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WJ
SERIES

User's Guide

HITACHI Inverter

WJ Series C1
for Extended Mode

NT363X

S.1 Introduction

Thank you for purchasing Hitachi WJ Series C1 Inverter. (Afterward "Hitachi WJ Series C1 Inverter" referred to as WJ-C1.)
This is a User's Guide that describes the handling and maintenance of the WJ-C1 Ver 2.00 or later.
For the purpose of paper consumption reduction and provision of the latest information, we enclose the WJ-C1 Basic Guide only, while providing the WJ-C1 User's Guide for more detailed description through electronic means instead of CD or a printed document.

About the Basic Guide

- The WJ-C1 Basic Guide provides the minimum information necessary for handling the product. Be sure to read this document as well as the WJ-C1 User's Guide for more detailed information.

About the User's Guide

- The WJ-C1 User's Guide provides detailed information necessary for handling the product. Be sure to read the User's Guide for proper use.
  If there are any differences between the WJ-C1 Basic Guide and the WJ-C1 User's Guide due to updates, etc., the contents on the guide with the latest version will have higher priority. The version of the guide is shown in underlined alphabet like the following example, and the alphabet changes to A, B, C... by the revision. For example, comparing the User's Guide NT363<u>A</u>X and the Basic Guide NT3631<u>B</u>X, the Basic Guide contains the latest contents. Always use the WJ-C1 inverter strictly within the range described in the latest contents on the guide and perform proper inspection and maintenance to prevent failures or accidents.

  Please note that the WJ-C1 User's Guide basically provided as electronic data (such as PDF).
  To get the latest version of the WJ-C1 User's Guide, please contact the supplier where this device was purchased.

Handling an Optional Products

- When using optional products, refer to the instruction manual, Basic Guide, User's Guide, and other related technical documents attached to the product.
- When using communication options with WJ-C1, refer to "Chapter 13 Communication Option".

S.2 Cautions

For a Proper Use

- Before using the inverter, carefully read the Basic Guide, User's Guide of the inverter and the instruction manuals for optional products.
- Before any attempt to install, operate, maintain or inspect this equipment, a complete understanding of the equipment specifications, safety instructions, precautions, handling and operation instructions is required. Follow all the specifications and instructions for a proper use. Additionally, review the inverter's Basic Guide, User's Guide and each optional product instruction manuals periodically.

Precautions

- It is prohibited to reproduce or reform this guide partially or totally in any form without the publisher's permission.
- The contents of this guide are subject to change without prior notice.
- Any handling, maintenance or operation method NOT described on the inverter's Basic Guide, User's Guide and each optional product instruction manuals is not covered by the product warranty. DO NOT perform any procedure NOT described on the WJ-C1 and optional product guides since it can be the cause of unexpected failures or accidents.
- We are not responsible for any impact from operations regardless of unexpected failure or accident due to operation or handling of the product in a manner not specified on the inverter's Basic Guide, User's Guide and each optional product instruction manuals. We appreciate your understanding.
- If you find any unclear or incorrect description, missing description, or misplaced or missing pages, please inform the Hitachi inverter technical service office or the supplier where this device was purchased.
- Note that, in case the inverter's Basic Guide, User's Guide and each optional product instruction manuals are enclosed, they should be delivered to the end user of the inverter. For detailed information, please contact the supplier where this device was purchased.

S.3 Product Warranty and Inquiry

About Product Inquiry

- For an inquiry about product damage or faults or a question about the product, notify your supplier or Hitachi inverter technical service office with the following information.

■ Model: The model code start with C1- on the specification label.
■ Manufacturing Number (MFG No.): Described on the specification label.
■ Date of purchase: Purchase date by customer.
■ Inquiry contents:
  - Inform the defective point and its condition.
  - Inform the suspicious content and its detail.

Product Warranty

- The product WJ-C1 will be warranted by Hitachi Industrial Equipment Systems Co., Ltd. (afterwards referred as "Hitachi")
- However, the warranty expressed here is covered only for products delivered from Hitachi, and will not be responsible for others damage or loss of products like a motor or any equipment or systems damage caused by improper usage of the product. We recommend applying safety design which is able to provide a hazard notice to the user in case of malfunction or damage of the delivered product to minimize the consequences on other equipment or system. We advise that the selection of the delivered product is done with sufficient margin for performance, as well as using redundant design for other equipment or systems. Also, the compatibility of the product with the customer's intended use is not warranted, hence the customer has the responsibility to perform validation tests before any operation.
- In case a defective product is delivered, or quality failure during the manufacturing process are detected, Hitachi will repair or exchange the product free of charge, only during the product warranty period (afterward, we call "warranty service").
- The product will be warranted for one year from the date of purchase. However, depending on the case, actual expenses for sending technical assistance will be charged to the customer. Also, Hitachi will not be responsible of any readjustment or testing on site.
- Warranty period for repaired or replaced part based on a warranty service is 6 months after the repair is completed for the relevant part. Hitachi will be responsible for repairing or exchanging the previously exchanged or repaired part only during this warranty period.
- In order to receive warranty service, you should present the receipt issued by the product supplier or any other document that allow us to check the purchase date. However, any defects, damage, malfunction or any other failure caused by one of the following facts will not be covered by warranty service.
  (1) The purchase date cannot be confirmed.
  (2) The damage or fault resulted from improper usage or inadequate handling of the product or usage that does not comply with the instructions described in the User's Guide or Basic Guide.
  (3) Incorrect usage of the product and/or the inverter, inadequate setting of the product and/or the inverter, remodeling or inadequate repair or repair carried out by an unqualified repair center.
  (4) Deterioration and wear as result of normal operation.
  (5) Fault resulted from natural disaster, such as earthquake, fire disaster, lightning strike, pollution, salt pollution, or abnormal voltage or any others external factors.
  (6) Shock, falling, or Vibration resulted during transportation or displacement after purchase.
  (7) Damage or fault resulted from remodeling firmware by unqualified personal not belonging to Hitachi.
  (8) Damage or fault resulted from using a program operation function EzSQ.
- By warranty service, it is very likely that parameters and customer created EzSQ program data will be lost. Be sure to back up by own responsibility. However, in case of malfunction resulting from the circuit board of the storage devices, the backup will not be possible. It is recommended to keep a backup during the testing phase by using remote operator VOP or Inverter configuration software ProDriveNext.

Liability Limitation

- In this product warranty, all warranties offered to the customer are stipulated, and neither Hitachi, affiliated companies nor related dealers are liable to any express warranties or implied warranties including, but not limited to, product merchantability or specific application fitness.
- Also, Hitachi, affiliated companies or related dealers are not responsible of any incidental damage, special damage, direct loss, or indirect loss (even predictable or not) sustained by the customer as a result of a faulty product.

Using the Warranty Service

- The customer can receive a warranty service during the warranty period from the product supplier or local Hitachi inverter sales office, if the product does not meet the specifications described in the latest User's or Basic Guide.
- A fare-paying service can also be obtained by contacting your supplier, local Hitachi distributor, or local Hitachi inverter sales office.

Precautions for Product Operation

- The product should be operated following the working conditions, handling methods and precautions described in Basic Guide, User's Guide or other technical Documents.
- Be sure to confirm that the Hitachi inverter is correctly configured and installed for the intended purpose in the customer designed system.
- When using the Hitachi inverter, take following actions.
  (1) Select an inverter with sufficient capacity for the rated current and performance of customer facilities.
  (2) Implement safety design such as redundant system design.
  (3) Implement safety design which minimizes risks in case of an inverter failure.
  (4) Design the system in a way it can warn the operator about any danger.
  (5) Carry out periodic maintenance to the customer's equipment as well as the inverter.
- Hitachi inverter is designed and manufactured intentionally to be applied for general industrial equipment application. It is not intended to be used for the applications listed below. Therefore, in case inverter is used for these applications, it is out of warranty unless there is a special written agreement.
  (1) For special application such as aircraft, spacecraft, nuclear, electric power, passenger transportation, medical, submarine repeater, etc.
  (2) For application which might have a big effect on human life and property such as elevator, amusement equipment, medical equipment, etc.
- Even for above application, in case there is an agreement for the limitation of the purpose and quality, please contact to our sales office. Further study will be carried out to check whether inverter is applicable for that specific application or not.
- For applications that involve human life, or have risk of important loss, be sure to avoid a critical accident by installing a fail-safe device, protecting device, detecting device, alarm device, or spare device, etc.
- This inverter is only for three phase induction motor (IM) or three phase synchronous (permanent-magnet) motor (SM(PMM)). For any other application make inquiries.

Change on Product Specifications

- Please be aware that the information described in Brochure, Basic Guide, User's Guide or Technical Document might be modified without notice.

Supplement

- Refer to "Chapter 16 Maintenance and Inspection" for short lifespan components.
- For optional products, refer to the guide attached to the option.
- This warranty term will not restrict a legal right of customer who has purchased the product.
- Please contact your sales agent for warranty of products.

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S.4 Related Technical Documents

Document name	Document number	Product bundle
WJ series C1 User's Guide for Extended Mode (This document)	NT363*X	(*1)
WJ series C1 User's Guide	NT361*X	(*1)
WJ series C1 Basic Guide for Extended Mode	NT3631*X	✓
WJ series C1 Safety Function Guide	NT3612*X	(*1)
WJ series C1 Safety Function Guide for Extended Mode	NT3632*X	(*1)
Easy-Sequence Function Programming Guide	NT252*X	(*1)
Inverter Configuration Software ProDriveNext Instruction Manual	NT8001*X	(*1)

(The document version (" * " is alphabet A, B, ...) is added to the end of document code.)

(*1) These are usually not bundled with the product but a simple Basic guide is included. For each Guides, please contact the supplier where this device was purchased or local Hitachi inverter sales office.

S.5 Trademark

- CRIMPFOX® is a registered trademark of Phoenix Contact GmbH & Co. KG.
- Modbus® is a registered trademark of Schneider Electric USA, Inc.
- CC-Link® is trademark of Mitsubishi Electric Corporation.
- EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- PROFIBUS® and PROFINET® is registered trademark of PROFIBUS Nutzerorganisation e.V. (PNO).
- DeviceNet® is the trademark of ODVA, Inc.

C.1 Contents

1

Chapter 1 Safety Instructions/Risks

This chapter includes instructions for installation, wiring, operation, maintenance, inspection and use of the inverter.
Be sure to read this User's Guide and other guides thoroughly before installing, wiring, operating, maintaining, inspecting or using the inverter.

1.1 Warning Indications and Symbols

1.1.1 Details of Warning Indications

- In the User's Guide, the severity levels of safety precautions and residual risks are classified as follows: "DANGER", "WARNING" and "CAUTION".

DANGER	Indicates that incorrect handling may cause hazardous situations, which have a high chance of resulting in serious personal injury or death and may result in major physical loss or damage.
WARNING	Indicates that incorrect handling may cause hazardous situations, which may result in serious personal injury or death, and may result in major physical loss or damage.
CAUTION	Indicates that incorrect handling may cause hazardous situations, which may result in serious personal injury or death, and may result in major physical loss or damage.

- Furthermore, "CAUTION" level description may lead to a serious risk depend on the circumstances. Be sure to follow the instruction because whichever contains important safety description.
- There are the text includes notes using a only safety symbol "". These also contains important safety instructions, so be sure to follow the instructions.

1.1.2 Description of Symbols

- This document contains annotations with graphic symbols. Be sure to pay close attention to the contents and be sure to follow them.

	Indicates a danger, warning or caution notice for fire, electric shock and high temperature in the operation of the product. Details are indicated in or near by pictures or words.	
		The drawing on the left indicates "a non-specific and general danger or caution".
		The drawing on the left indicates "a possible damage due to electric shock".
	Indicates "what you must not do" to prohibit the described acts in the operation of the product.	
	Indicates "what you must do" according to the instructions in the operation of the product.	

1.2 Cautions

1.2.1 Caution!

DANGER

CAUTION	• Incorrect handling may result in personal death or severe injury, or may result in damage to the inverter, motor or the whole system.
DO	• Be sure to read the Guide and appended documents thoroughly before installing, wiring, operating, maintaining, inspecting or using the inverter.

CAUTION	• Notes for possible causes of danger or damage are also provided for each explanation in other sections
DO	• Be sure to read the corresponding explanation thoroughly before installing, wiring, operating, maintaining, inspecting or using the inverter.

CAUTION	• Many of the drawings in the Guide show the inverter with covers and/or parts blocking your view removed to illustrate the details of the product.
DO	• Do not operate the inverter in the status shown in those drawings. If you have removed the covers and/or parts, be sure to reinstall them in their original positions before starting operation and follow all instructions in this guide when operating the inverter.

1.2.2 Precautions for Installation

⚠ WARNING

Fire	● **Risk of Fire!**
Prohibited	• Do not place flammable materials near the installed inverter. • Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter.
DO	• Install the inverter on a non-flammable surface, e.g., metal. • Install the inverter in a well-ventilated indoor site not exposed to direct sunlight. Avoid places where the inverter is exposed to high temperature, high humidity, condensation, dust, explosive gases, corrosive gases, flammable gases, grinding fluid mist, hydrogen sulfide or salt water.

Injury	● **Risk of injury!**
Prohibited	• Do not install and operate the inverter if it is damaged or parts are missing.

Fall Injury	● **Risk of injury due to the inverter falling!**
Prohibited	• When carrying the inverter, do not hold its cover parts.
DO	• Install the inverter on a structure able to bear the weight specified in the User's Guide. • Install the inverter on a vertical wall that is free of vibrations.

Failure	● **Risk of failure of the inverter!**
Prohibited	• The inverter is a precision equipment. Do not allow it to fall or be subject to high impacts. • Also do not step on it, or place a heavy load on it. • Avoid places where static electricity discharges often occur (for example, on a rug) for the operation of the product.
DO	• In order to discharge static electricity from your body, touch a safe metal surface first before starting the operation.

1.2.3 Precautions for Wiring

⚠ DANGER

⚠ Electric shock Fire	● **Risk of an electric shock and fire!**
DO	• Be sure to ground the inverter. • Entrust wiring work to a qualified electrician. • Before the wiring work make sure to turn off the power supply and wait for more than 10 minutes. (Confirm than the charge lamp is OFF and the voltage between terminals [P/+] and [N/-] (Single-phase model: terminals [+] and [-]) is 45 VDC or less.)

⚠ Failure	● **Risk of failure of the inverter!**
Prohibited	• Do not pull the wire after wiring.

⚠ Electric shock Injury	● **Risk of an electric shock and injury!**
DO	• Perform the wiring only after installing the inverter.

WARNING

Injury Fire	**Risk of injury and fire!**
Prohibited	• Do not connect AC power supply to any of the inverter output terminals ([U/T1], [V/T2], and [W/T3]).
DO	• Make sure that the voltage and frequency of AC power supply match the rated voltage (AC input voltage) and frequency of your inverter.

Electric shock Injury	**Risk of electric shock and injury!**
DO	• Before operating the slide switch in the inverter, be sure to turn off the power supply. • Since the inverter supports two modes of cooling-fan operation, the inverter power is not always off, even when the cooling fan is stopped. Before operating the switch, be sure to turn off the power supply and wait for more than 10 minutes. (Confirm that the Charge lamp on the inverter is off and the DC voltage between terminals [P/+] and [N/-] (Single-phase model: terminals [+] and [-]) is 45 V or less.) • Prevent the distribution cable from being compressed or getting caught to avoid damage to the cable.

Fire	**Risk of fire!**
Prohibited	• Do not input a single-phase power supply to the three-phase model. • Do not connect a resistor directly to any of the DC terminals ([PD/+1], [P/+], [N/-] or [+1], [+], [-]). • Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
DO	• Tighten the screws and bolts with the specified torque. • No screws and bolts must be left loose. • Connect an earth-leakage breaker to the power input circuit. • Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings).

Burnout	**Risk of damage to the inverter and burnout of the motor!**
Prohibited	• Do not operate the inverter when an output phase is lost (output phase loss).

1.2.4 Precautions for Running and Test Running

DANGER

Electric shock Fire	● **Risk of electric shock and fire!**
Prohibited	• While power is supplied to the inverter, do not touch any internal part or the terminal of the inverter. Also do not check signals, or connect/disconnect any wire or connector. • While power is supplied to the inverter, do not touch any internal part of the inverter. Also do not insert a bar in it.

Electric shock	● **Risk of electric shock!**
Prohibited	• Be sure to close the terminal block cover before turning on the inverter power. Do not open the terminal block cover while power is being supplied to the inverter or voltage remains inside. Do not touch the internal PCB, terminal block or connector while power is being supplied to the inverter or voltage remains inside. • Do not operate switches in the inverter or on the board with wet hands.

Injury Fire	● **Risk of injury and fire!**
Prohibited	• While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped.

Injury Damage	● **Risk of injury and damage to machine!**
Prohibited	• Do not select the retry mode for controlling an elevating or traveling device because free-running status occurs in retry mode. • If you use the EzSQ program, before operating the inverter, verify that secure operation of the program is ensured.

Injury	● Risk of injury!
Prohibited	• If the retry mode has been selected, the inverter will restart automatically after a break upon detection of an error. Stay away from the machine controlled by the inverter when the inverter is under such circumstances. (Design the machine so that human safety can be ensured, even when the inverter restarts suddenly.)
DO	• The STOP/RESET key on the keypad can be enabled/disabled using the "STOP-key enable [AA-13]". Prepare an emergency stop switch separately. • If a RUN command has been input to the inverter before a short-term power failure, the inverter may restart operation after the power recovery. If such a restart may put persons in danger, design a system configuration that disables the inverter from restarting after power recovery. • When an error (alarm) occurs, before moving to the next operation (resetting the alarm status or reapplying the power), make sure that no RUN command has been input. If the inverter has received a RUN command, it restarts automatically. • When an unexpected event occurs, do not touch the inverter or cable. • Thoroughly understand and check the functions set in the inverter, and use it only after confirming safety. Be careful that RUN command or resetting operation do not cause an unexpected restart.

WARNING

Injury Damage	● Risk of injury and damage to machine!
DO	• The inverter allows you to easily control the speed of the motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. • When using the inverter to operate a motor at a high frequency, check the allowable motor speeds with the manufacturers of the motor and the machine to be driven and obtain their consent before starting inverter operation. • During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations.

Burn injury	● Risk of burn injury!
Prohibited	• Do not touch the heat sink, which heats up during the inverter operation.

Injury Damage	● Risk of injury and damage to machine!
DO	• Install an external brake system if needed.

1.2.5 Precautions for Maintenance/Daily Inspection

DANGER

Electric shock	● **Risk of electric shock!**
Prohibited	• Do not perform maintenance, inspection, and the replacement of parts other than designated person. (Be sure to remove wristwatches and metal accessories, e.g., bracelets, before maintenance and inspection work and to use insulated tools for the work.)
DO	• Before inspecting the inverter, be sure to turn off the power supply and more than 10 minutes. (Confirm that the Charge lamp on the inverter is off and the DC voltage between terminals [P/+] and [N/-] (Single phase model: terminals [+] and [-]) is 45 V or less.)

1.2.6 Precautions for Disposal

DANGER

Injury Explosion	● **Risk of injury and explosion!**
DO	• For disposal of the inverter, outsource to a qualified industrial waste disposal contractor. Disposing of the inverter on your own may result in an explosion of the capacitor or produce poisonous gas. • Contact your supplier or local Hitachi sales office for fixing the inverter.
DO	• A qualified industrial waste disposal contractor includes industrial waste collector/transporter and industrial waste disposal operator. • Follow the laws and regulations of each country for disposing of the inverter.

1.2.7 Other Cautions

⚠ DANGER

Electric shock Fire Injury	● **Risk of electric shock, fire and injury!**
Prohibited	• Never modify the inverter.

⚠ CAUTION

Life cycle	● **Risk of significantly shortening the life cycle of a product!**
DO	• If wood materials for packaging are needed to be sterilized and disinfected, make sure to use a means other than the wood fumigation method. If the product is included in the fumigation treatment, electronic parts could receive critical damage from the emitted gases or vapors. Especially, halogen disinfectants (including fluorine, chlorine, bromine and iodine) can cause corrosion in the capacitor.

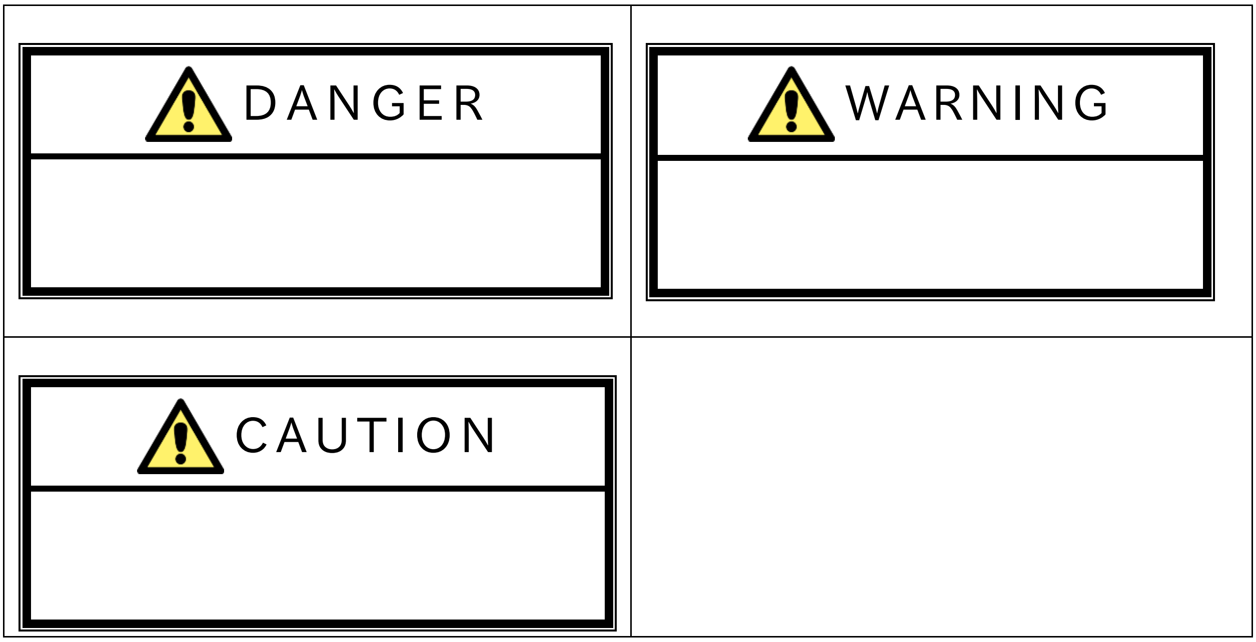
* For risks other than the above, also refer to "Chapter 6 Operation Check/Residual Risk".

1.2.8 Examples of Caution Labels

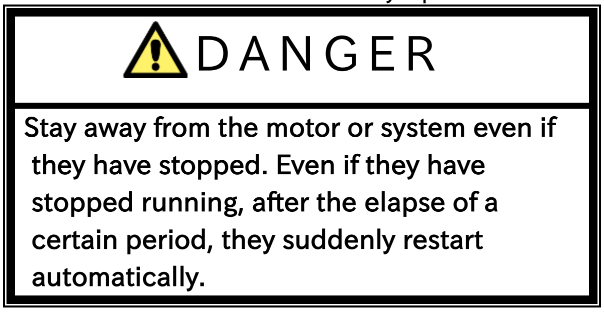
- The following describes label formats to prevent errors from occurring in the motor, inverter and system.
- If external operation, program operation or retry function has been set, the operation may start automatically after the power is on. Use these labels referring to the examples on the right as a reminder for caution.

(Examples of labels)

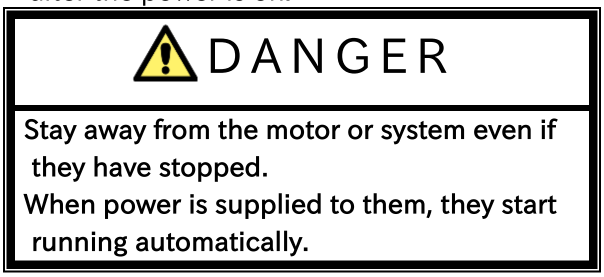
- Write instructions on these labels as a reminder.



- Reminder for caution for retry operation after an error.



- Reminder for caution for remote operation in communication and terminal contact operation after the power is on.



1.3 Compliance to European Directive (CE)

1.3.1 Caution for EMC (Electromagnetic Compatibility)

- The WJ-C1 inverter complies with Electromagnetic Compatibility (EMC) Directive (2014/30/EU). When using the inverter in Europe, you must comply with the following specifications and requirements to meet the EMC Directive and other standards in Europe.

WARNING

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

1. Power supply requirements:
   - Voltage fluctuation must be -15 % to +10 % or less.
   - Voltage imbalance must be ±3 % or less.
   - Frequency variation must be ±4 % or less.
   - Total harmonic distortion (THD) of voltage must be ±10 % or less.

2. Installation requirements:
   - WJ-C1 complies with the EMC Directive by installing an EMC filter. Applicable EMC filter depends on the series and capacity of the inverter. Be sure to use an EMC filter compatible with the inverter model by referring "Applicable EMC Filter" on the next page.

3. Wiring requirements:
   - Use a shielded wire (screened cable) with a length of 25 m or less for motor wiring.
   - If the length of the motor wire exceeds 25 m, use an output AC reactor to reduce the leakage current.
   - The carrier frequency should be 10 kHz or lower, which satisfies the EMC requirement.
   - The main circuit wiring must be separated from the control circuit wiring.

4. Environmental requirements (to be met when a filter is used):
   - Ambient temperature: -10 to 50 ˚C (at ND rating), -10 to 40 ˚C (at LD rating)
     (current derating required)
   - Humidity: 20 to 90 %RH (non-condensing)
   - Vibration: 10 to 57 Hz: amplitude 0.075 mm
     57 to 150 Hz: 9.8 m/s^2 (1.0 G)
   - Install location: altitude 1000 m or less (free from corrosive gases and dust)

■ Applicable EMC Filter

Power Supply	Model	EMC filter	EMC class		Carrier Frequency	Cable Length
			In metal cabinet	Not in metal cabinet		
1 ϕ 200 V	C1-001S	FPF-9120-10-SW [*1]	C1	C2	10 (kHz)	25 (m) (Shielded)
	C1-002S					
	C1-004S					
	C1-007S	FPF-9120-14-SW [*1]				
	C1-015S	FPF-9120-24-SW [*1]				
	C1-022S					
3 ϕ 200 V	C1-001L	NF-CEH7	-	C3		
	C1-002L					
	C1-004L					
	C1-007L					
	C1-015L	NF-CEH10				
	C1-022L	NF-CEH20				
	C1-037L					
	C1-055L	NF-CEH30				
	C1-075L	NF-CEH40				
	C1-110L	NF-CEH60				
	C1-150L	NF-CEH80				
3 ϕ 400 V	C1-004H	FPF-9340-05-SW [*1]	C1	C2		
	C1-007H					
	C1-015H	FPF-9340-10-SW [*1]				
	C1-022H					
	C1-030H					
	C1-040H	FPF-9340-14-SW [*1]				
	C1-055H	FPF-9340-30-SW [*1]				
	C1-075H					
	C1-110H	FPF-9340-50-SW [*1]				
	C1-150H					

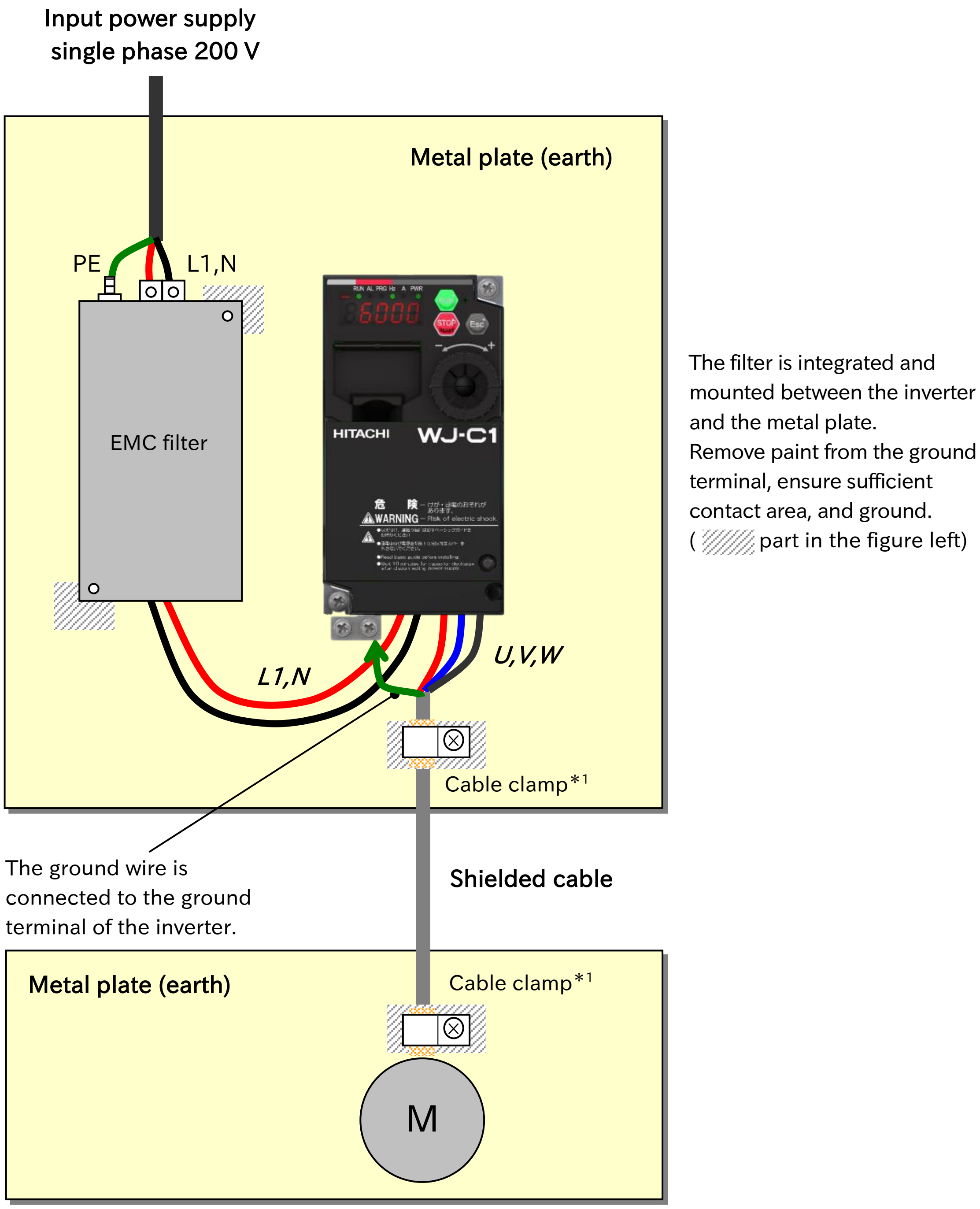
*1. Made by TDK Corporation

Cautions for Installation/Wiring

1. Input AC reactor or other equipment is required if necessary to comply with EMC directive from the harmonic distortion point of view (IEC 61000-3-2: 2018, IEC61000-3-4: 1998).
2. If the motor cable length exceeds 20 m, use output AC reactor 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. When installing, try to ensure that the HF (high frequency) impedance between 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. As user, you 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 be 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.
6. Take measures to minimize interference that is frequently coupled in through installation cables.
   - Separate interfering cables with 0.25 m 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°.
7. 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. 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 mm^2 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.)

Installation method (Example of single-phase 200V class model)

- The installation method is the same for the three-phase 200 V class model and the three-phase 400 V class model.



*1. The ground at both ends of the shielded cable must be connected to ground with a cable clamp. From the viewpoint of harmonic current, the CE-mark (IEC 61000-3-2: 2018, IEC61000-3-4: 1998) requires an input AC reactor (ALI) or facility to suppress harmonic current. The conducted noise and radiated noise pass even if the input AC reactor (ALI) is removed.

1.3.2 Caution for Machinery Directive (Functional Safety)

CAUTION

- **When using STO (Safe Torque Off) function, please be sure to read the "Safety function Guide for Extended Mode" of separate!**
  - WJ-C1 conforms to STO (Safe Torque Off) defined in Functional Safety EN 61800-5-2. When using the STO function, refer to "Safety Function Guide for Extended mode (NT3632*X)". Please contact your supplier or local Hitachi inverter sales office for the guide.

1.3.3 Note of European Directive (CE)

- This product complies with the requirements of IEC 60364-4-41:2005/AMD1: 2017: Clause 411 "Protective measure: automatic disconnection of supply", since it complies with the requirements of IEC 61800-5-1:2007+AMD1:2016:Clause 4.3.9.
- In order to comply with above mentioned requirements, installation must be in line with the conditions in "1.3 Compliance to European Directive (CE)" and "1.4 UL Compliance to UL standards".
- Regarding IEC 61800-5-1:Clause 5.2.3.6.3.3 "Short-circuit between phase terminals of power output and protective earth", circuitry in compliance test is as described as "Figure 13 – Example of short-circuit test between CDM/BDM d.c. link power output and protective earth" and "Class J 30A Non time delay fuse" is used as "OCPD" in "Fault loop".

1.4 Compliance to UL standards

1.4.1 UL Cautions

- This section summarizes the items required for UL standard compliant inverter installation.

GENERAL:
WJ series C1 inverter is open type AC Inverter with three/single phase input and three phase output. It is intended to be used in an enclosure. It is used to provide both an adjustable voltage and adjustable frequency to the AC motor. The inverter automatically maintains the required volts-Hz ratio allowing the capability through the motor speed range. It is multi-rated device, and the ratings are selectable according to load types by operator with keypad operation.

Markings:
Maximum Surrounding Temperature:
- ND (Normal Duty) : 50 deg C
- LD (Light Duty) : 40 deg C

Storage Environment rating:
- -20 to 65 deg C (for transportation)

Instruction for installation:
- Pollution degree 2 environment and Overvoltage category 3

Electrical Connections:
- See section "5.2 Main Circuit Terminal"

Interconnection and wiring diagrams:
- See section "5.4 Control Circuit Terminal"

Short circuit rating and overcurrent protection device rating:
- C1-S series, C1-001S to C1-022S models.
  - [Non-semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240 V maximum.
  - [Semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 240 V maximum.
- C1-L series, C1-001L to C1-037L models.
  - [Non-semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240 V maximum.
- C1-L series, C1-055L and C1-075L models.
  - [Non-semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240 V maximum.
- C1-L series, C1-110L and C1-150L models.
  - [Non-semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240 V maximum.
- C1-L series, C1-001L to C1-150L models.
  - [Semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 240 V maximum.
- C1-H series, C1-004H to C1-075H models.
  - [Non-semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 480 V maximum.
- C1-H series, C1-110H and C1-150H models.

  - [Non-semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 480 V maximum.
- C1-H series, C1-004H and C1-150H models.
  - [Semiconductor Fuses]
    Suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 480 V maximum.

Integral:
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

Integral:
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, Part 1. (For Canada)

■ **Field wiring conductor size and torque values making for wiring terminal**

Model	Screw Size	Required Torque (N·m)	Wire Range (AWG/mm^2)
C1-001S	M3.5	1.0	AWG16 (1.3mm^2)
C1-002S	M3.5	1.0	AWG16 (1.3mm^2)
C1-004S	M3.5	1.0	AWG16 (1.3mm^2)
C1-007S	M4	1.4	AWG12 (3.3mm^2)
C1-015S	M4	1.4	AWG10 (5.3mm^2)
C1-022S	M4	1.4	AWG10 (5.3mm^2)
C1-001L	M3.5	1.0	AWG16 (1.3mm^2)
C1-002L	M3.5	1.0	AWG16 (1.3mm^2)
C1-004L	M3.5	1.0	AWG16 (1.3mm^2)
C1-007L	M3.5	1.0	AWG16 (1.3mm^2)
C1-015L	M4	1.4	AWG14 (2.1mm^2)
C1-022L	M4	1.4	AWG12 (3.3mm^2)
C1-037L	M4	1.4	AWG10 (5.3mm^2)
C1-055L	M5	3.0	AWG6 (13mm^2)
C1-075L	M5	3.0	AWG6 (13mm^2)
C1-110L	M6	3.9 to 5.1	AWG4 (21mm^2)
C1-150L	M8	5.9 to 8.8	AWG2 (34mm^2)
C1-004H	M4	1.4	AWG16 (1.3mm^2)
C1-007H	M4	1.4	AWG16 (1.3mm^2)
C1-015H	M4	1.4	AWG16 (1.3mm^2)
C1-022H	M4	1.4	AWG14 (2.1mm^2)
C1-030H	M4	1.4	AWG14 (2.1mm^2)
C1-040H	M4	1.4	AWG12 (3.3mm^2)
C1-055H	M5	3.0	AWG10 (5.3mm^2)
C1-075H	M5	3.0	AWG10 (5.3mm^2)
C1-110H	M6	3.9 to 5.1	AWG6 (13mm^2)
C1-150H	M6	3.9 to 5.1	AWG6 (13mm^2)

Temperature rating of field wiring installed conductor:

・For models C1-001S, C1-002S, C1-004S, C1-007S, C1-015S, C1-001L, C1-004L, C1-007L, C1-015L, C1-004H, C1-007H, C1-015H, C1-022H, C1-030H and C1-040H - 60 degree C only.

・Except above models - 75 degree C only.

Field wiring terminal marking for wire type:

・Use copper conductors only.

■Required protection by Fuse

Model	Non-Semiconductor Fuse			Semiconductor Fuse
	Type	Maximum Rating		Manufacturer: Cooper Bussmann LLC
		Voltage	Current	
C1-001S	Class J, Class CC, Class G, Class T	600 V	3 A	FWH-10A14F
C1-002S			6 A	FWH-15A14F
C1-004S			10 A	FWH-15A14F
C1-007S			20 A	FWH-60B
C1-015S			30 A	FWH-60B
C1-022S			30 A	FWH-60B
C1-001L		600 V	3 A	FWH-10A14F
C1-002L			6 A	FWH-15A14F
C1-004L			10 A	FWH-15A14F
C1-007L			15 A	FWH-25A14F
C1-015L			15 A	FWH-25A14F
C1-022L			20 A	FWH-60B
C1-037L			30 A	FWH-60B
C1-055L			60 A	FWH-150B
C1-075L			60 A	FWH-150B
C1-110L			80 A	FWH-200B
C1-150L			80 A	FWH-200B
C1-004H		600 V	6 A	FWH-15A14F
C1-007H			10 A	FWH-25A14F
C1-015H			10 A	FWH-25A14F
C1-022H			10 A	FWH-25A14F
C1-030H			15 A	FWH-25A14F
C1-040H			15 A	FWH-25A14F
C1-055H			30 A	FWH-60B
C1-075H			30 A	FWH-60B
C1-110H			50 A	FWH-150B
C1-150H			50 A	FWH-150B

2

Chapter 2 Outline of This User's Guide/Procedure for Operation

This chapter describes the applicable products, the knowledge required to read this Guide, the target readers of this Guide, the purpose of this Guide, the structure of the chapters in this Guide, and an outline of the procedure (flowchart) for operating the inverter.

2.1 What Is Written in this User's Guide

2.1.1 Before Reading This Guide

A

- The contents of this Guide apply to WJ-C1 main unit. Refer to the corresponding guide or instruction manuals for other products and optional parts.

- This Guide is meant to be read by those who have knowledge of electricity (certified electrician or equivalent) and those who are in charge of introduction, installation or connection of control equipment, system design and workplace management. This Guide is written in SI units.

- This inverter can use the second control function to switch some parameters used for motor control from the 1st control parameter [**1**] (e.g. [AA101]) to the 2nd control parameter [**2**] (e.g. [AA201]) by turning on the "2nd-motor control [SET]" input terminal.
  In this user's guide, the descriptions of various functions basically refer to parameters [**-**] (e.g. [Ab-01]) that are not subject to the second control function and the 1st control parameter [**1**], but when the second control function is enabled, the first control parameter [**1**] is read as the second control parameter [**2**].
  For details on the second control function and the applicable parameters, refer to "9.7.13 Switching to 2nd Motor Control Mode".

- This Guide is intended to provide the following necessary information:
  (a) Installation and wiring of the product.
  (b) Parameter settings.
  (c) Conducting test run and operation.
  (d) Maintenance and inspection.

2.1.2 Overview of Each Chapter

- This guide consists of the following chapters:
  Refer also to the chapter to be referred to the various part of the inverter appearance drawing on the next page.

Chapter		Description
Chapter 1	Safety Instructions/Risks	Describes safety precautions for installation, wiring, operation, maintenance, and inspection.
Chapter 2	Outline of This User's Guide/ Procedure for Operation	Describes the people who will read this Guide and the purpose of this Guide. Also describes the overall flow from installation to test run, the flow chart for driving the motor, and related reference points.
Chapter 3	Main Body of the Product	Describes the contents of the inspection at the time of purchase, the package, the product model, the contents of the specification label, and the appearance of the product.
Chapter 4	Installation	Describes the installation of the inverter, installation environment and precautions for installation.
Chapter 5	Wire Connection	Describes the wiring of the inverter and input power supply, the motor and applicable peripheral equipment, and the wiring of the I/O signals for control.
Chapter 6	Operation Check/Residual Risk	Describes the residual risk checklist for inverter operation.
Chapter 7	Keypad and Related Functions	Describes how to operate the main unit keypad and related functions.
Chapter 8	Mandatory Setting for Motor Drive and Test Run	Describes the settings required to drive the motor and test run.
Chapter 9	Inverter Functions	Describes the functions available with the inverter.
Chapter 10	Monitor Functions	Describes various data that can be monitored by keypad, remote operator, etc.
Chapter 11	RS485 Communication	Describes the communication function using Modbus-RTU(RS485) communication. For the coil/register number used by communication function, refer to "Chapter 18 List of Parameters/ Modbus Coil/Register Numbers".
Chapter 12	ProDriveNext/EzSQ	Describes the outline what can be done by connecting WJ-C1 to a computer.
Chapter 13	Communication Option	Describes applicable communication option.
Chapter 14	Safety Function STO	Describes an overview of using the safety function STO.
Chapter 15	Tips/FAQ/Troubleshooting	Describes the inverter error status, warning status, and troubleshooting.
Chapter 16	Maintenance and Inspection	Describes how to perform maintenance and inspection.
Chapter 17	Specifications/Dimensions/ Derating	Describes the specifications and dimensions of this product and current derating characteristics.
Chapter 18	List of Parameters/Modbus Coil and Register Numbers	Describes the monitor and parameter list. Coil/register numbers for Modbus communication are also described in this chapter.
Appendix	Additional technical information, Glossary, etc.	The following contents are described. "Replacement from WJ200" "Glossary", "Revision History", etc.

What this Guide explains.

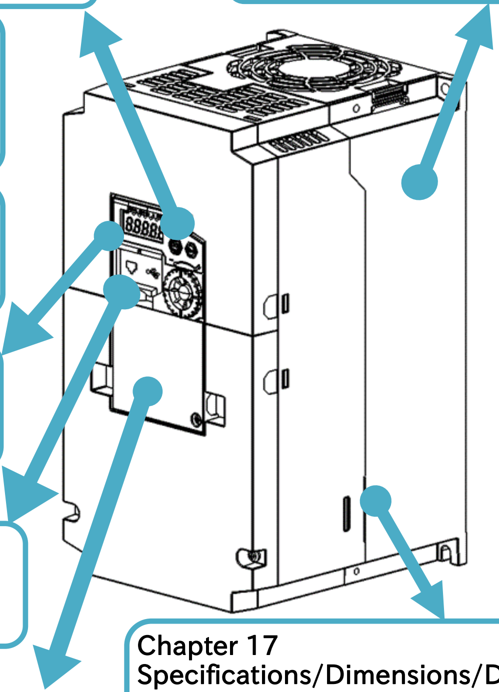
Chapter 2 Outline of This User's Guide/ Procedure for Operation (this chapter)
- Provides an overview of required procedures and the chapters to be referred before test run in flowchart form.

Chapter 3 Main Body of the Product
- Describes the package, specification label, appearance, and name of each part of the product.

Chapter 7 Keypad and Related Functions
- Explains how to operate the inverter.

Chapter 4 Installation
- Describes the installation of the product.

Chapter 8 Mandatory Setting for Motor Drive and Test Run
- Describes the settings required to drive the motor and test run.



Chapter 9 Inverter Functions
- Describes the functions that can be performed with the inverter.

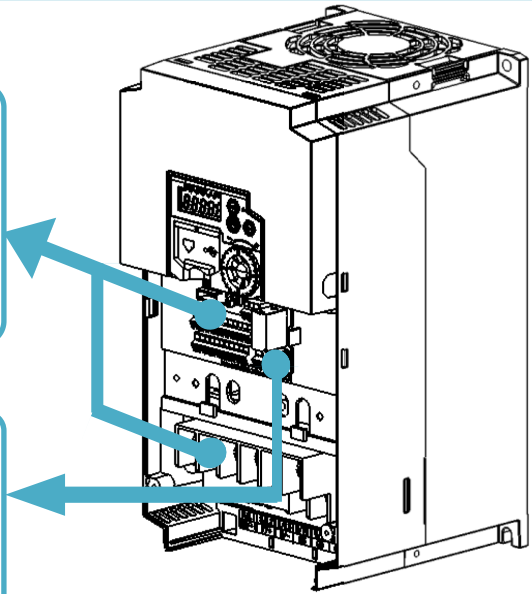
Chapter 10 Monitor Functions
- Describes various data that can be monitored by the inverter.

Chapter 12 ProDriveNext/EzSQ
- Provides an overview of what can be done by connecting to a computer.

Chapter 17 Specifications/Dimensions/Derating
- Describes the inverter specifications, external dimensions and current derating

Chapter 13 Communication Option
- Describes the supported option boards.

Chapter 5 Wire Connection
- Describes the wirings of the power line, motor line and optional device such as reactor and braking resistor to the main circuit terminal block.
- Also describes the wiring of the I/O contacts, relay output, analog I/O and so on to the control circuit terminal block.



Chapter 11 RS485 Communication
Chapter 14 Safety Function STO
- Describes detailed information when Modbus communication and safety function STO are used.
- For the wiring, also refer to "5.4 Control Circuit Terminal".

Chapter 6 Operation Check/Residual Risk
- Describes residual risks during operation and the items to be checked.

Chapter 15 Tips/FAQ/Troubleshooting
- Describes the countermeasures for trip and warning occurrence.

Chapter 16 Maintenance and Inspection
- Describes maintenance and inspection, such as daily inspection.

2.2 Procedure for Operation (Flowchart)

2.2.1 When Installing a New Inverter

- The flowchart below shows an outline of the procedures of installing, wiring, test run and various settings in case installing a new WJ-C1 (when it is not replaced with the old model WJ200).
The overview of each item in the flowchart and the main sections that describe the details are shown in the right column.

	For new installation	Overview of the checks and main reference section
1	Confirmation of safety	Check the precautions necessary for handling the inverter. "Chapter 1 Safety Instructions/Risks"
2	Checking the inverter	Check that there are no problems with the model, enclosed items, appearance, etc. of the inverter you purchased. "3.1 Confirmation at the Time of Purchase"
3	Installation of inverter	Check the status and environment of the inverter installation. "Chapter 4 Installation"
4	Wiring and checking the main circuit terminals	Wire the power supply, motor, applicable peripheral device (work only when necessary), etc. to the main circuit terminal of the inverter and check if the wiring to the inverter is correct. "5.2 Main Circuit Terminal" "5.3 Applicable Peripheral Device"
5	Wiring and checking the control circuit terminals	Wire I/O signals and analog I/O signals to the control terminal of the inverter and check if the wiring to the inverter is correct. "5.4 Control Circuit Terminal" "9.15 Functions with External Signal Input" "9.16 Functions with External Signal Output"
6	Checking how to use keypad	Check how to use keypad, and then change the parameter settings or monitor in the following steps. "7.1 How to Use Keypad"
7	Setting mandatory parameters for operating the motor and inverter	Set the load rating of the inverter according to the load. Set the basic data of the motor and protection settings such as electronic thermal, etc. according to the motor specifications to be driven. "8.1 Mandatory Setting for Operation"
8	Selecting control mode	Set the control mode according to the characteristics of the load machine. "9.5 Selecting Suitable Control Mode for the Motor and Load"

To next page

From previous page

9	Test run without load	To check if there is a basic problem with the inverter or motor, connect only the motor and rotate it with no load to check if it rotates properly. "8.2.2 Test Run by Connecting Only Motor"
10	Check if auto-tuning is required.	It is necessary to perform auto-tuning when using automatic torque boost, sensorless vector control, or when using a motor whose motor constant is unknown. "8.3 Carrying Out Motor Auto-tuning"
11	Test run with actual load	Perform a test run to confirm that there is no problem with the operation by connecting the mechanical system. "8.2.3 Perform a Test Run with a Machine Load"
12	Selecting RUN command source (a) Running with keypad's RUN-key (b) Running with Forward/Reverse signal input (c) Running with momentary switch (d) Select other RUN commands	Set RUN command source of the inverter. Refer to the following sections respectively: (a) "9.1.2 Operation by RUN Key on the Keypad" (b) "9.1.3 Operation by Forward/Reverse Input Terminals" (c) "9.1.4 Operation by Momentary Switch" (d) For other RUN commands and related functions, refer to "9.1.1 Types of RUN command Source" and refer to the section in which the run command method suitable for the purpose is described.
13	Selecting the frequency reference source (a) Set the frequency with keypad (b) Set the frequency with analog voltage input by connecting a variable resistor (c) Set the frequency with analog current input (d) Switch the frequency in multi-speed by combinations of signal input ON/OFF (e) Select other frequency reference	Set the frequency reference source of the inverter. Refer to the following sections respectively: (a) "9.2.2 Setting Frequency Reference by Keypad" (b),(c) "9.2.3 Setting Frequency Reference by Analog Input (Voltage/Current)" (d) "9.2.4 Setting Frequency Reference by Multi-Speed Operation Function" (e) For other frequency references and related functions, refer to "9.2.1 Types of Frequency Reference Source" and refer to the section in which the frequency reference method suitable for the purpose is described.
14	Setting various parameters for operation	Set various parameters related to the required functions by referring to "Chapter 9 Inverter Functions".

Tips for setting parameter

- If the parameter you want to set is not displayed or the parameter cannot be changed, refer to "7.2 Keypad Related Functions" to check if any restrictions have been applied.
- If the inverter does not operate as intended after setting several parameters, refer to "15.4 How to Check When Something Is Wrong" to deal with it.
- If possible, consider initializing the parameters. In this case, see "7.2.2 Initialize Parameters". (However, it is recommended to back up parameters and EzSQ programs with inverter configuration software "ProDriveNext", etc. prior to parameter initialization.)

2.2.2 When Replacing WJ200 (Previous Model) with WJ-C1

- Even when replacing WJ200 (old model) with a WJ-C1, the basic steps up to operation are the same as when installing a new one.
- The following is an overview of the procedures for replacing the inverter, assuming that the input/output signals of the control circuit terminals and other functions are the same as before. (After replacement, be sure to check operation by test run.)

	Replacing WJ200 with WJ-C1	Overview of the checks and main reference sections
1	Confirmation of safety	Check the precautions necessary for handling the inverter. "Chapter 1 Safety Instructions/Risks"
2	Checking the inverter	Check that there are no problems with the model, enclosed items, appearance, etc. of the inverter you purchased. "3.1 Confirmation at the Time of Purchase"
3	Checking the installation environment, external dimensions and installing the inverter	Check the user's guide, instruction manual, etc. of each device to be replaced, and confirm the differences in installation dimensions, external dimensions, installation environment, etc., and install the product correctly. "Chapter 4 Installation" "Appendix A.1.1 Comparison of External Dimensions and Mounting Dimensions"
4	• Checking and replacing main circuit wiring • Checking and replacing control circuit wiring	Wire the main circuit terminal block wirings and control terminal wirings removed from WJ200 (old model) to the main circuit terminal block and control terminal on WJ-C1. At this time, be careful not to mistake the connection place. Since wiring positions will change, check the contents of the following sections thoroughly before wiring. "Chapter 5 Wire Connection" "Appendix A.1.2 Comparison of Main Circuit Terminal" "Appendix A.1.3 Comparison of Control Circuit Terminal"
5	Checking how to use keypad	Check how to use keypad of WJ-C1, and then change the parameter settings or monitor in the following steps. "7.1 How to Use Keypad"
6	Checking the setting parameters from WJ200 to WJ-C1 and copying the data	• WJ-C1 from Ver. 2.00 or later is factory-set to Extended Mode, which differs from WJ200 in its operation system. When replacing the WJ-C1, refer to the following section to change the operation system to the basic mode, enter parameters, and then shift to the extended mode. "8.1.6 Changing Inverter Operation Mode" • When using the basic mode (same operation system as WJ200), refer to "WJ Series C1 User's Guide (NT361*X)".
7	Performing test run, various adjustments, parameter settings for functions to be used, etc.	Follow the procedure from step No. 7 in "2.2.1 When Installing a New Inverter" to make basic settings for the motor, test run with no load, test run with actual load, and set various parameters.

To No. 7 in "2.2.1 When Installing a New Inverter"

(Memo)

3

Chapter 3 Main Body of the Product

This chapter describes the main body of the product. The inspection at the time of purchase, the items included in the product, the explanation of the product model name, the details of the specification label, the appearance of the product and the names of each part are described.

3.1 Confirmation at the Time of Purchase

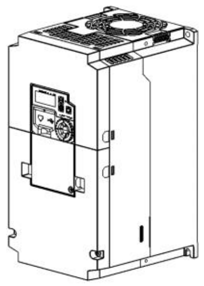
3.1.1 Checking the Product and the Included Items

Q

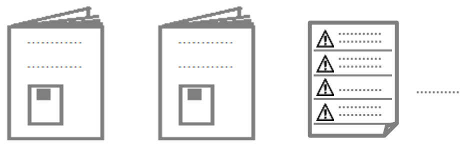
- What should be checked after purchase?
- What's included with the product?

A

- The following items are included in the package.
- If you find any faults or defects in the product or have any question about the product, please contact your supplier or local Hitachi inverter sales office.



WJ-C1 Inverter: 1 unit



- 1 × WJ-C1 Basic Guide for Extended Mode
- 1 × WJ-C1 Safety Function Guide Caution
- 1 × Caution reminder stickers (multilingual)

(Others, which are a correction error table/supplementary instruction manual, etc., may be included.)

Confirmations at unpacking
✓ When unpacking, check that the package contains ·1 inverter main unit, ·1 Basic Guide, and other included items.
✓ Check the specification label again to confirm that the product is the one you have ordered.
✓ Check the product for damage (including falling of parts and dents in the inverter body) caused during transportation.

Caution	Applying a different inverter voltage class or motor rated voltage from the specified input power voltage may lead to damage to your inverter or motor burnout.
Do	Check with the specification label to be sure that the inverter voltage class is correct.

!

- The User's Guide (this document) is not included in the product. To get the latest version of the WJ-C1 User's Guide, please contact the supplier where this device was purchased.
- When you use the inverter with optional products, you should also read the instruction manuals enclosed with those products.
- Note that the Basic Guide and the instruction manuals for each optional product to be used should be delivered to the end user of the inverter. For the User's Guide and instruction manual, contact your supplier or local Hitachi inverter sales office.

3.1.2 Model of the Product and Specification Label

Q

- How to read a model number.
- What's written on the specification label?

A

- The model of the product is as follows. Check that the model is same as you ordered.

	Type name						Version No.
e.g. 1: Single-phase 200 V class 0.4 kW (for Japan)	C1	-	004	S	F		2
e.g. 2: Three-phase 200 V class 7.5 kW (for North America)	C1	-	075	L	F	U	2
e.g. 3: Three-phase 400 V class, 15 kW (for Europe)	C1	-	150	H	F	E	2

Applicable motor output
001: 0.1 kW to 150: 15 kW

Input power specifications
S: Single-phase 200 V, L: Three-phase 200 V
H: Three-phase 400 V

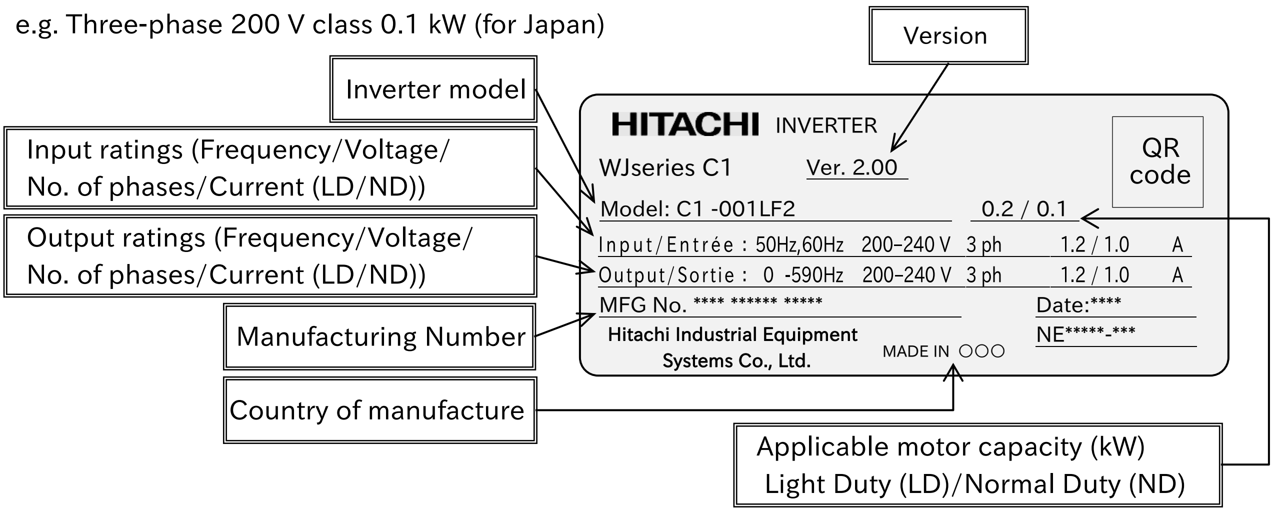
F: With operator keypad

Region:
None: Japan, E: Europe, U: North America, C: China

A

- The model of the product is indicated on the specification label on the side of the product body. The details on the specification label are as follows.

e.g. Three-phase 200 V class 0.1 kW (for Japan)



!

- In this Guide, some indications may be omitted from the model name. In that case, the omitted indications are not concerned with the description.
- The input and output currents on the specification label are UL certified current values.
- The " *** " part of the label above shows the product-specific values.

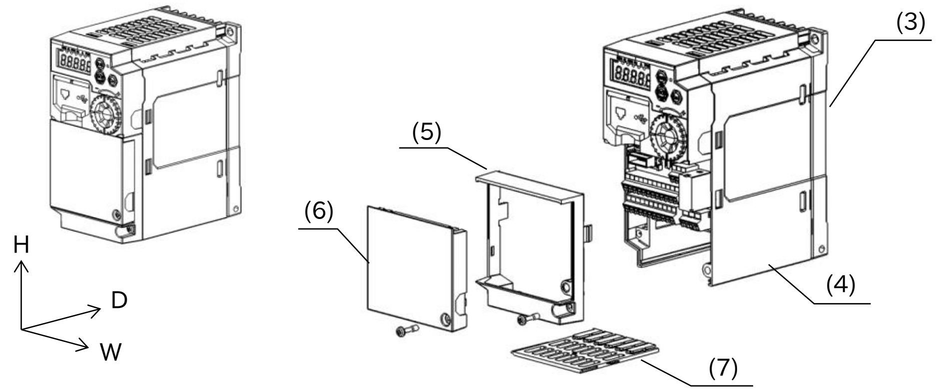
3.2 Appearance of the Product and Part Name

3.2.1 Appearance of Each Model

Q
- How to check the appearance and name of each part?

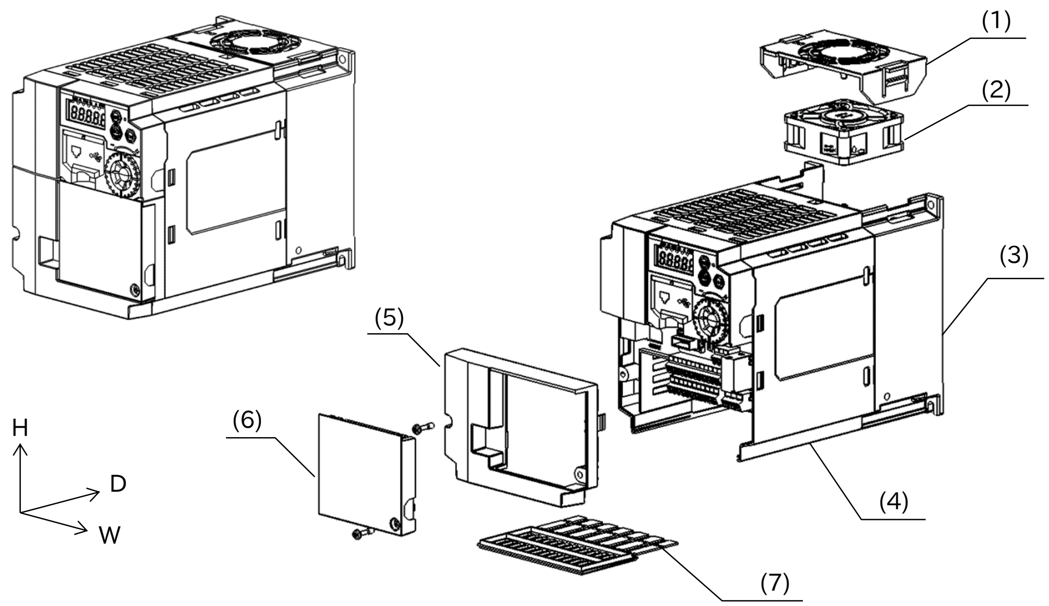
A
- The appearance of the product and the names of its parts are shown below for each model.

Single-phase 200 V class: C1-001SF/002SF/004SF
Three-phase 200 V class: C1-001LF/002LF/004LF/007LF



* The W and H dimensions are the same, but the D dimensions differ depending on the model due to the difference of the cooling fin.

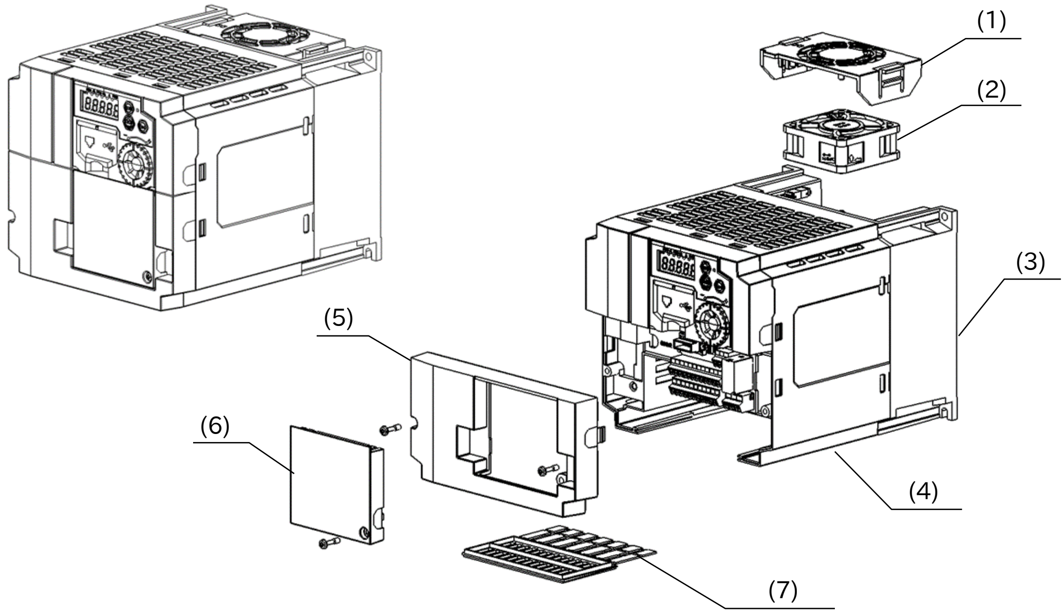
Single-phase 200 V class: C1-007SF/015SF/022SF
Three-phase 200 V class: C1-015LF/022LF
Three-phase 400 V class: C1-004HF/007HF/015HF/022HF/030HF



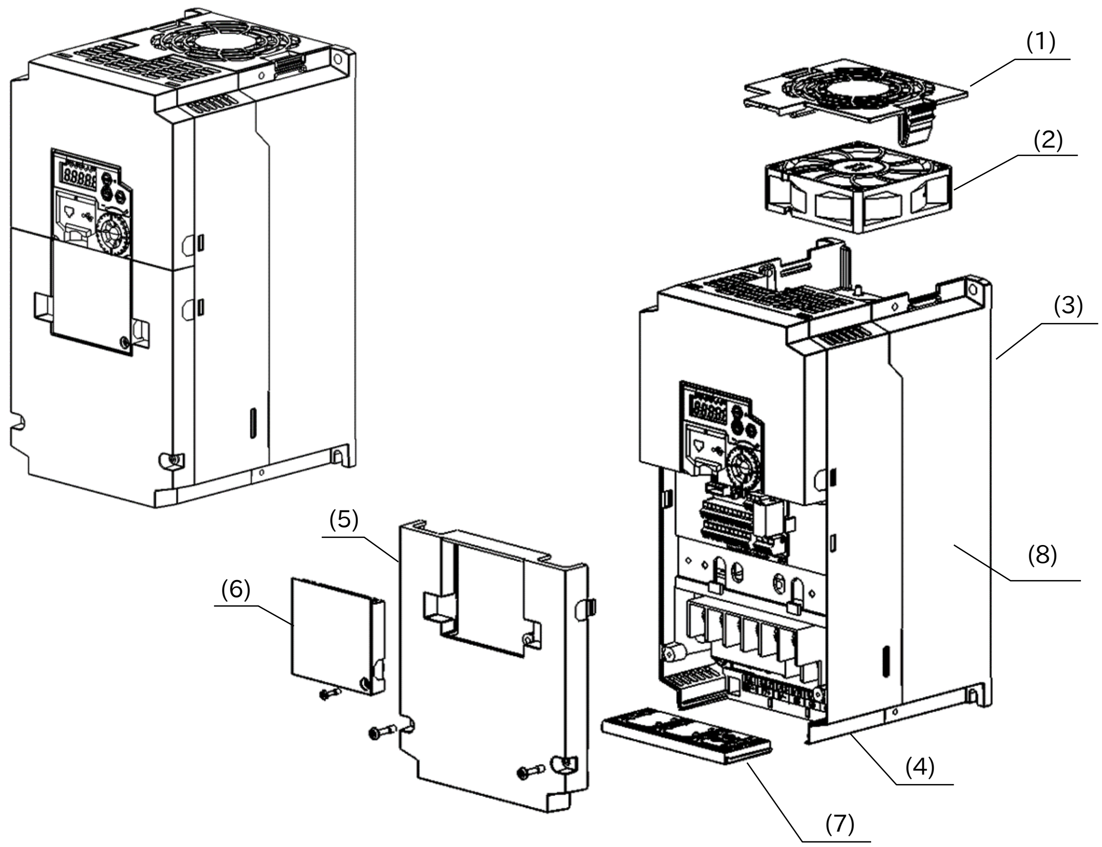
* The W and H dimensions are the same, but the D dimensions differ depending on the model due to the difference of the cooling fin.
* C1-007SF and C1-004HF do not have a cooling fan and a cooling fan cover.

(1) Cooling fan cover	(4) Main body cover	(7) Backing plate
(2) Cooling fan	(5) Terminal block cover	
(3) Cooling fin	(6) Control terminal cover	

Three-phase 200 V class: C1-037LF
Three-phase 400 V class: C1-040HF

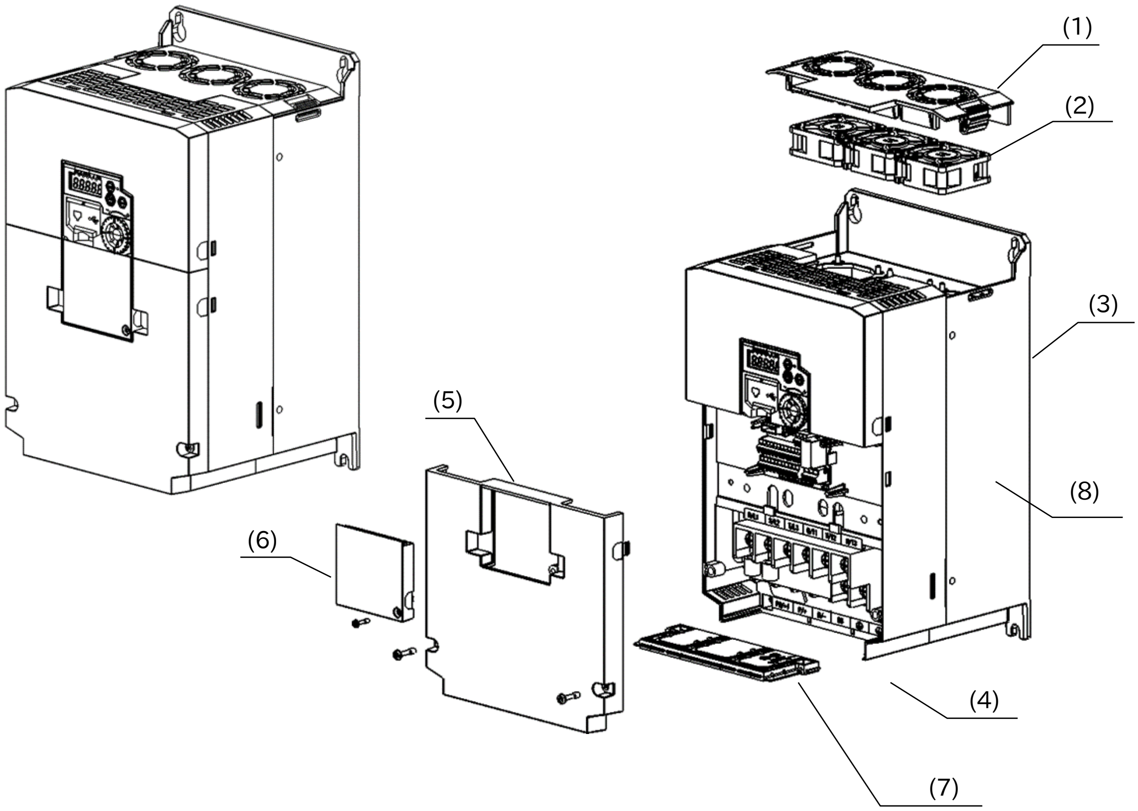


Three-phase 200 V class: C1-055LF/075LF
Three-phase 400 V class: C1-055HF/075HF

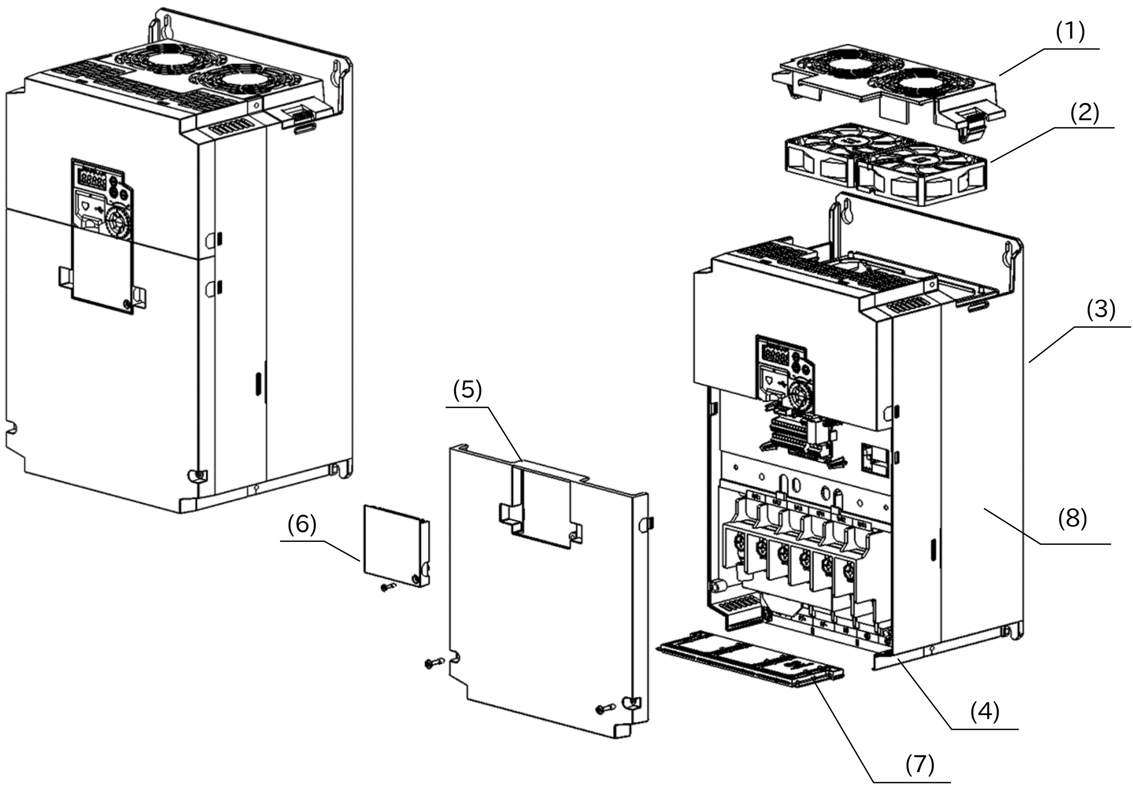


(1) Cooling fan cover
(2) Cooling fan
(3) Cooling fin
(4) Main body cover
(5) Terminal block cover
(6) Control terminal cover
(7) Backing plate
(8) Main body case

■ Three-phase 200 V class: C1-110LF
Three-phase 400 V class: C1-110HF/150HF



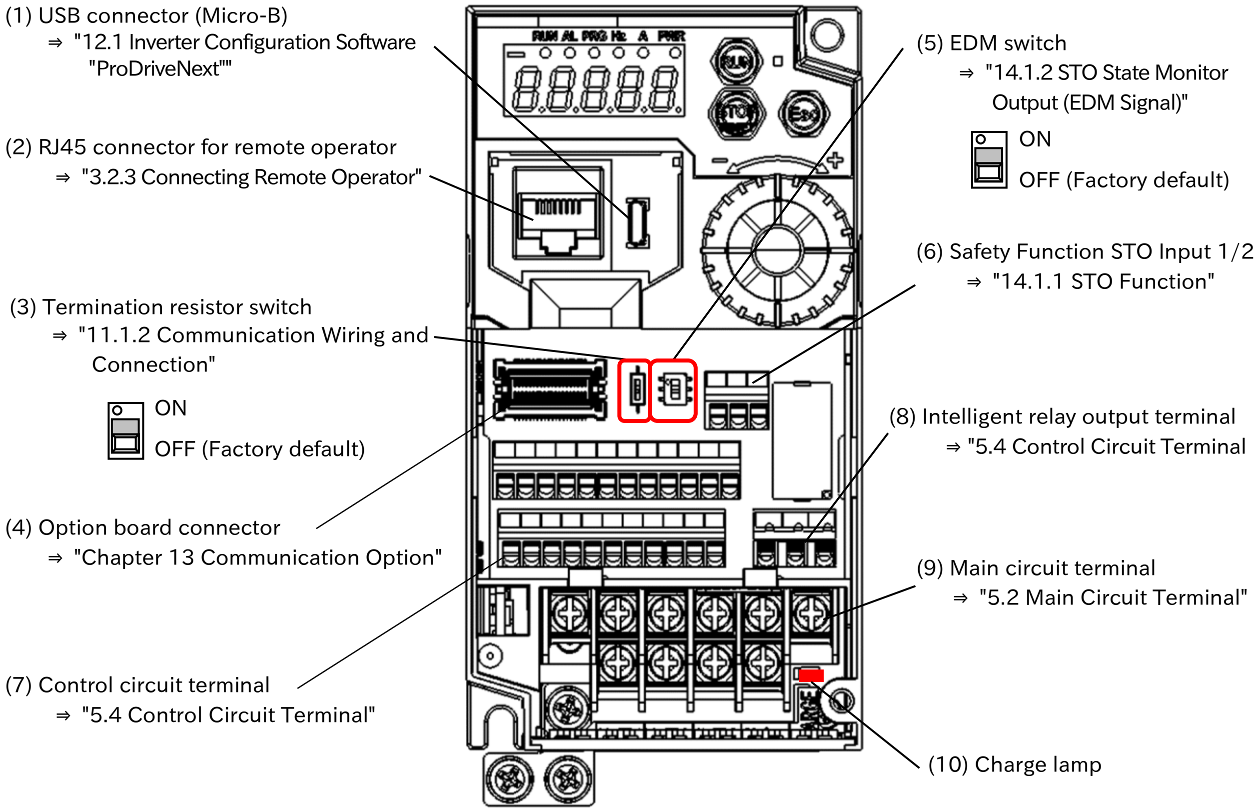
■ Three-phase 200 V class: C1-150LF



(1) Cooling fan cover
(2) Cooling fan
(3) Cooling fin
(4) Main body cover
(5) Terminal block cover
(6) Control terminal cover
(7) Backing plate
(8) Main body case

3.2.2 Part Names and Descriptions on the Front of the Product

A
- The appearance from the front of the product without the terminal cover and the names of the parts are shown below.



Name	Description
(1) USB connector	USB connector (Micro-B) for connecting to a PC. (Only when Inverter Configuration Software "ProDriveNext" and EzSQ function are used.)
(2) RJ45 connector for remote operator	Connector for connecting the optional remote operator.
(3) Termination resistor switch	Termination resister switch for the RS485 communication terminal on the control terminal. When turned on, the built-in resistor (120 Ω) is connected.
(4) Option board connector	Connector for mounting option board.
(5) EDM switch	Turn ON in case of using the [EDM] signal of the safety function. Be sure to turn off the power before switching ON/OFF. (Refer to section "14.1.2 STO State Monitor Output (EDM Signal)")
(6) Safety function STO input 1/2	Terminals block for input signals of safety function. (Refer to section "14.1.1 STO Function")
(7) Control circuit terminal	Terminal block for connecting various digital/analog input/output signals for inverter control.
(8) Intelligent relay output terminal	1c contact terminal block for intelligent relay output.
(9) Main circuit terminal	Terminal block for connecting the inverter main power supply, motor output, braking resistor, etc.
(10) Charge lamp (Charging indicator lamp)	This lamp lights when the main circuit DC voltage (between terminal [P/+] and [N/-], or between terminal [+] and [-]) is approximately 45 VDC or more even after the power supply is shut off. The voltage does not necessarily run out even if the charge lamp goes off. When changing the wiring, wait for 10 minutes or more after shutting off the power, and check that there is no residual DC voltage by using a tester or other instrument to confirm safety.

*) For the displays and keys on the keypad, refer to "7.1 How to Use Keypad".
*) The position of the (10) charge lamp depends on the model. For the positions of each model, refer to "5.2.3 Arrangement of Main Circuit Terminal Block".
*) Note that operation is also possible from the inverter main unit when driving from a PC via USB cable.
*) Disconnect the power supply before connecting or disconnecting the remote operator (VOP, etc.) to or from (2) RJ45 connector

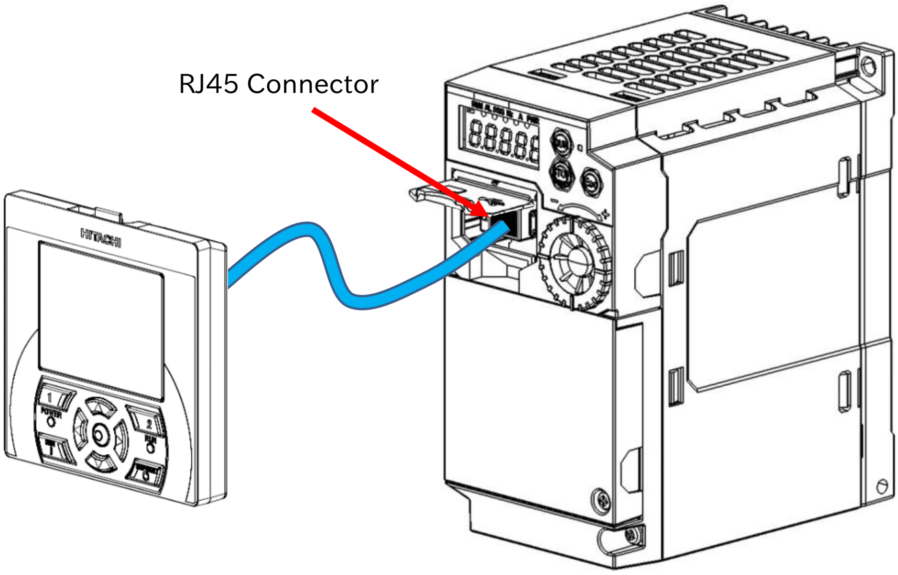
3.2.3 Connecting Remote Operator

Q

- How to operate the inverter by putting the remote operator on the control panel?

A

- Connecting the optional remote operator (VOP, MOP, MOP-VR) enables operation from outside the panel.
- It is recommended to use the connector cable option ICS-1 (1 m) or ICS-3 (3 m) to connect the inverter main unit and the remote operator.
- Other remote operators (OPE-SR, OPE-SBK, OPE-SR mini, WOP) can be used by changing the inverter operation mode. For detail, refer to "8.1.6 Changing Inverter Operation Mode".
- Inverter can detect remote operator disconnection and some remote operators can use the data R/W function. For detail, refer to "7.2.9 Remote Operator Functions".



!

- Use a connector cable within 3 m. If the cable is more than 3 m, it may cause malfunctioning.
- Do not connect or disconnect the remote operator while the inverter is energized.

4

Chapter 4 Installation

This chapter describes the instruction of the inverter.
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

4.1 Installation Environment

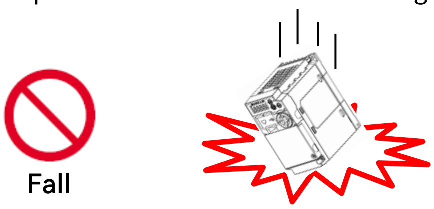
4.1.1 Installation Precautions

Q • What are the precautions when installing the inverter?

A • When installing the inverter, be sure to observe the following precautions.

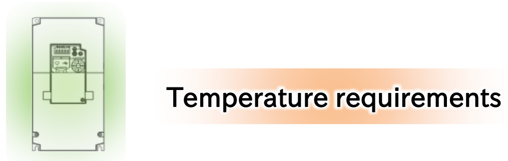
◆ Transportation

- Plastic parts are used for the inverter. When carrying the inverter, handle it carefully to prevent damage to the parts.
- Do not carry the inverter by holding the keypad or terminal block cover. Doing so may cause the inverter to fall.
- Do not install and operate the inverter if it is damaged or parts are missing.



◆ Ambient temperature

- Avoid installing the inverter in a place where the ambient temperature goes above or below the allowable range, as defined by the standard inverter specification.

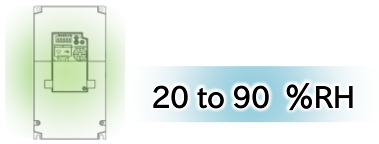


* Temperature requirements vary depending on the "Load type selection [Ub-03]". In addition, current derating may be required. For details, refer to "Chapter 17 Specifications/Dimensions/Derating".

- Leave sufficient space around the inverter. Measure the temperature in a position about 5 cm from the bottom-center point of the inverter, and check that the measured temperature is within the allowable range. Operating the inverter at a temperature outside this range will shorten the inverter life (especially the capacitor life).

◆ Humidity

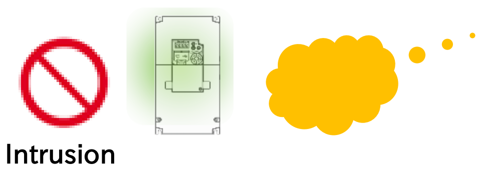
- Avoid installing the inverter in a place where the relative humidity goes above or below the allowable range (20 to 90% RH), as defined by the standard inverter specification. Especially, use the product in a place where there is no condensation.



- Condensation inside the inverter will result in short circuits and malfunctioning of electronic parts. Also avoid installing the product in a place exposed to direct sunlight.

◆ Ambient atmosphere

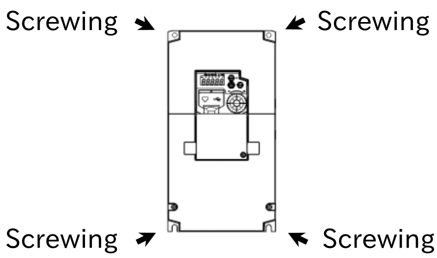
- Avoid installing the inverter in a place where the inverter will be subject to dust, water droplets, corrosive gases, explosive gases, flammable gases, grinding fluid mist, or salt air.



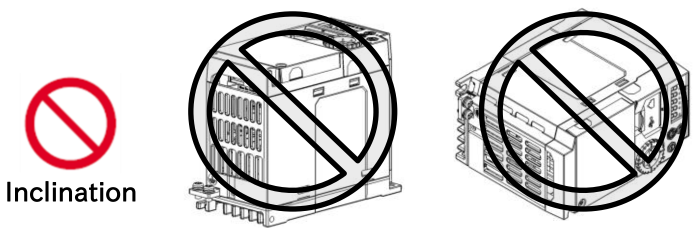
- Foreign particles entering the inverter will cause it to fail. If you use the inverter in a considerably dusty environment, install the inverter inside a sealed enclosure.

◆ Installation method and installation direction

- Install the inverter firmly and vertically with screws or bolts on a surface that can withstand the inverter weight and is free from vibrations.

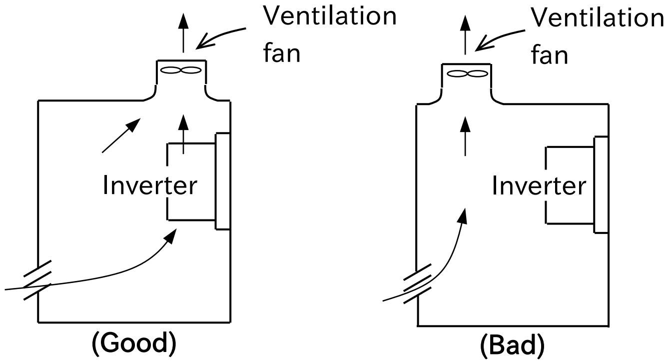


If the inverter is not installed vertically, its cooling performance may be degraded and tripping or inverter damage may result.



◆ Mounting in an enclosure

- When mounting multiple inverters in an enclosure with a ventilation fan, carefully design the layout of the ventilation fan, air intake port, and inverters. An inappropriate layout will reduce the inverter-cooling effect and raise the ambient temperature. Pay close attention so that the ambient temperature of the inverter is within the allowable operating temperature range.
  If a ventilation fan is located directly above the inverter, dust or dirt may drop on it. To prevent this, move the inverter horizontally to a suitable position.



