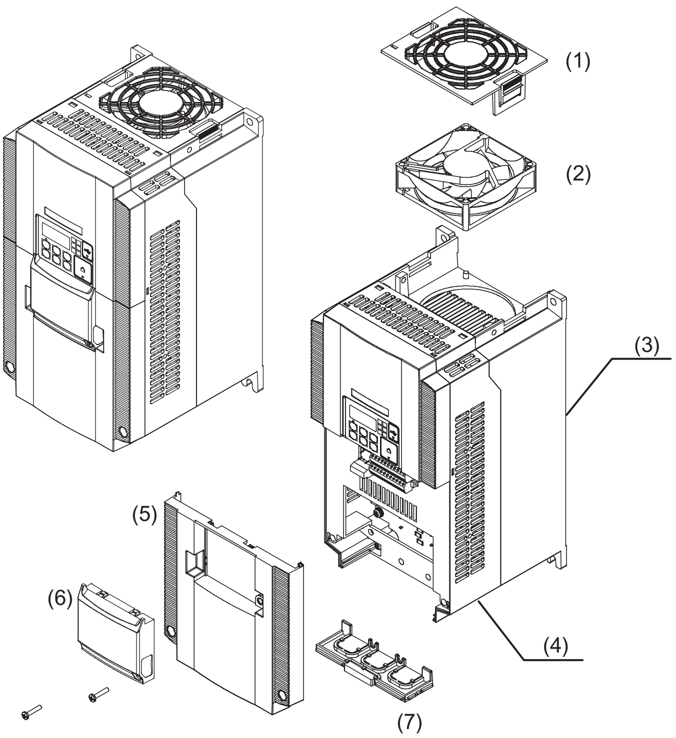
(1) Cooling fan cover
(2) Cooling fan
(3) Cooling fin
(4) Main housing
(5) Terminal block cover
(6) Optional board cover
(7) Backing plate

Note: • 3-phase 200 V/0.75 kW models come with a cooling fan.
• 1-phase 200 V/0.75 kW models and 3-phase 400 V/0.4 kW/0.75 kW models do not come with a cooling fan.

3-phase 200 V 3.7 kW
3-phase 400V 4.0 kW

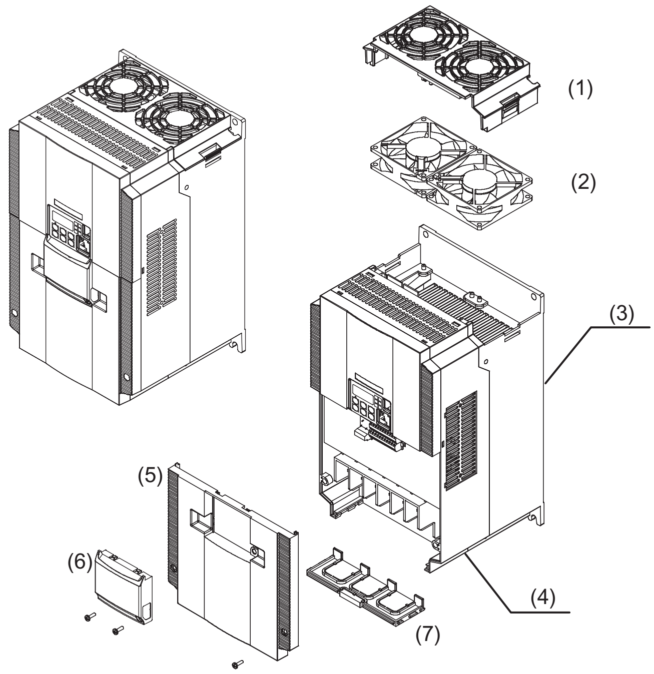


3-phase 200 V 5.5, 7.5 kW
3-phase 400 V 5.5, 7.5 kW

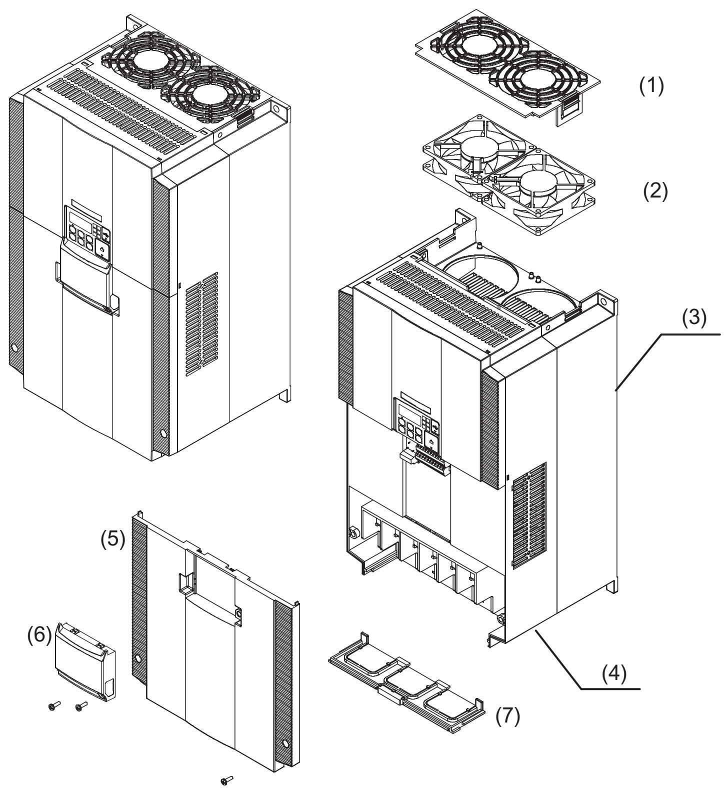


(1) Cooling fan cover
(2) Cooling fan
(3) Cooling fin
(4) Main housing
(5) Terminal block cover
(6) Optional board cover
(7) Backing plate

3-phase 200 V 11 kW
3-phase 400 V 11, 15 kW



3-phase 200 V 15 kW



(1) Cooling fan cover
(2) Cooling fan
(3) Cooling fin
(4) Main housing
(5) Terminal block cover
(6) Optional board cover
(7) Backing plate

2

Design

Describes the name and function of each part, installation method, wiring method, etc.

2-1 Installation

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 any strong impact to the Inverter to avoid damage to the parts and/or the Inverter.
- When transporting the Inverter, hold the fin, not the front cover or terminal block cover.
- Do not connect an AC power supply to the control I/O terminals. Doing so may cause damage to the Inverter.
- Be sure to tighten the screws on the terminal block securely. Perform the wiring after installing the Inverter.
- Do not connect any load other than the 3-phase induction motor to the output terminals (U/T1, V/T2, W/T3) of the Inverter.

- Take appropriate and sufficient countermeasures when using the Inverter in the following locations. Not doing so may result in damage to the Inverter.
  - Locations subject to static electricity or other forms of noise.
  - Locations subject to strong electromagnetic fields.
  - Locations close to power supplies.

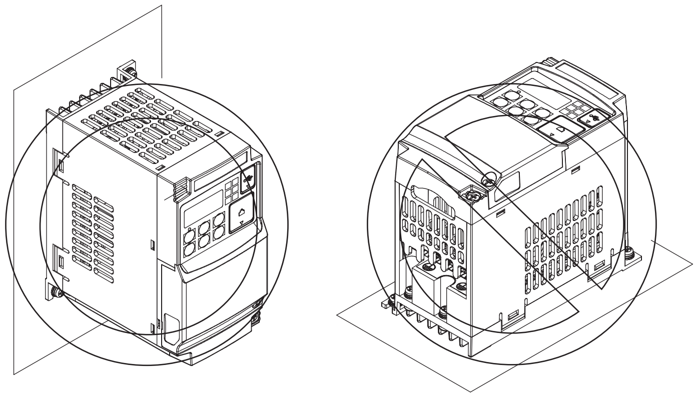
Main Circuit Power Supply

- Confirm that the rated input voltage of the Inverter matches the AC power supply voltage.

Precautions for Correct Use

Installation

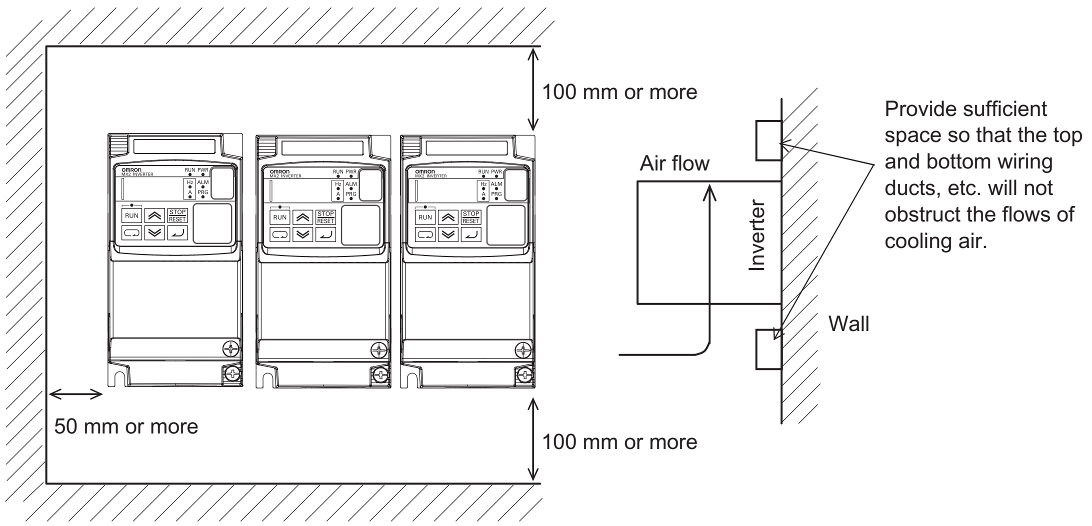
- Install the Inverter vertically on a wall.
  Install the Inverter on a nonflammable wall surface material, like metal.



Installation Environment

Make sure the ambient temperature remains within the rated range (–10 to 50°C). Take note that if the ambient temperature reaches or exceeds 40°C, the carrier frequency and output current must be derated. If the Inverter is used in an environment exceeding the allowable operating temperature range, the product life of the Inverter (specifically, the capacitor) will be shortened.
Measure and check the temperature approx. 5 cm from the bottom center of the Inverter body.

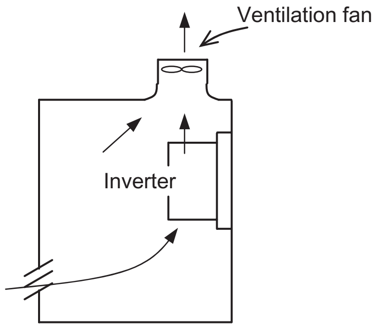
Provide sufficient space around the Inverter because it can become very hot (up to 150°C or so).
Keep the Inverter away from heating elements (such as a Braking Resistor, reactor, etc.).
Although side-by-side installation is possible. The ambient temperature of the installation site must not exceed 40°C and the carrier frequency and output current must be derated if side-by-side installation is used.



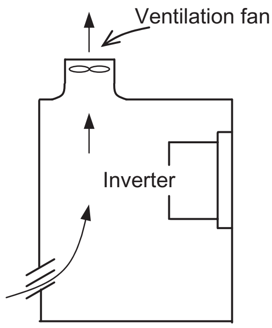
Do not install the Inverter in hot, humid sites or other sites subject to frequent bedewing.
Make sure that the humidity in the installation site is within the allowable operating range (20% to 90% RH), as defined in the standard specifications.

In particular, make sure that the installation site is free from condensation. If condensed water adheres to the Inverter's internal parts, the electronic components may short-circuit, causing failure of the Inverter. In addition to avoiding condensation, avoid installing the Inverter under direct sunlight.
Avoid an environment where the Inverter may be exposed to dust, gases (corrosive, explosive, and/or flammable), grinding fluid mist, or salt. If a foreign object (e.g. dust) enters the Inverter, it could result in failure of the Inverter. If using the Inverter in a dusty place, take appropriate measures. (For example, place the Inverter in a closed panel.)

When several Inverters are installed in a panel and a ventilation fan is mounted in the panel, be careful about the layout of the Inverters and the air intake apertures. Depending on the layout, the Inverter's cooling effect may deteriorate, resulting in an increase in the ambient temperature.



(Good example)



(Bad example)

Heat Radiation from Inverter

1-phase/3-phase 200 V

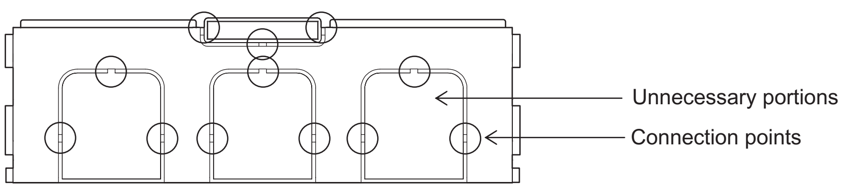
Inverter capacity (kW)	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
Load with 100% loss (W)	12	22	30	48	79	104	154	229	313	458	625
Efficiency at rated output (%)	89.5	90	93	94	95	95.5	96	96	96	96	96

3-phase 400 V

Inverter capacity (kW)	0.4	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15
Load with 100% loss (W)	35	56	96	116	125	167	229	296	411	528
Efficiency at rated output (%)	92	93	94	95	96	96	96	96.2	96.4	96.6

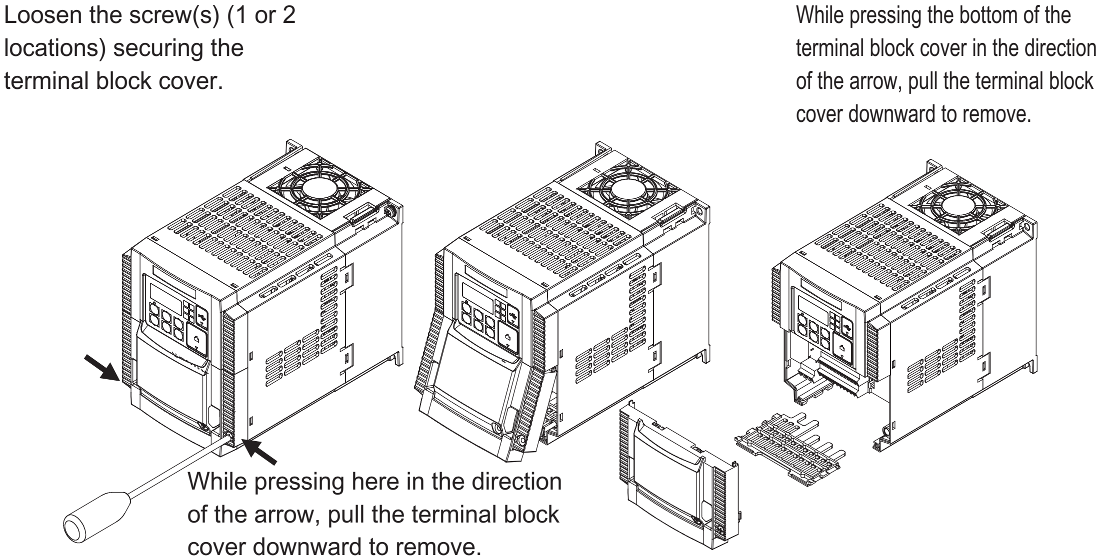
Backing Plate

With a model of 5.5 kW or higher capacity, cut off the connection points between the backing plate and unnecessary portions with nippers or a wire cutter when running cables.

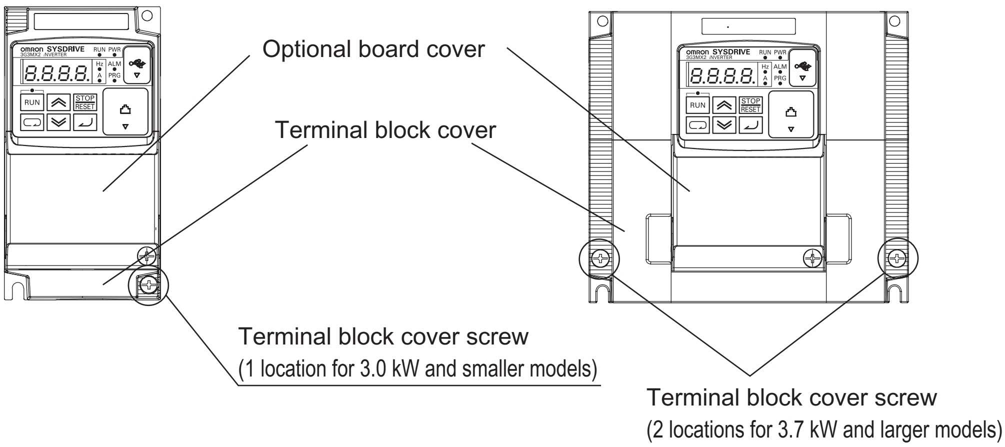


Installation/Removal Method of the Terminal Block Cover

1. Removal method



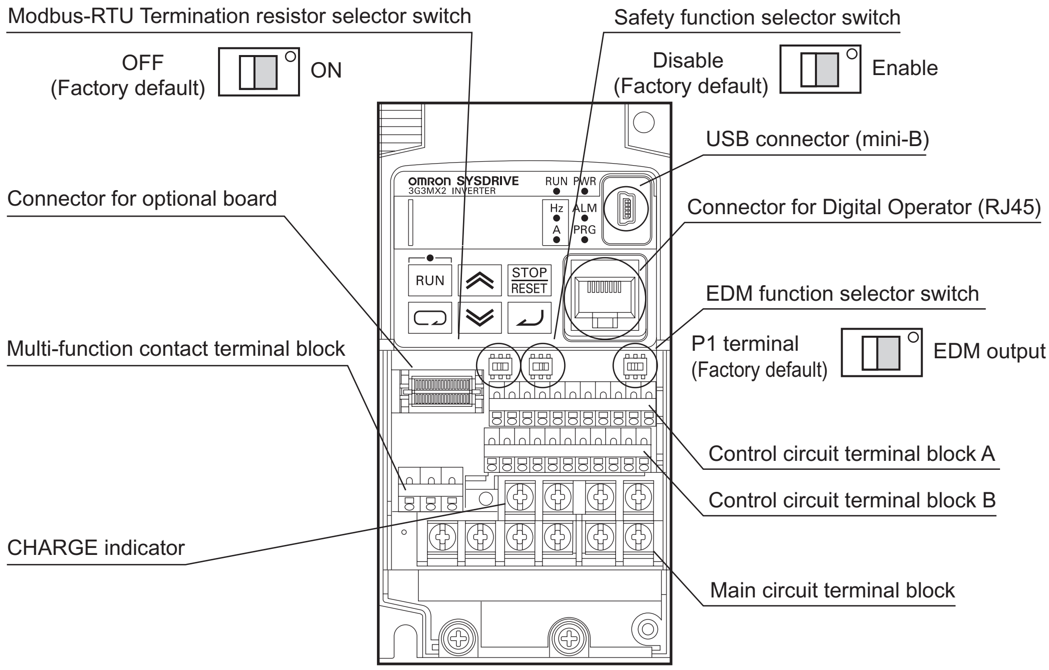
The terminal block cover is secured with one screw at the bottom right for 3.0 kW and smaller models, or with two screws on both sides for 3.7 kW and larger models.
The optional board cover is affixed with screws onto the terminal block cover, but it is not affixed onto the main unit. Accordingly, the terminal block cover can be removed without removing the optional board cover.



2. Installation method

Follow the removal procedure in reverse. Set the top side of the terminal block cover onto the main unit and push in the cover until you hear a "click" sound.

Names of Parts Inside the Terminal Block Cover

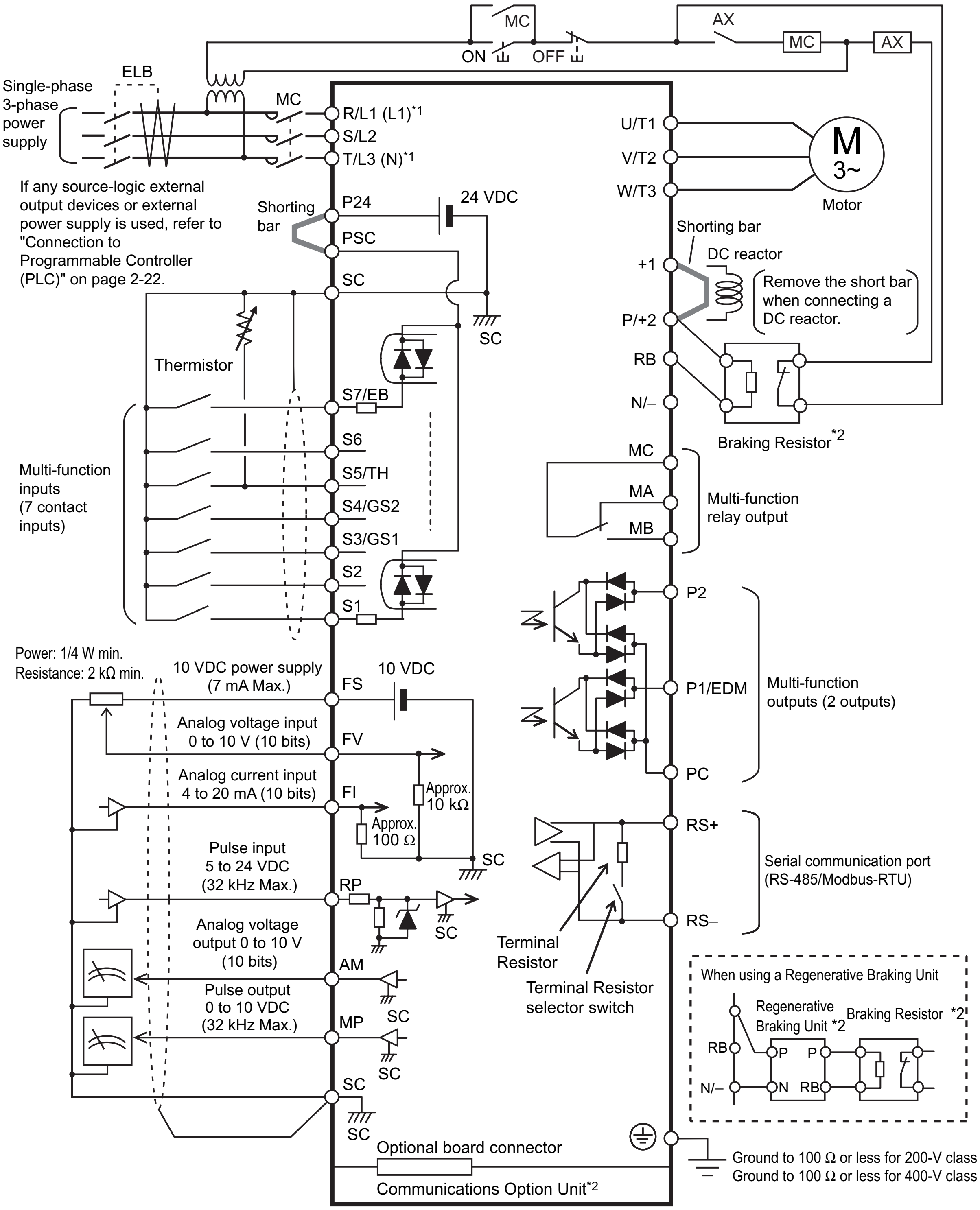


Name	Description
Modbus-RTU Termination resistor selector switch	Use this Terminal Resistor selector switch for RS-485 terminals on the control circuit terminal block. When this switch is turned ON, the internal 200 Ω Resistor is connected.
Safety function selector switch	Turn this switch ON when using the safety function. Turn OFF the power before turning this switch ON/OFF.For details, refer to "Safety Function" on page 5-170.
EDM function selector switch	Turn this switch ON when using the EDM output of the safety function. Turn OFF the power before turning this switch ON/OFF. For details, refer to "Safety Function" on page 5-170.
USB connector	Use this mini-B USB connector to connect a PC. Even when the Inverter is being operated by a PC, etc., via USB connection, it can still be operated using the Digital Operator.
Connector for Digital Operator	Use this connector to connect the Digital Operator.
Connector for optional board	Use this connector to mount the optional board. Communications Units and other options can be connected.
Control circuit terminal blocks A and B	These terminal blocks are used to connect various digital/analog input and output signals for inverter control, etc.
Multi-function contact terminal block	Use this SPDT contact terminal block for relay outputs.
Main circuit terminal block	Use this terminal block to connect an output to the motor and Braking Resistor, etc. Also, use this terminal block to connect the inverter to the main power supply.
CHARGE indicator (Charge indicator LED)	This LED indicator is lit if the DC voltage of the main circuit (between terminals P/+2 and N/–) remains approx. 45 V or above after the power has been cut off. Before wiring, etc. confirm that the Charge LED indicator is turned OFF.

Note. Refer to Chapter 3 "Operation" for the display and operating controls.

2-2 Wiring

Connection Diagram



*1 Connect to terminals L1 and N on a single-phase, 200-V Inverter (3G3MX2-AB□□□).
*2 Optional.

Main Circuit Terminals

Terminal symbol		Terminal name	Description
R/L1	L1	Main power supply input terminal	Connect the input AC power supply. Connect to terminals L1 and N on a single-phase, 200-V Inverter (3G3MX2-AB□□□).
S/L2			
T/L3	N		
U/T1		Inverter output terminal	Connect a 3-phase motor.
V/T2			
W/T3			
+1		DC reactor connection terminal	Remove the shorting bar between terminals +1 and P/+2, and connect the optional DC reactor.
P/+2			
P/+2		Braking Resistor connection terminal	Connect optional braking resistors. (If a braking torque is required)
RB			
P/+2		Regenerative braking unit connection terminal	Connect optional regenerative braking units. (When braking torque is required or the built-in braking circuit is not sufficient)
N/–			
G ⏚		Ground terminal	This is a ground terminal. Connect this terminal to the ground. Provide Class D grounding for 200 V class models, and class C grounding for 400 V class models. On 200 V class models of 3.7 kW or below and 400 V class models of 4.0 kW or below, the ground terminal is located on the cooling fin.

Control Circuit Terminals

		Terminal symbol	Terminal name	Description	Specifications
Analog	Power supply	SC	Input signal common	This is a common terminal used by the internal power supply, digital input and analog input/output terminals.	
		FS	Frequency reference power supply	10 VDC power supply for the FV terminal.	Allowable max. current: 7 mA
	Frequency setting input	FV	Frequency reference input terminal (analog voltage input)	Use this terminal if the frequency reference is provided by 0 to 10 VDC voltage input.	Input impedance Approx. 10 kΩ Allowable input voltage range –0.3 to +12 VDC
		FI	Frequency reference terminal (analog current input)	Use this terminal if the frequency reference is provided by 4 to 20 mA current input.	Input impedance 100 Ω Allowable input range 0 to 24 mA

<table>
<tr><th colspan="3"></th><th>Terminal symbol</th><th>Terminal name</th><th>Description</th><th>Specifications</th></tr>
<tr><td rowspan="2">Analog</td><td colspan="2">Sensor input</td><td>S5/TH</td><td>External thermistor input (also used as multi-function input terminal)</td><td>Connect an external thermistor between the SCs, to trip the Inverter when a temperature error occurs. (The inverter will trip when the input from thermistor is approx. 3 kΩ or higher.) Since this input is also used as the multi-function input terminal, setting of C005 is required. For details, refer to "Thermistor Trip Function" on page 5-120.</td><td>PTC type</td></tr>
<tr><td colspan="2">Output</td><td>AM</td><td>Multi-function analog output (voltage)</td><td>Specified signals can be output using voltage signals of 0 to 10 VDC.</td><td>AM</td></tr>
<tr><td rowspan="5">Digital</td><td colspan="2" rowspan="3">Power supply</td><td>SC</td><td>Input signal common</td><td>This is a common terminal used by the internal power supply, digital input and analog input/output terminals.</td><td></td></tr>
<tr><td>P24</td><td>Power supply terminal for input signal</td><td>24 VDC power supply for contact input signal. This is used as a common terminal if the source logic is input.</td><td>Allowable max. current: 100 mA</td></tr>
<tr><td>PSC</td><td>Power supply terminal for input terminal</td><td>Sink logic input: Shorted with P24
Source logic input: Shorted with SC
To drive the contact input using an external power supply, remove the shorting bar. For details, refer to "Connection to Programmable Controller (PLC)" on page 2-22.</td><td></td></tr>
<tr><td rowspan="2">Input</td><td rowspan="2">Contact</td><td>S7/EB
S6
S5/TH
S4/GS2
S3/GS1
S2
S1</td><td>Multi-function input terminal</td><td>Select 7 functions from among 59, and allocate them to terminals S1 through S7/EB. Both sink and source logics are supported. For details, refer to "Connection to Programmable Controller (PLC)" on page 2-22.</td><td rowspan="2">Voltage between each input and PSC
ON voltage: 18 V min.
OFF voltage: 3 V max.
Allowable max. voltage: 27 VDC
Load current: 5 mA (at 24 V)</td></tr>
<tr><td>S4/GS2
S3/GS1</td><td>Safety input</td><td>Enabled when the safety function selector switch is turned ON. For details, refer to "Safety Function" on page 5-170.</td></tr>
</table>

			Terminal symbol	Terminal name	Description	Specifications
Digital	Input	Pulse	RP	Pulse input-A	A pulse input for frequency setting. (Take note that the internal circuit is different from input terminals S7/ EB.)	Input pulse 32 kHz max. Voltage between input and SC ON voltage: 4 V min. OFF voltage: 1 V max. Allowable max. voltage: 27 VDC
			S7/EB	Pulse input-B	A pulse input for frequency setting. (Take note that the internal circuit is different from input terminal RP.)	Input pulse 1.8 kHz max. ON voltage: 18 V min. OFF voltage: 3 V max. Allowable max. voltage: 27 VDC Load current: 5 mA (at 24 V)
	Output	Open collector	P1/EDM P2	Multi-function output terminal	Select 2 functions from among 43, and allocate them to terminals P1 through P2. Both sink and source logics are supported. For details, refer to "Connection to Programmable Controller (PLC)" on page 2-22.	Open collector output Between each terminal and PC Allowable max. voltage: 27 V Allowable max. current: 50 mA Voltage drop when ON: 4 V max.
			P1/EDM	Safety monitor	Enabled when the EDM function selector switch is ON. For details, refer to "Safety Function" on page 5-170.	
		Relay	MA MB	Relay output terminal	Select the desired functions from among 43 functions, and allocate them to these terminals. SPDT contact. The factory default of Relay Output (MA, MB) Contact Selection (C036) is NC contact between MA-MC, and NO contact between MB-MC.	Max. contact capacity MA-MC: 250 VAC, 2 A (resistance) 0.2 A (induction) MB-MC: 250 VAC, 1 A (resistance) 0.2 A (induction) Contact min. capacity 100 VAC, 10mA 5 VDC, 100mA
			MC	Relay output common		
		Pulse	MP	Pulse output	Pulses are output.	Output pulse: 32 kHz max. Output voltage: 10 VDC Allowable max. current: 2 mA
Serial communication			RS+ RS–	Modbus port (RS-485)	RS-485 port RS+ RS-485 differential (+) signal RS- RS-485 differential (–) signal	Max. speed: 115.2 kbps Built-in Terminal Resistor: 200 Ω Slide switch selection

Wiring the Main Circuit Terminals

- Before wiring, make sure that the CHARGE indicator is OFF.
- Once the power supply is turned on, the capacitor in the Inverter is charged with high voltage for a while even after the power supply is turned off and regardless of whether the Inverter is running or not.
- If you are going to change cable connections after the power supply is turned off, wait for at least 10 minutes. Before wiring, check for a residual voltage between terminals "P/+2" and "N/–" with a circuit tester to ensure safety.

Main power supply input terminals (R/L1, S/L2, T/L3)

Use an earth leakage breaker for circuit (wiring) protection between the power supply and the main power supply terminals (R/L1, S/L2, T/L3).
An earth leakage breaker may malfunction at high frequency. Use an earth leakage breaker with a large high-frequency sensitive current rating.

As a guide for leakage current, if a CV wire is used and routed through a metal pipe, the leakage current is 30 mA/km. Due to the higher specific inductive capacity of the H-IV wire, the leakage current increases about eight times. Use a wire with a sensitivity current one-level higher. The leakage current mentioned here is the effective value of the fundamental wave, and high-frequency currents are excluded.

Inverter-motor distance	Sensitivity current of earth leakage breaker
100 m max.	30 mA
300 m max.	100 mA
800 m max.	200 mA

When the Inverter protective function is activated, your system may fail or an accident may occur. Connect a magnetic contactor to turn off the Inverter power supply.

Do not start or stop the Inverter by switching ON/OFF the magnetic contactor provided in the Inverter power supply input (primary) circuit and output (secondary) circuit. To start or stop the Inverter via an external signal, use the operation command terminals (FW, RV) on the control circuit terminal block.

Do not use this Inverter with an input phase loss connection. Doing so may damage the Inverter.

The Inverter operates with 1-phase input during input phase loss, causing a trip (due to undervoltage, overcurrent, etc.) or damage to the Inverter. Even if an input phase is open, the internal capacitor is charged with voltage, and electric shock or injury may occur.

When changing the cable connections, refer to "Precautions for Use."

In the following cases, the internal converter module may be damaged:

- Imbalance ratio of power supply voltage is 3% or more.
- Power supply capacity is ten times or more than the Inverter capacity, and 500 kVA or more.
- Rapid change in power supply voltage

Example) When several inverters are connected with a short bus.
When the phase advance capacitor is turned on/off.

Do not turn on the power and then turn it off again more than once every 3 minutes. Doing so may damage the Inverter.

Inverter output terminal (U/T1, V/T2, W/T3)

For connection of the output terminal, use the compatible cable or a cable with a larger diameter. Otherwise, the output voltage between the Inverter and the motor may drop.
Particularly during low-frequency output, a voltage drop occurs with the cable, resulting in motor torque reduction.

Do not mount a phase advance capacitor or surge absorber, because these devices may cause the Inverter to trip or cause damage to the capacitor or surge absorber.

If the cable length exceeds 20 m (particularly, with 400 V class), a surge voltage may be generated at the motor terminal depending on stray capacitance or inductance of the cable, causing the motor to burn out.
To suppress surge voltage, we offer a special filter (3G3AX-NFxxx). For details, contact our authorized dealer.

To connect several motors, provide a thermal relay for each.
The RC value of each thermal relay should be 1.1 times larger than the motor rated current.
The relay may trip earlier depending on the cable length. In this case, connect an AC reactor to the Inverter output.

DC Reactor Connection Terminal (+1, P/+2)

This terminal is used to connect the optional DC reactor.
By factory default, a shorting bar has been connected between terminals +1 and P/+2. Before connecting the DC reactor, remove this shorting bar.
The length of the DC reactor connection cable should be 5 m or shorter.

If the DC reactor is not being used, do not remove the shorting bar.
If you remove the shorting bar without connecting the DC reactor, no power is supplied to the Inverter main circuit, disabling operation.

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

All models in the 3G3MX2 Series have a built-in regenerative braking circuit.
To improve braking capacity, mount the optional braking resistor to this terminal.
Do not mount a resistor whose resistance is lower than the specified value. Doing so may damage the regenerative braking circuit.

The cable length should be 5 m or shorter. Twist the two wires.

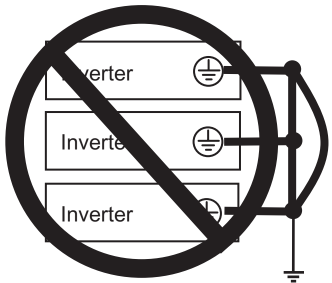
Do not connect any device other than the optional Regenerative Braking Unit or Braking Resistor to this terminal.

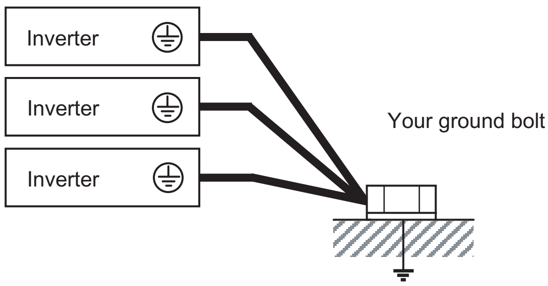
Ground Terminal ⏚

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 Class 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 Class C grounding conditions (conventional special Class 3 grounding conditions: 10 Ω or less ground resistance).

For the ground cable, use the compatible cable or a cable with a larger diameter. Make the cable length as short as possible.

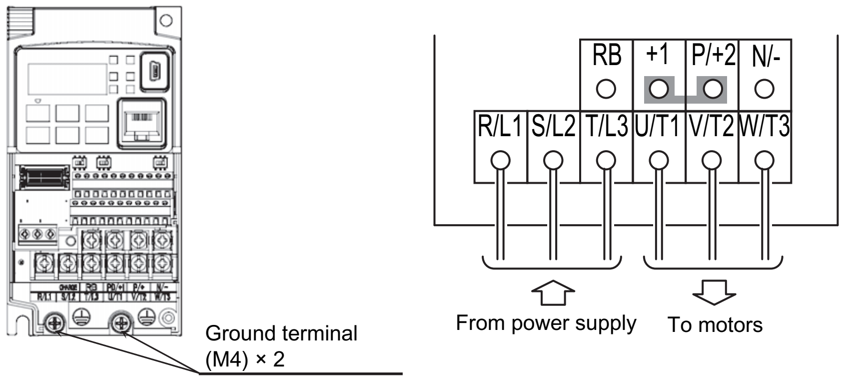
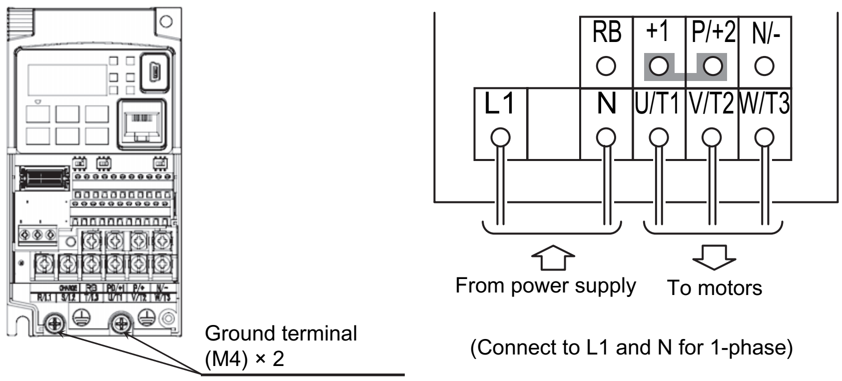
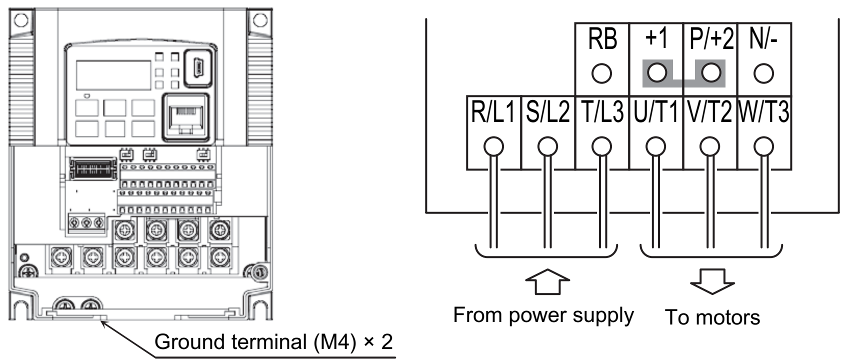
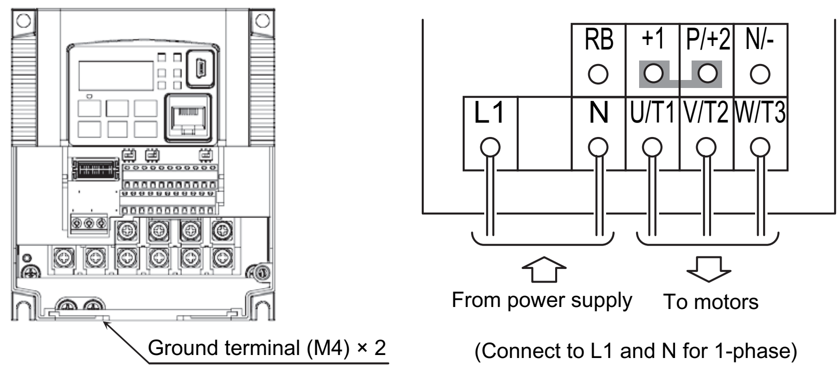
When several Inverters are connected, the ground cable must not be connected across several Inverters, and must not be looped. Otherwise, the Inverter and surrounding control machines may malfunction.

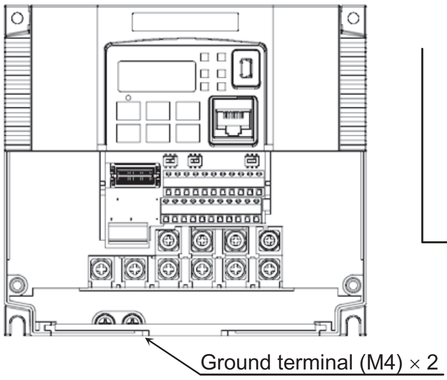
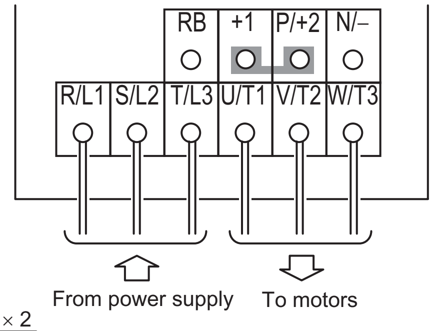
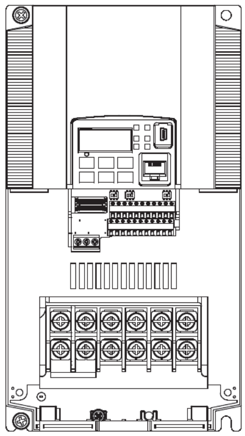
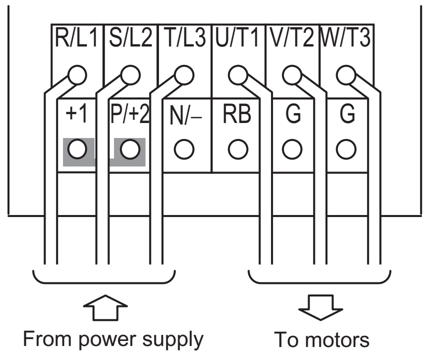
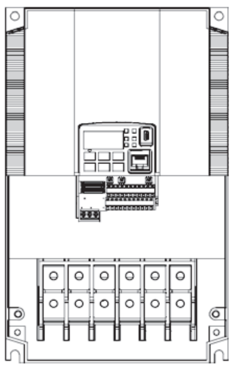
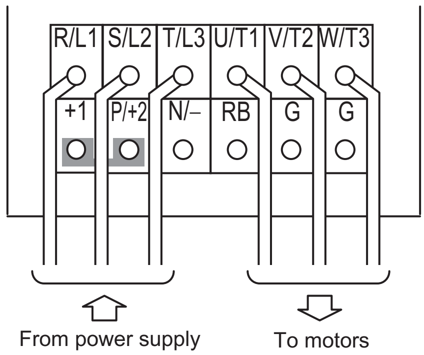
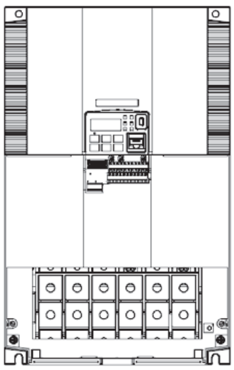
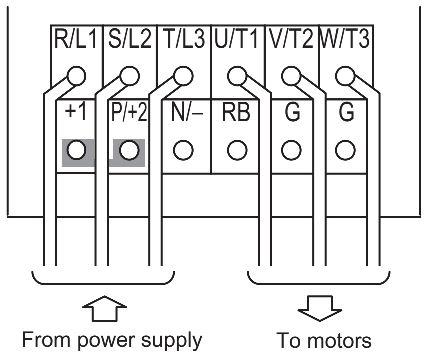




Arrangement of Main Circuit Terminal Block

Open the terminal block cover and wire the main circuit terminal blocks.

Applicable model	Terminal arrangement
3G3MX2-A2001 to A2007	
3G3MX2-AB001 to AB004	
3G3MX2-A2015, A2022 3G3MX2-A4004 to A4030	
3G3MX2-AB007, AB015, AB022	

Applicable model	Terminal arrangement
3G3MX2-A2037 3G3MX2-A4040	 
3G3MX2-A2055, A2075 3G3MX2-A4055, A4075	 
3G3MX2-A2110 3G3MX2- A4110 to A4150	 
3G3MX2-A2150	 

2

Design

2

Design

Recommended Cable Size, Wiring Device and Crimp Terminal

Voltage class	Motor output (CT) kW	Inverter model	Wiring			Applicable device		
			Power cable mm	Terminal-block screw size (terminal block width) mm	Tightening torque	Earth Leakage Breaker (ELB)	Magnetic contactor (MC)	Fuse size (class J) Rated 600 V AIC 200kA
3-phase 200 V	0.1	3G3MX2-A2001	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (5A)	H10C	10A
	0.2	3G3MX2-A2002	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (5A)	H10C	10A
	0.4	3G3MX2-A2004	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (10A)	H10C	10A
	0.75	3G3MX2-A2007	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (10A)	H10C	15A
	1.5	3G3MX2-A2015	AWG14 (2.0)	M4 (10)	1.4	EX30 (20A)	H20	15A
	2.2	3G3MX2-A2022	AWG12 (3.5)	M4 (10)	1.4	EX30 (20A)	H20	20A
	3.7	3G3MX2-A2037	AWG10 (5.5)	M4 (10)	1.4	EX50 (50A)	H25	30A
	5.5	3G3MX2-A2055	AWG6 (14)	M5 (13)	3.0	EX60 (60A)	H35	30A
	7.5	3G3MX2-A2075	AWG6 (14)	M5 (13)	3.0	EX100 (75A)	H50	40A
	11	3G3MX2-A2110	AWG4 (22)	M6 (17.5)	3.9 to 5.1	EX100 (100A)	H65C	60A
	15	3G3MX2-A2150	AWG2 (38)	M8 (23)	5.9 to 8.8	EX100 (100A)	H65C	80A
3-phase 400 V	0.4	3G3MX2-A4004	AWG16 (1.25)	M4 (10)	1.4	EX50 (5A)	H10C	10A
	0.75	3G3MX2-A4007	AWG16 (1.25)	M4 (10)	1.4	EX50 (10A)	H10C	10A
	1.5	3G3MX2-A4015	AWG16 (1.25)	M4 (10)	1.4	EX50 (10A)	H10C	10A
	2.2	3G3MX2-A4022	AWG14 (2.0)	M4 (10)	1.4	EX50 (15A)	H20	10A
	3.0	3G3MX2-A4030	AWG14 (2.0)	M4 (10)	1.4	EX50 (15A)	H20	15A
	4.0	3G3MX2-A4040	AWG12 (3.5)	M4 (10)	1.4	EX50 (20A)	H20	15A
	5.5	3G3MX2-A4055	AWG10 (5.5)	M5 (13)	3.0	EX50 (30A)	H25	15A
	7.5	3G3MX2-A4075	AWG10 (5.5)	M5 (13)	3.0	EX50 (50A)	H35	20A
	11	3G3MX2-A4110	AWG6 (14)	M6 (17.5)	3.9 to 5.1	EX60B (60A)	H35	30A
	15	3G3MX2-A4150	AWG6 (14)	M6 (17.5)	3.9 to 5.1	EX100B (75A)	H65C	40A

Voltage class	Motor output (CT) kW	Inverter model	Wiring			Applicable device		
			Power cable mm	Terminal-block screw size (terminal block width) mm	Tightening torque	Earth Leakage Breaker (ELB)	Magnetic contactor (MC)	Fuse size (class J) Rated 600 V AIC 200kA
1-phase 200 V	0.1	3G3MX2-AB001	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (5A)	H10C	10A
	0.2	3G3MX2-AB002	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (5A)	H10C	10A
	0.4	3G3MX2-AB004	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (10A)	H10C	10A
	0.75	3G3MX2-AB007	AWG12 (3.5)	M4 (10)	1.4	EX30 (15A)	H10C	15A
	1.5	3G3MX2-AB015	AWG10 (5.5)	M4 (10)	1.4	EX30 (20A)	H20	20A
	2.2	3G3MX2-AB022	AWG10 (5.5)	M4 (10)	1.4	EX30 (20A)	H20	30A

Note 1: Applicable devices assume use of a standard 3-phase, 4-pole motor.

Note 2: Select an applicable circuit breaker by also considering the cutoff capacity. (Use an inverter type.) Use one circuit breaker for one inverter according to the applications shown in the above table.

Note 3: If the wiring distance exceeds 20 m, the power cable size must be increased.

Note 4: A H-IV wire (75°C) is recommended.

Note 5: Use an earth leakage breaker (ELB) to ensure safety.

Note 6: To meet the UL standards, always insert a UL-standard fuse of class J type on the power supply side.

Note 7: Use a ground wire with a larger diameter than that of the power cable shown above.

Note 8: Tighten the terminal-block screws with the specified torque. If the screws are not tightened securely, short-circuiting or fire may occur. Excessive tightening may cause damage to the terminal block or the Inverter.

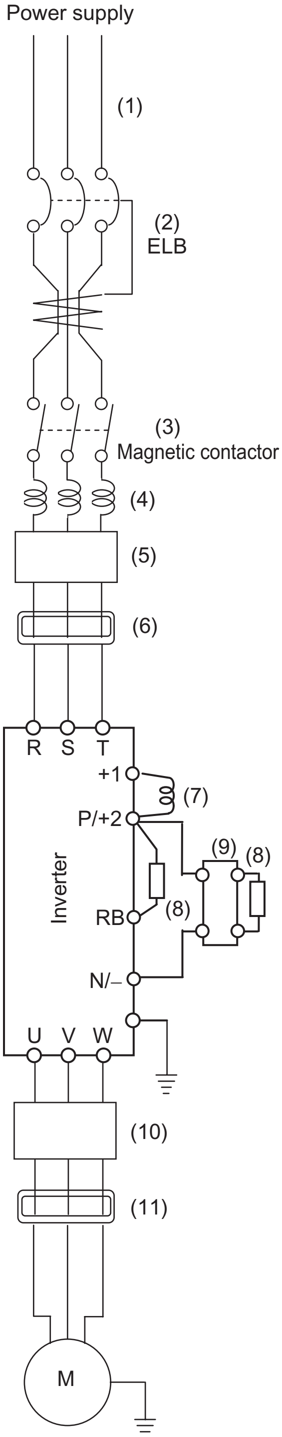
Note 9: Choose the sensitivity current of the earth leakage breaker (ELB) depending on the total distance between the Inverter and the power supply, and the Inverter and the motor. Also, use an earth leakage breaker of time-delay type. Use of a high-speed type may result in malfunction.

Note 10: If a CV wire is used and routed through a metal pipe, the leakage current becomes 30 mA/km.

Note 11: Due to the higher specific inductive capacity of the IV wire, the leakage current increases about eight times. Accordingly, use a wire with a sensitivity current of eight times the applicable level shown in the table below. Also, use a CV wire if the total wiring length exceeds 100 m.

Total wiring length	Sensitivity current (mA)
100 m max.	50
300 m max.	100

Main Circuit Connection Diagram



Name	Function
(1) (2) (3)	Refer to "Recommended Cable Size, Wiring Device and Crimp Terminal" on page 2-15.
(4) AC reactor	Apply this reactor as a harmonic suppression measure, or when the imbalance ratio of power supply voltage is 3% or more, power supply capacity is 500 kVA or more, or power supply voltage changes suddenly. It also helps improve the power factor.
(5) Input noise filter	This noise filter reduces the conducted noise generated by the Inverter and traveling through the wires. Connect it to the primary (input) side of the Inverter.
(6) Radio noise filter	When the Inverter is used, noise may generate in a nearby radio, etc. through the power wiring, etc. Use this noise filter to reduce such noise (= reduce radiated noise).
(7) DC reactor	This reactor suppresses the harmonics generated by the Inverter.
(8) Braking Resistor (9) Regenerative braking unit	Use this Unit to increase the braking torque of the Inverter to permit frequent ON/OFF switchings, or decelerate a load whose inertial moment is large.
(10) Output noise filter	This noise filter is installed between the Inverter and motor to reduce the radiated noise emitted from the wires. Use it to reduce radio interference in radios and TVs, or prevent malfunctioning of measuring equipment, sensors, etc.
(11) Radio noise filter	Apply this noise filter to reduce the noise generating on the output side of the Inverter (both the input side and output side).

Wiring Control Circuit Terminals

Wiring and Arranging a Control Circuit Terminal Block

Terminals SC and PC are common terminals for input/output signals. They are isolated each other. Do not short-circuit or ground these common terminals.
Do not ground these common terminals via external equipment and check the external equipment ground conditions.

- Connect diodes when wiring input/output signals for multiple inverters, because sneak circuit paths are created.

For wiring of each control circuit terminal, use a twisted-pair shielded cable and connect the shielded cable to each common terminal.

The control circuit terminal connection cable should be 20 m or shorter. Separate the control circuit terminal connection cables from the main circuit cable (power cable) and the relay control circuit cable. If the two cables must be crossed with each other, make sure they bisect at right angles. Otherwise, the Inverters may malfunction.

For connection of the thermistor input terminal, connect the twisted wires to terminal SC individually, and separate them from other SC common cables. Since a weak current flows through the thermistor, the thermistor connection cable must be separated from the main circuit cable (power cable).The thermistor connection cable should be 20 m or shorter.

When providing contacts for control circuit terminals (multi-function input terminals, etc.), use a relay that will not cause contact failure even when the current or voltage is weak, such as a relay with cross-bar twin contacts.

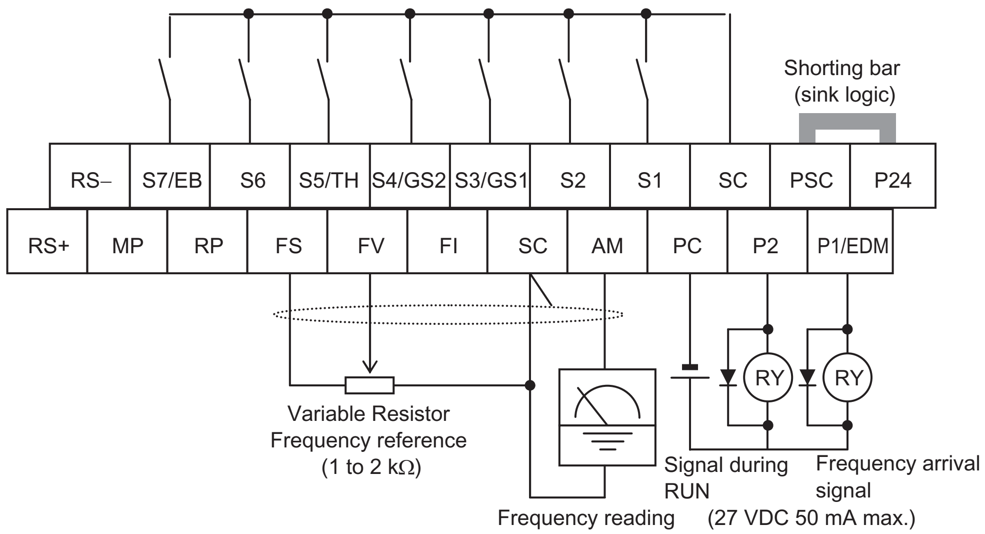
To use a relay for a multi-function output terminal, connect a surge-absorbing diode in parallel with the coil.

Do not short-circuit the analog power supply terminals (FS-SC) and/or the interface power supply terminals (P24 and SC). Doing so could result in failure of the Inverter.

The control circuit terminal block has two rows of terminals at top and bottom. Since wiring the top terminals first makes it difficult to wire the bottom terminals, wire the bottom terminals first.

After the wiring, gently pull the wires to confirm that they are securely connected.

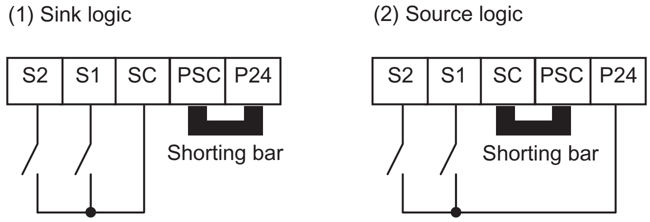
Wiring Example (Sink Logic)

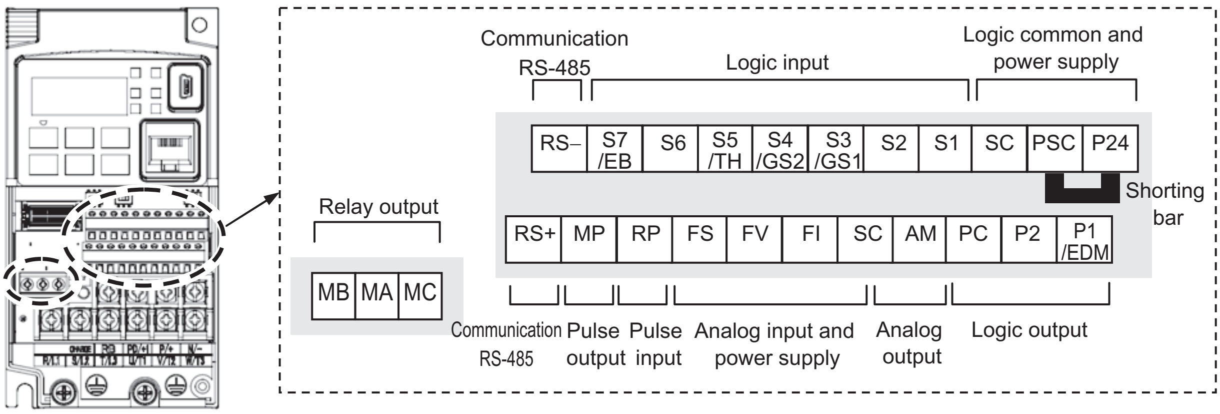


When connecting a relay to the multi-function output terminal, install a surge-absorbing diode in parallel with the relay. The output circuit can break down due to surge voltage when the relay is switched on/off.

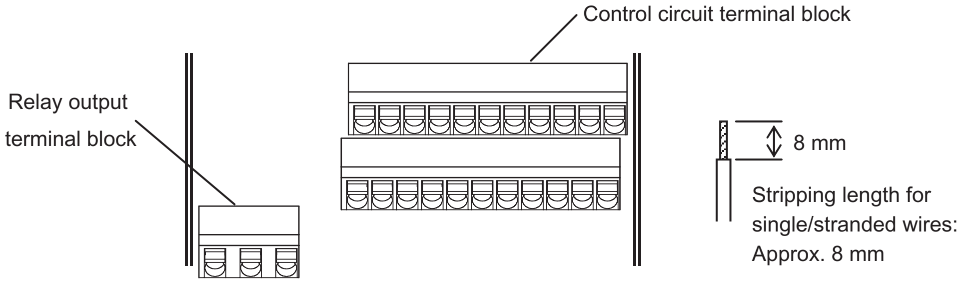
Switching Method for Input Control Logics

Multi-function input terminals are set to sink logic at the factory.
To switch the input control logic to source logic, remove the shorting bar between terminals P24 and PSC on the control circuit terminal block, and connect it between terminals PSC and SC.





Wire Sizes for Control Circuit Terminal Block and Relay Output Terminal Block

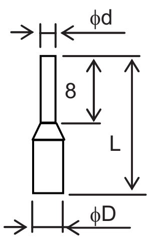


	Applicable wire		
	Single wire mm^2 (AWG)	**Stranded wire mm^2 (AWG)**	**Ferrules mm^2 (AWG)**
Control Circuit Terminal Block	0.2 to 1.5 (AWG 24 to 16)	0.2 to 1.0 (AWG 24 to 17)	0.25 to 0.75 (AWG 24 to 18)
Relay output terminal block	0.2 to 1.5 (AWG 24 to 16)	0.2 to 1.0 (AWG 24 to 17)	0.25 to 0.75 (AWG 24 to 18)

Recommended Terminal

To improve the ease of wiring and reliability of connection, use of ferrules of the following specifications is recommended for signal wires:

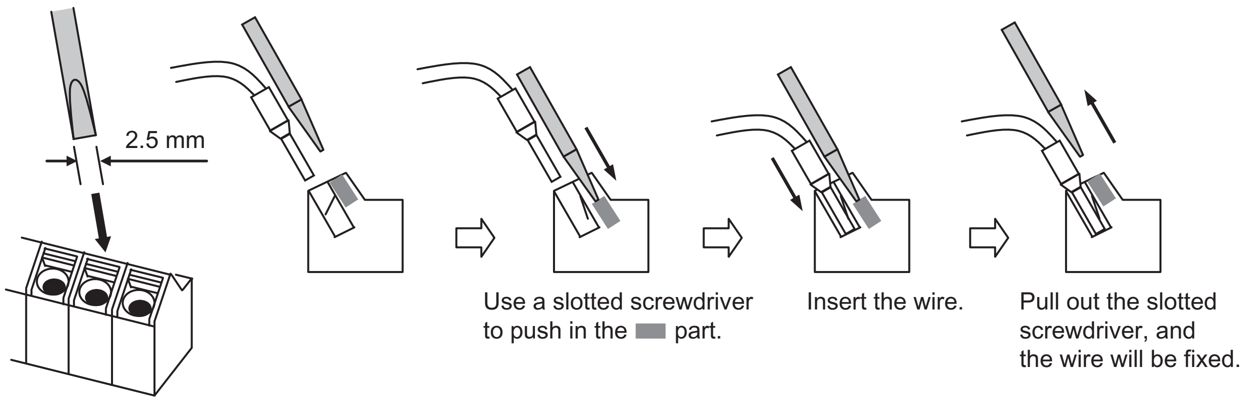
Wire size mm^2 (AWG)	Ferrules type*	L [mm]	ϕd [mm]	ϕD [mm]
0.25 (24)	AI 0.25-8YE	12.5	0.8	2.0
0.34 (22)	AI 0.34-8TQ	12.5	0.8	2.0
0.5 (20)	AI 0.5-8WH	14	1.1	2.5
0.75 (18)	AI 0.75-8GY	14	1.3	2.8



* Manufacturer: Phoenix Contact
Crimp tool CRIPMFOX UD 6-4 or CRIMPFOX ZA 3

Wiring Method

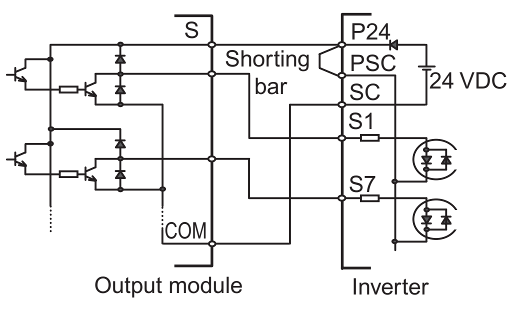
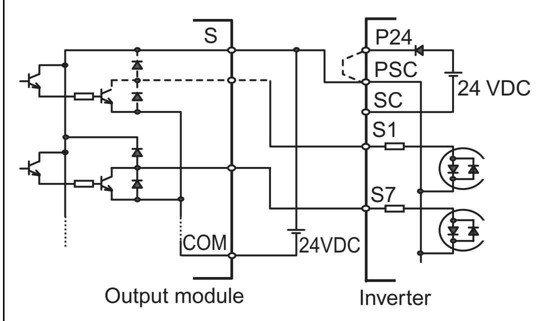
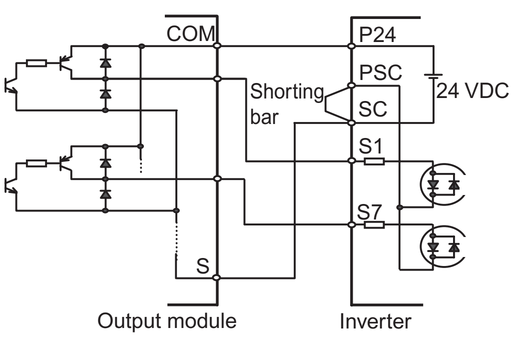
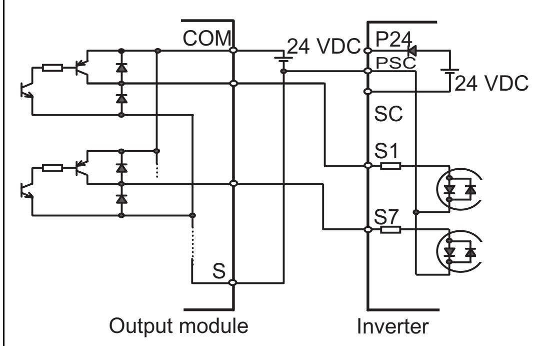
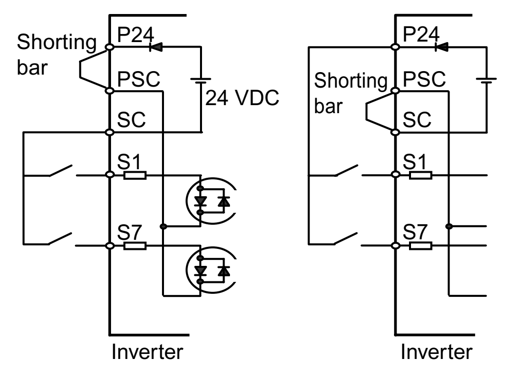
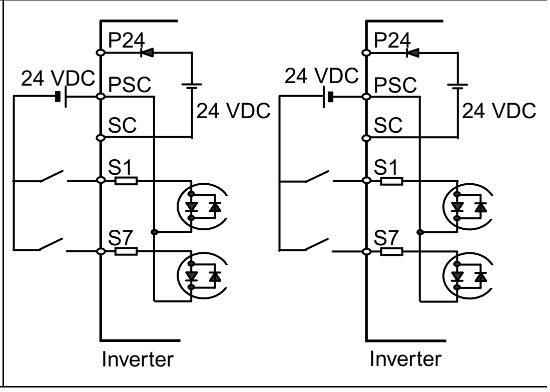
1. Use a slotted screwdriver (width: 2.5 mm or less) to push in the orange part of the control circuit terminal block. (The wire insertion part opens.)
2. With the slotted screwdriver pushed in, insert the wire or ferrule in the wire insertion part (round hole).
3. Pull out the slotted screwdriver, and the wire will be fixed.



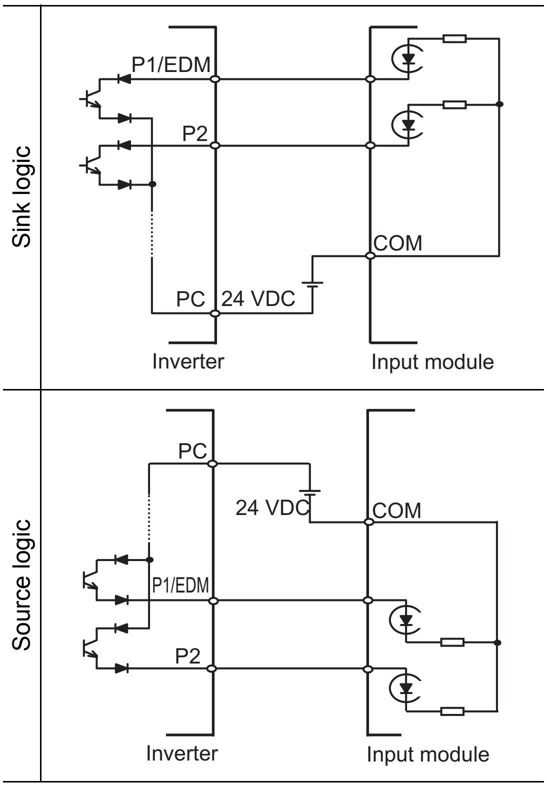
Note: When pulling out a wire, do so by also pushing in the part denoted by ▬ with a slotted screwdriver.

Connection to Programmable Controller (PLC)

Connection of Multi-function Input Terminal and Programmable Controller

	When the Inverter's internal interface power supply is used	When an external power supply is used (Remove shorting bar on the control terminal block.)
Sink logic		
Source logic		
No-voltage switch		

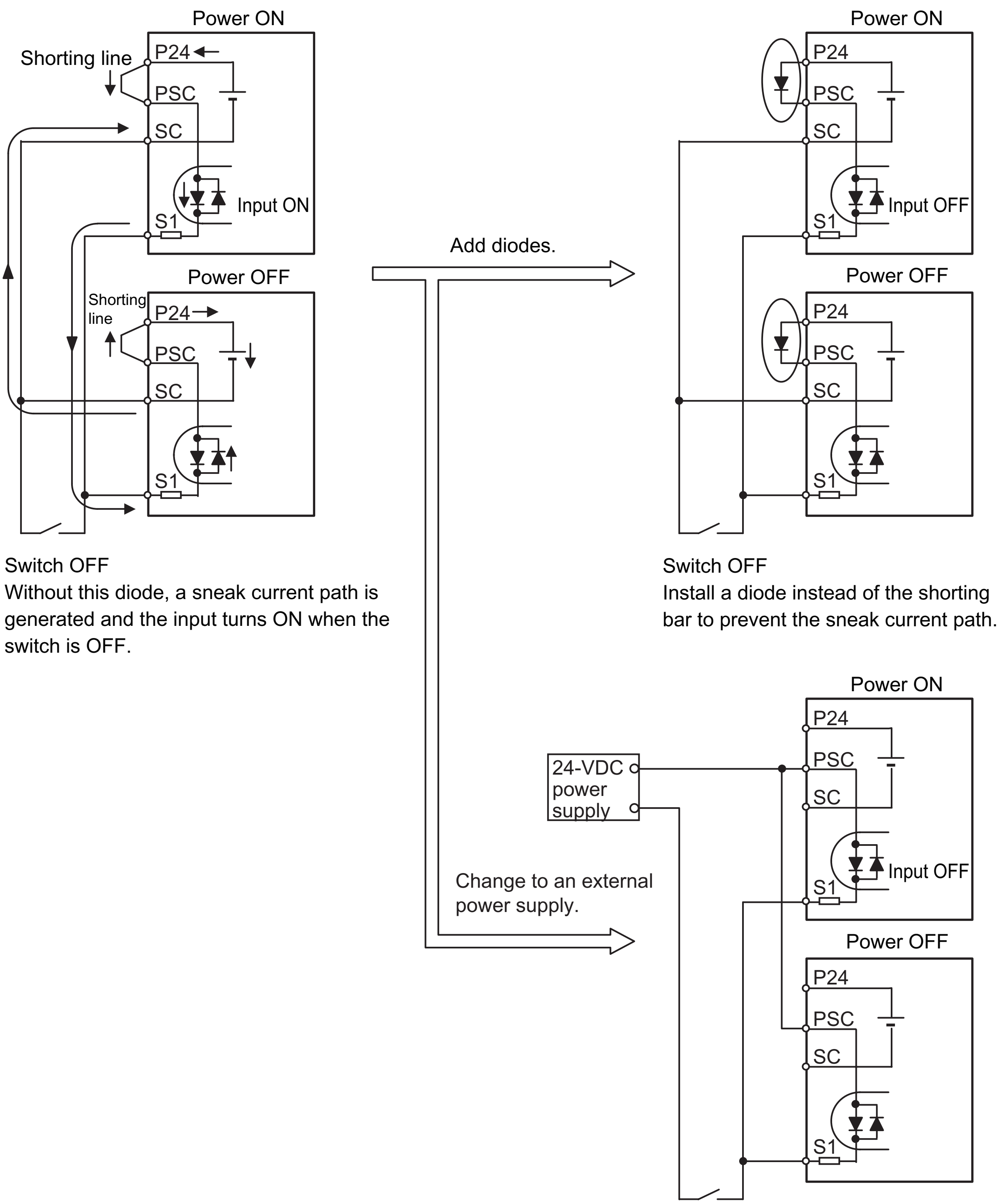
Connection of Multi-function Output Terminal and Programmable Controller



Note on Use of Multiple Inverters

If multiple Inverters are using a common input (switch, etc.) and the Inverters are turned on at different timings, a sneak current path will be generated as shown below and the input may be recognized as ON when it is actually OFF. In this case, be sure to insert a diode (rating: 50 V/ 0.1 A) in the location shown below or use external power supply circuits to prevent the sneak current path.

1. For Sink Logic

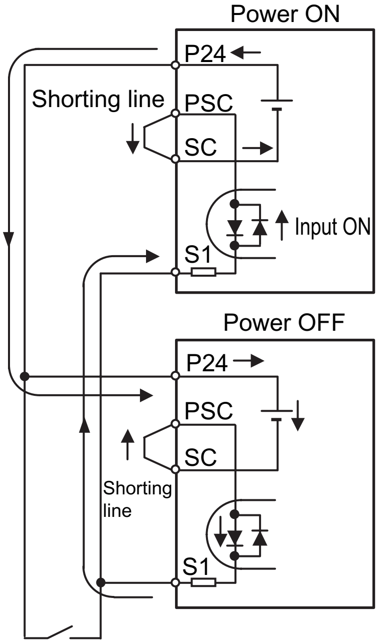


Switch OFF
Without this diode, a sneak current path is generated and the input turns ON when the switch is OFF.

Switch OFF
Install a diode instead of the shorting bar to prevent the sneak current path.

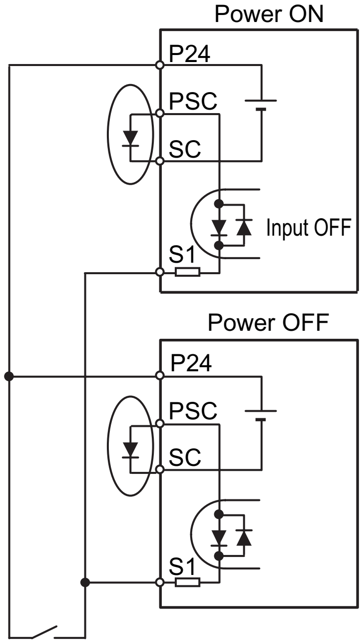
Switch OFF
A sneak current path will not occur if the short bar is removed and an external power supply is used.

2. **For Source Logic**



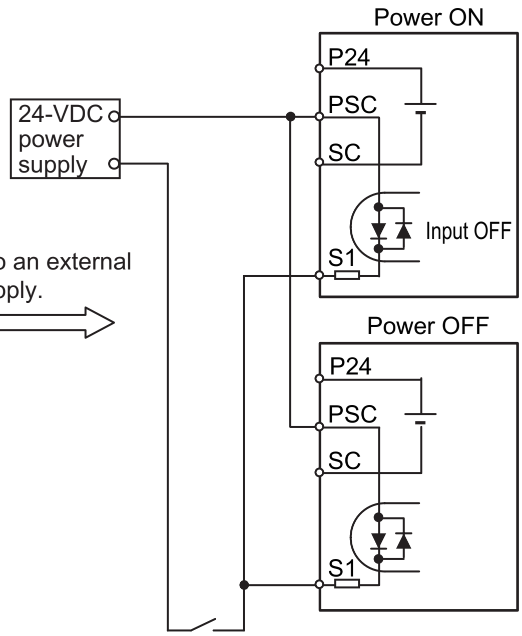
Switch OFF
Without this diode, a sneak current path is generated and the input turns ON when the switch is OFF.

Add diodes.



Switch OFF
Install a diode instead of the shorting bar to prevent the sneak current path.

Change to an external power supply.



Switch OFF
A sneak current path will not occur if the short bar is removed and an external power supply is used.

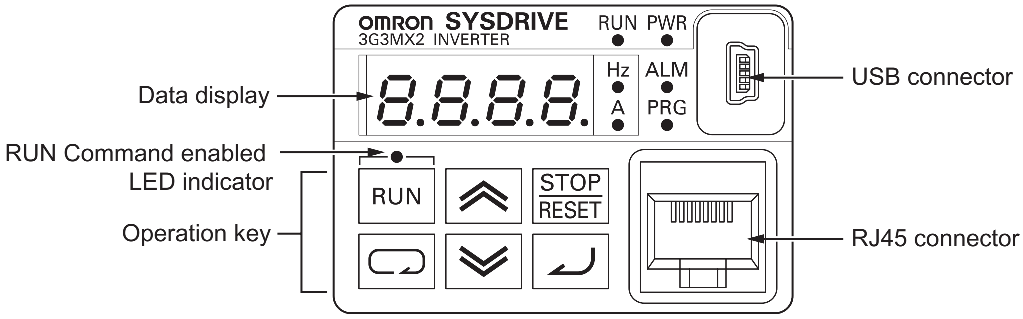
3

Operation

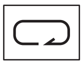
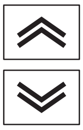
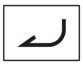
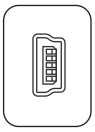
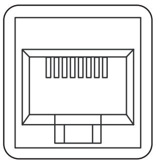
Describes the operating procedures including procedures for trial operation.

3-1 Name of Parts of the Digital Operator

Names of Parts and their Descriptions

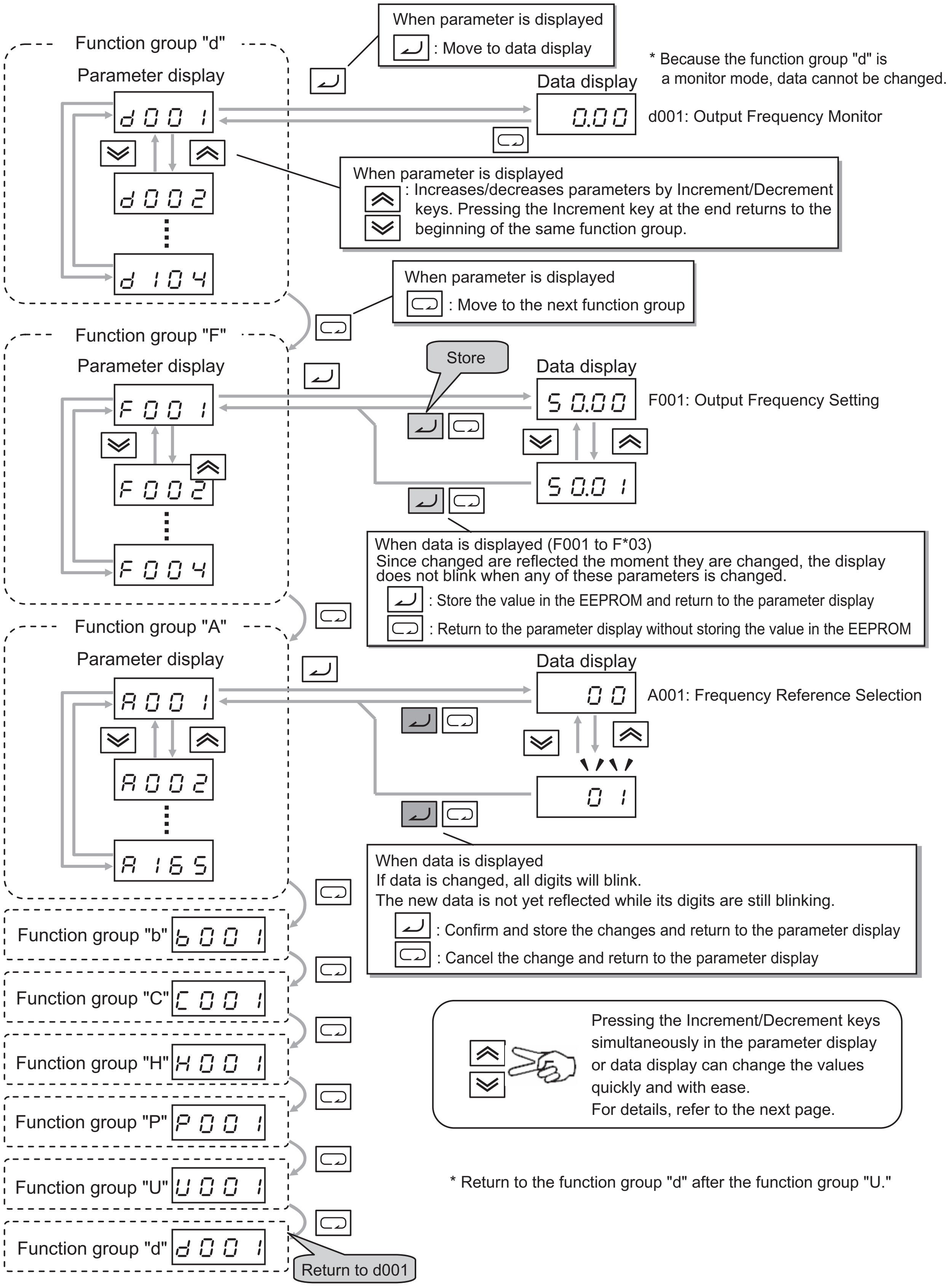


	Name	Description
PWR	POWER LED	Lit (green) while the Inverter is receiving power.
ALM	ALARM LED	Lit (red) when the Inverter trips. For information on how to reset the trip, refer to "Method for Resetting Trip" on page 7-1.
PRG	PROGRAM LED indicator	Lit (green) when the displayed data (set value) can be changed. Blinks if the set value is invalid. Refer to "Warning Display" on page 7-7.
RUN	RUN (during RUN) LED indicator	Lit (green) when the Inverter is running. (Lit when there is either a "valid RUN command" or "inverter output." Accordingly, it is also lit when a RUN command is issued at a set frequency of 0 Hz or while the motor is decelerating after the RUN command is turned OFF.)
Hz	Monitor LED indicator (Hz)	Lit (green) when the displayed data is frequency.
A	Monitor LED indicator (A)	Lit (green) when the displayed data is current.
	RUN Command enabled LED indicator	Lit (green) when the RUN command is set to the Digital Operator. (The RUN key on the Digital Operator is enabled.)
8.8.8.8.	Display	Various parameters, frequency/set value and other data are displayed (red).
RUN	RUN key	Runs the Inverter. Take note that this key is enabled only when the RUN command destination is the Digital Operator.
STOP RESET	STOP/RESET key	This key decelerates the Inverter to a stop. (Although the STOP/RESET key is enabled even when a RUN command is issued to a destination other than the Digital Operator (factory default), it can be disabled by a Setting (b087).) If the Inverter is already tripped, the trip will be reset (return from the tripping).

	Name	Description
	Mode key	Parameter is displayed: Move to the beginning of the next function group. Data is displayed: Cancel the setting and return to the parameter display. Individual input mode: Move the blinking digit to the left. Regardless of the displayed screen, pressing and holding this key (for 1 second or more) displays the data for Output Frequency Monitor (d001).
	Increment key Decrement key	These keys are used to increment/decrement a parameter or set data. Pressing and holding each key increases the incrementing/decrementing speed. Pressing the Increment and Decrement keys together activates the "Individual Input MODE" where each digit can be edited independently.
	Enter key	Parameter is displayed: Move to the data display. Data is displayed: Confirm/store the setting (in the EEPROM) and return to the parameter display. Individual input mode: Move the blinking digit to the right.
	USB connector	Use this connector (mini-B type) to connect a PC. The Inverter can still be operated from the Digital Operator even when it is being operated using a PC, etc., via USB communication.
	RJ45 connector	Use this connector (RS-422) to connect the optional Remote Operator. Once the Remote Operator is connected, the keys on the main unit become disabled. In this case, use b150 to set the item to be displayed.

Key Operation System

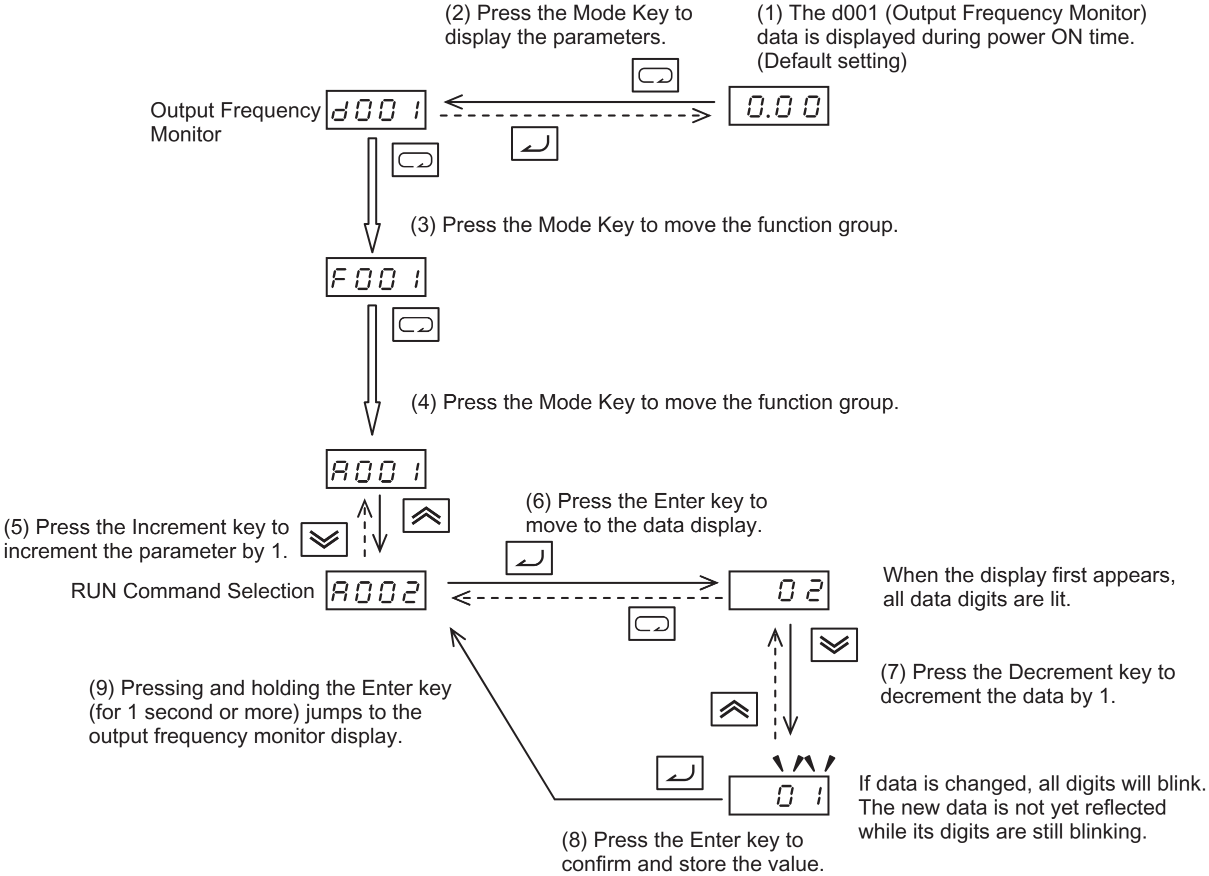
The following describes the key operation system of the Digital Operator.



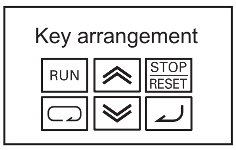
Example of Basic Operations

An example of basic parameter change operations is given below.

<Operation example of changing RUN Command Selection (A002) from Digital Operator (02) to Terminal Block (01) when "0.00" is shown on the output frequency monitor screen after the power has been turned ON>



Since F parameters other than F004 are reflected in real time the moment they are changed, the display does not blink when any of these parameters is changed.



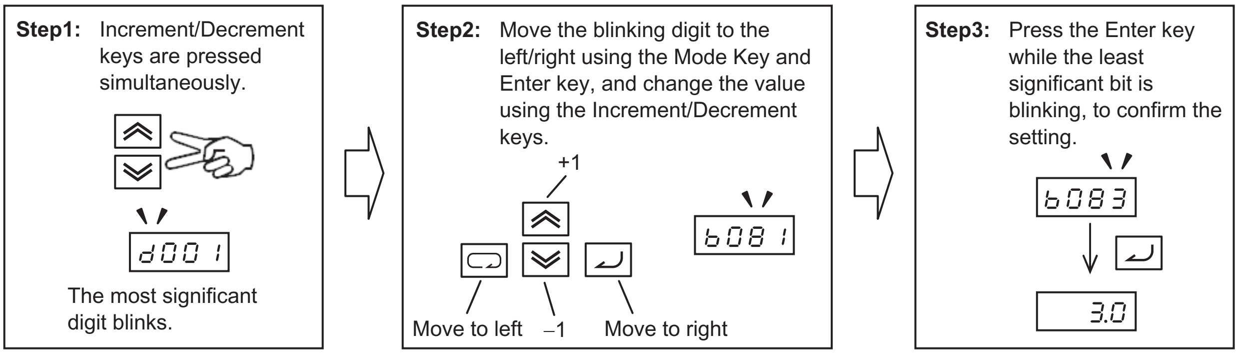
Key name	Function code is displayed	Data is displayed
Mode key	Move to the next function group	Value is cancelled and return to the parameter display
Enter key	Proceed to the data display	Value is confirmed/stored and return to the parameter display
Increment key	Parameter is incremented by 1	Data is incremented by 1
Decrement key	Parameter is decremented by 1	Data is decremented by 1
Increment/Decrement are pressed simultaneously	Move to the individual input mode	Move to the individual input mode

Reference

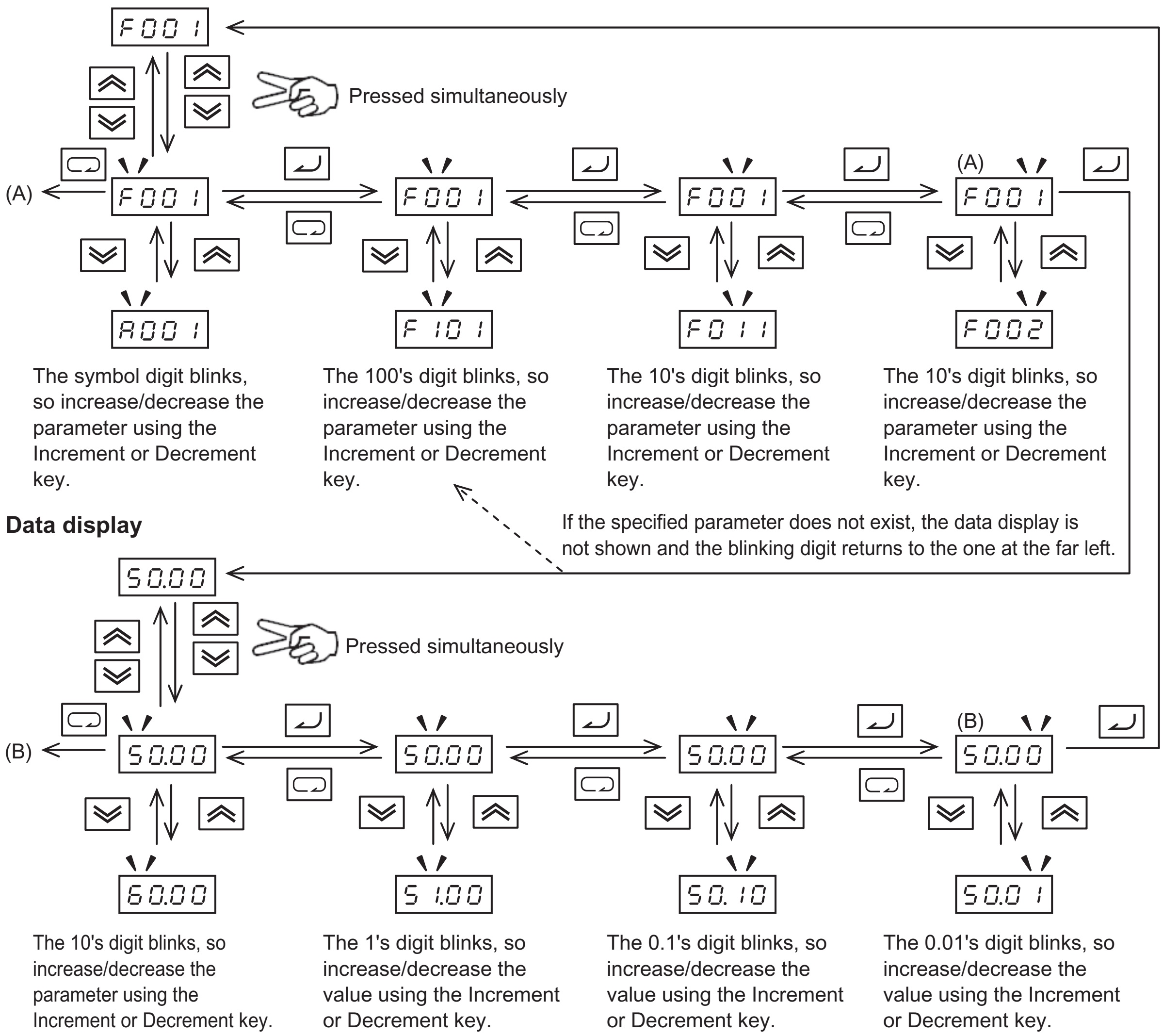
- Regardless of the Digital Operator display, pressing and holding the Mode key (for 1 second or more) displays the data for Output Frequency Monitor (d001) again. However, the selected mode continues to cycle among the function groups while the Mode Key is held, according to the designed operation of the key. (Example: A001→F001→b001→C001→...Elapse of 3 seconds, followed by display of "50.00")

Operation Example in the Individual Input Mode

If the parameter or data to be changed is far away from the currently displayed value, use the individual input mode to change the parameter efficiently.



The individual input mode is effective regardless of whether a parameter or data is currently displayed.



Note 1: Pressing the Mode Key while the cursor (blinking digit) is at the far left moves the cursor to the far right.

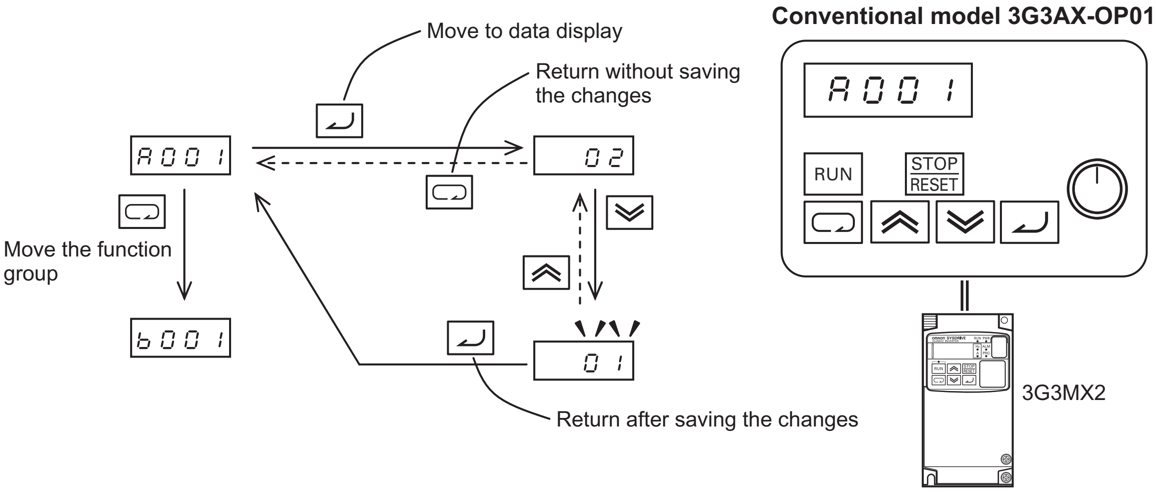
Note 2: Pressing the Increment and Decrement keys together in the individual input mode restores the normal input mode.

Note 3: While the displayed data is blinking, the change has not yet reflected even when the function group is "F."

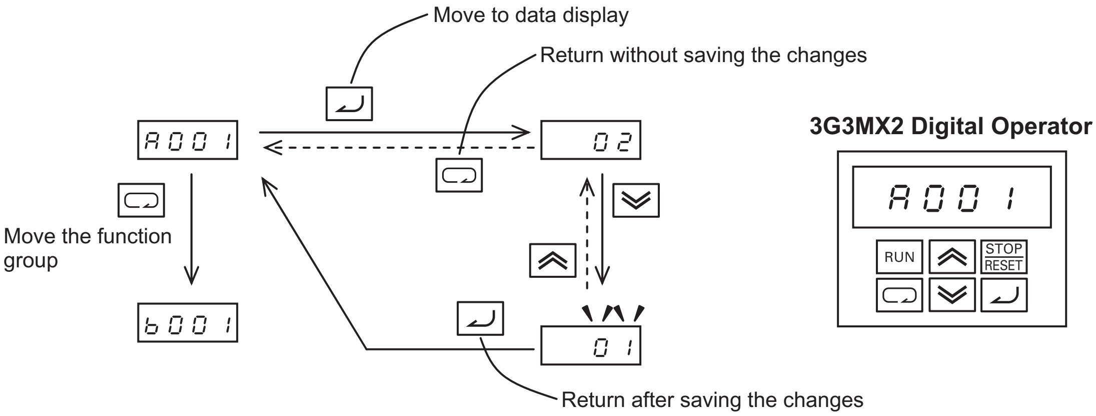
Operation Example When the Digital Operator is Connected to the Conventional Model

Although operations can be performed by connecting the conventional Digital Operator model (3G3AX-OP01) to the 3G3MX2, the operations associated with the Mode key and Enter key vary from that of the conventional key operation system. To switch to the parameter display to data display, use the Enter key instead of the Mode key. Take note that pressing the FUNC key while a parameter is displayed means moving the function group.

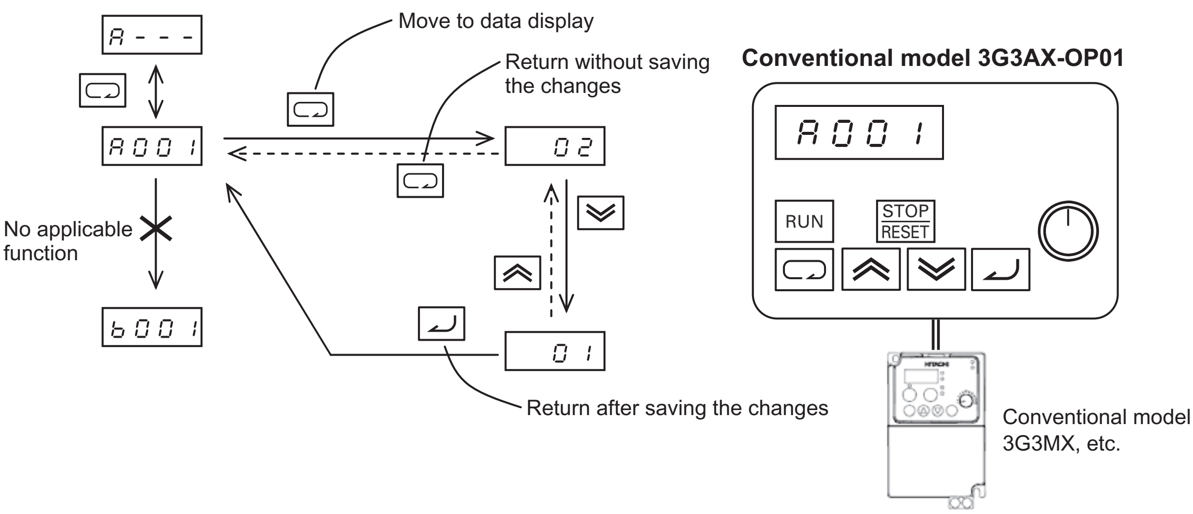
Key Operation System When the Conventional Digital Operator Model (3G3AX-OP01) is Connected to the 3G3MX2



(Reference) Key Operation System of the 3G3MX2 Digital Operator



(Reference) Key Operation System When the Conventional Digital Operator Model (3G3AX-OP01) is Connected to the Conventional Model



3-2 Operation Method

To operate the Inverter, two commands are required including a RUN command and frequency reference. Take note that the Inverter does not operate if only one of these commands is issued, such as when a RUN command is issued but not a frequency reference (0 Hz setting), or a frequency reference is issued but not a RUN command.

RUN Command/Frequency Reference Input

Command/Reference Input From the Digital Operator

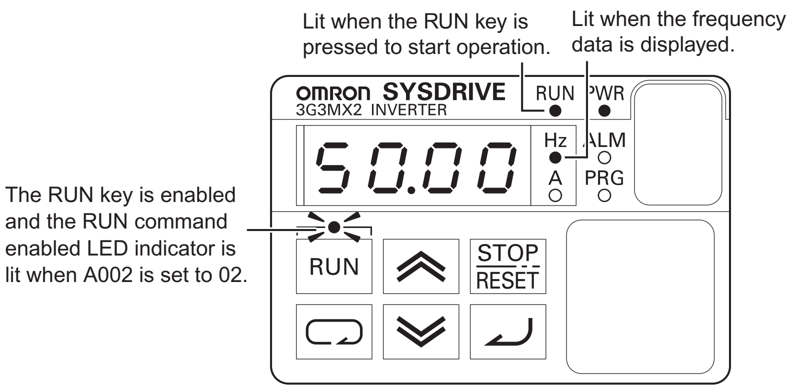
Operates the Inverter via the key operation of the standard Digital Operator or optional Remote Operator.

Setting

Parameter No.	Function name	Data	Default value	Note
A001	Frequency Reference Selection 1	02 (Digital Operator)	02	
A002	RUN Command Selection 1	02 (Digital Operator)	02	The RUN command enabled LED indicator is lit.
F001	Output Frequency Setting	0.0 to Max. frequency	6.00	
F004	RUN Direction Selection	00 (Forward) 01 (Reverse)	00	Parameters cannot be changed while the Inverter is operating.

Change the following parameters, if necessary:

Parameter No.	Function name	Data	Default value
F002	Acceleration Time Setting 1	0.01 to 99.99 s 100.0 to 999.9 s 1,000. to 3,600. s	10.00 s (30.00 s)
F003	Deceleration Time Setting 1	0.01 to 3,600 s 100.0 to 999.9 1,000. to 3,600. s	10.00 s (30.00 s)



Operation

Refer to "Test Run" on page 3-10.

Command/Reference Input From the Control Circuit Terminal Block

Operates the Inverter by connecting the external signals (frequency setting volume, switch, etc.) to the control circuit terminal block.

<Setting the Forward/Reverse Direction Using the FW/RV Input Terminal and Setting the Frequency Using the Frequency Volume>

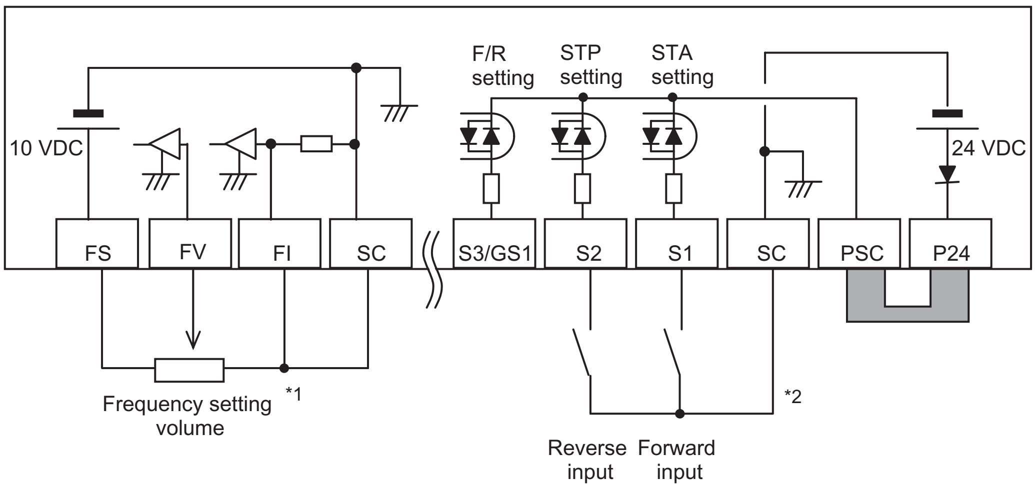
Setting

Parameter No.	Function name	Data	Default value	Note
A001	Frequency Reference Selection 1	01 (Control circuit terminal block)	02	
A002	RUN Command Selection 1	01 (Control circuit terminal block)	02	
C001	Multi-function Input 1 Selection	00 (FW: Forward)	00(FW)	If other input terminal is used, the parameter number becomes different.
C002	Multi-function Input 2 Selection	01 (RV: Reverse)	01(RV)	If other input terminal is used, the parameter number becomes different.

Change the following parameters, if necessary:

Parameter No.	Function name	Data	Default value
F002	Acceleration Time Setting 1	0.01 to 99.99 s 100.0 to 999.9 s 1,000. to 3,600. s	10.00 s (30.00 s)
F003	Deceleration Time Setting 1	0.01 to 99.99 s 100.0 to 999.9 s 1,000. to 3,600. s	10.00 s (30.00 s)

Wiring the Control Circuit Terminal Block



*1 Allocate 16: FV/FI (Analog input switch) to a multi-function input to use as the voltage setting. If terminal FV/FI is not allocated, the frequency reference becomes the sum of voltage input (FV) and current input (FI). To use only one of voltage or current, therefore, short the other analog input to the SC terminal.

*2 This wiring diagram shows an example of using the built-in power supply of the Inverter. If an external power supply is used, refer to "Connection to Programmable Controller (PLC)" on page 2-22.

Operation

Refer to "Test Run" on page 3-10.

<Running/Stopping the Inverter via 3-wire Input and Setting the Frequency Using an Analog Current Signal>

Setting

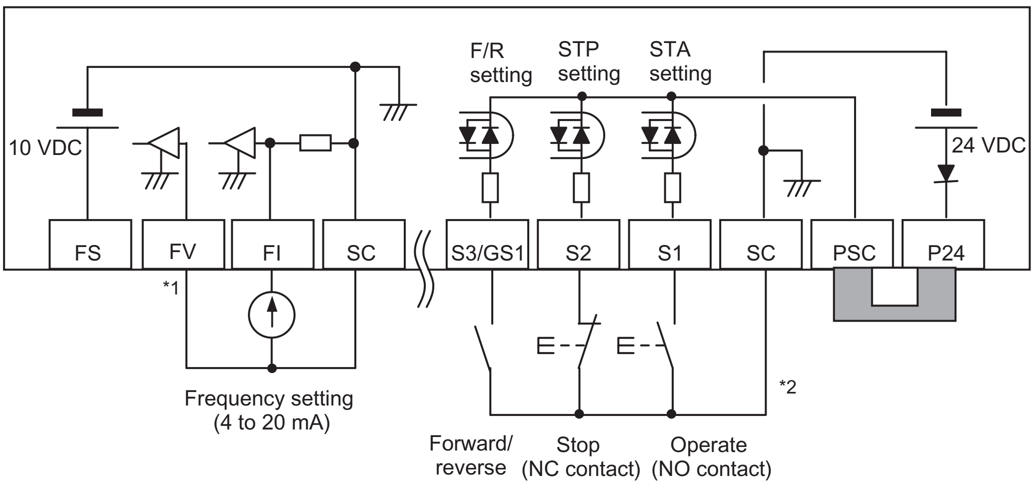
Parameter No.	Function name	Data	Default value	Note
A001	Frequency Reference Selection 1	01 (Control circuit terminal block)	02	
A002	RUN Command Selection 1	01 (Control circuit terminal block)	02	
C001	Multi-function Input 1 Selection	20 (STA: 3-wire start)*	00 (FW)	If other input terminal is used, the parameter number becomes different.
C002	Multi-function Input 2 Selection	21 (STP: 3-wire stop)*	01 (RW)	If other input terminal is used, the parameter number becomes different.
C003	Multi-function Input 3 Selection	22 (F/R: 3-wire forward/reverse)*	18 (RS)	If other input terminal is used, the parameter number becomes different.

* For details on the 3-wire input method, refer to "3-wire Input Function (STA, STP, F/R)" on page 5-56.

Change the following parameters, if necessary:

Parameter No.	Function name	Data	Default value
F002	Acceleration Time Setting 1	0.01 to 99.99 s 100.0 to 999.9 s 1,000. to 3,600. s	10.00 s (30.00 s)
F003	Deceleration Time Setting 1	0.01 to 99.99 s 100.0 to 999.9 s 1,000. to 3,600. s	10.00 s (30.00 s)

Wiring the Control Circuit Terminal Block



*1 Allocate 16: FV/FI (Analog input switch) to a multi-function input to use as the current setting. If terminal FV/FI is not allocated, the frequency reference becomes the sum of voltage input (FV) and current input (FI). To use only one of voltage and current, therefore, short the other analog input to the SC terminal.

*2 This wiring diagram shows an example of using the built-in power supply of the Inverter. If an external power supply is used, refer to "Connection to Programmable Controller (PLC)" on page 2-22.

Operation

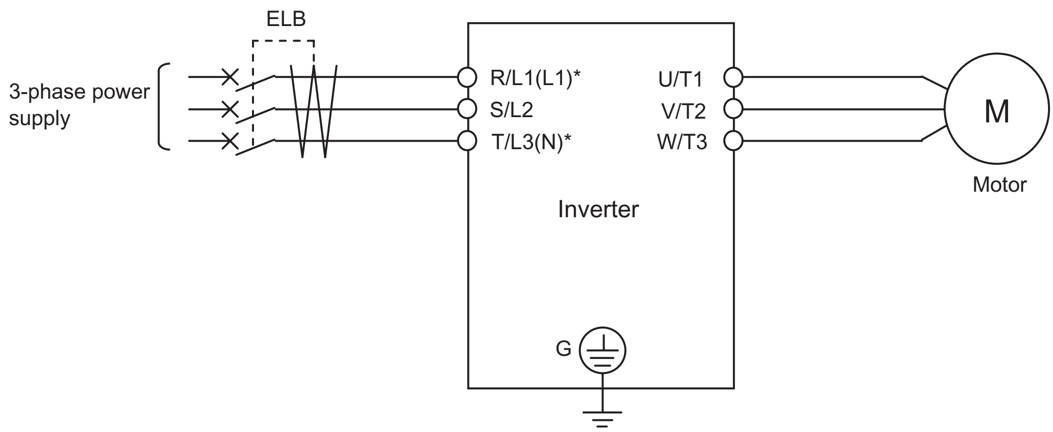
Refer to "Test Run" on page 3-10.