Position of ventilation fan

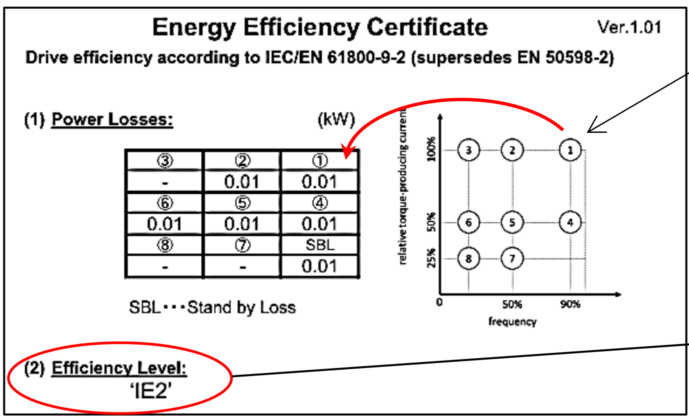
Watt loss

For the watt loss of the inverter, refer to the power losses listed in https://ecodesign.hitachi-industrial.eu/.

(1) By accessing the above URL, the "ENERGY EFFICIENCY CERTIFICATES" page is displayed.

(2) Select WJ-C1 from the above-mentioned web site. WJ-C1 model list appears.

(3) Click the model for which you want to know the power loss. The following PDF file will be displayed with the loss of each model.



Energy Efficiency Certificate Ver.1.01

Drive efficiency according to IEC/EN 61800-9-2 (supersedes EN 50598-2)

(1) Power Losses: (kW)

③	②	①
-	0.01	0.01
⑥	⑤	④
0.01	0.01	0.01
⑧	⑦	SBL
-	-	0.01

SBL･･･Stand by Loss

(2) Efficiency Level: 'IE2'

① shows the inverter power loss at 90% of the motor rated frequency and load 100% (ND rating).
(In the example shown at left, ① is 0.01 kW)

Indicates the efficiency level specified in IEC 60034-30: 2014 "Efficiency classes for single-speed three-phase induction motor".

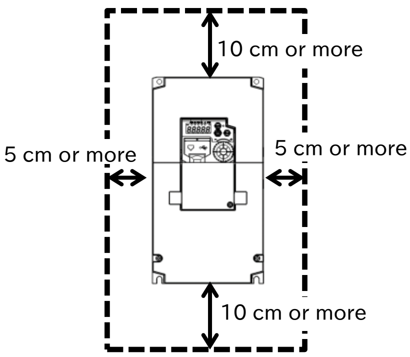
(4) The inverter losses at each point shown by the numbers on the Output Frequency vs. Load Factor (ND Rating) graph at the right of the figure above are shown in the table on the left.

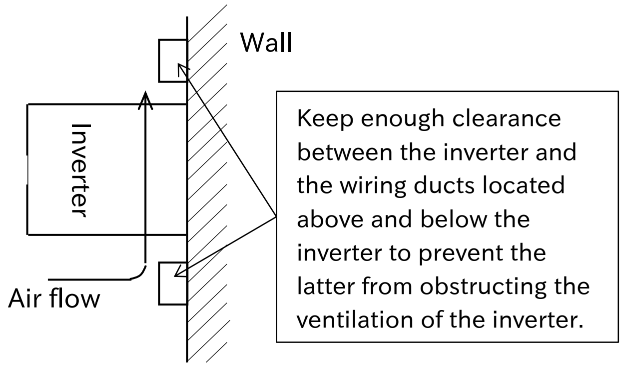
(5) Calculate the calorific value based on the inverter operation status and generated loss.

◆ Surface on which to install the inverter

- The inverter will reach a high temperature (up to about 150˚C) during operation. Install the inverter on a vertical wall surface made of nonflammable material (e.g., metal) to avoid the risk of fire.

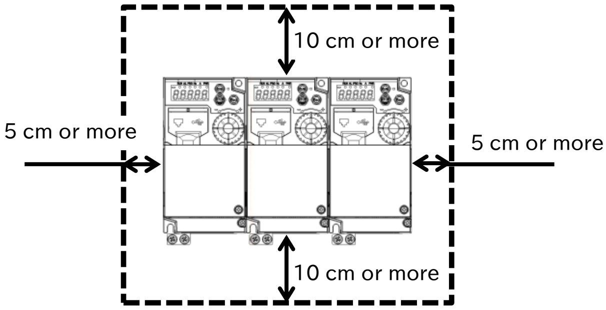
- Leave sufficient space around the inverter. Keep sufficient distance between the inverter and other heat sources (e.g., braking resistors and reactors) so that the heat discharged from the heat sources does not affect the inverter.





* For the inverter dimensions, refer to "17.2 External Dimensions".

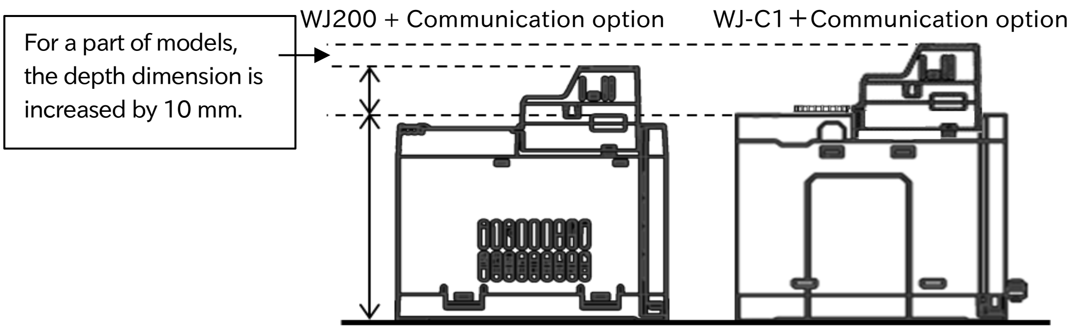
It is also possible to install multiple inverters side by side in the panel. In this case, derating is required for the carrier frequency and output current. For details, refer to "17.3 Current Derating" for details.



* Even in case WJ-C1 and WJ200 series are installed together, leave enough clearance around them as shown on the left. Also, follow the current derating of each model.

◆ Installing the communication option for WJ200 series

When using WJ-C1 in basic mode, the communication option for the WJ200 series is available. However, for a part of models, the depth dimension is 10 mm larger. Before replacing WJ200 to WJ-C1, check in advance whether the WJ-C1 with communication option will fit inside the panel. For details, refer to "13.1 Communication Option for WJ200 Series".



(Memo)

5

Chapter 5 Wire Connection

This chapter describes the wirings of the power supply to the main circuit terminal of the inverter, motor and peripheral options, and the analog and digital input/ output signal wirings to the control circuit terminal. When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

5.1 Remove the Terminal Block Cover

Q

- How to remove and attach the terminal block cover?

A

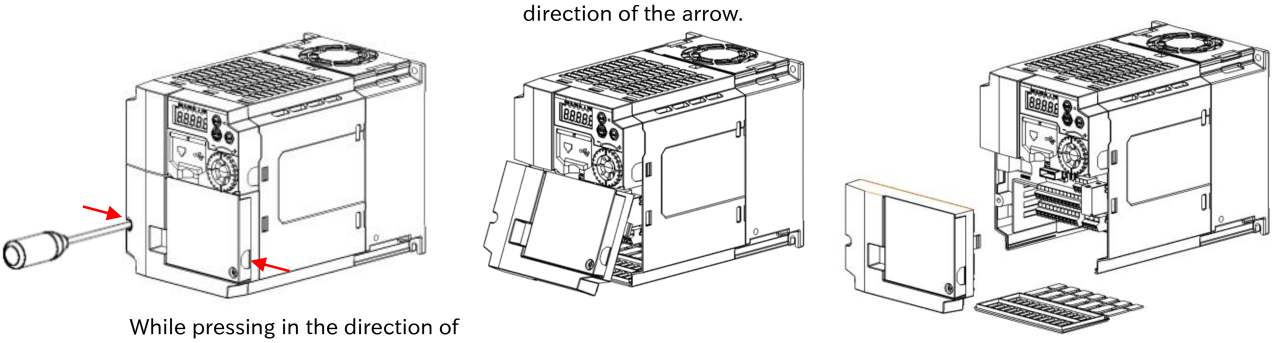
- Control terminal can be checked by removing the terminal block cover. The main circuit terminal block can be checked by removing the backing plate.

How to remove the terminal block cover

(1) Loosen the terminal block cover fixing screws (one or two locations).

(2) Remove the terminal block cover from the bottom while pressing the lower part of the terminal block cover in the direction of the arrow.

(3) When wiring, slide the backing plate forward and remove it.

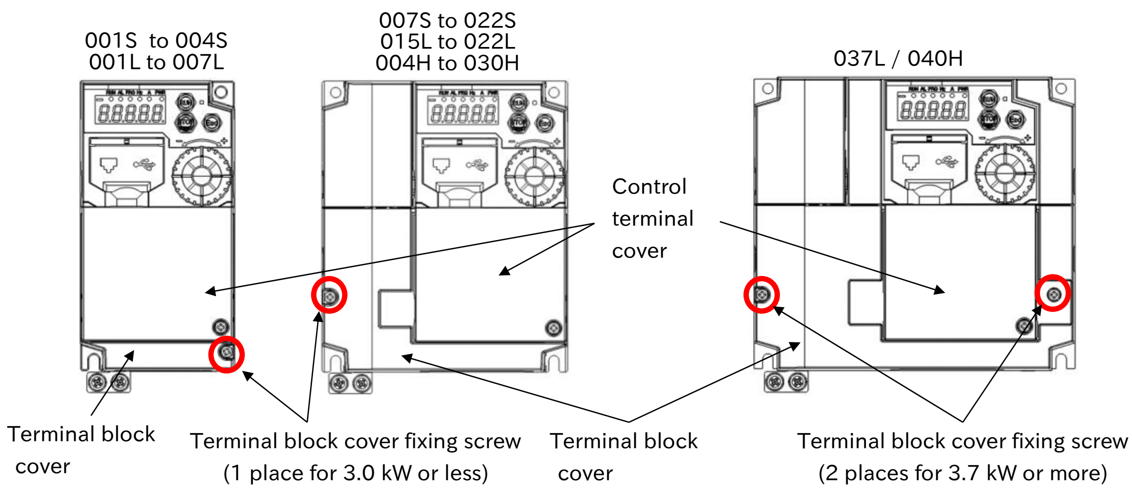


While pressing in the direction of the arrow, remove the terminal block cover from below.

* The terminal block cover fixing screws are provided in one place on the lower right or lower left for models with a capacity of 3.0 kW or less, and in two places on both sides for models with a capacity of 3.7 kW or more. Also, the control terminal cover is fixed to the terminal block cover with a screw, but it is not fixed to the main unit. Therefore, the terminal block cover can be removed without removing the control terminal cover.

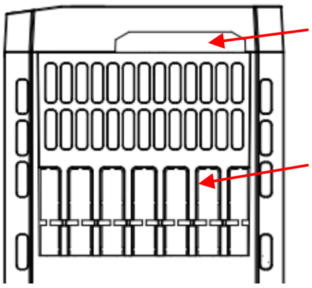
How to attach the terminal block cover

- Contrary to removing, attach the terminal block cover to the main unit from the upper side first and push it in until it clicks. (Tighten the fixing screws of the control terminal cover and the terminal block cover with a tightening torque of 0.2 to 0.3 N·m.)



How to use the backing plate

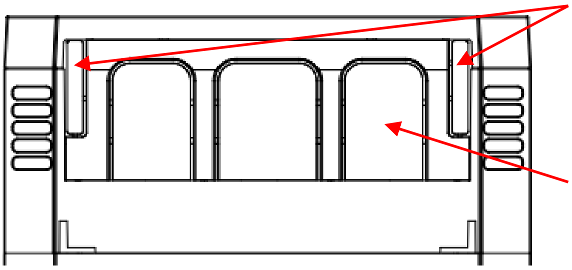
- C1-001S to 022S, C1-001L to 075L, C1-004H to 075H



Control circuit wiring
- Pull out from the terminal block cover.

Main circuit wiring
- Cut the connection points between the unnecessary part and the backing plate using a nipper or a cutter, to cut off the unnecessary part for wiring.

- C1-110L/150L, C1-110H/150H



Control circuit wiring
- Cut the left and right unnecessary parts of the backing plate with a nipper or a cutter, to cut off the unnecessary part for wiring.

Main circuit wiring
- Cut the connection points between the unnecessary part and the backing plate using a nipper or a cutter, to cut off the unnecessary part for wiring.

!

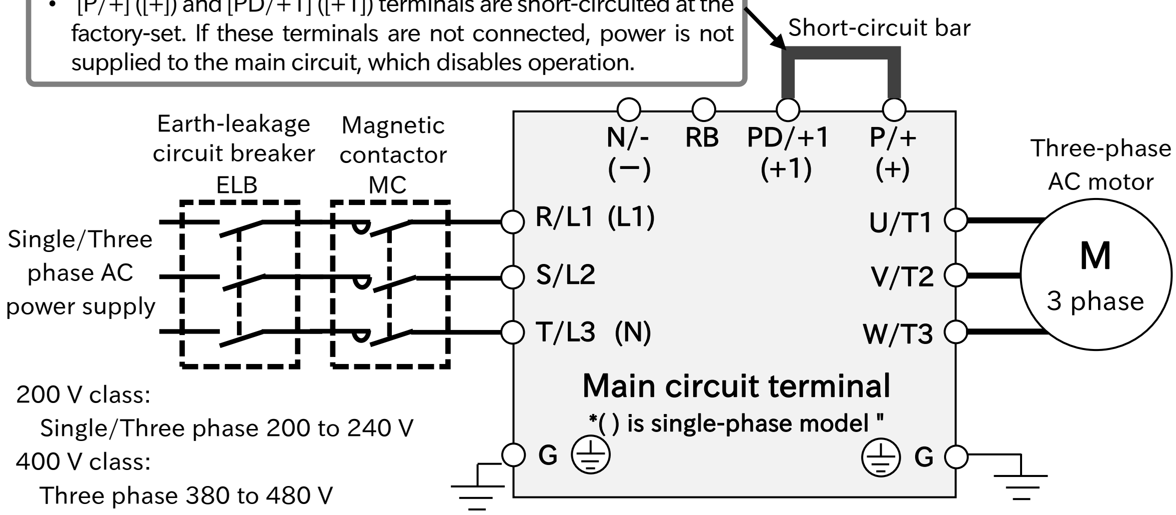
- Cut the connection points between the unnecessary part and the backing plate using a nipper or a cutter, to cut off the unnecessary part for wiring. Be careful not to get injured.
- When high voltage is applied to the relay output terminals, etc., pull out the wires separately from the low voltage wires such as the control circuit wires.

5.2 Main Circuit Terminal

5.2.1 Configuration of Main Circuit Terminal

Short circuit between P and PD (factory default state)

- [P/+] ([+]) and [PD/+1] ([+1]) terminals are short-circuited at the factory-set. If these terminals are not connected, power is not supplied to the main circuit, which disables operation.



Terminal symbol	Name	Description
R/L1 (Single-phase: L1) S/L2 T/L3 (Single-phase: N)	Input terminal for main power supply	Connects to AC power supply. There is no [S/L2] terminal in the single-phase model. In this case, connect AC power supply to [L1] and [N] terminals.
U/T1 V/T2 W/T3	Inverter output terminal	Connect a three-phase motor.
PD/+1 (Single-phase: +1) P/+ (Single-phase: +)	DC link choke connection terminal	Remove the short-circuit bar between [P/+]([+]) and [PD/+1]([+1]) terminal and connect the optional DC link choke for power factor improvement.
P/+ (Single-phase: +) RB	Braking resistor connection terminal	When braking torque is required, connect the optional external braking resistor between [P/+]([+]) and [RB] terminal.
P/+ (Single-phase: +) N/- (Single-phase: -)	Regenerative braking unit connection terminal	When braking torque is required and the built-in braking circuit is insufficient, connect the optional regenerative braking unit between [P/+]([+]) and [N/-]([-]) terminal. * In this guide, the voltage between these terminals is referred to as the DC bus voltage.
G (⏚)	Inverter grounding terminal	Ground terminal. Ground to prevent electric shock and reduce noise. Connect according to the applicable local grounding standards. For models of 200 V class 3.7 kW or less and 400 V class 4.0 kW or less, connect the ground bar on the bottom left of the inverter.

! Precautions for wiring the main circuit terminals

Electric shock Fire

- **Risk of electric shock and fire!**

Do

- Be sure to check that the charge lamp is off before making any work such as wiring change after the power is shut off. Once the power is turned on, regardless of whether open phase is occurring or the device is running or not, it is very dangerous because the capacitor in the inverter is charged at high voltage for certain period even after the power is shut off. Check that the input power is turned OFF, and wait at least 10 minutes before starting the work. (Check that the charge lamp is off and the DC voltage between [P/+]([+]) and [N/-]([-]) terminals is 45 VDC or less.)

5.2.2 Wiring Power Supply and Motor

Q

- How to connect the power supply and motor to the inverter?

A

- Connect [R/L1], [S/L2] and [T/L3] terminal to the AC power supply, and [U/T1], [V/T2] and [W/T3] terminal to the motor.
- Pay attention to the following points when wiring.

!

Cautions for wiring the main circuit terminals

Cautions for Input Power Supply

DANGER Burnout	● **Risk of burnout of the motor!!**
Prohibited	• Do not drive a 200 V class motor with a 400 V class inverter.
Do	• The input power supply should be within the following ranges. · 200 V class: 200 to 240 VAC (allowable fluctuation range +10 %/-15 %) 50 Hz/60 Hz (fluctuation range ±5 %) · 400 V class: 380 to 480 VAC (allowable fluctuation range +10 %/-15 %) 50 Hz/60 Hz (fluctuation range ±5 %)

Cautions for the main power input terminal

Fire Damage	● **Risk of fire and damage to machine!**
Do	• For connection between the power supply and the main power input terminal ([R/L1], [S/L2], [T/L3]), use the earth-leakage breaker for protecting the circuit and wiring. • If the protection function of the inverter is activated, there is a possibility that a failure or an accident is occurring on your system. Connect a magnetic contactor that shuts off the power supplied to the inverter. • Since the earth-leakage breaker may malfunction due to effects of high frequency noise, please use a model with large high-frequency sensitivity current value.

Failure	● **Risk of damage to the inverter!**
Prohibited	• Do not turn on or off the magnetic contactor installed on the input (primary) and output (secondary) sides of the inverter to start or stop operation.
Do	• To start or stop operation using external signals, use the RUN command (FW, RV) of the control circuit terminal block.

Electric shock Injury Failure	● **Risk of electric shock, injury and damage to the inverter!**
Prohibited	• Do not operate the inverter when an input phase is lost. • With the three-phase input model, even if an input phase is missing, the internal capacitor will be charged, which may cause an electric shock or injury. In addition, if an input phase is missing, the inverter may be damaged due to frequent undervoltage and overcurrent errors due to single-phase operation. • With a single-phase input model, power will not be supplied due to a single-wire disconnection. However, contact with the power line on the unbroken side may cause electric shock or injury.

Failure	● **Risk of damage to the inverter!**
Prohibited	• Do not use the following types of power supplies. Otherwise, the internal converter module may be damaged. (a) Unbalance of the power supply voltage is 3 % or more. (b) The power supply capacity is 10 times or more than the inverter capacity and 500 kVA or more. (c) When the power supply change suddenly for reason such as the following example. (e.g. 1) When two or more inverters are installed and connected each other with a short cable. (e.g. 2) When the inverter and the thyristor converter are connected to each other with a short cable. (e.g. 3) When a phase advance capacitor is inserted or shut off.

Failure	● **Risk of damage to the inverter!**
Prohibited	• Do not turn on and off the power frequently, which should not be done more than once every 3 minutes.

Cautions for inverter output terminals

DANGER Fire	● **Risk of fire, malfunction and damage to machine!**
実施	• Use wires with a thickness equal to or above the applicable wire. Otherwise, the output voltage may drop between the inverter and the motor. Especially at low speed output, voltage drop caused by wiring reduces the torque of the motor.

Failure	● **Risk of damage to the inverter!**
Prohibited	• Do not install a phase advance capacitor or surge absorber between the inverter and the motor, as they may cause inverter errors or damage to the capacitor or surge absorber.

Burnout	● **Risk of burnout of the motor!**
Do	• When connecting multiple motors, install thermal relays for each of them.

Burnout	● **Risk of burnout of the motor!**
Do	• When the wire length exceeds 20 m, due to the stray capacitance or the inductance of the wire, surge voltage may be generated on the motor terminals (especially on 400 V class), which may cause the motor to burnout. • For suppressing surge voltage filter, please contact your supplier or local Hitachi sales office.

Burnout	● **Risk of burnout of the motor!**
Do	• The RC value of the thermal relay should be 1.1 times the rated current of the motor. The thermal relay may trip earlier than intended depending on the wire length. In that case, install an AC reactor on the output side of the inverter.

Cautions for ground terminal for inverter

Electric shock

● **Risk of electric shock!**

Do

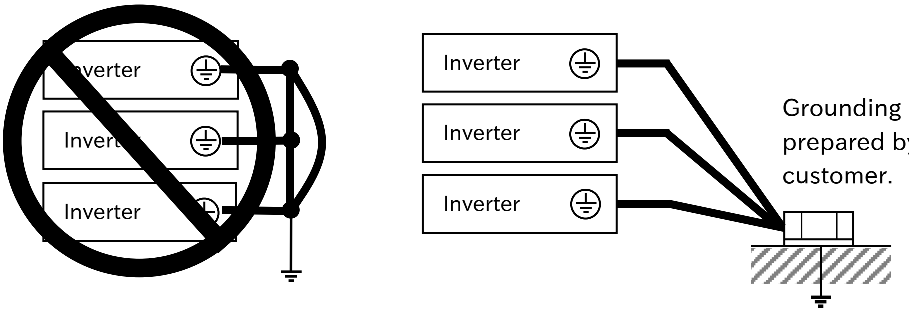
- Be sure to ground the inverter and motor for use in accordance with the applicable local grounding standards.
- Use grounding wires whose thickness is thicker then that of the applicable wires and make them short as much as possible.

Malfunction

● **Risk of malfunction of the inverter and peripheral control devices!**

Prohibited

- When more than one inverter are used, connect them that the grounding route (condition) should not be cascaded or loops connection.



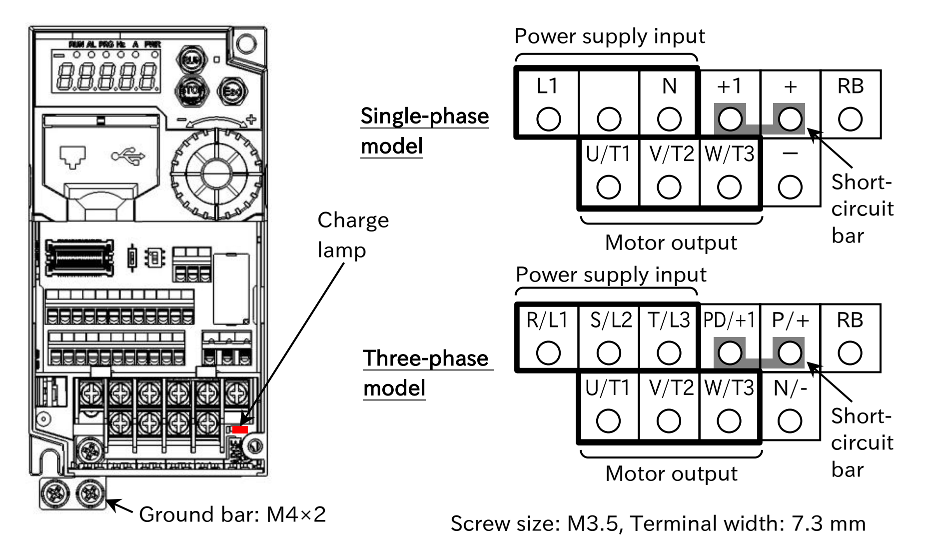
Other cautions

- For details on compliance with CE and UL standards, refer to "1.3 Compliance to European Directive (CE)" and "1.4 Compliance to UL Standards".
- If exports to the U.S. or Canada, or compliance with UL, cUL standards is required, the wires and circuit breakers specified in the UL, cUL standards must be used. When connecting wires to the main circuit terminal block, use round crimping terminals (UL-certified item) suitable for the wires for use. Use a crimp tool recommended by the manufacturer of the crimping terminal to crimp the terminal.
- Screw size may differ depending on the terminal. For the screw sizes of the main circuit terminal and the ground terminal, refer to "5.2.3 Arrangement of Main Circuit Terminal Block".
- For the wiring to the inverter and the tightening torque of the crimp terminal and terminal screw, refer to the table in "5.3.2 Recommended Wire Diameter, Wiring Equipment, Crimp Terminal".
- In case of replacing from WJ200 series, when the wire diameter, etc., differs, please contact your supplier or local Hitachi sales office.

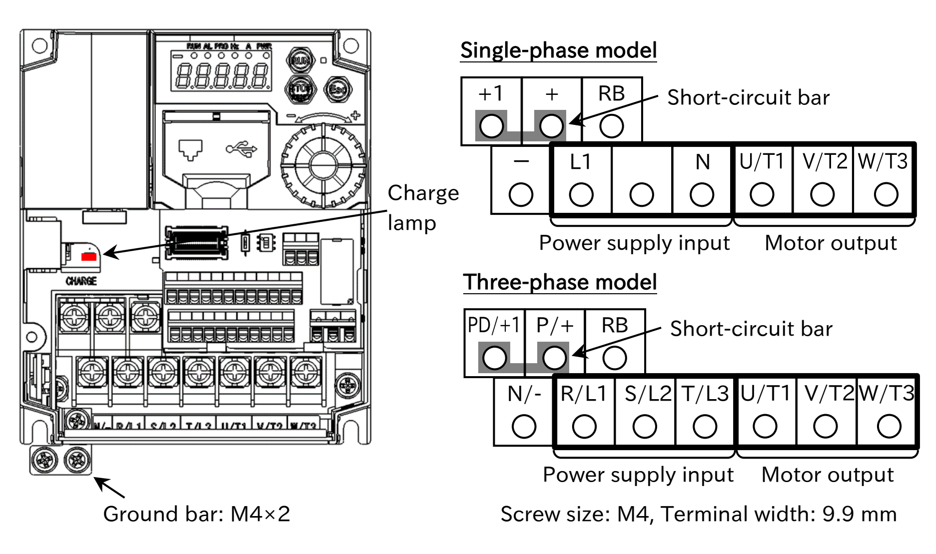
5.2.3 Arrangement of Main Circuit Terminal Block

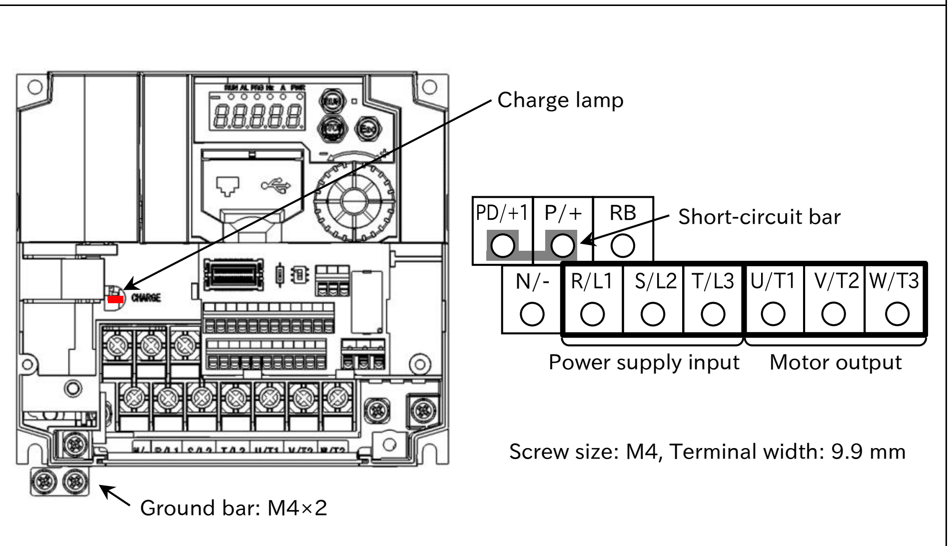
- The arrangement of the main circuit terminal of the inverter is shown in the figure below.
- The main circuit terminal arrangement is different from that of WJ200 series. When replacing, pay attention to differences in the main circuit terminal arrangement before wiring.

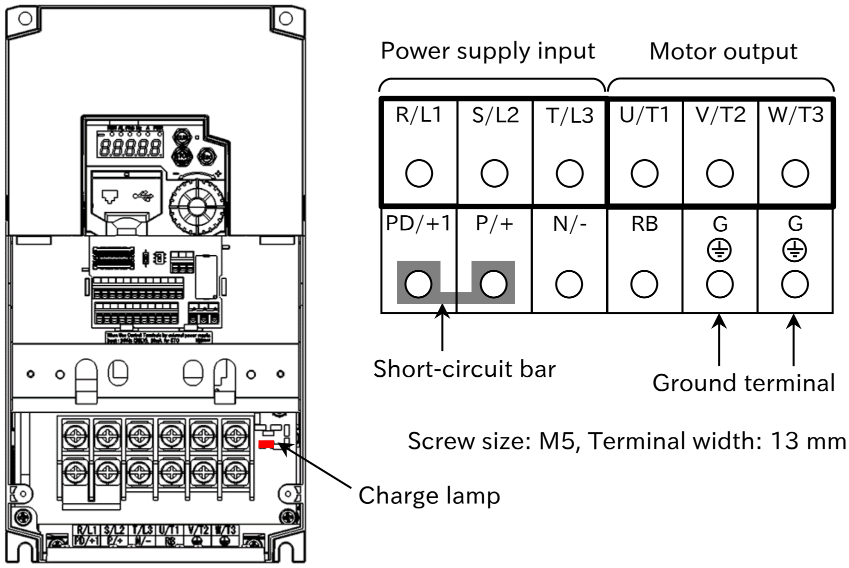
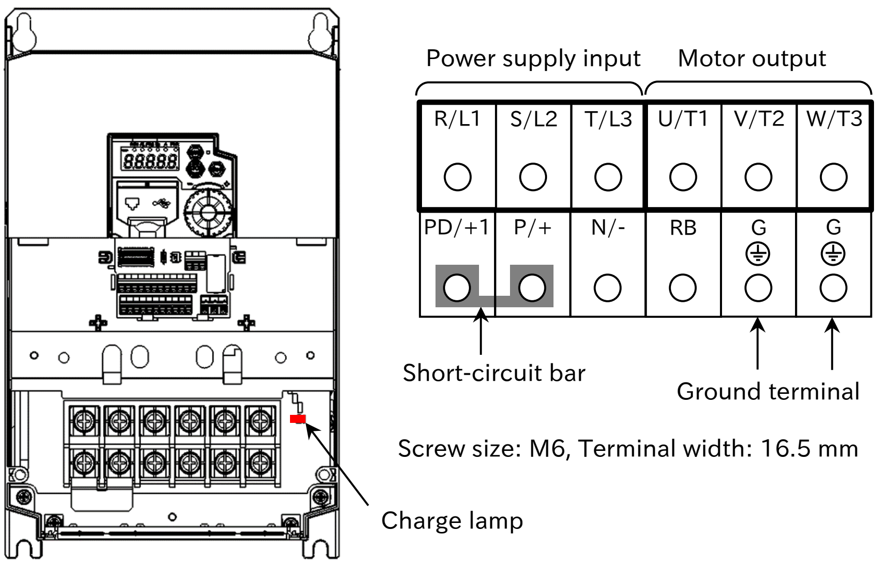
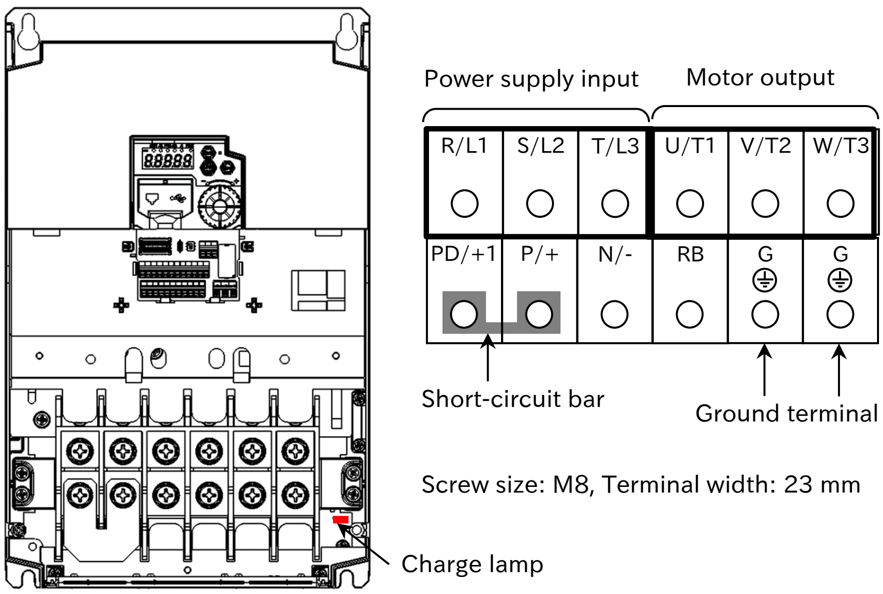
<table>
<tr><th>Model</th><th>Terminal arrangement</th></tr>
<tr><td>Single-phase 200 V
0.1 to 0.4 kW
C1-001S
C1-002S
C1-004S

Three-phase 200 V
0.1 to 0.75 kW
C1-001L
C1-002L
C1-004L
C1-007L</td><td>
</td></tr>
<tr><td>Single-phase 200 V
0.75 to 2.2 kW
C1-007S
C1-015S
C1-022S

Three-phase 200 V
1.5 to 2.2 kW
C1-015L
C1-022L

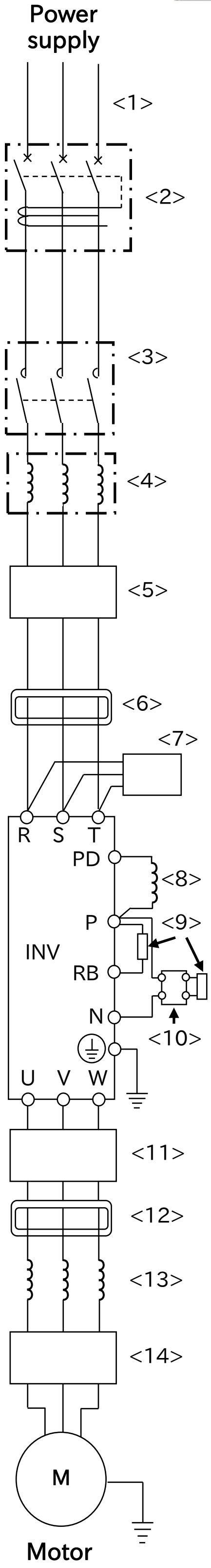
Three-phase 400 V
0.4 to 3.0 kW
C1-004H
C1-007H
C1-015H
C1-022H
C1-030H</td><td>
</td></tr>
<tr><td>Three-phase 200 V
3.7 kW
C1-037L

Three-phase 400 V
4.0 kW
C1-040H</td><td>
</td></tr>
</table>

Model	Terminal arrangement
Three-phase 200 V 5.5/7.5 kW C1-055L C1-075L Three-phase 400 V 5.5/7.5 kW C1-055H C1-075H	 Screw size: M5, Terminal width: 13 mm
Three-phase 200 V 11 kW C1-110L Three-phase 400 V 11/15 kW C1-110H C1-150H	 Screw size: M6, Terminal width: 16.5 mm
Three-phase 200 V 15 kW C1-150L	 Screw size: M8, Terminal width: 23 mm

5.3 Applicable Peripheral Device

5.3.1 Overview of Applicable Peripheral Devices



Cautions

- The applicable devices shown in this chapter are those when Hitachi standard 3-phase 4-pole induction motor is used.
- For the circuit breaker, choose an appropriate device by taking breaking capacity into consideration. (Use an inverter-compatible type.)
- To ensure safety, use an earth-leakage breaker (ELB).
  Use a 75˚C copper wire (HIV wire). (For details, refer to "1.4.1 UL Cautions".)
- When the wiring length exceeds 20 m, a thick power line needs to be used.
- Use 0.75 mm^2 wire for relay output terminals.
- Tighten the terminal screws at specified torques. Loose tightening may cause a short circuit or fire. Excessive tightening may damage the terminal block or inverter.
- Employ different sensitivity current of earth-leakage breaker (ELB) depending on the total wiring length between the inverter and the power supply and between the inverter and the motor. Also, use an inverter-compatible type earth-leakage breaker. High-speed type products may malfunction.
- Leakage current is approx. 30 mA/km when XLPE wire is used and wired with a metal tube.
- As relative permittivity of HIV wire is high, the leakage current of HIV wire increases to about 8 times that of XLPE wire. Therefore, use an item with 8 times sensitivity current that is shown on the table right. When the total wiring length exceeds 100 m, use a XLPE wire.

Total wiring length	sensitivity current (mA)
100 m or shorter	30
300 m or shorter	100
800 m or shorter	200

No.	Name	Function
<1>	Wire	Refer to "5.3.2 Recommended Wire Diameter, Wiring Equipment, Crimp Terminal".
<2>	Earth-leakage breaker (ELB)	
<3>	Magnetic contactor (MC)	
<4>	Input AC reactor (for harmonic suppression, power coordination, power factor improvement) (ALI-***)	This is applied as a countermeasure against harmonic suppression, or when imbalance of power supply voltage is 3% or above, or when power supply capacity is 500 kVA or above. It is also used when a rapid change is made to power supply voltage. It is also effective in improving power factor.
<5>	Inverter noise filter (NF-***)	This reduces conducted noise generated from the inverter and transmitted through the wires. Connected to the primary side (input side) of the inverter.
<6>	Radio noise filter (Zero-phase reactor) (ZCL-*)	When the inverter is used, noise may be generated on an adjacent radio or other devices through wiring on the primary side (input side) of inverter. This is used for reducing the noise (reducing radiation noise).
<7>	Input-side radio noise filter (CFI-*)	This reduces the radiation noise that is emitted from the wire on the input side.
<8>	DC link choke (DCL-*-**)	This suppresses harmonics generated from the inverter.
<9>	Braking resistor	This is used for increasing the braking torque of inverter, repeating power on and off at high interval, or reducing the speed of high load caused by moment of inertia.
<10>	Regenerative braking unit (BRD-**)	
<11>	Output-side noise filter (ACF-C*)	This is installed between the inverter and motor to reduce the radiation noise that is emitted from the wire. It is used to reduce radio interference on radios or televisions or prevent malfunctioning of measurement instruments and sensors.
<12>	Radio noise filter (Zero-phase reactor) (ZCL-*)	This is applied for reducing noise generated on the output side of inverter. (It can be used on both input side and output side.)
<13>	Output AC reactor (for reducing vibration/ preventing malfunctioning of thermal relay) (ACL-*-**)	When a general-use motor is driven by the inverter, compared with when it is run by commercial power supply, larger vibration may be generated. By connecting this device between the inverter and motor, the vibration of motor can be reduced. Also, if the wiring length between the inverter and motor is long (10 m or longer), by inserting a reactor, malfunctioning of the thermal relay caused by harmonic attributable to switching of inverter can be prevented. It is also possible to use a current sensor instead of a thermal relay.
<14>	LCR filter	This is an output-side sinusoidal filter to be installed between the inverter and motor to improve output current and voltage waveform to reduce motor vibration, noise, and radiation noise from wires. It is also effective in suppressing surge voltage.

5.3.2 Recommended Wire Diameter, Wiring Equipment, Crimp Terminal

Q

- What is the recommended wire diameter for the main circuit wiring?

A

- The following table shows the recommended wiring to the inverter, crimp terminals and tightening torque of the terminal screws.

■ Single-phase 200 V model

Model	Load rating setting	Main circuit terminal wiring AWG (mm^2)	Terminal screw size (Terminal width)	Crimp terminal Power/Ground	Tightening torque (N m) Power/Ground (maximum value)
C1-001S	Normal duty (ND) Light duty (LD)	AWG16 (1.3 mm^2)	M3.5 (7.3 mm)	R2-3.5/R2-4	0.9 to 1.2/1.3 to 1.5 (1.4/1.8)
C1-002S	Normal duty (ND) Light duty (LD)	AWG16 (1.3 mm^2)	M3.5 (7.3 mm)	R2-3.5/R2-4	0.9 to 1.2/1.3 to 1.5 (1.4/1.8)
C1-004S	Normal duty (ND) Light duty (LD)	AWG16 (1.3 mm^2)	M3.5 (7.3 mm)	R2-3.5/R2-4	0.9 to 1.2/1.3 to 1.5 (1.4/1.8)
C1-007S	Normal duty (ND) Light duty (LD)	AWG12 (3.3 mm^2)	M4 (9.9 mm)	R5.5-4/R5.5-4	1.4/1.3 to 1.5 (1.6/1.8)
C1-015S	Normal duty (ND) Light duty (LD)	AWG10 (5.3 mm^2)	M4 (9.9 mm)	R5.5-4/R5.5-4	1.4/1.3 to 1.5 (1.6/1.8)
C1-022S	Normal duty (ND) Light duty (LD)	AWG10 (5.3 mm^2)	M4 (9.9 mm)	R5.5-4/R5.5-4	1.4/1.3 to 1.5 (1.6/1.8)

■ Three-phase 200 V model

Model	Load rating setting	Main circuit terminal wiring AWG (mm^2)	Terminal screw size (Terminal width)	Crimp terminal Power/Ground	Tightening torque (N m) Power/Ground (maximum value)
C1-001L	Normal duty (ND) Light duty (LD)	AWG16 (1.3 mm^2)	M3.5 (7.3 mm)	R2-3.5/R2-4	0.9 to 1.2/1.3 to 1.5 (1.4/1.8)
C1-002L	Normal duty (ND) Light duty (LD)	AWG16 (1.3 mm^2)	M3.5 (7.3 mm)	R2-3.5/R2-4	0.9 to 1.2/1.3 to 1.5 (1.4/1.8)
C1-004L	Normal duty (ND) Light duty (LD)	AWG16 (1.3 mm^2)	M3.5 (7.3 mm)	R2-3.5/R2-4	0.9 to 1.2/1.3 to 1.5 (1.4/1.8)
C1-007L	Normal duty (ND) Light duty (LD)	AWG16 (1.3 mm^2)	M3.5 (7.3 mm)	R2-3.5/R2-4	0.9 to 1.2/1.3 to 1.5 (1.4/1.8)
C1-015L	Normal duty (ND) Light duty (LD)	AWG14 (2.1 mm^2)	M4 (9.9 mm)	R2-4/R2-4	1.4/1.3 to 1.5 (1.6/1.8)
C1-022L	Normal duty (ND) Light duty (LD)	AWG12 (3.3 mm^2)	M4 (9.9 mm)	R5.5-4/R5.5-4	1.4/1.3 to 1.5 (1.6/1.8)
C1-037L	Normal duty (ND) Light duty (LD)	AWG10 (5.3 mm^2)	M4 (9.9 mm)	R5.5-4/R5.5-4	1.4/1.3 to 1.5 (1.6/1.8)
C1-055L	Normal duty (ND) Light duty (LD)	AWG6 (13 mm^2)	M5 (13 mm)	R14-5/R14-5	3.0/3.0 (3.0/3.0)
C1-075L	Normal duty (ND) Light duty (LD)	AWG6 (13 mm^2)	M5 (13 mm)	R14-5/R14-5	3.0/3.0 (3.0/3.0)
C1-110L	Normal duty (ND) Light duty (LD)	AWG4 (21 mm^2)	M6 (16.5 mm)	R22-6/R22-6	3.9 to 5.0/3.9 to 5.0 (5.2/5.2)
C1-150L	Normal duty (ND) Light duty (LD)	AWG2 (34 mm^2)	M8 (23 mm)	R38-8/R38-8	5.9 to 8.8/5.9 to 8.8 (10.5/10.5)

■ Three-phase 400 V model

Model	Load rating setting	Main circuit terminal wiring AWG (mm^2)	Terminal screw size (Terminal width)	Crimp terminal Power/Ground	Tightening torque (N m) Power/Ground (maximum value)
C1-004H	Normal duty (ND)	AWG16	M4	R2-4/R2-4	1.4/1.3 to 1.5
	Light duty (LD)	(1.3 mm^2)	(9.9 mm)		(1.6/1.8)
C1-007H	Normal duty (ND)	AWG16	M4	R2-4/R2-4	1.4/1.3 to 1.5
	Light duty (LD)	(1.3 mm^2)	(9.9 mm)		(1.6/1.8)
C1-015H	Normal duty (ND)	AWG16	M4	R2-4/R2-4	1.4/1.3 to 1.5
	Light duty (LD)	(1.3 mm^2)	(9.9 mm)		(1.6/1.8)
C1-022H	Normal duty (ND)	AWG14	M4	R2-4/R2-4	1.4/1.3 to 1.5
	Light duty (LD)	(2.1 mm^2)	(9.9 mm)		(1.6/1.8)
C1-030H	Normal duty (ND)	AWG14	M4	R2-4/R2-4	1.4/1.3 to 1.5
	Light duty (LD)	(2.1 mm^2)	(9.9 mm)		(1.6/1.8)
C1-040H	Normal duty (ND)	AWG12	M4	R5.5-4/R5.5-4	1.4/1.3 to 1.5
	Light duty (LD)	(3.3 mm^2)	(9.9 mm)		(1.6/1.8)
C1-055H	Normal duty (ND)	AWG10	M5	R5.5-5/R5.5-5	3.0/3.0
	Light duty (LD)	(5.3 mm^2)	(13 mm)		(3.0/3.0)
C1-075H	Normal duty (ND)	AWG10	M5	R5.5-5/R5.5-5	3.0/3.0
	Light duty (LD)	(5.3 mm^2)	(13 mm)		(3.0/3.0)
C1-110H	Normal duty (ND)	AWG6	M6	R14-6/R14-6	3.9 to 5.0/3.9 to 5.0
	Light duty (LD)	(13 mm^2)	(16.5 mm)		(5.2/5.2)
C1-150H	Normal duty (ND)	AWG6	M6	R14-6/R14-6	3.9 to 5.0/3.9 to 5.0
	Light duty (LD)	(13 mm^2)	(16.5 mm)		(5.2/5.2)

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- The wire size in the above table shows the designed values based on HIV cables (with thermal resistance of 75˚C).
- When the wiring length exceeds 20 m, a thick power line needs to be used.
- When connecting wires to the main circuit terminal block, use round crimping terminals (UL-certified item) suitable for the wires for use. Use a crimp tool recommended by the manufacturer of the crimping terminal to crimp the terminal.
- Use a ground wire with a diameter equal to or thicker than that indicated on the power line.
- It is recommended to tight screws at the "maximum value" of the tightening torque in the above table.

5.3.3 Applicable Breaker

■ Single-phase 200 V class

Model C1-*****	Load rating	Applicable Motor (kW)	Applicable devices (input voltage 200 to 220 V)							
			Without reactor (DCL or ALI)				With reactor (DCL or ALI)			
			Earth-leakage breaker (ELB)		Magnetic contactor (MC)		Earth-leakage breaker (ELB)		Magnetic contactor (MC)	
			Example Model	Rated current (A)	AC-1	AC-3	Example Model	Rated current (A)	AC-1	AC-3
001S	Normal duty (ND)	0.1	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
002S		0.2	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
004S		0.4	EB-30E	10	HC8	HC8	EB-30E	5	HC8	HC8
007S		0.75	EB-30E	15	HC8	HC10	EB-30E	10	HC8	HC8
015S		1.5	EB-30E	20	HC8	HC20	EB-30E	10	HC8	HC8
022S		2.2	EB-30E	30	HC8	HC35	EB-30E	15	HC8	HC10
001S	Light duty (LD)	0.2	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
002S		0.4	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
004S		0.55	EB-30E	10	HC8	HC8	EB-30E	5	HC8	HC8
007S		1.1	EB-30E	15	HC8	HC20	EB-30E	10	HC8	HC8
015S		2.2	EB-30E	30	HC8	HC20	EB-30E	15	HC8	HC8
022S		3.0	EB-30E	30	HC8	HC35	EB-30E	15	HC8	HC10

■ Three-phase 200 V class

Model C1-*****	Load rating	Applicable Motor (kW)	Applicable devices (input voltage 200 to 220 V)							
			Without reactor (DCL or ALI)				With reactor (DCL or ALI)			
			Earth-leakage breaker (ELB)		Magnetic contactor (MC)		Earth-leakage breaker (ELB)		Magnetic contactor (MC)	
			Example Model	Rated current (A)	AC-1	AC-3	Example Model	Rated current (A)	AC-1	AC-3
001L	Normal duty (ND)	0.1	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
002L		0.2	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
004L		0.4	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
007L		0.75	EB-30E	10	HC8	HC8	EB-30E	10	HC8	HC8
015L		1.5	EB-30E	10	HC8	HC10	EB-30E	10	HC8	HC8
022L		2.2	EB-30E	15	HC8	HC20	EB-30E	15	HC8	HC10
037L		3.7	EB-30E	30	HC8	HC35	EB-30E	20	HC8	HC20
055L		5.5	EB-50E	40	HC20	HC55	EB-30E	30	HC20	HC35
075L		7.5	EB-50E	50	HC20	HC55	EB-50E	40	HC20	HC55
110L		11	EB-100E	60	HC55	H65C	EB-50E	50	HC35	HC55
150L		15	EB-100E	75	HC55	H80C	EB-100E	75	HC55	H65C
001L	Light duty (LD)	0.2	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
002L		0.4	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
004L		0.75	EB-30E	5	HC8	HC8	EB-30E	5	HC8	HC8
007L		1.5	EB-30E	10	HC8	HC8	EB-30E	10	HC8	HC8
015L		2.2	EB-30E	15	HC8	HC10	EB-30E	15	HC8	HC8
022L		3.7	EB-30E	15	HC8	HC20	EB-30E	15	HC8	HC10
037L		5.5	EB-30E	30	HC8	HC35	EB-30E	20	HC8	HC20
055L		7.5	EB-50E	40	HC20	HC55	EB-50E	40	HC20	HC35
075L		11	EB-50E	50	HC35	HC55	EB-50E	50	HC35	HC55
110L		15	EB-100E	75	HC55	H80C	EB-100E	75	HC55	H65C
150L		18.5	EB-100E	100	HC55	H80C	EB-100E	75	HC55	H80C

■ Three-phase 400 V class

Model C1-*****	Load rating	Applicable Motor (kW)	Applicable devices (input voltage 400 to 440 V)							
			Without reactor (DCL or ALI)				With reactor (DCL or ALI)			
			Earth-leakage breaker (ELB)		Magnetic contactor (MC)		Earth-leakage breaker (ELB)		Magnetic contactor (MC)	
			Example Model	Rated current (A)	AC-1	AC-3	Example Model	Rated current (A)	AC-1	AC-3
004H	Normal duty (ND)	0.4	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
007H		0.75	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
015H		1.5	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
022H		2.2	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
030H		3.0	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
040H		4.0	EXK60-C	15	HC8	HC10	EXK60-C	15	HC8	HC8
055H		5.5	EXK60-C	20	HC8	HC20	EXK60-C	15	HC8	HC20
075H		7.5	EXK60-C	20	HC8	HC20	EXK60-C	20	HC8	HC20
110H		11	EXK60-C	40	HC20	HC35	EXK60-C	30	HC20	HC35
150H		15	EXK60-C	40	HC20	HC55	EXK60-C	40	HC20	HC50
004H	Light duty (LD)	0.75	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
007H		1.5	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
015H		2.2	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
022H		3.0	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
030H		4.0	EXK60-C	15	HC8	HC8	EXK60-C	15	HC8	HC8
040H		5.5	EXK60-C	15	HC8	HC20	EXK60-C	15	HC8	HC10
055H		7.5	EXK60-C	30	HC8	HC20	EXK60-C	20	HC8	HC20
075H		11	EXK60-C	30	HC8	HC35	EXK60-C	30	HC8	HC35
110H		15	EXK60-C	40	HC20	HC55	EXK60-C	40	HC20	HC35
150H		18.5	EXK60-C	50	HC20	HC55	EXK60-C	40	HC20	HC50

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- Applicable motor capacity is based on Hitachi 200 VAC (for 200 V class)/400 VAC (for 400 V class), 60 Hz, 4 pole IE3 motor.
- When exports to the U.S. or Canada, or compliance with UL, cUL standards is required, the wires and circuit breakers specified in the UL, cUL standards must be used. For details, refer to "1.4 Compliance to UL Standards".
- Device model name on above table shows example selection. The device selection should be based on rated current, short circuit current capability and accordance to the local electrical legislation.
- For the wire diameter, refer to the "Main circuit terminal wiring AWG (mm^2)" column in "5.3.2 Recommended Wire Diameter, Wiring Equipment, Crimp Terminal".
- The electrical endurance of the class AC-1 magnetic contactor is 500,000 times, but when using for emergency stops during motor drive, the electrical endurance is 25 times.
- When using a MC for emergency stop during motor drive, select a MC of the class AC-3 rated current depending on the inverter input current.
- When selecting oversize inverter capacity compared to motor rating, select magnetic contactor according to the inverter capacity.

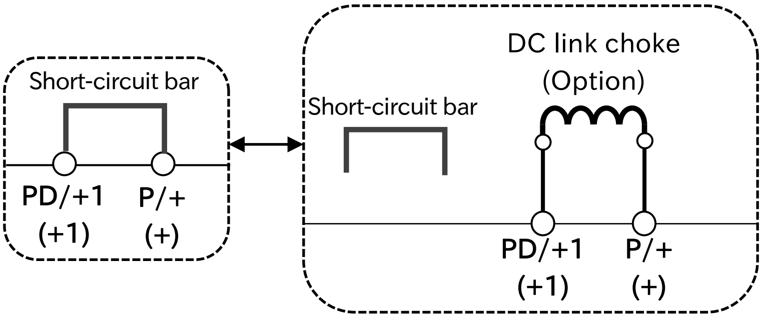
5.3.4 Wiring of DC Link Choke (DCL)

Q

- How can noise be reduced?
- What is the measures against harmonic noise?
- How can power factor be improved?

A

- When using a DC link choke (DCL), connect it after removing the short-circuit bar between [PD/+1] and [P/+] terminals (Single phase model: [+1] and [+] terminals).
- The power factor can be improved, and harmonic noises can be reduced by using DC link choke (DCL).



*) Terminal names in ( ) are for single phase models.

! **Cautions for DC link choke connection terminals ([PD/+1], [P/+] or [+1], [+])**

Caution	• When the short-circuit bar between [PD/+1] and [P/+] terminals (Single phase model: [+1] and [+] terminals) is removed and the DC link choke (DCL) is not connected, power is not supplied to the main circuit part of the inverter and the inverter cannot be operated.
Prohibited	• When the DC link choke (DCL) is not used, do not remove the short-circuit bar between [PD/+1] and [P/+] terminals (Single phase model: [+1] and [+] terminals).
Do	• The wiring length to DC link choke (DCL) should be within 5 m. Otherwise, it may not perform efficiently. • When installing the DC link choke (DCL), please make sure that its heat does not affect the inverter.

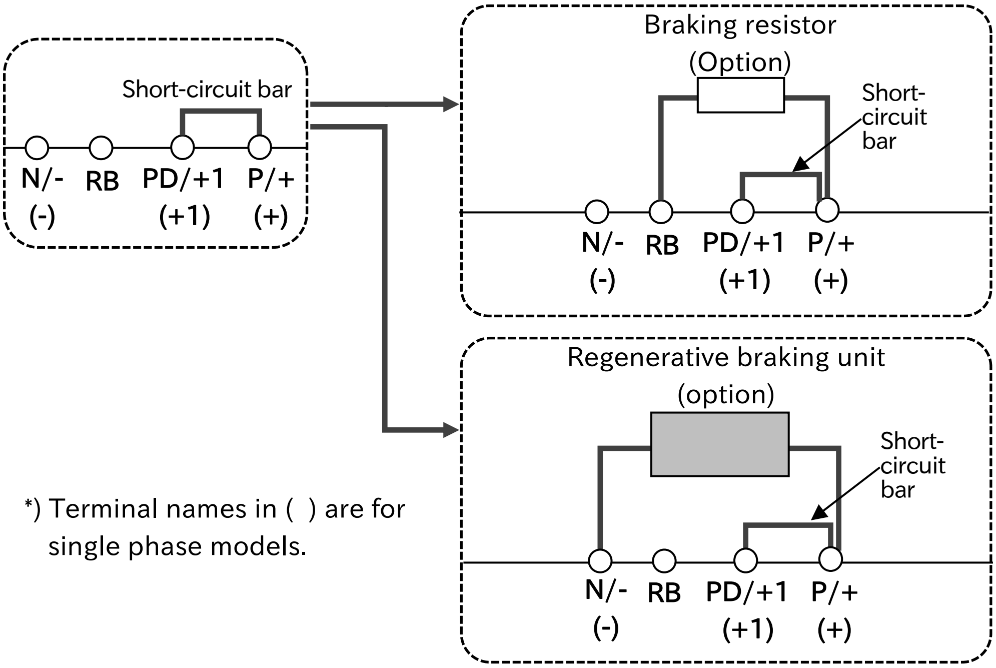
5.3.5 Wiring of Braking Resistor and Regenerative Braking Unit

Q

- How can an overvoltage error be avoided when short deceleration time is set?
- How can an overvoltage error be avoided at lowering or hanging for crane or elevator?

A

- In WJ-C1, a braking resistor circuit is built-in as standard.
- By installing optional braking resistor or regenerative braking unit, the braking force can be improved and the overvoltage can be suppressed, and it can be used even with large regenerative loads (lowering load or load applied at high-speed rotation).
- For details of the setting when connecting a braking resistor, refer to "9.9.5 Overvoltage Suppression with Braking Resistor". When connecting the regenerative braking unit, set "Dynamic brake activation selection [bA-61]" to "Disable (00)".



!

Cautions for the brake resistor connection terminals ([P/+], [RB] or [+], [RB]) and regenerative brake unit connection terminals ([P/+], [N/-] or [+], [-])

Failure Burnout	● **Risk of damage to the inverter and burnout of the braking resistor!**
Prohibited	• Do not connect items other than the braking resistor between [P/+] and [RB] (Single phase model: [+] and [RB] terminals) terminals. • Do not short-circuit [P/+] ([+])and [RB] terminals. • Do not attach a resistor whose resistance is lower than the predefined value. Otherwise, the braking resistor (BRD) circuit or the regenerative braking unit may be damaged.
Do	• Wiring to the braking resistor and regenerative braking unit (BRD) should be within 5 m, and the wires should be twisted. • Arrange devices so that the heat generated by the braking resistor and regenerative braking unit does not affect the inverter.

■ Selection and wiring of regenerative braking resistor

Model	Applicable motor capacity (kW)	Regenerative braking torque without resistor (%)	Connectable minimum resistance	
			Resistance value (Ω)	BRD use ratio (%)
C1-001S	0.1	50	100	10
C1-002S	0.2	50	100	10
C1-004S	0.4	50	100	10
C1-007S	0.75	50	50	10
C1-015S	1.5	50	50	10
C1-022S	2.2	20	35	10
C1-001L	0.1	50	100	10
C1-002L	0.2	50	100	10
C1-004L	0.4	50	100	10
C1-007L	0.75	50	50	10
C1-015L	1.5	50	50	10
C1-022L	2.2	20	35	10
C1-037L	3.7	20	35	10
C1-055L	5.5	20	20	10
C1-075L	7.5	20	17	10
C1-110L	11.0	10	17	10
C1-150L	15.0	10	10	10
C1-004H	0.4	50	180	10
C1-007H	0.75	50	180	10
C1-015H	1.5	50	180	10
C1-022H	2.2	20	100	10
C1-030H	3.0	20	100	10
C1-040H	4.0	20	100	10
C1-055H	5.5	20	70	10
C1-075H	7.5	20	70	10
C1-110H	11.0	10	70	10
C1-150H	15.0	10	35	10

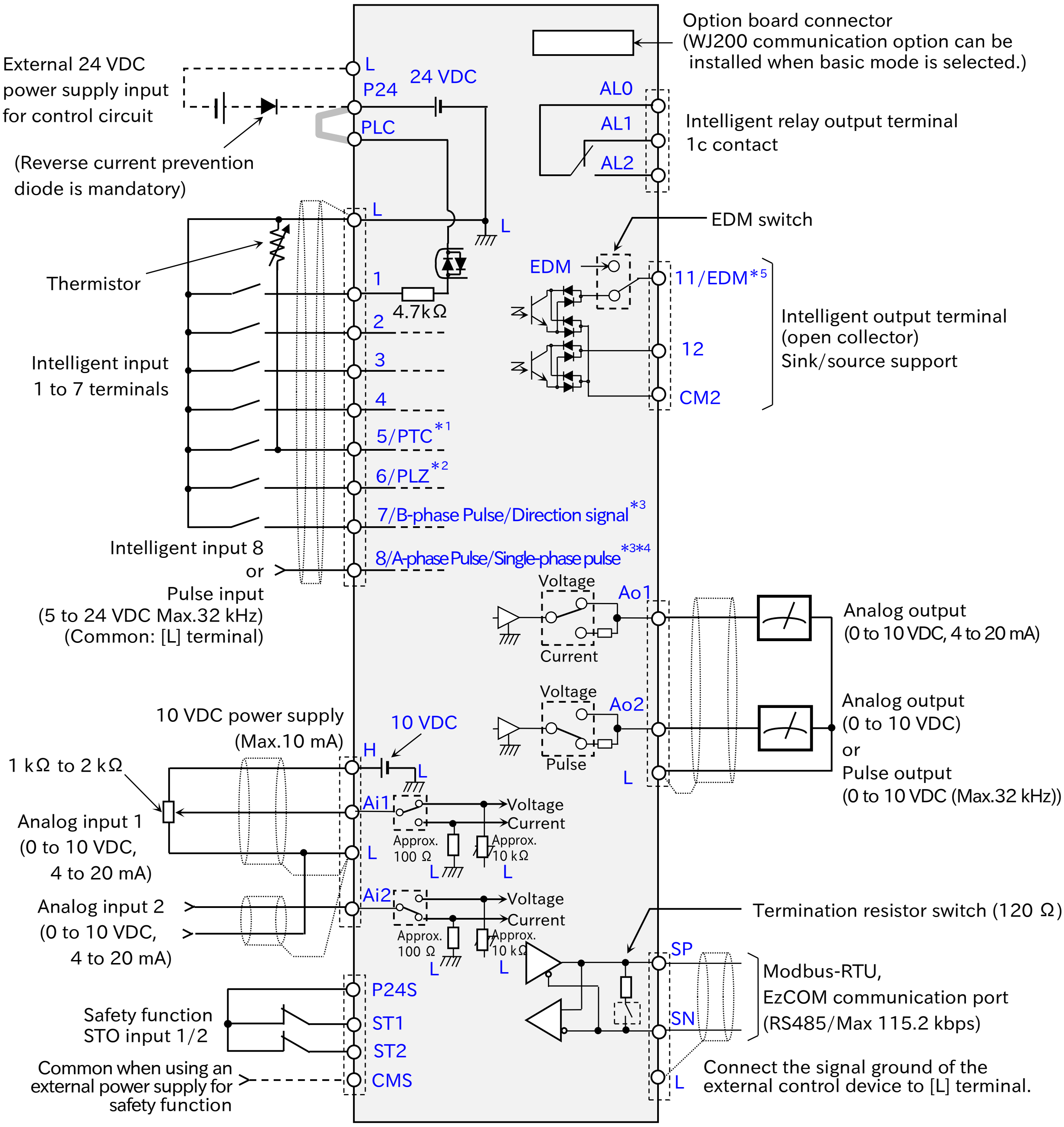
5.4 Control Circuit Terminal

5.4.1 Configuration of Control Circuit Terminal

A

- Control circuit terminal wires are shown in the figure below. Check the cautions, functions, and electrical specifications of the control circuit terminal wiring in this section, and pay sufficient attention to wiring so that there is no incorrect wiring.

*) For details when switching the sink/source logic and using external devices or external power supply, refer to "5.4.3 Switching Sink/Source Logic and Connecting External Power Supply/Programmable Controller".



*1. When "Thermistor type selection [Cb-40]" is set to "PTC (01)", input terminal [5] becomes a terminal for connecting an external thermistor (PTC).
*2. When using "Pulse input Z [PLZ]" input terminal, assign it to input terminal [6].
*3. When "Pulse input target function selection [CA-90]" is set to anything other than "Disable (00)", input terminal [7] is automatically switched to the terminal for B-phase pulse input or direction signal, and input terminal [8] is automatically switched to the terminal for A-phase pulse input or single-phase pulse input. For details, refer to "9.5.11 Setting for Encoder Feedback".
*4. The electrical specifications of input terminal [8] differ from those of other input terminals [1] to [7]. For details, refer to "Functions and electrical specifications of control circuit terminals" in this section.
*5. When the EDM switch on the board is turned ON, output terminal [11] switches to "STO state monitor [EDM]". When the switch is turned back to OFF, output terminal [11] becomes "Not use [no]".

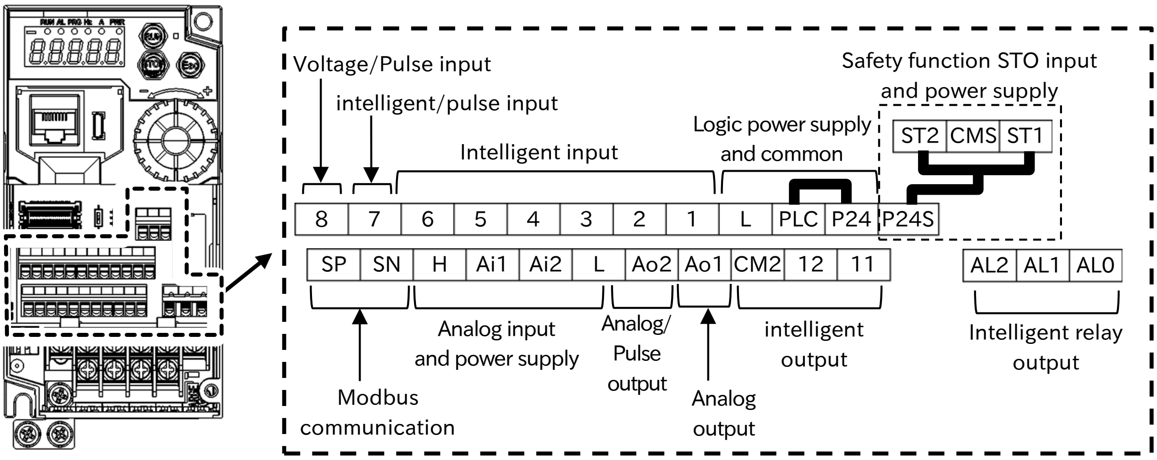
Cautions for wiring control circuit terminals

Electric shock Failure	● **Risk of electric shock and damage to the inverter!**
Prohibited	• [L] terminal and [CM2] terminal are common terminals for input and output signals. They are isolated from each other. Do not short-circuit or ground these common terminals. • Also, do not ground them through external devices. (Check the grounding condition of the external devices.) • Do not short-circuit between [H] terminal (10 VDC power supply) and [L] terminal, [P24] terminal (24 VDC power supply) and [L] terminal.

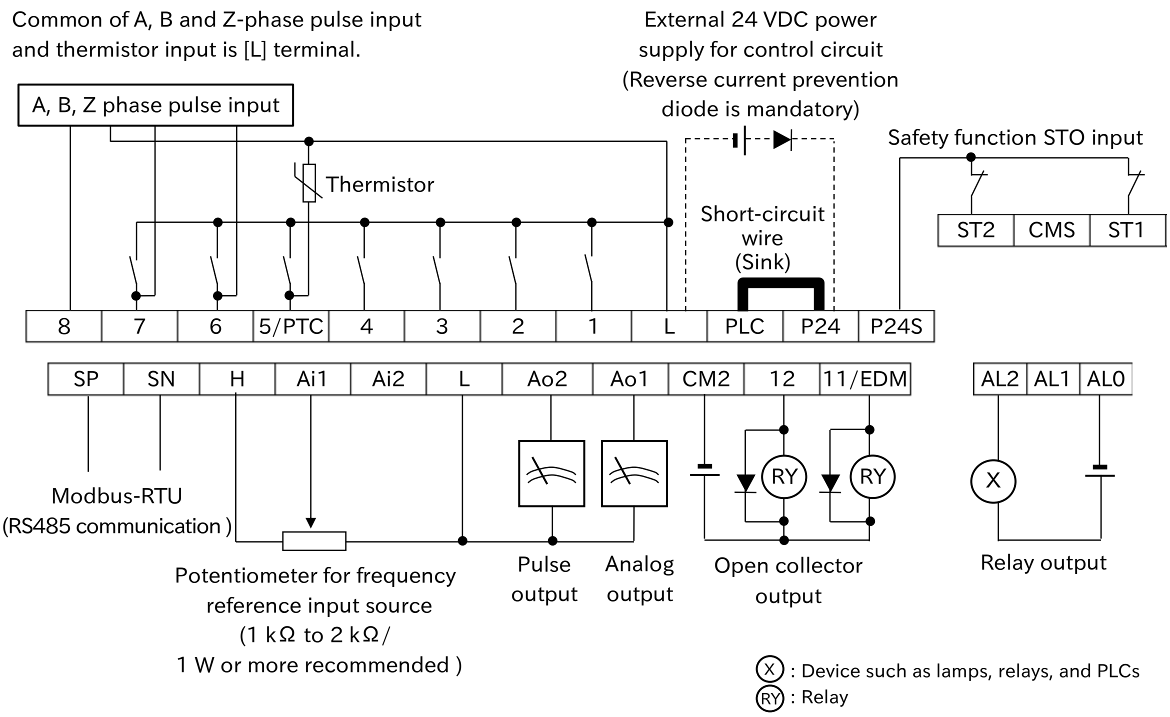
Failure	● **Risk of damage to the inverter!**
Do	• Switching the dip switch on the board while the power is on may cause a failure. Turn off the power, check that Power LED [PWR] on the keypad is off, and then switch. • Difference of the switch status and the actual input/output specifications may cause a failure. Be sure to check that the characteristics of the input/output and the switch are correct. • When connecting a relay to the intelligent output terminal, connect a diode for surge absorption in parallel with the coil. Surge-voltage at switching the relay may cause a failure of the internal circuit. • By supplying external 24 VDC to [P24] terminal, it is possible to operate only the control circuit and parameters can be read/written. When an external 24 VDC power supply is connected, be sure to connect a reverse current prevention diode. Also, be careful not to shut off the external 24 VDC power supply when writing parameters in this state.

Malfunction	● **Risk of malfunction of the inverter!**
Do	• Separate the wiring to the control circuit terminal from the wiring of the main circuit line (power line) or relay control circuit. when it is unavoidable to do so, make them positioned at right angles to each other. • For wiring to the control circuit terminal, use twisted shield wires, and connect the shield films to each common terminal. • The wiring length to the control circuit terminal shall be within 20 m. When the connecting wire exceeds 20 m, sufficient characteristics may not be obtained due to the effects of voltage drop. When it is unavoidable to set the length to more than 20 m, use an analog insulation signal converter, and check that there is no problem with operation. • When "Thermistor type selection [Cb-40]" is set to "PTC (01)", input terminal [5] becomes a terminal for connecting an external thermistor (PTC). In this case, the connection to the input terminal [5] should be twisted to the individual common wire to terminal [L] and separated from the other common wires. In addition, the power supply to the thermistor should be separated from the power line because of the weak current. The wire connected to the thermistor should be within 20 m. • For wiring to "External thermistor [PTC]", twist it together with [L] terminal common wires individually, and separate it from the other [L] common wires. Since the power supply flowing through the thermistor is a weak current, separate it from the power line. The wiring length to the thermistor should be within 20 m. • When connecting contacts to the control circuit terminals, use crossbar twin contacts, etc. that do not easily cause contact failure even with a weak current/voltage. • After wiring, pull the wire lightly to check that it is securely connected.

A Arrangement of control circuit terminal



Wiring example of control circuit terminal



- When "Thermistor type selection [Cb-40]" is set to "PTC (01)", input terminal [5] becomes the terminal for connecting an external thermistor (PTC). When a thermistor is used, the common is [L] terminal regardless of the sink/source logic.
- When "Pulse input target function selection [CA-90]" is set to anything other than "Disable (00)", input terminal [7] is automatically switched to the terminal for B-phase pulse input or direction signal, and input terminal [8] is automatically switched to the terminal for A-phase pulse input or single-phase pulse input. For details, refer to "9.5.11 Setting for Encoder Feedback".
- When using "Pulse input Z [PLZ]" input terminal for home return function or orientation function, assign it to input terminal [6].
- Output terminal [11] switches to the "STO state monitor [EDM]" by turning on the EDM switch on the board.

A Functions and electrical specifications of control circuit terminals

Item		Symbol	Name	Description	Electrical characteristics
Analog input/output					
	Power supply	L	Common for input signal	Common terminal for internal power supply, input terminal [1] to [8], analog input/output and pulse input/output terminals.	—
		H	Power supply for frequency reference	10 VDC power supply. Used when inputting a frequency reference by analog voltage input with a potentiometer.	Maximum allowable current: 10 mA
	Analog input	Ai1	Analog input 1 (Voltage/Current)	[Ai1] and [Ai2] terminals are terminal for analog input. Both terminals can be switched between voltage input and current input by parameter setting. - Analog voltage input 0 to 10 VDC voltage input. It is adjusted at the factory to reach the maximum frequency at 9.8 VDC input. - Analog current input 4 to 20 mA current inputs. It is adjusted at the factory to reach the maximum frequency at 19.8 mA input.	Analog voltage input: Input impedance: Approx. 10 kΩ Allowable input voltage range: -0.3 to 12 VDC Analog current input: Input impedance: Approx. 100 Ω Allowable input current range: 0 to 24 mA
		Ai2	Analog input 2 (Voltage/Current)		
	Thermistor input	5 ([PTC])	External thermistor input	When "Thermistor type selection [Cb-40]" is set to "PTC (01)", input terminal [5] becomes the terminal for connecting an external thermistor (PTC). An external thermistor is connected between this terminal and [L] terminal to trip the inverter due to a temperature error. (Trip at approx. 3 kΩ or more.) Regardless of the sink or source logic, the common is [L] terminal.	PTC type
Digital input					
	Power supply	L	Common for input signal	Common terminal for internal power supply, input terminal [1] to [8], analog input/output and pulse input/output terminals.	—
		P24	Power supply terminal for input signal	24 VDC internal power supply terminal for contact input. Common for source logic input. By supplying external 24 VDC to this terminal, it is possible to operate only the control circuit and parameters can be read/written. When an external 24 VDC power supply is connected, be sure to connect a reverse current prevention diode.	Maximum allowable current: 100 mA
		PLC	Sink/Source logic switching terminal for input signal	Sink logic: short-circuit to [P24] terminal Source logic: short-circuit to [L] terminal When driving the contact input with an external power supply, remove the short-circuit wire. For details, refer to "5.4.3 Switching Sink/Source Logic and Connecting External Power Supply/ Programmable Controller".	—

Item		Symbol	Name	Description	Electrical characteristics
	Contact input	1 2 3 4 5	Intelligent input	Each terminal function can be selected by parameter setting for each terminal. Both sink and source logic are supported. For details, refer to "5.4.3 Switching Sink/Source Logic and Connecting External Power Supply/ Programmable Controller".	Voltage between each terminal and [PLC] terminal ON voltage: min. 18 VDC OFF voltage: Max. 3 VDC Maximum allowable voltage: 27 VDC Load current: 5 mA (at 24 VDC) Internal resistance : 4.7 kΩ
	Contact input or Pulse input	6	Intelligent input or Z-phase pulse input	Assign "Pulse input Z [PLZ]" to input terminal [6] when inputting Z-phase pulses in order to use the home return function or orientation function.	Input pulse: min. 0.3 Hz to Max. 32 kHz [6]/[7] - [PLC] voltage: ON voltage: min. 18 VDC OFF voltage: Max. 3 VDC Maximum allowable voltage: 27 VDC Load current: 8 mA (at 24 VDC) Internal resistance: 3.0 kΩ
		7	Intelligent input or B-phase pulse input/ Direction signal	When "Pulse input target function selection [CA-90]" is set to other than "Disable (00)", the input terminal [7] is a terminal for B-phase pulse input or direction signal in single-phase pulse input. When [CA-90] is set to "Disable (00)", it becomes an intelligent input terminal.	
		8	Intelligent input (Voltage input) or A-phase pulse input/ Single-phase pulse input	When "Pulse input target function selection [CA-90]" is set to other than "Disable (00)", the input terminal [8] become 0/5 to 24 VDC pulse input terminal. When [CA-90] is set to "Disable (00)", it becomes an intelligent input terminal. In this case, use the source logic or provide an external power supply between this terminal and the [L] terminal. (Note that the internal circuit differs from the input terminals [1] through [7].)	Input pulse: min. 0.3 Hz to Max. 32 kHz [8] - [L] voltage: ON voltage: min. 4 VDC OFF voltage: Max. 1 VDC Maximum allowable voltage: 27 VDC Internal resistance: 11 kΩ
Digital output					
	Open collector output	11 12	Intelligent output	Each terminal function can be selected with the parameter setting of each terminal. Both sink and source logic are supported. For details, refer to "5.4.3 Switching Sink/Source Logic and Connecting External Power Supply/Programmable Controller".	Open collector output Between each terminal and [CM2] Max. allowable voltage: 27 VDC Max. allowable current: 50 mA Voltage drop when turned on: 4 VDC or less
		CM2	Common for intelligent output	Common terminal for output terminal [11] and [12].	Maximum allowable current: 100 mA
	Relay output	AL0 AL1 AL2	Intelligent relay output	1c contact output. Output terminal function can be selected by parameter setting. (The factory default setting is alarm output.)	Maximum contact capacity [AL1] to [AL0]: 250 VAC 2 A (Resistance) 0.2 A (Inductive load) 30 VDC 3 A (Resistance) 0.6 A (Inductive load) [AL2]-[AL0]: 250 VAC 1 A (Resistance) 0.2 A (Inductive load) 30 VDC 1 A(Resistance) 0.2 A(Inductive load) Minimum contact capacity 100 VAC, 10 mA 5 VDC, 100 mA

Item	Symbol	Name	Description	Electrical characteristics
Monitor output	Ao1	Analog output (Voltage/Current)	Terminal [Ao1] can be switched between analog voltage output and analog current output by parameter setting. - Analog voltage output Output any monitor as a 0 to 10 VDC voltage signal. - Analog current output Output any monitor as a 4 to 20 mA current signal.	Analog voltage output: Maximum allowable current: 2 mA Output voltage accuracy: ±10 % (Ambient temp.: 25 ℃±10 ℃) Analog current output: Allowable load impedance: 250 Ω or less Output voltage accuracy: ±20 % (Ambient temp.: 25 ℃±10 ℃)
	Ao2	Analog voltage output or Pulse output	Terminal [Ao2] can be switched between analog voltage output and pulse output by parameter setting. - Analog voltage output Output any monitor as a 0 to 10 VDC voltage signal. - Pulse output Output any monitor as a 0/10 VDC pulse signal or PWM signal.	Analog voltage output: Maximum allowable current: 2 mA Output voltage accuracy: ±10 % (Ambient temp.: 25 ℃±10 ℃) Pulse output : Maximum allowable current: 2 mA Maximum output frequency: 32 kHz
Serial communication	SP SN	Modbus communication	RS485 ports for Modbus-RTU/ EzCOM. To connect the signal ground of the external control device, use [L] terminal.	Maximum baud rate: 115.2 kbps Built-in termination resistor: 120 Ω (Switched by dip switch) SP: RS485 differential (+) signal SN: RS485 differential (-) signal
Functional safety	P24S	24 VDC output	24 VDC power supply dedicated for [ST1]/[ST2] input.	Maximum output current: 100 mA
	CMS	Common for 24 VDC output	Common terminal for [P24S].	—
	ST1 ST2	STO input 1 STO input 2	Input terminal for STO signal. For details, refer to "14.1 Using the Safety Function STO (Safe Torque Off)".	Between [ST1]/[ST2] and [CMS] ON voltage: Min. 15 VDC OFF voltage: Max. 5 VDC Max. allowable voltage: 27 VDC Load current: 5.8 mA (at 27 VDC) Internal resistance: 4.7 kΩ
	11 ([EDM])	STO state monitor	When EDM switch is turned ON, output terminal [11] becomes "STO state monitor output [EDM]". For details, refer to "14.1 Using the Safety Function STO (Safe Torque Off)".	Open collector output Between [EDM] and [CM2] Max. allowable voltage: 27 VDC Max. allowable current: 50 mA Voltage drop when turned on: 4 VDC or less

5.4.2 Recommended Wire Diameter and Wiring to Control Circuit Terminals

Q

- What are the recommended terminals and how to wire for the control terminal?

A

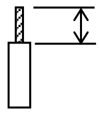
- The control circuit terminal block of WJ-C1 is a spring clamp type terminal.
- For the convenience of wiring and improvement of connection reliability, it is recommended to use ferrule terminals with the following specifications.

!

• When mounting the option board, use ferrules without a sleeve and wire them that they do not hit the option case.

Recommended wire diameter

Item	Applicable wire		
	Solid wire mm^2 (AWG)	Stranded wire mm^2 (AWG)	Ferrule terminal mm^2 (AWG)
Control terminal	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	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)

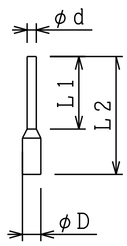


Stripped length for solid wire and stranded wire: approx. 8 mm

Recommended terminal

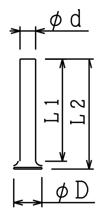
■ Ferrule with sleeve

Wire size mm^2 (AWG)	Ferrule model*1	L1 [mm]	L2 [mm]	φd [mm]	φD [mm]
0.25 (24)	AI 0,25-8YE	8	12.5	0.8	2.0
0.34 (22)	AI 0,34-8TQ	8	12.5	0.8	2.0
0.5 (20)	AI 0,5-8WH	8	14	1.1	2.5
0.75 (18)	AI 0,75-8GY	8	14	1.3	2.8



■ Ferrule without sleeve

Wire size mm^2 (AWG)	Ferrule model*1	L1 [mm]	L2 [mm]	φd [mm]	φD [mm]
0.5 (20)	A 0,5-8	7.3	8	1.0	2.1
0.75 (18)	A 0,75-8	7.3	8	1.2	2.3



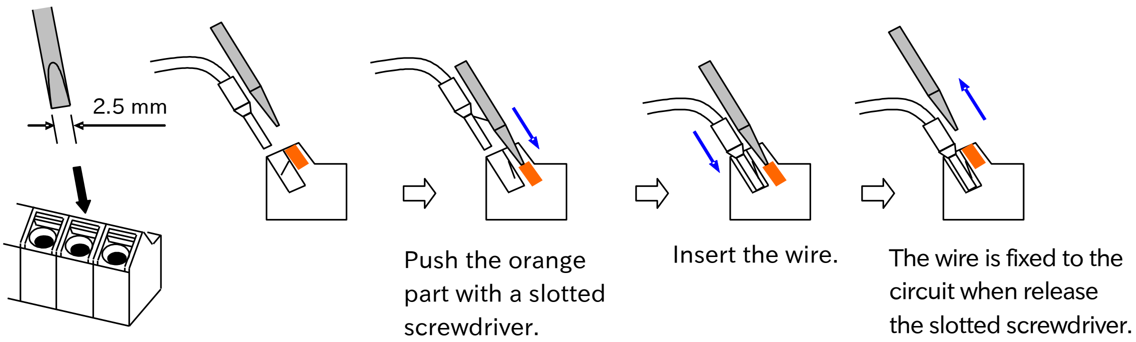
*1. Manufacturer: Phoenix Contact GmbH & Co. KG Crimping tool: CRIMPFOX 6

Method of wiring/detaching wires

(1) Push the orange part on the control terminal with a slotted screwdriver (with a wide of 2.5 mm or less). (Insertion hole will open).

(2) Plug in the wire or ferrule terminal to the wire insertion hole (round hole) while pressing the orange part with a slotted screwdriver.

(3) The wire is fixed to the circuit when release the screwdriver.



- When pulling out the wire, press the orange part with a slotted screwdriver.

5.4.3 Switching Sink/Source Logic and Connecting External Power Supply/Programmable Controller

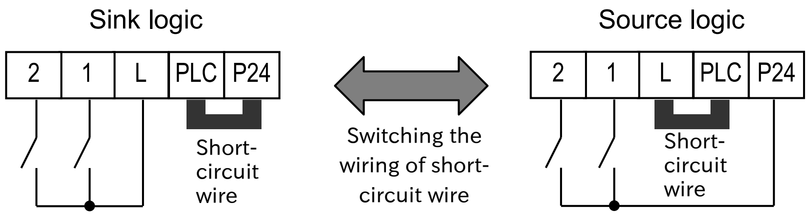
Q

- How can the sink/source logic of the terminals be switched?
- How can an external power supply or external devices such as a programmable controller (PLC) be connected to the terminals?

A

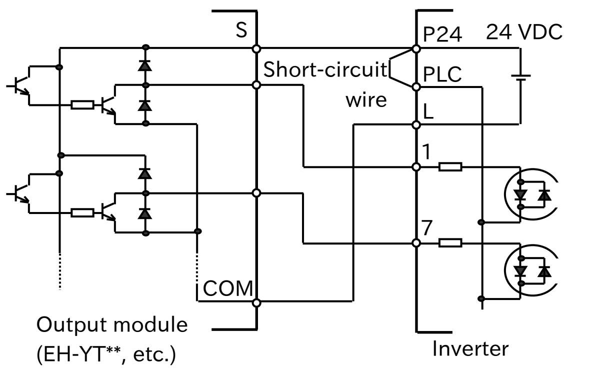
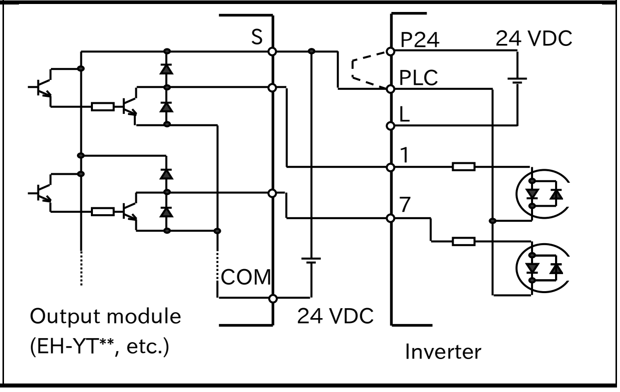
Method of switching sink/source logic for intelligent input terminals

- To switch the logic of the input terminals to source logic, remove the short-circuit wire between [P24] and [PLC] terminal on the control circuit terminal and connect it between [PLC] and [L] terminal. (The factory default of the logic depends on the destination.)
- Refer to the figure below for wiring when using an external power supply and wiring with external devices such as programmable controllers.

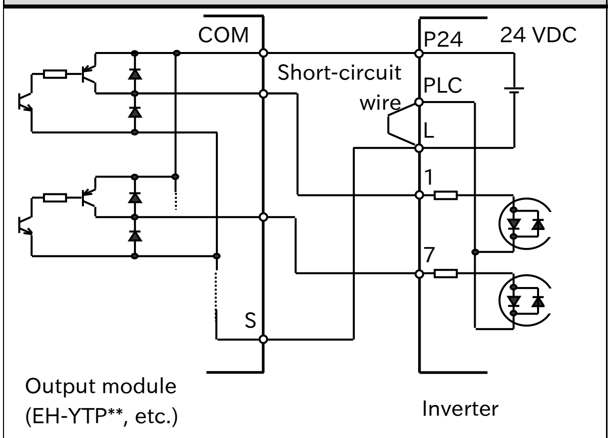
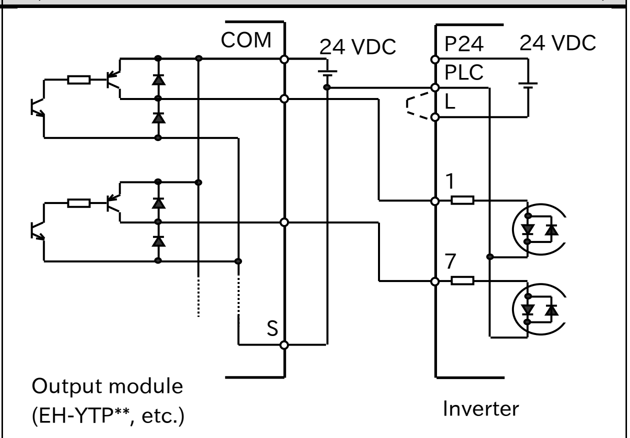


Connecting the intelligent input terminals to a programmable controller

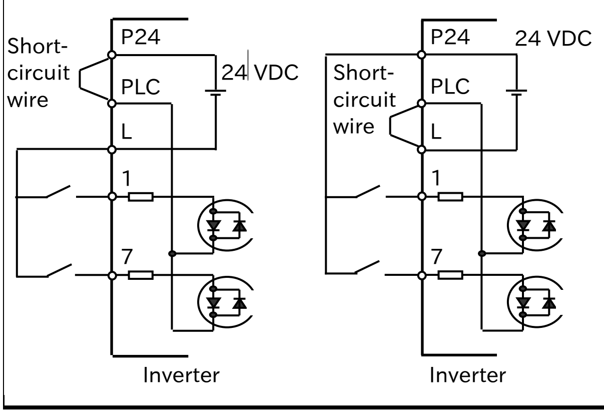
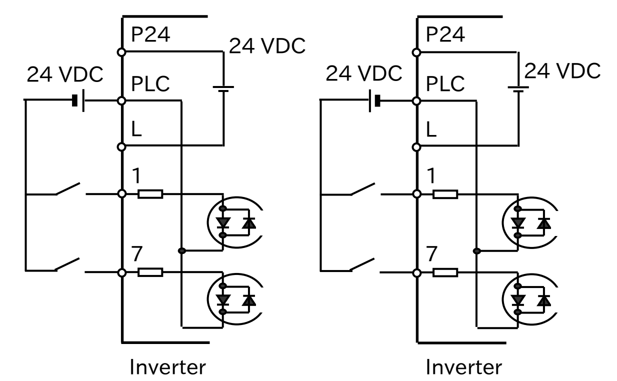
Sink logic

When using the inverter's internal power supply	When using an external power supply (Remove the short-circuit wire from the control terminal.)
	

Source logic

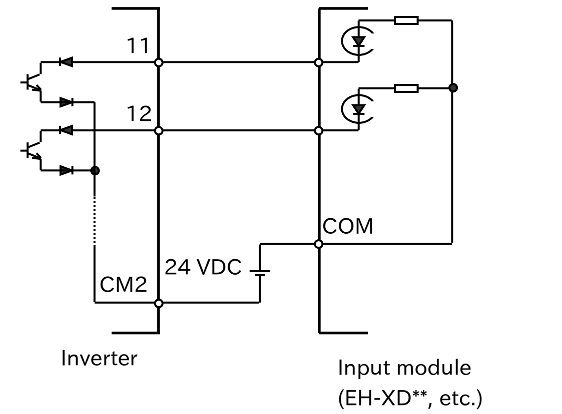
When using the inverter's internal power supply	When using an external power supply (Remove the short-circuit wire from the control terminal.)
	

No-voltage switch

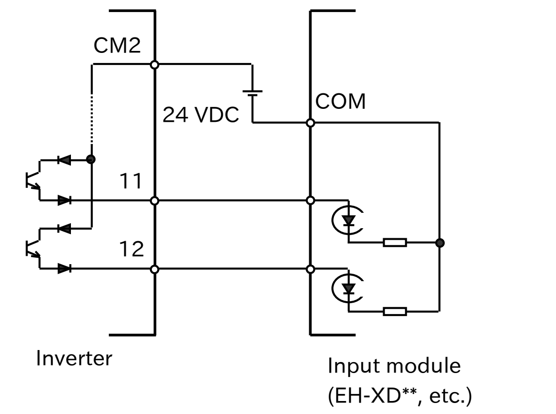
When using the inverter's internal power supply	When using an external power supply (Remove the short-circuit wire from the control terminal.)
	

Connecting the intelligent output terminals to a programmable controller

Sink logic



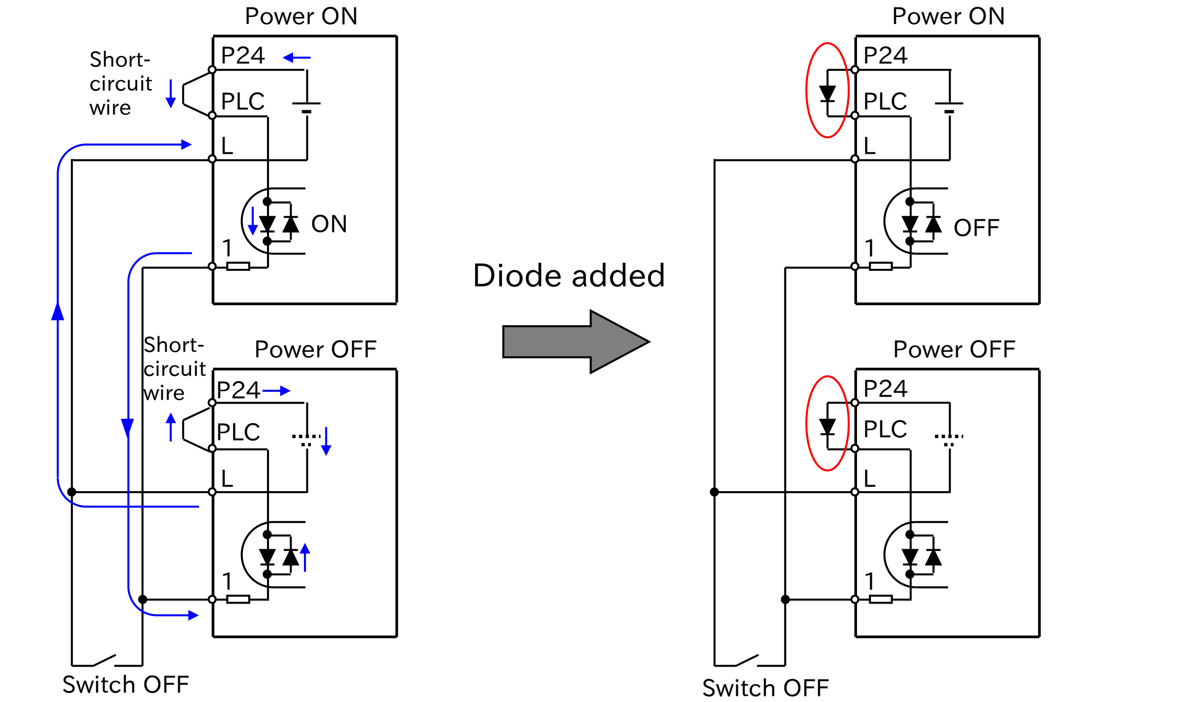
Source logic



Cautions when using multiple inverters

- When a common input (switch, etc.) is used for multiple inverters and the timing of power-on is different, the current may run around as shown in the figure below, and it may be recognized as ON even if the input is OFF. In that case, be sure to insert a diode (rated 50 V/0.1 A) in the positions shown in the figure to prevent the sneak current.

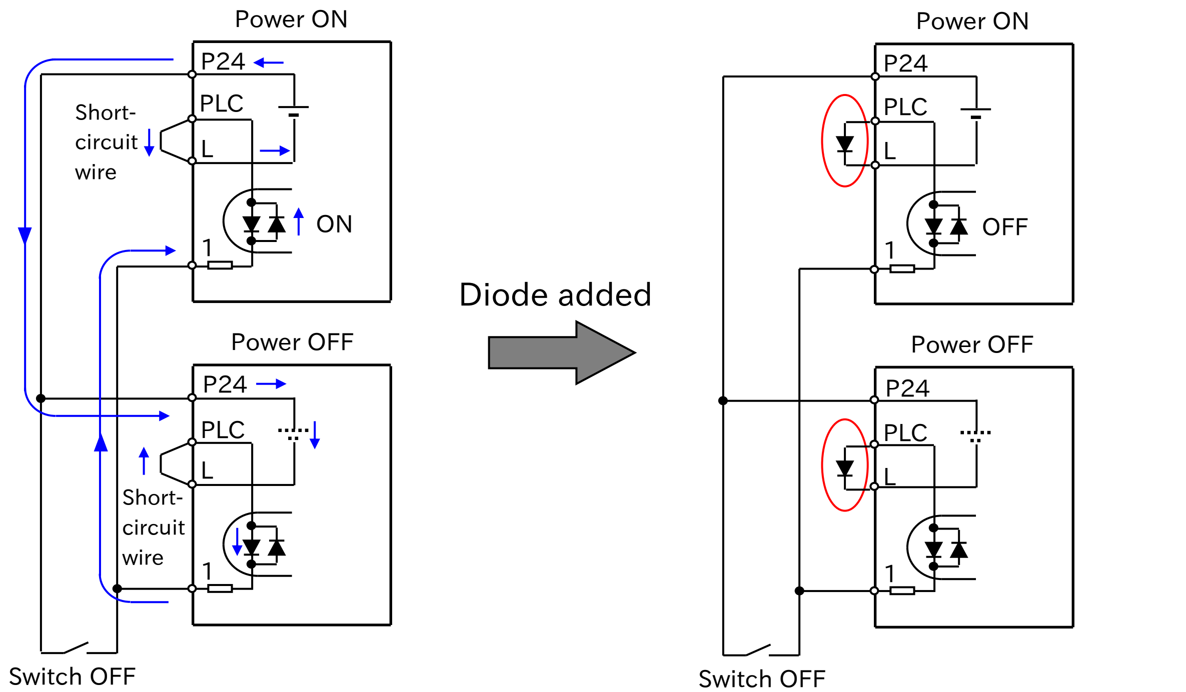
Sink logic



When there is no diode, the current will flow round and the input will turn on even though the switch is off.

Diodes are installed instead of the short-circuit wires to prevent the sneak current.

Source logic



When there is no diode, the current will flow round and the input will turn on even though the switch is off.

Diodes are installed instead of the short-circuit wires to prevent the sneak current.

(Memo)

6

Chapter 6 Operation Check/Residual Risk

This chapter describes residual risks during operation and items to be checked.
The customer who uses the product should appropriately conduct risk assessment before trial run and using the product, and properly protect their personnel and systems.
Although this chapter describes all the possible measures to make sure, it does not cover all the risks in your systems. Please note that we will bear no responsibility for damages resulting from causes described in this chapter. Be sure to conduct risk assessment of the system equipped with this product.
Also carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

6.1 Overview of Residual Risk Checklist

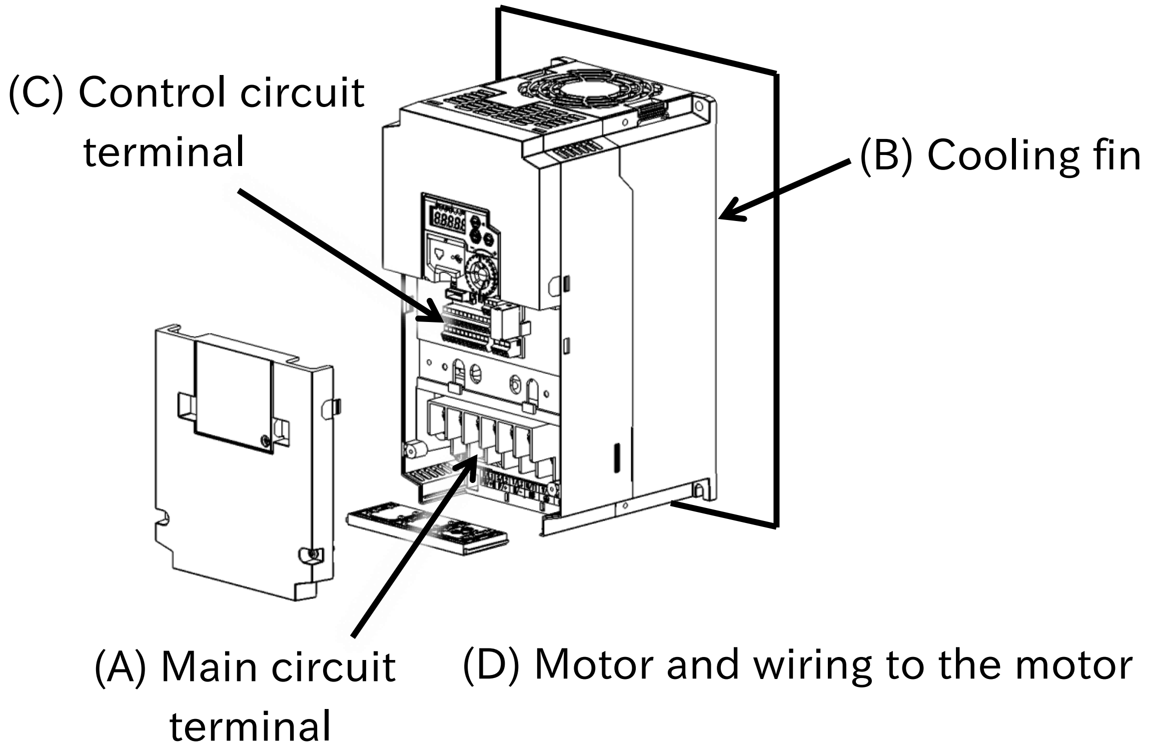
- The residual risk checklist is classified according to the following two definitions based on "Chapter 1 Safety Instructions/Risks".

⚠ DANGER	Indicates that incorrect handling may cause hazardous situations, which have a high possibility of resulting in serious personal injury or death, and may result in major physical loss or damage.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous situations, which may result in moderate or slight personal injury or damage, and may result in only physical loss or damage.

- Even the content described as "⚠CAUTION" may lead to serious danger depending on the situation. They all contain important information. Be sure to follow these instructions.
- Other notes are also described with "⚠". Pay attention to this information and be sure to observe it.

Check points for residual risk

- Please check for residual risks before turning on the power supply upon completion of the installation.



6.2 Residual Risk Checklist

No.	Process	Work	Target section	Residual risk	Details of hazard	Protection measures	✓
1	Installation	Installation	(B)	CAUTION	Damage caused by careless carrying.	Do not drop the product. Do not carry the inverter in a manner that applies force to the cover or the keypad.	☐
2	Installation	Installation	General	CAUTION	Reduction of component life due to use in a location exposed to direct sunlight or at a temperature outside of the specification range.	Ensure that the ambient temperature is within the standard specification range in the whole year by means of cooling and ventilation.	☐
3	Installation	Installation	General	CAUTION	Short-circuit failure due to use in a location with humidity or condensation outside of the specification range.	Ensure that the ambient temperature is within the standard specification range in the whole year by means of cooling and ventilation. Otherwise, install the product in a location free from condensation.	☐
4	Installation	Installation	(B)	DANGER	The cooling fin that is heated to exceed 150˚C ignites a flammable wall.	Install the inverter on an inflammable metal wall.	☐
5	Installation	Installation	General	CAUTION	Component failure due to ingress of dust, corrosive gas, or other substances.	Install the inverter inside a totally enclosed panel.	☐
6	Installation	Installation	General	CAUTION	Reduction of a component life due to degradation of cooling capability by horizontal installation.	Install the inverter vertically.	☐
7	Installation	Installation	General	CAUTION	When the fin of the inverter is installed outside of cabinet, the cooling fan fails due to droplet, oil mist, etc.	When the fin of the inverter is installed outside of cabinet, install it in a location free from droplet, oil mist, etc.	☐
8	Installation Maintenance	Wiring	(A)	DANGER	The arc discharge due to screws loosened by vibration, and ignites the internal components.	Check screws are appropriately tightened on a regular basis.	☐
9	Installation Maintenance	Wiring	General	DANGER	The arc discharge due to screws loosened by vibration, and ignites the flammable materials.	Check screws are appropriately tightened on a regular basis. Do not place flammable materials around the installed inverter.	☐
10	Use Maintenance	Wiring Inspection	(A)	DANGER	When the cover is removed, electric shock is caused in a high-voltage section.	Do not remove the cover when power is supplied. After power is turned off, wait 10 minutes or more to perform working.	☐
11	Use Maintenance	Wiring Inspection	(C)	DANGER	When the operator removes the cover, electric shock is caused when a tool touches a high-voltage section.	Do not remove the cover when power is supplied. After power is turned off, wait 10 minutes or more to perform working.	☐

No.	Process	Work	Target section	Residual risk	Details of hazard	Protection measures	✓
12	Installation	Wiring	(D)	DANGER	Due to long wiring length, the insulation of the motor degraded by surge, which eventually burns the motor.	If the wiring length exceeds 20 m, shorten the motor wiring length. Or install the optional LCR filter and output-side AC reactor.	☐
13	Installation	Wiring	(D)	DANGER	By connecting a motor to the different voltage class inverter, insulation of the motor degraded, which eventually burns the motor.	Match the voltage class of the inverter and the motor.	☐
14	Installation	Wiring	(A)	DANGER	Due to unstable output caused by imbalance of power supply voltage, undervoltage, extreme voltage drop or aging of motor, the motor burns, and eventually the inverter fails.	Check the receiving voltage of inverter, power receiving method, and power supply capacity are appropriate.	☐
15	Use Maintenance	Wiring Inspection	(D)	DANGER	The short circuit failure caused by degradation of motor insulation, cracking of aged wires or other causes will eventually cause the inverter fails.	Check there is no cracking of wires and the screws are not loose by inspection.	☐
16	Installation Use	Setting	(D)	DANGER	By performing inappropriate parameter settings, high current flows in the motor, causing it to burn.	Set appropriate values for parameters related to output to the motor, such as parameters described in "Chapter 8 Mandatory Setting for Motor Drive and Test Run" (load type, base frequency, motor rated voltage, motor constants, and electronic thermal), control mode, torque boost ([AA121], [Hb140] to [Hb142], [HC101] to [HC102]), and DC braking setting ([AF101] to [AF109]).	☐
17	Use	Operation	(D)	DANGER	The stopped motor automatically starts running.	To restart the motor after stopping it by a function, define it in the system.	☐
18	General	General	General	DANGER	Damage and injury caused by hidden risks.	Conduct risk assessment on the system, and check that the fail-safe function is incorporated into the system.	☐
19	General	General	General	DANGER	Damage and injury caused by failure to obtain additional information concerning risks.	Obtain the latest version of User's Guide so that necessary information can be checked. Communicate information to the end user as necessary.	☐

* Installation, wiring and setting work need to be performed by specialized technicians.

7

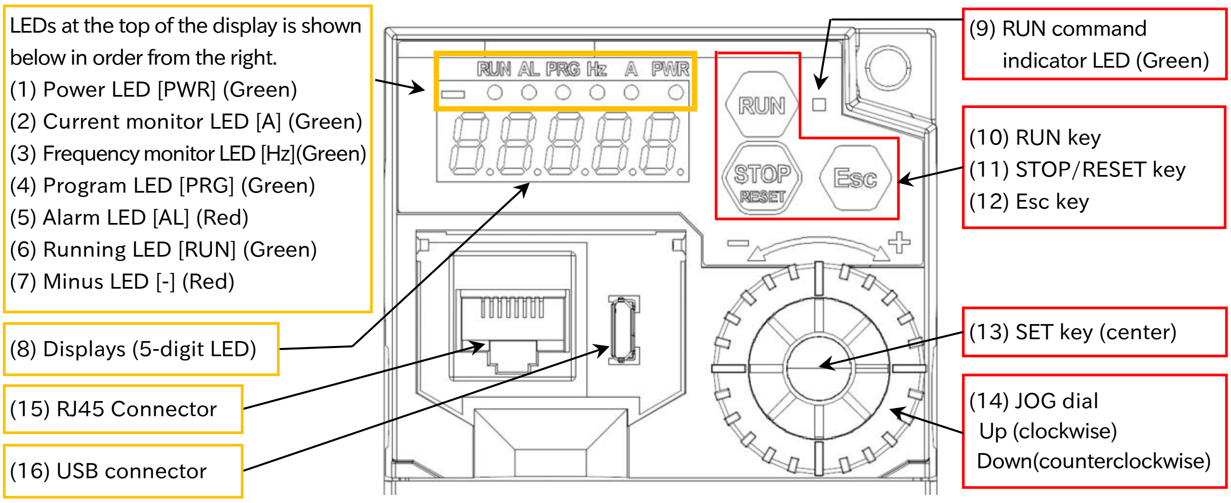
Chapter 7 Keypad and Related Functions

This chapter describes the details of the keypad and related functions of the inverter.
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

7.1 How to Use Keypad

7.1.1 Name and Content of Each Part

- The names and descriptions of each part of the keypad are shown below.

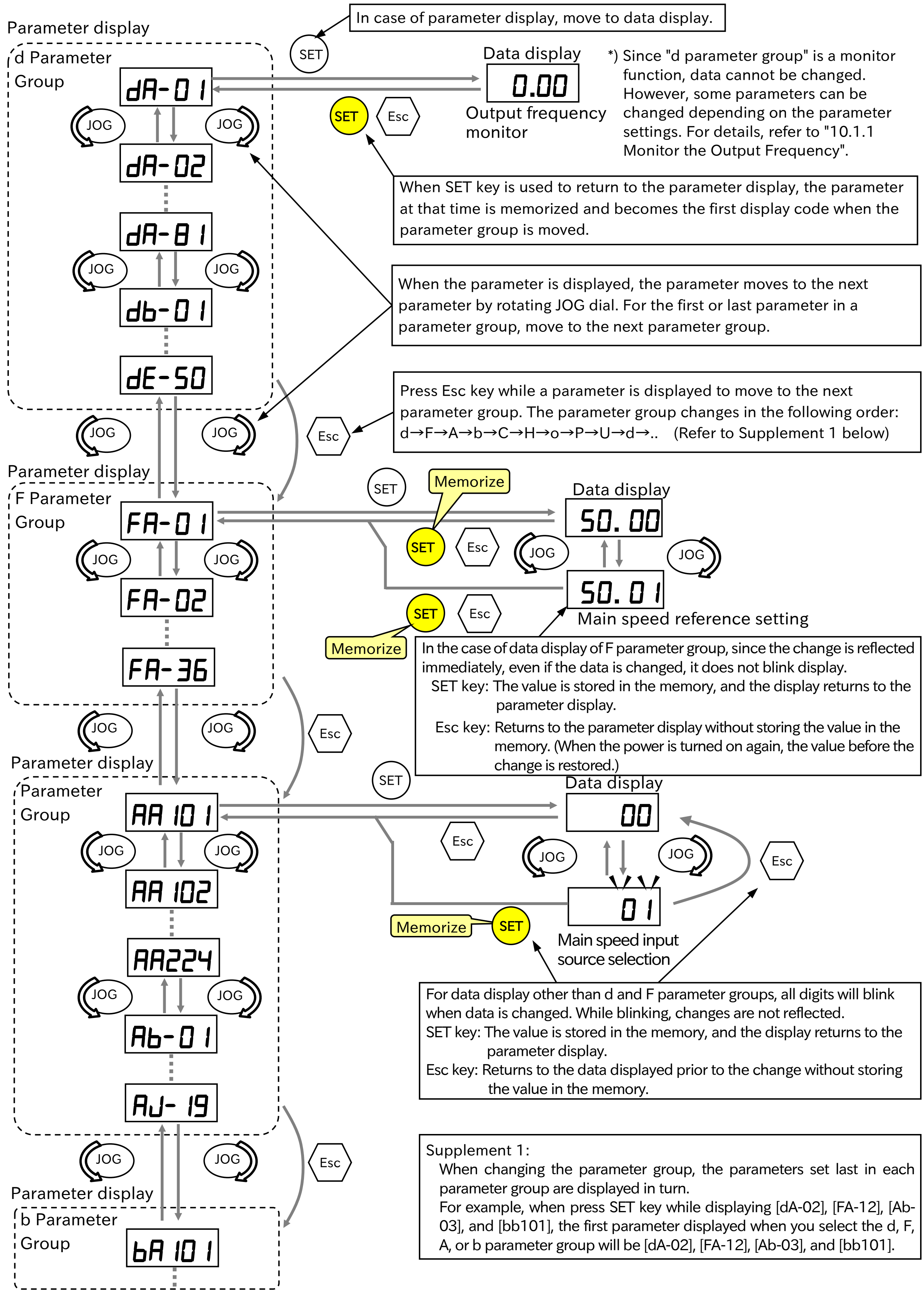


Name	Description
(1) Power LED [PWR] ● (Green)	Lights up (green) while the power is supplying to the inverter.
(2) Current monitor LED [A] ● (Green)	Lights up (green) when the unit of the displayed data is current.
(3) Frequency monitor LED [Hz] ● (Green)	Lights up (green) when the unit of the displayed data is frequency.
(4) Program LED [PRG] ● (Green)	• Lights up (green) when the display shows changeable data (set value). • Flashes when the setting value is inconsistent. Refer to See "15.3 Troubleshooting for Warning Functions".
(5) Alarm LED [AL] ● (Red)	Lights up (red) when the inverter trips. For details on tripping actions, refer to "Chapter 15 Tips/FAQ/ Troubleshooting".
(6) Running LED [RUN] ● (Green)	Lights up (green) when the inverter is running. (This LED lights in [With RUN command] or [Inverter output in progress]. This LED also lights during deceleration after RUN command OFF or when RUN command is input at 0 Hz of the set frequency.)
(7) Minus LED [-] ● (Red)	Lights up (red) when the display data is negative.
(8) Displays (5-digit LED)	Displays data (red) such as various parameters and frequency setting values.
(9) RUN command indicator LED ● (Green)	• Lights up (green) when the RUN command input source is "Keypad". (RUN key on the keypad is enabled.) • Even if the RUN command input source is RUN key on the keypad, this LED blinks when RUN key is pressed while operation is disabled due to some function. For details, refer to section "10.3.7 Checking the Detail of Warning Status".
(10) RUN key	Run the inverter. However, it is effective when RUN command input source is "Keypad's RUN key". Operation direction is set by "RUN-key command rotation direction [AA-12]".
(11) STOP/RESET key	• Decelerates and stops the inverter. Use the "STOP-key enable [AA-13]" to enable/disable the operation stopping function. • Resets (recovers from trip state) when the inverter is tripping.

Name	Description
(12) Esc key	• In case of parameter display, it moves to the next parameter group and displays the parameter set at the end of each group. Even after the power is turned off, the memory of the last set parameter is maintained. • When displaying data, cancel setting and return to parameter display. • Regardless of the screen, press and hold (about 3 seconds) to display the data (output frequency) of "Output frequency monitor [dA-01]". • When a remote operator (such as a VOP) is connected, pressing and holding Esc key for 1 second enables the remote operator. Press and hold Esc key again to return to the remote operator.
(13)SET key	• When displaying parameters, move to data display. • When displaying the data, the setting is determined and stored, and the display returns to the parameter display. You can also memorize the last parameter that you pressed SET and view that parameter when the power is turned on. For details, refer to "7.2.6 Setting the Initial Keypad Display". • For each parameter group, the last parameter set is stored and becomes the first parameter displayed when Esc key is used to move the parameter group.
(14)JOG dial	• Change the parameter or increase/decrease the set data. Rotate clockwise to increase, or rotate counterclockwise to decrease. • The degree of increase/decrease and carry of parameters and setting data with respect to the speed of turning JOG dial can be set with "JOG sensitivity [UA-76]" and "JOG carry sensitivity [UA-77]".
(15)RJ45 Connector	Connector for optional remote operator connection (dedicated for RS-422). When a remote operator is connected, the keys on the main unit do not work. The data to be displayed on the (8) Displays at this time is set in "Display while external operator connected [UA-95]". Caution: The remote operator should be connected or disconnected with the power supply disconnected.
(16)USB connector	This is a connector (USB 2.0 Micro-B connector) for connecting a PC. Used to connect to the Inverter configuration software ProDriveNext.

7.1.2 Key Operation Method

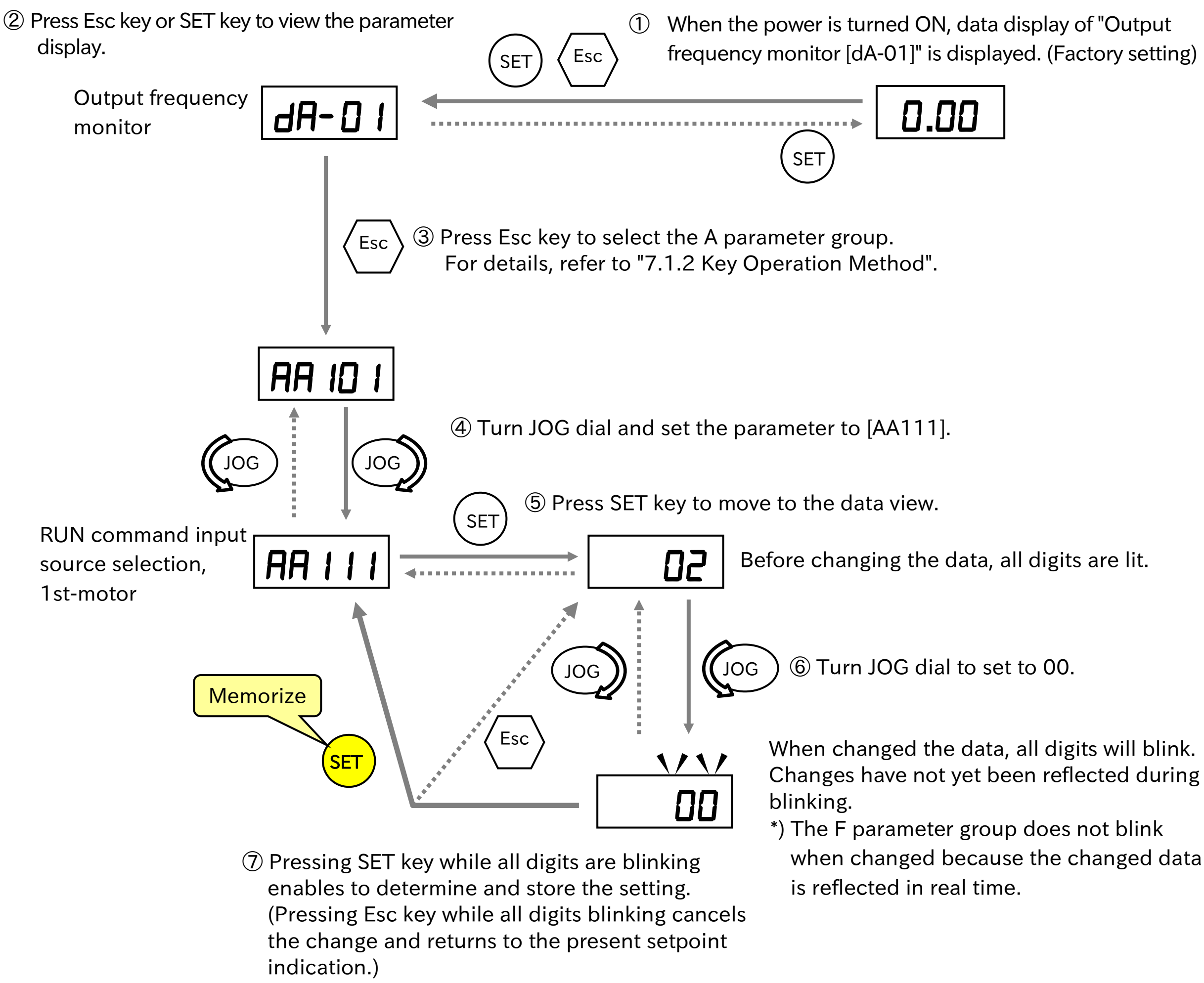
How to display and change data using the keypad



7.1.3 Example of Parameter Setting by Keypad

Operation example when changing the parameter setting value

- The following shows an operation example in which the indication on the keypad is changed from "0.00" (factory-default status when the power is turned ON) in the data section of "Output frequency monitor [dA-01]" to "[FW]/[RV] terminal (00)" from "Keypad's RUN-key (02)" for "RUN command input source selection [AA111]", and then change [AA111] setting from "Keypad's RUN key (02)" to "[FW]/[RV] terminal (00)"

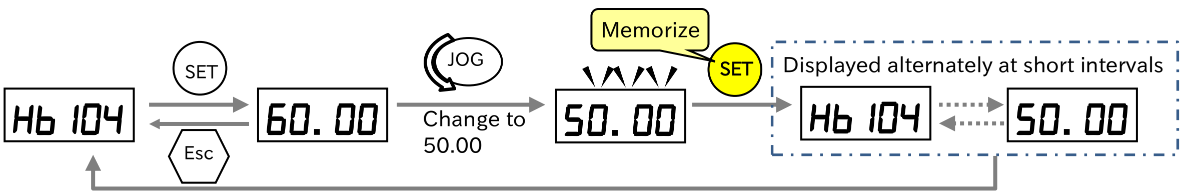


Reference:

- Pressing and holding Esc key (about 3 seconds) enables to jump to the data display of "Output frequency monitor [dA-01]".
- When there are parameters that cannot be displayed or changed, "Display restriction selection [UA-10]" or "Soft-Lock selection [UA-16]" may be set. For details, refer to "7.2 Keypad Related Funcions".

Display when changing setting data

- When the setting is changed and SET key is pressed, parameters and data are alternately displayed for a short time so that it can be confirmed that the data has been changed, and then the display returns to the parameter display.



Changing Parameters/Data for Each Digit (Single-edit mode)

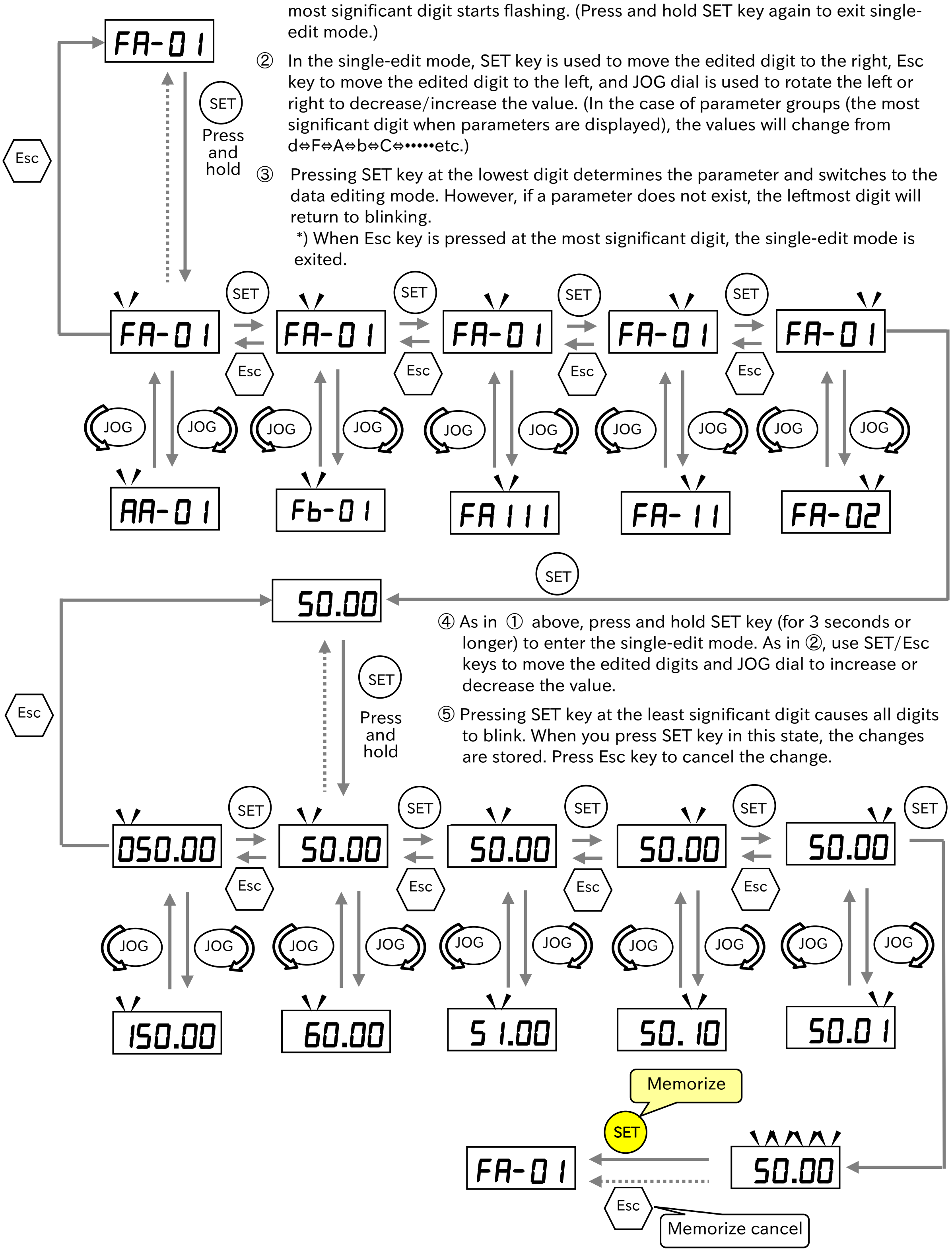
• Parameter selection and data change can also be made in the single-edit mode, in which the value is increased or decreased by one digit after specifying the digit to be increased or decreased. It is effective for changing setting value with large number of digits etc.

① Press and hold SET key (for 3 seconds or longer) to enter the single-edit mode. The most significant digit starts flashing. (Press and hold SET key again to exit single-edit mode.)

② In the single-edit mode, SET key is used to move the edited digit to the right, Esc key to move the edited digit to the left, and JOG dial is used to rotate the left or right to decrease/increase the value. (In the case of parameter groups (the most significant digit when parameters are displayed), the values will change from d⇔F⇔A⇔b⇔C⇔•••••etc.)

③ Pressing SET key at the lowest digit determines the parameter and switches to the data editing mode. However, if a parameter does not exist, the leftmost digit will return to blinking.

*) When Esc key is pressed at the most significant digit, the single-edit mode is exited.



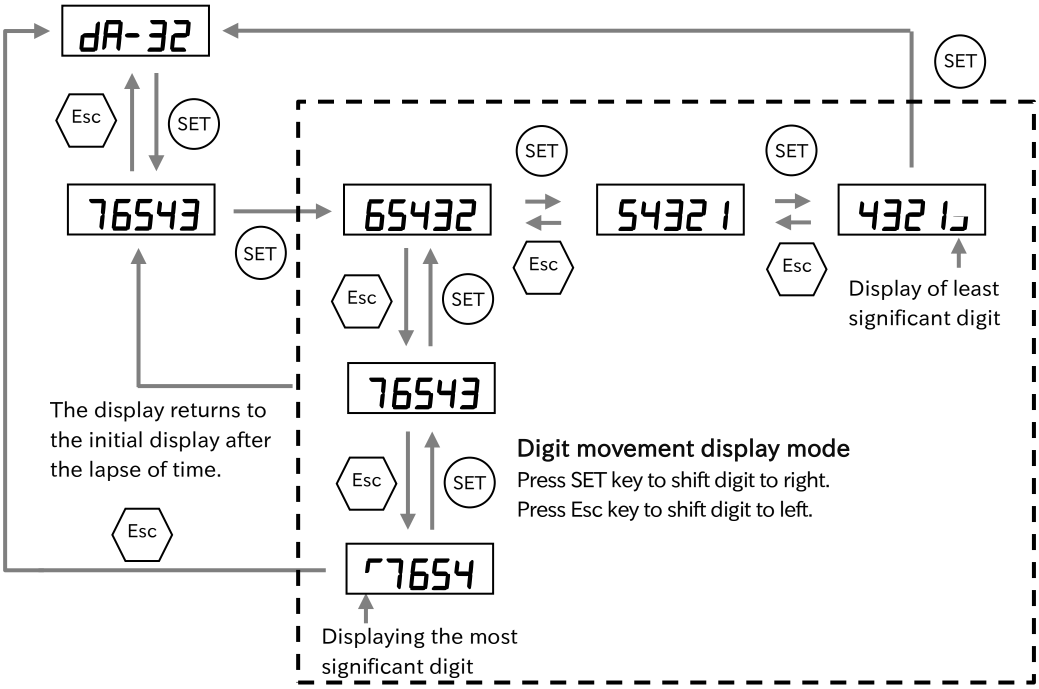
④ As in ① above, press and hold SET key (for 3 seconds or longer) to enter the single-edit mode. As in ②, use SET/Esc keys to move the edited digits and JOG dial to increase or decrease the value.

⑤ Pressing SET key at the least significant digit causes all digits to blink. When you press SET key in this state, the changes are stored. Press Esc key to cancel the change.

• Single-edit mode is valid for parameter display and when the setting range is numeric. It is invalid when the setting range is a number selection such as 01, 02, 03...

Digit movement display mode

- The display section of the keypad basically displays the upper five digits at all times, but it is possible to check the hidden part temporarily by carrying out the following operation.



!

- It is possible to adjust the amount of increase or decrease when turn JOG dial using the following parameters. Adjust the value if necessary.

Code	Name	Contents	Data
[UA-76]	JOG sensitivity	Set the amount of increase or decrease by JOG dial. The larger this setting is, the more JOG dial rotations are required to increase or decrease the setting.	1 to 24
[UA-77]	JOG carry sensitivity	Set the degree of carry (carry down) performed when increasing or decreasing with JOG dialing. The smaller this setting is, the easier it is to carry (carry down).	1 to 100

7.2 Keypad Related Functions

7.2.1 Restrict Display Parameter

Q
- You want to display only the necessary parameters.
- You want to display fewer parameters.
- You want to display only the changed parameters.

A
- Parameters displayed on the keypad can be partially hidden by setting "Display restriction selection [UA-10]". Refer to the table in this section for the parameters that are displayed at each setting.
- When the 2nd-motor control function is not used, the number of displays can be reduced by setting "2nd-motor parameter display selection [UA-21]" to "Hidden (00)". For details of the 2nd-motor control function and the target parameter, refer to "9.7.13 Switching to 2nd Motor Control Mode".
- When the communication option is not used, the number of displays can be reduced by setting "Option parameter display selection [UA-22]" to "Hidden (00)". For details of communication options, refer to "Chapter 13 Communication Option".
- [UA-10] settings can also be password-protected. For details, refer to "7.2.5 Protecting Data with Passwords".

Code	Name	Description	Data
[UA-10]	Display restriction selection	Full display (initial value)	00
		Function-specific display	01
		User setting display	02
		Data compare display	03
		Monitor only	04
[UA-21]	2nd-motor parameter display selection	Hide the second setting parameter [**2**].	00
		The 2nd motor parameter [**2**] is displayed.	01
[UA-22]	Option parameter display selection	Hide the optional parameter [o****].	00
		The optional parameter [o ****] is displayed.	01
[UA-31] to [UA-62]	User-parameter 1 selection to User-parameter 32 selection	No registration	No
		Register the parameter to be displayed. Up to 32 parameters can be registered.	Parameters other than [UA-31] to [UA-62]

■ Detailed information on the settings of "Display restriction selection [UA-10]"

Setting for [UA-10]	Details
Full display (00)	Displays all parameters.
Function-specific display (01)	Use this setting to hide the parameters of a function that you are not using to reduce its display. When a specific function is not selected, the parameters related to that function are hidden. For details on display conditions, refer to "Conditions and displayed parameters of individual function display ([UA-10]=01)" in this section.
User setting display (02)	Use this setting to display only the parameters that are set by the user. Up to 32 parameters can be registered in "User-parameters 1 to 32 selection ([UA-31] to [UA-62])". When "User setting display (02)" is set after registration, only the parameters registered in [UA-31] to [UA-62], "Output frequency monitor [dA-01]", "Main speed reference setting (monitor) [FA-01]", "Password for display [UA-01]" and "Display restriction selection [UA-10]" are displayed. The user parameter can also be set to automatically store the changed parameter. For details, refer to "7.2.7 Automatic Registration of Changed Parameter History".
Data compare display (03)	Use this setting to know the changed parameter from the factory setting, etc. All monitor displays [d****] and [F****], "Password for display [UA-01]", and "Display restriction selection [UA-10]" are displayed at all times.
Monitor only (04)	Only the monitor displays [d****] and [F****], "Password for display [UA-01]", and "Display restriction selection [UA-10]" are displayed.

Conditions and displayed parameters of individual function display ([UA-10]=01)

- " * " of parameter code and " *** " of parameter name in the table below indicates the parameters subject to the 2nd-motor control function. When " * " is 1 and " *** " is 1st, it will be the 1st-motor setting, and when " * " is 2 and " *** " is 2nd, it will be the 2nd-motor setting.

IM Control parameter
Display condition: [AA121]≦10 or [AA221]≦10

Code	Name
[Hb*02]	Async. Motor capacity setting, ***-motor
[Hb*03]	Async. Motor number of poles setting, ***-motor
[Hb*04]	Async. Motor base frequency setting, ***-motor
[Hb*05]	Async. Motor maximum frequency setting, ***-motor
[Hb*06]	Async. Motor rated voltage, ***-motor
[Hb*08]]	Async. Motor rated current, ***-motor
[Hb*10]	Async. Motor constant R1, ***-motor
[Hb*12]	Async. Motor constant R2, ***-motor
[Hb*14]	Async. Motor constant L, ***-motor
[Hb*16]	Async. Motor constant I0, ***-motor
[Hb*18]	Async. Motor constant J, ***-motor
[Hb*30]	Minimum frequency adjustment, ***-motor
[Hb*31]	Reduced voltage start time setting, ***-motor
[Hb*40]	Manual torque boost operation mode selection, ***-motor
[Hb*41]	Manual torque boost value, ***-motor
[Hb*42]	Manual torque boost peak speed, ***-motor
[Hb*45]	Eco drive enable, ***-motor
[Hb*46]	Eco drive response adjustment, ***-motor
[Hb*50]	Free-V/f frequency 1 setting, ***-motor
[Hb*51]	Free-V/f voltage 1 setting, ***-motor
[Hb*52]	Free-V/f frequency 2 setting, ***-motor
[Hb*53]	Free-V/f voltage 2 setting, ***-motor
[Hb*54]	Free-V/f frequency 3 setting, ***-motor
[Hb*55]	Free-V/f voltage 3 setting, ***-motor
[Hb*56]	Free-V/f frequency 4 setting, ***-motor
[Hb*57]	Free-V/f voltage 4 setting, ***-motor
[Hb*58]	Free-V/f frequency 5 setting, ***-motor
[Hb*59]	Free-V/f voltage 5 setting, ***-motor
[Hb*60]	Free-V/f frequency 6 setting, ***-motor
[Hb*61]	Free-V/f voltage 6 setting, ***-motor
[Hb*62]	Free-V/f frequency 7 setting, ***-motor
[Hb*63]	Free-V/f voltage 7 setting, ***-motor
[Hb*70]	Slip compensation P-gain with encoder, ***-motor
[Hb*71]	Slip compensation I-gain with encoder, ***-motor
[Hb*80]	Output voltage gain, ***-motor
[HC*01]	Automatic torque boost voltage compensation gain, ***-motor
[HC*02]	Automatic torque boost slip compensation gain, ***-motor
[HC*11]	Boost value at start, ***-motor (IM-SLV)
[HC*14]	Direction reversal protection, ***-motor
[HC*15]	Torque conversion method selection, ***-motor
[HC*20]	Torque current reference filter time constant, ***-motor
[HC*21]	Speed feedforward compensation gain, ***-motor
[HC*37]	Flux settling level, ***-motor
[HC*41]	Modulation threshold 1, ***-motor
[HC*42]	Modulation threshold 2, ***-motor

SM(PMM) Control parameter
Displayed conditions: [AA121]>10 or [AA221]>10

Code	Name
[Hd*02]	Sync. Motor capacity setting, ***-motor
[Hd*03]	Sync. Motor number of poles setting, ***-motor
[Hd*04]	Sync. Motor base frequency setting, ***-motor
[Hd*05]	Sync. Motor maximum frequency setting, ***-motor
[Hd*06]	Sync. Motor rated voltage, ***-motor
[Hd*08]	Sync. Motor rated current, ***-motor
[Hd*10]	Sync. Motor constant R, ***-motor
[Hd*12]	Sync. Motor constant Ld, ***-motor
[Hd*14]	Sync. Motor constant Lq, ***-motor
[Hd*16]	Sync. Motor constant Ke, ***-motor
[Hd*18]	Sync. Motor constant J, ***-motor
[Hd*30]	Sync. Motor minimum frequency adjustment, ***-motor
[Hd*31]	Sync. Motor No-Load current, ***-motor
[Hd*32]	Sync. Motor starting method, ***-motor
[Hd*33]	Sync. Motor IMPE 0V wait number, ***-motor
[Hd*34]	Sync. Motor IMPE detect wait number, ***-motor
[Hd*35]	Sync. Motor IMPE detect number, ***-motor
[Hd*36]	Sync. Motor IMPE voltage gain, ***-motor
[Hd*37]	Sync. Motor IMPE Mg-pole position offset, ***-motor

These parameters are SM(PMM) motor related functions.
For details, contact your supplier or local Hitachi sales office.

Position control parameter
Display condition: [AA123]≠00 or [AA223]≠00

Code	Name
[AE-04]	Positioning completed range setting
[AE-05]	Positioning completed delay time setting

Orientation function
Display condition: [AA123]=01 or [AA223]=01

Code	Name
[AE-10]	Stop position selection of home search function
[AE-11]	Stop position of home search function
[AE-12]	Speed reference of home search function
[AE-13]	Direction of home search function

Absolute position control function
Display condition: [AA123]>01 or [AA223]>01

Code	Name
[AE-20] to [AE-50]	Position reference 0 to 15
[AE-52]	Position control range setting (forward)
[AE-54]	Position control range setting (reverse)
[AE-56]	Position control mode selection
[AE-60]	Teach-in function target selection
[AE-61]	Save current position at power off
[AE-62]	Pre-set position data
[AE-64]	Deceleration stop distance calculation gain
[AE-65]	Deceleration stop distance calculation bias
[AE-70]	Homing function selection
[AE-71]	Direction of homing function
[AE-72]	Low-speed homing speed setting
[AE-73]	High-speed homing speed setting

Internal DC braking function
Display conditions: [AF*01]=01, 02

Code	Name
[AF*03]	DC braking frequency, ***-motor
[AF*04]	DC braking delay time, ***-motor
[AF*05]	DC braking force setting, ***-motor
[AF*06]	DC braking active time at stop, ***-motor
[AF*07]	DC braking operation method selection, ***-motor
[AF*08]	DC braking force at start, ***-motor
[AF*09]	DC braking active time at start, ***-motor

Acceleration/deceleration function
Display conditions: [AC-02]=00

Code	Name
[AC*15]	Accel/Decel change trigger, ***-motor
[AC*16]	Accel 1 to Accel 2 frequency transition point, ***-motor
[AC*17]	Decel 1 to Decel 2 frequency transition point, ***-motor
[AC*20]	Acceleration time 1, ***-motor
[AC*22]	Deceleration time 1, ***-motor
[AC*24]	Acceleration time 2, ***-motor
[AC*26]	Deceleration time 2, ***-motor

Acceleration/Deceleration function
Display conditions: [AC-02]=01

Code	Name
[AC-30]	Acceleration time for Multi-speed 1
[AC-32]	Deceleration time for Multi-speed 1
[AC-34]	Acceleration time for Multi-speed 2
[AC-36]	Deceleration time for Multi-speed 2
[AC-38]	Acceleration time for Multi-speed 3
[AC-40]	Deceleration time for Multi-speed 3
[AC-42]	Acceleration time for Multi-speed 4
[AC-44]	Deceleration time for Multi-speed 4
[AC-46]	Acceleration time for Multi-speed 5
[AC-48]	Deceleration time for Multi-speed 5
[AC-50]	Acceleration time for Multi-speed 6
[AC-52]	Deceleration time for Multi-speed 6
[AC-54]	Acceleration time for Multi-speed 7
[AC-56]	Deceleration time for Multi-speed 7
[AC-58]	Acceleration time for Multi-speed 8
[AC-60]	Deceleration time for Multi-speed 8
[AC-62]	Acceleration time for Multi-speed 9
[AC-64]	Deceleration time for Multi-speed 9
[AC-66]	Acceleration time for Multi-speed 10
[AC-68]	Deceleration time for Multi-speed 10
[AC-70]	Acceleration time for Multi-speed 11
[AC-72]	Deceleration time for Multi-speed 11
[AC-74]	Acceleration time for Multi-speed 12
[AC-76]	Deceleration time for Multi-speed 12
[AC-78]	Acceleration time for Multi-speed 13
[AC-80]	Deceleration time for Multi-speed 13
[AC-82]	Acceleration time for Multi-speed 14
[AC-84]	Deceleration time for Multi-speed 14
[AC-86]	Acceleration time for Multi-speed 15
[AC-88]	Deceleration time for Multi-speed 15

Brake control (forward/reverse common setting)
Display conditions: [AF*30]=01, 02

Code	Name
[AF*31]	Brake release wait time (Forward), ***-motor
[AF*32]	Brake wait time for accel. (Forward), ***-motor
[AF*33]	Brake wait time for stopping (Forward), ***-motor
[AF*34]	Brake confirmation signal wait time (Forward), ***-motor
[AF*35]	Brake release frequency setting (Forward), ***-motor
[AF*36]	Brake release current setting (Forward), ***-motor
[AF*37]	Braking frequency (Forward), ***-motor

Brake control (reverse)
Display conditions: [AF*30]=02

Code	Name
[AF*38]	Brake release wait time (Reverse), ***-motor
[AF*39]	Brake wait time for accel. (Reverse), ***-motor
[AF*40]	Brake wait time for stopping (Reverse), ***-motor
[AF*41]	Brake confirmation signal wait time (Reverse), ***-motor
[AF*42]	Brake release frequency setting (Reverse), ***-motor
[AF*43]	Brake release current setting (Reverse), ***-motor
[AF*44]	Braking frequency (Reverse), ***-motor

Free electronic thermal
Display conditions: [bC*11]=02

Code	Name
[bC*20]	Free electronic thermal frequency-1, ***-motor
[bC*21]	Free electronic thermal current-1, ***-motor
[bC*22]	Free electronic thermal frequency-2, ***-motor
[bC*23]	Free electronic thermal current-2, ***-motor
[bC*24]	Free electronic thermal frequency-3, ***-motor
[bC*25]	Free electronic thermal current-3, ***-motor

Gain Mapping 1
Display conditions: [HA*20]=00

Code	Name
[HA*21]	ASR gain switching time setting, ***-motor
[HA*27]	ASR gain mapping P control P-gain 1, ***-motor
[HA*30]	ASR gain mapping P control P-gain 2, ***-motor

Gain Mapping 2
Display conditions: [HA*20]=01

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

Instantaneous power failure non-stop
Display condition: [bA-30]≠00

Code	Name
[bA-31]	Instantaneous power failure non-stop function, start voltage level
[bA-32]	Instantaneous power failure non-stop function, target voltage level
[bA-34]	Instantaneous power failure non-stop function, deceleration time
[bA-36]	Instantaneous power failure non-stop function, start frequency decrement
[bA-37]	Instantaneous power failure non-stop function, DC bus voltage control P gain
[bA-38]	Instantaneous power failure non-stop function, DC bus voltage control I gain

Overvoltage Suppression Function
Display condition: [bA*40]≠00

Code	Name
[bA*41]	Overvoltage suppression active level, ***-motor
[bA*42]	Overvoltage suppression active time, ***-motor
[bA*44]	Constant DC bus voltage control P gain, ***-motor
[bA*45]	Constant DC bus voltage control I gain, ***-motor

Over-magnetization function
Display Condition: [bA*40]≠00

Code	Name
[bA*47]	Over-magnetization function output filter time constant, ***-motor
[bA*48]	Over-magnetization function voltage gain, ***-motor
[bA*49]	Over-magnetization function level setting, ***-motor

Simulation mode
Display conditions: [PA-20]=01

Code	Name
[PA-21]	Error code selection for alarm test
[PA-22]	Simulation mode: Optional output selection for the output current monitor
[PA-23]	Optional output value setting for the output current monitor
[PA-24]	Simulation mode: Optional output selection for the DC bus voltage monitor
[PA-25]	Optional output value setting for the DC bus voltage monitor
[PA-26]	Simulation mode: Optional output selection for the output voltage monitor
[PA-27]	Optional output value setting for the output voltage monitor
[PA-28]	Simulation mode: Optional output selection for the output torque monitor
[PA-29]	Optional output value setting for the output torque monitor
[PA-30]	Simulation mode: Optional frequency matching start enable setting
[PA-31]	Optional frequency matching start setting value

PID function in general
Display conditions: [AH-01]=01, 02 or [AJ-01]=01, 02

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

PID1 Function
Display conditions: AH-01=01, 02

Code	Name
[db-30]	PID1 feedback value 1 monitor
[db-32]	PID1 feedback value 2 monitor
[db-34]	PID1 feedback value 3 monitor
[db-42]	PID1 set-point monitor (after calculation)
[db-44]	PID1 feedback value monitor (after calculation)
[db-50]	PID1 output monitor
[db-51]	PID1 deviation monitor
[db-52]	PID1 deviation 1 monitor
[db-53]	PID1 deviation 2 monitor
[db-54]	PID1 deviation 3 monitor
[db-61]	Current PID P-Gain monitor
[db-62]	Current PID I-Gain monitor
[db-63]	Current PID D-Gain monitor
[db-64]	PID feedforward monitor
[FA-30]	PID1 set-point 1 setting (monitor)
[FA-32]	PID1 set-point 2 setting (monitor)
[FA-34]	PID1 set-point 3 setting (monitor)
[AH-02]	PID1 deviation inversion
[AH-03]	PID1 unit selection
[AH-04]	PID1 scale adjustment (0%)
[AH-05]	PID1 scale adjustment (100%)
[AH-06]	PID1 scale adjustment (decimal point position)
[AH-07]	PID1 set-point 1 input source selection
[AH-10]	PID1 set-point 1 setting
[AH-12]	PID1 multistage set-point 1
[AH-14]	PID1 multistage set-point 2
[AH-16]	PID1 multistage set-point 3
[AH-18]	PID1 multistage set-point 4
[AH-20]	PID1 multistage set-point 5
[AH-22]	PID1 multistage set-point 6
[AH-24]	PID1 multistage set-point 7
[AH-26]	PID1 multistage set-point 8
[AH-28]	PID1 multistage set-point 9
[AH-30]	PID1 multistage set-point 10
[AH-32]	PID1 multistage set-point 11
[AH-34]	PID1 multistage set-point 12
[AH-36]	PID1 multistage set-point 13
[AH-38]	PID1 multistage set-point 14
[AH-40]	PID1 multistage set-point 15
[AH-42]	PID1 set-point 2 input source selection
[AH-44]	PID1 set-point 2 setting
[AH-46]	PID1 set-point 3 input source selection
[AH-48]	PID1 set-point 3 setting
[AH-50]	PID1 set-point calculation symbol selection
[AH-51]	PID1 feedback 1 input source selection
[AH-52]	PID1 feedback 2 input source selection
[AH-53]	PID1 feedback 3 input source selection
[AH-54]	PID1 feedback calculation symbol selection

PID1 Function (continued)
Display conditions: AH-01=01, 02

Code	Name
[AH-60]	PID1 gain change method selection
[AH-61]	PID1 proportional gain 1
[AH-62]	PID1 integral time constant 1
[AH-63]	PID1 derivative gain 1
[AH-64]	PID1 proportional gain 2
[AH-65]	PID1 integral time constant 2
[AH-66]	PID1 derivative gain 2
[AH-67]	PID1 gain change time
[AH-70]	PID1 feedforward input source selection
[AH-71]	PID1 output range
[AH-72]	PID1 over deviation level
[AH-73]	Turn-off level for the PID1 feedback compare signal
[AH-74]	Turn-on level for the PID1 feedback compare signal

PID2 Function
Display conditions: AJ-01=01, 02

Code	Name
[db-36]	PID2 feedback value monitor
[db-55]	PID2 output monitor
[db-56]	PID2 deviation monitor
[FA-36]	PID2 set-point setting (monitor)
[AJ-02]	PID2 deviation inversion
[AJ-03]	PID2 unit selection
[AJ-04]	PID2 scale adjustment (0%)
[AJ-05]	PID2 scale adjustment (100%)
[AJ-06]	PID2 scale adjustment (decimal point position)
[AJ-07]	PID2 set-point input source selection
[AJ-10]	PID2 set-point setting
[AJ-12]	PID2 feedback input source selection
[AJ-13]	PID2 proportional gain
[AJ-14]	PID2 integral time constant
[AJ-15]	PID2 derivative gain
[AJ-16]	PID2 output range
[AJ-17]	PID2 over deviation level
[AJ-18]	Turn-off level for the PID2 feedback compare signal
[AJ-19]	Turn-on level for the PID2 feedback compare signal

Trace function
Display conditions: Ud-01=01

Code	Name
[Ud-02]	Trace start
[Ud-03]	Number of trace data setting
[Ud-04]	Number of trace signals setting
[Ud-10]	Trace data 0 selection
[Ud-11]	Trace data 1 selection
[Ud-12]	Trace data 2 selection
[Ud-13]	Trace data 3 selection
[Ud-14]	Trace data 4 selection
[Ud-15]	Trace data 5 selection
[Ud-16]	Trace data 6 selection
[Ud-17]	Trace data 7 selection
[Ud-20]	Trace signal 0 input/output selection
[Ud-21]	Trace signal 0 input terminal selection
[Ud-22]	Trace signal 0 output terminal selection
[Ud-23]	Trace signal 1 input/output selection
[Ud-24]	Trace signal 1 input terminal selection
[Ud-25]	Trace signal 1 output terminal selection
[Ud-26]	Trace signal 2 input/output selection
[Ud-27]	Trace signal 2 input terminal selection
[Ud-28]	Trace signal 2 output terminal selection
[Ud-29]	Trace signal 3 input/output selection
[Ud-30]	Trace signal 3 input terminal selection
[Ud-31]	Trace signal 3 output terminal selection
[Ud-32]	Trace signal 4 input/output selection
[Ud-33]	Trace signal 4 input terminal selection
[Ud-34]	Trace signal 4 output terminal selection
[Ud-35]	Trace signal 5 input/output selection
[Ud-36]	Trace signal 5 input terminal selection
[Ud-37]	Trace signal 5 output terminal selection
[Ud-38]	Trace signal 6 input/output selection
[Ud-39]	Trace signal 6 input terminal selection
[Ud-40]	Trace signal 6 output terminal selection
[Ud-41]	Trace signal 7 input/output selection
[Ud-42]	Trace signal 7 input terminal selection
[Ud-43]	Trace signal 7 output terminal selection
[Ud-50]	Trace trigger 1 selection
[Ud-51]	Trigger 1 activation selection at trace data trigger
[Ud-52]	Trigger 1 level setting at trace data trigger
[Ud-53]	Trigger 1 activation selection at trace signal trigger
[Ud-54]	Trace trigger 2 selection
[Ud-55]	Trigger 2 activation selection at trace data trigger
[Ud-56]	Trigger 2 level setting at trace data trigger
[Ud-57]	Trigger 2 activation selection at trace signal trigger
[Ud-58]	Trigger condition selection
[Ud-59]	Trigger point setting
[Ud-60]	Sampling time setting

Program operation function (EzSQ)
Displayed: UE-02=01,02

Code	Name
[db-01]	Program download monitor
[db-02]	Program No. monitor
[db-03]	Program counter (Task-1)
[db-04]	Program counter (Task-2)
[db-05]	Program counter (Task-3)
[db-06]	Program counter (Task-4)
[db-07]	Program counter (Task-5)
[db-08]	User monitor-0
[db-10]	User monitor-1
[db-12]	User monitor-2
[db-14]	User monitor-3
[db-16]	User monitor-4
[db-18]	Analog output monitor YA0
[db-19]	Analog output monitor YA1
[db-28]	Program status
[db-29]	Error task number
[UE-01]	EzSQ Execution cycle
[UE-10] to [UE-73]	EzSQ User parameter U(00) to U(63)
[UF-02] to [UF-64]	EzSQ User parameter UL(00) to UL(31)

7.2.2 Initialize Parameters

Q

- I want to redo the setting from the beginning. Or, I would like to return to the factory setting.
- I want to clear the trip history.
- I/O terminal functions and communication settings should be retained, and I/O terminal settings should be initialized.

A

- After setting "Initialize mode selection [Ub-01]", you can clear the trip history or reset the parameters to the factory setting by "Enable initialization [Ub-05]" to "Execute Initialization (01)".
- "EzSQ User parameter U(00) to U(63) ([UE-10] to [UE-73])" and "EzSQ User parameter UL(00) to UL(31) ([UF-02] to [UF-64])" are initialized only when "Trip history clear & Parameter initialize & EzSQ clear (04)" is selected for "Initialize mode selection [Ub-01]".

Code	Name	Description	Data
[Ub-01]	Initialize mode selection	Initialize mode disable	00
		Trip history clear	01
		Parameter initialization	02
		Trip history clear + parameter initialization	03
		Trip history clear + parameter initialization + EzSQ program clear	04
		Initialization for all data except for terminal configuration*1	05
		Initialize all parameter except for communication configuration*1	06
		Initialize all parameter except for terminal configuration and communication configuration*1	07
		Initialize EzSQ program only	08
		Initialize "User-parameter 1 to 32 selection ([UA-31] to [UA-62])"	10
		Initialize all parameter except "User-parameter 1 to 32 selection ([UA-31] to [UA-62])" and "Display restriction selection [UA-10]"	11
[Ub-02]	Initialize data selection*2	Mode 0 (Japan/USA)	00
		Mode 1 (Europe)	01
		Mode 3 (China)	03
[Ub-05]	Enable initialization	Disable (Factory setting)	00
		Execute initialization	01

*1. When "Initialize mode selection [Ub-01]" is "All parameter except terminal configuration (05)", "All parameter except communication configuration (06)", and "All parameter except terminal & communication configuration (07)", the "terminal configuration" and "communication configuration" are the parameters in the table below.

	Code	Name	Code	Name
Terminal configuration	[CA-01] to [CA-08]	Input terminal function	[CC-01] to [CC-07]	Output terminal function
	[CA-21] to [CA-28]	Input terminal active state	[CC-11] to [CC-17]	Output terminal active state
	[CA-41] to [CA-48]	Input terminal response time	[CC-20] to [CC-33]	Output terminal delay time
	[Cb-40]	Thermistor type selection	[CC-40] to [CC-48]	Logical operation function

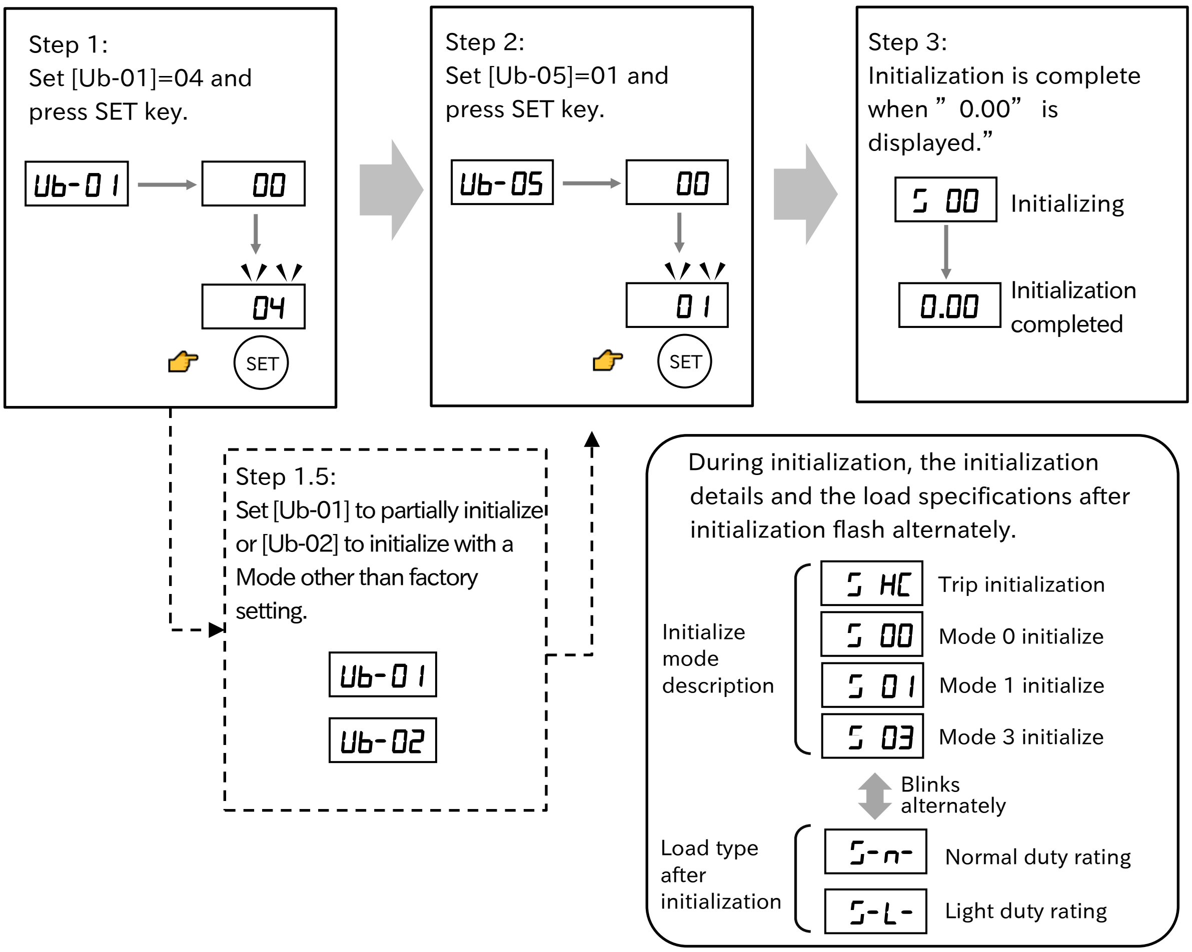
	Code	Name	Code	Name
Communication configuration	[CF-01] to [CF-08]	Parameters related to RS485 communication	[CF-20] to [CF-38]	EzCOM function related parameters

*2. The setting of "Initialize data selection [Ub-02]" (Mode 0/ Mode 1/ Mode 3) is determined by WJ-C1 destination. Normally, [Ub-02] should not be changed from the factory-shipped condition. For the default settings, refer to "18.2 List of Parameters/Register Numbers".

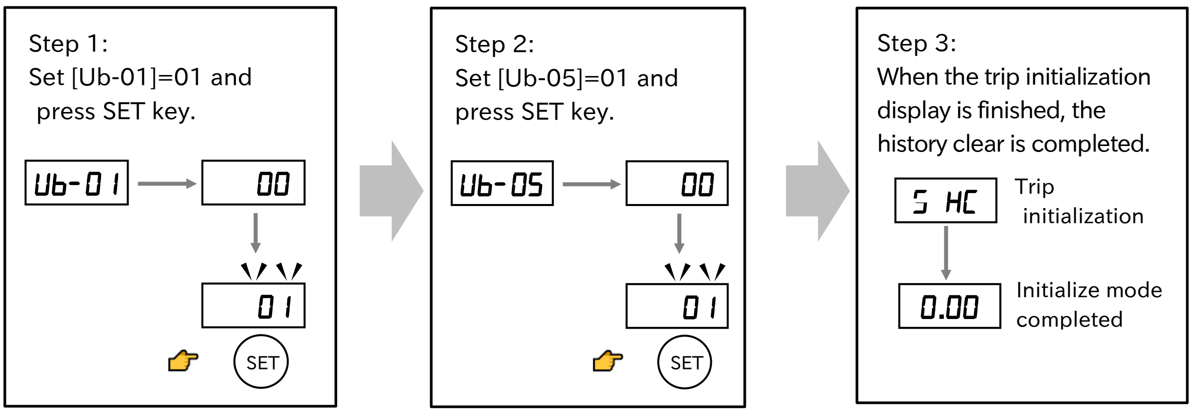
!

- When set "Execute Initialization (01)" to "Enable initialization [Ub-05]" and press SET key, initialization starts immediately. Note that the data cannot be restored after initialization.
- "Accumulated RUN time monitor [dC-22]", " Accumulated power-on time monitor [dC-24]", "Initialize data selection [Ub-02]", "Load type selection [Ub-03]", "Code type selection [Ub-04]" are not initialized.
- When "Display restriction selection [UA-10]" or "Soft-Lock selection [UA-16]" are set to enable, initialization is not possible because the settings of initialization parameters cannot be changed. Release display restriction or Soft-Lock before initialization.

Initialization (Trip history clear + Parameter initialization + EzSQ program initialization)



Initialization (Trip history clear only)



!

- To prevent accidental initialization, the "Initialize mode selection [Ub-01]" and "Enable initialization [Ub-05]" settings will return to "Disable (00)" upon completion of initialization or power cycle. Set these parameters each time initialization is performed.
- Refer to "8.1.2 Changing Load Type of the Inverter" or "8.1.6 Changing Inverter Operation Mode" for the parameters "Load type selection [Ub-03]" and "Code type selection [Ub-04]" that are not initialized even after the initialization setting.

7.2.3 Restart Communication Settings

Q

- How do I reflect the setting of the parameter related to communication without turning on the power again?

A

- In WJ-C1, the settings of communication-related parameters can be reflected without turning the power off and then on again.

!

- When "Restart communication [Ub-06]" is changed to "Execute communication restart (01)", the changes of communication-related parameters shown in the table below are reflected in the operation.
- Even if the communication-related parameters in the table below are changed, they will not be reflected in the operation unless the power is turned OFF and ON again or this function is used.
- When this operation is performed, the communication settings are reflected immediately.
- In WJ200 series, input to the reset terminal or power on again is required. In WJ-C1, communication-related parameters can be restarted in this method.

Code	Name	Description	Data
[Ub-06]	Restart communication	Disable	00
		Execute communication restart: Applies the changes of communication-related parameters.	01

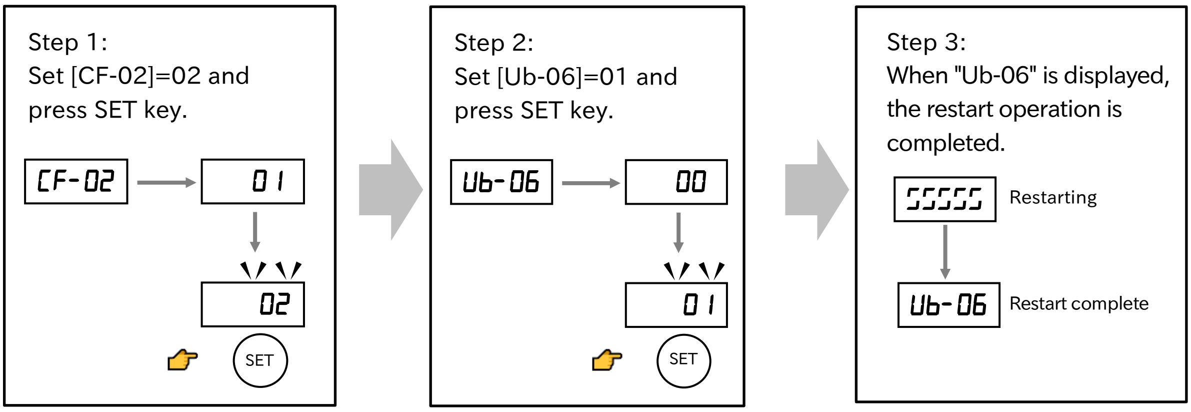
■ **Communication-related parameters**

Code	Name	Description	Data
[CF-01]	RS485 communication baud rate selection	Set the communication transmission speed.	03 (2400bps) 04 (4800bps) 05 (9600bps) 06 (19.2kbps) 07 (38.4kbps) 08 (57.6kbps) 09 (76.8kbps) 10 (115.2kbps)
[CF-02]	RS485 communication node address	Assign the inverter station number.	1 to 247
[CF-03]	RS485 communication parity selection	No parity	00
		Even parity	01
		Odd parity	02
[CF-04]	RS485 communication stop bit selection	1 bit	01
		2 bit	02
[CF-08]	RS485 communication mode selection	Modbus-RTU	01
		Inter-inverter communication (EzCOM)	02
		Inter-inverter communication (EzCOM control)	03
[CF-11]	Register data A,V and % conversion function	Set the response data unit to A (current) and V (voltage).	00
		Set the response data unit as a percentage of the rated value.	01
[CF-12]	RS485 endianness selection	Big endian	00
		Little endian	01
		Special endian	02
[CF-20] to [CF-38]	EzCOM function	Parameters related to EzCOM function	Refer to "11.4 Inter-inverter Communication Function EzCOM ".
[CF-50]	USB communication node address	Assign the station number used in PDN.	1 to 247
[CG-01] to [CG-80]	Register mapping function	Parameters related to the register mapping function (Modbus mapping function)	Refer to "11.3 Modbus Mapping Function".
[oA-10] to [oA-13]	Communication option	Parameters related to communication option	Refer to "Chapter 13 Communication Option".
[oJ-01] to [oJ-20]	Flexible command	Parameters related to flexible command function	

Operation procedure

- When communication is not established normally with the external control device and the inverter or communication setting is changed, the setting can be reflected by the operation of restart communication after setting the communication-related parameters.

e.g. : Apply changes to "RS485 communication node address [CF-02]"



- Note that the communication between the external control device and the inverter is cut off when the operation with [Ub-06] is performed.

7.2.4 Prohibit Parameter Changes

Q

- You want to protect the changed parameter.
- You do not want to change the setting.

A

- Various data changes can be prohibited by the Soft-Lock function. This function is used to prevent data rewriting due to erroneous operation. You can select the software lock function and its method from the following options. When using in conjunction with the intelligent input terminal, assign "Soft-Lock [SFT](036)" to one of the "Input terminal function ([CA-01] to [CA-08])".

Code	Name	Description	Data
[UA-16]	Soft-Lock selection	Soft-Lock operation when [SFT] input terminal is ON	00
		Soft-Lock function always active	01
[UA-17]	Soft-Lock target selection	All data cannot be changed during Soft-Lock operation	00
		Parameters other than the frequency setting cannot be changed during Soft-Lock operation	01*1
[CA-01] to [CA-08]	Input terminal function	Soft-Lock [SFT]: Used when the Soft-Lock function is performed at the input terminal.	036

*1. For parameters that are not subject to Soft-Lock when selected, refer to the table below " Parameters that are not applicable when data change other than the set frequency is not selectable".

!

- The setting of "Soft-Lock selection [UA-16]" can also be password-protected. For details, refer to "7.2.5 Protecting Data with Passwords".
- When the parameter is write-protected by the Soft-Lock function, the parameter cannot be batch-written (Write) by the remote operator with the data R/W function. However, parameter batch-read (Read) is possible. For details of the data R/W function, refer to "7.2.9 Remote Operator Functions".

■ Parameters that are not applicable when data change other than the set frequency is not selectable

Code	Name
[FA-01]	Main speed reference setting (monitor)
[FA-02]	Sub speed reference setting (monitor)
[AA104]	Sub speed setting, 1st-motor
[AA204]	Sub speed setting, 2nd-motor
[Ab110]	Multi-speed 0 setting, 1st-motor
[Ab-11] to[Ab-25]	Multi-speed 1 setting to 15 setting
[Ab210]	Multi-speed 0 setting, 2nd-motor
[bA102]	Upper frequency limit, 1st-motor
[bA103]	Lower frequency limit, 1st-motor
[bA202]	Upper frequency limit, 2nd-motor
[bA203]	Lower frequency limit, 2nd-motor
[CE-10]	Arrival frequency 1 value setting during acceleration
[CE-11]	Arrival frequency 1 value setting during deceleration
[CE-12]	Arrival frequency 2 value setting during acceleration
[CE-13]	Arrival frequency 2 value setting during deceleration
[UA-02]	Password for softlock
[UA-16]	Soft-Lock selection

7.2.5 Protecting Data with Passwords

Q

- To protect the parameters displayed on the keypad with a password so that they cannot be changed unexpectedly.
- I want to protect the set parameter with a password so that it cannot be changed unexpectedly.

A

- The password function can be used to protect the settings of "Display restriction selection [UA-10]", "Soft-Lock selection [UA-16]" and "Soft-Lock target selection [UA-17]". The display and setting of parameters are prevented from being changed unexpectedly.

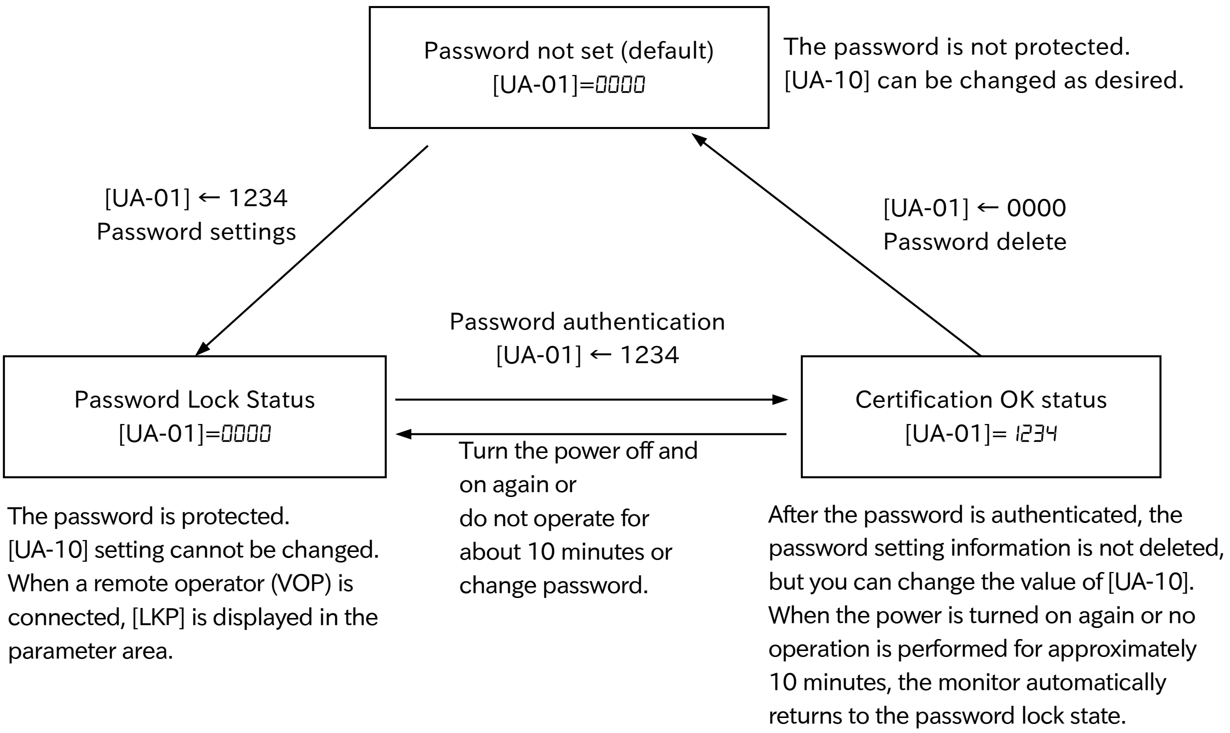
!

- If you forget the password you set, there is no way to unlock the password. Also, our factory or service station cannot check the password, so please be careful when setting the password.

Code	Name	Description	Data
[UA-01]	Password for display	Password for display setting.	0000 to FFFF
[UA-02]	Password for softlock	Password for softlock setting.	0000 to FFFF

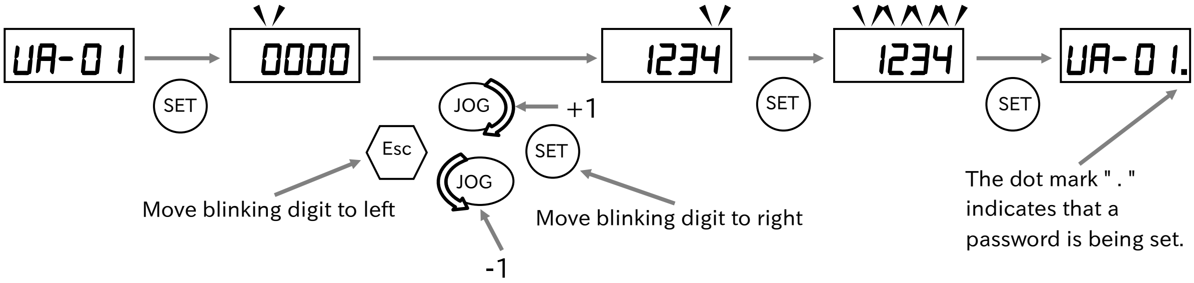
*1. "0000" can not be specified for the password.
*2. Numbers and characters (0～9, A, b, C, d, E, F in hexadecimal) can be set in passwords.

■ Outline of password function (Sample password setting for "Display restriction selection [UA-10]")



Setting a Password

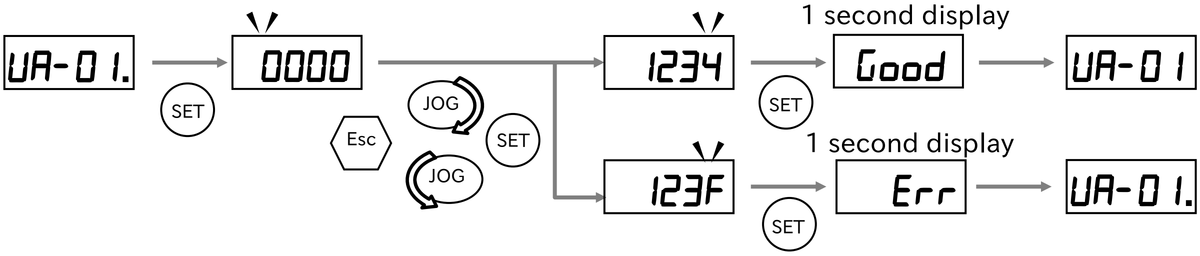
(1) Set "Display restriction selection [UA-10]", "Soft-Lock selection [UA-16]" and "Soft-Lock target selection [UA-17]" according to the content to be protected.
(2) Enter a password of your choice in the password parameter ([UA-01]/[UA-02]).
(Note that 0000 cannot be used.)



(3) The password is locked. [UA-10]/[UA-16]/[UA-17] cannot be changed.

Password Approval

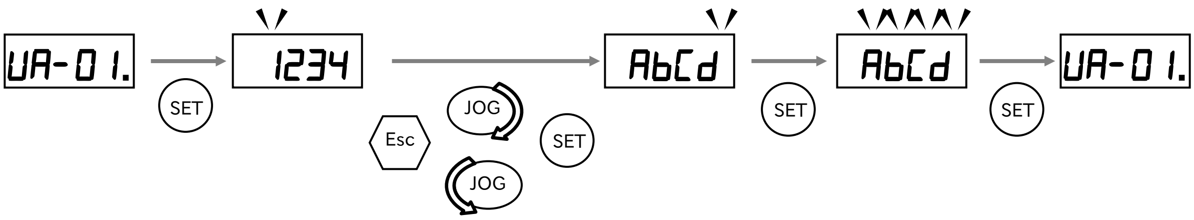
(1) Enter the password in the password parameter ([UA-01]/[UA-02]).