3

Operation

3-3 Test Run

An example of basic connection is given below. Refer to "Operation Method" on page 3-7 when issuing a RUN command/frequency reference from the control circuit terminal block.
Refer to "Name of Parts of the Digital Operator" on page 3-1 for the parameter setting method.



* Connect to terminals L1 and N on a single-phase, 200-V Inverter (3G3MX2-AB□□□).

Procedure for Test Run

Command/Reference Input From the Digital Operator

1. **Check if the wires are connected correctly.**
2. **Turn on the power of the Inverter.**
3. **Set Frequency Reference Selection (A001) to "02" (Digital Operator).**
4. **Set RUN Command Selection (A002) to "02" (Digital Operator).**
5. **Set Output Frequency Setting (F001). It is recommended to set a low speed of approx. 10 Hz first to ensure safety.**
6. **Set RUN Direction Selection (F004).**
7. **Display Output Frequency Monitor (d001) and press the Enter key. Confirm that "0.00" (Hz) is displayed.**
8. **Press the RUN key. The RUN (during RUN) LED indicator is lit and the motor starts to turn.**
9. **Confirm the output frequency and motor rotation direction displayed on the Digital Operator, and check if the Invertor is free from errors. For the motor rotation direction, refer to Rotation Direction Monitor (d003).**
10. **If no problem is found, gradually increase the output frequency using Output Frequency Setting (F001).**
11. **After checking the operation, press the STOP/RESET key. The motor starts to decelerate and once it stops, the RUN (during RUN) LED indicator turns OFF.**

Command/Reference Input From the Control Circuit Terminal Block

1. **Check if the wires are connected correctly.**
2. **Turn on the power to the Inverter.**
3. **Set Frequency Reference Selection (A001) to "01" (Control circuit terminal block).**
4. **Set RUN Command Selection (A002) to "01" (Control circuit terminal block).**

5. **Display Output Frequency Monitor (d001) and press the Enter key.**
   Confirm that "0.00" (Hz) is displayed.
6. **After confirming that the analog voltage/current value for frequency reference is 0, turn the RUN command ON. The RUN (during RUN) LED indicator is lit.**
7. **Gradually increase the analog voltage/current value for frequency reference.**
   *** The frequency reference can be set first, before setting the RUN command in 6. The motor accelerates/decelerates according to the acceleration/deceleration time set in F002/F003.**
8. **The motor starts to turn. Confirm the output frequency and motor rotation direction displayed on the Digital Operator, and check if the Inverter is free from errors.**
9. **After checking the operation, turn the RUN command OFF (turn the STP input ON in the case of 3-wire input). The motor starts to decelerate and once it stops, the RUN (during RUN) LED indicator turns OFF.**

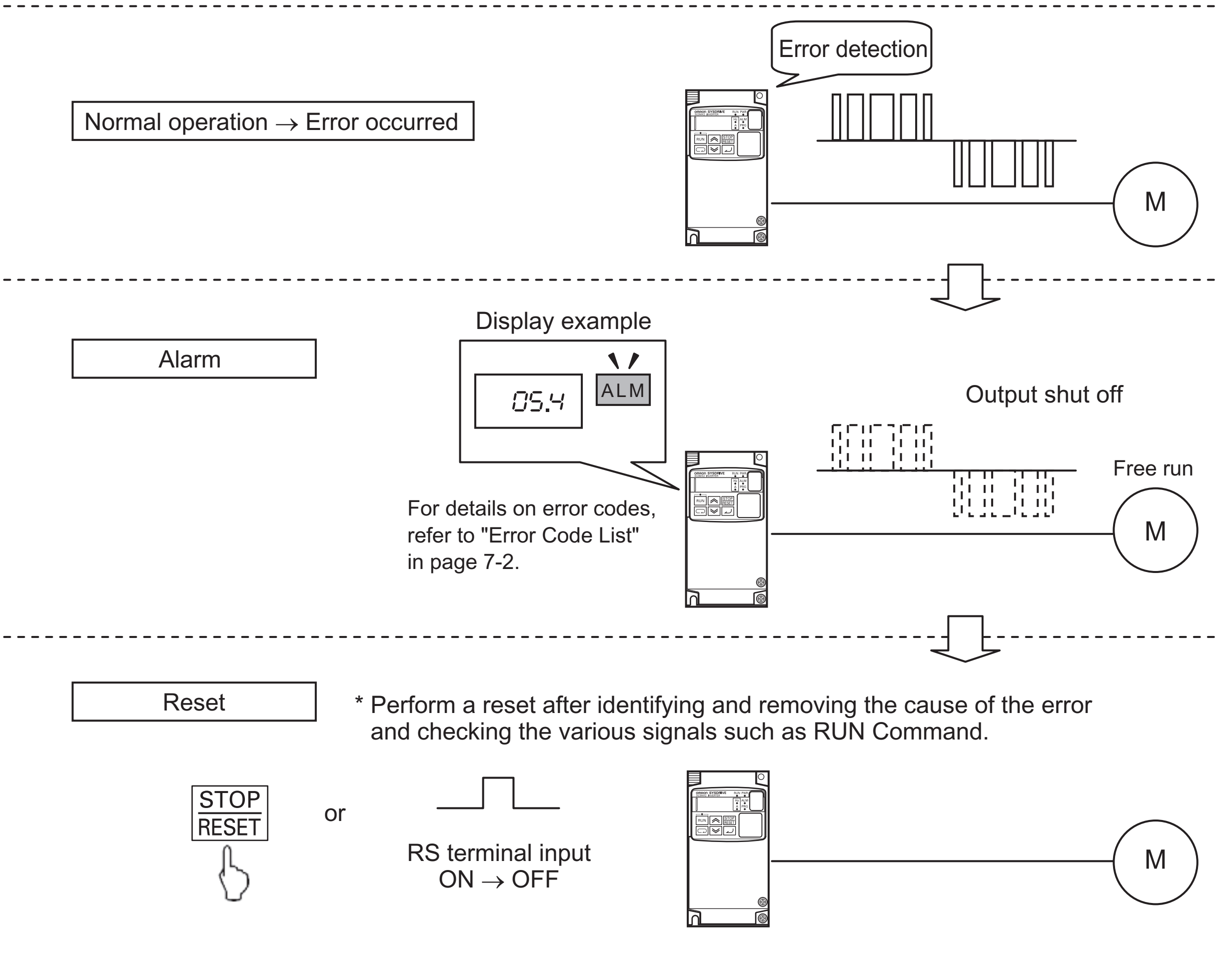
- Check for tripping during acceleration/deceleration, and also check if the rotation speed and frequency readings are correct.
- If an overcurrent or overvoltage tripping occurs during trial operation, try to increase the acceleration/deceleration time.
- Confirm by Output Current Monitor (d002) and DC Voltage Monitor (d102) to confirm that the current/voltage values are sufficiently away from the tripping values.

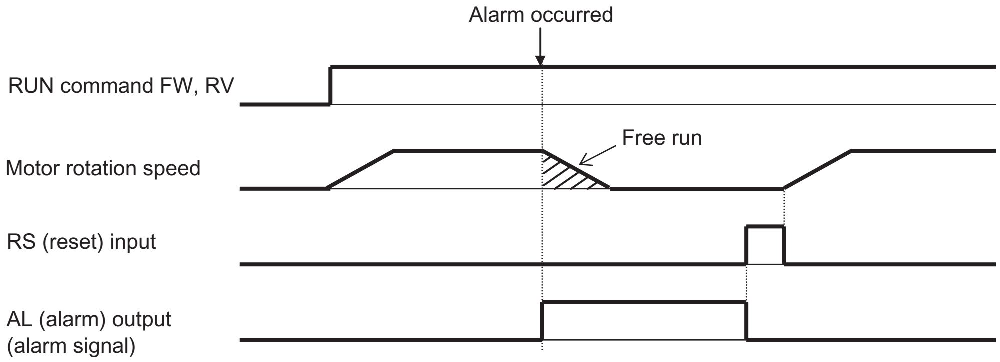
3-4 Tripping

Upon detecting an error (overcurrent, overload, etc.) during operation, the Inverter cuts off the output to the motor to protect the motor and Inverter. At the same time, the ALARM LED indicator is lit and an error code is displayed. "Tripping" refers to this series of operations. When a tripping occurs, the motor goes into free-run status. Identify the cause of the error from the displayed error code, and remove the cause.

A RUN command is not accepted during a tripping. To reset a tripping, press the STOP/RESET key. If a Reset (18: RS) is allocated to the multi-function input terminal, switching the reset input from ON to OFF resets a tripping.
Note, however, that a tripping may not be reset depending on the cause of the tripping. In such case, reconnect the power.
Also, confirm the RUN command and various other input signals thoroughly before executing a reset. If the RUN command signal remains ON, the Inverter will restart immediately after the reset.

Overview of Operation upon Tripping




Alarm occurred
RUN command FW, RV
Free run
Motor rotation speed
RS (reset) input
AL (alarm) output
(alarm signal)

4

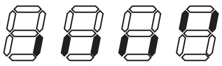
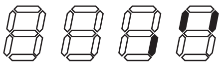
Parameter List

Describes the parameters used by this Unit.

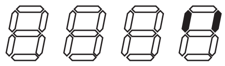
4-1 Monitor Mode

The description in "d001" is always displayed in the default setting at power-on. To fix the optional display, change the setting in "b038".

- The displayed parameters are limited in the default setting. To display all parameters, set Display Selection (b037) to "00 (Complete display)".
- Setting Soft Lock Selection (b031) to "10" permits data change during RUN.
- Data ranges given in parentheses are for high-frequency mode. Refer to page 5-178 for details.

Parameter No.	Function name	Monitor or data range	Default setting	Data can be set during RUN	Data can be changed during RUN	Unit	Page
d001	Output Frequency Monitor	0.00 to 99.99 100.0 to 1,000. (High-frequency mode)	–	yes	yes	Hz	5-1
d002	Output Current Monitor	0.0 to 655.3	–	–	–	A	5-1
d003	Rotation Direction Monitor	F: Forward o: Stop r: Reverse	–	–	–	–	5-2
d004	PID Feedback Value Monitor	0.00 to 99.99 100.0 to 999.9 1000. to 9999. 1000 to 9999(10000 to 99990) ⌈100 to ⌈999(100000 to 999000)	–	–	–	–	5-2
d005	Multi-function Input Monitor	 ON OFF S7 S6 S5 S4 S3 S2 S1 (Example) Terminal S1, S2: ON Terminal S3 to S7: OFF	–	–	–	–	5-3
d006	Multi-function Output Monitor	 ON OFF MA P2 P1 (Example) Terminal P1, P2: ON Terminal AL: OFF	–	–	–	–	5-3
d007	Output Frequency Monitor (after conversion)	0.00 to 99.99 100.0 to 999.9 1000. to 4000 (9999) 1000 to 4000 (9999/⌈100)	–	yes	yes	–	5-4
d008	Real Frequency Monitor	(–100/–999.) –400. to –100. –99.9 to –10.0 –9.99 to –0.00 0.00 to 99.99 100.0 to 400.0 (400.1 to 999.9/1000.)	–	–	–	Hz	5-5
d009	Torque Reference Monitor	–200. to +200.	–	–	–	%	5-5
d010	Torque Bias Monitor	–200. to +200.	–	–	–	%	5-6
d012	Output Torque Monitor	–200. to +200.	–	–	–	%	5-6
d013	Output Voltage Monitor	0.0 to 600.0	–	–	–	V	5-6

4

Parameter No.	Function name	Monitor or data range	Default setting	Data can be set during RUN	Data can be changed during RUN	Unit	Page
d014	Input Power Monitor	0.0 to 100.0	–	–	–	kW	5-7
d015	Integrated Power Monitor	0.0 to 999.9 1000. to 9999. 1000 to 9999 (10000 to 99990) ⌈100 to ⌈999 (100000 to 999000)	–	–	–	–	5-7
d016	Total RUN Time	0.0 to 9999. 1000 to 9999 (10000 to 99990) ⌈100 to ⌈999 (100000 to 999000)	–	–	–	h	5-8
d017	Power ON Time	0.0 to 9999. 1000 to 9999 (10000 to 99990) ⌈100 to ⌈999 (100000 to 999000)	–	–	–	h	5-8
d018	Fin Temperature Monitor	–20.0 to 150.0	–	–	–	°C	5-8
d022	Life Assessment Monitor	 2 1 1: Capacitor on main circuit board 2: Cooling fan	–	–	–	–	5-9
d023	(Reserved)	–	–	–	–	–	–
d024							
d025							
d026							
d027							
d029	Position Command Monitor	–268435455 to 268435455 (Displays MSB 4 digits including "–")	–	–	–	–	5-9
d030	Current Position Monitor	–268435455 to 268435455 (Displays MSB 4 digits including "–")	–	–	–	–	5-9
d050	User Selection Monitor (2 types)	Monitor data selected by b160/b161 is displayed.	–	–	–	–	5-10
d060	Inverter Mode Monitor	The currently set mode is displayed. I-C (IM motor heavy load) I-V (IM motor light load) H-I (IM motor high frequency)	–	–	–	–	5-10
d080	Fault Counter	0. to 9999. 1000 to 6553 (10000 to 65530)	–	–	–	Time	5-11
d081	Fault Monitor 1 (Latest)	Cause →Frequency (Hz) →Current (A) →Voltage between PNs (V) →RUN time (h) →Power ON time (h)	–	–	–	–	5-11
d082	Fault Monitor 2						
d083	Fault Monitor 3						
d084	Fault Monitor 4						
d085	Fault Monitor 5						
d086	Fault Monitor 6						

Parameter No.	Function name	Monitor or data range	Default setting	Data can be set during RUN	Data can be changed during RUN	Unit	Page
d090	Warning Monitor	Warning code	–	–	–	–	5-11
d102	DC Voltage Monitor	0.0 to 999.9 1000.	–	–	–	V	5-12
d103	Regenerative Braking Load Rate Monitor	0.0 to 100.0	–	–	–	%	5-12
d104	Electronic Thermal Load Rate Monitor	0.0 to 100.0	–	–	–	%	5-12

4-2 Function Mode

Parameter No.	Function name	Monitor or data range	Default setting	Data can be set during RUN	Data can be changed during RUN	Unit	Page
F001	Output Frequency Setting	0.0 Starting frequency to maximum frequency 1/2 0.0 to 100.0 (PID function enabled)	6.00	yes	yes	Hz %	5-15
F002	Acceleration Time Setting 1	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00)	yes	yes	s	5-24
F202	Acceleration Time Setting 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00)	yes	yes	s	
F003	Deceleration Time Setting 1	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00)	yes	yes	s	
F203	Deceleration Time Setting 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00)	yes	yes	s	
F004	RUN Direction Selection	00: Forward 01: Reverse	00	no	no	–	5-23

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Basic setting	A001	Frequency Reference Selection 1	00: Digital Operator (volume) 01: Control circuit terminal block 02: Digital Operator (F001) 03: Modbus communication (Modbus-RTU) 04: Optional board 06: Pulse train frequency 07: Do not set. 10: Operation function output	02		no	no	–	5-15
	A201	Frequency Reference Selection 2		02		no	no		
	A002	RUN Command Selection 1	01: Control circuit terminal block 02: Digital Operator 03: Modbus communication (Modbus-RTU) 04: Optional board	02		no	no	–	5-22
	A202	RUN Command Selection 2		02		no	no		
	A003	Base Frequency 1	30.0. to Maximum Frequency 1 [A004]	60.0 (1000.0)		no	no	Hz	5-26
	A203	Base Frequency 2	30.0 to Maximum Frequency 2 [A204]	60.0 (1000.0)		no	no	Hz	
	A004	Maximum Frequency 1	Base Frequency 1 [A003] to 400.0 (1000.)	60.0 (1000.0)		no	no	Hz	5-28
	A204	Maximum Frequency 2	Base Frequency 2 [A203] to 400.0 (1000.)	60.0 (1000.0)		no	no	Hz	
Analog input, others	A005	FV/FI Selection	00: Switch between FV (voltage)/FI (current) 02: Switch between FV (voltage)/volume*1 03: Switch between FI (current)/volume*1	00		no	no	–	5-38
	A011	FV Start Frequency	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-40
	A012	FV End Frequency	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	
	A013	FV Start Ratio	0. to FV end ratio	0.		no	yes	%	
	A014	FV End Ratio	FV start ratio to 100.	100.		no	yes	%	
	A015	FV Start Selection	00: Start Frequency A011 01: 0 Hz	01		no	yes	–	
	A016	Analog Input Filter (FV, FI Sampling)	1. to 30. 31. (with 500 ms filter ±0.1 Hz hysteresis)	8		no	yes	–	5-38
	A017	(Reserved)	Do not change.	00		–	–	–	–

*1. Enabled when the Digital Operator with Volume 3G3AX-OP01 is connected.

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
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		no	no	–	5-63
	A020	Multi-step Speed 1 Reference 0	0.00 Starting frequency to Maximum Frequency 1	6.00		yes	yes	Hz	
	A220	Multi-step Speed 2 Reference 0	0.00 Starting frequency to Maximum Frequency 2	6.00		yes	yes	Hz	
	A021	Multi-step Speed Reference 1	0.00 Starting frequency to Maximum Frequency	0.00		yes	yes	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 Reference11		0.00					
	A032	Multi-step Speed Reference 12		0.00					
	A033	Multi-step Speed Reference 13		0.00					

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Multi-step speed/jogging	A034	Multi-step Speed Reference 14	0.00 Starting frequency to Maximum Frequency	0.00		yes	yes	Hz	5-63
	A035	Multi-step Speed Reference 15		0.00					
	A038	Jogging Frequency	Starting frequency to 9.99	0.00		yes	yes	Hz	5-59
	A039	Jogging Stop Selection	00: Free run on jogging stop/ Disabled during operation 01: Deceleration stop on jogging stop/Disabled during operation 02: DC injection braking on jogging stop/Disabled in operation 03: Free run on jogging stop/ Enabled in operation 04: Deceleration stop on jogging stop/Enabled in operation 05: DC injection braking on jogging stop/Enabled in operation	04		no	yes	–	
V/f characteristics	A041	Torque Boost Selection 1	00: Manual torque boost 01: Automatic torque boost	00		no	no	–	5-49
	A241	Torque Boost Selection 2	00: Manual torque boost 01: Automatic torque boost	00		no	no	–	
	A042	Manual Torque Boost Voltage 1	0.0 to 20.0 (Percentage of motor voltage A082)	1.0		yes	yes	%	
	A242	Manual Torque Boost Voltage 2	0.0 to 20.0 (Percentage of motor voltage A282)	1.0		yes	yes	%	
	A043	Manual Torque Boost Frequency 1	0.0 to 50.0 (Ratio to base frequency A003)	5.0		yes	yes	%	
	A243	Manual Torque Boost Frequency 2	0.0 to 50.0 (Ratio to base frequency A203)	5.0		yes	yes	%	
	A044	Control Method 1	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power <VC, if low speed>) 02: Free V/f setting 03: Sensorless vector control (heavy load only)	00		no	no	–	5-46 5-144

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
V/f characteristics	A244	Control Method 2	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power <VC, if low speed>) 02: Free V/f setting 03: Sensorless vector control (heavy load only)	00		no	no	-	5-46 5-144
	A045	Output Voltage Gain 1	20. to 100.	100.		yes	yes	%	5-72
	A245	Output Voltage Gain 2	20. to 100.	100.		yes	yes	%	
	A046	Automatic Torque Boost Voltage Compensation Gain 1	0. to 255.	100.		yes	yes	–	5-49
	A246	Automatic Torque Boost Voltage Compensation Gain 2	0. to 255.	100.		yes	yes	–	
	A047	Automatic Torque Boost Slip Compensation Gain 1	0. to 255.	100.		yes	yes	–	
	A247	Automatic Torque Boost Slip Compensation Gain 2	0. to 255.	100.		yes	yes	–	

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
External DC injection braking	A051	Internal DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only on set frequencies.)	00		yes	no	–	5-135
	A052	Internal DC Injection Braking Frequency	0.00 to 60.00	0.50		no	yes	Hz	
	A053	DC Injection Braking Delay Time	0.0 to 5.0	0.0		no	yes	s	
	A054	DC Injection Braking Power	0. to 100./70. (heavy load/light load)	50		no	yes	%	
	A055	DC Injection Braking Time	0.0 to 60.0	0.5		no	yes	s	
	A056	DC Injection Braking Edge/ Level Selection	00: Edge operation 01: Level operation	01		no	yes	–	
	A057	Startup DC Injection Braking Power	0. to 100./70. (heavy load/light load)	0.		no	yes	%	
External DC injection braking	A058	Startup Internal DC Injection Braking Time	0.0 to 60.0	0.0		no	yes	s	5-135
	A059	DC Injection Braking Carrier Frequency	2.0 to 15.0/10.0 (heavy load/light load or high frequency)	5.0/2.0		no	yes	kHz	

4

Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Limit/jump	A061	Frequency Upper Limit 1	0.00 Frequency Lower Limit 1 to Maximum Frequency 1	0.00		no	yes	Hz	5-60
	A261	Frequency Upper Limit 2	0.00 Frequency Lower Limit 2 to Maximum Frequency 2	0.00		no	yes	Hz	
	A062	Frequency Lower Limit 1	0.00 Starting Frequency to Frequency Upper Limit 1	0.00		no	yes	Hz	
	A262	Frequency Lower Limit 2	0.00 Starting Frequency to Frequency Upper Limit 2	0.00		no	yes	Hz	
	A063	Jump Frequency 1	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-61
	A064	Jump Frequency Width 1	0.00 to 10.00(100.0)	0.50		no	yes	Hz	
	A065	Jump Frequency 2	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	
	A066	Jump Frequency Width 2	0.00 to 10.00 (100.0)	0.50		no	yes	Hz	
	A067	Jump Frequency 3	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	
	A068	Jump Frequency Width 3	0.00 to 10.00 (100.0)	0.50		no	yes	Hz	
Others	A069	Acceleration Stop Frequency	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-62
	A070	Acceleration Stop Time	0.0 to 60.0	0.0		no	yes	s	

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
PID control	A071	PID Selection	00: Disabled 01: Enabled 02: Reverse output enabled	00		no	yes	–	5-73
	A072	PID P Gain	0.00 to 25.00	1.00		yes	yes	–	
	A073	PID I Gain	0.0 to 999.9 1000. to 3600.	1.0		yes	yes	s	
	A074	PID D Gain	0.00 to 99.99 100.0	0.00		yes	yes	s	
	A075	PID Scale	0.01 to 99.99	1.00		no	yes	Time	
	A076	PID Feedback Selection	00: FI (current) 01: FV (voltage) 02: Modbus communication (Modbus-RTU) 03: Pulse train frequency 10: Operation function output	00		no	yes	–	
	A077	PID Deviation Reverse Output	00: Disabled 01: Enabled	00		no	yes	–	
	A078	PID Variable Range Limit	0.0 to 100.0	0.0		no	yes	%	
	A079	PID Feedforward Selection	00: Disabled 01: FV (voltage) 02: FI (current)	00		no	yes	–	
AVR	A081	AVR Selection 1	00: Always ON 01: Always OFF 02: OFF during deceleration	02		no	no	–	5-27
	A281	AVR Selection 2		02		no	no		
	A082	Motor Incoming Voltage Selection 1	200V class: 200/215/220/230/240 400V class: 380/400/415/440/460/480	200/400		no	no	V	5-26 5-148
	A282	Motor Incoming Voltage Selection 2		200/400		no	no	V	
	A083	AVR Filter Time Parameter	0.000 to 10.00	0.300		no	yes	s	5-27
	A084	AVR Deceleration Voltage Gain	50. to 200.	100.		no	yes	%	

4

Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Operation mode/acceleration/deceleration	A085	RUN Mode Selection	00: Normal operation 01: Energy-saving operation	00		no	no	–	5-79
	A086	Energy-saving Response/ Accuracy Adjustment	0.0 to 100.0	50.0		yes	yes	–	

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Operation mode/acceleration/deceleration function	A092	1st Acceleration Time 2	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (15.00)		yes	yes	s	5-66
	A292	2nd Acceleration Time 2		10.00 (15.00)		yes	yes		
	A093	1st Deceleration Time 2		10.00 (15.00)		yes	yes		
	A293	2nd Deceleration Time 2		10.00 (15.00)		yes	yes		
	A094	2-step Acceleration/ Deceleration Selection 1	00: Switched via 2CH terminal 01: Switched by setting 02: Enabled only when switching forward/reverse	00		no	no	–	
	A294	2-step Acceleration/ Deceleration Selection 2		00		no	no		
	A095	2-step Acceleration Frequency 1	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	no	Hz	
	A295	2-step Acceleration Frequency 2		0.00		no	no		
	A096	2-step Deceleration Frequency 1		0.00		no	no		
	A296	2-step Deceleration Frequency 2		0.00		no	no		
	A097	Acceleration Pattern Selection	00: Linear 01: S shape 02: U shape 03: Reverse-U shape 04: EL-S shape	01		no	no	–	5-68
	A098	Deceleration Pattern Selection		01		no	no		

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Frequency adjustment	A101	FI Start Frequency	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-40
	A102	FI End Frequency		0.00		no	yes		
	A103	FI Start Ratio	0. to FI end ratio	20.		no	yes	%	
	A104	FI End Ratio	FI start ratio to 100.	100.		no	yes	%	
	A105	FI Start Selection	00: Use Start Frequency [A101] 01: 0 Hz	00		no	yes	–	
Acceleration/Deceleration	A131	Acceleration Curve Parameter	01 (small curve) to 10 (large curve)	02		no	yes	–	5-68
	A132	Deceleration Curve Parameter		02		no	yes		
Operation frequency	A141	Operation Frequency Selection 1	00: Digital Operator 01: Digital Operator (volume) *1 02: FV (voltage) input 03: FI (current) input 04: Modbus communication (Modbus-RTU) 05: Optional board 07: Pulse train frequency	02		yes	no	–	5-70
	A142	Operation Frequency Selection 2		03		yes	no		

*1. Enabled when the Digital Operator with Volume 3G3AX-OP01 is connected.

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Operation frequency	A143	Operation Function Operator Selection	00: Addition (A141+A142) 01: Subtraction (A141–A142) 02: Multiplication (A141 × A142)	00		no	yes	–	5-70
	A145	Frequency Addition Amount Setting	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-71
	A146	Frequency Addition Sign Selection	00: Frequency reference + A145 01: Frequency reference – A145	00		no	yes	–	
Acceleration/Deceleration	A150	EL-S Shape Acceleration Curve Ratio 1	0. to 50.	10.		no	no	%	5-68
	A151	EL-S Shape Acceleration Curve Ratio 2		10.		no	no		
	A152	EL-S Shape Deceleration Curve Ratio 1		10.		no	no		
	A153	EL-S Shape Deceleration Curve Ratio 2		10.		no	no		
Others	A154	Deceleration Stop Frequency	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-62
	A155	Deceleration Stop Time	0.0 to 60.0	0.0		no	yes	s	
PID	A156	PID Sleep Function Operation Level	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-73
	A157	PID Sleep Operation Delay Time	0.0 to 25.5	0.0		no	yes	s	
Frequency adjustment	A161	VR Start Frequency	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-40
	A162	VR End Frequency	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	
	A163	VR Start Ratio	0. to VR End Ratio	0.		no	yes	%	
	A164	VR End Ratio	VR Start Ratio to 100	100.		no	yes	%	
	A165	VR Start Selection	00: Use Start Frequency [A161] 01: 0 Hz	01		no	yes	Hz	

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Momentary power interruption/Trip restart	b001	Retry Selection	00: Trip 01: 0 Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	00		no	yes	–	5-96
	b002	Allowable Momentary Power Interruption Time	0.3 to 25.0	1.0		no	yes	s	
	b003	Restart Standby Time	0.3 to 100.0	1.0		no	yes	s	5-96 5-100 5-103

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Momentary power interruption/Trip restart	b004	Momentary Power Interruption/ Undervoltage Trip During Stop Selection	00: Disabled 01: Enabled 02: Disabled during stop and deceleration stop	00		no	yes	–	5-96
	b005	Restart During Momentary Power Interruption Count Selection	00: 16 times 01: Unlimited	00		no	yes	–	
	b007	Frequency Matching Lower Limit Frequency Setting	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-97 5-100 5-103
	b008	Overvoltage/ Overcurrent 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		no	yes	–	5-97
	b010	Overvoltage/ Overcurrent Restart Count Selection	1 to 3	3		no	yes	Time	
	b011	Overvoltage/ Overcurrent Restart Standby Time	0.3 to 100.0	1.0		no	yes	s	
Electronic Thermal	b012	Electronic Thermal Level 1	0.20 × Rated current to 1.00 × Rated current	Inverter rated current		no	yes	A	5-110
	b212	Electronic Thermal Level 2		Inverter rated current		no	yes		
	b013	Electronic Thermal Characteristics Selection 1	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	01		no	yes	–	
	b213	Electronic Thermal Characteristics Selection 2		01		no	yes		

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Parameter List

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Electronic Thermal	b015	Free-electronic Thermal Frequency 1	0. to Free-electronic Thermal Frequency 2	0.		no	yes	Hz	5-112
	b016	Free-electronic Thermal Current 1	0.00 to Rated current	0.00		no	yes	A	
	b017	Free-electronic Thermal Frequency 2	Free-electronic Thermal Frequency 1 to Free-electronic Thermal Current 3	0.		no	yes	Hz	
	b018	Free-electronic Thermal Current 2	0.00 to Rated current	0.00		no	yes	A	
	b019	Free-electronic Thermal Frequency 3	Free-electronic Thermal Frequency 2 to 400. (1000.)	0.		no	yes	Hz	5-112
	b020	Free-electronic Thermal Current 3	0.00 to Rated current	0.00		no	yes	A	
Overload limit, Overcurrent Protection	b021	Overload Limit 1 Selection	00: Disabled 01: Enabled in acceleration/ constant speed operation 02: Enabled in constant speed operation 03: Enabled during acceleration/constant speed operation (accelerated during regeneration)	01		no	yes	–	5-114
	b221	Overload Limit 2 Selection		01		no	yes		
	b022	Overload Limit 1 Level	0.20 × Rated current to 2.00 × rated current (heavy load setting) 0.20 × Rated current to 1.50 × rated current (light load setting)	Rated current × 1.50 (heavy) or 1.20 (light)		no	yes	A	
	b222	Overload Limit 2 Level				no	yes	A	
	b023	Overload Limit 1 Parameter	0.1 to 999.9 1000. to 3000.	1.0		no	yes	s	
	b223	Overload Limit 2 Parameter		1.0		no	yes		
	b024	Overload Limit 1 Selection 2	00: Disabled 01: Enabled in acceleration/ constant speed operation 02: Enabled in constant speed operation 03: Enabled during acceleration/constant speed operation (accelerated during regeneration)	01		no	yes	–	
	b025	Overload Limit 1 Level 2	0.20 × Rated current to 2.00 × rated current (heavy load setting) 0.20 × Rated current to 1.50 × rated current (light load setting)	Rated current × 1.50 (heavy) or 1.20 (light)		no	yes	A	

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Overload limit, Overcurrent Protection	b026	Overload Limit 1 Parameter 2	0.1 to 999.9 1000. to 3000.	1.0		no	yes	s	5-114
	b027	Overcurrent Suppression Selection	00: Disabled 01: Enabled	00		no	yes	–	5-116
	b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × rated current (heavy load setting) 0.20 × Rated current to 1.50 × rated current (light load setting)	Inverter rated current		no	yes	A	5-97 5-100 5-103
	b029	Frequency Pull-in Restart Parameter	0.1 to 999.9 1000. to 3000.	0.50		no	yes	s	
	b030	Starting Frequency at Frequency Pull-in Restart Selection	00: Frequency at interruption 01: Maximum frequency 02: Set frequency	00		no	yes	–	
Lock	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		no	yes	–	5-84
Others	b033	Motor Cable Length Code Selection	5. to 20.	10.		no	yes	–	5-145
	b034	RUN Time/Power ON Time Level	0. to 9999. (0 to 99990) 1000 to 6553 (100000 to 655350)	0.		no	yes	h	5-124
	b035	Rotation Direction Limit Selection	00: No direction limit 01: Only Forward is enabled (Reverse is limited) 02: Only Reverse is enabled (Forward is limited)	00		no	no	–	5-23

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Others	b036	Reduced Voltage Startup Selection	0 (Reduced voltage startup time: short) to 255 (Reduced voltage startup time: long)	2		no	yes	–	5-58
	b037	Display Selection	00: Complete display 01: Individual display of functions 02: User setting + b037 03: Data comparison display 04: Basic display 05: Monitor display only	04		no	yes	–	5-88
	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 use this setting.	001		no	yes	–	5-86
	b039	User Parameter Automatic Setting Function	00: Disabled 01: Enabled	00		no	yes	–	5-177
Torque limit	b040	Torque Limit Selection	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Optional board	00		no	yes	–	5-153
	b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	0. to 200. no (Torque limit disabled)	200.		no	yes	%	
	b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)		200.		no	yes		
	b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)		200.		no	yes		
	b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)		200.		no	yes		
	b045	Torque LADSTOP Selection	00: Disabled 01: Enabled	00		no	yes	–	5-155
	b046	Reverse Rotation Prevention Selection	00: Disabled 01: Enabled	00		no	yes	–	5-157
Other	b049	Heavy Load/ Light Load Selection	00: Heavy load mode 01: Light load mode	00		no	no	–	5-13

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Controlled deceleration on power loss	b050	Controlled Deceleration on Power Loss	00: Controlled deceleration on power loss disabled. 01: Controlled deceleration on power loss enabled (deceleration stop) 02: Controlled deceleration on power loss (constant voltage, without recovery) 03: Controlled deceleration on power loss (constant voltage, with recovery)	00		no	no	–	5-106
	b051	DC Bus Voltage Trigger Level of Ctrl. Decel.	0.0 to 999.9 1000.	220.0/ 440.0		no	no	V	
	b052	Deceleration Hold Level of Ctrl. Decel	0.0 to 999.9 1000.	360.0/ 720.0		no	no	V	
	b053	Deceleration Time of Ctrl. Decel	0.01 to 3600.00	1.0		no	no	s	
	b054	Freq. Drop to Start Ctrl. Decel	0.00 to 10.00 (100.0)	0.00		no	no	Hz	5-106
Window comparator	b060	Window Comparator FV Upper Limit Level	Set an upper limit level. Setting range: 0. to 100. Lower limit: Lower limit level + Hysteresis width × 2	100.		yes	yes	%	5-132
	b061	Window Comparator FV Lower Limit Level	Set a lower limit level. Setting range: 0. to 100. Upper limit: Upper limit level – Hysteresis width × 2	0.		yes	yes	%	
	b062	Window Comparator FV Hysteresis Width	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	0.		yes	yes	%	
	b063	Window Comparator FI Upper Limit Level	Set an upper limit level.Setting range: 0. to 100. Lower limit: Lower limit level + Hysteresis width × 2	100.		yes	yes	%	
	b064	Window Comparator FI Lower Limit Level	Set a lower limit level. Setting range: 0. to 100. Upper limit: Upper limit level – Hysteresis width × 2	0.		yes	yes	%	
Window comparator	b065	Window Comparator FI Hysteresis Width	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	0.		yes	yes	%	5-132
	b070	Analog Operation Level at FV Disconnection	0. to 100. no (ignore)	no		no	yes	–	5-132
	b071	Analog Operation Level at FI Disconnection	0. to 100. no (ignore)	no		no	yes	–	

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Others	b075	Ambient Temperature	–10. to 50.	40.		yes	yes	°C	5-127
	b078	Integrated Power Clear	Cleared with the Enter key after changing to 01	00		yes	yes	–	5-7
	b079	Integrated Power Display Scale	1. to 1000.	1.		yes	yes	–	
	b082	Starting Frequency	0.10 to 9.99 (100.)	0.50		no	yes	Hz	5-57
	b083	Carrier Frequency	2.0 to 15.0/10.0 (heavy load/light load or high frequency) * With derating	10.0/ 2.0 (5.0)		no	yes	kHz	5-51
	b084	Initialization Selection	00: Initialization disabled 01: Fault monitor clear 02: Initializes data 03: Fault monitor clear + Data initialization 04: Do not set.	00		no	no	–	5-174
	b085	Initialization Data Selection	00: Do not change.	00		no	no	–	
	b086	Frequency Conversion Coefficient	0.01 to 99.99	1.00		yes	yes	–	5-4
	b087	STOP Key Selection	00: Enabled 01: Disabled 02: Only reset is enabled	00		no	yes	–	5-84
	b088	Free-run Stop Selection	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00		no	yes	–	5-103
	b089	Automatic Carrier Reduction	00: Disabled 01: Enabled/depends on current 02: Enabled/depends on fin temperature	01		no	no	–	5-52
	b090	Usage Rate of Regenerative Braking	0.0 to 100.0	0.0		no	yes	%	5-141
	b091	Stop Selection	00: Deceleration stop 01: Free-run stop	00		no	yes	–	5-24
	b092	Cooling Fan Operation	00: Always 01: Only during operation (including 5 minutes after power on/stop) 02: Depends on the fin temperature	01		no	yes	–	5-127
	b093	Cooling Fan Total Operation Time Clear	00: Total operation time count 01: Clear total operation time	00		no	no	–	

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Others	b094	Initialization Target Selection	00: All data 01: All data other than terminals/communication 02: U*** registration function only 03: Other than U*** registration function and Display Selection (b037)	00		no	no	–	5-174
	b095	Regenerative Braking Selection	00: Disabled 01: Enabled (Disabled while stopped) 02: Enabled (Enabled while operating and stopped)	00		no	yes	–	5-141
	b096	Regenerative Braking ON Level	330 to 380 660 to 760	360/ 720		no	yes	V	
V/f free setting	b100	Free V/f Frequency 1	0. to Free V/f Frequency 2	0.		no	no	Hz	5-47
	b101	Free V/f Voltage 1	0.0 to 800.0	0.0		no	no	V	
	b102	Free V/f Frequency 2	Free V/f Frequency 1 to Free V/f Frequency 3	0.		no	no	Hz	
	b103	Free V/f Voltage 2	0.0 to 800.0	0.0		no	no	V	
	b104	Free V/f Frequency 3	Free V/f Frequency 2 to Free V/f Frequency 4	0.		no	no	Hz	
	b105	Free V/f Voltage 3	0.0 to 800.0	0.0		no	no	V	
	b106	Free V/f Frequency 4	Free V/f Frequency 3 to Free V/f Frequency 5	0.		no	no	Hz	
	b107	Free V/f Voltage 4	0.0 to 800.0	0.0		no	no	V	
	b108	Free V/f Frequency 5	Free V/f Frequency 4 to Free V/f Frequency 6	0.		no	no	Hz	5-47
	b109	Free V/f Voltage 5	0.0 to 800.0	0.0		no	no	V	
	b110	Free V/f Frequency 6	Free V/f Frequency 5 to Free V/f Frequency 7	0.		no	no	Hz	
	b111	Free V/f Voltage 6	0.0 to 800.0	0.0		no	no	V	
	b112	Free V/f Frequency 7	Free V/f Frequency 6 to 400. (1000.)	0.		no	no	Hz	
	b113	Free V/f Voltage 7	0.0 to 800.0	0.0		no	no	V	

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Others	b120	Brake Control Function Selection	00: Disabled 01: Enabled	00		no	yes	–	5-143
	b121	Brake Release Wait Time	0.00 to 5.00	0.00		no	yes	s	
	b122	Acceleration Wait Time	0.00 to 5.00	0.00		no	yes	s	
	b123	Stop Wait Time	0.00 to 5.00	0.00		no	yes	s	
	b124	Brake Wait Time for Confirmation	0.00 to 5.00	0.00		no	yes	s	
	b125	Brake Release Frequency	0.00 to 99.99 100.0 to 400.0	0.00		no	yes	Hz	
	b126	Brake Release Current	0.00 to 2.00 × Inverter rated current	Inverter rated current		no	yes	A	
	b127	Break ON Frequency	0.00 to 99.99 100.0 to 400.0	0.00		no	yes	Hz	
	b130	Overvoltage Suppression Function Selection During Deceleration	00: Disabled 01: Enabled (DC voltage kept constant) 02: Enabled (Acceleration enabled)	00		no	yes	–	5-117
	b131	Overvoltage Suppression Level During Deceleration	200V class: 330. to 395. 400V class: 660. to 790.	380/760		no	yes	V	
	b132	Overvoltage Suppression Parameter	0.10 to 30.00	1.00		no	yes	s	
	b133	Overvoltage Suppression Proportional Gain Setting	0.00 to 5.00	0.20		yes	yes	–	
	b134	Overvoltage Suppression Integral Time Setting	0.0 to 150.0	1.0		yes	yes	s	
	b145	GS Input Operation Selection	00: Not tripped (cut off by hardware) 01: Tripped	00		no	yes	–	5-171
	b150	Main Panel Display Selection	001 to 060 (corresponding to d001 to d060)	001		yes	yes	–	5-87
	b160	d050 Monitor Target 1	001 to 030 (corresponding to d001 to d030)	001		yes	yes	–	5-10
	b161	d050 Monitor Target 2	001 to 030 (corresponding to d001 to d030)	002		yes	yes	–	
	b163	d001/d007 Frequency Setting Mode Selection	00: Disabled 01: Enabled	00		yes	yes	–	5-1 5-4

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Others	b164	Initial Screen Automatic Switching Function	00: Disabled 01: Enabled	00		yes	yes	–	5-87
	b165	Selection of Operation on Digital Operator Disconnection	00: Trip 01: Trip after deceleration stop 02: Ignored 03: Free-run stop 04: Deceleration stop	02		yes	yes	–	5-86
	b171	Inverter Mode Selection	00: Selection disabled 01: Induction motor 02: High-frequency induction motor	00		no	no	–	5-178
	b180	Perform Initialization/ Mode Selection	00: Initialization disabled 01: Perform initialization/ mode selection	00		no	no	–	5-174
Password	b190	Password A Setting	0000: Password function disabled 0001 to FFFF: Password	0000		no	no	–	5-91
	b191	Password A Authentication	0000 to FFFF	0000		no	no	–	
	b192	Password B Setting	0000: Password function disabled 0001 to FFFF: Password	0000		no	no	–	
	b193	Password B Authentication	0000 to FFFF	0000		no	no	–	

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Multi-function input terminal	C001	Multi-function Input 1 Selection	00: FW (Forward) 01: RV (Reverse) 02: CF1 (Multi-step speed 1) 03: CF2 (Multi-step speed 2) 04: CF3 (Multi-step speed 3) 05: CF4 (Multi-step speed 4) 06: JG (Jogging) 07: DB (External DC injection braking) 08: SET (Motor 2 control) 09: 2CH (2-step acceleration/deceleration) 11: FRS (Free-run stop) 12: EXT (External trip) 13: USP (USP function) 14: CS (Commercial switch) 15: SFT (Soft lock) 16: FV/FI (Analog input switch) 18: RS (Reset) 19: TH (PTC thermistor thermal protection) 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) 27: UP (UP/DWN function accelerated) 28: DWN (UP/DWN function decelerated) 29: UDC (UP/DWN function data clear) 31: OPE (Forced operator) 32: SF1 (Multi-step speed bit 1) 33: SF2 (Multi-step speed bit 2) 34: SF3 (Multi-step speed bit 3) 35: SF4 (Multi-step speed bit 4) 36: SF5 (Multi-step speed bit 5) 37: SF6 (Multi-step speed bit 6) 38: SF7 (Multi-step speed 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) 44: BOK (Brake confirmation) 46: LAC (LAD cancel) 47: PCLR (Position deviation clear) 50: ADD (Frequency addition) 51: F-TM (Forced terminal block) 52: ATR (Torque reference input permission) 53: KHC (Integrated power clear) 56: Reserved. 57: Reserved. 58: Reserved. 59: Reserved. 60: Reserved. 61: Reserved. 62: Reserved. 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) 73: SPD (Speed/position switching) 77: GS1 (GS1 input (C003 only)) 78: GS2 (GS2 input (C004 only)) 81: 485 (Start co-inverter communication) 82: Reserved. 83: HLD (Retain output frequency) 84: ROK (Permission of RUN command) 85: EB (Rotation direction detection (C007 only)) 86: DISP (Display fixed) no: NO (Not assigned)	00 (FW)		no	yes	–	5-29
	C002	Multi-function Input 2 Selection		01 (RV)		no	yes		
	C003	Multi-function Input 3 Selection *1		18 (RS)		no	yes		
	C004	Multi-function Input 4 Selection *1		12 (EXT)		no	yes		
	C005	Multi-function Input 5 Selection		02 (CF1)		no	yes		
	C006	Multi-function Input 6 Selection		03 (CF2)		no	yes		
	C007	Multi-function Input 7 Selection		06 (JG)		no	yes		

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Multi-function input terminal	C011	Multi-function Input Terminal 1 Operation Selection	00: NO (NO contact) 01: NC (NC contact)	00		no	yes	–	5-31
	C012	Multi-function Input Terminal 2 Operation Selection		00		no	yes		
	C013	Multi-function Input Terminal 3 Operation Selection		00		no	yes		
	C014	Multi-function Input Terminal 4 Operation Selection		00		no	yes		
	C015	Multi-function Input Terminal 5 Operation Selection		00		no	yes		
	C016	Multi-function Input Terminal 6 Operation Selection		00		no	yes		
	C017	Multi-function Input Terminal 7 Operation Selection		00		no	yes		

<table>
<tr><th colspan="2">Parameter No.</th><th>Function name</th><th>Monitor or data range</th><th>Default setting</th><th>Set data</th><th>Data can be set during RUN</th><th>Data can be changed during RUN</th><th>Unit</th><th>Page</th></tr>
<tr><td rowspan="3">Multi-function output terminal</td><td>C021</td><td>Multi-function Output Terminal P1/EDM Selection</td><td rowspan="3">00: RUN (During RUN)
01: FA1 (Constant speed reached)
02: FA2 (Set frequency min. reached)
03: OL (Overload warning)
04: OD (PID excessive deviation)
05: AL (Alarm output)
06: FA3 (Set frequency only)
07: OTQ (Overtorque/Undertorque)
09: UV (Signal during undervoltage)
10: TRQ (During torque limit)
11: RNT (RUN time over)
12: ONT (Power on time over)
13: THM (Thermal warning)
19: BRK (Brake release)
20: BER (Brake error)
21: ZS (0Hz)
22: DSE (Excessive speed deviation)
23: POK (Position ready)
24: FA4 (Set frequency min. reached 2)
25: FA5 (Set frequency only 2)
26: OL2 (Overload warning 2)
27: FVdc (Analog FV disconnection detection)
28: FIdc (Analog FI disconnection detection)
31: FBV (PID FB status output)
32: NDc (Communication disconnection detection)
33: LOG1 (Logic operation output 1)
34: LOG2 (Logic operation output 2)
35: LOG3 (Logic operation output 3)
39: WAC (Capacitor life warning)
40: WAF (Cooling fan life warning signal)
41: FR (Starting contact signal)
42: OHF (Fin overheat warning)
43: LOC (Low current signal)
44: Reserved.
45: Reserved.
46: Reserved.
50: IRDY (Operation ready)
51: FWR (During forward operation)
52: RVR (During reverse operation)
53: MJA (Fatal fault signal)
54: WCFV (Window comparator FV)
55: WCFI (Window comparator FI)
58: FREF (Frequency command source)
59: REF (RUN command source)
60: SETM (Motor 2 selection)
62: EDM (Safety device monitor)
63: OPO (Optional board)
no: NO (Not assigned)</td><td>00 (RUN)</td><td></td><td>no</td><td>yes</td><td rowspan="3">–</td><td rowspan="3">5-32</td></tr>
<tr><td>C022</td><td>Multi-function Output Terminal P2 Selection</td><td>01 (FA1)</td><td></td><td>no</td><td>yes</td></tr>
<tr><td>C026</td><td>Multi-function Relay Output (MA, MB) Function Selection</td><td>05 (AL)</td><td></td><td>no</td><td>yes</td></tr>
</table>

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Analog monitor	C027	MP Selection	00: Output frequency 01: Output current 02: Output torque (heavy load only) 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: Do not set. 15: Pulse train input monitor 16: Optional board	07		no	yes	–	5-42
Analog monitor	C028	AM Selection	00: Output frequency 01: Output current 02: Output torque (heavy load only) 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 11: Output torque (signed) (heavy load only) 16: Optional board	07		no	yes	–	5-44
Analog monitor	C030	Digital Current Monitor Reference Value	0.20 × rated current to 2.00 × rated current (current value at digital current monitor output 1,440 Hz)	Rated current		yes	yes	A	5-43
Multi-function output terminal	C031	Multi-function Output Terminal P1/EDM Contact Selection	00: NO contact at P1, P2, MA, NC contact at MB 01: NC contact at P1, P2, MA, NO contact at MB	00		no	yes	–	5-34
Multi-function output terminal	C032	Multi-function Output Terminal P2 Contact Selection		00		no	yes		
Multi-function output terminal	C036	Multi-function Relay Output (MA, MB) Contact Selection		01		no	yes		

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Level and output terminal status	C038	Low Current Signal Output Mode Selection	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed	01		no	yes	–	5-129
	C039	Low Current Detection Level	0.0 to 2.00 × Rated current	Rated current		yes	yes	A	
	C040	Overload Warning Signal Output Mode Selection	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed	01		no	yes	–	5-115
	C041	Overload Warning Level 1	0.0 to 2.00 × Rated current	Rated current × 1.15		yes	yes	A	
	C241	Overload Warning Level 2		Rated current × 1.15		yes	yes		
	C042	Arrival Frequency During Acceleration	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-122
	C043	Arrival Frequency During Deceleration	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	
	C044	PID Deviation Excessive Level	0.0 to 100.0	3.0		no	yes	%	5-73
	C045	Arrival Frequency During Acceleration 2	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	5-122
	C046	Arrival Frequency During Deceleration 2	0.00 to 99.99 100.0 to 400.0 (1000.)	0.00		no	yes	Hz	
	C047	Pulse Train Output Coefficient	0.01 to 99.99	1.00		yes	yes	–	5-43
	C052	Feedback Comparison Signal Off Level	0.0 to 100.0	100.0		no	yes	%	5-73
	C053	Feedback Comparison Signal On Level	0.0 to 100.0	0.0		no	yes	%	

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Parameter List

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Level and output terminal status	C054	Overtorque/ Undertorque Selection	00: Overtorque 01: Undertorque	00		no	yes	–	5-152
	C055	Overtorque/ undertorque level (Forward Power Running)	0. to 200.	100.		no	yes	%	
	C056	Overtorque/ undertorque level (Reverse Regeneration)		100.		no	yes		
	C057	Overtorque/ undertorque level (Reverse Power Running)		100.		no	yes		
	C058	Overtorque/ undertorque level (Forward Regeneration)		100.		no	yes		
	C059	Overtorque/ Undertorque Signal Output Mode Selection	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed	01		no	yes	–	
	C061	Electronic Thermal Warning Level	0. to 100.	90.		no	yes	%	5-113
	C063	0 Hz Detection Level	0.00 to 99.99 100.0	0.00		no	yes	Hz	5-125
	C064	Cooling Fin Overheat Warning Level	0. to 110.	100.		no	yes	°C	5-129
Communication function	C071	Communication Speed Selection	03: 2,400 bps 04: 4,800 bps 05: 9,600 bps 06: 19.2 kbps 07: 38.4 kbps 08: 57.6 kbps 09: 76.8 kbps 10: 115.2 kbps	05		no	yes	–	6-3
	C072	Communication Station No. Selection	1. to 247.	1.		no	yes	–	
	C074	Communication Parity Selection	00: No parity 01: Even 02: Odd	00		no	yes	–	
	C075	Communication Stop Bit Selection	1: 1 bit 2: 2 bits	1		no	yes	–	

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Communication function	C076	Operation Selection on Communication Error	00: Trip 01: Trip after deceleration stop 02: Ignored 03: Free-run stop 04: Deceleration stop	02		no	yes	–	6-3
	C077	Communication Error Timeout Time	0.00: Timeout disabled 0.01 to 99.99	0.00		no	yes	s	
	C078	Communication Wait Time	0. to 1000.	0.		no	yes	ms	
Adjustment	C081	FV Adjustment	0.0 to 200.0	100.		yes	yes	%	5-40
	C082	FI Adjustment	0.0 to 200.0	100.		yes	yes	%	
	C085	Thermistor Adjustment	0.0 to 200.0	100.0		yes	yes	%	5-120
	C091	Debug Mode Selection	Use "00". *Do not change.	00		yes	yes	–	–
Communication function	C096	Communication Selection	00: Modbus communication (Modbus-RTU) 01: Co-inverter communication 02: Co-inverter communication (management inverter)	00		no	no	–	6-22
	C098	Co-inverter Communication Starting Station Number	1. to 8.	1.		no	no	–	
	C099	Co-inverter Communication Ending Station Number	1. to 8.	1.		no	no	–	
	C100	Co-inverter Communication Start Selection	00: 485 terminal 01: Always started	00		no	no	–	

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Others	C101	UP/DWN Storage Selection	00: Do not store frequency data 01: Store frequency data	00		no	yes	–	5-71
	C102	Reset Selection	00: Trip reset at power-on 01: Trip reset at power-off 02: Enabled only during trip (Reset when the power is ON.) 03: Trip reset only	00		yes	yes	–	5-100
	C103	Reset Restart Selection	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00		no	yes	–	
	C104	UP/DWN Clear Terminal Mode	00: 0 Hz 01: EEPROM data at power-on	00		no	yes	–	5-71
	C105	MP Gain Setting	50. to 200.	100.		yes	yes	%	5-43
	C106	AM Gain Adjustment	50. to 200.	100.		yes	yes	%	5-45
	C109	AM Bias Setting	0. to 100.	0.		yes	yes	%	5-45
	C111	Overload 1 Warning Level 2	0.00 to 2.00 × Rated current	Rated current × 1.15		yes	yes	A	5-115

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
I/O terminal function	C130	Output P1/EDM ON Delay Time	0.0 to 100.0	0.0		no	yes	s	5-36
	C131	Output P1/EDM OFF Delay Time		0.0		no	yes		
	C132	Output P2 ON Delay Time		0.0		no	yes		
	C133	Output P2 OFF Delay Time		0.0		no	yes		
	C140	Output RY ON Delay Time		0.0		no	yes		
	C141	Output RY OFF Delay Time		0.0		no	yes		
	C142	Logic Output Signal 1 Selection 1	Same as the options for C021 (33 (LOG1), 34 (LOG2), 35 (LOG3), 62 (EDM), 63 (OPO), and "no" cannot be selected.)	00		no	yes	–	5-125
	C143	Logic Output Signal 1 Selection 2	Same as the options for C021 (33 (LOG1), 34 (LOG2), 35 (LOG3), 62 (EDM), 63 (OPO), and "no" cannot be selected.)	00		no	yes	–	
	C144	Logic Output Signal 1 Operator Selection	00: AND 01: OR 02: XOR	00		no	yes	–	
	C145	Logic Output Signal 2 Selection 1	Same as the options for C021 (33 (LOG1), 34 (LOG2), 35 (LOG3), 62 (EDM), 63 (OPO), and "no" cannot be selected.)	00		no	yes	–	
	C146	Logic Output Signal 2 Selection 2	Same as the options for C021 (33 (LOG1), 34 (LOG2), 35 (LOG3), 62 (EDM), 63 (OPO), and "no" cannot be selected.)	00		no	yes	–	
	C147	Logic Output Signal 2 Operator Selection	00: AND 01: OR 02: XOR	00		no	yes	–	
	C148	Logic Output Signal 3 Selection 1	Same as the options for C021 (33 (LOG1), 34 (LOG2), 35 (LOG3), 62 (EDM), 63 (OPO), and "no" cannot be selected.)	00		no	yes	–	
	C149	Logic Output Signal 3 Selection 2	Same as the options for C021 (33 (LOG1), 34 (LOG2), 35 (LOG3), 62 (EDM), 63 (OPO), and "no" cannot be selected.)	00		no	yes	–	
	C150	Logic Output Signal 3 Operator Selection	00: AND 01: OR 02: XOR	00		no	yes	–	

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
I/O terminal function	C160	Input Terminal 1 Response Time	0. to 200. (× 2 ms)	1.		no	yes	ms	5-32
	C161	Input Terminal 2 Response Time		1.		no	yes		
	C162	Input Terminal 3 Response Time		1.		no	yes		
	C163	Input Terminal 4 Response Time		1.		no	yes		
	C164	Input Terminal 5 Response Time		1.		no	yes		
	C165	Input Terminal 6 Response Time		1.		no	yes		
	C166	Input Terminal 7 Response Time		1.		no	yes		
	C169	Multi-step Speed/Position Determination Time	0. to 200. (× 10 ms)	0.		no	yes	ms	5-63
Control parameter	H001	Auto-tuning Selection	00: Disabled 01: Enabled (motor does not rotate) 02: Enabled (motor rotates)	00		no	no	–	5-146
	H002	Motor Parameter 1	00: Standard motor parameter 01: Auto-tuning parameter	00		no	no	–	5-145
	H202	Motor Parameter 2		00		no	no		
	H003	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	Default setting		no	no	kW	
	H203	Motor Capacity 2		Default setting		no	no	kW	
	H004	Motor Pole Number 1	2/4/6/8/10	4		no	no	pole	
	H204	Motor Pole Number 2		4		no	no		
	H005	Speed Response 1	1. to 1000.	100.		yes	yes	–	
	H205	Speed Response 2		100.		yes	yes		

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Control parameter	H006	Stabilization Parameter 1	0. to 255.	100.		yes	yes	–	5-81
	H206	Stabilization Parameter 2		100.		yes	yes		
	H020	Motor 1 Parameter R1	0.001 to 9.999 10.00 to 65.53	Depends on the capacity		no	no	Ω	5-145
	H220	Motor 2 Parameter R1		Depends on the capacity		no	no		
	H021	Motor 1 Parameter R2		Depends on the capacity		no	no		
	H221	Motor 2 Parameter R2		Depends on the capacity		no	no		
	H022	Motor 1 Parameter L	0.01 to 99.99 100.0 to 655.3	Depends on the capacity		no	no	mH	
	H222	Motor 2 Parameter L		Depends on the capacity		no	no		
	H023	Motor 1 Parameter Io	0.01 to 99.99 100.0 to 655.3	Depends on the capacity		no	no	A	
	H223	Motor 2 Parameter Io		Depends on the capacity		no	no		
	H024	Motor 1 Parameter J	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Depends on the capacity		no	no	kgm^2	
	H224	Motor 2 Parameter J		Depends on the capacity		no	no		

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Control parameter	H030	Motor 1 Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Depends on the capacity		no	no	Ω	5-145
	H230	Motor 2 Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Depends on the capacity		no	no	Ω	
	H031	Motor 1 Parameter R2 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Depends on the capacity		no	no	Ω	
	H231	Motor 2 Parameter R2 (Auto-tuning Data)		Depends on the capacity		no	no		
	H032	Motor 1 Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Depends on the capacity		no	no	mH	
	H232	Motor 2 Parameter L (Auto-tuning Data)		Depends on the capacity		no	no		
	H033	Motor 1 Parameter Io (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Depends on the capacity		no	no	A	
	H233	Motor 2 Parameter Io (Auto-tuning Data)		Depends on the capacity		no	no		
	H034	Motor 1 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 capacity		no	no	kgm^2	
	H234	Motor 2 Parameter J (Auto-tuning Data)		Depends on the capacity		no	no		
	H050	V/f Control with Speed Feedback Slip Compensation Proportional Gain	0.00 to 10.0	0.20		yes	yes	Time	5-83 5-160
	H051	V/f Control with Speed Feedback Slip Compensation Integral Gain	0.0. to 100.0	2		yes	yes	s	

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Others	P001	Operation Selection on Option Error	00: Trip 01: Continue operation	00		no	yes	–	–
Others	P003	Pulse Train Input Terminal RP Selection	00: Frequency setting (including PID) 01: Feedback pulse (enabled only when motor 1 control is selected) 02: Do not set.	00		no	no	–	5-82 5-160
Simple position control	P004	Feedback Pulse Train Input Type Selection	00: Single-phase pulse train 01: Dual-phase pulse train 1 02: Dual-phase pulse train 2 03: Single-phase pulse train + direction	00		no	no	–	5-160
Simple position control	P011	Number of Encoder Pulses	32. to 1024.	512.		no	no	Pulse	5-160
Simple position control	P012	Simple Position Control Selection	00: Simple position control disabled 02: Simple position control enabled	00		no	no	–	5-160
Simple position control	P015	Creep Speed Setting	Starting frequency to 10.0 (100.0)	5.00		no	yes	Hz	5-160
Simple position control	P026	Overspeed Error Detection Level	0.0 to 150.0	115.0		no	yes	%	5-160
Simple position control	P027	Speed Deviation Error Detection Level	0.00 to 99.99 100.0 to 120.0	10.00		no	yes	Hz	5-160
Others	P031	Acceleration/ Deceleration Time Input Type	00: Digital Operator 03: Do not set.	00		no	no	–	5-24
Simple torque control	P033	Torque Reference Input Selection	00: Terminal FV 01: Terminal FI 03: Digital Operator 06: Optional board	00		no	no	–	5-156
Simple torque control	P034	Torque Reference Setting	0. to 200.	0.		yes	yes	%	5-156
Simple torque control	P036	Torque Bias Mode	00: Disabled 01: Set via the Digital Operator 05: Optional board	00		no	no	–	5-156
Simple torque control	P037	Torque Bias Value	–200. to +200.	0.		yes	yes	%	5-156
Simple torque control	P038	Torque Bias Polarity Selection	00: As per sign 01: Depends on the RUN direction	00		no	no	–	5-156

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Simple torque control	P039	Speed Limit Value in Torque Control (Forward)	0.00 to 99.99 100.0 to 120.0	0.00		yes	yes	Hz	5-156
	P040	Speed Limit Value in Torque Control (Reverse)	0.00 to 99.99 100.0 to 120.0	0.00		yes	yes	Hz	
	P041	Speed/Torque Control Switching Time	0 to 1000					ms	
Communications options	P044	Communications Error Detection Timer Setting	0.00 to 99.99 (S)	1.00		no	no	–	–
	P045	Operation at Host Communications Error Selection	00: Trip 01: Deceleration stop and then trip 02: Ignore 03: Free-run stop 04: Deceleration stop	01		no	no		
	P046	Assembly Instance Number	00 to 20	00		no	no		
	P048	Operation at Idle Mode Detection Setting	00: Trip 01: Deceleration stop and then trip 02: Ignore 03: Free-run stop 04: Deceleration stop	01		no	no		
	P049	Number of Poles for Rotation Speed Setting	0/2/4/6/8/10/12/14/16/18/20/ 22/24/26/28/30/32/34/36/38	0		no	no		
Pulse train input	P055	Pulse Train Frequency Scale	1.0 to 32.0	25.0		no	yes	kHz	5-82
	P056	Pulse Train Frequency Filter Time Parameter	0.01 to 2.00	0.10		no	yes	s	
	P057	Pulse Train Bias Amount	–100. to +100.	0.		no	yes	%	
	P058	Pulse Train Limit	0. to 100.	100.		no	yes	%	

<table>
<tr><th colspan="2">Parameter No.</th><th>Function name</th><th>Monitor or data range</th><th>Default setting</th><th>Set data</th><th>Data can be set during RUN</th><th>Data can be changed during RUN</th><th>Unit</th><th>Page</th></tr>
<tr><td rowspan="8">Simple position control</td><td>P060</td><td>Multi-step Position Command 0</td><td rowspan="8">Position range setting (reverse side) to position range setting (forward side)
(Displays MSB 4 digits including "–")</td><td>0</td><td></td><td>yes</td><td>yes</td><td rowspan="8">–</td><td rowspan="8">5-164</td></tr>
<tr><td>P061</td><td>Multi-step Position Command 1</td><td>0</td><td></td><td>yes</td><td>yes</td></tr>
<tr><td>P062</td><td>Multi-step Position Command 2</td><td>0</td><td></td><td>yes</td><td>yes</td></tr>
<tr><td>P063</td><td>Multi-step Position Command 3</td><td>0</td><td></td><td>yes</td><td>yes</td></tr>
<tr><td>P064</td><td>Multi-step Position Command 4</td><td>0</td><td></td><td>yes</td><td>yes</td></tr>
<tr><td>P065</td><td>Multi-step Position Command 5</td><td>0</td><td></td><td>yes</td><td>yes</td></tr>
<tr><td>P066</td><td>Multi-step Position Command 6</td><td>0</td><td></td><td>yes</td><td>yes</td></tr>
<tr><td>P067</td><td>Multi-step Position Command 7</td><td>0</td><td></td><td>yes</td><td>yes</td></tr>
<tr><td rowspan="8">Simple position control</td><td>P068</td><td>Zero Return Mode</td><td>00: Zero return mode 1
01: Zero return mode 2</td><td>00</td><td></td><td>yes</td><td>yes</td><td>–</td><td rowspan="4">5-168</td></tr>
<tr><td>P069</td><td>Zero Return Direction Selection</td><td>00: Forward side
01: Reverse side</td><td>01</td><td></td><td>yes</td><td>yes</td><td>–</td></tr>
<tr><td>P070</td><td>Zero Return Mode 1 Frequency</td><td>0.00 to 10.00 (100.0)</td><td>5.00</td><td></td><td>yes</td><td>yes</td><td>Hz</td></tr>
<tr><td>P071</td><td>Zero Return Mode 2 Frequency</td><td>0.00 to 99.99
100.0 to 400.0</td><td>5.00</td><td></td><td>yes</td><td>yes</td><td>Hz</td></tr>
<tr><td>P072</td><td>Position Range Setting (Forward Side)</td><td>0 to 268,435,455
(Displays MSB 4 digits)</td><td>268435455</td><td></td><td>yes</td><td>yes</td><td>–</td><td rowspan="4">5-160</td></tr>
<tr><td>P073</td><td>Position Range Setting (Reverse Side)</td><td>–268,435,455 to 0
(Displays MSB 4 digits including "–")</td><td>–268435455</td><td></td><td>yes</td><td>yes</td><td>–</td></tr>
<tr><td>P075</td><td>Positioning Mode Selection</td><td>00: Limit
01: Not limited</td><td>00</td><td></td><td>no</td><td>no</td><td>–</td></tr>
<tr><td>P077</td><td>Encoder Disconnection Detection Time</td><td>0.0 to 10.0</td><td>1.0</td><td></td><td>yes</td><td>yes</td><td>s</td></tr>
</table>

Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
P100	(Reserved)	–	–		–	–	–	–
P101								
P102								
P103								
P104								
P105								
P106								
P107								
P108								
P109								
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P129								
P130								
P131								

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Co-inverter communication	P140	Number of Sent Data of All Stations in Co-inverter Communication	1. to 5.	5.		yes	yes	–	6-22
	P141	Recipient Station Number of All Stations in Co-inverter Communication 1	1. to 247.	1.		yes	yes	–	
	P142	Recipient Register of All Stations in Co-inverter Communication 1	0000 to FFFF Hex	0000		yes	yes	–	
	P143	Sender Register of All Stations in Co-inverter Communication 1	0000 to FFFF Hex	0000		yes	yes	–	
	P144	Recipient Station Number of All Stations in Co-inverter Communication 2	1. to 247.	2.		yes	yes	–	

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Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Inverter-to-Inverter communication	P145	Recipient Register of All Stations in Co-inverter Communication 2	0000 to FFFF Hex	0000		yes	yes	–	6-22
	P146	Sender Register of All Stations in Co-inverter Communication 2	0000 to FFFF Hex	0000		yes	yes	–	
	P147	Recipient Station Number of All Stations in Co-inverter Communication 3	1. to 247.	3.		yes	yes	–	
	P148	Recipient Register of All Stations in Co-inverter Communication 3	0000 to FFFF Hex	0000		yes	yes	–	
	P149	Sender Register of All Stations in Co-inverter Communication 3	0000 to FFFF Hex	0000		yes	yes	–	
	P150	Recipient Station Number of All Stations in Co-inverter Communication 4	1. to 247.	4.		yes	yes	–	
	P151	Recipient Register of All Stations in Co-inverter Communication 4	0000 to FFFF Hex	0000		yes	yes	–	
	P152	Sender Register of All Stations in Co-inverter Communication 4	0000 to FFFF Hex	0000		yes	yes	–	

	Parameter No.	Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
Co-inverter communication	P153	Recipient Station Number of All Stations in Co-inverter Communication 5	1. to 247.	5.		yes	yes	–	6-22
	P154	Recipient Register of All Stations in Co-inverter Communication 5	0000 to FFFF Hex	0000		yes	yes	–	
	P155	Sender Register of All Stations in Co-inverter Communication 5	0000 to FFFF Hex	0000		yes	yes	–	
	P160 P161 P162 P163 P164 P165 P166 P167 P168 P169 P170 P171 P172 P173 P174 P175 P176 P177 P178 P179 P180 P181 P182 P185 P186	(Reserved)	–	–		–	–	–	–

4

Parameter List

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
User parameter	U001	User 1 Selection	no d001 to P186	no		yes	yes	–	5-177
	U002	User 2 Selection		no		yes	yes		
	U003	User 3 Selection		no		yes	yes		
	U004	User 4 Selection		no		yes	yes		
	U005	User 5 Selection		no		yes	yes		
	U006	User 6 Selection		no		yes	yes		
	U007	User 7 Selection		no		yes	yes		
	U008	User 8 Selection		no		yes	yes		
	U009	User 9 Selection		no		yes	yes		
	U010	User 10 Selection		no		yes	yes		
	U011	User 11 Selection		no		yes	yes		
	U012	User 12 Selection		no		yes	yes		
	U013	User 13 Selection		no		yes	yes		
	U014	User 14 Selection		no		yes	yes		
	U015	User 15 Selection		no		yes	yes		
	U016	User 16 Selection		no		yes	yes		
	U017	User 17 Selection		no		yes	yes		
	U018	User 18 Selection		no		yes	yes		
	U019	User 19 Selection		no		yes	yes		
	U020	User 20 Selection		no		yes	yes		
	U021	User 21 Selection		no		yes	yes		
	U022	User 22 Selection		no		yes	yes		
	U023	User 23 Selection		no		yes	yes		
	U024	User 24 Selection		no		yes	yes		

Parameter No.		Function name	Monitor or data range	Default setting	Set data	Data can be set during RUN	Data can be changed during RUN	Unit	Page
User parameter	U025	User 25 Selection	no d001 to P186	no		yes	yes	–	5-177
	U026	User 26 Selection		no		yes	yes		
	U027	User 27 Selection		no		yes	yes		
	U028	User 28 Selection		no		yes	yes		
	U029	User 29 Selection		no		yes	yes		
	U030	User 30 Selection		no		yes	yes		
	U031	User 31 Selection		no		yes	yes		
	U032	User 32 Selection		no		yes	yes		

5

Functions

Describes the details of each parameter.

5

Functions

5-1 Monitor Mode

The following explains the Inverter's display functions such as the output frequency monitor and fault monitor.

Output Frequency Monitor [d001]

Displays the output frequency of the Inverter. During stop, "0.00" is displayed.
The monitor LED indicator "Hz" is lit while the d001setting is displayed.

Parameter No.	Function name	Data	Default setting	Unit
d001	Output Frequency Monitor	0.00 to 400.0	–	Hz
		0.00 to 1000. High-frequency mode		
b163	d001/d007 Frequency Setting Mode Selection	00: Disabled (The output frequency cannot be changed using d001/d007.)	00	–
		01: Enabled (The output frequency can be changed using d001/d007.)		
Related functions		A001, F001		

Reference

- If Frequency Reference Selection is set to Digital Operator (A001 = 02), enabling d001/d007 Frequency Setting Mode Selection (b163 = 01) lets you change the Output Frequency Monitor (d001) setting using the Increment/Decrement keys only during operation.
- Changed Output Frequency Monitor (d001) will be reflected to the Output Frequency Setting (F001). Pressing the Enter key stores the setting in the EEPROM.
- Since F001 is rewritten while d001 is still displayed, there may be a time gap between the key operation and display change depending on the acceleration/deceleration time.
- While the PID function is activated or being stopped, the output frequency cannot be changed.
- The frequency cannot be changed in the individual input mode by pressing the Increment/ Decrement keys simultaneously.

Output Current Monitor [d002]

Displays the output current value of the Inverter. During stop, "0.0" is displayed.
The monitor LED indicator "A" is lit while the d002 setting is displayed.

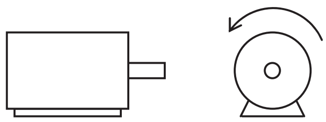
Parameter No.	Function name	Data	Default setting	Unit
d002	Output Current Monitor	0.0 to 655.3 The minimum unit varies depending on the capacity.	–	A

Rotation Direction Monitor [d003]

Displays the rotation direction of the Inverter.
The RUN LED indicator is lit during forward/reverse rotation.

Parameter No.	Function name	Data	Default setting	Unit
d003	Rotation Direction Monitor	F: Forward	–	–
		o: Stop		
		r: Reverse		

In general, the forward direction of the motor is the counterclockwise direction as viewed from the axial direction.



Forward

PID Feedback Value Monitor [d004]

When "01: Enabled" or "02: Reverse output enabled" is selected in PID Selection (A071), the PID feedback value can be monitored.
Also, conversion is possible using PID Scale (A075).

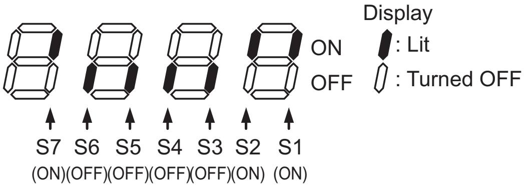
"d004 display" = "Feedback value [%]" × PID Scale (A075)

Parameter No.	Function name	Data	Default setting	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.)		
		1,000. to 9,999. (Displayed in increments of 1.)		
		1,000 to 9,999 (Displayed in increments of 10.)		
		⌈100 to ⌈999 (Displayed in increments of 1,000.)		
A075	PID Scale	0.01 to 99.99 (Displayed in increments of 0.01.)	1.00	Time
Related functions		A071, A075		

Multi-function Input Monitor [d005]

The LED lighting position indicates the input status of the multi-function inputs.
The item that the built-in CPU recognizes to be "input" is indicated as being ON. This does not depend on the NO/NC contact setting.

Example) Multi-function input terminals S7/EB, S2, S1 : ON
RP terminal, multi-function input terminals S6, S5/TH, S4/GS2, S3/GS1 : OFF

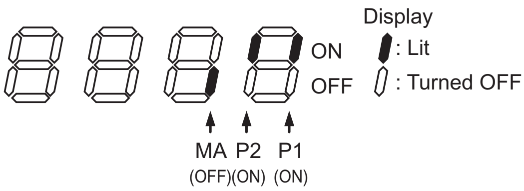


- If the input terminal response time function is used, the recognition of "input" is delayed. (Refer to "Input Terminal Response Time" on page 5-32.)
- Monitoring cannot be performed even when TH (thermistor) is allocated to the multi-function input terminal S5 and a digital signal is input.

Multi-function Output Monitor [d006]

The LED lighting position indicates the output status of the multi-function output terminals.
The output status of the built-in CPU is indicated. This is not the status of the control circuit terminal.
This does not depend on the NO/NC contact setting.

Example) Multi-function output terminals P2, P1/EDM : ON
Relay output terminal MA : OFF



Output Frequency Monitor (After Conversion) [d007]

Displays a conversion value based on the coefficient set in Frequency Conversion Coefficient (b086).
This monitor is used to change the unit of displayed data (e.g. motor rpm).

"Display of the Output Frequency Monitor (d007)" = "Output Frequency Monitor (d001)" × "Frequency Conversion Coefficient (b086)"

Example) Displaying rpm of 4-pole motor.
Motor rpm N [min-1] = (120 × f [Hz])/P [pole] = f [Hz] × 30
As such, when b086 = 30.0, a motor rpm of 1800 (60 × 30.0) is displayed at 60 Hz.

Parameter No.	Function name	Data	Default setting	Unit
d007	Output Frequency Monitor (after conversion)	0.00 to 99.99 (Displayed in increments of 0.01.)	–	–
		100.0 to 999.9 (Displays in increments of 0.1.)		
		1000. to 4000 (9999) (Displays in increments of 1.)		
		1,000 to 9,999 (Displayed in increments of 10.)		
		(⎡100) (Displays in increments of 1000.)		
b086	Frequency Conversion Coefficient	0.01 to 99.99 Set in increments of 0.01. (d007 = d001 × b086)	1.00	–
b163	d001/d007 Frequency Setting Mode Selection	00: Disabled (The output frequency cannot be changed using d001/d007.)	00	–
		01: Enabled (The output frequency can be changed using d001/d007.)		

Note: Data in ( ) indicates the value when the high-frequency mode is selected.

- If Frequency Reference Selection is set to Digital Operator (A001 = 02), enabling d001/d007 Frequency Setting Mode Selection (b163 = 01) lets you change the Output Frequency Monitor (d001) setting using the Increment/Decrement keys only during operation.
- Changed Output Frequency (d001) will be reflected to the Output Frequency Setting (F001). Pressing the Enter key stores the setting in the EEPROM.
- Since F001 is rewritten while d007 is still displayed, there may be a time gap between the key operation and display change depending on the acceleration/deceleration time.
- While the PID function is activated or being stopped, the output frequency cannot be changed.
- The frequency cannot be changed in the individual input mode by pressing the Increment/ Decrement keys simultaneously.

Real Frequency Monitor [d008]

Displays the real motor frequency, when Pulse Train Input Terminal RP Selection is set to "01: Feedback pulse."
The display does not depend on the control method.

Parameter No.	Function name	Data	Default setting	Unit
d008	Real Frequency Monitor	0.00 to 99.99 Forward. Displayed in increments of 0.01 Hz.	–	Hz
		100.0 to 400.0 (999.9) Forward. Displayed in increments of 0.1 Hz.		
		(1000.) Forward. Displayed in increments of 1 Hz.		
		–9.99 to –0.00 Reverse. Displayed in increments of 0.01 Hz.		
		–99.9 to –10.0 Reverse. Displayed in increments of 0.1 Hz.		
		–400. (–999.) to –100. Reverse. Displayed in increments of 1 Hz.		
		(–100) Reverse. Displayed in increments of 10 Hz.		
Related functions		P011, H004		

Note: Data in ( ) indicates the value when the high-frequency mode is selected.

- Set Number of Encoder Pulse (P011) and Motor Pole Number (H004/H204) correctly.
  For connections, etc., refer to "Simple Position Control Function" on page 5-158.

Torque Reference Monitor [d009]

Displays the currently entered torque reference value, when torque control is selected for sensorless vector control.
Torque control becomes active when "52: ATR" is allocated to a multi-function input terminal and the ATR terminal is turned ON.
For details, refer to "Torque Control" on page 5-156.

Parameter No.	Function name	Data	Default setting	Unit
d009	Torque Reference Monitor	–200. to 200.	–	%
Related functions		A044, C001 to C007, P033, P034		

Torque Bias Monitor [d010]

During sensorless vector control, the currently set torque bias amount is displayed.

Parameter No.	Function name	Data	Default setting	Unit
d010	Torque Bias Monitor	–200. to 200.	–	%
Related functions		A044, P036, P037, P038		

Output Torque Monitor [d012]

Displays an estimated value of the Inverter's output torque.

Parameter No.	Function name	Data	Default setting	Unit
d012	Output Torque Monitor	–200. to 200.	–	%
Related functions		A044/A244		

Note: The power running direction is positive and regeneration direction is negative during forward rotation, while the power running direction is negative and regeneration direction is positive during reverse rotation.

- This display is shown only when the sensorless vector control is selected. If any other control mode is selected, the correct value is not displayed.

Output Voltage Monitor [d013]

Displays the output voltage of the Inverter.

Parameter No.	Function name	Data	Default setting	Unit
d013	Output Voltage Monitor	0.0 to 600.0	–	V

- Set Motor Incoming Voltage Selection (A082/A282) correctly. The correct value may not be displayed.

Input Power Monitor [d014]

Displays the input power (instantaneous value) of the Inverter.

Parameter No.	Function name	Data	Default setting	Unit
d014	Input Power Monitor	0.0 to 100.0	–	kW

Integrated Power Monitor [d015]

Displays the integrated power (electric energy) of the Inverter.
The conversion of displayed data is performed with Integrated Power Display Scale (b079).

"d015 display" = "Actual integrated power [kWh]"/"Integrated Power Display Scale (b079)"

Example) If b079 = 100 and the displayed value is 1,000, the actual integrated power is 100,000 [kWh].

The integrated power value can be cleared by setting Integrated Power Clear (b078) to "01."
The integrated power value can also be cleared via terminal input, if "53: KHC (Integrated power clear)" is allocated to any of the multi-function inputs.
When Integrated Power Display Scale (b079) is set to "1000", up to "999,000,000" [kWh] can be displayed.
This parameter is saved in the EEPROM when the power is shut off.

Parameter No.	Function name	Data	Default setting	Unit
d015	Integrated Power Monitor	0.0 to 9999. Displayed in increments of the setting unit 1 kW × (b079).	–	–
		1000 to 9999 Displayed in increments of the setting unit 10 kW × (b079).		
		⌈100 to ⌈999 Displayed in increments of the setting unit 1,000 kW × (b079).		
b078	Integrated Power Clear	00: Normal	00	–
		01: Perform integrated power clear (01 is reset to 00 after the clear.)		
b079	Integrated Power Display Scale	1. to 1000.	1.	–
C001 to C007	Multi-function Input Selection	53: KHC (Integrated power clear)	–	–

Total RUN Time [d016]

Displays the total RUN time of the Inverter.
This parameter is saved in the EEPROM when the power is shut off.

Parameter No.	Function name	Data	Default setting	Unit
d016	Total RUN Time	0.0 to 9,999. (Displays in increments of 1 hour.)	–	h
		1,000 to 9,999 (Displays in increments of 10 hours.)		
		⌈100 to ⌈999 (Displayed in increments of 1,000 hours.)		

Note: Initialization will not clear the setting.

Power ON Time [d017]

Displays the total power ON time of the Inverter.
This parameter is saved in the EEPROM when the power is shut off.

Parameter No.	Function name	Data	Default setting	Unit
d017	Power ON Time	0.0 to 9,999. (Displays in increments of 1 hour.)	–	h
		1,000 to 9,999 (Displays in increments of 10 hours.)		
		⌈100 to ⌈999 (Displayed in increments of 1,000 hours.)		

Note: Initialization will not clear the setting.

Fin Temperature Monitor [d018]

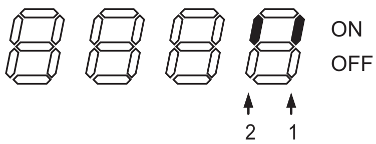
Displays the temperature of the cooling fin inside the Inverter.

Parameter No.	Function name	Data	Default setting	Unit
d018	Fin Temperature Monitor	–20.0 to 150.0	–	°C

Life Assessment Monitor [d022]

The LED lighting position indicates the status of life assessment signal.
The following two items can be monitored:

1: Main circuit board capacitor service life
2: Cooling fan life



- The capacitor service life is calculated every 10 minutes. If the Inverter is turned on/off frequently within this interval, the capacitor service life cannot be correctly diagnosed.
- The cooling fan life assessment function is not available for 1-phase 200V class motors of 0.4 kW max. and 3-phase 200V class motors of 0.75 kW max., because these motors are not equipped with a cooling fan.

Position Command Monitor [d029]

Position commands can be monitored during simple position control.
For details, refer to "Simple Position Control Function" on page 5-158.

Parameter No.	Function name	Data	Default setting	Unit
d029	Position Command Monitor	–268 (–268435455) to 2684 (268435455) Displays MSB 4 digits for forward command. Displays (–) and MSB 3 digits for reverse command. (Example) Command value 15600 → Displays as 1560 Command value –15600 → Displays as –156	–	–

Current Position Monitor [d030]

The current position can be monitored during simple position control.
For details, refer to "Simple Position Control Function" on page 5-158.

Parameter No.	Function name	Data	Default setting	Unit
d030	Current Position Monitor	–268 (–268435455) to 2684 (268435455) Displays MSB 4 digits for forward position. Displays (–) and MSB 3 digits for reverse position. (Example) Current position 1560000 → Displays as 1560 Current position –1560000 → Displays as –156	–	–

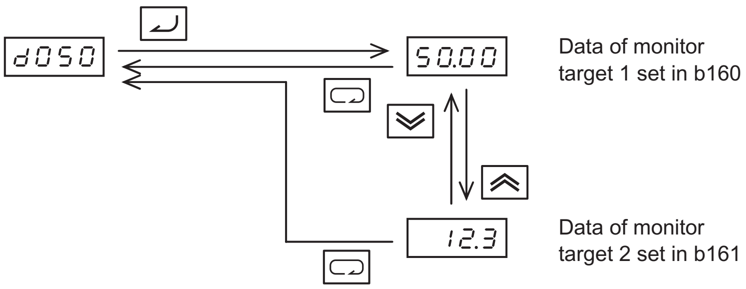
User Selection Monitor (2 Types) [d050]

Desired two monitor items can be set and monitored by switching the item using the Increment/ Decrement keys.
Set the parameter numbers to be monitored in b160 and b161.

Example) To monitor d001, set "001" in b160/b161.

Parameter No.	Function name	Data	Default setting	Unit
d050	User Selection Monitor (2 Types)	The two items set in b160 and b161 are monitored.	–	
b160	d050 Monitor Target 1	001 to 030 Corresponding to d001 to d030.*1	001	–
b161	d050 Monitor Target 2		002	

*1.Fault Monitor parameters (d081 to d086) are excluded.



- When d001/d007 Frequency Setting Mode Selection (b163) is set to "01: Enabled," the output frequencies in d001 and d007 can be changed using the Increment/Decrement keys during operation. It cannot be changed if d001 and d007 are monitored using d050.

Inverter Mode Monitor [d060]

Displays the current Inverter mode.
The Inverter mode is changed using b171. For details, refer to "Inverter Mode Selection" on page 5-178.

Parameter No.	Function name	Data	Default setting	Unit
d060	Inverter Mode Monitor	I-C IM (induction motor) heavy load mode	–	–
		I-V IM (induction motor) light load mode		
		H-I IM (induction motor) high-frequency mode		

Fault Counter [d080]

Displays the number of times the Inverter has tripped.
This number is saved in the EEPROM when the power is turned off.

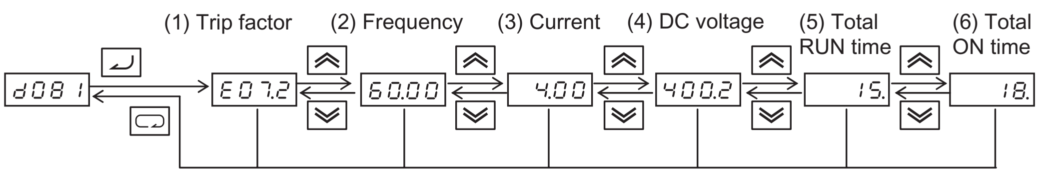
Parameter No.	Function name	Data	Default setting	Unit
d080	Fault Counter	0. to 9999.	–	Time
		1,000 to 6,553 (Displayed in increments of 10.)		

Fault Monitors 1 to 6 [d081 to 086]

Displays the records of the last 6 errors. Error records are saved in the EEPROM when the power is turned off.
The record of the latest error is displayed under Fault Monitor 1 (d081).

(Display)

(1) Cause of trip (One of E01 to E83 is displayed.)
Refer to "Inverter Fault Factor List" on page 6-35.
(2) Output frequency [Hz] at the time of tripping
(3) Output current [A] at the time of tripping
If the Inverter is currently stopped (E**.1), the monitor value may become zero.
(4) P-N DC voltage [V] in the main circuit at the time of tripping
If tripping occurs due to ground fault at power-on, the monitor value may become zero.
(5) Total Inverter RUN time [h] before the trip
(6) Total Inverter power ON time [h] before the trip



_ _ _ _ is shown if no trip has occurred.

Warning Monitor [d090]

If the set data is inconsistent with other data, a warning is displayed.
While a warning is present, the Program LED (PRG) indicator remains lit until the data is corrected.
For details on the Warning display, refer to "Warning Display" on page 7-7.

DC Voltage Monitor [d102]

The Inverter P-N DC voltage (DC voltage between the Inverter terminals P/+2 and N/-) is displayed.
During operation, the monitor value changes depending on the actual DC voltage of the Inverter.

Parameter No.	Function name	Data	Default setting	Unit
d102	DC Voltage Monitor	0.0 to 999.9/1000.	–	V

Regenerative Braking Load Rate Monitor [d103]

Displays a regenerative braking load rate. When the displayed value exceeds the value set in Usage Rate of Regenerative Braking (b090), the Inverter trips because of "E06 (Braking resistor overload protection)".

Parameter No.	Function name	Data	Default setting	Unit
d103	Regenerative Braking Load Rate Monitor	0.0 to 100.0	–	%
Related functions		b090		

Electronic Thermal Load Rate Monitor [d104]

Displays an electronic thermal load rate. When the displayed value exceeds 100%, the Inverter trips because of "E05 (Overload protection)".
When the power is shut off, the displayed value changes to 0. Also when totaling does not occur for 10 minutes, the displayed value changes to 0.

Parameter No.	Function name	Data	Default setting	Unit
d104	Electronic Thermal Load Rate Monitor	0.0 to 100.0	–	%

5-2 Basic Functions

The following explains the basic parameters such as RUN Command Selection and Acceleration/Deceleration Time.

Heavy Load/Light Load Selection

The rated specification of the Inverter is selected from the two types: heavy load rating and light load rating.
The rated current is different between the heavy load rating and light load rating, and the electronic thermal characteristics, overload warning level and other items also vary accordingly. Select either type according to the load actually used.

When the setting of Heavy Load/Light Load Selection is changed, the parameters shown in the table below are reset to their default values and at the same time the heavy load/light load rating changes. There is no need to reconnect the power or perform initialization.

The high-frequency mode is supported only when the heavy load rating is selected. For the high-frequency mode, refer to "Inverter Mode Selection" on page 5-178.

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

The features of the heavy load mode and light load mode are described below.

	Heavy load (CT)	Light load (VT)
Feature	A load that requires high torque under certain conditions such as at the start and during acceleration/ deceleration.	A load that does not require much torque.
Application	Lifts, cranes, conveyors, etc.	Fans, pumps, air-conditioners, etc.
Rated current (example)	1.0 A (3-phase 200 V 0.1 kW)	1.2 A (3-phase 200 V 0.1 kW)
Overload current rating	150% 60 s	120% 60 s

The setting ranges and default values of the following parameters are different between the heavy load rating and light load rating. Take note that when the heavy load/light load setting is changed using b049, the default values of all these parameters other than H003/H203 will also change. (Even when the parameters shown in the table below are set to values within a range supported by both the heavy load mode and light load mode, these values will be reset to the default value once b049 is changed.)

Parameter No.	Function name	Heavy load (CT)		Light load (VT)	
		Setting range	Default value	Setting range	Default value
A044/A244	Control Method 1/2	00: Constant torque 01: Reduced torque 02: Free V/f setting 03: Sensorless vector control	00: Constant torque	00: Constant torque 01: Reduced torque 02: Free V/f setting	00: Constant torque

Parameter No.	Function name	Heavy load (CT)		Light load (VT)	
		Setting range	Default value	Setting range	Default value
A054	DC Injection Braking Power	0 to 100[%]	50[%]	0 to 70[%]	50[%]
A057	Startup DC Injection Braking Power	0 to 100[%]	0[%]	0 to 70[%]	0[%]
A059	DC Injection Braking Carrier Frequency	2.0 to 15.0 [kHz]	5.0 [kHz]	2.0 to 10.0 [kHz]	2.0 [kHz]
b022/b222	Overload Limit 1/2 Level	0.20 to 2.00 × Rated current [A]	1.50 × Rated current [A]	0.10 to 1.50 × Rated current [A]	1.20 × Rated current [A]
b025	Overload Limit 1 Level 2				
b028	Frequency Pull-in Restart Level	0.20 to 2.00 × Rated current [A]	Inverter rated current [A]	0.10 to 1.50 × Rated current [A]	Inverter rated current [A]
b083	Carrier Frequency	2.0 to 15.0 [kHz]	10.0 [kHz]	2.0 to 10.0 [kHz]	2.0 [kHz]
H003/ H203	Motor Capacity 1/2	0.1 to 18.5 [kW]	Capacity indicated by the type	0.1 to 18.5 [kW]	Capacity indicated by the type

Take note that the following parameters are not displayed in the light load mode:

Parameter No.	Function name	Parameter No.	Function name
d009	Torque Reference Monitor	H005/H205	Speed Response 1/2
d010	Torque Bias Monitor	H020/H220	Motor 1/2 Parameter R1
d012	Output Torque Monitor	H021/H221	Motor 1/2 Parameter R2
b040	Torque Limit Selection	H022/H222	Motor 1/2 Parameter L
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	H023/H223	Motor 1/2 Parameter Io
b042	Torque Limit 2 (Four-quadrant Mode Reversed Regeneration)	H024/H224	Motor 1/2 Parameter J
b043	Torque Limit 3 (Four-quadrant Mode Reversed Power Running)	H030/H230	Motor 1/2 Parameter R1 (Auto-tuning Data)
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	H031/H231	Motor 1/2 Parameter R2 (Auto-tuning Data)
b045	Torque LADSTOP Selection	H032/H232	Motor 1/2 Parameter L (Auto-tuning Data)
b046	Reverse Rotation Prevention Selection	H033/H233	Motor 1/2 Parameter Io (Auto-tuning Data)
C054	Overtorque/Undertorque Selection	H034/H234	Motor 1/2 Parameter J (Auto-tuning Data)
C055	Overtorque Level (Forward Power Running)	P033	Torque Reference Input Selection

Parameter No.	Function name	Parameter No.	Function name
C056	Overtorque Level (Reverse Regeneration)	P034	Torque Reference Setting
C057	Overtorque Level (Reverse Power Running)	P036	Torque Bias Mode
C058	Overtorque Level (Forward Regeneration)	P037	Torque Bias Value
C059	Overtorque/Undertorque Signal Output Mode Selection	P038	Torque Bias Polarity Selection
H001	Auto-tuning Selection	P039	Speed Limit Value in Torque Control (forward)
H002/H202	Motor Parameter 1/2	P040	Speed Limit Value in Torque Control (reverse)

Take note that the following multi-function input terminals cannot be selected in the light load mode:

Multi-function input terminals		Multi-function output/relay terminals	
40: TL	Torque limit enabled/disabled	07: OTQ	Overtorque/undertorque
41: TRQ1	Torque limit switching 1	10: TRQ	During torque limit
42: TRQ1	Torque limit switching 2	–	–
52: ATR	Torque reference input permission	–	–

Frequency Reference Selection and Output Frequency Setting

Select the method of the frequency reference.
Since multi-step speed operation (in which a combination pattern of input terminals is used to specify the speed) is given priority over Frequency Reference Selection (A001), A001 need not be set. Only when all multi-step speed inputs are OFF and therefore 0th is specified, the frequency conforms to the setting of A001.

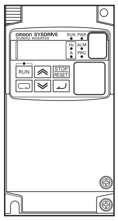
Parameter No.	Function name	Data	Default setting	Unit
A001 A201	Frequency Reference Selection 1 Frequency Reference Selection 2	00 (Enabled when 3G3AX-OP01 is used.) Data is set using the volume on the external Digital Operator 3G3AX-OP01.	02	–
		01 Data is set using the control circuit terminal (analog input signal).		
		02 Data is set using the Digital Operator or Remote Operator (set frequency: F001).		
		03 Data is set via Modbus communication (Modbus-RTU).		
		04 Data is set from optional board.		
		06 Data is set using a pulse train. Refer to "Pulse Train Frequency Input" on page 5-82.		
		07 Do not set.		
		10 The operation result of the set frequency operation function is defined as a frequency reference. Refer to "Frequency Operation Function" on page 5-70.		
F001	Output Frequency Setting*1	0.0, starting frequency to Maximum Frequency 1/2	6.00	%
C001 to C007	Multi-function Input Selection	16: FV/FI (Analog input switch)	–	–

*1.Only when Frequency Reference is selected to Digital Operator (A001/A201 = 02), the output frequency can be set using F001.

If only one frequency reference method is available, data is set using A001/A201 according to the above table.
If a frequency is set in F001, the same value is automatically set in Multi-step Speed 1 Reference 0 (A020) (F001 = A020). If Motor 2 Control is enabled (SET input = ON), the same value set in Multi-step Speed 2 Reference 0 is set (F001 = A220).

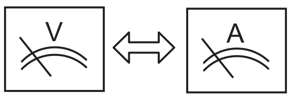
To switch between two frequency references by combining analog current/voltage switching based on frequency reference specification via analog input (A001/A201 = 01), and the Digital Operator with volume 3G3AX-OP01, allocate the FV/FI terminal (16: FV/FI) to a multi-function input. The detailed setting method is explained below. (A005: FV/FI Selection)

Specified by the Digital Operator



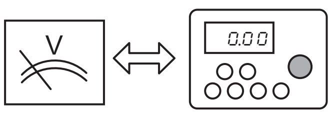
Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1	02: Specified by the Digital Operator (Set by F001.)	02	–

Switching between Analog Voltage and Analog Current via the FV/FI Terminal



Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1	01: Control circuit terminal block	02	–
A005	FV/FI Selection	00: Switch between voltage/current	00	–
C001 to C007	Multi-function Input Selection	16: FV/FI (Analog input switch) ON: Current OFF: Voltage	–	–

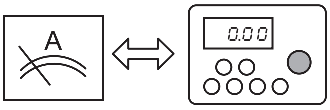
Switching between Analog Voltage and Volume via the FV/FI Terminal



Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1	01: Control circuit terminal block	02	–
A005	FV/FI Selection	02: Switch between FV (voltage)/ Volume*1	00	–
C001 to C007	Multi-function Input Selection	16: FV/FI (Analog input switch) ON: Volume*1 OFF: Voltage	–	–

*1.Volume: Volume on the external Digital Operator 3G3AX-OP01.

Switching between Analog Current and VR via the FV/FI Terminal

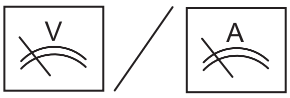


Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1	01: Control circuit terminal block	02	–
A005	FV/FI Selection	03: Switch between voltage/VR*1	00	–
C001 to C007	Multi-function Input Selection	16: FV/FI (Analog input switch) ON: Volume*1 OFF: Current	–	–

*1.Volume: Volume on the external Digital Operator 3G3AX-OP01.

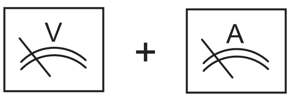
Either Analog Voltage or Analog Current is Used

To minimize the effect of noise, allocate the FV/FI terminal even when either analog voltage or current is used, and select either current or voltage by turning ON/OFF the terminal. If the FV/FI terminal cannot be allocated, be sure to short the unused analog input terminal as shown below.



Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1	01: Control circuit terminal block	02	–
C001 to C007	Multi-function Input Selection	– (FV\FI not allocated)	–	–
Wiring	Voltage: FV terminal is used, FI-SC shorted Current: FI terminal is used, FV-SC shorted			

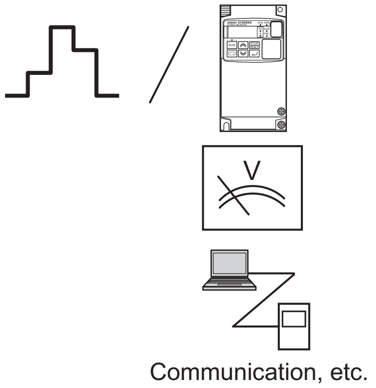
Specified by a Sum of Analog Voltage and Analog Current



Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1	01: Control circuit terminal block	02	–
C001 to C007	Multi-function Input Selection	– (Need not be allocated)	–	–

Specified by Multi-step Speed

When a multi-step speed is allocated to a multi-function input and the input is turned ON, multi-step speed operation is started regardless of the setting of A001. The frequency conforms to the applicable value set in A021 to A035. Only when all multi-step speed inputs are turned OFF, or specifically in the case of "0th," the frequency conforms to the setting of A001.



Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1 *1	***	02	–
C001 to C007	Multi-function Input Selection	02 to 05 Binary 15 Speed (CF1 to CF4) Data is selected by A019.	–	–
		32 to 38 Bit 7 Speed (SF1 to SF7) Data is selected by A019.		
A020 to A220	Multi-step Speed 1/2 Reference 0	Random	6.00	Hz
A021 to A035	Multi-step Speed Reference 1 to 15	Random	0.00	Hz

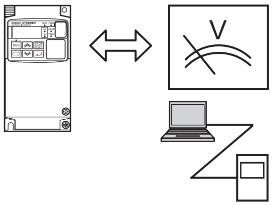
*1.Only when the speed is 0th the frequency reference conforms to the setting of A001.

Forced Digital Operator Function/Forced Terminal Block Function is Used

Besides using Frequency Reference Selection (A001), the RUN command and frequency reference can be changed forcibly using an input terminal.
An overview is given below. For details, refer to "Forced Operator Function (OPE)" on page 5-85 and "Forced Terminal Block Function (F-TM)" on page 5-85.

Switching between the Digital Operator and Other (Analog Input/Communication, etc.)

When the forced Digital Operator function (31: OPE) is allocated to a multi-function input and the input is turned ON, the command and reference from a Digital Operator become effective regardless of the setting of A001. Take note that not only the frequency reference, but also the RUN command conforms to the Digital Operator.

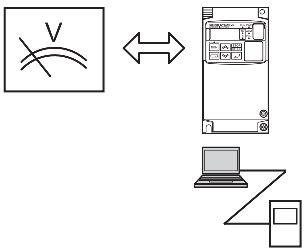


Communication, etc.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	31: OPE (Forced operator) ON: Digital Operator OFF: According to A001	–	–

Switching between Analog Input and Other (Digital Operator/Communication, etc.)

When the Forced terminal block (51: F-TM) is allocated to a multi-function input and the input is turned ON, the command and reference from the control circuit terminal block (analog input) become effective regardless the setting of A001. Take note that not only the frequency reference, but also the RUN command conforms to the control circuit terminal block.
In the terminal block mode, the analog current/voltage selection conforms to A005 and the FV/FI terminal status. When the Volume VR mode is selected (A005 = 02, 03 and the FV/FI terminal turned ON), however, the input command/reference effective when the FV/FI terminal is OFF are used.



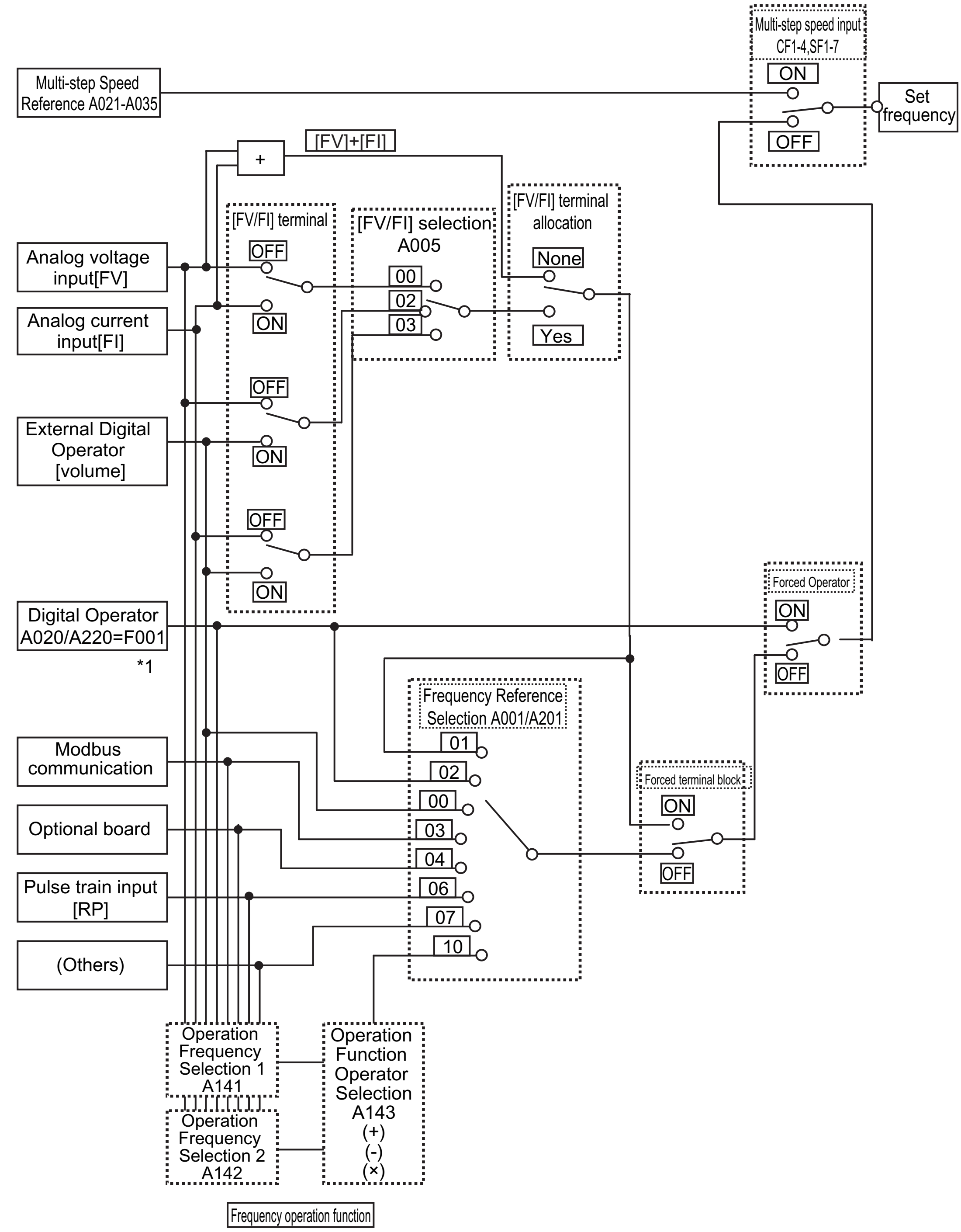
Communication, etc.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	51: F-TM (Forced terminal block) ON: Control circuit terminal block OFF: According to A001	–	–

Reference

- If the forced operator terminal and forced terminal block terminal are both turned ON, the forced operator function is given priority.

A relation diagram for frequency reference selection is as follows:



*1. If the frequency reference source is a Digital Operator, the frequency can be set using F001. If the frequency reference source is not a Digital Operator, F001 shows a monitored value of the specified frequency. If Frequency Change is enabled (b163 = 01) during monitoring, the frequency can be changed by pressing the Up/Down keys on the d001 or d007 monitor display.

RUN Command Selection

Select the method for using the RUN/STOP command.
To issue a RUN command from the Control Circuit Terminal Block (A002/A202 = 01), allocate the FW and RV terminals or STA, STP and F/R terminals (3-wire input) to multi-function input terminals.
To switch the NO/NC contact logic of each terminal, set the corresponding terminal using C011 to C017.

Parameter No.	Function name	Data	Default setting	Unit
A002 A202	RUN Command Selection 1 RUN Command Selection 2	01: Run/stop from the control circuit terminal block	02	–
		02: Run/stop from the Digital Operator or Remote Operator		
		03: Run/stop via Modbus communication (Modbus-RTU)		
		04: Run/stop from optional board		
C001 to C007	Multi-function Input Selection	00: FW (Forward)	–	–
		01: RV (Reverse)		
		20: STA (3-wire start)		
		21: STP (3-wire stop)		
		22: F/R (3-wire forward/reverse)		

Note : If the Forced operator (31: OPE) or Forced terminal block (51: F-TM) is allocated to a multi-function input, turning ON the terminal disables the settings of A001 and A002 and the frequency reference/ RUN command source specified by each terminal becomes effective.

The table below lists the forward/reverse/stop methods corresponding to different settings of RUN Command selection.

RUN Command Selection		Forward	Reverse	Stop
Terminal Block (A002=01)	FW/RV Terminal	FW terminal ON (level)	RV terminal ON (level)	FW/RV terminals both OFF (level)
	3-wire	STA terminal ON (edge) F/R terminal OFF (level)	STA terminal ON (edge) F/R terminal ON (level)	STP terminal ON (edge) (NC contact)
Digital Operator (A002=02)	Digital Operator	RUN key F004 = 00	RUN key F004 = 01	STOP key
	LCD Digital Operator	FWD RUN key	REV RUN key	STOP key
Modbus communications (A002 = 03)		Forward command	Reverse command	Stop command
Optional board (A002 = 04)				

Operation stops when the FW terminal and RV terminal are both turned ON.

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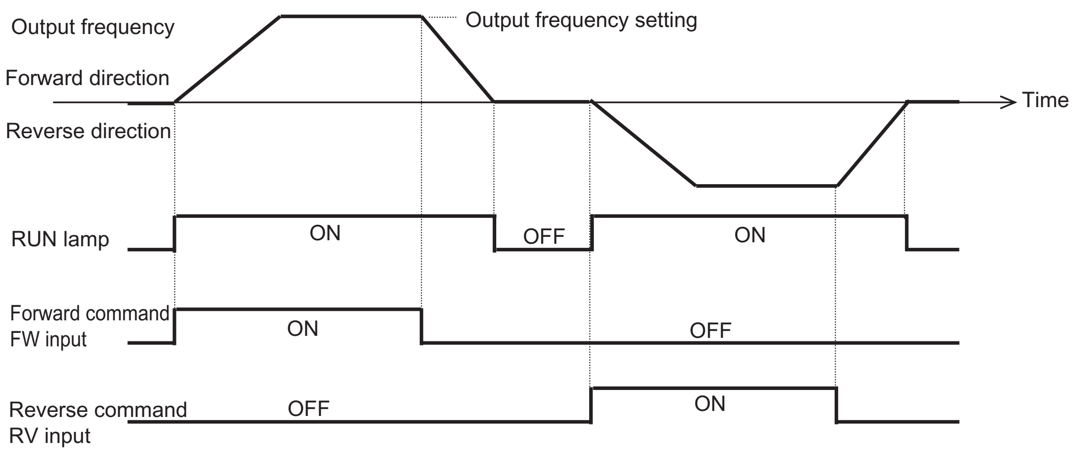
Functions

An overview of run/stop operations using the FW/RV terminals is shown below.



RUN Direction Selection

Select the rotation direction to be applied when a RUN command is input from the Digital Operator or external Digital Operator.
Becomes invalid when any RUN command issued from the control circuit terminal block or Remote Operator.

Parameter No.	Function name	Data	Default setting	Unit
F004	RUN Direction Selection	00: Forward operation	00	–
		01: Reverse operation		

Rotation Direction Limit Selection

Limits motor rotation directions.
Enabled in either "control circuit terminal block" or "Digital Operator" control mode.
When a limited RUN command is input from the control circuit terminal block, the Digital Operator displays  .

Parameter No.	Function name	Data	Default setting	Unit
b035	Rotation Direction Limit Selection	00: No direction limit	00	–
		01: Only Forward is enabled (No Reverse)		
		02: Only Reverse is enabled (No Forward)		

Stop Selection

It is possible to select deceleration stop or free-run stop according to the set deceleration time, when a stop command is issued.
If operation is resumed during free-run operation, the Inverter will restart according to the method set in Free-run Stop Selection (b088). For details, refer to "Deceleration Stop at Power-off (Controlled Deceleration on Power Loss Function)" on page 5-106.

Parameter No.	Function name	Data	Default setting	Unit
b091	Stop Selection	00: Deceleration stop	00	–
		01: Free-run stop		

Acceleration/Deceleration Time

Set an acceleration/deceleration time for the motor.
The set time indicates the acceleration/deceleration time from 0 Hz to the maximum frequency.

When the LAD (acceleration/deceleration) cancel (LAC) function is selected for a multi-function input selection and the signal is turned ON, the acceleration/deceleration time changes to the minimum acceleration/deceleration time (0.01 s) and the output frequency instantaneously follows the set frequency.
You can also divide the acceleration/deceleration in two steps. For details, refer to "2-step Acceleration/Deceleration Function (2CH)" on page 5-66.

Parameter No.	Function name	Data	Default setting	Unit
F002/F202	Acceleration Time Setting 1/2	0.01 to 3600. Set the acceleration time from 0 to the maximum frequency.	10.00 (30.00)	s
F003/F203	Deceleration Time Setting 1/2	0.01 to 3600. Set the deceleration time from the maximum frequency to 0.	10.00 (30.00)	s
P031	Acceleration/Deceleration Time Input Type	00: Digital Operator	00	–
		03: Do not set.		
C001 to C007	Multi-function Input Selection	46: LAC (LAD cancel)	–	–
Related functions		A004/A204, P031, C001 to C007		

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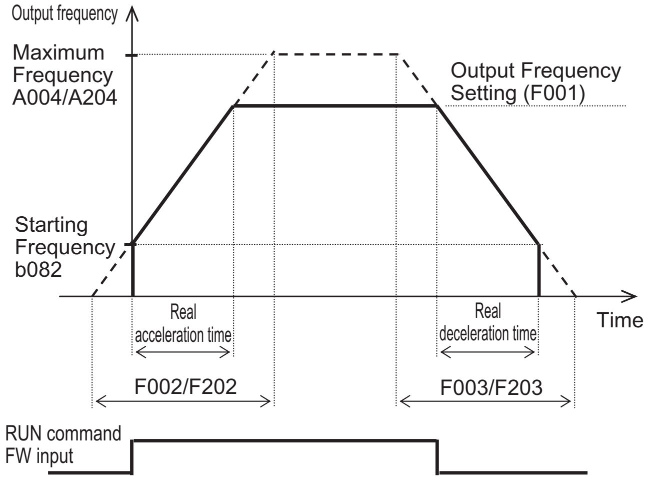
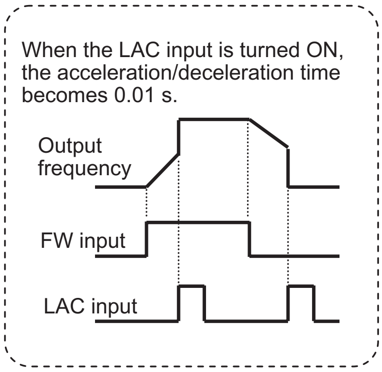
Functions

Take note that, as shown in the figure, the actual acceleration/deceleration time becomes shorter than the set acceleration/deceleration time depending on the set values of maximum frequency, output frequency and starting frequency.





No matter how shot the acceleration/deceleration time is set, the actual acceleration/ deceleration time cannot be shorter than the minimum acceleration/deceleration time determined by the mechanical inertia J and the motor torque. If you set a time shorter than the minimum acceleration/deceleration time, an overcurrent (OC) or overvoltage (OV) trip may occur.

The calculations of the minimum acceleration/deceleration time are as follows. Use as a reference.

Acceleration time T_S

$$t_S = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_S - T_L)}$$

Deceleration time T_B

$$T_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$$

J_L : Motor-shaft converted load J ($kg \cdot m^2$)
J_M : Motor load J ($kg \cdot m^2$)
N_M : Motor rotation speed (r/min)
T_S : Maximum acceleration torque based on inverter drive ($N \cdot m$)
T_B : Maximum deceleration torque based on inverter drive ($N \cdot m$)
T_L : Required running torque ($N \cdot m$)

5

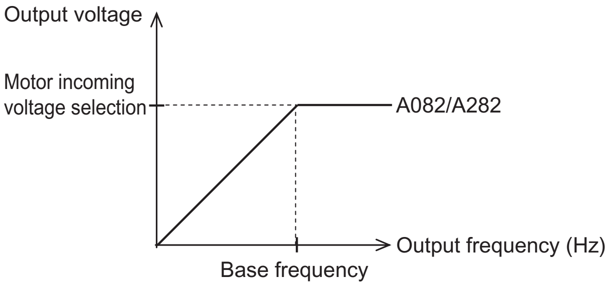
Functions

Base Frequency

Adjust the base frequency to the motor specification.
If you apply a base frequency of over 60 Hz, a special motor is required. This may require the Inverter to increase its capacity to accommodate a different applicable motor.
Set the motor incoming voltage selection according to the motor specifications.
This function is disabled if the control method is Free V/f Setting (A044/A244 = 02). (Refer to "Free V/f Setting" on page 5-47.)

- Take note that if a base frequency below 50 Hz is set, the motor may burn out.
- If a motor voltage exceeding the motor specification is selected, the motor may burn out.

Parameter No.	Function name	Data	Default setting	Unit
A003/A203	Base Frequency 1/2	30.0 to Maximum Frequency 1/2 [Hz]	60.0 (1000.0)	Hz
A082/A282	Motor Incoming Voltage Selection 1/2	200V class: 200/215/220/230/240	200	V
		400V class: 380/400/415/440/460/480	400	
Related functions		A081, A082		



AVR Function

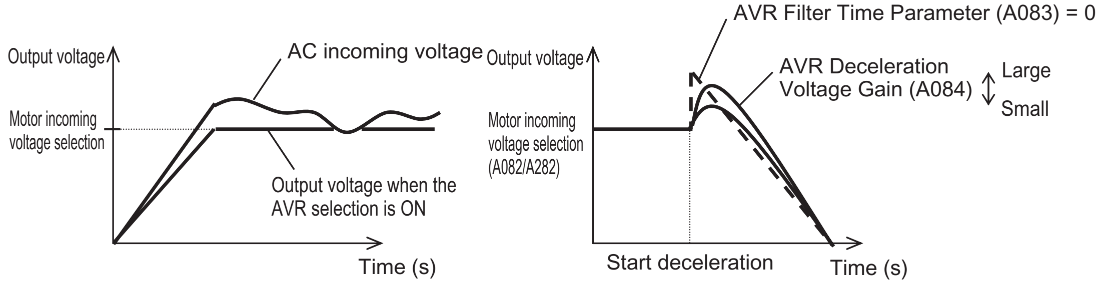
This function outputs voltage to the motor correctly even if the incoming voltage to the Inverter fluctuates.
The output voltage to the motor is based on the voltage selected by motor incoming voltage selection. Note, however, that a voltage exceeding the incoming voltage cannot be output.

AVR Filter Time Parameter/Voltage Gain During Deceleration

During deceleration, the motor functions as a generator and the generated energy is returned to the Inverter. As a result, the Inverter's DC voltage rises and if it exceeds the overvoltage level, an overvoltage (OV) trip occurs. Setting a higher output voltage increases the motor loss and energy consumptions, and consequently shortens the deceleration time. (However, the motor load increases.)
To shorten the deceleration time without causing an overvoltage trip, select OFF for AVR selection during deceleration for or tune the voltage characteristics using the AVR filter time parameter and voltage gain during deceleration.

Parameter No.	Function name	Data	Default setting	Unit
A081/A281	AVR Selection 1/2	00: Always ON	02	–
		01: Always OFF		
		02: OFF during deceleration*1		
A082/A282	Motor Incoming Voltage Selection 1/2	200V class: 200/215/220/230/240	200	V
		400V class: 380/400/415/440/460/480	400	
A083	AVR Filter Time Parameter	0.000 to 10.00	0.300	s
A084	AVR Deceleration Voltage Gain	50. to 200.	100.	%

*1.The deceleration time can be shortened by increasing the motor loss during deceleration and thereby reducing the regenerated energy returned to the Inverter. If the location of AC incoming voltage is away from the location of motor incoming voltage, however, an overcurrent trip may occur during deceleration. In this case, make adjustment by, for example, selecting "Always ON" for AVR Selection.



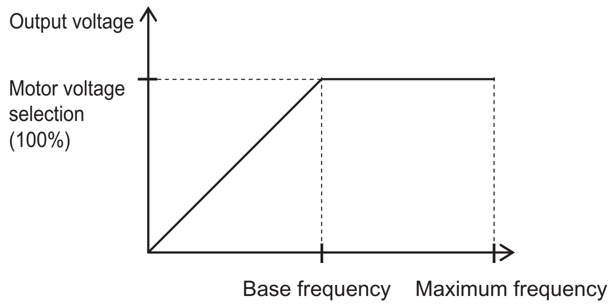
Example of setting the AVR Selection OFF during deceleration (A081 = 02)

Maximum Frequency

Set the maximum value of motor frequency to be used.
The set value corresponds to the maximum value of external analog input (such as 10 V in the range from is 0 to 10 V). For details, refer to "External Frequency Start/End" on page 5-40.
The Inverter output voltage from the base frequency to the maximum frequency is the voltage selected by Motor Incoming Voltage Selection (A082/A282).
This function is disabled if the control method is Free V/f Setting (A044/A244 = 02). (Refer to "Free V/f Setting" on page 5-47.)

Parameter No.	Function name	Data	Default setting	Unit
A004/A204	Maximum Frequency 1/2	Base Frequency 1/2 to 400.0 (1000.)	60.0 (1000.0)	Hz

Note: Data in ( ) indicates the value when the high-frequency mode is selected.



Reference

- All parameters whose function code is 2XX apply to Motor 2 (Motor 2 Control).
  Switch between Motor 1 and Motor 2 using the input terminal allocated to 08 (SET).
  Example) A020: Frequency of Motor 1 at Multi-step Speed 1 Reference 0
  A220: Frequency of Motor 2 at Multi-step Speed 2 Reference 0

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Functions

5-3 Input/Output Terminals

The following explains the Inverter's input/output signals.

Multi-function Input Selection

The following functions can be allocated to any of multi-function input terminals S1 to S7/EB to operate each function that has been set.
Terminals S1 to S7/EB correspond to C001 to C007.

You can select NO- or NC-contact input for each multi-function input.

The same function cannot be allocated to multiple multi-function input terminals. If the same function was allocated to multiple functions by mistake, the terminal to which the function was allocated last becomes effective. no is allocated to all terminals to which the function was allocated earlier, and their functions are disabled.
After allocating functions to terminals S1 to S7/EB, make sure that the function settings have been stored.

Parameter No.	Data	Description	Reference item	Page
C001 to C007	00	FW: Forward	RUN Command Selection	5-22
	01	RV: Reverse		
	02	CF1: Multi-step speed 1	Multi-step Speed Operation Function (Binary)	5-64
	03	CF2: Multi-step speed 2		
	04	CF3: Multi-step speed 3		
	05	CF4: Multi-step speed 4		
	06	JG: Jogging	Jogging Operation	5-59
	07	DB: External DC injection braking	External DC Injection Braking	5-135
	08	SET: Motor 2 Control	Motor 2 Control Function	5-54
	09	2CH: 2-step acceleration/ deceleration	2-step Acceleration/deceleration Function	5-66
	11	FRS: Free-run stop	Free-run Stop	5-103
	12	EXT: External trip	External Trip	5-120
	13	USP: USP function	Power Recovery Restart Prevention Function	5-105
	14	CS: Commercial switch	Commercial Switching	5-79
	15	SFT: Soft lock	Soft Lock	5-84
	16	FV/FI: Analog input switch	Analog Input	5-37
	18	RS: Reset	Reset	5-100
	19	TH: PTC thermistor thermal protection	Thermistor Trip Function	5-120

Parameter No.	Data	Description	Reference item	Page
C001 to C007	20	STA: 3-wire start	3-wire Input Function	5-56
	21	STP: 3-wire stop		
	22	F/R: 3-wire forward/reverse		
	23	PID: PID disabled	PID Function	5-73
	24	PIDC: PID integral reset		
	27	UP: UP/DWN function accelerated	Remote Operation Function	5-71
	28	DWN: UP/DWN function decelerated		
	29	UDC: UP/DWN function data clear		
	31	OPE: Forced operator	Forced Digital Operator Function	5-85
	32	SF1: Multi-step speed bit 1	Multi-step Speed Operation Function (Bit)	5-65
	33	SF2: Multi-step speed bit 2		
	34	SF3; Multi-step speed bit 3		
	35	SF4: Multi-step speed bit 4		
	36	SF5: Multi-step speed bit 5		
	37	SF6: Multi-step speed bit 6		
	38	SF7: Multi-step speed bit 7		
	39	OLR: Overload limit switching	Overload Limit/Overload Warning	5-114
	40	TL: Torque limit enabled/disabled	Torque Limit Function	5-153
	41	TRQ1: Torque limit switching 1		
	42	TRQ2: Torque limit switching 2		
	44	BOK: Brake confirmation	Brake Control Function	5-142
	46	LAC: LAD cancel	Acceleration/Deceleration Function	5-24
	47	PCLR: Position deviation clear	Simple Position Control Function	5-158
	50	ADD: Frequency addition	Frequency Addition Function	5-71
	51	F-TM: Forced terminal block	Forced Terminal Block Function	5-85
	52	ATR: Torque reference input permission	Torque Control	5-156
	53	KHC: Integrated power clear	Integrated Power Monitor	5-7
	56	Reserved.	–	–
	57			
	58			
	59			
	60			
	61			
	62			
	65	AHD: Analog command held	Analog Command Hold Function	5-39

Parameter No.	Data	Description	Reference item	Page
C001 to C007	66	CP1: Position command selection 1	Simple Position Control Mode	5-158
	67	CP2: Position command selection 2		
	68	CP3: Position command selection 3		
	69	ORL: Zero return limit signal		
	70	ORG: Zero return startup signal		
	73	SPD: Speed/position switching		
	77	GS1: GS1 input (C003 only)	Safety Function	5-170
	78	GS2: GS2 input (C004 only)		
	81	485: Start co-inverter communication	Inverter-to-Inverter Communication	6-22
	82	Reserved.	–	–
	83	HLD: Retain output frequency	Acceleration/Deceleration Hold Function	5-62
	84	ROK: Permission of RUN command	RUN Permission Signal	5-63
	85	EB: Rotation direction detection (C007 only)	Simple Position Control Function	5-158
	86	DISP: Display fixed	Fixed Display	5-91
	no	No: Not assigned	–	–

Multi-function Input Operation Selection

NO or NC contact can be selected individually for each of multi-function input terminals S1 to S7/EB.
A terminal with reset (RS) setting functions as NO contact only.

Parameter No.	Function name	Data	Default setting	Unit
C011 to C017	Multi-function Input Terminal Operation Selection	00: NO (NO contact)	00	–
		01: NC (NC contact)		

C011 to C017 set values	Status	Actual input signal status	Input signal status as recognized by the Inverter
00 (NO contact)	Normal	OFF (Open = No conduction)	OFF
	Operating	ON (Closed = Conduction)	ON
01 (NC contact)	Normal	ON (Closed = Conduction)	OFF
	Operating	OFF (Open = No conduction)	ON

Input Terminal Response Time

A sampling time can be set individually for each of multi-function input terminals S1 to S7/EB. Helps remove chattering and other noises. If the terminal input becomes unstable because of chattering, etc. increase the data value.
The larger the data value is, the slower the response time. A setting range of 0 to 200 is available, which corresponds to approx. 2 to 400 ms.

Parameter No.	Function name	Data	Default setting	Unit
C160 to C166	Input Terminal Response Time	0. to 200. (× 2 ms) Approx. 2 to 400 ms	1.	ms

Note. The response time is ignored upon power ON or reset. For example, if the power is turned on while the FW terminal is still ON, operation resumes immediately regardless of the set value of response time.

Multi-function Output Terminal Selection

The following functions can be allocated to Multi-function Output Terminal P1/EDM to P2 Selections (C021 to C022) and Multi-function Relay Output (MA, MB) Function Selection (C026). Multi-function output terminals P1/EDM, P2 are open-collector output, while multi-function relay output terminal MA, MB are relay output.
NO or NC contact can be selected individually for each output terminal using C031, C032 or C036.

Data	Description	Reference item	Page
00	RUN: During RUN	Signal During RUN	5-121
01	FA1: Constant speed reached	Frequency Arrival Signal	5-122
02	FA2: Set frequency min. reached		
03	OL: Overload warning	Overload Limit/Overload Warning	5-115
04	OD: PID excessive deviation	PID Function	5-73
05	AL: Alarm output	Alarm Signal	5-119
06	FA3: Set frequency only	Frequency Arrival Signal	5-122
07	OTQ: Overtorque/Undertorque	Overtorque/undertorque	5-152
09	UV: Signal during undervoltage	Restart Upon Momentary Power Interruption/ Undervoltage, Overvoltage/Overcurrent	5-96
10	TRQ: During torque limit	Torque Limit Function	5-153
11	RNT: RUN time over	RUN/Power ON Time Exceeded	5-124
12	ONT: Power on time over		
13	THM: Thermal warning	Electronic Thermal Function	5-113
19	BRK: Brake release	Brake Control Function	5-142
20	BER: Brake error		
21	ZS: 0Hz	0-Hz Signal (ZS)	5-125
22	DSE: Excessive speed deviation	Simple Position Control Mode	5-160
23	POK: Position ready		

Data	Description	Reference item	Page
24	FA4: Set frequency min. reached 2	Frequency Arrival Signal	5-122
25	FA5: Set frequency only 2		
26	OL2: Overload warning 2	Overload Limit/Overload Warning	5-115
27	FVdc: Analog FV disconnection detection	Window Comparator Function	5-132
28	FIdc: Analog FI disconnection detection		
31	FBV: PID FB status output	PID Function	5-73
32	NDc: Communication disconnection detection	RS485	5-128
33	LOG1: Logic operation output 1	Logic Operation Function	5-125
34	LOG2: Logic operation output 2		
35	LOG3: Logic operation output 3		
39	WAC: Capacitor life warning	Capacitor Life Warning Signal	5-126
40	WAF: Cooling fan life warning signal	WAF: Cooling Fan Life Warning Signal	5-127
41	FR: Starting contact signal	Starting Contact Signal	5-128
42	OHF: Fin overheat warning	Cooling Fin Overheat Warning	5-129
43	LOC: Low current signal	Low Current Signal	5-129
44	Reserved.	–	–
45			
46			
50	IRDY: Operation ready	Operation Ready Signal	5-130
51	FWR: During forward operation	Signal During Forward Operation	5-130
52	RVR: During reverse operation	Signal During Reverse Operation	5-131
53	MJA: Fatal fault signal	Fatal Fault Signal	5-131
54	WCFV: Window comparator FV	Window Comparator Function	5-132
55	WCFI: Window comparator FI		
58	FREF: Frequency command source	Frequency Reference Selection Status Signal	5-133
59	REF: RUN command source	RUN Command Status Signal	5-133
60	SETM: Motor 2 selection	Motor 2 Control Selected Signal	5-134
62	EDM: Safety device monitor	Safety Function	5-170
63	OPO: Optional board	–	–
255	no: Not assigned	–	–

Multi-function Output Terminal Contact Selection

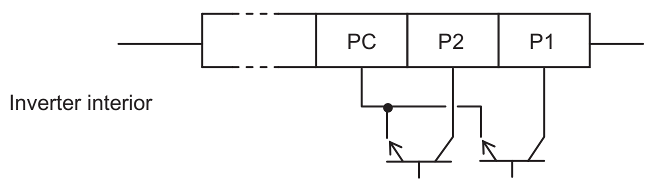
Whether to apply the NO or NC contact output specification can be set individually for each of multi-function output terminals P1/EDM, P2 and multi-function relay output terminal MA, MB. Multi-function output terminals P1/EDM, P2 are open-collector output, while multi-function relay output terminal MA, MB are relay output.

Parameter No.	Function name	Data	Default setting	Unit
C031 C032	Multi-function Output Terminal P1/EDM Contact Selection Multi-function Output Terminal P2 Contact Selection	00: NO (NO contact) at P1, P2, MA, NC (NC contact) at MB	00	–
		01: NC (NC contact) at P1, P2, MA, NO (NO contact) at MB		
C036	Multi-function Relay Output (MA, MB) Contact Selection	00: NO (NO contact) at P1, P2, MA, NC (NC contact) at MB	01	–
		01: NC (NC contact) at P1, P2, MA, NO (NO contact) at MB		

C031 to C032 set values	Power supply	Inverter status	Output signal status
00 (NO contact)	ON	Normal	OFF (No conduction)
		Operating (Error)	ON (Conduction)
	OFF	–	Indeterminable
01 (NC contact)	ON	Normal	ON (Conduction)
		Operating (Error)	OFF (No conduction)
	OFF	–	Indeterminable

Specifications of Multi-function Output Terminals P1/EDM to P2

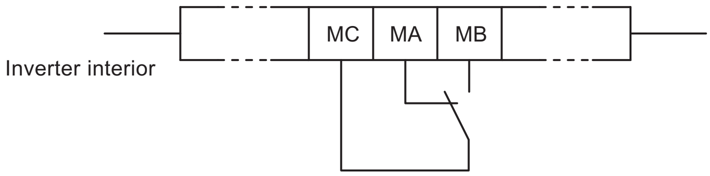
Below are the specifications of multi-function output terminals P1/EDM and P2.



Electrical characteristics
Between each terminal and PC Voltage drop 4 V max. at power-on Max. allowable voltage: 27 VDC Allowable max. current: 50 mA

Specification of Multi-function Relay Output Terminals

Multi-function relay output terminals has a SPDT contact specification. Below is the operation.



Example of use as an alarm

C036 Set value	Power supply	Inverter status	Output terminal status	
			MA-MC	MB-MC
00	ON	Abnormal	Closed	Open
		Normal	Open	Closed
	OFF	–	Open	Closed
01 (Default value)	ON	Abnormal	Open	Closed
		Normal	Closed	Open
	OFF	–	Open	Closed

		Resistance load	Inductive load
MA-MC	Max. contact capacity	250 VAC, 2 A 30 VDC, 3 A	250 VAC, 0.2 A 30 VDC, 0.6 A
	Min. contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	
MB-MC	Max. contact capacity	250 VAC, 1 A 30 VDC, 1 A	250 VAC, 0.2 A 30 VDC, 0.2 A
	Min. contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	

5

Functions

Output Signal Delay/Hold Function

ON delay/OFF delay times can be set for each output terminal.
All output signals immediately turn ON/OFF when the specified 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 output terminals (a total of three terminals corresponding to multi-function outputs P1/EDM and P2 and multi-function relay outputs MA, MB and MC) one by one. For the output terminals and the corresponding parameters, refer to the table below.

Output terminal	ON delay time	OFF delay time
P1/EDM	C130	C131
P2	C132	C133
Relays (MA, MB, MC)	C140	C141

Parameter No.	Function name	Data	Default setting	Unit
C130/C132	Output P1/EDM ON Delay Time	0.0 to 100.0	0.0	s
C131/C133	Output P1/EDM OFF Delay Time	0.0 to 100.0	0.0	s
C140	Output RY ON Delay Time	0.0 to 100.0	0.0	s
C141	Output RY OFF Delay Time	0.0 to 100.0	0.0	s

5-4 Analog Signal

The following explains the Inverter's analog input/output signals.

Analog Input (FV, FI)

The Inverter has 2 types of external analog input terminals.
FV-SC terminal: 0 to 10 V
Variable Resistor (volumes) inputs are also recognized as voltage inputs in the context of Inverter signals.
FI-SC terminal: 0 to 20 mA
If the current is 4 to 20 mA, set A103 to 20%.

The following functions can be allocated to analog input signals. The required settings are as follows.

Parameter No.	Setting item	Function name	Data	Default setting	Unit
A001	Frequency Reference*1	Frequency Reference Selection 1	01: Control circuit terminal block	02	–
A071	PID Feedback Selection *2	PID Selection	01: Enabled 02: Reverse output enabled	00	–
A076		PID Feedback Selection	00: Current (FI) 01: Voltage (FV)	00	–
A071	PID Feedforward Selection *3	PID Selection	01: Enabled 02: Reverse output enabled	00	–
A079		PID Feedforward Selection	01: FV (voltage) 02: FI (current)	00	–
b040	Torque Limit Selection *4	Torque Limit Selection	02: Analog voltage input	00	–
P033	Torque Control	Torque Reference Input Selection	00: Terminal FV 10 V = 200%	00	–
			01: Terminal FI 20 mA = 200%		
C001 to C007		Multi-function Input Selection	52: ATR (Torque reference input permission)	–	–

*1.Switch among the volume, current and voltage using FV/FI Selection (A005). Volume (VR) on the external Digital Operator 3G3AX-OP01.

*2.If Frequency Reference is set to Control circuit terminal block (A001 = 01) and PID Selection (A071) is enabled, PID is given priority and the analog input specified by A076 is allocated for PID feedback. Regardless of A005 or the FV/FI terminal status, the analog input not selected by A076 is allocated to Frequency Reference.

*3.Even when the specified analog input is overlapping with the target value or feedback value, the setting of A079 is applied as is.

*4.Only the analog voltage 10 V = 200% of the torque limit value. The FV/FI terminal is not allocated.

If an analog input is used for the frequency reference, current/voltage switch is performed as follows.

Parameter No.	Function name	Data	Default setting	Unit
A005	FV/FI Selection	00 Use the FV/FI terminal to switch between FV (voltage) and FI (current). FV/FI terminal ON: Current FV/FI terminal OFF: Voltage	00	–
		02 Enabled only when 3G3AX-OP01 is used. Use the FV/FI terminal to switch between FV (voltage) and volume. FV/FI terminal ON: Volume FV/FI terminal OFF: Voltage		
		03 Enabled only when 3G3AX-OP01 is used. Use the FV/FI terminal to switch between FI (current) and volume. FV/FI terminal ON: Volume FV/FI terminal OFF: Current		
C001 to C007	Multi-function Input Selection	16: FV/FI (Analog input switch)	–	–

Note: For details, refer to "Frequency Reference Selection and Output Frequency Setting" on page 5-15.

Analog Input Filter (FV, FI Sampling)

Helps remove noise in the frequency setting circuit.
If the frequency reference is specified using an external analog signal, a sampling time can be set for voltage input or current input.

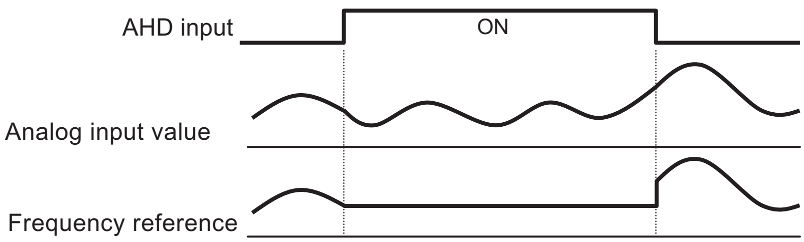
Set a larger data value if stable operation cannot be secured because of noise.
The larger the data value is, the slower the response time. This parameter specifies a filter time constant for a set value of 1 to 30 (× 2 ms).
When data "31" is selected, a filter time parameter of 500 ms and a hysteresis of ±0.1 Hz are set.

Parameter No.	Function name	Data	Default setting	Unit
A016	Analog Input Filter (FV, FI Sampling)	1. to 30.: Set value × 2 ms filter	8	–
		31.: Fixed to 500 ms filter With ±0.1 Hz hysteresis		

Analog Command Held Function (AHD)

While the AHD terminal is turned on, the Inverter keeps external analog input results on hold. While the AHD terminal is turned ON, the UP/DWN function can be used based on the reference value of the analog signal kept on hold by this function. If UP/DWN Storage Selection (C101) is set to "01", the Inverter can store an UP/DWN result.
If the power is turned on with the AHD terminal turned on, or if the Reset (18: RS) terminal is turned on and then off, the Inverter employs the data kept on hold immediately before.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	65: AHD (Analog command held)	–	–
Related functions		C101		

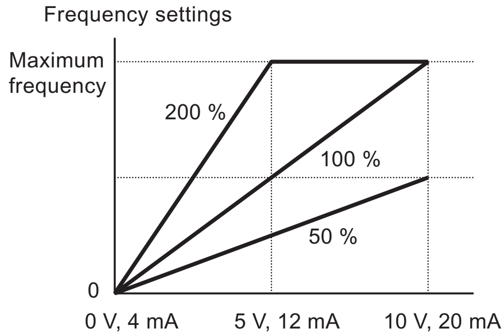


- If the control function is switched via the SET terminal with the AHD terminal turned ON, the set frequency is retained. To switch the control function, turn OFF the AHD terminal once, and keep the analog signal on hold again.
- If this function is frequently used, the internal EEROM element service life may be shortened.

Analog Input Adjustment

The analog input gain can be changed. Use this function to fine-tune analog input signals. Use "External Frequency Start/End" on page 5-40 to set for scale conversion from 0 to 10 V, to 0 to 5 V, for example.

Parameter No.	Function name	Data	Default setting	Unit
C081	FV Adjustment	0. to 200.0 The gain of input voltage is fine-tuned.	100.	%
C082	FI Adjustment	0. to 200.0 The gain of input current is fine-tuned.	100.	%



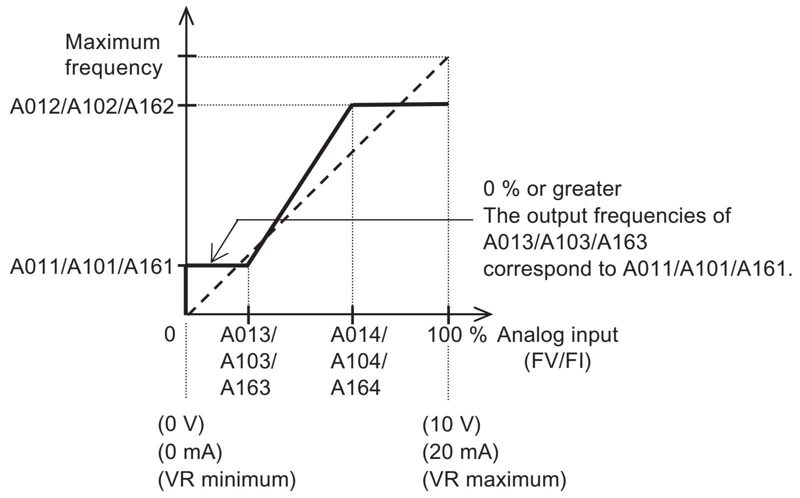
External Frequency Start/End

External Analog Input (Frequency Reference)
FV-SC terminal : 0 to 10 V
FI-SC terminal : 4 to 20 mA
VR : Volume on the external Digital Operator 3G3AX-OP01.

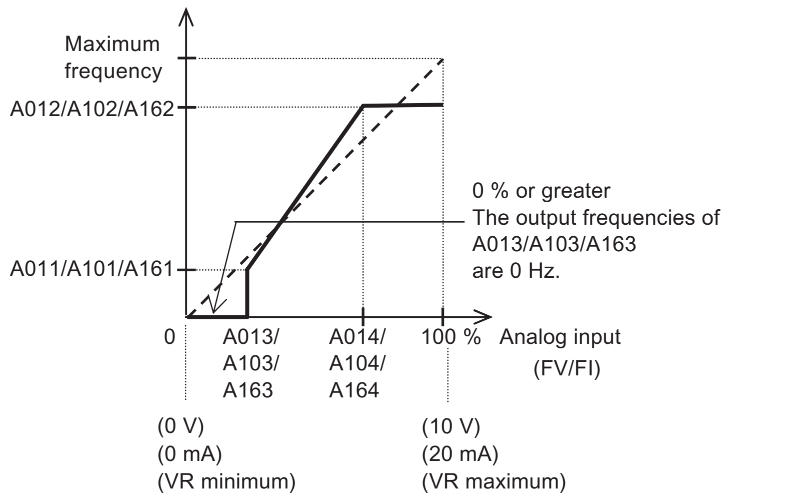
Parameter No.	Function name	Data	Default setting	Unit
A011/A101/ A161	FV/FI/VR Start Frequency	0.00 to 400.0 (1000.) Set a start frequency.	0.00	Hz
A012/A102/ A162	FV/FI/VR End Frequency	0.00 to 400.0 (1000.) Set an end frequency.	0.00	Hz
A013/A103/ A163	FV/FI/VR Start Ratio	0. to FV/FI/VR end ratio Set a start ratio relative to an external frequency reference of 0 to 10 V, 0 to 20 mA.	0.	%
A014/A104/ A164	FV/FI/VR End Ratio	FV/FI/VR start ratio to 100. Set an end ratio relative to an external frequency reference of 0 to 10 V, 0 to 20 mA.	100.	%
A015/A105/ A165	FV/FI/VR Start Selection	00: Start Frequency (A011/A101/A161) (For the output frequencies from 0% to A013/A103/A163, the values of A011/A101/A161 are output.)	01	–
		01: 0 Hz (For the output frequencies from 0% to A013/A103/A163, 0 Hz is output.)		

Note 1: To input current between 4 and 20 mA, set A103 to 20%. (Default value: 20% = 20 mA × 20% = 4 mA)
Note 2: To input voltage between 0 and 5 V, set A014 to 50%.

Example 1) A015/A105 = 00 (External Start Frequency)



Example 2) A015/A105 = 01 (0 Hz)



5

Functions

MP Terminal (Pulse/PWM Output)

The MP terminal is a 10 VDC pulse output or PWM output.
The output frequency and output current can be monitored using the MP terminal on the control circuit terminal block.

MP Selection

Select a signal to output from the following table.
If pulse output 03, 08 or 15 is selected, use the digital frequency counter. For other output signals, use the analog meter.

Parameter No.	Data	Description	PWM/ pulse	Full-scale value
C027	00	Output frequency*1	PWM	0 to maximum frequency [Hz]
	01	Output current	PWM	0 to 200%
	02	Output torque*2	PWM	0 to 200%
	03	Digital output frequency*3	Pulse	0 to maximum frequency [Hz]
	04	Output voltage	PWM	0 to 133% (Example: 7.5 V at 200 V for a 200 V class)
	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	Refer to "MP Gain Setting" on page 5-43.
	10	Cooling fin temperature	PWM	0 to 200°C (0°C output at 0°C or lower)
	12	Do not set.	–	–
	15	Pulse train input monitor	Pulse	Refer to "MP Gain Setting" on page 5-43.
	16	Optional board	–	–

*1."07: LAD frequency" is the frequency reference issued by the Inverter and corresponds to Output Frequency Monitor (d001)."00: Output frequency" is the value that is calculated reflecting vector control compensation and stabilization control under sensorless vector control, etc.

*2.This setting is effective only when the control method is Sensorless Vector Control (A044/A244 = 03).

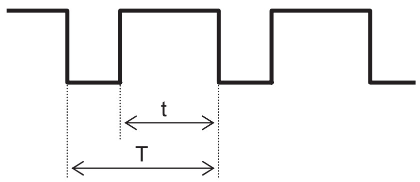
*3.If Frequency Conversion Coefficient (b086) is set, a gain-converted value is output for the digital output frequency. Refer to "Output Frequency Monitor [d001]" on page 5-1.

MP Gain Setting

The output gain can be set using C105 only when the PWM output target is selected by C027.
The output pulse can be set to C030 only when the digital current monitor is selected by C027. (C030 value = 1,440 Hz)
The output pulse can be set to C047 only when the pulse train input monitor is selected by C027. (Output = Input × C047)

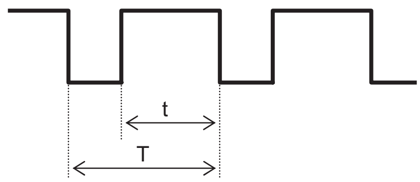
Parameter No.	Function name	Data	Default setting	Unit
C105	MP Gain Setting	50. to 200. Set a gain for the MP monitor.	100.	%
C030	Digital Current Monitor Reference Value	0.2 × Rated current to 2.0 × Rated current (Set a current value at 1440 Hz output.)	Rated current	A
C047	Pulse Train Output Coefficient	0.01 to 99.99 Output pulse frequency = Input pulse frequency × (C047)	1.00	–

Example 1) PWM output



Cycle T: Constant (6.4 ms)
Duty t/T : Variable

Example 2) Pulse output



Cycle T: Variable
Duty t/T : Fixed to 1/2

AM Terminal (Analog Output)

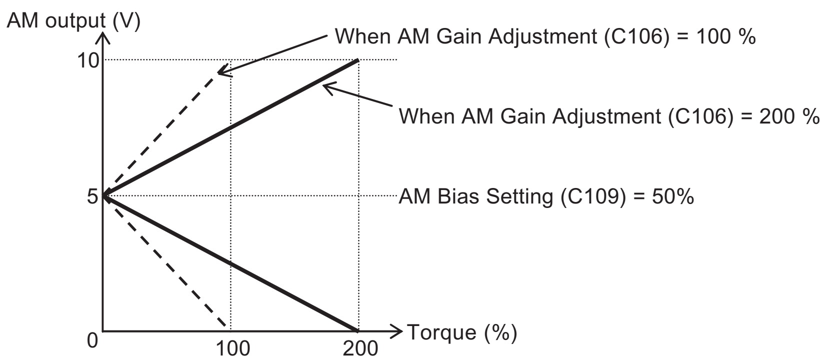
The AM terminal provides 0 to 10 VDC analog output.
The output frequency and output current can be monitored using the AM terminal on the control circuit terminal block.

AM Selection

Select a signal to output from the following.

Parameter No.	Function name	Data	Description	Full-scale value
C028	AM 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 133% (Example: 7.5 V at 200 V for a 200V class)
		05	Input power	0 to 200%
		06	Electronic thermal load rate	0 to 100%
		07	LAD frequency*1	0 to maximum frequency [Hz]
		10	Cooling fin temperature	0 to 200°C (0°C output at 0°C or lower)
		11	Output torque (signed)*3	0 to 200%*4
		13	Do not set.	–
		16	Optional board	–

*1."07: LAD frequency" is the frequency reference issued by the Inverter and corresponds to Output Frequency Monitor (d001).
"00: Output frequency" is the value that is calculated reflecting vector control compensation and stabilization control under sensorless vector control, etc.
*2.During Simple Position Control (P003 = 01), the real frequency (detected frequency) is displayed.
*3.This setting is effective only when the control method is Sensorless Vector Control (A044/A244 = 03).
*4.Below are the specifications of the output torque (signed).



Note: If "00: Output frequency" is monitored during deceleration due to overload limit, the displayed value may seem unstable in the low-speed range. In this case, changing the selection to "07: LAD frequency" stabilizes the displayed value.

AM Gain Setting

Set the Inverter output gain according to the meters connected to the AM and AMI terminals.

Parameter No.	Function name	Data	Default setting	Unit
C106	AM Gain Adjustment	50. to 200. Set a gain for the AM monitor.	100.	%
C109	AM Bias Setting	0 to 100 Set an offset for the AM monitor.	0.	%

Note: When a reset signal is input, the offset becomes 0% once.

Example) AM provides 4 to 20 mA output, the offset value is 20% (= 4 / 20). (Default value)

5-5 Settings Relating to Control Method

The following explains the control-related settings such as the control method and torque boost.

Control Method (V/f Characteristics)

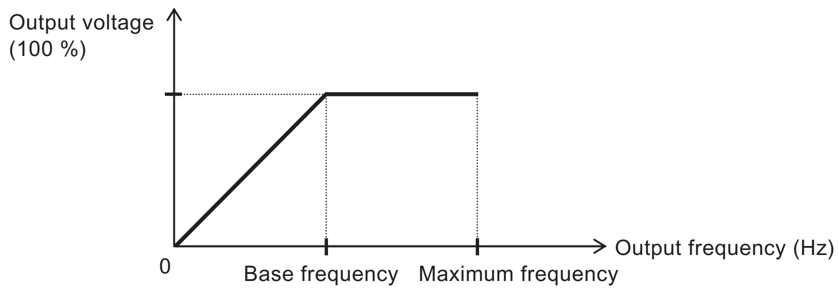
You can set V/f characteristics (output voltage/output frequency).
Switch between Control Methods 1/2 (V/f characteristics) using the SET terminal which is a multi-function input terminal to which Motor 2 Control (08: SET) is allocated.

Parameter No.	Function name	Data	Default setting	Unit
A044/A244	Control Method 1/2	00: Constant torque characteristics (VC)	00	–
		01: Reduced torque characteristics (VP 1.7th power)		
		02: Free V/f setting		
		03: Sensorless vector control (SLV) For high-starting-torque, high-accuracy operation *1		

*1.This option cannot be selected in the Light Load Mode (b049 = 01) or high-frequency mode.

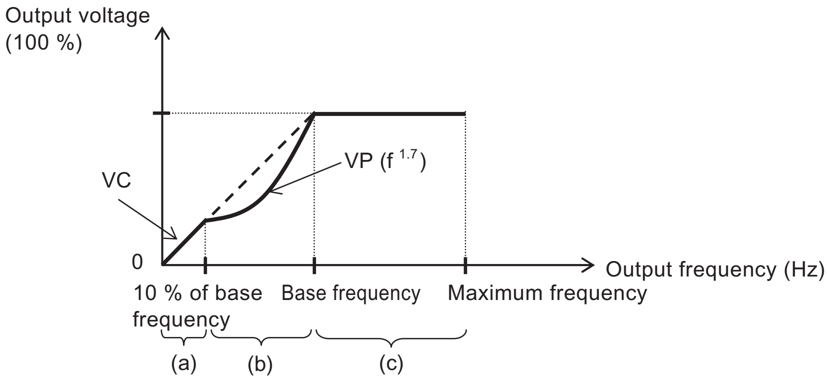
Constant Torque Characteristics (VC)

Output voltage is proportional to output frequency.
While the output voltage is proportional from 0 Hz to base frequency, the output voltage is constant from base to maximum frequency regardless of the frequency.



Reduced Torque Characteristics (VP 1.7th power)

Suitable for a fan or pump that does not require large torque in a low speed range.
It will provide high efficiency, reduce noise and vibration, owing to reduced output voltage in a low speed range.
V/f characteristics are shown below.



Period (a): Provides constant torque characteristics within a range from 0 Hz to 10% of the base frequency.
Example) If the base frequency is 60 Hz, the Inverter provides constant torque characteristics within a range from 0 to 6 Hz.

Period (b): Provides reduced torque characteristics within a range from 10% of the base frequency to the base frequency.
The Inverter outputs voltage based on a curve of the 1.7th power of the frequency.

Period (c): Provides constant voltage characteristics within a range from the base frequency to the maximum frequency.

Free V/f Setting

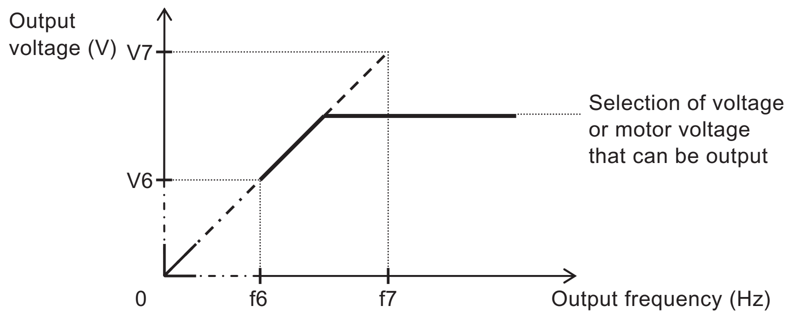
Under the free V/f setting function, desired V/f characteristics can be set by setting seven points of voltage and frequency.(b100 to b113)
The set frequency should always be $1 \leq 2 \leq 3 \leq 4 \leq 5 \leq 6 \leq 7$.
All default data is 0 Hz, so set free V/f frequency 7 first. (Operation is disabled by factory default.)

If the free V/f setting is enabled, the functions of Torque Boost Selection (A041/A241), Base Frequency (A003/A203), and Maximum Frequency (A004/A204) are disabled. (Free V/f frequency 7 is handled as the maximum frequency.)

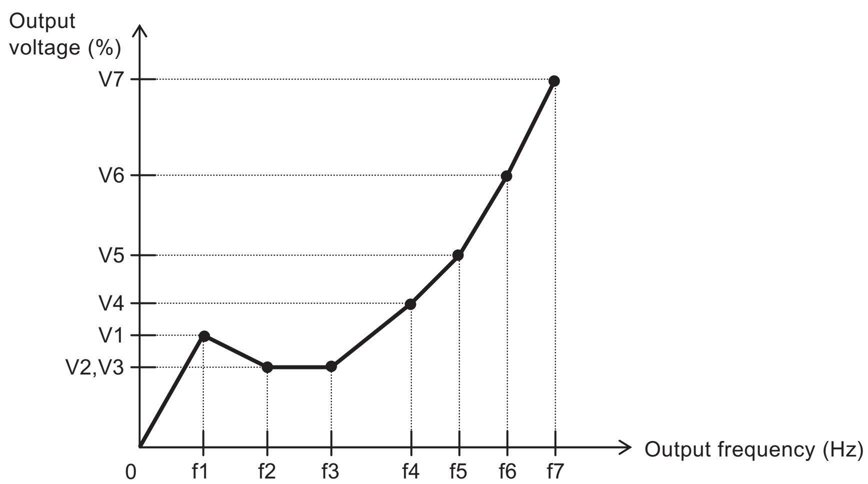
Parameter No.	Function name	Data	Default setting	Unit	Description
b112	Free V/f Frequency 7 (f7)	Free V/f frequencies 6 to 400. (1000.)	0.	Hz	Set frequencies for each break point.
b110	Free V/f Frequency 6 (f6)	Free V/f frequency 5 to free V/f frequency 7	0.		
b108	Free V/f Frequency 5 (f5)	Free V/f frequency 4 to free V/f frequency 6	0.		
b106	Free V/f Frequency 4 (f4)	Free V/f frequency 3 to free V/f frequency 5	0.		
b104	Free V/f Frequency 3 (f3)	Free V/f frequency 2 to free V/f frequency 4	0.		
b102	Free V/f Frequency 2 (f2)	Free V/f frequency 1 to free V/f frequency 3	0.		
b100	Free V/f Frequency 1 (f1)	0. to Free V/f frequency 2	0.		

Parameter No.	Function name	Data	Default setting	Unit	Description
b113	Free V/f Voltage 7 (V7)	0.0 to 800.0	0.0	V	Set output voltages for each break point.*1
b111	Free V/f Voltage 6 (V6)				
b109	Free V/f Voltage 5 (V5)				
b107	Free V/f Voltage 4 (V4)				
b105	Free V/f Voltage 3 (V3)				
b103	Free V/f Voltage 2 (V2)				
b101	Free V/f Voltage 1 (V1)				

*1.Even when a voltage greater than the Inverter input voltage is set in any one of Free V/f Voltages 1 to 7, the Inverter cannot output such voltage. Use thorough caution to verify that the output characteristic setting is proper. An improper setting causes overcurrent during acceleration or deceleration, or vibration of the motor and/or machine.



(Example)



Torque Boost

Compensates for the voltage drop caused by the resistance in the 1st resistance of the motor, or by wiring to suppress torque reduction at a low speed range.
To select the automatic torque boost for A041/A241, set Motor Capacity (H003/H203) and Motor Pole Number (H004/H204) according to your motor.

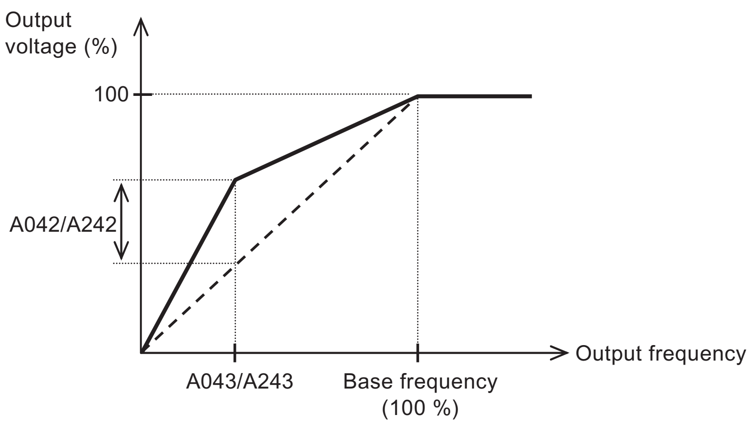
Parameter No.	Function name	Data	Default setting	Unit
A041/A241	Torque Boost Selection 1/2	00: Manual torque boost 01: Automatic torque boost	00	–
A042/A242	Manual Torque Boost Voltage 1/2	0.0 to 20.0 Ratio to motor voltage (A082/A282)	1.0	%
A043/A243	Manual Torque Boost Frequency 1/2	0.0 to 50.0 Ratio to base frequency (A003/A203)	5.0	%
H003/H203	Motor Capacity 1/2	0.1 to 18.5	Default setting	kW
H004/H204	Motor Pole Number 1/2	2/4/6/8/10	4	pole
A046/A246	Automatic Torque Boost Voltage Compensation Gain 1/2	0. to 255. Refer to "Automatic Torque Boost" on page 5-50.	100.	–
A047/A247	Automatic Torque Boost Slip Compensation Gain 1/2	0. to 255. Refer to "Automatic Torque Boost" on page 5-50.	100.	–

Manual Torque Boost

Outputs the voltage set in A042/A242 or A043/A243.
In A042/A242, set a ratio based on the voltage set in the motor voltage selection as 100%. The ratio set here corresponds to the output frequency of 0 Hz.

If you raise the set value of the manual torque boost, be careful about motor overexcitation. Otherwise, the motor may burn out.

The Manual Torque Boost Frequency A043/A243 is set in percentage terms based on the base frequency as 100%.
Switch between Controls 1/2 using the SET terminal which is a multi-function input terminal to which "08: SET" is allocated.



Automatic Torque Boost

If Automatic torque boost is selected for Torque Boost Selection (041/A241 = 01), the output frequency and output voltage are adjusted automatically according to the load level.
The output voltage due to automatic torque boost is added to the manual torque boost voltage.
If the desired characteristics cannot be achieved, adjust the Manual Torque Boost Parameters (A042/A242,A043/A243) by referring to the table below.
Set Motor Capacity (H003/H203) and Motor Pole Number (H004/H204) accurately according to the motor used.
To avoid a overcurrent trip during deceleration, set the AVR Selection to "Always ON" (A081= 00).
If the desired characteristics cannot be achieved using automatic torque boost, adjust each item by referring to the table below.

Phenomenon	Adjusting method	Adjustment item
Insufficient torque at low speed (Motor does not rotate at low speed.)	(1) Gradually increase the Manual Torque Boost Voltage Setting.	A042/A242
	(2) Gradually increase the Automatic Torque Boost Slip Compensation Gain.	A047/A247
	(3) Gradually increase the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(4) Reduce the set value of the Carrier Frequency.	b083
Rotation speed lowers when load is applied.	Gradually increase the Automatic Torque Boost Slip Compensation Gain.	A047/A247
Rotation speed increases when load is applied.	Gradually reduce the Automatic Torque Boost Slip Compensation Gain.	A047/A247
Overcurrent trip occurs when load is applied.	(1) Gradually reduce the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(2) Gradually reduce the Automatic Torque Boost Slip Compensation Gain.	A047/A247
	(3) Gradually reduce the Manual Torque Boost Voltage Setting.	A042/A242

Carrier Frequency

The carrier frequency of the PWM waveform output from the Inverter can be changed.
Increasing the carrier frequency reduces the metallic noise from the motor. However, this may increase noise or leakage current from the Inverter.
Helps avoid mechanical or motor resonance.

Parameter No.	Function name	Data	Default setting	Unit
b083	Carrier Frequency	Heavy Load (b049 = 00) 2.0 to 15.0 Light Load (b049 = 01) 2.0 to 10.0 High-frequency (2.0 to 10.0)	10.0 2.0 (5.0)	kHz
Related functions		b089		

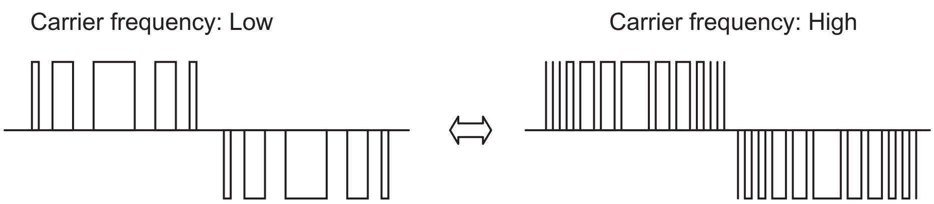
Note: The maximum carrier frequency varies depending on the capacity.
To raise the carrier frequency (fc), derate the output current. (Refer to "Appendix" at the end of this manual.)
Set a derating output current value as electronic thermal level.
For details, refer to "Electronic Thermal Function" on page 5-110.
(If the existing electronic thermal value is lower than the derating value, the above setting is not required.)

- If the above maximum rated carrier frequency and the derating value at 15 kHz are exceeded, the Inverter may be damaged and/or the service life may be shortened.

Raising the carrier frequency reduces the DC braking force. For details, refer to "DC Injection Braking (DB)" on page 5-135.

Carrier frequency and Extent of impact

Carrier frequency	Low	High
Motor noise	Large	Small
Noise/leak current	Small	Large
Torque	Large	Small



5

Functions

Automatic Carrier Frequency Reduction Function

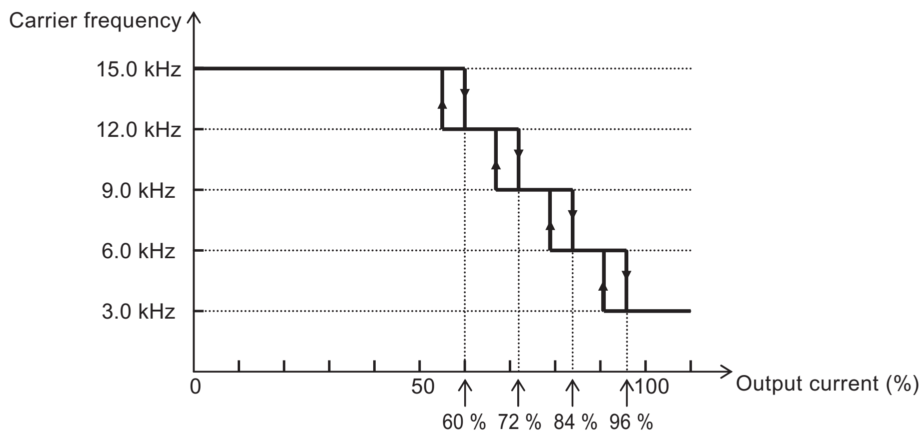
This function automatically reduces carrier frequency according to an increase in output current.
This function is enabled when Automatic Carrier Reduction (b089) is set to "01: Enabled."

Parameter No.	Function name	Data	Default setting	Unit
b089	Automatic Carrier Reduction	00: Disabled 01: Enabled/depends on current 02: Enabled/depends on fin temperature	00	–
Related functions		b083		

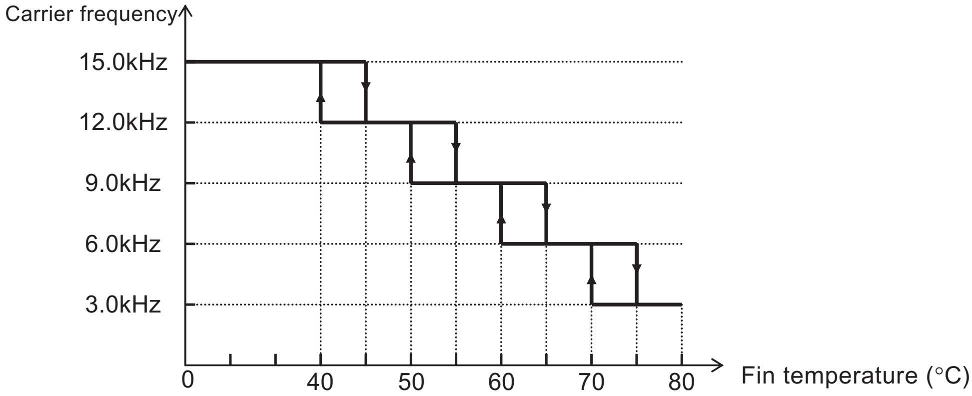
When the output current exceeds 60%, 72%, 84% or 96% of the rated current, the carrier frequency is reduced to 12, 9, 6 or 3 kHz, respectively. When the output current falls below -5% of each level, this function will be reset.

Starting level of carrier frequency reduction (Recovery level)	Reduced carrier frequency [kHz]
Less than 60% of the rated current	15.0
60% (55%) of the rated current	12.0
72% (67%) of the rated current	9.0
84% (79%) of the rated current	6.0
96% (91%) of the rated current	3.0

- When b089 set to 01



- When b089 set to 02



The carrier frequency reduction rate is 2 kHz per second.
The upper limit of Carrier Frequency (b083) variable with this function conforms to the set value of carrier frequency b083, and the lower limit is 3 kHz.
If b083 is 3 kHz or below, this function is disabled regardless of the setting of b089.

5

Functions

Motor 2 Control Function (SET)

The motors specified by two different parameters can be switched and controlled accordingly. Switch between the two motors can be conducted by allocating "08: SET" to Multi-function Input Selections (C001 to C007) and then turning the SET terminal ON/OFF. (OFF: Motor 1 control, ON: Motor 2 control)

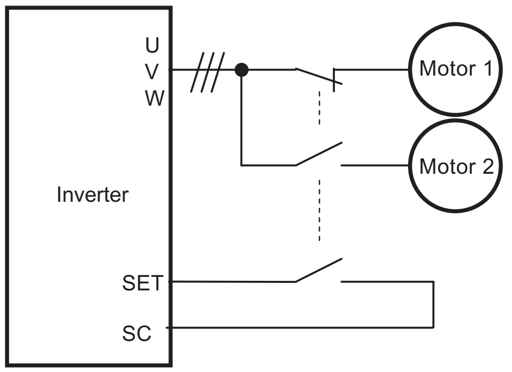
Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	08: SET (Motor 2 control)	–	–

The functions switchable via the SET terminal are as follows:

Motor 1 control	Motor 2 control	Setting item
F001		Output Frequency Setting
F002	F202	Acceleration Time Setting
F003	F203	Deceleration Time Setting
A001	A201	Frequency Reference Selection
A002	A202	RUN Command Selection
A003	A203	Base Frequency
A004	A204	Maximum Frequency
A020	A220	Multi-step Speed Reference 0
A041	A241	Torque Boost Selection
A042	A242	Manual Torque Boost Voltage
A043	A243	Manual Torque Boost Frequency
A044	A244	Control Method
A045	A245	Output Voltage Gain
A046	A246	Automatic Torque Boost Voltage Compensation Gain
A047	A247	Automatic Torque Boost Slip Compensation Gain
A061	A261	Frequency Upper Limit
A062	A262	Frequency Lower Limit
A081	A281	AVR Selection
A082	A282	Motor Incoming Voltage Selection
A092	A292	Acceleration Time 2
A093	A293	Deceleration Time 2
A094	A294	2-step Acceleration/Deceleration Selection
A095	A295	2-step Acceleration Frequency
A096	A296	2-step Deceleration Frequency
b012	b212	Electronic Thermal Level
b013	b213	Electronic Thermal Characteristics Selection
b021	b221	Overload Limit Selection

Motor 1 control	Motor 2 control	Setting item
b022	b222	Overload Limit Level
b023	b223	Overload Limit Parameter
C041	C241	Overload Warning Level
H002	H202	Motor Parameter
H003	H203	Motor Capacity
H004	H204	Motor Pole Number
H005	H205	Speed Response
H006	H206	Stabilization Parameter
H020	H220	Motor Parameter R1
H021	H221	Motor Parameter R2
H022	H222	Motor Parameter L
H023	H223	Motor Parameter Io
H024	H224	Motor Parameter J
H030	H230	Motor Parameter R1 (Auto-tuning Data)
H031	H231	Motor Parameter R2 (Auto-tuning Data)
H032	H232	Motor Parameter L (Auto-tuning Data)
H033	H233	Motor Parameter Io (Auto-tuning Data)
H034	H234	Motor Parameter J (Auto-tuning Data)

There's no indication of control functions 1/2 on the display. You'll see which one is enabled by checking whether the terminal is turned on/off.
The control functions 1/2 cannot be switched during operation. Switching is possible only while operation is stopped, which means that the functions will switch after the operation stops.



SET terminal
OFF: Control 1 (motor 1)
OFF: Control 2 (motor 2)

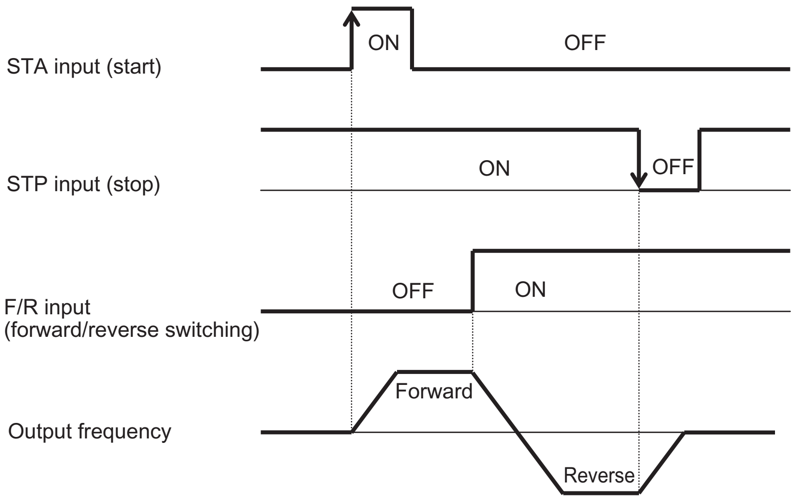
5-6 Operation Functions

The following explains the parameters relating to operation functions.

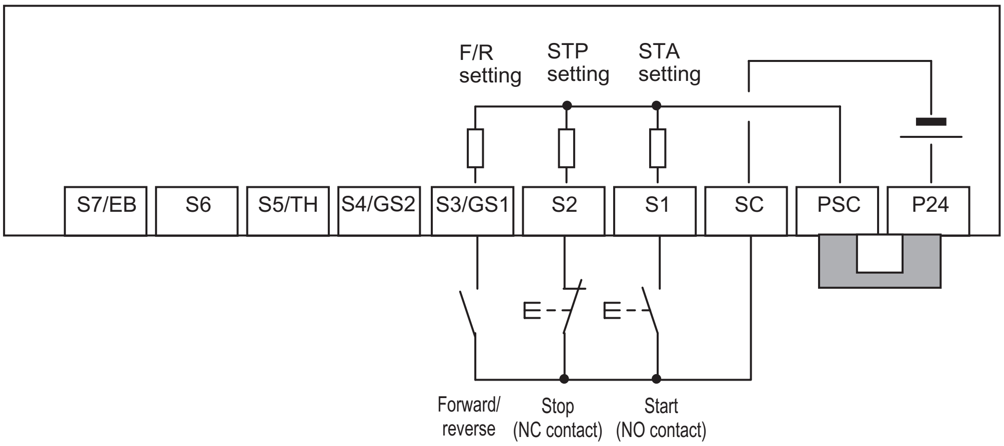
3-wire Input Function (STA, STP, F/R)

3-wire input refers to a RUN command method which is useful when the Inverter is to be run and stopped using auto-reset contacts such as pushbutton switches.
Set RUN Command Selection (A002) to "01: Control circuit terminal block".
When "20: STA," "21: STP" and "22: F/R" are allocated to Multi-function Input Selections (C001 to C007), the operation shown in below figure becomes possible. Allocating the STP terminal disables, the FW and RV terminals are disabled.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	20: STA (3-wire start)	–	–
		21: STP (3-wire stop)		
		22: F/R (3-wire forward/reverse)		
Related functions		A002		



Wiring Example (When STA, STP and F/R are Allocated to Multi-function Input Terminals S1 to S3/GS1)

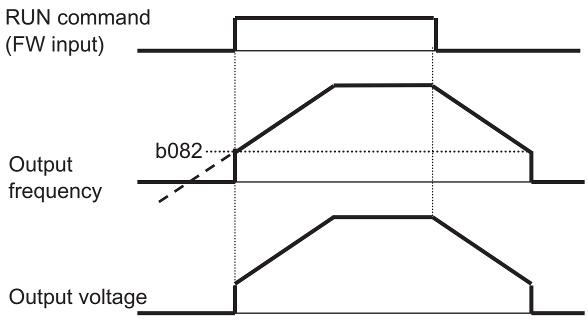


- In the case of 3-wire input, STOP (STP input) is used with NC contact. Take note that it is not necessary to set the output selection to NC for the Multi-function Input Terminal Operation Selection (C011 to C017) to which the STP input is allocated.

Starting Frequency

Set the frequency for starting Inverter output when the RUN signal is turned on.
Use mainly to adjust the starting torque.
With Starting Frequency (b082) set high, the starting current should increase. Therefore, the current may exceed the overload limit and overcurrent protection may work to cause a trip.

Parameter No.	Function name	Data	Default setting	Unit
b082	Starting Frequency	0.10 to 9.99 (100.00)	0.50	Hz



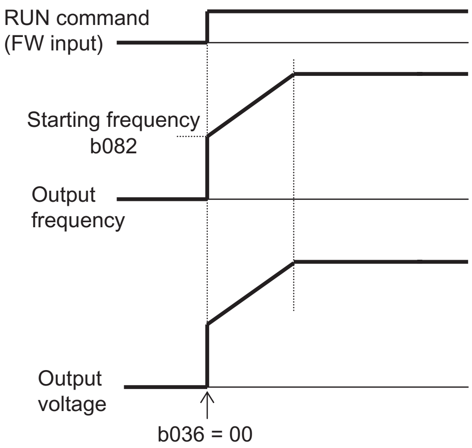
5

Functions

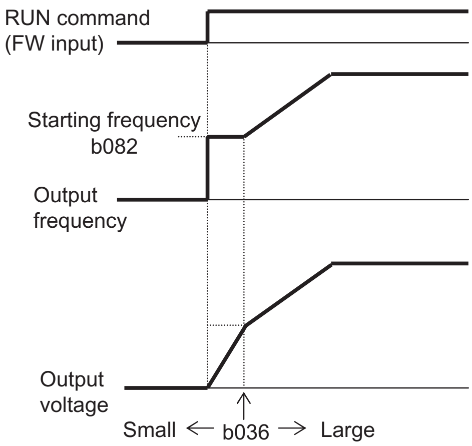
Reduced Voltage Startup Selection

Slowly increases voltage during motor startup.
Increase the value of b036 if you want to prevent a current surge at the start or when an overcurrent trip occurs at the start. A smaller value increases the starting torque. As a result, an overcurrent trip occurs more easily.

Parameter No.	Function name	Data	Default setting	Unit
b036	Reduced Voltage Startup Selection	0: Reduced voltage startup disabled	2	–
		01: (Short) to 255 (Long)		
Related functions		b082		



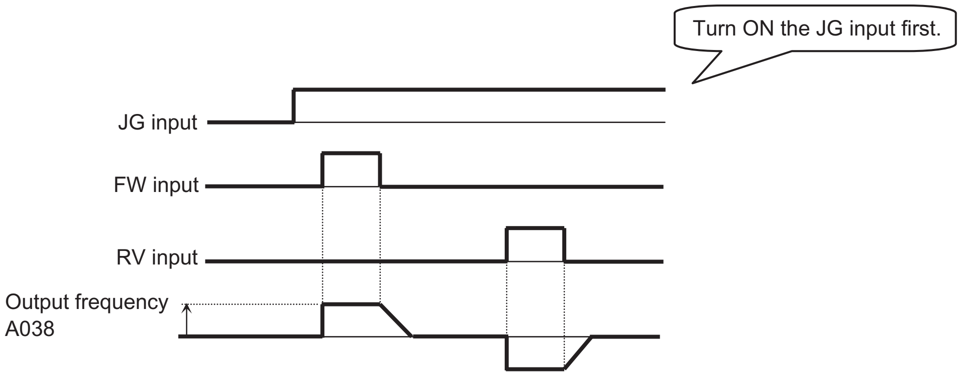
Reduced voltage startup disabled



Reduced voltage startup enabled

Jogging Operation (JG)

Set "06: JG" to a multi-function input terminal.
When a RUN command is issued with the JG terminal turned ON, operation starts at the jogging frequency set by A038.
During jogging operation, the Inverter trips easily because it starts at full voltage. Adjust the set value of Jogging Frequency (A038) to prevent the Inverter from tripping.

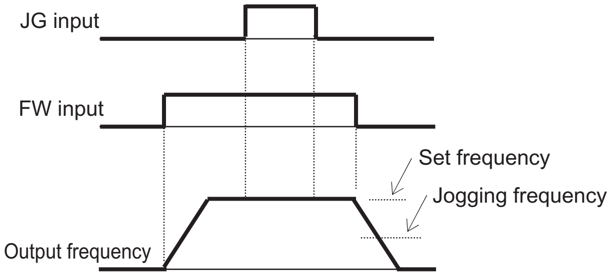


Parameter No.	Function name	Data	Default setting	Unit
A038	Jogging Frequency	Starting frequency to 9.99	6.00	Hz
A039	Jogging Stop Selection	00: Disabled during operation, free-run on jogging stop	04	–
		01: Disabled during operation, deceleration stop on jogging stop		
		02: Disabled during operation, DC injection braking on jogging stop*1		
		03: Enabled during operation, free-run on jogging stop		
		04: Enabled during operation, deceleration on stop jogging stop		
		05: Enabled during operation, DC injection braking on jogging stop*1		
C001 to C007	Multi-function Input Selection	06: JG (Jogging)	–	–

*1.If Jogging Stop Selection (A039) is set to 02 or 05, DC injection braking data must be set. Refer to "DC Injection Braking (DB)" on page 5-135.

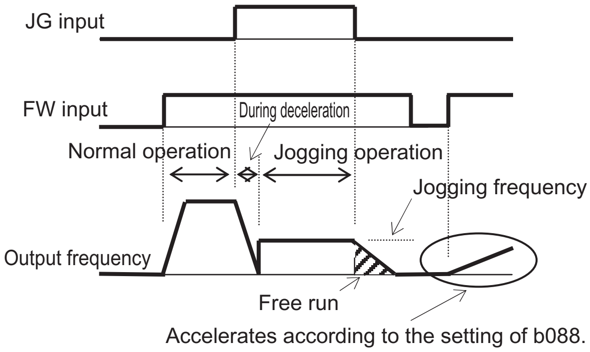
Note: To perform the jogging operation, turn on the JG terminal before the FW or RV terminal.
(Even when the RUN command source is the Digital Operator, issue a RUN command after turning ON the JG terminal.) Also note that the frequency reference can be changed by F001 even during jogging operation.

Example 1) Jogging Operation is Not Performed



When A039 = 00, 01 or 02, jogging operation is not performed if the FW signal is turned ON first.

Example 2) Jogging Operation is Performed



For details, refer to "Free-run Stop Function (FRS)" on page 5-103.
When A039 = 03, 04 or 05, jogging operation is performed even when the FW signal is turned ON first. However, if the JG signal is turned OFF first, the motor performs a free-run stop.

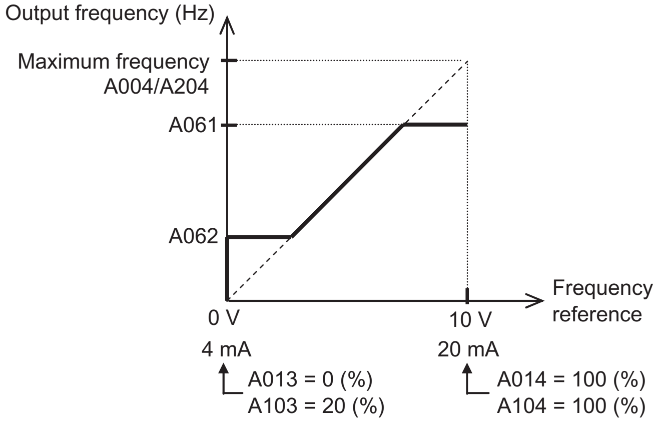
Frequency Limit

Both the upper and lower limits can be set for the output frequency. If a frequency reference beyond the upper/lower limits is input, the frequency is limited by the upper or lower limit.

- Set the upper limiter first. Make sure the upper limit (A061/A261) is higher than the lower limit (A062/A262).
- Make sure the upper and lower limit settings do not exceed the Maximum Frequency (A004/A204).
- Make sure the Output Frequency (F001) and Multi-step Speed References 1 to 15 (A021 to A035) are not lower than the lower limit and not higher than the upper limit.
- Neither limit would work if is set to upper and lower limits.

Parameter No.	Function name	Data	Default setting	Unit
A061/A261	Frequency Upper Limit 1/2	0.00, frequency lower limit 1/2 to maximum frequency	0.00	Hz
A062/A262	Frequency Lower Limit 1/2	0.00, starting frequency to 1/2 frequency upper limit	0.00	Hz

Use of Analog Voltage Input (FV-SC) and Analog Current Input (FI-SC)



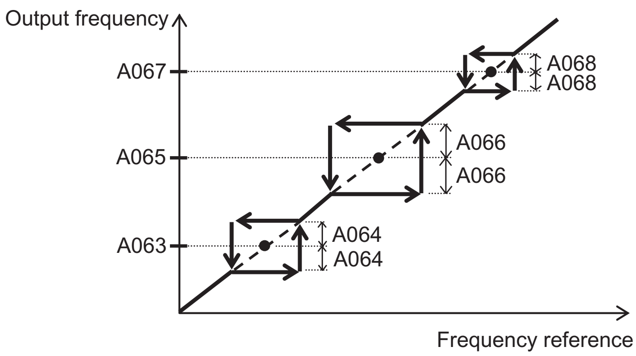
Once the lower limit is set, the Inverter outputs the frequency set for the Frequency Lower Limit (A062), if 0 V (4 mA) is input to the frequency reference.

Frequency Jump Function

Use this function to avoid resonant points of loaded machines during operation.
If a jump frequency is set, an output frequency cannot be set within the jump frequency range in order to avoid steady-state operation within the jump frequency range.
The output frequency fluctuates continuously according to the acceleration/deceleration time during both acceleration and deceleration.
A jump frequency can be set at 3 points.

Parameter No.	Function name	Data	Default setting	Unit
A063/A065/ A067	Jump Frequency 1/2/3	0.00 to 400.0 (1000.) Set the center of the frequencies at which to execute a jump.*1	0.00	Hz
A064/A066/ A068	Jump Frequency Width 1/2/3	0.00 to 10.00 (100.0) Set one-half of the frequency width in which to execute a jump.	0.50	Hz

*1.If 0 Hz is set, this function is disabled.



Acceleration/Deceleration Stop Function

This function temporarily stops acceleration/deceleration to perform constant speed operation at the applicable frequency.
This function can be used to make the Inverter wait until the motor slip decreases during acceleration/deceleration, when the moment of inertia of the loaded machine is large. Also use this function if an overcurrent/overvoltage trip occurs during acceleration/deceleration.

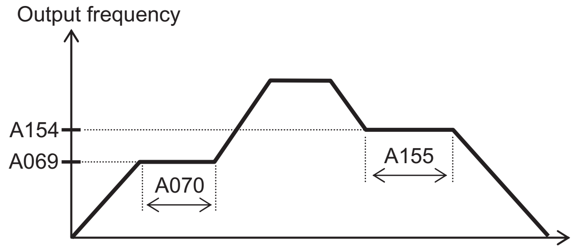
This function is not affected by the setting of Acceleration Pattern Selection (A097). It is available in all acceleration patterns.
The following two methods can be used for a stop during acceleration/deceleration, and the two methods can be combined:

(1) Automatic stopping at a desired frequency/stopping time
(2) Stopping with a multi-function input terminal

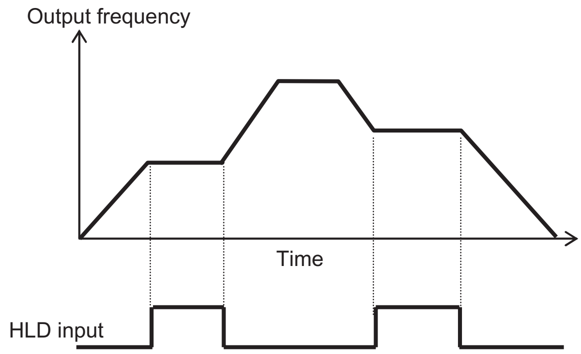
Take note that the acceleration/declaration time set in F001/F202 or F003/F203 will not be enabled.

Parameter No.	Function name	Data	Default setting	Unit
A069	Acceleration Stop Frequency	0.00 to 400.0(1000.)	0.00	Hz
A070	Acceleration Stop Time	0.0 to 60.0	0.0	s
A154	Deceleration Stop Frequency	0.00 to 400.0(1000.)	0.00	Hz
A155	Deceleration Stop Time	0.0 to 60.0	0.0	s
C001 to C007	Multi-function Input Selection	83: HLD (Retain output frequency)	–	–

(1) Automatic Stopping at a Desired Frequency/Stopping Time



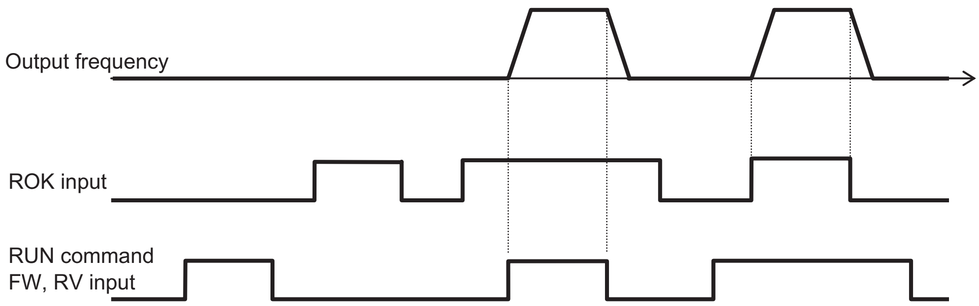
(2) Stopping with a Multi-function Input Terminal



RUN Permission Signal

A RUN command is accepted only while the RUN permission signal is ON.
To use this function, allocate "84: ROK" to the multi-function input terminal.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	84: ROK (Permission of RUN command)	–	–



Multi-step Speed Operation Function (CF1 to CF4, SF1 to SF7)

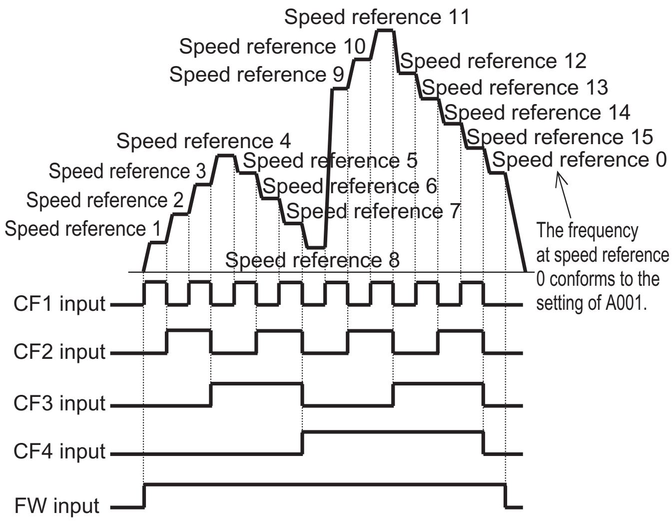
Multiple RUN speeds can be set in parameters and the applicable speed can be switched using the terminals.
For multi-step speed operation, either 4-terminal binary operation (with maximum 16 steps) or 7-terminal bit operation (with maximum 8 steps) can be selected.

Parameter No.	Function name	Data	Default setting	Unit
A019	Multi-step Speed Selection	00 4-terminal binary operation with up to 16 variable steps	00	–
		01 7-terminal bit operation with up to 8 variable steps		
A020	Multi-step Speed 1 Reference 0	0.00, starting frequency to maximum frequency	6.00	Hz
A021 to A035	Multi-step Speed References 1 to 15	0.00, starting frequency to maximum frequency	0.00	Hz
A220	Multi-step Speed 2 Reference 0	0.00, starting frequency to maximum frequency	6.00	Hz
C001 to C007	Multi-function Input Selection	02 to 05 Binary operation, 16 steps (CF1 to CF4)	–	–
		32 to 38 Bit operation, 8 steps (SF1 to SF7)		
C169	Multi-step Speed/ Position Determination Time	0. to 200. (× 10 ms) Wait time until determination of terminal input	0.	ms

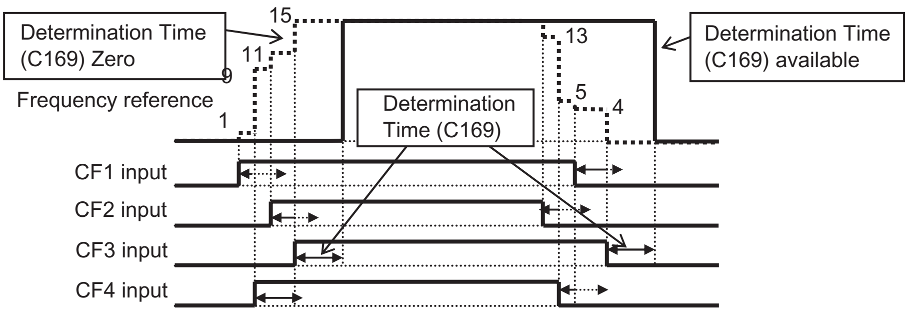
Binary Operation

Selection of multi-step speed references 0 to 15 becomes possible when CF1 to CF4 (02 to 05) are allocated to any four of Multi-function Input Selections (C001 to C007).
Use Multi-step Speed References 1 to 15 (A021 to A035) to set the frequencies for speed references 1 to 15.
Multi-step speed operation is given priority over Frequency Reference Selection (A001). However, the frequency reference 0 conforms to the setting of Frequency Reference Selection (A001).

Multi-step speed	CF4	CF3	CF2	CF1
Speed reference 0	OFF	OFF	OFF	OFF
Speed reference 1	OFF	OFF	OFF	ON
Speed reference 2	OFF	OFF	ON	OFF
Speed reference 3	OFF	OFF	ON	ON
Speed reference 4	OFF	ON	OFF	OFF
Speed reference 5	OFF	ON	OFF	ON
Speed reference 6	OFF	ON	ON	OFF
Speed reference 7	OFF	ON	ON	ON
Speed reference 8	ON	OFF	OFF	OFF
Speed reference 9	ON	OFF	OFF	ON
Speed reference 10	ON	OFF	ON	OFF
Speed reference 11	ON	OFF	ON	ON
Speed reference 12	ON	ON	OFF	OFF
Speed reference 13	ON	ON	OFF	ON
Speed reference 14	ON	ON	ON	OFF
Speed reference 15	ON	ON	ON	ON



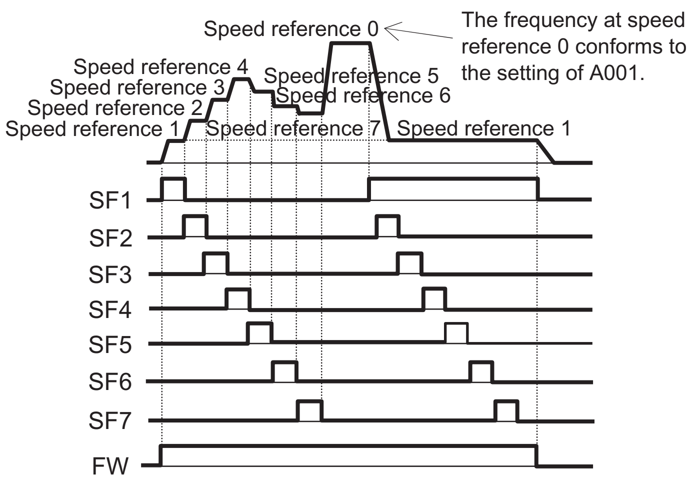
With multi-step speed binary operation, the wait time until the terminal input is determined can be set using Multi-step Speed/Position Determination Time (C169) (set value × 10 ms = Determination time). This prevents the transition status before input establishment from being applied.
If no input is made during the time set in C169, the data is determined.
Note that the longer the determination time, the slower the input response.



Bit Operation

Selection of multi-step speed references 0 to 7 becomes possible when SF1 to SF7 (32 to 38) are allocated to Multi-function Input Selections (C001 to C007).
Use Multi-step Speed References 1 to 7 (A021 to A027) to set the frequencies for SF1 to SF7.
Multi-step speed operation is given priority over Frequency Reference Selection (A001). However, the frequency reference 0 conforms to the setting of Frequency Reference Selection (A001).

Multi-step speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1
Speed reference 0	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Speed reference 1	×	×	×	×	×	×	ON
Speed reference 2	×	×	×	×	×	ON	OFF
Speed reference 3	×	×	×	×	ON	OFF	OFF
Speed reference 4	×	×	×	ON	OFF	OFF	OFF
Speed reference 5	×	×	ON	OFF	OFF	OFF	OFF
Speed reference 6	×	ON	OFF	OFF	OFF	OFF	OFF
Speed reference 7	ON	OFF	OFF	OFF	OFF	OFF	OFF



When several terminals are simultaneously turned on, priority is given to the terminal with the smallest number.
The × mark in the above table means that speed is selected regardless of ON/OFF status.

5

Functions

2-step Acceleration/Deceleration Function (2CH)

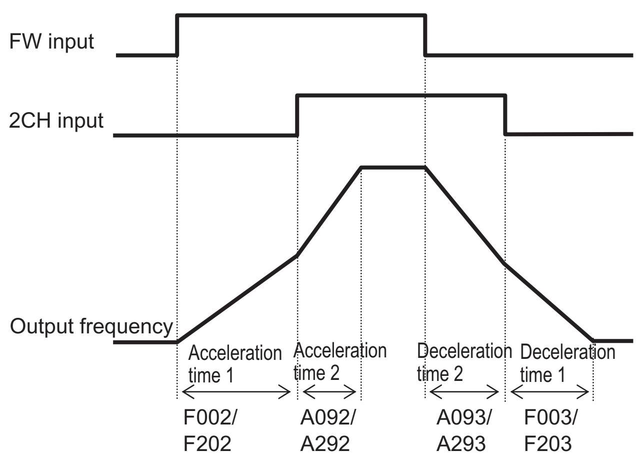
The acceleration/deceleration time can be changed during acceleration/deceleration.
Select an acceleration/deceleration time switching method from the following 3:

(1) Switching using a multi-function input terminal
(2) Automatic switching at a desired frequency
(3) Automatic switching together with forward/reverse switching only

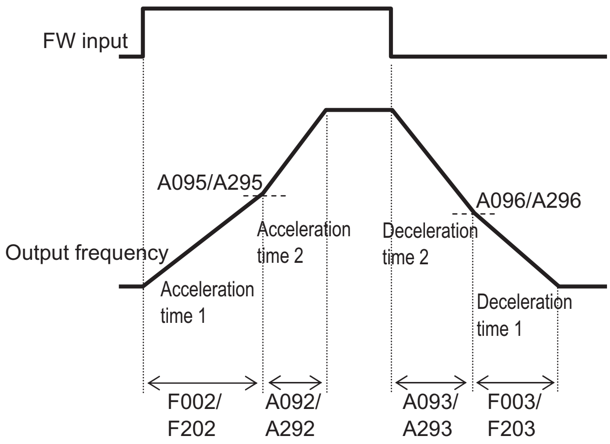
To switch via a multi-function input terminal, allocate "09: 2CH" to any of C001 to C007.

Parameter No.	Function name	Data	Default setting	Unit
A092/A292	1st/2nd Acceleration Time 2	0.01 to 3600. (Example 1.2)	10.00 (15.00)	s
A093/A293	1st/2nd Deceleration Time 2	0.01 to 3600. (Example 1.2)	10.00 (15.00)	s
A094/A294	2-step Acceleration/ Deceleration Selection	00 Switched via 2CH terminal (example 1)	00	–
		01 Switching via 2-step acceleration/deceleration frequency (example 2)		
		02 Enabled only when switching between forward/ reverse (example 3)		
A095/A295	2-step Acceleration Frequency	0.00 to 400.0 (1000.) Enabled when 2-step Acceleration/Deceleration Selection (A094/A294) is 01 (example 2)	0.00	Hz
A096/A296	2-step Deceleration Frequency	0.00 to 400.0 (1000.) Enabled when 2-step Acceleration/Deceleration Selection (A094/A294) is 01 (example 2)	0.00	Hz
C001 to C007	Multi-function Input Selection	09: 2CH (2-step acceleration/deceleration)	–	–
Related functions		F002/F202, F003/F203		

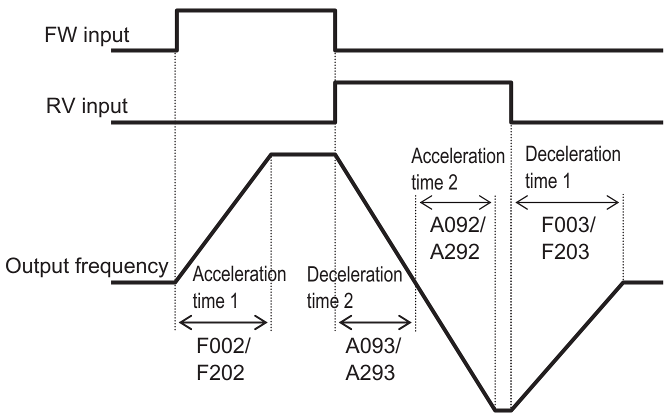
Example 1) Switching via Input Terminal (A094/A294 = 00)



Example 2) Switching via Frequency (A094/A294 = 01)



Example 3) Forward/Reverse Switching (A094/A294 = 02)



Acceleration/Deceleration Pattern

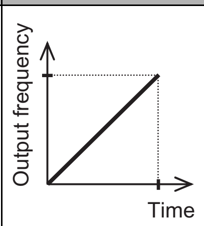
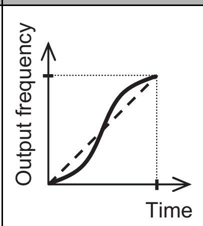
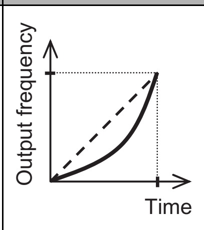
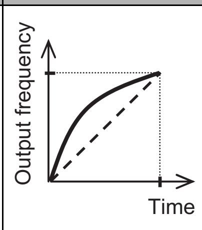
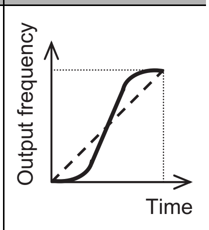
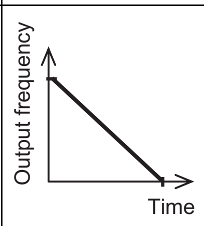
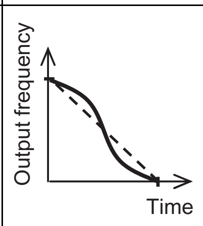
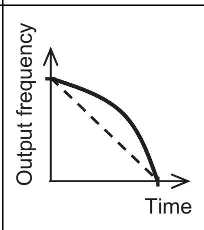
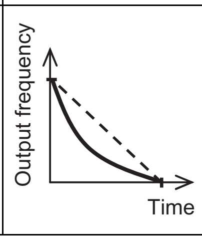
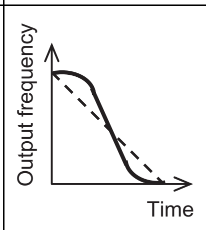
Acceleration/deceleration pattern can be set for each system. Select a desired pattern using A097 or A098.
A different pattern can be set for acceleration and deceleration, respectively.
If the selected acceleration/deceleration pattern is not Linear (A097/A098 = 00), do not use this function with an Analog Input (A001 = 01) because it increases the acceleration/deceleration time.

Parameter No.	Function name	Data	Default setting	Unit
A097/A098	Acceleration Pattern Selection/ Deceleration Pattern Selection	00: Linear 01: S shape 02: U shape curve 03: Reverse-U shape 04: EL-S shape	01	–
A131/ A132	Acceleration Curve Parameter/ Deceleration Curve Parameter	01(small curve) to 10 (large curve) Enabled with other than EL-S shape (A097/ A098 = 04)	02	–
A150/A151	EL-S Shape Acceleration Curve Ratio 1/2	0 to 50 Specify the ratio of the curved section when the EL-S shape is used. (for acceleration)	10.	%
A152/A153	EL-S Shape Deceleration Curve Ratio 1/2	0 to 50 Specify the ratio of the curved section when the EL-S shape is used. (for deceleration)	10.	%

Note: When the EL-S shape is selected, use multi-step speed operation and do not change the frequency reference during acceleration/deceleration. Only line acceleration/deceleration can be selected in the high-frequency mode.

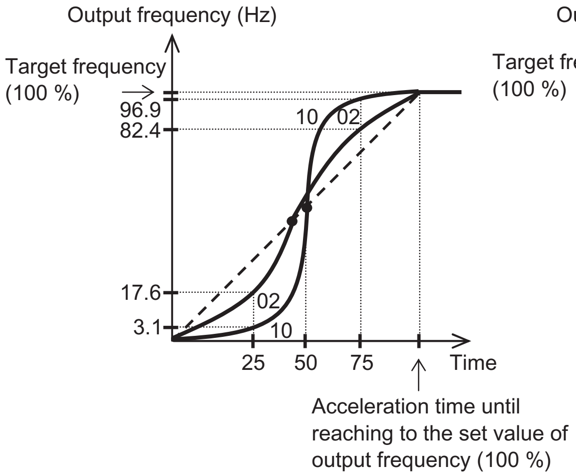
Pattern Selection

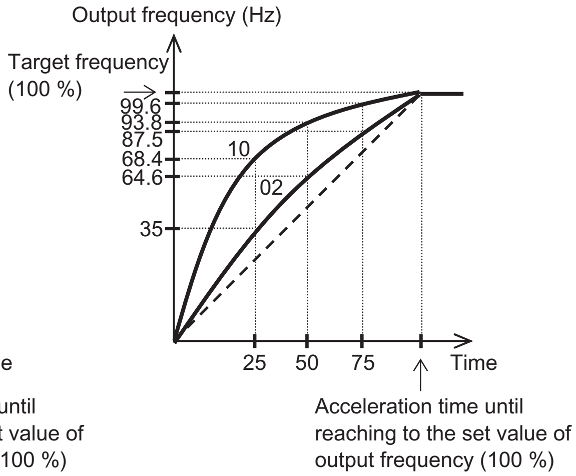
Select an acceleration/deceleration pattern with reference to the following table.

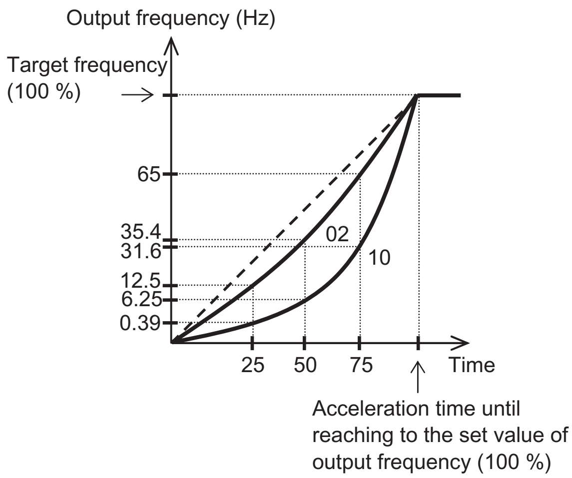
Set value	00	01	02	03	04
Curve	Line	S shape	U shape	Inverted U shape	EL-S shape
A097 (Acceleration)					
A098 (Deceleration)					
Description	Accelerates/ Decelerates linearly before reaching the set output frequency value.	Helps prevent the collapse of cargo on the elevating machine or conveyor.	Helps with tension control and roll break prevention (for a winding machine, etc.).		Provides shockless start/ stop as with the S shape, but the intermediate section is linear.

Pattern Curve Parameter (Curve Factor)

Determine a curve factor with reference to the figures below.



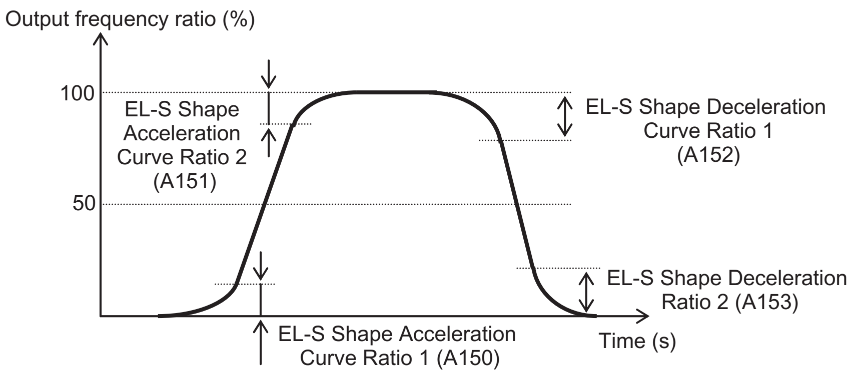




The S shape has an intermediate section where acceleration/deceleration time is shortened.
If "46: LAC (LAD cancel)" is selected for a multi-function input and the input is turned ON, the acceleration/deceleration pattern is ignored and the output frequency instantaneously follows to the reference frequency.

EL-S shape Ratio

When the EL-S shape is used, various Curve Ratios (A150 to A153) can be set for acceleration/deceleration.
If all settings are "50 [%]", the Inverter operates in the same manner as with the S shape.



Frequency Operation Function

Two sets of frequency reference operation results can be used for frequency reference or PID feedback values.
To use this function for frequency reference, set Frequency Reference Selection (A001) to "10: Operation function output."
To use this function for PID feedback, set PID Feedback Selection (A076) to "10: Operation function output."

Parameter No.	Function name	Data	Default setting	Unit
A141/A142	Operation Frequency Selection 1/ Operation Frequency Selection 2	00: Digital Operator (A020/A220)	02/03	–
		01: Digital Operator (volume) (Enabled only when the 3G3AX-OP01 is connected.)		
		02: FV (voltage) input		
		03: FI (current) input		
		04: Modbus communication (Modbus-RTU)		
		05: Optional board		
		07: Pulse train frequency		
A143	Operation Function Operator Selection	00: Addition (A141) + (A142)	00	–
		01: Subtraction (A141) – (A142)		
		02: Multiplication (A141) × (A142)		
A001	Frequency Reference Selection	10: Operation function output	02	–
A076	PID Feedback Selection	10: Operation function output	00	–

Note 1: The remote operation function cannot be used when this function is enabled. Also, frequency cannot be changed through key operations of Output Frequency Monitor (d001), Output Frequency Monitor (After Conversion) (d007), or Output Frequency Setting (F001).

Note 2: The same setting is available in A141/A142.

Frequency Addition Function

The value set in Frequency Addition Amount Setting (A145) can be added to or subtracted from the selected frequency reference value.
To use this function, allocate "50: ADD" to any of the multi-function inputs.
A145 is added or subtracted with the ADD terminal is turned on.

Parameter No.	Function name	Data	Default setting	Unit
A145	Frequency Addition Amount Setting	0.00 to 400.0 (1000.)	0.00	Hz
A146	Frequency Addition Sign Selection	00: (Frequency reference) + (A145)	00	–
		01: (Frequency reference) – (A145)		
C001 to C007	Multi-function Input Selection	50: ADD (Frequency addition)	–	–

Note 1: If the sign of the frequency reference is changed ((–) → (+), or (+) → (–)) as a result of operation, the rotation direction will be reversed.

Note 2: When the PID function is used, this function is also enabled for a PID target value. (Note that A145 is displayed in % (in increments of 0.01%).)

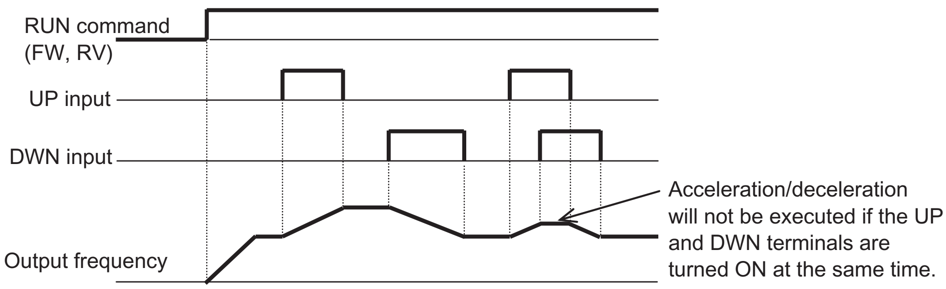
Remote Operation Function (UP, DWN)

This function changes the Inverter output frequency using UP and DWN terminals of the multi-function input terminal.
Allocate "27: UP" and "28: DWN" to Multi-function Input Selections (C001 to C007).

While the UP/DWN terminal is turned ON, the acceleration/deceleration time conforms to F002, F003/F202, and F203. Switch between Controls 1 and 2 using the SET terminal which is a multi-function input terminal to which "08: SET" is allocated.
Also note that if "01: Store frequency data" is selected for C101, the set frequency value after UP/DWN adjustment can be stored when the power is shut off.

Parameter No.	Function name	Data	Default setting	Unit
C101	UP/DWN Storage Selection	00: Do not store frequency data	00	–
		01: Store frequency data[*1]		
C104	UP/DWN Clear Terminal Mode	00: 0 Hz	00	–
		01: EEPROM data at power-on (value stored in the EEPROM)		
C001 to C007	Multi-function Input Selection	27: UP (UP/DWN function accelerated)	–	–
		28: DWN (UP/DWN function decelerated)		
		29: UDC (UP/DWN function data clear)		

*1.Do not turn ON/OFF the UP/DWN terminal after shutting off the power. Otherwise, the Inverter may not store data normally.



- This parameter is enabled only when Frequency Reference Selection A001 is set to "01: Control circuit terminal block" or "02: Digital Operator" or during multi-step speed operation. Note that "01: Control circuit terminal block" can be used only when the analog command held (AHD) is enabled. For details, refer to "Analog Command Held Function (AHD)" on page 5-39.
- This function is disabled when an external analog input is used for frequency reference, or it cannot be used to set a Jogging Operation frequency.

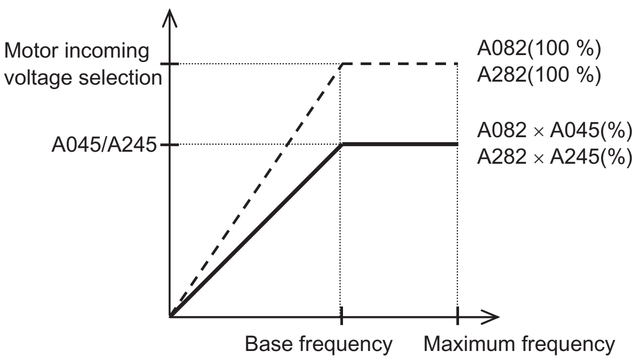
Reference

- The stored frequency set value can also be cleared. The frequency reference that has been adjusted by UP/DWN can be cleared by allocating "29: UDC" to a multi-function input terminal and then turning ON/OFF the UDC terminal. After clearing the data, the set value conforms to the setting of C104.

Output Voltage Gain

The voltage output by the Inverter can be changed based on the voltage selected by Motor Incoming Voltage Selection (A082/A282) which is handled as 100%.
Motor hunting can be avoided by lowering the gain.
If the control method is Sensorless Vector Control (A044/A244 = 03), the setting change is effective only while operation is stopped. After the setting has been changed, be sure to turn Reset (RS terminal) to ON and then OFF. The motor parameter is recalculated after the reset.
Do not change the setting significantly during operation. (As a guide, keep the change to within 10%). A sudden change in output voltage may trigger an overcurrent trip.

Parameter No.	Function name	Data	Default setting	Unit
A045/A245	Output Voltage Gain 1/2	Set the rate of reduction of output voltage. 20. to 100.	100.	%
Related functions		A082		



PID Function

This function enables process control of such elements as flow rate, air volume, and pressure.
To use this function, set A071 to "01: Enabled" or "02: Reverse output enabled."
You can disable the PID operation in progress using an external signal.

To use this function, allocate "23: PID disabled" to any of the multi-function inputs. While the PID terminal is turned ON, the Inverter disables the PID function and outputs normally.
You can limit the PID output under various conditions.
Refer to "Maximum Frequency" on page 5-28, "Frequency Limit" on page 5-60 and PID Variable Range Limit (A078).

Parameter No.	Function name	Data	Default setting	Unit
A071	PID Selection	00: Disabled 01: Enabled 02: Reverse output enabled	00	–
A072	PID P Gain	0.00 to 25.00 Proportional gain	1.00	–
A073	PID I Gain	0.0 to 3600. Integral gain	1.0	s
A074	PID D Gain	0.00 to 100. Differential gain	0.00	s
A075	PID Scale	0.01 to 99.99 For unit conversion of PID Feedback Value Monitor (d004)	1.00	–
A076	PID Feedback Selection	00: FI (current) 4 to 20 mA 01: FV (voltage) 0 to 10V 02: Modbus communication (Modbus-RTU) 03: Pulse train frequency 10: Operation function output*1	00	–
A077	PID Deviation Reverse Output	00: Disabled 01: Enabled (reversing of deviation polarity)	00	–
A078	PID Variable Range Limit	0.0 to 100.0 Variable range with reference to the target value	0.0	%
A079	PID Feedforward Selection	00: Disabled 01: FV (voltage)*2 0 to 10V 02: FI (current)*2 4 to 20 mA	00	–
A156	PID Sleep Function Operation Level	0.0 to 400.0(1000.) Operation stops once the PID output drops to below the operation level.	0.00	Hz

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Functions

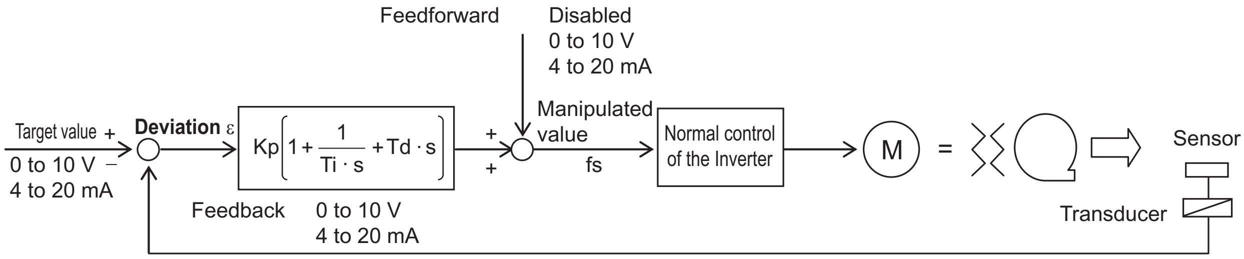
Parameter No.	Function name	Data	Default setting	Unit
A157	PID Sleep Operation Delay Time	0.0 to 25.5 Set the delay time until sleep operation is started.	0.0	s
C044	PID Deviation Excessive Level	0.0 to 100.0 OD signal output judgment level	3.0	%
C052	Feedback Comparison Signal Off Level	0.0 to 100.0 FBV signal output judgment level	100.0	%
C053	Feedback Comparison Signal On Level	0.0 to 100.0 FBV signal output judgment level	0.0	%
C001 to C007	Multi-function Input Selection	23: PID (PID disabled) 24: PIDC (PID integral reset)	–	–
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	04: OD (PID excessive deviation) 31: FBV (PID FB status output)	–	–
Related functions		A001, A005, d004		

*1. Refer to "Frequency Operation Function" on page 5-70.
*2. Refer to "Analog Input (FV, FI)" on page 5-37.