(2) If the password is correct, "Good" is displayed and the [UA-10]/[UA-16]/[UA-17] can be changed. If the password is incorrect, "Err" is displayed and the display returns to the original status (password locked status). If no operation is performed for 10 minutes or the power is turned on again, the machine automatically returns to the password lock state.

Change password

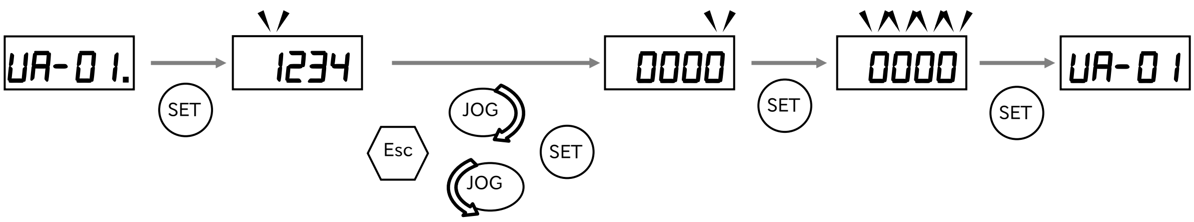
(1) Authenticate your password.
(The password cannot be changed when the password is locked (0000 is displayed).)
(2) Enter a different password in the password parameter ([UA-01]/[UA-02]).



(3) Changing the password automatically transits to the password lock state.

Deleting a password

(1) Authenticate your password.
(Password cannot be deleted in Password Lock status (0000 is displayed).)
(2) Enter 0000 in the password parameter ([UA-01]/[UA-02]).
(3) The password is reset to the default setting and all password information is cleared.



7.2.6 Setting the Initial Keypad Display

Q

- I want to set the display on the keypad at power-on to the specified monitor or parameter at all times.
- If I have not operated the keypad for more than a few minutes, I want to automatically display the specified parameters.

A

- With the "Initial display selection [UA-91]", the display of the keypad at power-on can be selected from the following. ("Output frequency monitor [dA-01]" is selected as the default.)
- When "Enable auto-return to the initial display [UA-92]" is set to "Enable (01)", if there is no keypad operation for 10 minutes, the display data is automatically changed as set in "Initial display selection [UA-91]".

Code	Name	Description	Data
[UA-91]	Initial display selection	The last set parameter is set as the initial screen. (including when SET key is pressed in data display of [d****]) When [d****] is selected, the data display is displayed. Otherwise, the parameter display is displayed.	no
		All parameters except [UA-31] to [UA-62]	[dA-01] and others
[UA-92]	Enable auto-return to the initial display	Disable (no automatic transition)	00
		Enable (automatic transition)	01

!

- When a remote operator (VOP) is connected, you cannot select "no" for "Initial display selection [UA-91]". When selecting, use the keypad of the main unit or the remote operator (MOP, MOP-VR) with 7-segment label.

7.2.7 Automatic Registration of Changed Parameter History

Q

- I want to know the parameter that has been changed from the initial value.

A

- When "User-parameter auto setting function enable [UA-30]" is "Enable (01)", parameters that have been changed from the default are automatically stored in the order of "User-parameter 1 to 32 selection ([UA-31] to [UA-62])". It can also be used as a change history.
- Parameters are memorized at the timing of pressing SET key. [UA-31] is the most recent changed parameter and [UA-62] is the oldest changed parameter.
- If the same parameter is changed, the old memories are erased, and new changes are remembered. If the number of parameters exceeds 32, it will be deleted from the [UA-62] of the oldest memory.

Code	Name	Description	Data
[UA-30]	User-parameter auto setting function enable	Disable: The changed parameter history is not retained.	00
		Enable: The changed parameters are saved as user parameters in the order in which they were changed.	01

!

- When [UA-30] is changed from "Disable (00)" to "Enable (01)", all parameters registered in "User-parameter 1 to 32 selection ([UA-31] to [UA-62])" are initialized ("no" setting).

7.2.8 Display Lock [DISP] Function

Q

• You do not want to change the keypad display.

A

• When "Display lock [DISP] (102)" is assigned to one of the "Input terminal function ([CA-01] to [CA-08])" and that terminal is turned ON, the keypad's display is fixed by the data display of the parameter set in "Initial display selection [UA-91]", and other parameter display becomes impossible.

Code	Name	Description	Data
[UA-91]	Initial display selection (Display at power-on)	The last parameter set is set as the initial display. (including when SET key is pressed in data display of [d****])	no
		All parameters except [UA-31] to [UA-62]	[dA-01] and others
[CA-01] to [CA-08]	Input terminal function	Display lock [DISP]: Fix the display of the keypad to the display set in "Initial display selection [UA-91]".	102

!

• When a remote operator (VOP) is connected, you cannot select "no" for "Initial display selection [UA-91]". When selecting, use the keypad of the main unit or the remote operator (MOP, MOP-VR) with 7-segment display.

7.2.9 Remote Operator Functions

Q

- You want to copy the same parameter settings to another WJ-C1.
- I want to set the display of the keypad of WJ-C1 when connecting a remote operator.
- You want to prohibit copying data.
- You want to be warned if the remote operator RTC (Real Time Clock) has been reset.
- I want to specify the inverter operation such as trip or operation continuation when the remote operator cable is disconnected.

A

- WJ-C1 can optionally be connected to a remote operator (Extended mode: VOP, MOP, MOP-VR, WOP (WOP functions are limited in extended mode)).
- In VOP, LCD panel is used. In MOP/MOP-VR, the 7-segment LED is used.
- This section describes the details of various functions that operate when a remote operator is connected.

!

- When a remote operator is connected, the operation by the keypad of WJ-C1 is disabled. However, pressing and holding Esc key on the keypad of WJ-C1 (approx. 3 seconds) will temporarily switch to the operation on the main unit. Press and hold Esc key again to return to the remote operator.
- When WJ-C1 is used in extended mode, WOP functions are limited. For more information, see "What you can do with WOP in extended mode" in this section.

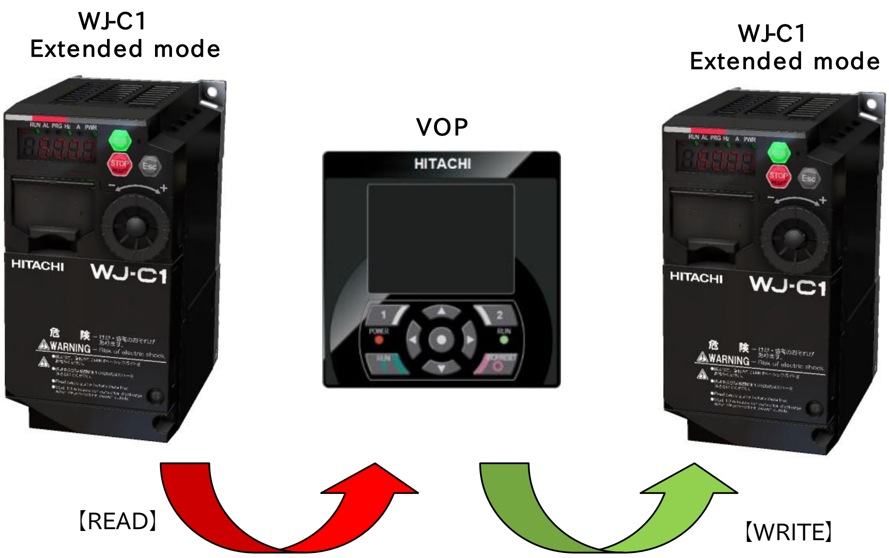
A

Copying Data with a Remote Operator

- The optional VOP is a remote operator with the capability of copying parameter setting data and EzSQ programs. When WJ-C1 is used in the extended mode, data can be copied or backed up between models.
- Even when WJ-C1 is used in extended mode, data can be written by WOP (WOP functions are limited in extend mode). For more information, see "What you can do with WOP in extended mode" in this section.

!

- Copying and backup of parameter setting data and EzSQ program can also be done by using Inverter configuration software ProDriveNext. For more information, see section "12.1 Inverter Configuration Software "ProDriveNext"".
- When WJ-C1 is used in the basic mode, VOP cannot be connected. Use WOP or ProDriveNext when copying files.



A

Detect disconnection of remote operator

- You can set the operation when the remote operator is disconnected. The wire is judged to be disconnected approximately 5 seconds after communication with the remote operator is interrupted.
- Operation at disconnection can be changed by setting of "Action selection at keypad disconnection [UA-20]".

Code	Name	Description	Data
[UA-20]	Action selection at keypad disconnection	When disconnection occurs, trip will be made with "Operator keypad disconnection error [E040]".	00
		When the wire is broken, the motor trips due to "Operator keypad disconnection error [E040]" after decelerating and stopping.	01
		Ignores disconnection detection.	02
		Free-run stop is performed when the wire is disconnected. No error occurs.	03
		Decelerates and stops when the wire is broken. No error occurs.	04

A

Detecting the Remote Operator's Low Battery

- WJ-C1 in extended mode allows a remote operator VOP with a built-in RTC(Real Time Clock) to connect. The RTC is powered by the battery in VOP. However, if WJ-C1 fails to correctly read this RTC, it is judged that the battery is exhausted, and a warning or trip can be generated.
- When "Low battery warning enable [UA-19]" is set to "Warning (01)", the output terminal function "Low-battery of keypad [LBK]" will ON when the low battery is detected. When "Error (02)" is set, trip occurs due to "RTC error [E042]" in addition to ON of [LBK] signal.

!

- When VOP is removed and no longer detectable, the battery is not judged as running out. However, the retained time data is cleared.
- To set "Low battery warning enable [UA-19]" to other than "Disable (00)", insert the battery into the remote operator (VOP) and set [UA-19] after setting the time.
- [LBK] signal is canceled when the battery power is cleared and RTC is set correctly.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Low-battery of keypad [LBK]: When the remote operator (VOP) is connected, the built-in RTC operation is monitored and it is turned ON when it is judged that the batteries are exhausted.	080
[UA-19]	Low battery warning enable	Disable	00
		Warning : ON [LBK] as a warning.	01
		Error: ON the [LBK] signal. At the same time, "RTC error [E042]" is outputted.	02

A

Prevent unnecessary data from being written

- With "Data R/W selection [UA-18]", you can enable or disable batch parameter read/write by the remote operator (VOP, WOP (write only)) with the data copy function. This is useful for securing backup data and preventing unnecessary read/write operations after determining parameters.

!

- Even if "Data R/W selection [UA-18]" is set to "Enable R/W by remote operator (00)", parameter batch write is not possible when Soft-Lock is applied (batch read is possible). For details on the Soft-Lock function, see "7.2.4 Prohibit Parameter Changes".

Code	Name	Description	Data
[UA-18]	Data R/W selection	Enable batch read/write of parameters	00
		Disable batch read/write of parameters	01

When operation is not performed, the back light of the remote operator is turned off

- When using a remote operator (MOP, MOP-VR) that displays by 7-segment LED, the operator's display can be turned off if the status in which no operation is performed continues. This enables power consumption to be reduced.
- When "Waiting time for turning off the display [UA-90]" is set to 0 min, this function is disabled and the LED is not turned off.

Code	Name	Description	Data
[UA-90]	Waiting time for turning off the display	When the remote operator (MOP) is connected and the non-operation status set in this parameter continues for a period of time, the operator's display is turned off to save power.	0 to 60 (min)

Changing the parameters displayed on the main unit when connecting to a remote operator

- When a remote operator is connected, the operation by the keypad of WJ-C1 is disabled. At this time, the monitor data set in "Display while external operator connected [UA-95]" is displayed on the display.

- While the remote operator is connected, press and hold Esc key on the keypad of WJ-C1 (for about 3 seconds) to temporarily switch to the operation on the main unit. Press and hold Esc key again to return to the remote operator.

Code	Name	Description	Data
[UA-95]	Display while external operator connected	Set the display of the main unit when the remote operator is connected. [dA-**], [db-**], [dC-**], [FA-**] parameters can be set.	[dA-**]/[db-**] [dC-**]/[FA-**] Parameter

What you can do with WOP in extended mode

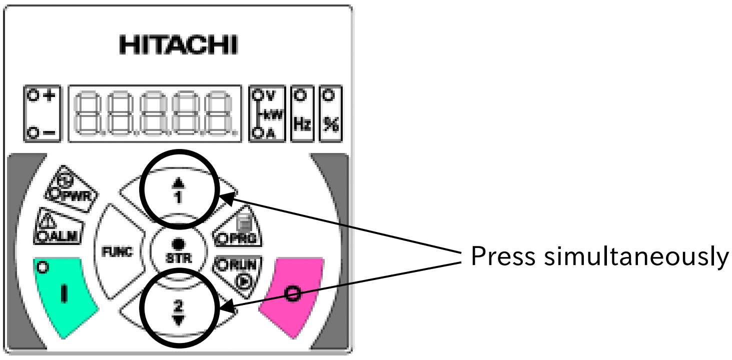
- When WJ-C1 is used in extended mode, WOP can only be used for writing data. Normal parameters cannot be displayed, changed, and data cannot be read.
- In WOP, the parameters of WJ200 or WJ-C1 in basic mode can be copied and automatically converted to the parameters of the extended mode of WJ-C1 for writing.

- Parameters cannot be copied if the version of WJ200 is earlier than Ver.2.0 (without version notation on the specification label). For WJ200 version, refer to the specification label on WJ200.

A

Single-edit mode in MOP/MOP-VR

- When using a MOP or MOP-VR with a 7-segment LED similar to that of the keypad of WJ-C1 as a remote operator, the procedure for switching to the single-edit mode described in "7.1.3 Example of Parameter Setting by Keypad" is different.
- To use the single-edit mode in MOP/MOP-VR, press the up (△) key and the down (▽) key simultaneously.



8

Chapter 8 Mandatory Setting for Motor Drive and Test Run

This chapter describes the mandatory setting items, setting procedures, and test operation to operate the motor and inverter.
Before actual operation, be sure to make the settings described in this chapter and perform a test run.
Refer to the corresponding chapters for details of the installation, wiring and various inverter functions.
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

8.1 Mandatory Setting for Operation

8.1.1 Overview of Mandatory Setting Items

Q
- I want to know the parameters necessary to operate the motor and the inverter.

A
- This section describes the necessary parameter settings and procedures to drive the inverter and motor correctly.
- It also describes the electronic thermal function to protect the motor.

!
- Perform test run and adjustment after setting the parameters appropriately according to the sections in the table below.

Section	Description
8.1.2 Changing Load Type of the Inverter	• Set the load specifications according to the application. Select from normal duty rating suitable for elevators, conveyors, etc. and light duty rating suitable for fans, pumps, etc.
8.1.3 Setting Motor Specification Label Data to Parameters	• Set the motor specifications to be driven to the inverter. Set the base frequency, maximum frequency, motor capacity, number of motor poles, motor rated voltage, motor rated current, etc. before starting operation.
8.1.4 Setting Electronic Thermal for Motor	• The electronic thermal function protects the motor or inverter from burnout. Be sure to set this according to the environment and system to be used.
8.1.5 Setting Motor Constant	• When using automatic torque boost/sensorless vector control, the motor constant must be set. • If the motor constant is unknown, obtain it from the motor manufacturer or measure the motor constant referring to "8.3 Carrying Out Motor Auto-tuning".
8.1.6 Changing Inverter Operation Mode	• As for the operation mode of the inverter, besides the extended mode of the default setting, the basic mode to operate with the same parameter as WJ200 can be selected. • When using WJ-C1 in the basic mode. Refer to the separate "WJ Series C1 User's Guide (NT361□X)".
8.2 Test Run	• To confirm that the inverter and the motor operate correctly, perform a test run with the motor alone and a test run with the actual load connected. • When using automatic torque boost or sensorless vector control, set the motor constant referring to "8.1.5 Setting Motor Constant" or "8.3 Carrying Out Motor Auto-tuning".
8.3 Carrying Out Motor Auto-tuning	• This section explains how to perform auto-tuning. When using a motor other than Hitachi standard or an unknown motor, measure the motor constant using the auto-tuning function.

8.1.2 Changing Load Type of the Inverter

Q

- How do I change to the load rating mode considered when selecting?
- For light load applications such as fans and pumps, I want to lower the capacity frame of the inverter for the motor.

A

- The load specification of the inverter can be selected from the normal duty (ND) rating and the light duty (LD) rating.
  The rated current, overload current rating, temperature rating, etc. of the inverter differ depending on the difference in load specifications. Choose either one according to your load.

■ Features of standard load rating/light load rating

Item	Normal duty rating	Light duty rating
Features	Suitable for loads requiring high torque at starting, acceleration/deceleration, etc.	Suitable for loads with less drive than the rated torque, etc. It may be possible to drive the one size bigger motor.
Application examples	Elevators, cranes, conveyors, etc.	Fans, pumps, air conditioners, etc.
Rated output current (example)	25.0 A (Three-phase 200 V, 5.5 kW inverters)	30.0 A (Three-phase 200 V, 5.5 kW inverters)
Overload current rating	150 %/1 min, 200 %/3 s	120 %/1 min, 150 %/0.5 s

!

- The load rating is set in "Load type selection [Ub-03]". When [Ub-03] is changed and SET is pressed, the mode is changed immediately. The setting range/default value is switched by some parameters as shown in the table below. Note that the setting value at that time is also initialized or changed.

Code	Name	Description	Data
[Ub-03]	Load type selection	Light Duty (LD)	01
		Normal Duty (ND)	02

■ List of parameters to be changed when changing from LD to ND

Code	Name	Data range for ND selection	Initial value during ND selection	LD⇒ND Value at the time of change
[AF136]	Brake release current setting (Forward)	(0.00 to 2.00)× ND rated output current (A)	1.00×ND rated output current (A)	Converted value
[AF143]	Brake release current setting (Reverse)			
[bA123]	Overload restriction 1 active level	(0.20 to 2.00)× ND rated output current (A)	1.50×ND rated output current (A)	Converted value
[bA127]	Overload restriction 2 active level			
[bb-43]	Active frequency matching restart level	(0.00 to 2.00)× ND rated output current (A)	1.00×ND rated output current (A)	
[bb101]	Carrier frequency setting	2.0 to 15.0(kHz)	2.0 (kHz) [Pattern 0] 10.0 (kHz) [Pattern 1] 2.0 (kHz) [Pattern 3]	No change
[bC110]	Electronic thermal level setting	(0.00 to 3.00) × ND rated output current (A)	ND rated output current (A)	Converted value
[bC121] [bC123] [bC125]	Free electronic thermal current-1 to 3	(0.00 to 3.00) × ND rated output current (A)	0.00 (A)	Converted value
[CE102]	Low current detection level 1	(0.00 to 2.00)× ND rated output current (A)	ND rated output current (A)	Converted value
[CE103]	Low current detection level 2			
[CE106]	Overload warning level 1	(0.00 to 2.00)× ND rated output current (A)	1.15×ND rated output current (A)	
[CE107]	Overload warning level 2			
[PA-23]	Optional output value setting for the output current monitor	(0.00 to 3.00) × ND rated output current (A)	0.00 (A)	Converted value

■ List of parameters to be changed when changing from ND to LD

Code	Name	Data range for LD selection	Initial value during LD selection	ND⇒LD Value at the time of change
[AF136]	Brake release current setting (Forward)	(0.00 to 2.00)× LD rated output current (A)	1.00×LD rated output current (A)	Converted value
[AF143]	Brake release current setting (Reverse)			
[bA123]	Overload restriction 1 active level	(0.20 to 2.00)× LD rated output current (A)	1.50×LD rated output current (A)	Light duty Initial value
[bA127]	Overload restriction 2 active level			
[bb-43]	Active frequency matching restart level	(0.00 to 2.00)× LD rated output current (A)	1.00×LD rated output current (A)	
[bb101]	Carrier frequency setting	2.0 to 10.0 (kHz)	2.0 (kHz) [Pattern 0] 10.0 (kHz) [Pattern 1] 2.0 (kHz) [Pattern 3]	2.0 (kHz)
[bC110]	Electronic thermal level setting	(0.00 to 3.00)× LD rated output current (A)	LD rated output current (A)	Converted value
[bC121] [bC123] [bC125]	Free electronic thermal current-1 to 3	(0.00 to 3.00)× LD rated output current (A)	0.00A	Converted value
[CE102]	Low current detection level 1	(0.00 to 2.00)× LD rated output current (A)	LD rated output current (A)	Converted value
[CE103]	Low current detection level 2			
[CE106]	Overload warning level 1	(0.00 to 2.00)× LD rated output current (A)	1.15×LD rated output current (A)	
[CE107]	Overload warning level 2			
[PA-23]	Optional output value setting for the output current monitor	(0.00 to 3.00) × LD rated output current (A)	0.00 (A)	Converted value

!

- The parameter described as "Converted value" converts the current set value by the rated current ratio of ND and LD.
  (e.g.) When ND rated output current = 8.0 A/LD rated output current = 10.0 A, the set 4.0 A at the time of ND is converted as shown below when it is changed to LD.
  $(10/8)\times 4.0$ A = 5.0 A
  (For conversion from LD to ND, it is converted by the inverse ratio shown above.)

- When the load specifications are changed, the parameters may need to be reconfigured. Refer to the above table to recheck each parameter. Also recheck the parameters related to inverter heat generation and cooling, such as torque and current setting related parameters, automatic carrier reduction function, and cooling fan operation selection.
- The currently selected load specification can be checked in "Inverter load type status [dC-01]".

8.1.3 Setting Motor Specification Label Data to Parameters

Q

- Setting according to the motor is desired.
- Motor drive is not stable.

A

- To control and protect the motor, set the basic parameters of the motor in the table below.
- Set the motor capacity/number of motor poles/motor rated voltage/motor rated current/base frequency (motor rated frequency) according to the specifications of the motor (value indicated on the motor specification nameplate). Set the maximum output frequency required for the maximum frequency setting. However, please set so as not to exceed the specification of the maximum rotational speed of the motor.

■ **For induction motor**

Code	Name	Description	Data
[Hb102]	Async. Motor capacity setting	Set the capacity of the induction motor.	0.01 to 30.00 (kW)
[Hb103]	Async. Motor number of poles setting	Set the number of poles of the induction motor.	00 to 23 (2 to 48 (poles))
[Hb104]	Async. Motor base frequency setting	Set the base frequency of the induction motor.	30.0 to Maximum frequency (Hz)
[Hb105]	Async. Motor maximum frequency setting	Set the maximum frequency of the induction motor.	Base frequency to 590.00 (Hz)
[Hb106]	Async. Motor rated voltage	Set the rated voltage of the induction motor.	1 to 1000 (V)
[Hb108]	Async. Motor rated current	Set the rated current of the induction motor.	0.01 to 10000.00 (A)

Note
Burnout

Do

- When the base frequency is set below the rated frequency of the motor, the motor may burn out. (For standard-type induction motors, the rated frequency is 50/60 Hz.)
- Do not set the maximum frequency and motor rated voltage exceeding the motor specifications. The motor may burn out.
- When initialization is performed, set the basic parameters of the motor again. Continued use after initialization may cause motor burnout.
- When setting the maximum frequency exceeding 60 Hz, check with the motor manufacturer for the maximum allowable frequency.

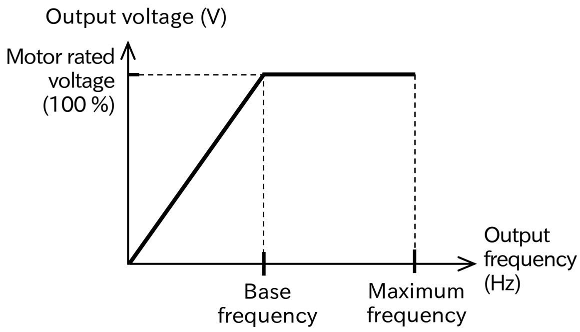
!

Motor Capacity and Number of Poles

- For induction motors, when "Async. Motor capacity setting [Hb102]" or "Async. Motor number of poles setting [Hb103]" is changed, the motor constant parameter settings will change to the motor constant of Hitachi standard motor stored in advance. Accurately setting the capacity and number of poles may prevent motor hunting or stabilize the motor drive. Refer to "8.1.5 Setting Motor Constant" for details of the motor constant parameter.
- When setting the control mode to V/f control (constant torque characteristic (VC), reduced torque characteristic (VP1.7) or free V/f) and driving two or more motors with one drive, set the total motor capacity to [Hb102].
- For details on setting the motor constant, refer to "8.3 Carrying Out Motor Auto-tuning".

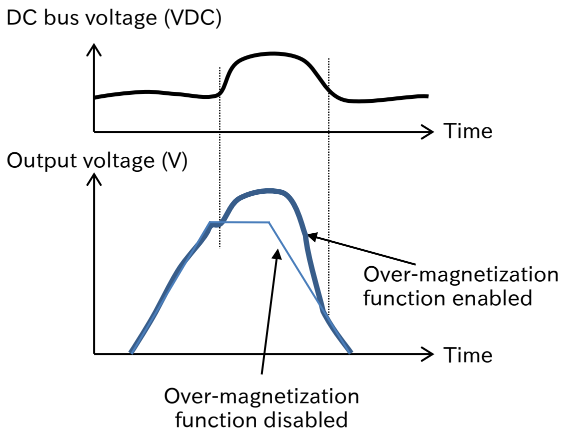
Frequency-voltage relation during typical V/f control (induction motor)

- When the base frequency and rated voltage are set, the voltage is output in typical V/f control (constant torque characteristic (VC)) as shown in the diagram.
- The output voltage from the base frequency to the maximum frequency is the motor rated voltage at the maximum. The maximum frequency setting is the maximum value of the analog external input (for example, 0 to 10 VDC for analog voltage input).
- When an induction motor is used by setting the base frequency to a value exceeding 60 Hz, a special motor is used. With a special motor, the rated current may be larger than the inverter even if the motor capacity is the applicable capacity of the inverter. In this case, increase the inverter capacity.



Over-magnetization Function

- The over-magnetization function suppresses overvoltage errors by increasing the loss of the motor and reducing the energy that is regenerated. The over-magnetization function operates when "V/f control (00 to 03)" is selected in "Control mode selection [AA121]".
- When the over-magnetization function is disabled in "Over-magnetization function selection [bA146]", the relation between the output voltage and the output frequency selected in [AA121]. For example, when constant-torque characteristic (VC) is selected, control is performed as shown in "Frequency-voltage relation during typical V/f control (induction motor)" above. For other characteristics, refer to "9.5.1 Select Control Mode".



- Even if this function is used, voltage exceeding AC voltage equivalent to DC bus voltage between P-N cannot be outputted.
- For the output voltage to the motor, refer to "9.9.4 Overvoltage Suppression by Output Voltage Control".

Output current

- When the motor rated current is set beyond the inverter rated current, the desired characteristics may not be met. In addition, inverter protection may be applied to the tip.

8.1.4 Setting Electronic Thermal for Motor

Q
- How do I perform thermal protection of the motor and inverter?
- How do I freely change the thermal protection characteristic pattern?
- How do I set the heat radiation characteristics according to the motor?
- To continue motor protection by integrating the load factor even when restarting after the power is turned off.

A

Basic characteristics of electronic thermal

- The electronic thermal function provides thermal protection based on the output current, output frequency, and electronic thermal characteristics. Two types of the electronic thermal function for motor and for inverter) operate separately.
- Electronic thermal for motor is set according to "Electronic thermal level setting [bC110]" to the motor rated current. When an output current exceeding the rated current continues to flow through the motor, it will be protected. When earlier protection is required, set [bC110] lower than the motor rated current. In addition, the duration until the protective function is applied also varies depending on the " Electronic thermal accumulation gain [bC115]" setting. Refer to "Changing the Heat Dissipation Characteristics of Electronic Thermal" in this section.
- By "Electronic thermal characteristic selection [bC111]", set the thermal characteristic (reduction rate by operating frequency) according to the motor to be used. For details, refer to the following pages.
- The operation level and thermal characteristics of the inverter electronic thermal cannot be changed from the contents in the table below.
- The basic characteristics (time characteristics) of the electronic thermal depends on the setting of "Load type selection [Ub-03]". Each basic characteristic (time characteristic) is shown in the figure below.
- When the output current becomes unstable due to disturbance, etc., the inverter may trip earlier than the specified time.

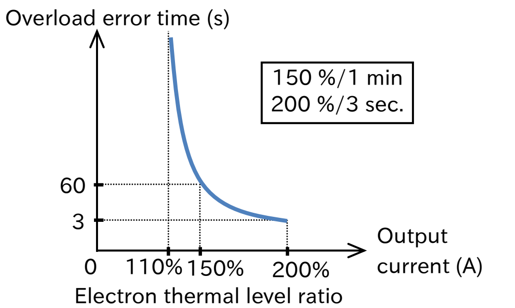
Code	Name	Description	Data
[bC110]	Electronic thermal level setting	When a current exceeding the set value continues to flow, protection is applied and "Motor overload error [E005]" occurs.	(0.00 to 3.00)× ND/LD rated output current (A)
[bC115]	Electronic thermal accumulation gain	The load factor for each calculation cycle of the electronic thermal for the motor is multiplied by this setting value to be integrated as the load factor. The default value is 100 %, multiplied by 1. When the set value is less than initial 100.0%, the protection becomes slower and the motor burns out easily.	1.0 to 200.0 (%)

Electronic thermal	Time characteristic	Electronic thermal level	Thermal characteristic	Trip
Motor electronic thermal	Properties of ND standards (Refer to the figure below.)	Calculate the accumulated loading factor from [bC110] and [bC115].	Select with [bC111]	[E005]
Inverter electronic thermal	Characteristic by ND/LD (Refer to the figure below.)	ND/LD rated power current of the inverter	Constant torque (Reduced ratio in low-speed range*1)	[E039]

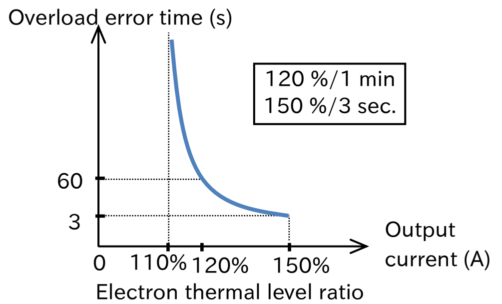
*1. The thermal characteristic (constant torque characteristic) of the electronic thermal for the inverter are different from the electronic thermal for the motor. For details, refer to "Constant Torque Characteristics" in this section.

Electronic thermal time characteristics

● Electronic thermal time characteristic for motors/ Electronic thermal time characteristic for inverters (when ND is selected)



●Electronic thermal time characteristic for inverters (when LD is selected)



!

- This setting is necessary for motor protection. If the correct value is not input, the motor may burn out.
- Even if "Electronic thermal level setting [bC110]" is set larger, "Overcurrent error [E001]" may occur before "Motor overload error [E005]" if the current grows steeply.
- If overload occurs in the extremely low speed range below 0.2Hz, "Overload error at low speed [E038]" will occur. Refer to "Tips/FAQ/Troubleshooting" for the corrective actions to be taken when an overload error [E005]/[E038]/[E039] occurs.
- [E005] and "Controller overload error [E039]" when "Electronic thermal decrease function enable [bC112]" is set to "Disable (00)" will not accept a trip reset for about 10 seconds after it occurs. [E005] and [E038] when [bC112] is set to other than "Disable (00)" can be canceled immediately after tripping. For more information on [bC112], refer to "Changing the heat dissipation characteristics of electronic thermal" in this section.

A

Change the electronic thermal characteristics

- By setting "Electronic thermal characteristics selection [bC111]", you can set the electronic thermal characteristics for the motor according to the motor to be used. It is possible to set the protection characteristics in consideration of the decrease in the cooling capacity of the motor at low speed.

Code	Name	Description	Data
[bC111]	Electronic thermal characteristic selection	Reduced torque: This pattern corresponds to a decrease in cooling function in the low-speed range.	00
		Constant torque: This pattern considers constant output.	01
		Free setting: The pattern can be changed according to the motor characteristics.	02

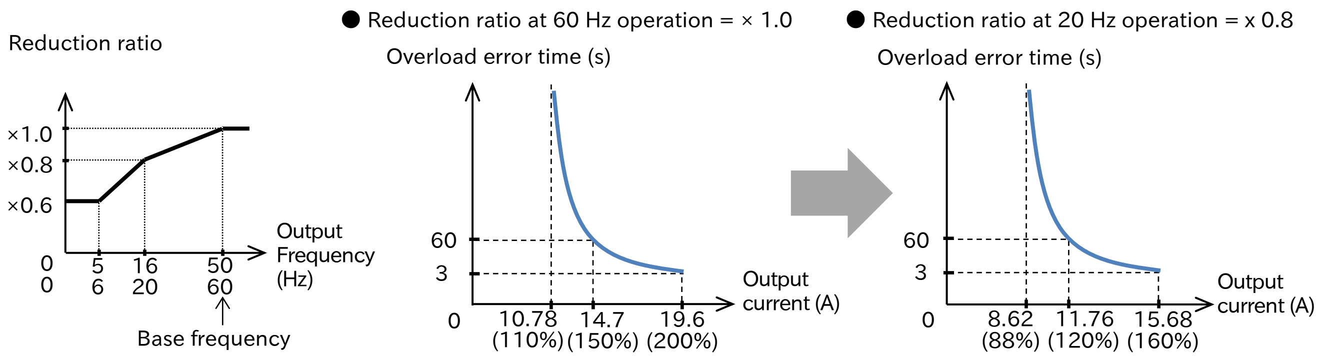
Reduced torque

- By setting "Electronic thermal characteristic selection [bC111]" to "Reduced torque (00)", it is possible to make the protective characteristic considering the cooling capacity reduction of the motor at low speed.
- A general-purpose motor (self-cooling type motor) must be used with a reduced load (current) because the cooling function of the self-cooling fan decreases when the motor speed decreases. (When the frequency decreases, the reduction ratio also decreases, and the thermal level (current) also decreases.)
- The reduced torque characteristics are matched to the heat generated by the self-cooling motor.
- The figure below (e.g.1) shows an example of the reduced-torque characteristics when the "Electronic thermal level setting [bC110]" is 9.6 A at the light duty rating.

(e.g. 1) Example of reduced torque characteristics

Three-phase 200 V 1.5 kW, LD Rating, Electronic thermal level setting [bC110] = 9.8 A
Base frequency[Hb104]=60 Hz

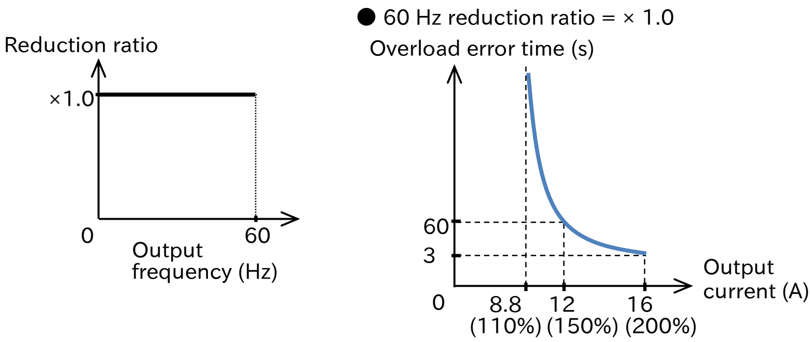
Since the reduction ratio is 1.0 times for 60 Hz operation, tripping occurs after 60 seconds of continuous flow of 14.7 A (9.8 A×150 %).
Since the reduction ratio is 0.8 times when operating in 20 Hz, 11.76 A (9.8 A×150 %×0.8) will be tripped after 60 seconds of continuous flow.



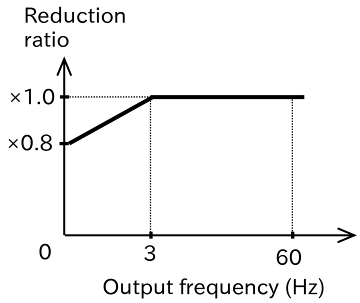
Constant torque

- When using a constant torque motor, set "Electronic thermal characteristics selection [bC111]" to "Constant torque (01)".
- When the constant torque characteristic is selected, the reduction ratio does not apply to the electronic thermal for the motor as shown in the figure below.

(e.g. 2) Example of Constant Torque Characteristics
3-Phase 200 V 1.5 kW, Normal Duty Rating,
Electronic thermal level setting [bC110] = 8.0 A



- Regardless of the "Electronic thermal level setting [bC110]", the inverter electronic thermal operates at a constant-torque characteristic based on ND/LD inverter-output current. However, to protect the inverter main unit, the reduction ratio is applied in the low-speed range below 3 Hz as shown in the right diagram.
- When using a self-cooling motor that reduces motor cooling in the low-speed range, pay attention to motor heat generation. Depending on the motor's heat generation characteristics, use with the reduction characteristics or free setting.

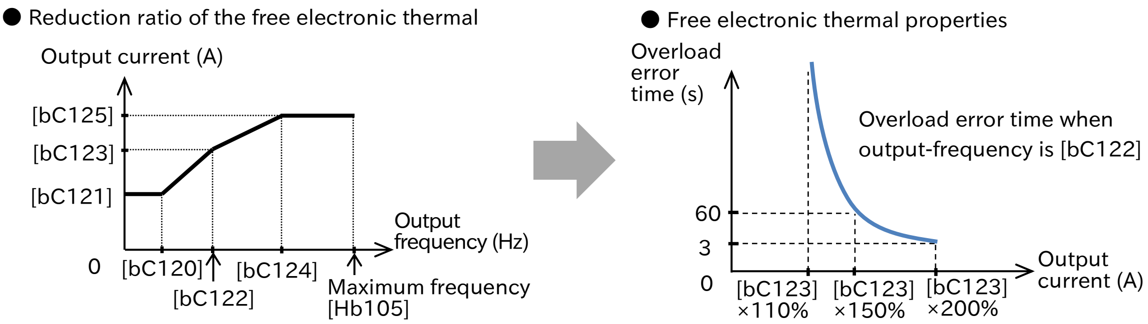


Free electronic thermal setting

- By setting "Electronic thermal characteristic selection [bC111]" to "Free setting (02)", you can freely set the electronic thermal characteristic (reduction ratio characteristic) with the aim of protecting the motor according to the loads at every speed.

Code	Name	Description	Data
[bC120]	Free electronic thermal frequency-1	Set the frequency at each segmental point. Be sure to set each frequency to the relationship shown below. [bC120] < [bC122] < [bC124]	0 to 590.00 (Hz)
[bC122]	Free electronic thermal frequency-2		
[bC124]	Free electronic thermal frequency-3		
[bC121]	Free electronic thermal current-1	Set the current value at each segmental point.	(0.00 to 3.00)× ND/LD rated output current (A)
[bC123]	Free electronic thermal current-2		
[bC125]	Free electronic thermal current-3		

(e.g. 3) Free electronic thermal setting
3-phase 200 V 1.5 kW, Normal Duty Rating, Electronic thermal level setting [bC110] = 8.0 A



- If [bC121]/[bC123]/[bC125] is set to the default 0.0 A and "Electronic thermal characteristic selection [bC111]" is set to "Free setting (02)", a [E005] occurs immediately after the setting is changed.
- Set the Free Electron Thermal frequency in the order of [bC124]→[bC122]→[bC120].

A

Changing the heat dissipation characteristics of electronic thermal

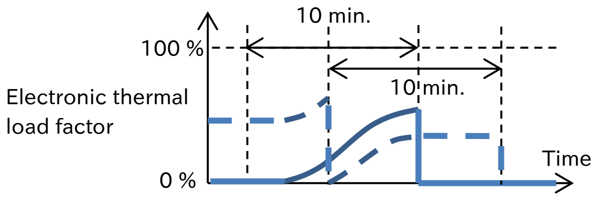
- When "Electronic thermal decrease function enable [bC112]" is set to other than "Disable (00)", the electronic thermal decrease function is enabled, and the electronic thermal load factor for the motor is subtracted when the output current is less than 110 % of the electronic thermal level (when the reduction ratio is × 1.0).
- Subtraction characteristics can be selected by [bC112]. Set according to the heat radiation characteristics of the motor.

Code	Name	Description	Data
[bC112]	Electronic thermal decrease function enable	Disable: The doubled counters are cleared every 10 minutes. In addition, the clearing timing is shifted by 5 minutes and is performed alternately.	00
		Enable (Linear decrement): Subtract from 100 % to 0 % according to [bC113] setting.	01
		Enable (time constant decrement): [bC113] setting treated as a time constant for subtraction.	02
[bC113]	Electronic thermal decreasing time	Decreasing time setting when [bC112] is set to "Enable (01 or 02)". Note that if the setting is less than the default 600 s, the protective function becomes slower and the motor tends to burn out.	1 to 65535 (s)
[bC115]	Electronic thermal accumulation gain	The load factor for each calculation cycle of the electronic thermal for the motor is multiplied by this setting value to be integrated as the load factor. 100.0 % of the initial value is multiplied by 1. Note that if the setting is less than 100.0 % of the initial value, the protection becomes slow and the motor tends to burn out.	1.0 to 200.0 (%)

- Use "Electronic thermal decreasing time [bC113]" to set the subtraction rate. Check the thermal time constant of the motor with the motor manufacturer. In addition, set a larger value with sufficient margin for the characteristics of the motor used.
- Regarding "Electronic thermal accumulation gain [bC115]", if the overload withstand value of the motor is available, adjust it to a larger value as possible based on [(Trip time of electronic thermal time characteristic)/ (Motor overload withstand time)]×100 %.
- Even if the setting value of [bC113]/[bC115] is larger than the default value, the motor may burn out if the setting value is inappropriate small value for the motor characteristic value. For these settings, set a value larger than the motor characteristic value with sufficient margin.
- If the motor characteristic value is not available, set [bC112] to "Disable (00)" for use.
- Use [bC113] to set the subtraction rates for each decrement method. Set a larger value with sufficient margin to the characteristics of the motor used.

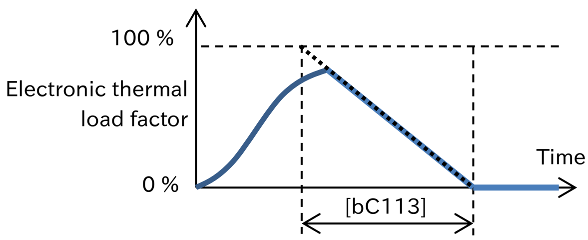
Electronic thermal decrease function enable [bC112] = Disable (00)

- The load factor is cleared every 10 minutes. When one of the duplicated counters reaches 100 %, the motor trips due to "Motor overload error [E005]".



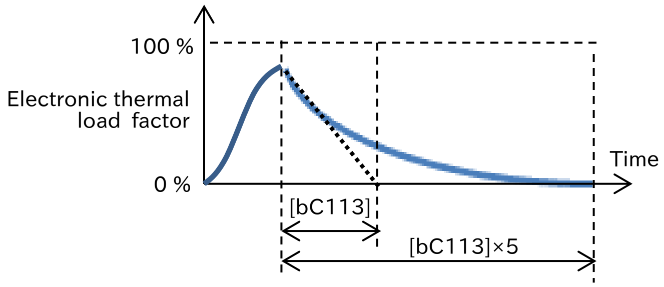
Electronic thermal decrease function enable [bC112] = Enable (Linear decrement) (01)

- The electronic thermal load factor is subtracted at the rate where the load factor changes from 100 % to 0 % at the setting time of [bC113].



■ Electronic thermal decrease function enable [bC112] = Enable (Time constant decrement) (02)

- The electronic thermal load factor at the point when the output current falls below the electronic thermal level is subtracted by the primary filter with the time constant set in [bC113]. Thermal-load factor becomes 0% in approximately five times longer than [bC113].



A Saving the accumulated value of the electronic thermal at power shutdown

- The accumulated value of the electronic thermal is saved when the power is turned off, and can be read when the power is turned on the next time.

Code	Name	Description	Data
[bC-14]	Electronic thermal counter memory selection at power-off	Disable: Integrated amount is set to zero when the power is turned on.	00
		Enable: Displays the accumulated value saved when the power was shut off.	01

A Related functions

- The electronic thermal load factor for the motor can be checked in "Electronic thermal load factor monitor (Motor) [dA-42]", and the electronic thermal load factor for the inverter can be checked in "Electronic thermal load factor monitor (Inverter) [dA-43]".
- If you want to output a warning signal when the electronic thermal load factor exceeds a certain level, set the output terminal function "Electronic thermal alarm (Motor) [THM](026)", "Electronic thermal alarm (Inverter) [THC](027)" and "Electronic thermal warning level (Motor) [CE-30]" and "Electronic thermal warning level (Inverter) [CE-31]". For details, refer to "9.11.5 Motor Electronic Thermal Warning" or "9.11.6 Inverter Electronic Thermal Warning".

Code	Name	Description	Data
[dA-42]	Electronic thermal load factor monitor (Motor)	Displays the accumulated value of the electronic thermal for the motor. If this monitor reaches 100 %, "Motor overload error [E005]" will occur.	0.00 to 100.00 (%)
[dA-43]	Electronic thermal load factor monitor (Inverter)	Displays the accumulated value of the electronic thermal for inverter. When this monitor reaches 100 %, "Controller overload error [E039]" occurs.	0.00 to 100.00 (%)
[CC-01] [CC-02] [CC-07]	Output terminal function	Electronic thermal alarm (Motor) [THM]: When the [dA-42] value reaches the level set to [CE-30], this signal turns ON.	026
		Electronic thermal alarm (Inverter) [THC]: When the [dA-43] value reaches the level set to [CE-31], this signal turns ON.	027
[CE-30]	Electronic thermal warning level (Motor)	Set the overload level that turns the signal [THM] ON.	0.00 to 100.00 (%)
[CE-31]	Electronic thermal warning level (Inverter)	Set the overload level that turns the signal [THC] ON.	0.00 to 100.00 (%)

8.1.5 Setting Motor Constant

Q

- Motor drive is not stable.
- How do I use the Hitachi standard induction motor?
- How do I set the motor constants required for automatic torque boost function and sensorless vector control?

A

- When using the automatic torque boost function or sensorless vector control with an induction motor, the motor constant must be set according to the motor to be used. There are three methods for setting the motor constant as follows.
  - (1) A Hitachi standard motor is used.
    When using a Hitachi standard motor, if "Async. Motor capacity setting [Hb102]" or "Async. Motor number of poles setting [Hb103]" is changed, the motor constant parameter settings will automatically change to the motor constant of the Hitachi standard motor (IE3).
  - (2) Measured by the auto-tuning function.
    This function is used to measure the motor constant when a motor whose motor constant is unknown is used. Even when using a Hitachi standard motor, if the moment of inertia is large or the wiring length is long, it may be better to perform auto-tuning. For details, refer to "8.3 Carrying Out Motor Auto-tuning".
  - (3) Manually change the parameters.
    Values obtained from the motor manufacturer, etc. can be set directly to the parameters in the table below. Or, after (1) or (2), change the parameters in the table below for fine adjustment.
- Hitachi standard motor constant setting in the table below is the data for one phase of Y-connected motor converted to 200 V/400 V, 50 Hz input.

!

- The motor constant parameters in the table below can also be adjusted and changed manually. However, note that changing the motor capacity or number of motor poles will change to the Hitachi standard motor constant. If you have an optional remote operator (VOP), it is recommended that you back up the motor constants with the data R/W function.
- When using a motor with unknown motor constants, inquire about the motor constants from the motor manufacturer or measure the motor constants using the auto-tuning function. For details, refer to "8.3 Carrying Out Motor Auto-tuning".
- Refer to "9.5.5 V/f Control with Automatic Torque Boost" or "9.5.10 Sensorless Vector Control" for the tuning of the automatic torque boost function or sensorless vector control when the satisfactory performance cannot be obtained.

■ When using a Hitachi standard induction motor

Code	Name	Description	Data
[Hb110]	Async. Motor constant R1 (Primary resistance)	Parameter for setting the motor constant of an induction motor. Changing "Async. Motor capacity setting [Hb102]" or "Async. Motor number of poles setting [Hb103]" initializes the motor constants to the corresponding Hitachi standard. It can also be adjusted and changed manually. In addition, when the motor constant is measured by the auto-tuning function, this parameter will be overwritten.	0.000001 to 1000.000000 (Ω)
[Hb112]	Async. Motor constant R2 (Secondary resistance)		0.000001 to 1000.000000 (Ω)
[Hb114]	Async. Motor constant L (Leakage inductance)		0.000001 to 1000.000000 (mH)
[Hb116]	Async. Motor constant I0 (no-load current)		0.01 to 10000.00 (A)
[Hb118]	Async. Motor constant J (Moment of inertia)		0.00001 to 10000.00000(kgm^2)
[HA181]	Cable length parameter	This parameter corrects the current detection accuracy due to the difference in the motor cable length. If the motor constant cannot be measured correctly, set a larger value.	5 to 20

!

- The base (maximum) frequency is obtained from the rated speed (min^{-1}) and number of poles of the motor as shown below.

$$Base(Max.)Frequency(\mathrm{Hz}) = \frac{rated\ rot.(\mathrm{min}^{-1}) \times poles(\mathrm{pole})}{120}$$

8.1.6 Changing Inverter Operation Mode

Q

- How do I use the same parameters as WJ200 series?
- I would like to use the function that was not installed in WJ200.

A

- For WJ-C1 operation mode, "Extended mode" (default) and "Basic mode" (WJ200 equivalent) can be selected.
- To change the operation mode, change "Code type selection ([Ub-04], [b170])" and then change the "Initialize mode selection ([Ub-01], [b084])" according to the table below, and then execute initialization.
- When changing from "Extended mode" to "Basic mode", initialization of data is required. At this time, EzSQ program will also be cleared.
- When changing from "Basic mode" to "Extended mode", the parameter settings can be retained and changed. In this case, the set value is converted to the extended mode system. However, EzSQ program cannot be migrated. If you do not hold the data, all the data will be initialized regardless of the setting of "initialization target selection [b094]".

■ Required parameters to change from "Extended mode" to "Basic mode"

Code	Name	Description	Data
[Ub-01]	Initialize mode selection	Parameter Initialization: Changes to the operation mode are performed.	02
		Trip history clear + parameter initialization: Changes to the operation mode are performed.	03
		Trip history clear + parameter initialization + EzSQ: Changes to the operation mode are performed.	04
		Other settings: No operation mode changes are performed.	00,01,05 to 11
[Ub-04]	Code type selection	Extended mode (5-digit parameter, e.g. AA101)	00
		Basic mode (4-digit parameter sample: A001)	01
[Ub-05]	Enable initialization	Initialize mode disable	00
		Execute initialization	01

■ Required parameters to change from "Basic mode" to "Extended mode"

Code	Name	Description	Data
[b084]	Initialize mode selection	Disable: Changes to the operation mode are performed. (Data hold)	00
		Trip history clear: Changes to the operation mode are performed. (Data hold)	01
		Parameter Initialization: Changes to the operation mode are performed. (Data Initialization)	02
		Trip history clear + parameter initialization: Changes to the operation mode are performed. (Data Initialization)	03
		Trip history clear + parameter initialization + EzSQ: Changes to the operation mode are performed. (Data Initialization)	04
[b170]	Code type selection	Extended mode (5-digit parameter, e.g. AA101)	00
		Basic mode (4-digit parameter sample: A001)	01
[b180]	Enable initialization	Initialize mode disable	00
		Execute initialization	01

!

- To change the operation mode, set "Enable initialization [Ub-05]" to "Execute initialization (01)" and perform initialization. At that time, regardless of the setting of "Initialize mode selection [Ub-01]", all data such as setting, trip history and EzSQ program will be initialized and cannot be restored. However, "Accumulated number of starts monitor [dC-20]", "Accumulated number of power-on times monitor [dC-21]", "Accumulated RUN time monitor [dC-22]", "Accumulated power-on time monitor [dC-24]", "Accumulated cooling-fan run time monitor [dC-26]" and "Initialize data selection [Ub-02]" will not be initialized.
- In Basic mode, there are no parameters corresponding to [dC-20], [dC-21], and [dC-26], but they are stored internally. If these data are required, use the extended mode.
- When using WJ-C1 in the basic mode. Refer to the separate "WJ Series C1 User's Guide (NT361☐X)".

8.2 Test Run

8.2.1 Setting Confirmation without Inverter Output

Q

- I want to check the I/O terminal operation without voltage outputting.
- I want to check the operation without voltage outputting to the motor by putting an RUN command artificially.

A

- If "Simulation mode enable [PA-20]" is set to "Enable (01)" and the power is turned on again, the simulation mode is entered and no longer outputting to the motor.
- To cancel the simulation mode, set [PA-20] to "Disable (00)" and turn the power off and then on again.
- In simulation mode, you operate the inverter in the same manner as normal except that the output to the motor is not present. Therefore, it is possible to check the terminals and communication operation, etc.
- Although the output to the motor is not performed, internal data such as output current and output voltage can be specified by parameters or analog input. It is possible to simulate the internal data during actual operation.
- Operation can be checked in simulation mode even when power is supplied to the terminals with an external 24 VDC power supply to [P24].
- In simulation mode, if you set any error code (1 if "Overcurrent error [E001]") to "Error code selection for alarm test [PA-21]", a trip of the error code set at the time of setting will be issued. To cancel the trip, use the reset operation (ON of the "Reset [RS]" input terminal or press STOP/RESET key) as normal. After resetting, [PA-21] automatically returns to 0.

!

- The motor cannot be driven in simulation mode.
- To check the actual operation by connecting the motor, set "Simulation mode enable [PA-20]" to "Disable (00)" and turn the power on again.
- To operate the simulation mode, leave the input with 24 VDC power supply if 24 VDC power supply is supplied, or leave the main power input if the main power supply is input, and turn off the power at the state of termination.
- The simulation mode simulates the terminal operation, and the function by the motor control operation does not operate.
- If an error code that does not exist in the "Error code selection for alarm test [PA-21]" is inserted in the simulation mode, no error will occur and [PA-21] will automatically return to 0.
- In the simulation mode, if an error code judged as a major failure is inserted in [PA-21], the power must be turned on again to cancel the trip.
(Error codes judged as serious failure: [E008], [E011], [E014], and [E030])

▼

- Enable simulation mode.

1. Set "Simulation mode enable [PA-20]" to "Enable (01)".
2. Shut off the power and turn on the power again.
3. The simulation mode starts.

▼

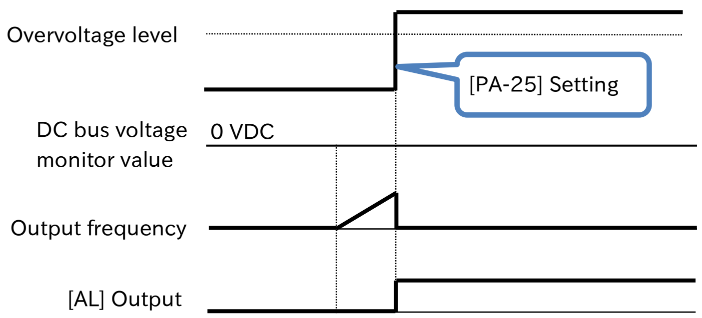
- Disable simulation mode.

1. Set "Simulation mode enable [PA-20]" to "Disable (00)".
2. Shut off the power and turn on the power again.
3. The simulation mode is canceled.

Code	Name	Description	Data
[PA-20]	Simulation mode enable	Disable	00
		Enable	01
[PA-21]	Error code selection for alarm test	Set the error code to be issued. An error that does not exist does not occur.	0 to 255
[PA-22]	Simulation mode: Optional output selection for the output current monitor	Disable: Although the detected value is displayed as usual, it is virtually zero because the output is shut off.	00
		Enable (set by parameter [PA-23])	01
		Enable (set from [Ai1])	02
		Enable (set from [Ai2])	03
[PA-23]	Optional output value setting for the output current monitor	The set value is treated as the internal output value.	(0.00 to 3.00)× ND/LD rated output current (A)
[PA-24]	Simulation mode: Optional output selection for the DC bus voltage monitor	Disable: Displays the detection value as usual. 24 VDC power feed will be zero.	00
		Enable (set by parameter [PA-25])	01
		Enable (set from [Ai1])	02
		Enable (set from [Ai2])	03
[PA-25]	Optional output value setting for the DC bus voltage monitor	The set value is treated as the internal output value.	200V class: 0.0 to 450.0(VDC) 400V class: 0.0 to 900.0(VDC)
[PA-26]	Simulation mode: Optional output selection for the output voltage monitor	Disable: Displays the output voltage expected for control.	00
		Enable (set by parameter [PA-27])	01
		Enable (set from [Ai1])	02
		Enable (set from [Ai2])	03
[PA-27]	Optional output value setting for the output voltage monitor	The set value is treated as the internal output value.	200V class: 0.0 to 300.0 (V) 400V class: 0.0 to 600.0 (V)
[PA-28]	Simulation mode: Optional output selection for the output torque monitor	Disable: Displays the output torque assumed in control.	00
		Enable (set by parameter [PA-28])	01
		Enable (set from [Ai1])	02
		Enable (set from [Ai2])	03
[PA-29]	Optional output value setting for the output torque monitor	The set value is treated as the internal output value.	-500.0 to 500.0(%)
[PA-30]	Simulation mode: Optional frequency matching start enable setting	Disable: Restart from the output frequency when a retry cause occurs.	00
		Enable (set by parameter [PA-31])	01
		Enable (set from [Ai1])	02
		Enable (set from [Ai2])	03
[PA-31]	Optional frequency matching start setting value	The set value is treated as the internal output value.	0.00 to 590.00(Hz)

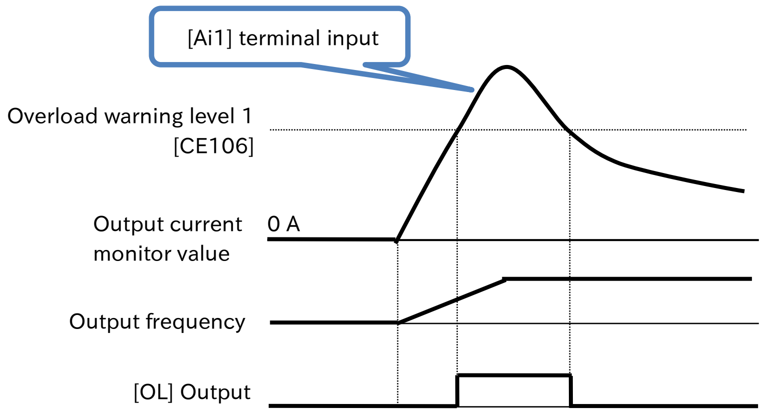
(e.g.1) Check the operation when the output terminal function "Alarm [AL]" is output.

- Set "Simulation mode: Optional output selection for the DC bus voltage monitor [PA-24]" to "Parameter [PA-25] (01)" and "Optional output value setting for the DC bus voltage monitor [PA-25]" to the normal operation range.
- After starting operation, set [PA-25] to the max value.
- After setting [PA-25] to max value, "Overvoltage error [E007]" occurs and the "Alarm [AL]" is turned ON.



(e.g. 2) Check the signal output level of the output terminal function "Overload warning notice [OL]".

- Set "Simulation mode: Optional output selection for the output current monitor [PA-22]" to "Setting by Terminal [Ai1] (02)".
- Set "Overload warning level 1 [CE106]" to begin operation.
- Increase or decrease the voltage/current input to the terminal [Ai1] to change the value on the "Output current monitor [dA-02]".
- If the value displayed in [dA-02] exceeds [CE106], "Overload warning notice [OL]" is ON.



8.2.2 Test Run by Connecting Only Motor

Q

- I want to connect only the motor to the inverter and perform a test run.

A

- To confirm that there are no basic problems with the inverter, motor, wiring, etc., carry out a test run with no load with only the motor connected in the procedure described in the next section.
- Perform the necessary settings for the motor to be used in the test run according to the "8.1 Mandatory Setting for Operation ", and then perform the test run with no load to confirm that the motor can be turned forward, backward, or stopped without any problems.

Note Burnout

- Be sure to read "Chapter 1 Safety Precautions/Risks" carefully before starting operation.
- It is recommended that the control mode be used as V/f control in the test run of the motor only.

Do

- Do not operate the motor with an extremely small capacity than the inverter capacity. Also, when performing a test run with a motor of capacity under several frames, set the control mode as V/f control, and set the basic settings of the motor such as motor capacity and electronic thermal level according to the motor used. If the setting is incorrect, a current larger than the rated motor current may flow, causing motor burnout.
- STOP/RESET key on the keypad can be enabled or disabled using "STOP-key enable [AA-13]". Prepare an emergency stop/emergency shut-off switch separately in case of emergency.

Check items for test run with no load

- Check if the machine operation direction is correct, if the machine operates smoothly and there is no abnormal noise or vibration, and if the machine operates normally without abnormal noise or vibration even if the frequency command or operation direction is changed.
- Check that there is no trip during acceleration/deceleration, and that the speed and frequency meter are correct.
- Check that the current and voltage values have a margin to the trip value in "Output current monitor [dA-02]" and "DC bus voltage monitor [dA-40]."
- If "Overcurrent error [E001]" or "Overvoltage error [E007]" occurs during a test run, try increasing the acceleration/deceleration times. Refer to "15 Tips/FAQ/Troubleshooting" for more information on tripping and corrective actions.

Operation by RUN command and frequency reference from the keypad

(1) Before test operation, check that each parameter is set correctly according to "8.1 Mandatory Setting for Operation ".

(2) Set "Main speed reference setting (monitor) [FA-01]", "RUN-key command rotation direction [AA-12]", "Main speed input source selection, 1st-motor [AA101]" and "RUN command input source selection, 1st-motor [AA111]" as shown in the table below. It is recommended that [FA-01] be at a low speed of about 10 Hz for safety at first.
The default setting of "Acceleration time setting (monitor) [FA-10]"/"Deceleration time setting (monitor) [FA-12]" is 10 seconds. Change it as necessary. In the no-load test run, the constant-torque characteristic of V/f control is recommended for "Control mode selection [AA121]".

(3) Check that "0.00 Hz" is displayed in "Output frequency monitor [dA-01]".

(4) When RUN key is pressed, the running LED [RUN] on the keypad lights and the motor starts rotating.

(5) Check that there is no abnormality in the output frequency monitor, actual motor rotation speed, motor rotation direction, and inverter. Check the rotating direction of the motor by "Rotation direction monitor [dA-03]".

(6) If there is no problem with above procedures, use [FA-01] to gradually increase the output frequency.

(7) After confirming the operation, press STOP/RESET key. When the motor starts to decelerate and stops, the running LED [RUN] on the keypad turns off.

Code	Name	Description	Data
[dA-01]	Output frequency monitor	Displays the inverter output frequency.	0.00 to 590.00 (Hz)
[dA-03]	Rotation direction monitor	Displays the inverter operation direction.	F (Forward) r (Reverse) o (Stop)
[FA-01]	Main speed reference setting (monitor)	Set the output frequency command to the motor.	0.00 to Maximum frequency (Hz)
[FA-10]	Acceleration time setting (monitor)	Set the acceleration time/deceleration time as required. The default settings are both 10.00 s.	0.00 to 3600.00 (s)
[FA-12]	Deceleration time setting (monitor)		
[AA-12]	RUN-key command rotation direction	Set the rotational direction when operating with RUN key on the keypad.	00 (Forward) 01 (Reverse)
[AA101]	Main speed input source selection, 1st-motor	Operation is performed with the frequency command set to [FA-01].	07
[AA111]	RUN command input source selection, 1st-motor	Press RUN key to start operation.	02
[AA121]	Control mode selection, 1st-motor	Operation with the constant-torque characteristic of V/f control is recommended.	00

Operation by RUN command and frequency reference from the control circuit terminal block

(1) Before test operation, check that each parameter is set correctly according to ""8.1 Mandatory Setting for Operation ".

(2) Set "Main speed reference setting (monitor) [FA-01]", "Main speed input source selection, 1st-motor [AA101]", "RUN command input source selection, 1st-motor [AA111]", "Input terminal [1] function [CA-01]", "Input terminal [2] function [CA-02]" as shown in the table below. It is recommended that [FA-01] be at a low speed of about 10 Hz for safety at first.

(3) Check that "0.00 Hz" is displayed in "Output frequency monitor [dA-01]".

(4) Check in [FA-01] that the analog voltage is 0 VDC and the frequency reference is 0.00 Hz. When turn ON the "Forward rotation [FW]" input terminal or the "Reverse rotation [RV]" input terminal, the running LED [RUN] on the keypad lights.

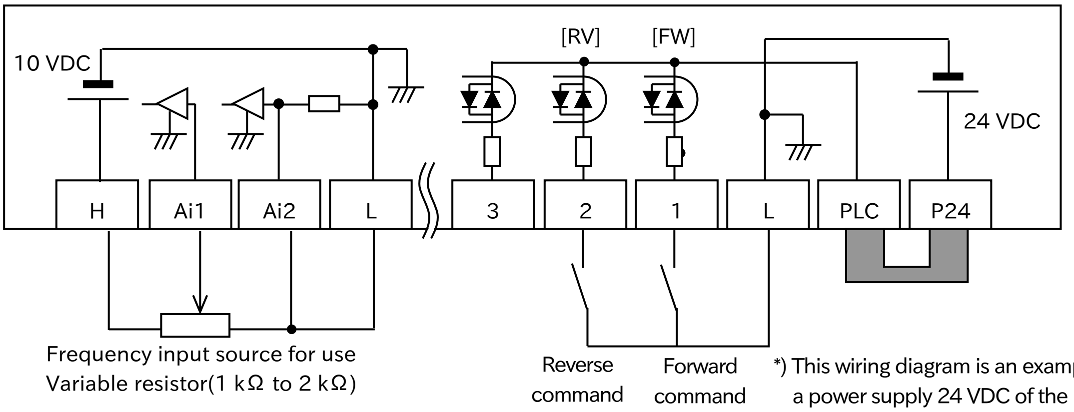
(5) When the analog voltage, which is a frequency reference, is gradually increased, the motor starts to rotate.

(6) Check that there is no abnormality in the output frequency monitor, actual motor rotation speed, motor rotation direction, and inverter. Check the rotational direction of the motor by "Rotation direction monitor [dA-03]".

(7) After confirming operation, turn OFF the [FW] input terminal or [RV] input terminal. When the motor starts to decelerate and stops, the running LED [RUN] on the keypad turns off.

Code	Name	Description	Data
[dA-01]	Output frequency monitor	Displays the inverter output frequency.	0.00 to 590.00 (Hz)
[dA-03]	Rotation direction monitor	Displays the inverter operation direction.	F (Forward) r (Reverse) o (Stop)
[FA-01]	Main speed reference setting (monitor)	When the frequency reference input source is analog input, it is the main speed reference monitor.	0.00 to Maximum frequency (Hz)
[FA-10]	Acceleration time setting (monitor)	Set the acceleration time and deceleration time as necessary. The default settings are both 10.00 s.	0.00 to 3600.00 (s)
[FA-12]	Deceleration time setting (monitor)		
[AA101]	Main speed input source selection, 1st-motor	The analog input from the terminal [Ai1] is regarded as a frequency command.	01
[AA111]	RUN command input source selection, 1st-motor	Operate with "Forward rotation [FW]" / "Reverse rotation [RV]" of the input terminal.	00
[AA121]	Control mode selection, 1st-motor	Operates with the constant-torque characteristic of V/f control.	00
[CA-01]	Input terminal [1] function	Assign "Forward rotation [FW]".	001
[CA-02]	Input terminal [2] function	Assign "Reverse rotation [RV]".	002

■ Wire control circuit terminal block example



*) This wiring diagram is an example when using a power supply 24 VDC of the inverter.

8.2.3 Perform a Test Run with a Machine Load

Q
- I want to connect the motor and the load machine to the inverter and perform a test run.

A
- If no problem is found in the no-load operation, perform a test run with the actual load to which the mechanical system is connected, and confirm that there is no problem.

Note
Burnout
Breakage

Do

- Be sure to read "Chapter 1 Safety Precautions/Risks" carefully before starting operation.
- Before performing a test run with the machine load connected, be sure to perform the test run and operation check with the motor alone in accordance with "8.2.2 Test Run by Connecting Only Motor."
- Be sure to set the motor basic settings such as motor capacity and electronic thermal level according to the motor to be used. Operation with incorrect settings may cause damage to the load machine or burnout of the motor.
- STOP/RESET key on the keypad can be enabled or disabled using "STOP-key enable [AA-13]". Prepare an emergency stop/emergency shut-off switch separately in case of a situation.

Confirmation during Test Run under actual load

- Confirm that the machine operation direction is correct and that the machine moves smoothly.
- If possible, check that there is no vibration or abnormal noise of the machine even if the frequency command or the operation direction is changed.
- Check that there is no trip during acceleration/deceleration, and that the speed and frequency meter are correct.
- Check if "Overcurrent error [E001]", "Overload error ([E005], [E038], [E039])" or "Overvoltage error [E007]" occurs during test run.
- In "Output current monitor [dA-02]", "DC bus voltage monitor [dA-40]", "Electronic thermal load factor monitor (Motor) [dA-42]", and "Electronic thermal load factor monitor (Inverter) [dA-43]", confirm that there is a margin for the value at which the values of the current, voltage, and load factor monitor are tripped.
- If operation during V/f control is not stable, adjust it referring to "9.5.9 Stabilizing Motor Hunting".
- If adequate performance is not obtained, such as when starting with automatic torque boost or operation with sensorless vector control, such as when the motor gets shocked or the motor is hunting, refer to "9.5.5 V/f Control with Automatic Torque Boost" and "9.5.10 Sensorless Vector Control".
- For more information about tripping and corrective actions, refer to "Chapter 15 Tips/FAQ/Troubleshooting".

Test Run under Actual Load with Load Machine Connected

(1) After confirming that the motor is completely stopped, connect the mechanical system and confirm that there are no loose mounting screws, etc. If the inverter is connected, wait at least 10 minutes after the power is turned off, use a multimeter or the like to check that there is no residual voltage between the [P/+] and [N/-] terminals (single-phase models: [+] and [-] terminals) on the main circuit terminal block, and then perform the work after confirming safety.

(2) When using automatic torque boost or sensorless vector control, be sure to set the motor constant of the motor to be used. For details, refer to "8.1.5 Setting Motor Constant" or "8.3 Carrying Out Motor Auto-tuning". If auto-tuning cannot be performed with the load machinery connected, perform auto-tuning with only the motor connected in advance and calculate the moment of inertia of the load in terms of motor shaft and add it to "Async. Motor constant J [Hb118]."

(3) Start operation using the RUN command as a ON after making the required settings such as frequency reference input source selection and RUN command input source selection. It is recommended to set the frequency reference to the low speed of 10 Hz level for safety at first.

(4) Check the above items to see if there is no problem in the operating condition.

8.3 Carrying Out Motor Auto-tuning

8.3.1 Procedure for Auto-tuning of an Induction Motor

Q

- Use a motor other than the Hitachi standard induction motor.
- Motor drive is not stable.
- The motor and wiring were replaced.

A

- Auto-tuning is a function that measures and automatically sets the required motor constants in order to increase the accuracy of automatic torque boost and sensorless vector control, etc.
- If you do not know the motor constant, perform auto-tuning to measure the motor constant.
- Auto-tuning can be selected from two methods of "No-rotation (01)" and "Rotation (02)" in "Auto-tuning selection [HA-01]". Select according to the situation.
- When auto-tuning an induction motor (IM), set "Control mode selection [AA121]" to "V/f control (IM) (00 to 03)" and "Sensorless vector control (IM) (08)".
- The measured motor constants are data (including wiring) for one phase of Y-connection.

!

- In the factory setting, the motor constant of the Hitachi standard induction motor is set. When using a Hitachi standard induction motor, characteristics can be obtained without problems in most cases even if auto-tuning is not performed.
- If you change "Async. Motor capacity setting [Hb102]" or "Async. Motor number of poles setting [Hb103]" after auto-tuning, the motor will be initialized to the corresponding Hitachi standard motor constants. Be sure to set [Hb102] and [Hb103] prior to performing auto-tuning.
- In the factory default parameter state, performing auto-tuning first enables smooth tuning.
- The motor capacity that can be measured is up to the maximum applicable frame and one lower frame motor. Otherwise, the correct constant may not be obtained. When performing auto-tuning with a one-frame lower motor, set "Overload restriction 1 mode selection [bA122]" to "Enable during accel. and constant speed (01)", and set "Overload restriction 1 active level [bA123]" to 1.5 times the rated motor current.

■ Parameters related to auto-tuning of induction motor (IM)

Code	Name	Description	Data
[HA-01]	Auto-tuning selection	Disable	00
		Enable: Motor no-rotation	01
		Enable: Motor rotation	02
[HA-02]	Auto-tuning RUN command source selection	Keypad (RUN-key)	00
		Follow the [AA111]/[AA211] setting	01
[HA181]	Cable length parameter	Set according to the length of the motor cable used.	5 to 20
[Hb102]	Async. Motor capacity setting	Set according to the motor specifications.	0.01 to 30.00 (kW)
[Hb103]	Async. Motor number of poles setting		2/4/6/ to /46/48 (pole)
[Hb104]	Async. Motor base frequency setting		30.0 to Maximum frequency (Hz)
[Hb105]	Async. Motor maximum frequency setting		Base frequency to 590.00(Hz)
[Hb106]	Async. Motor rated voltage		1 to 1000 (V)
[Hb108]	Async. Motor rated current		0.01 to 10000.00 (A)
[Hb110]	Async. Motor constant R1 (primary resistance)	Parameter for setting the motor constant of an induction motor. When the motor constant is measured with the auto-tuning function, this parameter will be overwritten. It is also possible to adjust and change manually after performing auto-tuning.	0.000001 to 1000.000000 (Ω)
[Hb112]	Async. Motor constant R2 (secondary resistance)		0.000001 to 1000.000000 (Ω)
[Hb114]	Async. Motor constant L (Leakage inductance)		0.000001 to 1000.000000 (mH)
[Hb116]	Async. Motor constant I0 (no-load current)		0.01 to 10000.00 (A)
[Hb118]	Async. Motor constant J (moment of inertia)		0.00001 to 10000.00000 (kgm^2)

Auto-tuning execution step

1 Pre-setting of parameters

(1) Select "Async. Motor capacity setting [Hb102]" and "Async. Motor number of poles setting [Hb103]" according to the motor to be used.
(2) Set the "Async. Motor base frequency setting [Hb104]" and "Async. Motor rated voltage [Hb106]" according to the specifications of the motor to be measured.
(3) Set "DC braking selection [AF101]" to "Disable (00)" and "Vector control mode selection [AA123]" to "Speed/Torque control mode (00)". If it is not "Speed/Torque control mode (00)", the correct measurement will not be performed.
(4) Set the motor cable length in "Cable length parameter [HA181]". The motor cable length code selection is a parameter that compensates for the current detection accuracy due to differences in the motor cable length. No setting is required for 11 kW, 15 kW models. Also, if the motor cable length is long (exceeding 20 m), auto-tuning may not be performed sufficiently.
(5) Do not ON "Permission of torque control [ATR]" of the input terminal function. If the [ATR] input terminal is ON, the inverter will not measure motor constants correctly.

2 Selection of "Motor rotation" and "Motor no-rotation"

- Set whether the motor rotates or not during auto-tuning to "Auto-tuning selection [HA-01]." Each of them has the following characteristics.

[HA-01] Setting	Description
No-rotation (01)	Measure the motor constant without rotating the motor. Use this function when the motor must not rotate. Because the motor does not rotate, the motor constant I0 (no-load current) and motor constant J (moment of inertia) cannot be measured. Even "No-rotation (01)" may cause the motor to rotate slightly.
Rotation (02)	Measure the motor constant by actually rotating the motor. Use it when there is no problem even if the motor rotates.

Warning
Injury
Failure

Do

- Note the following when "Rotation (02)" is selected.
  - Rotation to around the base frequency of 80% is acceptable.
  - The motor is not driven from the outside.
  - The brake must be open.
- Since the output torque is not sufficient during auto-tuning, there is a possibility of slipping off in elevators, etc. In such applications, disconnect the motor from the load machine and perform auto-tuning with the motor alone. Since the measured motor constant J (moment of inertia) is a single motor, separately set the value obtained by converting the moment of inertia of the load machine to the motor shaft.
- During auto-tuning, when the moment of inertia of the load machine is large or the receiving voltage is high, the deceleration stop tends to be slow. In this case, increase the deceleration time or perform auto-tuning as the motor alone and set the motor constant J (moment of inertia) separately.
- In a machine (elevator, ball screw, etc.) where the motor shaft rotation amount is limited, the machine may be damaged due to the drive exceeding the allowable rotation amount. Select "Motor no-rotation (01)".

To next page

3 Auto tune run

- When the RUN command is turned ON from the RUN command input source set in "RUN command input source selection [AA111]", auto-tuning starts according to the following steps. When the RUN command is OFF, auto-tuning can be stopped halfway. However, the tuning data is not memorized.
- If abnormal termination or trip occurs during auto-tuning, refer to "Countermeasures for failure during auto-tuning" in this section to clear the cause of the error.

(1) AC excitation first time (Motor does not rotate.)

↓

(2) Second time of AC excitation (The motor does not rotate.)

↓

(3) DC excitation 1st time (Motor does not rotate.) [HA-01]: When "No-rotation (01)" is selected → (6)

↓

(4) V/f control operation (The motor rotates up to 80 % of the base frequency.) *1

↓

(5) Sensorless vector control operation (Motor rotates up to X %*2 of base frequency) *1

↓

(6) DC excitation 2nd time (Motor does not rotate.)

↓

(7) Displays the tuning result. *3

*1. (4)(5) will not be executed in case of "Motor no-rotation".

*2. The rotational speed in (5) is as follows when the larger of the acceleration time and deceleration time in (4) is taken as T.

When 0 s < T < 50 s: X=40 %
When 50 s ≦ T < 100 s: X=20 %
When 100 s ≦ T: X = 10 %

*3. The tuning result is displayed as follows.
If abnormal termination occurs, execute auto-tuning again.
The display is released by pressing STOP/RESET key.

Normal completion	Abnormal end
----0	-----1

4 Setting at the end of auto-tuning

- After normal completion, the measured value will be overwritten in "Async. Motor constant ([Hb110] to [Hb118])".
- If auto-tuning is performed without rotating the motor, "Async. Motor constant I0 [Hb116] and "Async. Motor constant J [Hb118]" are not measured. Make the following settings.
  - No-load current I0: Measure and set the no-load current of the motor itself in advance when operating at an output frequency equal to Async. Motor base frequency setting [Hb104], using "Control mode selection [AA121]" as "V/f constant-torque characteristic (00)". Or, set the motor no-load current confirmed with the motor manufacturer to "Async. Motor constant I0 [Hb116]".
  - Moment of inertia J: Calculate the moment of inertia of the load in terms of motor shaft, and set the sum of the moment of inertia of the motor alone to "Async. Motor constant J [Hb118]."
- After auto-tuning is completed, "Auto-tuning selection [HA-01]" automatically returns to "Disable (00)" regardless of normal end or abnormal end. To execute auto-tuning again, set it again.

Countermeasures for failure during auto-tuning

- If abnormal termination or trip occurs and forced termination occurs during auto-tuning, refer to the following troubleshooting and "15 Tips/FAQ/Troubleshooting" to clear the cause of abnormal termination or trip. Then, set "Auto-tuning selection [HA-01]" to "No-rotation (01)" or "Rotation (02)" again and perform auto-tuning again.

Possible cause	Example of remedy
The control mode does not match the motor.	Set "Control mode selection [AA121]" to "V/f control (Constant torque)(IM) (00)". Otherwise, it may end abnormally.
The motor nameplate data setting is incorrect.	Incorrect parameter settings related to motor nameplate data may cause tripping such as overcurrent. Refer to "8.1.3 Setting Motor Specification Label Data to Parameters" and check the parameter settings.
STOP/RESET key was pressed.	Press STOP/RESET key. Auto-tuning is interrupted. Check the auto-tuning setting again and start.
A trip occurred due to external factors such as braking.	The cause of the trip must be removed.
The input terminal function was activated.	If the input terminal function operates during auto-tuning, tuning may be hindered. Perform auto-tuning after confirming that the input terminal function is OFF.
The motor capacity is too small for the applicable motor frame of the inverter.	If tuning does not finish normally, you must set the motor constant manually.
"Overvoltage error [E007]" occurred because the machine load is large or the deceleration time setting is short.	• Increase the deceleration time. Return the deceleration time to the original value after completion of auto-tuning. • Perform auto-tuning as the motor alone.
"Overcurrent error [E001]" occurred during acceleration or deceleration due to heavy load.	• Increase the acceleration time/deceleration time. After auto-tuning is completed, return the acceleration time/deceleration time to the original value before auto-tuning.

9

Chapter 9 Inverter Functions

This chapter describes the various functions installed in the inverter. Select the function you want to use and perform the setting.
Before you perform any work, carefully read "Chapter 1 Safety Precautions/Risks" and the corresponding chapters to ensure safety.

9.1 Selecting RUN Command and Alarm Reset

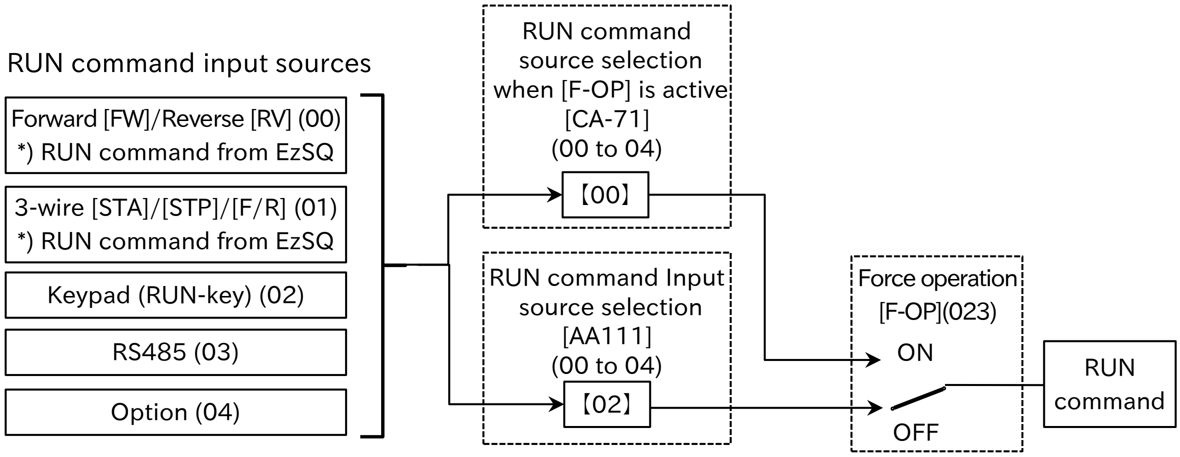
9.1.1 Types of RUN Command Source

Q

- What are the types of RUN command that can be selected for the inverter?

A

- The RUN command input source can be set in "RUN command input source selection [AA111]". For details, refer to the explanation in the following section and beyond.



* The values in square brackets and the switch positions shown in the figure are the default values.
All functions not assigned to "Input terminal function ([CA-01] to [CA-08]) are turned off.

Description about each RUN command source	Data
Input terminal function "Forward rotation [FW]", "Reverse rotation [RV]" set in the control circuit terminal or command by EzSQ program is regarded as RUN command.	00
Input terminal function "3-wire start [STA]", "3-wire stop [STP]" and "3-wire Forward/Reverse [F/R]" set in the control circuit terminal or the command by EzSQ program is regarded as the RUN command.	01
Enter the RUN command from the keypad or optional remote operator.	02
Enter the RUN command via Modbus communication.	03
Enter the RUN command via communication option.	04

!

- By setting "RUN command input source selection [AA111]" to "[FW]/[RV] terminal (00)", the reserved variable <FW>/<RV> in the program operation function EzSQ are enabled.
- By setting [AA111] to "3-wire (01)", the reserved variable <STA>/<STP>/<F/R> in the program operation function (EzSQ) are enabled.
- When "Force operation [F-OP]" is turned ON, the RUN command source switches the one set to "RUN command source selection when [F-OP] is active [CA-71]" regardless of the [AA111] setting. For details, refer to "9.1.7 Temporarily Changing RUN Command Source". At the same time, Speed input source also switches to the input source set to "Speed reference source selection when [F-OP] is active [CA-70]" regardless of the "Main speed input source selection [AA101]" setting. For details, refer to "9.2.1 Types of Frequency Reference Source" or "9.2.15 Temporarily Changing Frequency Reference Source".
- When a RUN command is given from the operation screen of the inverter configuration software ProDriveNext, [AA101] and [AA111] are forcibly overwritten with [AA101] = "Parameter setting (07)" and [AA111] ="RS485 (03)", respectively, when the operation screen is opened. When the operation screen is closed, they return to the setting when the operation screen is opened.

9.1.2 Operation by RUN Key on the Keypad

Q
- How to operate the inverter via the keypad during a test run?
- How to operate the inverter via the RUN key on the keypad?

A
- To start or stop the inverter using the RUN and STOP/RESET keys on the keypad or the optional remote operator (VOP/MOP/MOP-VR), set the "RUN command input source selection [AA111]" parameter to "Keypad's RUN-key (02)".
- To start operation using the RUN key on the keypad, set the correct direction of operation with "RUN-key command rotation direction [AA-12]".
- When the [AA111] is set to " Keypad's RUN-key (02)", or when the RUN command is switched to the keypad by the input terminal function "Force operation [F-OP]", the output terminal function "Run command = Keypad is selected [REF]" is turned ON. For details of [F-OP], refer to "9.1.7 Temporarily Changing RUN Command Source".

Code	Name	Description	Data
[AA111]	RUN command input source selection	Operation is started and stopped using the RUN and STOP/RESET keys on the keypad or optional remote operator.	02
[AA-12]	RUN-key command rotation direction	Forward rotation operation from the keypad.	00
		Reverse rotation operation from the keypad.	01
[CC-01] [CC-02] [CC-07]	Output terminal function	Run command = Keypad is selected [REF] : This output terminal turns on when inverter RUN command can be initiated using the RUN key on the keypad or optional remote operator.	011

!
- For the inverter to start operation, a frequency command is required in addition to a RUN command.

9.1.3 Operation by Forward/Reverse Input Terminals

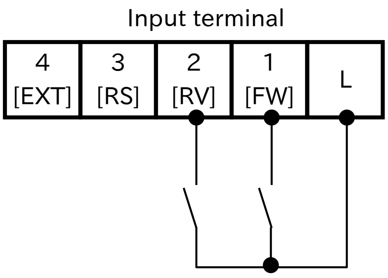
Q

- How to start or stop operation by an input signal to the control circuit terminal block?
- How to switch between forward and reverse rotation by turning on/off the input terminal on the control circuit terminal block?

A

- To perform forward/reverse rotation and stop operation using the input terminal function "Forward rotation [FW]" and "Reverse rotation [RV]" on the control circuit terminal, set the "RUN command input source selection [AA111]" to "[FW]/[RV] terminal (00)" and assign [FW] and [RV] to "Input terminal function ([CA-01] to [CA-08])".
- In the factory default state, [FW] terminal is assigned to terminal [1] and [RV] terminal to terminal [2]. The terminal assignments can be changed by configuring [CA-01] to [CA-08].
- The a/b (NO/NC) contact state can be changed for each terminal by configuring the "Input terminal active state ([CA-21] to [CA-28])".
- When the [FW] and [RV] input terminals are both on at the same time, a stop command is issued. The relationship between the [FW]/[RV] input terminal states and the RUN commands is shown in the following table.