Reference

- When the PID function is used, do not set the Analog Input Filter to 500 ms (A016 = 31).

Basic Structure of PID Control

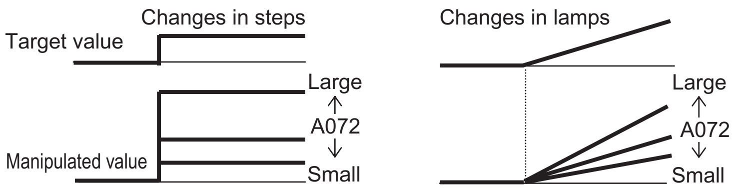


Kp: Proportional gain Ti: Integral time Td: Differential time s: Operator ε: Deviation

PID Operation

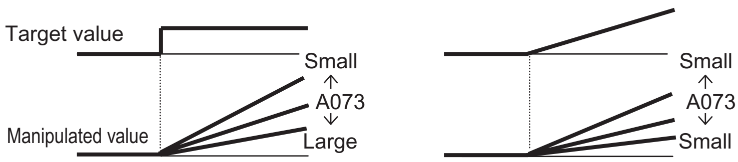
(1) P operation

Operation where the manipulated value is proportional to the deviation (target value − current value).



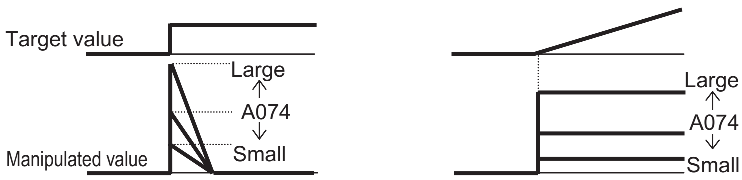
(2) I operation

Operation where the manipulated value is proportional to the time-integrated value of deviations. As the current value becomes closer to the target value, the deviation decreases and thus the effect of P operation is reduced, and consequently the time needed to achieve the target value increases. I operation compensates for this condition.



(3) D operation

Operation where the maniplated value is proportional to the ratio of change in deviation. Although use of PI operations alone require a response time, D operation has the effect of compensating for the response.



PID scale

When PID Scale (A075) is set, the following parameters undergo scale conversion.
(Value after conversion) = (Value before conversion) × (A075)

d004	F001	A011	A012	A020	A220	A021	A022
A023	A024	A025	A026	A027	A028	A029	A030
A031	A032	A033	A034	A035	A101	A102	A145

Feedback Selection

Select a terminal used for the feedback signal in PID feedback selection A076.
The target value depends on the terminal selected in frequency reference A001 other than that in A076. Also note that when A001 is set to "01: Control circuit terminal block," the setting of FV/FI Selection (A005) is disabled.
To specify "02: Modbus communication (Modbus-RTU)" for PID Feedback Selection (A076), transfer the data as follows.
Write the data in holding register address 0006h based on 100% representing 10,000.

Register Number	Function name	Parameter No.	R/W	Monitor and setting parameters	Data Resolution
0006h	PID Feedback Selection	–	R/W	0 to 10000	0.01 [%]

Note: You can read and write data. However, you can read data only when Modbus-RTU is selected for the PID feedback.
Data cannot be read under other settings.

If "03: Pulse train input" is set for PID Feedback Selection (A076), the Inverter obtains a percent conversion result (100% at maximum frequency) of the input pulse train frequency (Hz) as a feedback value.
For details on pulse train input frequency, refer to "Pulse Train Frequency Input" on page 5-82.

Feedforward Selection

Select a terminal used for feedforward signals in PID Feedforward Selection A079.
The A079 setting is enabled even if the terminal selected in A079 is duplicated with the terminal selected for target value or feedback value input.
If A079 is set to "disabled", feedforward control is disabled.

PID Deviation Reverse Output

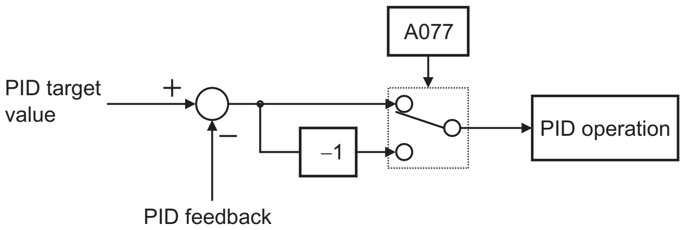
Depending on the sensor characteristics, etc. the polarity of deviation between the target value feedback values may not match the Inverter's command. In this case, the deviation polarity can be reversed by using the PID Deviation Reverse Output (A077 = 01).

Example) Controlling a refrigerator compressor

The temperature sensor specification is 0 to 100°C: 0 to 10 (V) and the target value is 5°C.

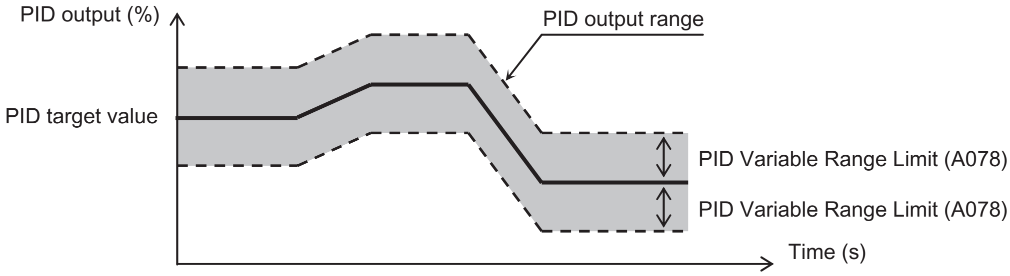
If the current temperature is 10°C, "(Feedback value) > (Target value)" is satisfied and therefore the Inverter frequency drops under normal PID control.

→ Set A077 to "01" so that the Inverter increases the frequency.



PID Variable Range Limit

This function limits PID output within a variable range relative to the target value.
To use this function, set PID Variable Range Limit (A078). The output frequency is limited within a range of "target value ± (A078)", with the maximum frequency defined as 100%.
With A078 set to 0.0, this function is disabled.



PID Reverse Output

If the PID operation result is a negative value under normal PID control, the frequency reference given to the Inverter is limited by 0 Hz. When PID Selection (A071) is set to "02: Reverse output enabled," a reverse output can be output to the Inverter even when the PID operation result is a negative value.
If A071 = 02: Reverse output enabled, PID Variable Range Limit (A078) explained above is disabled.

5

Functions

PID Gain Adjustment

If a stable response cannot be obtained in PID function operation, adjust each gain as follows according to the situation.

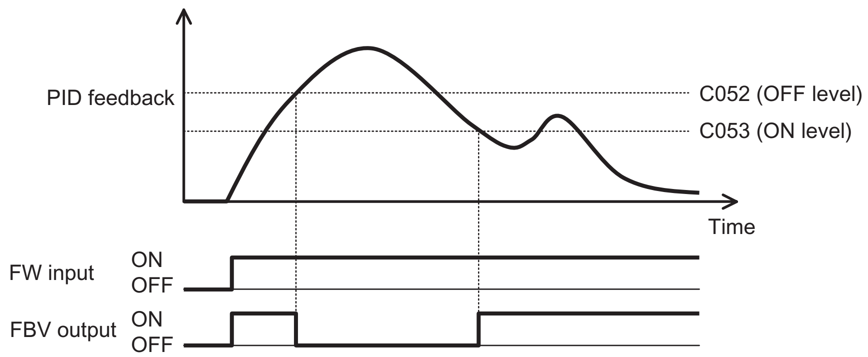
- The feedback value changes slowly when the target value is changed. → Raise P Gain A072.
- The PID feedback value changes fast but isn't stable. → Lower P Gain A072.
- The target and the PID feedback values wouldn't match smoothly. → Lower I Gain A073.
- The PID feedback value fluctuates unstably. → Raise I Gain A073.
- Response is slow even with P gain raised. → Raise D Gain A074.
- With P gain raised, the PID feedback value fluctuates and isn't stable. → Lower D Gain A074.

PID Excessive Deviation (OD)

You can set PID excessive deviation level C044 during PID control. A signal can be output to a multi-function output terminal when the PID deviation ε reaches the level set in C044 or above.
Allocate "04: OD" to any Multi-function Output Terminal Selections (C021 to C022) or Relay Output Function Selection (C026).
C044 can be set from 0 to 100. The setting corresponds to the range of 0 to the maximum target value.

Feedback Comparison Signal

A signal can be output to a multi-function output terminal when the PID feedback is out of the specified range.
Allocate "31: FBV" to any Multi-function Output Terminal Selections (C021 to C022) or Relay Output Function Selection (C026).



PID Feedback Value Monitor (d004)

You can monitor the PID feedback value.
The monitor value is displayed as the product of PID Scale (A075).
"d004 display" = "Feedback value [%]" × "PID Scale (A075)"

PID Integral Reset (PIDC)

Clears the integral value of PID operation.
Allocate "24: PIDC" to any Multi-function Input Selections (C001 to C007).
Clears the integral value every time the PIDC terminal is turned on.
Do not turn on the PIDC terminal during PID operation to avoid a possible overcurrent trip. Turn ON the PIDC terminal after turning OFF PID operation.

PID Sleep Function

When the PID output drops to below the setting of PID Sleep Function Operation Level (A156), output will stop after the period set in PID Sleep Operation Delay Time (A157). The stop method (deceleration stop/free run) conforms to Stop Selection (b091). The PID sleep function does not actuate if recovery occurs within the PID sleep operation delay time.
Even when the PID function is disabled, output will still stop after the period of A157 when the frequency reference value drops to below the setting of A156. The stop method conforms to the setting of b091.

Automatic Energy-saving Operation Function

This function automatically adjusts the Inverter output power during constant speed operation in order to minimize it. This function is suitable for load with reduced torque characteristics (e.g. fan, pump).
When operation is performed using this function, set RUN Mode Selection (A085) to "01: Energy-saving operation."

Response and accuracy can be adjusted using Energy-saving Response/Accuracy Adjustment (A086).
Control is performed at a relatively slow rate, so if a sudden load fluctuation like an impact load, etc. occurs, the motor may stall, resulting in an overcurrent trip.
When the frequency reference uses the terminal block (analog input), the automatic energy-saving function may not function sufficiently. In this case, set Analog Input Filter (A016) to "31: 500 ms."

Parameter No.	Function name	Data	Default setting	Unit
A085	RUN Mode Selection	00: Normal operation 01: Energy-saving operation	00	–

Parameter No.	Function name	Data	Default setting	Unit
A086	Energy-saving Response/ Accuracy Adjustment	0 to 100 (Response: Slow to fast) (Accuracy: High to low)	50.0	–

Commercial Switch (CS)

Use this function to drive a system with large moment of inertia during acceleration and deceleration by using the Inverter, and during constant speed by using a commercial power supply.
Allocate "14: CS" to any Multi-function Input Selections (C001 to C007).

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	14: CS (Commercial switch)	–	–
Related functions		b003, b007		

Switching from Inverter Operation to Commercial Power Supply Operation

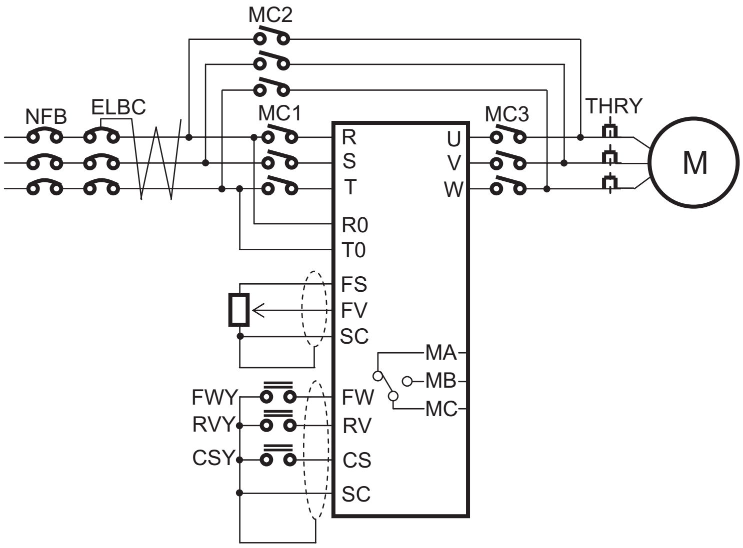
Switch MC1 to MC3, FW terminal and CS terminal according to the sequence shown on the next page. When the CS terminal is turned ON, the Inverter stops the output and the motor performs free-run operation.

Switching from Commercial Power Supply Operation to Inverter Operation

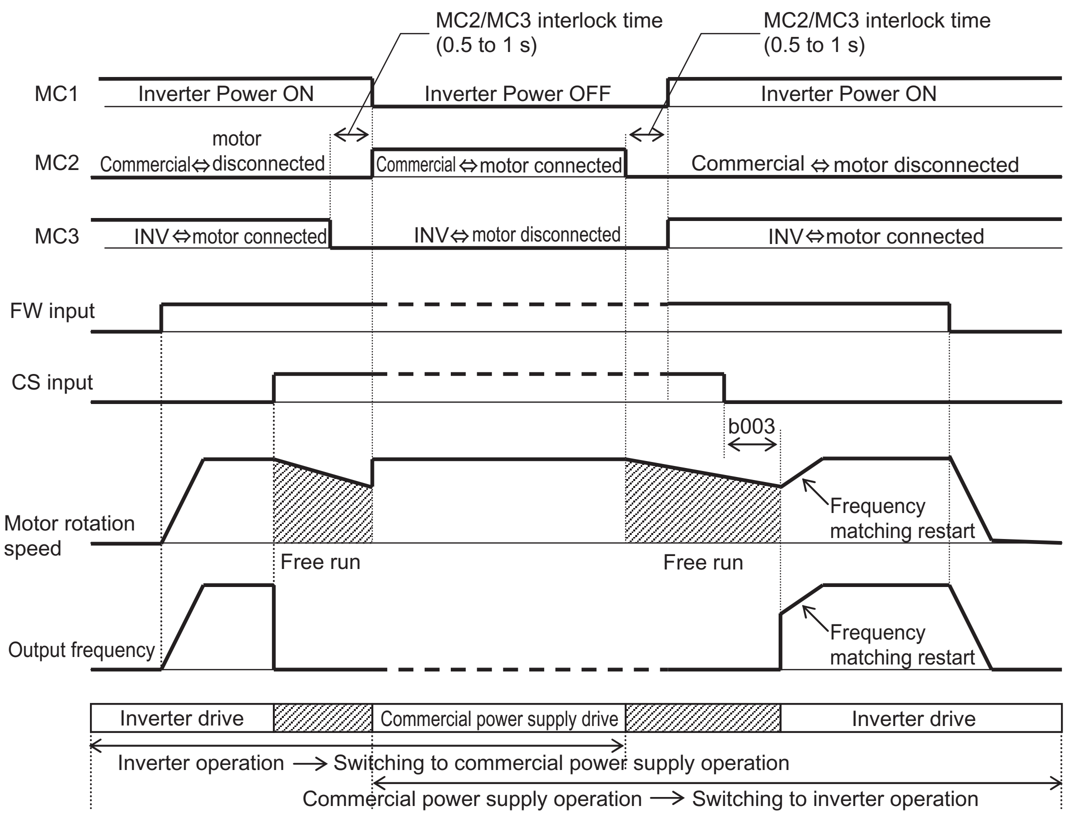
Switch MC1 to MC3 according to the sequence shown below. Turn the CS terminal to ON and then OFF, when both RUN command and CS input are ON. After an elapse of the period set by Restart Standby Time (b003), the Inverter will accelerate by matching the frequency to the rotation speed of the motor running freely (frequency matching restart). However, the Inverter may restart at 0 Hz in the following cases:

- The motor rotation speed is equal to or lower than 1/2 of the base rotation speed
- The motor induction voltage quickly attenuates
- The motor rotation speed dropped to below the level set by Frequency Matching Lower Limit Frequency Setting (b007).

Examples of Connections and Timing of Commercial Switching Operation



Example of Commercial Switching Timing



5

Functions

- Ensure that MC3 and MC2 are mechanically interlocked. Otherwise the Inverter may be damaged.

Reference

- If the earth leakage breaker ELB has tripped because of ground fault, etc. the commercial power supply circuit will not work, either. If backup is necessary, supply power from a commercial power supply circuit ELBC.
- For FWY, RVY, and CSY, use low-voltage relays. Refer to the above sequence for timing.
- If an overcurrent trip occurs at frequency matching, extend the setting of Restart Standby Time b003.
- For the Commercial Switching operation, refer to "Examples of connections and timing of Commercial Switching operation."
- The system can also be set to automatically restart upon power-on. This does not require the CS terminal. For details, refer to "Reset (RS)" on page 5-100.

Stabilization Parameter

This function is used for adjustment to reduce motor hunting.
In case of motor hunting, check whether motor capacity H003/H203 and motor pole number selection H004/H204 match your motor. If they do not, match them. If the motor's primary resistance is smaller than that of the standard motor, increase the H006/H206 set value gradually. To run a motor with a capacity larger than the Inverter's rated capacity, reduce the set value.
Other than this function, the following methods are suggested to reduce hunting:

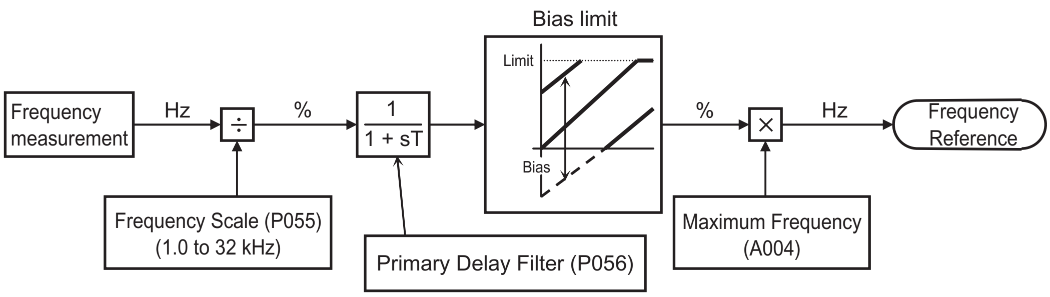
- Lower the Carrier Frequency (b083). → Refer to "Carrier Frequency" on page 5-51.
- Lower the Output Voltage Gain (A045/A245). → Refer to "Output Voltage Gain" on page 5-72.

Parameter No.	Function name	Data	Default setting	Unit
H006/H206	Stabilization Parameter 1/2	0. to 255. Increase/decrease the value if the motor hunts.	100.	–
A045/A245	Output Voltage Gain 1/2	20. to 100. If hunting occurs, reduce the set value.	100.	%
b083	Carrier Frequency	2.0 to 15.0/2.0 to 10.0 or 2.0 to 10.0 (heavy load/light load or high frequency) If hunting occurs, reduce the set value.	10.0/2.0 (5.0)	kHz

Pulse Train Frequency Input

This function uses the pulse train (1 phase) input to the RP terminal, as the frequency reference or PID feedback value in each control mode.
Set the input frequency at the maximum frequency in Pulse Train Frequency Scale (P055).
The analog input start/end function cannot be used. To limit the input frequency, use Pulse Train Bias Amount (P057) and Pulse Train Limit (P058).

Parameter No.	Function name	Data	Default setting	Unit
P003	Pulse Train Input Terminal RP Selection	00: Frequency setting or PID feedback value	00	–
P055	Pulse Train Frequency Scale	1.0 to 32.0 Specify the input pulse frequency at the motor's Maximum Frequency (A004).	25.0	kHz
P056	Pulse Train Frequency Filter Time Parameter	0.01 to 2.00 Set the filter time constant for pulse train input.	0.10	s
P057	Pulse Train Bias Amount	–100. to +100.	0.	%
P058	Pulse Train Limit	0. to 100.	100.	%
A001	Frequency Reference Selection	06: Pulse train frequency	02	–
A076	PID Feedback Selection	03: Pulse train frequency	00	–
A141	Operation Frequency Selection 1	07: Pulse train frequency	02	–
A142	Operation Frequency Selection 2	07: Pulse train frequency	03	–



V/f Control with Speed Feedback

This function performs V/f control along with slip compensation by loading as feedbacks (FB) the pulse trains from the encoder that have been input to the RP and EB terminals.
When this function is used, set Control Method (A044/A244) to "00: Constant torque characteristics," "01: Reduced torque characteristics" or "02: Free V/f setting."
Refer to "Encoder Connection" on page 5-158 for details on encoder wiring and feedback pulse selection.

Parameter No.	Function name	Data	Default setting	Unit
P003	Pulse Train Input Terminal RP Selection	01: Feedback pulse	00	–
P004	Feedback Pulse Train Input Type Selection	00: 1-phase pulse train	00	–
		01: Dual-phase pulse train with 90° phase difference 1		
		02: Dual-phase pulse train with 90° phase difference 2		
		03: 1-phase pulse train + direction		
P011	Number of Encoder Pulses	32. to 1024.	512.	Pulse
P012	Simple Position Control Selection	00: Simple position control disabled	00	–
P026	Overspeed Error Detection Level	0.0 to 150.0 *1	115.0	%
P027	Speed Deviation Error Detection Level	0.00 to 120.00	10.00	Hz
P077	Encoder Disconnection Detection Time	0.0 to 10.0	1.0	s
H050	V/f Control with Speed Feedback Slip Compensation Proportional Gain	0.00 to 10.00	0.20	Time
H051	V/f Control with Speed Feedback Slip Compensation Integral Gain	0. to 1000.	2	s

*1. Set the percentage of the Maximum Frequency (A004).

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Functions

5-7 Digital Operator/Operation Functions

The following explains the functions relating to Digital Operators and operations.

STOP Key Selection

When the RUN command selection is not set to "Digital Operator" (A002/A202 = 02), the function of the Digital Operator's STOP key can be set.
When the RUN command is set to "Digital Operator", the STOP command and error reset operation are enabled regardless of this setting.

Parameter No.	Function name	Data	Default setting	Unit
b087	STOP Key Selection	00 Both the STOP command and error reset operation are enabled	00	–
		01 Both the STOP command and error reset operation are disabled		
		02 The STOP command is disabled and only the error reset operation is enabled		

Soft Lock Function (SFT)

Changing of various data can be prohibited. This helps prevent data rewriting due to erroneous operation.

Select the soft lock setting and performing method from the following table.
To combine this function with a multi-function input terminal, allocate "15: SFT" to any Multi-function Input Selections (C001 to C007).
When b031 is set to 10, the "Data can be changed during RUN" is enabled and only the functions specified in Chapter 4, "Parameter List" can be changed. Take note that this function is not for locking the parameter, but is the direction to reset.
This function can also be password-protected. Refer to "Password Function" on page 5-91.

Parameter No.	Function name	Data	SFT terminal	Description	Default setting	Unit
b031	Soft Lock Selection	00	ON	Only b031 can be rewritten	01	–
			OFF	Soft lock function is disabled (normal operation)		
		01	ON	Only b031 and Frequency Settings (F001, A020, A220, A021 to A035, A038) can be rewritten		
			OFF	Soft lock function is disabled (normal operation)		
		02	–	Only b031 can be rewritten		
		03	–	Only b031 and Frequency Settings (F001, A020, A220, A021 to A035, A038) can be rewritten		
		10	–	"Data can be changed during RUN" mode is enabled (Only the functions specified in Chapter 4, "Parameter Lists" can be changed.)		
C001 to C007	Multi-function Input Selection	15: SFT (Soft lock)			–	–

Forced Operator Function (OPE)

This function forcibly enables operation via the Digital Operator by turning ON/OFF the applicable multi-function input terminal if the selected frequency reference/RUN command sources are not the Digital Operator.

When "31: OPE" is allocated to a multi-function input terminal and the terminal is turned ON, the frequency reference and RUN command from the Digital Operator are applied forcibly. When the terminal is OFF, the settings of A001 and A002 are applied.
If this function is switched during operation, the RUN command is cancelled to stop the Inverter output. Before resuming operation, stop the RUN command from each command source to avoid possible danger and then input it again.

If the forced Digital Operator function and Forced terminal block (51: F-TM) are turned ON simultaneously, the forced Digital Operator function is given priority.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	31: OPE (Forced operator)	–	–
Related functions		A001, A002		

Forced Terminal Block Function (F-TM)

This function forcibly enables operation via the control circuit terminal block by turning ON/OFF the applicable multi-function input terminal if the selected frequency reference/RUN command sources are not the control circuit terminal block.

If "51: Forced terminal block" is selected by any Multi-function Input Selections (C001 to C007), the Inverter is operated with the signal from the frequency reference source and RUN command source selected in A001 and A002, when the input signal is OFF. When the signal is ON, the Inverter is forced to operate with the frequency reference or RUN command from the control circuit terminal block.
If you switch on/off this function during operation, the RUN command is reset to stop the Inverter output. Before resuming operation, stop the RUN command from each command source to avoid possible danger and then input it again.

If the Forced operator (31: OPE) and forced terminal block function are turned ON simultaneously, the forced Digital Operator function is given priority.
When the F-TM terminal is turned ON with the FV/FI terminal turned ON and VR (volume on the external Digital Operator) selected, the frequency reference that was selected when the FV/FI terminal was OFF is selected.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	51: F-TM (Forced terminal block)	–	–
Related functions		A001, A002		

Selection of Operation upon Digital Operator Disconnection

If the Inverter detects disconnection of the Digital Operator (= communication with the Digital Operator has been disrupted for 5 s or more), the Inverter operation conforms to the setting of Selection of Operation on Digital Operator Disconnection (b165).

Parameter No.	Function name	Data	Default setting	Unit
b165	Selection of Operation on Digital Operator Disconnection	00: Trip (E40. □)	02	–
		01: Trip after deceleration stop (E40. □)		
		02: Ignore		
		03: Free-run stop		
		04: Deceleration stop		

Initial Screen Selection (Screen at Power-ON)

The Digital Operator screen to be displayed at power-on can be selected from among the following: (By factory default, "001 (d001)" is selected.)

Main Built-in Digital Operator

Parameter No.	Function name	Data	Description (Digital Operator)	Default setting	Unit
b038	Initial Screen Selection	000	Screen on which the Enter key was pressed last (All items other than d*** and F001 are parameters.)*1	001	–
		001	d001 (Output Frequency Monitor)		
		002	d002 (Output Current Monitor)		
		003	d003 (Rotation Direction Monitor)		
		:	: (Each item corresponds to d***.)		
		060	d060 (Inverter Mode Monitor)		
		201	F001 (Output Frequency Setting)		
		202	Do not use this setting.		

*1.If "000" is selected and then the power is turned off without changing the setting, this item (b038) will be displayed the next time the power is turned on.

Initial Screen Automatic Switching Function

This function is enabled when Initial Screen Automatic Switching Function is set to "01: Enabled." If the Digital Operator is not operated for 10 minutes, the display automatically switches to the initial screen set by b038.

Parameter No.	Function name	Data	Default setting	Unit
b164	Initial Screen Automatic Switching Function	00: Disabled (Not switching automatically)	00	–
		01: Enabled (Switching automatically)		

Main Panel Display Selection

Once the Remote Operator is connected, the keys on the main unit become disabled. Set the parameter number to be displayed on the main display at this time.

Parameter No.	Function name	Data	Default setting	Unit
b150	Main Panel Display Selection	001 to 060 Corresponding to d001 to d060 in the monitor mode.	001	

Display Selection

The items displayed on the Digital Operator can be partially hidden.
This function can also be password-protected. Refer to "Password Function" on page 5-91.

Parameter No.	Function name	Data	Default setting	Unit
b037	Display Selection	00: Complete display	04	–
		01: Individual display of functions		
		02: User setting + b037		
		03: Data comparison display		
		04: Basic display		
		05: Monitor (d***) display only		
U001 to U032	User Selection	no: No allocation	no	–
		d001 to P183 Select the parameter you want to display (All parameters can be displayed.)		

Individual Display of Functions (b037 = 01)

If a specific function is not selected, its relevant parameter is not displayed.
For details on the display requirements, refer to the following table.

No.	Display requirements		Parameters displayed when the applicable conditions are met
1	Displayed when 2 is set	C001 to C007 = 08	F202, F203, A201 to A204, A220, A241 to A247, A261, A262, A281, A282, A292 to A296, b212, b213, b221 to b223, C241, H202 to H206, H220 to H224, H230 to H234
2	Displayed when Control method 1 is sensorless vector control	A044 = 03	d009, d010, d012, b040 to b046, C054 to C059, H001, H005, H020 to H024, H030 to H034, P033, P034, P036 to P040
3	Displayed when Control method 2 is sensorless vector control	C001 to C007 = 08 and A244 = 03	d009, d010, d012, b040 to b046, C054 to C059, H001, H205, H220 to H224, H230 to H234, P033, P034, P036 to P040
4	Displayed when Control method 1/2 is free V/f setting	A044 = 02 or C001 to C007 = 08 and A244 = 02	b100 to b113
5	Displayed in the free electronic thermal mode	b013 = 02 or C001 to C007 = 08 and b213 = 02	b015 to b020
6	Displayed when Control method 1 is free V/f setting	A044 = 00, 01	A041 to A043, A046, A047
7	Displayed when Control method 2 is free V/f setting	C001 to C007 = 08 and A244 = 00, 01	A241 to A243, A246, A247

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Functions

No.	Display requirements		Parameters displayed when the applicable conditions are met
8	Displayed when DC injection braking is used	A051 = 01, 02 or C001 to C007 = 07	A052 to A059
9	Displayed when PID is used	A071 = 01, 02	d004, A072 to A079, A156, A157, C044, C052, C053
10	Displayed when Co-inverter communication is used	C096 = 01, 02	C098 to C100, P140 to P155
11	Displayed during curved acceleration/ deceleration	A097, A098 = 01 to 04	A131, A132, A150 to A153
12	Displayed when controlled deceleration on power loss is used	b050 = 01, 02, 03	b051 to b054
13	Displayed when the brake control function is used	b120 = 01	b121 to b127
14	Displayed when the overvoltage suppression function during deceleration is used	b130 = 01, 02	b131 to b134
15	Displayed during simple position control is used	P003 = 01	d008, P004, P011, P012, P015, P026, P027, P060 to P073, P075, P077, H050, H051

Note: The comma "," in the Display requirements means OR.

User Setting (b037=02)

Displays only the parameters optionally set in U001 to U032.
In addition to U001 to U032, d001, F001, b037, b190 and b191 are displayed.

Data Comparison Display (b037=03)

Displays only the parameters changed from the factory default.
All monitors (d***) and F001, b190 and b191 are always displayed.

Basic Display (b037=04)

The basic parameters are displayed (factory defaults).
The following parameters are displayed when this function is enabled:

No.	Parameter No.	Function name
1	d001 to d104	Monitor Display
2	F001	Output Frequency Setting
3	F002	Acceleration Time Setting 1
4	F003	Deceleration Time Setting 1
5	F004	RUN Direction Selection
6	A001	Frequency Reference Selection 1
7	A002	RUN Command Selection 1
8	A003	Base Frequency 1
9	A004	Maximum Frequency 1
10	A005	FV/FI Selection
11	A020	Multi-step Speed 1 Reference 0
12	A021	Multi-step Speed Reference 1
13	A022	Multi-step Speed Reference 2
14	A023	Multi-step Speed Reference 3
15	A044	Control Method 1
16	A045	Output Voltage Gain 1
17	A085	RUN Mode Selection
18	b001	Retry Selection
19	b002	Allowable Momentary Power Interruption Time
20	b008	Overvoltage/Overcurrent Restart Selection
21	b011	Overvoltage/Overcurrent Restart Standby Time
22	b037	Display Selection
23	b083	Carrier Frequency
24	b084	Initialization Selection
25	b130	Overvoltage Suppression Function Selection During Deceleration
26	b131	Overvoltage Suppression Level During Deceleration
27	b180	Perform-Initialization/Mode Selection
28	b190	Password A Setting
29	b191	Password A Authentication
30	C021	Multi-function Output Terminal P1/EDM Selection
31	C022	Multi-function Output Terminal P2 Selection
32	C036	Multi-function Relay Output (MA, MB) Contact Selection

Monitor Display Only (b037 = 05)

Displays the Monitor Display (b037) for d***.

Display Fixed (DISP)

When "86: DISP" is allocated to a multi-function input terminal and the terminal is turned ON, the Digital Operator switches to the display selected by Initial Screen Selection (b038) and other parameters can no longer be displayed.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	86: DISP (Display fixed)	–	–
Related functions		b038		

Password Function

A password can be set for Display Selection (b037) and Soft Lock Selection (b031) to prevent displaying and changing of parameters.

- If you forget the set password, no other method is available to cancel the password lock. Exercise due caution when setting a password, because our factory or service station cannot check the password.

Parameter No.	Function name	Data	Description	Default setting	Unit
b190	Password A Setting	0000	Password function disabled	0000	–
		0001 to FFFF	Set password A for Display Selection (b037).		
b191	Password A Authentication	0000 to FFFF	This parameter is used to authenticate password A.	0000	–
b192	Password B Setting	0000	Password function disabled	0000	–
		0001 to FFFF	Set password B for Soft Lock Selection (b031).		
b193	Password B Authentication	0000 to FFFF	This parameter is used to authenticate password B.	0000	–
Related functions		b031, b037			

Note 1: 0000 cannot be set as a password.

Note 2: Sixteen characters including 0 to 9, A, b, C, d, E and F (hexadecimals) can be used to set a password.

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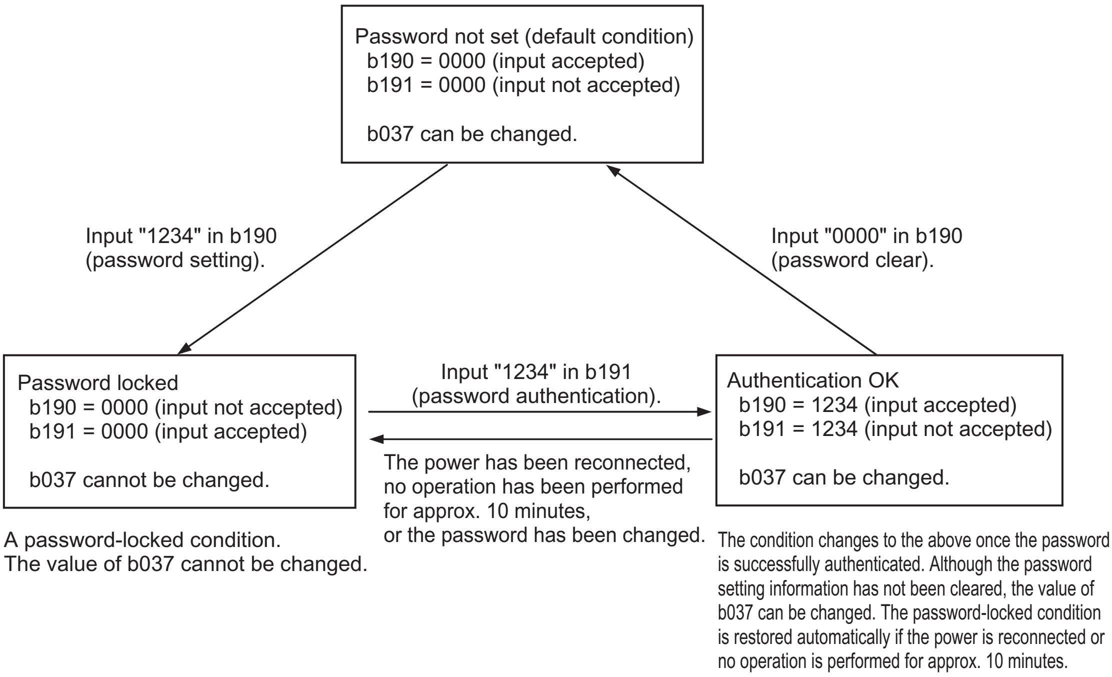
Functions

Overview of Password Function

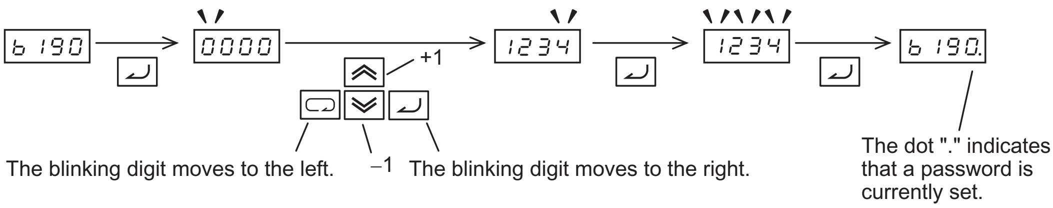
Example) Password A



Password Setting

Password Setting

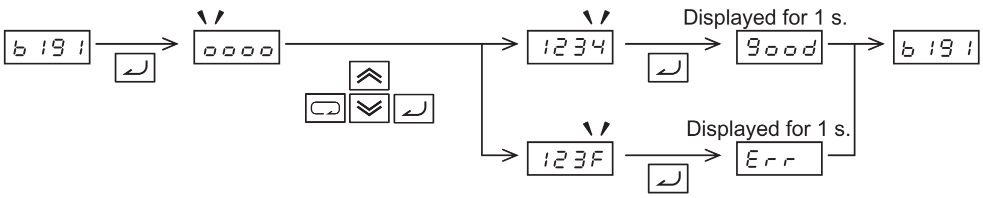
(1) Set Display Selection (b037)/Soft Lock Selection (b031) according to the target to be protected.
(2) Enter a desired password in Password Setting (b190/b192).(Note that 0000 cannot be used.)



(3) The password-locked condition is obtained. b037/b031 can no longer be changed.

Password Authentication (When a Person Who Knows the Password Changes the Data of b037/b031)

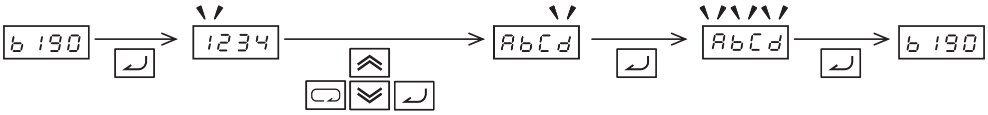
(4) Enter the password in Password Setting (b191/b193).



(5) If the password is correct, "Good" is displayed and b037 become editable. If the password is incorrect, "Err" is displayed and the system returns to the original condition (password-locked condition in (3)). If no operation is performed for 10 minutes or the power is reconnected, the system automatically returns to the password-locked condition in (3).

Password Change

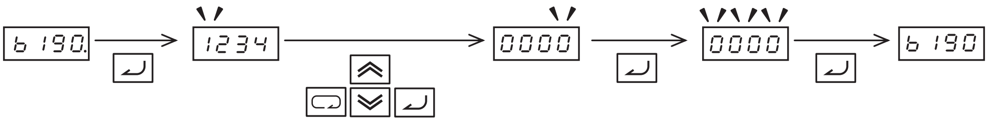
(6) Perform password authentication. (The password cannot be changed in the password-locked condition in (3) ("0000" is displayed).)
(7) Enter a desired password in Password Setting (b190/b192).



(8) When the password is changed, the system automatically switches to the password-locked condition.

Password Clear

(9) Perform password authentication. (The password cannot be cleared in the password-locked condition in (3) ("0000" is displayed).)
(10) Enter 0000 in Password Setting (b190/b192).
(11) The system returns to the condition where no password is set (initial condition) and all password information is cleared.



5-8 Restart Functions

The following explains the operations performed upon restart.

Frequency Matching Restart and Frequency Pull-in Restart

The 3G3MX2 provides two restart methods, frequency matching restart and frequency pull-in restart, which can be selected using the functions described below.

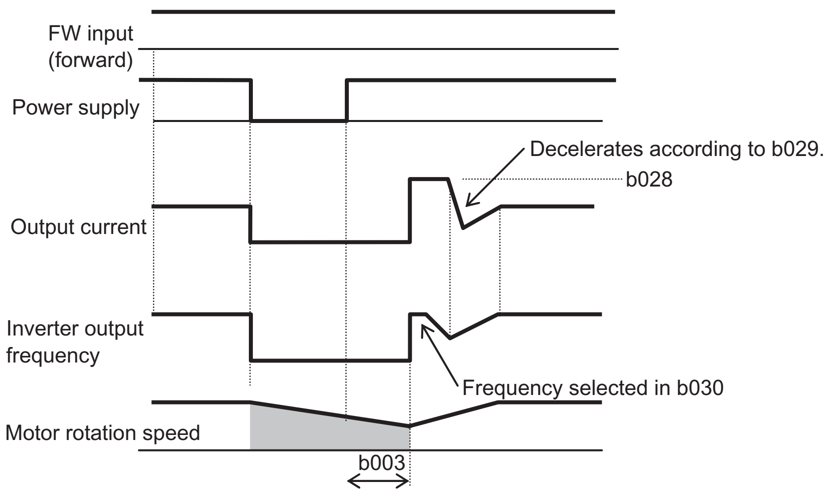
Functions relating to frequency matching restart and frequency pull-in restart		Description	Default setting	Unit
b001	Retry Selection →Refer to 5-96 page.	Selection of restart method upon cutoff of output after detection of momentary power interruption/undervoltage	00	–
b008	Overvoltage/Overcurrent Restart Selection →Refer to 5-97 page.	Selection of restart method upon cutoff of output after detection of overvoltage/ overcurrent	00	–
C103	Reset Restart Selection →Refer to 5-101 page.	Selection of restart method upon reset	00	–
b088	Free-run Stop Selection →Refer to 5-103 page.	Selection of restart method after cancellation (turning ON and OFF) of free-fun stop input	00	–

Both the frequency matching restart and frequency pull-in restart functions are provided to allow for restart without stopping the motor running freely. The Digital Operator displays oooo until restart, after output is shut off.

	Frequency matching restart	Frequency pull-in restart
Function	This method restarts the Inverter by detecting frequency based on the motor's residual voltage.	The Inverter starts output at the frequency set in Starting Frequency (b030), and searches for a point where the frequency and voltage are balanced, while holding the current at the setting of Restart Current Level (b028), to restart itself. If the Inverter trips with this method, reduce the b028 set value.
Advantages	The Inverter can be restarted smoothly.	The Inverter can be restarted regardless of whether or not there is residual voltage.
Disadvantages	The Inverter cannot be restarted if the residual voltage is at a certain level or below (in which case the Inverter restarts at 0 Hz).	Shock may occur upon restart. (The current may surge. If an overcurrent trip occurs, also use Overcurrent Suppression Function b027.)

The major parameters relating to frequency matching restart and frequency pull-in restart are listed below.
For details, refer to the section on each function.

Classification	Parameter No.	Function name	Data	Default setting	Unit
Common	b003	Restart Standby Time	0.3 to 100.0 Time until restart	1.0	s
Frequency matching restart	b007	Frequency Matching Lower Limit Frequency Setting	0.00 to 400.0 (1000.) If the frequency drops to b007 or below during the motor free run, the Inverter restarts at 0 Hz.	0.00	Hz
Frequency pull-in restart	b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × Rated current	Inverter rated current	A
	b029	Frequency Pull-in Restart Parameter	0.10 to 30.00 Frequency reduction time	0.50	s
	b030	Starting Frequency at Frequency Pull-in Restart Selection	00: Frequency at interruption 01: Maximum frequency 02: Set frequency	00	–



Restart Upon Momentary Power Interruption/Undervoltage, Overvoltage/Overcurrent

Whether to trip or restart the Inverter upon momentary power interruption/undervoltage or overvoltage/overcurrent can be selected.

Restart upon Momentary Power Interruption/Undervoltage, Overvoltage/Overcurrent

When a restart function is selected under Retry Selection (b001), the Inverter restarts repeatedly for the number of times set in b005 in the case of momentary power interruption/ undervoltage, or in b010 in the case of overvoltage/overcurrent, and then trips at the next restart. The Inverter does not trip when unlimited restart is set. Unlimited restart can be set only for Momentary Power Interruption/Undervoltage Restart (b005).

b004 can be used to select whether the Inverter trips or not when a momentary power interruption or undervoltage occurs while stopped.
When selecting a restart function, set the following restart conditions according to the system.
A desired function can be selected from 0 Hz restart, frequency matching restart, frequency matching deceleration trip, and frequency pull-in restart.
Even when the Inverter is restarting, an E09 (undervoltage) trip occurs if an undervoltage condition continues for 40 seconds.

Parameter No.	Function name	Data	Description	Default setting	Unit
b001	Retry Selection *1*2	00	Trip	00	–
		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		
b002	Allowable Momentary Power Interruption Time	0.3 to 25.0	Restarts if the momentary power interruption is within the set time. (example 1) Trips if the momentary power interruption is beyond the set time. (example 2)	1.0	s
b003	Restart Standby Time	0.3 to 100.0	Time until restart	1.0	s
b004	Momentary Power Interruption/ Undervoltage Trip During Stop Selection*1	00	Disabled (Not tripping during stop)	00	–
		01	Enabled (Tripping also during stop)		
		02	Disabled while the operation is stopped or during a deceleration stop due to turning OFF of the RUN command.		
b005	Restart During Momentary Power Interruption Count Selection	00	16 times	00	–
		01	Unlimited		

Parameter No.	Function name	Data	Description	Default setting	Unit
b007	Frequency Matching Lower Limit Frequency Setting	0.00 to 400.0 (1000.)	If the frequency drops to b007 or below while the motor is running freely, the Inverter restarts at 0 Hz. (examples 3, 4)	0.00	Hz
b008	Overvoltage/ Overcurrent Restart Selection	00	Trip	00	–
		01	0 Hz restart		
		02	Frequency matching restart		
		03	Trip after frequency matching deceleration stop		
		04	Frequency pull-in restart		
b010	Overvoltage/ Overcurrent Restart Count Selection	1 to 3	Number of retries for restart upon overvoltage/overcurrent*5	3	Time
b011	Overvoltage/ Overcurrent Restart Standby Time	0.3 to 100.	Wait time until restart	1.0	s
b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × Rated current	Current limit level at frequency pull-in restart	Inverter rated current	A
b029	Frequency Pull-in Restart Parameter	0.1 to 3000.	Frequency reduction time at frequency pull-in restart	0.50	s
b030	Starting Frequency at Frequency Pull-in Restart Selection	00	Frequency at interruption	00	–
		01	Maximum frequency		
		02	Set frequency		
C021 to C022, C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	09	UV: Signal during undervoltage	–	–

*1. Even when Retry Selection (b001) is set to any restart function (01 to 03) and Momentary Power Interruption/Undervoltage Trip during Stop Selection (b004) is disabled (00 or 02), a trip still occurs if the momentary power interruption time exceeds the allowable momentary power interruption/ undervoltage time. (Example 2)

*2. Even if a restart function is selected, the Inverter trips when undervoltage remains for 40 seconds or longer.

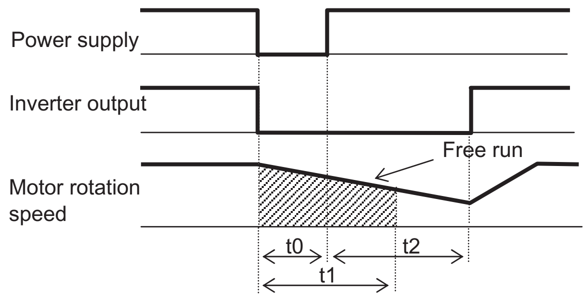
*3. 0 Hz restart may occur in the following cases:
- The output frequency is one-half the base frequency or below
- The induced voltage of the motor attenuates quickly

*4. If an overvoltage/overcurrent trip occurs during declaration, Undervoltage Error E09 is displayed and the motor goes into free-run status. In this case, increase the deceleration time.

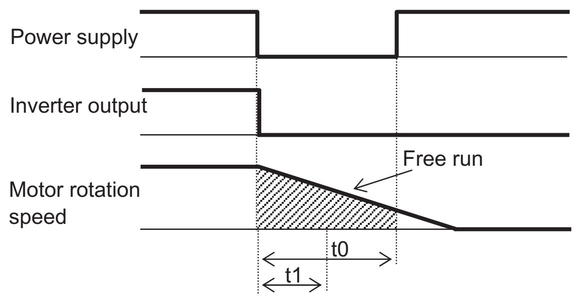
*5. Even when a restart operation upon trip is selected, the Inverter continues to trip if the cause of the trip is not yet removed after Restart Standby Time (b003) elapses. In this case, increase the restart standby time.

A timing chart of Frequency Matching Restart (b001 = 02) is shown below.
t0: Momentary power interruption time
t1: Allowable Momentary Power Interruption Time (b002)
t2: Restart Standby Time (b003)

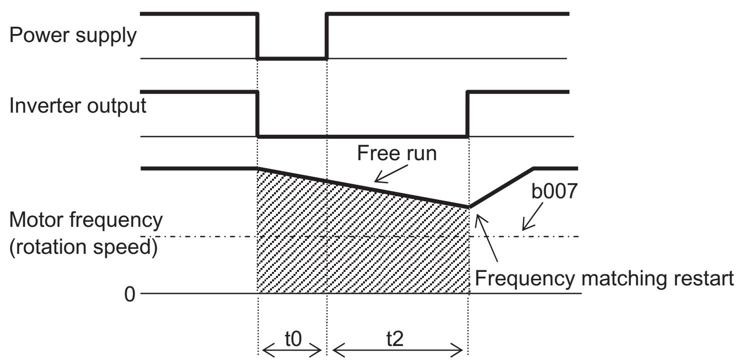
Example 1) When t0 < t1



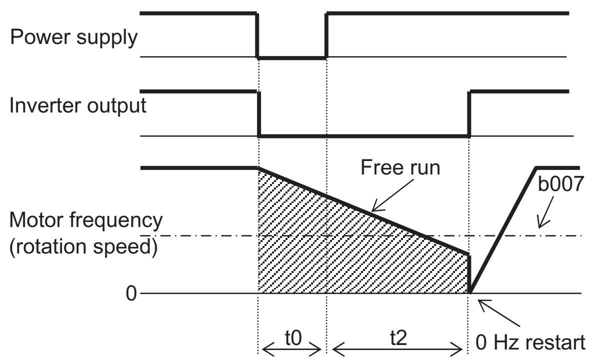
Example 2) When t0 > t1



Example 3) Motor frequency (rotation speed) > b007



Example 4) Motor frequency (rotation speed) < b007



5

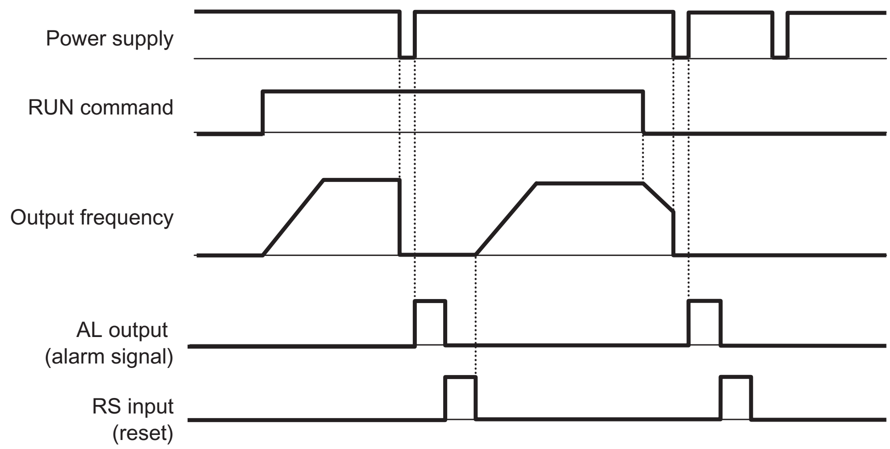
Functions

Alarm Signal Output upon Momentary Power Interruption/Undervoltage during Stop

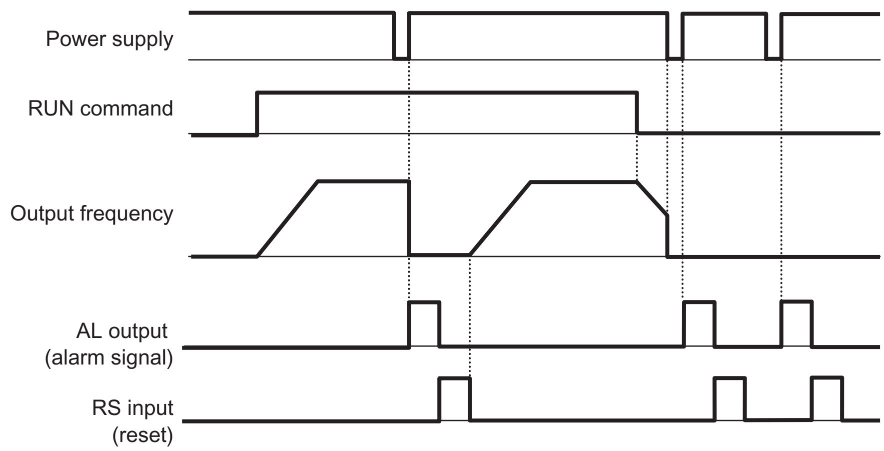
Use b004 to select whether to enable an alarm signal output in case of momentary power interruption or undervoltage.
An alarm signal output continues while the Inverter control power supply remains.

Alarm Signal Output upon Momentary Power Interruption/Undervoltage during Stop

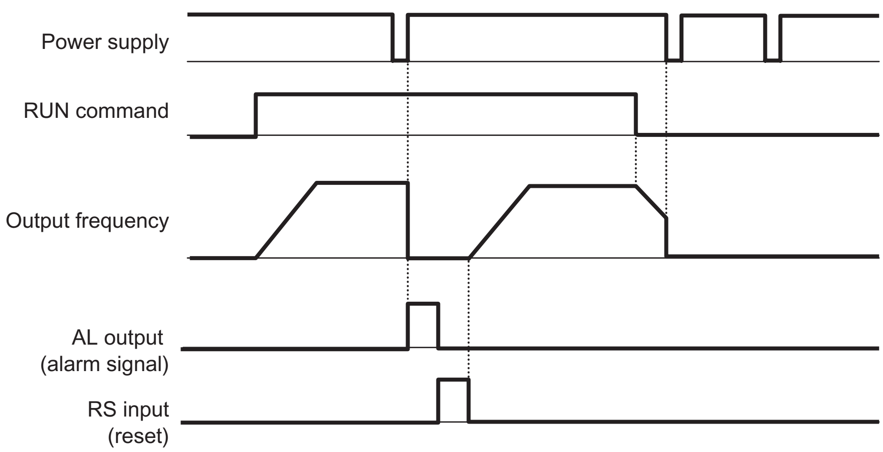
Example 1) b004 = 00 (Disabled)



Example 2) b004 = 01 (Enabled)



Example 3) b004 = 02 (Disabled also during deceleration stop)



Reset (RS)

This function resets an Inverter trip.
To reset an Inverter trip, press the STOP/RESET key on the Digital Operator, or turn ON the reset (RS) terminal.
When using the reset terminal, allocate "18: RS" to a multi-function input terminal.

The restart method to be applied after the reset operation can be selected by Reset Restart Selection (C103). Take note, however, that the Inverter will restart at 0 Hz if Reset Selection (C102) is set to "03: Trip reset only," regardless of the setting of C103. If an overcurrent trip occurs at frequency matching, extend the Restart Standby Time (b003).

A trip reset time can be selected by Reset Selection (C102). In addition, the reset signal can be applied only to trip reset due to an error.
For the Reset (RS) terminal, only the NO contact setting is effective.

- Do not use the reset terminal to stop the Inverter output. The reset operation will clear various data such as electronic thermal function and usage rate counter for regenerative braking, thereby causing damage to the Inverter.

Parameter No.	Function name	Data	Description	Default setting	Unit
b003	Restart Standby Time	0.3 to 100.0	Time from reset to restart	1.0	s
b007	Frequency Matching Lower Limit Frequency Setting	0.00 to 400.0 (1000.)	If the frequency drops to the set frequency or below during the motor free run, the Inverter restarts at 0 Hz.	0.00	Hz
b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × Rated current	Current limit level at frequency pull-in restart	Inverter rated current	A
b029	Frequency Pull-in Restart Parameter	0.1 to 3000.	Frequency reduction time at frequency pull-in restart	0.5	s
b030	Starting Frequency at Frequency Pull-in Restart Selection	00	Frequency at interruption	00	–
		01	Maximum frequency		
		02	Set frequency		
C102	Reset Selection	00	Trip reset at power-on (example 1) Normal: Output shut off Abnormal: Trip reset	00	–
		01	Trip reset at power-off (example 2) Normal: Output shut off Abnormal: Trip reset		
		02	Trip reset at power-on (example 1) Normal: Disabled Abnormal: Trip reset		

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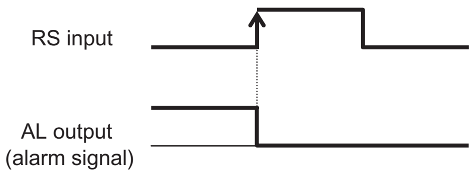
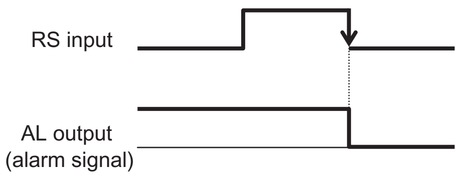
Functions

Parameter No.	Function name	Data	Description	Default setting	Unit
C102	Reset Selection	03	Trip reset only (example 1) Not initializing internal data such as current values upon trip reset (Refer to "Initialization Setting" on page 5-174.) Normal: Disabled Abnormal: Trip reset	00	–
C103	Reset Restart Selection	00	0 Hz restart	00	–
		01	Frequency matching restart (example 3)		
		02	Frequency pull-in restart (example 4)		
C001 to C007	Multi-function Input Selection	18	RS: Reset	–	–

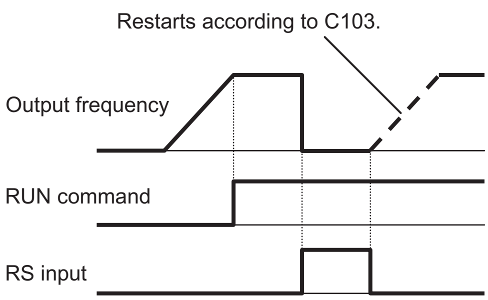
Example 1) Trip reset at power ON (C102 = 00, 02, 03)



Example 2) Trip reset at power OFF (C102= 01)

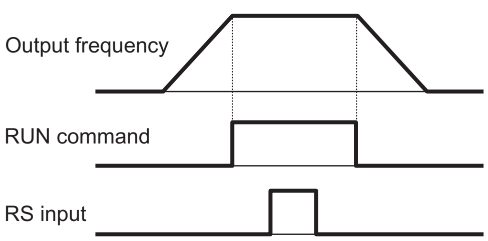


Example 3) Reset enabled when normal (C102 = 00, 01)



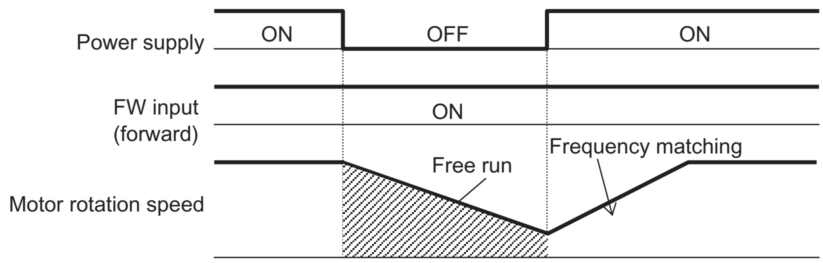
Example 4) Reset disabled when normal (C102 = 02, 03)

Reset is disabled during operation.



Example 5) When "01: Frequency matching restart" is selected by Reset Restart Selection (C103), frequency matching restart can be applied also when the power is reconnected.
If C103 is set to 00 (0 Hz restart), Restart Standby Time (b003) is ignored.
Note, however, that 0 Hz restart may be applied even when frequency matching restart is selected, in the following cases:

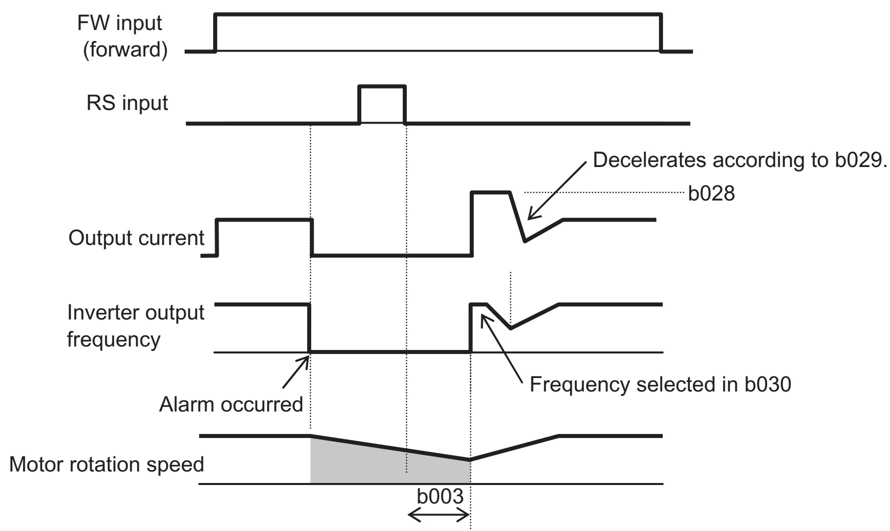
- The output frequency is equal to or lower than 1/2 of the base frequency
- The motor induction voltage quickly attenuates
- Frequency Matching Lower Limit Frequency Setting (b007) is set and a frequency below the set frequency is detected.



Reference

- The counters used for the Inverter's internal protection will be cleared during reset.
  To shut off the Inverter's output via a multi-function input, use the free-run terminal (FRS).

Example 6) Frequency pull-in restart



After an elapse of the time set in Restart Standby Time (b003), output is started from the value set in Starting Frequency at Frequency Pull-in Restart (b030). Thereafter, The Inverter decelerates according to Frequency Pull-in Restart Parameter (b029) while keeping the output current at the value set in Frequency Pull-in Restart Level (b028).
When the frequency matches the voltage, the Inverter accelerates again to reach to the original frequency level. If an overcurrent trip occurs under this method, reduce the b028 setting.

Reference

- If a reset signal is input during the restart wait time, the value of frequency at interruption stored in the Inverter's internal is cleared, resulting in a 0 Hz restart.

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Functions

Free-run Stop Function (FRS)

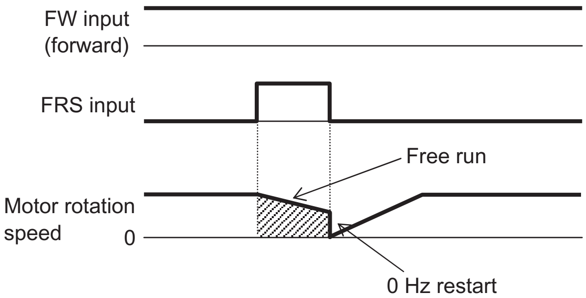
Activating the free-run stop (FRS) function shuts off the Inverter output, letting the motor go into free-run status.
This function is effective when you stop the motor using the mechanical brake such as an electromagnetic. Note that an overcurrent trip may occur if the mechanical brake forces the motor to stop during Inverter output.

Allocate "11: FRS" to any Multi-function Input Selections (C001 to C007). The motor performs a free-run stop while the FRS terminal is turned ON.
When the FRS terminal is turned ON and then OFF, the Inverter will restart after an elapse of the time set in Restart Standby Time (b003). However, the Inverter will not restart if RUN Command Selection is set to "Digital Operator" (A002 = 02). To restart the Inverter, input the RUN command.

As the Inverter output method at restart, 0 Hz restart, frequency matching restart or frequency pull-in restart can be selected by Free-run Stop Selection (b088). (Examples 1, 2, 3)
When Frequency Matching Lower Limit Frequency Setting (b007) is set, the Inverter will restart at 0 Hz if a frequency below the frequency set here is detected at the time of frequency matching restart.
The setting of this function will be applied to the FRS terminal, and also when the Inverter is reset from free-run status.

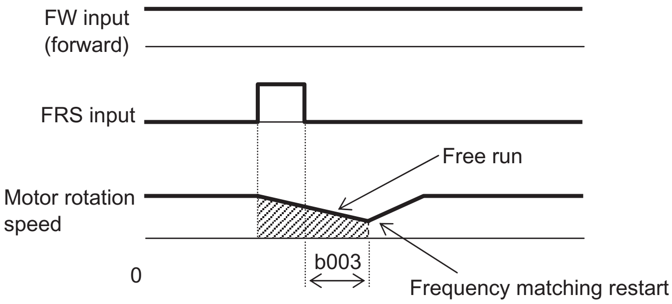
Parameter No.	Function name	Data	Description	Default setting	Unit
b088	Free-run Stop Selection	00	0 Hz restart (example 1)	00	–
		01	Frequency matching restart (example 2)		
		02	Frequency pull-in restart (example 3)		
b003	Restart Standby Time	0.3 to 100.0	Time until restart	1.0	s
b007	Frequency Matching Lower Limit Frequency Setting	0.00 to 400.0 (1000.)	Setting of frequency matching level	0.00	Hz
b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × Rated current	Current limit level at frequency pull-in restart	INV rated current	A
b029	Frequency Pull-in Restart Parameter	0.1 to 3000.		0.50	s
b030	Starting Frequency at Frequency Pull-in Restart Selection	00	Frequency at interruption	00	–
		01	Maximum frequency		
		02	Set frequency		
C001 to C007	Multi-function Input Selection	11	FRS: Free-run stop	–	–

Example 1) 0 Hz restart (b088 = 00)



The Inverter restarts running at 0 Hz regardless of the motor rotation speed. At 0 Hz restart, the restart standby time is ignored.
If the Inverter restarts running at 0 Hz with the motor rotation speed high, an overcurrent trip may occur.

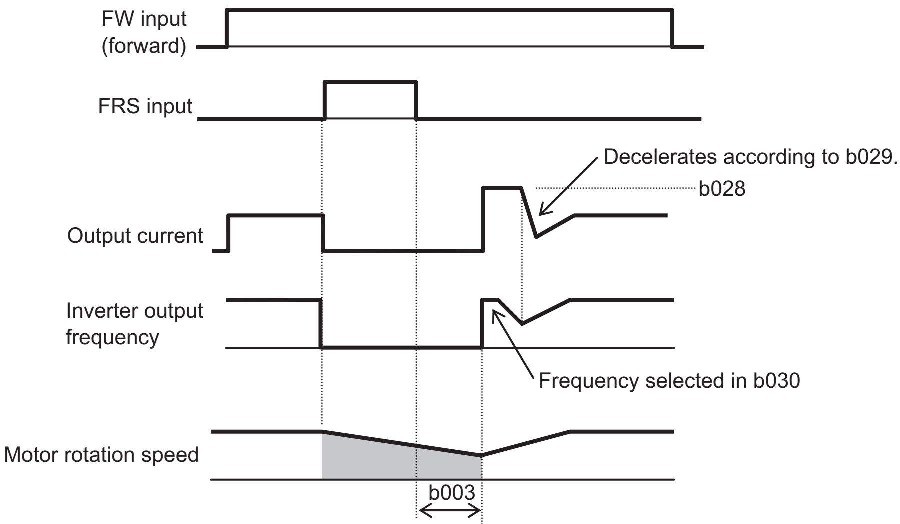
Example 2) Frequency matching restart (b088 = 01)



When the FRS terminal is turned OFF and the restart standby time elapses, the motor frequency is detected and a frequency pull-in restart is performed without stopping the motor. If an overcurrent trip occurs at frequency matching restart, extend the setting of restart standby time. Note, however, that 0 Hz restart may be applied even when frequency matching restart is selected, in the following cases:

- The output frequency is equal to or lower than 1/2 of the base frequency
- The motor induction voltage quickly attenuates
- Frequency Matching Lower Limit Frequency Setting (b007) is set and a frequency below the set frequency is detected.

(Example 3) Frequency pull-in restart (b088 = 02)



After an elapse of the time set in Restart Standby Time (b003), output is started from the value set in Starting Frequency at Frequency Pull-in Restart (b030). Thereafter, The Inverter decelerates according to Frequency Pull-in Restart Parameter (b029) while keeping the output current at the value set in Frequency Pull-in Restart Level (b028).
When the frequency matches the voltage, the Inverter accelerates again to reach to the original frequency level.
If an overcurrent trip occurs under this method, reduce the b028 setting.

Power Recovery Restart Prevention Function (USP)

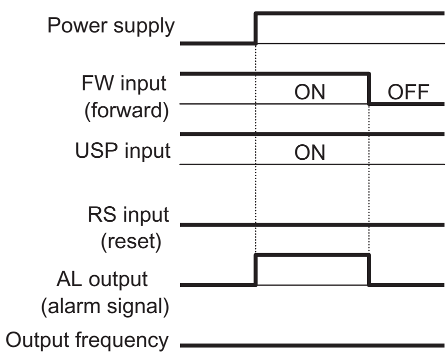
This function trips the Inverter if the power is supplied when a RUN command is input to the Inverter. In this case, E13 is displayed.

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 is kept on, the Inverter will restart operation immediately after the trip is reset. (Example 2)
If the RUN command is turned ON after the power is turned on, the Inverter operates normally. (Example 3)
Allocate "13: USP" to any Multi-function Input Selections (C001 to C007).

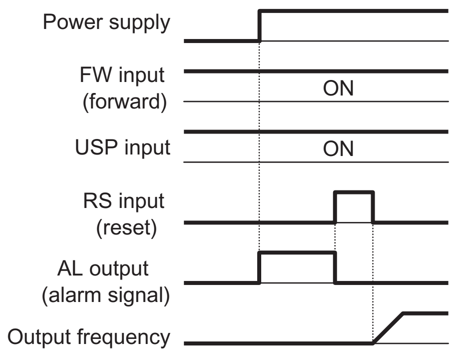
Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	13: USP (USP function)	–	–

The operations under the power recovery restart prevention function are explained below.

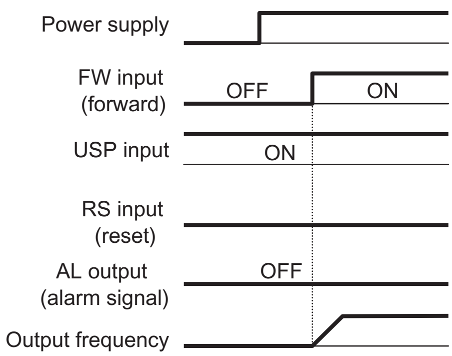
Example 1) Turn ON the power when a RUN command is input (Reset when the RUN command is turned OFF)



Example 2) Turn ON the power when a RUN command is input (Reset by Reset (RS))



Example 3) Turn ON the power and then turn ON the RUN command (normal operation)



Deceleration Stop at Power-off (Controlled Deceleration on Power Loss Function)

After the power is shut off during operation, this function decelerates the Inverter to a stop while keeping the voltage below the overvoltage level.
You can select from 3 modes in momentary power interruption non-stop selection b050.
This function will not be reset until the operation stops completely. To run the Inverter after power recovery while this function is active, input a STOP command (after turning OFF the RUN command) and then input a RUN command again.

Parameter No.	Function name	Data	Default setting	Unit
b050	Controlled Deceleration on Power Loss	00: Controlled deceleration on power loss function disabled 01: Controlled deceleration on power loss enabled (deceleration stop) 02: Controlled deceleration on power loss enabled (DC voltage kept constant, without recovery) *1 03: Controlled deceleration on power loss enabled (DC voltage kept constant, with recovery)*1	00	–
b051	DC Bus Voltage Trigger Level of Ctrl. Decel*2	0.0 to to 1000. Operation starts when the DC voltage drops to below b051.	220.0/440.0	V
b052	Deceleration Hold Level of Ctrl. Decel*2, *3	0.0 to 1000. The Inverter starts to decelerate when the overvoltage due to regeneration exceeds b052 after the start of operation.	360.0/720.0	V
b053	Deceleration Time of Ctrl. Decel*4	0.01 to 3600.00 Set the deceleration time under the controlled deceleration on power loss function.	1.0	s
b054	Freq. Drop to start Ctrl. Decel*2	0.00 to 10.00 (100.00) Set the frequency at which the Inverter starts to decelerate, as the difference from the output frequency.	0.00	Hz

*1. When b050 = 02 or 03, PI control is performed to keep the internal DC voltage constant. Though quicker response is expected when the setting of Proportional Gain (b133) is increased, if the setting is too large a trip will occur easily. With a smaller proportional gain setting on the other hand, an undervoltage trip will occur due to a drop in voltage immediately after this function starts operating. Response also becomes quicker when the setting of Integral Time (b134) is decreased, but if the setting is too small a trip will occur easily, as well.

*2. Make sure that the set values of b051 and b052 are larger than the undervoltage level (210 V for 200 V class, 410V for 400V class). If undervoltage occurs, this function is disabled. Make sure that b051 is smaller than b052. If the difference between the settings of (b051) and (b052) is large, and setting too large a value for proportional Gain (b133) may cause sudden acceleration immediately after this function starts operating and overcurrent may flow.

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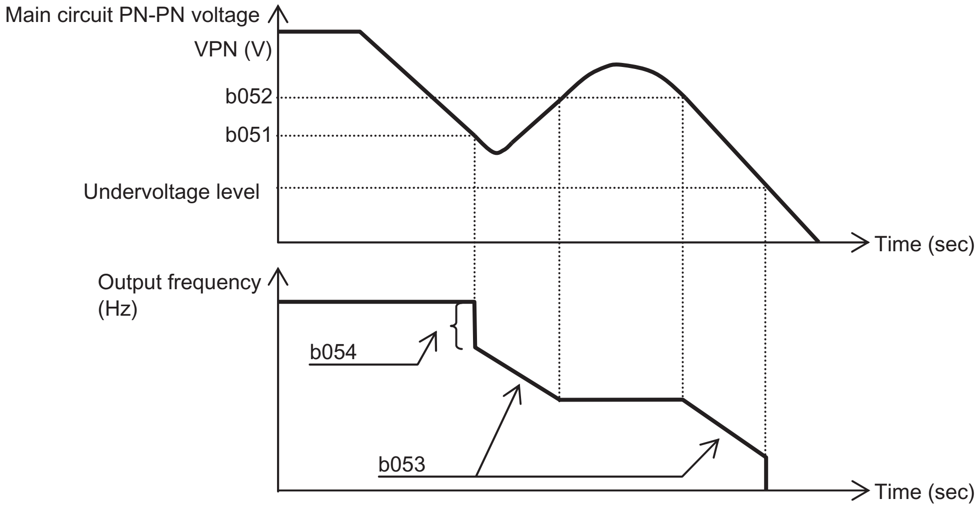
*3.When the Deceleration Hold Level of Ctrl. Decel (b052) < the DC Bus Voltage Trigger Level of Ctrl. Decel (b051), the Inverter performs this function by increasing the Deceleration Hold Level of Ctrl. Decel (b052) to the DC Bus Voltage Trigger Level of Ctrl. Decel (b051). (Take note that the set values are not changed.) If b052 is smaller than the equivalent incoming voltage (equivalent DC voltage after rectification [incoming voltage $\times\sqrt{2}$]), this function does not operate and the Inverter cannot decelerate when the power supply is cut off during the operation. (The Inverter will accept neither a STOP command nor frequency reference change until the operation is completed.)Make sure that the b052 setting is higher than the normal incoming voltage or equivalent.

*4.If the Freq. Drop to Start Ctrl. Decel (b054) is too large, an overcurrent trip occurs because of rapid deceleration. If b054 is too small, or if the Deceleration Time of Ctrl. Decel (b053) is too long, an undervoltage trip occurs because of insufficient regeneration power.

Controlled Deceleration on Power Loss (b050 = 01)

After the power is shut off during operation, the Inverter decelerates to a stop while keeping the voltage below the setting of Deceleration Hold Level of Ctrl. Decel (b052).
If the power is shut off during operation and the voltage falls below the DC Bus Voltage Trigger Level of Ctrl. Decel (b051), the frequency deceleration width decreases to the Freq. Drop to Start Ctrl. Decel (b054), and then the Inverter decelerates for the Deceleration time of Ctrl. Decel (b053).
If an overvoltage condition occurs (the level of Deceleration Hold Level of Ctrl. Decel (b052) is exceeded) due to regeneration while the Inverter is decelerating, this function does not operate and the Inverter will not decelerate until the overvoltage condition is reset.



Controlled Deceleration on Power Loss DC Voltage Constant Control (b050 = 02: Without Recovery, b050 = 03: With Recovery)

If a momentary power interruption or main circuit DC voltage drop occurs during operation, the Inverter decelerates while keeping the main circuit DC voltage at the value set in Deceleration Hold Level of Ctrl. Decel (b052).
This function will be started when the following conditions are all satisfied:

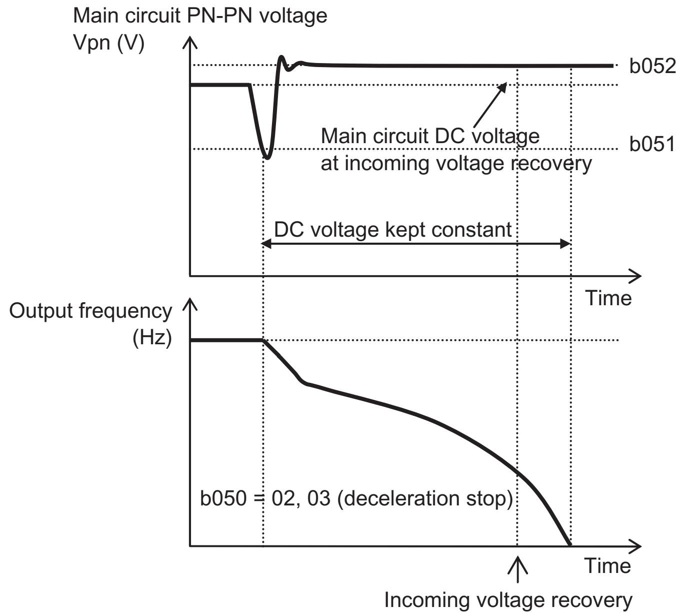
- b050 = 02 or 03
- The Inverter is operating. (This function is disabled during trip/undervoltage/stop.)
- The control power supply is momentarily interrupted, or the main circuit DC voltage falls below the setting of DC Bus Voltage Trigger Level of Ctrl. Decel b051.

If the time of momentary power interruption is short, the Inverter can continue to run without shutting off the output. However, if undervoltage occurs because of momentary power interruption, the Inverter immediately shuts off the output, and stops operating this function. The subsequent power recovery depends on the Retry Selection b001.
With b050 = 03, the Inverter can be restored to normal operation, if a momentary power interruption occurs and incoming voltage recovers before the output is shut off. Note that the Inverter may decelerate to a stop, depending on the b051 setting. Below are the details.

b050	b051	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 operation of this function results in deceleration stop, the Inverter is forced to stop, even if the FW (forward) command is ON. To restart the Inverter, make sure that the incoming voltage has recovered, and input the FW (forward) command again.

Example 1)



The main circuit DC voltage level, while this function is activated, may fall below the b052 set value depending on the proportional gain and integral time settings.

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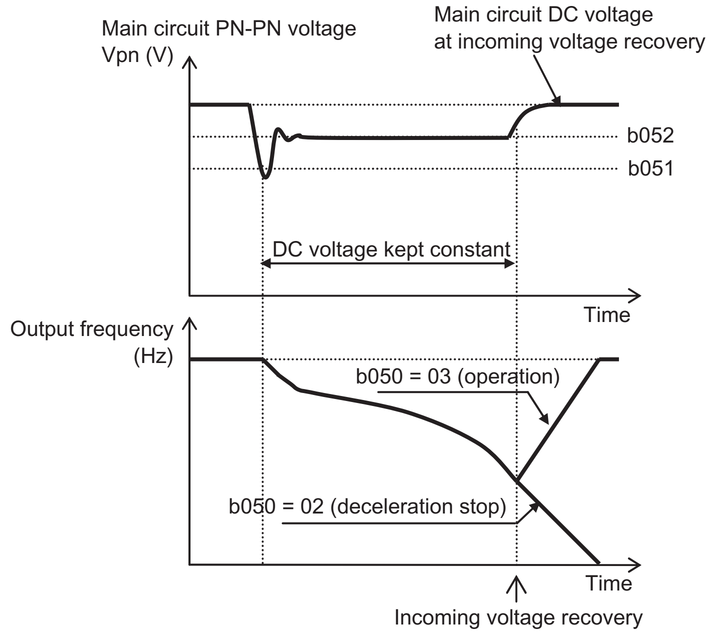
Example 2)


Main circuit PN-PN voltage
Vpn (V)
Main circuit DC voltage
at incoming voltage recovery
b052
b051
DC voltage kept constant
Time
Output frequency
(Hz)
b050 = 03 (operation)
b050 = 02 (deceleration stop)
Time
Incoming voltage recovery

5-9 Functions Relating to Protections, Warnings and Various Output Signals

The following explains the protective functions such as warning signals.

Electronic Thermal Function

This function calculates the rise in motor temperature in the Inverter based on the output current, output frequency, motor characteristics and other data, to protect the motor against overheating.

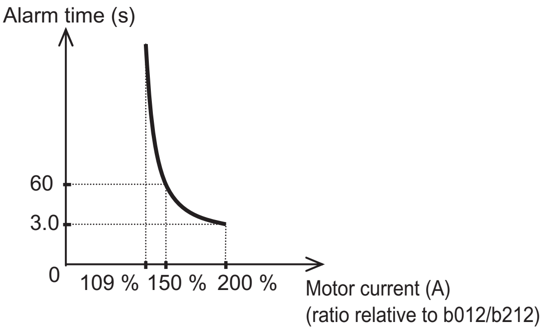
Provides the most appropriate protection characteristics, taking into account the decline of the motor cooling capability at a low speed.

Outputs an alarm before the electronic thermal trips.
The time limit characteristics of the electronic thermal vary depending on the setting of Heavy Load/Light Load Selection (b049).

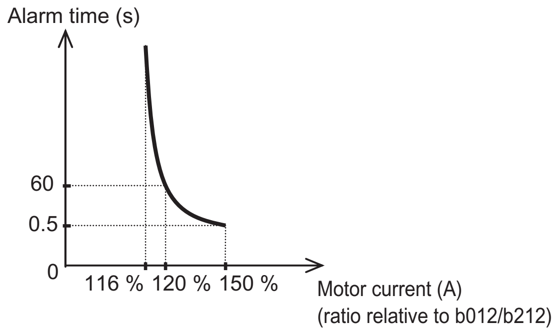
Electronic Thermal Level

Parameter No.	Function name	Data range	Default setting	Unit
b012/b212	Electronic Thermal Level 1/2	0.20 × Rated current to 1.00 × Rated current	Inverter rated current	A

Example 1) Heavy load setting



Example 2) Light load setting



Electronic Thermal Characteristics

Although only one type of electronic thermal characteristic curve is available each for heavy load and light load, the frequency characteristics can be switched by Electronic Thermal Characteristics Selection (b013/b213).
A standard motor requires reduced load (current) because the lower the motor rotation speed is, the lower the cooling capacity of its self-cooling fan gets. When the frequency drops, the reduction multiple also decreases and the thermal level (current) drops, as well.
The reduced torque characteristics depend on the heat radiation of a standard motor.

Parameter No.	Function name	Data	Default setting	Unit
b013/b213	Electronic Thermal Characteristics Selection 1/2	00: Reduced torque characteristics	01	–
		01: Constant torque characteristics		
		02: Free setting		

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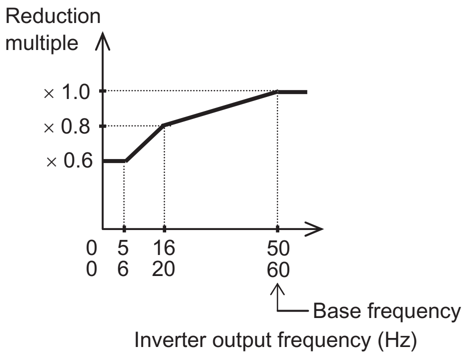
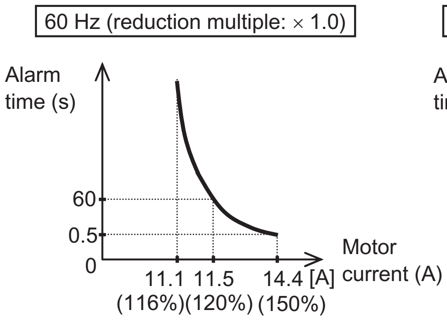
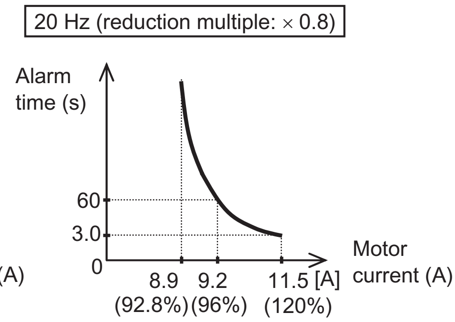
Reduced Torque Characteristics

Multiplied by the time limit characteristics set in b012/212 for each frequency.



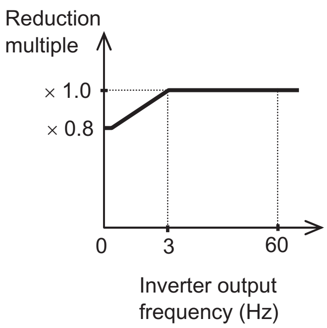
Example) 3G3MX2-**, base frequency 60 Hz, light load setting (rating 9.6 A = b012)



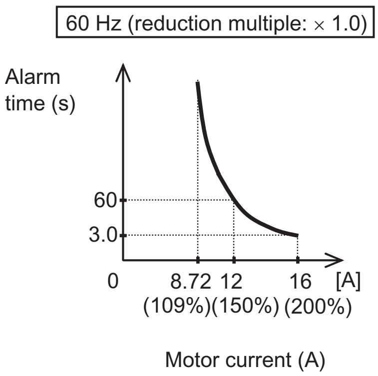


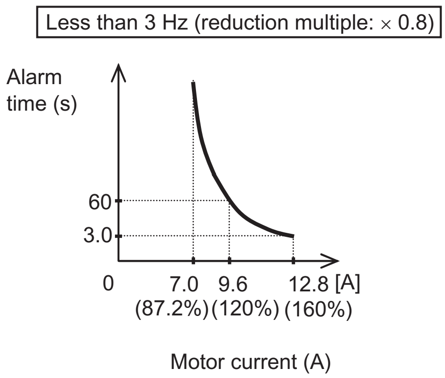
Constant Torque Characteristics

Do not skip this setting when using a constant torque motor.



Example) 3G3MX2-**, base frequency 60 Hz, heavy load setting (rating 8.0 A = b012)





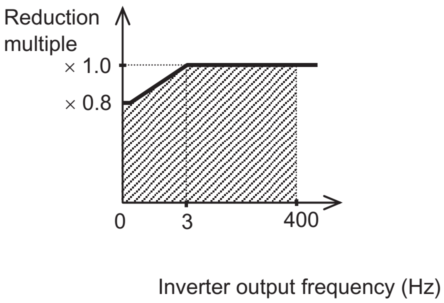
Free Setting

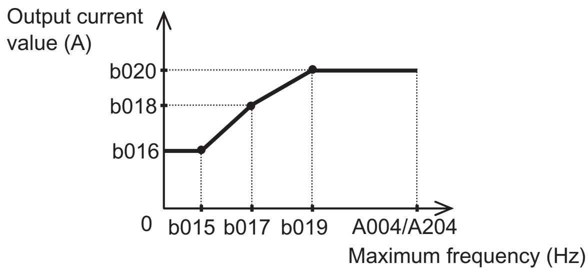
Desired electronic thermal characteristics (reduction multiple characteristics) can be set according to the load for the purpose of protecting the motor.
The setting range is shown below.

Parameter No.	Function name	Data	Default setting	Unit
b015	Free-electronic Thermal Frequency 1	0 to Free-electronic Thermal Frequency 2	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. (1000.)		
b016/b018/ b020	Free-electronic Thermal Current 1/2/3	0.0 to Rated current Set current values for each break point.	0.00	A

Reference

- If the rated current value is set to (b016), (b018) and (b020), the reduction multiple becomes × 1.0.





Example) 3-phase 200 V, 1.5 kW (CT rating 8 A)
- b012 = 8 (A), b015 = 30 (Hz), b016 = 8 (A)
  Since the reduction multiple is 8/8 = 1.0, the trip characteristic at 30 Hz is 60 s at 12 A.

5

Functions

Thermal Warning

This function outputs an alarm signal before electronic thermal overload protection is activated. The warning level can be set in C061.
Allocate "13: THM" to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026).

Parameter No.	Function name	Data	Default setting	Unit
C061	Electronic Thermal Warning Level	0. The Inverter does not operate.	90.	%
		1. to 100.*1 Set a thermal warning signal output level.		
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	13: THM (Thermal warning)	–	–

*1.Set a percentage relative to the electronic thermal multiplication value. When the value reaches 100%, Overload Trip (E05) occurs.

Overload Limit/Overload Warning

Overload Limit

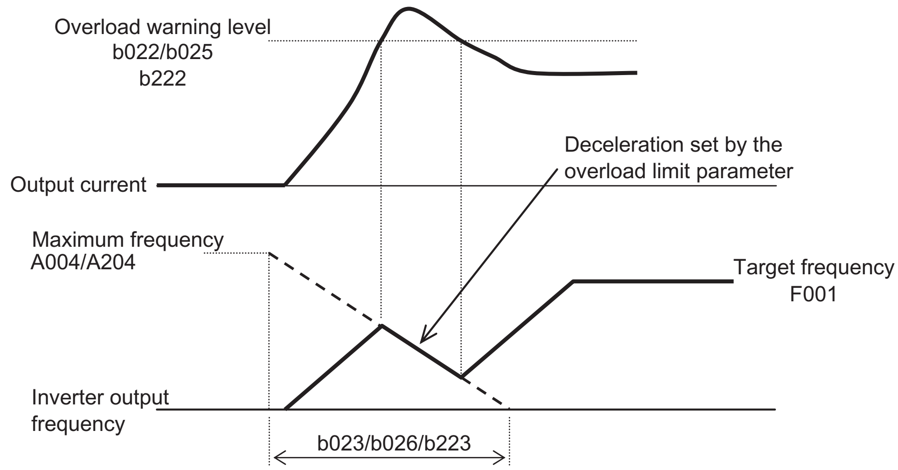
The Inverter monitors the motor current during acceleration or constant speed operation and lowers output frequency automatically when the motor current reaches to the overload limit level.
This function prevents an overcurrent trip caused by excessive moment of inertia during acceleration, or caused by sporadic load fluctuations during constant speed operation.
You can set 2 types of overload limit functions in b021/b022/b023 and b024/b025/b026.
To switch between b021/b022/b023 and b024/b025/b026, allocate "39: OLR" to a multi-function input terminal and then turn it ON/OFF.

The overload limit level sets a current value for this function to work.
The overload limit parameter sets a time of deceleration from the maximum frequency to 0 Hz.

When this function operates while the Inverter is accelerating, the acceleration time becomes longer than the set time.
When the selected control method is sensorless vector control and "03: Enabled during acceleration/constant speed (accelerated during regeneration)" is selected for b021/b024, the frequency will increase if current exceeding the overload limit level flows during regeneration operation.
If the setting of Overload Limit Parameter b023/b026 is too small, an overvoltage trip may occur because of regenerative energy from the motor even during acceleration. This is due to automatic deceleration under this function.
Make the following adjustments if this function operates during acceleration and the frequency doesn't reach the target level.

- Increase the acceleration time (refer to "Acceleration/Deceleration Time" on page 5-24).
- Increase the overload limit level (b022/b025).

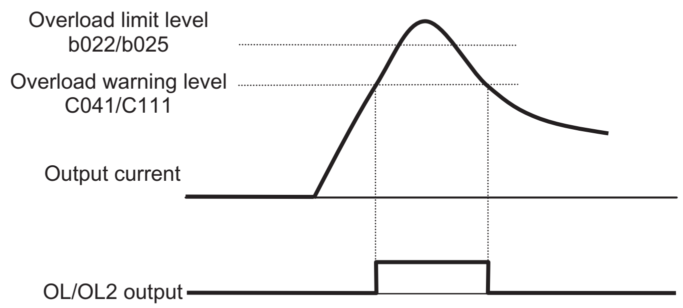
Parameter No.	Function name	Data	Default setting	Unit
b021/b024 b221	Overload Limit 1 Selection/ Overload Limit 1 Selection 2 Overload Limit 2 Selection	00: Disabled 01: Enabled in acceleration/constant speed operation 02: Enabled in constant speed operation 03: Enabled during acceleration/constant speed (accelerated during regeneration)	01	–
b022/b025 b222	Overload Limit 1 Level/ Overload Limit 1 Level 2 Overload Limit 2 Level	Current value at which the overload limit actuates Heavy load (b049 = 00): 0.20 × Rated current to 2.0 × Rated current Light load (b049 = 01): 0.20 × Rated current to 1.5 × Rated current	Heavy load: Rated current × 1.50 Light load: Rated current × 1.20	A
b023/b026 b223	Overload Limit 1 Parameter/ Overload Limit 1 Parameter 2 Overload 2 Limit Parameter	0.1 to 3000. Deceleration time at which the overload limit actuates	1.0	s
C001 to C007	Multi-function Input Selection	39: OLR (Overload limit switching)	–	–



Overload Warning

If the applied load is large, the Inverter can output an overload warning signal before an overload trip occurs.
This helps prevent mechanical damage due to an overload in the carrier machine, or an operation line stop due to overload protection of the Inverter.
Allocate "03: OL (Overload warning)" or "26: OL2 (Overload warning 2)" to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026). (Two types of overload warning signals can be output.)

Parameter No.	Function name	Data	Default setting	Unit
C040	Overload Warning Signal Output Mode Selection	00: Enabled in acceleration/deceleration and constant speed operation	01	–
		01: Enabled in constant speed operation		
C041/C241	Overload Warning Level 1/2	0.0 The Inverter does not operate.	Rated current × 1.15	A
		0.0 to 2.0 × Rated current Outputs an OL signal when the overload warning level is reached.		
C111	Overload 1 Warning Level 2	0.0 The Inverter does not operate.	Rated current × 1.15	A
		0.0 to 2.0 × Rated current Outputs an OL2 signal when the overload warning level is reached.		
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	03: OL (Overload warning)	–	–
		26: OL2 (Overload warning 2)		

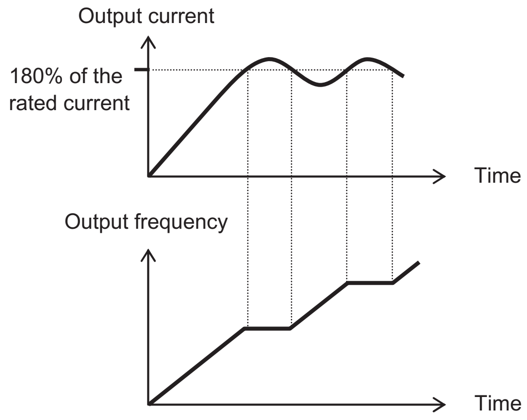


Overcurrent Suppression Function

This function suppresses the overcurrent caused by a steep current rise increase in an impact load, etc.
Acceleration is stopped temporarily when the output current reaches approx. 180% of the rated current.

Parameter No.	Function name	Data	Default setting	Unit
b027	Overcurrent Suppression Selection	00: Disabled 01: Enabled	00	–

- If the Inverter is used with an elevating machine, etc. disable this function. The system may "slip and fall" due to loss of torque.
- If the acceleration time is too short, an overcurrent trip may occur because the current increases quickly.



Overvoltage Suppression Function During Deceleration

This function helps avoid an overvoltage trip due to regenerative energy from the motor during deceleration.

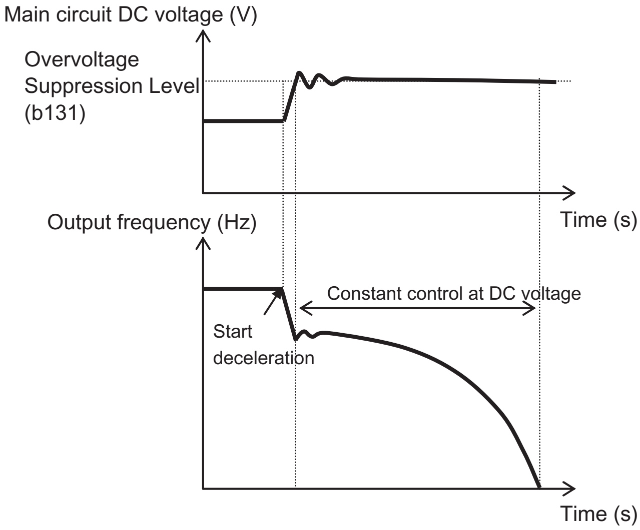
Whether to enable or disable this function can be selected by Overvoltage Suppression Function Selection During Deceleration (b130). If "01: Enabled (DC voltage kept constant)" is selected, the Inverter decelerates automatically in order to keep the voltage rise in the main circuit DC unit at the start of deceleration, to the value of Overvoltage Suppression Level During Deceleration (b131).
If "02: Enabled (Acceleration enabled)" is selected, the Inverter will accelerate according to the setting of Overvoltage Suppression Parameter (b132) when the voltage of the main circuit DC unit rises at the start of deceleration and exceeds the value of Overvoltage Suppression Level During Deceleration (b131). After that, when the main circuit DC voltage falls below the b131 level, the Inverter starts deceleration again.

Parameter No.	Function name	Data	Default setting	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)	00	–
b131	Overvoltage Suppression Level During Deceleration*2	330. to 395. (200 V class)	380.	V
		660. to 790. (400 V class)	760.	V
b132	Overvoltage Suppression Parameter	0.10 to 30.00 Set the acceleration rate applied when this function is enabled.	1.00	s
b133	Overvoltage Suppression Proportional Gain Setting	0.00 to 5.00 Proportional gain for DC voltage constant control (b130 = 01 only)	0.20	–
b134	Overvoltage Suppression Integral Time Setting	0.0 to 150.0 Proportional gain for DC voltage constant control (b130 = 01 only)	1.0	S

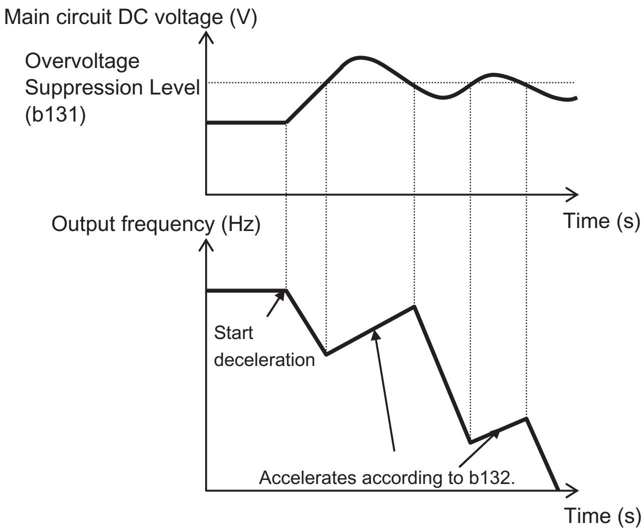
*1.When b130 = 01, PI control works to keep the internal DC voltage constant.
Though quicker response is expected when the setting of Proportional Gain (b133) is increased, control tends to be divergent and this may easily lead to a trip. Response also becomes quicker when the setting of Integral Time (b134) is decreased, but if the setting is too small the same situation may occur.

*2.If the value set in b131 is lower than the incoming voltage or equivalent, the motor may not be stopped.

Example 1) DC voltage kept constant (b130 = 01)



Example 2) Acceleration enabled (b130 = 02)



- With this function enabled, the actual deceleration time may be longer than the set value. Particularly with b130 = 02, if b131 is set too low, the Inverter may not decelerate.
- Even if this function is enabled, an overvoltage trip may occur depending on the deceleration rate and load condition.
- When using this function, the Inverter may reduce frequency depending on the moment of inertia of motor load, and takes a long time to stop.
- If the value set in b131 is lower than the incoming voltage or equivalent, the motor may not be stopped.
- When (b130 = 01), PI control works to keep the internal DC voltage constant. Though quicker response is expected when the setting of Proportional Gain (b133) is increased, if the setting is too large a trip will occur easily. Response also becomes quicker when the setting of Integral Time (b134) is decreased, but if the setting is too small, a trip will occur easily, as well.

5

Functions

Alarm Signal (AL)

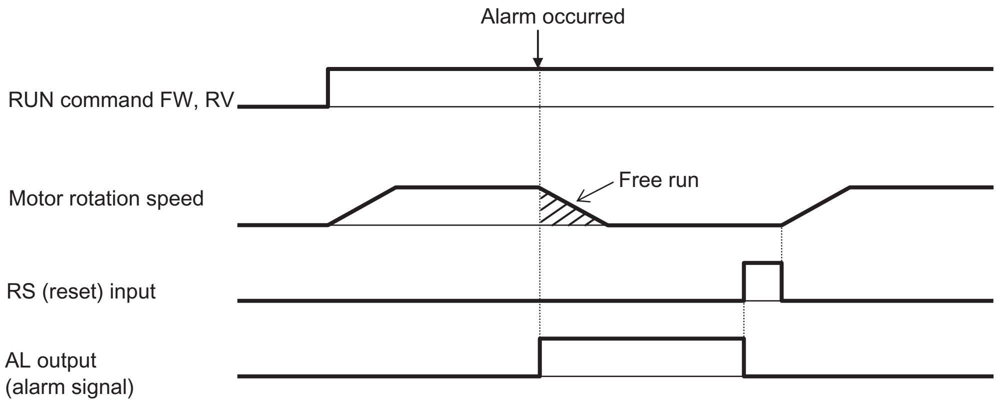
Upon detecting an overcurrent, overvoltage or other error, the Inverter stops the output and outputs an alarm signal (AL). This is called a "trip."

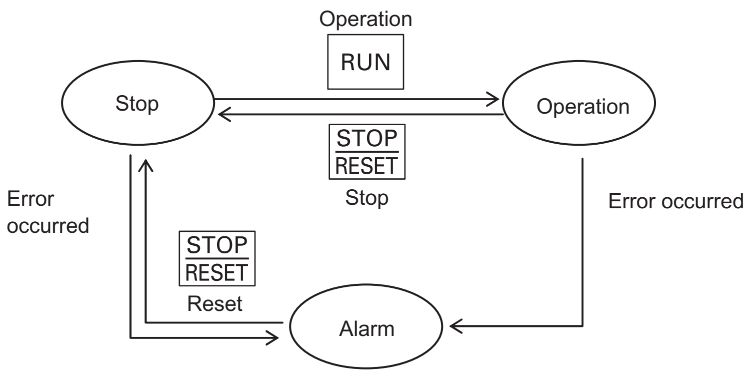
When the Inverter is reset, the trip status is reset and the alarm signal also turns OFF. A trip can be reset by pressing the STOP/RESET key or turning the reset terminal ON and then OFF. (Some trips may not be reset using the reset terminal depending on their cause. In this case, the power must be reconnected.)

Allocate "05: AL (Alarm output)" to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026). (This function is allocated to the relay in default setting.)

The relay is based on SPDT contact. For details, refer to "Multi-function Output Terminal Contact Selection" on page 5-34.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	05: AL (Alarm output)	–	–
C026	Multi-function Relay Output Function Selection			





5

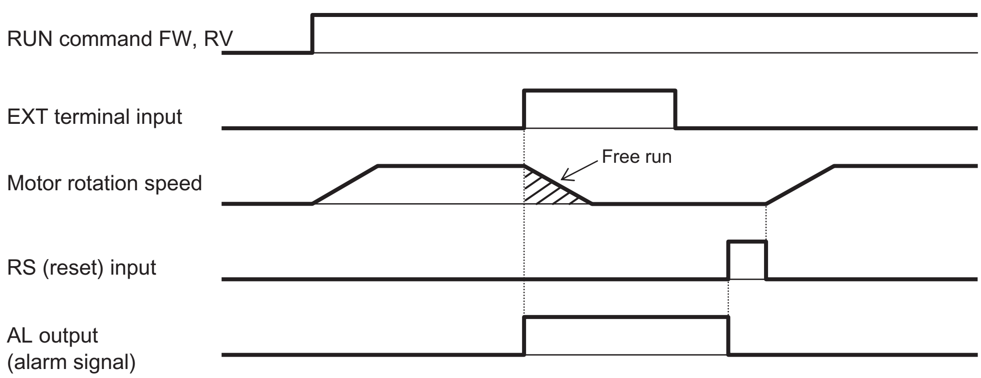
Functions

External Trip (EXT)

Use this function to trip the Inverter via an error signal generated from a peripheral system. In this case, allocate "12: EXT" to any Multi-function Input Selections (C001 to C007).
When the EXT terminal is turned ON, E12 is displayed and the Inverter trips to shut off the output.
When the Inverter has tripped, indicating E12, the trip will not be reset even if the error signal from external equipment is reset (EXT terminal is turned OFF).
To reset the trip, perform the reset operation or turn the power off and on again.

Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	12: EXT (External trip)	–	–

- Do not turn on the EXT terminal after shutting off the power. The fault monitor data may not be stored correctly.



Thermistor Trip Function

This function enables thermal protection of the external equipment (e.g. motor) if its internal thermistor is connected to the Inverter.
Connect a PTC thermistor. The Inverter will be tripped (E35) when the resistance of the PTC thermistor exceeds approximately 3 kΩ.
To trip the Inverter at less than 3 kΩ, increase the value of C085. To trip the Inverter at greater than 3 kΩ, decrease the value of C085.
Wire the external thermistor between control terminals S5/TH and SC and allocate TH to Multi-function Input Terminal S5 (C005 = 19: TH).
Set the following functions according to the specifications of your thermistor.
When this function is used, keep the cable length between the motor and Inverter within 20 m. Since the current flowing through the thermistor is weak, consider separating the wires, etc. to prevent noise due to motor current.

Parameter No.	Function name	Data	Default setting	Unit
C085	Thermistor Adjustment	0.0 to 200.0. The gain of input voltage is fine-tuned.	100.0	%
C005	Multi-function Input Selection	19: TH (PTC thermistor thermal protection)	02(CF1)	–

Note: If "Thermistor" is allocated to C005 but no thermistor is connected, a trip occurs.

5

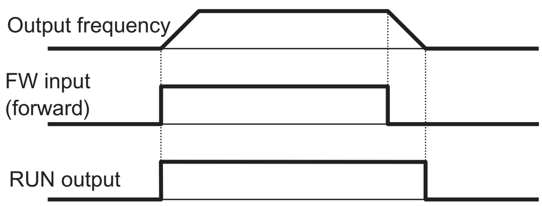
Functions

Signal During RUN (RUN)

A signal is output by a multi-function output terminal or multi-function relay output terminal while the Inverter is operating.

This signal turns ON only with Inverter output, and it is not output even when a RUN command is issued by setting the frequency to 0 Hz. (The RUN lamp is lit when a RUN command is input.)
Allocate "00: RUN (During RUN)" to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026).
Also outputs a signal during DC injection braking.
Below is the time chart. The RUN signal will remain ON until the motor stops, even when the RUN command is turned OFF.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	00: RUN (During RUN)	–	–
C026	Multi-function Relay Output Function Selection			



Frequency Arrival Signal (FA1 to FA5)

When the output frequency reaches the set level, a frequency arrival signal is output.

Allocate "01: FA1 (constant speed reached)," "02: FA2 (set frequency min. reached)," "06: FA3 (set frequency only)," "24: FA4 (set frequency min. reached 2)," or "25: FA5 (set frequency only 2)" to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026).

Below is the hysteresis of the frequency arrival signal:

ON : (Set frequency) – (1% of the maximum frequency) [Hz]
OFF : (Set frequency) – (2% of the maximum frequency) [Hz]

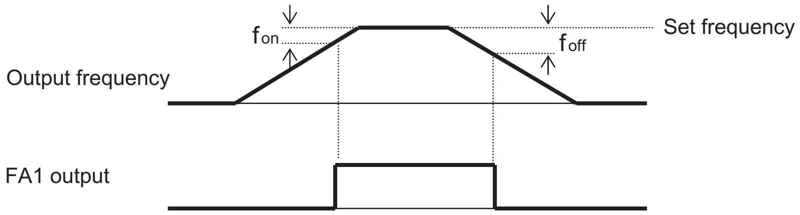
If "06: FA3" or "25: FA5" is set, however, operation during acceleration is:
ON : (Set frequency) – (1% of the maximum frequency) [Hz]
OFF : (Set frequency) – (2% of the maximum frequency) [Hz]

During deceleration
ON : (Set frequency) + (1% of the maximum frequency) [Hz]
OFF : (Set frequency) – (2% of the maximum frequency) [Hz]

Parameter No.	Function name	Data	Default setting	Unit
C042/C045	Arrival Frequency During Acceleration/ Arrival Frequency During Acceleration 2	0.0 Does not output arrival signal during acceleration.	0.00	Hz
		0.01 to 400.0 (1000.) Outputs arrival signal during acceleration.		
C043/C046	Arrival Frequency During Deceleration/ Arrival Frequency During Deceleration 2	0.0 Does not output arrival signal during deceleration.	0.00	Hz
		0.01 to 400.0 (1000.) Outputs arrival signal during deceleration.		
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	01: FA1 (Constant speed reached)	–	–
		02: FA2 (Set frequency min. reached)		
		06: FA3 Set frequency only)		
		24: FA4 (Set frequency min. reached 2)		
		25: FA5 (Set frequency only 2)		

Constant speed reached (01: FA1)

This signal is output when the frequency reaches the level set by Frequency Setting (F001, A020, A220) or any of Multi-step Speed References 1 to 15 (A021 to A035).

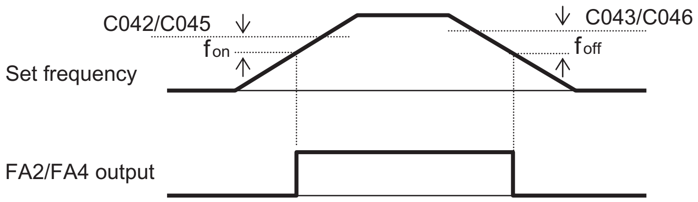


fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

Example) Maximum frequency fmax = 120 (Hz)
Set frequency fset = 60 (Hz)
fon = 120 × 0.01 = 1.2 (Hz)
foff = 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 min. reached (02: FA2, 24: FA4)

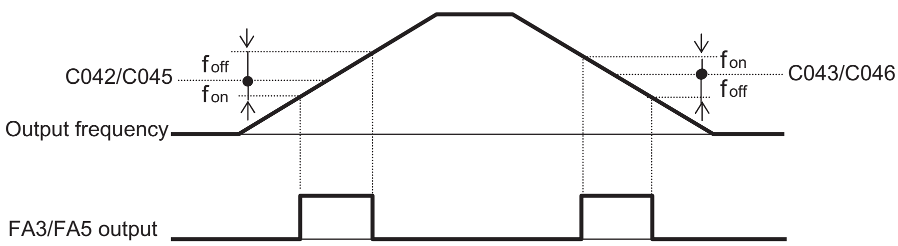
This signal is output when the frequency exceeds the level set by Arrival Frequency During Acceleration (C042/C045) or Arrival Frequency During Deceleration (C043/C046).



fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

Set frequency only (06: FA3, 25: FA5)

This signal is output only when the frequency corresponds to the level set by Arrival Frequency During Acceleration (C042/C045) or Arrival Frequency During Deceleration (C043/C046).



fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

RUN Time/Power ON Time Over (RNT/ONT)

The RUN time/power ON time over (RNT/ONT) signal is output when the total sum of the Inverter power ON time and RUN time exceeds the time set in Power ON Time Level (b034).

Parameter No.	Function name	Data	Default setting	Unit
b034	RUN Time/Power ON Time Level	0. Function disabled	0.	–
		1. to 9999. Set in increments of 10 hours (10 to 99,990 hours).		
		1000 to 6553 Set in increments of 100 hours (100,000 to 655,350 hours).		
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	11: RNT (RUN time over)	–	–
		12: ONT (Power ON time over)		
Related functions		d016, d017		

RUN Time Over (RNT)

Allocate "11: RNT (RUN time over)" to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026).
Set Power ON Time Level (b034).

Power ON Time Over (ONT)

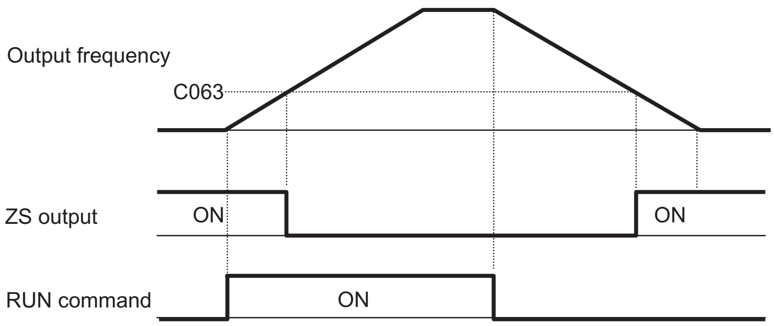
Allocate "12: ONT (Power ON time over)" to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026).
Set Power ON Time Level (b034).

0 Hz (ZS)

This function outputs a detection signal when the Inverter output frequency drops to below the level set by 0 Hz Detection Level (C063).

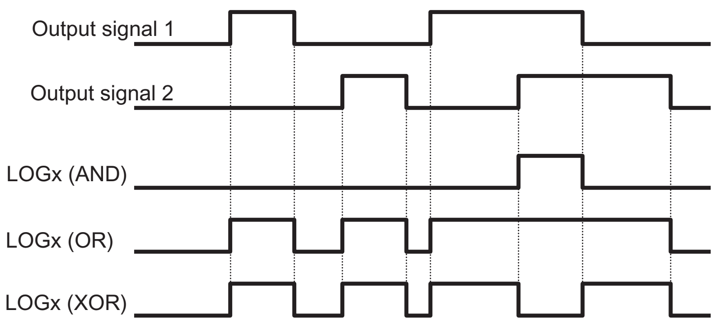
This function is enabled when "21: ZS (0 Hz)" is allocated to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection (C026).
Although this function normally operates according to the Inverter output frequency, during simple position control it operates according to the motor frequency.

Parameter No.	Function name	Data	Default setting	Unit
C063	0 Hz Detection Level	0.00 to 100.0 Set a frequency to be detected as 0 Hz.	0.00	Hz
C021 to C022	Multi-function Output Terminal Selection	21: ZS (0 Hz)	–	–
C026	Multi-function Relay Output Function Selection			



Output Signal Logic Operation (LOG1 to LOG3)

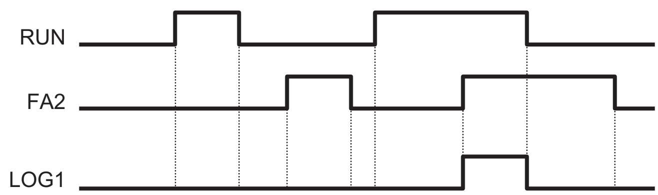
This function performs output signal logic operations inside the Inverter. "No" (not assigned), 62, 63, and logic operation results (LOG1 to LOG3) cannot be selected.
Three types of operators, AND, OR and XOR, can be selected.



The setting parameters vary depending on the logic output signal selected.
Refer to the following table to set the necessary parameters.

Selected signal	Operand 1 selection	Operand 2 selection	Operator selection
33: Logic operation output 1 (LOG1)	C142	C143	C144
34: Logic operation output 2 (LOG2)	C145	C146	C147
35: Logic operation output 3 (LOG3)	C148	C149	C150

Example) To output a logic output 1 (LOG1) signal through AND operation of RUN signal (00: RUN) and Set frequency min. reached (02: FA2) to multi-function output terminal P2
Multi-function Output Terminal 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)



Parameter No.	Function name	Data	Default setting	Unit
C142 C145 C148	Logic Output Signal Selection 1*1	00 to 63 (Except 33 to 35, 62, 63, and "no".)	00	–
C143 C146 C149	Logic Output Signal Selection 2*2		00	–
C144 C147 C150	Logic Output Signal Operator Selection	00: AND	00	–
		01: OR		
		02: XOR		
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	33: LOG1: Logic operation output 1	–	–
		34: LOG2: Logic operation output 2		
		35: LOG3: Logic operation output 3		

*1.Select operand 1.
*2.Select operand 2.

Capacitor Life Warning (WAC)

This function estimates service life of the capacitor on the PCB, based on the Inverter's internal temperature and ON time.
Life assessment monitor d022 shows the status of this signal.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	39: WAC (Capacitor life warning)	–	–
C026	Multi-function Relay Output Function Selection			

Cooling Fan Operation

You can set whether to operate the Inverter's cooling fan constantly or only during Inverter operation.

Parameter No.	Function name	Data	Default setting	Unit
b092	Cooling Fan Operation	00: Always	01	–
		01: Only during operation (However, the cooling fan operates for 5 minutes after power-on, and for 5 minutes after the Inverter stops.)		
		02: Depends on the fin temperature		
b093	Cooling Fan Total Operation Time Clear	00: Total operation time count	00	–
		01: Clear total operation time (After this function is executed, 01 is reset to 00.)		

Note 1: If a momentary power interruption occurs or the power is cut off while the cooling fan is operating, the cooling fan stops temporarily and will resume operation automatically once the power recovers.

Note 2: Do not clear the total operation time except when the cooling fan is replaced, because doing so will disable the correct Life Assessment Monitor of the cooling fan (d022).

Cooling Fan Life Signal (WAF)

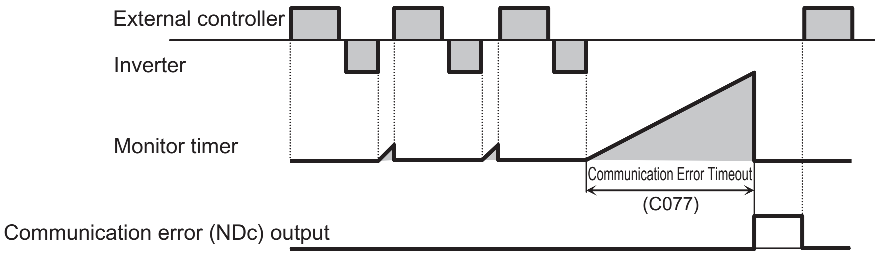
Set the ambient temperature in the environment where the Inverter is used, in b075. Estimate the life of the cooling from the total operation time and set ambient temperature and have a signal output when the replacement timing arrives.

It is recommended that the cooling fan be checked for clogging, etc. or replaced when this signal is output.
Life Assessment Monitor (d022) shows the status of this signal.

Parameter No.	Function name	Data	Default setting	Unit
b075	Ambient Temperature	–10. to 50. Set the ambient temperature in the use environment.	40.	°C
C021 to C022	Multi-function Output Terminal Selection	40: WAF (Cooling fan life warning signal)	–	–
C026	Multi-function Relay Output Function Selection			
Related functions		b092, d022		

Communication Disconnection Detection Signal (NDc)

Enabled only when Modbus communication (Modbus-RTU) is selected for RS485 communication.
If a reception timeout error occurs, this signal is output until reception of the next data.
Set a time before reception timeout in Communication Error Timeout Time(C077).
For details, refer to Chapter 6, "Communication Function".

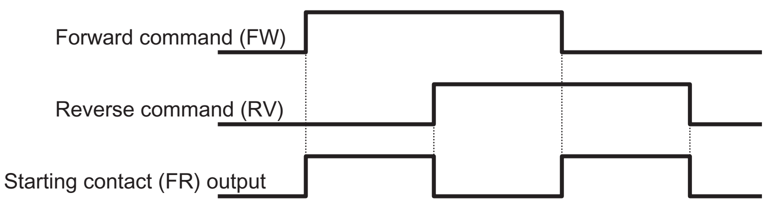


Parameter No.	Function name	Data	Default setting	Unit
C077	Communications Error Timeout Time	0.00 to 99.99 Set a time before reception timeout.	0.00	s
C021 to C022	Multi-function Output Terminal Selection	32: NDc (Communication disconnection detection)	–	–
C026	Multi-function Relay Output Function Selection			

Starting Contact Signal (FR)

While the Inverter is receiving the RUN command, a starting contact signal is output.
This signal is output regardless of the setting of RUN Command Selection (A002).
If inputs FW and RV are simultaneously turned on, the Inverter stops.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	41: FR (Starting contact signal)	–	–
C026	Multi-function Relay Output Function Selection			



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Functions

Fin Overheat Warning (OHF)

This function monitors the Inverter's internal cooling fin temperature and outputs a signal when the temperature exceeds the Cooling Fin Overheat Warning Level (C064).

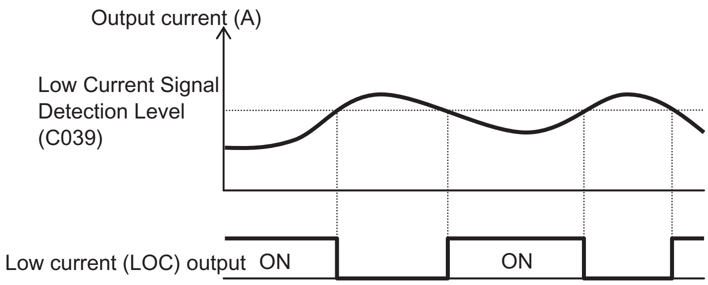
Parameter No.	Function name	Data	Default setting	Unit
C064	Cooling Fin Overheat Warning Level	0. to 110. Set a temperature to output the overheat warning signal.	100.	°C
C021 to C022	Multi-function Output Terminal Selection	42: OHF (Fin overheat warning)	–	–
C026	Multi-function Relay Output Function Selection			

Low Current Signal (LOC)

This signal is output when output current falls below the Low Current Detection Level (C039). Whether this signal is always output during operation or only in constant speed operation can be selected by Low Current Signal Output Mode Selection (C038).

Parameter No.	Function name	Data	Default setting	Unit
C038	Low Current Signal Output Mode Selection	00: Enabled during acceleration/ deceleration and constant speed.	01	–
		01: Enabled only during constant speed*		
C039	Low Current Detection Level	0.0 to 2.0 × Rated current Set a low current signal output level.	Rated current	A
C021 to C022	Multi-function Output Terminal Selection	43: LOC (Low current signal)	–	–
C026	Multi-function Relay Output Function Selection			

* When 01 (control circuit terminal block) is selected for Frequency Reference Selection 1 (A001), constant speed may not be recognized due to sampling. In this case, set C038 to 00 (enabled during acceleration/deceleration and constant speed) or increase the value set in Analog Input Filter (A016).



Operation Ready (IRDY)

This signal is output when the Inverter becomes ready for operation (ready to receive the RUN command).
Even if a RUN command is input while this signal is not output, the Inverter will not operate.
If this signal is not output, check if the input power supply voltage (R, S, T) is within the rated range.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	50: IRDY (Operation ready)	–	–
C026	Multi-function Relay Output Function Selection			

Signal During Forward Operation (FWR)

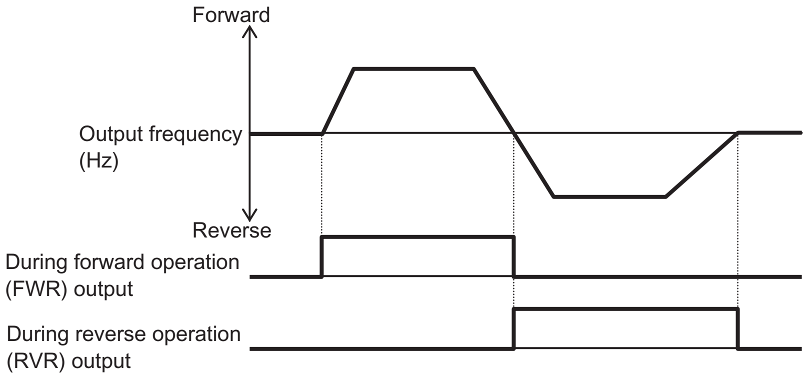
This signal is output while the Inverter is running forward.
While the Inverter is running in reverse, or when stopped, this signal is turned off.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	51: FWR (During forward operation)	–	–
C026	Multi-function Relay Output Function Selection			

Signal During Reverse Operation (RVR)

This signal is output while the Inverter is running in reverse.
While the Inverter is running forward, or when stopped, this signal is turned off.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	52: RVR (During reverse operation)	–	–
C026	Multi-function Relay Output Function Selection			



Fatal Fault Signal (MJA)

In addition to an Alarm output (05: AL), this signal is output separately if any of the following trips occurs.
This signal applies to a trip caused by the hardware.

No.	Error code	Description
1	E08: □	EEPROM error
2	E10: □	Current detector error
3	E11: □	CPU error
4	E14: □	Grounding protection
5	E22: □	CPU communication error
6	E25: □	Main circuit error

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	53: MJA (Fatal fault signal)	–	–
C026	Multi-function Relay Output Function Selection			

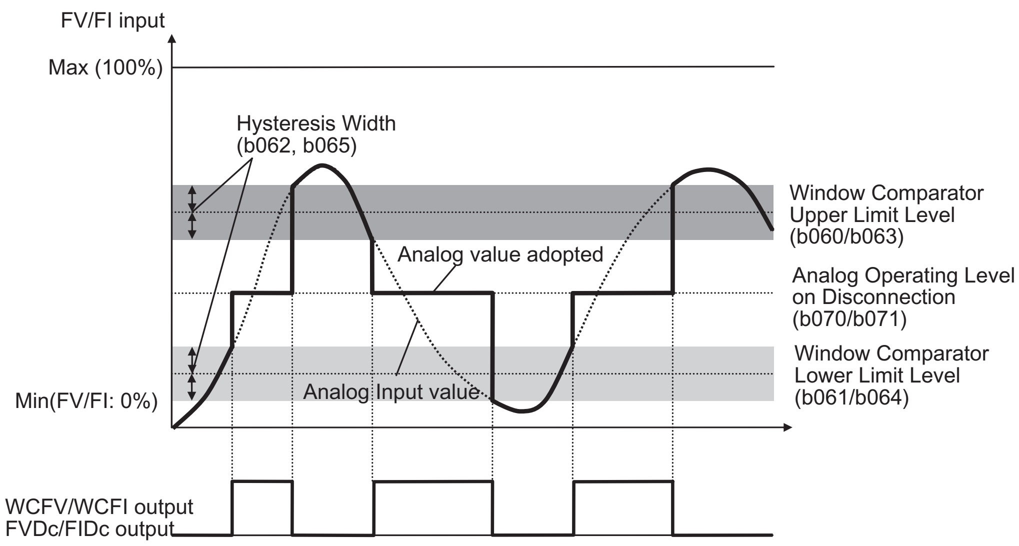
Window Comparator (WCFV/WCFI) (Disconnection Detection FVdc/FIdc)

The Inverter activates the window comparator output when the FV/FI analog input value is within the upper and lower limit levels of the window comparator. Analog inputs such as disconnection detection can be monitored on a desired level.

Hysteresis widths can be set for the window comparator upper and lower limit levels.
Levels and hysteresis widths can be set separately for individual FV/FI inputs.
The analog value to be adopted upon WCFV/WCFI output can be fixed to a desired value. Set values in FV/FI Disconnection Operation Levels (b070/b071). If "no" is set, the analog input value will be directly reflected.
FVdc/FIdc outputs are the same as WCFV/WCFI, respectively.

Parameter No.	Function name	Data range	Default setting	Unit
b060	Window Comparator FV Upper Limit Level	Lower limit level + Hysteresis width × 2 (0 min.) to 100. Set an upper limit level.	100.	%
b063	Window Comparator FI Upper Limit Level			
b061	Window Comparator FV Lower Limit Level	0 to Upper limit level - Hysteresis width × 2 (100 max.) Set an upper limit level.	0.	%
b064	Window Comparator FI Lower Limit Level			
b062	Window Comparator FV Hysteresis Width	0 to (Upper limit level - Lower limit level) / 2 (10 max.) Set a hysteresis width for the upper and lower limit levels.	0.	%
b065	Window Comparator FI Hysteresis Width			
b070	Analog Operation Level at FV Disconnection	0. to 100./no (ignored) Set the analog value to be adopted upon WCFV/WCFI (FVdc/FIdc) output.	no	–
b071	Analog Operation Level at FI Disconnection			
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	27: FVdc (Analog FV disconnection detection)	–	–
		28: FIdc (Analog FI disconnection detection)		
		54: WCFV (Window comparator FV)		
		55: WCFI (Window comparator FI)		

Note: The window comparator upper/lower level settings have nothing to do with the external frequency start/end settings.
Set the voltage limits as percentages [%] corresponding to 0 to 10 V, and current limits as percentages [%] corresponding to 0 to 20 mA.



Reference

- If this function is used to detect a disconnection, set the disconnection detection level to the window comparator upper limit level.
  (Normally a bandwidth exceeding the upper limit value is used and once the upper limit value is breached, a disconnection is detected.)

5

Functions

Frequency Command Source (FREF)

This signal is output when Frequency Reference is set to Digital Operator (A001 = 02).
The signal is turned OFF when Frequency Reference is not set to Digital Operator.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	58: FREF (Frequency command source)	–	–
C026	Multi-function Relay Output Function Selection			

RUN Command Source (REF)

This signal is output when RUN Command is set to Digital Operator (A002 = 02).
The signal is turned OFF when RUN Command is not set to Digital Operator.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	59: REF (RUN command source)	–	–
C026	Multi-function Relay Output Function Selection			

Motor 2 Selection (SETM)

This signal is output when the multi-functional input SET terminal is turned ON and Motor 2 control (Motor 2) is selected.

Parameter No.	Function name	Data	Default setting	Unit
C021 to C022	Multi-function Output Terminal Selection	60: SETM (Motor 2 selection)	–	–
C026	Multi-function Relay Output Function Selection			

5-10 Brake Settings

The following explains the functions relating to brake control.

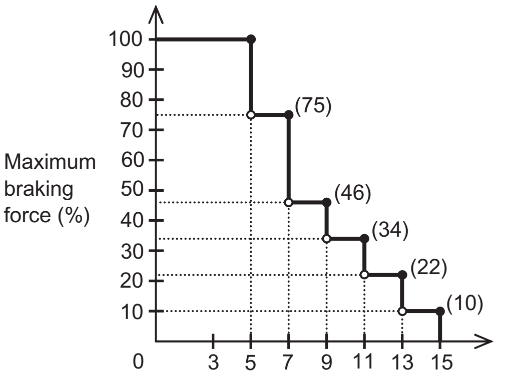
DC Injection Braking (DB)

DC injection braking can be applied to the motor depending on the load.
DC injection braking is performed in one of two methods: external DC injection braking using a multi-function input terminal, and internal DC injection braking performed automatically when starting/stopping. Even if DC injection braking is used, however, the motor may not stop depending on the moment of inertia of the motor load.

Parameter No.	Function name	Data	Default setting	Unit
A051	Internal DC Injection Braking Selection	00: Disabled	00	–
		01: Enabled		
		02: Enabled (Operates only at the set frequency.)		
A052	Internal DC Injection Braking Frequency	0.00 to 60.00 When internal DC injection braking is enabled, DC injection braking starts if the frequency drops to below the set level while the Inverter is stopped.	0.50	Hz
A053	DC Injection Braking Delay Time	0.0 to 5.0 Delay time after the DC injection braking time is reached or DB terminal turns ON until DC injection braking is started.	0.0	s
A054	DC Injection Braking Power	Heavy load (b049 = 00) 0. to 100. Light load (b049 = 01) 0. to 70. 0: Weak (zero current) to 100: Strong (rated current)	50.	%
A057	Startup DC Injection Braking Power		0.	%
A055	DC Injection Braking Time	0.0 to 60.0 This function becomes effective for edge operation of external DC injection braking or when internal DC injection braking is set.	0.5	s
A056	DC Injection Braking Edge/ Level Selection	00: Edge operation (Examples 1-a to 6-a)	01	–
		01: Level operation (Examples 1-b to 6-b)		
A058	Startup Internal DC Injection Braking Time	0.0 to 60.0 This function becomes effective when internal DC injection braking is performed. When the RUN command is turned ON, DC injection braking is started.	0.0	s
A059	DC Injection Braking Carrier Frequency	Heavy load (b049 = 00) 2.0 to 15.0 Light load (b049 = 01) 2.0. to 10.0	5.0/2.0	kHz
C001 to C007	Multi-function Input Selection	07: DB (External DC injection braking)	–	–

DC Injection Braking Carrier Frequency

This function can be set using DC Injection Braking Carrier Frequency (A059). Note that setting a 5 kHz or higher frequency automatically reduces the braking power.
Refer to the DC injection braking power limiter shown below.

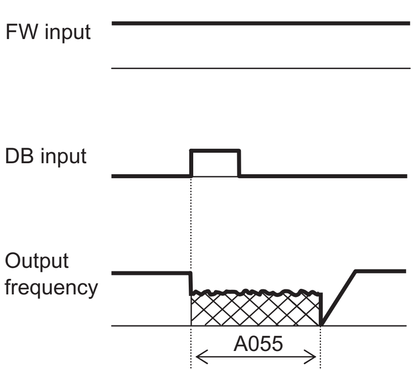
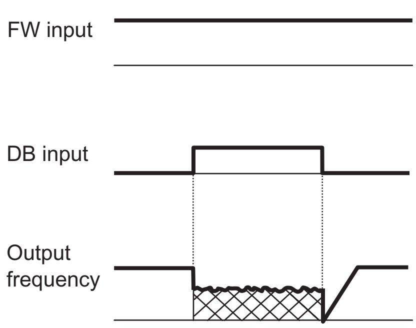


DC injection braking power limiter

External DC Injection Braking

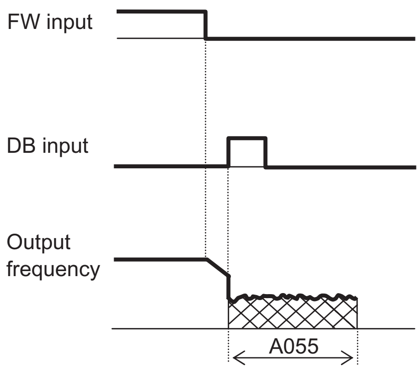
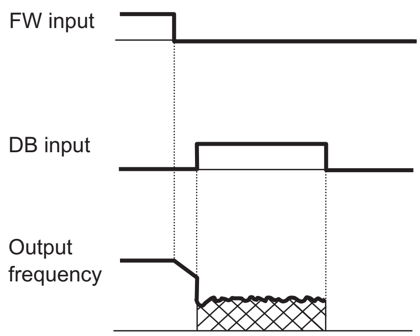
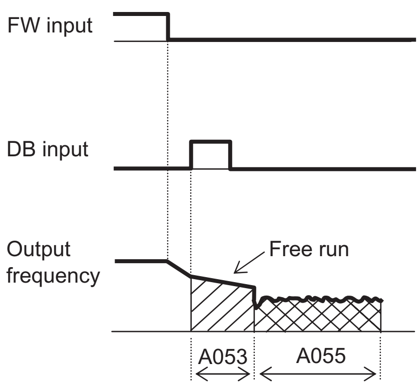
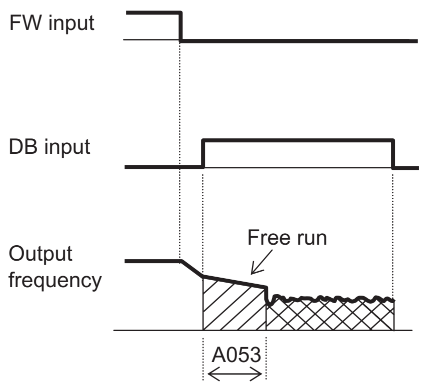
Allocate "07: DB (External DC injection braking)" to any Multi-function Input Selections (C001 to C007).
DC injection braking is applied when the DB terminal is turned ON/OFF, regardless of Internal DC Injection Braking Selection (A051).

Set a braking power level in DC Injection Braking Power (A054).
If DC Injection Braking Delay Time (A053) is set, the Inverter output is shut off during the set time period and the motor goes into free-run status. After the set time elapses, DC injection braking starts.
Set the DC Injection Braking Time (A055) via the Digital Operator or the DB terminal while taking into account motor heat generation.
Perform each setting according to your system after selecting the setting of DC Injection Braking Edge/Level Selection (A056).

(a) Edge Operation (A056 = 00)	(b) Level Operation (A056 = 01)
Example 1-a)  	Example 1-b) 

5

Functions

<table>
<tr><th>(a) Edge Operation (A056 = 00)</th><th>(b) Level Operation (A056 = 01)</th></tr>
<tr><td>Example 2-a)

</td><td>Example 2-b)

</td></tr>
<tr><td>Example 3-a)

</td><td>Example 3-b)

</td></tr>
</table>

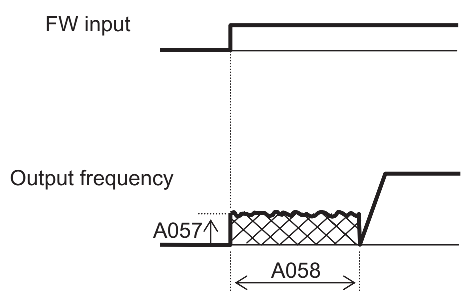
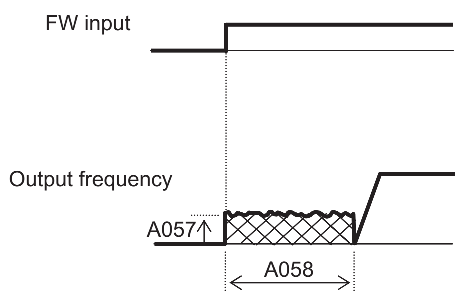
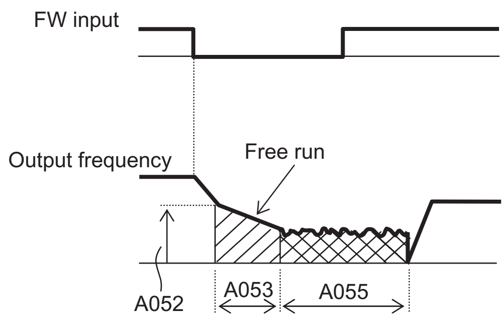
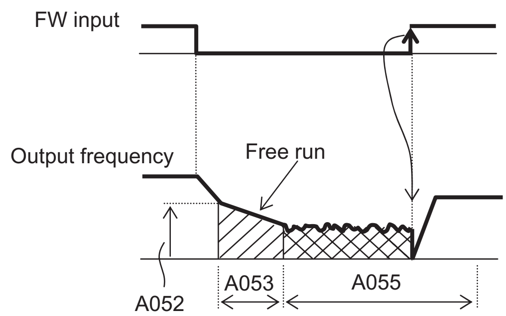
Note. The output frequency becomes zero during free run and DB operation.

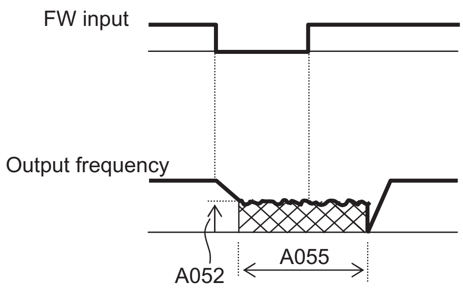
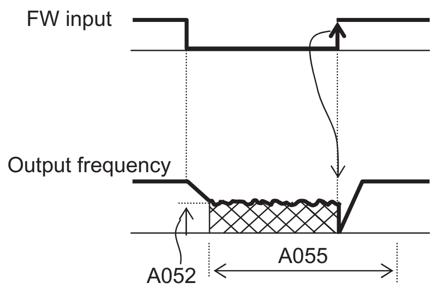
Internal DC Injection Braking (A051 = 01)

DC injection braking can be applied without terminal operation at start/stop of the Inverter.
To use internal DC injection braking, set Internal DC Injection Braking Selection (A051) to "01: Enabled."
Set the Startup DC Injection Braking Power using A057, and set the startup DC Injection Braking Time using A058 regardless of the edge or level operation. (Examples 1-a, 1-b)
Set DC Injection Braking Power (A054) to define the braking power other than at startup.
Use Internal DC Injection Braking Frequency (A052) to set the frequency at which to start DC injection braking.
Once DC Injection Braking Delay Time (A053) is set, the Inverter stops output when the frequency reaches the A052 value after the RUN command (FW) has been turned off. During the set time in A053, the motor remains in free-run status. After an elapse of the period set in A053, DC injection braking starts.
Edge and Level operations for internal DC injection braking work differently when the RUN command switches from STOP to RUN.

Edge operation: Giving priority to DC Injection Braking Time (A055), performs DC injection braking for the set time in A055.
DC injection braking operates for the set time in A055 when the output frequency reaches the set value in A052 after the RUN command (FW) is turned OFF.
Even when the RUN command is turned ON, DC injection braking continues to be applied during the period set in A055. (Examples 2-a, 3-a)

Level operation: Giving priority to the RUN command, shifts to normal operation, ignoring the DC Injection Braking Time (A055).
When the RUN command is turned ON during DC injection braking, the period set in A055 is ignored and the Inverter returns to normal operation. (Examples 2-a, 3-b)

<table>
<tr><th>(a) Edge Operation (A056 = 00)</th><th>(b) Level Operation (A056 = 01)</th></tr>
<tr><td>Example 1-a) When starting

</td><td>Example 1-b) When starting

</td></tr>
<tr><td>Example 2-a) When stopping

</td><td>Example 2-b) When stopping

</td></tr>
</table>

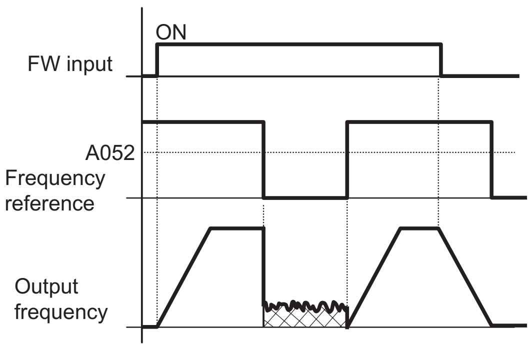
<table>
<tr><th>(a) Edge Operation (A056 = 00)</th><th>(b) Level Operation (A056 = 01)</th></tr>
<tr><td>Example 3-a) When stopping

</td><td>Example 3-b) When stopping

</td></tr>
</table>

Note. The output frequency becomes zero during free run and DB operation.

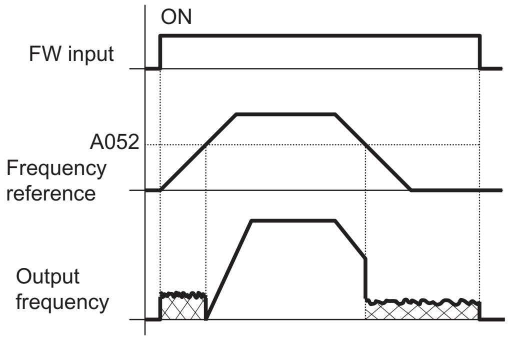
Internal DC Injection Braking (Operation Only Based on Set Frequency) (A051 = 02)

DC injection braking can be applied when the output frequency becomes lower than the setting of Internal DC Injection Braking Frequency (A052).
Neither external nor internal DC injection braking is available while this function is selected.
Operates only when the RUN command is turned on.
DC injection braking starts when both frequency reference and current frequency become lower than A052. (Example 1-a)
When the reference frequency becomes 2 Hz higher than the A052 set value, DC injection braking is released and the output returns to normal. (Example 1-a)
If the reference frequency is zero when the operation starts with analog input, operation is started with DC injection breaking because both the reference and current frequencies are zero.(Example 1-b)
If the RUN command is turned on with the determined frequency reference (a value larger than the A052 setting is input), operation is started with normal output.

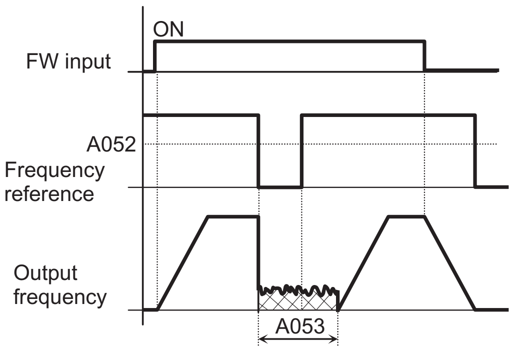
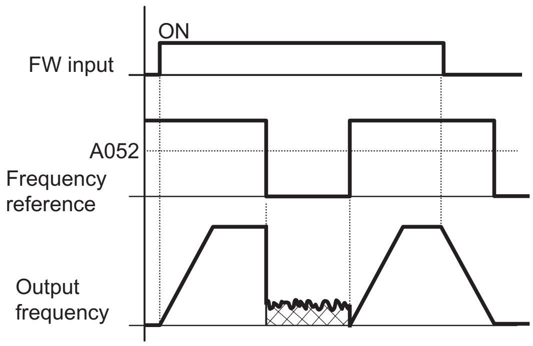
Example 1-a)



Example 1-b)



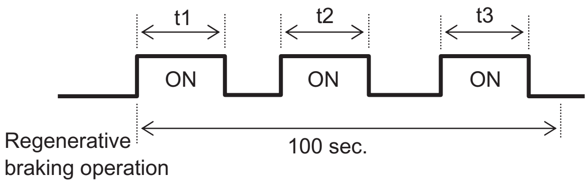
The operation to return to normal varies depending on the setting of DC Injection Braking Edge/Level Selection (A056).

(a) Edge Operation (A056 = 00)	(b) Level Operation (A056 = 01)
	

Regenerative Braking Function

During deceleration, the motor functions as a generator and the generated energy is returned to the Inverter. As a result, the Inverter's DC voltage rises and if the overvoltage level is exceeded, an overvoltage (OV) trip occurs.
This function is intended to prevent this problem by allowing the regenerative energy to be consumed using an external Resistor. It is effective if you want to quickly decelerate the motor or when the load inertia is large.

All 3G3MX2 models have a built-in regenerative braking circuit, so install only a Braking Resistor externally to the Inverter. To use the Regenerative Braking Unit, set Regenerative Braking Selection (b095) to "00: Disabled."b090 and b096 will be ignored.
To use the regenerative braking function, set the following conditions.

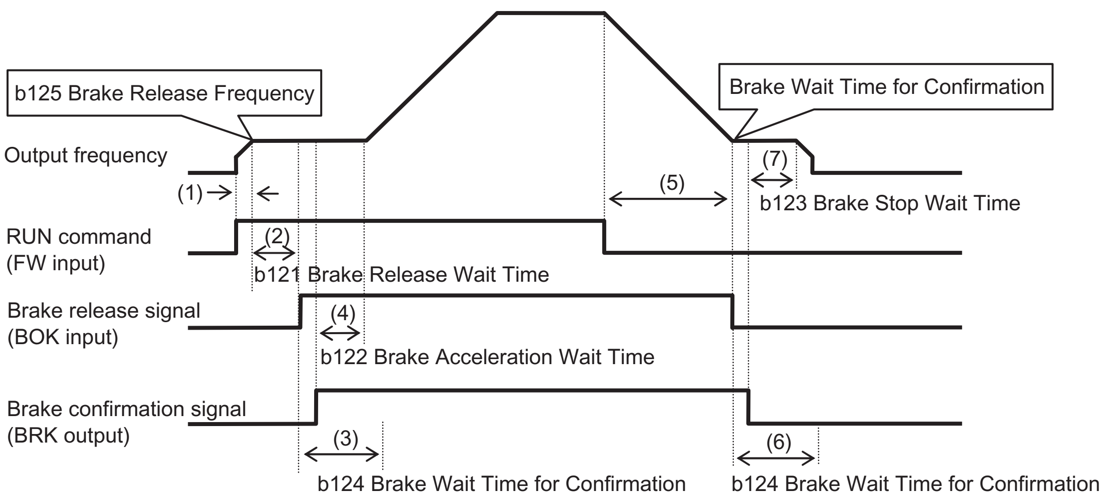
Parameter No.	Function name	Data	Default setting	Unit
b090	Usage Rate of Regenerative Braking	0.0 Regenerative braking does not operate.	0.0	%
		0.1 to 100.0 The usage rate of regenerative braking can be set in increments of 0.1%. A trip occurs if the set usage rate is exceeded.  Usage rate (%) = $\frac{(t1+t2+t3)}{100\ \text{sec.}} \times 100$		
b095	Regenerative Braking Selection	00: Disabled	00	–
		01 While operating: Enabled (Regenerative braking operates.) While stopped : Disabled (Regenerative braking does not operate.)		
		02: Enabled while operating and stopped (Regenerative braking operates.)		
b096	Regenerative Braking ON Level	330 to 380*1 (200 V class)	360	V
		660 to 760*1 (400 V class)	720	

*1.The regenerative braking ON level conforms to the output voltage setting for the Inverter's internal converter (DC unit). The regenerative braking circuit turns ON when the set voltage is exceeded. When the Resistor consumes the energy and the voltage drops to below the ON level, the regenerative braking circuit turns OFF.

Brake Control Function

This function allows the Inverter to control the external brake of an elevating system.
When Brake Control Function Selection (b120) is set to "01: Enabled," the Inverter operates as follows.

(1) At RUN command input, the Inverter starts output, and accelerates to the release frequency.
(2) After the reaching to the release frequency, the Inverter outputs the brake release signal (BRK) after the Brake Release Wait Time (b121) elapses. However, if the Inverter's output current is less than the current value set in Brake Release Current (b126), the Inverter does not output the brake release signal. In this case, the Inverter trips, and outputs the brake error signal (BER).
(3) When Brake Confirmation (44: BOK) is set for a multi-function input terminal and a brake release signal is output, the Inverter waits for a brake confirmation signal, without accelerating, for the period set in Brake Wait Time for Confirmation (b124). If the brake confirmation signal does not turn on within the period set in b124, the Inverter outputs the brake error signal (BER), resulting in trip. If the brake confirmation signal is not allocated to a multi-function input, brake confirmation wait time b124 is disabled, and the Inverter performs processing (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 Acceleration wait time (b122) elapses.
(5) After the RUN command is turned OFF, the Inverter decelerates to the Break ON Frequency (b127), and turns off the brake release signal (BRK).
(6) When Brake Confirmation (44: BOK) is set for a multi-function input terminal and the brake release signal is turned OFF, the Inverter waits for the brake confirmation signal to turn OFF, without decelerating, for the period set in Wait Time for Confirmation (b124). If the brake confirmation signal is not turned off within the period set in b124, the Inverter outputs the brake error signal (BER), resulting in trip. If the brake confirmation signal is not allocated to a multi-function input, Brake Wait Time for Confirmation (b124) is disabled, and the Inverter performs processing (7) after the brake release signal is turned OFF.
(7) After the brake confirmation signal is turned OFF (or after the brake release signal is turned OFF if BOK is not selected), the Inverter restarts deceleration down to 0 Hz after the period set in Stop Wait Time (b123) elapses.



Note: This operation chart applies to a case where the Brake confirmation (44: BOK) is selected for any of Multi-function Input Selections (C001 to C007).
If BOK is not selected, the Acceleration Wait Time (b122) starts at the brake release signal ON timing. The Stop Wait Time (b123) starts at the brake release signal OFF timing.

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 the Brake confirmation (44: BOK) to any of Multi-function Input Selections (C001 to C007).

(2) Allocate the Brake release (19: BRK) for releasing the brake, to any Multi-function Output Terminal Selections (C021 to C022) or Multi-function Relay Output Function Selection. Also, to use a brake error output signal, allocate the Brake error (20: BER). When the Brake Control function is used, it is recommended to use Sensorless Vector Control (A044 = 03) in which high torque is generated at start. For details, refer to "Sensorless Vector Control" on page 5-144.

When the Brake Control function is used, it is recommended to use Sensorless Vector Control (A044 = 03) in which high torque is generated at start. For details, refer to "Sensorless Vector Control" on page 5-144.

Parameters Required for Brake Control Function

Parameter No.	Function name	Data	Default setting	Unit
b120	Brake Control Function Selection	00: Disabled 01: Enabled	00	–
b121	Brake Release Wait Time	0.00 to 5.00 Set a time required for the output current to reach the rate of the release current after reaching the release frequency.	0.00	s
b122	Acceleration Wait Time	0.00 to 5.00 Set a mechanical delay time from when the release signal is output until the brake is released.	0.00	s
b123	Stop Wait Time	0.00 to 5.00 Set a mechanical delay time from when the release signal is turned off until the brake is closed.	0.00	s
b124	Brake Wait Time for Confirmation	0.00 to 5.00 Set a wait time longer than the time from when the release signal is output until the brake sends the release completion signal to the Inverter.	0.00	s
b125	Brake Release Frequency	0.00 to 400.0 Set a frequency to output the brake release signal. *1	0.00	Hz
b126	Brake Release Current	0.0 to 2.0 × Inverter rated current Set an output current that allows the brake to be released.*2	Inverter rated current	A
b127	Break ON Frequency	0.00 to 400.0 Set a frequency to close the brake during stop.*1	0.00	Hz
C001 to C007	Multi-function Input Selection	44: BOK (Brake confirmation)	–	–
C021 to C022 C026	Multi-function Output Terminal Selection Multi-function Relay Output Function Selection	19: BRK (Brake release) 20: BER (Brake error)	–	–

*1.Set a value greater than what is set in Starting Frequency (b082).

*2.If the set current is too low, sufficient torque may not be provided when the brake is released.

In any of the following cases, the Inverter trips and outputs the brake error signal (BER). (Brake error: E36)

- The output current is lower than the release current after the Brake Release Wait Time (b121) elapses.
- When the brake confirmation signal (BOK) is used. The brake confirmation signal did not turn ON within the Brake Wait Time for Confirmation (b124) during acceleration. Or the brake confirmation signal did not turn OFF within the Brake Wait Time for Confirmation (b124) during deceleration. In case that Brake Confirmation Signal (BOK) is turned OFF when Brake Release Signal (BRK) is output.

5-11 Sensorless Vector Control

The following explains the sensorless vector control, which is based on estimation of the motor rpm and output torque from the motor parameter settings.
Sensorless vector control cannot be selected for High-frequency Induction Motor (b171 = 02) and Light Load Mode (b049 = 01).

Sensorless Vector Control

In this method, the motor rpm and output torque are controlled by estimating these parameters based on the Inverter's output voltage and current, as well as the motor parameter settings. High starting torque can be generated to enable high-accuracy operation, even in a low-frequency range (0.5 Hz).
When this function is used, set Control Method (A044/A244) to "03: Sensorless vector control."
When this function is used, make sure to refer to "Motor Parameter Selection" on page 5-145 and that the settings are optimum for the motor used.

Parameter No.	Function name	Data	Default setting	Unit
A044/A244	Control Method 1/2	03: Sensorless vector control (SLV)	00	–

- Sufficient characteristics may not be obtained if you select a motor size two or more ranks lower than the maximum applicable motor.
- The speed may increase at low frequencies (several hertz).
- When the Inverter incoming voltage is higher than the rated voltage of the drive motor, current may increase and normal operation may not be performed if "01: Always OFF" or "02: OFF during deceleration" is selected for AVR Selection (A081/A281). In this case, change AVR Selection to "00: Always ON."

Motor Parameter Selection

When sensorless vector control is performed, set the motor parameters according to the motor used.
If multiple motors are used with one Inverter using constant torque characteristics (VC), reduced torque characteristics (VP 1.7th power) or free V/F setting, calculate the total motor capacity and select the closest data in Motor capacity.
When automatic torque boost is used, improper setting of this parameter may result in torque reduction or motor hunting.

The motor parameters can be set by one of the following three methods:

(1) Use the motor parameters of a standard motor
⇒ When the "Standard Motor Parameters" are selected (H002/H202 = 00), the motor parameter values set in H020/220 to H024/224 are applied. The parameters of a standard motor are set in H020/220 to H024/224 by default.

(2) Measure automatically via offline auto-tuning
⇒ When the auto-tuning parameters are selected in Motor Parameter (H002/H202 = 02) after offline auto-tuning, the motor parameters automatically measured by offline auto-tuning (H030/230 to H034/234) are applied. Refer to "Offline Auto-Tuning Function" on page 5-146.

(3) Set desired parameters
⇒ In either (1) or (2) above, the motor parameters can be changed to desired values. Change the values of H020/220 to H024/224 or H030/230 to H034/234 according to the value of H002/202. (The parameters of a standard motor are set in H030/230 to H034/234 by default.)

Parameter No.	Function name	Data	Default setting	Unit
H002/H202	Motor Parameter 1/2	00: Standard motor parameter (Application of H020/220 to H024/224 as motor parameters)	00	–
		02: Auto-tuning parameter (Application of H030/230 to H034/234 as motor parameters)		
H003/H203	Motor Capacity Selection 1/2	0.1 to 18.5	Default setting	kW
H004/H204	Motor Pole Number Selection 1/2	2/4/6/8/10	4	pole
H005/H205	Speed Response 1/2	1. to 1000. Reduce the value if the motor hunts.	100.	–
Standard motor parameters*1				
H020/H220	Motor 1/2 Parameter R1	0.001 to 65.53 (Primary resistance)	Depends on the capacity	Ω
H021/H221	Motor 1/2 Parameter R2	0.001 to 65.53 (Secondary resistance)	Depends on the capacity	Ω
H022/H222	Motor 1/2 Parameter L	0.01 to 655.3 (Leakage inductance)	Depends on the capacity	mH
H023/H223	Motor 1/2 Parameter Io	0.01 to 655.3 (No-load current)	Depends on the capacity	A
H024/H224	Motor 1/2 Parameter J	0.001 to 9999. (Moment of inertia)	Depends on the capacity	kgm^2
Auto-tuning parameters*2				
H030/H230	Motor 1/2 Parameter R1 (auto-tuning data)	0.001 to 65.53 (Primary resistance)	Depends on the capacity	Ω

Parameter No.	Function name	Data	Default setting	Unit
H031/H231	Motor 1/2 Parameter R2 (auto-tuning data)	0.001 to 65.53 (Secondary resistance)	Depends on the capacity	Ω
H032/H232	Motor 1/2 Parameter L (auto-tuning data)	0.01 to 655.3 (Leakage inductance)	Depends on the capacity	mH
H033/H233	Motor 1/2 Parameter Io (auto-tuning data)	0.01 to 655.3 (No-load current)	Depends on the capacity	A
H034/H234	Motor 1/2 Parameter J (auto-tuning data)	0.001 to 9999. (Moment of inertia)	Depends on the capacity	kgm^2
Motor cable length*3				
b033	Motor Cable Length Code Selection	5. to 20.	10.	–

*1.These parameters are used to set motor parameters when auto-tuning is not used. The parameters of a standard motor are set by default.

*2.These parameters are measured automatically when offline auto-tuning is performed. They can also be changed to desired value manually after tuning.

*3.Set an appropriate value according to the motor cable length used.

Note 1: For moment of inertia J, set a conversion value for the motor. After setting the J value, adjust the response speed in Speed Response (H005/H205). The larger the Speed Response (H005/H205), the higher the response speed , resulting in a steep torque rise; the smaller the J value, the lower the response speed, resulting in gradual torque rise.

Note 2: In sensorless vector control, an output in the direction opposite to the RUN command direction may be issued in the control in the low-speed range, etc.
If the motor's reverse rotation may cause a problem, such as damage to the machine driven by the motor, set Reverse Rotation Prevention Selection (b046) to "01: Enabled". (Refer to "Reverse Rotation Prevention Function" on page 5-157.)

Note 3: Motor Cable Length Code Selection (b033) is a parameter for compensating the current detection accuracy based on the difference in the motor cable length. This parameter need not be set for 11 kW and 15 kW models.

Offline Auto-Tuning Function

In offline auto-tuning, whether the "motor rotates or not" can be selected.
The features of each setting are described below.

Term		Description
Offline Auto-Tuning		The motor parameters required in sensorless vector control are automatically measured in a dedicated operation pattern different from that of normal operation, to increase the accuracy of vector control.
	Motor does not rotate	The motor parameters are measured without rotating the motor. Use this setting if motor rotation must be prevented. Since the motor does not rotate, motor parameter Io (no-load current) and motor parameter J (moment of inertia) cannot be measured. The previously set values are held for motor parameter Io and motor parameter J.
	Motor rotates	The motor parameters are measured by actually rotating the motor. Use this setting if motor rotation does not cause problems. *
Related functions		b046

- When vector control is performed using a motor whose motor parameters are unknown, perform offline auto-tuning to measure the motor parameters.
- The motor parameters correspond to data on one phase of Y-connection at 50 Hz.
- Adjust the settings of Base Frequency (A003/A203) and Motor Incoming Voltage Selection (A082/A282) to the specifications of the motor to be measured. If the applicable motor voltage is not available among the options for Motor Incoming Voltage Selection, set the output voltage gain so that "Motor Incoming Voltage (A082/A282) × Output Voltage Gain (A045/A245) = Rated Motor Voltage" is established.
- The motor parameters can be determined for motors with the maximum applicable capacity or subsequent lower capacity. For motors with other capacities, the Inverter may not correctly determine the motor parameters. (In some cases, auto-tuning may not be completed. In this case, pressing the STOP/RESET key displays an abort message.)
- Set Internal DC Injection Braking Selection (A051) and Simple Position Control Selection (P012) to "00: Disabled." If they are set to "01: Enabled," measurement is not performed correctly.
- Turn OFF the Torque reference input permission (52: ATR). If it is ON, measurement is not performed correctly.
- When performing auto-tuning while the motor is rotating, take note of the following items:
  1) There will be no problem even if the motor accelerates up to near 80% of the base frequency.
  2) The motor is not driven by external equipment.
  3) The brake is released.
  4) The torque is not sufficient during auto-tuning. In the case of a lift, etc. the system may "slip and fall." Accordingly, remove the motor from the loaded machine and perform auto-tuning for the motor alone.
     (Here, moment of inertia J applies to the motor alone. Accordingly, add the motor-shaft converted value of the moment of inertia of the loaded machine.)
  5) In the case of a machine whose motor shaft rotations are limited (lift, ball screw, etc.), the motor may rotate exceeding the allowable rotation and the machine may be damaged as a result. Accordingly, select "01: Enabled (Motor does not rotate)" in H001.
  6) No-load current Io can also be checked by the current monitor function as the current during no-load, 50-Hz operation at V/f setting.
     Also, the setting obtained by auto-tuning (with the motor rotating) can be rewritten (H023/H223) to the monitored value. It can be rewritten to the monitored value after executing auto-tuning (with the motor rotating).
- Even when H001 = 01 (Motor does not rotate), the motor may still rotate slightly.
- To perform auto-tuning for a motor with the subsequent lower capacity, enable Overload Limit Selection (b021/b221b024) and set Overload Limit Level (b022/b222) to 1.5 times larger than the rated current of the motor.
- If the value of Overvoltage Suppression Integral Time (b134) is small, an Overvoltage Trip (E07) may occur at an auto-tuning.
  In this case, increase b134 and then perform auto-tuning again.

Parameter No.	Function name	Data	Default setting	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (Motor does not rotate) 02: Enabled (Motor rotates)	00	–
H002/H202	Motor Parameter 1/2	00: Standard motor parameter 02: Auto-tuning parameter	00	–
H003/H203	Motor Capacity 1/2	0.1 to 18.5	Default setting	kW
H004/H204	Motor Pole Number 1/2	2/4/6/8/10	4	pole
H030/H230	Motor 1/2 Parameter R1 (auto-tuning data)	0.001 to 65.53* (Primary resistance)	Depends on the capacity	Ω
H031/H231	Motor 1/2 Parameter R2 (auto-tuning data)	0.000 to 65.53* (Secondary resistance)	Depends on the capacity	Ω
H032/H232	Motor 1/2 Parameter L (auto-tuning data)	0.00 to 655.3* (Leakage inductance)	Depends on the capacity	mH
H033/H233	Motor 1/2 Parameter Io (auto-tuning data)	0.00 to 655.3* (No-load current)	Depends on the capacity	A
H034/H234	Motor 1/2 Parameter J (auto-tuning data)	0.001 to 9999.* (Moment of inertia)	Depends on the capacity	kgm^2
A003/A203	Base Frequency 1/2	30.0 to Maximum Frequency 1/2	60.0 (1000.0)	Hz
A051	Internal DC Injection Braking Selection	00: Disabled 01: Enabled	00	–
A082/A282	Motor Incoming Voltage Selection 1/2	200/215/220/230/240 This function can be selected for 200V class models.	200	V
		380/400/415/440/460/480 This function can be selected for 400V class models.	400	V
Related functions		b046		

* These parameters are measured automatically when offline auto-tuning is performed. They can also be changed to desired value manually after tuning.

- If H002/H202 remains 00 after the completion of auto-tuning, the motor parameters obtained by auto-tuning are not reflected in the operation data.
- If the auto-tuning result indicates that the tuning was aborted, perform auto-tuning again.
- If a trip occurs during auto-tuning, the auto-tuning processing is forced to stop.
  (No abort message appears. Trip display is given higher priority.)
  After removing the cause of the trip, set H001 to 01 and then perform the auto-tuning again.
- If the offline auto-tuning is performed with "free V/f setting" selected as the control method, the Inverter displays the abort message and stops processing.
- During auto-tuning, the deceleration stop tends to slow under certain conditions such as when the incoming voltage is high. In this case, press the STOP key and adjust the parameters so that the value of Over voltage Suppression Integral Time Setting (b134) will decrease and the value of Overvoltage Suppression Level During Deceleration (b131) will increase.

- If an overcurrent trip occurs during acceleration while auto-tuning is in progress, adjust the parameters so that the acceleration time will increase and the overload limit level will decrease. If an overcurrent trip occurs during deceleration, adjust the parameters so that the value of Overvoltage Suppression Integral Time Setting (b134) will increase and the value of Overvoltage Suppression Level During Deceleration (b131) will decrease.

Operating Procedure (Motor rotates: H001 = 02)

Step 1: Set the motor capacity and number of poles according to the motor ratings.

H003 Motor capacity

H004 Number of motor poles

Step 2: Set the base frequency and motor voltage selection according to the motor ratings.

A003 Base frequency

A082 Motor voltage

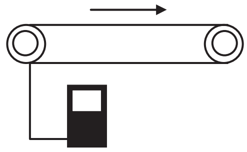
Step 3: Set Auto-tuning Selection (H001) to 02.

H001 → 02

Step 4: Issue a RUN command according to the setting of RUN Command Selection (A002).

RUN

Starts the automatic operation.



After the auto-tuning, the result is displayed.

- - - o Successful

- - - ┘ Aborted

Step 5: After the operation is completed, use the STOP/RESET key to cancel the result display.

STOP RESET

Step 6: Reflect the automatically measured motor parameters in the operation data.

H002 → 02

Issuing a RUN command starts automatic operation in the following sequence:

(1) 1st AC excitation (The motor does not rotate.)
↓
(2) 2nd AC excitation (The motor does not rotate.)
↓
(3) 1st DC excitation (The motor does not rotate.)
↓
(4) V/f control operation (The motor rotates until 80% of the base frequency.) *
↓
(5) Sensorless vector control operation (The motor rotates until x% of the base frequency.) *
↓
(6) 2nd DC excitation (The motor does not rotate.)
↓
(7) The auto-tuning result is displayed.

* If the "motor does not rotate" (H001 = 01) is selected, steps (4) and (5) are not performed.

- The rotation frequency in step (5) is defined as follows, if "T" represents the acceleration time or deceleration time in step (4), whichever is larger:

$0\ s < T < 50\ s$: $x = 40\%$
$50\ s \leq T < 100\ s$: $x = 20\%$
$100\ s \leq T$: $x = 10\%$

If sensorless vector control cannot provide the desired characteristics, adjust the motor parameters depending on the phenomena, as shown in the table below.

Operation status	Phenomenon	Adjusting method	Adjustment item
Power running	Speed change ratio is a negative value.	Increase motor parameter R2 gradually up to the set parameter × 1.2.	H021/H221/ H031/H231
	Speed change ratio is a positive value.	Decrease motor parameter R2 gradually up to the set parameter × 0.8.	H021/H221/ H031/H231
Regeneration	Insufficient torque at low frequency (several Hz)	Increase motor parameter R1 gradually up to the set parameter × 1.2.	H020/H220/ H030/H230
		Increase motor parameter Io gradually up to the set parameter × 1.2.	H023/H223/ H033/H233
During startup	Shock occurs during startup.	Reduce motor parameter J from the set parameter.	H024/H224/ H034/H234
		Reduce the speed response.	H005/H205
	The motor momentarily rotates in the direction opposite the reference rotation direction.	Set Reverse Rotation Prevention Selection (b046) to "01: Enabled."	b046
During deceleration	Motor hunting	Reduce motor parameter J from the set parameter.	H024/H224/ H034/H234
		Reduce the speed response.	H005/H205
Low-frequency operation	Rotation is not constant.	Increase motor parameter J from the set parameter.	H024/H224/ H034/H234
		Raise the speed response.	H005/H205

Note: To use a motor with a capacity lower than that of the Inverter, set Torque Limit (b041 to b044) by making sure the value α, calculated with the following formula, does not exceed 200%. Otherwise, the motor may burn out.

α = Torque limit value × (Inverter capacity) / (Motor capacity)

Example) From the above formula, the torque limit value to achieve α = 200% with a 0.75 kW Inverter and 0.4 kW motor is calculated as follows:

Torque Limit (b041 to b044) = α × (Motor capacity) / (Inverter capacity)
= 200% × (0.4 kW) / (0.75 kW) = 106%.

Torque Monitor Function

This function monitors the estimate output torque of the motor.

This function is enabled only when Sensorless Vector Control is selected for control method (A044/A244 = 03). Take note that if constant torque characteristics (VC), reduced torque characteristics (VP 1.7th power) or free V/f setting is selected for Control Method (A044/A244), this function is disabled and the output signals for display or through the control terminal block become indeterminable.

To perform monitoring via the Digital Operator, select Display Parameter d012.
To perform monitoring using signals from the control terminal block, refer to "MP Terminal (Pulse/PWM Output)" on page 5-42 or "AM Terminal (Analog Output)" on page 5-44.

The torque monitor value under this function assumes that the torque corresponding to the Inverter's rated current is 100%.
Accordingly, the absolute value of torque varies depending on the motor to be combined.

Parameter No.	Function name	Data	Default setting	Unit
A044/A244	Control Method 1/2	03: Sensorless vector control	00	–
d012	Output Torque Monitor	–200. to 200. Output torque	–	–
C027 C028	MP Selection AM Selection	02: Output torque	07	–
		11: Output torque (signed) *1	07	–

*1: This setting can be allocated only to C028.

Overtorque/Undertorque Selection (OTQ)

This function outputs a signal upon detection of the estimate motor output torque exceeding a given level. This function is enabled only when Sensorless Vector Control is selected for control method (A044/A244 = 03). Take note that under all other settings, the output becomes indeterminable.
This function is enabled when the Overtorque/Undertorque (07: OTQ) is selected in Multi-function Output Terminal Selection.

Parameter No.	Function name	Data	Default setting	Unit
C054	Overtorque/ Undertorque Selection	00: Overtorque 01: Undertorque	00	–
C055	Overtorque/ Undertorque Level (Forward Power Running)	0. to 200. OTQ signal output level for forward power running	100.	%
C056	Overtorque/ Undertorque Level (Reverse Regeneration)	0. to 200. OTQ signal output level for reverse regeneration	100.	%
C057	Overtorque/ Undertorque Level (Reverse Power Running)	0. to 200. OTQ signal output level for reverse power running	100.	%
C058	Overtorque/ Undertorque Level (Forward Regeneration)	0. to 200. OTQ signal output level for forward regeneration	100.	%
C059	Overtorque/ Undertorque Signal Output Mode Selection	00: Enabled in acceleration/deceleration and constant speed operation 01: Only during constant speed	01	–
C021 to C022	Multi-function Output Terminal Selection	07: OTQ (Overtorque/Undertorque)	–	–
C026	Multi-function Relay Output Function Selection			

Torque Limit Function

This function limits the motor output torque. This function is enabled only when Sensorless Vector Control is selected for control method (A044/A244 = 03).

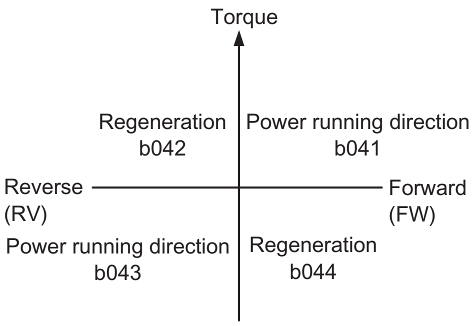
You can select any of the following 3 torque limit functions from Torque Limit Selection (b040).

- Four-quadrant separate setting mode
  In this mode, torque limits are set separately for the four quadrants of forward power running, forward regeneration, reverse power running and reverse regeneration, using Torque Limits 1 to 4 (b041 to b044).
- Terminal switching mode
  In this mode, the values set in Torque Limits 1 to 4 (b041 to b044) are switched based on the combination of torque limit switching terminals 1 and 2 (TRQ1,TRQ2) which are set using multi-function input terminals. Selected torque limit values are enabled for all operation modes.
- Analog input mode
  In this mode, the torque limits are set based on the voltage applied to the FV terminal (analog voltage) on the control terminal block.
  0 to 10 V correspond to torque limit values of 0% to 200%. Selected torque limit values are enabled for all operation modes.
- Option mode
  This mode is valid when an optional board is used. Refer to the manual for the optional board.

If the Torque limit enabled function (40: TL) is set to a multi-function input terminal, the torque limit function set in b040 is enabled only when TL is turned ON. When TL is off, the torque limit setting is disabled, and the maximum value is defined as the torque limit value. If the Torque limit enabled function (40: TL) is not set to a multi-function input terminal, the torque limit function set in Torque Limit Selection (b040) is always enabled.
The torque limit value under this function assumes that the torque corresponding to the Inverter's rated current is 100%. Accordingly, the absolute value of torque varies depending on the motor to be combined.
When the Torque limit (10: TRQ) is selected in the multi-function output selection, the torque limit signal turns on when the above torque limit function is activated.

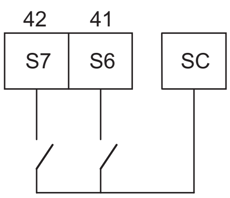
Parameter No.	Function name	Data	Default setting	Unit
b040	Torque Limit Selection	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Optional board	00	–
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	0 to 200/no (Disabled) Forward power running under four-quadrant separate setting	200.	%
b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	0 to 200/no (Disabled) Reverse regeneration under four-quadrant separate setting	200.	%
b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	0 to 200/no (Disabled) Reverse power running under four-quadrant separate setting	200.	%
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	0 to 200/no (Disabled) Forward regeneration under four-quadrant separate setting	200.	%
C001 to C007	Multi-function Input Selection	40: TL (Torque limit enabled/disabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2)	–	–
C021 to C022	Multi-function Output Terminal Selection	10: TRQ (During Torque limit)	–	–
C026	Multi-function Relay Output Function Selection			

When "00: Four-quadrant separate setting" is selected in Torque Limit Selection (b040), Torque Limits 1 to 4 (b041 to b044) conform to the figure below.



When "01: Terminal switching" is selected in Torque Limit Selection (b040), Torque Limits 1 to 4 (b041 to b044), which are switched by Torque Limit Switchings 1, 2 allocated to multi-function input terminals, are set as follows.

Example) Torque limit switching 1 (41: TRQ1) is allocated to multi-function input terminal S6, and Torque limit switching 2 (42: TRQ2) is allocated to multi-function input terminal S7/EB.



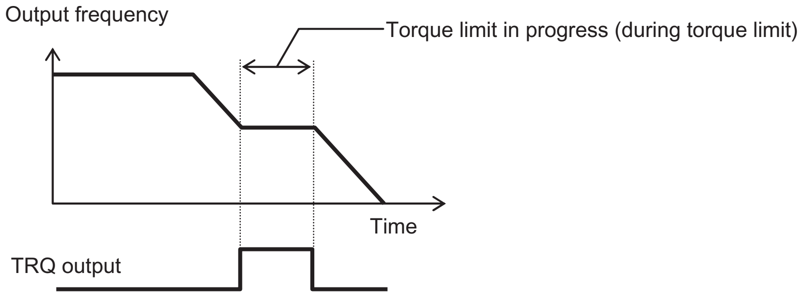
41:TRQ1	42:TRQ2	
OFF	OFF	→ b041
ON	OFF	→ b042
OFF	ON	→ b044
ON	ON	→ b043

To use the torque limit function in a low-speed range, also use Overload Limit Selection (b021/b221/b024).

Torque LADSTOP Function

This function temporarily stops the frequency deceleration function (LAD) when the torque limit function is actuated. This function is enabled only when Sensorless Vector Control is selected for control method (A044/A244 = 03).

Parameter No.	Function name	Data	Default setting	Unit
b045	Torque LADSTOP Selection	00: Disabled	00	–
		01: Enabled		
Related functions		A044/A244, b040, b041to b044		



Torque Control

This function is enabled only when Sensorless Vector Control is selected for control method (A044/A244 = 03).
To operate in the torque control, allocate "52: ATR" to any multi-function input terminal. While the ATR terminal is turned on, the torque reference input is enabled.
The torque reference source can be selected from two analog types, Digital Operator, etc. using P033. When analog setting is used, the full-scale value is 200%. (When voltage is used, 10 V corresponds to 200%.)
The torque control speed depends on the balance between torque and load. To prevent the Inverter from running out of control, set a speed limit value in P039 (forward) or P040 (reverse).
Increasing the speed/torque control switching time reduces the switching shock. The torque reference value under this function assumes that the torque corresponding to the Inverter's rated current is 100%. Accordingly, the absolute value of torque varies depending on the motor to be combined.

Parameter No.	Function name	Data	Default setting	Unit
P033	Torque Reference Input Selection	00: Input from the FV terminal (10V = 200%)	00	–
		01: Input from the FI terminal (20 mA = 200%)		
		03: Input via the Digital Operator		
		06: Input from optional board		
P034	Torque Reference Setting	0. to 200. (Torque reference when P033 = 03)	0.	%
P039	Speed Limit Value in Torque Control (forward)	0.00 to 99.99/100.0 to 120.0	0.00	Hz
P040	Speed Limit Value in Torque Control (reverse)	0.00 to 99.99/100.0 to 120.0	0.00	Hz
P041	Speed/Torque Control Switching Time	0 to 1000	0.	ms
C001 to C008	Multi-function Input Selection	52: ATR (Torque reference input permission)	–	–

Torque Bias Function

This function is used to apply a bias to the torque reference generated by torque control. This function is enabled only when Sensorless Vector Control is selected for control method (A044/A244 = 03).
The torque bias value under this function assumes that the torque corresponding to the Inverter's rated current is 100%. Accordingly, the absolute value of torque varies depending on the motor to be combined.

Parameter No.	Function name	Data	Default setting	Unit
P036	Torque Bias Mode	00: Disabled	00	–
		01: Set via the Digital Operator		
		05: Input from optional board		
P037	Torque Bias Value	–200 to +200 (Enabled when P036 = 01)	0.	%
P038	Torque Bias Polarity Selection*1	00: As per sign	00	–
		01: Depends on the RUN direction		

*1.• As per sign (00) When the polarity of a torque bias signal is (+), the torque increases for forward rotation, and when it is (–), the torque increases for reverse rotation, regardless of the RUN direction.
• Depends on the RUN direction (01)
The torque bias signal sign and torque bias direction vary depending on the RUN command direction.
Forward command: Applies torque in the same direction as the torque bias.
Reverse command: Applies torque in the reversed direction of the torque bias.

Reverse Rotation Prevention Function

This function is enabled only when Sensorless Vector Control is selected for control method (A044/A244 = 03).
Because of its control characteristics, the Inverter may output a rotation signal in the direction opposite to that of the RUN command under certain conditions such as in a low-speed range. If the motor's reverse rotation may cause a problem, such as damage to the machine driven by the motor, set Reverse Rotation Prevention Selection (b046) to "Enabled".

Parameter No.	Function name	Data	Default setting	Unit
b046	Reverse Rotation Prevention Selection	00: Disabled	00	–
		01: Enabled (No reverse rotation)		

5-12 Simple Position Control Function

The following explains the simple position control mode.

Encoder Connection

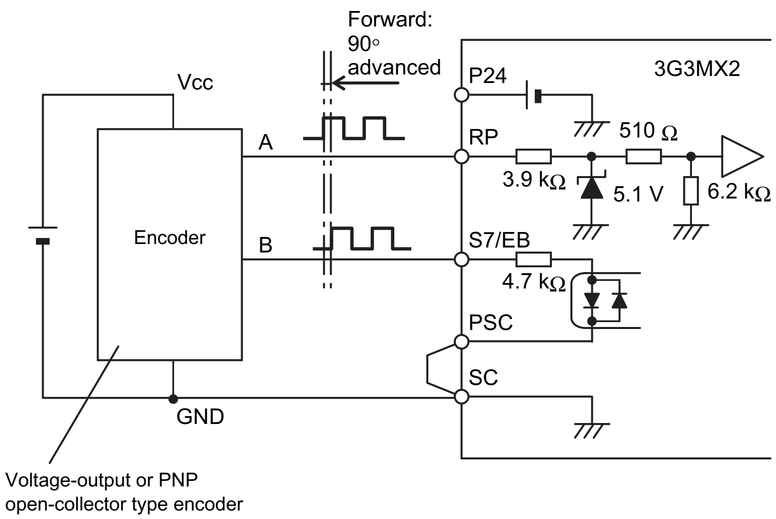
The hardware specification for pulse train input is described below.

	Maximum frequency	RP terminal (5 to 24VDC) (32 kHz max.)	S7/EB terminal (24 VDC) (1.8 kHz max.)
Dual-phase pulse train input with 90°C phase difference (P004 = 01, 02)	to 1.8 kHz	Phase-A pulse train (PNP open-collector or voltage-output encoder)	Phase-B pulse train (PNP open-collector or voltage-output encoder)
1-phase pulse train input + direction (P004 = 03)	to 32 kHz	1-phase pulse train (PNP open-collector or voltage-output encoder)	Direction signal (Sink/source transistor or selector switch)
1-phase pulse train input (P004 = 00)	to 32 kHz	1-phase pulse train (PNP open-collector or voltage-output encoder)	–

Wire the incremental encoder as shown below when using this function.

Dual-phase Pulse Train

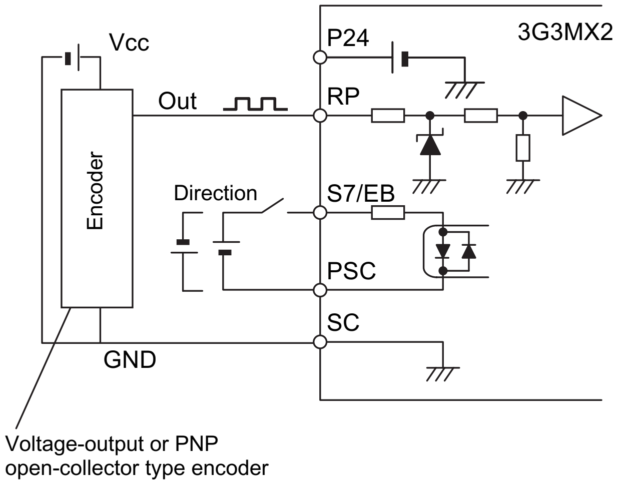
Input the dual-phase pulses to the RP and EB terminals. Since the EB terminal is also used as multi-function input terminal S7/EB, use all multi-function inputs, including the EB terminal, based on the source logic (voltage-output encoder or PNP open collector encoder). Also make sure the input voltage is within the rated range for the multi-function input terminal (18 to 24 V). Allocate EB to multi-function input terminal S7/EB.

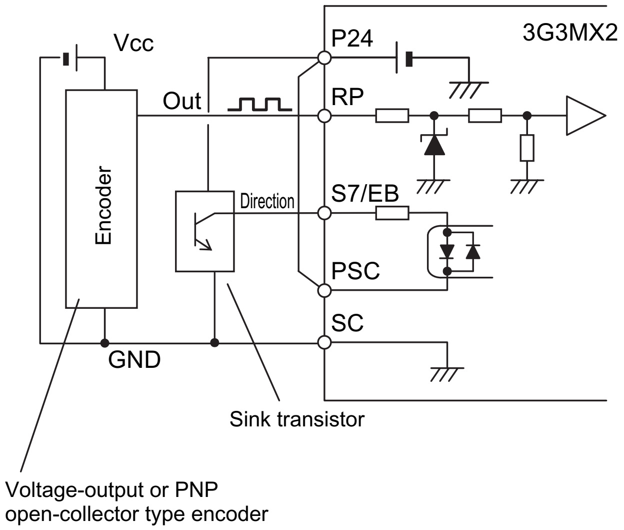


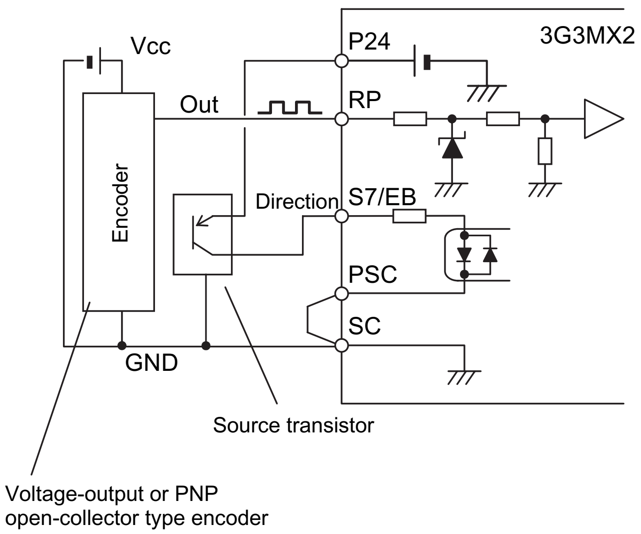
Connect the Inverter output terminals (U, V, and W) and the motor input terminals (U, V, and W) in the correct phase order. In this case, the motor turns forward when a forward command is applied to the Inverter. Forward is the direction in which the motor shaft turns counterclockwise when viewed from the load. Reverse is the direction in which the motor shaft turns clockwise. For the dual-phase pulse on terminals RP and EB, forward is detected when the pulse on the RP terminal is 90° advanced from the EB terminal, and reverse is detected when the pulse on the RP terminal is 90° delayed from the EB terminal. Input the encoder signals so that the RP terminal is 90° advanced from the EB terminal when the motor is turning forward.

1-pulse + Direction Signal

Input the 1-phase pulse to the RP terminal and direction signal to the EB terminal. The EB terminal can support both the sink logic and source logic by changing the shorting bar position. Allocate EB to multi-function input terminal S7/EB.
The EB terminal is OFF for forward and ON for reverse.







Simple Position Control Mode

When Pulse Train Input Terminal RP Selection (P003) is set to "01: Feedback pulse," the pulse train signals are used as feedback information from the encoder. (Enabled for Control 1 only) The position reference is specified by the combination of multi-function input terminals. Up to eight position references can be specified.
The speed for a position command conforms to the Output Frequency Setting (F001). For data with many digits, such as position commands, only the higher four digits are displayed. A run command (FW or RV) is required separately as well as the position command. (Set A002 to 01.) This is needed to enable DC injection braking when stopping. During Digital Operator operation (A002 = 2), DC injection braking does not function. DC injection braking functions when A002 is 03 and A002 is 04.) For information on DC injection braking (DB), refer to"Brake Settings" on page 5-135. (DC Injection Braking Power (A054) must be set. Set A051 to 00. Even with these settings, DC injection braking will function for simple position control when external DC injection braking is selected. For position control, external DC injection braking takes priority, so do not set A051 to 01 or 02.)

Parameter No.	Function name	Data	Default setting	Unit
P003	Pulse Train Input Terminal RP Selection	01: Feedback pulse	00	–
P004	Feedback Pulse Train Input Type Selection	00: 1-phase pulse train *2	00	–
		01: Dual-phase pulse train with 90° phase difference 1*1 , *2		
		02: Dual-phase pulse train with 90° phase difference 2 *1, *2		
		03: 1-phase pulse train + direction *1, *2		
P011	Number of Encoder Pulses	32. to 1024. Set the calculated number of pulses per motor rotation for each connected encoder phase. This setting is used for speed detection and position control by calculating pulse to stop.	512.	Pulse
P012	Simple Position Control Selection	00: Simple position control disabled	00	–
		02: Simple position control enabled		
P015	Creep Speed Setting	Starting frequency to 10.00 (100.0)	5.00	Hz
P026	Overspeed Error Detection Level	0.0 to 150.0 The Inverter will be tripped if the motor speed detected by the encoder exceeds the maximum frequency times the Overspeed Error Detection Level (P026) during operation when P003 is set to 01 (encoder feedback) and P026 is not set to 0. This does not depend on whether simple position control of V/f control with FB is ON or OFF.	115.0	%

Parameter No.	Function name	Data	Default setting	Unit
P027	Speed Deviation Error Detection Level	0.00 to 120.0 If this parameter is not set to 0 and DSE (excessive speed deviation) is assigned to the intelligent output terminal, the DSE signal will turn ON if the absolute value of the output frequency minus the speed FB is equal to or greater than the setting of P027. The Inverter will not be tripped. This does not depend on whether simple position control or V/f control with FB is either ON or OFF.	10.00	Hz
P072	Position Range Setting (forward side)	0 to +268,435,455	268435455	–
P073	Position Range Setting (reverse side)	–268,435,455 to 0	–268435455	–
P075	Positioning Mode Selection	00: Limit 01: Not limited *3	00	–
P077	Encoder Disconnection Detection Time	0.0 to 10.0	1.0	s
d029	Position Command Monitor	–268,435,455 to +268,435,455	–	–
d030	Current Position Monitor*5	–268,435,455 to +268,435,455	–	–
C102	Reset Selection	03: Trip reset only Internal data (current values) are not initialized upon reset.	00	–
C001 to C007	Multi-function Input Selection	47: PCLR (Position deviation clear) 85: EB (Rotation direction detection) *1	–	–
C021 to C022	Multi-function Output Terminal Selection	22: DSE (Excessive speed deviation)	–	–
C026	Multi-function Relay Output Function Selection	23: POK (Position ready)		

*1.To use the EB terminal (P004 = 01 to 03), allocate "85: EB" to multi-function input terminal S7/EB. The selection of an NO or NC contact will be disabled. The EB terminal is OFF for forward and ON for reverse.

*2. The run command, command rotation direction, and detected rotation direction are as follows:

- Run command (FW/RV terminal): Tells the Inverter to start operation.
- Command rotation direction: The direction in which the Inverter is intended to rotate the motor. For positioning control, this is determined by the sign of the position deviation.
- Detected rotation direction: The current rotation direction as detected by the Inverter.

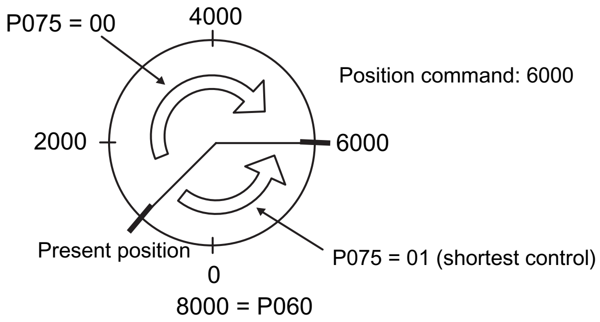
P004 specifies the number of encoder phases and the method used to detect the motor rotation direction. The methods for determining the command rotation direction and detected rotation direction are given in the following table. For a dual-phase pulse, the maximum input pulse frequencies are 32 kHz for phase A and 1.8 kHz for phase B. At less than 1.8 kHz, which is valid for both phases A and B, the motor rotation phase and direction detection (number of pulses: x4) is performed using a 90° encoder phase difference. For 1.8 kHz or higher, where phase B is not valid, the phase-B signal is ignored and only phase A is used to detect the motor rotation phase (number of pulses: x1). Motor rotation direction, which cannot be detected from the encoder, is detected with a different method, as shown in the following table.

Determining the Command Rotation Direction and Detected Rotation Direction

P004	RV terminal	FW terminal	EB terminal	Phase difference	Command rotation direction	Detected rotation direction
00 Single-phase pulse	OFF	OFF	-	-	None	None
	OFF	ON	-	Positive/ negative	Forward/ reverse	Forward/reverse *
	ON	OFF	-	Positive/ negative	Forward/ reverse	Forward/reverse *
	ON	ON	-	-	None	None
01 90° phase difference, dual-phase pulse 1	OFF	OFF	-	-	None	None
	Either ON		Less than 1.8 kHz	Positive/ negative	Forward/ reverse	Detected from encoder (90° phase difference)
			1.8 kHz or higher	Positive/ negative	Reverse/ reverse	Detected direction maintained when EB terminal is less than 1.8 kHz.
	ON	ON	-	-	None	None
02 90° phase difference, dual-phase pulse 2	OFF	OFF	-	-	None	None
	Either ON		Less than 1.8 kHz	Positive/ negative	Forward/ reverse	Detected from encoder (90° phase difference)
	OFF	ON	1.8 kHz or higher	Positive/ negative	Forward/ reverse	Forward/reverse *
	ON	OFF	1.8 kHz or higher	Positive/ negative	Forward/ reverse	Forward/reverse *
	ON	ON	-	-	None	None
03 Single-phase pulse + direction	OFF	OFF	-		None	None
	Either ON		OFF	Positive/ negative	Forward/ reverse	Forward (according to EB terminal)
			ON	Positive/ negative	Reverse/ reverse	Reverse (according to EB terminal)
	ON	ON	-		None	None

* If the command rotation direction changes before the completion of positioning, the current detected rotation direction will be maintained until deceleration of the Inverter output frequency has been completed and then the command rotation direction will be used. However, even if the Inverter output frequency follows the command rotation direction the actual number of motor rotations may not keep up, and the present position will be counted in the opposite direction until it catches up, causing deviation. If this occurs, operation can be improved by increasing the acceleration/deceleration time.

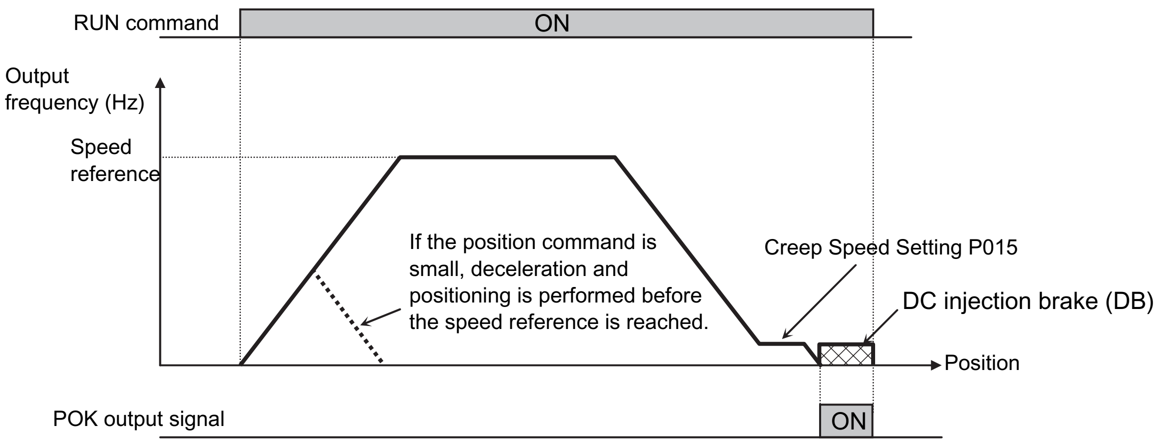
*3. When a rotary coordinate system such as a turntable is used, setting b075 = 01 allows for positioning in the rotation direction corresponding to the shorter moving distance. In this case, set the position per rotation in the rotary coordinate system, in Multi-step Position Command 0 (P060). (This must be a positive value.) The set value of P060 is used to determine the correct rotation direction. For position commands for which movement will actually be stopped, set a multi-step position other than P060 (for example, P061 = 6000). Take note that this function can be used only when Feedback Pulse Train Input (P004) is "00" or "01."



*4. This setting is not required if control method is set to Sensorless vector control (A044/A244 = 03).

*5. If P004 is 00, counting will not be performed if the motor runs idle when neither FW nor RV is input. (This is because FW/RV specify the motor rotation direction.) The value of d030 is cleared when PCLR (position clear signal), SPD (speed/position switch signal), ORG (zero return start signal) or RS (RS terminal input) turns ON or the power supply is turned ON. Calculations are based on a x1 number of pulses and are not dependent on whether a single-phase or dual-phase encoder input is used.

P003	P004	P012	A044	Enabled function
00 (Frequency setting (including PID))	00 (1-phase pulse input)	00 (Simple position control disabled)	-	Pulse train frequency input
01 Encoder feedback	-	00 (Simple position control disabled)	00 to 02	V/f control with FB
01 Encoder feedback	-	02 (Simple position control enabled)	-	Simple position control



In simple position control, DC injection braking (DB) is applied after moving to the target position according to the following:

(1) Position command
(2) Speed reference (frequency reference)
(3) Acceleration time, deceleration time

DC injection braking must be set. (DC injection braking (DB) will remain effective until the RUN command is turned OFF.)

In absolute position control, the frequency reference and acceleration/deceleration reference conform to the currently selected parameters.

The exact target position may not be achieved depending on the DC injection braking force or creep speed setting. Adjust the strength of the DC injection brake to minimize rotational fluctuations when the DC injection brake is applied and in a range that will not cause the electronic thermal to trip. If the creep speed setting is small, displacement will tend to be smaller.

The trigger for starting deceleration according to the speed reference is as follows:
Number of pulses required for (the number of rotations equivalent to the triangle for deceleration from the current frequency at the applicable deceleration time + 1.25 rotations) < Position deviation
If movement decelerates to the creep speed before the following stopping condition is met, movement continues at the creep speed. Movement stops using DC injection braking when the position deviation becomes less than 50 pulses (calculated at x4).
If the position command is set to a low value, the Inverter may conduct deceleration and perform positioning before the speed command value is reached. If the position command is "0," DC injection braking (DB) is applied immediately when the RUN command is turned ON.
The position at power-on is recognized as the zero (position = 0). (When the power is turned off, the current value is cleared.)
If the current position counter exceeds the specified position range, a Position Control Range Trip (E83) occurs and the Inverter runs freely. If the PCLR terminal is allocated, turning ON the PCLR terminal clears the current position counter. (The internal position deviation counter is cleared simultaneously.)

- In Reset Selection (C102), select "03: Trip reset only."
  If Reset Selection (C102) is not set to 03, turning ON the Inverter's reset terminal (STOP/RESET key) clears the current position counter. To operate the Inverter by using the current position count value after resetting a trip by turning ON the reset terminal (STOP/RESET key), be sure to set Reset Selection (C102) to 03.

Reference

- In the simple position control mode, the direction of RUN command (FW, RV) does not indicate the rotation direction. The FW or RV signal starts or stops the Inverter. The Inverter runs forward when "Target position - Current position" is a positive value, or runs in reverse when it is a negative value.
- In the simple position control mode, the ATR terminal is disabled.(Torque control is disabled.)

Multi-step Position Switching Function (CP1/CP2/CP3)

Selection of multi-step positions 0 to 7 becomes possible when "66: CP1" to "68: CP3" are allocated to Multi-function Input Selections (C001 to C007).
Set position commands in Multi-step Position Commands 0 to 7 (P060 to P067). (The unit is based on poool setting. This is not dependent on whether a single-phase or dual-phase encoder input is used and no need consider for x4 operation.)
If no position command is allocated to the terminals, Multi-step Position Command 0 (P060) is defined as the position command.

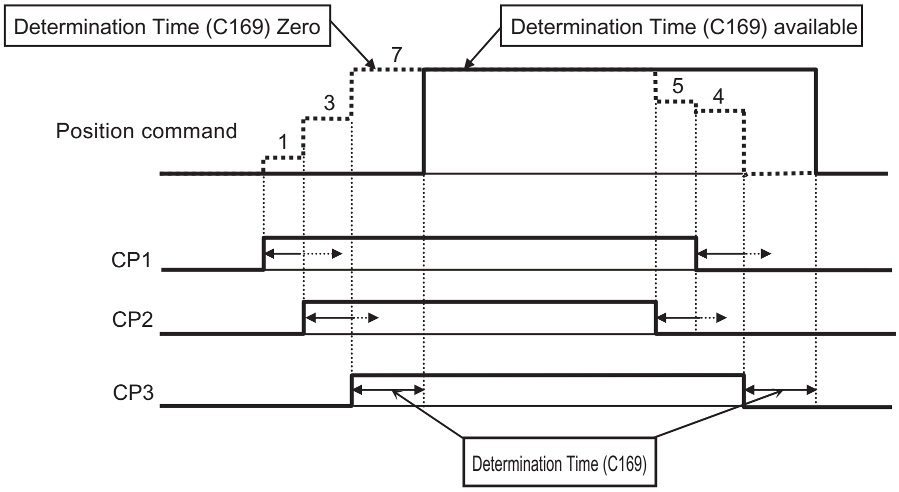
Parameter No.	Function name	Data	Default setting	Unit
P060	Multi-step Position Command 0	Position Range Setting (Reverse Side) (P073) to Position Range Setting (Forward Side) (P072) *1*2	0	–
P061	Multi-step Position Command 1		0	–
P062	Multi-step Position Command 2		0	–
P063	Multi-step Position Command 3		0	–
P064	Multi-step Position Command 4		0	–
P065	Multi-step Position Command 5		0	–
P066	Multi-step Position Command 6		0	–
P067	Multi-step Position Command 7		0	–
C001 to C007	Multi-function Input Selection	66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3)	–	–
C169	Multi-step Speed/Position Determination Time	0. to 200. (× 10 ms) Wait time until determination of terminal input	0.	s

*1. Only when P075 is set to 01 the position corresponding to one rotation in the rotary coordinate system should be set in Multi-step Position Command 0 (P060).

*2. +: Forward rotation from the zero
– : Reverse rotation from the zero

Position command	CP3	CP2	CP1
Multi-step position 0	0	0	0
Multi-step position 1	0	0	1
Multi-step position 2	0	1	0
Multi-step position 3	0	1	1
Multi-step position 4	1	0	0
Multi-step position 5	1	0	1
Multi-step position 6	1	1	0
Multi-step position 7	1	1	1

To prevent an erroneous input due to a time lag between inputs in the multi-step position command input mode, the wait time until the terminal input is confirmed can be set using Multi-step Speed/ Position Determination Time (C169). This prevents the transition status before input establishment from being applied.
After an input change is detected, data will be confirmed upon an elapse of the time set in C169. Note that the longer the determination time, the slower the input response.

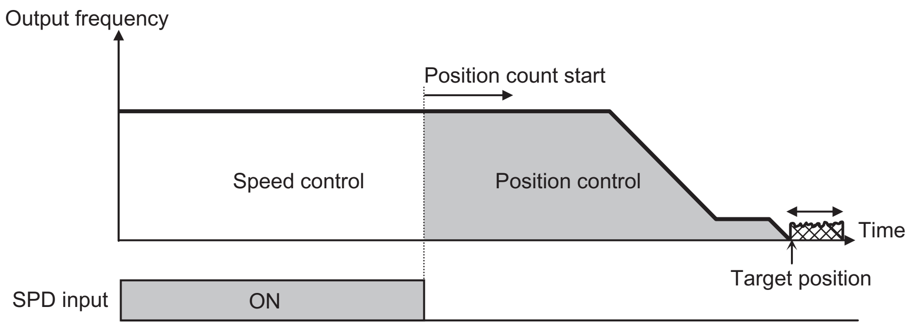

Determination Time (C169) Zero
Determination Time (C169) available
7
3
1
5
4
Position command
CP1
CP2
CP3
Determination Time (C169)

Speed/Position Switching Function (SPD)

To perform speed control operation in the simple position control mode, turn ON this terminal. While the SPD terminal is turned ON, the current position counter remains at zero. When the SPD terminal is turned OFF during operation, position control operation is started the moment the terminal is turned OFF (speed/position switching). At this time, if the position command is "0" the Inverter immediately stops. (Hunting may occur depending on the DC injection braking force.)

Reference

- While the SPD terminal is ON, the Inverter runs in the direction specified by the run command. Accordingly, set P004 to 02 (90° dual-phase pulse 2) when using this function.
- When using speed/position switching (SPD), set P075 (Positioning Mode Selection) to 00 (limit).



Parameter No.	Function name	Data	Default setting	Unit
C001 to C007	Multi-function Input Selection	73: SPD (Speed/position switching)	–	–

Zero Return Function

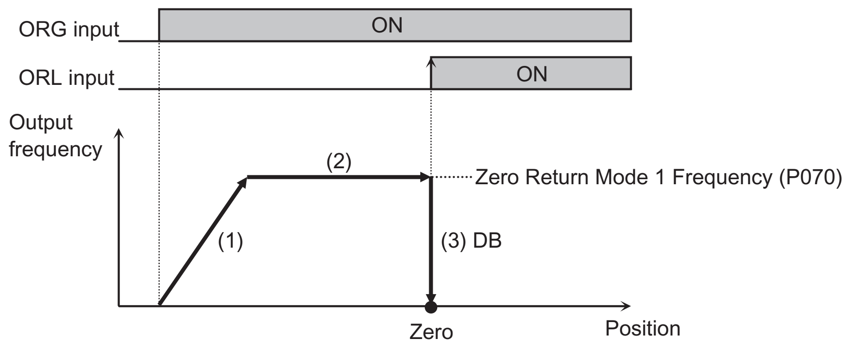
This function performs two types of zero return operations according to Zero Return Mode (P068).
Zero return starts when the Zero return start signal (70: ORG) turns ON. When zero return is complete, the current position is cleared (= 0).
Select the zero return direction in Zero Return Direction Selection (P069).
If zero return is not performed, the Inverter performs position control with the position at power-on defined as the origin.
force.)

Reference

- When using the zero return function (mode 1 or 2), set P075 (Positioning Mode Selection) to 00 (limit).

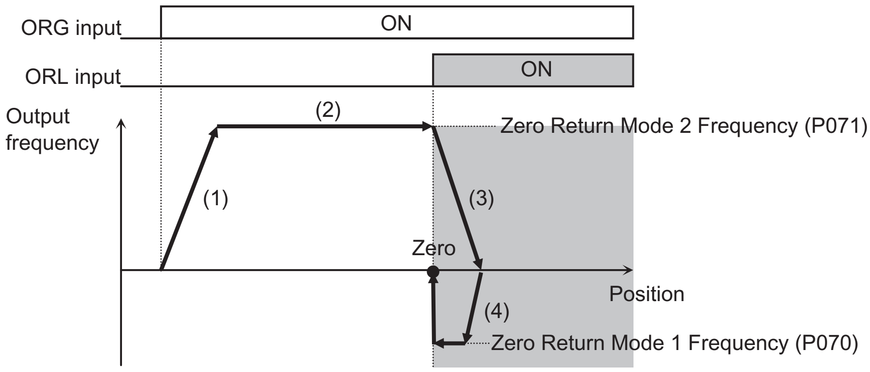
Parameter No.	Function name	Data	Default setting	Unit
P068	Zero Return Mode	00: Zero return mode 1 01: Zero return mode 2	00	–
P069	Zero Return Direction Selection	00: Forward side 01: Reverse side	01	–
P070	Zero Return Mode 1 Frequency	0.00 to 10.00 (100.0)	5.00	Hz
P071	Zero Return Mode 2 Frequency	0.00 to 400.0	5.00	Hz
C001 to C007	Multi-function Input Selection	69: ORL (Zero return limit signal) 70: ORG (Zero return startup signal)	–	–

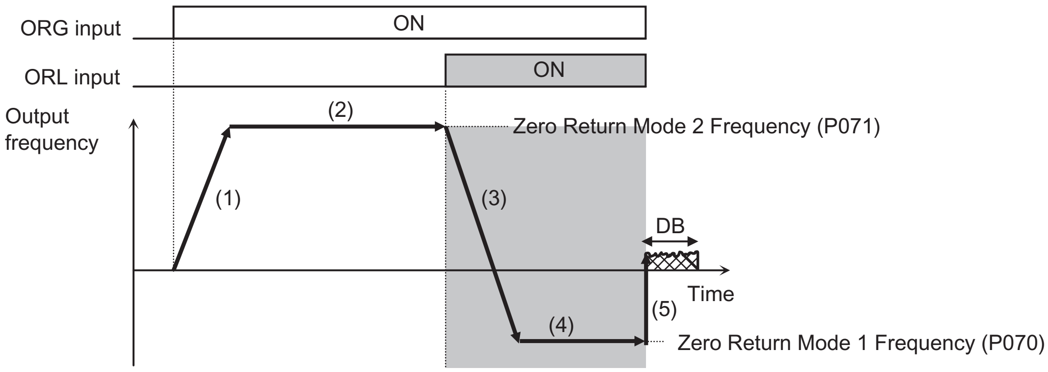
Zero Return Mode 1 (P068 = 00)



(1) Accelerate until the zero return mode 1 frequency (speed) according to the acceleration time.
(2) Operate at the zero return mode 1 frequency (speed).
(3) Apply DC injection braking (DB) the moment an ORL signal is input.

Zero Return Mode 2 (P068 = 01)





(1) Accelerate until the zero return mode 2 frequency (speed) according to the acceleration time.
(2) Operate at the zero return mode 2 frequency (speed).
(3) Start decelerating the moment the ORL signal turns ON.
(4) Operate in the reverse direction at the zero return mode 1 frequency (speed).
(5) Apply DC injection braking (DB) the moment the ORL signal turns OFF.

5-13 Safety Function

Overview of Safety Function

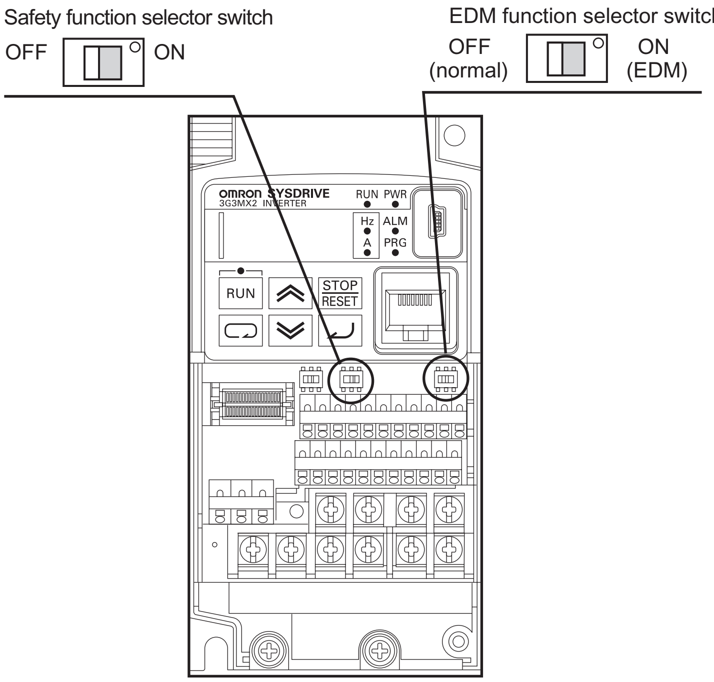
The safety function is designed so that the safety stop function of category 0 (uncontrolled stop) specified in IEC 60204-1 is used to meet the safety standard of Stop PLd under ISO 13849-1.
The safety input function allows inverter output when current is flowing to both the GS1 and GS2 terminals. When the safety input function actuates, the Inverter's output transistor operation is stopped while ensuring the level of safety conforming to the above standard, and the electric power to the motor stops (the motor executes a free-run stop).

- It takes less than 10 ms after the safety input is received until the output is stopped.
- An Emergency Shutoff (E37) message is displayed and a trip occurs. In the case of a competitive External Trip (E12) setting, the Emergency Shutoff (E37) setting is given priority unless at power-on.

Note. If the EDM function is not used, PLc under ISO13849-1 applies.

Safety Function Setting

Turn ON the safety function selector switch while the Inverter power is turned OFF. The GS1 input and GS2 input are allocated to multi-function input terminals S3/GS1 and S4/GS2 automatically.
If the EDM output (safety monitor output) is used, turn ON the EDM function selector switch. The EDM output is allocated to multi-function output terminal P11/EDM automatically.



- Take note that when the safety function selector switch or EDM function selector switch is turned ON and then OFF, the input/output terminals previously allocated to the GS1/GS2 inputs and EDM output are reset to "no," meaning no allocation and the I/O contact selection remains NC contact.

How to Wire for/Use Safety Function

Observe the above safety standard and follow the wiring example. Be sure to use both the GS1 input and GS2 input to design a system where both GS1 input and GS2 input are turned OFF upon actuation of the safety function.
Upon detecting an OFF state of the GS1 input or GS2 input, the Inverter actuates the safety function and stops the output.

Reference

- The safety monitor (62: EDM) turns ON when the output is cut off upon detection of an OFF state of both the GS1 input and GS2 input signals. If the output stopped due to the safety function but the EDM output did not turn ON, check the GS1 and GS2 input circuits and EDM detection circuit.

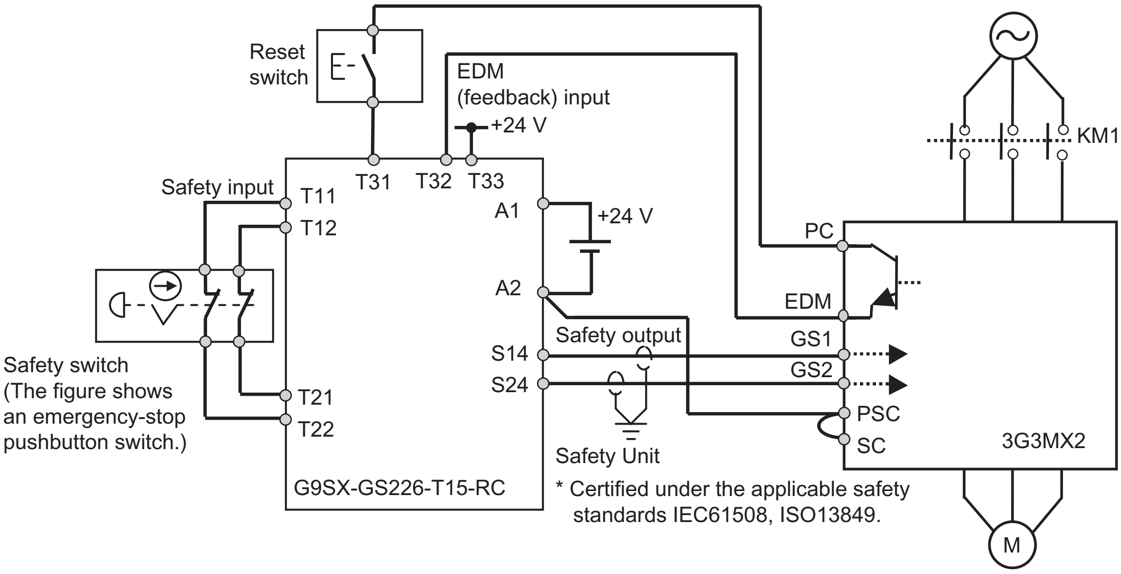
Parameter No.	Function name	Data	Default setting	Unit
C003	Multi-function Input Selection	77: GS1 input (safety input 1)*1 78: GS2 input (safety input 2) *1	18	–
C004			12	
C013	Multi-function Input Operation Selection	01: NC (NC contact) *1	00	–
C014				
C021	Multi-function Output Terminal P1/EDM Selection	62: EDM (Safety device monitor)*2	00	–
C031	Multi-function Output Terminal P1/EDM Contact Selection	00: NO (NO contact)*2	00	–
b145	GS Input Operation Selection	00: Not tripped (Cut off by hardware)	00	–
		01: Tripped*3 , *4		

*1.When the safety function selector switch is turned ON, this setting is applied forcibly and the selection can no longer be changed.
*2.When the EDM function selector switch is turned ON, this setting is applied forcibly and the selection can no longer be changed.
*3. An E37 trip occurs. In the case of a competitive External Trip (E12) setting, "E37" setting is given priority unless at power-on.
*4.If either the GS1 or GS2 input terminal turns ON while an E37 trip is still present, safety cannot be ensured by the safety function.

Wiring Example

Wiring Example

Wiring Example When EDM is Used (Conforming to PLd under ISO13849-1)



When the emergency stop button is pressed, the current flowing through GS1 and GS2 is cut off and the Inverter output is cut off. As a result, the motor enters a free-run status. This operation corresponds to stop category 0 under IEC60204-1.

Note 1. Shown above are wirings that apply when the multi-function input terminals are used based on the source logic. If they are used based on the sink logic, the wiring must be changed. For details, refer to "Connection to Programmable Controller (PLC)" on page 2-22.

Note 2. The safety relay and emergency shutoff input signal line must use a shielded coaxial cable such as RG174/U (by LAPP) per MIL-C17 or KX3B per NF C 93-550 with an outer diameter of 2.8 mm and length of 20 m or less. Ground the shield.

Note 3. All inductor parts such as relays and contactors must have an overvoltage protection circuit.

Example of System Components

Shown below is an example of peripherals conforming to the applicable safety standards which are recommended as system components.

Series name	Model	Manufacturer	Applicable standard	Date of certification
G9SA	G9SA-301	OMRON Corporation	ISO13849-2 cat4, SIL3	06.06.2007
G9SX	G9SX-GS226-T15-RC	OMRON Corporation	IEC61508 SIL1-3	04.11.2004
NE1A	NE1A-SCPU01-V1	OMRON Corporation	IEC61508 SIL3	27.09.2006

The Inverter meets the PLd safety requirement only when combined with PLd-compliant equipment.

Periodic Inspection

If the current stops flowing to either the GS1 or GS2 terminal while the safety function is operating, the Inverter cuts off output. Accordingly, absence of defect in GS1 and GS2 wirings must be inspected periodically. Be sure to conduct a periodic inspection once a year.
The wiring inspection method for GS1/GS2/EDM is shown below.