"Forward rotation [FW]"/"Reverse rotation [RV]" states and RUN command



[FW]	[RV]	RUN command
OFF	OFF	Stop
ON	OFF	Forward
OFF	ON	Reverse
ON	ON	Stop

Code	Name	Description	Data
[AA111]	RUN command input source selection	The RUN command from the control terminal is enabled, and inverter operation can be started and stopped using the "Forward rotation [FW]"/"Reverse rotation [RV]" input terminals.	00
[CA-01] to [CA-08]	Input terminal function	Forward rotation [FW]: When turned on, operation is in the forward direction.	001
		Reverse rotation [RV]: When turned on, operation is in the reverse direction.	002
[CA-21] to [CA-28]	Input terminal active state	"a" contact state (NO: Normally Open)	00
		"b" contact state (NC: Normally Closed)	01

!

- For the inverter to start operation, a frequency command is required in addition to a RUN command.
- By setting "RUN command input source selection [AA111]" to "[FW]/[RV] terminal (00)", the reserved variable <FW>/<RV> in the program operation function EzSQ are enabled.

9.1.4 Operation by Momentary Switch

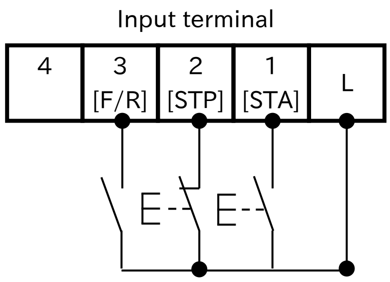
Q

- How to operate the inverter using a terminal input signal?
- How to start operation using a momentary switch?
- How to omit a self-holding circuit of the operation button?

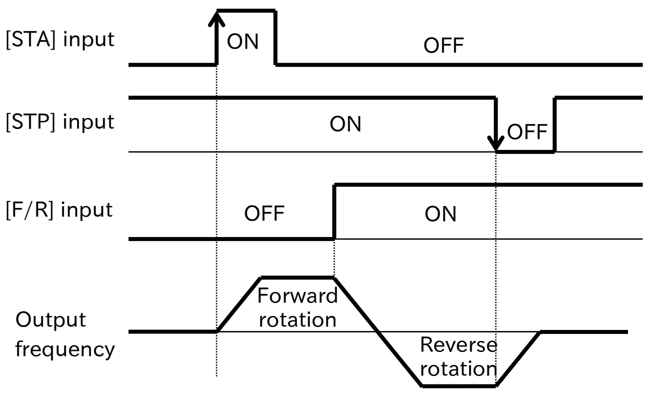
A

- To perform forward/reverse rotation and stop operation using 3-wire control function, set "RUN command input source selection [AA111]" to "3-wire (01)", and assign "3-wire start [STA](016)", "3-wire stop [STP](017)", and "3-wire forward/reverse [F/R](018)" to "Input terminal function ([CA-01] to [CA-08])".
- When the [STP] terminal is ON, operation is started by a rising-edge input on the [STA] terminal. When the [STP] terminal is turned off while the inverter is running, inverter will stop the operation.
- [STP] terminal is fixed to the b-contact (NC) input regardless of the setting of "Input terminal active state ([CA-21] to [CA-28])" for the corresponding terminal.

Example of terminal assignment and operation when using 3-wire control function



This example shows a following terminal assignment.
Terminal [1] = [STA]
Terminal [2] = [STP]
Terminal [3] = [F/R]



Code	Name	Description	Data
[AA111]	RUN command input source selection	RUN and stop is performed using the [STA]/[STP] terminal from the control circuit terminal.	01
[CA-01] to [CA-08]	Input terminal function	3-wire start [STA] : The start signal for the 3-wire control function. Operation starts when [STA] is ON while [STP] is ON (circuit is normally open due to the "b" contact state).	016
		3-wire stop [STP] : The stop signal for the 3-wire control function. It switches to the "b" (NC) contact state during assignment. The inverter stops when it is OFF state.	017
		3-wire forward/reverse [F/R] : OFF = Forward rotation, ON = Reverse rotation	018

!

- For the inverter to start operation, a frequency command is required in addition to a RUN command.
- By setting "RUN command input source selection [AA111]" to "3-wire (01)", the reserved variable <STA>/<STP>/<F/R> in the program operation function EzSQ are enabled.

9.1.5 Operation by Modbus-RTU Communication (RS485 Communication)

Q

- How to operate the inverter using Modbus-RTU communication (RS485 communication) commands?

A

- To perform forward/reverse rotation and stop operation using Modbus-RTU communication (RS485 communication), set the "RUN command input source selection [AA111]" to "RS485 (03)".

Code	Name	Description	Data
[AA111]	RUN command input source selection	Modbus-RTU communication (RS485 communication) commands are used to start and stop inverter operation.	03

!

- For the inverter to start operation, a frequency command is required in addition to a RUN command.
- For more information regarding Modbus-RTU communication (RS485 communication), refer to "Chapter 11 RS485 Communication".

9.1.6 Operation by Communication Option

Q

- How to operate the inverter using communication option.

A

- To perform forward/reverse rotation and stop operation using communication option, set the "RUN command input source selection [AA111]" to "Option (04)".

Code	Name	Description	Data
[AA111]	RUN command input source selection	Commands from the communication option are used to start and stop inverter operation.	04

!

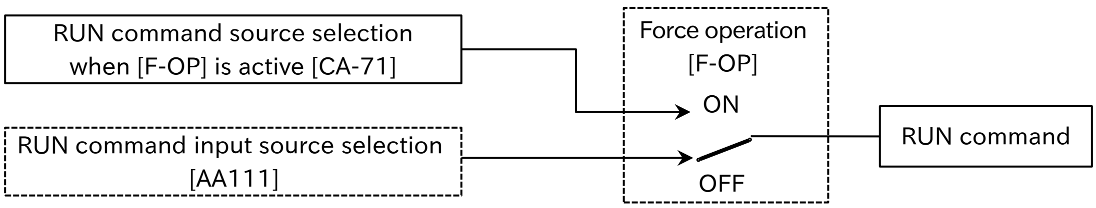
- For the inverter to start operation, a frequency command is required in addition to a RUN command.
- For more information regarding communication option, refer to "Chapter 13 Communication Option".

9.1.7 Temporarily Changing RUN Command Source

- How to temporarily change the RUN command input source to the RUN key on the keypad?
- How to temporarily change the RUN command input source to the input signals from the control circuit terminal block?

- When the "Force operation [F-OP] (023)" input terminal is turned ON, RUN command source switches from input source set in "RUN command input source selection [AA111]" to input source set in "RUN command source selection when [F-OP] is active [CA-71]" .

"Force operation [F-OP]" operation



*) Functions not assigned to input terminals [1] to [8] are OFF.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Force operation [F-OP] : When [F-OP] input terminal is ON, the RUN command input source and frequency reference input source are switched to the setting of [CA-70]/[CA-71].	023
[CA-71]	RUN command source selection when [F-OP] is active	RUN/stop is performed using the "Forward [FW]"/"Reverse [RV]" input terminals assigned to the control terminal.	00
		RUN/stop is performed by the "3-wire start [STA]"/"3-wire stop [STP]" input terminals assigned to the control terminal.	01
		RUN/stop is performed with RUN key and STOP/RESET key on the keypad.	02
		RUN/stop is performed by a command from Modbus-RTU communication (RS485 communication).	03
		RUN/stop is performed according to the command from the communication option.	04

- When the "Force operation [F-OP]" input terminal is turned ON, the frequency reference input source is also the input source set to "Speed reference source selection when [F-OP] is active [CA-70]" is enabled. For details, refer to "9.2.15 Temporarily Changing Frequency Reference Source".
- When the [F-OP] input terminal is turned ON/OFF and the RUN command input source is changed while the inverter is running, the drive will be stopped once. To start operation again, OFF the RUN command and ON it again. If the change by the [F-OP] input terminal is only the frequency reference input source, RUN state is continued.

9.1.8 Disabling the STOP/RESET Key on the Keypad

Q

- How to prevent the operation from being accidentally stopped from the keypad when the inverter is operating via external RUN command?
- How to perform a trip reset without stopping the operation currently performing via communication function?

A

- When the "RUN command input source selection [AA111]" is set to anything other than "Keypad's RUN-key (02)", the inverter stop command from the keypad can be disabled by setting "STOP-key enable [AA-13]" to "Disable (00)" or "Enable at only trip reset (02)".
- To use the STOP/RESE -key only for trip reset, set the "STOP-key enable [AA-13]" to "Enable at only trip reset (02)".

!

- To issue a stop command from the keypad in an emergency event, set the "STOP-key enable [AA-13]" to "Enable (01)". The STOP/RESET key can stop output even if the RUN command is issued by a source other than "Keypad's RUN-key (02)".
- When a stop command is issued from the keypad while the "RUN command input source selection [AA111]" is set to other than "Keypad's RUN-key (02)", the selected RUN command must be OFF once and ON again in order to operate the inverter again.
- The setting of [AA-13] is enabled when [AA111] is set to other than "Keypad's RUN-key (02)".

<table>
<tr><th>Code</th><th>Name</th><th>Description</th><th>Data</th></tr>
<tr><td rowspan="5">[AA111]</td><td rowspan="5">RUN command input source selection</td><td>RUN/Stop command by "Forward [FW]"/"Reverse [RV]" input terminal</td><td>00</td></tr>
<tr><td>RUN/Stop command by the 3-wire control function</td><td>01</td></tr>
<tr><td>RUN/Stop command from keypad</td><td>02</td></tr>
<tr><td>RUN/Stop command from modbus comunication</td><td>03</td></tr>
<tr><td>RUN/Stop command from communication option</td><td>04</td></tr>
<tr><td rowspan="3">[AA-13]</td><td rowspan="3">STOP-key enable</td><td>Disable:
The STOP/RESET-key is disabled when the "RUN command input source selection [AA111]" is set to other than "Keypad's RUN-key (02)".</td><td>00</td></tr>
<tr><td>Enable:
The STOP/RESET-key on the keypad is always enabled.</td><td>01</td></tr>
<tr><td>Enable at only trip reset :
The STOP/RESET-key on the keypad can be used to reset a trip only after the inverter has tripped.</td><td>02</td></tr>
</table>

9.2 Selecting Frequency Reference Source

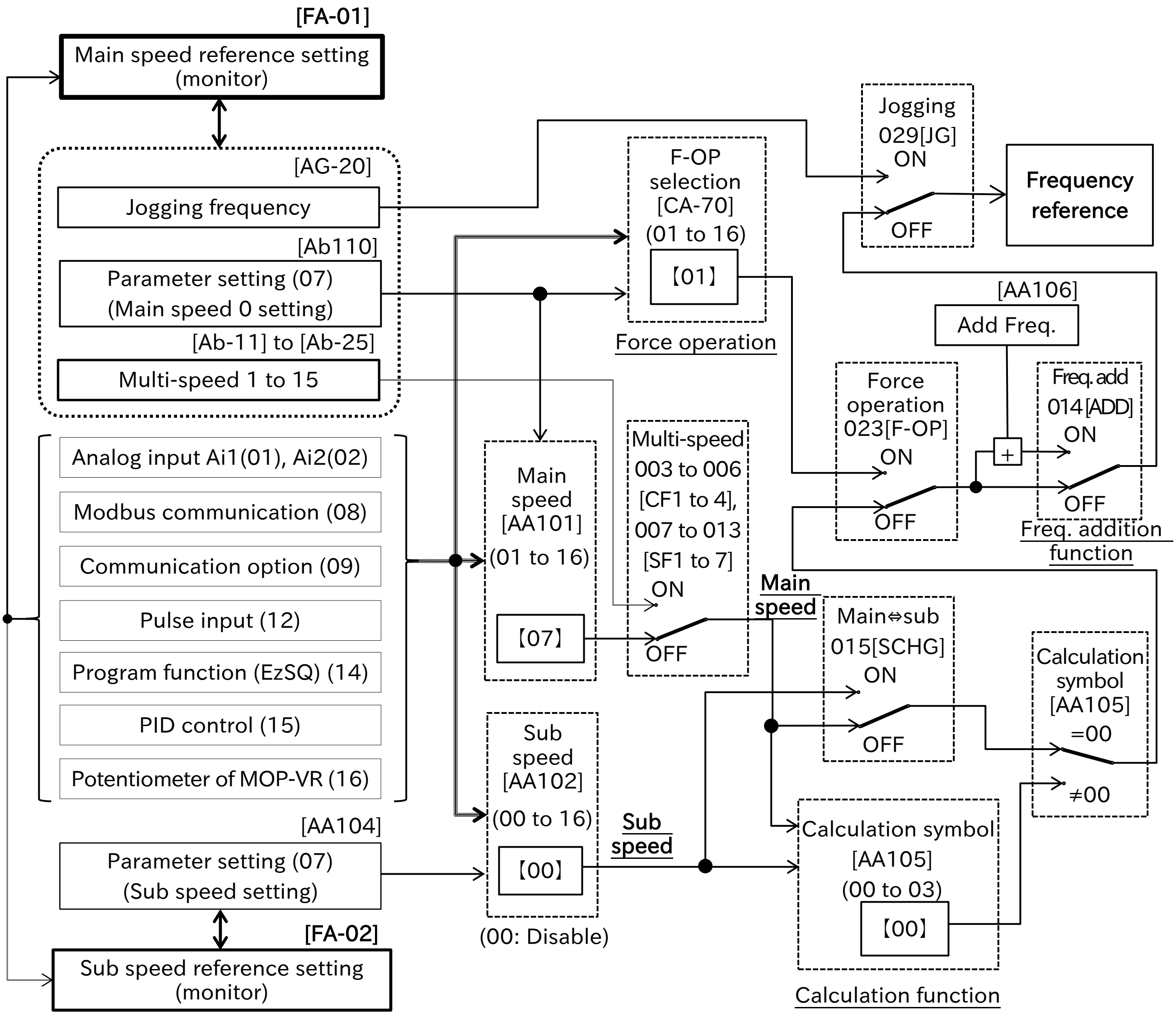
9.2.1 Types of Frequency Reference Source

Q

- What types of frequency reference input sources can be selected for the inverter and what is their order of priority?

A

- The following diagram shows the parameters and input terminal functions that affect the frequency reference input source selection.
- The frequency reference input source is set according to the "Main speed input source selection [AA101]". Note that when multiple functions are turned on, the frequency reference for each input terminal function is selected with the following order or priority: "Jogging [JG]", "Force operation [F-OP]" and then "Multi-speed ([CF1] to [CF4])" or "Multi-speed bit ([SF1] to [SF7])".
- When the frequency reference input source is the multi-speed 0, multi-speed 1 to 15, or jogging frequency, the "Main speed reference setting (monitor) [FA-01]" can be used to change the frequency reference. A setting change with the [FA-01] also changes the value of the selected frequency input source parameter.
  (For example, when the frequency reference input source is set to "Multi-speed 1 setting [Ab-11]", [Ab-11] setting is displayed in [FA-01]. When [FA-01] is changed, this is also reflected in [Ab-11].)
- When the frequency reference input source is an analog input or Modbus communication, etc., [FA-01] is used to monitor the output frequency reference value.



*) The values in 【 】 and the switch positions shown in the figure are the default values. All input terminal functions not assigned to "Input terminal function ([CA-01] to [CA-08])" are turned off.

A

- The following table shows the details of the frequency input sources that can be selected with the "Main speed input source selection [AA101]".

Overview of frequency reference	データ
The frequency reference is set using analog input to terminal [Ai1] on the control circuit terminal.	01
The frequency reference is set using analog input to terminal [Ai2] on the control circuit terminal.	02
The frequency reference is set according to the [FA-01] setting using the keypad or remote operator.	07
The frequency reference is set using Modbus communication.	08
The frequency reference is set using communication option.	09
The frequency reference is set using pulse input.	12
The frequency reference is set according to the <SET-Freq> reserved variable in the EzSQ program.	14
The frequency reference is set according to the calculation by PID function.	15
When the optional remote operator with potentiometer (MOP-VR) is connected, the frequency reference is set using the potentiometer on the remote operator.	16

!

- Other command input sources can also be selected even when using Modbus communication (including EzCOM function) or a program operation function EzSQ.
- When issuing a RUN command from the Inverter configuration software ProDriveNext, "Main speed input source selection [AA101]" = "Parameter setting (07)" and "RUN command input source selection [AA111]" = "RS485 (03)" are forcibly written when the operation screen is opened. When the operation screen is closed, these values return to the original values set before the operation screen is opened.

9.2.2 Setting Frequency Reference by Keypad

Q

- How to set the frequency reference from the keypad during a test run or normal operation?
- How to change the frequency reference from an optional remote operator?
- How to change the frequency reference while watching the monitor display?

A

- To set the output frequency reference from the keypad or optional remote operator, set the "Main speed input source selection [AA101]" to "Parameter setting (07)".
- When [AA101] is set to "Parameter setting (07)", the output frequency is set by "Main speed reference setting (monitor) [FA-01]" or "Multi-speed 0 setting [Ab110]". Similarly, when "Sub speed input source selection [AA102]" is set to "Parameter setting (07)", the output frequency is set by "Sub speed reference setting (monitor) [FA-02]" or "Sub speed setting [AA104]".

  e.g. : When [FA-01] is changed, [Ab110] is also changed to same value. When " 2nd-motor control [SET]" is ON, "Multi-speed 0 setting, 2nd-motor [Ab210]" is changed.
- When [AA101] is set to "Parameter setting (07)", or the frequency reference from the keypad has been switched by the input terminal function "Force operation [F-OP]", the output terminal function "Frequency reference = Keypad is selected [FREF]" is ON when the frequency reference from the keypad or the remote operator is accepted. For details of [F-OP] input terminal, refer to "9.2.15 Temporarily Changing Frequency Reference Source".
- For details regarding operation when a remote operator is connected, refer to "7.2.9 Remote Operator Functions".

Code	Name	Description	Data
[FA-01]	Main speed reference setting (monitor)	This parameter is used when setting the frequency reference of main speed from the keypad. Changing [FA-01] will also change [Ab110].	0.00 to Maximum frequency (Hz)
[FA-02]	Sub speed reference setting (monitor)	This parameter is used when setting the frequency reference of sub speed from the keypad. Changing [FA-02] will also change [AA104].	0.00 to 590.00 (Hz)
[AA101]	Main speed input source selection	From the keypad, set the main speed with the parameter setting. Use [FA-01] or [Ab110] to set the output frequency of main speed.	07
[AA102]	Sub speed input source selection	From the keypad, set the sub speed with the parameter setting. Use [FA-02] or [AA104] to set the output frequency of sub speed.	07
[AA104]	Sub speed setting	This parameter is used to set the sub speed from the keypad.	0.00 to 590.00 (Hz)
[Ab110]	Multi-speed 0 setting	This parameter is used to set the main speed from the keypad.	0.00 to Maximum frequency (Hz)
[CC-01] [CC-02] [CC-07]	Output terminal function	Frequency reference = Keypad is selected [FREF]: Turns on when the output frequency reference can be set from the keypad.	010

!

- Main speed and sub speed are selected or calculated by ON/OFF of the input terminal function "Main/Sub speed reference change [SCHG]" and "Speed reference calculation symbol selection [AA105]". For details, refer to "9.2.12 Select or Calculate Two Frequency References".
- When the input terminal functions "Multi speed selection ([CF1] to [CF4])", "Multi speed Bit ([SF1] to [SF7])", "Jogging [JG]" or "Force operation [F-OP]" are turned on, those frequency references are given priority regardless of the "Main speed input source selection [AA101]". Note that changing parameter [FA-01] while any of these terminal functions are turned on will also change the frequency setting parameter of each function.
- When [AA101] is set to "Parameter setting (07)" and "Enable frequency changes through monitor display [UA-93]" is set to "Enable (01)", the frequency command can be changed using "Output frequency monitor [dA-01]" or "Output frequency scale conversion monitor [dA-06]". For details, refer to "10.1.1 Monitor the Output Frequency".

9.2.3 Setting Frequency Reference by Analog Input (Voltage/Current)

Q

- How to input a frequency command from an external device according to a voltage or current input signal?
- How to connect a variable resistor (potentiometer) to change the frequency command?

A

- To set the output frequency reference with analog voltage input or analog current input from the terminal [Ai1]/[Ai2] on the control circuit terminal, set "Main speed input source selection [AA101]" to "Terminal [Ai1] (01)" or "Terminal [Ai2] (02)".
- When [AA101] is set to "Terminal [Ai1] (01)" or "Terminal [Ai2] (02)", "Main speed reference setting (monitor) [FA-01]" becomes the output frequency reference monitor and displays the output frequency setting value corresponding to the selected analog input value.
- Whether to use analog voltage input or analog current input can be selected by "[Ai1] Input selection [Cb-08]" or "[Ai2] Input selection [Cb-18]". By default, terminal [Ai1] is set to analog voltage input (0 to 10 VDC) and the terminal [Ai2] is set to analog current input (4 to 20 mA).

!

- WJ-C1 is adjusted at factory so that a 9.8 VDC or a 19.8 mA input from the terminal [Ai1]/[Ai2] are the full scale of the input (the maximum frequency setting for frequency command). This can be fine-tuned as necessary. For details regarding adjustment, refer to "9.15.3 Adjusting Analog Input".

Code	Name	Description	Data
[FA-01]	Main speed reference setting (monitor)	Displays the output frequency set value according to the selected analog input value. When analog input is selected as the frequency reference, this parameter is treated as a monitor and cannot be changed directly.	0.00 to Maximum frequency (Hz)
[AA101]	Main speed input source selection	Set the output-frequency using the analog input to the terminal [Ai1] on the control-circuit terminal.	01
		Set the output-frequency using the analog input to the terminal [Ai2] on the control-circuit terminal.	02
[Cb-08]	[Ai1] Input selection	Terminal [Ai1] use analog voltage input.	01
		Terminal [Ai1] use analog current input.	02
[Cb-18]	[Ai2] Input selection	Terminal [Ai2] use analog voltage input.	01
		Terminal [Ai2] use analog current input.	02

9.2.4 Setting Frequency Reference by Multi-Speed Operation Function

Q

- How to perform multi-speed switching of the frequency reference by turning the I/O input signal on and off?

A

- The multi-speed operation function allows switching of several preset frequency references by ON/OFF pattern of the "Multi speed 1 to 4 selection ([CF1] to [CF4]) (003 to 006)" input terminal or the "Multi speed Bit 1 to 7 ([SF1] to [SF7]) (007 to 013)" input terminal.
- When multi-speed 1 to 15 is selected, priority is given to the multi-speed reference regardless of the "Main speed input source selection [AA101]" setting. However, when input terminal function "Jogging [JG]" and "Force operation [F-OP]" are ON, the frequency command of every input terminal function will be selected with precedence in this order.
- The following 2 modes can be selected for the multi-speed operation function according to the setting of "Multi-speed operation selection [Ab-03]".
  - Binary operation mode:
    It is possible to switch between up to 16 different speeds from multi speed 0 to 15 according to the ON/OFF pattern of the 4 input terminal functions ([CF1] to [CF4]). The time until the frequency reference is changed at the time of signal input can be set by "Multistage input determination time [CA-55]".
  - Bit operation mode:
    It is possible to switch between up to 8 different speeds from 0 to 7 according to which of the seven input terminals function ([SF1] to [SF7]) is turned on. The setting of "Multistage input determination time [CA-55]" is not applied to the bit operation mode.

!

- When all multi-speed input terminal functions [CF1] to [CF4] and [SF1] to [SF7] are off, multi-speed 0 operates at the frequency reference value set by the "Main speed input source selection [AA101]".

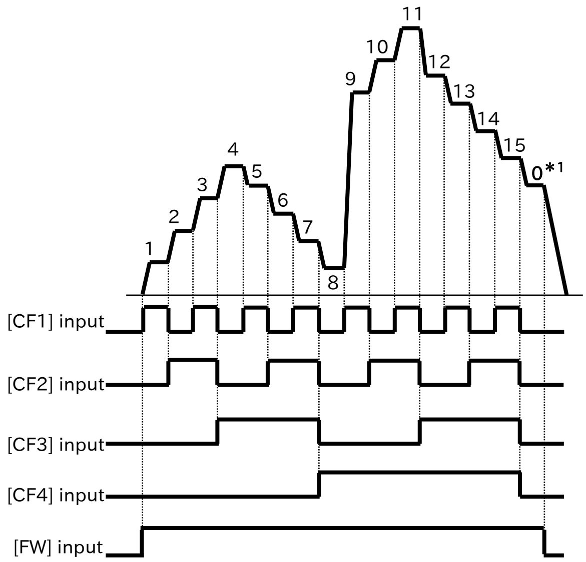
Code	Name	Description	Data
[FA-01]	Main speed reference setting (monitor)	Change the frequency reference of the multi-speed currently selected. (For example, when you change [FA-01] at the time of the multi-speed 2, [Ab-12] will be changed to the same value at the same time.)	0.00 to Maximum frequency (Hz)
[Ab-03]	Multi-speed operation selection	Binary operation mode up to 16 speeds	00
		Bit operation mode of up to 8 speeds	01
[Ab110]	Multi-speed 0 setting	Multi-speed 0 when "Main speed input source selection [AA101]" is "Parameter setting (07)".	0.00 to Maximum frequency (Hz)
[Ab-11] to [Ab-25]	Multi-speed 1 to 15 setting	Parameters for setting frequency reference of multi-speed 1 to 15.	0.00 to Maximum frequency (Hz)
[CA-01] to [CA-08]	Input terminal function	Multi speed selection 1[CF1] to Multi speed selection 4[CF4]: Multi-speed input terminal for binary operation (maximum. 16-speeds).	003[CF1] 004[CF2] 005[CF3] 006[CF4]
		Multi speed selection Bit-1[SF1] to Multi speed selection Bit-7[SF7]: Multi-speed input terminal for bit operation (maximum. 8 speeds).	007[SF1] 008[SF2] 009[SF3] 010[SF4] 011[SF5] 012[SF6] 013[SF7]
[CA-55]	Multistage input determination time	This is the time until the output frequency reference is determined when the multi-speed switching is performed in the binary operation mode.	0 to 2000 (ms)

A Binary operation mode (Maximum 16-speed commands: [Ab-03] = 00)

- Multi-speed 0 to 15 can be switched by assigning "Multi-speed selection ([CF1] to [CF4])" to "Input terminal function ([CA-01] to [CA-08])".

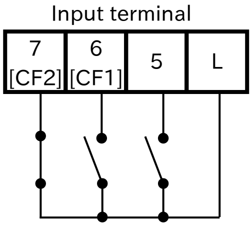
Binary operation mode control table

Multi-speed	CF4	CF3	CF2	CF1	Frequency reference
0*1	OFF	OFF	OFF	OFF	[Ab110]
1	OFF	OFF	OFF	ON	[Ab-11]
2	OFF	OFF	ON	OFF	[Ab-12]
3	OFF	OFF	ON	ON	[Ab-13]
4	OFF	ON	OFF	OFF	[Ab-14]
5	OFF	ON	OFF	ON	[Ab-15]
6	OFF	ON	ON	OFF	[Ab-16]
7	OFF	ON	ON	ON	[Ab-17]
8	ON	OFF	OFF	OFF	[Ab-18]
9	ON	OFF	OFF	ON	[Ab-19]
10	ON	OFF	ON	OFF	[Ab-20]
11	ON	OFF	ON	ON	[Ab-21]
12	ON	ON	OFF	OFF	[Ab-22]
13	ON	ON	OFF	ON	[Ab-23]
14	ON	ON	ON	OFF	[Ab-24]
15	ON	ON	ON	ON	[Ab-25]



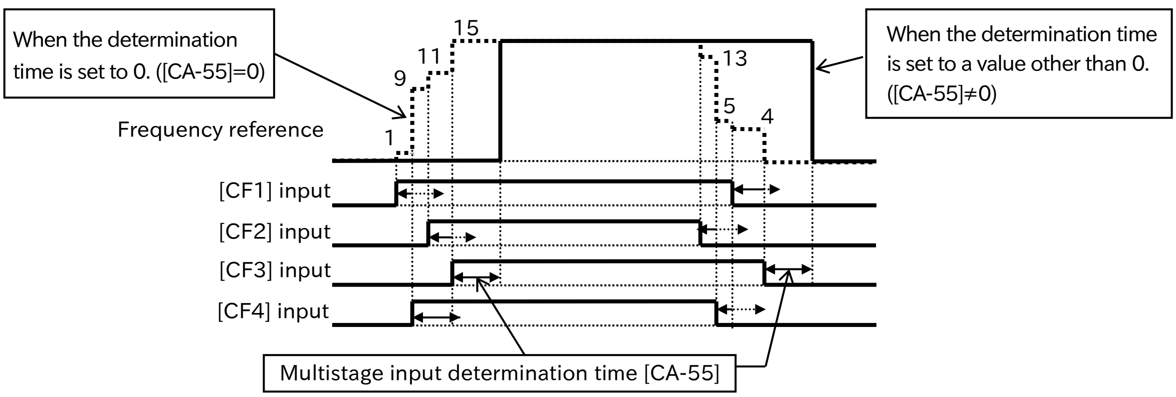
Example of binary operation mode (When multi-speed 2 is selected)

[CA-06]="Multi-speed seection 1 [CF1]" and [CA-07]="Multi-speed selection 2 [CF2]" are assigned. [CF3] and [CF4] are not assigned.
When only the input terminal [7] =[CF2] is ON, the frequency reference will be multi-speed 2, and the setting of "Multi-speed 2 [Ab-12]" will be displayed in the "Main speed reference setting (monitor) [FA-01]".



Multi-speed	CF4	CF3	CF2	CF1
1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON

- When using binary operation mode, the wait time until the multi-speed command is determined can be set by "Multistage input determination time [CA-55]". This function can prevent unintended change of multi-speed during multi-speed terminal switching.
- After the last rising/falling edge input to the multi-speed terminal, the multi-speed command is determined after the [CA-55] set time has elapsed. Note that the input response will be slower when the settling time is increased.



*1. Multi-speed 0 is the frequency reference set by the "Main speed input source selection [AA101]".

A

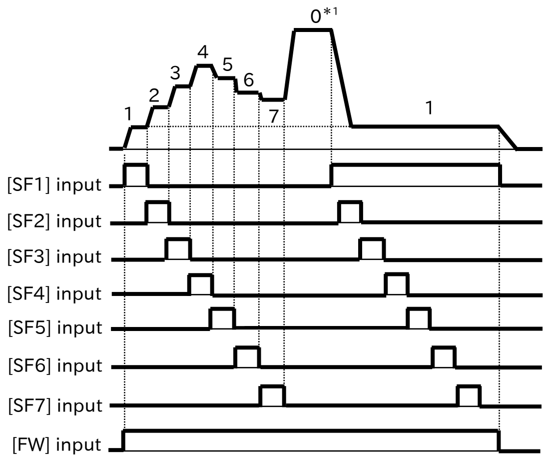
Bit operation mode (Maximum 8-speed commands: [Ab-03] = 01)

- Multi-speed 0 to 7 can be switched by assigning "Multi-speed Bit ([SF1] to [SF7])" to "Input terminal function ([CA-01] to [CA-08])".

!

- When multiple multi-speed bit input terminals are turned on simultaneously, the one with the lowest number is given priority.
- In the cells marked with an "x" in the table below, ON/OFF state of the terminal is ignored.

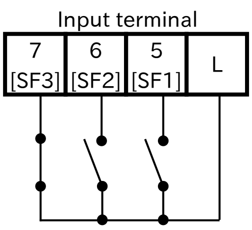
■ Bit operation mode control table



Multi-speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1	Frequency refernece
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Ab110[*1]
1	x	x	x	x	x	x	ON	Ab-11
2	x	x	x	x	x	ON	OFF	Ab-12
3	x	x	x	x	ON	OFF	OFF	Ab-13
4	x	x	x	ON	OFF	OFF	OFF	Ab-14
5	x	x	ON	OFF	OFF	OFF	OFF	Ab-15
6	x	ON	OFF	OFF	OFF	OFF	OFF	Ab-16
7	ON	OFF	OFF	OFF	OFF	OFF	OFF	Ab-17

■ Example of bit operation mode (When multi-speed 3 is selected)

[CA-05]="Multi-speed bit 1 [SF1]", [CA-06]="Multi-speed bit 2 [SF2]" and [CA-07]="Multi-speed bit 3 [SF3]" are assigned. [SF4] to [SF7] are not assigned.
When only input terminal [7] = [SF3] is ON, the frequency reference will be multi-speed 3, and the setting of "Multi-speed 3-speed [Ab-13]" will be displayed in " Main speed reference setting (monitor) [FA-01]".



Multi-speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1
1	×	×	×	×	×	×	ON
2	×	×	×	×	×	ON	OFF
3	×	×	×	×	ON	OFF	OFF

!

- "Multistage input determination time [CA-55]" is enabled only when binary operation mode is selected. Not applicable to bit operation mode.

*1. Multi-speed 0 is the frequency reference set by the "Main speed input source selection [AA101]".

9.2.5 Setting Frequency Reference for Jogging and Inching Operation

Q

- How to drive the motor in short discrete steps?
- How to perform inching?

A

- Jogging operation allows positioning and fine adjustments while the motor is stopped.
- After the "Jogging [JG]" input terminal is turned on, jogging operation can be started by giving the RUN command.

!

- During jogging operation, a frequency reference is set according to "Jogging frequency [AG-20]" setting without including an acceleration time. This can easily lead to issue such as an overcurrent trip. Be sure to appropriately adjust the [AG-20] to avoid a trip.
- Jogging operation is given priority over "Main speed input source selection [AA101]", "Multi-speed selection ([CF1] to [CF4])", "Multi-speed Bit ([SF1] to [SF7])" and "Force operation [F-OP]".

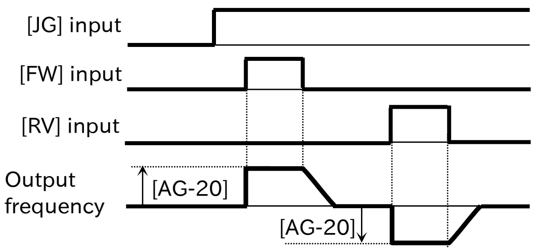
Code	Name	Description	Data
[AG-20]	Jogging frequency	Set the frequency reference value during jogging operation.	0.00 to 10.00 (Hz)
[AG-21]	Jogging stop mode selection	Disable [JG] input during RUN, free-run when stopped*1	00
		Disable [JG] input during RUN, deceleration stop when stopped	01
		Disable [JG] input during RUN, DC braking when stopped*2	02
		Enable [JG] input during RUN, free-run when stopped*1	03
		Enable [JG] input during RUN, deceleration stop when stopped	04
		Enable [JG] input during RUN, DC braking when stopped*2	05
[CA-01] to [CA-08]	Input terminal function	Jogging [JG]: When the RUN command is ON after this terminal is turned ON, the jogging operation is performed.	029

*1. When [AG-21] is "Free run when stopped (00, 03)", operation setting of free-run is required. For details, refer to section 9.7.6, Restart after Free Run Stop.
*2. When [AG-21] is "DC braking when stopped (02, 05)", DC braking must be set. For details, refer to section 9.7.8, "DC Braking at Stop."

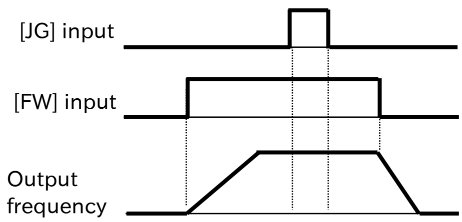
■ Jogging operation disable during RUN [AG-21]= Disable at RUN (00, 01, 02)

- When the setting of "Jogging stop mode selection [AG-21]" is "Disable at RUN (00, 01, 02)", the jogging operation cannot be performed when the RUN command ON first.

When jogging operation is activated

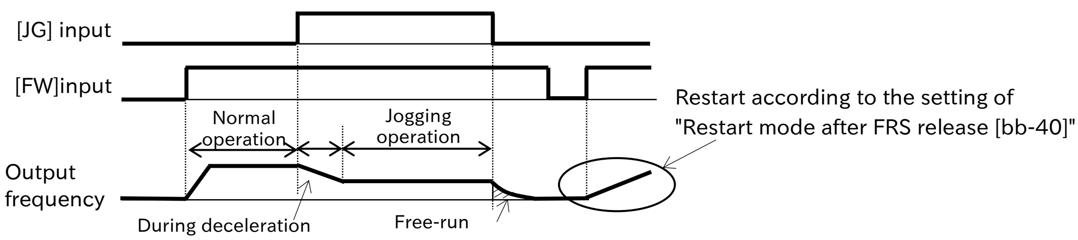


When jogging operation does not work



■ Jogging operation enable during RUN [AG-21]=Enable at RUN (03, 04, 05)

- When the setting of "Jogging stop mode selection [AG-21]" is "Enable at RUN (03, 04, 05)", the jogging operation can be performed even if the RUN command ON first. However, when [JG] input terminal OFF first, it will become free-run stop.



9.2.6 Setting Frequency Reference by Modbus-RTU Communication (RS485 Communication)

Q

- How to set the frequency reference using Modbus-RTU communication (RS485 communication)?

A

- To set output frequency reference by Modbus-RTU communication (RS485 communication), set "RS485 (08)" to "Main speed input source selection [AA101]".

Code	Name	Description	Data
[AA101]	Main speed input source selection	Set output frequency reference from Modbus communication (RS485 communication).	08

!

- For details of Modbus communication, "Chapter 11 RS485 Communication".

9.2.7 Setting Frequency Reference by Communication Option

Q

- How to set the frequency reference using a communication option board?

A

- To set the output frequency reference using a communication option board, set the "Main speed input source selection [AA101]" parameter to "Option (09)".

Code	Name	Description	Data
[AA101]	Main speed input source selection	Set the output frequency reference from the communication option.	09

!

- For details of communication option, "Chapter 13 Communication Option".

9.2.8 Setting Frequency Reference by Pulse Input

Q

- How to set the frequency reference using a pulse input of open-collector?

A

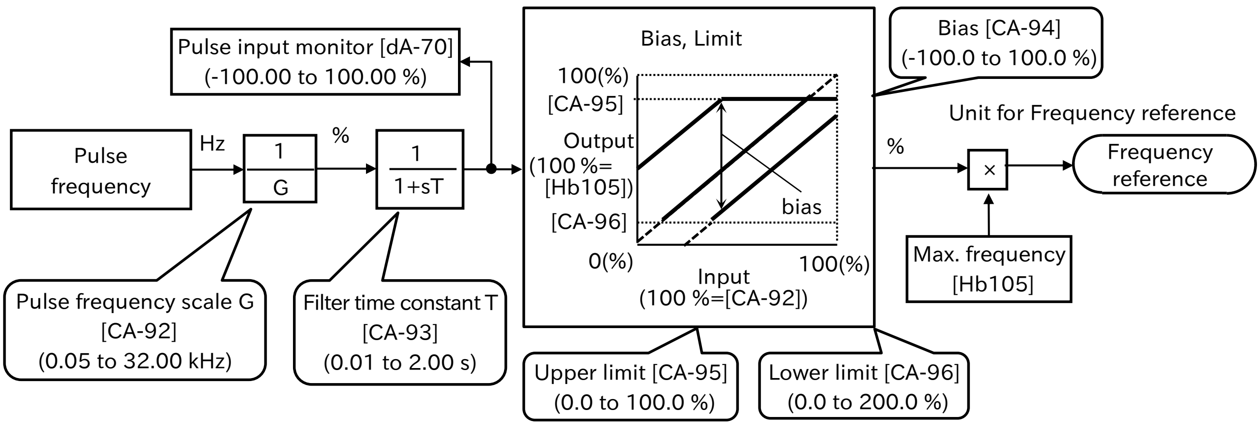
- To set the output frequency reference by pulse input, set "Main speed input source selection [AA101]" to "Pulse input (12)". At the same time, set "Pulse input target function selection [CA-90]" to "Frequency reference (01)". Depending on the setting of [CA-90], the input terminal [8] becomes the terminal for A-phase pulse input and the input terminal [7] becomes the terminal for B-phase pulse input.
- Set the input pulse frequency at which the frequency reference corresponds to the "Async. Motor maximum frequency setting [Hb105]" in "Pulse input frequency scale [CA-92]".
- Pulse input can be monitored by "Pulse input monitor [dA-70]".

!

- To limit the pulse input frequency reference, set "Pulse input frequency bias value [CA-94]", "Pulse input upper frequency detection level [CA-95]" and "Pulse input lower frequency detection level [CA-96]".
- Attempting to stop the inverter by turning 0 Hz the pulse input frequency may cause the deceleration to stagnate. If this happens, turn OFF the RUN command to stop.
- When the pulse input frequency falls below [CA-96], it will be processed assuming that 0 Hz is being input.
- When the setting of [CA-96] is large, the start may be slow.

Code	Name	Description	Data
[dA-70]	Pulse input monitor	Monitor the frequency of the input pulse as a percentage with [CA-92] as 100 %. This monitor is enabled when [CA-90] is set to "Frequency reference (01)".	-100.00 to 100.00 (%)
[AA101]	Main speed input source selection	Setting when pulse input is used as frequency reference.	12
[CA-90]	Pulse input target function selection	Setting when pulse input is used as frequency command.	01
[CA-92]	Pulse input frequency scale	Enter the pulse frequency equivalent to the maximum frequency.	0.05 to 32.00 (kHz)
[CA-93]	Pulse input frequency filter time constant	Filters the input pulse frequency.	0.01 to 2.00 (s)
[CA-94]	Pulse input frequency bias value	Applies a bias to the input pulse frequency.	-100.0 to 100.0 (%)
[CA-95]	Pulse input upper frequency detection level	Set the upper limit as a percentage of "Async. Motor maximum frequency [Hb105]" to 100% of the input pulse frequency reference.	0.0 to 100.0 (%)
[CA-96]	Pulse input lower frequency detection level	This parameter sets the frequency reference by pulse input to be 0.0% below the frequency set by the ratio that [Hb105] is 100%.	0.0 to 100.0 (%)

■ Pulse Frequency Reference Processing Block Diagram



9.2.9 Setting Frequency Reference by Program Operation Function EzSQ

Q

- How to set the frequency command from a program created with the program operation function EzSQ?

A

- To set the output frequency reference by program operation function EzSQ, set "Main speed input source selection [AA101]" to "Program function (14)". It is possible to set the frequency reference at any timing by using the reserved variable <SET-Freq> in EzSQ program.
- By setting "EzSQ Function enable selection [UE-02]", the EzSQ program start timing can be selected whether to operate EzSQ program when the power of the inverter is turned on or when the "Program RUN [PRG](099)" input terminal assigned to one of the input terminals [1] to [8] is ON.
- For details of the program operation function EzSQ, refer to "12.2 Program Operation Function EzSQ".

!

- For EzSQ programming and downloading to the drive, the inverter configuration software ProDriveNext must be installed on a Windows PC.
- For details, refer to "Inverter Configuration Software ProDriveNext Instruction Manual (NT8001*X)" and "Easy-Sequence Function Programming Guide (NT252*X)". For downloading of these operation guides, refer to "S.4 Related Technical Documents".

Code	Name	Description	Data
[AA101]	Main speed input source selection	Set the output frequency reference in EzSQ program reserved variable <SET-Freq>.	14
[CA-01] to [CA-08]	Input terminal function	Program RUN [PRG]: When [UE-02] is set to "PRG terminal (01)", programming is executed when this terminal is turned ON.	099
[UE-02]	EzSQ Function enable selection	Downloaded program operation is disabled.	00
		EzSQ program operates when the "Program RUN [PRG]" input terminal is ON.	01
		After the power is turned on, EzSQ programme will operate at all times.	02
		The debugging function of EzSQ program can be used. For details, refer to "12.2.3 Debug Function for EzSQ".	03

9.2.10 Setting Frequency Reference by PID Control

Q

- How to use PID control for the fan and pump?
- How to use process control?

A

- To use the calculation result by PID function as the frequency reference input source, set "PID calculation (15)" to "Main speed input source selection [AA101]". In addition, the parameters related to PID function must be set. For details, refer to "9.8 Driving by PID Process Control".

Code	Name	Description	Data
[AA101]	Main speed input source selection	Set the output frequency reference in PID function.	15

9.2.11 Setting Frequency Reference by Potentiometer on Remote Operator

Q

- How to use potentiometer of the remote operator for frequency reference?

A

- There are optional remote operators with the potentiometer (MOP-VR). When using this potentiometer as the frequency reference source, set "VR (MOP-VR) (16)" in " Main speed input source selection [AA101]".

Code	Name	Description	Data
[AA101]	Main speed input source selection	When an optional remote operator with potentiometer (MOP-VR) is connected, set the frequency with potentiometer [VR].	16

9.2.12 Select or Calculate Two Frequency References

Q

- Switching between two frequency commands is desired.
- How do I apply gain to the frequency command?
- How to set the frequency command according to the sum of two input values?
- How to switch between forward and reverse rotation by subtracting the frequency command?

A

- By setting of "Speed reference calculation symbol selection [AA105]", the following can be selected.
  - When [AA105] is "Disable (00)":
    By input terminal function "Main/Sub speed reference change [SCHG](015)", the frequency reference input source is switched between "Main speed input source selection [AA101]" and "Sub speed input source selection [AA102]".
  - When [AA105] is other than "Disable (00)":
    The frequency reference is the result of the calculation (addition/subtraction/multiplication) specified in [AA105] for the frequency specified in "Main speed input source selection [AA101]" and "Sub speed input source selection [AA102]".
- Only [AA102] can be set to "Disable (00)". The operation when another frequency reference input source is set is the same as the setting of [AA101]. For details of each choice, refer to the description of [AA101].

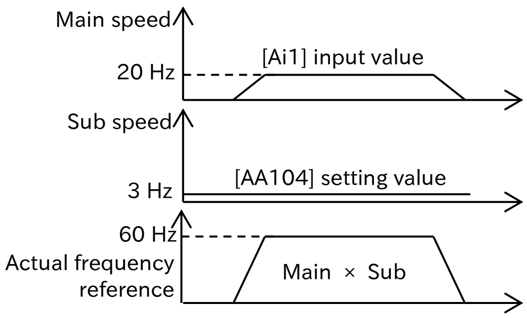
Code	Name	Description	Data
[AA101]	Main speed input source selection	For details, refer to "9.2.1 Types of Frequency Reference Source".	
[AA102]	Sub speed input source selection	Disable (Sub speed only)	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		Parameter setting	07
		Modbus communication	08
		Communication option	09
		Pulse input	12
		Program operation function EzSQ	14
		PID control	15
		VR (Remote operator MOP-VR)	16
[AA104]	Sub speed setting	Parameter for frequency reference input source setting of sub speed when [AA102] is set to "Parameter setting (07)".	0.00 to 590.00[Hz]
[AA105]	Speed reference calculation symbol selection	Disable: Frequency reference = Main speed or Sub speed	00
		Addition: Frequency reference = Main speed + Sub speed	01
		Subtraction: Frequency reference = Main speed - Sub speed	02
		Multiplication: Frequency reference = Main speed × Sub speed	03
[CA-01] to [CA-08]	Input terminal function	Main/Sub speed reference change [SCHG] : When [AA105] is set to "Disable (00)", it is posible to switch between main speed and sub speed with this input terminal function. OFF: Main speed enabled, ON: Sub speed enabled	015

!

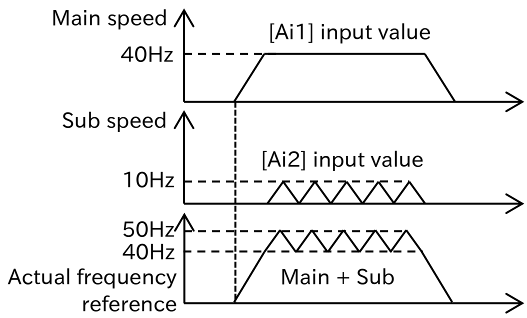
- Input terminal function "Remote control Speed-UP function [FUP]" and " Remote control Speed-DOWN function [FDN]" is enabled when the setting (parameter setting, multi-speed setting, or "Analog command holding [AHD]" operation in the analog input setting) in which this function is enabled as the main speed input source is selected.
- The same command input source can be selected for "Main speed input source selection [AA101]" and "Sub speed input source selection [AA102]", and can also be calculated by squared by the multiplication.

Example of frequency math function

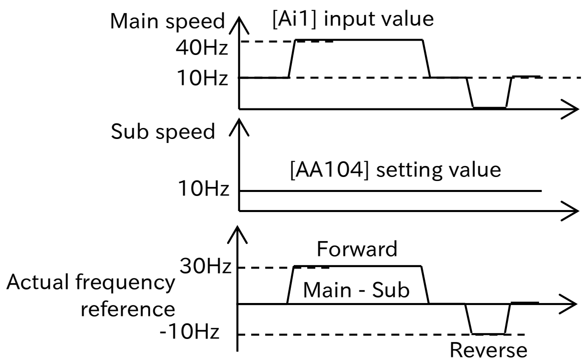
(e.g. 1) Applying gain
[AA101] = Terminal [Ai1] (01)
[AA102] = Parameter setting (07)
[AA104] = 3.00 Hz
[AA105] = Multiplication (03)



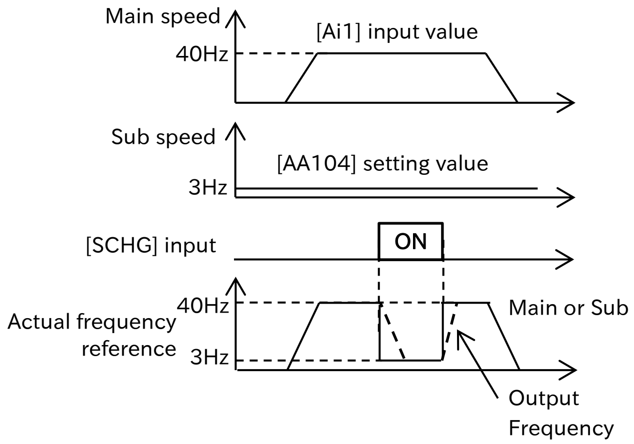
(e.g. 2) Addition
[AA101] = Terminal [Ai1] (01)
[AA102] = Terminal [Ai2] (02)
[AA105] = Addition (01)



(e.g. 3) High-speed forward rotation and Low-speed reverse rotation
[AA101] = Terminal [Ai1] (01)
[AA102] = Parameter setting (07)
[AA104] = 10.00 Hz
[AA105] = Subtraction (02)



(e.g. 4) Switching between 2 references
[AA101] = Terminal [Ai1] (01)
[AA102] = Parameter setting (07)
[AA104] = 3.00 Hz
[AA105] = Disable (00)



9.2.13 Temporarily Adding a Set Value to Frequency Reference

Q

- How to increase or decrease the frequency reference using an input signal?
- How to increase or decrease the transfer speed only when a signal is input, such as conveyor?
- When the pump becomes clogged, raise the frequency temporarily to remove the clogging.

A

- When the " Trigger for frequency addition [ADD](014)" input terminal is turned ON, the frequency set in the "Add frequency setting [AA106]" is added or subtracted from the frequency reference.
- Addition and subtraction are determined by the sign of "Add frequency setting [AA106]".

Code	Name	Description	Data
[AA106]	Add frequency setting	Set the frequency to add.	-590.00 to 590.00 (Hz)
[CA-01] to [CA-08]	Input terminal function	Trigger for frequency addition [ADD]: When this terminal is turned ON, [AA106] is added to the frequency reference.	014

!

- Frequency addition by "Trigger for frequency addition [ADD]" is performed within the frequency limit range. Therefore, when the upper/lower limit setting or the maximum frequency setting is exceeded, the frequency reference is limited.
- Frequency addition by [ADD] input terminal is disabled for the jogging function.
- When "FUP/FDN data save enable [CA-61]" is “Save(01)” , the frequency reference value saved in the inverter internal memory does not include the frequency addition by [ADD] input terminal.[*1]
- When the sign of the frequency reference changes ((-) → (+), (+) → (-)), the rotation direction is reversed.
- This function is also available for PID targets.

*1. For details, "9.2.14 Increasing/Decreasing Frequency Reference by Input Terminal Function".

9.2.14 Increasing/Decreasing Frequency Reference by Input Terminal Function

Q

- How to increase or decrease the frequency command using an input signal?
- How to increase or decrease the frequency command or PID target value using an external control device?

A

Remote control function ([FUP]/[FDN]/[UDC] input terminal function)

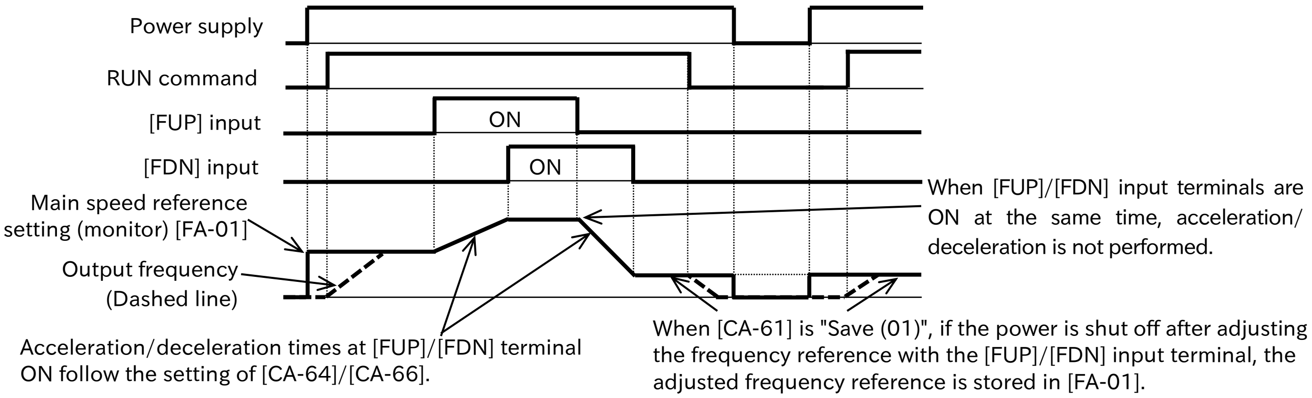
- The remote control function accelerates or decelerates the present frequency reference by turning on "Remote control Speed-UP function [FUP](020)" or "Remote control Speed-DOWN function [FDN](021)" input terminals.
- This function is enabled when the frequency reference input source is as follows. It is disabled for the jogging function.
  - When "Main speed input source selection [AA101]" is "Parameter setting (07)".
  - When the frequency reference input sourvce is a multi-speed function.
  - When [AA101] is the analog input of "Terminal [Ai1] (01)" or "Terminal [Ai2] (02)", and "Analog command holding [AHD]" input terminal is ON.
- When "FUP/FDN data save enable [CA-61]" is "Save (01)", the frequency reference value after [FUP]/[FDN] input is stored in the inverter internal-memory when the power is turned off and when the frequency reference input source is switched.
- The acceleration/deceleration time when [FUP]/[FDN] input terminal is ON follows "Acceleration time setting for FUP/FDN function [CA-64]"/"Deceleration time setting for FUP/FDN function [CA-66]".
- When the "Remote control Speed data clearing [UDC](022)" input terminal is turned ON, the frequency reference value adjusted by the [FUP]/[FDN] input terminal will be the original value saved prior to adjustment by the [FUP]/[FDN] input terminal or 0 Hz according to the setting of the "FUP/FDN UDC selection [CA-62]".

Code	Name	Description	Data
[CA-60]	FUP/FDN overwrite target selection	Overwrite the frequency reference value (multi-speed 0 ([Ab110] or [FA-01]), multi-speed 1 to 15 ([Ab-11] to [Ab-25]) and analog input holding value by [AHD] input terminal).	00
		PID1 set-point 1	01*1
[CA-61]	FUP/FDN data save enable	Not save: When the power is turned off or the frequency input source is switched, the frequency reference value that was accelerated/decelerated by [FUP]/[FDN] is not saved in the internal memory.	00
		Save: When the power is turned off or the frequency input source is switched, the frequency reference value that was accelerated/decelerated by [FUP]/[FDN] is saved in the internal memory.	01
[CA-62]	FUP/FDN UDC selection	0Hz: Cleared to 0Hz	00
		Saved data: Change to the data saved before using [FUP]/[FDN] input terminals.	01
[CA-64]	Acceleration time setting for FUP/FDN function	Set the acceleration time when [FUP]/[FDN] is turned on.	0.00 to 3600.00 (s)
[CA-66]	Deceleration time setting for FUP/FDN function	Set the deceleration time when [FUP]/[FDN] is turned on	0.00 to 3600.00 (s)
[CA-01] to [CA-08]	Input terminal function	Remote control Speed-UP function [FUP]: When this terminal is ON, the frequency reference is incleased.	020
		Remote control Speed-DOWN function [FDN]: When this terminal is ON, the frequency reference is decreased.	021
		Remote control Speed data clearing [UDC]: When this terminal is ON, the frequency rederence is cleared. The value at clearing follows the setting of [CA-62].	022

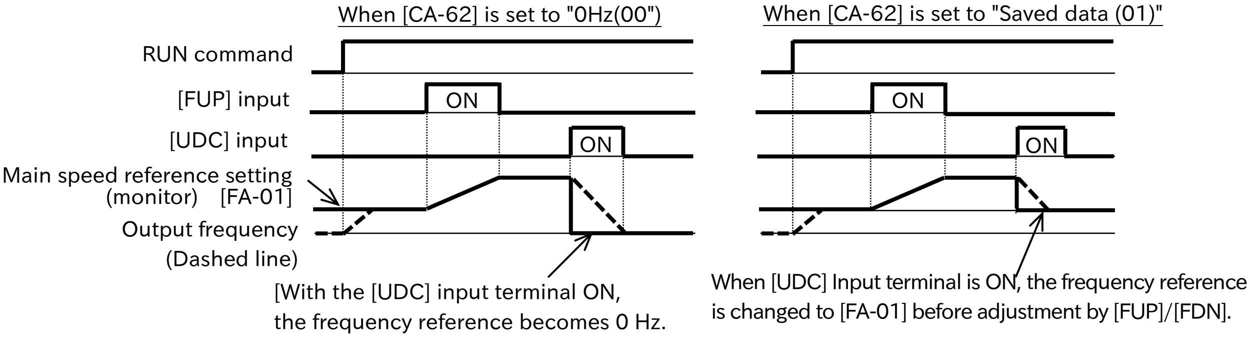
*1. For details, refer to "9.8.2 Using PID1 Control".

- Do not ON/OFF [FUP]/[FDN] input terminal or operate JOG dial on the keypad immediately after turning off the power. The changed frequency reference may not be memorized correctly.
- When "[FUP]/[FDN] data save enable [CA-61]" is set to "Save (01)", [Ab110]/[Ab-11] to [Ab-25], [FA-01], and [dA-01]/[dA-06][*2] frequency references can be changed using JOG dial. In this case, even if SET key is not pressed, the changed values are stored in the inverter's internal memory when the power is turned off.

■ Operation of the remote control function (When the frequency command is [FA-01])



■ Operation of "Remote control Speed data clearing [UDC]"



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2. For details, refer to "10.1.1 Monitor the Output Frequency".

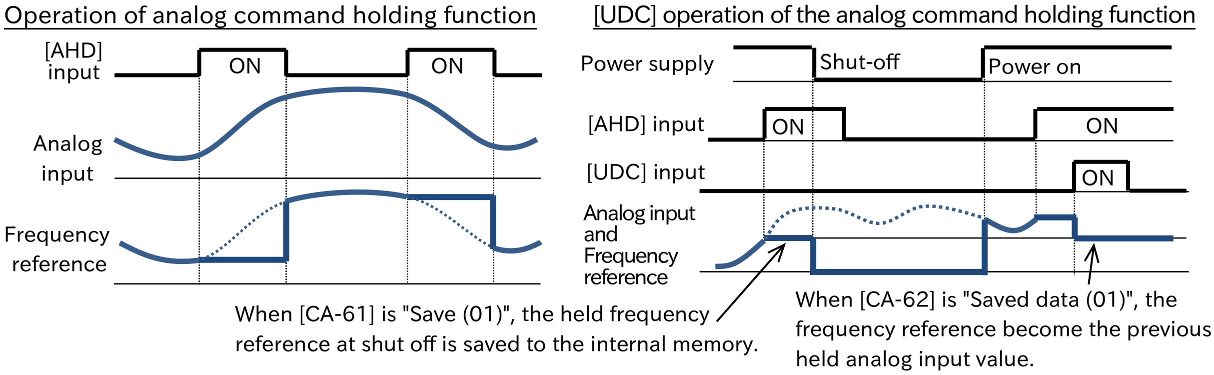
A

Analog command holding function (Input terminal function [AHD])

- The analog command holding function holds the analog input when the "Analog command holding [AHD](019)" input terminal ON, and returns to the analog command when it OFF.
- While the [AHD] input terminal is ON, [FUP]/[FDN] can be used to increase or decrease the analog input.
- When "[FUP]/[FDN] data save enable [CA-61]" is "Save (01)", the analog input value adjusted by [FUP]/[FDN] input terminal is stored in the inverter as "Frequency command value of the analog input held" when the power is cut off.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal funciton	Analog command holding [AHD]: This terminal retains the analog input-value at ON of this terminal for as long as it is ON.	019

■ Operation Diagram of Analog Command Holding Function (Using [AHD] and [UDC] for Analog Frequency Reference)



!

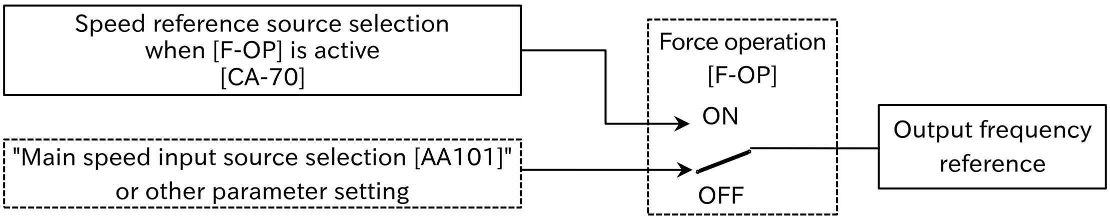
- When the power is turned on with "Analog command holding [AHD]" turned ON or "Reset [RS]" input terminal turned ON→OFF, the data held immediately before is adopted.
- When the 1st/2nd control is switched by the "2nd-motor control [SET]" input terminal while [AHD] input terminal is ON, the held analog input remains as it is. To switch the 1st/2th control, turn OFF and hold the [AHD] input terminal.

9.2.15 Temporarily Changing Frequency Reference Source

- How to temporarily switch the frequency reference input source to the parameter setting by the keypad?
- How to temporarily switch the frequency reference input source to an analog input on the control circuit terminal?

- When the "Force operation [F-OP](023)" input terminal is turned ON, the frequency reference input source set in the "Speed reference source selection when [F-OP] is active [CA-70]" takes precedence over the frequency reference input source set in the "Main speed input source selection [AA101]".

Operation of "Force operation [F-OP]"



*) Input terminal functions not assigned to input terminals [1] to [8] are OFF.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Force operation [F-OP]: When this terminal is ON, the RUN command and frequency reference input source are switched to the setting of [CA-70]/ [CA-71].	023
[CA-70]	Speed reference source selection when [F-OP] is active	Set the output frequency using the analog input to the [Ai1] terminal on the control-circuit terminal.	01
		Set the output frequency using the analog input to the [Ai2] terminal on the control-circuit terminal.	02
		From the keypad, set the output frequency using the parameter settings. Use [FA-01] or [Ab110] to set the output frequency.	07
		Set the output frequency from Modbus-RTU communication (RS485 communication).	08
		Set the output frequency from communication option.	09
		Set the output frequency by pulse input to the control terminal.	12
		Set the output frequency with EzSQ program-reserved variable <SET-Freq>.	14
		Set the target value when PID function is enabled.	15
		When a remote operator with potentiometer (MOP-VR) is connected, set the frequency with the potentiometer [VR] of the remote operator.	16

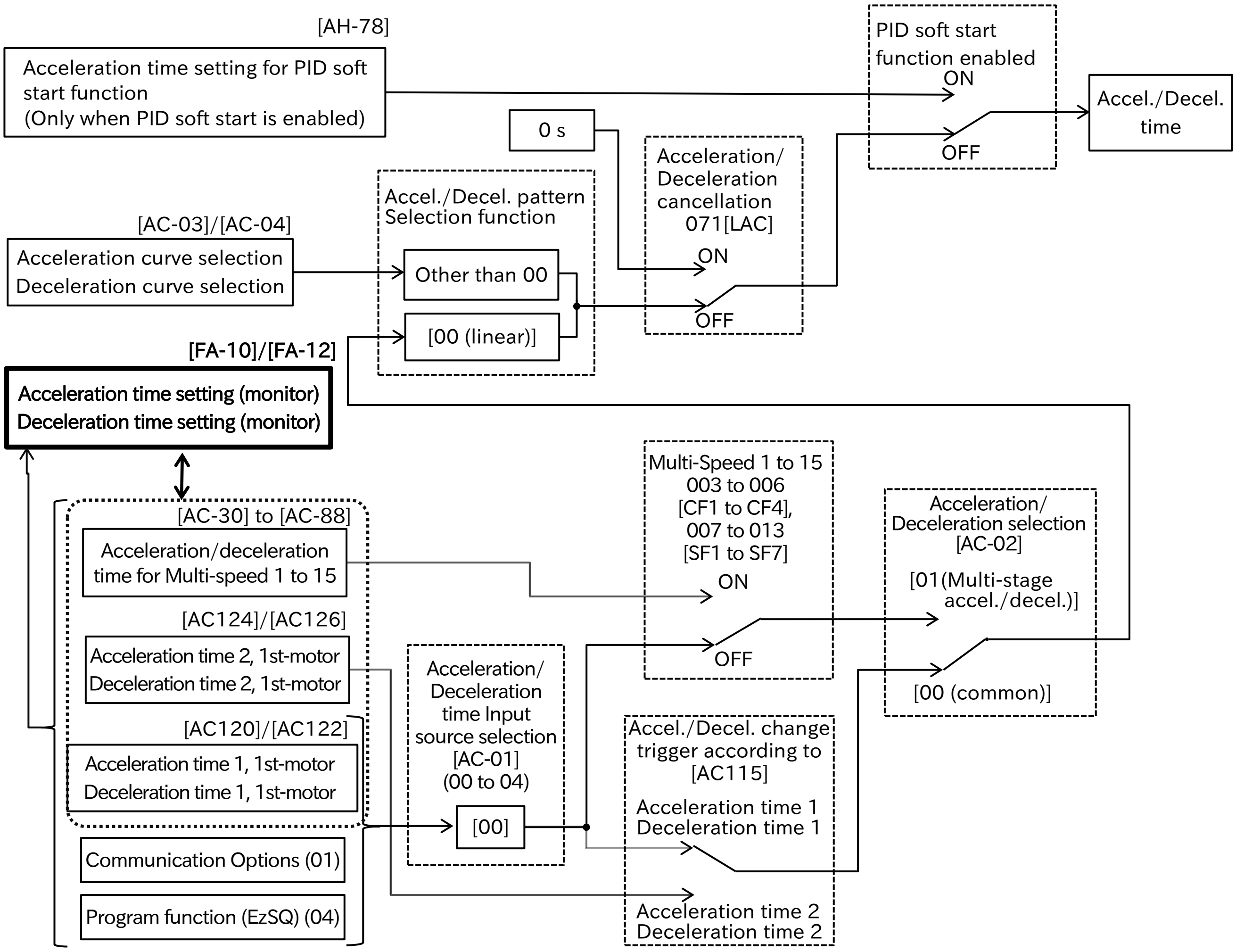
- When the "Force operation [F-OP]" input terminal is turned ON, the RUN command source is also set to "RUN command source selection when [F-OP] is active [CA-71]". For details, refer to "9.1.7 Temporarily Changing RUN Command Source".
- When [F-OP] input terminal is turned ON/OFF and the RUN command input source is changed while the inverter is running, the drive will be stopped once. To start operation again, OFF the RUN command and ON again. When the change by [F-OP] input terminal is only the frequency reference input source, the operation state is continued.

9.3 Using Acceleration/Deceleration Function

9.3.1 Changing Acceleration/Deceleration Time

Q
- I want to increase the response by increasing the acceleration of the motor.
- To prevent overcurrent, you want to increase the acceleration time.
- To prevent overvoltage, you want to increase the deceleration time.
- The load inertia is large, so I would like to accelerate and decelerate slowly.

A
- Set the acceleration/deceleration time of the motor. Set a long time for slow acceleration/deceleration and a short time for fast acceleration/deceleration.
- The acceleration/deceleration time sets the time from 0 Hz to the maximum frequency setting.
- The acceleration/deceleration time can also be changed during operation according to the command of the two-stage acceleration/deceleration function. For details, refer to "9.3.2 Switching Acceleration/Deceleration Time in Two Stages".
- Acceleration/deceleration can be slowly started by "Acceleration curve selection [AC-03]", "Deceleration curve selection [AC-04]". For details, refer to "9.3.4 Changing Acceleration/Deceleration Pattern".
- When the "Acceleration/Deceleration cancellation [LAC] (071)" input terminal is turned ON, the acceleration/deceleration time becomes 0 seconds and the output frequency instantaneously follows the frequency reference. For details, refer to "9.3.5 Maiking Output Frequency Follow the Frequency Reference Instantaneously".

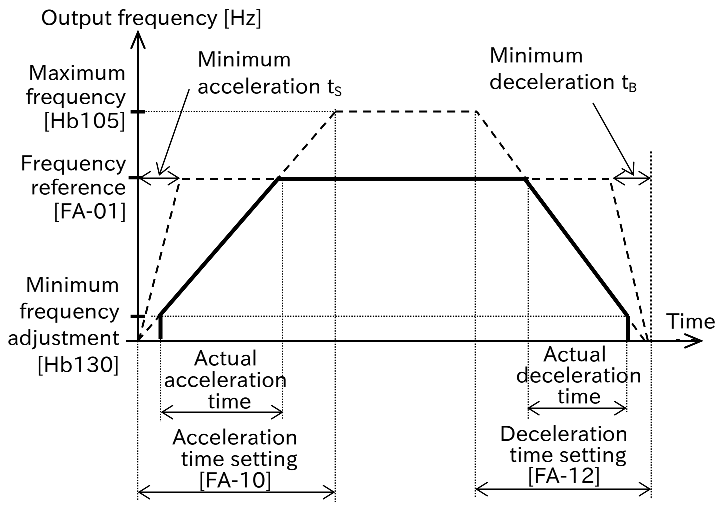


*) In the figure, [ ] and the position of the switch for each parameter indicates the initial value.
Also, the input terminal functions that are not assigned to "Input terminal function ([CA-01] to [CA-08])" will be OFF.

!
- If "Acceleration curve selection [AC-03]" and "Deceleration curve selection [AC-04]" are other than linear and the acceleration/deceleration hold function is ON/OFF, the acceleration/deceleration pattern will be recalculated with the frequency reference at hold function OFF as the starting point, and the acceleration/deceleration will be re-accelerated/decelerated.

! Actual acceleration/deceleration time setting

- To set the acceleration/deceleration time parameter, set the acceleration/deceleration time for 0 Hz to maximum frequency setting. For example, if the maximum frequency setting is 60 Hz and the acceleration time setting is 30 seconds, the actual acceleration time until the frequency reference reaches the command in 30 Hz is 15 seconds.
- Even if the acceleration/deceleration time is set as short as possible, the actual motor's acceleration/deceleration time will not be shorter than the shortest acceleration/deceleration time determined by the moment of inertia J of the mechanical system and the motor torque. Setting the acceleration/deceleration time setting shorter than the shortest acceleration/deceleration time may cause "Overcurrent error [E001]", "Motor overload error [E005]", "Overvoltage error [E007]", etc. For more information, refer to "Chapter 15 Tips/FAQ/Troubleshooting".



Speed 0 → Acceleration time t_s at speed N_M

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

Speed N_M → Deceleration time t_B at speed 0

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

J_L : Load inertia converted into the motor axis (kg·m^2)
J_M : Motor inertia (kg·m^2)
N_M : Motor rotation speed (r/min) <min^{-1}>
T_s : Maximum acceleration torque with inverter (N·m)
T_B : Maximum decelerating torque with inverter (N·m)
T_L : Load torque (N·m)

Code	Name	Description	Data
[FA-10]	Acceleration time setting (monitor)	Monitors or changes the currently selected acceleration time.	0.00 to 3600.00 (s)
[FA-12]	Deceleration time setting (monitor)	Monitors or changes the currently selected deceleration time.	0.00 to 3600.00 (s)
[AC-01]	Acceleration/ Deceleration time input source selection	Parameter setting	00
		Communication Option	01
		Program function (EzSQ)	04
[AC120]	Acceleration time 1	Set the acceleration duration from 0 Hz to the maximum frequency.	0.00 to 3600.00 (s)
[AC122]	Deceleration time 1	Set the deceleration duration from the maximum frequency to 0 Hz.	0.00 to 3600.00 (s)
[CA-01] to [CA-08]	Input terminal function	Multi speed selection 1 to 4 [CF1] to [CF4]: Operates the multi-speed command.	003[CF1] 004[CF2] 005[CF3] 006[CF4]
		Multi-speed Bit-1 to 7 [SF1] to [SF7]: The multi-speed bit command is operated.	007[SF1] 008[SF2] 009[SF3] 010[SF4] 011[SF5] 012[SF6] 013[SF7]
		2-stage acceleration/deceleration [2CH]: When [AC115] is "Switching by [2CH] Terminal (00)", acceleration/deceleration times are switched by ON/OFF of this signal.	031
		Acceleration/Deceleration cancellation [LAC]: When this signal is turned ON, acceleration/ deceleration is canceled and the output frequency is made to follow the frequency reference.	071
[Hb105]	Async. Motor maximum frequency setting	Set the maximum frequency of the induction motor (IM).	Base frequency to 590.00 (Hz)

9.3.2 Switching Acceleration/Deceleration Time in Two Stages

Q

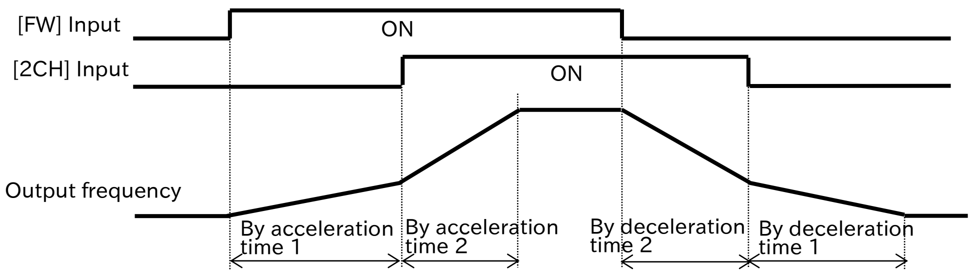
- How do I change the acceleration/deceleration time of the motor according to an external input signal?
- Since torque is required to start moving, we want to accelerate slowly at low speed and accelerate faster at a constant speed or higher.
- I want to accelerate and decelerate the motor faster in forward rotation and slower in reverse rotation.

A

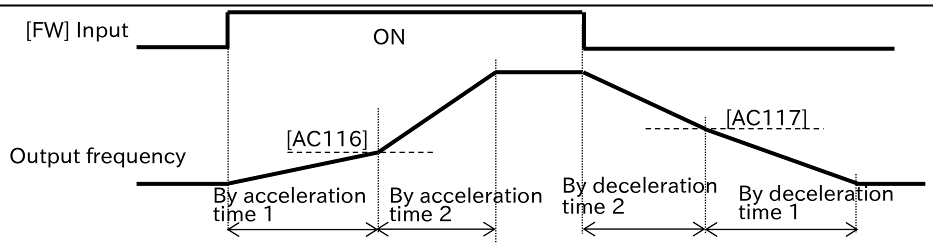
- The 2-stage acceleration/deceleration function can be switched during operation by setting "Accel/Decel change trigger [AC115]".
- Assign "2-stage acceleration/deceleration [2CH](031)" to one of the "Input terminal function ([CA-01] to [CA-08])" when switching by the signal to the control terminal.

Code	Name	Description	Data
[AC115]	Accel/Decel change trigger	Acceleration/Deceleration time switching by [2CH] input terminal	00
		Acceleration/Deceleration time switching by frequency transition point.	01
		Acceleration/Deceleration time switching only at forward/ reverse rotation switching	02
[AC116]	Accel 1 to Accel 2 frequency transition point	Set the switching frequency when [AC115] is set to "Switching by setting (01)" and in acceleration mode.	0.00 to 590.00 (Hz)
[AC117]	Decel 1 to Decel 2 frequency transition point	Set the switching frequency when [AC115] is "Switching by setting (01)" and in decelerating status.	
[AC120]	Acceleration time 1	Set the acceleration duration from 0 Hz to the maximum frequency.	0.00 to 3600.00 (s)
[AC122]	Deceleration time 1	Set the deceleration duration from the maximum frequency to 0 Hz.	
[AC124]	Acceleration time 2	Set the acceleration duration from 0 Hz to the maximum frequency.	
[AC126]	Deceleration time 2	Set the deceleration duration from the maximum frequency to 0 Hz.	
[CA-01] to [CA-08]	Input terminal function	2-stage acceleration/deceleration [2 CH]: When [AC115] is "Switching by [2CH] terminal (00)", acceleration /deceleration times are switched by ON/OFF of this signal.	031

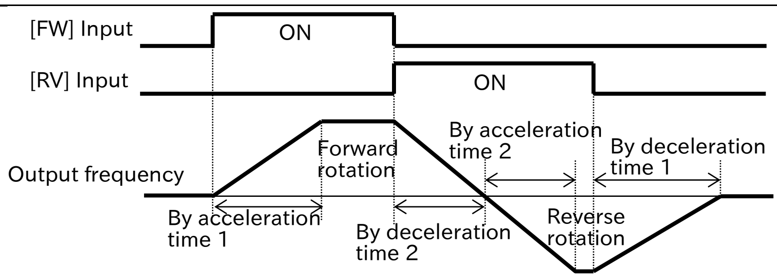
■ When switching acceleration/deceleration time by input terminal [2CH]



■ When switching the acceleration/deceleration time at the set frequency



■ When switching acceleration/deceleration time by rotation command direction



9.3.3 Temporarily Stopping Acceleration/Deceleration

Q

- Since torque is required to start moving, it is desired to stagnate acceleration once until the motor rotation follows the command.
- Since the motor cannot be stopped when the motor is stopped, the deceleration should stagnate once until the actual speed drops.

A

- The acceleration/deceleration hold function temporarily stops acceleration/deceleration and performs constant speed operation at the frequency at that time.
- The hold function is effective when the moment of inertia of the mechanical system is large.
- Acceleration hold can be used for applications such as preventing overcurrent trip at startup by waiting until the slippage of the motor at startup becomes small.
- The deceleration hold can be used for applications such as preventing an overvoltage trip during deceleration by waiting until the slippage of the motor at deceleration becomes small.
- There are the following two methods of acceleration/deceleration hold, both of which can be used together.
  - Automatically stops at any frequency and stop time.
  - Stops when the "Acceleration/Deceleration disable [HLD](100)" input terminal is ON.

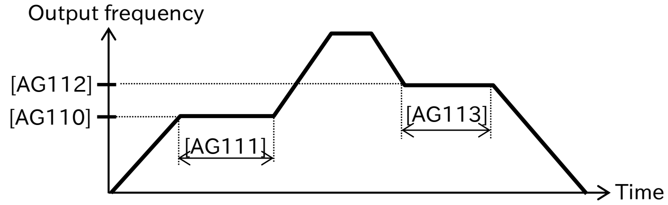
!

- If the acceleration/deceleration hold function is turned ON when "Acceleration/deceleration curve selection [AC-03]/[AC-04]" is other than "Linear (00)," the acceleration/deceleration pattern is not cleared and re-acceleration/deceleration is performed in the same acceleration/deceleration pattern at the timing of the hold OFF.

Code	Name	Description	Data
[AG110]	Acceleration stop frequency setting	Set the frequency to stagnate during acceleration.	0.00 to 590.00 (Hz)
[AG111]	Acceleration stop time setting	Set the time to stagnate during acceleration.	0.0 to 60.0 (s)
[AG112]	Deceleration stop frequency setting	Set the frequency to stagnate at deceleration.	0.00 to 590.00 (Hz)
[AG113]	Deceleration stop time setting	Set the time to stagnate at deceleration.	0.0 to 60.0 (s)
[CA-01] to [CA-08]	Input terminal function	Acceleration/Deceleration disable [HLD]: Acceleration/deceleration is stopped once when this signal is ON. When it becomes OFF, it will re-accelerate and decelerate.	100

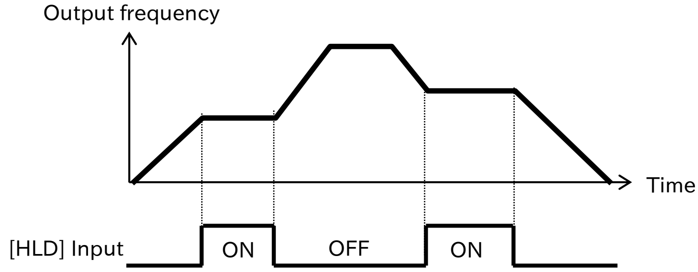
■ To hold at any set frequency and time

- When the frequency command at acceleration or deceleration is reached to the stop frequency setting, acceleration/deceleration stops for the set time. Hold frequency and hold time can be set for acceleration and deceleration respectively.



■ Holding at the input terminal [HLD]

- Acceleration/deceleration stops when the "Acceleration/Deceleration disable [HLD]" input terminal is ON.



9.3.4 Changing Acceleration/Deceleration Pattern

Q

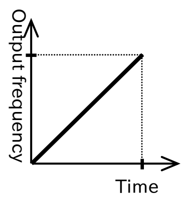
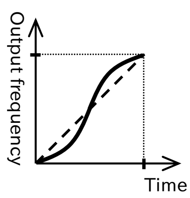
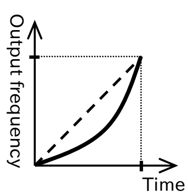
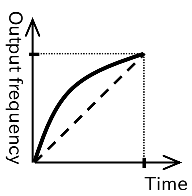
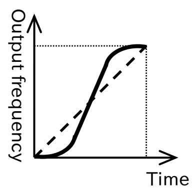
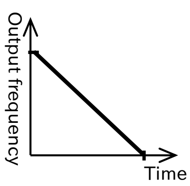
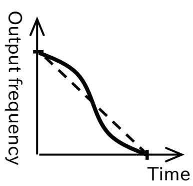
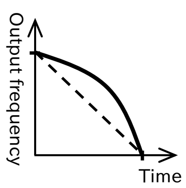
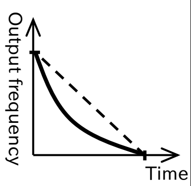
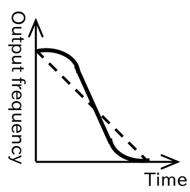
- I want to mitigate the impact of sudden movements such as load collapse on elevators and conveyors.
- I want to soften the impact when moving and stopping.
- I want to change the acceleration gradient according to the winding and feeding.

A

- The pattern of acceleration/deceleration corresponding to each system can be set.
- In "Acceleration curve selection [AC-03]" and "Deceleration curve selection [AC-04]", the pattern can be set individually for acceleration and deceleration.
- Even when the acceleration/deceleration pattern is set, the time from 0 Hz to the maximum frequency or from the maximum frequency to 0 Hz arrival is the set acceleration/deceleration time.

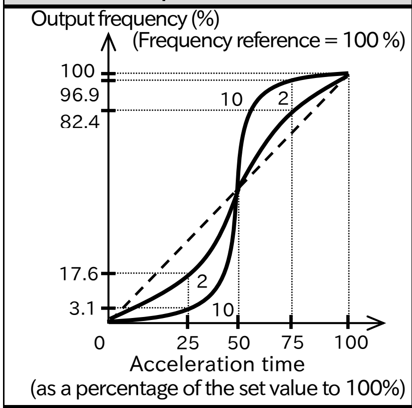
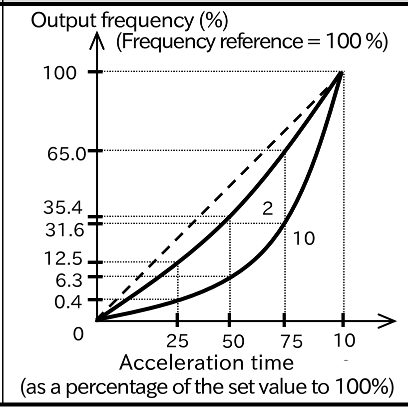
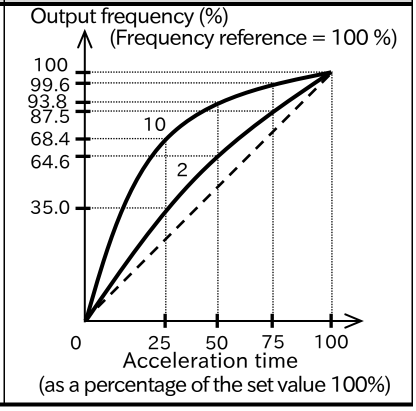
Code	Name	Description	Data
[AC-03]	Acceleration curve selection	The acceleration pattern is linear.	00
		The acceleration pattern is an S-curve.	01
		The acceleration pattern is a U-curve.	02
		The acceleration pattern is an inverted U-curve.	03
		The acceleration pattern is an elevator S-curve (EL-S curve).	04
[AC-04]	Deceleration curve selection	Curve pattern selection at deceleration equivalent to acceleration pattern selection.	00 to 04
[AC-05]	Acceleration curve constant setting	Set the curve constant (degree of bulge) in S-curve, U-curve and inverted U-curve. When set to 1, the bulge of the curve becomes the smallest. By increasing the set value, the bulge can be increased.	1(Bulge: Small) to 10(Bulge: Big)
[AC-06]	Deceleration curve constant setting		
[AC-08]	EL-S-curve ratio at start of acceleration	Specifies the ratio of the curved part when using a EL-S character. (For acceleration)	0 to (100 - [AC-09]) (%)
[AC-09]	EL-S-curve ratio at end of acceleration		0 to (100 - [AC-08]) (%)
[AC-10]	EL-S-curve ratio at start of deceleration	Specifies the ratio of the curved part when using a EL-S character. (For deceleration)	0 to (100 - [AC-11]) (%)
[AC-11]	EL-S-curve ratio at end of deceleration		0 to (100 - [AC-10]) (%)

Types of acceleration/deceleration curve patterns and application examples

Pattern Setting	Linear (00)	S-curve (01)	U-curve (02)	Inverted U-curve (03)	EL-S-curve (04)
[AC-03] (Acceleration)					
[AC-04] (Deceleration)					
Application Examples	Acceleration/ Deceleration is performed up to the frequency setting value in a straight line.	Enabled in preventing load collapse in elevators, conveyors, etc.	Effective for tension control of winder, etc. and prevention of breakage of wound material. It can also be used to take-up and feed one shot.		Similar shock-less start/stop as S-curve, but the middle part becomes straight line. Effective for elevator applications, etc.