Terminal	Status			
GS1	Current OFF	Current ON	Current OFF	Current ON
GS2	Current OFF	Current OFF	Current ON	Current ON
EDM	ON	OFF	OFF	OFF
Inverter output	Output cut off	Output cut off	Output cut off	Output available

Precautions

- To make sure the safety function operates normally, evaluate the overall safety system against all risk factors.
- The safety function does not mean the input is cut off or output is electrically insulated. Before installation or maintenance work, turn off the Inverter input power supply.
- The wires used for the safety function must be 30 m or shorter.
- If common GS1 and GS2 are used for two or more Inverters, be sure to install a diode according to "Note on Use of Multiple Inverters" on page 2-24. GS1 and GS2 may turn ON, thus causing the Inverter to produce output even in the safety mode.

5-14 Other Functions

The following explains the functions other than those relating to operation settings, such as initialization setting functions.

Initialization Setting

The set values can be initialized to the factory defaults. The fault monitor data can also be cleared.
To prevent inadvertent initialization, initialization cannot be performed unless multiple parameters are set.
Total RUN Time (d016) and Power ON Time Monitor (d017) cannot be cleared.
If Display Selection (b037) or Soft Lock Selection (b031) is set, initialization cannot be performed because the following parameters used in initialization cannot be accessed. Cancel the fixed display or soft lock and then perform initialization.

- If you forget the password, there is no other means for recovery. Exercise due caution when setting a password.

Parameter No.	Function name	Data	Default setting	Unit
b084	Initialization Selection	00: Initialization disabled 01: Fault monitor clear 02: Initializes data 03: Fault monitor clear + Data initialization 04: Do not set.	00	–
b094	Initialization Target Selection	00: All data (Complete initialization) 01: Initialize all data other than input/output terminal/basic communication settings*1 02: Initialize only user-set/registered functions (U001 to U032) *2 03: Initialize all data other than user-set/registered functions (U001 to U032) and Display Selection (b037)	00	–
b085	Initialization Data Selection	00: Do not change.	00	–
b180	Perform Initialization/Mode Selection *3	00: Initialization disabled 01: Perform initialization/mode selection	00	–

*1.Refer to the next page for the details of "input/output terminal/basic communication settings" when Initialization Target Selection is set (b094 = 01).
*2.Only the data of user-registered parameters are initialized and the user-registered parameters themselves remain.
*3.Exercise caution because when "01" is selected for Perform Initialization/Mode Selection (b180) and the Enter key is pressed, initialization starts immediately and the process cannot be undone.

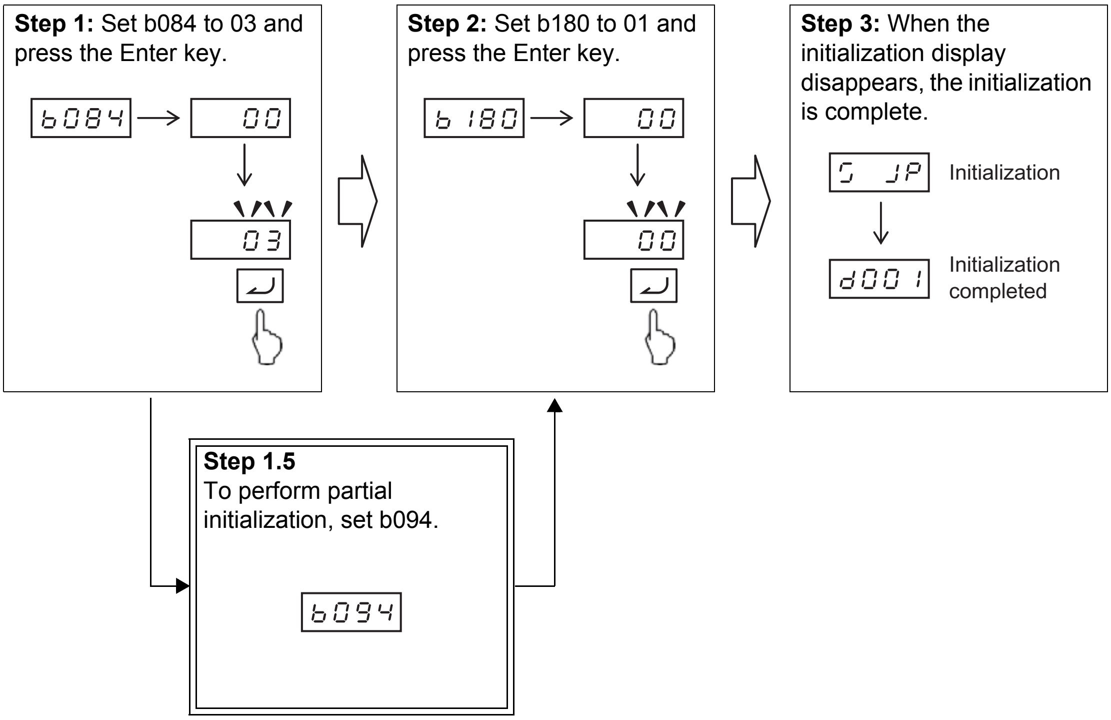
5

Functions

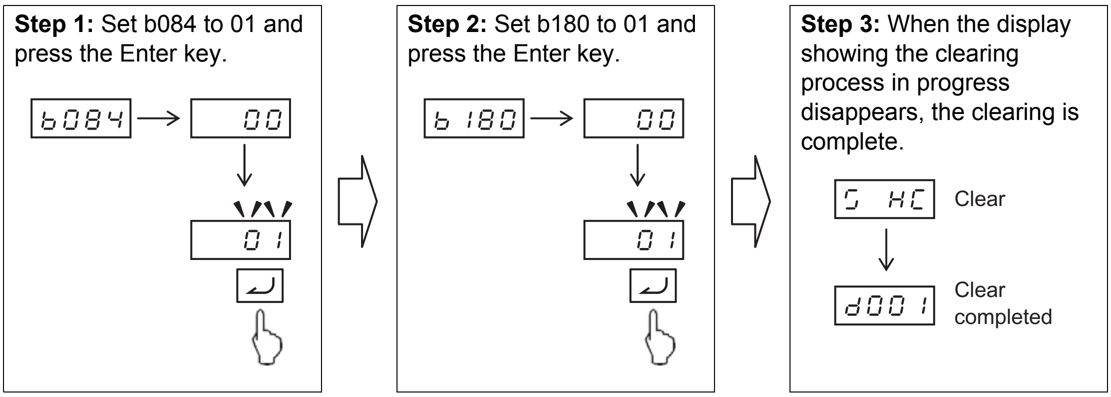
Details of input/output terminals/basic communication settings when Initialization Target Selection is set (b094 = 01)

Parameter No.	Description
Input/output terminal data	
C001 to C007	Multi-function input selection
C011 to C017	Multi-function input terminal operation selection
C021 to C022	Multi-function output terminal selection
C026	Multi-function relay output function selection
C031 to C032	Multi-function output terminal contact selection
C036	Multi-function relay output contact selection
Basic communication setting data	
C071	Communication speed selection
C072	Communication station No. selection
C074	Communication parity selection
C075	Communication stop bit selection
C076	Operation selection on communication error
C077	Communications error timeout time
C078	Communication wait time

Initialization Method (Complete Initialization of Fault Monitor/Data)



How to Clear Fault Monitor



Note 1: To prevent inadvertent initialization, b084 and b180 will return to 00, even if changed, once the initialization is complete and when the power is reconnected.
Set these parameters every time the initialization is performed.

Note 2: Even if initialization is performed, the parameters for Initialization-related Functions (b085, b094), Heavy/Light Load Selection (b049), FV/FI Adjustment (C081, C082) and Thermistor Adjustment (C085) are not initialized.

Note 3: Once initialized, the current settings can no longer be restored.

5

Functions

User Parameter Manual Setting Function

"U" parameters are user parameters, and up to 32 parameters can be registered, as desired. When user parameters are set and then Display Selection (b037) is set to "02: User setting," only the functions registered under U001 to U032, d001, F001 and b037 will be displayed thereafter.

Parameter No.	Function name	Data	Default setting	Unit
U001 to U032	User Selection	no: Not registered	no	–
		d001 to P186 Register a desired function code.		
b037	Display Selection	02: User setting + b037	04	–

User Parameter Automatic Setting Function

When User Parameter Automatic Setting Function (b039) is set to "01: Enabled," the parameters subjected to a data change are automatically stored in sequence under U001 to U032. This data can be used as modification records.
The screen information (parameters) is stored when the Enter key is pressed. The monitor screens (d***) are also stored in the same manner.
U001 is the latest parameter, while U032 is the oldest parameter.
The same parameter is not duplicated. If the number of parameters stored exceeds 32, the oldest parameters are erased (from U032).

Parameter No.	Function name	Data	Default setting	Unit
b039	User Parameter Automatic Setting Function	00: Disabled	00	–
		01: Enabled		
Related functions		U001 to U032		

Note: Take note that all parameters that are currently registered in User Parameters (U001 to U032) when b039 is changed from 00 to 01 will be initialized (set to "no").

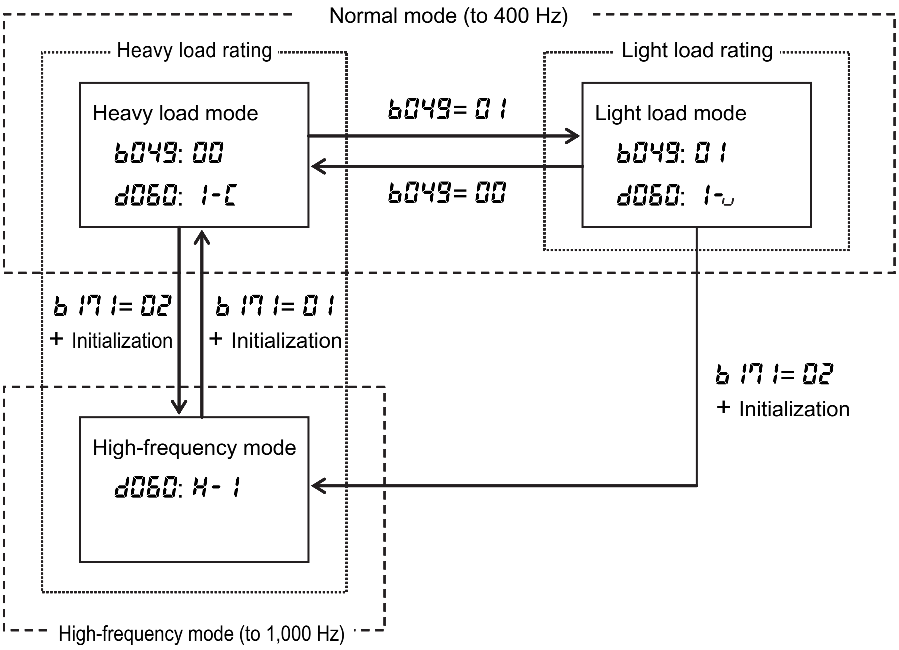
Inverter Mode Selection

Changing the setting of Inverter Mode Selection alone does not change the mode. After changing this setting, perform an initialization/Mode Selection Command (b180). When the Inverter mode is changed, the fault monitor data is cleared and the parameters are initialized. The current Inverter mode can be monitored using d060.

Although the maximum output frequency of the 3G3MX2 is 400 Hz, switching to the high-frequency mode permits output of up to 1,000 Hz. Since the high-frequency mode is supported only in the heavy load rating setting, set the high-frequency mode after selecting Heavy Load Rating (b049 = 00). (The rating type cannot be changed to light load when the high-frequency mode is selected.)
To perform initialization or clear the fault monitor data while in the high-frequency mode, set appropriate values in b084 and b094 and then perform initialization via b180 according to the normal initialization procedure. It is not necessary to set a value in b171.

- Sensorless vector control operation cannot be performed in the high-frequency mode.

Switching between Normal Mode (Heavy Load Rating or Light Load Rating) and High-frequency Mode



Parameter No.	Function name	Data	Default setting	Unit
b171	Inverter Mode Selection	00: Selection disabled	00	–
		01: Induction motor		
		02: Induction motor (high-frequency mode)		
b180	Perform Initialization/ Mode Selection	00: Initialization disabled	00	–
		01: Perform initialization/mode selection		

Major Differences between High-frequency Mode and Normal Mode

Function name	High-frequency mode	Normal mode	
Heavy Load/Light Load Selection (b049)	Heavy load rating (CT)	Heavy load rating (CT)	Light load rating (VT)
Maximum Frequency (A004)	1000 [Hz]	400 [Hz]	400 [Hz]
Starting Frequency (b082)	0.10 to 100.0 [Hz]	0.10 to 9.99 [Hz]	0.10 to 9.99 [Hz]
Carrier Frequency (b083)	2.0 to 10.0 [kHz]	2.0 to 15.0 [kHz]	2.0 to 10.0[kHz]
Control Method (A044)	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting
Acceleration Pattern Selection (A097) Deceleration Pattern Selection (A098)	00: Line	00: Linear 01: S shape curve 02: U shape curve 03: Reverse-U shape curve 04: EL-S shape curve	00: Linear 01: S shape curve 02: U shape curve 03: Inverted U shape curve 04: EL-S shape curve
Automatic Carrier Reduction (b089)	00: Disabled	00: Disabled 01: Enabled, depends on current 02: Enabled, depends on fin temperature	00: Disabled 01: Enabled, depends on current 02: Enabled, depends on fin temperature

Note: In the high-frequency mode, the values are fixed and thus parameters b049, A097, A098 and b089 are not displayed.

The following table gives the differences in the setting ranges and default settings for parameters in Normal Mode with a Heavy Load Rating (CT) and High-frequency Mode.

Parameter No.	Function name	Normal Mode with a Heavy Load Rating (CT)		High-frequency Mode	
		Setting range	Default	Setting range	Default
F002	Acceleration Time Setting 1	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	30.00
F202	Acceleration Time Setting 2	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	30.00
F003	Deceleration Time Setting 1	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	30.00
F203	Deceleration Time Setting 2	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	30.00
A003	Base Frequency 1	30.0 to Maximum Frequency 1 (A004) [Hz]	60.0	30.0 to Maximum Frequency 1 (A004) [Hz]	1000.0
A203	Base Frequency 2	30.0 to Maximum Frequency 2 (A204) [Hz]	60.0	30.0 to Maximum Frequency 2 (A204) [Hz]	1000.0
A004	Maximum Frequency 1	Base Frequency 1 (A003) to 400.0 [Hz]	60.0	Base Frequency 1 (A003) to 1,000.0 [Hz]	1000.0
A204	Maximum Frequency 2	Base Frequency 2 (A203) to 400.0 [Hz]	60.0	Base Frequency 2 (A203) to 1000.0 [Hz]	1000.0
A011	FV Start Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A012	FV End Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A044	Control Method 1	00: VC 01: VP 1.7th power <VC, if low speed> 02: Free V/f setting 03: Sensorless vector control	00	00: VC 01: VP 1.7th power <VC, if low speed> 02: Free V/f setting	00
A244	Control Method 2	00: VC 01: VP 1.7th power <VC, if low speed> 02: Free V/f setting 03: Sensorless vector control	00	00: VC 01: VP 1.7th power <VC, if low speed> 02: Free V/f setting	00
A059	DC Injection Braking Carrier Frequency	2.0 to 15.0 [kHz]	5.0	2.0 to 10.0 [kHz]	5.0
A063	Jump Frequency 1	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A064	Jump Frequency Width 1	0.00 to 10.00 [Hz]	0.50	0.00 to 100.00 [Hz]	0.50
A065	Jump Frequency 2	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A066	Jump Frequency Width 2	0.00 to 10.00 [Hz]	0.50	0.00 to 100.00 [Hz]	0.50
A067	Jump Frequency 3	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A068	Jump Frequency Width 3	0.00 to 10.00 [Hz]	0.50	0.00 to 100.00 [Hz]	0.50
A069	Acceleration Stop Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A092	1st Acceleration Time 2	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	15.00
A292	2nd Acceleration Time 2	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	15.00

5

Functions

Parameter No.	Function name	Normal Mode with a Heavy Load Rating (CT)		High-frequency Mode	
		Setting range	Default	Setting range	Default
A093	1st Deceleration Time 2	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	15.00
A293	2nd Deceleration Time 2	0.01 to 3,600.00 [s]	10.00	0.01 to 3,600.00 [s]	15.00
A095	2-step Acceleration Frequency 1	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A295	2-step Acceleration Frequency 2	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A096	2-step Deceleration Frequency 1	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A296	2-step Deceleration Frequency 2	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A101	FI Start Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A102	FI End Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A145	Frequency Addition Amount Setting	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A154	Deceleration Stop Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A156	PID Sleep Function Operation Level	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A161	VR Start Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
A162	VR End Frequency	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
b007	Frequency Matching Lower Limit Frequency Setting	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
b019	Free-electronic Thermal Frequency 3	Free-electronic Thermal Frequency 2 to 400 [Hz]	0.0	Free-electronic Thermal Frequency 2 to 1,000 [Hz]	0.0
b054	Freq. Drop to Start Ctrl. Decel	0.00 to 10.00 [Hz]	0.00	0.00 to 100.00 [Hz]	0.00
b082	Starting Frequency	0.10 to 9.99 [Hz]	0.50	0.10 to 100.00 [Hz]	0.50
b083	Carrier Frequency	2.0 to 15.0 [kHz]	10.0	2.0 to 10.0 [kHz]	5.0
b112	Free V/f Frequency 7	Free V/f Frequency 6 to 400 [Hz]	0.	Free V/f Frequency 6 to 1,000 [Hz]	0.
C027	MP Selection	00: Output frequency 01: Output current 02: Output torque 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: Do not use this setting. 15: Pulse train input monitor 16: Optional board	07	00: Output frequency 01: Output current 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: Do not use this setting. 15: Pulse train input monitor 16: Optional board	07

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Functions

Parameter No.	Function name	Normal Mode with a Heavy Load Rating (CT)		High-frequency Mode	
		Setting range	Default	Setting range	Default
C028	AM Selection	00: Output frequency 01: Output current 02: Output torque 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 11: Output torque (signed) 13: Do not use this setting. 16: Optional board	07	00: Output frequency 01: Output current 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 13: Do not use this setting. 16: Optional board	07
C042	Arrival Frequency During Acceleration	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
C043	Arrival Frequency During Deceleration	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
C045	Arrival Frequency During Acceleration 2	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
C046	Arrival Frequency During Deceleration 2	0.00 to 400.00 [Hz]	0.00	0.00 to 1,000.00 [Hz]	0.00
P015	Creep Speed Setting	Starting Frequency to 10.00 [Hz]	5.00	Starting Frequency to 100.00 [Hz]	5.00
P070	Zero Return Mode 1 Frequency	Starting Frequency to 10.00 [Hz]	5.00	Starting Frequency to 100.00 [Hz]	5.00

* Shaded cells are the same as those for Normal Mode (heavy load rating).

The following parameters are not displayed in High-frequency Mode.

Parameter No.	Function name
d009	Torque Reference Monitor
d010	Torque Bias Monitor
d012	Output Torque Monitor
A097	Acceleration Pattern Selection
A098	Deceleration Pattern Selection
A131	Acceleration Curve Parameter (S, U, reverse U)
A132	Deceleration Curve Parameter (S, U, reverse U)
A150	EL-S Shape Acceleration Curve Ratio 1
A151	EL-S Shape Acceleration Curve Ratio 2
A152	EL-S Shape Deceleration Curve Ratio 1
A153	EL-S Shape Deceleration Curve Ratio 2
b040	Torque Limit Selection
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)
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)
b045	Torque LADSTOP Selection
b046	Reverse Rotation Prevention Selection
b049	Heavy Load/Light Load Selection
b089	Automatic Carrier Reduction
C054	Overtorque/Undertorque Selection
C055	Overtorque/Undertorque Level (Forward Power Running)
C056	Overtorque/Undertorque Level (Reverse Regeneration)
C057	Overtorque/Undertorque Level (Reverse Power Running)
C058	Overtorque/Undertorque Level (Forward Regeneration)
C059	Overtorque/Undertorque Signal Output Mode Selection
H001	Auto-tuning Selection
H002	Motor Parameter 1
H202	Motor Parameter 2
H005	Speed Response 1
H205	Speed Response 2
H020	Motor 1 Parameter R1
H220	Motor 2 Parameter R1
H021	Motor 1 Parameter R2
H221	Motor 2 Parameter R2
H022	Motor 1 Parameter L

Parameter No.	Function name
H222	Motor 2 Parameter L
H023	Motor 1 Parameter Io
H223	Motor 2 Parameter Io
H024	Motor 1 Parameter J
H224	Motor 2 Parameter J
H030	Motor 1 Parameter R1 (Auto-tuning Data)
H230	Motor 2 Parameter R1 (Auto-tuning Data)
H031	Motor 1 Parameter R2 (Auto-tuning Data)
H231	Motor 2 Parameter R2 (Auto-tuning Data)
H032	Motor 1 Parameter L (Auto-tuning Data)
H232	Motor 2 Parameter L (Auto-tuning Data)
H033	Motor 1 Parameter Io (Auto-tuning Data)
H233	Motor 2 Parameter Io (Auto-tuning Data)
H034	Motor 1 Parameter J (Auto-tuning Data)
H234	Motor 2 Parameter J (Auto-tuning Data)
P033	Torque Reference Input Selection
P034	Torque Reference Setting
P036	Torque Bias Mode
P037	Torque Bias Value
P038	Torque Bias Polarity Selection
P039	Speed Limit Value in Torque Control (Forward)
P040	Speed Limit Value in Torque Control (Reverse)
P041	Speed/Torque Control Switching Time

Multi-function Input Selections (C001, C002, C003, C004, C005, C006, and C007)

In High-speed Mode, functions cannot be selected for the multi-function input terminals listed in the following table.

Setting		Function name
40	TL	Torque limit enabled/disabled
41	TRQ1	Torque limit switching 1
42	TRQ2	Torque limit switching 2
52	ATR	Torque reference input permission

Multi-function Output and Multi-function Relay Output Function Selections (C021, C022, and C026)

In High-speed Mode, functions cannot be selected for the multi-function output and relay output terminals listed in the following table.

Setting		Function name
7	OTQ	Overtorque/undertorque
10	TRQ	During torque limit

6

Communication Function

Describes the connection and setting methods for implementing Modbus communication with external network control equipment, as well as each function required in this communication. The method of Co-inverter communication is also described.

6

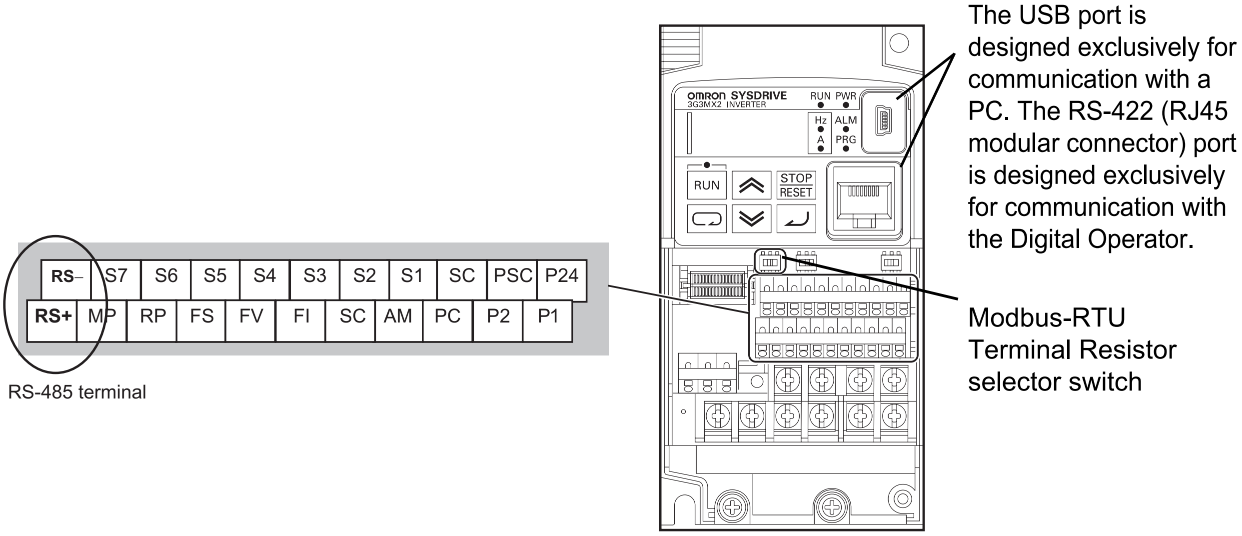
6-1 Communication Specifications

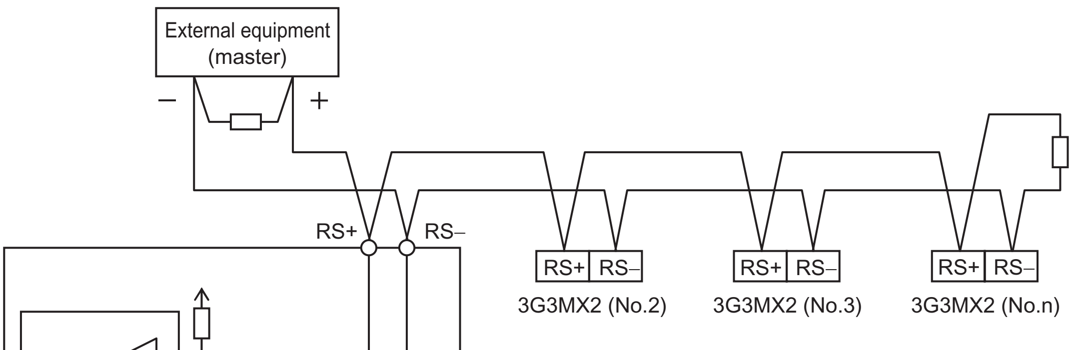
The 3G3MX2 Series Inverter comes standard with a RS-485 Modbus communication (Modbus-RTU) port to enable communication with external network control equipment. The communication specifications are specified below. The Modbus communications function of the Inverter cannot be used if an optional board that provides communications functions is mounted.

Function name	Description	Note
Protocol	Modbus communication (Modbus-RTU) (Slave)	
Transfer Speed	2400, 4800, 9600, 19.2 k, 38.4 k, 57.6 k, 76.8 k, 115.2 kbps	Selected/set by a parameter.
Synchronous System	Asynchronous system	
Transfer Code	Binary	
Transmission Mode	LSB first (Sent sequentially from the least significant bit.)	
Complying Interface	RS-485	
Data Bit Length	8 bits	
Parity	No parity/Even/Odd	Selected/set by a parameter.
Stop Bit Length	1 bit or 2 bits	Selected/set by a parameter.
Startup Method	One-side start using host command	–
Wait Time	Silent interval + 0 to 1,000 [ms]	Selected/set by a parameter.
Connection	1: N (N = Max. 247) (Up to 32 units can be connected without repeater.)	Selected/set by a parameter.
Error Check	Overrun/Framing/CRC-16/Horizontal parity	
Communication length	500 m	

6-2 RS-485 Port Specifications and Connection

Each communication connector pin is shown below.





Note. If communication is unstable, install on both ends of the communication cable a Terminal Resistor matching the characteristic impedance of the cable.
The built-in Terminal Resistor inside the Inverter is 200 Ω.

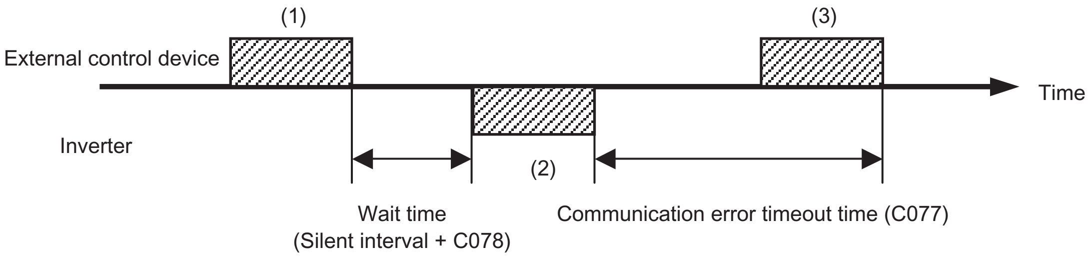
6-3 List of Modbus Communication (Modbus-RTU) Parameters

Set the following parameters according to the communication specifications.
As for C071, C074 and C075, modified data are not reflected until the power is reconnected or a reset is performed. To perform a reset, turn the reset terminal (18: RS) OFF, ON and then OFF again.

Parameter No.	Function name	Data	Default setting	Unit
A001	Frequency Reference Selection 1	03: Modbus communication (Modbus-RTU)	02	–
A002	RUN Command Selection 1	03: Modbus communication (Modbus-RTU)	02	–
C071	Communication Speed Selection	03: 2,400 bps	05	–
		04: 4,800 bps		
		05: 9,600 bps		
		06: 19.2 kbps		
		07: 38.4 kbps		
		08: 57.6 kbps		
		09: 76.8 kbps		
		10: 115.2 kbps		
C072	Communication Station No. Selection	1. to 247.	1.	–
C074	Communication Parity Selection	00: No parity	00	–
		01: Even		
		02: Odd		
C075	Communication Stop Bit Selection	1: 1 bit	1	–
		2: 2 bits		
C076	Operation Selection on Communication Error	00: Trip	02	–
		01: Trip after deceleration stop		
		02: Ignore		
		03: Free run		
		04: Deceleration stop		
C077	Communications Error Timeout Time	0.00: Timeout disabled	0.00	s
		0.01 to 99.99		
C078	Communication Wait Time	0. to 1000.	0.	ms

6-4 Modbus Communication (Modbus-RTU) Protocol

Follow the procedures below in regards to communication between the external control device and the Inverter.



(1) Frame to be sent from the external control device to the Inverter (Query)

(2) Frame to be returned from the Inverter to the external control device (Response)

(3) Unless the Inverter completes reception of a query from the host within the time set in C077 after the Inverter completes a response (response transmission), the Inverter becomes ready to receive the first data again. In this case, the Inverter sends no response. Also, the Inverter's operation conforms to the setting of Operation Selection on Communication Error (C076). For details, refer to Chapter 4. "Parameter List".
The receiving timeout monitor will be started after the first transmission/reception is performed after power-on or reset. Timeout will not occur until reception or transmission is performed.

Response from the Inverter (Frame (2)) will be output as return after the Inverter receives the query (Frame (1)), not output independently.
The silent interval corresponds to 3.5 characters.
Below is each frame format (command).

Message Structure

A command message sent from the master to a slave is called "Query," while a response message sent from the slave is called "Response". The query and response transmission formats are specified below.

Query	Response
Slave address	Slave address for confirmation
Parameter No.	Parameter No. for confirmation
Query data	Response data
Error check (CRC-16)	Error check (CRC-16)

Slave address

Pre-set numbers ranging from 1 to 247 in each Inverter (slave). (Only the Inverter having the same slave address as the query will take the corresponding query.)

Broadcasting can be performed by setting the slave address to zero.
A broadcast message is received by all slaves, but the slaves do not return a response.

Data read or loop-back cannot be performed while broadcasting.
Although slave addresses 1 to 247 are used under the Modbus specification, the master can use any of slave addresses 250 to 254 to broadcast to each group. (The slaves do not return a response.)
Note that this function is effective only with write commands (05h, 06h, 0Fh and 10h).

Slave address	Recipient
250 (FAh)	Broadcast it to slave addresses 01 to 09.
251 (FBh)	Broadcast it to slave addresses 10 to 19.
252 (FCh)	Broadcast it to slave addresses 20 to 29.
253 (FDh)	Broadcast it to slave addresses 30 to 39.
254 (FEh)	Broadcast it to slave addresses 40 to 247.

Parameter No.

Use a Parameter No. to specify the function to be executed by the Inverter.
Supported Parameter Nos. are shown below.

Parameter No.

Parameter No.	Function	Maximum number of data bytes in 1 message	Maximum data number in 1 message
01h	Read the status of a coil	4	32 coils (in bit)
03h	Read the content of a holding register	32	16 registers (in byte)
05h	Write into a coil	2	1 coil (in bit)
06h	Write into a holding register	2	1 register (in byte)
08h	Loop-back test	–	–
0Fh	Write into multiple coils	4	32 coils (in bit)
10h	Write into multiple registers	32	16 registers (in byte)
17h	Read from or write into multiple holding resisters	32/32	16/16 registers (in byte)

Data

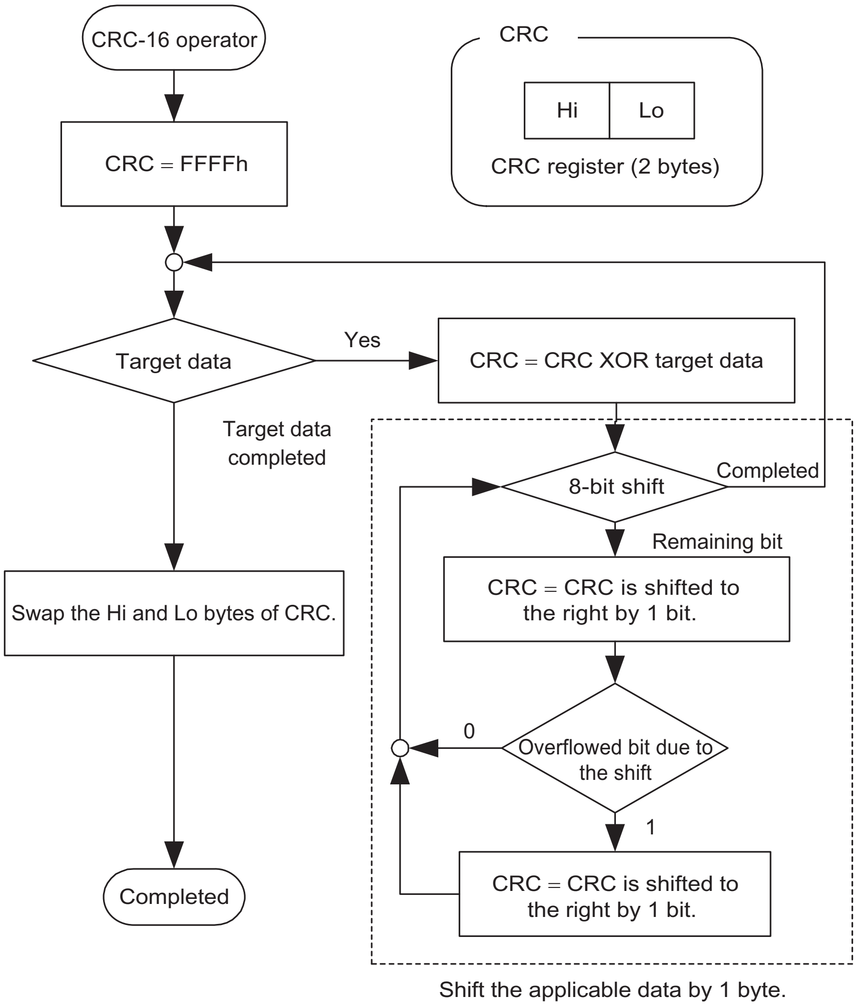
Send data relating to a Parameter No.
The data transmission format varies depending on the Parameter No.
The 3G3MX2 Series supports the data types specified below, among the types used in Modbus communication (Modbus-RTU).

Data name	Description
Coil	Binary data (1 bit) that can be read or written
Holding register	16-bit data that can be read or written

Error Check

CRC (Cyclic Redundancy Check) is used for the Modbus communication (Modbus-RTU) error check.
The CRC code is a 16-bit data generated against the block of random length data in the 8-bit unit. Generation of CRC codes uses the generation polynomial "CRC-16 ($X^{16} + X^{15} + X^2 + 1$)".

<CRC-16 Calculation Example>



Total Communication Time

The time from receiving query to the response by the Inverter will be the total of <the silent interval (3.5-character length) and C078 (communication wait time) setting>.
If sending another query to the Inverter after receiving the response, be sure to provide the silent interval length (3.5 characters) at the minimum.

Normal Response

If the Parameter No. in the query indicates a loop-back (08h), writing to a coil(s) (05h/0Fh) or writing to a holding register(s) (06h/10h), the Inverter returns a response whose content is the same as the query.
If the Parameter No. in the query indicates reading from a coil (01h) or reading from a holding register (03h), a response is returned whose slave address and Parameter No. are the same as the query and to which data has been added.
Refer to the format for each query specified below.

Abnormal Response

Response

Slave address
Parameter No.
Exceptional code
Error check (CRC-16)

If an error (aside from a communication error) is found in the query content, the Inverter returns exceptional responses without performing any operation.
To determine the cause of an error, check the Parameter No. of the response. The Parameter No. of the exceptional response will be the value of the query Parameter No. to which 80h is added.
Check the details of the error with the exceptional code.

Exceptional code

Code	Description
01h	Specified an unsupported function.
02h	Specified address does not exist.
03h	Specified data has an unacceptable format.
21h	Data is out of the Inverter's range for writing but for the holding register.
22h	The Inverter does not allow this function. • Has attempted to change the register that cannot be changed during operation. • Has issued the enter command during operation (UV*). • Has written into the register during trip (UV*). • Has written into a soft-locked register. • Has attempted to change an I/O terminal that cannot be changed. • Has attempted to change the contact type of the RS (reset) allocation terminal. • Has attempted to write into a register when auto-tuning was enabled. • Has attempted to write into a locked register while a password was set. Etc.
23h	Has written into the read-only register (coil).

* UV: During undervoltage

No Response

The Inverter ignores the query and does not respond if:
- Has received a broadcast command (query of address 0).
- A communication error is detected in receiving a query.
- The query slave address is different from the slave address set for the Inverter.
- The time interval between 2 pieces of data that configure the message is less than a 3.5-character length.
- Query data length is inappropriate.
- The reception interval in a frame exceeds the 1.5-character length.
- The error check code in the query does not match (CRC error).
- Has received a broadcast command for each group (query of address 250 to 254).

- If the timer is set in the master to monitor response, but no response is returned within the set time, send the same query again.

6-5 Explanation of Each Parameter No.

Coil Status Read [01h]

Reads out the coil status (ON/OFF).

Example) Read multi-function input terminals S1 to S7/EB of the Inverter whose slave address is "1".

Refer to the following table for the multi-function input statuses.

Function name	Data						
Coil No.	0007h	0008h	0009h	000Ah	000Bh	000Ch	000Dh
Multi-function Input Terminals	S1	S2	S3/GS1	S4/GS2	S5/TH	S6	S7/EB
Coil Status	ON	OFF	ON	OFF	OFF	OFF	ON

Query:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	01
3	Coil start address (MSB)*2	00
4	Coil start address (LSB)*2	06
5	Number of coils (MSB)	00
6	Number of coils (LSB)	07
7	CRC-16 (LSB)	9D
8	CRC-16 (LSB)	C9

(Coil address) = (Coil number) – 1

Response:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	01
3	Number of data bytes	01
4	Coil data*3	45
7	CRC-16 (MSB)	90
8	CRC-16 (LSB)	7B

Input terminal S7/EB

Input terminal S1

→ 45h = 0100 0101

*1. Broadcasting cannot be performed.

*2. Note that the coil start address is "0006", which is smaller by 1 than the coil number "0007". The coil number less 1 corresponds to the coil address.

*3. Transfers the byte length data. The most significant byte (data received first) indicates the younger coil address.

The data received as the response shows the statuses of coils 0007h to 000Dh. The received data "45h = 0100 0101b" is read as shown in the preceding page, where the status of coil 0007h represents the LSB.
If the reading coil exceeds the defined coil range in the final coil data, such coil data is regarded as "0" and returned.
Refer to "Exceptional Response" on page 6-18 if the coil status read command was unsuccessful.

Example) If the statuses of 16 coils are read from Coil No. 0001h, the data sequence will be as follows:

	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Data 1	0008h	0007h	0006h	0005h	0004h	0003h	0002h	0001h
Data 2	0010h	000Fh	000Eh	000Dh	000Ch	000Bh	000Ah	0009h

Reading the Holding Register Content [03h]

Reads the specified number of consecutive holding register contents from the specified holding register addresses.

Example) Read the latest trip information (0012h to 0017h) from the Inverter whose slave address is "1".

Query:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	03
3	Register start address (MSB)*3	00
4	Register start address (LSB)*3	11
5	Number of holding registers (MSB)	00
6	Number of holding registers (LSB)	06
7	CRC-16 (MSB)	95
8	CRC-16 (LSB)	CD

(Register address) = (Register number) – 1

6 registers

Response:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	03
3	Number of data bytes*2	0C
4	Register data 1 (MSB)	00
5	Register data 1 (LSB)	03
6	Register data 2 (MSB)	00
7	Register data 2 (LSB)	04
8	Register data 3 (MSB)	00
9	Register data 3 (LSB)	00
10	Register data 4 (MSB)	04
11	Register data 4 (LSB)	D2
12	Register data 5 (MSB)	00
13	Register data 5 (LSB)	1E
14	Register data 6 (MSB)	01
15	Register data 6 (LSB)	1C
16	CRC-16 (MSB)	77
17	CRC-16 (LSB)	3D

0003h → 03d → E03 (Cause: Overcurrent)

0004h → 4 (Inverter status: Accelerating)

0000 04D2h → 1234d → 12.34 [Hz] (Frequency)

001Eh → 30d → 3.0 [A] (Current)

011Ch → 284d → 284 [V] (DC)

"d": Decimal

"h": Hexadecimal

*1. Broadcasting cannot be performed.

*2. Data is transferred by the number of data bytes. In this example, 12 (0Ch) bytes are used since 6 pieces of holding register data are returned.

*3. Note that the holding register start address is "0011h", which is smaller by 1 than the register number "0012h". The register number less 1 corresponds to the register address.

Writing Into the Coil [05h]

Writes into 1 coil. The following table shows the coil status change.

Data	Coil status	
	OFF→ON	ON→OFF
Written data (MSB)	FFh	00h
Written data (LSB)	00h	00h

Example) Issue a RUN command to the Inverter whose slave address is "1".

The RUN command selection must be set to Communication (A002 = 03).
The coil number of the RUN command is "0001".

Query:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	05
3	Coil address (MSB)*2	00
4	Coil address (LSB)*2	00
5	Written data (MSB)	FF
6	Written data (LSB)	00
7	CRC-16 (MSB)	8C
8	CRC-16 (LSB)	3A

(Coil address) = (Coil number) – 1

OFF → ON: FF00h

Response:

No.	Field name	Example (Hex)
1	Slave address	01
2	Parameter No.	05
3	Coil address (MSB)*2	00
4	Coil address (LSB)*2	00
5	Written data (MSB)	FF
6	Written data (LSB)	00
7	CRC-16 (MSB)	8C
8	CRC-16 (LSB)	3A

*1. There is no response for broadcasting.

*2. Note that the coil start address is "0000", which is smaller by 1 than the coil number "0001". The coil number less 1 corresponds to the coil address.

Refer to "Exceptional Response" on page 6-18 if writing into the coil cannot be performed normally.

Writing Into the Holding Register [06h]

Writes data into the specified holding register.

Example) Write "50.00 Hz" into Output Frequency Setting (F001 = A020) of the Inverter whose slave address is "1".

Since the holding register for output frequency setting has a data resolution of 0.01 Hz, the data to be written should be "5000 (1388h)" when setting 50.00 Hz.

Query:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	06
3	Register address (MSB)*2,*3	00
4	Register address (LSB)*2,*3	01
5	Written data (MSB)	13
6	Written data (LSB)	88
7	CRC-16 (MSB)	D5
8	CRC-16 (LSB)	5C

(Register address) = (Register number) – 1

1388h → 5000d → 50.00 Hz

Response:

No.	Field name	Example (Hex)
1	Slave address	01
2	Parameter No.	06
3	Register address (MSB)*2	00
4	Register address (LSB)*2	01
5	Written data (MSB)	13
6	Written data (LSB)	88
7	CRC-16 (MSB)	D5
8	CRC-16 (LSB)	5C

*1. There is no response for broadcasting.

*2. Although the Frequency Reference (F001) normally uses two registers (0001h and 0002h), 50.00 Hz (5000) is covered by the range of the LSB register, therefore, the data is written to only one register in the above sample. When setting a frequency exceeding 655.35 Hz, write it into two registers simultaneously using a multiple holding register write command (10h).

*3. Note that the holding register start address in F001 (LOW) is "0001h", which is smaller by 1 than the register number "0002h". The register number less 1 corresponds to the register address.

Note that if any parameter other than F001 is rewritten while the data is displayed, the displayed data does not change in real time. Return to the parameter display and show the data gain, and the value reflecting the change will be displayed.
Refer to "Exceptional Response" on page 6-18 if the writing into the holding register cannot be performed normally.

Loop-back Test [08h]

Used to check the communications between master and slave. A random value can be used for test data.

Example) Loopback test to the Inverter whose slave address is "1".

Query:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Random
6	Data (LSB)	Random
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

Response:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Random
6	Data (LSB)	Random
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

*1. Broadcasting cannot be performed.

As for test sub code, only those relating to echo-back of query data (00h, 00h) are supported. Other commands are not supported.

Writing Into Multiple Coils [0Fh]

Rewrites consecutive multiple coils.

Example) Change the statuses of multi-function input terminals S1 to S7/EB of the Inverter with the slave address "1".

Change multi-function input terminals S1 to S7/EB to the statuses shown in the table below.

Function name	Data						
Coil No.	0007h	0008h	0009h	000Ah	000Bh	000Ch	000Dh
Multi-function input terminals	S1	S2	S3/GS1	S4/GS2	S5/TH	S6	S7/EB
Terminal status	ON	ON	ON	OFF	ON	OFF	OFF

Query:

No.	Field name	Example (Hex)
1	Slave address[*1]	01
2	Parameter No.	0F
3	Coil start address (MSB)[*2]	00
4	Coil start address (LSB)[*2]	06
5	Number of coils (MSB)	00
6	Number of coils (LSB)	07
7	Number of bytes	02
8	Change data (MSB)	17
9	Change data (LSB)	00
10	CRC-16 (MSB)	06
	CRC-16 (LSB)	98

(Coil address) = (Coil number) – 1

17h = 0001 0111

Input terminal S1

Input terminal S7/EB

Response:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	0F
3	Coil start address (MSB)*2	00
4	Coil start address (LSB)*2	06
5	Number of coils (MSB)	00
6	Number of coils (LSB)	07
7	CRC-16 (MSB)	F4
8	CRC-16 (LSB)	08

*1. There is no response for broadcasting.

*2. 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.

*3. Note that the coil start address is "0006", which is smaller by 1 than the coil number "0007". The coil number less 1 corresponds to the coil address.

A multi-function input is recognized as ON when the status of either the terminal block input or communication setting becomes ON.
As for Multi-function Input Monitor (d005), only the terminal block input is monitored.

Refer to "Exceptional Response" on page 6-18 if writing into multiple coils cannot be performed normally.

Writing Into Multiple Holding Register [10h]

Writes into consecutive multiple registers.

Example) Set Acceleration Time Setting 1 (F002) to "10 s" for the Inverter whose slave address is "1".

Since holding registers "1103h and 1104h" used for Acceleration Time Setting 1 (F002) have a data resolution of 0.01 s, the data to be written should be "1000 (0000 03E8h)" when setting 10 s.

Query:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	10
3	Register start address (MSB)*2	11
4	Register start address (LSB)*2	02
5	Number of registers (MSB)	00
6	Number of registers (LSB)	02
7	Number of bytes*3	04
8	Written data 1 (MSB)	00
9	Written data 1 (LSB)	00
10	Written data 2 (MSB)	03
11	Written data 2 (LSB)	E8
12	CRC-16 (MSB)	B2
13	CRC-16 (LSB)	98

(Register address) = (Register number) – 1

0000 03E8h → 1000d → 10.00 s

Response:

No.	Field name	Example (Hex)
1	Slave address*1	01
2	Parameter No.	10
3	Register start address (MSB)*2	11
4	Register start address (LSB)*2	02
5	Number of registers (MSB)	00
6	Number of registers (LSB)	02
7	CRC-16 (MSB)	E5
8	CRC-16 (LSB)	34

*1. There is no response for broadcasting.

*2. Note that the holding register start address is "1102h", which is smaller by 1 than the register number "1103h". The register number less 1 corresponds to the register address.

*3. Specifies the number of actual bytes to change to, not the number of holding registers.

Refer to "Exceptional Response" on page 6-18 if the writing into the multiple registers cannot be performed normally.

6

Communication Function

Multiple Holding Register Read or Write [17h]

Writes into or reads from consecutive multiple registers.

Example) Write 50,00 Hz into Output Frequency Setting (F001) of the Inverter with Slave Address "1," and Read Output Frequency Monitor Value (d001).

Query:

No.	Field name	Example (Hex)	
1	Slave address	01	
2	Parameter No.	17	
3	Read register start address (MSB)*1	10	(Register address) = (Register number) − 1
4	Read register start address (LSB)*1	00	
5	Number of read registers (MSB)	00	
6	Number of read registers (LSB)	02	
7	Write register start address (MSB)*1	00	(Register address) = (Register number) −1
8	Write register start address (LSB)*1	00	
9	Number of write registers (MSB)	00	
10	Number of write registers (LSB)	02	
11	Number of written data bytes n	04	
12	Written data 1 (MSB)	00	0000 1388h → 5000d → 50.00 Hz
13	Written data 1 (LSB)	00	
14	Written data 2 (MSB)	13	
15	Written data 2 (LSB)	88	
16	CRC-16 (MSB)	F4	
17	CRC-16 (LSB)	86	

Response:

No.	Field name	Example (Hex)	
1	Slave address	01	
2	Parameter No.	17	
3	Number of read data bytes n	04	
4	Read data 1 (MSB)	00	0000 1388h → 5000d → 50.00 Hz
5	Read data 1 (LSB)	00	
6	Read data 2 (MSB)	13	
7	Read data 2 (LSB)	88	
8	CRC-16 (MSB)	F4	
9	CRC-16 (LSB)	71	

*1. Note that the holding register start address is smaller by 1 than the register number. The register number less 1 corresponds to the register address.

Refer to "Exceptional Response" on page 6-18 if writing into or reading from multiple registers cannot be performed normally.

Exceptional Response

The master requests the response for a query other than broadcast or broadcast to each group. Though the Inverter should return a response corresponding with the query, it returns an exceptional response if the query has an error.

The exceptional response has the field configuration shown in the following table.

Field Configuration
Slave address
Parameter No.
Exceptional code
Error check

The detailed field configuration is shown in the table below. The Parameter No. of the exceptional response will be the value of the query Parameter No. to which 80h is added. The exceptional code shows the cause of exceptional response.

Parameter No.	
Query	Exceptional response
01h	81h
03h	83h
05h	85h
06h	86h
0Fh	8Fh
10h	90h
17h	97h

Exceptional code	Description
01h	Specified an unsupported function.
02h	Specified address does not exist.
03h	Specified data has an unacceptable format.
21h	Data is out of setting range for writing into the holding register.
22h	The Inverter does not allow this function. • Has attempted to change the register that cannot be changed during operation. • Has issued the enter command during operation (UV*). • Has written into the register during trip (UV*). • Has written into a soft-locked register. • Has attempted to change an I/O terminal that cannot be changed. • Has attempted to change the contact type of the RS (reset) allocation terminal. • Has attempted to write into a register when auto-tuning was enabled. • Has attempted to write into a locked register while a password was set.
23h	Has written into the read-only register (coil).

* UV: During undervoltage

6-6 To Save the Change to the Holding Register (Enter Command)

If a holding register write command (06h) or consecutive holding register write command (10h) is used, the new register value will become effective but it will not be stored in the Inverter's EEPROM memory. Accordingly, once the Inverter power is cut off the status will return to the one effective before the holding register was changed.
To store the change to the holding register in the Inverter's EEPROM memory, issue an Enter command according to the method specified below. When the control parameters are changed, the motor parameters must be re-calculated. In this case, also perform recalculation with the Enter command.

Issuing Method for the Enter Command

Use a Holding Register Write command (06h) to write into the holding register for Enter command (0900h). At this time, the value to be written into the holding register (0900h) is as follows.

Set value	Description
0000	Motor parameter recalculation
0001	Set value storage
0002 to FFFF	Motor parameter recalculation and set value storage

Note. If any of the following parameters is changed, the motor parameters must be recalculated. In this case, the motor parameters can be recalculated by writing 0000h or 0002h into the Enter command holding register.

Parameter List Requiring Motor Parameter Recalculation

Parameter No.	Function name	Parameter No.	Function name
A003/A203	Base Frequency	H003/H203	Motor Capacity
A004/A204	Maximum Frequency	H004/H204	Motor Pole Number
A044/A244	Control Method	H005/H205	Speed Response
A082/A282	Motor Incoming Voltage Selection	H020/H220 to H024/H224	Motor Parameters
b112	Free V/f Frequency 7	H030/H230 to H034/H234	Motor Parameters (Auto-tuning)
H002/H202	Motor Parameter		

Note 1. The Inverter returns a response to the host when it receives an Enter command, and then executes EEPROM memory write. You can check whether the data is being written by monitoring the data writing signal (coil number 0049h).

Note 2. Since the Inverter's EEPROM memory has a limit for the number of rewrites (approx. 100,000 times), the Inverter life may be shortened if Enter commands are frequently used.

Example) Issue an Enter command (storage of set value) to the Inverter whose slave address is "8".

Query:

No.	Field name	Example (Hex)
1	Slave address*1	08
2	Parameter No.	06
3	Register address (MSB)*2	08
4	Register address (LSB)*2	FF
5	Written data (MSB)	00
6	Written data (LSB)	01
7	CRC-16 (MSB)	7A
8	CRC-16 (LSB)	C3

(Register address) = (Register number) – 1

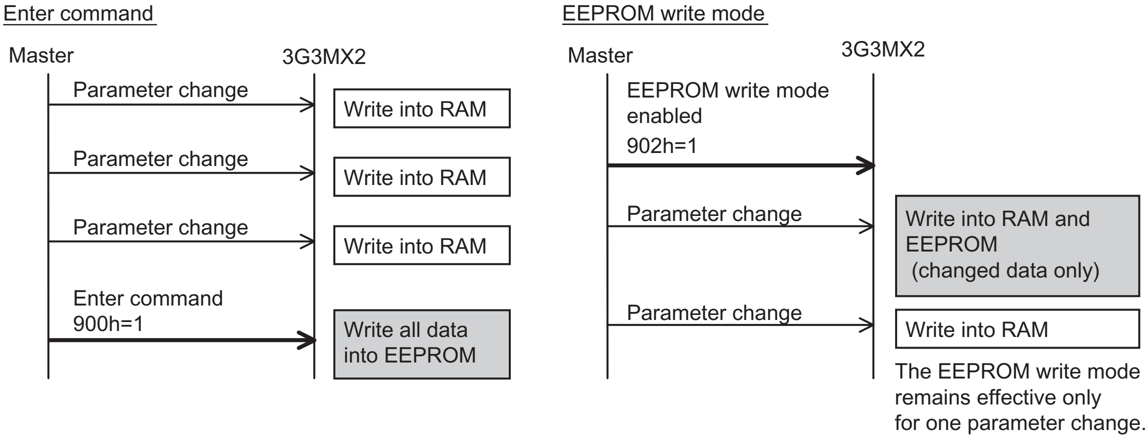
Response:

No.	Field name	Example (Hex)
1	Slave address	08
2	Parameter No.	06
3	Coil address (MSB)*2	08
4	Coil address (LSB)*2	FF
5	Written data (MSB)	00
6	Written data (LSB)	01
7	CRC-16 (MSB)	7A
8	CRC-16 (LSB)	C3

EEPROM Write Mode

- If the holding register write command (06h), etc. is used to write "1" into the holding register for EEPROM write mode (0902h), the EEPROM, the EEPROM write mode will become active.
- If data is changed using the holding register write command (06h) after switching to the EEPROM write mode, the new data is written into both the volatile memory for operation (RAM) and nonvolatile memory for storage (EEPROM). At the same time, the EEPROM write mode is cancelled.
- If any command other than the holding register write command (06h) is received after switching to the EEPROM write mode, the EEPROM write mode is cancelled.

Difference Between Enter Command and EEPROM Write Mode



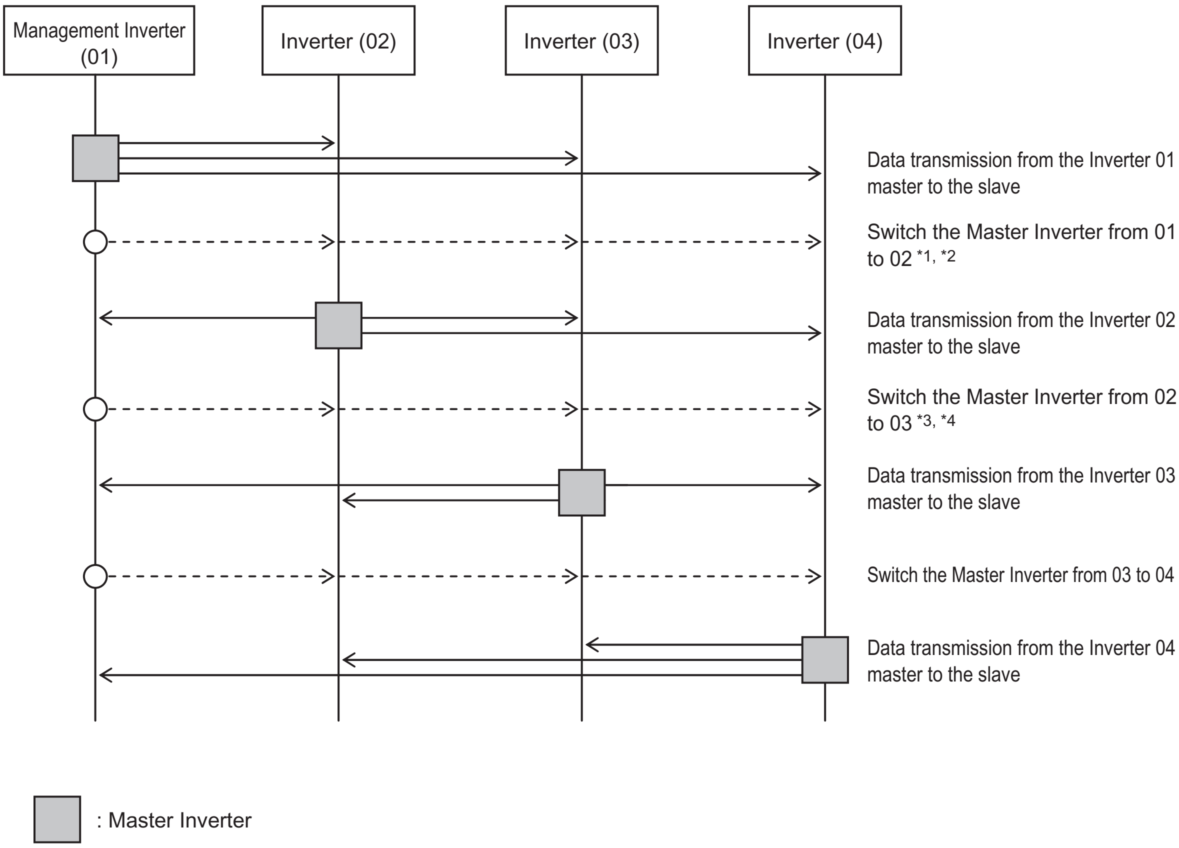
6-7 Co-Inverter Communication

The 3G3MX2 provides the Co-inverter communication function to allow for communication among multiple 3G3MX2 Inverters without using a PC, PLC or other master equipment, in addition to performing normal Modbus communication (Modbus-RTU) (slave).
In Co-inverter communication, each Inverter plays the role of "Management Inverter", "Master Inverter" or "Slave Inverter". For the Management Inverter, the Master Inverter as set by the user is specified. All other Inverters become slave Inverters. Although the Management Inverter is always fixed, the Master Inverter changes sequentially. Accordingly, the Management Inverter may be the Master Inverter or Slave Inverter. Other conditions are specified below:

- One Management Inverter is required within the network.
- Up to eight Inverters can be selected that function as the Master Inverter.
- Up to 247 Inverters (or 32 Inverters without repeater, regulated by the RS-485 network) can be connected across the network.

- Station No. 1 operates as the Management Inverter in Co-inverter communication. Accordingly, be sure to provide a Management Inverter of Station No. 1.

The Master Inverter can write data into holding registers in a given Slave Inverter. Up to five different station numbers and holding registers can be specified at a time. When one data transmission is completed between the master and slave, the Master Inverter changes sequentially and data transmission is repeated according to the details set for each Master Inverter.



*1. The Master Inverter is switched automatically by the Management Inverter.
*2. A command to switch the Master Inverter from 01 to 02 is sent after an elapse of the silent interval + Communication Wait Time (C078), following the data transmission from the Inverter 01 master to the slave.
*3. Upon receiving the data sent from the Master Inverter, the Management Inverter sends the next master switching command after an elapse of the silent interval + Communication Wait Time (C078). If the data sent from the Master Inverter could not be received within the Communication Error Timeout

Time (C077), a communication timeout occurs. At this time, the action to be performed conforms to the Operation Selection on Communication Error (C076).

*4. Be sure to set the communication timeout for the Management Inverter so that this setting is enabled (C077 = 0.01 to 99.99). When this setting is disabled (C077 = 0), Co-inverter communication will stop if the data sent from the Master Inverter cannot be received. In this case, reconnect the Management Inverter or perform a reset (by turning the RS terminal ON and then turning if OFF).

Parameter No.	Function name	Data	Default setting	Unit	Setting destination*1
C072*2	Communication Station No. Selection	1. to 247.*8	1.	–	ALL*3
C076*4	Operation Selection on Communication Error	00: Trip	02	–	ALL
		01: Trip after deceleration stop			
		02: Ignore			
		03: Free-run stop			
		04: Deceleration stop			
C077	Communications Error Timeout Time	0.00: Timeout disabled	0.00	s	ALL
		0.01 to 99.99			
C078	Communication Wait Time	0. to 1000.	0.	ms	ALL
C096*2	Communication Selection	00: Modbus communication (Modbus-RTU)	00	–	–
		01: Co-inverter communication			B
		02: Co-inverter communication (Management Inverter)			A
C098*2	Co-inverter Communication Starting Station Number	1. to 8. Setting is required only for the Management Inverter.*9	1.	–	A
C099*2	Co-inverter Communication Ending Station Number	1. to 8. Setting is required only for the Management Inverter.*9	1.	–	A
C100*2	Co-inverter Communication Start Selection	00: Starting by an input terminal*5	00	–	A
		01: Constant communication*6			A
P140	Number of Sent Data of All Stations in Co-inverter Communication	1. to 5.	5.	–	M
P141	Recipient Station Number of All Stations in Co-inverter Communication 1	1. to 247.*7	1.	–	M
P142	Recipient Register of All Stations in Co-inverter Communication 1	0000 to FFFF Hex	0000	–	M
P143	Sender Register of All Stations in Co-inverter Communication 1	0000 to FFFF Hex	0000	–	M

Parameter No.	Function name	Data	Default setting	Unit	Setting destination*1
P144	Recipient Station Number of All Stations in Co-inverter Communication 2	1. to 247.	2.	–	M
P145	Recipient Register of All Stations in Co-inverter Communication 2	0000 to FFFF Hex	0000	–	M
P146	Sender Register of All Stations in Co-inverter Communication 2	0000 to FFFF Hex	0000	–	M
P147	Recipient Station Number of All Stations in Co-inverter Communication 3	1. to 247.	3.	–	M
P148	Recipient Register of All Stations in Co-inverter Communication 3	0000 to FFFF Hex	0000	–	M
P149	Sender Register of All Stations in Co-inverter Communication 3	0000 to FFFF Hex	0000	–	M
P150	Recipient Station Number of All Stations in Co-inverter Communication 4	1. to 247.	4.	–	M
P151	Recipient Register of All Stations in Co-inverter Communication 4	0000 to FFFF Hex	0000	–	M
P152	Sender Register of All Stations in Co-inverter Communication 4	0000 to FFFF Hex	0000	–	M
P153	Recipient Station Number of All Stations in Co-inverter Communication 5	1. to 247.	5.	–	M
P154	Recipient Register of All Stations Co-inverter Communication 5	0000 to FFFF Hex	0000	–	M
P155	Sender Register of All Stations in Co-inverter Communication 5	0000 to FFFF Hex	0000	–	M
C001 to C007	Multi-function Input Selection	81: 485 (inverter communication start)	–	–	A

*1. The details of the setting destination are as follows.
ALL: Set for all connected Inverters.
A: Set only for the Management Inverter (Station No. 01).
B: Set for Inverters other than the Management Inverter (Station No. 01).
M: Set for the Inverter whose station number is specified in C098 or C099 (= Master Inverter).

*2. Even when C072 and C096 to C100 of the Management Inverter are changed, the changes will not be reflected until the power is reconnected or a reset is performed (by turning the RS terminal ON and then turning it OFF). Changes made to the same parameters of other Inverters are immediately reflected.

*3. Set 01 (C072 = 01) as the station number of the Management Inverter.

*4. If the Communication Error Selection of the Management Inverter is set to other than "Ignore" (C076 = 02), Co-inverter communication will stop once the management Inverter experiences a communication timeout. In this case, reconnect or perform a reset (by turning the RS terminal ON and then turning if OFF).

*5. If input terminal start is selected for the Co-inverter Communication Start Selection (C100 = 00), allocate 81 to one of multi-function inputs S1 to S7/EB (485: Start Co-inverter Communication).

*6. If constant communication is selected for the Co-inverter Communication Start Selection (C100 = 01), the Management Inverter starts sending data the moment the power is input. If starting of the Inverter to switch the master to is delayed and thus receiving of the master switching command fails, the Master Inverter cannot send data and consequently the Management Inverter experiences a receive timeout.
If C100 = 01 is selected, confirm starting of all other Inverters and then start the Management Inverter.

*7. Although the station number of the recipient slave is set in master-slave communication, actually this communication is performed as broadcast communication (station number: 00). Accordingly, data is sent to all stations. The data received by a slave not specified as the recipient by the master will be discarded.

*8. If multiple Master Inverters are provided, set consecutive station numbers for the Inverters. Communication cannot be performed if the numbers are discontinuous.

*9. Make sure that C098 is equal to or smaller than C099.

Co-inverter Communication Setting

- Set (C072) a station number for each of the Inverters performing Co-inverter communication by avoiding duplicate numbers. Be sure to set station number 01. The Inverter of station number 01 becomes the "Management Inverter".
- For the Management Inverter, set Communication Selection (C096) to "02: Co-inverter communication (management)". For all other Inverters, set Communication Selection (C096) "01: Co-inverter communication".
- Set the station number for Master Inverter in the Management Inverter (C098, C099).
- Set the Inverter communication starting method in the Management Inverter (C100). If "00: 485 terminal" is selected for Co-inverter Communication Start Selection (C100), allocate "81: 485 (Start Co-inverter communication)" to one of multi-function Inputs 1 to 7.
- Set in the Master Inverter the number of send data items, recipient station number, recipient register and sender register for which the Master Inverter writes into.

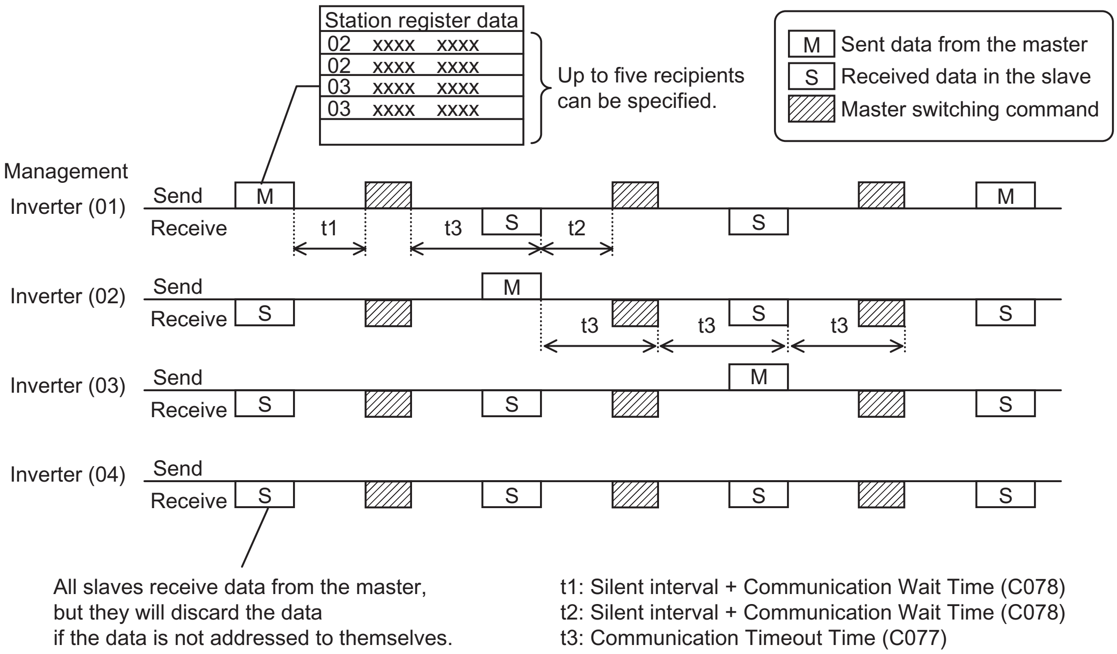
Inverter-Inverter Communication Operation

(1) The Master Inverter sends data to each slave inverter according to the items set in the Master Inverter.
(2) The Management Inverter sends a master switching command and the Master Inverter changes.
(3) The next Master Inverter sends data to each slave inverter in the same manner as in (1).
(4) (2) and (3) are repeated.

Note: Since the Inverter communication is performed in the form of broadcasting (station number: 00), all communication data are sent to all stations. Accordingly, while a slave not specified as the recipient of the Master also receives data, if the data is not addressed to that slave the data will be discarded in the slave.

Example of Inverter-Inverter Communication Sequence

Shown below is a communication sequence involving a total of four Inverters from station numbers 01 to 04, where the Master Inverter is one of 01 to 03.



- For the Management Inverter, be sure to set a value other than 0 (1 s or more is recommended) in Communication Error Timeout Time (C077). When 0 is set, the Co-inverter communication function will stop if the data sent from the Master Inverter cannot be received. If the function has stopped, reconnect the Management Inverter or perform a reset (by turning the RS terminal ON and then turning it OFF).
- The communication timeout timer starts counting when the recipient starts waiting for data. If data reception is not completed within the set time, a timeout occurs (t3 in the above figure) and the operation specified by Operation Selection on Communication Error (C076) takes place.
- If the Management Inverter is the master, the master switching command is sent after an elapse of the silent interval + Communication Wait Time (C078) following the sending of data by the Master Inverter (t1 in the figure above).
- If an Inverter other than the Management Inverter is the master, the master switching command is sent after an elapse of the silent interval + Communication Wait Time (C078) following the receiving of data from the Master Inverter (t2 in the figure above).
- If "01: Always started" is selected for Co-inverter Communication Start Selection, the Management Inverter starts sending the moment the power is turned on. Accordingly, any delay in the power-on timing of other Inverter prevents normal communication and the Management Inverter experiences a communication timeout. If "Always started" is selected, confirm starting of all other Inverters and then start the Management Inverter at the end.
- Do not set 08FFh (EEPROM write) or 0901h (EEPROM write mode selection) in the recipient register.
- If any one of C096 to C100 is changed, the change will not be reflected until the power is reconnected or a reset is performed (by turning the RS terminal ON and then turning it OFF).

6-8 List of Modbus Communication (Modbus-RTU) Data

R/W in the list shows whether the coil or holding register accepts reading and/or writing.
(R: Read-only, R/W: Can be read and/or written)

(i) Coil Number List

Coil No.	Function name	R/W	Description
0000h	Not used	–	Inaccessible
0001h	RUN Command	R/W	1: RUN 0: Stop (Enabled when A002/A202 = 03)
0002h	Rotation Direction Command	R/W	1: Reverse 0: Forward (Enabled when A002/ A202 = 03)
0003h	External Trip (EXT)	R/W	1: Trips
0004h	Trip Reset (RS)	R/W	1: Reset
0005h 0006h	Reserved	–	–
0007h	Multi-function Input 1	R/W	1: ON 0: OFF*1
0008h	Multi-function Input 2	R/W	1: ON 0: OFF*1
0009h	Multi-function Input 3	R/W	1: ON 0: OFF*1
000Ah	Multi-function Input 4	R/W	1: ON 0: OFF*1
000Bh	Multi-function Input 5	R/W	1: ON 0: OFF*1
000Ch	Multi-function Input 6	R/W	1: ON 0: OFF*1
000Dh	Multi-function Input 7	R/W	1: ON 0: OFF*1
000Eh	Reserved	–	–
000Fh	Operation Status	R	1: RUN 0: Stop (Interlocked with d003)
0010h	RUN Direction	R	1: Reverse 0: Forward (Interlocked with d003)
0011h	Inverter Ready	R	1: Ready 0: Not ready
0012h	Reserved	–	–
0013h	RUN (during RUN)	R	1: During trip 0: Normal
0014h	FA1 (constant speed reached)	R	1: ON 0: OFF
0015h	FA2 (set frequency min. reached)	R	1: ON 0: OFF

6

Communication Function

Coil No.	Function name	R/W	Description
0016h	OL (overload warning)	R	1: ON 0: OFF
0017h	OD (PID excessive deviation)	R	1: ON 0: OFF
0018h	AL (alarm output)	R	1: ON 0: OFF
0019h	FA3 (set frequency only)	R	1: ON 0: OFF
001Ah	OTQ (overtorque/undertorque)	R	1: ON 0: OFF
001Bh	Reserved	–	–
001Ch	UV (signal during undervoltage)	R	1: ON 0: OFF
001Dh	TRQ (during torque limit)	R	1: ON 0: OFF
001Eh	RNT (RUN time over)	R	1: ON 0: OFF
001Fh	ONT (Power ON time over)	R	1: ON 0: OFF
0020h	THM (thermal warning)	R	1: ON 0: OFF
0021h 0022h 0023h 0024h 0025h	Reserved	–	–
0026h	BRK (brake release)	R	1: ON 0: OFF
0027h	BER (brake error)	R	1: ON 0: OFF
0028h	ZS (0Hz)	R	1: ON 0: OFF
0029h	DSE (excessive speed deviation)	R	1: ON 0: OFF
002Ah	POK (position ready)	R	1: ON 0: OFF
002Bh	FA4 (Set frequency min. reached 2)	R	1: ON 0: OFF
002Ch	FA5 (Set frequency only 2)	R	1: ON 0: OFF
002Dh	OL2 (overload warning 2)	R	1: ON 0: OFF
002Eh	FVdc (analog FV disconnection detection)	R	1: ON 0: OFF
002Fh	FIdc (analog FI disconnection detection)	R	1: ON 0: OFF
0030h 0031h	Reserved	–	–

Coil No.	Function name	R/W	Description
0032h	FBV (FB status output)	R	1: ON 0: OFF
0033h	NDc (communication disconnection detection)	R	1: ON 0: OFF
0034h	LOG1 (logic operation output 1)	R	1: ON 0: OFF
0035h	LOG2 (logic operation output 2)	R	1: ON 0: OFF
0036h	LOG3 (logic operation output 3)	R	1: ON 0: OFF
0037h	Reserved	–	–
0038h			
0039h			
003Ah	WAC (capacitor life warning)	R	1: ON 0: OFF
003Bh	WAF (cooling fan life warning)	R	1: ON 0: OFF
003Ch	FR (starting contact signal)	R	1: ON 0: OFF
003Dh	OHF (fin overheat warning)	R	1: ON 0: OFF
003Eh	LOC (low current signal)	R	1: ON 0: OFF
003Fh	Reserved	–	–
0040h			
0041h			
0042h			
0043h			
0044h			
0045h	IRDY (operation ready)	R	1: ON 0: OFF
0046h	FWR (during forward operation)	R	1: ON 0: OFF
0047h	RVR (during reverse operation)	R	1: ON 0: OFF
0048h	MJA (fatal fault signal)	R	1: ON 0: OFF
0049h	Data being written	R	1: Being written 0: Normal
004Ah	CRC error	R	1: Error 0: No error*2
004Bh	Overrun error	R	1: Error 0: No error*2
004Ch	Framing error	R	1: Error 0: No error*2
004Dh	Parity error	R	1: Error 0: No error*2

Coil No.	Function name	R/W	Description
004Eh	Checksum error	R	1: Error 0: No error*2
004Fh	Reserved	–	–
0050h	WCFV (window comparator FV)	R	1: ON 0: OFF
0051h	WCFI (window comparator FI)	R	1: ON 0: OFF
0052h	Reserved	–	–
0053h			
0054h	FREF (Frequency Reference Operator)	R	1: Digital Operator 0: Other than Digital Operator
0055h	REF (RUN Command Operator)	R	1: Digital Operator 0: Other than Digital Operator
0056h	SETM (Motor 2 Selected)	R	1: Motor 2 control selected 0: Motor 1 control selected
0057h	Reserved	–	–
0058h			
0059h to 005Ah	Not used	–	Inaccessible

*1. The input terminal can be turned ON/OFF via Modbus communication (Modbus-RTU). The Inverter recognizes an ON status if the input terminal is ON due to communication or the input signal at the control circuit terminal block is ON.

*2. The communications error is retained until a fault reset is input. (Can be reset during operation.)

(ii) Holding Register Number List (Frequency Reference and Fault Monitor)

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution
0000h	Reserved	–	–	–	–
0001h	Output Frequency Setting	F001 (HIGH)	R/W	0 to maximum frequency (Enabled when A001 = 03)	0.01 [Hz]
0002h		F001 (LOW)	R/W		
0003h	Inverter Status A	–	R	0: Initial status 2: Stop 3: RUN 4: Free-run stop 5: Jogging 6: DC injection braking 7: Restart 8: Trips 9: During UV	–
0004h	Inverter Status B	–	R	0: During stop 1: During RUN 2: During trip	–
0005h	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	–
0006h	PID Feedback	–	R/W	0 to 10000	0.01 [%]
0007h to 0010h	Reserved	–	–	–	–
0011h	Fault Counter	d080	R	0 to 65530	1 [time]
0012h	Fault Monitor 1: Cause	d081	R	Refer to "Inverter Fault Factor List" on page 6-35.	–
0013h	Fault Monitor 1: Inverter Status			Refer to "Inverter Fault Factor List" on page 6-35.	–
0014h	Fault Monitor 1: Frequency (HIGH)			0 to 100000	0.01 [Hz]
0015h	Fault Monitor 1: Frequency (LOW)				
0016h	Fault Monitor 1: Current			Output current value at the time of tripping	0.01 [A]
0017h	Fault Monitor 1: Voltage			DC input voltage at the time of tripping	0.1 [V]
0018h	Fault Monitor 1: RUN Time (HIGH)			Total RUN time at the time of tripping	1 [h]
0019h	Fault Monitor 1: RUN Time (LOW)				

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution
001Ah	Fault Monitor 1: ON Time (HIGH)	d081	R	Power ON time at the time of tripping	1 [h]
001Bh	Fault Monitor 1: ON Time (LOW)				
001Ch	Fault Monitor 2: Cause	d082	R	Refer to "Inverter Fault Factor List" on page 6-35.	–
001Dh	Fault Monitor 2: Inverter Status			Refer to "Inverter Fault Factor List" on page 6-35.	–
001Eh	Fault Monitor 2: Frequency (HIGH)			0 to 100000	0.01 [Hz]
001Fh	Fault Monitor 2: Frequency (LOW)				
0020h	Fault Monitor 2: Current			Output current value at the time of tripping	0.01[A]
0021h	Fault Monitor 2: Voltage			DC input voltage at the time of tripping	0.1 [V]
0022h	Fault Monitor 2: RUN Time (HIGH)			Total RUN time at the time of tripping	1 [h]
0023h	Fault Monitor 2: RUN Time (LOW)				
0024h	Fault Monitor 2: ON Time (HIGH)			Power ON time at the time of tripping	1 [h]
0025h	Fault Monitor 2: ON Time (LOW)				
0026h	Fault Monitor 3: Cause	d083	R	Refer to "Inverter Fault Factor List" on page 6-35.	–
0027h	Fault Monitor 3: Inverter Status			Refer to "Inverter Fault Factor List" on page 6-35.	–
0028h	Fault Monitor 3: Frequency (HIGH)			0 to 100000	0.01 [Hz]
0029h	Fault Monitor 3: Frequency (LOW)				
002Ah	Fault Monitor 3: Current			Output current value at the time of tripping	0.01 [A]
002Bh	Fault Monitor 3: Voltage			DC input voltage at the time of tripping	0.1 [V]
002Ch	Fault Monitor 3: RUN Time (HIGH)			Total RUN time at the time of tripping	1 [h]
002Dh	Fault Monitor 3: RUN Time (LOW)				
002Eh	Fault Monitor 3: ON Time (HIGH)			Power ON time at the time of tripping	1 [h]
002Fh	Fault Monitor 3: ON Time (LOW)				

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution
0030h	Fault Monitor 4: Cause	d084	R	Refer to "Inverter Fault Factor List" on page 6-35.	–
0031h	Fault Monitor 4: Inverter Status			Refer to "Inverter Fault Factor List" on page 6-35.	–
0032h	Fault Monitor 4: Frequency (HIGH)			0 to 100000	0.01 [Hz]
0033h	Fault Monitor 4: Frequency (LOW)				
0034h	Fault Monitor 4: Current	d084	R	Output current value at the time of tripping	0.01 [A]
0035h	Fault Monitor 4: Voltage			DC input voltage at the time of tripping	0.1 [V]
0036h	Fault Monitor 4: RUN Time (HIGH)			Total RUN time at the time of tripping	1 [h]
0037h	Fault Monitor 4: RUN Time (LOW)				
0038h	Fault Monitor 4: ON Time (HIGH)			Power ON time at the time of tripping	1 [h]
0039h	Fault Monitor 4: ON Time (LOW)				
003Ah	Fault Monitor 5: Cause	d085	R	Refer to "Inverter Fault Factor List" on page 6-35.	–
003Bh	Fault Monitor 5: Inverter Status			Refer to "Inverter Fault Factor List" on page 6-35.	–
003Ch	Fault Monitor 5: Frequency (HIGH)			0 to 100000	0.01 [Hz]
003Dh	Fault Monitor 5: Frequency (LOW)				
003Eh	Fault Monitor 5: Current			Output current value at the time of tripping	0.01 [A]
003Fh	Fault Monitor 5: Voltage			DC input voltage at the time of tripping	0.1 [V]
0040h	Fault Monitor 5: RUN Time (HIGH)			Total RUN time at the time of tripping	1 [h]
0041h	Fault Monitor 5: RUN Time (LOW)				
0042h	Fault Monitor 5: ON Time (HIGH)			Power ON time at the time of tripping	1 [h]
0043h	Fault Monitor 5: ON Time (LOW)				

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution
0044h	Fault Monitor 6: Cause	d086	R	Refer to "Inverter Fault Factor List" on page 6-35.	–
0045h	Fault Monitor 6: Inverter Status			Refer to "Inverter Fault Factor List" on page 6-35.	–
0046h	Fault Monitor 6: Frequency (HIGH)			0 to 100000	0.01 [Hz]
0047h	Fault Monitor 6: Frequency (LOW)				
0048h	Fault Monitor 6: Current			Output current value at the time of tripping	0.01 [A]
0049h	Fault Monitor 6: Voltage			DC input voltage at the time of tripping	0.1 [V]
004Ah	Fault Monitor 6: RUN Time (HIGH)			Total RUN time at the time of tripping	1 [h]
004Bh	Fault Monitor 6: RUN Time (LOW)				
004Ch	Fault Monitor 6: ON Time (HIGH)			Power ON time at the time of tripping	1 [h]
004Dh	Fault Monitor 6: ON Time (LOW)				
004Eh	Warning Monitor	d090	R	Warning code	–
004Fh to 08FFh	Not used	–	–	Inaccessible	–
0900h	EEPROM Write	–	W	0: Motor parameter recalculation 1: Set value storage in EEPROM Other: Motor parameter recalculation and set value storage in EEPROM	–
0901h	Not used	–	–	Inaccessible	–
0902h	EEPROM Write Mode Selection	–	W	0: Write disabled 1: Write enabled	–
0903h to 1000h	Not used	–	–	Inaccessible	–

Inverter Fault Factor List

Trip factor high-order (factor)		Trip factor low-order (Inverter status)	
Name	**Code**	**Name**	**Code**
No trip factor	0	During reset	0
Overcurrent protection during constant speed	1	During stop	1
Overcurrent protection during deceleration	2	During deceleration	2
Overcurrent protection during acceleration	3	At a constant speed	3
Overcurrent protection during stop	4	During acceleration	4
Overload protection	5	Operates at frequency = 0	5
Braking resistor overload protection	6	During startup	6
Overvoltage protection	7	DB active (DC injection braking active)	7
EEPROM error	8	During overload limit	8
Undervoltage protection	9		
Current detector error	10		
CPU error	11		
External trip	12		
USP error	13		
Grounding protection	14		
Incoming overvoltage protection	15		
Abnormal temperature	21		
Main circuit error	25		
Driver error	30		
Thermistor error	35		
Brake error	36		
Emergency shutoff	37		
Overload protection in a low speed range	38		
Poor Digital Operator connection	40		
Modbus communication (Modbus-RTU) error	41		
Internal data error	43 to 45 50 to 69		
Encoder disconnection	80		
Excess speed	81		
Position control range trip	83		

(iii) Holding Register Number List (Monitor)

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1001h	Output Frequency Monitor	d001(HIGH)	R	0 to 40000(100000)	0.01 [Hz]	5-1
1002h		d001 (LOW)				
1003h	Output Current Monitor	d002	R	0 to 65530	0.01 [A]	5-1
1004h	Rotation Direction Monitor	d003	R	0: Stop 1: Forward 2: Reverse	–	5-2
1005h	PID Feedback Value Monitor	d004 (HIGH)	R	0 to 1000000	0.1	5-2
1006h		d004 (LOW)				
1007h	Multi-function Input Monitor	d005	R	2^0: Terminal S1 to 2^6 : Terminal S7/EB	Bit	5-3
1008h	Multi-function Output Monitor	d006	R	2^0: Terminal P1/EDM to 2^1: Terminal P2 2^6: Relay output terminal	Bit	5-3
1009h	Output Frequency Monitor (after conversion)	d007 (HIGH)	R	0 to 4000000(10000000)	0.01	5-4
100Ah		d007 (LOW)				
100Bh	Real Frequency Monitor	d008 (HIGH)	R	–100000 to +100000	0.01 [Hz]	5-5
100Ch		d008 (LOW)	R			
100Dh	Torque Reference Monitor	d009	R	–200 to +200	1 [%]	5-5
100Eh	Torque Bias Monitor	d010	R	–200 to +200	1 [%]	5-6
100Fh	Reserved	–	–	–	–	–
1010h	Output Torque Monitor	d012	R	–200 to +200	1 [%]	5-6
1011h	Output Voltage Monitor	d013	R	0 to 6000	0.1 [V]	5-6
1012h	Input Power Monitor	d014	R	0 to 9999	0.1 [kW]	5-7
1013h	Integrated Power Monitor	d015 (HIGH)	R	0 to 9999000	–	5-7
1014h		d015 (LOW)				
1015h	Total RUN Time Monitor	d016 (HIGH)	R	0 to 999000	1 [h]	5-8
1016h		d016 (LOW)				
1017h	Power ON Time Monitor	d017 (HIGH)	R	0 to 999000	1 [h]	5-8
1018h		d017 (LOW)				
1019h	Fin Temperature Monitor	d018	R	–200 to 1500	0.1 [°C]	5-8

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
101Ah to 101Ch	Reserved	–	–	–	–	–
101Dh	Life Assessment Monitor	d022	R	2^0: Capacitor on main circuit board 2^1: Cooling fan	Bit	5-9
101Eh to 1025h	Reserved	–	–	–	–	–
1026h	DC Voltage Monitor	d102	R	0 to 10000	0.1 [V]	5-12
1027h	Regenerative Braking Load Rate Monitor	d103	R	0 to 1000	0.1 [%]	5-12
1028h	Electronic Thermal Load Rate Monitor	d104	R	0 to 1000	0.1 [%]	5-12
1029h to 1035h	Reserved	–	–	–	–	–
1036h	Position Command Monitor	d029 (HIGH)	R	–268435455 to 268435455	1	5-9
1037h		d029 (LOW)	R			
1038h	Current Position Monitor	d030 (HIGH)	R	–268435455 to 268435455	1	5-9
1039h		d030 (LOW)	R			
103Ah to 1056h	Reserved	–	–	–	–	–
1057h	Inverter Mode Monitor	d060	R	0: I-C (IM load heavy) 1: I-V (IM load light) 2: H-I (IM power supply harmonics)	–	5-10
1058h to 1102h	Not used	–	–	Inaccessible	–	–

(iv) Holding Register Number List (Group F)

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1103h	Acceleration Time Setting 1	F002 (HIGH)	R/W	1 to 360000	0.01 [s]	5-24
1104h		F002 (LOW)				
1105h	Deceleration Time Setting 1	F003 (HIGH)	R/W	1 to 360000	0.01 [s]	
1106h		F003 (LOW)				
1107h	RUN Direction Selection	F004	R/W	0: Forward 1: Reverse	–	5-23
1108h to 1200h	Not used	–	–	Inaccessible	–	–

(v) Holding Register Number List (Groups A, b, C, H and P)

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1201h	Frequency Reference Selection 1	A001	R/W	00: Volume 01: Control circuit terminal block 02: Digital Operator 03: Modbus communication (Modbus-RTU) 04: Optional board 06: Pulse train frequency 07: Do not set. 10: Operation function output	–	5-15
1202h	RUN Command Selection 1[*1]	A002	R/W	01: Control circuit terminal block 02: Digital Operator 03: Modbus communication (Modbus-RTU) 04: Optional board	–	5-22
1203h	Base Frequency 1	A003	R/W	300 to Maximum Frequency 1	0.1 [Hz]	5-26
1204h	Maximum Frequency 1	A004	R/W	Base Frequency 1 to 4000 (10000)	0.1 [Hz]	5-28
1205h	FV/FI Selection	A005	R/W	00: Switch between FV/FI 02: Switch between FV/ volume 03: Switch between FI/ volume	–	5-38
1206h to 120Ah	Reserved	–	–	–	–	–

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
120Bh	FV Start Frequency	A011 (HIGH)	R/W	0 to 40000(100000)	0.01 [Hz]	5-40
120Ch		A011 (LOW)				
120Dh	FV End Frequency	A012 (HIGH)	R/W	0 to 40000(100000)	0.01 [Hz]	
120Eh		A012 (LOW)				
120Fh	FV Start Ratio	A013	R/W	0 to 100	1 [%]	
1210h	FV End Ratio	A014	R/W	0 to 100	1 [%]	
1211h	FV Start Selection	A015	R/W	00: Start frequency 01: 0 Hz	–	
1212h	Analog Input Filter (FV, FI Sampling)	A016	R/W	1 to 30/31 (with 500 ms filter ± 0.1 Hz hysteresis)	1	5-38
1213h	Reserved	–	–	–	–	–
1214h						
1215h	Multi-step Speed Selection	A019	R/W	00: Binary, 4 terminals, 16 steps 01: Bit, 7 terminals, 8 steps	–	5-63
1216h	Multi-step Speed 1 Reference 0	A020 (HIGH)	R/W	0 Starting frequency to Maximum Frequency 1	0.01 [Hz]	
1217h		A020 (LOW)	R/W			

*1. After changing the RUN Command Selection 1, provide an interval of at least 40 ms before the RUN command is actually executed.

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1218h	Multi-step Speed Reference 1	A021 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	5-63
1219h		A021 (LOW)	R/W			
121Ah	Multi-step Speed Reference 2	A022 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
121Bh		A022 (LOW)	R/W			
121Ch	Multi-step Speed Reference 3	A023 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
121Dh		A023 (LOW)	R/W			
121Eh	Multi-step Speed Reference 4	A024 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
121Fh		A024 (LOW)	R/W			
1220h	Multi-step Speed Reference 5	A025 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
1221h		A025 (LOW)	R/W			

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1222h	Multi-step Speed Reference 6	A026 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	5-63
1223h		A026 (LOW)	R/W			
1224h	Multi-step Speed Reference 7	A027 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
1225h		A027 (LOW)	R/W			
1226h	Multi-step Speed Reference 8	A028 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
1227h		A028 (LOW)	R/W			
1228h	Multi-step Speed Reference 9	A029 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
1229h		A029 (LOW)	R/W			
122Ah	Multi-step Speed Reference 10	A030 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
122Bh		A030 (LOW)	R/W			
122Ch	Multi-step Speed Reference 11	A031 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
122Dh		A031 (LOW)	R/W			
122Eh	Multi-step Speed Reference 12	A032 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
122Fh		A032 (LOW)	R/W			
1230h	Multi-step Speed Reference 13	A033 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
1231h		A033 (LOW)	R/W			
1232h	Multi-step Speed Reference 14	A034 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
1233h		A034 (LOW)	R/W			
1234h	Multi-step Speed Reference 15	A035 (HIGH)	R/W	0 Starting frequency to nth maximum frequency	0.01 [Hz]	
1235h		A035 (LOW)	R/W			
1236h 1237h	Reserved	–	–	–	–	–
1238h	Jogging Frequency	A038	R/W	Starting frequency to 999 (10000)	0.01 [Hz]	5-59

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1239h	Jogging Stop Selection	A039	R/W	00: Free run on jogging stop/Disabled in operation 01: Deceleration stop on jogging stop/Disabled in operation 02: Injection braking on jogging stop/Disabled in operation 03: Free run on jogging stop/Enabled in operation 04: Deceleration stop on jogging stop/Enabled in operation 05: DC injection braking on jogging stop/Enabled in operation	–	5-59
123Ah	Reserved	–	–	–	–	–
123Bh	Torque Boost Selection 1	A041	R/W	00: Manual torque boost 01: Automatic torque boost	–	5-49
123Ch	Manual Torque Boost Voltage 1	A042	R/W	0 to 200	0.1 [%]	
123Dh	Manual Torque Boost Frequency 1	A043	R/W	0 to 500	0.1 [%]	
123Eh	Control Method 1	A044	R/W	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control (heavy load only)	–	5-46 5-144
123Fh	Output Voltage Gain 1	A045	R/W	20 to 100	1 [%]	5-72
1240h	Automatic Torque Boost Voltage Compensation Gain 1	A046	R/W	0 to 255	1 [%]	5-49
1241h	Automatic Torque Boost Slip Compensation Gain 1	A047	R/W	0 to 255	1 [%]	
1242h to 1244h	Reserved	–	–	–	–	–

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1245h	Internal DC Injection Braking Selection	A051	R/W	00: Disabled 01: Enabled 02: Enabled (Operates only on set frequencies.)	–	5-135
1246h	Internal DC Injection Braking Frequency	A052	R/W	0 to 6000	0.01 [Hz]	
1247h	DC Injection Braking Delay Time	A053	R/W	0 to 50	0.1 [s]	
1248h	DC Injection Braking Power	A054	R/W	0 to 100	1 [%]	
1249h	DC Injection Braking Time	A055	R/W	0 to 600	0.1 [s]	
124Ah	DC Injection Braking Edge/Level Selection	A056	R/W	00: Edge operation 01: Level operation	–	
124Bh	Startup DC Injection Braking Power	A057	R/W	0 to 100	1 [%]	
124Ch	Startup Internal DC Injection Braking Time	A058	R/W	0 to 600	0.1 [s]	5-135
124Dh	DC Injection Braking Carrier Frequency	A059	R/W	20 to 150 (100)	0.1 [kHz]	
124Eh	Reserved	–	–	–	–	–
124Fh	Frequency Upper Limit 1	A061 (HIGH)	R/W	0 Frequency Lower Limit 1 to Maximum Frequency 1	0.01 [Hz]	5-60
1250h		A061 (LOW)	R/W			
1251h	Frequency Lower Limit 1	A062 (HIGH)	R/W	0 Starting Frequency to Frequency Upper Limit 1	0.01 [Hz]	5-60
1252h		A062 (LOW)	R/W			
1253h	Jump Frequency 1	A063 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-61
1254h		A063 (LOW)	R/W			
1255h	Jump Frequency Width 1	A064	R/W	0 to 1000 (10000)	0.01 [Hz]	
1256h	Jump Frequency 2	A065 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
1257h		A065 (LOW)	R/W			
1258h	Jump Frequency Width 2	A066	R/W	0 to 1000 (10000)	0.01 [Hz]	
1259h	Jump Frequency 3	A067 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
125Ah		A067 (LOW)	R/W			
125Bh	Jump Frequency Width 3	A068	R/W	0 to 1000 (10000)	0.01 [Hz]	
125Ch	Acceleration Stop Frequency	A069 (HIGH)	R/W	0 to 40000 (10000)	0.01 [Hz]	5-62
125Dh		A069 (LOW)	R/W			
125Eh	Acceleration Stop Time	A070	R/W	0 to 600	0.1 [s]	

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
125Fh	PID Selection	A071	R/W	00: Disabled 01: Enabled 02: Reverse output enabled	–	5-73
1260h	PID P Gain	A072	R/W	2 to 2500	0.01	
1261h	PID I Gain	A073	R/W	0 to 36000	0.1 [s]	
1262h	PID D Gain	A074	R/W	0 to 10000	0.01 [s]	
1263h	PID Scale	A075	R/W	1 to 9999	0.01	
1264h	PID Feedback Selection	A076	R/W	00: FI (current) 01: FV (voltage) 02: Modbus communication (Modbus-RTU) 03: Pulse train frequency 10: Operation function output	–	
1265h	PID Deviation Reverse Output	A077	R/W	00: Disabled 01: Enabled	–	
1266h	PID Variable Range Limit	A078	R/W	0 to 1000	0.1 [%]	
1267h	PID Feedforward Selection	A079	R/W	00: Disabled 01: FV (voltage) 02: FI (current)	–	5-73
1268h	Reserved	–	–	–	–	–
1269h	AVR Selection 1	A081	R/W	00: Always ON 01: Always OFF 02: OFF during deceleration	–	5-27
126Ah	Motor Incoming Voltage Selection 1	A082	R/W	200V class: 00 (200) 01 (215) 02 (220) 03 (230) 04 (240) 400V class: 05 (380) 06 (400) 07 (415)		5-26 5-148
126Bh	AVR Filter Time Parameter	A083	R/W	0 to 1000	0.01 [s]	5-27
126Ch	AVR Deceleration Voltage Gain	A084	R/W	50 to 200	1 [%]	
126Dh	RUN Mode Selection	A085	R/W	00: Normal operation 01: Energy-saving operation	–	5-79
126Eh	Energy-saving Response/Accuracy Adjustment	A086	R/W	0 to 1000	0.1 [%]	
126Fh to 1273h	Reserved	–	–	–	–	–

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Communication Function

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1274h	1st Acceleration Time 2	A092 (HIGH)	R/W	1 to 360000	0.01 [s]	5-66
1275h		A092 (LOW)	R/W			
1276h	1st Deceleration Time 2	A093 (HIGH)	R/W	1 to 360000	0.01 [s]	
1277h		A093 (LOW)	R/W			
1278h	2-step Acceleration/ Deceleration Selection 1	A094	R/W	00: Switched via 2CH terminal 01: Switched by setting 02: Enabled only when switching forward/ reverse	–	
1279h	2-step Acceleration Frequency 1	A095 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
127Ah		A095 (LOW)	R/W			
127Bh	2-step Deceleration Frequency 1	A096 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
127Ch		A096 (LOW)	R/W			
127Dh	Acceleration Pattern Selection	A097	R/W	00: Linear 01: S shape 02: U shape 03: Inverted U shape 04: EL-S shape	–	5-68
127Eh	Deceleration Pattern Selection	A098	R/W	00: Line 01: S shape 02: U shape curve 03: Inverted U shape curve 04: EL-S shape	–	
127Fh 1280h	Reserved	–	–	–	–	–
1281h	FI Start Frequency	A101 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-40
1282h		A101 (LOW)	R/W			
1283h	FI End Frequency	A102 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
1284h		A102 (LOW)	R/W			
1285h	FI Start Ratio	A103	R/W	0 to 100	1 [%]	
1286h	FI End Ratio	A104	R/W	0 to 100	1 [%]	
1287h	FI Start Selection	A105	R/W	00: Start frequency 01: 0Hz	–	
1288h to 12A4h	Reserved	–	–	–	–	–
12A5h	Acceleration Curve Parameter	A131	R/W	01 (small curve) to 10 (large curve)	–	5-68
12A6h	Deceleration Curve Parameter	A132	R/W	01 (small curve) to 10 (large curve)	–	

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
12A7h to 12AEh	Reserved	–	–	–	–	–
12AFh	Operation Frequency Selection 1	A141	R/W	00: Digital Operator 01: Volume 02: FV (voltage) input 03: FI (current) input 04: Modbus communication (Modbus-RTU) 05: Optional board 07: Pulse train frequency	–	5-70
12B0h	Operation Frequency Selection 2	A142	R/W	00: Digital Operator 01: Volume 02: FV (voltage) input 03: FI (current) input 04: Modbus communication (Modbus-RTU) 05: Optional board 07: Pulse train frequency	–	
12B1h	Operation Function Operator Selection	A143	R/W	00: Addition (A141 + A142) 01: Subtraction (A141 – A142) 02: Multiplication (A141 × A142)	–	
12B2h	Reserved	–	–	–	–	–
12B3h	Frequency Addition Amount Setting	A145 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-71
12B4h		A145 (LOW)	R/W			
12B5h	Frequency Addition Sign Selection	A146	R/W	00: Frequency reference + A145 01: Frequency reference – A145	–	
12B6h to 12B8h	Reserved	–	–	–	–	–
12B9h	EL-S Shape Acceleration Curve Ratio 1	A150	R/W	0 to 50	1 [%]	5-68
12BAh	EL-S Shape Acceleration Curve Ratio 2	A151	R/W	0 to 50	1 [%]	
12BBh	EL-S Shape Deceleration Curve Ratio 1	A152	R/W	0 to 50	1 [%]	
12BCh	EL-S Shape Deceleration Curve Ratio 2	A153	R/W	0 to 50	1 [%]	
12BDh	Deceleration Stop Frequency	A154 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-62
12BEh		A154 (LOW)				
12BFh	Deceleration Stop Time	A155	R/W	0 to 600	0.1 [s]	
12C0h	PID Sleep Function Operation Level	A156 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-73
12C1h		A156 (LOW)				
12C2h	PID Sleep Operation Delay Time	A157	R/W	0 to 255	0.1 [s]	

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Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
12C3h to 12C5h	Reserved	–	–	–	–	–
12C6h	VR Start Frequency	A161 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-40
12C7h		A161 (LOW)	R/W			
12C8h	VR End Frequency	A162 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
12C9h		A162 (LOW)	R/W			
12CAh	VR Start Ratio	A163	R/W	0 to VR End Ratio	1 [%]	
12CBh	VR End Ratio	A164	R/W	VR Start Ratio to 100	1 [%]	
12CCh	VR Start Selection	A165	R/W	00: Start frequency A161 01: 0 Hz	–	
12CDh to 1300h	Not used	–	–	Inaccessible	–	–
1301h	Retry 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	–	5-96
1302h	Allowable Momentary Power Interruption Time	b002	R/W	3 to 250	0.1 [s]	
1303h	Restart Standby Time	b003	R/W	3 to 1000	0.1 [s]	5-96 5-100 5-103
1304h	Momentary Power Interruption/ undervoltage Trip During Stop Selection	b004	R/W	00: Disabled 01: Enabled 02: Disabled during stop/ deceleration stop	–	5-96
1305h	Restart During Momentary Power Interruption Count Selection	b005	R/W	00: 16 times 01: Unlimited	–	
1306h	Reserved	–	–	–	–	–
1307h	Frequency Matching Lower Limit Frequency Setting	b007 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-97 5-100 5-103
1308h		b007 (LOW)	R/W			
1309h	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	–	5-97
130Ah	Reserved	–	–	–	–	–

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
130Bh	Overvoltage/Overcurrent Restart Count Selection	b010	R/W	1 to 3	1 [time]	5-97
130Ch	Overvoltage/Overcurrent Restart Standby Time	b011	R/W	3 to 1000	0.1 [s]	
130Dh	Electronic Thermal Level 1	b012	R/W	200 to 1000	0.1 [%]	5-110
130Eh	Electronic Thermal Characteristics Selection 1	b013	R/W	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–	
130Fh	Reserved	–	–	–	–	–
1310h	Free-electric Thermal Frequency 1	b015	R/W	0 to Free-electric Thermal Frequency 2	1 [Hz]	5-112
1311h	Free-electronic Thermal Current 1	b016	R/W	0 to Rated current	0.01 [%]	
1312h	Free-electric Thermal Frequency 2	b017	R/W	Free-electric Thermal Frequency 1 to Free-electric Thermal Frequency 3	1 [Hz]	
1313h	Free-electronic Thermal Current 2	b018	R/W	0 to Rated current	0.01 [%]	
1314h	Free-electric Thermal Frequency 3	b019	R/W	Free-electric Thermal Frequency 2 to 400(1000)	1 [Hz]	
1315h	Free-electronic Thermal Current 3	b020	R/W	0 to Rated current	0.01 [%]	
1316h	Overload Limit 1 Selection	b021	R/W	00: Disabled 01: Enabled in acceleration/ constant speed operation 02: Enabled in constant speed operation 03: Enabled during acceleration/constant speed (accelerated during regeneration)	–	5-114
1317h	Overload Limit 1 Level	b022	R/W	200 to 2000	0.01 [%]	
1318h	Overload Limit 1 Parameter	b023	R/W	1 to 30000	0.1 [s]	
1319h	Overload Limit 1 Selection 2	b024	R/W	00: Disabled 01: Enabled in acceleration/ constant speed operation 03: Enabled during acceleration/constant speed (accelerated during regeneration)	–	
131Ah	Overload Limit 1 Level 2	b025	R/W	200 to 2000	0.01 [%]	
131Bh	Overload Limit 1 Parameter 2	b026	R/W	1 to 30000	0.1 [s]	
131Ch	Overcurrent Suppression Selection	b027	R/W	00: Disabled 01: Enabled	–	5-116

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
131Dh	Frequency Pull-in Restart Level	b028	R/W	200 to 2000	0.01 [%]	5-97 5-100 5-103
131Eh	Frequency Pull-in Restart Parameter	b029	R/W	1 to 30000	0.1 [s]	
131Fh	Starting Frequency at Frequency Pull-in Restart Selection	b030	R/W	00: Frequency at interruption 01: Max. frequency 02: Set frequency	–	
1320h	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 set frequency cannot be changed 10: Data can be changed during RUN.	–	5-84
1321h	Reserved	–	–	–	–	–
1322h	Motor Cable Length Code Selection	b033	R/W	5 to 20	–	5-145
1323h	RUN Time/Power ON Time Level	b034 (HIGH)	R/W	0 to 65535	10 [h]	5-124
1324h		b034 (LOW)	R/W			
1325h	Rotation Direction Limit Selection	b035	R/W	00: No direction limit 01: Only Forward is enabled (Reverse is limited) 02: Only Reverse is enabled (Forward is limited)	–	5-23
1326h	Reduced Voltage Startup Selection	b036	R/W	0 (Reduced voltage startup time: small) to 255 (Reduced voltage startup time: large)	–	5-58
1327h	Display Selection	b037	R/W	00: Complete display 01: Individual display of functions 02: User setting, + b037 03: Data comparison display 04: Basic display 05: Monitor display only	–	5-88
1328h	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 use this setting.	–	5-86

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Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1329h	User Parameter Automatic Setting Function	b039	R/W	00: Disabled 01: Enabled	–	5-177
132Ah	Torque Limit Selection	b040	R/W	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Optional board	–	5-153
132Bh	Torque Limit 1 (four-quadrant mode forward power running)	b041	R/W	0 to 200/255 (no)	1 [%]	
132Ch	Torque Limit 2 (four-quadrant mode reverse regeneration)	b042	R/W	0 to 200/255 (no)	1 [%]	
132Dh	Torque Limit 3 (four-quadrant mode reverse power running)	b043	R/W	0 to 200/255 (no)	1 [%]	
132Eh	Torque Limit 4 (four-quadrant mode forward regeneration)	b044	R/W	0 to 200/255 (no)	1 [%]	
132Fh	Torque LADSTOP Selection	b045	R/W	00: Disabled 01: Enabled	–	5-155
1330h	Reverse Rotation Prevention Selection	b046	R/W	00: Disabled 01: Enabled	–	5-157
1331h 1332h	Reserved	–	–	–	–	–
1333h	Heavy Load/Light Load Selection	b049	R/W	00: Heavy load mode 01: Light load mode	–	5-13
1334h	Controlled Deceleration on Power Loss	b050	R/W	00: Disabled 01: Deceleration stop 02: Constant voltage (without recovery) 03: Constant voltage (with recovery)	–	5-106
1335h	DC Bus Voltage Trigger Level of Ctrl. Decel	b051	R/W	0 to 10000	0.1 [V]	
1336h	Deceleration Hold Level of Ctrl. Decel	b052	R/W	0 to 10000	0.1 [V]	
1337h	Deceleration Time of Ctrl. Decel	b053 (HIGH)	R/W	1 to 360000	0.01 [s]	
1338h		b053 (LOW)	R/W			
1339h	Freq. Drop to start Ctrl. Decel	b054	R/W	0 to 1000	0.01 [Hz]	
133Ah to 133Eh	Reserved	–	–	–	–	–
133Fh	Window Comparator FV Upper Limit Level	b060	R/W	0. to 100. (lower limit: b061 + b062 × 2)	1 [%]	5-132
1340h	Window Comparator FV Lower Limit Level	b061	R/W	0. to 100. (upper limit: b060 – b062 × 2)	1 [%]	

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1341h	Window Comparator FV Hysteresis Width	b062	R/W	0. to 10. (upper limit: (b061 – b062)/2)	1 [%]	5-132
1342h	Window Comparator FI Upper Limit Level	b063	R/W	0. to 100. (lower limit: b064 + b065 × 2)	1 [%]	
1343h	Window Comparator FI Lower Limit Level	b064	R/W	0. to 100. (upper limit: b063 – b065 × 2)	1 [%]	
1344h	Window Comparator FI Hysteresis Width	b065	R/W	0. to 10. (upper limit: (b063 – b064)/2)	1 [%]	
1345h to 1348h	Reserved	–	–	–	–	–
1349h	Analog Operation Level at FV Disconnection	b070	R/W	0 to 100/255 (no)	1 [%]	5-132
134Ah	Analog Operation Level at FI Disconnection	b071	R/W	0 to 100/255 (no)	1 [%]	
134Bh to 134Dh	Reserved	–	–	–	–	–
134Eh	Ambient Temperature	b075	R/W	–10 to 50	1 [°C]	5-127
134Fh to 1350h	Reserved	–	–	–	–	–
1351h	Integrated Power Clear	b078	R/W	00: Disabled 01: Clear (Return to 00 after clear)	–	5-7
1352h	Integrated Power Display Scale	b079	R/W	1 to 1000	1	
1353h 1354h	Reserved	–	–	–	–	–
1355h	Starting Frequency	b082	R/W	10 to 999 (10000)	0.01 [Hz]	5-57
1356h	Carrier Frequency	b083	R/W	20 to 150 (100)	0.1 [kHz]	5-51
1357h	Initialization Selection	b084	R/W	00: Initialization disabled 01: Fault monitor clear 02: Initializes data 03: Fault monitor clear + Data initialization 04: Do not set.	–	5-174
1358h	Initialization Data Selection	b085	R/W	00: Do not change.	–	
1359h	Frequency Conversion Coefficient	b086	R/W	1 to 9999	0.01	5-4
135Ah	STOP Key Selection	b087	R/W	00: Enabled 01: Disabled 02: Only resetting enabled	–	5-84
135Bh	Free-run Stop Selection	b088	R/W	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–	5-103
135Ch	Automatic Carrier Reduction	b089	R/W	00: Disabled 01: Enabled, depends on current 02: Enabled, depends on the fin temperature	–	5-52

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
135Dh	Usage Rate of Regenerative Braking	b090	R/W	0 to 1000	0.1 [%]	5-141
135Eh	Stop Selection	b091	R/W	00: Deceleration stop 01: Free-run stop	–	5-24
135Fh	Cooling Fan Operation	b092	R/W	00: Always 01: Only during operation (including 5 minutes after power on/stop) 02: Depends on the fin temperature	–	5-127
1360h	Cooling Fan Total Operation Time Clear	b093	R/W	00: Operation time count 01: Clear (Return to 00 after clear)	–	
1361h	Initialization Target Selection	b094	R/W	00: All data 01: All data other than terminals/ communication 02: U*** registration function only 03: Other than U*** registration function	–	5-174
1362h	Regenerative Braking Selection	b095	R/W	00: Disabled 01: Enable (Disable during stop) 02: Enable (Enable during stop)	–	5-141
1363h	Regenerative Braking ON Level	b096	R/W	330 to 380/660 to 760	1 [V]	
1364h to 1366h	Reserved	–	–	–	–	–
1367h	Free V/f Frequency 1	b100	R/W	0 to Free V/f frequency 2	1 [Hz]	5-47
1368h	Free V/f Voltage 1	b101	R/W	0 to 8000	0.1 [V]	
1369h	Free V/f Frequency 2	b102	R/W	Free V/f Frequency 1 to Free V/f frequency 3	1 [Hz]	
136Ah	Free V/f Voltage 2	b103	R/W	0 to 8000	0.1 [V]	
136Bh	Free V/f Frequency 3	b104	R/W	Free V/f Frequency 2 to Free V/f frequency 4	1 [Hz]	
136Ch	Free V/f Voltage 3	b105	R/W	0 to 8000	0.1 [V]	
136Dh	Free V/f Frequency 4	b106	R/W	Free V/f Frequency 3 to Free V/f frequency 5	1 [Hz]	
136Eh	Free V/f Voltage 4	b107	R/W	0 to 8000	0.1 [V]	
136Fh	Free V/f Frequency 5	b108	R/W	Free V/f Frequency 4 to Free V/f frequency 6	1 [Hz]	
1370h	Free V/f Voltage 5	b109	R/W	0 to 8000	0.1 [V]	
1371h	Free V/f Frequency 6	b110	R/W	Free V/f Frequency 5 to Free V/f frequency 7	1 [Hz]	
1372h	Free V/f Voltage 6	b111	R/W	0 to 8000	0.1 [V]	
1373h	Free V/f Frequency 7	b112	R/W	Free V/f Frequency 6 to 400 (1000) (Hz)	1 [Hz]	
1374h	Free V/f Voltage 7	b113	R/W	0 to 8000	0.1 [V]	
1375h to 137Ah	Reserved	–	–	–	–	–

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
137Bh	Brake Control Function Selection	b120	R/W	00: Disabled 01: Enabled	–	5-143
137Ch	Brake Release Wait Time	b121	R/W	0 to 500	0.01 [s]	
137Dh	Acceleration Wait Time	b122	R/W	0 to 500	0.01 [s]	
137Eh	Stop Wait Time	b123	R/W	0 to 500	0.01 [s]	
137Fh	Brake Wait Time for Confirmation	b124	R/W	0 to 500	0.01 [s]	
1380h	Brake Release Frequency	b125	R/W	0 to 40000	0.01 [Hz]	5-143
1381h	Brake Release Current	b126	R/W	0 to 20000	0.01 [%]	
1382h	Break ON Frequency	b127	R/W	0 to 40000	0.01 [Hz]	
1383h 1384h	Reserved	–	–	–	–	–
1385h	Overvoltage Suppression Function Selection During Deceleration	b130	R/W	00: Disabled 01: Enabled (DC voltage kept constant) 02: Enabled (Acceleration enabled)	–	5-117
1386h	Overvoltage Suppression Level During Deceleration	b131	R/W	200 V class: 330 to 390 400 V class: 660 to 780	1 [V]	
1387h	Overvoltage Suppression Parameter	b132	R/W	10 to 3000	0.01 [s]	
1388h	Overvoltage Suppression Proportional Gain Setting	b133	R/W	0 to 500	0.01	
1389h	Overvoltage Suppression Integral Time Setting	b134	R/W	0 to 1500	0.1 [s]	
138Ah to 1393h	Reserved	–	–	–	–	–
1394h	GS Input Operation Selection	b145	R/W	00: Do not trip 01: Tripped	–	5-171
1395h to 1398h	Reserved	–	–	–	–	–
1399h	Reserved	–	–	–	–	–
139Ah to 13A2h	Reserved	–	–	–	–	–
13A3h	Reserved	–	–	–	–	–
13A4h	Reserved	–	–	–	–	–
13A5h	Reserved	–	–	–	–	–
13A6h	d001/d007 Frequency Setting Mode Selection	b163	R/W	00: Disabled 01: Enabled	–	5-1 5-4
13A7h	Initial Screen Automatic Switching Function	b164	R/W	00: Disabled 01: Enabled	–	5-87

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
13A8h	Selection of Operating Level on Digital Operator Disconnection	b165	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	5-86
13A9h to 13ADh	Reserved	–	–	–	–	–
13AEh	Inverter Mode Selection	b171	R/W	00: Selection disabled 01: Induction motor 02: High-frequency induction motor	–	5-178
13AFh to 13B6h	Reserved	–	–	–	–	–
13B7h	Perform Initialization/ Mode Selection	b180	R/W	00: Initialization disabled 01: Perform initialization/ mode selection	–	5-174
13B8h to 1400h	Not used	–	–	Inaccessible	–	–

- There are no corresponding registers in Modbus communications for parameters b150, b160, and b161.