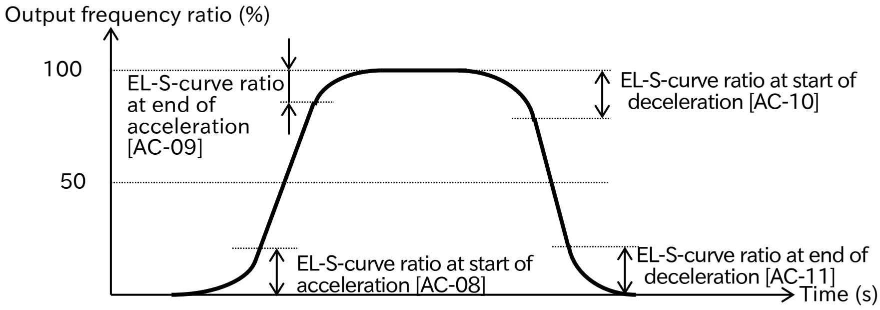
■ Setting of curve constant (degree of bulge) of acceleration/deceleration pattern (for S-curve, U-curve, inverted U-curve)

- When S-curve, U-curve or inverted U-curve is selected in [AC-03]/[AC-04], the curve swelling condition can be set in [AC-05]/[AC-06].
- The figure below shows an example of an S-curve, U-curve, or inverted U-curve and an example in which the curve constant is set to 2 or 10.

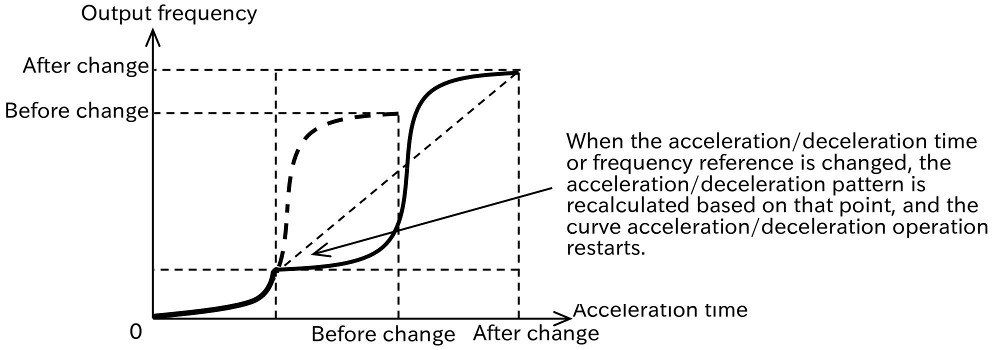
Example of S-curve	Example of U-curve	Example of inverted U-curve
		

■ Setting of curve ratio at acceleration/deceleration (for EL-S-curve)

- When using an elevator S-curve (EL-S-curve), it is possible to set the curve ratio ([AC-08] to [AC-11]) at acceleration/deceleration.
- [AC-08], [AC-09], [AC-10] and [AC-11] are set by dividing 100 %, so the sum of the two parameter settings is 100 % at most (e.g., [AC-09] can be set from 0 to 75 % for [AC-08]=25 %]).
- When all the curve ratios are set to 50 %, the curve is equivalent to an S-curve. When either of the curve ratios at start and end is set to 100 %, the curve is equivalent to a U-shape curve or an inverted U-shape curve.



- Note the following when the acceleration/deceleration pattern is set to other than "Linear (00)".
  - The slope of the acceleration/deceleration time becomes partially steep. If overcurrent or overvoltage occurs, it is necessary to adjust the acceleration/deceleration time.
  - Use a frequency reference other than the analog input. If the command value is not stable, the acceleration/deceleration pattern is recalculated and the actual acceleration/deceleration time may be extended.
  - If the frequency reference or acceleration/deceleration time is changed during acceleration/deceleration, or the acceleration/deceleration hold is performed by the "Acceleration/Deceleration disable [HLD]" input terminal, the acceleration/deceleration pattern will be recalculated based on the time the change was made. Note that an impact may be generated at the changed part as shown in the example below.



9.3.5 Making Output Frequency Follow the Frequency Reference Instantaneously

Q

- How do I output the frequency reference of analog input as it is?
- I want the motor to follow the command at the highest speed.

A

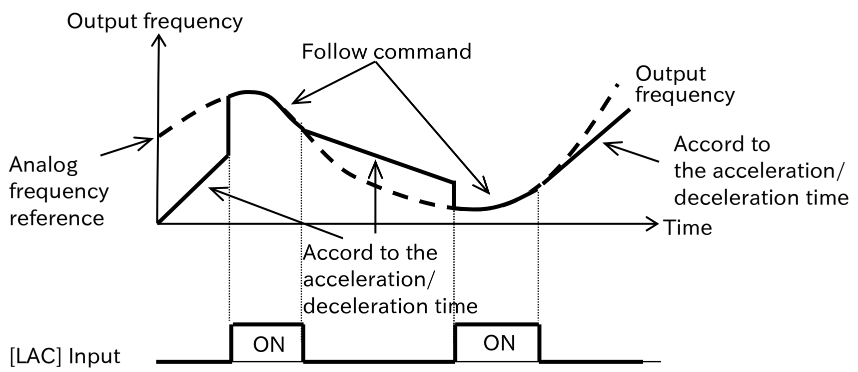
- When the "Acceleration/Deceleration cancellation [LAC] (071)" input terminal is turned ON, the acceleration/deceleration time is ignored and the output frequency instantaneously follows the frequency command value.

!

- Since the output follows the command when LAD cancellation function is used, if the increase/decrease range of the frequency reference becomes large, it becomes a factor such as "Overcurrent error [E001]", "Overload error ([E005], [E038], [E039])" or "Overvoltage error [E007]", so care must be taken.
- The "Acceleration/Deceleration cancellation [LAC]" input terminal is enabled for any frequency reference such as the command from the parameter setting and communication option.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Acceleration/Deceleration cancellation [LAC]: When this signal is turned ON, acceleration/deceleration is canceled and the output frequency is made to follow the frequency command.	071

■ Operation of LAD Cancellation Function



9.3.6 Switching Acceleration/Deceleration Time for Each Multi-Speed

Q

- When using a multi-speed command, change the acceleration/deceleration time to give a frequency command.
- When accelerating to a constant frequency, it is desired to move separately at multiple acceleration and deceleration times.

A

- When this function is set, the acceleration/deceleration times can be changed according to the multi-speed command by the "Multi speed selection ([CF1] to [CF4]) (003 to 006)" or "Multi speed Bit ([SF1] to [SF7]) (007 to 013)" input terminal.
- For details of the acceleration/deceleration time adopted for each multi-speed command, refer to the Acceleration/Deceleration operation example" in this section.

!

- When switching the multi-speed by the input terminal function, assign "Multi speed selection ([CF1] to [CF4])" or "Multi speed Bit ([SF1] to [SF7])" to any of "Input terminal function ([CA-01] to [CA-08])" to operate.
- When " Acceleration/Deceleration selection [AC-02]" is "Multi stage acceleration/deceleration (01)", the 2-stage acceleration/deceleration function is disabled. For details of the 2-stage acceleration/deceleration function, refer to "9.3.2 Switching Acceleration/ Deceleration Time in Two Stages".

Code	Name	Description	Data
[AC-02]	Acceleration/ Deceleration selection	Acceleration/deceleration times are [AC120]/[AC122] or [AC124]/[AC126] Follow (when 2-stage acceleration/deceleration function is enabled).	00
		The acceleration/deceleration time changes according to the multi-speed command.	01
[Ab-11] to [Ab-25]	[Ab-11] to [Ab-25] Multi-speed 1 to 15 setting	The multi-speed command is set in the speed-1 [Ab-11] to speed-15 [Ab-25].	0.00 to Maximum frequency (Hz)
[AC-30], [AC-34] [AC-38], [AC-42] [AC-46], [AC-50] [AC-54], [AC-58] [AC-62], [AC-66] [AC-70], [AC-74] [AC-78], [AC-82] [AC-86]	Acceleration time for Multi-speed 1 to 15	Set the acceleration times from 0 Hz to the maximum frequency for each multi-speed command.	0.00 to 3600.00(s)
[AC-32], [AC-36] [AC-40], [AC-44] [AC-48], [AC-52] [AC-56], [AC-60] [AC-64], [AC-68] [AC-72], [AC-76] [AC-80], [AC-84] [AC-88]	Deceleration time for Multi-speed 1 to 15	Set the deceleration times from the maximum frequency to 0 Hz for each multi-speed command.	0.00 to 3600.00(s)
[Ab-03]	Multi-speed operation selection	16-speeds binary operation. Multi-speed operation is performed by "Multi-speed ([CF1] to [CF4])".	00
		8-speeds bit operation. Multi-speed operation is performed by "Multi-speed bit ([SF1] to [SF7])".	01
[CA-01] to [CA-08]	Input terminal function	Multi-speed 1 [CF1] to Multi-speed 4 [CF4]: Multi-speed input terminal for binary operation (maximum. 16-speed).	003 to 006
		Multi-speed bit 1 [SF1] to Multi-speed bit 7 [SF7]: Multi-speed input terminal for bit operation (up to 8 speeds).	007 to 013

A

- The table below shows the correspondence between the multi-speed and multi-speed acceleration/deceleration times when "Binary (00)" is selected for "Multi-speed operation selection [Ab-03]" and "Bit (01)".

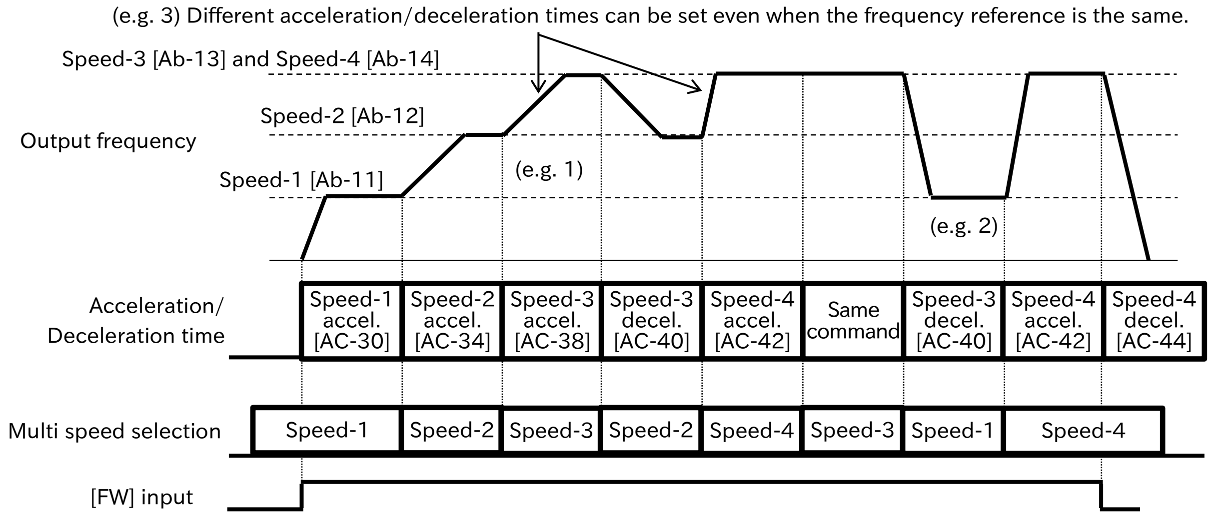
Binary operation mode operation table

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

Bit operation mode operation table

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

Acceleration/Deceleration operation example



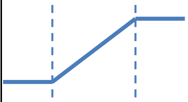
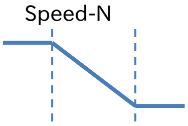
e.g. 1: When the multi-speed 3 is engaged, if the operation is in the acceleration direction, the "Acceleration time for Multi-speed 3 [AC-38]" is enabled.

e.g. 2: When a multi-speed 1 is engaged, if it is in the deceleration direction, the "Deceleration time for Multi-speed 3 [AC-40]" of the multi-speed 3 prior to the entry of the multi-speed 1 is enabled.

e.g. 3: When the multi-speed 3 and multi-speed 4 are the same, different settings of the "Acceleration time for Multi-speed 3 [AC-38]" and "Acceleration time for Multi-speed 4 [AC-42]" lead different acceleration times to be set for the same frequency reference value as shown in the above figure.

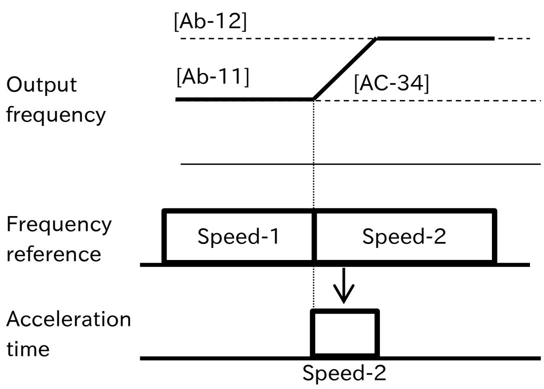
■ Acceleration/Deceleration time correspondence table

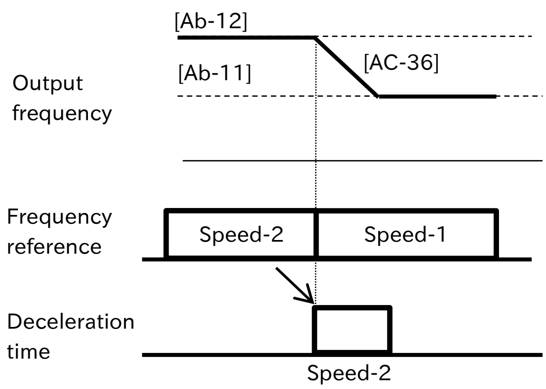
- The table below shows the correspondence between multi-speed command and acceleration/ deceleration time.

Setting status	Multi-speed command	State of the command	Acceleration/deceleration time to be adopted
Higher frequency after ON To the accelerated state Speed-M  Multi speed M Acceleration time	Speed-1 ON	Multi-speed 1 [Ab-11] > Frequency before speed-1 ON	Acceleration time for Multi-speed 1 [AC-30]
	Speed-2 ON	Multi-speed 2 [Ab-12] > Frequency before speed-2 ON	Acceleration time for Multi-speed 2 [AC-34]
	Speed-3 ON	Multi-speed 3 [Ab-13] > Frequency before speed-3 ON	Acceleration time for Multi-speed 3 [AC-38]
	Speed-4 ON	Multi-speed 4 [Ab-14] > Frequency before speed-4 ON	Acceleration time for Multi-speed 4 [AC-42]
	Speed-5 ON	Multi-speed 5 [Ab-15] > Frequency before speed-5 ON	Acceleration time for Multi-speed 5 [AC-46]
	Speed-6 ON	Multi-speed 6 [Ab-16] > Frequency before speed-6 ON	Acceleration time for Multi-speed 6 [AC-50]
	Speed-7 ON	Multi-speed 7 [Ab-17] > Frequency before speed-7 ON	Acceleration time for Multi-speed 7 [AC-54]
	Speed-8 ON	Multi-speed 8 [Ab-18] > Frequency before speed-8 ON	Acceleration time for Multi-speed 8 [AC-58]
	Speed-9 ON	Multi-speed 9 [Ab-19] > Frequency before speed-9 ON	Acceleration time for Multi-speed 9 [AC-62]
	Speed-10 ON	Multi-speed 10 [Ab-20] > Frequency before speed-10 ON	Acceleration time for Multi-speed 10 [AC-66]
	Speed-11 ON	Multi-speed 11 [Ab-21] > Frequency before speed-11 ON	Acceleration time for Multi-speed 11 [AC-70]
	Speed-12 ON	Multi-speed 12 [Ab-22] > Frequency before speed-12 ON	Acceleration time for Multi-speed 12 [AC-74]
	Speed-13 ON	Multi-speed 13 [Ab-23] > Frequency before speed-13 ON	Acceleration time for Multi-speed 13 [AC-78]
	Speed-14 ON	Multi-speed 14 [Ab-24] > Frequency before speed-14 ON	Acceleration time for Multi-speed 14 [AC-82]
	Speed-15 ON	Multi-speed 15 [Ab-25] > Frequency before speed-15 ON	Acceleration time for Multi-speed 15 [AC-86]
	Without multi-speed	Other than the above	Acceleration time 1 [AC120]
Lower frequency after OFF To deceleration state Speed-N  Multi speed N Deceleration time	Speed-1 OFF	Multi-speed 1 [Ab-11] < Frequency after speed-1 OFF	Deceleration time for Multi-speed 1 [AC-32]
	Speed-2 OFF	Multi-speed 2 [Ab-12] < Frequency after speed-2 OFF	Deceleration time for Multi-speed 2 [AC-36]
	Speed-3 OFF	Multi-speed 3 [Ab-13] < Frequency after speed-3 OFF	Deceleration time for Multi-speed 3 [AC-40]
	Speed-4 OFF	Multi-speed 4 [Ab-14] < Frequency after speed-4 OFF	Deceleration time for Multi-speed 4 [AC-44]
	Speed-5 OFF	Multi-speed 5 [Ab-15] < Frequency after speed-5 OFF	Deceleration time for Multi-speed 5 [AC-48]
	Speed-6 OFF	Multi-speed 6 [Ab-16] < Frequency after speed-6 OFF	Deceleration time for Multi-speed 6 [AC-52]
	Speed-7 OFF	Multi-speed 7 [Ab-17] < Frequency after speed-7 OFF	Deceleration time for Multi-speed 7 [AC-56]
	Speed-8 OFF	Multi-speed 8 [Ab-18] < Frequency after speed-8 OFF	Deceleration time for Multi-speed 8 [AC-60]
	Speed-9 OFF	Multi-speed 9 [Ab-19] < Frequency after speed-9 OFF	Deceleration time for Multi-speed 9 [AC-64]
	Speed-10 OFF	Multi-speed 10 [Ab-20] < Frequency after speed-10 OFF	Deceleration time for Multi-speed 10 [AC-68]
	Speed-11 OFF	Multi-speed 11 [Ab-21] < Frequency after speed-11 OFF	Deceleration time for Multi-speed 11 [AC-72]
	Speed-12 OFF	Multi-speed 12 [Ab-22] < Frequency after speed-12 OFF	Deceleration time for Multi-speed 12 [AC-76]
	Speed-13 OFF	Multi-speed 13 [Ab-23] < Frequency after speed-13 OFF	Deceleration time for Multi-speed 13 [AC-80]
	Speed-14 OFF	Multi-speed 14 [Ab-24] < Frequency after speed-14 OFF	Deceleration time for Multi-speed 14 [AC-84]
	Speed-15 OFF	Multi-speed 15 [Ab-25] < Frequency after speed-15 OFF	Deceleration time for Multi-speed 15 [AC-88]
	Without multi-speed	Other than the above	Deceleration time 1 [AC122]

!

- Switching timing between frequency command and deceleration time by multi-speed terminal command is different.





9.4 Limiting Frequency Reference/RUN Command

9.4.1 Limiting Frequency Reference

Q

- How to limit the range of the frequency reference?
- How to set a lower limit on the frequency reference value to prevent the flow rate from becoming too low?
- How to control the upper limit of the frequency reference value as a system?

A

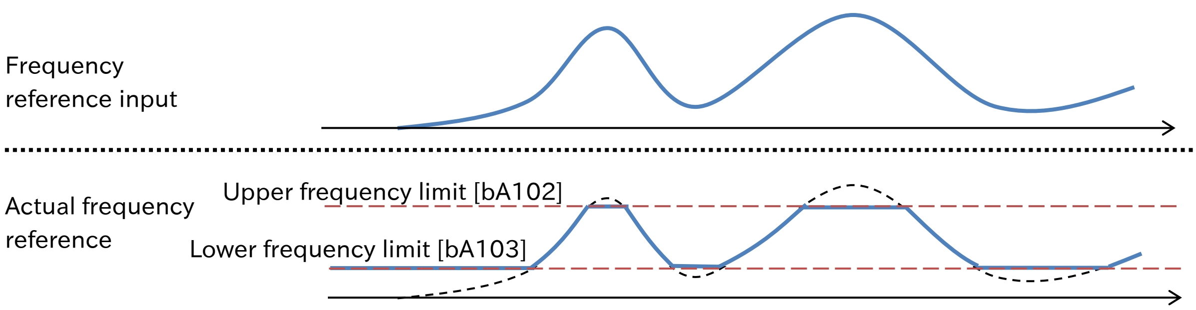
- The frequency limit function can limit the frequency reference range. In addition, the upper frequency limiter can be specified with analog input, etc. by setting "Upper frequency limit source selection [bA101]".
- Even if a frequency reference outside the frequency upper/lower limiter range is input, it will be limited by this function.
- Upper frequency limit setting can be checked by "Frequency upper limit monitor [dA-14]".

!

- To enable the upper frequency limiter, set "Upper frequency limit source selection [bA101]" to other than "Disable (00)".
- When [bA101] is set to "Parameter setting (07)", be sure to set "Upper frequency limit [bA102]". Note that the frequency setting upper limit is 0.00Hz because the upper frequency limiter operates even in the default 0.00Hz.
- Be sure to set the frequency limit function so that the upper limit does not exceed "Async. Motor maximum frequency setting [Hb105]". Note that inconsistent settings may trigger a warning message.
- When setting "Lower frequency limit [bA103]", be sure to set [bA103] after setting [bA102] to larger value than lower limiter.
- The lower limit of the frequency reference can also be set by "Minimum frequency adjustment [Hb130]". However, note that the operation when [Hb130] is changed is different from the lower frequency limiter. For more information on [Hb130], refer to "9.7.1 Starting with Gradually Increasing Voltage".
- When the remote operator (VOP) is connected, [LIM] icon is displayed during the restriction due to the upper/lower limiter and minimum frequency.

Code	Name	Description	Data
[dA-14]	Frequency upper limit monitor	Monitors the current upper frequency limit.	0.00 to 590.00 (Hz)
[bA101]	Upper frequency limit source selection	Disable	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		Parameter setting	07
		RS485	08
		Option	09
		Pulse input	12
[bA102]	Upper frequency limit	Set the upper frequency limit when [bA101] set to "Parameter setting (07)".	0.00 to Maximum frequency (Hz)
[bA103]	Lower frequency limit	Set the lower frequency limit.	0.00 to Upper frequency limit (Hz)
[Hb105]	Async. Motor maximum frequency setting	Set the maximum frequency of the motor.	Base frequency to 590.00 (Hz)

Example of upper/lower frequency limiter operation for frequency reference



9.4.2 Limiting RUN Command Direction

Q

- How to apply a limit to the RUN command direction?
- How to prevent equipment from being damaged if the inverter outputs in the reverse direction?

A

- By setting the "RUN direction restriction selection [AA114]" parameter, it is possible to limit the RUN command direction to either forward or reverse rotation.
- This function can also limit reverse rotation command that are triggered by the frequency reference sign changing to negative.
- When the operation direction limit function is activated, output to the motor is stopped, and 00000 is displayed on the inverter display.

!

- This function works by limiting RUN command direction. Therefore, it is not effective in cases such as when using control modes other than V/f control where control calculations can result in an output that causes reverse operation. To limit the output, enable "Direction reversal protection [HC114]". For details, refer to "9.4.3 Limiting Motor Rotation Direction".
- Even when this function is used, the motor may rotate in the reverse direction when subject to external forces. When using this function as a protection against reverse rotation, the system must be free of external forces that are applied in the reverse direction.

Code	Name	Description	Data
[AA114]	RUN direction restriction selection	No restriction	00
		Only forward rotation commands are enabled. (Reverse rotation is limited.)	01
		Only reverse rotation commands are enabled. (Forward rotation is limited.)	02

9.4.3 Limiting Motor Rotation Direction

Q

- How to prevent equipment damage caused by the motor reversing?

A

- In some cases, the control system may result in a output that is in the opposite direction of the RUN command, such as when operating at low speeds. The "Direction reversal protection [HC114]" can be set to limit the rotation output so it keeps the same direction as the command.
- This function should be enabled in cases when reverse rotation of the motor results in equipment damage.

!

- This function is enabled when "Control mode selection [AA121]" is set to "Sensorless vector control (IM) (08)".
- Even when this function is used, the motor may rotate in the reverse direction when subject to high-load external forces. When using this function as a protection against an improper rotation direction, be sure to thoroughly confirm that the equipment does not rotate in the reverse direction.

Code	Name	Description	Data
[AA121]	Control mode selection	Sensorless vector control (IM)	08
[HC114]	Direction reversal protection	Disable	00
		Enable: Prohibit rotation in the opposite direction.	01

9.4.4 Disabling Output until RUN Command Permission

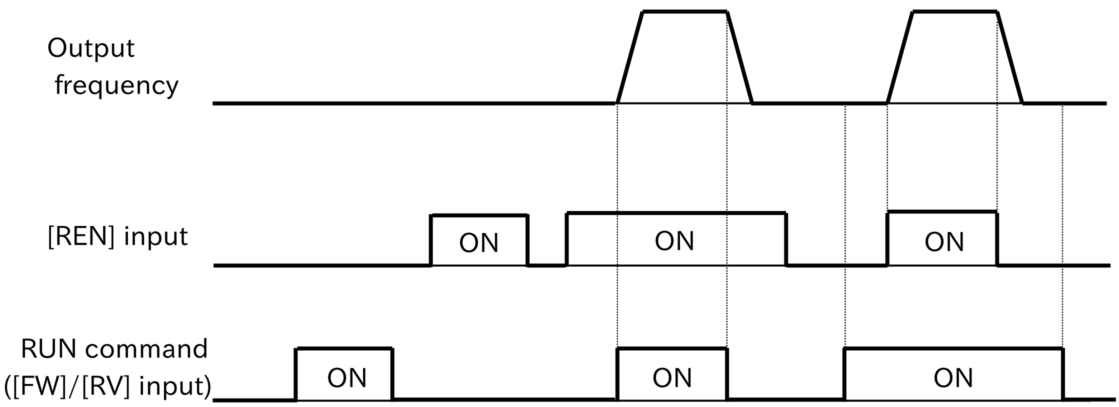
Q
- How to prevent the motor from running without permission from the control system?

A
- To ensure that the system configuration remains safe, inverter operation can be disabled until an operation permission signal that is separate from the RUN command is input.
- When "RUN enable [REN] (84)" input terminal is assigned to a control circuit terminal, the inverter operation is not permitted until the [REN] input terminal is turned on.

!
- This function is enabled by assigning "RUN enable [REN]" input terminal function to one of the control circuit terminals.
- When the [REN] input terminal is assigned and the signal is off, the inverter is prevented from operating. When performing temporary operation such as commissioning, the [REN] input terminal must be set to "No assignment [no]".

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	RUN enable [REN] : Control enable/disable of operation. ON: Operation Enable OFF: Operation Disable	101

Example of the "RUN enable [REN]" operation



9.5 Selecting Suitable Control Mode for the Motor and Load

9.5.1 Select Control Mode

Q
- How do I know the type of motor control mode?
- I want to set an appropriate control mode according to the application.

A
- Set the appropriate control mode according to the motor to be driven and the application using "Control mode selection [AA121]". For details, refer to the table below and the description of each control mode in the following sections.

!
- When using the sensorless vector control or automatic torque boost, be sure to set the motor constant of the motor to be used. For details, refer to "8.1.5 Setting Motor Constant" or "8.3 Carrying Out Motor Auto-tuning".
- When driving multiple induction motors (IM) with one inverter, use V/f control other than auto torque boost.
- By feeding back the actual speed of the motor with an external encoder, high accuracy and stable speed control can be achieved. For details, refer to "9.5.8 Speed Control with Encoder".
- When using synchronous (permanent magnets) motors (SM(PMM)), please contact your supplier.

Code	Name	Description		Data
		Applicable motor	Control mode selection	
[AA121]	Control mode selection	Induction motor (IM)	V/f control, Constant torque characteristics (VC)	00
			V/f control, Reduction torque characteristics (VP)	01
			V/f control, Free V/f	02
			V/f control, Auto torque boost	03
			Sensorless vector control	08
		Synchronous (permanent-magnet) motor (SM(PMM))	Synchronous activation type sensorless vector control*1	11

■ Features of each control mode

Control mode selection	Overview	Manual torque boost	Eco drive	Speed control with sensor	Multiple motors drive	Setting motor constant
V/f control Constant-torque characteristics	Suitable for applications that require a certain amount of torque, such as conveyors and buckets, and for applications that want to simplify setting and adjustment, etc.	○	○	○	○	Not required
V/f control Reduced torque characteristics	Suitable for applications that do not require large torque, such as fans and pumps, and for applications that want to make setting and adjustment easier.	○	○	○	○	Not required
V/f control Free-V/f	Suitable for applications such as special motors where you want to freely set the output voltage with respect to the output frequency.	×	○	○	○	Not required
V/f control Automatic torque boost	If the torque is insufficient, the frequency and output voltage are automatically adjusted to improve the torque shortage.	×	×	○	×	Mandatory
Sensorless vector control	It is suitable for applications where a large torque is required from a low speed or a high-precision output frequency is required.	×	×	○	×	Mandatory
Synchronous activation type sensorless vector control *1	Setting for driving a synchronous motor (SM)/permanent-magnet motor (PMM).	×	×	×	×	Mandatory

*1. Contact your supplier when using the SM(PMM) motor.

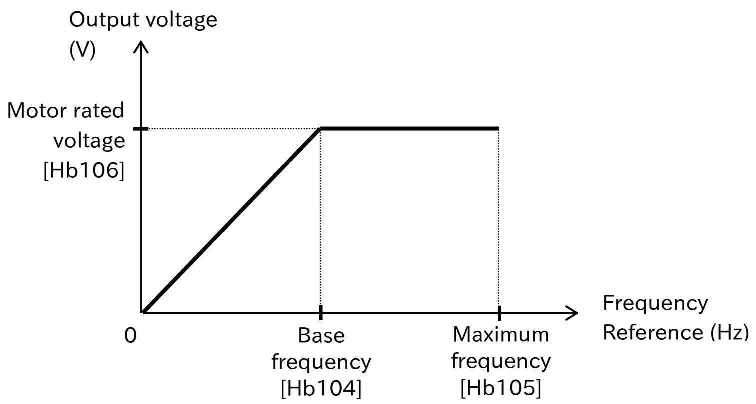
9.5.2 V/f Control with Constant Torque Characteristic

Q

- I want to use an inverter in applications that require torque regardless of the speed of conveyors, carts, etc.
- I want to use an inverter with a fan pump that frequently changes the output.
- Easy to trip when operated with reduced torque characteristics.
- How do I move multiple motors with one inverter?

A

- V/f control is a method for controlling a motor by setting the output voltage-characteristics to the frequency output by the inverter. It is not necessary to set the motor constant of the motor to be used, and it can be used easily.
- The output voltage of the constant-torque characteristic is output to be proportional to the frequency command in a straight line connecting 0 Hz/0 V and the base frequency/rated voltage.
- From 0 Hz to the base frequency, the output voltage is determined in proportion to the frequency, but the output voltage from the base frequency to the maximum frequency is constant regardless of the frequency.
- When the manual torque boost function is used, the boost voltage is added to the basic proportional line for output. The manual torque boost function is effective when torque is insufficient at low speeds. For details, refer to "9.5.6 Manual Torque Boost Function".



!

- If the motor is hunting or vibrates, it may be improved by adjusting " Stabilization constant [HA110]".
- If the motor vibrates when more than one motor is being moved by one inverter, it may be stabilized by adjusting the [HA110] in the downward direction.

Code	Name	Description	Data
[AA121]	Control mode selection	Used in V/f control constant torque characteristics (IM).	00
[HA110]	Stabilization constant	Adjusts the control to suppress the motor hunting when V/f control is selected.	0 to 1000 (%)
[Hb104]	Async. Motor base frequency setting	Set the base frequency of async. motor (IM).	30.00 to Async. Motor maximum frequency (Hz)
[Hb105]	Async. Motor maximum frequency setting	Set the maximum frequency of async. motor (IM).	Async. Motor base frequency to 590.00 (Hz)
[Hb106]	Async. Motor rated voltage	Set the rated voltage of async. motor (IM).	1 to 1000 (V)

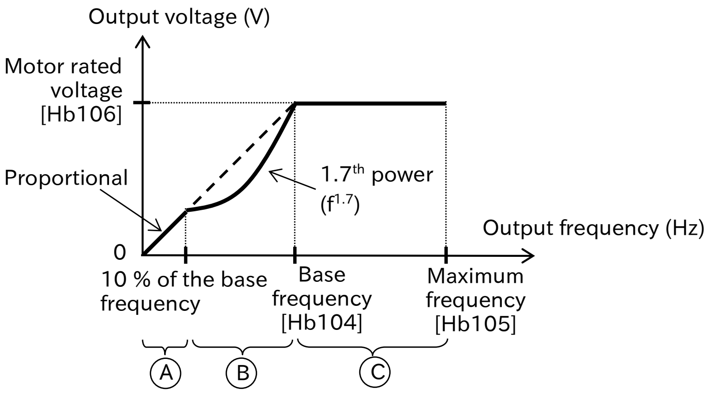
9.5.3 V/f Control with Reduced Torque Characteristic

Q

- We would like to improve the energy saving effect by reducing the output voltage according to the characteristics of the fan and pump.
- Since torque is not required at low speeds, I want to use it with more efficiency, vibration reduction, and noise reduction.

A

- V/f control is a way of controlling the motor by setting the voltage-characteristics to be output with respect to the frequency output by the inverter. It is effective when you do not need to set the individual motor constant of the motor to be used and you want to use it easily.
- The reduced torque characteristic (VP1.7th power characteristic) is suitable for applications such as fans/pumps that do not require large torque in the low-speed range. In the low-speed range, the output voltage is reduced to improve efficiency, reduce noise, and reduce vibration.
- When the manual torque boost function is used, the boost voltage is added to V/f pattern of the reduced torque characteristic. The boost voltage is then output. The manual torque boost function is effective when torque is insufficient at low speeds. For details, refer to "9.5.6 Manual Torque Boost Function".



Period a : The range from 0 Hz to 10 % of the base frequency is a constant-torque characteristic.
(e.g.) If the base frequency is 60 Hz, the range from 0 to 6 Hz is the constant-torque characteristic.

Period b : The range from 10 % of the base frequency to the base frequency is the reduced torque characteristic.
The voltage is output with a curve of the 1.7th power with respect to the frequency.

Period c : The voltage from the base frequency to the maximum frequency is a constant output characteristic.

!

- If the motor is hunting or vibrates, it may be improved by adjusting the "Stabilization constant [HA110]".
- If the motor vibrates when more than one motor is being moved by one inverter, it may be stabilized by adjusting the [HA110] in the downward direction.

Code	Name	Description	Data
[AA121]	Control mode selection	Used in V/f control reduction torque characteristics (IM).	01
[HA110]	Stabilization constant	Adjusts the control to suppress the motor hunting when V/f control is selected.	0 to 1000 (%)
[Hb104]	Async. Motor base frequency setting	Set the base frequency of async. motor (IM).	30.00 to Async. Motor maximum frequency (Hz)
[Hb105]	Async. Motor maximum frequency setting	Set the maximum frequency of async. motor (IM).	Async. Motor base frequency to 590.00 (Hz)
[Hb106]	Async. Motor rated voltage	Set the rated voltage of async. motor (IM).	1 to 1000 (V)

9.5.4 V/f control with Free V/f

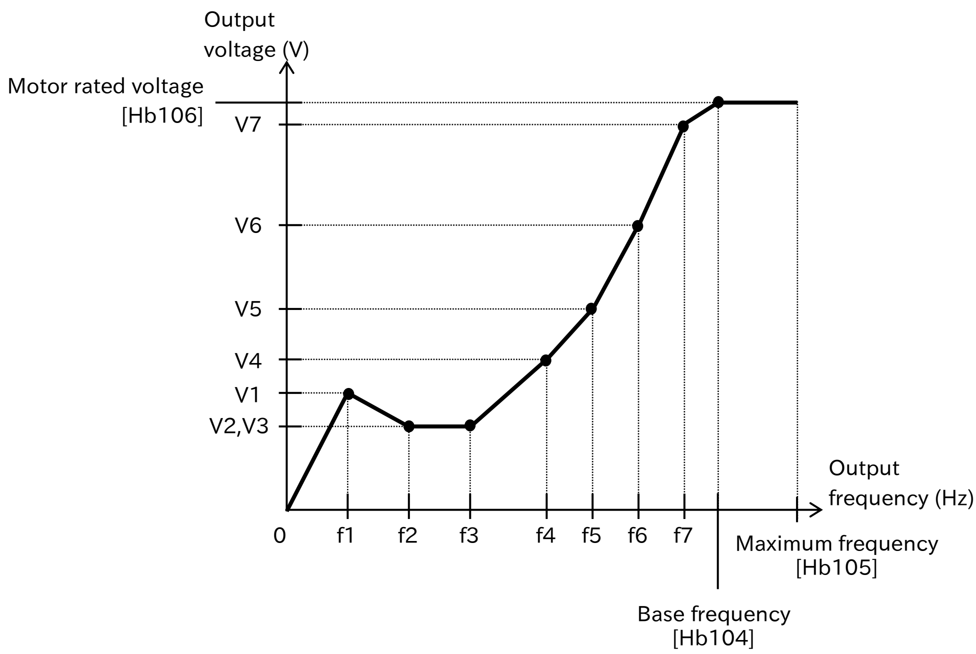
Q

- I want to change the characteristics of V/f control according to the voltage characteristics of the special motor.
- I want to manually adjust the voltage characteristics to achieve energy savings.

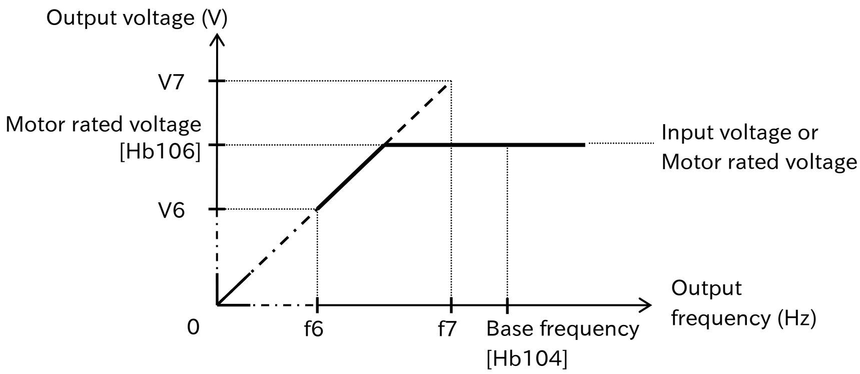
A

- V/f control is a way of controlling the motor by setting the voltage-characteristics to be output with respect to the frequency output by the inverter. It is effective when you do not need to set the individual motor constant of the motor to be used and you want to use it easily.
- The free V/f is suitable for applications in which the load varies greatly depending on a special motor or rotational speed. Therefore, it is suitable for applications in which the output voltage is freely set with respect to the output frequency. It is also effective when adjusting the voltage characteristics optimally manually for energy saving.
- In the free V/f setting, any V/f characteristic can be set by setting 7 output voltages and output frequencies.

Code	Name	Description	Data
[AA121]	Control mode selection	Used in V/f control free V/f (IM).	02
[HA110]	Stabilization constant	Adjusts the control to suppress the motor hunting when V/f control is selected.	0 to 1000 (%)
[Hb104]	Async. Motor base frequency setting	Set the base frequency of async. motor (IM).	30.00 to Async. Motor maximum frequency (Hz)
[Hb105]	Async. Motor maximum frequency setting	Set the maximum frequency of async. motor (IM).	Async. Motor base frequency to 590.00 (Hz)
[Hb106]	Async. Motor rated voltage	Set the rated voltage of async. motor (IM).	1 to 1000 (V)
[Hb150]	Free-V/f frequency 1 setting	Set the frequency at each segmental point.	0.00 to [Hb152] (Hz)
[Hb152]	Free-V/f frequency 2 setting		[Hb150] to [Hb154] (Hz)
[Hb154]	Free-V/f frequency 3 setting		[Hb152] to [Hb156] (Hz)
[Hb156]	Free-V/f frequency 4 setting		[Hb154] to [Hb158] (Hz)
[Hb158]	Free-V/f frequency 5 setting		[Hb156] to [Hb160] (Hz)
[Hb160]	Free-V/f frequency 6 setting		[Hb158] to [Hb162] (Hz)
[Hb162]	Free-V/f frequency 7 setting		[Hb160] to Base Frequency (Hz)
[Hb151]	Free-V/f voltage 1 setting	Set the output voltage at each segmental point.	0.0 to 1000.0 (V)
[Hb153]	Free-V/f voltage 2 setting		
[Hb155]	Free-V/f voltage 3 setting		
[Hb157]	Free-V/f voltage 4 setting		
[Hb159]	Free-V/f voltage 5 setting		
[Hb161]	Free-V/f voltage 6 setting		
[Hb163]	Free-V/f voltage 7 setting		



- If the motor is hunting or vibrates, it may be improved by adjusting the "Stabilization constant [HA110]".
- The frequency of the free V/f setting should always be f1≦f2≦f3≦f4≦f5≦f6≦f7 ≦ base frequency. The defaults for the Free V/f setting are all 0 Hz. After setting the maximum frequency and the base frequency, set 6, 5, 4, 3, 2, and 1 in order from Free V/f setting 7.
- Even if 1000 V is set to the free V/f voltage 1 to 7, the inverter cannot output a voltage higher than the input voltage or the "Async. Motor rated voltage [Hb106]".
- If the characteristics are not set properly, it may cause overcurrent during acceleration/ deceleration or vibration of the motor or machine. Be very careful.



9.5.5 V/f Control with Automatic Torque Boost

Q

- Start of motor rotation after starting operation is slow.
- The heavier the load, the slower the rotation of the motor relative to the frequency command.

A

- Automatic torque boost function automatically adjusts the frequency and output voltage to produce torque.
- In automatic torque boost, the frequency and output voltage are corrected in order to control the motor. For this reason, the motor constant must be taken in by auto-tuning, etc.

!

- If the motor is hunting or vibrates, it may be improved by adjusting "Stabilization constant [HA110]".
- For automatic torque boost, set the motor capacity, number of motor poles, base frequency, rated voltage, and rated current appropriately to perform motor control.
- If the characteristics are not obtained, perform auto-tuning referring to "8.3 Carrying Out Motor Auto-tuning". If the characteristics do not appear after auto-tuning, adjust the following page.

Code	Name	Description	Data
[AA121]	Control mode selection	Used for V/f control auto torque boost (IM).	03
[HA110]	Stabilization constant	Adjusts the control to suppress the motor hunting when V/f control is selected.	0 to 1000 (%)
[Hb104]	Async. Motor base frequency setting	Set the base frequency of async. motor (IM).	30.00 to Async. Motor maximum frequency (Hz)
[Hb105]	Async. Motor maximum frequency setting	Set the maximum frequency of async. motor (IM).	Async. Motor base frequency to 590.00 (Hz)
[Hb106]	Async. Motor rated voltage	Set the rated voltage of async. motor (IM).	1 to 1000 (V)
[HC101]	Automatic torque boost voltage compensation gain	Adjusts the voltage addition of the automatic torque boost.	0 to 255 (%)
[HC102]	Automatic torque boost slip compensation gain	Adjusts the frequency addition of the automatic torque boost.	0 to 255 (%)

- If the desired characteristics cannot be obtained even after inputting the motor constant or performing auto-tuning, perform the adjustment referring to the remedy example in the table below.
- If the rotation of the motor is obstructed by brake or motor lock due to foreign matter, overcurrent may occur. If it is not improved by adjustment, it may be improved by checking around the motor.
- If the display of "Output frequency monitor [dA-01]" changes significantly when a load is applied, the overload restriction function, instantaneous power failure non-stop function, overvoltage control function, or other function to change the frequency in a moving manner may be activated depending on the setting of the function. Refer to "Chapter 15 Tips/FAQ/Troubleshooting" for more information.

Phenomena ▷	Possible causal ▷	Example of remedy
Slow motor rotation at low speed	Output voltage is insufficient and torque is not output.	Increase "Automatic torque boost voltage compensation gain [HC101]" by 5%.
		Decrease "Carrier frequency setting [bb101]".
	The frequency correction is insufficient and the torque is not output.	Increase "Automatic torque boost slip compensation gain [HC102]" by 5%.
When the load becomes heavy, the motor rotation frequency decreases.	The frequency correction is insufficient and the torque is not output.	Increase "Automatic torque boost slip compensation gain [HC102]" by 5%.
When the load becomes heavy, the motor rotation frequency increases.	Frequency correction is excessive and frequency increases.	Decrease "Automatic torque boost slip compensation gain [HC102]" by 5%.
Overcurrent error occurs when the load becomes heavy or accelerates.	Excessive voltage correction results in increased current.	Decrease "Automatic torque boost voltage compensation gain [HC101]" by 5%.
	Frequency correction is excessive and frequency increases.	Decrease "Automatic torque boost slip compensation gain [HC102]" by 5%.

9.5.6 Manual Torque Boost Function

Q

- Start of motor rotation after starting operation is slow.
- Low-speed torque is low.

A

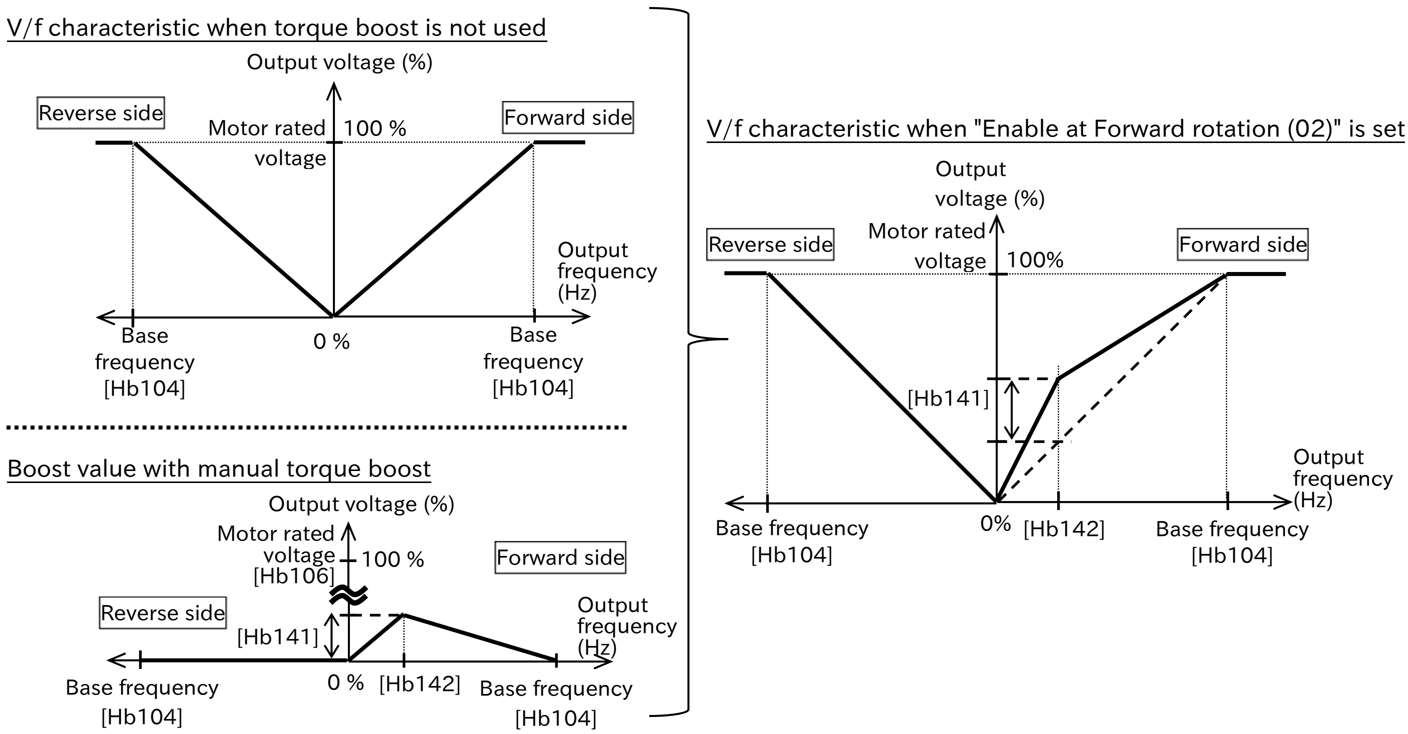
- Manual torque boost is a function that adds a correction to the output voltage so that torque can be produced even at low speeds by V/f control.
- In V/f control, no extra compensation is made to control the motor. For this reason, when the output voltage is low, the voltage applied to the motor drops due to the resistance component inside the motor or the voltage drop caused by wiring. The manual torque boost function improves the torque drop in the low-speed range by correcting the voltage.

!

- With this function, when the "Control mode selection [AA121]" is "V/f control (Constant torque) (00)" or "V/f control (Reduced torque) (01)", the manual torque boost function is available.
- When increasing the set value of manual torque boost, pay attention to overexcitation of the motor. Boosting may increase the current flow, resulting in motor burnout.
- In "Manual torque boost value [Hb141]", set the ratio when "Async. Motor rated voltage [Hb106]" is regarded as 100 %. The set value is the maximum addition value at the "Manual torque boost peak speed [Hb142]".
- For the "Manual torque boost peak speed [Hb142]", set the ratio assuming that the "Async. Motor base frequency setting [Hb104]" is 100 %.

Code	Name	Description	Data
[Hb140]	Manual torque boost operation mode selection	Disable	00
		Always enable	01
		Enable at Forward rotation	02
		Enable at Reverse rotation	03
[Hb141]	Manual torque boost value	Manual Torque Boost Sets the amount of boost at the peak speed. Set the ratio assuming that "Async. Motor rated voltage [Hb106]" is 100 %.	0.0 to 20.0 (%)
[Hb142]	Manual torque boost peak speed	Set the manual torque boost break point (the point at which the summed voltage becomes the maximum). Set "Async. Motor base frequency setting [Hb104]" as a percentage (100 %).	0.0 to 50.0 (%)

■ Manual Torque Boost Setting Example: [Hb140] = Enable at Forward rotation (02)



9.5.7 Eco Drive Function

Q

- We would like to operate the equipment more energy-saving in applications such as fans and pumps.

A

- The Eco drive function automatically adjusts the inverter output power so that it is minimized during constant speed operation. Suitable for load with reduced torque characteristics of fan and pump.
- To use this function, set "Eco drive enable [Hb145]" to "Enable (01)". Response and accuracy can be adjusted with "Eco drive response adjustment [Hb146]".
- This function is available when "Control mode selection [AA121]" is "V/f control (Constant torque)(IM) (00)", "V/f control (Reduce torque)(IM) (01)" or "V/f control (Free-V/f)(IM) (02)".

!

- Since this function is controlled relatively slowly, if a sudden load fluctuation such as an impact load occurs, the motor may stall and cause an overcurrent trip.

Code	Name	Description	Data
[Hb145]	Eco drive enable	Disable	00
		Enable	01
[Hb146]	Eco drive response adjustment	Data : 0 ⇔ 100 Response: Slow ⇔ Fast Accuracy: High ⇔ Low	0 to 100 (%)

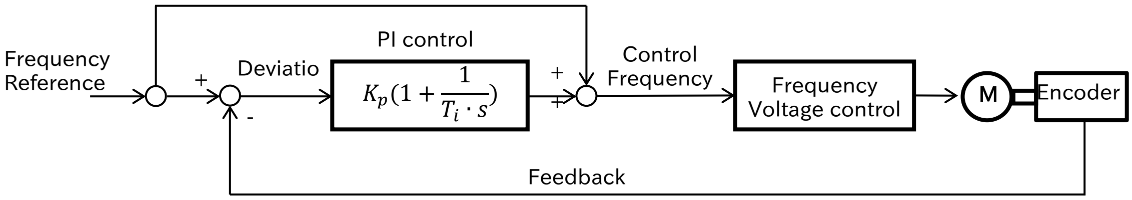
9.5.8 Speed Control with Encoder

Q

- How do I control the inverter speed with high rotational accuracy using the speed feedback of the motor?
- I want the inverter to output the rotation of the fan and pump strictly according to the equipment speed characteristics.
- How to follow the frequency command with high accuracy to calculate the number of turns, etc.?

A

- The speed control function with sensor is a function that performs high-precision frequency control by using an encoder to feed back the actual speed of the motor. It can be used when "Control mode selection [AA121]" is either V/f control or sensorless vector control.
- When speed feedback is used in sensorless vector control, be sure to set "Vector control mode selection [AA123]" to "Speed/Torque control mode (00)".
- In order to control the motor, this function corrects PI control so that the motor revolutions follow the frequency command.
- When "Pulse input target function selection [CA-90]" is set to other than "Disable (00)", the input terminal [7] becomes the phase B input of the encoder signal and the input terminal [8] becomes the phase A input of the encoder signal, regardless of the other parameter setting, and a/b(NO/NC) setting is also disabled.
- If the motor operation is unstable or the follow-up to the command is slow, adjustment "Slip compensation P-gain with encoder [Hb170]" and "Slip compensation I-gain with encoder [Hb171]" by referring to " Adjustment method for speed control with sensor" in this section.
- Refer to "9.5.11 Setting for Encoder Feedback" for details on settings for performing encoder feedback and the protection function when used.



Kp: Proportional gain setting Ti: Integral time s: Operator ε : Deviation
Ki: Integral gain setting (Ki=Kp/Ti)

Code	Name	Description	Data
[AA123]	Vector control mode selection	Mode of speed control to torque control	00
[AA124]	Speed compensation with encoder selection	Enable	01
[CA-07]	Input terminal [7] function	When (01) to (03) are selected for [CA-90], this setting is disabled, and input terminals [7] and [8] become input terminals for encoder-signal.	—
[CA-08]	Input terminal [8] function		
[CA-27]	Input terminal [7] active state		
[CA-28]	Input terminal [8] active state		
[CA-81]	Encoder constant setting	Set the number of pulses per revolution of the encoder.	1 to 65535 (pls)
[CA-86]	Speed feedback filter	Filter time constant for the detection speed by encoder pulse input.	0 to 1000 (ms)
[CA-90]	Pulse input target function selection	Speed feedback	02
[CA-91]	Pulse input mode selection	90° phase difference pulse input	00
		Forward/Reverse pulse input and direction signal	01
		Single phase pulse input	03
[Hb170]	Slip compensation P-gain with encoder	Proportional (P) gain for slip compensation of speed control with sensor.	0 to 1000 (%)
[Hb171]	Slip compensation I-gain with encoder	Integral (I) gain for slip compensation of speed control with sensor.	0 to 1000 (%)

Adjustment method for speed control with encoder

- If sufficient characteristics cannot be obtained, adjust each item referring to the table below.
- If the rotation of the motor is obstructed by brake or motor lock due to foreign matter, overcurrent may occur. If it is not improved by adjustment, it may be improved by checking around the motor.
- If the "Output frequency monitor [dA-01]" changes significantly when a load is applied, the function that automatically changes the frequency, such as the overload restriction function, instantaneous power failure non-stop function, and overvoltage suppression function, may be working depending on the setting status of the function. Refer to "Chapter 15 Tips/FAQ/ Troubleshooting" for more information.

Phenomena ▷	Possible causal ▷	Example of remedy
Slow motor speed follow-up to command.	Slow output response and slow motor speed (feedback value) change.	Increase "Slip compensation P-gain with encoder [Hb170]".
Motor operation is not stable.	The response to the feedback value is too fast.	Decrease "Slip compensation P-gain with encoder [Hb170]".
Overshoot and hunting occur.		
Motor speed vibrates gently.	The integral action reacts slowly.	Increase "Slip compensation I-gain with encoder [Hb171]".
It takes time for the operation to stabilize.		
The motor speed vibrates and does not match the command speed well.	The integral action reacts quickly.	Decrease "Slip compensation I-gain with encoder [Hb171]".

9.5.9 Stabilizing Motor Hunting

Q

- In V/f control, if the motor exceeds a certain frequency, it vibrates and does not stabilize.
- Motor rotation becomes unstable.

A

- "Stabilization constant [HA110]" is a function that adjusts to stabilize the motor when the motor is hunting. Find and adjust the point within the setting range where the tuning will stop.
- When driving more than one motor with one inverter, setting [HA110] to 0% may improve the performance.
- When rotating a fan or other highly inertial load, reduce the [HA110] by 10% increments to improve the performance.
- If the motor capacity is smaller than the rated capacity of the inverter, an improvement may be made by increasing the setting value by 10 % increments. Conversely, if the motor capacity is large, you can improve by decreasing the setting value by 10% increments.
- [HA110] can be used to set the output-frequency response based on "Stabilization ramp function end ratio [HA112]" and "Stabilization ramp function start ratio [HA113]".

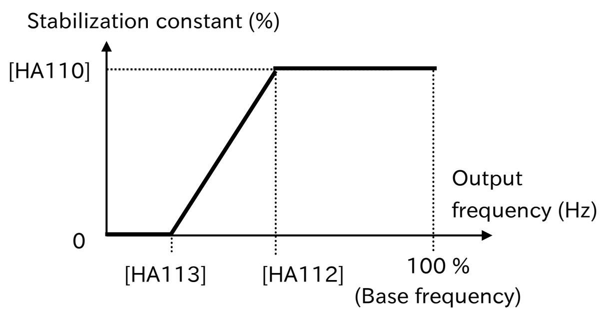
!

- If the motor gets blurred or vibrated, check if the motor capacity, number of motor poles, base frequency, maximum frequency, motor rated voltage, and motor rated current are properly set. For details, refer to "8.1.3 Setting Motor Specification Label Data to Parameters".
- The following methods can be used to suppress hunting. If there is no effect, return the value.

  -Adjust by gradually lowering the "Carrier frequency setting [bb101]" to 2 kHz.
  -Gradually decrease the "Output voltage gain [Hb180]" to 80%.
- "Stabilization constant [HA110]" and "Output voltage gain [Hb180]" are enabled when "V/f control (00 to 03)" is set to "Control mode selection [AA121]".

Stabilization end/start rate setting

- When "Stabilization ramp function end ratio [HA112]" and "Stabilization ramp function start ratio [HA113]" are set, the characteristics of "Stabilization constant [HA110]" are as shown in the diagram.
- If the output frequency is [HA113] or less, the stabilization constant will be 0 %. If the output frequency is [HA113] to [HA112], the stabilization constant will increase proportionally from 0 % to [HA110] setting. If the output frequency is [HA112] or more, the stabilization constant will be [HA110] setting.



Code	Name	Description	Data
[bb101]	Carrier frequency setting	Change the carrier frequency of PWM output. Decrease the value if the motor is hunting.	2.0 to 15.0 (kHz) (ND: Normal Duty) 2.0 to 10.0 (kHz) (LD: Light Duty)
[HA110]	Stabilization constant	If the motor is hunting, adjust the setting.	0 to 1000 (%)
[HA112]	Stabilization ramp function end ratio	These parameters adjust the output frequency characteristics of the stabilization constant. Set the values with the base frequency as 100% reference.	0 to 100 (%)
[HA113]	Stabilization ramp function start ratio		0 to 100 (%)
[Hb180]	Output voltage gain	If the motor is hunting, lower the setting. Decreasing the setting decreases the output voltage.	0 to 255 (%)

9.5.10 Sensorless Vector Control

Q

- For transportation and crane traveling applications where high torque is required at the time of starting.
- When the load is heavy, the rotation of the motor becomes slow with respect to the frequency command.
- To perform stable operation with high starting torque and high accuracy.

A

- The sensorless vector control system estimates and controls the motor speed and output torque according to the inverter output voltage and current and the set motor constant. High starting torque from the low frequency range (0.5 Hz) and high accuracy operation with little rotational speed variation even if the load varies.
- When using sensorless vector control, be sure to set the specifications and motor constant of the motor to be used. For details, refer to "8.1.3 Setting Motor Specification Label Data to Parameters", "8.1.5 Setting Motor Constant", or "8.3 Carrying Out Motor Auto-tuning".
- The "Speed Response [HA115]" can be used to adjust the follow-up possible of the actual speed in response to a frequency command, such as when a load fluctuates.
- If the motor is shaky or vibrates, it may be improved by adjusting [HA115] or "Torque current reference filter time constant [HC120]".
- In the low-speed range (several Hz or less), the motor may rotate in reverse to the RUN command direction. If this happens, enabled "Direction reversal protection [HC114]". For details, refer to "9.4.3 Limiting Motor Rotation Direction".
- If the torque at start is insufficient and the desired performance cannot be obtained, set "Boost value at start (IM-SLV)[HC111]" to a larger value.
- At startup, acceleration starts after the magnetic flux of the level set in "Flux settling level [HC137]" is established. When [HC137] is set to a large value, the operation at start can be stabilized, but the standby time until acceleration starts is longer.
- The upper level can be adjusted by setting "Modulation threshold ([HC141], [HC142])". If the [HC141]/[HC142] is adjusted to a large value, the output current may be suppressed as the output voltage increases. On the other hand, however, the distortion of the output waveform may increase and the operation may become unstable.

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- If the wire length is long (more than the reference 20 m) or a motor other than us is controlled, the characteristics may not be satisfactory.
- Sufficient characteristics may not be obtained if a motor of 2 frames or less of the maximum applicable motor is operated.
- In low-speed operation, the "Carrier frequency setting [bb101]" is automatically reduced to 2 kHz even if it is set to a value exceeding 2 kHz. In addition, since the carrier frequency increases with acceleration, electromagnetic noise, etc. from the motor may change depending on the output frequency.
- Be sure to set the same value when changing the "Modulation threshold ([HC141], [HC142])".

Code	Name	Description	Data
[AA121]	Control mode selection	Sensorless vector control (IM)	08
[HA115]	Speed response	Adjusts the response of the control. Increasing the value increases the follow-up ability to the frequency command.	0 to 1000 (%)
[Hb110]	Async. Motor constant R1	For details, refer to "8.1.3 Setting Motor Specification Label Data to Parameters", "8.1.5 Setting Motor Constant", or "8.3 Carrying Out Motor Auto-tuning".	0.000001 to 1000.000000 (Ω)
[Hb112]	Async. Motor constant R2		0.000001 to 1000.000000 (Ω)
[Hb114]	Async. Motor constant L		0.000001 to 1000.000000 (mH)
[Hb116]	Async. Motor constant I0		0.01 to 10000.00 (A)
[Hb118]	Async. Motor constant J		0.00001 to 10000.00000 (kgm^2)
[HC111]	Boost value at start (IM-SLV)	Adjust the current command at start when the starting torque is insufficient.	0 to 50 (%)
[HC114]	Direction reversal protection	Disable	00
		Reverse prevention function is enabled. Limit output to prevent it from being output in the opposite direction.	01
[HC120]	Torque current reference filter time constant	Adjust the torque current filter.	0 to 100 (ms)
[HC121]	Speed feedforward compensation gain	Adjusts the feedforward control of the speed controller.	0 to 1000 (%)
[HC137]	Flux settling level	Adjust the magnetic flux establishment level at start.	0.0 to 100.0 (%)
[HC141]	Modulation threshold 1	Adjust the upper limit level of the output voltage. Be sure to set the same value when adjusting [HC141]/[HC142].	0 to 133 (%)
[HC142]	Modulation threshold 2		

Adjustment method in sensorless vector control

- If the desired characteristics cannot be obtained, first perform auto-tuning to set the motor constant. Then, perform the adjustment referring to the table below.
- Before adjusting "Speed response [HA115]", set "Async. Motor constant J [Hb118]" as the sum of the load moment of inertia of the motor shaft conversion and the moment of inertia of the motor.
- If the rotation of the motor is obstructed by brake or motor lock due to foreign matter, overcurrent may occur. If it is not improved by adjustment, it may be improved by checking around the motor.
- If the "Output frequency monitor [dA-01]" changes significantly when a load is applied, the function that automatically changes the frequency, such as the overload restriction function, instantaneous power failure non-stop function, and overvoltage suppression function, may be working depending on the setting status of the function. Refer to "15 Tips/FAQ/Troubleshooting" for more information.

Phenomena ▷	Possible causal ▷	Example of remedy
Shock occurs when starting.	The speed response of the control system is high.	Decrease the "Speed response [HA115]" by 5% increments.
		Reduce "Async. Motor constant J [Hb118]" by 5% increments.
		Reduce the "Boost value at start (IM-SLV) [HC111]" by 5% increments.
The time from the input of the RUN command to the actual start is long.	Large magnetic flux at start.	Reduce the "Flux settling level [HC137]" by 5 % increments.
Operation at start is unstable.	Motor is started before the magnetic flux becomes large enough.	Increase the "Flux settling level [HC137]" by 5 % increments.
During start or low-speed operation, the motor rotates in the direction opposite to the commanded rotation direction for a moment.	As a result of the control, a command in the reverse direction is issued for a moment.	Enable "Direction reversal protection [HC114]".
Rotation is not stable during low-speed operation and unevenness occurs.	The speed response of the control system is low.	Increase the "Speed response [HA115]" by 5 % increments.
		Increase "Async. Motor constant J [Hb118]" by 5 % increments.
When the motor is loaded in the direction of rotation (regenerative) during low-speed operation (several Hz), the rotation frequency increases.	Insufficient regenerative torque in low-speed operation.	Increase the "Async. Motor constant R1 [Hb110]" by 5% increments up to 1.2 times the set value.
		Increase the "Async. Motor constant I0 [Hb116]" by 5% increments up to 1.2 times the set value.
The motor is hunting.	The speed response of the control system is high.	Decrease the "Speed response [HA115]" by 5 % increments.
		Reduce "Async. Motor constant J [Hb118]" by 5 % increments.
When a load in the stopping direction (drive) is applied to the motor, the rotation frequency decreases.	The motor constant R2 is set low.	Increase the "Async. Motor constant R2 [Hb112]" by 5 % increments up to 1.2 times the set value.
When a load in the stopping direction (drive) is applied to the motor, the rotation frequency increases.	The motor constant R2 is set high.	Adjust "Async. Motor constant R2 [Hb112]" by 5 % increments as the limit of 0.8 times the set value.
The output current value is large during high-speed operation (above the base frequency).	The upper level of the output voltage is low.	Increase the "Modulation threshold ([HC141], [HC142])" by 5 % increments.
Operation at high speed operation (above base frequency) is not stable.	High modulation factor level.	Reduce the "Modulation threshold ([HC141], [HC142])" by 5 % increments.

9.5.11 Setting for Encoder Feedback

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- I want to confirm that it can be done with encoder feedback.
- How do I know the settings and wiring when performing encoder feedback?

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- Speed control function with sensor or position control function can be used by inputting encoder feedback.
- To use the speed control function with sensor or position control function, set "Pulse input target function selection [CA-90]" to "Speed Feedback (02)". When [CA-90] is set to other than "Disable (00)", input terminals [7] and [8] become terminals for pulse input or encoder feedback input. When using encoder feedback, connect the phase A to the input terminal [8] and the phase B to the input terminal [7].
- The detection speed by encoder-feedback can be checked in "Detect speed monitor [dA-08]". [dA-08] operates by setting "Speed feedback (02)" to "Pulse input target function selection [CA-90]". Also, when using [dA-08], set "Async. Motor number of poles setting [Hb103]", "Encoder setting ([CA-81] to [CA-84])" and "Pulse input mode selection [CA-91]" correctly.

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- Set the encoder constant in units of (pulse/revolution) of the motor shaft conversion.
- If the detection speed by the encoder-feedback is not stable, set "Speed feedback filter [CA-86]" to larger value.
- In WJ-C1, pulse input can also be used for pulse input frequency command or pulse counting function. To enable each function, refer to "Combination of related functions and settings that use pulse input" in this section, and set each parameter.

Code	Name	Description	Data
[dA-08]	Detect speed monitor	Monitors the feedback detection speed. This parameter is enabled when "Speed feedback (02)" is selected for "Pulse input target function selection [CA-90]".	-590.00 to 590.00 (Hz)
[AA123]	Vector control mode selection	Mode of speed control to torque control	00
		Absolute position control mode	02
		High-resolution absolute position control mode	03
[AA124]	Speed compensation with encoder selection	Disable	00
		Enable	01
[CA-81]	Encoder constant setting	Set the number of connected encoder pulses in the number of pulses (multiplied by 1) of motor 1 rotation conversion.	1 to 65535 (pls)
[CA-82]	Encoder phase sequence selection	Phase A lead	00
		Phase B lead	01
[CA-83]	Motor gear ratio numerator	Set the numerator of motor gear ratio.	1 to 10000
[CA-84]	Motor gear ratio denominator	Set the denominator of the motor gear ratio.	1 to 10000
[CA-86]	Speed feedback filter	Set the filter time constant for the detection speed by the input from the encoder.	0 to 1000 (ms)
[CA-90]	Pulse input target function selection	Disable	00
		Frequency reference	01
		Speed feedback	02
		Pulse count	03
[CA-91]	Pulse input mode selection	90° phase difference pulse input	00
		Forward/Reverse pulse input and direction signal	01
		Single phase pulse input	03
[Hb103]	Async. Motor number of poles setting	Set the number of motor poles.	2 to 48 (pole)

■ Combination of related functions and settings that use pulse input

Effective function	Setting	Reference
Pulse input frequency command function	[CA-90] = Frequency reference (01)	"9.2.8 Setting Frequency Reference by Pulse Input"
Speed control function with sensor	[CA-90] = Speed feedback (02) [AA123] = Speed/Torque control mode (00) [AA124] = Enable (01)	"9.5.8 Speed Control with Encoder"
Pulse count function	[CA-90] =Disable (00) [CA-01] to [CA-08]=[PLB](103)、[PLA](104) Or [CA-90] = Pulse count (03)	"9.15.5 Counting the Number of Input Pulse"
Position control function	[CA-90] = Speed feedback (02) [AA123] = Absolute position control mode (02) or High-resolution absolute position control mode (03)	"9.14 Perform Positioning Operation"

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Pulse input mode Connecting the Encoder

- If "Pulse input target function selection [CA-90]" is set to other than "Disable (00)", input terminals [7] and [8] are automatically switched to terminals for phase B and phase A of pulse input, respectively. At this time, the setting of "Input terminal active state ([CA-21] to [CA-28])" is disabled. Also note that the hardware specifications differ between input terminal [7] and input terminal [8]. Hardware specifications, rotation direction recognition, and wiring of "Pulse input mode selection [CA-91]" setpoints for input terminals [7] and [8] are shown below.

■ Hardware Specifications of Input Terminals [7]/[8]

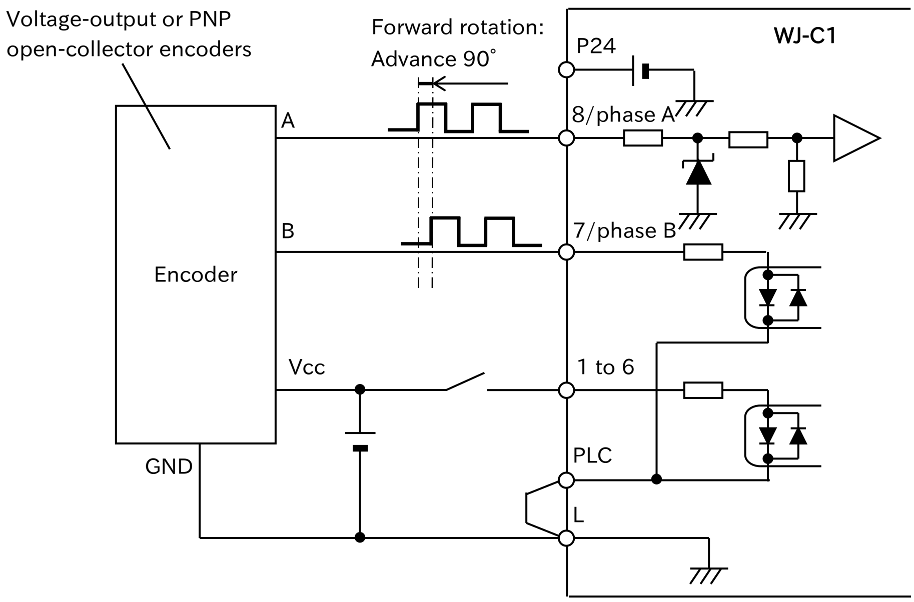
Pulse input mode selection [CA-91]	Input terminal [7] (24 VDC/ max. 32 kHz)	Input terminal [8] (5 to 24 VDC/ max. 32 kHz)
90˚ phase difference pulse input (00)	Phase B pulse (PNP open-collector or voltage-output encoders)	Phase A pulse (PNP open-collector or voltage-output encoders)
Forward/Reverse pulse input and direction signal (01)	Direction signal (sink/source transistor or switching switch)	Single phase pulse (PNP open-collector or voltage-output encoders)
Single phase pulse input (03)	—	Single phase pulse (PNP open-collector or voltage-output encoders)

■ Feedback rotation direction recognition

Pulse input mode selection [CA-91]	RUN command		Input terminal [7]	Feedback Rotation direction recognition
	Forward rotation	Reverse rotation		
90˚ phase difference pulse input (00)	Either ON		-	Encoder detection (90˚ phase difference)
Forward/Reverse pulse input and direction signal (01)	Either ON		OFF	Forward rotation (according to input terminal [7])
			ON	Reverse rotation (according to input terminal [7])
Single phase pulse input (03)	ON	OFF	-	Forward rotation
	OFF	ON	-	Reverse rotation

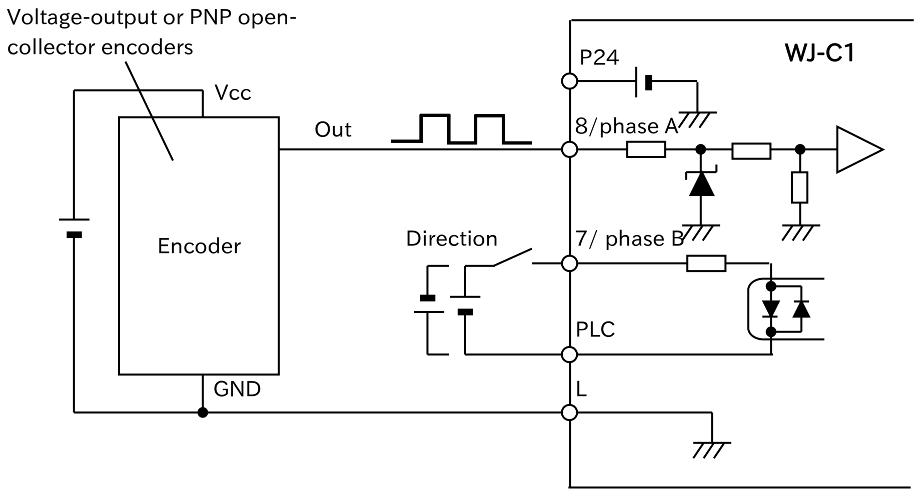
Wiring of phases A/B for 90° phase differential pulse ([CA-91]=00)

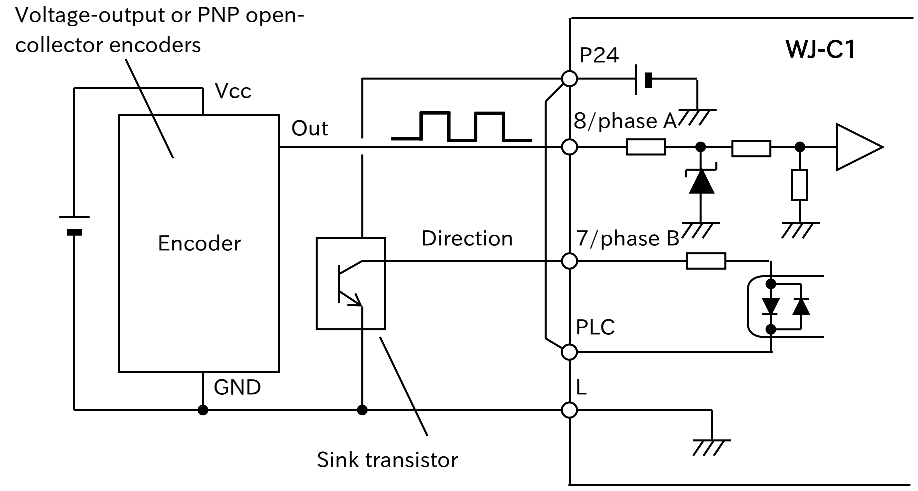
- Wire phases A/B for 90° phase differential pulses to the input terminals [7] and [8] as shown in the figure below. Input of phase B is to input terminal [7], so use all intelligent input terminals including input terminal [7] with source logic (voltage-output type encoder or PNP open collector type encoder). In addition, input-voltage high level must be within the specifications (18 to 24 VDC) of the intelligent input terminal.

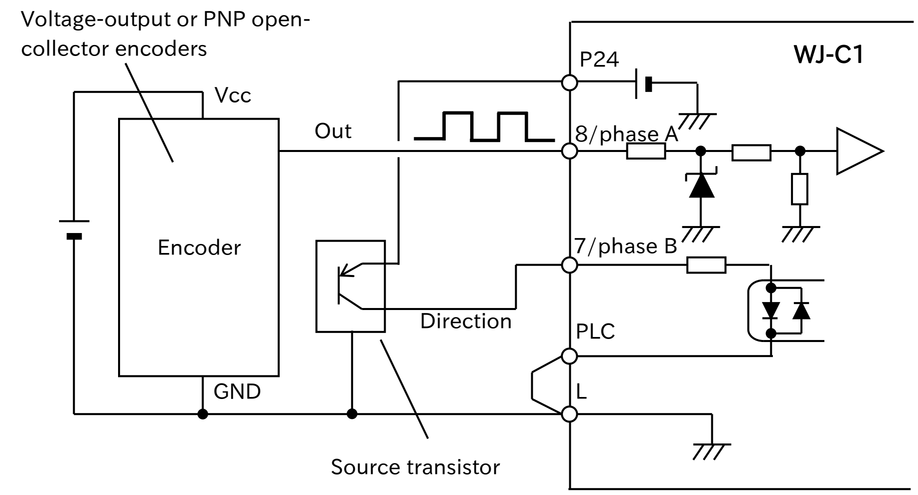


■ Wiring of Single-phase Pulse and Forward/Reverse Command ([CA-91]=01, 03)

- For single-phase pulse or forward/reverse command and pulse input, wire as shown in the figure below.
  Input single-phase pulse and pulse input to input terminal [8] and direction signal to input terminal [7]. The input terminal [7] can be used for both synchro logic and source logic by changing the position of the short circuit line. When the input terminal [7] is OFF, it is forward and inverted when it is ON.







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Protection function during encoder feedback

- When encoder feedback is enabled, the following protection functions can be set. Use it according to the application.

■ Overspeed error detection

- If the feedback-detection speed exceeds "Over-speed detection level [bb-80]" and "Over-speed detection time [bb-81]" or more has elapsed, the inverter trips due to "Excessive speed error [E107]". Set [bb-80] according to the maximum speed of the application. This function is enabled when "Pulse input target function selection [CA-90]" = "Speed feedback (02)" and [bb-80]≠0.0%.

■ Speed deviation error detection

- During operation, if the absolute value of the speed deviation (output frequency-detection speed) exceeds the "Speed deviation error detection level [bb-83]" and exceeds the "Speed deviation error detection time [bb-84]" or more, the "Speed over deviation [DSE]" signal is turned ON. If excessive speed deviation is detected by setting of "Speed deviation error mode selection [bb-82]" = 01, it can also be tripped by "Speed deviation error [E105]". To enable this function, set [bb-83] to a value other than 0.00%.

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- If the inverter is stopping the output, the "Speed over deviation [DSE]" will not be output.

■ Encoder disconnection

- If the output frequency is greater than or equal to the "Creep speed setting [AE-15]" and the detection speed is less than the "Minimum frequency adjustment [Hb130]" for the duration of the "Encoder disconnection time [CA-85]", the inverter trips due to the "Encoder disconnection error [E100]". Adjust [AE-15] and [CA-85] according to the application if false detection occurs due to heavy loads and slow start-up, etc.

Code	Name	Description	Data
[AE-15]	Creep speed setting	Low-speed operation speed before positioning completion of position control and speed of encoder disconnection detection determination.	Minimum frequency [Hb130] to 10.00 (Hz)
[bb-80]	Over-speed detection level	Set the level at which the detection speed is judged to be excessive. Set "Async. Motor maximum frequency setting [Hb105]" to 100 %.	0.0 to 150.0 (%)
[bb-81]	Over-speed detection time	Set the duration from when the detection speed exceeds [bb-80] to when tripping at "Excessive speed error [E107]".	0.0 to 5.0 (s)
[bb-82]	Speed deviation error mode selection	Even if a speed deviation error is detected, the motor does not trip.	00
		If a speed deviation error is detected, the motor trips with "Speed deviation error [E105]".	01
[bb-83]	Speed deviation error detection level	Set the level at which the deviation between the detection speed and the target speed is judged to be excessive.	0.00 to 100.00 (%)
[bb-84]	Speed deviation error detection time	Set the duration from when "Speed deviation error detection time [bb-83]" to when it is judged to be abnormal.	0.0 to 5.0 (s)
[CA-85]	Encoder disconnection time	Set the time to detect encoder disconnection. Disconnection detection is disabled when the set value is 0.0.	0.0 to 10.0 (s)
[CC-01] [CC-02] [CC-07]	Output terminal function	Speed over deviation [DSE]: This signal is turned ON when the conditions below are met during operation and [bb-84] or longer are continued. |Output Frequency-Detect Speed| ≧ [bb-83]	041

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Check after setting encoder wiring and related parameters

- After setting the encoder wiring and related parameters, check the wiring and settings by referring to the table below.
- Check whether the inverter is correctly counted by running the inverter in the forward or reverse direction while checking the "Current position monitor [dA-20]".
- If the wiring and setting are correct, the [dA-20] display will add [CA-81] for one revolution in the forward direction of the motor and subtract [CA-81] for one revolution in the reverse direction of the motor.
  (When the phase sequence of R, S, T phase of the inverter and U, V, W phase of the motor is correctly wired, and the encoder-output is a 90˚ phase-difference pulse, and the phase A is a 90˚ lead phase during forward rotation.)

Phenomena ▷	Possible causal ▷	Example of remedy
Forward rotation and reverse rotation are reversed.	The motor or encoder wiring is reversed.	Check the motor wiring U, V, W and the wiring of phase A and phase B of the encoder. Re-wire correctly if reversed.
[dA-20] does not count.	phase A/B pulse from the encoders is not outputted correctly.	Measure the voltage waveforms of the phase A and phase B wiring with a multimeter to check for any abnormalities. If the voltage waveform is abnormal, check the power, wiring, disconnection, etc. of the encoder.
	Inverter setting is not correct.	Refer to this section and set the inverter parameters correctly.
	The inverter input circuit is faulty.	Repair inverter.
[dA-20] does not count only during forward or reverse rotation.	The same reason as the above "[dA-20] does not count" for the phase A or phase B only.	Using the above as a reference, check the output of the phase A or B of the encoder and the input of the phase A or B of the inverter.
	The pulse-input cannot be counted correctly due to the effect of crosstalk of the encoder phase A/B signal-output.	Use a shielded cable for phase A/B distribution cable, and connect the shield to the L terminal.

9.6 Speed/Torque Control According to Load

9.6.1 Speed Control and Torque Control

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- The following two control modes are used to control the motor with high accuracy using the inverter. Both control modes can be used by setting "Control mode selection [AA121]" to "Sensorless vector control (IM) (08)".

  (1) Speed control : A method of controlling the output so that the motor speed is tracked to the speed reference and torque is generated at a constant speed.

  (2) Torque control: A method of controlling the output so that the output torque is constant regardless of the speed by following the output torque with respect to the torque reference.

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- Each function related to torque described in this section is enabled only when the control mode is sensorless vector control. For details on setting and adjustment of sensorless vector control, refer to "9.5.10 Sensorless Vector Control".
- The setting of "Torque conversion method selection [HC115]" switches the 100% reference value of the torque value for each function. One is the output torque at the rated current output of the inverter, and the other is the rated torque of the motor calculated from the "Async. Motor capacity setting [Hb102]", "Async. Motor number of poles setting [Hb103]", and "Async. Motor base frequency setting [Hb104]" set as motor constants. Refer to "9.6.3 Operate by Torque Reference" for details.

■ Difference between speed control and torque control

Control mode selection	Speed control	Torque control
Operation	Speed control is a control mode to make the motor speed follow the speed reference. Therefore, control is performed so that the speed is kept constant even when the torque of the load fluctuates.	Torque control is a control mode that causes the output torque to follow the torque reference. Therefore, the rotation speed of the motor fluctuates according to the fluctuation of the torque of the load.

■ Related function overview of speed control and torque control

Function	Overview	Control mode
Output torque monitor function	Output torque estimate in sensorless vector control can be monitored by "Output torque monitor [dA-17]". Analog voltage/current output from the [Ao1] terminal and analog voltage/pulse output from the [Ao2] terminal are available. For details, refer to "9.16.4 Monitor Data Output by Pulse Output" and "9.16.5 Monitor Data Output by Analog Output".	Speed control Torque control
Response gain setting Gain switching Gain mapping	Adjust the speed control response gain to increase or stabilize speed tracking. Gain switching and gain mapping functions are used when the load inertia changes due to changes in the load characteristics or speed.	Speed control
Droop control	This function is used to perform load balancing operation, etc., in which one load is driven by multiple motors.	Speed control
Torque limit function	This function controls the motor so that the output torque does not exceed the specified torque limit value even if the load condition changes. Used in applications where force is not applied unnecessarily during pushing operation, etc.	Speed control Torque control

Function	Overview	Control mode
Switching of speed control to torque control	Switching function of speed control ⇔ torque control.	Speed control Torque control
Torque bias function	In speed control or torque control, the torque bias value is separately added to the output torque.	Speed control Torque control
Torque control operation	Control is performed so that the output torque follows the torque reference value. Used for applications that require a constant output torque even when an irregularly fluctuating external force is applied, such as applications that require a constant tension of a winder. In the torque control mode, if the load becomes too light for the torque reference, the motor speed continues to increase. Therefore, the speed limit function can be set during torque control.	Torque control

9.6.2 Switch between Speed Control and Torque Control

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- To control stopping contact after moving an object.
- To switch between speed control and torque control.

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- Torque control and speed control can be switched for operation by turning ON/OFF the input terminal function "Permission of torque control [ATR](067)".
- Torque control can be used when "Vector control mode selection [AA123]" is set to "Speed/Torque Control Mode (00)" after "Control mode selection [AA121]" is set to "Sensorless vector control (IM) (08)".
- If shock occurs when switching from speed control to torque control, set "Switching time of speed control to torque control [Ad-04]" longer.

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- If the torque reference changes stepwise when switching from speed control to torque control, the current may increase instantaneously.

Code	Name	Description	Data
[AA121]	Control mode selection	Sensorless vector control (IM)	08
[AA123]	Vector control mode selection	Mode of speed control to torque control	00
[Ad-04]	Switching time of speed control to torque control	Switches the torque reference gently according to the set time when switching from speed control to torque control.	0 to 1000 (ms)
[CA-01] to [CA-11]	Input terminal function	Permission of torque control [ATR]: ON: Torque control OFF: Speed control	067

9.6.3 Operate by Torque Reference

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- How do I control the motor so that a constant torque is applied to it?
- I would like to perform stop control.
- How do I make the take-up torque constant with a Winder, etc.

A

- When operating in torque control, assign "Permission of torque control [ATR](067)" to the input terminal. ON the terminal [ATR] to switch from speed control to torque control.
- Torque control can be used when "Sensorless vector control (IM) (08)" is set in "Control mode selection [AA121]".
- Torque reference input source is selected by "Torque reference input source selection [Ad-01]".
- When [Ad-01] is "Parameter setting (07)", the torque reference value is set by "Torque reference value setting [Ad-02]". In addition, the "Torque reference setting (monitor) [FA-15]" can also be changed or saved. This change/save is also reflected in [Ad-02].
- When [Ad-01] is other than "Parameter setting (07)", the [FA-15] is a monitor that displays the torque reference currently entered in the way set in [Ad-01].
- It is also possible to add bias to the torque reference value. For details, refer to "9.6.5 Torque Bias Function".
- The current output torque can be checked in "Output torque monitor [dA-17]". The filter can also be set using the "Output torque monitor filter [CF-62]". For details, refer to "10.1.5 Monitor the Torque Reference/Output Torque Related Data".

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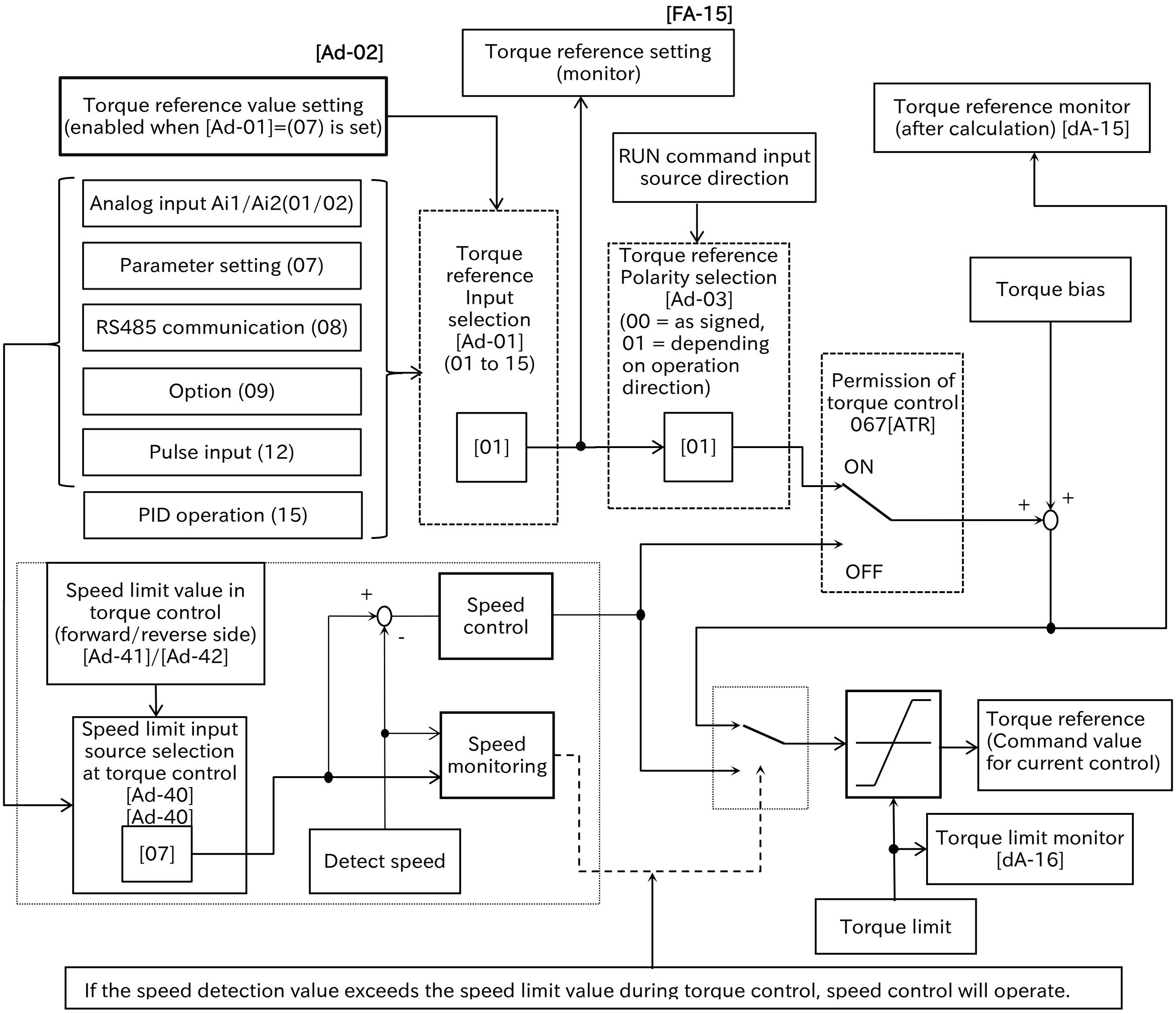
- When switching between speed control and torque control, a shock may occur in motor operation due to differences in control. It can be adjusted with "Switching time of speed control to torque control [Ad-04]" to reduce shocks when switching. Longer setting times reduce shock.
- The setting of "Torque conversion method selection [HC115]" switches the 100% reference value of the torque value for this function. One is the output torque at the rated current output of the inverter, and the other is the rated torque of the motor calculated from the "Async. Motor capacity setting [Hb102]", "Async. Motor number of poles setting [Hb103]", and "Async. Motor base frequency setting [Hb104]" set as motor constants. Therefore, note that the absolute value of torque changes depending on the combined motor.
- Since the speed in torque control is determined by the balance with the load, the output speed increases when the actual output torque is smaller than the torque reference. Therefore, set "Speed limit input source selection at torque control [Ad-40]" as the speed limit value for preventing runaway.



※ In the figure, [ ] and the position of the switch for each parameter indicates the initial value.
Input terminal functions that are not assigned to the "Input terminal function ([CA-01] to [CA-08])" will be OFF.

Code	Name	Description	Data
[dA-15]	Torque reference monitor (after calculation)	Monitors the current torque reference value.	-1000.0 to 1000.0 (%)
[dA-17]	Output torque monitor	Monitors the output torque value.	-1000.0 to 1000.0 (%)
[FA-15]	Torque reference setting (monitor)	Monitors or changes sets of the currently selected torque reference value. When [Ad-01] is set to "Parameter setting (07)", changing/saving [FA-15] will also change/save the setting value of [Ad-02].	-500.0 to 500.0 (%)
[Ad-01]	Torque reference input source selection	Input torque reference by analog input of [Ai1] terminal. 0 to 100 % of analog input is 0 to 500 % torque.	01
		Input torque reference by analog input of [Ai2] terminal. 0 to 100 % of analog input is 0 to 500 % torque.	02
		[Ad-02] is used for the torque reference.	07
		Torque reference is set by Modbus communication.	08
		Set the torque reference from the communication option.	09
		Set the torque reference by pulse input.	12
		PID calculation is used for the torque reference.	15

Code	Name	Description	Data
[Ad-02]	Torque reference value setting	When [Ad-01] is "Parameter setting (07)", set the torque reference value.	-500.0 to 500.0 (%)
[Ad-03]	Torque reference polarity selection	Regardless of the direction of the RUN command, the torque increases in the forward direction when the value is (+) and in the reverse direction when the value is (-).	00
		The sign of the value and the direction in which the torque bias acts change depending on the direction of the RUN command.	01
[Ad-04]	Switching time of speed control to torque control	Set the switching time of speed control/torque control. The longer the setting time, the lower the shock when switching.	0 to 1000 (ms)
[Ad-40]	Speed limit input source selection at torque control	Input the upper speed limit value at torque control using the analog input of the [Ai1] terminal. 0 to 100% of analog input is 0 Hz to maximum frequency.	01
		Input the upper speed limit value at torque control using the analog input of the [Ai2] terminal. 0 to 100% of analog input is 0 Hz to maximum frequency.	02
		The value entered in [Ad-41]/[Ad-42] is used for the upper speed limit at torque control.	07
		Set the upper speed limit at the of torque control by Modbus communication.	08
		Set the upper speed limit value at torque control by the communication option.	09
		Set the upper speed limit value at torque control by pulse input.	12
[Ad-41]	Speed limit at torque control (forward)	Set the speed limit value on the forward rotation side in torque control.	0.00 to Maximum frequency (Hz)
[Ad-42]	Speed limit at torque control (reverse)	Set the speed limit value on the reverse rotation side in torque control.	0.00 to Maximum frequency (Hz)
[CA-01] to [CA-08]	Input terminal function	Permission of torque control [ATR]: Switches to torque-control when this signal is ON.	067
[CF-62]	Output torque monitor filter for [dA-17] and similar communication data	Filter time constant can be set for "Output torque monitor [dA-17]".	0 to 1000 (ms)
[HC115]	Torque conversion method selection	Torque: The torque reference value (100 %) is calculated as follows: Torque reference value = 79.58 x Motor capacity x number of poles/base frequency (Example) Torque reference value = 79.58×5.5(kW)×4(P)/50(Hz)≒35 N m	00
		Current: The torque reference value (100 %) is the motor output torque at rated current output.	01

9.6.4 Limiting Output Torque

Q

- I want to limit the output torque so that it does not become too large.
- When the end of the system is reached, stop control should be performed.
- To output a signal when the output torque exceeds the specified range.
- How do I monitor the torque that the inverter is limiting?

A

- When "Sensorless vector control (IM) (08)" is set in "Control mode selection [AA121]", and speed control is performed, the motor output torque is limited.
- Torque limit command input source is set by "Torque limit selection [bA110]".
- The enabled torque limit can be checked in "Torque limit monitor [dA-16]".
- If "Torque limit enable [TL](060)" is set to the input terminal, the torque limit function according to the input methods set in [bA110] will be enabled only when the [TL] input terminal is turned ON. For OFF, the torque limit function is disabled.
- When "Switched by [TRQ1][TRQ2] terminals (01)" is set to "Torque limiting parameters mode selection [bA111]", four torque limits set to "Torque limit 1 to 4 [bA112] to [bA115]" can be switched and used by combining ON/OFF of "Torque limit selection bit 1 [TRQ1](061)" and "Torque limit selection bit 2 [TRQ2](062)".
- If torque pulsation occurs when releasing after torque limit operation, it may be improved by enabling "Torque limit LADSTOP selection [bA116]".
- When "Over-torque [OTQ](019)" is set to the output terminal, the [OTQ] signal turns ON when the output torque exceeds "Over-torque level [CE120] to [CE123]".
- If "Torque limited [TRQ](022)" is set to the output terminal, the [TRQ] signal turns ON when the torque limit function described above operates.

!

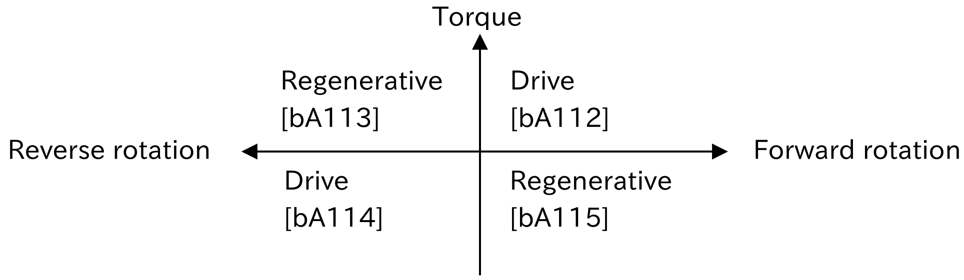
- If "Torque limit enable [TL]" is not assigned, the torque limit function set in "Torque limit selection [bA110]" is always enabled.
- If the torque limit function is used in the low-speed range, the motor may not start, resulting in overload protection. In this case, use the overload restriction function together. For details of the overload restriction function, refer to " 9.9.1 Overload Restriction Function".
- The reference torque in this function is calculated based on the output torque at the time of inverter rated current output or the rated torque of the motor calculated from "Async. Motor capacity setting [Hb102]", "Async. Motor number of poles setting [Hb103]" and "Async. Motor base frequency setting [Hb104]" which is set as the motor constant by the setting of "Torque conversion method selection [HC115]" as 100%. Refer to "9.6.3 Operate by Torque Reference" for details.
- Input terminal functions [TL], [TRQ1], [TRQ2] and output terminal functions [TRQ] and [OTQ] are enabled only when "Sensorless vector control (IM) (08)" is assigned to "Control mode selection [AA121]".
- When "Torque limit enable [TL]" is assigned to an input terminal for OFF, or "4 quadrants individual (00)" is set to "Torque limiting parameters mode selection [bA111]", "Torque limit monitor [dA-16]" is displayed as 0.0 %.

Code	Name	Description	Data
[dA-16]	Torque limit monitor	Displays the currently set torque limit value. If torque limit is disabled or [bA111] is set to "4 quadrants (01)", it will be 0.0.	0.0 to 500.0 (%)
[dA-17]	Output torque monitor	Monitors the estimated output torque.	-1000.0 to 1000.0 (%)
[bA110]	Torque limit selection	Disable	00
		Set the torque limit value using analog input from the terminal [Ai1].	01
		Set the torque limit value using analog input from the terminal [Ai2].	02
		Torque limits set in [bA112] to [bA115] are used.	07
		Set the torque limit using Modbus communication.	08
		Set the torque limit value from the communication option.	09
[bA111]	Torque limiting parameters mode selection	Specify the 4 quadrants individually.	00
		Specified by [TRQ1]/[TRQ2] terminals combination.	01
[bA112]	Torque limit 1 (Forward drive)	Set the torque limit value. When [bA110] is set to "Parameter setting (07)" and [bA111] is set to "4 quadrants (00)", set "Forward drive" /"Reverse regenerative"/"Reverse drive" /"Forward regenerative" individually. When [bA110] is set to "Parameter setting (07)" and [bA111] is set to "Switched by [TRQ1][TRQ2] terminals (01)", the limit specified by the [TRQ1]/[TRQ2] input terminal combination is applied to all quadrants.	0.0 to 500.0 (%)
[bA113]	Torque limit 2 (Reverse regenerative)		
[bA114]	Torque limit 3 (Reverse drive)		
[bA115]	Torque limit 4 (Forward regenerative)		
[bA116]	Torque limit LADSTOP selection	Disable	00
		Enable: Stops deceleration temporarily when the output torque reaches the torque limit operation level.	01
[CA-01] to [CA-08]	Input terminal function	Torque limit enable [TL]: Enables or disables the torque limit function.	060
		Torque limit selection bit 1/2 [TRQ1]/[TRQ2] : If [bA111] is set to "Switched by [TRQ1][TRQ2] terminals (01)", the torque limit is specified by combining these signals.	061/062
[CC-01] [CC-02] [CC-07]	Output terminal function	Over-torque [OTQ]: This signal turns ON when the output torque monitor exceeds [CE120] to [CE123] or falls below.	019
		Torque limited [TRQ]: This signal is turned ON while the torque limit function is operating.	022
[CE120]	Over-torque level (Forward drive)	The output torque level of [OTQ] signal can be set in each of the 4 quadrants: "Forward drive"/"Reverse regenerative"/"Reverse drive"/ "Forward regenerative". If [CE125] is "Over torque (00)", the [OTQ] signal turns ON when the output torque monitor value exceeds the respective level-setting value. When [CE125] is "Under torque (01)", the opposite is true.	0.0 to 500.0 (%)
[CE121]	Over-torque level (Reverse regenerative)		
[CE122]	Over-torque level (Reverse drive)		
[CE123]	Over-torque level (Forward regenerative)		
[CE124]	Over/Under torque output signal mode	During accel./decel. and constant speed: The [OTQ] signal is detected during operation at all times.	00
		During constant speed only: The [OTQ] signal is detected only in constant speed status, and not during acceleration/deceleration.	01
[CE125]	Over/Under torque selection	Over torque	00
		Under torque	01
[CE-62]	Output torque related filter for terminal function	Filters can be set for torque-output-related output terminal functions ([OTQ] signal and [TRQ] signal).	0 to 2000 (ms)

A Torque limit set methods

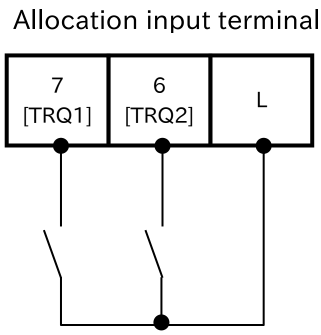
■ "Torque limit selection [bA110]" = "Parameter setting (07)" and " Torque limiting parameters mode selection [bA111]" = "4 quadrants (00)"

- In this mode, the torque limit in the four quadrants of forward drive, forward regenerative, reverse drive, and reverse regenerative is individually set by "Torque Limit 1 to 4 ([bA112] to [bA115])". The relationship between the quadrant and the torque limit value is shown in the figure below.



■ "Torque limit selection [bA110]" = "Parameter setting (07)" and "Torque limiting parameters mode selection [bA111]"="Switched by [TRQ1][TRQ2] terminal (01)"

- As shown in the figure below, by combining the "Torque limit selection bit 1 [TRQ1](061)"/ "Torque limit selection bit 2 [TRQ2](062)" input terminal function, the set value of the parameter selected from "Torque limit 1 to 4 ([bA112] to [bA115])" will be the torque limit value in all operating conditions.



[TRQ1]	[TRQ2]	Value of torque limit
OFF	OFF	[bA112]
ON	OFF	[bA113]
OFF	ON	[bA114]
ON	ON	[bA115]

■ "Torque limit selection [bA110]" = "Terminal [Ai1] (01)" or "Terminal [Ai2] (02)"

- Specify the torque limit using the analog input applied to the [Ai1]/[Ai2] terminal on the control terminal block. In the default setting, voltage-input 0 to 10 VDC/ current input 4 to 20 mA correspond to torque limit 0 to 500 %. The input torque limit value is the torque limit value in all operation status.
- When specifying torque limit value with analog input, be careful not to make other command input such as frequency command become analog input setting.
- For details on adjusting the analog input, see section 9.15.3, Adjusting Analog Input.

■ "Torque limit selection [bA110]" = "RS485 (08)"

- Setting when torque limit is specified by Modbus communication. For more information, see "Chapter 11 RS485 Communication".

■ "Torque limit selection [bA110]" = "Option (09)"

- Setting when torque limit value is specified from communication option. For details, refer to "Chapter 13 Communication Option" and the operation manual of each communication option.

A

Monitor torque limit value

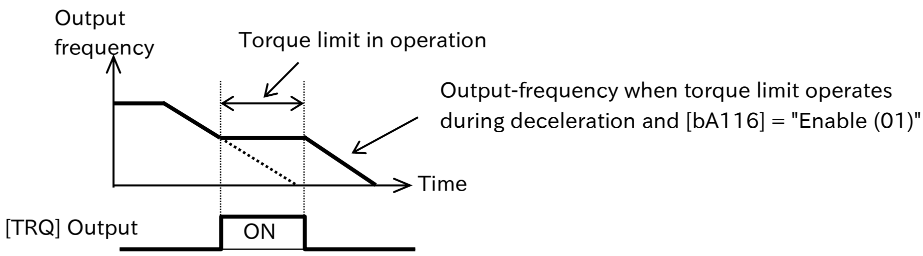
- The currently selected torque limit can be checked in the torque limit monitor [dA-16].

Code	Name	Description	Data
[dA-16]	Torque limit monitor	Displays the currently set torque limit value. If torque limit is disabled or [bA111] is set to "4 quadrants (01)", 0.0% will be applied.	0.0 to 500.0 (%)

A

Torque LAD stop function

- If the motor is shocked by torque pulsation, etc. when the torque limit function operates or is released during deceleration, it may be improved by setting "Torque limit LADSTOP selection [bA116]" to "Enable (01)". This function stabilizes the operation of the motor when the torque limit function is activated or released by temporarily stopping the deceleration operation.



Code	Name	Description	Data
[bA116]	Torque limit LADSTOP selection	Disable	00
		Enable: Stops deceleration temporarily when the output torque reaches the torque limit operation level.	01
[CC-01] [CC-02] [CC-07]	Output terminal function	Torque limited [TRQ]: This signal is turned ON while the torque limit function is operating.	022

A

Filter the output signals related to output torque

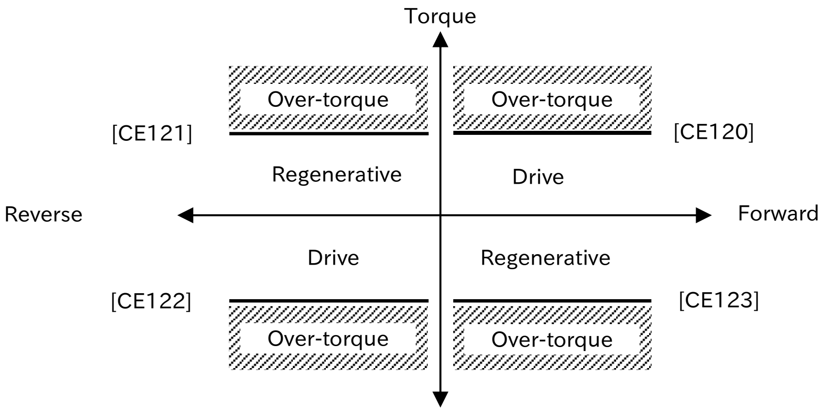
- You can set filters for the torque to be used for judgment in response to the judgment of the output terminal function " Over-torque [OTQ]" and " Torque limited [TRQ]" related to torque output.
- The time constant of the filter can be adjusted by "Output torque related filter for terminal function [CE-62]".

Code	Name	Description	Data
[CE-62]	Output torque related filter for terminal function	Filters can be set for torque-output-related output terminal functions ([OTQ] and [TRQ] signals).	0 to 2000 (ms)

A **Output a signal when the torque increases or decreases**

- By assigning "Over-torque [OTQ]" to the output terminal, it is possible to detect when the output torque exceeds or falls below a desired level and output the signal. Use this function to detect a warning before a trip occurs due to an abnormal high load in the system.
- You can set the detection level for each of the 4 quadrants: Forward drive, Reverse regenerative, Reverse drive and Forward regenerative.
- It is possible to select whether the detection target is at or above any level (over-torque) or below any level (under-torque) with "Over/Under torque selection [CE125]."
- By setting "Over/Under torque output signal mode [CE124]", it is possible to select whether to always detect the [OTQ] signal during operation or only during constant speed operation.

e.g.: When [CE125] = "Overtorque (00)"



Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Over-torque [OTQ]: This signal turns ON when the output torque monitor exceeds [CE120] to [CE123] or falls below.	019
[CE120]	Over-torque level (Forward drive)	The output torque level of [OTQ] signal can be set in each of the 4 quadrants: "Forward drive"/"Reverse regenerative"/"Reverse drive"/ "Forward regenerative". If [CE125] is " Over torque (00)", the [OTQ] signal turns ON when the output torque monitor value exceeds the respective level-setting value. When [CE125] is "Under torque (01)", the opposite is true.	0.0 to 500.0 (%)
[CE121]	Over-torque level (Reverse regenerative)		
[CE122]	Over-torque level (Reverse drive)		
[CE123]	Over-torque level (Forward regenerative)		
[CE124]	Over/Under torque output signal mode	During accel./decel. and constant speed: [OTQ] signal is detected during operation at all times.	00
		During constant speed only: [OTQ] signal detected only when operating at constant speed. [OTQ] signal detection is not performed during acceleration/deceleration.	01
[CE125]	Over/Under torque selection	Over torque	00
		Under torque	01

9.6.5 Torque Bias Function

Q

- In the torque control mode with an extruder or winder, it is desired to temporarily add the torque and operate it.
- How do I raise the starting torque reference when starting the operation?

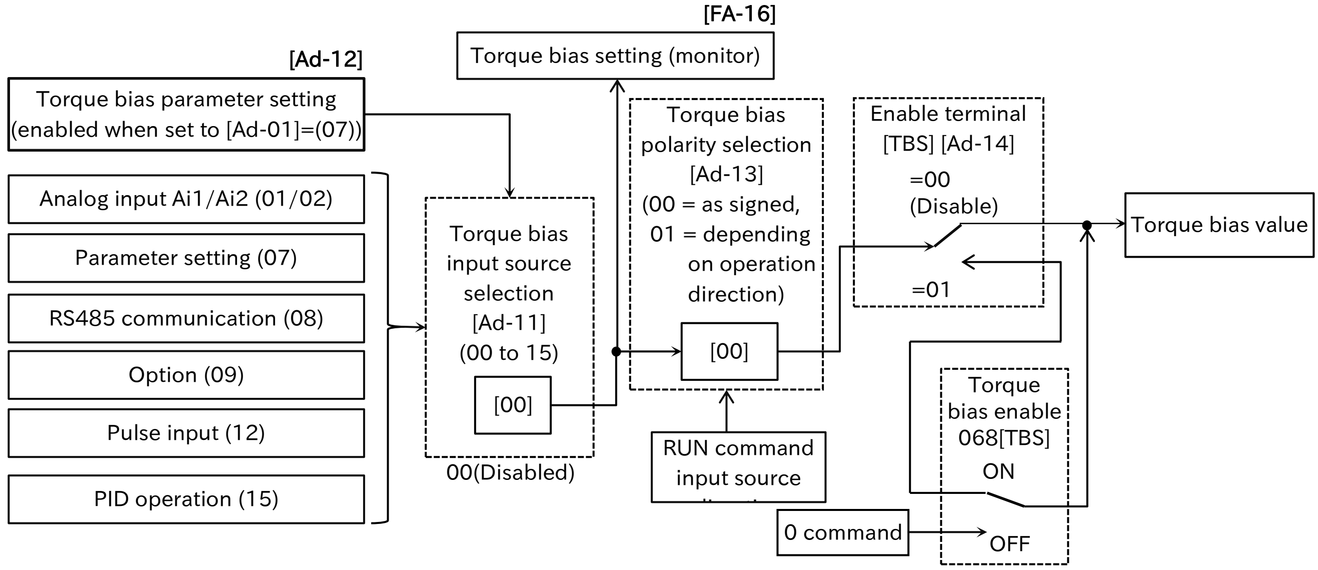
A

- A torque bias function that adds more torque to the torque reference value can be used.
- This function is enabled when "Sensorless vector control (IM) (08)" is set to "Control mode selection [AA121]". It also operates in both speed control and torque control.
- When "Enable terminal [TBS] [Ad-14]" is "Enable (01)", torque bias is enabled only when "Torque bias enable [TBS] (068)" is turned ON. When [TBS] is OFF, the torque bias is "0.0". When [Ad-14] is "Disable (00)", the torque bias value is always added to the torque reference value.
- When "Torque bias input source selection [Ad-11]" is "Parameter setting (07)", the torque bias setting is set with "Torque bias setting [Ad-12]". In addition, the torque reference can be changed and saved even in "Torque bias setting (monitor) [FA-16]". This change/save is also reflected in [Ad-12].
- When [Ad-11] is other than "Parameter setting (07)", the [FA-16] is a monitor that displays the torque reference currently entered in the way set in [Ad-11].
- "Torque reference monitor (after calculation) [dA-15]" displays the value obtained by adding the torque bias value to the present torque reference.
- Torque bias value can be switched in addition direction of torque by switching forward/reverse direction of RUN command by setting of "Torque bias polarity selection [Ad-13]".

  - [Ad-13] = "According to sign (00)":
    Regardless of the operation direction, the torque increases in the forward direction when the torque bias value is (+), and the torque increases in the reverse direction when it is (-).
  - [Ad-13] = "Depending on the operation direction (01)":
    Torque bias value is added with the direction of RUN command as (+). When the torque bias value is (+), the torque increases in the RUN command direction, and when it is (-), the torque increases in the reverse direction of the RUN command.
    e.g.) When the RUN command is reverse;
    Torque bias value is (+), the reverse torque increases.
    Torque bias value is (-), the forward torque increases.

!

- Since the torque bias function adds the torque reference, the output current increases.
- The 100 % reference value of the torque value in this function is the output torque at the time of the inverter rated current output, or the rated torque of the motor calculated from the motor capacity [Hb102], the number of motor poles [Hb103], and the base frequency [Hb104], which are set as the motor constant, according to the setting of "Torque conversion method selection [HC115]."
- The set torque value assumes that the torque equivalent to the rated output current of the inverter is 100 %. Therefore, note that the absolute value of torque changes depending on the combined motor.



※ In the figure, [ ] and the position of the switch for each parameter indicates the initial value.
Input terminal functions that are not assigned to the "Input terminal function ([CA-01] to [CA-08])" will be OFF.

Code	Name	Description	Data
[dA-15]	Torque reference monitor (after calculation)	Monitors the current torque reference value.	-1000.0 to 1000.0 (%)
[FA-16]	Torque bias value setting (Monitor)	Monitors or changes setting for the currently selected torque bias. If [Ad-11] is set to 07 (Parameter) and you change or save [FA-16], the [Ad-12] setting is also changed or saved.	-500.0 to 500.0 (%)
[Ad-11]	Torque bias input source selection	Torque bias function disable.	00
		Input torque bias using the analog input of the terminal [Ai1]. 0 to 100% of analog input is 0 to 500% torque.	01
		Input torque bias using the analog input of the terminal [Ai2]. 0 to 100% of analog input is 0 to 500% torque.	02
		Input of [Ad-12] is used for torque bias.	07
		Set the torque bias by Modbus communication.	08
		Set the torque bias from the communication option.	09
		Torque bias is set by pulse input.	12
		PID operation is used for torque bias.	15
[Ad-12]	Torque bias value setting	Set the torque bias when [Ad-11] is set to "Parameter setting (07)".	-500.0 to 500.0 (%)
[Ad-13]	Torque bias polarity selection	As indicated: Regardless of the operation direction, the torque increases in the forward direction when the value is (+) and in the reverse direction when the value is (-).	00
		According to the rotation direction: Torque bias is added by setting the direction of RUN command as (+).	01
[Ad-14]	Enable terminal [TBS]	Disable: Torque biasing function is enabled regardless of the status of the [TBS] input terminal.	00
		Enable: [TBS] ON/OFF of torque bias function can be selected by input terminal.	01
[CA-01] to [CA-08]	Input terminal function	Torque bias enable [TBS]: When [Ad-14] = "Enable (01)" and [TBS] is assigned to an input terminal, the enabling/disabling of torque bias function is switched by ON/OFF of the terminal. ON: Enable/OFF: Disable	068

9.6.6 Setting Motor Control Gain

Q

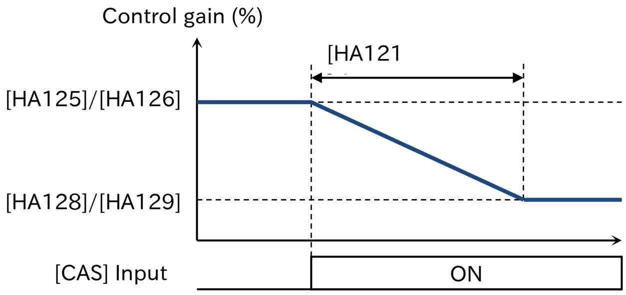
- How do I switch the response of the motor control depending on the situation?
- You want to change the responsiveness depending on the speed.
- When taking up, I want to change the control gain according to the speed that changes depending on the penalty.
- Since the inertia varies depending on the speed, you want to set the gain accordingly.

A

- Speed control gain (ASR (Automatic Speed Regulatr)) of motor control can be switched according to terminal input/output frequency.
- When "ASR gain switching mode selection [HA120]" is set to "[CAS] terminal (00)", two types of control gains can be switched and applied according to ON/OFF of the "Control gain change [CAS](064)" input terminal. Switching time when input terminal [CAS] is ON/OFF can be set by "ASR gain switching time setting [HA121]".
- When "ASR gain switching mode selection [HA120]" is set to "Parameter setting (01)", the gain mapping function is enabled. With the gain mapping function, it is possible to change the control gain in up to four stages according to the output frequency.
- P control and PI control can also be switched using the "P/PI control mode selection [PPI](063)" input terminal. For details, refer to "9.6.7 Operate a Load with Multiple Motors (Droop control)".
- When this function is used, "Control mode selection [AA121]" must be set to "Sensorless vector control (IM) (08)".

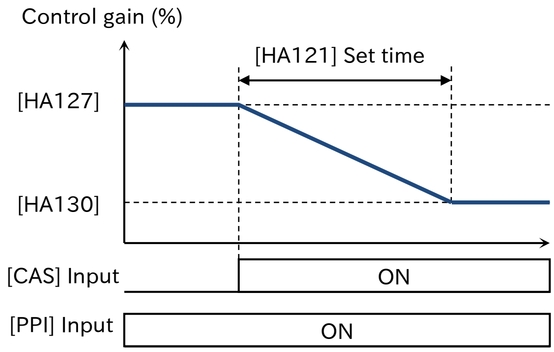
Code	Name	Description	Data
[HA120]	ASR gain switching mode selection	Gain 1 and 2 are switched by [CAS] input terminal.	00
		The speed changes according to the setting.	01
[HA121]	ASR gain switching time setting	When [CAS] terminal is turned ON/OFF, the gain will be changed by this setting.	0 to 10000 (ms)
[HA122]	ASR gain mapping intermediate speed 1	The frequency to which control gain 2 of the gain mapping function is applied.	0.00 to 590.00(Hz)
[HA123]	ASR gain mapping intermediate speed 2	The frequency to which control gain 3 of the gain mapping function is applied.	0.00 to 590.00(Hz)
[HA124]	ASR gain mapping maximum speed	The frequency to which control gain 4 of the gain mapping function is applied.	0.00 to 590.00(Hz)
[HA125]	ASR gain mapping P-gain 1	Set the P gain of PI control at OFF of [CAS] input terminal or at the 0 (zero) Hz of gain mapping.	0.0 to 1000.0(%)
[HA126]	ASR gain mapping I-gain 1	Set the I-gain of PI control at OFF of [CAS] input terminal or at 0 (zero) Hz of gain mapping.	0.0 to 1000.0(%)
[HA127]	ASR gain mapping P control P-gain 1	Set the P gain of P control at OFF of [CAS] input terminal or at 0 (zero) Hz of gain mapping.	0.0 to 1000.0(%)
[HA128]	ASR gain mapping P-gain 2	Set the P-gain for PI control at ON of [CAS] input terminal or at the intermediate speed 1 of gain mapping.	0.0 to 1000.0(%)
[HA129]	ASR gain mapping I-gain 2	Set the I-gain of PI control at ON of [CAS] input terminal or at the intermediate speed 1 of gain mapping.	0.0 to 1000.0(%)
[HA130]	ASR gain mapping P control P-gain 2	Set the P gain of P control at ON of [CAS] input terminal or at the intermediate speed 1 of gain mapping.	0.0 to 1000.0(%)
[HA131]	ASR gain mapping P-gain 3	Set the P gain for PI control at the intermediate speed 2 for gain mapping.	0.0 to 1000.0(%)
[HA132]	ASR gain mapping I-gain 3	Set the I gain for PI control at the intermediate speed 2 for gain mapping.	0.0 to 1000.0(%)
[HA133]	ASR gain mapping P-gain 4	Set the P gain for PI control at the maximum-speed of gain mapping.	0.0 to 1000.0(%)
[HA134]	ASR gain mapping I-gain 4	Set the I gain for PI control at the maximum-speed of gain mapping.	0.0 to 1000.0(%)
[CA-01] to [CA-08]	Input terminal function	P/PI control mode selection [PPI]: Switches between PI control and P control by ON/OFF.	063
		Control gain change [CAS]: Gain is switched by ON/OFF.	064

■ When [CAS] terminal is assigned for switching as [HA120] is set "[CAS] terminal (00)".



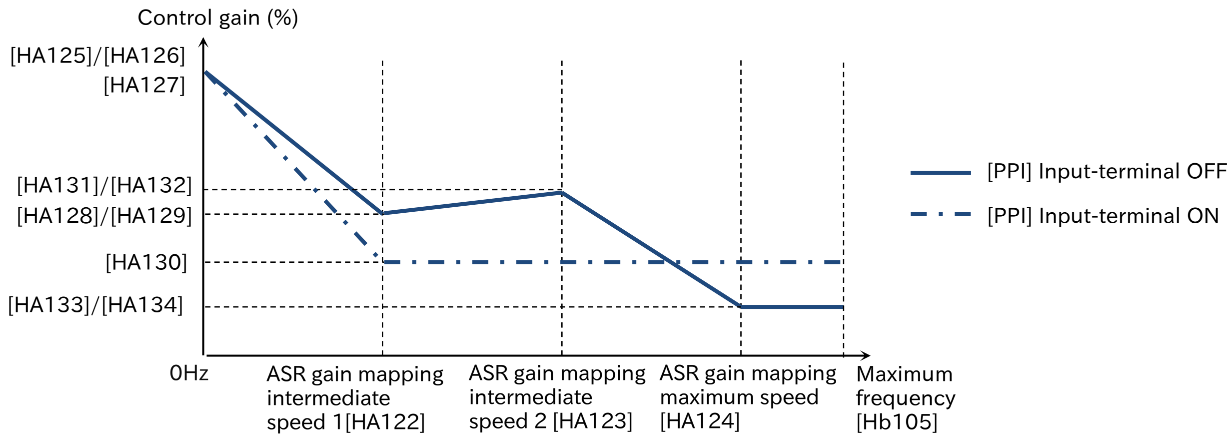
Functions	[PPI]OFF
[CAS]OFF	PI control P gain 1 = [HA125] PI control I gain 1 = [HA126]
[CAS]ON	PI control P gain 2 = [HA128] PI control I gain 2 = [HA129]

■ When [PPI] terminal is ON and [CAS] terminal is assigned for switching as [HA120] is set "[CAS] terminal (00)".



Functions	[PPI]ON
[CAS]OFF	P control P gain 1 = [HA127]
[CAS]ON	P control P gain 2 = [HA130]

■ Switching by setting (Gain mapping function) ([HA120] = "Switching by setting (01)")



Frequency	Applicable gain	[PPI]OFF	[PPI]ON
0 Speed (Zero Hz)	Gain 1	PI control P gain 1 = [HA125] PI control I gain 1 = [HA126]	P control P gain 1 = [HA127]
ASR gain mapping intermediate speed 1 [HA122]	Gain 2	PI control P gain 2 = [HA128] PI control I gain 2 = [HA129]	P control P gain 2 = [HA130]
ASR gain mapping intermediate speed 2 [HA123]	Gain 3	PI control P gain 3 = [HA131] PI control I gain 3 = [HA132]	
ASR gain mapping maximum speed [HA124]	Gain 4	PI control P gain 4 = [HA133] PI control I gain 4 = [HA134]	

9.6.7 Operate a Load with Multiple Motors (Droop Control)

Q

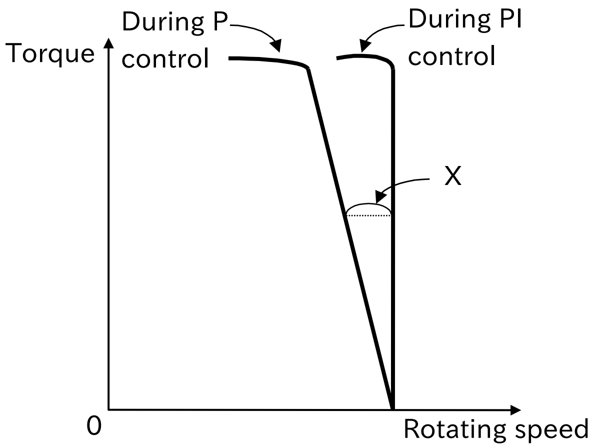
- When driving a single load shaft with multiple motors and inverters, we want to balance the output torque of each motor and inverter.

A

- When two motors and inverters are used to drive one shaft by distributing the torques, ON of the "P/PI control mode selection [PPI](063)" input terminal of one inverter switches from PI control to P control.
- By switching the speed-control gain (ASR (Automatic Speed Regulator)) of one motor control from PI control to P control, the inverter automatically increases or decreases the frequency according to the output torque of the other motor to balance the load.
- In P control, (X) in the figure below increases when the P control P gain is decreased. Adjust according to the actual system.
- P control P gain can be set in two ways: "P control P gain 1 [HA127]" and "P control P gain 2 [HA130]". P gain is switched by ON/OFF of "Control gain switching [CAS](064)".

!

- When this function is used, "Control mode selection [AA121]" must be selected "Sensorless vector control (IM) (08)".
- When one load is driven by more than one inverter with PI control, it may be improved by making the inverter that generates "overcurrent error [E001]" or "overvoltage error [E007]" to P control. Set the inverter to be changed to P control and its P control gain adjustment according to the actual system.



■ [CAS] Control Gain (Switching by [HA120] ="[CAS] Terminal (00)) that is enabled for terminal switching

Functions	[PPI]OFF	[PPI]ON
[CAS]OFF	PI control P gain 1 = [HA125] PI control I gain 1 = [HA126]	P control P gain 1 = [HA127]
[CAS]ON	PI control P gain 2 = [HA128] PI control I gain 2 = [HA129]	P control P gain 2 = [HA130]

■ Control gain ([HA120] = "Switching by setting (01)") to be enabled when switching by setting (gain mapping function)

Frequency	Applicable gain	[PPI]OFF	[PPI]ON
0 Speed (Zero Hz)	Gain 1	PI control P gain 1 = [HA125] PI control I gain 1 = [HA126]	P control P gain 1 = [HA127]
ASR gain mapping intermediate speed 1 [HA122]	Gain 2	PI control P gain 2 = [HA128] PI control I gain 2 = [HA129]	P control P gain 2 = [HA130]
ASR gain mapping intermediate speed 2 [HA123]	Gain 3	PI control P gain 3 = [HA131] PI control I gain 3 = [HA132]	
ASR gain mapping maximum speed [HA124]	Gain 4	PI control P gain 4 = [HA133] PI control I gain 4 = [HA134]	

9.7 Selecting Start/Stop Modes

9.7.1 Starting with Gradually Increasing Voltage

Q

- To obtain torque, we want to suppress overcurrent at start-up when the minimum frequency is increased.

A

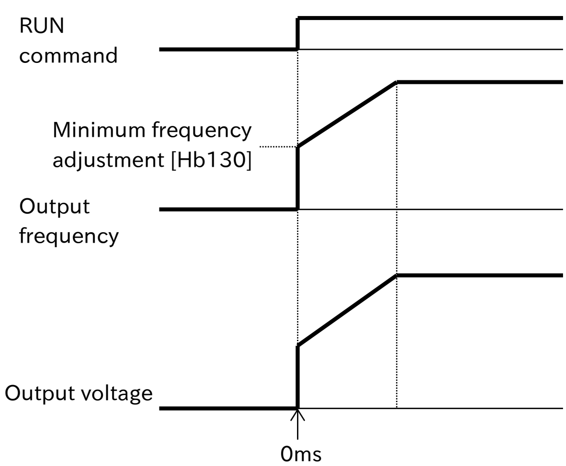
- This function slowly increases the voltage while outputting "Minimum frequency adjustment [Hb130]" when the motor starts.

!

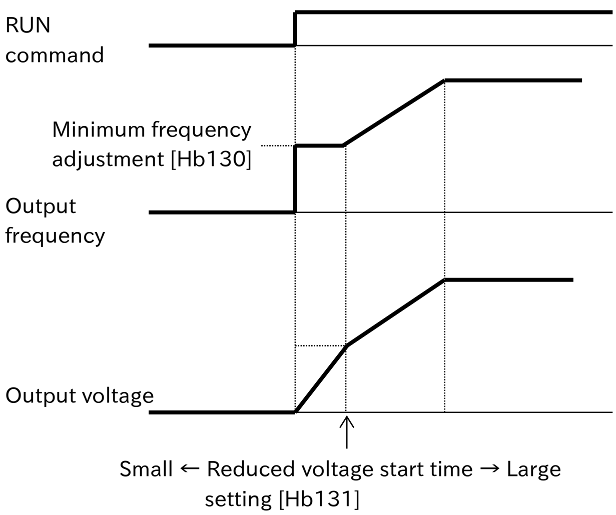
- If you want to increase the torque at startup, etc., reduce the setting of "Reduced voltage start time setting [Hb131]". However, when the setting is made smaller, it becomes like a direct-on start, so it is easier to trip by overcurrent error.
- If you want to prevent the current from jumping during startup, or if overcurrent trips during startup, increase the [Hb131] setting. However, the torque at start may be insufficient.
- This function is enabled when the control mode is V/f control.

Code	Name	Description	Data
[Hb130]	Minimum frequency adjustment	This is the frequency at which the drive starts outputting when an RUN command is ON.	0.01 to 10.00 (Hz)
[Hb131]	Reduced voltage start time setting	The output voltage is increased over the set time from the start of operation to the voltage command equivalent to the minimum frequency.	0 to 2000 (ms)

■ When the voltage reduction start-time setting is 0 ms ([Hb131] = 0)



■ When the voltage reduction start-up period is other than 0 ms ([Hb131]≠0)



9.7.2 DC Braking at Start

Q

- I want to stop the rotating fan once by inertia and then start it.
- How do I start the operation after stopping the rotation of the motor once?

A

- Start the motor after stopping the motor by performing DC braking (DB) before outputting the frequency to the motor.
- The following settings are required to perform DC braking at startup.
  - -Set "Enable (01)" in "DC braking selection [AF101]."
  - -Set the braking force required for "DC braking force at start [AF108]".
  - -Set other than 0.00 s to "DC braking active time at start [AF109]".
- DC braking at startup performs DC braking for the time set in [AF109] after the RUN command is input.
- DC braking is performed with a braking force equivalent to ND rated output current when [AF108] is set to 100 % when standard duty (ND) is selected.
- DC braking is performed with a braking force equivalent to 70 % of LD rated output current when [AF108] is set to 100 % when light duty (LD) is selected.

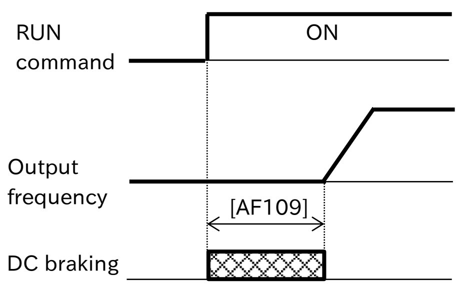
!

- Set and operate "DC braking force at start [AF108]" and "DC braking active time at start [AF109]" paying attention to heat generation of the motor.
- When "Enable (by frequency reference) (02)" is set to "DC braking selection [AF101]", DC braking starts when both the frequency reference and the output frequency are less than "DC braking frequency [AF103]", regardless of start/stop. For details, refer to section "9.7.8 DC Braking at Stop".
- If "Carrier frequency setting [bb101]" exceeds 2 kHz, the DC braking force is limited. For details, refer to section "9.7.8 DC Braking at Stop".

Code	Name	Description	Data
[AF101]	DC braking selection*1	Internal DC Braking: Disable	00
		Internal DC Braking: Enable	01
		Internal DC Braking: Enable (Operations with set frequency only)	02
[AF108]	DC braking force at start	Adjust the DC braking force at start. The maximum braking force when set to 100 %.	0 to 100 (%)
[AF109]	DC braking active time at start	Set the DC braking active time at start when "Enable (01)" is selected for [AF101].	0.00 to 60.00 (s)

*1. Internal DC braking means that DC braking is performed according to the output frequency and operating status by setting parameters, regardless of external signals. When DC braking is performed by an external signal, this is called external DC braking. For details of the external DC braking, refer to "9.7.8 DC Braking at Stop".

■ DC braking at start ([AF101]=01)



9.7.3 Frequency Matching Restart Function

Q

- I want to start from a frequency reference that matches the idling motor speed.
- How do I quickly follow a frequency reference when tripping, free-run stop, resetting, or turning on the power?

A

- By WJ-C1 in the restart function when frequency matching restart is selected, the same operation as the active frequency matching restart from the output frequency at shut down is executed. (Operation when "Active frequency matching restart" is selected in restart method selection and "Active frequency matching restart speed selection [bb-47]" is set to "Output frequency at shut down (00)")
- The frequency matching restart function can be set for each of the following functions.
  - Instantaneous power failure/undervoltage restart
    (Refer to "9.9.6 Restart after Instantaneous Power Failure/Undervoltage Error" in [bb-24]=01.)
  - Overcurrent restart (Refer to "9.9.7 Restart after Overcurrent Error" in [bb-28]=01)
  - Overvoltage restart (Refer to "9.9.8 Restart after Overvoltage Error" in [bb-30]=01)
  - Restart after free run stop (Refer to "9.7.6 Restart after Free Run Stop" in [bb-40]=01.)
  - Restart after reset release or power-on
    (Refer to "9.7.5 Restart after Trip Reset or Power-ON" in [bb-41]=01)
- For detailed operation when frequency matching restart is selected for one of the above functions, refer to "9.7.4 Active Frequency Matching Restart Function".

!

- When "RUN command input source selection [AA111]" is "Keypad's RUN key (02)", RUN command is also OFF when "Free run stop [FRS]" or "Reset [RS]" input terminal is ON. If restart after free run stop or resetting is set at this time, the retry operation will start when RUN key on the keypad is pressed to start operation. In the event of instantaneous power failure/undervoltage restart, overcurrent restart, or overvoltage restart, the RUN command is maintained in ON status, so retry operation is started without pressing RUN key.
- For the restart function, also refer to "9.9 Using Trip Prevention Functions".
- When using the frequency matching function in synchronous (permanent magnets) motors (SM(PMM), the operation differs from the above. Contact the place of purchase for details.

9.7.4 Active Frequency Matching Restart Function

Q

- I want to start up so that it follows the frequency reference quickly regardless of the rotational speed frequency when the motor runs idle.
- How do I quickly follow the frequency reference when tripping, free-run stop, resetting, or turning on the power?

A

- With active frequency matching restart function, the motor can be quickly pulled from the rotation speed of the idling motor to the set frequency and restarted while suppressing the increase in current. Refer to "(e.g. 1) How to restart with active frequency matching" for details of operation.
- The active frequency matching restart function can be set for each of the following functions.
  - Instantaneous power failure/undervoltage error restart
    (Refer to "9.9.6 Restart after Instantaneous Power Failure/Undervoltage Error" in [bb-24]=02.)
  - Overcurrent restart (Refer to "9.9.7 Restart after Overcurrent Error" in [bb-28]=02)
  - Overvoltage restart (Refer to "9.9.8 Restart after Overvoltage Error" in [bb-30]=02)
  - Restart after free run stop (Refer to "9.7.6 Restart after Free Run Stop" in [bb-40]=02)
  - Restart after reset release or power-on
    (Refer to "9.7.5 Restart after Trip Reset or Power-ON" in [bb-41]=02)

!

- When restarting after canceling free status or restarting after canceling reset, restarting starts after waiting for "Retry wait time after instantaneous power failure/under-voltage error [bb-26]" after free run or reset is canceled and the RUN command is ON.
- Active frequency matching restart function is available only for induction motor drive.
- When "RUN command input source selection [AA111]" is "Keypad's RUN key (02)", RUN command is also OFF when "Free run stop [FRS]" or "Reset [RS]" input terminal is ON. If restart after releasing of free run stop or reset is set at this time, the retry operation will start when RUN key on the keypad is pressed to start operation. In the event of instantaneous power failure/undervoltage restart, overcurrent restart, or overvoltage restart, the RUN command is maintained in ON status, so retry operation is started without pressing RUN key.

Code	Name	Description	Data
[bb-42]	Frequency matching minimum restart frequency	If the starting frequency is less than this setting due to the setting of [bb-47], it will be restarted 0Hz.	0.00 to 590.00 (Hz)
[bb-43]	Active frequency matching restart level	Set the current limit level at active frequency matching restart.	(0.00 to 2.00)× ND/LD rated output current (A)
[bb-44]	Restart constant (speed) of Active frequency matching	Set the deceleration time when the current is increased.	0.10 to 30.00 (s)
[bb-45]	Active frequency matching restart constant (voltage)	Set the output voltage increase rate when active frequency matching restart. (e.g. 10.00 s = output voltage 0 to 100 % for 10 s)	0.10 to 30.00 (s)
[bb-46]	OC-suppress level at active frequency matching	If the current increases to the [bb-46] setting when restarting, the over-current suppression function will be activated.	(0.30 to 1.80)× ND rated output current (A)
[bb-47]	Active frequency matching restart speed selection	Start from the previous cut-off frequency.	00
		Start from the maximum frequency setting value.	01
		Start from the current frequency reference value.	02

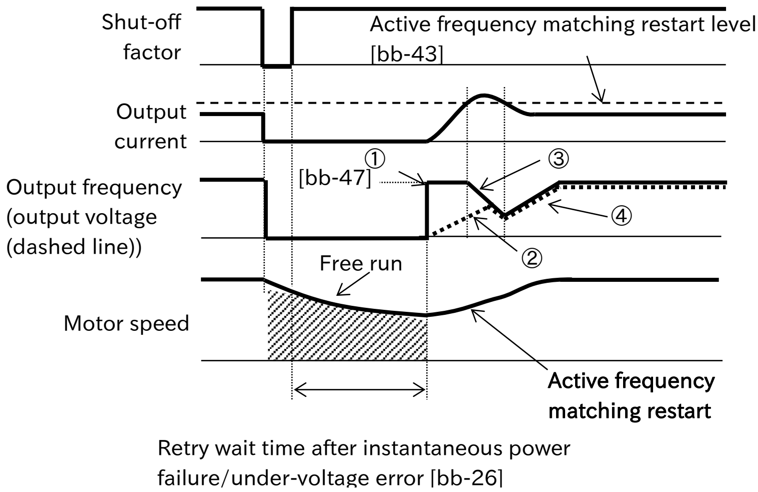
■ (e.g. 1) How to restart with active frequency matching

① After the retry wait time, it starts outputting at the frequency set in [bb-47].

② At the same time, the output power is gradually increased to prevent an overcurrent or the like from occurring according to the setting in [bb-45]. (dashed line in the right figure)

③ If the output current exceeds [bb-43], decelerate the output frequency according to the setting of [bb-44] to suppress the output current.

④ When the output frequency and the output voltage are balanced, normal operation takes place.

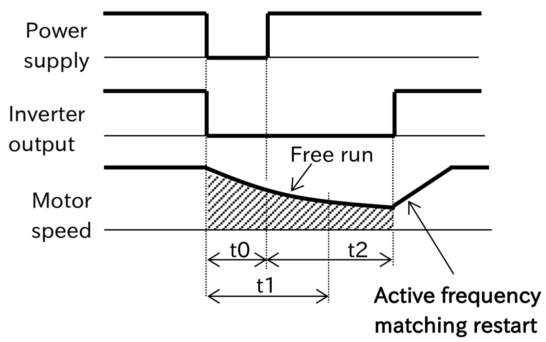


A Active frequency matching restart at instantaneous power failue and undervoltage ([bb-24]=02)

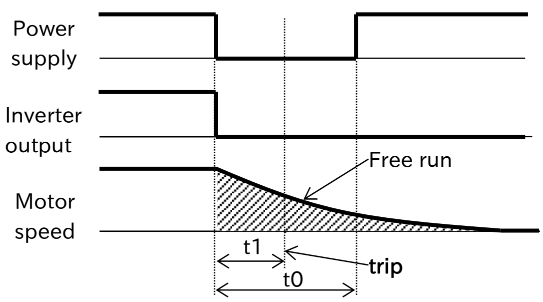
- To restart with active frequency matching when instantaneous power failure or undervoltage error occurs, set "Restart mode selection after instantaneous power failure/under-voltage error [bb-24]" to "Restart with active frequency matching (02)".
- Even if the active frequency matching restart is set, a trip will occur if the instantaneous power failure or undervoltage error time exceeds the "Instantaneous power failure allowed time [bb-25]".

Code	Name	Description	Data
[bb-21]	Number of retries after under-voltage	When the DC voltage between P-N drops to the undervoltage level, it trips immediately without restarting.	0 (times)
		When the DC voltage between P-N drops to the undervoltage level, restart is performed for the set number of times, and the motor trips at the next error. The count of the number of times is cleared by reset input or power shutdown.	1 to 16 (times)
		When the DC voltage between P-N drops to the undervoltage level, restart is performed. The number of restarts is unlimited and no trip occurs.	255
[bb-24]	Restart mode selection after instantaneous power failure/ under-voltage error	Active frequency matching restart	02
[bb-25]	Instantaneous power failure allowed time	If the power is restored within this set time, the unit will restart. (e.g. 2) If the instantaneous power failure or undervoltage time is longer than this setting time, the motor trips. (e.g. 3)	0.3 to 25.0 (s)
[bb-26]	Retry wait time after instantaneous power failure/under-voltage error	Set the waiting time from power restoration to restart.	0.3 to 100.0 (s)
[bb-27]	Enable instantaneous power failure/under-voltage error while in stop status	During stop, if the DC voltage between P-N drops to the undervoltage level, it will not be judged as an instantaneous power failure or undervoltage error.	00
		When the DC voltage between P-N drops to the undervoltage level, even when the operation is stopped, it is judged as an instantaneous power failure or undervoltage error.	01
		During stop and deceleration stop, if the DC voltage between P-N drops to the undervoltage level, it will not be judged as an instantaneous power failure or undervoltage error.	02

■ (e.g. 2) When power is restored within "Instantaneous power failure allowed time [bb-25]"



■ (e.g. 3) When power is restored after "Instantaneous power failure allowed time [bb-25]"



t0: Instantaneous power failure/undervoltage time
t1: "Instantaneous power failure allowed time [bb-25]"
t2: "Retry wait time after instantaneous power failure/under-voltage error [bb-26]"

!

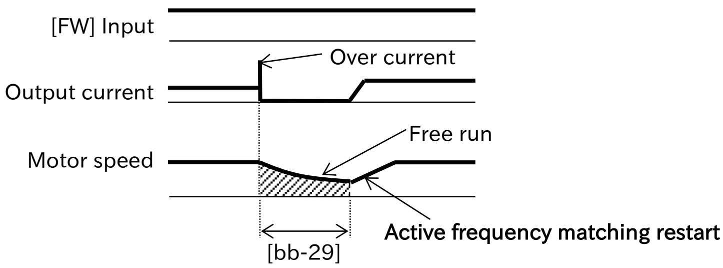
- "Enable instantaneous power failure/under-voltage error while in stop status [bb-27]", which disables instantaneous power failure or undervoltage error during inverter stop or deceleration due to RUN command OFF. However, even if [bb-27] is set to disable instantaneous power failure/undervoltage error while stopped, inverter will trip if the instantaneous power failure/undervoltage time is equal to or greater than the "Instantaneous power failure allowed time [bb-25]".
- Even when restarting is set, "Undervoltage Error [E009]" will occur if the instantaneous power failure/undervoltage status continues for approximately 40 seconds.
- When the power-off time is long and the inverter-controlled microcomputer is turned off, it operates according to the setting of "Restart mode after RS release [bb-41]" instead of "Restart mode selection after instantaneous power failure/under-voltage error [bb-24]" after power restoration.

Active frequency matching restart when overcurrent occurs ([bb-28]=02)

- To restart with active frequency matching when overcurrent occurs, set "Restart mode selection after an overcurrent error [bb-28]" to "Restart with active frequency matching (02)".
- If Restart is selected when overcurrent occurs, restart is performed for the number of times set in "Number of retries after overcurrent [bb-22]" and trips at the next time. If [bb-22] is set to 0 times, restart is not performed and the motor trips immediately.

Code	Name	Description	Data
[bb-22]	Number of retries after overcurrent	Set the number of retries when overcurrent occurs.	0 to 5 (times)
[bb-28]	Restart mode selection after an overcurrent error	Active frequency matching restart	02
[bb-29]	Retry wait time after an overcurrent error	Set the wait time between the occurrence of overcurrent and the restart.	0.3 to 100.0 (s)

■ (e.g. 4) Active frequency matching restart when overcurrent occurs

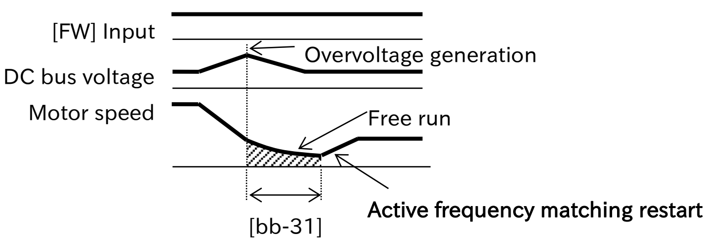


Active frequency matching restart when overvoltage occurs ([bb-30]=02)

- To restart with active frequency matching when an overvoltage occurs, set "Restart mode selection after an overvoltage error [bb-30]" to "Restart with active frequency matching (02)".
- If Restart is selected when an overvoltage occurs, restart is performed for the number of times set in "Number of retries after overvoltage [bb-23]" and tripped at the next time. If [bb-23] is set to 0 times, restart is not performed and the motor trips immediately.

Code	Name	Description	Data
[bb-23]	Number of retries after overvoltage	Set the number of retries when overvoltage occurs.	0 to 5 (times)
[bb-30]	Restart mode selection after an overvoltage error	Active frequency matching restart	02
[bb-31]	Retry wait time after an overvoltage error	Set the wait time between the occurrence of overvoltage and the restart.	0.3 to 100.0 (s)

■ (e.g. 5) Active frequency matching restart when overvoltage occurs at deceleration



- Even if the retry operation at trip is selected, trip will be detected again if the trip factor has not been cancelled after the retry standby time. In this case, increase the retry wait time.

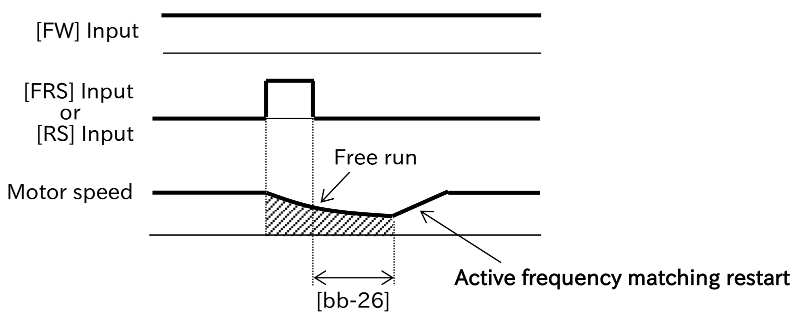
A

Active frequency matching restart after releasing free run stop or reset ([bb-40]/[bb-41]=02)

- To restart with active frequency matching after releasing free-run stop, set "Restart mode after FRS release [bb-40]" to "Restart with active frequency matching (02)".
- To restart with active frequency matching after releasing reset, set "Restart mode after RS release [bb-41]" to "Restart with active frequency matching (02)".
- When the retry standby time has elapsed after the "Free run stop [FRS]" or "Reset [RS]" input terminal is OFF, active frequency matching restart is performed without stopping the motor.
- If an overcurrent trip occurs at active frequency matching restart, increase the retry wait time.

Code	Name	Description	Data
[bb-26]	Retry wait time after instantaneous power failure/under-voltage error	Set the waiting time from free-run release or reset release to restart.	0.3 to 100.0 (s)
[bb-40]	Restart mode after FRS release	Active frequency matching restart	02
[bb-41]	Restart mode after RS release	Active frequency matching restart	02

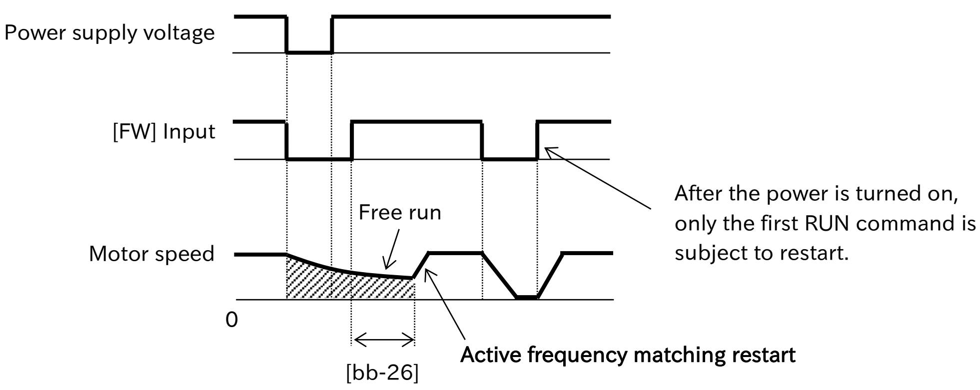
■ (e.g. 7) Active frequency matching restart after free-run/reset release



!

- When "Restart mode after RS release [bb-41]" is set to "Restart with active freuency matching (02)", the first operation after power-on will also be active freuency matching restart operation.

■ (e.g. 8) Active frequency matching restart restart at power-



9.7.5 Restart after Trip Reset or Power-ON

Q

- How do I restart according to the idling motor speed after trip reset or when the power is turned on?
- Start from 0 Hz as braking is applied after tripping or when the power is turned on.

A

- By "Restart mode after RS release [bb-41]", the starting methods after trip reset and when the power is turned on can be selected from 0 Hz restart, frequency matching restart*1, active frequency matching restart*2, and restart from the detected speed by the encoder feedback.
- The setting of restart after trip reset is valid for any method such as "Reset [RS]" input terminal and STOP/RESET key on the keypad.
- For 0 Hz restart, retry wait time cannot be set.

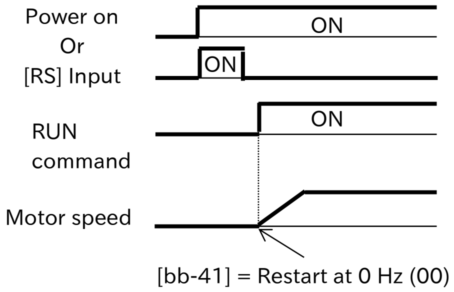
!

- The startup method when the power is turned on and the restart when returning from a reset are common settings.
- When active frequency matching restart is performed, the RUN command direction at the restart is the same as the RUN command direction at the [RS] input.
- If the power supply shutdown time is long and the internal power supply for control of the inverter is turned off, the inverter operates by restarting after releasing the reset, not by instantaneous power failure or undervoltage restart.
- When "RUN command input source selection [AA111]" is "Keypad's RUN key (02)", the RUN command is OFF when the [RS] input terminal is turned ON. In such cases, if the operation is started from the keypad after the "Reset [RS]" input terminal is turned OFF, the restart set in "Restart mode after RS release [bb-41]" will be performed.

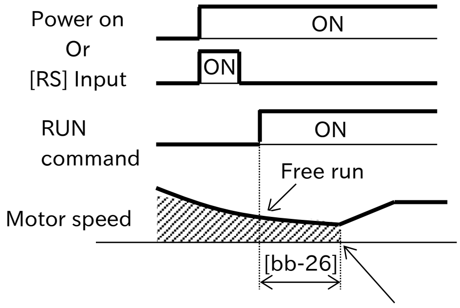
Code	Name	Description	Data
[bb-26]	Retry wait time after instantaneous power failure/under-voltage error	Set the waiting time from power-on or recovery to restart.	0.3 to 100.0 (s)
[bb-41]	Restart mode after RS release	0 Hz restart is performed.	00
		Restart with the frequency matching (Restart with active frequency matching from the output frequency at shut down).	01*1
		Active frequency matching restart	02*2
		Restart is performed from the detected speed by encoder feedback.	03

*1. For details, refer to "9.7.3 Frequency Matching Restart Function".
*2. For details, refer to "9.7.4 Active Frequency Matching Restart Function".

■ (e.g. 1) Example of operation while stopped and after resetting the power ON

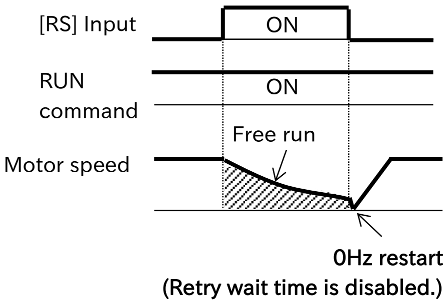


■ (e.g. 2) Example of operation while stopped and after resetting the power ON

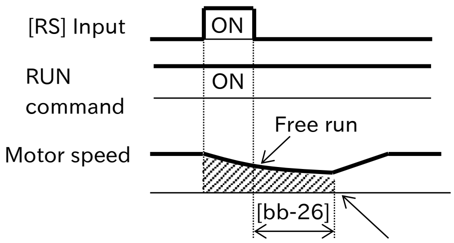


※If RUN command is ON after the power is turned on or reset, the actuator will start up with an operation that conforms to the [bb-41] setting.

■ (e.g. 3) Example of operation during operation and after OFF of [RS] input terminal
(bb-41=00)



■ (e.g. 4) Example of operation during operation and after OFF of [RS] input terminal



[bb-41]=01: Frequency matching restart
[bb-41]=02: Active frequency matching restart
[bb-41]=03: Restart from detected speed

9.7.6 Restart after Free Run Stop

Q

- How do I restart from the state where the motor is idling after the free run stop?
- Free-run stop at stop, but braking is applied at stop, so start from 0 Hz.

A

- By "Restart mode after FRS release [bb-40]", you can select the starting method when the "Free run stop [FRS]" input terminal is turned OFF from ON from 0 Hz restart, frequency matching restart*1, active frequency matching restart*2 and restart from the detected speed by the encoder feedback.
- When "STOP mode selection [AA115]" is "Free-run stop (01)", the inverter is in the free-run stop status when the RUN command is OFF (stop command), and it follows the setting of [bb-40] at the next operation. For more information on [AA115], see "9.7.7 Select a Stop Method".
- For 0 Hz restart, there is no setting for the retry wait period.

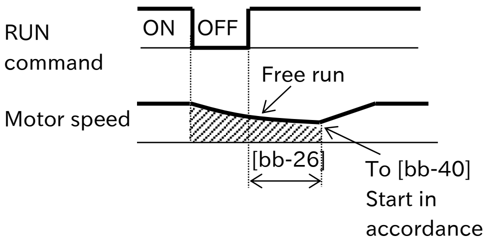
!

- The startup method when the power is turned on and the restart when returning from a reset are common settings.
- When active frequency matching restart is performed, the RUN command direction at the restart is the same as the RUN command direction at [FRS] input.
- If the power supply shutdown time is long and the internal power supply for control of the inverter is turned off, the inverter operates by restarting after releasing the reset, not by instantaneous power failure or undervoltage restart.
- If the "RUN command input source selection [AA111]" is "Keypad's RUN key (02)", the RUN command will be OFF when the "Free run stop [FRS]" input terminal is ON. In this situation, if operation is started from the keypad after the [FRS] input terminal is turned OFF, the restart set in "Restart mode after FRS release [bb-40]" will be performed.

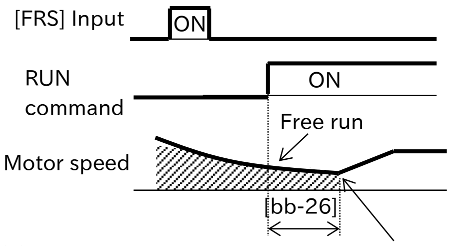
Code	Name	Description	Data
[bb-26]	Retry wait time after instantaneous power failure/under-voltage error	Set the waiting time from power restoration to restart.	0.3 to 100.0 (s)
[bb-40]	Restart mode after FRS release	0 Hz restart is performed.	00
		Restart with the frequency matching (Restart with active frequency matching from the output frequency at shut down).	01*1
		Active frequency matching restart	02*2
		Restart is performed from the detected speed by encoder feedback.	03

*1. For details, refer to "9.7.3 Frequency Matching Restart Function".
*2. For details, refer to "9.7.4 Active Frequency Matching Restart Function".

■ (e.g. 1) Operation example when "Stop mode selection [AA115]" = "Free-run stop (01)"

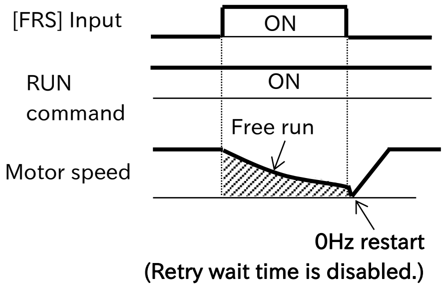


■ (e.g. 2) Example of operation when [FRS] input terminal is turned ON→OFF while stopped

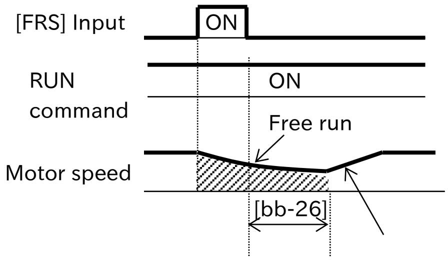


※When the [FRS] input terminal is ON⇒OFF and the RUN command is ON, the actuator will start up according to the [bb-40] setting.

■ (e.g. 3) When [FRS] input terminal is turned ON/OFF during operation (bb-40=00)



■(e.g. 4) When [FRS] input terminal is turned ON/OFF during operation (bb-40≠00)



[bb-40]=01: Frequency matching restart
[bb-40]=02: Active frequency matching restart
[bb-40]=03: Restart from detected speed

9.7.7 Select a Stop Method

Q

- I want to shut off the output without deceleration because the load inertia is large and an overvoltage error occurs during deceleration.
- I want to cut off the output of the inverter immediately because it is stopped by the mechanical brake.

A

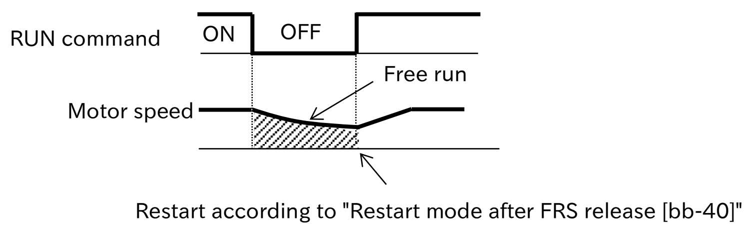
- Select either decelerating stop according to the decelerating time setting when a stop command is input or immediately shut off the output to make the motor become free run state by using "STOP mode selection [AA115]".
- Assign "Free run stop [FRS](032)" to one of the input terminals when free-run stop is performed using the input of the control terminal.

!

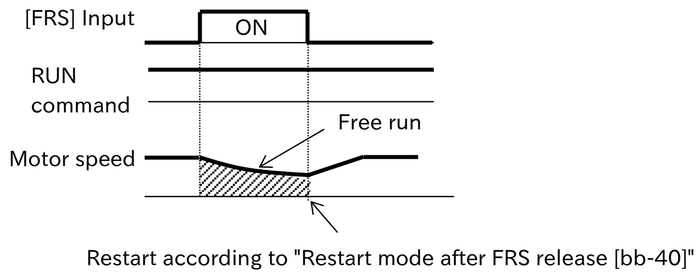
- If "Free-run stop (01)" is selected for "STOP mode selection [AA115]", the drive will be shut off and the motor will be idling at the timing when the RUN command is OFF.
- When a free run stop is performed, the next time an RUN command is input, the start will follow the selection of "Restart mode after FRS release [bb-40]".

Code	Name	Description	Data
[AA115]	STOP mode selection	When it stops, it performs normal deceleration stop.	00
		When stopped, free-run stop will occur due to output shutdown of the inverter.	01
[bb-40]	Restart mode after FRS release	0 Hz restart is performed.	00
		Restart with the frequency matching (Restart with active frequency matching from the output frequency shut down).	01
		Active frequency matching restart	02
		Restart is performed from the detected speed by encoder feedback.	03
[CA-01] to [CA-08]	Input terminal function	Free run stop [FRS]: This signal ON shuts off the inverter. The motor idles.	032

■ Operation when "Stop mode selection [AA115]" = Free-run stop (01)



■ Operation after OFF of [FRS] terminal



9.7.8 DC Braking at Stop

Q

- The motor rotates slightly even when the motor is decelerated to a stop due to a large external force or load inertia, so stop the motor completely.

A

- Rotation of the motor can be stopped by operating the DC braking (DB) when the motor is stopped. There are three DC braking methods.
  - External DC braking : Assign "External DC braking [DB](030)" to the input terminal, and control the DC braking with ON/OFF of the [DB] input terminal.
  - DC Braking at Stop: How to start DC braking when "DC braking frequency [AF103]" or less at deceleration stop after RUN command OFF.
  - Frequency reference DC braking: How to initiate DC braking when the frequency reference value and the output frequency become less than "DC braking frequency [AF103]".
- DC braking is performed with a braking force equivalent to ND rated output current when [AF105] is set to 100 % when normal duty (ND) is selected.
- DC braking is performed with a braking force equivalent to 70 % of LD rated output current when [AF105] is set to 100 % when light duty (LD) is selected.

!

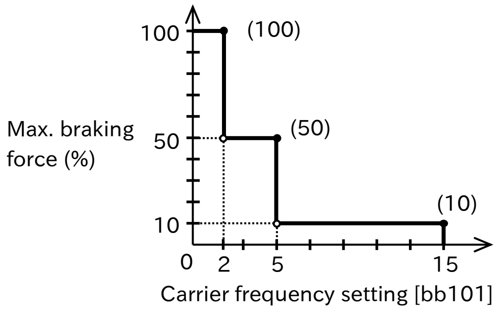
- Set and operate "DC braking force setting [AF105]" and "DC braking active time at stop [AF106]" paying attention to heat generation of the motor.
- When DC braking is performed with the "External DC Braking [DB](030)" input terminal, an overcurrent error or overvoltage error may occur if the product is used in a condition where the output frequency is high or the inertial load is large.

Code	Name	Description	Data
[AF101]	DC braking selection[*1]	Internal DC Braking: Disable	00
		Internal DC Braking: Enable	01
		Internal DC Braking: Enable (by frequency reference)	02
[AF103]	DC braking frequency	When [AF101] is set to "Enable (01)" or "Enable (by frequency reference) (02)", DC braking starts when the frequency falls below the frequency of this setting during deceleration stop.	0.00 to 590.00 (Hz)
[AF104]	DC braking delay time	Delay after [DB] ON or [AF103] is reached until DC braking starts. Free run stop (output shutoff) takes place during this time.	0.00 to 5.00 (s)
[AF105]	DC braking force setting	Adjust the direct current braking power. The maximum braking force when set to 100 %.	0 to 100 (%)
[AF106]	DC braking active time at stop	Set the DC braking duration when [AF107] is set to "Edge action (00)".	0.00 to 60.00 (s)
[AF107]	DC braking operation method selection	Edge operation: DC braking is performed for the duration set to [AF106]. (Operation 1-a to 7-a)	00
		Level operation: DC braking is performed only when the conditions are satisfied. (Operation 1-b to 7-b)	01
[CA-01] to [CA-08]	Input terminal function	External DC Braking [DB]: DC braking is applied at ON of this signal. Only enabled when [AF101] is set to "Disable (00)" and "Enable (01)".	030

*1. Internal DC braking means that DC braking is performed according to the output frequency and operating status by setting parameters, regardless of external signals.

! DC Braking Force and Carrier Frequency

- If the "Carrier frequency setting [bb101]" exceeds 2 kHz, the DC braking force is limited as shown in the figure below.

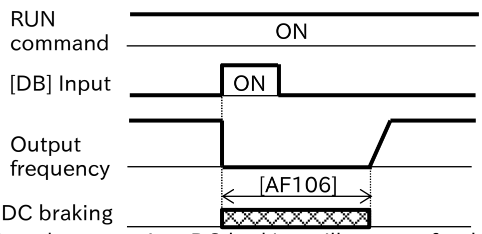


A DC Braking with the "External DC braking [DB]" Input terminal

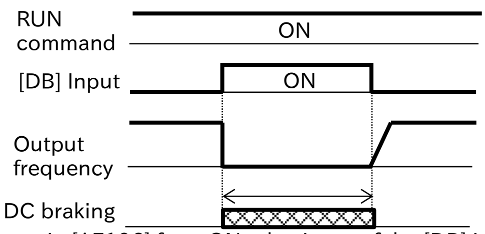
- When DC braking is performed using an input signal to the control circuit terminal block, assign "External DC braking [DB]" to the input terminal and set "DC braking force setting [AF105]."
- DC braking by [DB] input terminal is enabled when "DC braking selection [AF101]" = "Disable (00)" or "Enable (01)". Regardless of RUN command, DC braking operates when [DB] input terminal is ON.
- Operation of DC braking varies depending on the setting of edge/level operation of "DC braking operation method selection [AF107]". Set the edge operation or level operation according to the system. If edge operation is selected, set the DC braking active time at stop [AF106].

■ (e.g. 1) To ON/OFF [DB] input terminals during operation.

(e.g. 1-a) [AF107] = "Edge operation (00)"



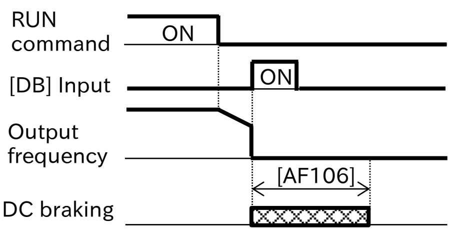
(e.g. 1-b) [AF107] = "Leveling (01)"



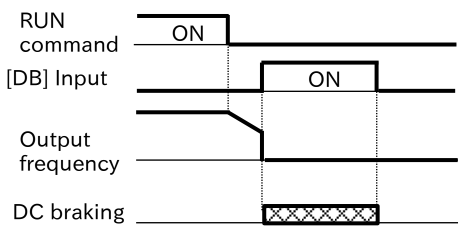
※ For edge operation, DC braking will operate for the duration set in [AF106] from ON edge input of the [DB] input terminal.
For level-operation, DC braking is activated while the [DB] input terminal is ON.

■ (e.g. 2) To ON/OFF the [DB] input terminal while the inverter is decelerating by the RUN command OFF. [AF104] The setting is 0.0 (s).

(e.g. 2-a) [AF107] = "Edge operation (00)"



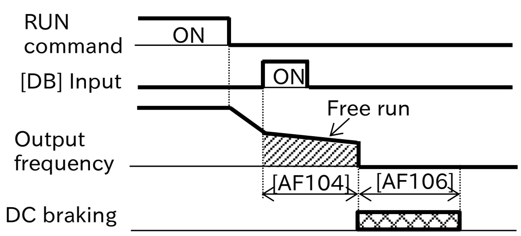
(e.g. 2-b) [AF107] = "Leveling (01)"



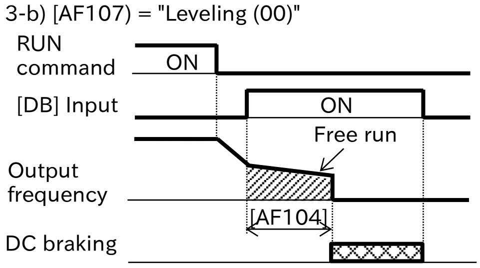
※When "DC braking delay time [AF104]" is 0.0 s, DC braking starts immediately after the [DB] input terminal is turned ON.

■ (e.g. 3) When a value other than 0.0 (s) is set in "DC Braking Delay Time [AF104]" and the operation is the same as (e.g. 2).

(e.g. 3-a) [AF107] = "Edge operation (00)"



(e.g. 3-b) [AF107] = "Leveling (00)"



※If a value other than 0.0 s is set to the "DC braking delay time [AF104]", DC braking will be started after a free run (output-off) of the set time. However, if the [DB] input terminal is turned ON when the inverter is stopped, DC braking starts immediately.

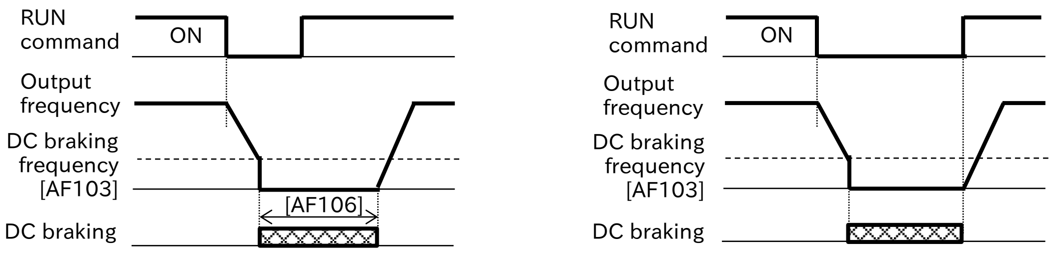
A

DC Braking when Stopped ([AF101] = "Enable (01)")

- When the inverter is stopped, DC braking can be applied even if the [DB] input terminals are not operated.
- To perform DC braking at stop, set "DC braking selection [AF101]" = "Enable (01)" and set "DC braking frequency [AF103]" and "DC braking force setting [AF105]."
- When the RUN command becomes OFF and the output frequency falls below [AF103], DC braking is applied.
- Operation of DC braking varies depending on the setting of edge/level operation of "DC braking operation method selection [AF107]". In addition, when "DC braking delay time [AF104]" is set to other than 0.00 s, free-run (output-shut-off) is performed prior to DC braking. Set the edge operation or level operation according to the system. Set the DC braking duration [AF106] at standstill when edge operation is selected, referring to the operation example in the figure below.

■(e.g. 4) When ON/OFF RUN command. [AF104] The setting is 0.00 s.

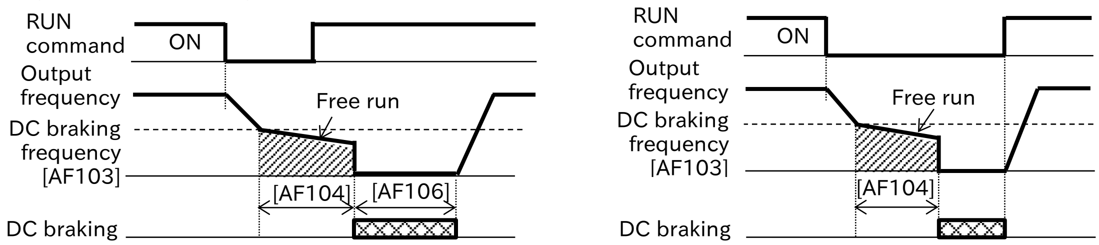
(e.g. 4-a) [AF107] = "Edge operation (00)"　　(e.g. 4-b) [AF107] = "Leveling (01)"



※ For edged operation, DC braking will operate for the [AF106] set period when the output frequency becomes less than or equal to [AF103].

■(e.g. 5) When a value other than 0.00 s is set to "DC Braking Delay Time [AF104]" and the operation is the same as (e.g. 4).

(e.g. 5-a) [AF107] = "Edge operation (00)"　　(e.g. 5-b) [AF107] = "Leveling (00)"



※If a value other than 0.00 s is set to the "DC braking delay time [AF104]", DC braking will be started after a free run (output-off) of the set time.

!

- When "DC braking selection [AF101]" is "Enable (01)", DC braking can be operated at start when the RUN command is ON. For details, refer to "9.7.2 DC Braking at Start".

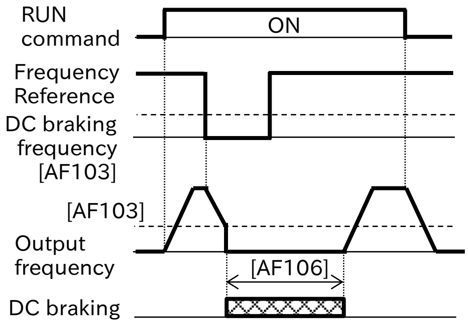
A

Frequency Reference DC Braking ([AF101] = "Enable (by frequency reference) (02)")

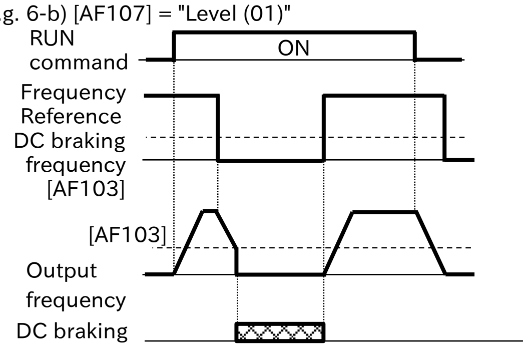
- To perform frequency reference DC braking, set "DC braking selection [AF101]" = "Enable (by frequency reference) (02)" and set "DC braking frequency [AF103]" and "DC braking force setting [AF105]".
- When frequency reference DC braking is enabled, external DC braking with the [DB] input terminals will not operate.
- DC braking is activated when both the frequency reference and the output frequency are below [AF103] in the operating condition.
- If the frequency reference becomes [AF103] + 2 Hz or more in the operation status, DC braking is released and normal operation starts.
- The DC braking will not operate if frequency reference over [AF103] + 2 Hz is set prior to operation and then RUN command is ON. (e.g. 6)
- If the frequency reference before operation is "0 Hz" and then the RUN command is ON, the operation starts from DC braking because both the frequency reference and the output frequency are [AF103] or less. (e.g. 7)
- Operation of DC braking varies depending on the edge/level operation setting of "DC braking operation method selection [AF107]". Set the edge operation or level operation according to the system. Set "DC braking active time at stop [AF106]" at standstill when edge operation is selected, referring to the operation example in the figure below.