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1401h	Multi-function Input 1 Selection	C001	R/W	00: FW (Forward) 01: RV (Reverse) 02: CF1 (Multi-step speed 1) 03: CF2 (Multi-step speed 2) 04: CF3 (Multi-step speed 3) 05: CF4 (Multi-step speed 4) 06: JG (Jogging) 07: DB (External DC injection braking) 08: SET (Motor 2 control) 09: 2CH (2-step acceleration/ deceleration) 11: FRS (Free-run stop) 12: EXT (External trip) 13: USP (USP function) 14: CS (Commercial switch) 15: SFT (Soft lock) 16: FV/FI (Analog input switch) 18: RS (Reset) 19: TH (PTC thermistor thermal protection) 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) 27: UP (UP/DWN function accelerated) 28: DWN (UP/DWN function decelerated) 29: UDC (UP/DWN function data clear) 31: OPE (Forced operator) 32: SF1 (Multi-step speed bit 1) 33: SF2 (Multi-step speed bit 2) 34: SF3 (Multi-step speed bit 3) 35: SF4 (Multi-step speed bit 4) 36: SF5 (Multi-step speed bit 5) 37: SF6 (Multi-step speed bit 6) 38: SF7 (Multi-step speed 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) 44: BOK (Brake confirmation) 46: LAC (LAD cancel) 47: PCLR (Position deviation clear) 50: ADD (Frequency addition) 51: F-TM (Forced terminal block) 52: ATR (Torque reference input permission) 53: KHC (Integrated power clear) 56: Reserved. 57: Reserved. 58: Reserved. 59: Reserved. 60: Reserved. 61: Reserved. 62: Reserved. 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) 73: SPD (Speed/position switching) 77: GS1 (GS1 input (C003 only)) 78: GS2 (GS2 input (C004 only)) 81: 485 (Start co-inverter communication) 82: Reserved. 83: HLD (Retain output frequency) 84: ROK (Permission of RUN command) 85: EB (Rotation direction detection (C007 only)) 86: DISP (Display fixed) no: NO (Not assigned)	–	5-29
1402h	Multi-function Input 2 Selection	C002	R/W		–	
1403h	Multi-function Input 3 Selection	C003	R/W		–	
1404h	Multi-function Input 4 Selection	C004	R/W		–	
1405h	Multi-function Input 5 Selection	C005	R/W		–	
1406h	Multi-function Input 6 Selection	C006	R/W		–	
1407h	Multi-function Input 7 Selection	C007	R/W		–	

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1408h to 140Ah	Reserved	–	–	–	–	–
140Bh	Multi-function Input Terminal 1 Operation Selection	C011	R/W	00: NO (NO contact) 01: NC (NC contact)	–	5-31
140Ch	Multi-function Input Terminal 2 Operation Selection	C012	R/W		–	
140Dh	Multi-function Input Terminal 3 Operation Selection	C013	R/W		–	
140Eh	Multi-function Input Terminal 4 Operation Selection	C014	R/W		–	
140Fh	Multi-function Input Terminal 5 Operation Selection	C015	R/W		–	
1410h	Multi-function Input Terminal 6 Operation Selection	C016	R/W		–	
1411h	Multi-function Input Terminal 7 Operation Selection	C017	R/W		–	
1412h to 1414h	Reserved	–	–	–	–	–

<table>
<tr><th>Register No.</th><th>Function name</th><th>Parameter No.</th><th>R/W</th><th>Monitor and setting parameters</th><th>Data resolution</th><th>Page</th></tr>
<tr><td>1415h</td><td>Multi-function Output Terminal P1/EDM Selection</td><td>C021</td><td>R/W</td><td rowspan="2">00: RUN (During RUN)
01: FA1 (Constant speed reached)
02: FA2 (Set frequency min. reached)
03: OL (Overload warning)
04: OD (PID excessive deviation)
05: AL (Alarm output)
06: FA3 (Set frequency only)
07: OTQ (Overtorque/Undertorque)
09: UV (Signal during undervoltage)
10: TRQ (During torque limit)
11: RNT (RUN time over)
12: ONT (Power on time over)
13: THM (Thermal warning)
19: BRK (Brake release)
20: BER (Brake error)
21: ZS (0Hz)
22: DSE (Excessive speed deviation)
23: POK (Position ready)
24: FA4 (Set frequency min. reached 2)
25: FA5 (Set frequency only 2)
26: OL2 (Overload warning 2)
27: FVdc (Analog FV disconnection detection)
28: FIdc (Analog FI disconnection detection)
31: FBV (PID FB status output)
32: NDc (Communication disconnection detection)
33: LOG1 (Logic operation output 1)
34: LOG2 (Logic operation output 2)
35: LOG3 (Logic operation output 3)
39: WAC (Capacitor life warning)
40: WAF (Cooling fan life warning signal)
41: FR (Starting contact signal)
42: OHF (Fin overheat warning)
43: LOC (Low current signal)
44: Reserved.
45: Reserved.
46: Reserved.
50: IRDY (Operation ready)
51: FWR (During forward operation)
52: RVR (During reverse operation)
53: MJA (Fatal fault signal)
54: WCFV (Window comparator FV)
55: WCFI (Window comparator FI)
58: FREF (Frequency command source)
59: REF (RUN command source)
60: SETM (Motor 2 selection)
62: EDM (Safety device monitor)
63: OPO (Optional board)
no: NO (Not assigned)</td><td>–</td><td rowspan="2">5-32</td></tr>
<tr><td>1416h</td><td>Multi-function Output Terminal P2 Selection</td><td>C022</td><td>R/W</td><td>–</td></tr>
<tr><td>1417h to 1419h</td><td>Reserved</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
</table>

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
141Ah	Multi-function Relay Output (MA, MB) Function Selection	C026	R/W	00: RUN (During RUN) 01: FA1 (Constant speed reached) 02: FA2 (Set frequency min. reached) 03: OL (Overload warning) 04: OD (PID excessive deviation) 05: AL (Alarm output) 06: FA3 (Set frequency only) 07: OTQ (Overtorque/Undertorque) 09: UV (Signal during undervoltage) 10: TRQ (During torque limit) 11: RNT (RUN time over) 12: ONT (Power on time over) 13: THM (Thermal warning) 19: BRK (Brake release) 20: BER (Brake error) 21: ZS (0Hz) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 24: FA4 (Set frequency min. reached 2) 25: FA5 (Set frequency only 2) 26: OL2 (Overload warning 2) 27: FVdc (Analog FV disconnection detection) 28: FIdc (Analog FI disconnection detection) 31: FBV (PID FB status output) 32: NDc (Communication disconnection detection) 33: LOG1 (Logic operation output 1) 34: LOG2 (Logic operation output 2) 35: LOG3 (Logic operation output 3) 39: WAC (Capacitor life warning) 40: WAF (Cooling fan life warning signal) 41: FR (Starting contact signal) 42: OHF (Fin overheat warning) 43: LOC (Low current signal) 44: Reserved. 45: Reserved. 46: Reserved. 50: IRDY (Operation ready) 51: FWR (During forward operation) 52: RVR (During reverse operation) 53: MJA (Fatal fault signal) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 58: FREF (Frequency command source) 59: REF (RUN command source) 60: SETM (Motor 2 selection) 62: EDM (Safety device monitor) 63: OPO (Optional board) no: NO (Not assigned)	–	5-32
141Bh	MP Selection	C027	R/W	00: Output frequency 01: Output current 02: Output torque (heavy load only) 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: Do not set. 15: Pulse train input monitor 16: Optional board	–	5-42

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Communication Function

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
141Ch	AM Selection	C028	R/W	00: Output frequency 01: Output current 02: Output torque (heavy load only) 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 11: Output torque (signed) (heavy load only) 13: Do not set. 16: Optional board	–	5-44
141Dh	Reserved	–	–	–	–	–
141Eh	Digital Current Monitor Reference Value	C030	R/W	2000 to 20000	0.01 [%]	5-43
141Fh	Multi-function Output Terminal P1/EDM Contact Selection	C031	R/W	00: NO (NO contact) 01: NC (NC contact)	–	5-34
1420h	Multi-function Output Terminal P2 Contact Selection	C032	R/W	00: NO (NO contact) 01: NC (NC contact)	–	
1421h to 1423h	Reserved	–	–	–	–	–
1424h	Multi-function Relay Output (MA, MB) Contact Selection	C036	R/W	00: NO (NO contact) 01: NC (NC contact)	–	5-34
1425h	Reserved	–	–	–	–	–
1426h	Low Current Signal Output Mode Selection	C038	R/W	00: During acceleration/ deceleration/constant speed 01: Only during constant speed	–	5-129
1427h	Low Current Detection Level	C039	R/W	0 to 20000	0.01 [%]	
1428h	Overload Warning Signal Output Mode Selection	C040	R/W	00: During acceleration/ deceleration/constant speed 01: Only during constant speed	–	5-115
1429h	Overload Warning Level 1	C041	R/W	0 to 20000	0.01 [%]	
142Ah	Arrival Frequency During Acceleration	C042 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-122
142Bh		C042 (LOW)	R/W			
142Ch	Arrival Frequency During Deceleration	C043 (HIGH	R/W	0 to 40000 (100000)	0.01 [Hz]	
142Dh		C043 (LOW)	R/W			
142Eh	PID Deviation Excessive Level	C044	R/W	0 to 1000	0.1 [%]	5-73

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
142Fh	Arrival Frequency During Acceleration 2	C045 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	5-122
1430h		C045 (LOW)	R/W			
1431h	Arrival Frequency During Deceleration 2	C046 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
1432h		C046 (LOW)	R/W			
1433h	Pulse Train Output Coefficient	C047	R/W	0001 to 9999	–	5-43
1434h to 1437h	Reserved	–	–	–	–	–
1438h	Feedback Comparison Signal Off Level	C052	R/W	0 to 1000	0.1 [%]	5-73
1439h	Feedback Comparison Signal On Level	C053	R/W	0 to 1000	0.1 [%]	
143Ah	Overtorque/Undertorque Selection	C054	R/W	00: Overtorque 01: Undertorque	–	5-152
143Bh	Overtorque/Undertorque Level (Forward Power Running)	C055	R/W	0 to 200	1 [%]	
143Ch	Overtorque/Undertorque Level (Reverse Regeneration)	C056	R/W	0 to 200	1 [%]	5-152
143Dh	Overtorque/Undertorque Level (Reverse power running)	C057	R/W	0 to 200	1 [%]	
143Eh	Overtorque/Undertorque Level (Forward Regeneration)	C058	R/W	0 to 200	1 [%]	
143Fh	Overtorque/Undertorque Signal Output Mode Selection	C059	R/W	00: During acceleration/ deceleration/constant speed 01: Only during constant speed	–	
1440h	Reserved	–	–	–	–	–
1441h	Electronic Thermal Warning Level	C061	R/W	0 to 100	1 [%]	5-113
1442h	Reserved	–	–	–	–	–
1443h	0 Hz Detection Level	C063	R/W	0 to 10000	0.01 [Hz]	5-125
1444h	Cooling Fin Overheat Warning Level	C064	R/W	0 to 110	1 [°C]	5-129
1445h to 144Ah	Reserved	–	–	–	–	–

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
144Bh	Communication Speed Selection	C071	R/W	03 (2,400 bps) 04 (4,800 bps) 05 (9,600 bps) 06 (19.2 kbps) 07 (38.4 kbps) 08 (57.6 kbps) 09 (76.8 kbps) 10 (115.2 kbps)	–	–
144Ch	Communication Station No. Selection	C072	R/W	1 to 247	–	
144Dh	Reserved	–	–	–	–	–
144Eh	Communication Parity Selection	C074	R/W	00: Disabled 01: Even 02: Odd	–	–
144Fh	Communication Stop Bit Selection	C075	R/W	1: 1 bit 2: 2 bits	–	
1450h	Operation Selection on Communication Error	C076	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	
1451h	Communication Error Timeout Time	C077	R/W	0: Timeout disabled 1 to 9999	0.01 [s]	
1452h	Communication Wait Time	C078	R/W	0 to 1000	1 [ms]	
1453h to 1454h	Reserved	–	–	–	–	–
1455h	FV Adjustment	C081	R/W	0 to 2000	0.1 [%]	5-40
1456h	FI Adjustment	C082	R/W	0 to 2000	0.1 [%]	
1457h to 1458h	Reserved	–	–	–	–	–
1459h	Thermistor Adjustment	C085	R/W	0 to 2000	0.1 [%]	5-120
145Ah to 145Eh	Reserved	–	–	–	–	–
145Fh	Debug Mode Selection	C091	R	For factory adjustment (Do not change.)	–	–
1460h to 1463h	Reserved	–	–	–	–	–
1464h	Communication Selection	C096	R/W	00: Modbus communication (Modbus-RTU) 01: Co-inverter communication 02: Co-inverter communication (management)	–	6-22
1465h	Reserved	–	–	–	–	–

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1466h	Co-inverter Communication Starting Station Number	C098	R/W	1 to 8	–	6-22
1467h	Co-inverter Communication Ending Station Number	C099	R/W	1 to 8	–	
1468h	Co-inverter Communication Starting Selection	C100	R/W	00: 485 terminal 01: Always started	–	
1469h	UP/DWN Storage Selection	C101	R/W	00: Do not store frequency data 01: Store frequency data	–	5-71
146Ah	Reset Selection	C102	R/W	00: Trip reset at power-on 01: Trip reset at power-off 02: Enabled only during trip (Reset when the power is ON.) 03: Trip reset only	–	5-100
146Bh	Reset Restart Selection	C103	R/W	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–	
146Ch	UP/DWN Clear Terminal Mode	C104	R/W	00: 0 Hz 01: EEPROM data at power-on	–	5-71
146Dh	MP Gain Setting	C105	R/W	50 to 200	1 [%]	5-43
146Eh	AM Gain Adjustment	C106	R/W	50 to 200	1 [%]	5-45
146Fh to 1470h	Reserved	–	–	–	–	–
1471h	AM Bias Setting	C109	R/W	0 to 100	1 [%]	5-45
1472h	Reserved	–	–	–	–	–
1473h	Overload 1 Warning Level 2	C111	R/W	0 to 20000	0.01 [%]	5-115
1474h to 1485h	Reserved	–	–	–	–	–
1486h	Output P1/EDM ON Delay Time	C130	R/W	0 to 1000	0.1 [s]	5-36
1487h	Output P1/EDM OFF Delay Time	C131	R/W	0 to 1000	0.1 [s]	
1488h	Output P2 ON Delay Time	C132	R/W	0 to 1000	0.1 [s]	
1489h	Output P2 OFF Delay Time	C133	R/W	0 to 1000	0.1 [s]	5-36
148Ah to 148F	Reserved	–	–	–	–	–
1490h	Output RY ON Delay Time	C140	R/W	0 to 1000	0.1 [s]	5-36
1491h	Output RY OFF Delay Time	C141	R/W	0 to 1000	0.1 [s]	

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1492h	Logic Output Signal 1 Selection 1	C142	R/W	Same with C021 and C022 (Except that "no," 62, 63, and LOG1 to LOG3 cannot be selected.)	–	5-125
1493h	Logic Output Signal 1 Selection 2	C143	R/W	Same with C021 and C022 (Except that "no," 62, 63, and LOG1 to LOG3 cannot be selected.)	–	
1494h	Logic Output Signal 1 Operator Selection	C144	R/W	00: AND 01: OR 02: XOR	–	
1495h	Logic Output Signal 2 Selection 1	C145	R/W	Same with C021 and C022 (Except that "no," 62, 63, and LOG1 to LOG3 cannot be selected.)	–	
1496h	Logic Output Signal 2 Selection 2	C146	R/W	Same with C021 and C022 (Except that "no," 62, 63, and LOG1 to LOG3 cannot be selected.)	–	
1497h	Logic Output Signal 2 Operator Selection	C147	R/W	00: AND 01: OR 02: XOR	–	
1498h	Logic Output Signal 3 Selection 1	C148	R/W	Same with C021 and C022 (Except that "no," 62, 63, and LOG1 to LOG3 cannot be selected.)	–	
1499h	Logic Output Signal 3 Selection 2	C149	R/W	Same with C021 and C022 (Except that "no," 62, 63, and LOG1 to LOG3 cannot be selected.)	–	
149Ah	Logic Output Signal 3 Operator Selection	C150	R/W	00: AND 01: OR 02: XOR	–	
149Bh to 14A3h	Reserved	–	–	–	–	–
14A4h	Input Terminal 1 Response Time	C160	R/W	0 to 200	1	5-32
14A5h	Input Terminal 2 Response Time	C161	R/W	0 to 200	1	
14A6h	Input Terminal 3 Response Time	C162	R/W	0 to 200	1	
14A7h	Input Terminal 4 Response Time	C163	R/W	0 to 200	1	
14A8h	Input Terminal 5 Response Time	C164	R/W	0 to 200	1	
14A9h	Input Terminal 6 Response Time	C165	R/W	0 to 200	1	
14AAh	Input Terminal 7 Response Time	C166	R/W	0 to 200	1	
14ABh to 14ACh	Reserved	–	–	–	–	–

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<tr><th>Register No.</th><th>Function name</th><th>Parameter No.</th><th>R/W</th><th>Monitor and setting parameters</th><th>Data resolution</th><th>Page</th></tr>
<tr><td>14ADh</td><td>Multi-step Speed/ Position Determination Time</td><td>C169</td><td>R/W</td><td>0 to 200</td><td>1</td><td>5-63</td></tr>
<tr><td>14AEh to 1500h</td><td>Not used</td><td>–</td><td>–</td><td>Inaccessible</td><td>–</td><td>–</td></tr>
<tr><td>1501h</td><td>Auto-tuning Selection</td><td>H001</td><td>R/W</td><td>00: Disabled
01: Enabled (motor does not rotate)
02: Enabled (motor rotates)</td><td>–</td><td>5-146</td></tr>
<tr><td>1502h</td><td>Motor Parameter 1</td><td>H002</td><td>R/W</td><td>00: Standard motor parameter
02: Auto-tuning parameter</td><td>–</td><td>5-145</td></tr>
<tr><td>1503h</td><td>Motor Capacity 1</td><td>H003</td><td>R/W</td><td>00: 0.1
01: 0.2
02: 0.4
03: 0.55
04: 0.75
05: 1.1
06: 1.5
07: 2.2
08: 3.0
09: 3.7
10: 4.0
11: 5.5
12: 7.5
13: 11.0
14: 15.0
15: 18.5</td><td>–</td><td rowspan="2">5-145</td></tr>
<tr><td>1504h</td><td>Motor Pole Number 1</td><td>H004</td><td>R/W</td><td>00: 2P
01: 4P
02: 6P
03: 8P
04: 10P</td><td>–</td></tr>
<tr><td>1505h</td><td>Reserved</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>1506h</td><td>Speed Response</td><td>H005</td><td>R/W</td><td>0 to 1000</td><td>1 [%]</td><td>5-145</td></tr>
<tr><td>1507h</td><td>Stabilization Parameter 1</td><td>H006</td><td>R/W</td><td>0 to 255</td><td>1</td><td>5-81</td></tr>
<tr><td>1508h to 1515h</td><td>Reserved</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>1516h</td><td>Motor 1 Parameter R1</td><td>H020</td><td>R/W</td><td>1 to 65530</td><td>0.001 [Ω]</td><td>5-145</td></tr>
<tr><td>1517h</td><td>Reserved</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>1518h</td><td>Motor 1 Parameter R2</td><td>H021</td><td>R/W</td><td>1 to 65530</td><td>0.001 [Ω]</td><td>5-145</td></tr>
<tr><td>1519h</td><td>Reserved</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>151Ah</td><td>Motor 1 Parameter L</td><td>H022</td><td>R/W</td><td>1 to 65530</td><td>0.01 [mH]</td><td>5-145</td></tr>
<tr><td>151Bh</td><td>Reserved</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>151Ch</td><td>Motor 1 Parameter Io</td><td>H023</td><td>R/W</td><td>1 to 65530</td><td>0.01 [A]</td><td rowspan="3">5-145</td></tr>
<tr><td>151Dh</td><td rowspan="2">Motor 1 Parameter J</td><td>H024 (HIGH)</td><td>R/W</td><td rowspan="2">1 to 9999000</td><td rowspan="2">0.001 [kgm^2]</td></tr>
<tr><td>151Eh</td><td>H024 (LOW)</td><td>R/W</td></tr>
<tr><td>151Fh to 1524h</td><td>Reserved</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td></tr>
</table>

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1525h	Motor 1 Parameter R1 (Auto-tuning Data)	H030	R/W	1 to 65530	0.001 [Ω]	5-145
1526h	Reserved	–	–	–	–	–
1527h	Motor 1 Parameter R2 (Auto-tuning Data)	H031	R/W	1 to 65530	0.001 [Ω]	5-145
1528h	Reserved	–	–	–	–	–
1529h	Motor 1 Parameter L (Auto-tuning Data)	H032	R/W	1 to 65530	0.01 [mH]	5-145
152Ah	Reserved	–	–	–	–	–
152Bh	Motor 1 Parameter Io (Auto-tuning Data)	H033	R/W	1 to 65530	0.01 [A]	5-145
152Ch	Motor 1 Parameter J (Auto-tuning Data)	H034 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	
152Dh		H034 (LOW)	R/W			
152Eh to 153Ch	Reserved	–	–	–	–	–
153Dh	V/f Control With Speed Feedback Slip Compensation Proportional Gain	H050	R/W	0 to 1000	0.01 [%]	5-83 5-160
153Eh	V/f Control With Speed Feedback Slip Compensation Integral Gain	H051	R/W	0 to 1000	1 [s]	
153Fh to 1600h	Not used	–	–	Inaccessible	–	–
1601h	Operation Selection on Option Error	P001	R/W	00: Trip 01: Continue operation	00	–
1602h	Reserved	–	–	–	–	–
1603h	Pulse Train Input Terminal RP Selection	P003	R/W	00: Frequency setting (including PID) 01: Feedback pulse (enabled only when motor 1 control is selected) 02: Do not set.	–	5-82 5-160
1604h	Feedback Pulse Train Input Type Selection	P004	R/W	00: 1-phase pulse input 01: Dual-phase pulse 1 02: Dual-phase pulse 2 03: 1-phase pulse train + direction	–	5-160
1605h to 160Ah	Reserved	–	–	–	–	–
160Bh	Number of Encoder Pulses	P011	R/W	32 to 1024	1	5-160
160Ch	Simple Position Control Selection	P012	R/W	00: Simple position control disabled 02: Simple position control enabled	–	

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
160Dh to 160Eh	Reserved	–	–	–	–	–
160Fh	Creep Speed Setting	P015	R/W	Starting frequency to 1000 (10000)	0.01 [Hz]	5-160
1610h to 1619h	Reserved	–	–	–	–	–
161Ah	Overspeed Error Detection Level	P026	R/W	0 to 1500	0.1 [%]	5-160
161Bh	Speed Deviation Error Detection Level	P027	R/W	0 to 12000	0.01 [Hz]	
161Ch to 161Eh	Reserved	–	–	–	–	–
161Fh	Acceleration/ Deceleration Time Input Type	P031	R/W	00: Digital Operator 03: Do not set.	–	5-24
1620h	Reserved	–	–	–	–	–
1621h	Torque Reference Input Selection	P033	R/W	00: Terminal FV 01: Terminal FI 03: Digital Operator 06: Do not set.	–	5-156
1622h	Torque Reference Setting	P034	R/W	0 to 200	1 [%]	
1623h	Reserved	–	–	–	–	–
1624h	Torque Bias Mode	P036	R/W	00: Disabled 01: Digital Operator 05: Do not set.	–	5-156
1625h	Torque Bias Value	P037	R/W	–200 to +200	1 [%]	
1626h	Torque Bias Polarity Selection	P038	R/W	00: As per sign 01: Depends on the RUN direction	–	
1627h	Speed Limit Value in Torque Control (forward)	P039 (HIGH)	R/W	0 to 12000	0.01 [Hz]	5-156
1628h		P039 (LOW)	R/W			
1629h	Speed Limit Value in Torque Control (reverse)	P040 (HIGH)	R/W	0 to 12000	0.01 [Hz]	
162Ah		P040 (LOW)	R/W			
162Bh	Speed/Torque Control Switching Time	P041	R/W	0 to 1000	1 [ms]	
162Ch to 1633h	Reserved	–	–	–	–	–
1634h to 1638h	Reserved	–	–	–	–	–

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Communication Function

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1639h	Pulse Train Frequency Scale	P055	R/W	10 to 320 *Input frequency at maximum frequency	0.1 [kHz]	5-82
163Ah	Pulse Train Frequency Filter Time Parameter	P056	R/W	1 to 200	0.01 [s]	
163Bh	Pulse Train Bias Amount	P057	R/W	–100 to +100	1 [%]	
163Ch	Pulse Train Limit	P058	R/W	0 to 100	1 [%]	
163Dh	Reserved	–	–	–	–	–
163Eh	Multi-step Position Command 0	P060 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	5-164
163Fh		P060 (LOW)	R/W			
1640h	Multi-step Position Command 1	P061 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	
1641h		P061 (LOW)	R/W			
1642h	Multi-step Position Command 2	P062 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	
1643h		P062 (LOW)	R/W			
1644h	Multi-step Position Command 3	P063 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	
1645h		P063 (LOW)	R/W			
1646h	Multi-step Position Command 4	P064 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	5-164
1647h		P064 (LOW)	R/W			
1648h	Multi-step Position Command 5	P065 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	
1649h		P065 (LOW)	R/W			
164Ah	Multi-step Position Command 6	P066 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	
164Bh		P066 (LOW)	R/W			
164Ch	Multi-step Position Command 7	P067 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side) (Displays MSB 4 digits including "–")	1	
164Dh		P067 (LOW)	R/W			
164Eh	Zero Return Mode	P068	R/W	00: Zero return mode 1 01: Zero return mode 2	–	5-168
164Fh	Zero Return Direction Selection	P069	R/W	00: Forward 01: Reverse	–	
1650h	Zero Return Mode 1 Frequency	P070	R/W	0 to 1000 (10000)	0.01 [Hz]	
1651h	Zero Return Mode 2 Frequency	P071	R/W	0 to 4000	0.01 [Hz]	

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Communication Function

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1652h	Position Range Setting (forward side)	P072 (HIGH)	R/W	0 to 268435455	1	5-160
1653h		P072 (LOW)	R/W			
1654h	Position Range Setting (reverse side)	P073 (HIGH)	R/W	–268435455 to 0	1	
1655h		P073 (LOW)	R/W			
1656h	Reserved	–	–	–	–	–
1657h	Positioning Mode Selection	P075	R/W	00: Limit 01: Unlimited	–	5-160
1658h	Reserved	–	–	–	–	–
1659h	Encoder Disconnection Detection Time	P077	R/W	0 to 100	0.1 [s]	5-160
165Ah to 168Dh	Reserved	–	–	–	–	–
168Eh	Number of Send Data of All Stations in Co-inverter Communication	P140	R/W	1 to 5	–	6-22
168Fh	Recipient Station Number of All Stations in Co-inverter Communication 1	P141	R/W	1 to 247	–	
1690h	Recipient Register of All Stations in Co-inverter Communication 1	P142	R/W	0000h to FFFFh	–	
1691h	Sender Register of All Stations in Co-inverter Communication 1	P143	R/W	0000h to FFFFh	–	
1692h	Recipient Station Number of All Stations in Co-inverter Communication 2	P144	R/W	1 to 247	–	
1693h	Recipient Register of All Stations in Co-inverter Communication 2	P145	R/W	0000h to FFFFh	–	
1694h	Sender Register of All Stations in Co-inverter Communication 2	P146	R/W	0000h to FFFFh	–	
1695h	Recipient Station Number of All Stations in Co-inverter Communication 3	P147	R/W	1 to 247	–	
1696h	Recipient Register of All Stations in Co-inverter Communication 3	P148	R/W	0000h to FFFFh	–	
1697h	Sender Register of All Stations in Co-inverter Communication 3	P149	R/W	0000h to FFFFh	–	
1698h	Recipient Station Number of All Stations in Co-inverter Communication 4	P150	R/W	1 to 247	–	

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
1699h	Recipient Register of All Stations in Co-inverter Communication 4	P151	R/W	0000h to FFFFh	–	6-22
169Ah	Sender Register of All Stations in Co-inverter Communication 4	P152	R/W	0000h to FFFFh	–	
169Bh	Recipient Station Number of All Stations in Co-inverter Communication 5	P153	R/W	1 to 247	–	
169Ch	Recipient Register of All Stations in Co-inverter Communication 5	P154	R/W	0000h to FFFFh	–	
169Dh	Sender Register of All Stations in Co-inverter Communication 5	P155	R/W	0000h to FFFFh	–	
169Eh to 16BCh	Reserved	–	–	–	–	–
16BDh to 1E00h	Not used	–	–	Inaccessible	–	–
1E01h	Coil Data 1*1	–	R	2^0: Coil number 0010h to 2^{15}: Coil number 001Fh	–	–
1E02h	Coil Data 2*1	–	R	2^0: Coil number 0020h to 2^{15}: Coil number 002Fh	–	–
1E03h	Coil Data 3*1	–	R	2^0: Coil number 0030h to 2^{15}: Coil number 003Fh	–	–
1E04h	Coil Data 4*1	–	R	2^0: Coil number 0040h to 2^{15}: Coil number 004Fh	–	–
1E05h	Coil Data 5*1	–	R	2^0: Coil number 0050h to 2^8: Coil number 0058h	–	–
1E06h to 1E18h	Reserved	–	–	–	–	–
1E19h to 1F00h	Not used	–	–	Inaccessible	–	–
1F01h	Coil Data 0*1	–	R/W	2^1: Coil number 0001h to 2^{15}: Coil number 000Fh	–	–
1F02h to 1F1Dh	Reserved	–	–	–*2	–	–
1F1Eh to 2102h	Not used	–	–	Inaccessible	–	–

*1. Each of the above holding registers (coil data 0 to 5) consists of 16 coil data. Since coils are not supported in Co-inverter communication (only holding registers are supported), use the above holding registers when accessing coils.

*2. Do not write into holding registers 1F02h to 1F1Dh.

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Communication Function

(vi) Holding Register Number List (2nd Setting, Group F)

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
2103h	Acceleration Time 2 Setting	F202 (HIGH)	R/W	1 to 360000	0.01 [s]	5-24
2104h		F202 (LOW)	R/W			
2105h	Deceleration Time 2 Setting	F203 (HIGH)	R/W	1 to 360000	0.01 [s]	
2106h		F203 (LOW)	R/W			
2107h to 2200h	Not used	–	–	Inaccessible	–	–

(vii) Holding Register Number List (2nd Setting, Groups A, b, C, H and P)

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
2201h	Frequency Reference Selection 2	A201	R/W	00: Volume 01: Control circuit terminal block 02: Digital Operator 03: Modbus communication (Modbus-RTU) 04: Optional board 06: Pulse train frequency 07: Do not set. 10: Operation function output	–	5-15
2202h	RUN Command Selection 2 *1	A202	R/W	01: Control circuit terminal block 02: Digital Operator 03: Modbus communication (Modbus-RTU) 04: Optional board	–	5-22
2203h	Base Frequency 2	A203	R/W	300 to Maximum Frequency 2	0.1 [Hz]	5-26
2204h	Maximum Frequency 2	A204	R/W	Base Frequency 2 to 4000 (10000)	0.1 [Hz]	5-28
2205h to 2215h	Reserved	–	–	–	–	–
2216h	Multi-step Speed 2 Reference 0	A220 (HIGH)	R/W	0 Starting frequency to Maximum frequency 2	0.01 [Hz]	5-63
2217h		A220 (LOW)	R/W			
2218h to 223Ah	Reserved	–	–	–	–	–

*1. After changing the 2nd RUN Command Selection, provide an interval of at least 40 ms before the RUN command is actually executed.

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
223Bh	Torque Boost Selection 2	A241	R/W	00: Manual torque boost 01: Automatic torque boost	–	5-49
223Ch	Manual Torque Boost Voltage 2	A242	R/W	0 to 200	0.1 [%]	
223Dh	Manual Torque Boost Frequency 2	A243	R/W	0 to 500	0.1 [%]	
223Eh	Control Method 2	A244	R/W	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control (heavy load only)	–	5-46 5-144
223Fh	Output Voltage Gain 2	A245	R/W	20 to 100	1 [%]	5-72
2240h	Automatic Torque Boost Voltage Compensation Gain 2	A246	R/W	0 to 255	1 [%]	5-49
2241h	Automatic Torque Boost Slip Compensation Gain 2	A247	R/W	0 to 255	1 [%]	
2242h to 224Eh	Reserved	–	–	–	–	–
224Fh	Frequency Upper Limit 2	A261 (HIGH)	R/W	0 Frequency Lower Limit 2 to Maximum Frequency 2	0.01 [Hz]	5-60
2250h		A261 (LOW)	R/W			
2251h	Frequency Lower Limit 2	A262 (HIGH)	R/W	0 Starting frequency to Frequency Upper Limit 2	0.01 [Hz]	
2252h		A262 (LOW)	R/W			
2253h to 2268h	Reserved	–	–	–	–	–
2269h	AVR Selection 2	A281	R/W	00: Always ON 01: Always OFF 02: OFF during deceleration	–	5-27
226Ah	Motor Incoming Voltage Selection 2	A282	R/W	200V class: 00 (200) 01(215) 02(220) 03(230) 04(240) 400V class: 05 (380) 06(400) 07(415)	–	5-26 5-148
226Bh to 226Eh	Reserved	–	–	–	–	–

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
226Fh	2nd Acceleration Time 2	A292 (HIGH)	R/W	1 to 360000	0.01 [s]	5-66
2270h		A292 (LOW)	R/W			
2271h	2nd Deceleration Time 2	A293 (HIGH)	R/W	1 to 360000	0.01 [s]	
2272h		A293 (LOW)	R/W			
2273h	2-step Acceleration/ Deceleration Selection 2	A294	R/W	00: Switched via 2CH terminal 01: Switched by setting 02: Enabled only when switching forward/ reverse	–	
2274h	2-step Acceleration Frequency 2	A295 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
2275h		A295 (LOW)	R/W			
2276h	2-step Deceleration Frequency 2	A296 (HIGH)	R/W	0 to 40000 (100000)	0.01 [Hz]	
2277h		A296 (LOW)	R/W			
2278h to 230Bh	Not used	–	–	Inaccessible	–	–
230Ch	Electronic Thermal Level 2	b212	R/W	2000 to 10000	0.01 [%]	5-110
230Dh	Electronic Thermal Characteristics Selection 2	b213	R/W	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–	
230Eh to 2315h	Reserved	–	–	–	–	–
2316h	Overload Limit 2 Selection	b221	R/W	00: Disabled 01: Enabled in acceleration/ constant speed operation 02: Enabled in constant speed operation 03: Enabled in acceleration/ constant speed operation (Accelerates during regeneration)	–	5-114
2317h	Overload Limit 2 Level	b222	R/W	100 to 2000	0.1 [%]	
2318h	Overload Limit 2 Parameter	b223	R/W	1 to 30000	0.1 [s]	
2319h to 2428h	Not used	–	–	Inaccessible	–	–
2429h	Overload Warning Level 2	C241	R/W	0 to 2000	0.1 [%]	5-115

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Communication Function

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
242Ah to 2501h	Not used	–	–	Inaccessible	–	–
2502h	Motor Parameter 2	H202	R/W	00: Standard motor parameter 02: Auto-tuning data	–	5-145
2503h	Motor Capacity 2	H203	R/W	00: 0.1 01: 0.2 02: 0.4 03: 0.55 04: 0.75 05: 1.1 06: 1.5 07: 2.2 08: 3.0 09: 3.7 10: 4.0 11: 5.5 12: 7.5 13: 11.0 14: 15.0 15: 18.5	–	
2504h	Motor Pole Number 2	H204	R/W	00: 2P 01: 4P 02: 6P 03: 8P 04: 10P	–	
2505h	Speed Response 2	H205 (HIGH)	R/W	1 to 1000	1 [%]	
2506h		H205 (LOW)	R/W			
2507h	Stabilization Parameter 2	H206	R/W	0 to 255	1	5-81
2508h to 2515h	Reserved	–	–	–	–	–
2516h	Motor 2 Parameter R1	H220	R/W	1 to 65530	0.001 [Ω]	5-145
2517h	Reserved	–	–	–	–	–
2518h	Motor 2 Parameter R2	H221	R/W	1 to 65530	0.001 [Ω]	5-145
2519h	Reserved	–	–	–	–	–
251Ah	Motor 2 Parameter L	H222	R/W	1 to 65530	0.01 [mH]	5-145
251Bh	Reserved	–	–	–	–	–
251Ch	Motor 2 Parameter Io	H223	R/W	1 to 65530	0.01 [A]	5-145
251Dh	Motor 2 Parameter J	H224 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	5-145
251Eh		H224 (LOW)	R/W			
251Fh to 2524h	Reserved	–	–	–	–	–
2525h	Motor 2 Parameter R1 (Auto-tuning Data)	H230	R/W	1 to 65530	0.001 [Ω]	5-145

Register No.	Function name	Parameter No.	R/W	Monitor and setting parameters	Data resolution	Page
2526h	Reserved	–	–	–	–	–
2527h	Motor 2 Parameter R2 (Auto-tuning Data)	H231	R/W	1 to 65530	0.001 [Ω]	5-145
2528h	Reserved	–	–	–	–	–
2529h	Motor 2 Parameter L (Auto-tuning Data)	H232	R/W	1 to 65530	0.01 [mH]	5-145
252Ah	Reserved	–	–	–	–	–
252Bh	Motor 2 Parameter Io (Auto-tuning Data)	H233	R/W	1 to 65530	0.01 [A]	5-145
252Ch	Motor 2 Parameter J (Auto-tuning Data)	H234 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	5-145
252Dh		H234 (LOW)	R/W			
252Eh to 3102h	Not used	–	–	Inaccessible	–	–

7

Maintenance Operations

Describes the error diagnosis based on error display, remedial actions to be taken, and items to check upon occurrence of a problem.

7-1 Error Display and Remedial Actions

Error Display

Upon detecting an error, the Inverter cuts off (trips) the output, the ALARM LED indicator is lit, and an error code is displayed. By pressing the Increment key while the error code is displayed, the output frequency, current, DC voltage and other detailed information at the time of occurrence of the alarm can be checked.
Before resetting the alarm, check each signal such as the RUN command.
Also before resetting the alarm, identify the cause of the trip based on the displayed error code and remove the cause.

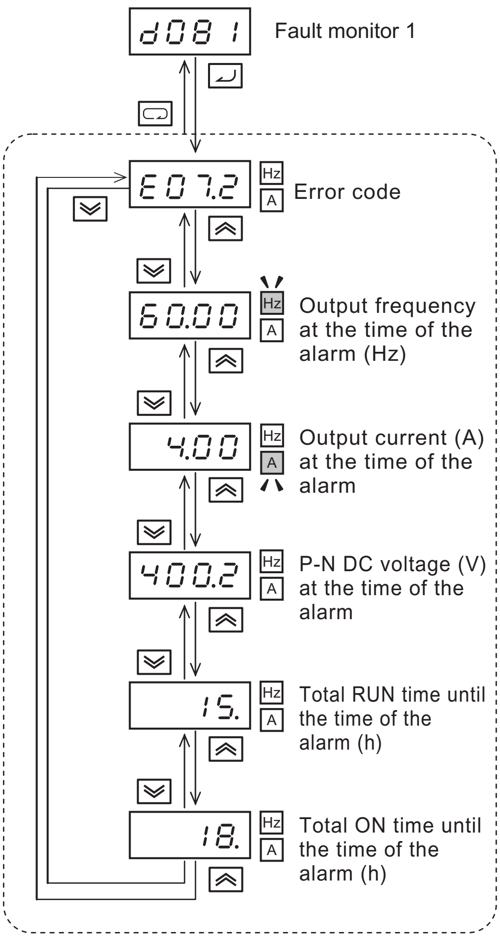
This Chapter explains how to handle problems that may occur after operation of the Inverter is started.

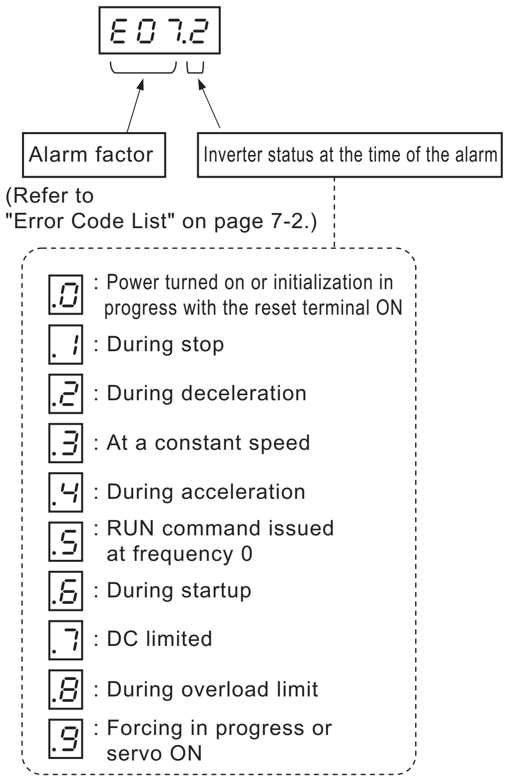
Method for Resetting Trip

A trip can be reset by one of the following two methods:

- Press the STOP/RESET Key.
- Allocate Reset (18: RS) to a multi-function input terminal, and turn this terminal ON and then turn it OFF.

- Depending on its factor, the trip may not be reset using the reset terminal. In this case, reconnect the power supply.





Note: This is the Inverter condition when a trip has occurred. It may be different from the apparent operation of the motor.
(During PID control or when the frequency is input using an analog signal, the Inverter may be repeating brief decelerations/accelerations due to analog signal fluctuation, etc., even when the motor appears to be operating at a constant speed.)

Error Code List

Name	Description		Error code	Check point and remedy	Reference page
Overcurrent protection	If the motor is restrained or rapidly accelerated or decelerated, a large current will flow through the Inverter, which will result in breakage. Accordingly, the protection circuit operates at approximately 200% of the Inverter rated output current and a trip occurs.	Constant speed	E01. □	Is there any rapid load fluctuation? →Eliminate load fluctuations. Is there any output short-circuit? →Check the output wiring. Is there any ground fault? →Check the output wiring and motor.	5-24 5-66
		During deceleration	E02. □	Is there any rapid deceleration? →Increase the deceleration time.	
		Acceleration	E03. □	Is there any rapid acceleration? →Increase the acceleration time. Has the motor been locked? →Check the motor and wiring. Is the torque boost too high? →Lower the torque boost.	
		Others	E04. □	Is the DC injection braking too high? →Decrease the braking force.	5-135
Overload protection[*1]	The Inverter output current is monitored and if a motor overload is detected by the built-in electronic thermal, a trip occurs.		E05. □	Is the load too large? →Decrease the load rate. Is the thermal level correct? →Adjust the thermal level to an appropriate level.	5-110
Braking resistor overload protection	A trip will occur if the usage rate of regenerative braking circuit exceeds the b090 set value.		E06. □	Is there any rapid deceleration? →Increase the deceleration time. Is the operation cycle too short? →Increase the operation cycle.	5-24 5-141
Overvoltage protection	Extremely high DC voltage between P/+2 and N/– may result in failure. Accordingly, a trip will occur if the DC voltage between P/+2 and N/– reaches approx. 400 VDC (200V class) or 800 VDC (400V class) or above due to increase in the regenerative energy from the motor or in the incoming voltage.		E07. □	Is there any rapid deceleration? →Increase the deceleration time. Is there any ground fault? →Check the output wiring and motor. Has the motor been rotated from the load side? →Reduce regenerative energy. Has incoming voltage increased? →Lower the incoming voltage, sustain the power supply fluctuation, apply the AC reactor to input.	–

*1. The reset command will not be accepted until approximately 10 seconds pass since the trip occurs (protection function works).

Name	Description	Error code	Check point and remedy	Reference page
EEPROM error *1	A trip will occur if the built-in EEPROM generates an error due to external noise, abnormal rise in temperature, etc. (It may become a CPU error depending on the case).	E08. □	Is there any large noise source around? →Countermeasures against noise Has the cooling efficiency been reduced? →Check that there is no clogging in the cooling fan and clean it. →Replace the cooling fan.	–
Undervoltage	The output is shut off if the incoming voltage drops to the specified value or below, because the control circuit no longer functions properly if the incoming voltage to the Inverter drops. A trip will also occur when the DC voltage between P/+2 and N/– drops to approx. 173 VDC (200V class) or 345 VDC (400V class) or below.	E09. □	Has the power supply voltage decreased? →Check the power supply. Is the power supply capacity insufficient? →Check the power supply. Has the thyristor been broken? →Check the thyristor.	5-72
Current detector error	A trip will occur if the current detector generates an error.	E10. □	The Inverter has a failure. →Repair	–
CPU error*1	A trip will occur if the built-in CPU experiences a malfunction or error.	E11. □	Is there any large noise source around? →Countermeasures against noise The Inverter has a failure. →Repair	–
External trip	A trip will occur if the multi-function input terminal set for External trip (12: EXT) turns ON.	E12. □	Faulty external equipment →Check the external equipment	5-120
USP error	A trip will occur if the power is turned on while a RUN signal is still input to the Inverter. (Available only when the USP function is selected).	E13. □	Is the power turned on while a RUN signal is still input? →Check the RUN signal.	5-105
Grounding protection*1	A trip will occur if a ground fault between the Inverter output unit and the motor is detected when turning on the power. (This function does not work when there is residual voltage in the motor).	E14. □	Is there any ground fault? →Check the output wiring and motor. Is there any error in the Inverter itself? →Disconnect the output wires to check. Is there any error in the main circuit? →Check the main circuit. (Refer to Chapter 8, "Inspection and Maintenance").	–

*1. If an error occurs, the reset operation using the RS terminal or STOP/RESET key is not accepted. Turn off the power once.
If an error is issued when the power is turned on again, the memory may be faulty or parameters may not be stored correctly. Perform parameter initialization and set the parameters again.

Name	Description	Error code	Check point and remedy	Reference page
Incoming overvoltage protection	A trip will occur if the incoming voltage remains in an overvoltage state for 100 s while the Inverter is stopped. The overvoltage detection value is approx. 390 VDC for 200V class models, or 780 VDC for 400V class models, based on the DC voltage between P/+2 and N/–.	E15. □	Is the incoming voltage too high? →Decrease the incoming voltage. →Suppress the power supply fluctuation. →Apply the AC reactor to input.	–
Abnormal temperature	A trip will occur if the temperature of the main circuit exceeds the specified value due to a high ambient temperature, etc.	E21. □	Is the installation direction vertical? →Check the installation. Is the ambient temperature high? →Lower the temperature.	–
CPU communication error	A trip will occur if the built-in CPU experiences a communication malfunction or error.	E22. □	Is there any large noise source around? →Countermeasures against noise Faulty inverter →Repair	–
Main circuit error	A trip will occur if the main circuit board generates an error.	E25. □	Is there any large noise source around? →Countermeasures against noise Faulty inverter →Repair	–
Driver error*1	This error is detected by the driver IC mounted in the Inverter. A trip will occur upon occurrence of momentary overcurrent, abnormal main element temperature or drop in main element drive power, in order to protect the main element. (Operation cannot be restarted following this trip).	E30. □	Is there any output short-circuit? →Check the output wiring. Is there any ground fault? →Check the output wiring and motor. Has the main element been damaged? →Check the IGBT. Is there any clogging in the fan? →Clean the fins.	–
Thermistor error	A trip will occur upon detection of abnormal temperature based on the resistance of the external thermistor, if the thermistor input function is enabled.	E35. □	Is the motor temperature too high? →Check the temperature. Is the thermistor damaged? →Check the thermistor. Is there any noise interfusion in the thermistor signal? →Separate the wiring.	5-120

*1. If an error occurs, the reset operation using the RS terminal or STOP/RESET key is not accepted. Turn off the power once.
If an error is issued when the power is turned on again, the memory may be faulty or parameters may not be stored correctly. Perform parameter initialization and set the parameters again.

Name	Description	Error code	Check point and remedy	Reference page
Brake error	A trip will occur if brake ON/OFF cannot be confirmed within the Brake Confirmation Wait Time (b124) after the Inverter has issued a brake release output, provided that the Brake Control function is enabled (b120 = 01).	E36. □	Is the brake ON/OFF function working? →Check the brake. Is the set time for b124 too short? →Increase b124 . Has the brake confirmation signal been input? →Check the wiring.	5-142
Emergency shutoff[*1]		E37. □	–	–
Overload protection in a low speed range	If an overload occurs in the extremely low speed range of 0.2 Hz or below, it will be detected by the built-in electronic thermal of the Inverter and a trip will occur. (However, the error history may indicate a high frequency).	E38. □	Is the load too large? →Decrease the load rate.	–
Poor Digital Operator connection	The Inverter is tripped when there is an error or broken line for communications with an externally connected Operator (optional).	E40. □	Is there a communications error? →Check the cable and replace it if necessary. This error will not be detected if b165 is set to 02 (ignore).	5-85 5-86
Modbus communication (Modbus-RTU) error	A trip will occur upon timeout if the communication error selection is set to tripping (C076 = 00).	E41. □	Is the communication speed correct? →Check the setting. Is the wiring distance appropriate? →Check the communication wiring. Has disconnection occurred? →Check the wiring.	6-3
Internal data error	–	E43. □ to E59. □	–	–
Option error	This error is reported by an optional board.	E60. □ to E68. □	Refer to the manual for the optional board for details.	–
Option timeout	A timeout occurred in communications between the Inverter and optional board, and the Inverter was tripped.	E69. □	The optional board is disconnected. →Check to see if the case of the optional board is mating properly with the Inverter. Tighten the mounting screws. The option board is malfunctioning. →If the optional board is mated properly, it may have failed.	–

Name	Description	Error code	Check point and remedy	Reference page
Encoder disconnection	The Inverter is tripped if the motor rotations detected by the motor are less than the Starting Frequency (b082) for longer than the Encoder Disconnection Detection Time (P077, P077 ≠ 0) when the output frequency is equal to or higher than the Creep Speed Setting (P015).	E80. □	The encoder wiring is disconnected or there is a faulty connection. →Check the encoder wiring. The actual motor rotations is less than the Starting Frequency (b082) for longer than the Encoder Disconnection Detection Time (P077). →Adjust the parameters. Increase the setting in P077 and P015. This error also occurs if the number of motor rotations is less than the starting frequency during simple position control. →Adjust the parameters. Increase the setting in P077 and P015.	5-83 5-160 5-161
Excess speed	The Inverter is tripped when the motor rotations equal or exceed the maximum frequency times the Overspeed Error Detection Level (P026 ≠ 0).	E81. □	This is determined via speed detection with the encoder. The encoder wiring is disconnected or there is a faulty connection. →Check the encoder wiring. The number of encoder pulses is not correct. →Check the Number of Encoder Pulses (P011). The actual motor rotations exceeded the error detection level. →Adjust the Overspeed Error Detection Level (P026)	5-83 5-160
Position control range trip	A trip will occur if the current position exceeds the Position Range Setting (P072, P073) during simple position control.	E83. □	Check the current position. →Check parameters P072 and P073. →Check the zero point.	5-161

*1. It cannot be reset with STOP/RESET keys. Perform a reset by reconnecting the power or operating the RS (reset) terminal.

7

Maintenance Operations

Warning Display

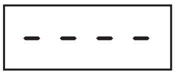
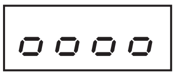
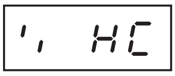
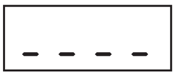
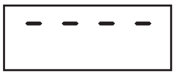
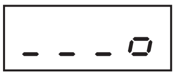
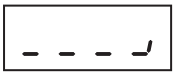
If the set parameter contradicts other set value, a warning will be displayed and the program LED indicator will flash.
The table below lists the warnings to be displayed and the conditions in which these warnings are displayed. If a warning is displayed, change the applicable parameter by referring to the content of the table. (Issuing a RUN command will not rewrite the parameter to the correct value automatically).
The last displayed warning is stored in d090.

Warning display	Warning display condition		
W001	Frequency Upper Limit 1 (A061)	>	Maximum Frequency 1 (A004)
W002	Frequency Lower Limit 1 (A062)	>	Maximum Frequency 1 (A004)
W005	Output Frequency Setting (F001), Multi-step Speed 1 Reference 0 (A020)	>	Maximum Frequency 1 (A004)
W015	Output Frequency Setting (F001), Multi-step Speed 1 Reference 0 (A020)	>	Frequency Upper Limit 1 (A061)
W025	Frequency Lower Limit 1 (A062)	>	Output Frequency Setting (F001), Multi-step Speed 1 Reference 0 (A020)
W031	Starting Frequency (b082)	>	Frequency Upper Limit 1 (A061)
W032	Starting Frequency (b082)	>	Frequency Lower Limit 1 (A062)
W035	Starting Frequency (b082)	>	Output Frequency Setting (F001), Multi-step Speed 1 Reference 0 (A020)
W037	Starting Frequency (b082)	>	Jogging Frequency (A038)
W085	Output Frequency Setting (F001), Multi-step Speed 1 Reference 0 (A020)	=	Jump frequency*1 (A063/A065/A067±A064/A066/A068)
W086	Multi-step Speed References 1 to 15 (A021 to A035)	=	
W091	Free V/f Frequency 7 (b112)	>	Frequency Upper Limit 1 (A061)
W092	Free V/f Frequency 7 (b112)	>	Frequency Lower Limit 1 (A062)
W095	Free V/f Frequency 7 (b112)	>	Output Frequency Setting (F001), Multi-step Speed 1 Reference 0 (A020)
W201	Frequency Upper Limit 2 (A261)	>	Maximum Frequency 2 (A204)
W202	Frequency Lower Limit 2 (A262)	>	Maximum Frequency 2 (A204)
W205	Output Frequency Setting (F001), Multi-step Speed 2 Reference 0 (A220)	>	Maximum Frequency 2 (A204)
W215	Output Frequency Setting (F001), Multi-step Speed 2 Reference 0 (A220)	>	Frequency Upper Limit 2 (A261)
W225	Frequency Lower Limit 2 (A262)	>	Output Frequency Setting (F001), Multi-step Speed 2 Reference 0 (A220)
W231	Starting Frequency (b082)	>	Frequency Upper Limit 2 (A261)
W232	Starting Frequency (b082)	>	Frequency Lower Limit 2 (A262)
W235	Starting Frequency (b082)	>	Output Frequency Setting (F001), Multi-step Speed 2 Reference 0 (A220)

Warning display	Warning display condition		
U285	Output Frequency Setting (F001), Multi-step Speed Reference 0 (A220)	=	Jump Frequency*1 (A063/A065/A067±A064/A066/A068)
U291	Free V/f Frequency 7 (b112)	>	Frequency Upper Limit 2 (A261)
U292	Free V/f Frequency 7 (b112)	>	Frequency Lower Limit 2 (A262)
U295	Free V/f Frequency 7 (b112)	>	Output Frequency Setting (F001), Multi-step Speed 2 Reference 0 (A220)

*1. A warning will occur if the frequency set in any one of F001, A020, A220 and A021 to A035 is within the frequency range set by the jump frequency.

Other Displays

Name	Description	Display on Digital Operator
Reset	This warning appears if the input terminal set to Reset (RS) is ON or a trip has been reset using the STOP/RESET key.	Turns. 
Undervoltage standby	Appears in undervoltage standby condition or with the power shut off.	
Restart during momentary power interruption, restart during trip	Restart function is in operation.	
RUN command is limited	Appears if the limited RUN command is received from the control terminal while the RUN direction is limited with b035.	
Setting initialization	Appears while the set values are being initialized. [00]: Setting for Japan	
Fault monitor being initialized	Appears while the fault monitor is being initialized.	
No data	Appears when no applicable data is available (a trip has not yet occurred in the fault monitor mode).	
Communications error	Appears if an error occurs between the Remote Operator and the Inverter.	Flashes. 
Auto-tuning OK	Appears upon successful completion of auto-tuning.	
Auto-tuning NG	Appears upon failure of auto-tuning.	

7-2 Troubleshooting

If the Inverter malfunctions or does not function as expected although no error display is shown, take a remedial action by referring to the information below.
If the Inverter trips after showing an error display, refer to "Error Display and Remedial Actions" on page 7-1.

Condition	Possible cause	Remedial actions	Reference Page
The power does not turn on. (The main POWER LED indicator is not lit).	The shorting bar between terminals +1 and P/+2 or DC reactor is disconnected.	Connect the shorting bar or DC reactor.	2-6 to 2-14
	The input wire is disconnected.	Check the wiring.	
The motor does not turn after a RUN command is issued.	The setting of RUN Command Selection (A002) is not correct.	Set the correct RUN Command Selection (A002).	5-22
	The setting of Frequency Reference Selection (A001) is not correct.	Set Frequency Reference Selection (A001) correctly according to the frequency reference input method, and specify the frequency.	5-15
	The frequency is set to 0 Hz.	If Frequency Reference Selection (A001) is set to "01: Control circuit terminal block, "input to the FV or FI terminal an analog voltage or current signal corresponding to the frequency. Refer to "Frequency Reference Selection and Output Frequency Setting" on page 5-15 for details on analog voltage/current switching.	
		If Frequency Reference Selection (A001) is set to "02: Digital Operator", set the frequency in Output Frequency Setting (F001).	
		Enter the frequency according to the set value in Frequency Reference Selection (A001). (The entered frequency is displayed under F001).	
		In the case of multi-step speed operation, set the frequency in Multi-step Speed Reference 0 to 15 (A020 to A035, A220).	5-63
	No multi-function input terminal (RUN command) is allocated.	If a multi-function input terminal is used to issue a RUN command, allocate "00: FW" or "01: RV" to the applicable terminal. If a RUN command is issued using the 3-wire input method, allocate "20: STA", "21: STP, "or "22: F/R".	5-29
	One of multi-step speed settings "02: CF1" to "05: CF4" is allocated to a multi-function input terminal and the terminal is turned ON.	Turn OFF the multi-step speed setting. (If the multi-step speed setting is turned ON, multi-step speed operation becomes effective. Accordingly, operation is not performed if the applicable frequency set in Multi-step Speed Reference 1 to 15 (A021 to A035) is 0 (default value)).	5-63
	Both the forward input and reverse input terminals are turned ON.	To use the forward or reverse input terminal to issue a RUN command, turn only one of the two terminals ON.	5-23

Condition	Possible cause	Remedial actions	Reference Page
The motor does not turn after a RUN command is issued.	Rotation Direction Limit Selection (b035) is set and forward or reverse rotation is prohibited.	Set the correct Rotation Direction Limit Selection (b035).	5-23
	The input terminal wiring for RUN command or shorting-bar connection position is incorrect.	Implement wiring correctly. (The ON/OFF status of the input terminal can be checked with Multi-function Input Monitor (d005)).	2-19 to 2-22
	The analog input for frequency reference or Variable Resistor wiring is incorrect.	Implement wiring correctly. • For the analog voltage or Variable Resistor input, measure the FV-SC terminal voltage using a tester, etc. to check if the correct voltage is output. • For the analog current input, disconnect the wiring and measure the source-FI terminal current using a tester, etc. to check if the correct current is supplied.	2-6 5-37
	"51: F-TM (Forced terminal block)" is allocated to a multi-function input terminal and the terminal is turned ON, even though a Digital Operator mode is selected.	Turn OFF the terminal to which the applicable function is allocated.	5-85
	"31: OPE (Forced operator)" is allocated to a multi-function input terminal and the terminal is turned ON, even though the control circuit terminal block mode is selected.	Turn OFF the terminal to which the applicable function is allocated.	5-85
	The Inverter has tripped. (The ALARM LED indicator is lit and "Exxx" is shown).	Press the STOP/RESET key to reset the trip, identify and remove the cause of the trip based on the error code, and then restart the operation.	3-12 5-119 7-1 to 7-6
	The safety function selector switch is turned ON and the multi-function input terminal S3/GS1 or S4/GS2 is turned OFF.	If the safety function is used, turn both the safety inputs GS1 and GS2 ON. If the safety function is not used, turn OFF the selector switch.	5-170
	"18: RS (Reset)", "14: CS (Commercial switch)", or "11: FRS (free-run stop)" is allocated to a multi-function input terminal and the terminal is turned ON.	Turn OFF the terminal to which the applicable function is allocated.	5-79 5-100 5-103
	"84: ROK (Permission of RUN command)" is allocated to a multi-function input terminal and the terminal is turned OFF.	Turn ON the terminal to which the applicable function is allocated.	5-63
	The wiring from the Inverter to the motor or wiring inside the motor is disconnected.	Check the wiring.	2-6 to 2-14
	The load is excessive.	Reduce the load.	–
	The motor is locked.	Unlock the motor.	–

Condition	Possible cause	Remedial actions	Reference Page
The motor rotation speed does not rise.	Contact failure of the analog input for frequency reference or Variable Resistor.	Check the wiring. • For the analog voltage or Variable Resistor input, measure the FV-SC terminal voltage using a tester, etc. to check if the correct voltage is output. • For the analog current input, disconnect the wiring and measure the source-FI terminal current using a tester, etc. to check if the correct current is supplied.	2-6 5-37
	The overload limit or overcurrent suppression function has actuated.	Disable the function or raise the operation level.	5-114
	The setting of Maximum Frequency (A004) or Frequency Upper Limit (A061/A261) is low.	Change the setting.	5-28 5-60
	Acceleration time is long.	Shorten the acceleration time (F002/F202/ A092/A292).	5-24
	"06: JG (jogging)" is allocated to a multi-function input terminal and the terminal is turned ON.	Turn OFF the terminal to which the applicable function is allocated.	5-59
	One of multi-step speed settings "02: CF1" to "05: CF4" is allocated to a multi-function input terminal and the terminal is turned ON.	Turn OFF the multi-step speed setting. (If the multi-step speed setting terminal is turned ON, multi-step speed operation becomes effective. Accordingly, operation is performed according to the frequency set in Multi-step Speed Reference 1 to 15 (A021 to A035)).	5-64
	The load is excessive.	Reduce the load.	–
	The motor is locked.	Unlock the motor.	–
The frequency cannot be set in Output Frequency Setting (F001) using the Digital Operator.	Frequency Reference Selection (A001) is not set to "Digital Operator".	Set Frequency Reference Selection (A001) to "02: Digital Operator".	5-15
	"51: F-TM (forced terminal block)" is allocated to a multi-function input terminal and the terminal is turned ON.	Turn OFF the terminal to which the applicable function is allocated.	5-85
Specified parameters are not displayed.	Display Selection (b037) is set to "01: Individual display of functions," "04: Basic display," etc.	Set Display Selection (b037) to "00: Complete display".	5-88
	"86: DISP (Display fixed)" is allocated to a multi-function input terminal and the terminal is turned ON.	Turn OFF the terminal to which the applicable function is allocated.	5-91
The Digital Operator keys do not work.	"86: DISP (Display fixed)" is allocated to a multi-function input terminal and the terminal is turned ON.	Turn OFF the terminal to which the applicable function is allocated.	5-91

Condition	Possible cause	Remedial actions	Reference Page
Parameters cannot be changed.	The Inverter is running.	Stop the Inverter and wait for the motor to decelerate to a stop, and then set again. When the mode is set to "Data can be changed during RUN" (b031 = 10), some parameters can be changed even during operation.	–
	Soft lock is effective.	Disable Soft Lock Selection (b031).	5-84
Motor turns in reverse.	The phase order of motor wiring is incorrect. (The specification of motor phase order is such that U/T1, V/T2, W/T3 does not indicate forward rotation).	Reverse two of U/T1, V/T2 and W/T3 or adjust the motor phases to the correct order.	2-6
	The forward/reverse logic is incorrect when the 3-wire input function is used.	Check the "22: F/R (3-wire forward/reverse)" logic of the applicable multi-function input terminal.	5-29 5-56
The motor turns in reverse when operation is started with the RUN key.	RUN Direction Selection (F004) is incorrect.	Change the setting of RUN Direction Selection (F004).	5-23
An Overcurrent Trip (E03) occurs during operation.	The acceleration time is too short.	Extend the Acceleration Time (F002/F202/A092/A292).	5-24 5-66
		Change the operation pattern to one in which acceleration is temporarily stopped using the acceleration hold function.	5-62
	The load is excessive.	Reduce the load.	–
		Perform tuning using the torque boost function.	5-49
		Set Control Method (A044/A244) to "02: Free V/f setting" and perform tuning.	5-46
	Overload Limit Selection (b021/b024) is set to "00: Disabled".	Enable Overload Limit Selection (b021/b024).	5-114
	[An overcurrent trip occurs during operation, even when the overload limit is enabled]		
	Overload Limit Level (b022/b025) is high.	Lower the Overload Limit Level (b022/b025).	5-114
	Overload Limit Parameter (b023/b026) is short.	Extend the Overload Limit Parameter (b023/b026).	5-114
The STOP/RESET key does not work.	The STOP/RESET key is disabled by setting.	Set STOP Key Selection (b087) correctly.	5-84
	Overvoltage Suppression Function During Deceleration (b130) is enabled.	Set Overvoltage Suppression Function During Deceleration (b130) to "00: Disabled" or adjust the operation level of each function.	5-117
	Controlled Deceleration on Power Loss (b050) is enabled.	Set Controlled Deceleration on Power Loss (b050) to "00: Disabled" or adjust the operating level of each function.	5-106

Condition	Possible cause	Remedial actions	Reference Page
The motor/machine is loud.	Carrier frequency is low.	Increase the Carrier Frequency (b083). However, this may increase noise or leakage current from the Inverter. Also note that the output current must be derated depending on the model. For details, refer to Appendix-1 Derating Table.	5-51 A-1
	The motor rotation frequency and machine's natural frequency are resonating.	Change the set frequency. If resonance occurs during acceleration/deceleration, avoid the resonance frequency using Frequency Jump Function (A063 to A068).	5-61
	The motor is over-excited.	Adjust Base Frequency (A003/A203) and Motor Incoming Voltage Selection (A082/A282) to the motor ratings. If the situation does not improve, slightly lower the setting of Output Voltage Gain (A045/A245). Or, set Control Method (A044/A244) to "02: Free V/f setting" and perform tuning.	5-26 5-46 5-72
An Overload Trip (E05) occurs.	The electronic thermal level is not appropriate.	Set Electronic Thermal Level (b012/b013) correctly.	5-110
An Overvoltage Trip (E07) occurs during deceleration.	The deceleration time is short.	Extend the Deceleration Time Setting (F003/F203/A093/A293).	5-24 5-66
	Overvoltage Suppression Function During Deceleration (b130) is set to "00: Disabled".	Enable Overvoltage Suppression Function During Deceleration (b130). (Note that when this function is enabled, the actual deceleration time may become longer than the set value). For details, refer to "Overvoltage Suppression Function During Deceleration" on page 5-117).	5-117
	[An Overvoltage Trip (E07) occurs during deceleration even though Overvoltage Suppression Function During Deceleration (b130) is enabled]		
	The value of Overvoltage Suppression Proportional Gain Setting During Deceleration (b133) or Overvoltage Suppression Integral Time Setting (b134) is not appropriate.	Change each set value. For details, refer to "Overvoltage Suppression Function During Deceleration" on page 5-117.	5-117
	The value of Overvoltage Suppression Level During Deceleration (b131) is high.	Lower the value of Overvoltage Suppression Level During Deceleration (b131). (Note, however, that deceleration may be disabled if this value is set too low. As a guide, the set value should be at least "Incoming voltage $\times \sqrt{2} \times$ 110%").	5-117
A Thermistor Error Trip (E35) occurs.	"19: TH (PTC thermistor thermal protection)" is allocated to the multi-function input terminal S5/TH and 24 VDC is input.	Cancel the TH allocation.	5-120

Condition	Possible cause	Remedial actions	Reference Page
The output frequency becomes unstable.	Various parameters are not appropriate.	Shift the output frequency slightly away from the power supply frequency.	5-15
		Change the value of Stabilization Parameter (H006/H206).	5-81
	The load fluctuates significantly.	Increase the motor/Inverter capacity.	–
	The power supply voltage fluctuates.	Suppress the fluctuation.	–
Sufficient torque does not generate.	Various parameters are not appropriate. [Acceleration/constant speed operation]	Increase the value of Manual Torque Boost Voltage (A042/A242) or Manual Torque Boost Frequency (A043/A243).	5-49
		Set Torque Boost Selection (A041/A241) to "01: Automatic torque boost".	5-49
		Decrease the Carrier Frequency (b083).	5-51
		Set Control Method (A044/A244) to "03: Sensorless vector control (SLV)".	5-144
	Various parameters are not appropriate. [Deceleration]	Extend the Deceleration Time (F003/F203/ A093/A293).	5-24 5-66
		Turn OFF the AVR Selection (A081/A281).	5-27
		Use a Braking Resistor or Regenerative Braking Unit.	–
The Inverter trips or executes a free-run or deceleration stop when the Digital Operator or LCD Operator cable is disconnected.	The operation to be taken upon Digital Operator disconnection is not selected properly.	Set Selection of Operation on Digital Operator Disconnection (b165) to "02: Ignore".	5-86

Condition	Possible cause	Remedial actions	Reference Page
Operation/setting cannot be performed via Modbus communication (Modbus-RTU).	Changes to communication parameters are not reflected.	If the setting of Communication Speed Selection (C071), Communication Parity Selection (C074) or Communication Stop Bit Selection (C075) was changed, reconnect the power or perform a reset (by turning the RS terminal ON and then OFF).	6-3
	The setting of RUN Command Selection (A002/A202) is not correct.	Set RUN Command Selection (A002/ A202) to "03: Modbus communication (Modbus-RTU)".	5-22
	The setting of Frequency Reference Selection (A001/A201) is not correct.	Set Frequency Reference Selection (A001/ A201) to "03: Modbus communication (Modbus-RTU)".	5-15
	The communication speed is not set correctly.	Set the correct communication speed in Communication Speed Selection (C071).	6-3
	The station number is not set correctly or duplicated.	Set the correct station number in Communication Station No. Selection (C072).	6-3
	The communication parity is not set correctly.	Set the correct communication parity in Communication Parity Selection (C074).	6-3
	The communication stop bit is not set correctly.	Set the correct stop bit in Communication Stop Bit Selection (C075).	6-3
	The wiring is incorrect.	Correctly wire the RS+ and RS– terminals on the control circuit terminal block.	6-2
The earth leakage breaker trips when the Inverter is operated.	The Inverter leak current is large.	Decrease the Carrier Frequency (b083).	5-51
		Increase the sensitivity current of the earth leakage breaker. Or, replace the earth leakage breaker with one of higher sensitivity current.	2-17
DC injection braking does not work.	The DC injection braking power is not set.	Set DC Injection Braking Power (A054).	5-135
	The DC injection braking time is not set.	Set DC Injection Braking Time (A055).	5-135
An Undervoltage Trip (E09) occurs.	The voltage drops due to insufficient power supply capacity.	Increase the power supply capacity.	–
Noise enters in the TV or radio located near the Inverter.	Irradiated noise from the Inverter.	Extend as much as possible the wiring distance from the TV or radio to the Inverter.	–
An optional board error (E60 to E68) occurred.	The optional board detected and error and notified the Inverter.	Refer to the manual for the optional board.	–
	Inverter failure: The optional board connector is not operating properly.	If the problem cannot be fixed in the optional board, the Inverter may have failed. The mating of the option connector may be bad. Check of dirty contacts and other possible causes. If the problem cannot be solved, replace the Inverter.	–
An optional board error (E69) occurred.	Communications became impossible after detecting the option. The optional board is partly disconnected.	Check for bad option connector mating, dirty terminal contacts, etc. Check to see if the terminal block cover on the Inverter and the cover on the optional board are mated properly and the screws are properly tightened.	–

8

Inspection and Maintenance

Describes the daily inspection and periodic inspection.

8-1 Inspection and Maintenance

⚠ WARNING

	Do not change wiring, slide switches, or optional devices while power is being supplied. Always turn off the power supply to the Inverter before changing wiring, changing the slide switches, or replacing options.
	Do not remove the terminal block cover during the power supply and 10 minutes after the power shutoff. 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 shutoff. Doing so may result in a burn.

⚠ Caution

	Do not dismantle, repair or modify this 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 life of the capacitor depends on ambient temperatures. Refer to the diagram of product life specified in the manual. When the capacitor stops operating at the end of the product's life, the Inverter must be replaced.

Precautions for Correct Use

Operation Stop Command

- Provide a separate emergency stop switch because the STOP key on the Digital 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

- The Inverter consists of many parts, and these parts must operate properly in order to make full use of the designed functions of the Inverter. Among the electronic components, there are some that require maintenance depending on their usage conditions. In order to keep the Inverter operating normally over a long period of time, it is necessary to perform periodic inspections and replace parts according to their service life.

Product Disposal

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

Daily Inspection

Check the following during operation.

- The motor operates according to the settings.
- There is no error in the installation environment.
- There are no errors in the cooling system.
- Check that there are no abnormal vibrations or sounds.
- There are no abnormal overheat or discoloration.
- Check that there are no abnormal odors.

Check the input voltage of the Inverter during operation using a tester or other equipment.

- There is no frequent power supply voltage fluctuation.
- The voltage level between the wires is balanced.

Cleaning

Always keep the Inverter clean for operation.
Lightly remove any dirt with a soft cloth moistened with a neutral detergent.

Do not use such solutions as acetone, benzene, toluene, or alcohol for cleaning. Doing so may cause the Inverter surface to dissolve or its coating to come off.
In particular, do not use detergent or alcohol on the display of the Digital Operator.

Periodic Inspection

Check the parts that cannot be checked without stopping operation, as well as those that require periodic inspection.
Contact OMRON Corporation for periodic inspections.

- Any abnormality in the cooling system? →Clean the air filter, etc.
- Tightening check and secure tightening →Screws, bolts and other tightened parts may become loose due to the effects of vibration, temperature change, etc. Thorough check the applicable locations and tighten them securely.
- Check that there is no corrosion or damage to the conductors and/or insulators.
- Measurement of insulation resistance
- Check and replace the cooling fan, smoothing capacitor, and relay.

Daily Inspection and Periodic Inspection

Inspection part	Inspection item	Inspection point	Inspection period			Inspection method	Criteria	Measurement device
			Daily	Periodic				
				1 year	2 years			
General	Ambient environment	Check ambient temperature, as well as humidity and dust levels.	√			Refer to "Installation" on page 2-1.	The ambient temperature shall be –10 to 50 °C, non-freezing, and the ambient humidity shall be 90% or below, non-condensing.	Thermometer Hygrometer Recorder
	Entire device	Check that there are no abnormal vibrations or sounds.	√			Visual or acoustic inspection	No faults	
	Power supply voltage	Check that the main circuit voltage is normal.	√			Measure the voltage between the Inverter main circuit terminals R/L1, S/L2 and T/L3.	Must be within allowable fluctuation of AC voltage.	Tester, digital multimeter
Main circuit	General	Megger check (between main circuit terminal and ground terminal)		√		Remove the I/O wirings of the Inverter's main circuit terminal block, remove the control terminal block board, and remove the Inverter's built-in filter function switching shorting bar, and then use a megger to measure between the shorted part of each terminal R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, P/+2, +1, N/– or RB and the ground terminal.	5 MΩ min.	500 V class DC megger
		Check that any parts which may need tightening are secure.		√		Tighten securely.	No faults	
		Check that no part has indications of overheating.		√		Visual inspection	No faults	

Inspection part	Inspection item	Inspection point	Inspection period			Inspection method	Criteria	Measurement device
			Daily	Periodic				
				1 year	2 years			
Main circuit	Connection conductor and wire	Check that there is no distortion with the conductor.		√		Visual inspection	No faults	
		Check that there is no tearing in the wire coverings.		√				
	Terminal block	Check that there is no damage.		√		Visual inspection	No faults	
	Inverter unit Converter unit (including the resistor)	Check the resistance between the terminals.			√	Remove the wirings of the Inverter's main circuit terminal block and measure between terminal R/L1, S/L2, T/L3 and terminals P/+2, N/–, and between terminals U/T1, V/T2, W/T3 and terminal P/+2, N/–, in the ×1Ω range.	Refer to "Checking the Inverter and Converter" on page 8-6. Inverter unit replacement reference Start/stop: 10^6 cycles*3	Analog tester
	Smoothing capacitor *1	Check that there is no liquid leakage.	√			Visual inspection	No faults	Capacity meter
		Check that the safety valve has not come out and that there are no bulges.	√					
	Relay	Check that there is no abnormal sound during operation.		√		Acoustic inspection	No faults	
		Check that there is no rough surface on the contact.		√		Visual inspection	No faults	
Control circuit Protection circuit	Operation check	Check the balance of output voltage levels between phases in single Inverter run.		√		Measure the voltage between 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 that there are no errors in protection and display circuits through sequence protection operation.		√		Short-circuit or open the Inverter protection circuit output under simulated conditions.	Error is found in the sequence.	

Inspection part	Inspection item	Inspection point	Inspection period: Daily	Periodic: 1 year	Periodic: 2 years	Inspection method	Criteria	Measurement device
Cooling system	Cooling fan	Check that there are no abnormal vibrations or sounds.	√			Rotate manually when the power is off.	Rotation shall be smooth and free from error. Reference of the replacement period: 10 years*2 , *3	
		Check that the connection parts are secure.		√		Visual inspection		
	Cooling Fin	Check that there is no clogging.		√		Visual inspection	No clogging.	
Fault display	Fault display	Check that the LED indicators are lit properly.	√			Visual inspection	Check that the LED indicators are lit.	
		Cleaning		√		Clean with a waste cloth.		
	Meter	Check that the indicated value is normal.	√			Check the indicated values on the panel meters.	The specified or control values must be satisfied.	Voltage, Ammeter, etc.
Motor	General	Check that there are no abnormal vibrations or sounds.	√			Acoustic, feeling, and/or visual inspection	No faults	
		Check that there are no abnormal odors.	√			Check that there is no abnormal odor caused by damage or overheating.	No faults	
	Insulation resistance	Megger check (Between the collective motor terminals and ground terminal)			√	Disconnect Inverter main circuit terminals U/T1, V/T2, and W/T3, and short-circuit the motor wires (3 phases). Then, use a megger to measure the resistance between the motor wires and ground terminal.	5 MΩ min.	500 V class DC megger

*1.Smoothing capacitor life depends on ambient temperature.
Refer to " Appendix-2 Smoothing Capacitor Life Curve" for the replacement reference.

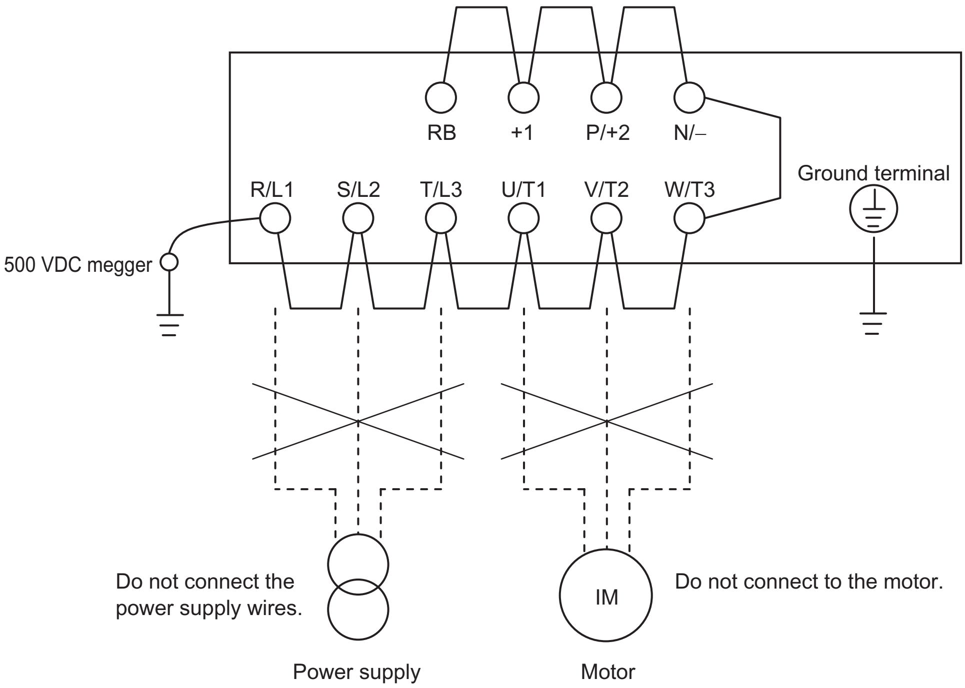
*2.The life of the cooling fan varies depending on the environmental conditions, such as ambient temperature and/or dust. Check the operation through daily inspections.

*3.The replacement reference (year/cycles) and diagram of smoothing capacitor life are based on the expected design life, which is not guaranteed.

Megger Test

For a megger test of the external circuit, be sure to disconnect all the terminals of the Inverter and not to apply the test voltage to the Inverter. Use a 500 V DC megger for a megger test.
Conduct the megger test for the Inverter's main circuit after short-circuiting terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, RB, +1, P/+2 and N/– using wires, as shown below.

- Conduct an Inverter megger test only to the main circuit, not to the control circuit.
- Use a high resistance tester for a power distribution test of the control circuit. Do not use a megger or buzzer.



Withstand Voltage Test

Do not conduct a withstand voltage test on any part of the Inverter.
Doing the test may cause damage or deteriorate to the parts inside the Inverter.

Checking the Inverter and Converter

The quality of the Inverter and converter can be checked 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 generation control resistance (P/+2, RB).**
2. **Prepare a tester. (Usable range is 1Ω measurement resistance.)**

Checking method

The quality can be judged by measuring the conduction state of Inverter main circuit terminal blocks R/L1, S/L2, T/L3U/T1, V/T2, W/T3, RB, P/+2, and N/– while alternating the tester polarity.

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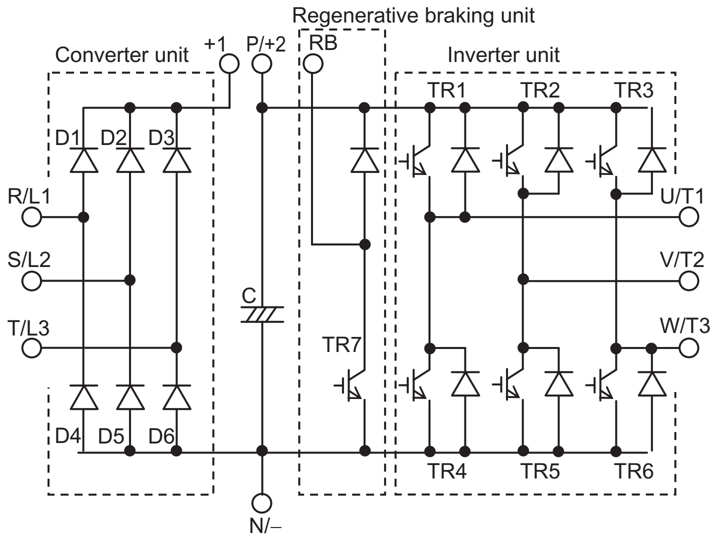
Inspection and Maintenance

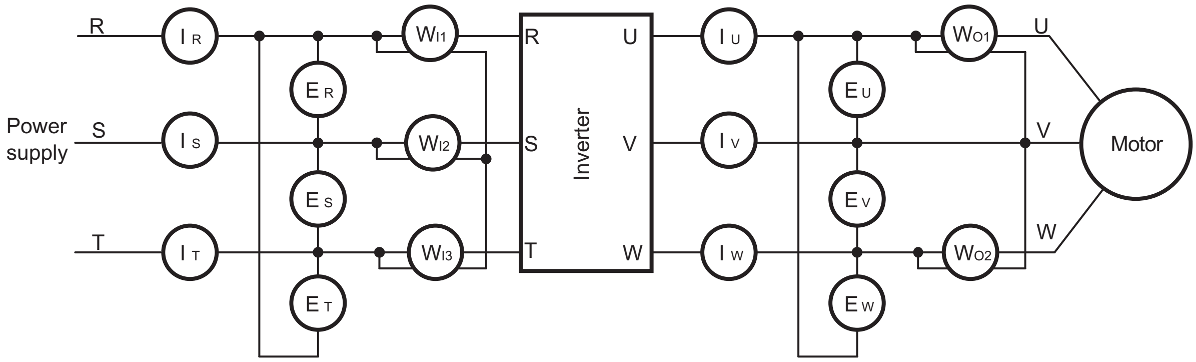
- Before checking, measure the voltage between P/+2 and N/– at DC voltage range in advance, and confirm that the smoothing capacitor is sufficiently discharged.
- A nearly infinite value is shown in a no-conduction state. (The value shows the range from a few to a few dozen Ω in a conduction state.)
  However, the value may not be infinite if the momentous conduction occurs through the influence of the smoothing capacitor.
  The Inverter or converter is in good shape if the values from various parameters are nearly equal, though they are not consistent depending on the types of elements or testers.

		Tester polarity		Measurement value
		+ (red)	– (black)	
Converter unit	D1	R/L1	+1	No conduction
		+1	R/L1	Conduction
	D2	S/L2	+1	No conduction
		+1	S/L2	Conduction
	D3	T/L3	+1	No conduction
		+1	T/L3	Conduction
	D4	R/L1	N/–	Conduction
		N/–	R/L1	No conduction
	D5	S/L2	N/–	Conduction
		N/–	S/L2	No conduction
	D6	T/L3	N/–	Conduction
		N/–	T/L3	No conduction
Inverter unit	TR1	U/T1	P/+2	No conduction
		P/+2	U/T1	Conduction
	TR2	V/T2	P/+2	No conduction
		P/+2	V/T2	Conduction
	TR3	W/T3	P/+2	No conduction
		P/+2	W/T3	Conduction
	TR4	U/T1	N/–	Conduction
		N/–	U/T1	No conduction
	TR5	V/T2	N/–	Conduction
		N/–	V/T2	No conduction
	TR6	W/T3	N/–	Conduction
		N/–	W/T3	No conduction
Regenerative braking unit	TR7	RB	P/+2	No conduction
		P/+2	RB	Conduction
		RB	N/–	No conduction
		N/–	RB	No conduction



Measurement Methods of I/O Voltage, Current, and Electric Power

Below is a general measurement device for input/output voltages, current, and electric power.

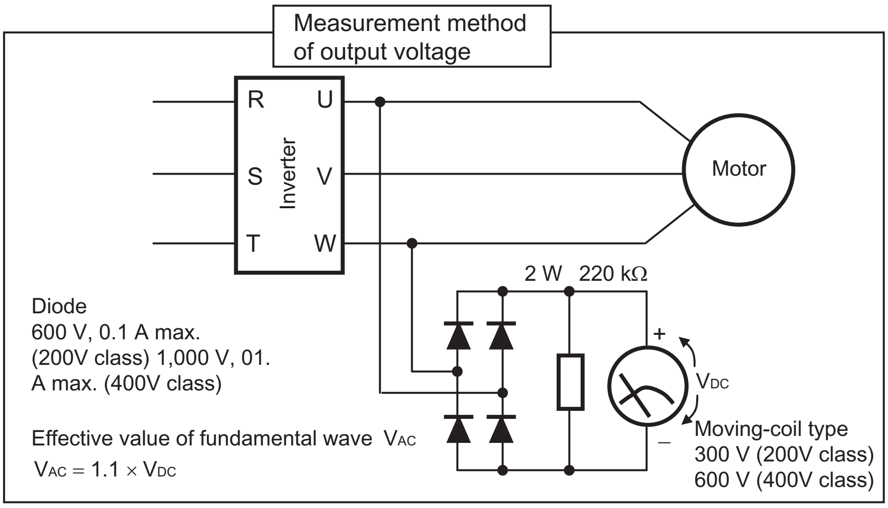


Measurement item	Measurement point	Measurement device	Note	Measurement value reference
Power supply voltage E_{IN}	Between R/L1 and S/L2 (E_R) Between S/L2 and T/L3 (E_S) Between T/L3 and R/L1(E_T)	Moving iron voltmeter or commutating voltmeter	All effective values	200 V class: 200 to 240 V, 50/60Hz 400 V class: 380 to 480 V, 50/60Hz
Power supply current I_{IN}	Current of R/L1, S/L2, T/L3 (I_R),(I_S),(I_T)	Moving iron ammeter	All effective values	When the 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})
Power factor of power supply Pf_{IN}	Calculated 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 commutating voltmeter	Fundamental wave Effective value	–
Output current I_{OUT}	Current of 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})

Measurement item	Measurement point	Measurement device	Note	Measurement value reference
Output power factor Pf_{OUT}	Calculated 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 output voltage, use a measurement device that displays effective values of fundamental wave. For current and electric power, use a measurement device that displays all effective values.

Note 2. The Inverter output waveform, under PWM control, may have a margin of error, especially at a low frequency. Testers (general-purpose type) are not applicable in many cases because of noise.



9

Specifications

Describes the standard specification list classified by input power supply, as well as external dimensions for different capacities.

9-1 Standard Specification List

Data of standard motors are shown. Take note that the actual torque characteristics vary depending on the motor used.

Three-phase 200 V Class

CT: Heavy load, VT: Light load

Function name			3-phase 200 V										
Model name (3G3MX2-)			A2001	A2002	A2004	A2007	A2015	A2022	A2037	A2055	A2075	A2110	A2150
Applicable motor capacity	kW	CT	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
		VT	0.2	0.4	0.75	1.1	2.2	3.0	5.5	7.5	11	15	18.5
	HP	CT	1/8	1/4	1/2	1	2	3	5	7 1/2	10	15	20
		VT	1/4	1/2	1	1 1/2	3	4	7 1/2	10	15	20	25
Rated output capacity [kVA]	200 V	CT	0.2	0.5	1.0	1.7	2.7	3.8	6.0	8.6	11.4	16.2	20.7
		VT	0.4	0.6	1.2	2.0	3.3	4.1	6.7	10.3	13.8	19.3	23.9
	240 V	CT	0.3	0.6	1.2	2.0	3.3	4.5	7.2	10.3	13.7	19.5	24.9
		VT	0.4	0.7	1.4	2.4	3.9	4.9	8.1	12.4	16.6	23.2	28.6
Rated input voltage			3-phase 200 V – 15% to 240 V + 10%, 50/60 ± 5%										
Rated output current [A]		CT	1.0	1.6	3.3	6.0	9.0	12.7	20.5	30.8	39.6	57.1	62.6
		VT	1.2	1.9	3.9	7.2	10.8	13.9	23.0	37.0	48.0	68.0	72.0
Rated output voltage			3-phase 200 to 240 V (The output cannot exceed the incoming voltage).										
Rated output current [A]		CT	1.0	1.6	3.0	5.0	8.0	11.0	17.5	25.0	33.0	47.0	60.0
		VT	1.2	1.9	3.5	6.0	9.6	12.0	19.6	30.0	40.0	56.0	69.0
Short-time deceleration braking torque (%) (Discharge Resistor not connected)			50	50	50	50	50	20	20	20	20	10	10
Braking Resistor circuit*1	Regenerative braking		Built-in Braking Resistor circuit (separate Discharge Resistor)										
	Min. connectable resistance [Ω]		100	100	100	50	50	35	35	20	17	17	10
Weight [kg]			1.0	1.0	1.1	1.2	1.6	1.8	2.0	3.3	3.4	5.1	7.4
Dimensions (width × height) [mm]			68 × 128				108 × 128		140 × 128	140 × 260		180 × 296	220 × 350
Dimensions (depth) [mm]			109		122.5	145.5	170.5		170.5	155		175	

*1. The BRD usage is 10%.

Three-phase 400 V Class

CT: Heavy load, VT: Light load

Function name			3-phase 400 V									
Model name (3G3MX2-)			A4004	A4007	A4015	A4022	A4030	A4040	A4055	A4075	A4110	A4150
Applicable motor capacity	kW	CT	0.4	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15
		VT	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5
	HP	CT	1/2	1	2	3	4	5	7 1/2	10	15	20
		VT	1	2	3	4	5	7 1/2	10	15	20	25
Rated output capacity [kVA]	380 V	CT	1.1	2.2	3.1	3.6	4.7	6.0	9.7	11.8	15.7	20.4
		VT	1.3	2.6	3.5	4.5	5.7	7.3	11.5	15.1	20.4	25.0
	480 V	CT	1.4	2.8	3.9	4.5	5.9	7.6	12.3	14.9	19.9	25.7
		VT	1.7	3.4	4.4	5.7	7.3	9.2	14.5	19.1	25.7	31.5
Rated input voltage			3-phase 380 V − 15% to 480 V + 10%, 50/60 ± 5%									
Rated output current [A]		CT	1.8	3.6	5.2	6.5	7.7	11.0	16.9	18.8	29.4	35.9
		VT	2.1	4.3	5.9	8.1	9.4	13.3	20.0	24.0	38.0	44.0
Rated output voltage			3-phase 380 to 480 V (The output cannot exceed the incoming voltage).									
Rated output current [A]		CT	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18.0	24.0	31.0
		VT	2.1	4.1	5.4	6.9	8.8	11.1	17.5	23.0	31.0	38.0
Short-time deceleration braking torque (%) (Discharge Resistor not connected)			50	50	50	20	20	20	20	20	10	10
Braking Resistor circuit*1	Regenerative braking		Built-in Braking Resistor circuit (separate Discharge Resistor)									
	Min. connectable resistance [Ω]		180	180	180	100	100	100	70	70	70	35
Weight [kg]			1.5	1.6	1.8	1.9	1.9	2.1	3.5	3.5	4.7	5.2
Dimensions (width × height) [mm]			108 × 128					140 × 128	140 × 260		180 × 296	
Dimensions (depth) [mm]			143.5	170.5				170.5	155		175	

*1. The BRD usage is 10%.

Single-phase 200 V class

CT: Heavy load, VT: Light load

Function name			1-phase 200 V					
Model name (3G3MX2-)			AB001	AB002	AB004	AB007	AB015	AB022
Applicable motor capacity	kW	CT	0.1	0.2	0.4	0.75	1.5	2.2
		VT	0.2	0.4	0.55	1.1	2.2	3.0
	HP	CT	1/8	1/4	1/2	1	2	3
		VT	1/4	1/2	3/4	1 1/2	3	4
Rated output capacity [kVA]	200 V	CT	0.2	0.5	1.0	1.7	2.7	3.8
		VT	0.4	0.6	1.2	2.0	3.3	4.1
	240 V	CT	0.3	0.6	1.2	2.0	3.3	4.5
		VT	0.4	0.7	1.4	2.4	3.9	4.9
Rated input voltage			1-phase 200 V − 15% to 240 V + 10%, 50/60 Hz ± 5%					
Rated output current [A]		CT	1.3	3.0	6.3	11.5	16.8	22.0
		VT	2.0	3.6	7.3	13.8	20.2	24.0
Rated output voltage			3-phase 200 to 240 V (The output cannot exceed the incoming voltage).					
Rated output current [A]		CT	1.0	1.6	3.0	5.0	8.0	11.0
		VT	1.2	1.9	3.5	6.0	9.6	12.0
Short-time deceleration braking torque (%) (Discharge Resistor not connected)			50	50	50	50	50	20
Braking Resistor circuit*1	Regenerative braking		Built-in Braking Resistor circuit (separate Discharge Resistor)					
	Min. connectable resistance [Ω]		100	100	100	50	50	35
Weight [kg]			1.0	1.0	1.1	1.6	1.8	1.8
Dimensions (width × height) [mm]			68 × 128			108 × 128		
Dimensions (depth) [mm]			109		122.5	170.5		

*1. The BRD usage is 10%.

Common Specifications

Function name		Specifications
Enclosure ratings*1		Open type (IP20)
Control	Control method	Phase-to-phase sinusoidal modulation PWM
	Output frequency range*2	0.10 to 400 Hz (or 1,000 Hz in the high-frequency mode; restrictions apply)
	Frequency precision*3	Digital command: ±0.01% of the max. frequency, Analog command: ±0.2% of the max. frequency (25°C±10°C)
	Frequency setting resolution	Digital setting: 0.01 Hz, Analog setting: One-thousandth of the maximum frequency
	Voltage/Frequency characteristics	V/f characteristics (constant/reduced torque) Sensorless vector control, V/f control with speed feedback
	Overload current rating	Heavy load rating (CT): 150%/60 s Light load rating (VT): 120%/60 s
	Instantaneous overcurrent protection	200% of the value of heavy load rating (CT)
	Acceleration/ Deceleration time	0.01 to 3600 s (linear/curve selection), acceleration/deceleration 2 setting available
	Carrier frequency adjustment range	2 to 15 kHz (with derating)
	Starting torque	200%/0.5 Hz (sensorless vector control)
	External DC injection braking	Starts at a frequency lower than that in deceleration via the STOP command, at a value set lower than that during operation, or via an external input. (Level and time settable).
Protective functions		Overcurrent, overvoltage, undervoltage, electronic thermal, temperature error, ground fault overcurrent at power-on status, rush current prevention circuit, overload limit, incoming overvoltage, external trip, memory error, CPU error, USP error, communication error, overvoltage suppression during deceleration, protection upon momentary power outage, emergency cutoff, etc.
Input signal	Frequency settings	Digital Operator External analog input signal: Variable resistance/0 to 10 VDC/4 to 20 mA, Modbus communication (Modbus-RTU)
	RUN/STOP command	Digital Operator External digital input signal (3-wire input supported), Modbus communication (Modbus-RTU)
	Multi-function input	7 points (Selectable from 59 functions)
	Analog input	2 points (Voltage FV terminal: 10 bits/0 to 10 V, Current FI terminal: 10 bits/4 to 20 mA)
	Pulse input	1 point (RP terminal: 32 kHz max., 5 to 24 VDC)
Output signal	Multi-function output	2 points (P1/EDM, P2; selectable from 43 functions)
	Relay output	1 point (1c contact: MC, MA, MB; selectable from 43 functions)
	Analog output (Frequency monitor)	1 point (AM terminal: Voltage 10 bits/0 to 10 V) (Frequency, current selectable)
	Pulse output	1 point (MP terminal: 32 kHz max., 0 to 10 V)
Communications	RS-422	RJ45 connector (for Digital Operator)
	RS-485	Control circuit terminal block, Modbus communication (Modbus-RTU)
	USB	USB1.1, mini-B connector

9

Specifications

Function name		Specifications
Other functions	AVR function, V/f characteristics switching, upper/lower limit, 16-step speeds, starting frequency adjustment, jogging operation, carrier frequency adjustment, PID control, frequency jump, analog gain/bias adjustment, S shape acceleration/deceleration, electronic thermal characteristics, level adjustment, restart function, torque boost function, fault monitor, soft lock function, frequency conversion display, USP function, motor 2 control function, UP/DWN, Overcurrent suppression, etc.	
General specifications	Ambient temperature	–10 to 50°C (However, derating is required).
	Ambient storage temperature	–20°C to 65°C (short-time temperature during transport)
	Humidity	20% to 90% RH (with no condensation)
	Vibration	5.9 m/s^2 (0.6G), 10 to 55 Hz
	Location	At a maximum altitude of 1,000 m; indoors (without corrosive gases or dust)
Options		DC reactor, AC reactor, radio noise filter, input noise filter, output noise filter, regenerative braking unit, Braking Resistor, EMC noise filter, etc.

*1. Protection method complies with JEM 1030.

*2. To operate the motor at over 50/60 Hz, contact the motor manufacturer to find out the maximum allowable speed of revolution.

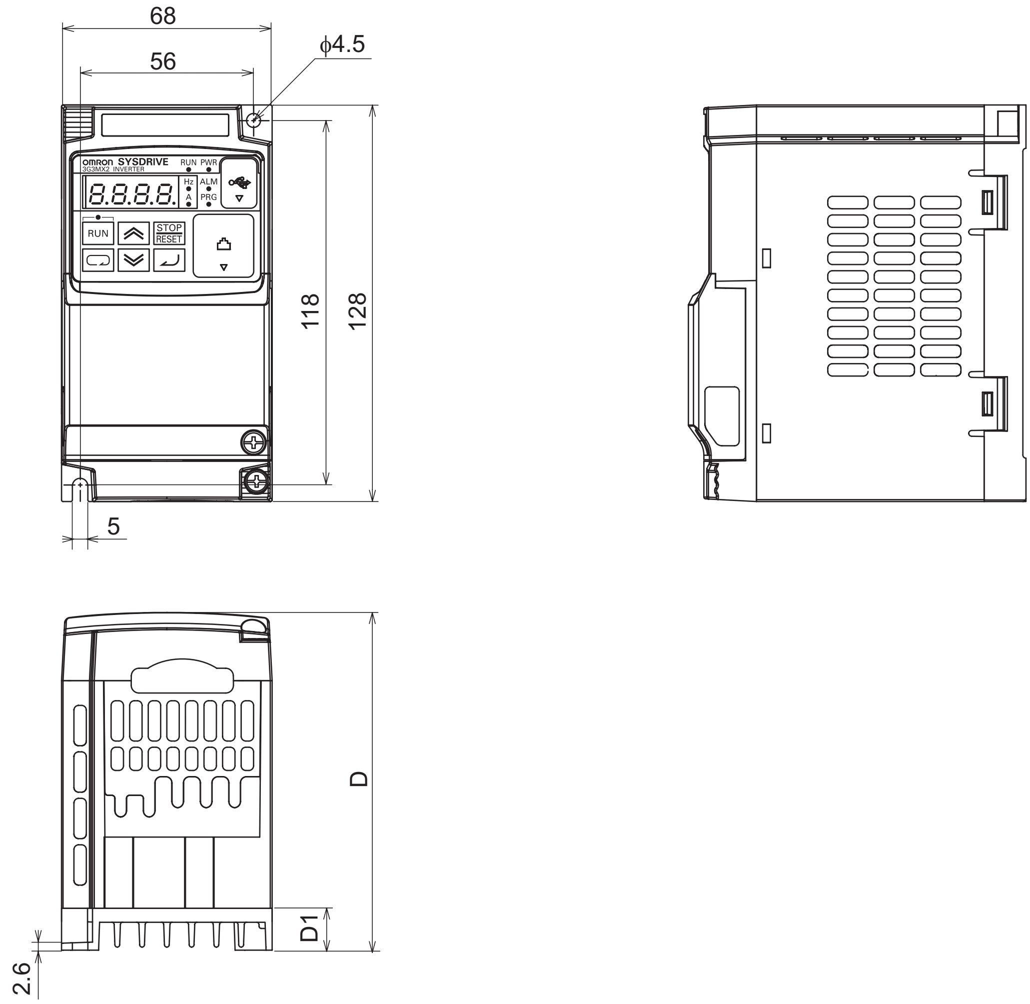
*3. For the stable control of the motor, the output frequency may exceed the maximum frequency set in A004 (A204) by 2 Hz max.

Note 1. The applicable motor is a 3-phase standard motor. For using any other type, be sure that the rated current does not exceed that of the Inverter.

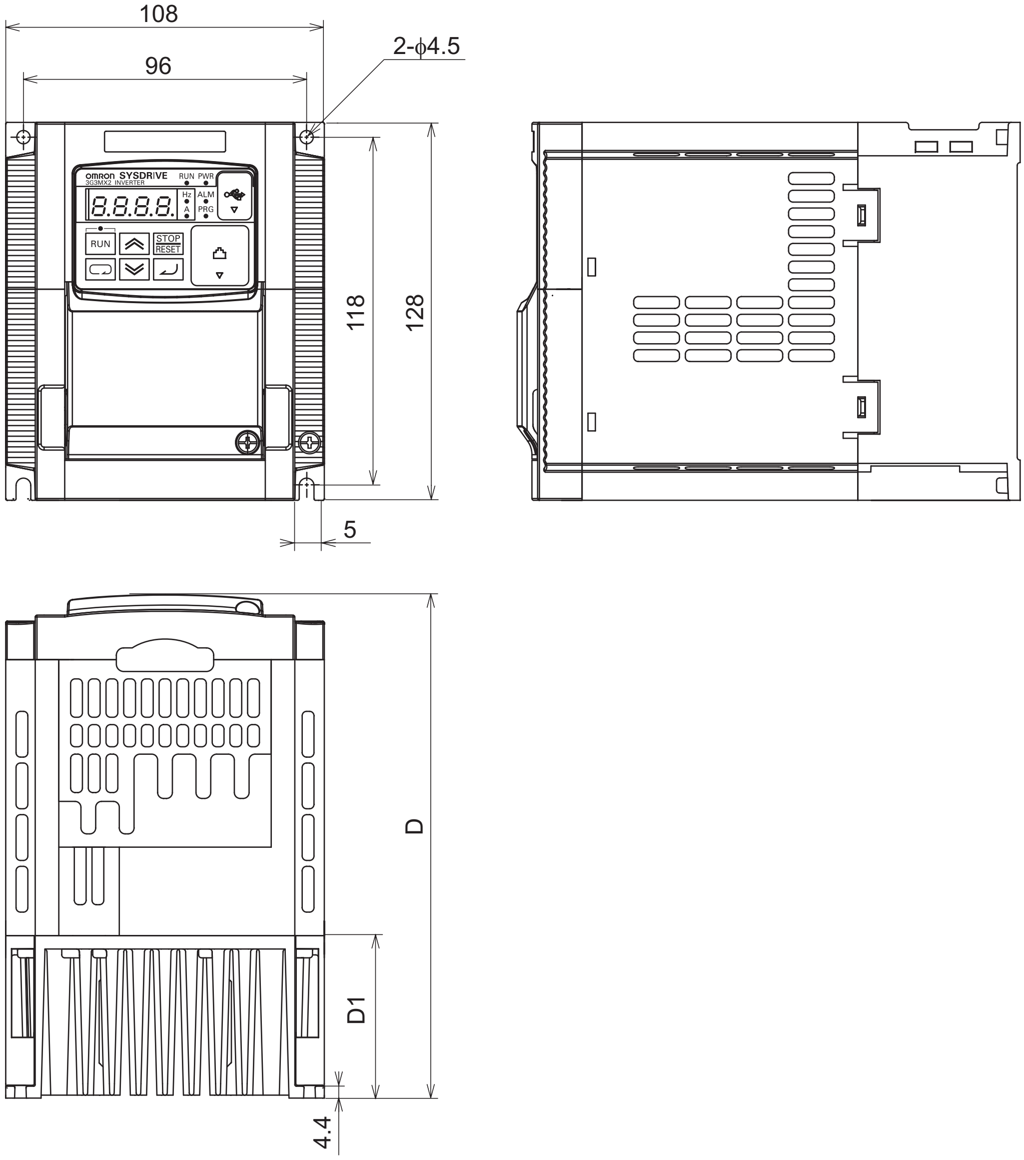
Note 2. Output voltage decreases according to the level of the power supply voltage.

Note 3. The braking torque at the time of capacitor feedback is an average deceleration torque at the shortest deceleration (when it stops from 50 Hz). It is not a continuous regeneration torque. Also, the average deceleration torque varies depending on the motor loss. The value is reduced in operation over 50 Hz.

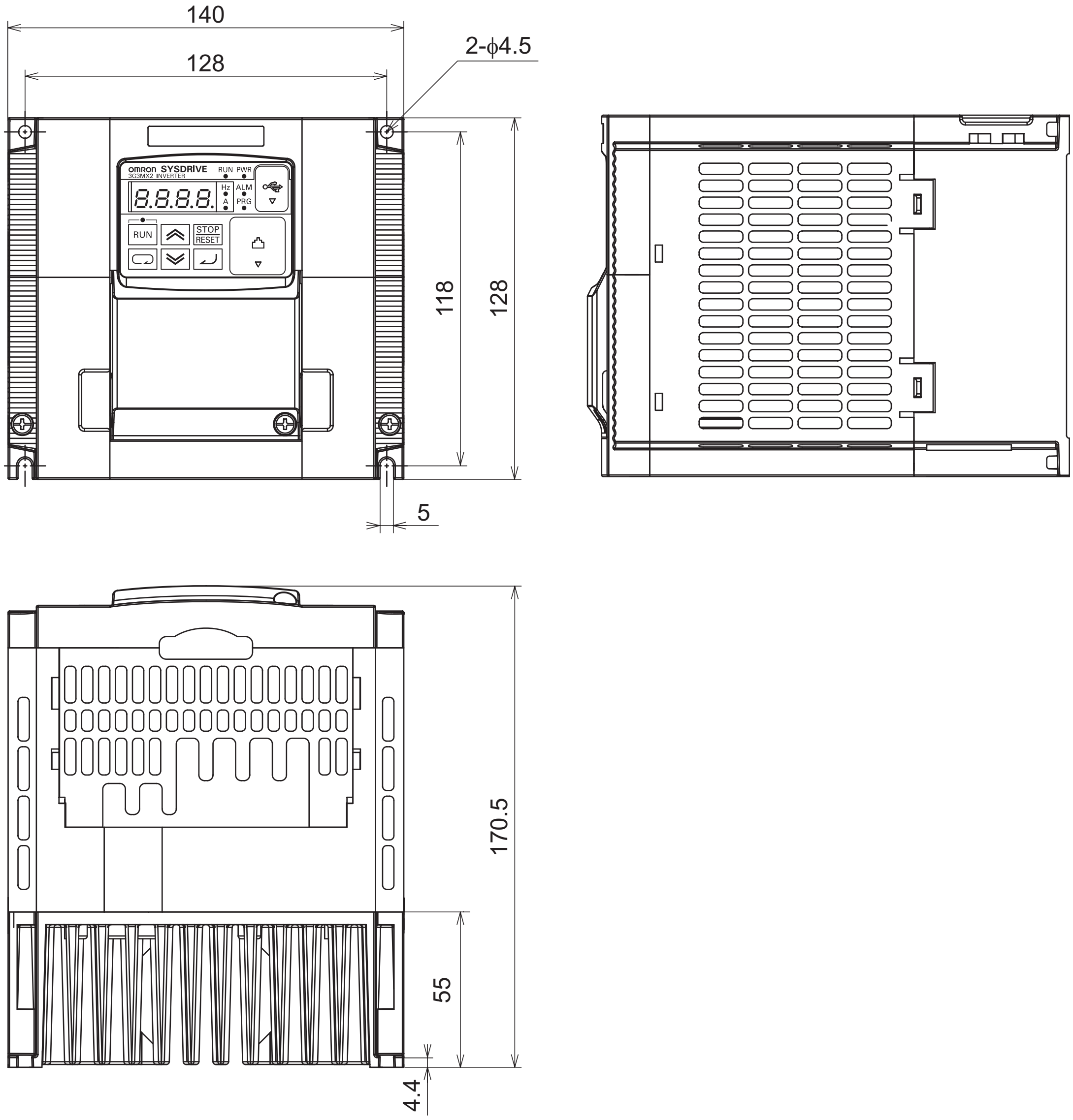
9-2 External Dimensions



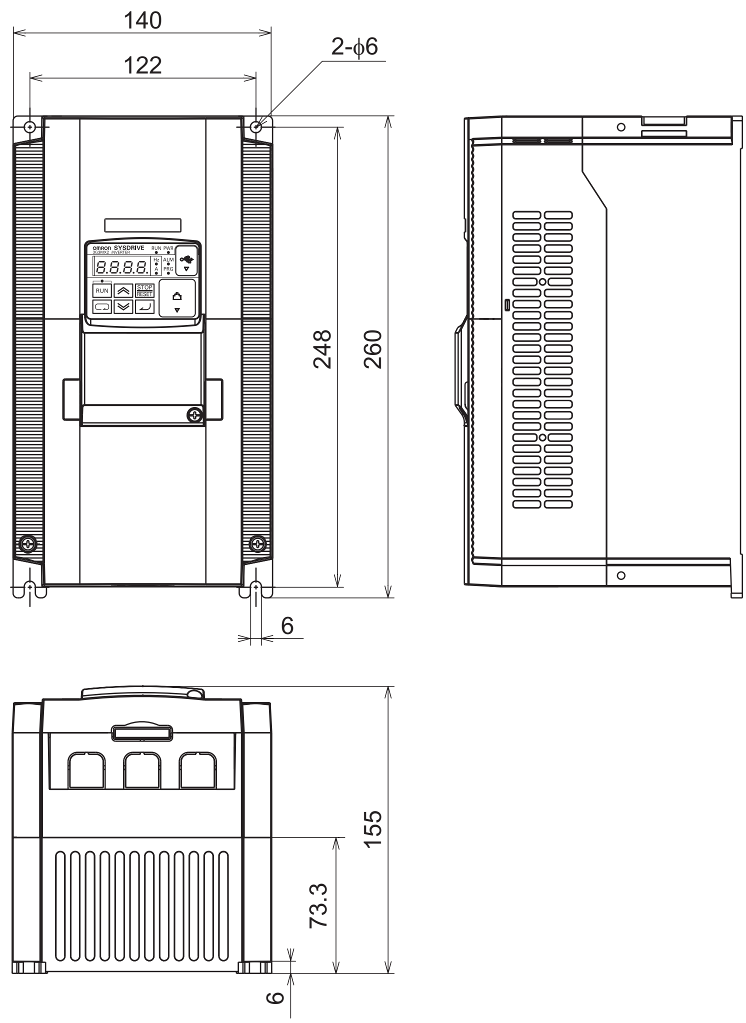
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
1-phase 200 V	3G3MX2-AB001 3G3MX2-AB002	68	128	109	13.5
	3G3MX2-AB004			122.5	27
3-phase 200 V	3G3MX2-A2001 3G3MX2-A2002			109	13.5
	3G3MX2-A2004			122.5	27
	3G3MX2-A2007			145.5	50



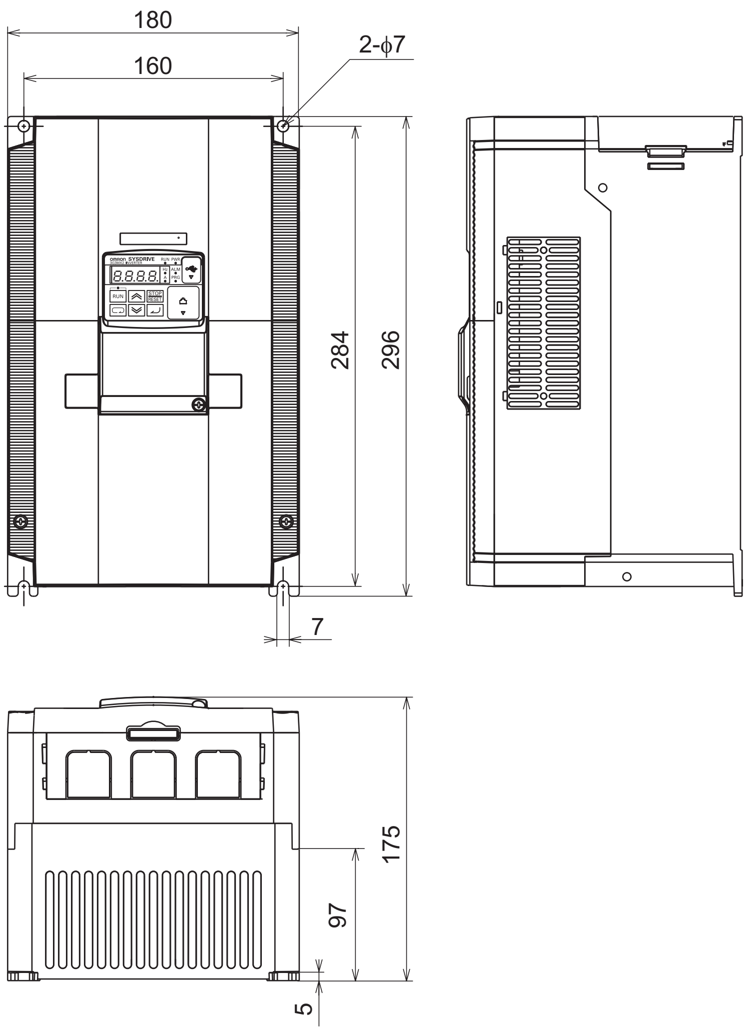
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
1-phase 200 V	3G3MX2-AB007 3G3MX2-AB015 3G3MX2-AB022	108	128	170.5	55
3-phase 200 V	3G3MX2-A2015 3G3MX2-A2022				
3-phase 400 V	3G3MX2-A4004			143.5	28
	3G3MX2-A4007 3G3MX2-A4015 3G3MX2-A4022 3G3MX2-A4030			170.5	55



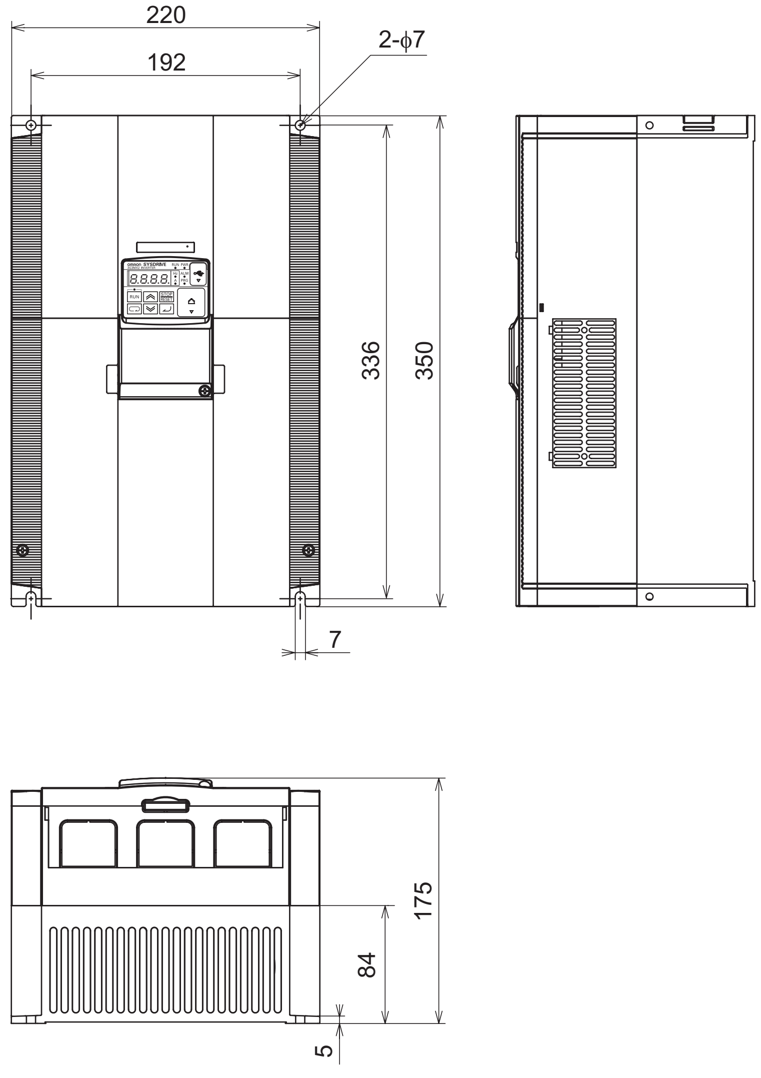
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2037	140	128	170.5	55
3-phase 400 V	3G3MX2-A4040				



Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2055 3G3MX2-A2075	140	260	155	73.3
3-phase 400 V	3G3MX2-A4055 3G3MX2-A4075				



Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2110	180	296	175	97
3-phase 400 V	3G3MX2-A4110 3G3MX2-A4150				



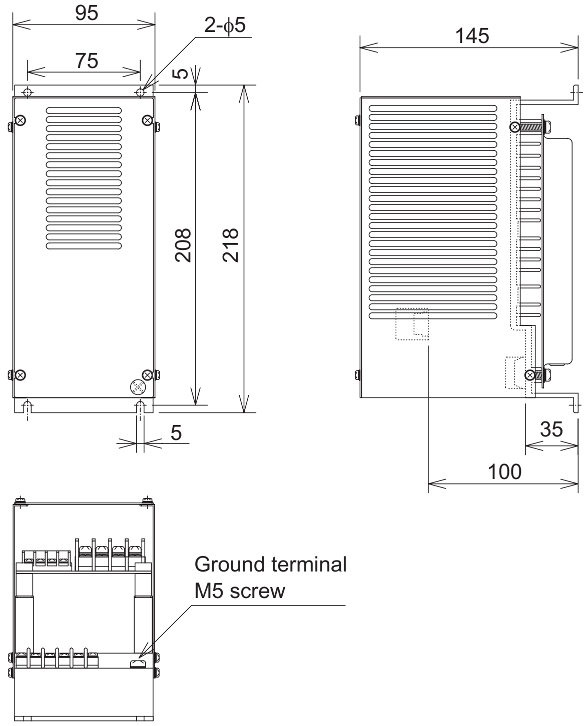
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2150	220	350	175	84

9-3 Options

Regenerative Braking Unit (3G3AX-RBUxxxx)

Dimensional Drawing

3G3AX-RBU21/-RBU22/-RBU41



Specifications

Built-in Resistance Type (3G3AX-RBU21/-RBU22/-RBU41)

Class		3-phase 200 V class		3-phase 400 V class
Model name (3G3AX-)		RBU21	RBU22	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	Built-in resistance	120 W 180	120 W 20	120 W 180 × 2 main elements
	Allowable consecutive ON time	10 s max.	0.5 s max.	10 s max.
	Allowable operation cycle	Cycle 1/10 (10 s ON/90 s OFF)	Cycle 1/80 (0.5 s ON/40 s OFF)	Cycle 1/10 (10 s ON/90 s OFF)
	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 functions	Built-in Resistor Overheat protection	Built-in relay specifications • The temperature relay operates if the built-in resistor reaches approx. 200°C. and recovers at approx. 170°C max. • Built-in temperature fuse (recovery impossible)*3 • Contact rating 250 VAC 200 mA (R load) 12 VDC 500 mA (R load) 42 VDC 200 mA (R road) • Minimum load 1 mA		
Operating environment	Ambient temperature	–10 to 50°C		
	Ambient storage temperature	–20°C to 65°C (short-time temperature during transport)		
	Humidity	20% to 90% (with no condensation)		
	Vibration	5.9 m/s^2 (0.6 G) 10 to 55 Hz		
	Location	At a maximum altitude of 1,000 m; indoors (without corrosive gases or dust)		
Paint color		Munselle 5Y7/1 (cooling fan: aluminum color)		

*1. To use the braking resistor (3G3AX-RAB/-RBB/-RBC) for a regenerative braking unit of the 400 V class, be sure to remove the built-in resistor, and connect 2 resistors of the same model in series.
If the regenerative braking unit of 400 V class is operated with a single braking resistor, the braking resistor may be damaged.

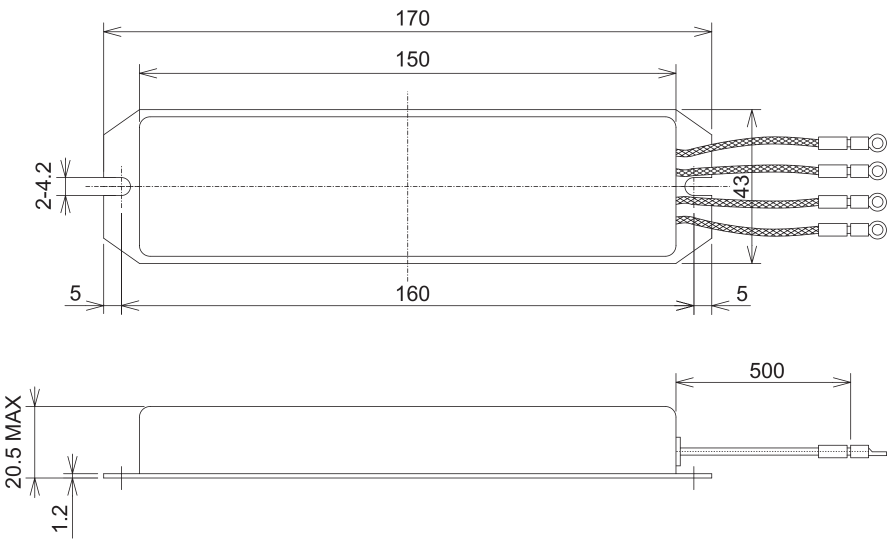
*2. Set the DIP switches.

*3. The built-in resistor incorporates a temperature fuse.
If the alarm terminal is not connected, the fuse may blow out in order to prevent the resistor burning due to overheating.
If the fuse blows out, the built-in resistor must be replaced.

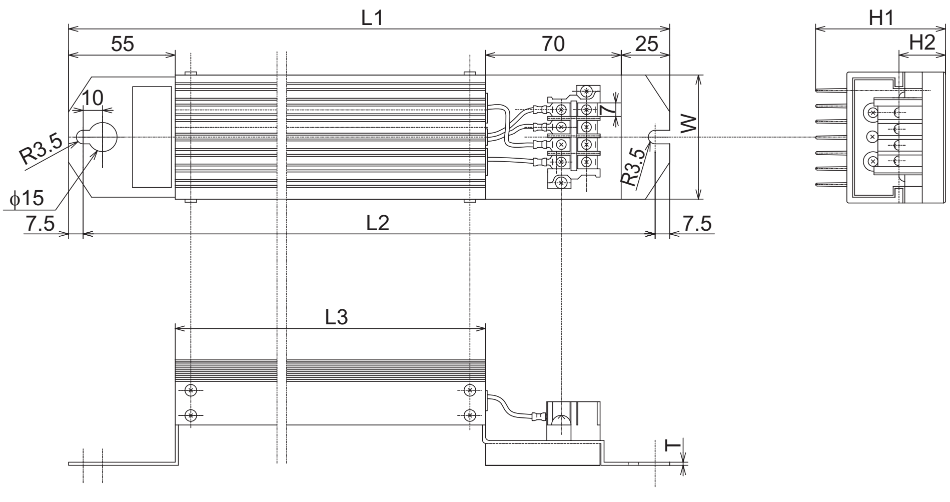
Specifications of Braking Resistor (3G3AX-RBA/-RBB/-RBCxxxx)

Dimensional Drawing

3G3AX-RBAxxxx

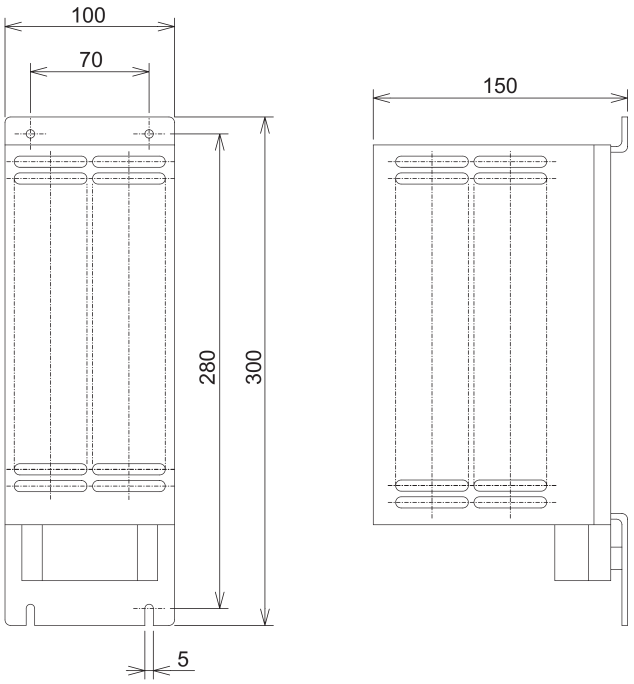


3G3AX-RBBxxxx

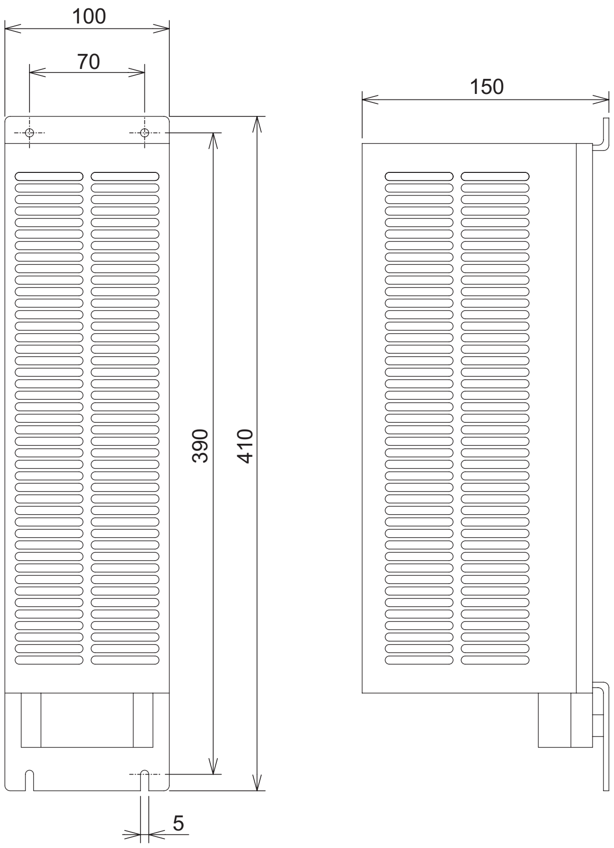


Model	Rated capacity (W)	Resistance (Ω)	Dimensions (mm)							Weight (kg)
			L1	L2	L3	H1	H2	W	T	
3G3AX-RBB2001	200	180	310	295	160	67	12	64	1.6	0.97
3G3AX-RBB2002	200	100	310	295	160	67	12	64	1.6	0.97
3G3AX-RBB3001	300	50	470	455	320	67	12	64	1.6	1.68
3G3AX-RBB4001	400	35	435	422	300	94	15	76	2	2.85

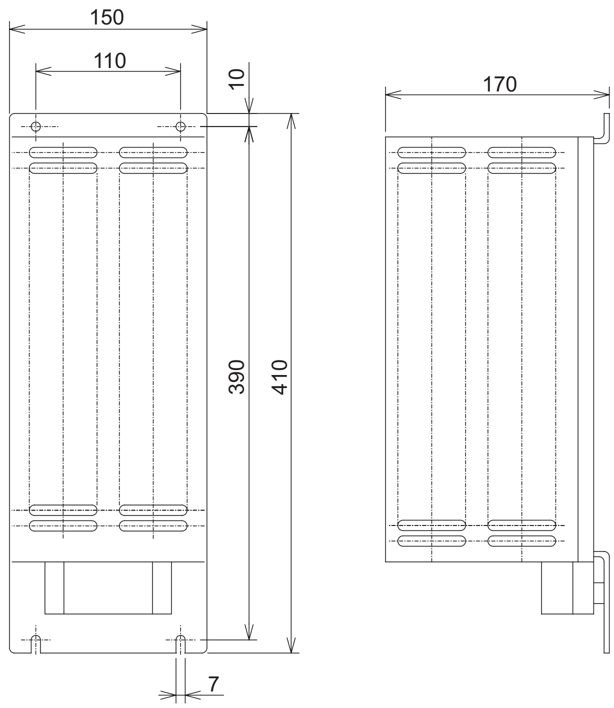
3G3AX-RBC4001



3G3AX-RBC6001



3G3AX-RBC12001



Specifications

		Compact type (3G3AX-RBAxxxx)				Standard type (3G3AX-RBBxxxx)				Medium capacity type (3G3AX-RBCxxxx)		
Model		1201	1202	1203	1204	2001	2002	3001	4001	4001	6001	12001
Resistance	Capacity	120 W				200 W		300 W	400 W	400 W	600 W	1,200 W
	Resistance (Ω)	180	100	50	35	180	100	50	35	50	35	17
Allowable braking frequency (%)		5	2.5	1.5	1.0	10	7.5	7.5	7.5	10		
Allowable continuous braking time (s)		20	12	5	3	30			20	10		
Weight (kg)		0.27				0.97		1.68	2.85	2.5	3.6	6.5
Fault detection function		Built-in thermal (contact capacity 240 VAC, 2 A max., minimum current 5 mA), Normally ON (NC contact) Built-in temperature fuse (non-recovery)								Built-in temperature relay, Normally ON (NC) Contact capacity: 240 VAC 3 A (R load), 0.2 A (L load), 36 VDC 2 A (R load)		
General specification	Ambient temperature	–10 to 50°C										
	Humidity	20% to 90% (RH) with no condensation										
	Vibration	5.9 m/s(0.6 G) 10 to 55 Hz Complies with JISC0911										
	Location	At a maximum altitude of 1,000 m; indoors (without corrosive gases or dust)										
	Cooling method	Self-cooling										

DC Reactor (3G3AX-DLxxxx)

Dimensional Drawing

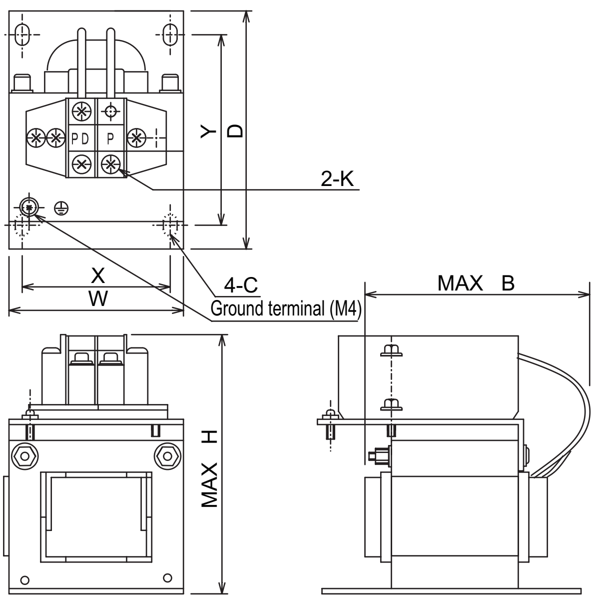


Fig. 1

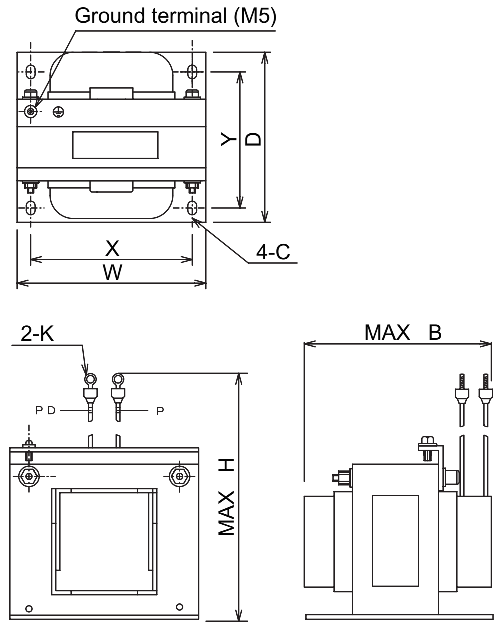


Fig. 2

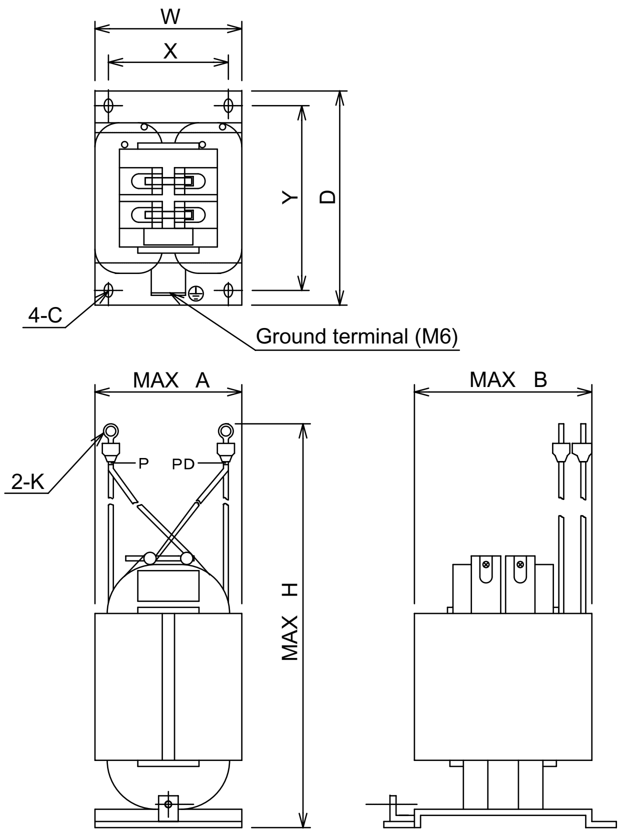


Fig. 3

Specifications

Inverter Input power supply	Model	Figure No.	Applicable Inverter	Dimensions (mm) Bmax: coil dimensions									Weight (kg)	Standard applicable wire
				W	D	H	A	B	X	Y	C	K		
3/1-phase 200 VAC	3G3AX-DL2002	Fig. 1	3G3MX2-A2001, AB001	66	90	98	–	85	56	72	5.2 × 8	M4	0.8	1.25 mm^2 min.
	3G3AX-DL2004		3G3MX2-A2002, AB002	66	90	98	–	95	56	72	5.2 × 8	M4	1.0	1.25 mm^2 min.
	3G3AX-DL2007		3G3MX2-A2004, AB004	66	90	98	–	105	56	72	5.2 × 8	M4	1.3	2 mm^2 min.
	3G3AX-DL2015		3G3MX2-A2007, AB007	66	90	98	–	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL2022		3G3MX2-A2015, AB015	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL2037		3G3MX2-A2022, AB022	86	100	118	–	120	71	80	6 × 9	M4	2.6	3.5 mm^2 min.
	3G3AX-DL2055	Fig. 2	3G3MX2-A2037	111	100	210	–	110	95	80	7 × 11	M5	3.6	8 mm^2 min.
	3G3AX-DL2075		3G3MX2-A2055	111	100	212	–	120	95	80	7×11	M6	3.9	14 mm^2 min.
	3G3AX-DL2110		3G3MX2-A2075	146	120	252	–	110	124	96	7×11	M6	6.5	22 mm^2 min.
	3G3AX-DL2150		3G3MX2-A2110	146	120	256	–	120	124	96	7×11	M8	7.0	38 mm^2 min.
	3G3AX-DL2220	Fig. 3	3G3MX2-A2150	120	175	356	140	145	98	151	7×11	M8	9.0	60 mm^2 min.
3-phase 400 VAC	3G3AX-DL4007	Fig. 1	3G3MX2-A4004	66	90	98	–	95	56	72	5.2 × 8	M4	1.1	1.25 mm^2 min.
	3G3AX-DL4015		3G3MX2-A4007*1	66	90	98	–	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL4022		3G3MX2-A4007, A4015	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL4037		3G3MX2-A4022 A4030	86	100	116	–	120	71	80	6 × 9	M4	2.6	2 mm^2 min.
	3G3AX-DL4055		3G3MX2-A4040	111	100	138	–	110	95	80	7×11	M4	3.6	3.5 mm^2 min.
	3G3AX-DL4075		3G3MX2-A4055*1	111	100	138	–	115	95	80	7×11	M4	3.9	3.5 mm^2 min.
	3G3AX-DL4110	Fig. 2	3G3MX2-A4055, A4075*1	146	120	250	–	105	124	96	7×11	M5	5.2	5.5 mm^2 min.
	3G3AX-DL4150		3G3MX2-A4075, A4110	146	120	252	–	120	124	96	7×11	M6	7.0	14 mm^2 min.
	3G3AX-DL4220	Fig. 3	3G3MX2-A4150	120	175	352	140	145	98	151	7×11	M6	9.5	22 mm^2 min.

*1. Only the CT rating is supported.

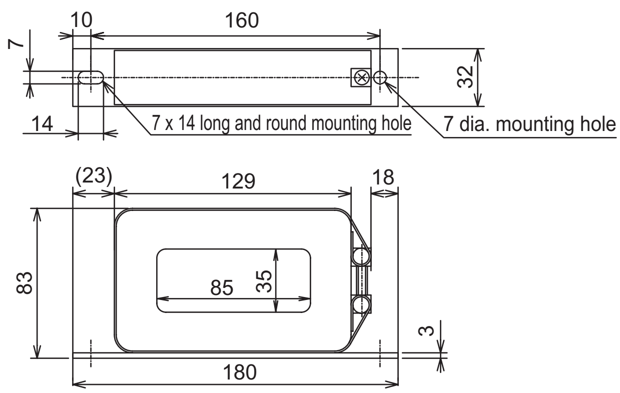
Operating environment

Ambient temperature	−10 to 50°C
Humidity	20% to 90% RH (with no condensation)
Vibration	15 kW max. 5.9 m/s^2 max. (0.6 G) 10 to 55 Hz 22 kW min. 2.0 m/s^2 max. (0.2 G) 10 to 55 Hz
Location	At a maximum altitude of 1,000 m; indoors (without corrosive gases or dust)

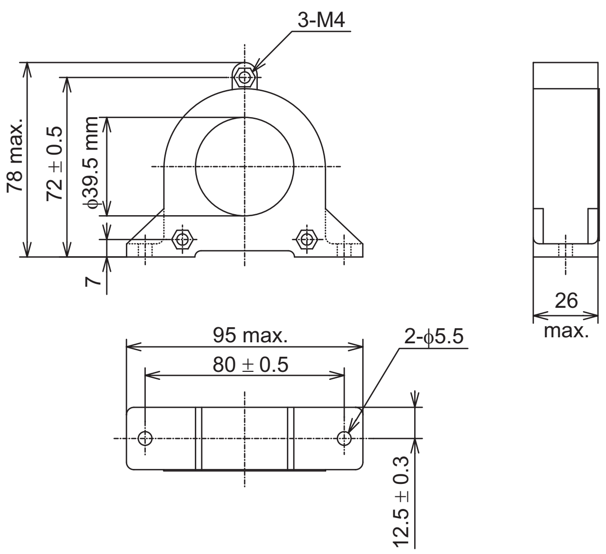
Radio Noise Filter

Dimensional Drawing

3G3AX-ZCL1



3G3AZ-ZCL2



Specifications

3G3AX-ZCL1

Applicable Inverter capacity (kW)	200 V class				400 V class			
	Input		Output		Input		Output	
	No. of filters	No. of penetrations	No. of filters	No. of penetrations	No. of filters	No. of penetrations	No. of filters	No. of penetrations
0.4	N/A		N/A		1	4	1	4
0.75					1	4	1	4
1.5					1	4	1	4
2.2					1	4	1	4
3.0					1	4	1	4
3.7	1	4	1	4	N/A		N/A	
4.0	N/A		N/A		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

Note: N/A means "Not applied".

3G3AX-ZCL2

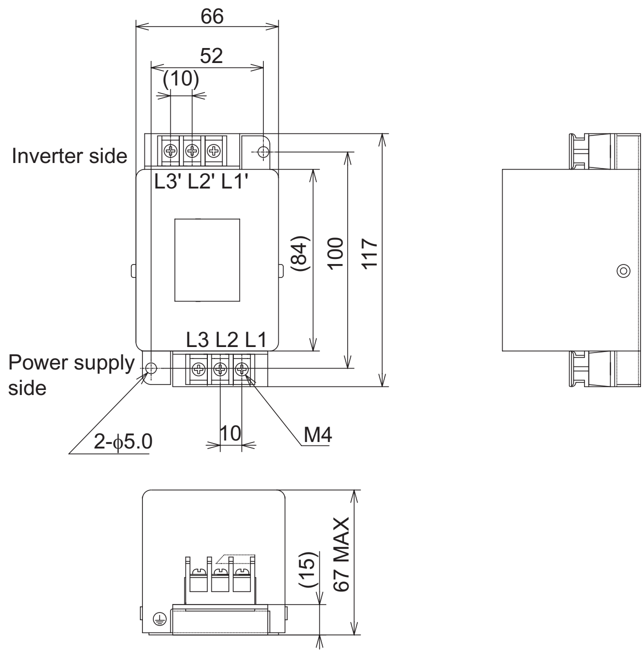
Applicable Inverter capacity (kW)	200 V class				400 V class			
	Input		Output		Input		Output	
	No. of filters	No. of penetrations	No. of filters	No. of penetrations	No. of filters	No. of penetrations	No. of filters	No. of penetrations
0.1	1	4	1	4	N/A		N/A	
0.2	1	4	1	4				
0.4	1	4	1	4	1	4	1	4
0.75	1	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	N/A		N/A		1	4	1	4
4.0					1	4	1	4
5.5					1	4	1	4

Note: N/A means "Not applied".

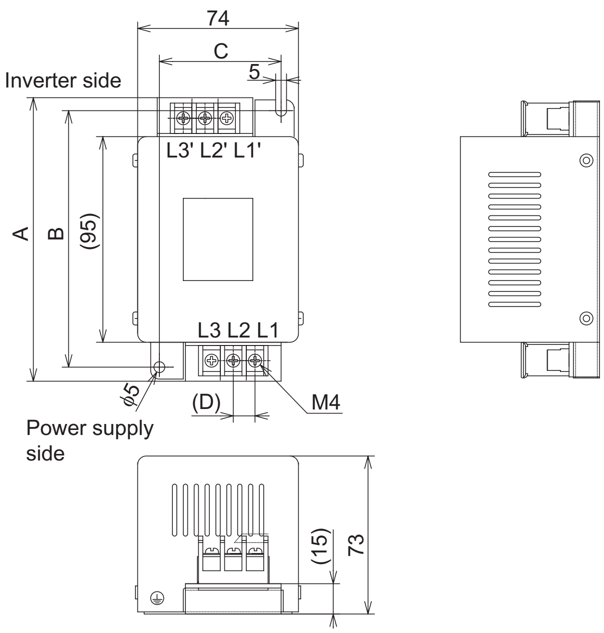
Input Noise Filter (3G3AX-NFIxxxx)

Dimensional Drawing

3G3AX-NFI21/-NFI22

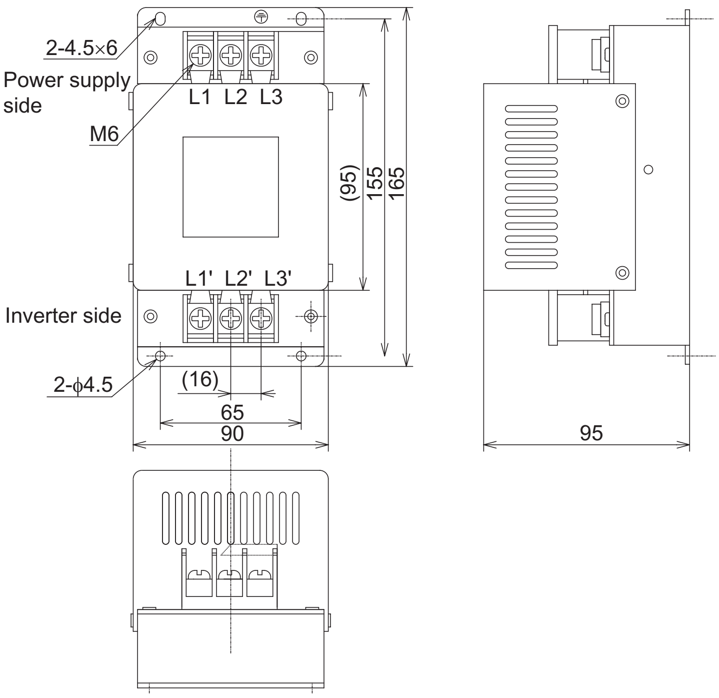


3G3AX-NFI23/-NFI24/-NFI41/-NFI42/-NFI43/-NFI44

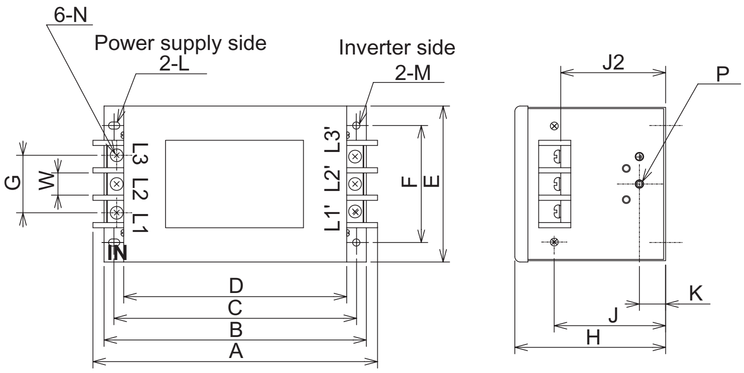


Model	Dimensions (Unit: mm)			
	A	B	C	D
3G3AX-NFI23	128	118	56	10
3G3AX-NFI24	144	130	56	11
3G3AX-NFI41	144	130	56	11
3G3AX-NFI42	144	130	56	11
3G3AX-NFI43	144	130	56	11
3G3AX-NFI44	144	130	56	11

3G3AX-NFI25/-NFI26/-NFI45/-NFI46



3G3AX-NFI27/-NFI28



Model	Dimensions (Unit: 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

Specifications

Power supply	Model	Inverter model	Rated input current In (A) at an ambient temperature of 50°C	Power loss (W)	Leakage current (mA/phase) at 60 Hz
3-phase 200 VAC	3G3AX-NFI21	3G3MX2-A2001	3 × 6 A	3	< 1.5 (250 V)
	3G3AX-NFI21	3G3MX2-A2002	3 × 6 A	3	< 1.5 (250 V)
	3G3AX-NFI21	3G3MX2-A2004	3 × 6 A	3	< 1.5 (250 V)
	3G3AX-NFI22	3G3MX2-A2007	3 × 10 A	4	< 1.5 (250 V)
	3G3AX-NFI23	3G3MX2-A2015	3 × 20 A	6	< 1.5 (250 V)
	3G3AX-NFI23	3G3MX2-A2022	3 × 20 A	6	< 1.5 (250 V)
	3G3AX-NFI24	3G3MX2-A2037	3 × 30 A	9	< 1.5 (250 V)
	3G3AX-NFI25	3G3MX2-A2055	3 × 40 A	12	< 1.5 (250 V)
	3G3AX-NFI26	3G3MX2-A2075	3 × 60 A	17	< 1.5 (250 V)
	3G3AX-NFI27	3G3MX2-A2110	3 × 80 A	21	< 1.5 (250 V)
	3G3AX-NFI28	3G3MX2-A2150	3 × 100 A	23	< 1.5 (250 V)
1-phase 200 VAC	3G3AX-NFI21	3G3MX2-AB001	3 × 6 A	3	< 1.5 (250 V)
	3G3AX-NFI21	3G3MX2-AB002	3 × 6 A	3	< 1.5 (250 V)
	3G3AX-NFI22	3G3MX2-AB004	3 × 10 A	4	< 1.5 (250 V)
	3G3AX-NFI23	3G3MX2-AB007	3 × 20 A	6	< 1.5 (250 V)
	3G3AX-NFI24 3G3AX-NFI23*1	3G3MX2-AB015	3 × 30 A 3 × 20 A	9 6	< 1.5 (250 V)
	3G3AX-NFI24	3G3MX2-AB022	3 × 30 A	9	< 1.5 (250 V)
3-phase 400 VAC	3G3AX-NFI41	3G3MX2-A4004	3 × 7 A	2	< 7.5 (480 V)
	3G3AX-NFI41	3G3MX2-A4007	3 × 7 A	2	< 7.5 (480 V)
	3G3AX-NFI41	3G3MX2-A4015	3 × 7 A	2	< 7.5 (480 V)
	3G3AX-NFI42	3G3MX2-A4022	3 × 10 A	4	< 7.5 (480 V)
	3G3AX-NFI42	3G3MX2-A4030	3 × 10 A	4	< 7.5 (480 V)
	3G3AX-NFI43	3G3MX2-A4040	3 × 20 A	6	< 7.5 (480 V)
	3G3AX-NFI43	3G3MX2-A4055	3 × 20 A	6	< 7.5 (480 V)
	3G3AX-NFI44	3G3MX2-A4075	3 × 30 A	9	< 7.5 (480 V)
	3G3AX-NFI45	3G3MX2-A4110	3 × 40 A	12	< 7.5 (480 V)
	3G3AX-NFI46	3G3MX2-A4150	3 × 50 A	15	< 7.5 (480 V)

*1. With the 3G3AX-NFI23, only the CT rating is supported.

Model	Case enclosure rating	Terminal size	Wire dia.	Weight (kg)
3G3AX-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-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

EMC-compatible Noise Filter

Schaffner

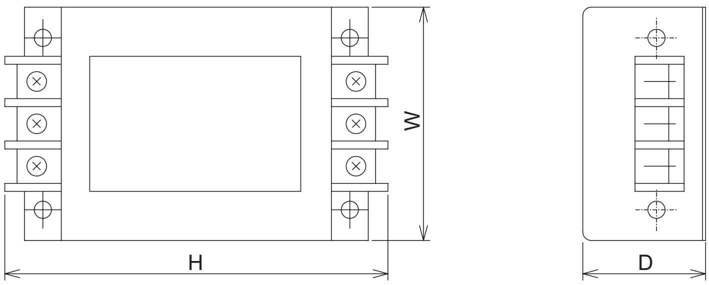
Power supply	Inverter model	EMC-compatible Noise Filter	
		Type (Schaffner)	Rating [A]
3-phase 200 VAC	3G3MX2-A2001	(Supported soon)	
	3G3MX2-A2002		
	3G3MX2-A2004		
	3G3MX2-A2007		
	3G3MX2-A2015		
	3G3MX2-A2022		
	3G3MX2-A2037		
	3G3MX2-A2055		
	3G3MX2-A2075		
	3G3MX2-A2110		
	3G3MX2-A2150		
1-phase 200 VAC	3G3MX2-AB001		
	3G3MX2-AB002		
	3G3MX2-AB004		
	3G3MX2-AB007		
	3G3MX2-AB015		
	3G3MX2-AB022		
3-phase 400 VAC	3G3MX2-A4004		
	3G3MX2-A4007		
	3G3MX2-A4015		
	3G3MX2-A4022		
	3G3MX2-A4030		
	3G3MX2-A4040		
	3G3MX2-A4055		
	3G3MX2-A4075		
	3G3MX2-A4110		
	3G3MX2-A4150		

Note: The noise filter type is the same regardless of the CT rating or VT rating.

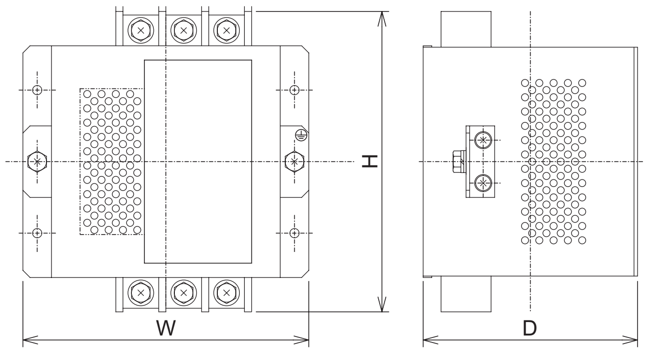
Output Noise Filter (3G3AX-NFOxx)

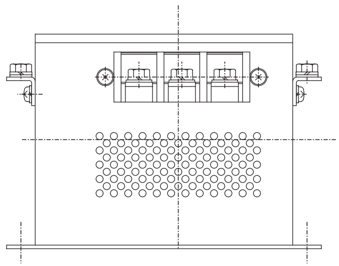
Dimensional Drawing

3G3AX-NFO01/-NFO02



3G3AX-NFO03/-NFO04/-NFO05/-NFO06





9

Specifications

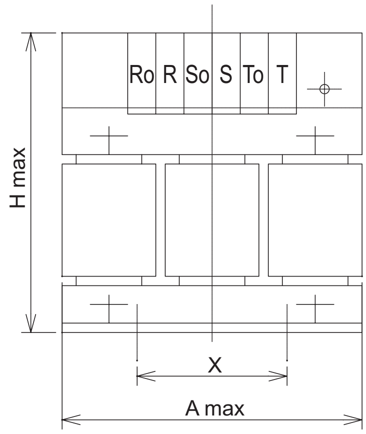
Specifications

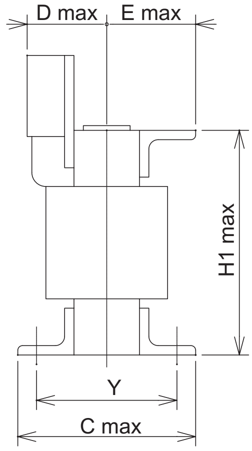
Power supply	Model	Rated current (A)	Inverter model			External Dimensions (H × W × D) (mm)	Weight (kg)
			3-phase AC 200 V class	1-phase AC 200 V class	3-phase AC 400 V class		
3-phase, 3-wire Rated voltage 500 VAC	3G3AX-NFO01	6	3G3MX2-A2001 /-A2002/-A2004	3G3MX2-AB001 /-AB002	3G3MX2-A4004 /-A4007	156 × 95 × 50	0.7
	3G3AX-NFO02	12	3G3MX2-A2007 /-A2015	3G3MX2-AB004 /-AB007	3G3MX2-A4015 /-A4022/-A4030	176 × 110 × 70	0.9
	3G3AX-NFO03	25	3G3MX2-A2022 /-A2037	3G3MX2-AB015 /-AB022	3G3MX2-A4040 /-A4055/-A4075	154 × 160 × 120	2.1
	3G3AX-NFO04	50	3G3MX2-A2055 /-A2075	–	3G3MX2-A4110 /-A4150	210 × 200 × 150	3.7
	3G3AX-NFO05	75	3G3MX2-A2110	–	–	230 × 220 × 170	5.7
	3G3AX-NFO06	100	3G3MX2-A2150	–	–	237 × 220 × 170	8.4

AC Reactor (3G3AX-ALxxxx)

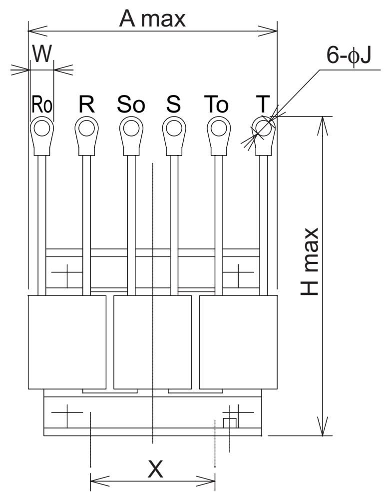
Dimensional Drawing

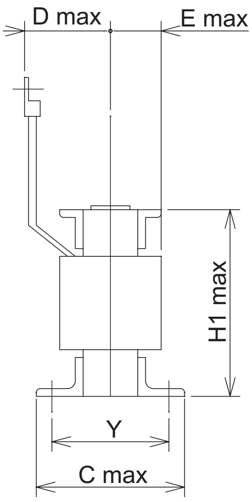
3G3AX-AL2025/-AL2055/-AL4025/-AL4055/-AL4110





3G3AX-AL2110/-AL2220/-AL2330/-AL4220/-AL4330





Specifications

Model	Inverter model	Motor capacity		Dimensions (mm)										Weight (kg)
		VT	CT	A	C	D	E	H	H1	J	W	X	Y	
3G3AX-AL2025	3G3MX2-A2001	√	√	130	82	60	40	150	92	–	–	50	67	2.8
	3G3MX2-A2002	√	√											
	3G3MX2-A2004	√	√											
	3G3MX2-A2007	√	√											
	3G3MX2-AB001	√	√											
	3G3MX2-AB002	√	√											
	3G3MX2-AB004	√	√											
3G3AX-AL2055	3G3MX2-A2015	√	√	140	98	60	40	150	92	–	–	50	75	4.0
	3G3MX2-A2022	√	√											
	3G3MX2-AB007	√	√											
	3G3MX2-AB015*1	–	√											
3G3AX-AL2110	3G3MX2-A2037	√	√	160	103	70	55	170	106	5.3	12.0	60	80	5.0
	3G3MX2-A2055*1	–	√											
	3G3MX2-AB015	√	√											
	3G3MX2-AB022	√	√											
3G3AX-AL2220	3G3MX2-A2055	√	√	180	113	75	55	190	138	8.4	16.5	90	90	10.0
	3G3MX2-A2075	√	√											
	3G3MX2-A2110*1	–	√											
3G3AX-AL2330	3G3MX2-A2110	√	√	180	113	85	60	230	138	8.4	22.0	125	90	11.0
	3G3MX2-A2150	√	√											

Model	Inverter model	Motor capacity		Dimensions (mm)										Weight (kg)
		VT	CT	A	C	D	E	H	H1	J	W	X	Y	
3G3AX-AL4025	3G3MX2-A4004	√	√	130	82	60	40	150	92	–	–	50	67	2.7
	3G3MX2-A4007	√	√											
3G3AX-AL4055	3G3MX2-A4015	√	√	130	98	60	40	150	92	–	–	50	75	4.0
	3G3MX2-A4022	√	√											
	3G3MX2-A4030	√	√											
3G3AX-AL4110	3G3MX2-A4040	√	√	160	116	75	55	170	106	–	–	60	98	6.0
	3G3MX2-A4055*1	–	√											
3G3AX-AL4220	3G3MX2-A4055	√	√	180	103	75	55	190	138	5.3	12.0	100	80	10.0
	3G3MX2-A4075	√	√											
	3G3MX2-A4110*1	–	√											
3G3AX-AL4330	3G3MX2-A4110	√	√	180	123	85	60	230	138	6.4	16.5	100	100	11.5
	3G3MX2-A4150	√	√											

*1. Only the CT rating is supported.

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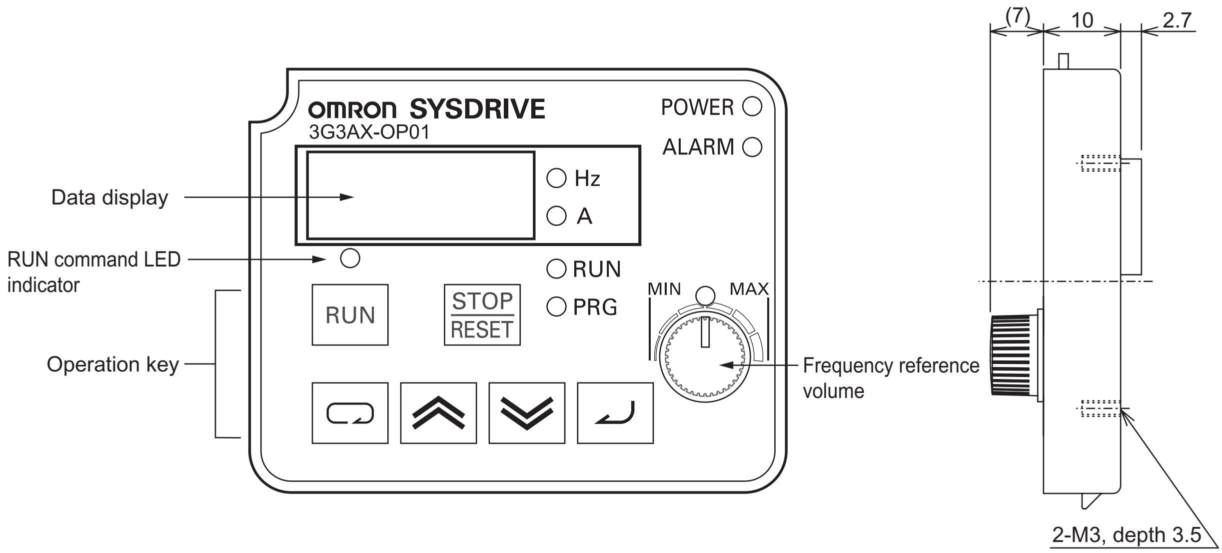
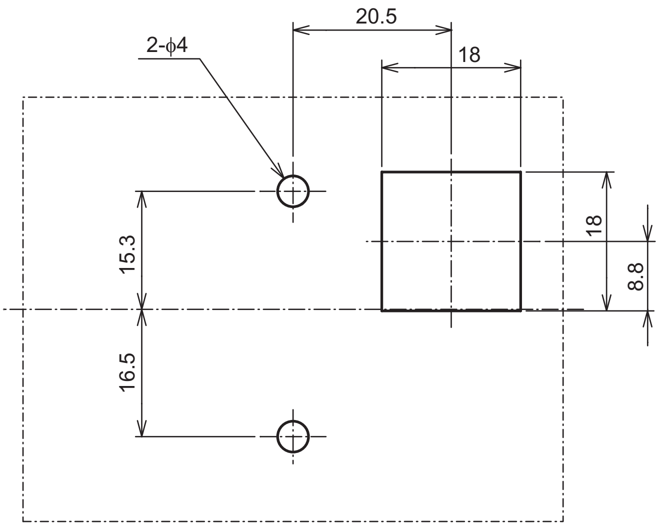
Specifications

Digital Operator (3G3AX-OP01)





Panel cut dimensions

External Dimensions	Height (55 mm) × Width (70 mm) × Depth (10 mm)

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Appendix

Describes the derating chart, capacitor life curve, and compliance with EC directives and UL/cUL standards.

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Appendix-1 Derating Table

In the following table, derate the output current according to the graph shown below if any model denoted by "Derating required" is used in an environment of 40°C or above in ambient temperature or if multiple Inverters are installed side by side (side-by-side installation). (The ambient temperature for side-by-side installation is specified as –10 to 40°C.)
Set a derating output current value as electronic thermal (b012/b212). For electronic thermal level, refer to "Electronic Thermal Function" on page 5-110.

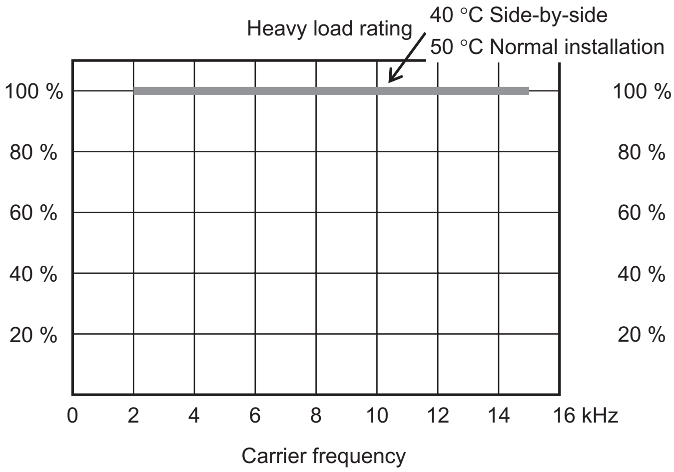
Derating Need Correspondence Table

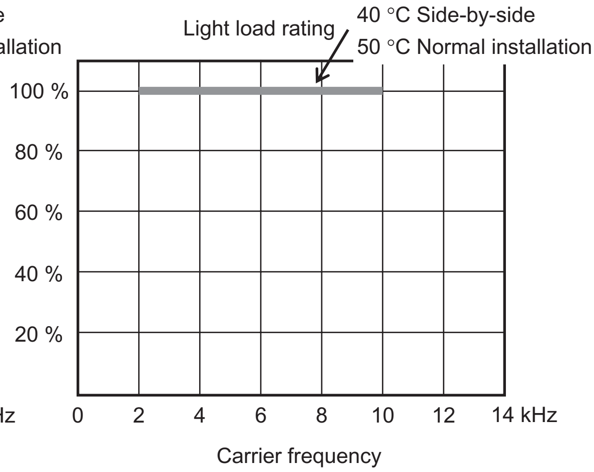
Rated voltage	Model	Required/ Not required
3-phase 200 VAC	3G3MX2-A2001	–
	3G3MX2-A2002	√
	3G3MX2-A2004	√
	3G3MX2-A2007	–
	3G3MX2-A2015	–
	3G3MX2-A2022	–
	3G3MX2-A2037	√
	3G3MX2-A2055	–
	3G3MX2-A2075	√
	3G3MX2-A2110	√
	3G3MX2-A2150	√
1-phase 200 V AC	3G3MX2-AB001	–
	3G3MX2-AB002	–
	3G3MX2-AB004	√
	3G3MX2-AB007	–
	3G3MX2-AB015	–
	3G3MX2-AB022	–
3-phase 400 VAC	3G3MX2-A4004	–
	3G3MX2-A4007	√
	3G3MX2-A4015	–
	3G3MX2-A4022	–
	3G3MX2-A4030	–
	3G3MX2-A4040	√
	3G3MX2-A4055	–
	3G3MX2-A4075	√
	3G3MX2-A4110	√
	3G3MX2-A4150	√

√: Derating required –: Derating not required

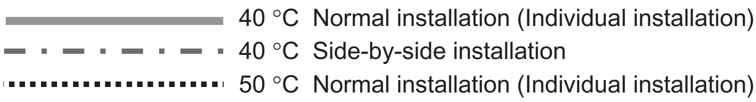
The output current need not be derated for models denoted as "Not required" in the above table. Use each model within the specified/rated ranges.

Models Not Requiring Derating

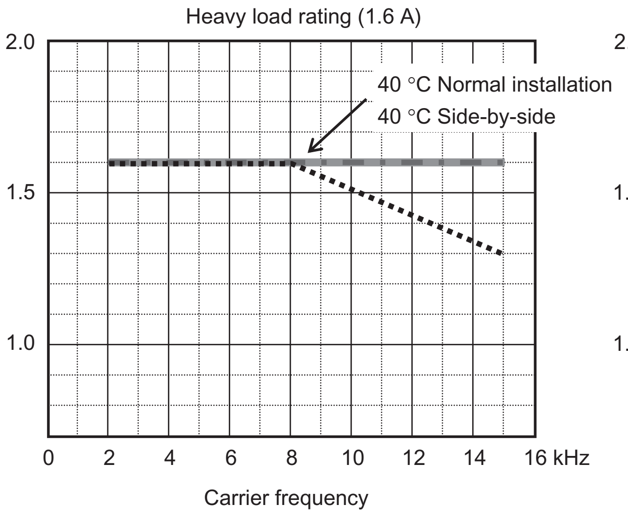


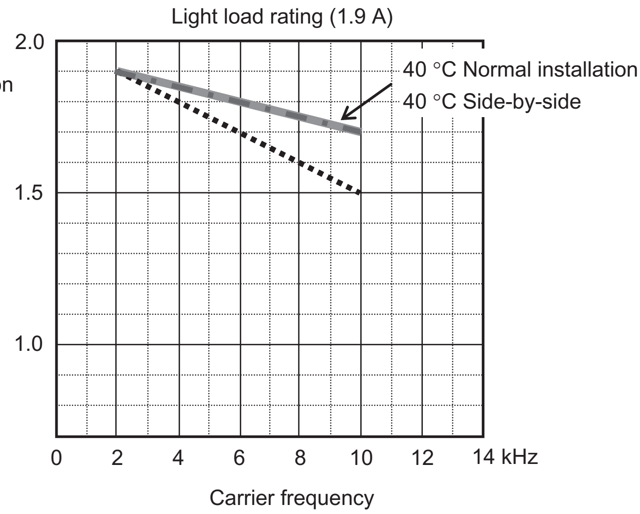


Models Requiring Derating

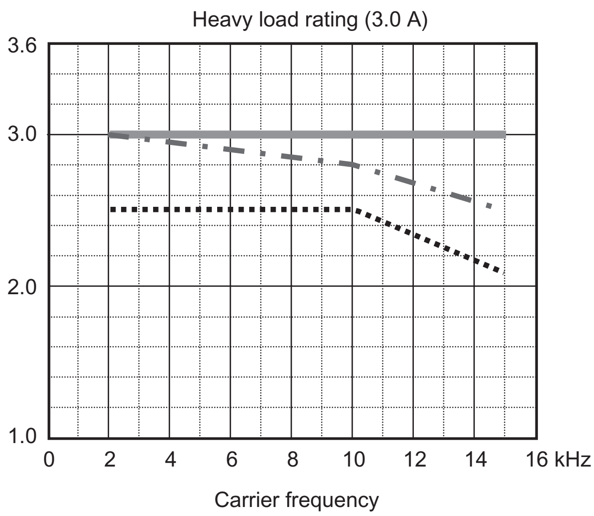


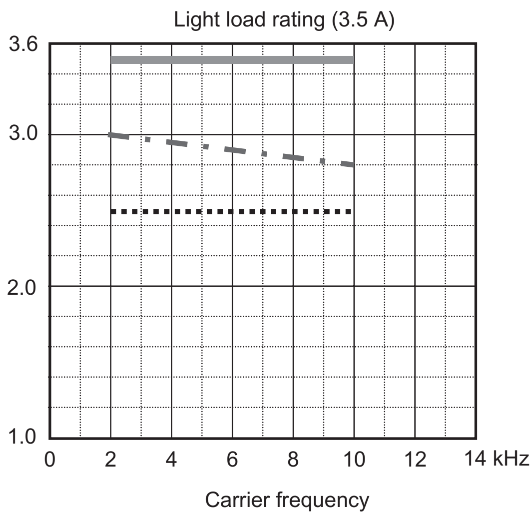
3G3MX2-A2002



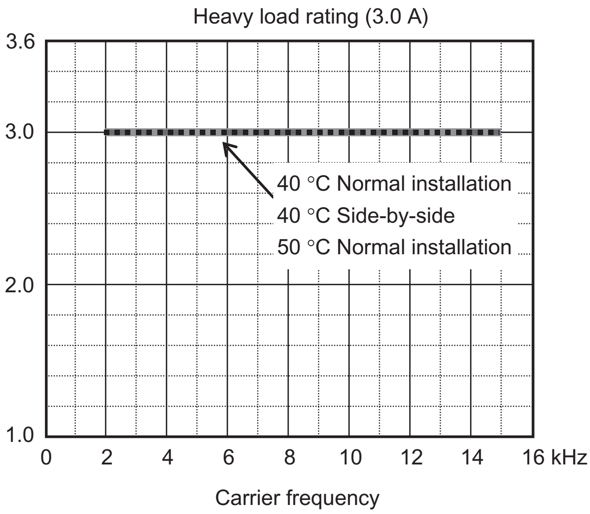


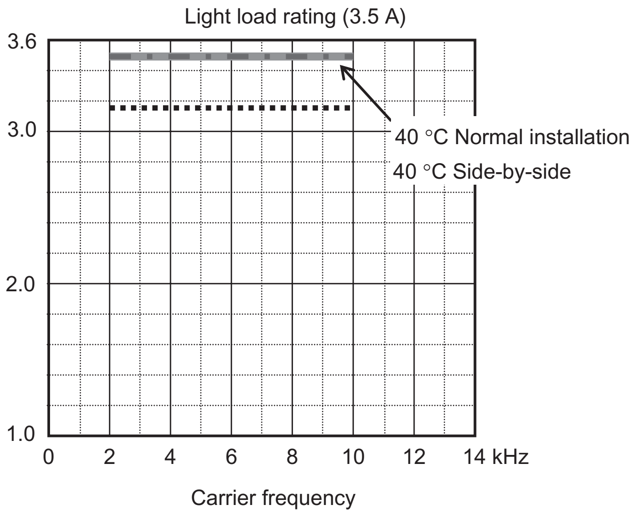
3G3MX2-AB004



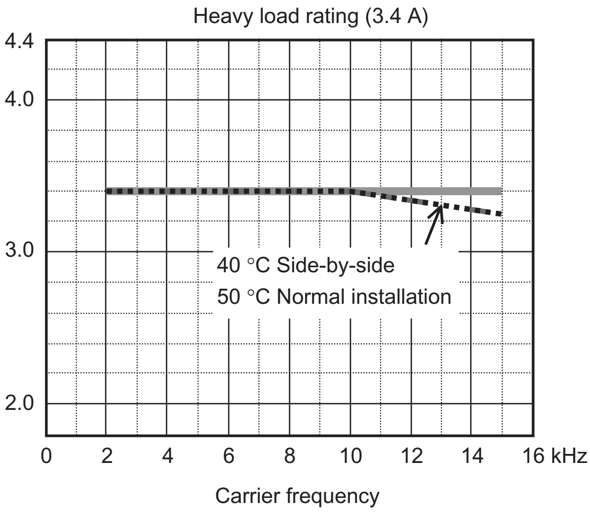


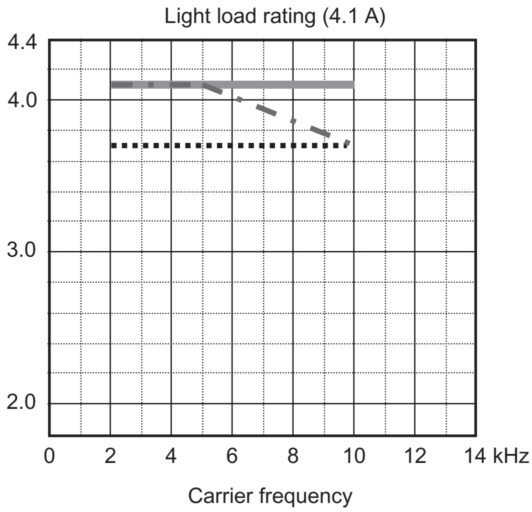
3G3MX2-A2004



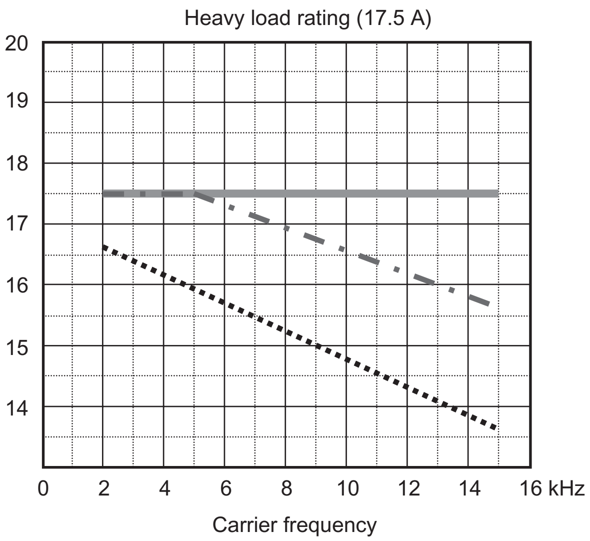


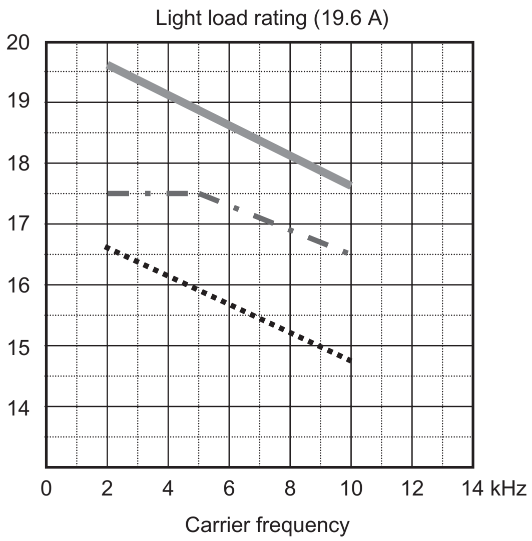
3G3MX2-A4007



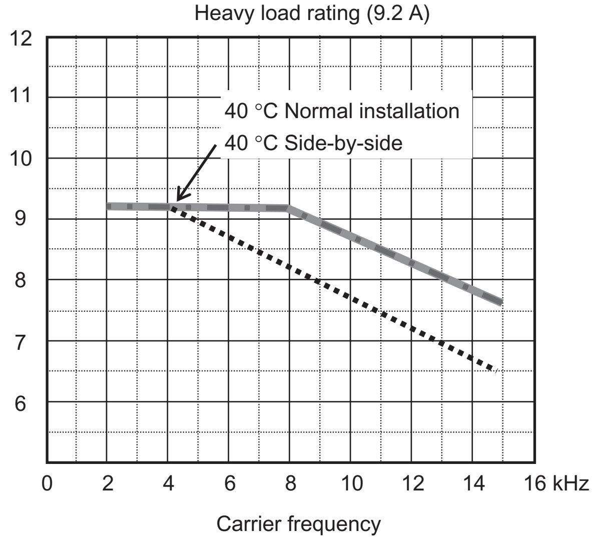


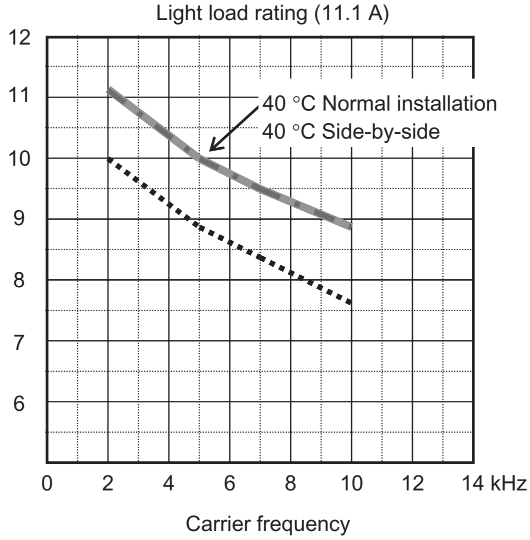
3G3MX2-A2037



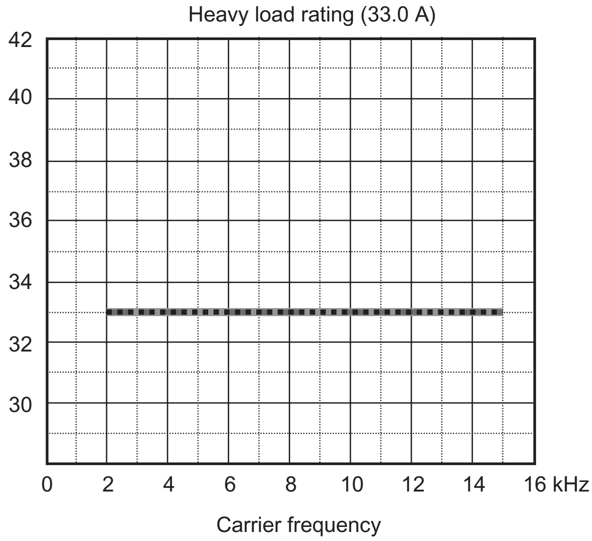


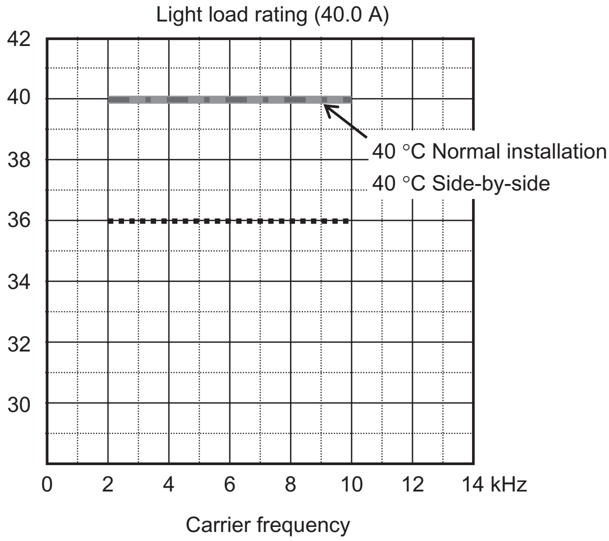
3G3MX2-A4040



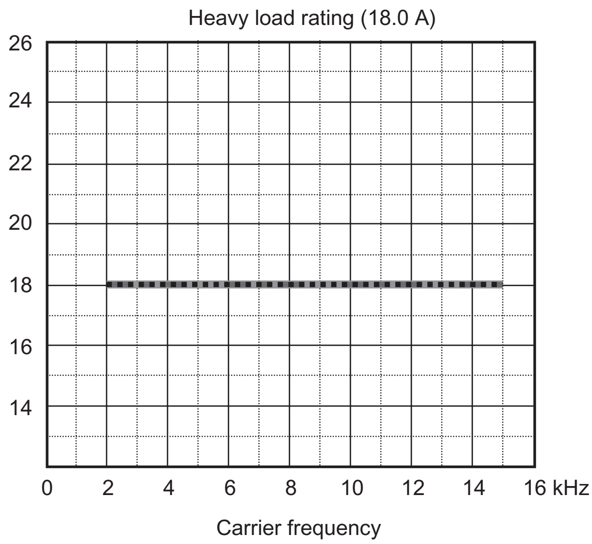


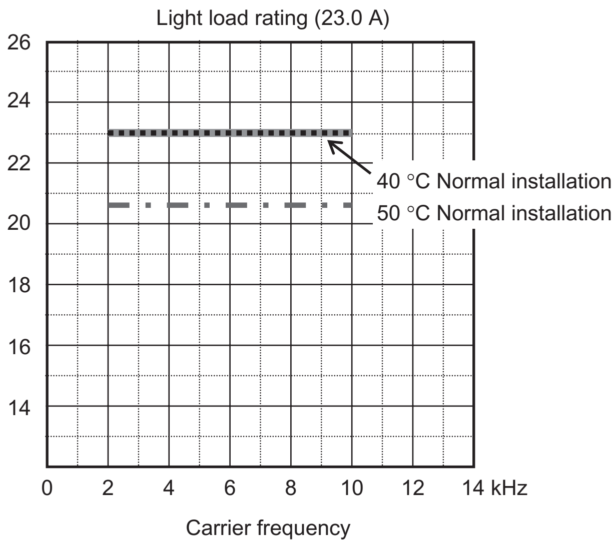
3G3MX2-A2075





3G3MX2-A4075





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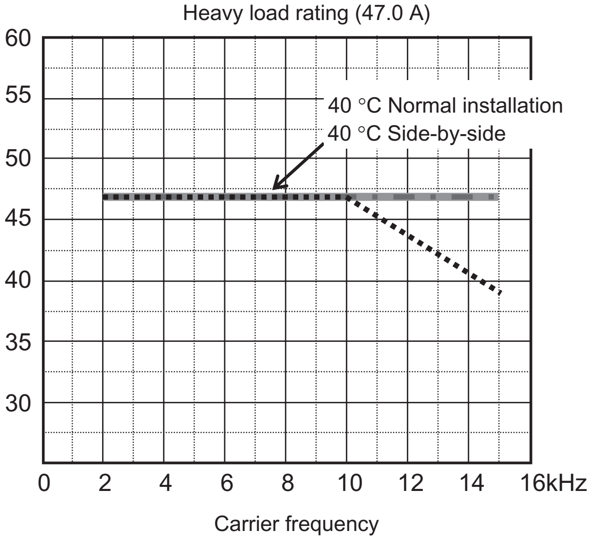
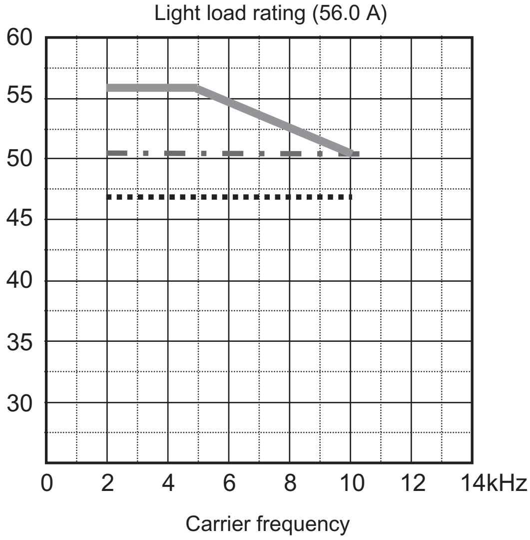
3G3MX2-A2110

Heavy load rating (47.0 A)

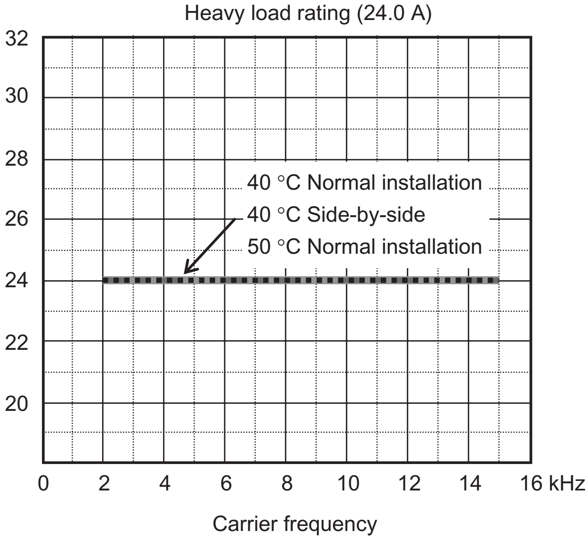


Light load rating (56.0 A)

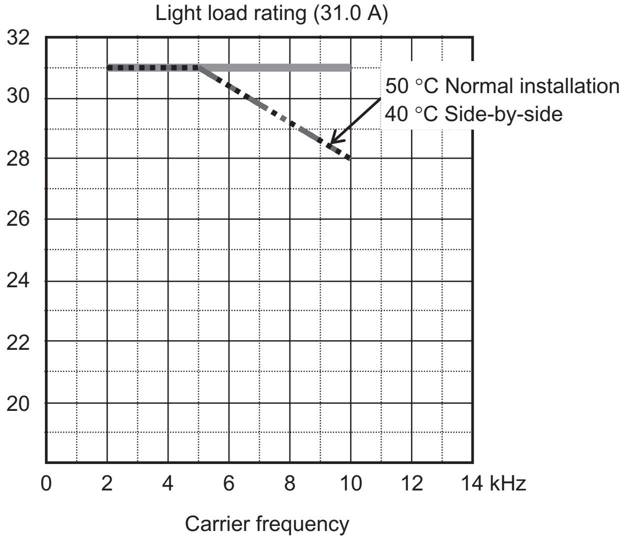


3G3MX2-A4110

Heavy load rating (24.0 A)

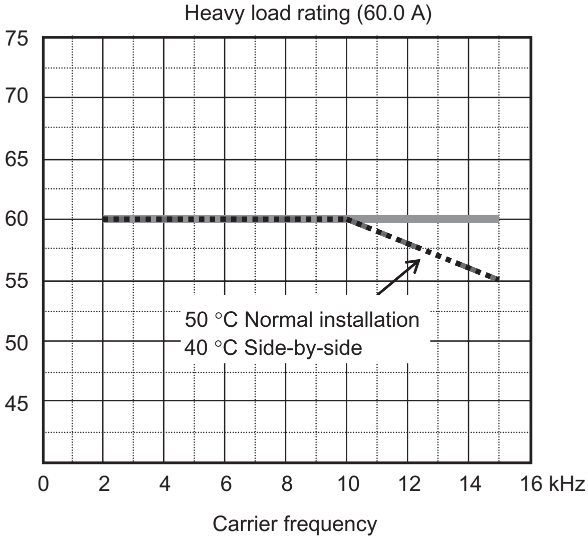


Light load rating (31.0 A)

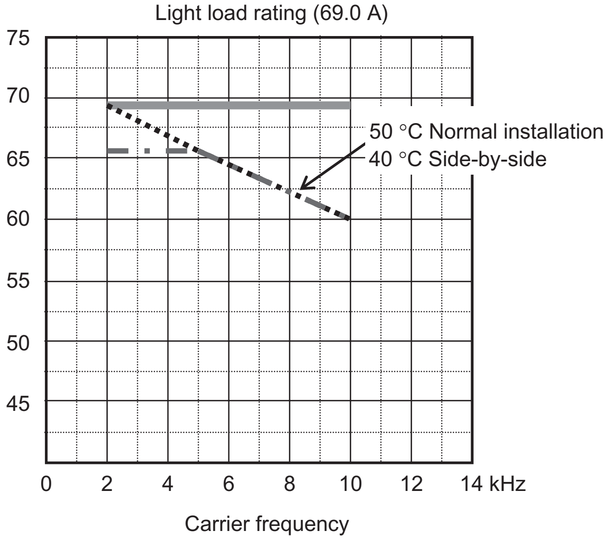


3G3MX2-A2150

Heavy load rating (60.0 A)



Light load rating (69.0 A)



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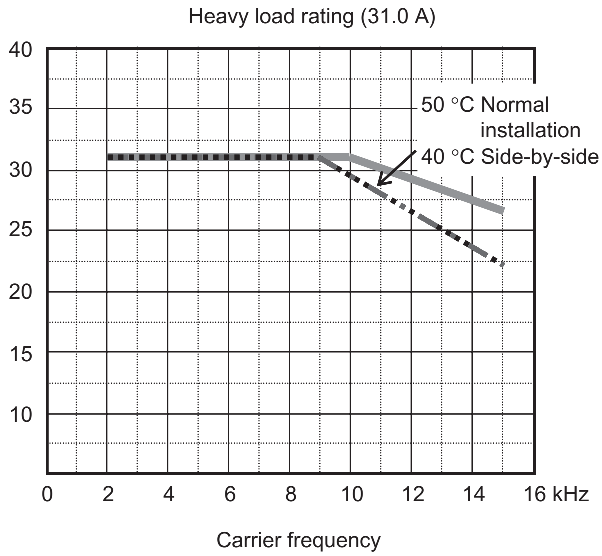
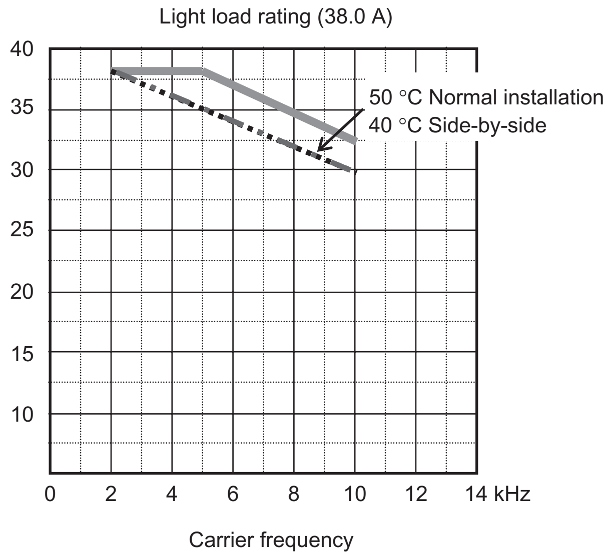
3G3MX2-A4150





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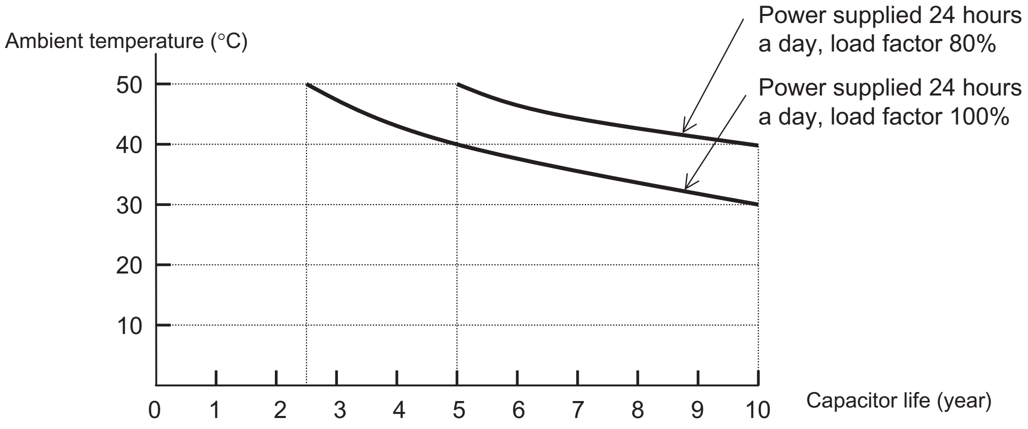
Appendix-2 Smoothing Capacitor Life Curve



Note 1: Ambient temperature refers to the temperature measured at the location approximately 5 cm from the bottom center of the Inverter.
Panel interior temperature is applied if the Inverter is stored in a control panel.

Note 2: The smoothing capacitor, which will deteriorate because of the chemical reaction caused by the temperatures of the parts, should normally be replaced once every 10 years (which is the expected design life, and not guaranteed).
However, if the ambient temperature is high, or the Inverter is used with its rated current exceeded, for example, under overload conditions, its life will be significantly shortened.

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Appendix-3 Life Alarm Output

When the product life becomes close to the end for limited life parts including the on-board smoothing capacitor or cooling fan, but excluding the main circuit smoothing capacitor, an alarm can be output through the self-diagnostic function. Use it as a reference of the parts replacement period.
This alarm is output through the self-diagnosis based on the expected design life (not a guaranteed value). Therefore, it has a margin of error depending on your environment or operation conditions.

For details, refer to "Life Assessment Monitor [d022]" on page 5-9, "Multi-function Output Terminal Selection" on page 5-32 and "Multi-function Output Terminal Contact Selection" on page 5-34.

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Appendix-4 Notes on Compliance with EC Directives and UL/cUL Standards

EC Directives

Notes on EMC (Electromagnetic Compatibility)

CE-EMC Installation Guidelines

You are required to satisfy the EMC directive (2004/108/EC) when using a 3G3MX2 inverter in an EU country.
To satisfy the EMC directive and to comply with standard, you need to use a dedicated EMC filter suitable for each model, and follow the guidelines in this section. Following table shows the compliance condition for reference.

Table 1. Condition for the compliance

Model	Cat.	Carrier f	Motor cable
All 3G3MX2 series	C1	2kHz	20m (Shielded)

Table 2. Applicable EMC filter

Input class	Inverter model	Filter model (Schaffner)
3-phase 200V class	3G3MX2-A2001	FS24829-8-07
	3G3MX2-A2002	
	3G3MX2-A2004	
	3G3MX2-A2007	
	3G3MX2-A2015	FS24829-16-07
	3G3MX2-A2022	
	3G3MX2-A2037	FS24829-25-07
	3G3MX2-A2055	FS24829-50-07
	3G3MX2-A2075	
	3G3MX2-A2110	FS24829-70-07
	3G3MX2-A2150	FS24829-75-07
1-phase 200V class	3G3MX2-AB001	FS24828-8-07
	3G3MX2-AB002	
	3G3MX2-AB004	
	3G3MX2-AB007	FS24828-27-07
	3G3MX2-AB015	
	3G3MX2-AB022	

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Input class	Inverter model	Filter model (Schaffner)
3-phase 400 V class	3G3MX2-A4004	FS24830-6-07
	3G3MX2-A4007	
	3G3MX2-A4015	FS24830-12-07
	3G3MX2-A4022	
	3G3MX2-A4030	
	3G3MX2-A4040	FS24830-15-07
	3G3MX2-A4055	FS24830-29-07
	3G3MX2-A4075	
	3G3MX2-A4110	FS24830-48-07
	3G3MX2-A4150	

* 3G3MX2-A2110 and A4150 needs to be installed in a metal cabinet and add ferrite core at the input cable to meet category C1. Unless otherwise category C2.

Important notes

1. Input choke or other equipment is required if necessary to comply with EMC directive from the harmonic distortion point of view (IEC 61000-3-2 and 4).
2. If the motor cable length exceeds 20m, use output choke to avoid unexpected problem due to the leakage current from the motor cable (such as malfunction of the thermal relay, vibration of the motor, etc.).
3. As user you must ensure that the HF (high frequency) impedance between adjustable frequency inverter, filter, and ground is as small as possible.
   - Ensure that the connections are metallic and have the largest possible contact areas (zinc-plated mounting plates).
4. Avoid conductor loops that act like antennas, especially loops that encompass large areas.
   - Avoid unnecessary conductor loops.
   - Avoid parallel arrangement of low-level signal wiring and power-carrying or noise-prone conductors.
5. Use shielded wiring for the motor cable and all analog and digital control lines.
   - Allow the effective shield area of these lines to remain as large as possible; i.e., do not strip away the shield (screen) further away from the cable end than absolutely necessary.
   - With integrated systems (for example, when the adjustable frequency inverter is communicating with some type of supervisory controller or host computer in the same control cabinet and they are connected at the same ground + PE-potential), connect the shields of the control lines to ground + PE (protective earth) at both ends. With distributed systems (for example the communicating supervisory controller or host computer is not in the same control cabinet and there is a distance between the systems), we recommend connecting the shield of the control lines only at the end connecting to the adjustable frequency inverter. If possible, route the other end of the control lines directly to the cable entry section of the supervisory controller or host computer. The shield conductor of the motor cables always must connected to ground + PE at both ends.
   - To achieve a large area contact between shield and ground + PE-potential, use a PG screw with a metallic shell, or use a metallic mounting clip.
   - Use only cable with braided, tinned copper mesh shield (type "CY") with 85% coverage.
   - The shielding continuity should not be broken at any point in the cable. If the use of reactors, contactors, terminals, or safety switches in the motor output is necessary, the unshielded section should be kept as short as possible.
   - Some motors have a rubber gasket between terminal box and motor housing. Very often, the terminal boxes, and particularly the threads for the metal PG screw connections, are painted. Make sure there is always a good metallic connection between the shielding of the motor cable, the metal PG screw connection, the terminal box, and the motor housing. If necessary, carefully remove paint between conducting surfaces.

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6. Take measures to minimize interference that is frequently coupled in through installation cables.
   - Separate interfering cables with 0.25m minimum from cables susceptible to interference. A particularly critical point is laying parallel cables over longer distances. If two cables intersect (one crosses over the other), the interference is smallest if they intersect at an angle of 90° . Cables susceptible to interference should therefore only intersect motor cables, intermediate circuit cables, or the wiring of a rheostat at right angles and never be laid parallel to them over longer distances.
7. Minimize the distance between an interference source and an interference sink (interference- threatened device), thereby decreasing the effect of the emitted interference on the interference sink.
   - You should use only interference-free devices and maintain a minimum distance of 0.25 m from the adjustable frequency inverter.
8. Follow safety measures in the filter installation.
   - If using external EMC filter, ensure that the ground terminal (PE) of the filter is properly connected to the ground terminal of the adjustable frequency inverter. An HF ground connection via metal contact between the housings of the filter and the adjustable frequency inverter, or solely via cable shield, is not permitted as a protective conductor connection. The filter must be solidly and permanently connected with the ground potential so as to preclude the danger of electric shock upon touching the filter if a fault occurs.

   To achieve a protective ground connection for the filter:
   - Ground the filter with a conductor of at least 10 mm2 cross-sectional area.
   - Connect a second grounding conductor, using a separate grounding terminal parallel to the protective conductor. (The cross section of each single protective conductor terminal must be sized for the required nominal load).

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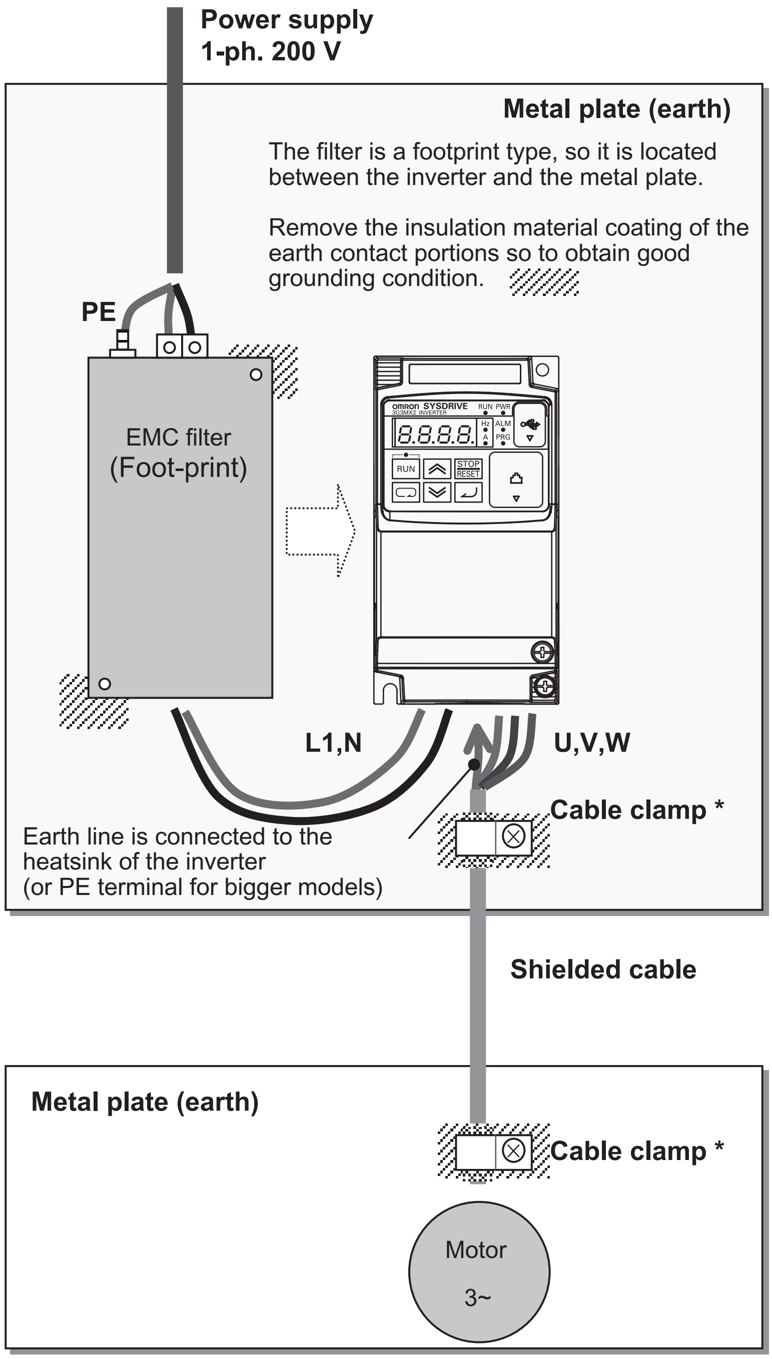
Installation for 3G3MX2 series (example of ABxxx models)

Model A2xxx (3-phase 200 V class) and A4xxx (3-phase 400 V class) are the same concept for the installation.



*) Both earth portions of the shielded cable must be connected to the earth point by cable clamps.
Input choke or equipment to reduce harmonic current is necessary for CE marking (IEC 61000-3-2 and IEC61000-3-4) from the harmonic current point of view, even conducted emission and radiated emission passed without the input choke.

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EMC Recommendations

Use the following checklist to ensure the inverter is within proper operating ranges and conditions.

1. The power supply to 3G3MX2 inverters must meet these specifications:
   - Voltage fluctuation 10% or less
   - Voltage imbalance ±3% or less
   - Frequency variation ±4% or less
   - Voltage distortion THD = 10% or less
2. Installation measure:
   - Use a filter designed for 3G3MX2 inverter. Refer to the instruction of the applicable external EMC filter.
3. Wiring:
   - Shielded wire (screened cable) is required for motor wiring, and the length must be 20 meter or less.
   - If the motor cable length exceeds the value shown above, use output choke to avoid unexpected problem due to the leakage current from the motor cable.
   - The carrier frequency setting must be 2 kHz to satisfy EMC requirements.
   - Separate the power input and motor wiring from the signal/process circuit wiring.
4. Environmental conditions-when using a filter, follow these guidelines:
   - Ambient temperature: –10 to 50°C (Derating is required when the ambient temperature exceeds 40°C)
   - Humidity: 20 to 90% RH (non-condensing)
   - Vibration: 5.9 m/sec2 (0.6 G) 10-55Hz

Location: 1000 meters or less altitude, indoors (no corrosive gas or dust)

Note on Low-voltage Directive

Ensure correct installation and wiring by following the instructions provided in Chapter 2 "Design" of this User's Manual.

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Notes on UL/cUL Standards

UL Cautions

The warnings and instructions in this section summarizes the procedures necessary to ensure an inverter installation complies with Underwriters Laboratories guidelines.

- Use 60/75°C Cu wire only.
  (For models: 3G3MX2-A2001, -A2002, -A2004, -A2007, -AB015, -AB022, -A4004, -A4007, -A4015, -A4022 and -A4030)
- Use 75°C Cu wire only.
  (For models: 3G3MX2-AB001, -AB002, -AB004, -AB007, -A2015, -A2022, -A2037, -A2055, -A2075, -A2110, -A2150, -A4040, -A4055, -A4075, -A4110 and -A4150)
- Suitable for use on a circuit capable of delivering not more than 100,000 rms Symmetrical Amperes, 240 or 480 Volts Maximum.
- When Protected by CC, G, J, or R Class Fuses, or when Protected By A Circuit Breaker Having An Interrupting Rating Not Less Than 100,000 rms Symmetrical Amperes, 240 or 480 Volts Maximum.
- Install device in pollution degree 2 environment.
- Maximum surrounding air temperature rating of 50°C.
- Solid State motor overload protection reacts with max. 150% of FLA.
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.

Fuse Size

The Inverter shall be connected with a UL Listed Cartridge Nonrenewable fuse, rated 600Vac with the current ratings as shown in the table below.

Model No.	Type	Rating
3G3MX2-AB001, 3G3MX2-AB002, 3G3MX2-AB004	Class J	10 A, AIC 200 kA
3G3MX2-AB007		15A, AIC 200 kA
3G3MX2-AB015		20A, AIC 200 kA
3G3MX2-AB022		30A, AIC 200 kA
3G3MX2-A2001, 3G3MX2-A2002, 3G3MX2-A2004		10 A, AIC 200 kA
3G3MX2-A2007, 3G3MX2-A2015		15A, AIC 200 kA
3G3MX2-A2022		20A, AIC 200 kA
3G3MX2-A2037, 3G3MX2-A2055		30A, AIC 200 kA
3G3MX2-A2075		40A, AIC 200 kA
3G3MX2-A2110		60A, AIC 200 kA
3G3MX2-A2150		80A, AIC 200 kA
3G3MX2-A4004, 3G3MX2-A4007, 3G3MX2-A4015, 3G3MX2-A4022		10 A, AIC 200 kA
3G3MX2-A4030, 3G3MX2-A4040, 3G3MX2-A4055		15A, AIC 200 kA
3G3MX2-A4075		20A, AIC 200 kA
3G3MX2-A4110		30A, AIC 200 kA
3G3MX2-A4150		40A, AIC 200 kA

Terminal Symbols and Screw Size

Model No.	Screw Size	Required Torque(N•m)	Wire Range
3G3MX2-AB001, 3G3MX2-AB002, 3G3MX2-AB004	M3.5	1.0	AWG16 (1.3mm^2)
3G3MX2-AB007	M4	1.4	AWG12 (3.3mm^2)
3G3MX2-AB015, 3G3MX2-AB022	M4	1.4	AWG10 (5.3mm^2)
3G3MX2-A2001, 3G3MX2-A2002, 3G3MX2-A2004, 3G3MX2-A2007	M3.5	1.0	AWG16 (1.3mm^2)
3G3MX2-A2015	M4	1.4	AWG14 (2.1mm^2)
3G3MX2-A2022	M4	1.4	AWG12 (3.3mm^2)
3G3MX2-A2037	M4	1.4	AWG10 (5.3mm^2)
3G3MX2-A2055, 3G3MX2-A2075	M5	3.0	AWG6 (13mm^2)
3G3MX2-A2110	M6	3.9 to 5.1	AWG4 (21mm^2)
3G3MX2-A2150	M8	5.9 to 8.8	AWG2 (34mm^2)
3G3MX2-A4004, 3G3MX2-A4007, 3G3MX2-A4015	M4	1.4	AWG16 (1.3mm^2)
3G3MX2-A4022, 3G3MX2-A4030,	M4	1.4	AWG14 (2.1mm^2)
3G3MX2-A4040	M4	1.4	AWG12 (3.3mm^2)
3G3MX2-A4055, 3G3MX2-A4075	M5	3.0	AWG10 (5.3mm^2)
3G3MX2-A4110, 3G3MX2-A4150	M6	3.9 to 5.1	AWG6 (13mm^2)

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