■(e.g. 6) Set a frequency reference higher than [AF103] prior to operation. When the frequency reference is less than or equal to [AF103] during operation.

(e.g. 6-a) [AF107] = "Edge (00)"



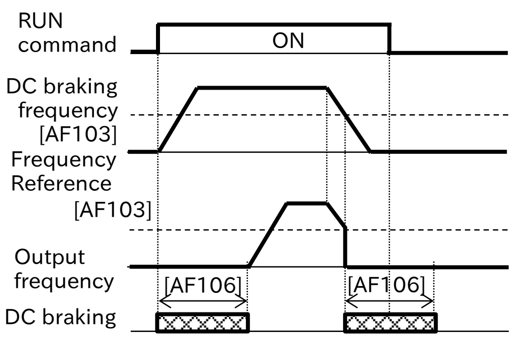
(e.g. 6-b) [AF107] = "Level (01)"



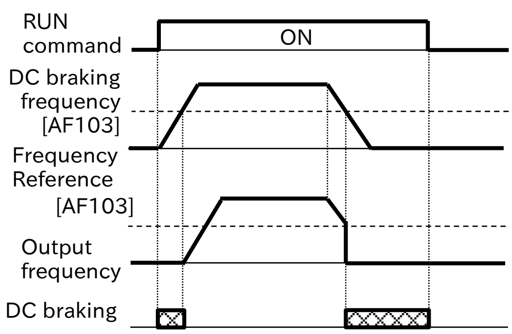
※ DC braking starts when the frequency reference is [AF103] or less in the RUN command ON.
For edge operation, DC braking operates during [AF106] after the frequency reference and the output frequency become less than [AF103].
For level operation, from when the frequency reference and the output frequency are below [AF103] until the frequency reference is above [AF103],

■(e.g. 7) Before operation, set the frequency reference below [AF103] for analog frequency reference, etc. When the frequency reference becomes [AF103] or less/or more after the operation.

(e.g. 7-a) [AF107] = "Edge (00)"



(e.g. 7-b) [AF107] = "Level (01)"



※ DC braking starts when the frequency reference is [AF103] or less in the RUN command ON.
For edge operation, DC braking operates during [AF106] after the frequency reference and the output frequency become less than [AF103].
For level operation, DC braking operates until the RUN command OFF is reached after the frequency reference and the output frequency become [AF103] or less.

9.7.9 Switching to Commercial Power Supply

Q

- Start the motor with an inverter. During continuous operation, I want to drive the motor with commercial power supply.
- I want to use it by switching between driving by commercial power supply and driving by inverter.

A

- Commercial power supply changeThis function can be used for a system with a large load moment of inertia where the acceleration/deceleration is driven by an inverter and the drive is driven by a commercial power supply at a constant speed.
- When "Commercial power supply change [CS]" input terminal is turned ON with the RUN command ON, the inverter is shut off and the motor become free run state. When [CS] input terminal is turned ON to OFF, the inverter restarts by active frequency matching from the output frequency at shut down immediately before [CS] input terminal turns ON after the "Retry wait time after instantaneous power failure/under-voltage error [bb-26]".

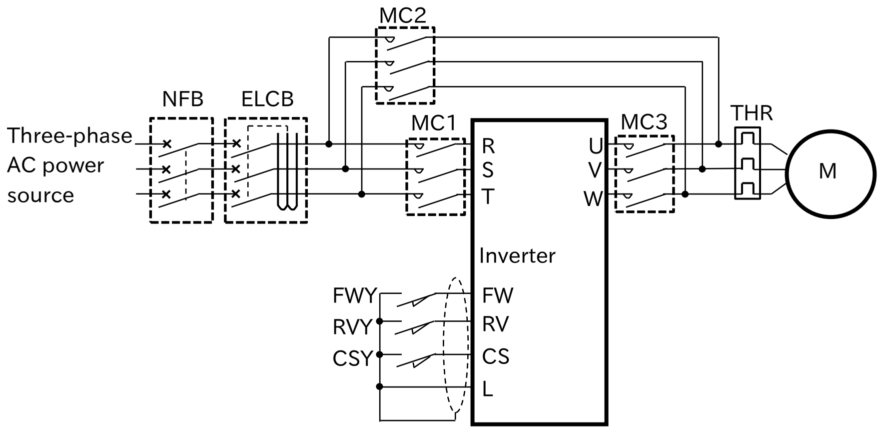
!

- Operation of the "Commercial power supply change [CS]" input terminal is the same as when the "Free run stop [FRS]" input terminal is ON/OFF with "Restart with active frequency matching (02)" for "Restart mode after FRS release [bb-40]" and "Active frequency matching restart speed selection [bb-47]" as "Output frequency at shut down (00)". For details, refer to "9.7.4 Active Frequency Matching Restart Function".

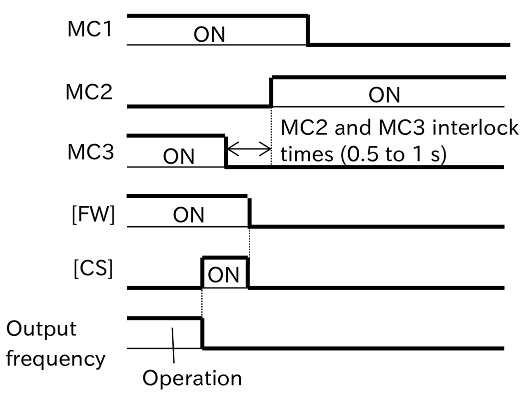
Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Commercial power supply change [CS]: This function is used during commercial switching. When [CS] input terminal is turned ON, the inverter shuts off the output.	035

■ Example of connection diagram and timing chart in commercial power supply change operation

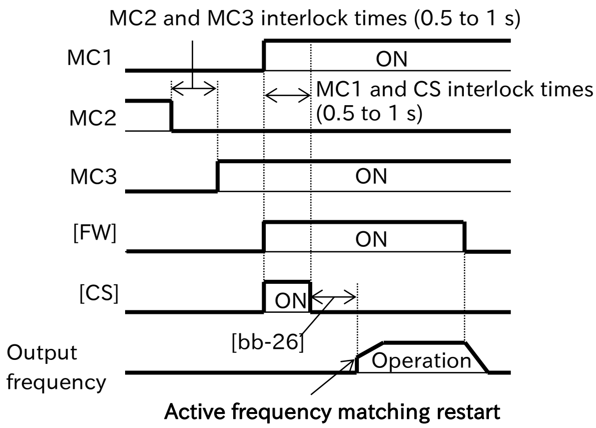
- For FWY, RVY, CSY, use relays for low voltage.
- Take the mechanical interlock of MC3 and MC2. Otherwise, the inverter may be damaged.
- The commercial circuit does not operate when the earth leakage breaker ELCB trips due to a ground fault or the like. Connect a commercial circuit of another system to MC2 when back-up is required.



■ Timing of switching from inverter to commercial power supply



■ Switching timing from commercial power supply to inverter



9.7.10 External Brake Control Function

Q

- I want to perform an operation sequence using an external brake.

A

- With the brake control function, an inverter can control the external brake used for elevating systems, etc. To use this function, set "Brake control enable [AF130]" to "Brake control enable (Common) (01)" or "Brake control enable (Separate for FWD/REV) (02)", and assign "Brake release [BRK]" to the output terminal.
- Setting [AF130] to "Brake control enable (Separate for FWD/REV) (02)" allows you to set a different operation between forward and reverse rotation. This function is effective when the operation differs between hoisting and lowering. When "Brake control enable (Common) (01)" is set to [AF130], the forward setting ([AF131] to [AF137]) is enabled for both forward and reverse.
- To operate this function while interlocking by inputting a confinement/release check signal from the external brake to the inverter, assign "Answer back from Brake [BOK]" to the input terminal and set "Brake confirmation signal wait time ([AF134] and [AF141])". Also, assign "Brake error [BER]" to the output terminals as required.
- The brake control function can also be used in combination with position control. For details, refer to "9.14.4 Operating Position Control with Brake Control".

!

- For the control mode when the brake control function is used, sensorless vector control ("Control mode selection [AA121]" = "Sensorless vector control (IM) (08)") that generates high torque at start is recommended.
- If an error occurs in the brake sequence, the inverter trips at the "Brake error [E036]" and turns ON the "Brake error [BER]" signalis. Refer to the operation sequence described below for the detailed conditions to trip.
- In brake control, trip occurs in the following cases.
  - When the output current is less than the "Brake release current setting ([AF136], [AF143])" after the "Brake release wait time ([AF131], [AF138])" has elapsed.
  - When using the "Answer back from Brake [BOK]" input terminal, if the [BOK] input terminal does not ON within the "Brake confirmation signal wait time ([AF134] and [AF141])" when starting.
  - When using the "Answer back from Brake [BOK]" input terminal, if the [BOK] input terminal does not OFF within the "Brake confirmation signal wait time ([AF134] and [AF141])" when stopping.
  - When the "Answer back from Brake [BOK]" input terminal is used, the "Brake release [BRK]" signal is output, but the [BOK] input terminal is turned OFF.

Code	Name	Description	Data
[AF130]	Brake control enable*1	Disable	00
		Brake control enable (Common)	01
		Brake control enable (Separate for FWD/REV)	02
[AF131]	Brake release wait time (Forward)	Set the time from when the brake release frequency is reached until the output current reaches the brake release current.	0.00 to 5.00 (s)
[AF138]	Brake release wait time (Reverse)		
[AF132]	Brake wait time for accel. (Forward)	Set the mechanical delay time from the brake confirmation signal (or brake release signal) until the brake is released.	0.00 to 5.00 (s)
[AF139]	Brake wait time for accel. (Reverse)		
[AF133]	Brake wait time for stopping (Forward)	Set the mechanical delay period from OFF of the brake release signal until the brake is restrained.	0.00 to 5.00 (s)
[AF140]	Brake wait time for stopping (Reverse)		
[AF134]	Brake confirmation signal wait time (Forward)	Set a time longer than the time from when the brake release signal is output until the release completion signal output from the brake is input to the inverter.	0.00 to 5.00 (s)
[AF141]	Brake confirmation signal wait time (Reverse)		
[AF135]	Brake release frequency setting (Forward) *2	Set the frequency to ON the brake-release signal.	0.00 to 590.00 (Hz)
[AF142]	Brake release frequency setting (Reverse) *2		
[AF136]	Brake release current setting (Forward)*3	Set the output current that enables brake release.	(0.00 to 2.00)× ND/LD rating output current (A)
[AF143]	Brake release current setting (Reverse)*3		
[AF137]	Braking frequency (Forward)*2	Set the frequency at which the brake is closed when stopped.	0.00 to 590.00 (Hz)
[AF144]	Braking frequency (Reverse)*2		
[CA-01] to [CA-08]	Input terminal function	Answer back from Brake [BOK]: Check this input signal as an answer back of the [BRK] signal to the external brake.	037
[CC-01] [CC-02] [CC-07]	Output terminal function	Brake release [BRK]: This signal is for restraining/releasing the external brake.	037
		Brake error [BER]: This relay is ON when a sequence error occurs in the brake control function. With ON of this signal, the inverter trips with "Brake error [E036]".	038

*1. The brake control related parameters that are enabled differ depending on "[AF130] setting. Refer to the table below for details.
*2. Set a value greater than "Minimum frequency adjustment [Hb130]".
*3. Note that the torque may not be sufficient when the brake is released if the setting is low.

Enabled parameters when [AF130] is "Brake control enable (Common) (01)"

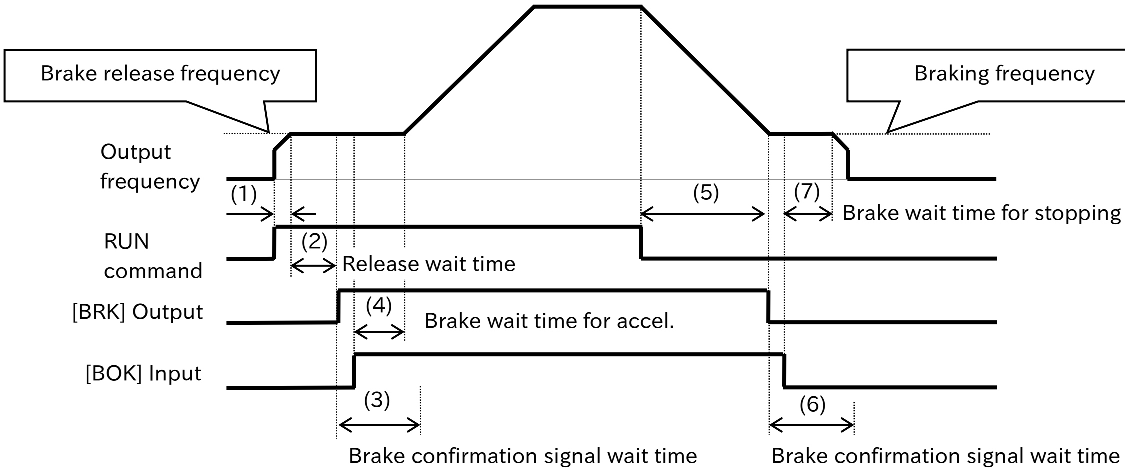
Name	Enabled parameters (Common)
Brake release wait time	[AF131]
Brake wait time for accel.	[AF132]
Brake wait time for stopping	[AF133]
Brake confirmation signal wait time	[AF134]
Brake release frequency setting	[AF135]
Brake release current setting	[AF136]
Braking frequency	[AF137]

Enabled parameters when [AF130] is "Brake control enabled (Separate for FWD/REV) (02)"

Name	Enabled parameters	
	Forward rotation	Reverse rotation
Brake release wait time	[AF131]	[AF138]
Brake wait time for accel.	[AF132]	[AF139]
Brake wait time for stopping	[AF133]	[AF140]
Brake confirmation signal wait time	[AF134]	[AF141]
Brake release frequency setting	[AF135]	[AF142]
Brake release current	[AF136]	[AF143]
Braking frequency	[AF137]	[AF144]

Operation sequence of the brake control function

- The following figure shows the operation sequence of the brake control function. In the following, the details of the brake control function are explained in this figure. (The figure below shows a case where "Answer back from Brake [BOK]" is assigned to the input terminal.)



(1) When the RUN command is issued, the inverter accelerates to "Brake release frequency setting ([AF135], [AF142])".

(2) After the output frequency reaches [AF135]/[AF142] and the time "Brake release wait time ([AF131], [AF138])" has elapsed, "Brake release [BRK]" signal is turned ON.
However, if the output current at this time is less than "Brake release current setting ([AF136], [AF143])", [BRK] signal will not be ON, and "Brake error [E036]" trip will occur instead, and "Brake error [BER]" signal will be turned ON.

(3) The operation differs depending on whether "Answer back from Brake [BOK]" is assigned to the input terminal.
With [BOK] assignment:
After [BRK] signal turns ON, the signal does not accelerate and waits for [BOK] input terminal to become ON during "Brake confirmation signal wait time ([AF134], [AF141])". If [BOK] input terminal does not turn ON within the waiting time, "Brake error [E036]" trip will occur and [BER] signal will be turned ON.
No [BOK] assignment: After [BRK] signal turns ON, go to step (4).

(4) After ON of [BOK] input terminal (or ON of [BRK] signal), when the time of "Brake wait time for accel. ([AF132], [AF139])" has elapsed, the machine accelerates to the set frequency again.

(5) When the RUN command is OFF, the inverter decelerates to "Braking frequency ([AF137], [AF144])" and OFF [BRK].

(6) The operation differs depending on whether [BOK] input terminal are assigned to the input terminal.
With [BOK] assignment:
After [BRK] signal turns OFF, the inverter does not decelerate and waits for the [AF134]/[AF141] to turn OFF [BOK] input terminal. If [BOK] input terminal does not turn OFF within the waiting time, "Brake error [E036]" trip occurs and [BER] signal turns ON.
No [BOK] assignment: After [BRK] signal turns OFF, proceed to step (7).

(7) The operation differs depending on whether [BOK] input terminal are assigned to the input terminal.
With [BOK] assignment:
After [BOK] input terminal is turned OFF, if "Brake wait time for stopping ([AF133], [AF140])" has elapsed, the actuator will decelerate to 0 Hz again.
No [BOK] assignment:
After [BRK] signal turns OFF, when "Brake wait time for stopping ([AF133], [AF140])" has elapsed, the actuator decelerates to 0 Hz.

9.7.11 External Contactor Control Function

Q

- I want to perform an operation sequence using a contactor.
- How do I control by inserting a contactor on the output side?
- We would like to control the contactor on the input side to save energy.

A

- When performing contactor operation, set "Contactor control enable [AF120]" to "Enable (Primary side) (01)" or "Enable (Secondary side) (02)".
- Input terminal function "Contactor check signal [COK]" and output terminal function "Contactor control [CON]" are available.

!

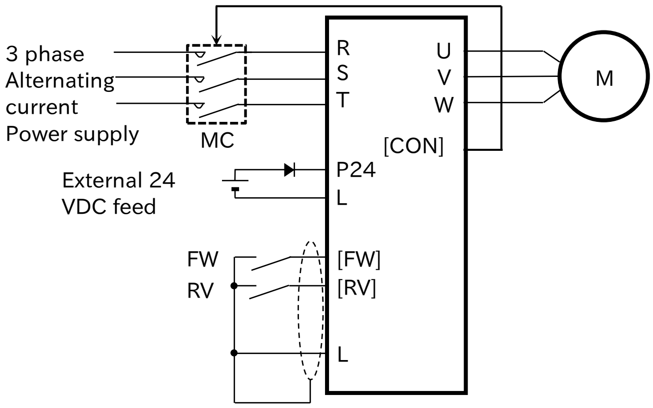
- This function must be used for contactor control, since operating the contactor during inverter output may cause surge and inverter damage.
- If an error occurs in the contactor sequence, the drive trips due to "Contactor error [E110]".
- In contactor control, trip occurs in the following cases when the input terminal function "Contactor check signal [COK]" is used.
  - When [COK] input terminal does not ON within "Contactor response check time [AF123]".
  - If [COK] input terminal does not OFF within "Contactor response check time [AF123]", when stopped.
  - When [COK] input terminal turns OFF while "Contactor control [CON]" signal is ON.

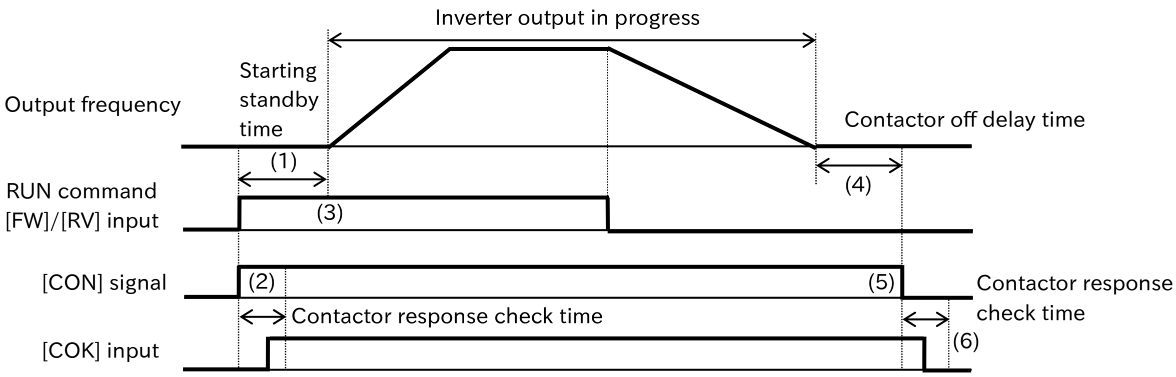
■ Required setting parameters for contactor control function

Code	Name	Description	Data
[AF120]	Contactor control enable	Disable	00
		Enable (Primary side): A contactor is installed on the primary side of the inverter to reduce standby power.	01
		Enable (Secondary side): A contactor is installed on the secondary side of the inverter to function as a brake sequence.	02
[AF121]	Run delay time	Set the standby time from the input of RUN command to the start of inverter output.	0.00 to 2.00(s)
[AF122]	Contactor off delay time	Set the time from inverter output shutoff to contactor control.	0.00 to 2.00(s)
[AF123]	Contactor response check time	Set the time from the input of the RUN command to the control of the contactor.	0.00 to 5.00(s)
[CA-01] to [CA-08]	Input terminal function	Contactor check signal [COK]: OFF: Contactor released ON: Contactor is operating	107
[CC-01] [CC-02] [CC-07]	Output terminal function	Contactor control [CON]: OFF: Contactor released ON: Contactor is operating	039

■ Example of energy conservation at the primary contactor (AF120=01: Enable (Primary side))

- Reduced standby power when combined with external 24 VDC input. For the external 24 VDC power supply to the control circuit, refer to "5.4.1 Configuration of Control Circuit Terminal".
- By ON/OFF the contactor MC of the main circuit power supply with the output of the setting terminal of the output terminal function "Contactor control [CON]", the power input to the inverter main circuit can be shut off while the inverter output is stopped, thereby realizing an energy saving operation sequence.





(1) After ON of the RUN command, the inverter waits until the start wait time "RUN delay time [AF121]" elapses.

(2) The "Contactor control [CON]" signal turns ON at the same time as the RUN command ON. Subsequent operation differs depending on whether "Contactor check signal [COK]" is assigned to the input terminal.

With [COK] assignment:

If [COK] input terminal is not ON within "Contactor response check time [AF123]", the inverter trips due to "Contactor error [E110]".

No [COK] assignment: Wait for the elapse of [AF121] setting time after ON the [CON] signal.

(3) Acceleration starts after [AF121] setting time has elapsed.

(4) Wait until "Contactor off delay time [AF122]" has elapsed after the inverter has stopped outputting.

(5) After [AF122] setting time has elapsed, [CON] signal turns OFF. Subsequent operations differ depending on whether [COK] input terminal is set for the input terminal function.

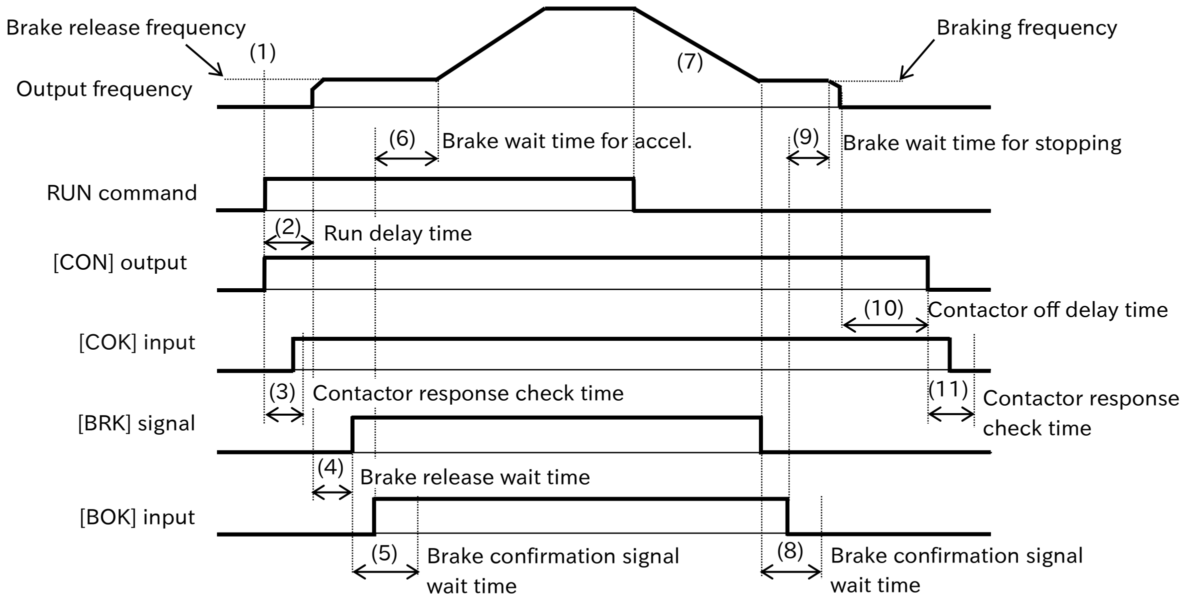
With [COK] assignment:

If [COK] input terminal is not OFF within [AF123] setting time, it trips with "Contactor error [E110]".

No [COK] assignment: The inverter does not do anything as it is.

■ Example of control with secondary contactor (AF120=02: Enable (Secondary side))

・ When "Enable (Secondary side)" is selected, it can be used in combination with brake control.



(1) When the RUN command is issued, the inverter ON "Contactor control [CON]" signal.

(2) Wait until the "RUN delay time [AF121]" has elapsed.

(3) Subsequent operation differs depending on whether "Contactor check signal [COK]" is assigned to the input terminal.

With [COK] assignment:

If the [COK] input terminal is not ON within "Contactor response check time [AF123]", the inverter trips with "Contactor error [E110]".

No [COK] assignment: Go to step (4).

(4) The inverter starts outputting and after the time "Brake release wait time ([AF131], [AF138])" has elapsed, the "Brake release [BRK]" signal turns ON. However, if the output current at this time is less than the "Brake release current setting ([AF136], [AF143])", the [BRK] signal will not be ON, and the "Brake error [E036]" trip will occur instead, and the "Brake error [BER]" signal will be turned ON.

(5) Subsequent operations differ depending on whether "Answer back from Brake [BOK]" is assigned to the input terminal.

With [BOK] assignment:

After [BRK] signal turns ON, the signal does not accelerate and waits for [BOK] input terminal to become ON during the "Brake confirmation signal wait time ([AF134], [AF141])". When [BOK] input terminal is ON, it will go to step (6), but if [BOK] input terminal does not turn ON within the waiting time, it trips due to "Brake error [E036]", and [BER] signal turns ON.

No [BOK] assignment: After [BRK] signal turns ON, go to step (6).

(6) When the time of "Brake wait time for accel. ([AF132], [AF139])" has elapsed, the actuator accelerates to the set frequency again.

(7) When the RUN command is OFF, the inverter decelerates to the "Braking frequency ([AF137], [AF144])" and OFF [BRK].

(8) Subsequent operations differ depending on whether [BOK] is assigned to the input terminal.

With [BOK] assignment:

After [BRK] signal turns OFF, the signal does not decelerate and waits for [BOK] input terminal to become OFF during [AF134]/[AF141] setting time. If [BOK] input terminal does not turn OFF within the waiting time, it trips due to "Brake error [E036]", and [BER] signal turns ON.

No [BOK] assignment: After [BRK] signal turns ON, go to step (9).

(9) After [BOK] input terminal is turned OFF (or [BRK] signal is turned OFF), when the time "Brake wait time for stopping ([AF133] and [AF140])" has elapsed, the speed is decelerated and the output is shut off.

(10) After "Contactor off delay time [AF122]" has elapsed, [CON] signal turns OFF.

(11) Subsequent operation differs depending on whether [COK] is assigned to the input terminal.

With [COK] assignment:

If [COK] input terminal is not OFF within [AF123] setting time, it trips with "Contactor error [E110]".

No [COK] assignment: The inverter is still in the stop state.

9.7.12 Emergency Force Operation

Q

- Switching to compulsory operation mode by signal input.
- How do I continue the operation state until the power is cut off?
- When the inverter cannot be restarted due to a failure, please enter the operation mode by the commercial power supply.

A

- When this function is activated, the output operates in "Emergency-force dirve mode (Em-force mode)" where the inverter runs at a constant rate without shutting down the drive until the power supply is shut off.
- "Em-force mode" is entered by setting "Enable Emergency-force drive mode [PA-01]" to "Enable (01)" and turning ON "Emergency-Force Drive activation [EMF]" assigned to the input terminal function.
- The RUN command in "Em-force mode" is set with "Emergency-force dirve frequency reference [PA-02]" and "Emergency-force dirve direction command [PA-03]".
- Whether the present status corresponds to normal operation, "Em-force mode" or "Bypass mode" can be checked in "Emergency-force drive mode monitor [dC-49]". For detail of "Bypass mode", refer to "Switch to operation with commercial power supply (Bypass mode)" in this section.

Code	Name	Description	Data
[dC-49]	Emergency-force drive mode monitor	Disabled: Not in "Em-force mode" and "Bypass mode".	00
		EMF active: Operation in "Em-force mode".	01
		BYP active: Operation in "Bypass mode".	02
[PA-01]	Enable Emergency-force drive mode	Disable: "Em-force mode" is disabled. "Em-force mode" is not activated even if [EMF] input terminal are turned ON.	00
		Enable: "Em-force mode" is disabled. When [EMF] input terminal is set to ON, the unit start to operate in "Em-force mode".	01
[PA-02]	Emergency-force drive frequency reference	Set the frequency reference in "Em-force mode".	0.00 to 590.00(Hz)
[PA-03]	Emergency-force drive direction command	Forward rotation is performed during "Em-force mode".	00
		Reverse operation is performed during "Em-force mode".	01
[CA-01] to [CA-08]	Input terminal function	[EMF]: Emergency-Force Drive activation OFF: Disable ON: "Em-force mode" is enabled when [PA-01] is 01.	105
[CC-01] [CC-02] [CC-07]	Output terminal function	[EMFC]: Emergency-Force Drive indicator OFF: Disable ON: "Em-force mode" in progress	076
		[EMBP]: Bypass mode indicator OFF: Disable ON: "Bypass mode" in progress	077

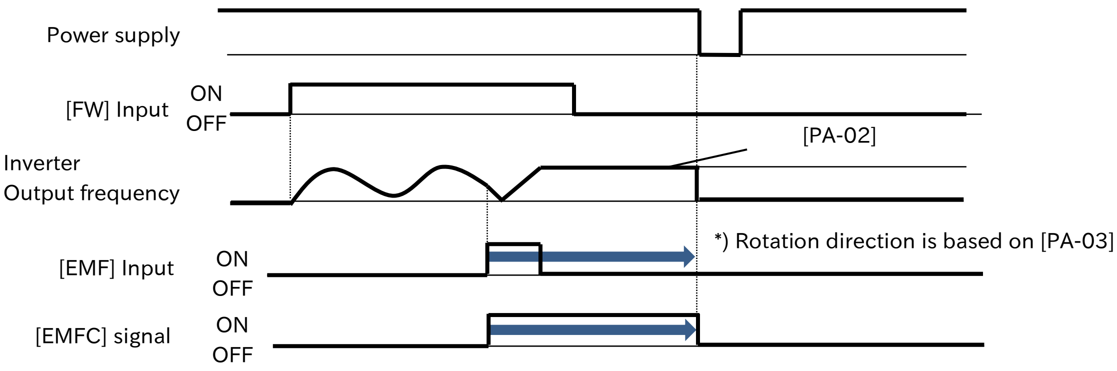
!

- In "Em-force mode", once it is turned ON, it continues operation until the power supply of the inverter is cut off.
- Overcurrent retry, overvoltage retry, and instantaneous power failure/undervoltage retry are automatically activated. To change the operation details, a separate setting is required.
- After the input terminal function "Emergency-Force Drive activation [EMF]" is ON, the input terminal function is disabled except "Contactor check signal [COK]".

A

Operation in Emergency-force dirve mode (Em-force mode)

- ON the input terminal function "Emergency-Force Drive activation [EMF]" to start "Emergency-force dirve mode (Em-force mode)".
- The drive outputs the frequency set in "Emergency-force drive frequency reference [PA-02]" and the rotation direction set in "Emergency-force drive direction command [PA-03]" until the power is shut off.



!

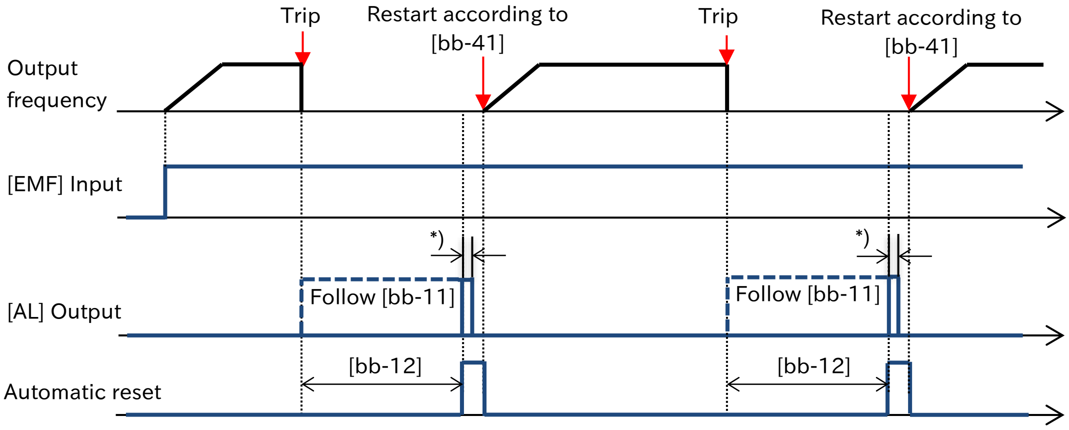
- In "Em-force mode", the following functions operate automatically. In addition, other functions operate according to their settings.
  - ① Soft-lock status (equivalent to [UA-16]=01)
    Parameters cannot be changed. To return the setting, set [EMF] input terminal to OFF, turn the power back on, and then change the parameters.
  - ② Automatic error reset ([bb-10]=02 and operating range is extended.)
    If a trip occurs, it will automatically reset and restart.
  - ③ STOP key disabled (equivalent to [AA-13]=00)
    Disables STOP/RESET key on the keypad.
  - ④ Operation enabled during optional start up ([oA-13]=01)
    Operation is permitted even during option start up.

Code	Name	Description	Data
[PA-01]	Enable Emergency-force drive mode	Disable: "Em-force mode" is disabled. "Em-force mode" is not activated even if [EMF] input terminal are turned ON.	00
		Enable: "Em-force mode" is disabled. When [EMF] input terminal is set to ON, the unit start to operate in "Em-force mode".	01
[PA-02]	Emergency-force drive frequency reference	Set the frequency reference in "Em-force mode".	0.00 to 590.00(Hz)
[PA-03]	Emergency-force drive direction command	Forward rotation is performed during "Em-force mode".	00
		Reverse operation is performed during "Em-force mode".	01
[CA-01] to [CA-08]	Input terminal function	[EMF]: Emergency-Force Drive activation OFF: Disable ON: "Em-force mode" is enabled when [PA-01] is 01.	105
[CC-01] [CC-02] [CC-07]	Output terminal function	[EMFC]: Emergency-Force Drive indicator OFF: Disable ON: "Em-force mode" in progress	076

A

Automatic error reset operation during Em-force mode

- When an error occurs during "Em-force mode" and the inverter trips, resetting is performed automatically equivalent to when the power is turned on.
- Automatic reset operation during "Em-force mode" differs from that described in "9.15.7 Automatic Alarm Resetting". For details, refer to the table "Automatic error reset operation during Em-force mode" in this section.



*) In the case of relay terminal, it operates momentarily even if anything is assigned due to the effect of system reset.

Automatic error reset operation during Em-force mode

Code	Name	Operation in Em-force mode
[bb-10]	Automatic error reset selection	Regardless of the setting, [bb-10] = "After set time (02)" is forcibly extended to the entire error.
[bb-11]	Alarm signal selection at automatic error reset	The setting in [bb-11] is enabled. However, the relay terminal operates only momentarily at system reset. Therefore, if "Alarm [AL]" is assigned to "Output terminal [AL] function [CC-07]", [AL] signal will ON for a moment even if [bb-11] is set to "Disable (01)".
[bb-12]	Automatic error reset wait time	The setting in [bb-12] is enabled.
[bb-13]	Automatic error reset number	Performs an infinite number of automatic resets forcibly regardless of the setting.
[bb-41]	Restart mode after RS release	The setting in [bb-41] is enabled. The settings for the other retry functions ([bb-20] to [bb-31]) are enabled in the same way.

A

Switch to operation with commercial power supply

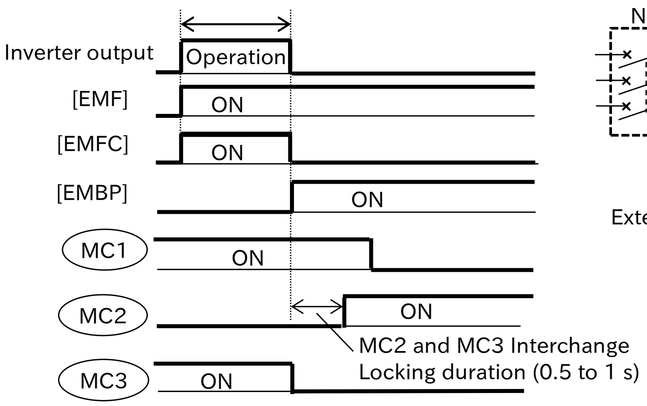
- When "Commercial power supply bypass function selection [PA-04]" is set to "Enable (01)", this function can be switched to "Commercial power supply operation mode (bypass mode)" during "Em-force mode" and when the specified operation status is not reached.
- During "Bypass mode", the output terminal function "Bypass mode indicator [EMBP]" is ON and the inverter output is shut off.
- For "Bypass mode" operation, refer to the connection diagram and timing in the commercial power supply switching operation shown below.
- In the example below, the main power supply of the inverter is also shut off. In such cases, the external 24 VDC power supply must be connected to prevent loss of the power supply for internally controlling the inverters.
- Perform contactor control based on [EMBP] signal.

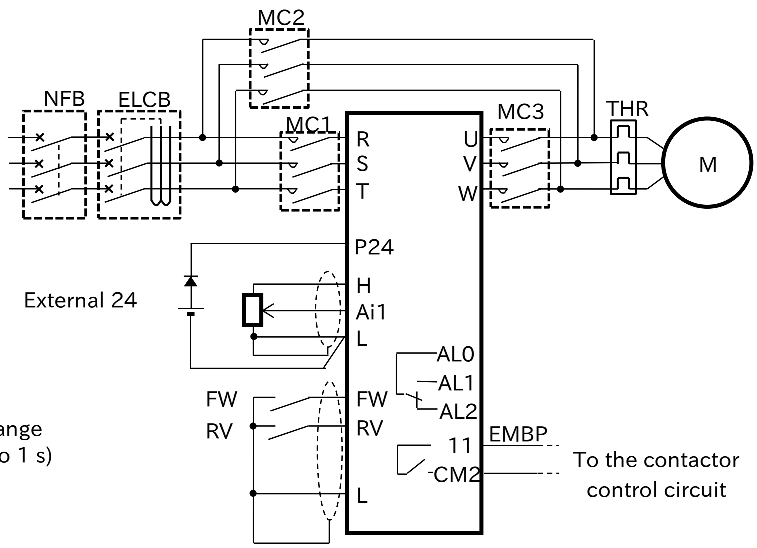
!

- When using "Bypass mode", an interlock must be provided that considers the operation delay of the contactor when switching to commercial power supply operation. Make sure that system operation is safe before use.
- The output terminal function "Bypass mode indicator [EMBP]" can be used as a contactor control signal to timing the contactor control. Use interlocks for the commercial power contactor and the inverter output contactor.
- The commercial power supply circuit does not operate when the earth leakage breaker ELCB trips due to a ground fault or the like. Connect a commercial power supply circuit of another system to MC2 when back-up is required.

■ INV-> Commercial Operation Timing

During "Em-force mode", [PA-05] accumulated operation
(See the next page for details.)



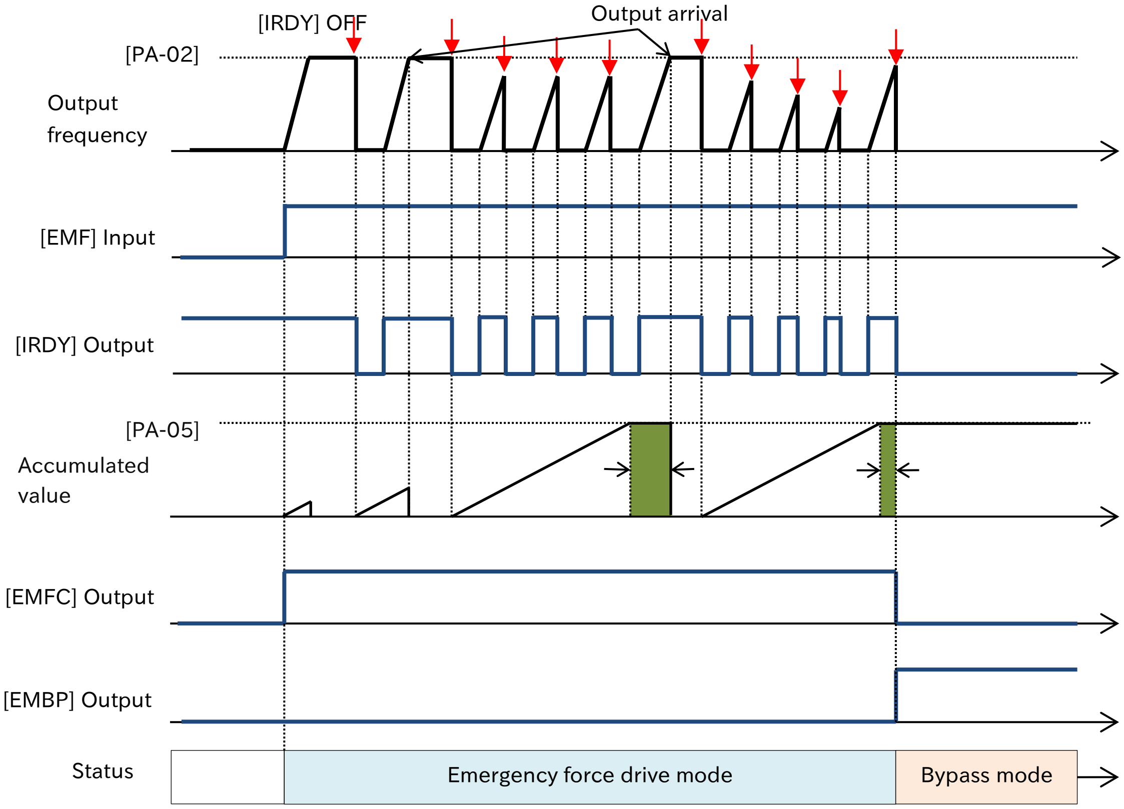


Code	Name	Description	Data
[PA-04]	Commercial power supply bypass function selection	Disable: Bypass feature is disabled.	00
		Enable: Bypass feature enabled.	01
[PA-05]	Commercial power supply bypass function delay time	During "Em-force mode", if the output frequency cannot reach "Emergency-force drive frequency reference [PA-02]", and [PA-05] setting has elapsed, the unit will start bypass mode.	0.0 to 1000.0 (s)
[CA-01] to [CA-08]	Input terminal function	[EMF]: Emergency-Force Drive activation OFF: Disable ON: "Em-force mode" is enabled when [PA-01] is 01.	105
[CC-01] [CC-02] [CC-07]	Output terminal function	[EMFC]: Emergency-Force Drive indicator OFF: Disable ON: "Em-force mode" in progress	076
		[EMBP]: Bypass mode indicator OFF: Disable ON: "Bypass mode" in progress	077

Determination of switching to Commercial power supply operation mode (Bypass mode)

- When "Commercial power supply bypass function selection [PA-04]" is set to "Enable (01)", if the time that "Emergency-force dirve frequency reference [PA-02]" cannot be reached during "Em-force mode" elapses "Commercial power supply bypass function delay time [PA-05]" and the inverter cahnge to "Not ready" status (output terminal function "Inverter ready [IRDY]" is OFF), the inverter operation is regarded as impossible and the inverter starts the operation in the commercial power supply operation mode (Bypass mode).

- "Bypass mode" continues to be maintained until power to the inverter is shut down once ON.
- While the inverter is starting immediately after resetting, the "Inverter ready [IRDY]" signal is OFF for about 1 second, but this section does not change to the bypass mode.
- When the upper frequency limit function is enabled and "Emergency-force drive frequency reference [PA-02]" cannot be reached, the bypass function delay time accumulated value is counted.



- In Bypass mode, the following functions operate automatically. In addition, other functions operate according to their settings.
  ① Soft-lock status (equivalent to [UA-16]=01)
  Parameters cannot be changed. To return the setting, set the [EMF] input terminal to OFF, turn the power back on, and then change the parameters.
  ② Auto-reset (equivalent to [bb-10]=00)
  The automatic reset function is disabled.
  ③ STOP key disabled (equivalent to [AA-13]=00)
  Disables STOP/RESET key on the keypad.
  ④ Operation enabled during optional startup ([oA-13]=01)
  Operation is permitted even during option start up.

9.7.13 Switching to 2nd Motor Control Mode

Q

- How do I move two types of motors with different settings?
- Store the settings of the two types of motors separately.
- To perform batch production, change the settings at once.

A

- The target parameters are switched by turning ON the "2nd-motor control [SET](024)" of the input terminal function. Two types of motors with different parameters can be switched and controlled by the 2nd motor control function.
- 2nd motor control function is linked with ON of [SET] input terminal, and the "2nd-motor control is selected [SETM](012)" of the output terminal function turns ON.
- Parameters whose parameter number is "- - 2 - -" are the 2nd control parameter.

  (e.g.) 2nd-motor control parameter corresponding to "Main speed input source selection, 1st-motor [AA101]" is "Main speed input source selection, 2nd-motor [AA201]".

!

- Even if the "2nd-motor control [SET]" input terminal is switched during inverter operation, the parameter will not be switched. In this case, it will be switched after the output is shut off.
- Even if you want to switch [SET] input terminals for immediate operation, take a switching time of 1 second or longer.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	2nd-motor control [SET]: Switches to the 2nd control parameter ON this function.	024
[CC-01] [CC-02] [CC-07]	Output terminal function	2nd-motor control is selected [SETM]: When switching to the 2nd control parameter after ON the [SET] input terminal, this signal is turned ON.	012

■List of parameters switched by ON/OFF of [SET] input terminal

1st/2nd motor code		Name	1st/2nd motor code		Name
AA101	AA201	Main speed input source selection	AF138	AF238	Brake release wait time (Reverse)
AA102	AA202	Sub speed input source selection	AF139	AF239	Brake wait time for accel. (Reverse)
AA104	AA204	Sub speed setting	AF140	AF240	Brake wait time for stopping (Reverse)
AA105	AA205	Speed reference calculation symbol selection	AF141	AF241	Brake confirmation signal wait time (Reverse)
AA106	AA206	Add frequency setting	AF142	AF242	Brake release frequency setting (Reverse)
AA111	AA211	RUN command input source selection	AF143	AF243	Brake release current setting (Reverse)
AA114	AA214	RUN direction restriction selection	AF144	AF244	Braking frequency (Reverse)
AA115	AA215	STOP mode selection	AG101	AG201	Jump frequency 1
AA121	AA221	Control mode selection	AG102	AG202	Jump frequency width 1
AA123	AA223	Vector control mode selection	AG103	AG203	Jump frequency 2
AA124	AA224	Speed compensation with encoder selection	AG104	AG204	Jump frequency width 2
Ab110	Ab210	Multi-speed 0 setting	AG105	AG205	Jump frequency 3
AC115	AC215	Accel/Decel change trigger	AG106	AG206	Jump frequency width 3
AC116	AC216	Accel 1 to Accel 2 frequency transition point	AG110	AG210	Acceleration stop frequency setting
AC117	AC217	Decel 1 to Decel 2 frequency transition point	AG111	AG211	Acceleration stop time setting
AC120	AC220	Acceleration time 1	AG112	AG212	Deceleration stop frequency setting
AC122	AC222	Deceleration time 1	AG113	AG213	Deceleration stop time setting
AC124	AC224	Acceleration time 2	bA101	bA201	Upper frequency limit source selection
AC126	AC226	Deceleration time 2	bA102	bA202	Upper frequency limit
AF101	AF201	DC braking selection	bA103	bA203	Lower frequency limit
AF103	AF203	DC braking frequency	bA110	bA210	Torque limit selection
AF104	AF204	DC braking delay time	bA111	bA211	Torque limit parameter mode selection
AF105	AF205	DC braking force setting	bA112	bA212	Torque limit 1 (Forward drive)
AF106	AF206	DC braking active time at stop	bA113	bA213	Torque limit 2 (Reverse regenerative)
AF107	AF207	DC braking operation method selection	bA114	bA214	Torque limit 3 (Reverse drive)
AF108	AF208	DC braking force at start	bA115	bA215	Torque limit 4 (Forward regenerative)
AF109	AF209	DC braking active time at start	bA116	bA216	Torque limit LADSTOP selection
AF120	AF220	Contactor control enable	bA120	bA220	Overcurrent suppression enable
AF121	AF221	Run delay time	bA121	bA221	Overcurrent suppression level
AF122	AF222	Contactor off delay time	bA122	bA222	Overload restriction 1 mode selection
AF123	AF223	Contactor response check time	bA123	bA223	Overload restriction 1 active level
AF130	AF230	Brake control enable	bA124	bA224	Overload restriction 1 action time
AF131	AF231	Brake release wait time (Forward)	bA126	bA226	Overload restriction 2 mode selection
AF132	AF232	Brake wait time for accel. (Forward)	bA127	bA227	Overload restriction 2 active level
AF133	AF233	Brake wait time for stopping (Forward)	bA128	bA228	Overload restriction 2 action time
AF134	AF234	Brake confirmation signal wait time (Forward)	bA140	bA240	Overvoltage suppression enable setting
AF135	AF235	Brake release frequency setting (Forward)	bA141	bA241	Overvoltage suppression active level
AF136	AF236	Brake release current setting (Forward)	bA142	bA242	Overvoltage suppression active time
AF137	AF237	Braking frequency (Forward)	bA144	bA244	Constant DC bus voltage control P gain

1st/2nd motor code		Name	1st/2nd motor code		Name
bA145	bA245	Constant DC bus voltage control I gain	HA123	HA223	ASR gain mapping intermediate speed 2
bA146	bA246	Over-magnetization function selection	HA124	HA224	ASR gain mapping maximum speed
bA147	bA247	Over-magnetization function output filter time constant	HA125	HA225	ASR gain mapping P-gain 1
bA148	bA248	Over-magnetization function voltage gain	HA126	HA226	ASR gain mapping I-gain 1
bA149	bA249	Over-magnetization function level setting	HA127	HA227	Gain mapping P control P-gain 1
bb101	bb201	Carrier frequency setting	HA128	HA228	ASR gain mapping P-gain 2
bb102	bb202	Sprinkle carrier pattern selection	HA129	HA229	ASR gain mapping I-gain 2
bb103	bb203	Automatic carrier reduction selection	HA130	HA230	Gain mapping P control P-gain 2
bb160	bb260	Overcurrent detection level	HA131	HA231	ASR gain mapping P-gain 3
bC110	bC210	Electronic thermal level setting	HA132	HA232	ASR gain mapping I-gain 3
bC111	bC211	Electronic thermal characteristic selection	HA133	HA233	ASR gain mapping P-gain 4
bC112	bC212	Electronic thermal decrease function enable	HA134	HA234	ASR gain mapping I-gain 4
bC113	bC213	Electronic thermal decreasing time	HA181	HA281	Cable length parameter
bC115	bC215	Electronic thermal accumulation gain	Hb102	Hb202	Async. Motor capacity setting
bC120	bC220	Free electronic thermal frequency-1	Hb103	Hb203	Async. Motor number of poles setting
bC121	bC221	Free electronic thermal current-1	Hb104	Hb204	Async. Motor base frequency setting
bC122	bC222	Free electronic thermal frequency-2	Hb105	Hb205	Async. Motor maximum frequency setting
bC123	bC223	Free electronic thermal current-2	Hb106	Hb206	Async. Motor rated voltage
bC124	bC224	Free electronic thermal frequency-3	Hb108	Hb208	Async. Motor rated current
bC125	bC225	Free electronic thermal current-3	Hb110	Hb210	Async. Motor constant R1
CE101	CE201	Low current signal output mode selection	Hb112	Hb212	Async. Motor constant R2
CE102	CE202	Low current detection level 1	Hb114	Hb214	Async. Motor constant L
CE103	CE203	Low current detection level 2	Hb116	Hb216	Async. Motor constant I0
CE105	CE205	Overload signal output mode selection	Hb118	Hb218	Async. Motor constant J
CE106	CE206	Overload warning level 1	Hb130	Hb230	Minimum frequency adjustment
CE107	CE207	Overload warning level 2	Hb131	Hb231	Reduced voltage start time setting
CE120	CE220	Over-torque level (Forward drive)	Hb140	Hb240	Manual torque boost operation mode selection
CE121	CE221	Over-torque level (Reverse regenerative)	Hb141	Hb241	Manual torque boost value
CE122	CE222	Over-torque level (Reverse drive)	Hb142	Hb242	Manual torque boost peak speed
CE123	CE223	Over-torque level (Forward regenerative)	Hb145	Hb245	Eco drive enable
CE124	CE224	Over/Under torque output signal mode	Hb146	Hb246	Eco drive response adjustment
CE125	CE225	Over/Under torque selection	Hb150	Hb250	Free-V/f frequency 1 setting
HA110	HA210	Stabilization constant (V/f,A.bst)	Hb151	Hb251	Free-V/f voltage 1 setting
HA112	HA212	Stabilization ramp function end ratio (V/f,A.bst)	Hb152	Hb252	Free-V/f frequency 2 setting
HA113	HA213	Stabilization ramp function start ratio (V/f,A.bst)	Hb153	Hb253	Free-V/f voltage 2 setting
HA115	HA215	Speed response	Hb154	Hb254	Free-V/f frequency 3 setting
HA120	HA220	ASR gain switching mode selection	Hb155	Hb255	Free-V/f voltage 3 setting
HA121	HA221	ASR gain switching time setting	Hb156	Hb256	Free-V/f frequency 4 setting
HA122	HA222	ASR gain mapping intermediate speed 1	Hb157	Hb257	Free-V/f voltage 4 setting

1st/2nd motor code		Name	1st/2nd motor code		Name
Hb158	Hb258	Free-V/f frequency 5 setting	Hd102	Hd202	Sync. Motor capacity setting
Hb159	Hb259	Free-V/f voltage 5 setting	Hd103	Hd203	Sync. Motor number of poles setting
Hb160	Hb260	Free-V/f frequency 6 setting	Hd104	Hd204	Sync. Motor base frequency setting
Hb161	Hb261	Free-V/f voltage 6 setting	Hd105	Hd205	Sync. Motor maximum frequency setting
Hb162	Hb262	Free-V/f frequency 7 setting	Hd106	Hd206	Sync. Motor rated voltage
Hb163	Hb263	Free-V/f voltage 7 setting	Hd108	Hd208	Sync. Motor rated current
Hb170	Hb270	Slip compensation P-gain with encoder	Hd110	Hd210	Sync. Motor constant R
Hb171	Hb271	Slip compensation I-gain with encoder	Hd112	Hd212	Sync. Motor constant Ld
Hb180	Hb280	Output voltage gain	Hd114	Hd214	Sync. Motor constant Lq
HC101	HC201	Automatic torque boost voltage compensation gain	Hd116	Hd216	Sync. Motor constant Ke
HC102	HC202	Automatic torque boost slip compensation gain	Hd118	Hd218	Sync. Motor constant J
HC111	HC211	Boost value at start (IM-SLV)	Hd130	Hd230	Sync. Motor minimum frequency adjustment
HC114	HC214	Direction reversal protection	Hd131	Hd231	Sync. Motor No-Load current
HC115	HC215	Torque conversion method selection	Hd132	Hd232	Sync. Motor Starting method
HC120	HC220	Torque current reference filter time constant	Hd133	Hd233	Sync. Motor IMPE 0V wait number
HC121	HC221	Speed feedforward compensation gain	Hd134	Hd234	Sync. Motor IMPE detect wait number
HC137	HC237	Flux settling level	Hd135	Hd235	Sync. Motor IMPE detect number
HC141	HC241	Modulation threshold 1	Hd136	Hd236	Sync. Motor IMPE voltage gain
HC142	HC242	Modulation threshold 2	Hd137	Hd237	Sync. Motor IMPE Mg-pole position offset

9.8 Driving by PID Process Control

9.8.1 PID Control

Q

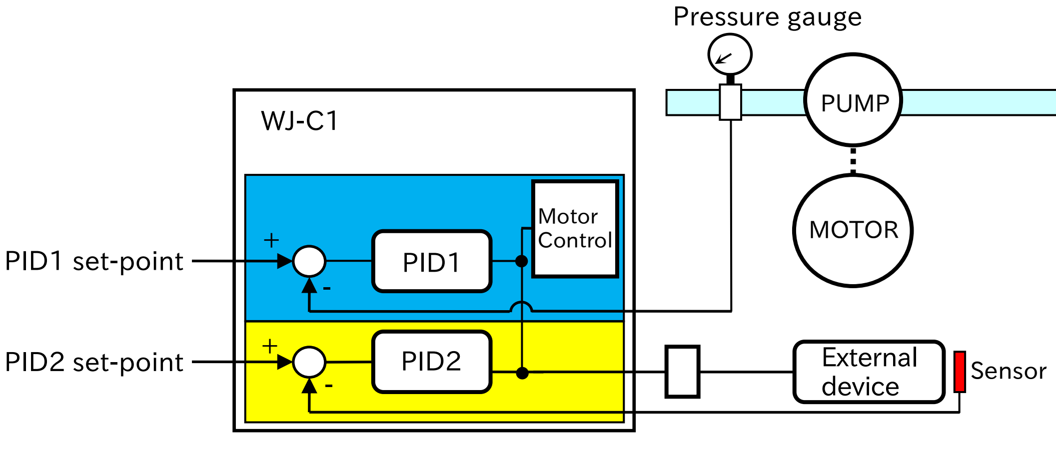
- I want to perform process control such as flow rate, air volume, and pressure.
- How do I switch between PID control and normal control?
- If the flow rate, air volume, pressure, etc. exceeds a certain level of output, we would like to stop the motor to save energy.

A

- PID function enables process control of flow rate, air volume, pressure, etc. In addition, WJ-C1 has two independent PID functions (PID1/PID2) that can be set individually for PID control.
- When using PID1, set "PID1 enable [AH-01]". When using PID2, set "PID2 enable [AJ-01]" to "Enable (01)" or "Enable (with inverted output) (02)", and adjust each related parameter.
- The two PID functions can be switched by the "PID output switching 1 [PIO1]" input terminal and used for motor control.
- PID functions that are not used for motor control can be freely used for external PID operation that is not related to the control of inverters.
- While "Disable PID1 [PID]"/"Disable PID2 [PID2]" of the input terminal function is ON, PID function is disabled and the inverter performs normal frequency output. At this time, a 100 % of the PID set-point will be the maximum frequency for frequency reference setting.
- PID cascading is also available to connect PID1 operation result to PID2 set-point. This enables more sophisticated PID control such as more stable control and disturbance suppression.
- The following functions are available in PID1. Please note that it cannot be used in PID2. For details on the functions, see "9.8.2 Using PID1 Control".
    - Three PID target values/feedback data sets
    - Two types of gain settings
    - PID multistage set-point function
    - PID feedforward function
    - PID soft start function
    - PID sleep function

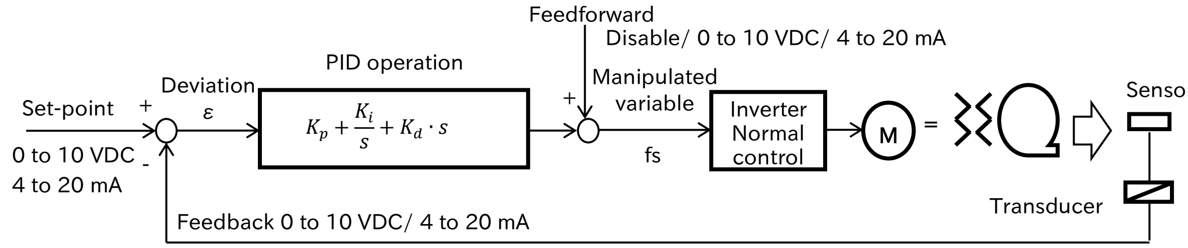
!

- When controlling the motor with PID function, "Main speed input source selection [AA101]" must be set to "PID function (15)".
- "Upper/Lower frequency limit function ([bA101] to [bA103])" operates for the frequency reference after PID operation. Does not operate against PID set-point.
- If the acceleration/deceleration time setting is longer than PID operation, output frequency tracking may be delayed and PID control may not work well. In this case, set the acceleration/deceleration time shorter.



A Basic configuration and operation of PID control

■ PID control block diagram



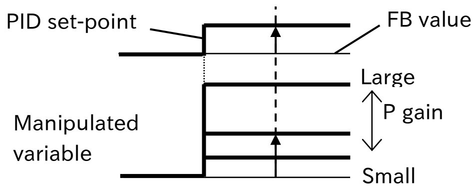
Kp: Proportional gain, Ki: Integral gain (Ki=1/Ti), Kd: Derivative gain (Kd=Td)
Ti: Integral time, Td: Derivative time, s: Operator, ε : Deviation

■ Operation of PID

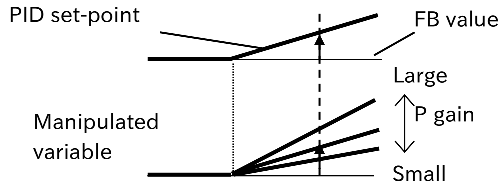
(1) P action: Proportional gain

- Operation in which the manipulated variable of PID reference value is proportional to the deviation between PID set-point and current feedback value (FB value).

Set-point step change



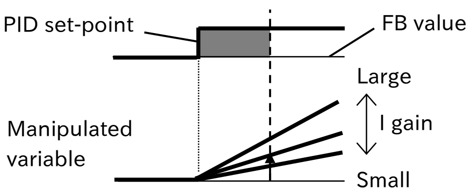
Set-point ramp change



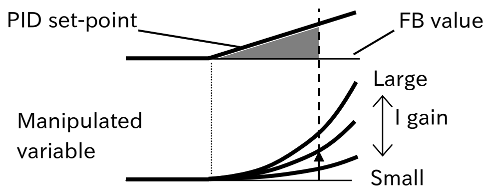
(2) I action: Integral gain

- Operation in which the manipulated variable of PID reference value is proportional to the integrated value of the deviation between PID set-point and the current feedback value (FB value).
- Integrated value can be cleared by "PID1 integration reset [PIDC]" and "PID2 integration reset [PIDC2]" of the input terminal function.
- In P operation, the manipulated variable becomes smaller when FB value approaches to PID set-point, and it takes time to reach the set-point, so I action compensates.

Set-point step change



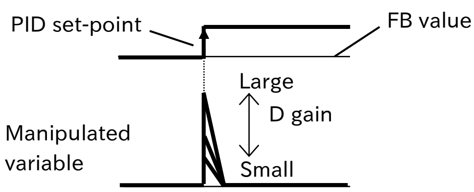
Set-point ramp change



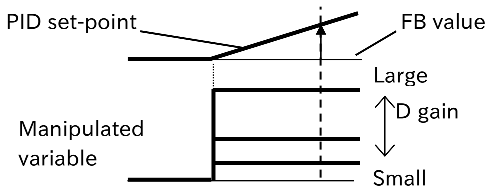
(3) D action: Derivative gain

- Operation in which the manipulated variable of PID reference value is proportional to the change of the deviation between PID set-point and the current feedback value (FB value).
- D action has the effect of supplementing the responsiveness of P action and I action, and performs correction when receiving a disturbance, etc.

Set-point step change



Set-point ramp change



9.8.2 Using PID1 Control

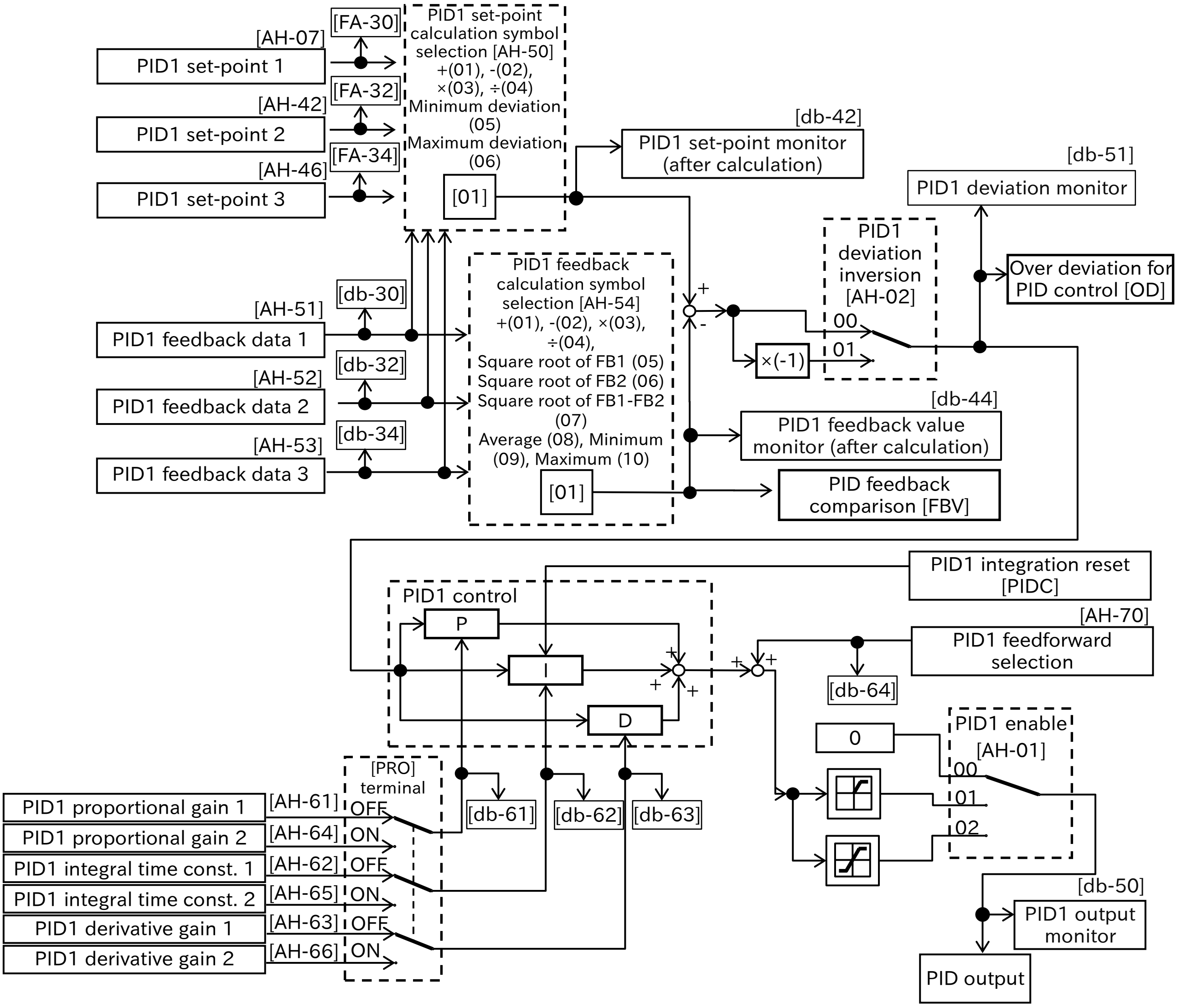
Q

- I want to perform process control such as flow rate, air volume, and pressure.
- How do I prevent a water hammer when starting the pump?
- When the output becomes unnecessary, we want to stop the motor automatically to save energy.

A

- PID1 can both be input three PID target value and PID feedback value. Refer to the block diagram below for an overview.
- PID gains 1 and 2 can be switched by input terminal function "PID gain switching [PRO]".
- Set-point 0 to set-point 15 can be set as PID set-point and can be switched by input terminal function "PID1 multistage set-point ([SVC1] to [SVC4])".
- Feed-forward control is available to stabilize the disturbance in advance.
- Soft-start function to perform normal speed control for a certain period of time from start of operation can be used.
- With PID sleep function, the output is stopped when PID output drops or a signal is input. After that, restart can be performed automatically when the condition is satisfied.

PID1 block diagram



*) In the figure, [] and the position of the switch for each parameter indicates the initial value.
Input terminal functions that are not assigned to the "Input terminal function ([CA-01] to [CA-08])" will be OFF.

- The following shows an example of setting steps when performing PID control.

e.g.: When simple PID control is performed by entering the set-point value [Ai1] and feedback value [Ai2] from the default parameter.

① Set "PID1 enable [AH-01]" to "Enable (01)".
② Set "Main speed input source selection [AA101]" to "PID function (15)".
③ Set the "Terminal [Ai1] (01)" to "PID1 set-point1 input source selection [AH-07]."
④ Set the "Terminal [Ai2] (02)" to "PID1 feedback 1 input source selection [AH-51]."
⑤ Set PID gain to "PID proportional gain/integral time/derivative gain 1 ([AH-61] to [AH-63])".
⑥ Enter the command set in "RUN command input source selection [AA111]" and begin PID control.

List of PID1 related parameters

- The table below lists the parameters related to PID1. For details of each parameter, please refer to the individual function description in this section.

PID1 related monitor

Code	Name	Description	Data
[FA-30]	PID1 set-point 1 setting (monitor)	Monitor or change the setting of the currently selected PID1 set-point 1. If [FA-30] is changed or saved when the input source selection of set-point 1 is parameter setting (=[AH-10]) or PID1 multistage set-point 1 to 15(=[AH-12] to [AH-40], the set value of the selected set-point of input source selection will also be changed or saved.	-100.00 to 100.00 (%)*1
[FA-32]	PID1 set-point 2 setting (monitor)	Monitor or change the setting of the currently selected PID1 set-point 2. If the input source selection of set-point is set to parameter setting (=[AH-44]), changing/saving [FA-32] will also change/save [AH-44].	
[FA-34]	PID1 set-point 3 setting (monitor)	Monitor or change the setting of the currently selected PID1 set-point 3. If the input source selection is set to parameter setting (=[AH-48]), changing/saving [FA-34] will also change/save [AH-48].	
[db-30]	PID1 feedback value 1 monitor	Displays PID1 feedback value 1.	-100.00 to 100.00 (%)*1
[db-32]	PID1 feedback value 2 monitor	Displays PID1 feedback value 2.	
[db-34]	PID1 feedback value 3 monitor	Displays PID1 feedback value 3.	
[db-42]	PID1 set-point monitor (after calculation)	Displays the set-point after calculation in [AH-50].	-100.00 to 100.00 (%)*1
[db-44]	PID1 feedback value monitor (after calculation)	Displays the feedback value after calculation in [AH-54].	-100.00 to 100.00 (%)*1
[db-50]	PID1 output monitor	Displays PID1 output.	-100.00 to 100.00 (%)
[db-51]	PID1 deviation monitor	Displays PID1 deviation.	-200.00 to 200.00 (%)
[db-52]	PID1 deviation 1 monitor	When [AH-50] is "Minimum deviation (05)" or "Maximum deviation (06)", monitor PID1 for three deviations.	-200.00 to 200.00 (%)
[db-53]	PID1 deviation 2 monitor		
[db-54]	PID1 deviation 3 monitor		
[db-61]	Current PID P-Gain monitor	Displays the current P gain.	0.0 to 100.0
[db-62]	Current PID I-Gain monitor	Displays the current I gain.	0.0 to 3600.0 (s)
[db-63]	Current PID D-Gain monitor	Displays the current D gain.	0.00 to 100.00 (s)
[db-64]	PID feed-forward input source monitor	Displays the feedforward reference value.	0.00 to 100.00 (%)

*1. "PID1 scale adjustment ([AH-04] to [AH-06]) will change the setting. For details, please refer to "9.8.5 Unit Converter Function for PID Control".

■ PID1 relevant parameters

Code	Name	Description	Data
[AH-01]	PID1 enable	Disable	00
		Enable: Even if the reference by PID operation becomes negative, it will not be outputting in the reverse direction.	01
		Enable (with inverted output): When the reference by PID calculation becomes negative, it will be outputting in the reverse direction.	02
[AH-02]	PID1 deviation inversion	Disable	00
		Enable: Deviation is the difference between the set-point and the feedback data multiplied by (-1).	01
[AH-03]	PID1 unit selection	Change the units and scale of some monitors/parameters of PID1. For more information, refer to "9.8.5 Unit Converter Function for PID Control".	00 to 58
[AH-04]	PID1 scale adjustment (0%)		-10000 to 10000
[AH-05]	PID1 scale adjustment (100%)		-10000 to 10000
[AH-06]	PID1 scale adjustment (decimal point position)		0 to 4
[AH-07]	PID1 set-point 1 input source selection	Not used	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		Parameter setting	07
		RS485	08
		Option	09
		Pulse input	12
[AH-10]	PID1 set-point 1 setting	When "Parameter setting (07)" is selected as PID1 set-point 1 input source selection, set PID1 set-point 1.	-100.00 to 100.00 (%)*1
[AH-12]	PID1 multistage set-point 1	Set the multistage set-point 1 to 15.	-100.00 to 100.00 (%)*1
[AH-14]	PID1 multistage set-point 2		
[AH-16]	PID1 multistage set-point 3		
[AH-18]	PID1 multistage set-point 4		
[AH-20]	PID1 multistage set-point 5		
[AH-22]	PID1 multistage set-point 6		
[AH-24]	PID1 multistage set-point 7		
[AH-26]	PID1 multistage set-point 8		
[AH-28]	PID1 multistage set-point 9		
[AH-30]	PID1 multistage set-point 10		
[AH-32]	PID1 multistage set-point 11		
[AH-34]	PID1 multistage set-point 12		
[AH-36]	PID1 multistage set-point 13		
[AH-38]	PID1 multistage set-point 14		
[AH-40]	PID1 multistage set-point 15		
[AH-42]	PID1 set-point 2 input source selection	Same as [AH-07]	00 to 12
[AH-44]	PID1 set-point 2 setting	When "Parameter setting (07)" is selected as PID1 set-point 2 input source selection, set PID1 set-point 2.	-100.00 to 100.00 (%)*1
[AH-46]	PID1 set-point 3 input source selection	Same as [AH-07]	00 to 12
[AH-48]	PID1 set-point 3 setting	When "Parameter setting (07)" is selected as PID1 set-point 3 input source selection, set PID1 set-point 3.	-100.00 to 100.00 (%)*1
[AH-50]	PID1 set-point calculation symbol selection	Addition	01
		Subtraction	02
		Multiplication	03
		Division	04
		Minimum deviation	05
		Maximum deviation	06

*1. "PID1 scale adjustment ([AH-04] to [AH-06]) will change the setting. For details, please refer to "9.8.5 Unit Converter Function for PID Control".

Code	Name	Description	Data
[AH-51] [AH-52] [AH-53]	PID1 feedback 1/2/3input source selection	Not used	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		RS485	08
		Option	09
		Pulse input	12
[AH-54]	PID1 feedback calculation symbol selection	Addition	01
		Subtraction	02
		Multiplication	03
		Division	04
		Square root of FB1	05
		Square root of FB2	06
		Square root of FB1-FB2	07
		Average of the three inputs	08
		Minimum of the three inputs	09
		Maximum of the three inputs	10
[AH-60]	PID1 gain change method selection	Constant gain (Using gain-1 only)	00
		Switching by [PRO] input terminal	01
[AH-61]	PID1 proportional gain 1	Set PID proportional gain 1.	0.0 to 100.0
[AH-62]	PID1 integral time constant 1	Set PID integral time constant 1.	0.0 to 3600.0 (s)
[AH-63]	PID1 derivative gain 1	Set PID derivative gain 1.	0.00 to 100.00 (s)
[AH-64]	PID1 proportional gain 2	Set PID proportional gain 2.	0.0 to 100.0
[AH-65]	PID1 integral time constant 2	Set PID integral time constant 2.	0.0 to 3600.0 (s)
[AH-66]	PID1 derivative gain 2	Set PID derivative gain 2.	0.00 to 100.00 (s)
[AH-67]	PID1 gain change time	Set the time to change the gain when activates [PRO] input terminal.	0 to 10000 (ms)
[AH-70]	PID1 feedforward input source selection	Not used	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
[AH-71]	PID1 output range	The output range of PID1 output is limited by PID set-point ± this setting. Set the maximum frequency as 100 %.	0.00 to 100.00 (%)
[AH-72]	PID1 over deviation level	Set the level at which the deviation between set-point of PID1 and feedback data is considered excessive. For more information, refer to "9.8.4 Output Terminal Function Related to PID control".	0.00 to 100.00 (%)
[AH-73]	Turn-off level for the PID1 feedback compare signal	Set the tolerance range for feedback data of PID1. For more information, refer to "9.8.4 Output Terminal Function Related to PID control".	0.00 to 100.00 (%)
[AH-74]	Turn-on level for the PID1 feedback compare signal		0.00 to 100.00 (%)
[AH-75]	PID soft start function enable	Disable	00
		Enable	01
[AH-76]	PID soft start target level	Set the set-point in percentage for the soft-start section assuming that the maximum frequency is 100 %.	0.00 to 100.00 (%)
[AH-78]	Acceleration time setting for PID soft start function	Set the acceleration time at soft start.	0.00 to 3600.00 (s)
[AH-80]	PID soft start time	Set the duration of PID soft start function.	0.00 to 600.00 (s)

Code	Name	Description	Data
[AH-81]	PID soft start error detection enable	Disable	00
		Enable (Error): When the start error is judged, trips with "PID soft start error [E120]".	01
		Enable (Warning): When the start error is judged, "PID soft start error [SSE]" will be ON.	02
[AH-82]	PID soft start error detection level	Set the level at which PID soft start error is activated during PID soft start.	0.00 to 100.00 (%)
[AH-85]	PID sleep trigger selection	Disable	00
		Low output: Starts sleep operation when output drops	01
		[SLEP] terminal: Starts operation when rises [SLEP] input terminal	02
[AH-86]	PID sleep start level	Set the frequency at which the sleep operation starts when [AH-85] is set to "Low output (01)".	0.00 to 590.00 (Hz)
[AH-87]	PID sleep active time	Set the waiting time before transitioning to sleep operation.	0.00 to 100.00 (s)
[AH-88]	Enable set-point boost before PID sleep	Disable	00
		Enable: Increase (boost) the set-point before the sleep operation starts.	01
[AH-89]	Set-point boost time before PID sleep	Set the time to perform the boost before the sleep operation starts.	0.00 to 100.00 (s)
[AH-90]	Set-point boost value before PID sleep	Set the amount of addition (boosting amount) to PID set-point before the sleep operation starts.	0.00 to 100.00 (%)
[AH-91]	Minimum RUN time before PID sleep	Until [AH-91] elapses after starting, will not go into sleep operation even if the conditions are met.	0.00 to 100.00 (s)
[AH-92]	Minimum active time of PID sleep	After enters to the sleep state, will remains in the sleep state until [AH-92] elapses, even if the conditions are met.	0.00 to 100.00 (s)
[AH-93]	PID wake trigger selection	Deviation value: If the deviation value is [AH-96] or more and continues for [AH-95] or longer, the sleep state is canceled.	01
		Low feedback: If the feedback value is below [AH-94] and continues for [AH-95] or longer, the sleep state is canceled.	02
		[WAKE] terminal: After the ON edge input of the [WAKE] input terminals, the sleep state is canceled when [AH-95] set time elapses.	03
[AH-94]	PID wake start level	Set the feedback level that cancel the sleep operation, when [AH-93] is set to "Low feedback (02)".	0.00 to 100.00 (%)
[AH-95]	PID wake start time	Set the standby time for canceling sleep operation.	0.00 to 100.00 (s)
[AH-96]	PID wake start deviation value	Set the deviation value between the set-point and feedback value that cancel the sleep operation, when [AH-93] is set to "Deviation value (01)".	0.00 to 100.00 (%)

■ PID1 related input/output terminal functions

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Disable PID1 [PID]: When this signal is turned ON, PID operation is disabled, and the normal frequency operation is performed.	041
		PID1 integration reset [PIDC]: When this signal is turned ON, the integral value of PID control is cleared to 0.	042
		PID1 multi set-point selection 1 to 4 ([SVC1] to [SVC4]): By combining [SVC1] to [SVC4], PID1 set-point 1 is switched to multistage set-point 1 to 15.	051([SVC1]) 052([SVC2]) 053([SVC3]) 054([SVC4])
		PID gain change [PRO]: The gain 1 and gain 2 of PID1 can be switched by ON/OFF this signal. The current PID gain can be checked on the monitor below. "Current PID P-Gain monitor [db-61]" "Current PID I-Gain monitor [db-62]" "Current PID D-Gain monitor [db-63]"	055
		PID output switching 1[PIO1]: Between the PID1 and PID2 output can switch by turning ON / OFF this signal.	056
		SLEEP condition activation [SLEP]: When "PID sleep trigger selection [AH-85]" is set to "[SLEP] terminal (02)", the sleep function is started by this signal.	058
		WAKE condition activation [WAKE]: When "PID wake trigger selection [AH-93]" is set to "[WAKE] terminal (03)", the sleep function is canceled by this signal.	059
[CC-01] [CC-02] [CC-07]	Output terminal function	Over deviation for PID control [OD]: When PID1 deviation exceeds the set level of "PID1 over deviation level [AH-72]", this signal turns ON.	045*1
		PID feedback comparison [FBV]: Compare the PID1 feedback value and "Turn-on/of level for the PID1 feedback compare signal ([AH-73], [AH-74])" and turns the signal ON/OFF.	046*1
		PID soft start error [SSE]: When "PID soft start error detection enable [AH-81]" is set to "Enable (Warning) (02)", turns ON the signal when detect abnormal startup.	093

*1. For more information, refer to "9.8.4 Output Terminal Function Related to PID Control".

A

PID1 set-point selection

- If "PID1 set-point 1 input source selection [AH-07]" is "PID1 set-point 1 setting [AH-10]", "PID1 multistage set-point 1 to 15([AH-12] to [AH-40]", PID1 set-point 1 input source can also be changed/saved by changing/saving "PID1 set-point 1 setting (monitor) [FA-30]".
- When "PID1 set-point 2/3 input source selection ([AH-42], [AH-46])" is "PID1 set-point 2/3 setting ([AH-44], [AH-48])," it is also possible to change/save PID1 set-point 2/3 input source by changing/saving "PID1 set-point 2 setting (monitor) [FA-32]" and "PID1 set-point 3 setting (monitor) [FA-34]".

  e.g.: If [AH-07] is referring to [AH-10], the [AH-10] setting will also be applied to [FA-30].
  If [FA-30] is changed in this condition, [AH-10] is changed in the same way.
- If PID target value can be changed with [FA-30]/[FA-32]/[FA-34], the value will be reflected as the entered value just by changing the value with JOG dialing on the keypad. However, if it is not saved, it will return to before the change by turning on the power again. If PID set-point cannot be changed, [FA-30]/[FA-32]/[FA-34] is the set-point monitor.
- To set the set-point input to PID1 set-point 1 setting only, set "PID1 set-point 2/3 input source selection ([AH-42], [AH-46])" to "Not used (00)", and set "PID1 set-point calculation symbol selection [AH-50]" to "Addition (01)".

!

- Select "Not used (00)" for the set-point and feedback value that are not used.
- Data set to 00 (Not used) in the input source selection is excluded from the calculation target.
- The "Upper/Lower frequency limit ([bA101] to [bA103])" function, operates for the frequency reference after PID calculation. It does not work for PID set-point.

■ Operation of "PID1 set-point calculation symbol selection [AH-50]"

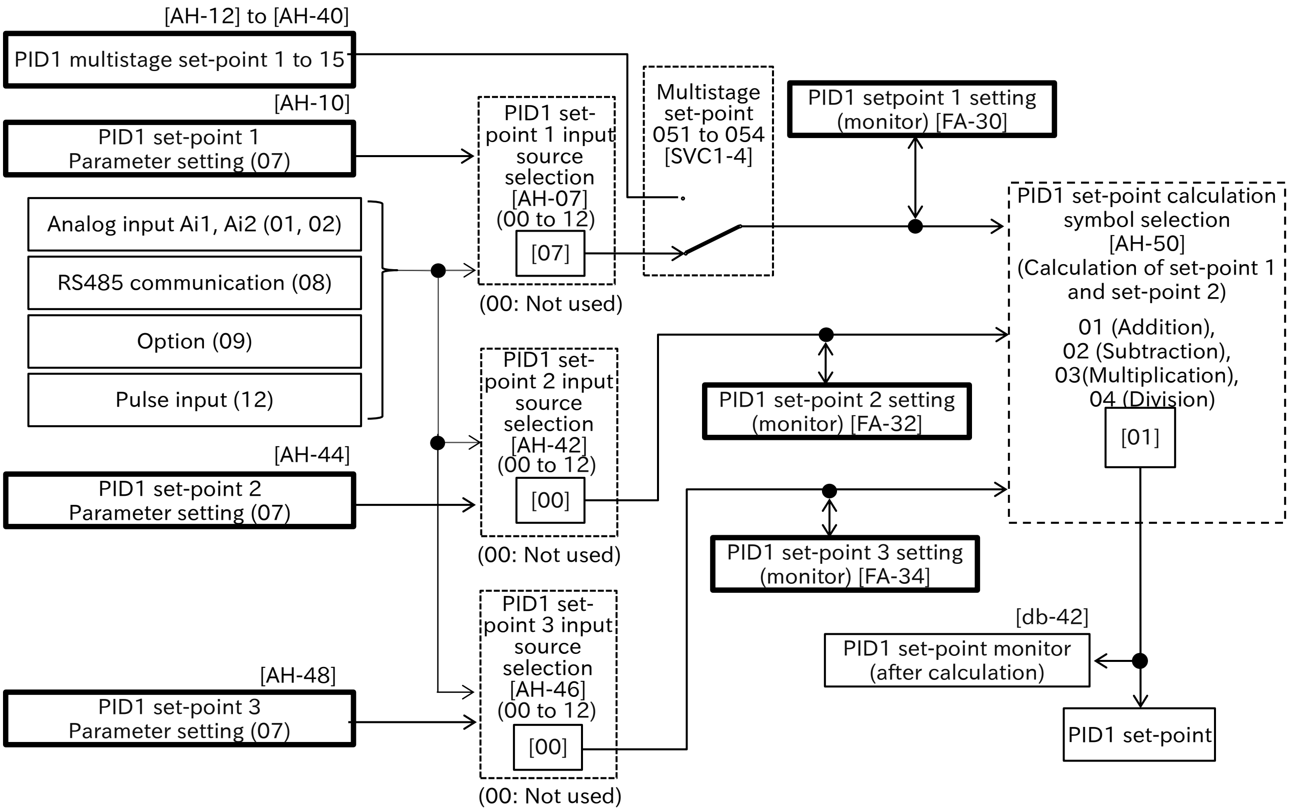
- The operation changes as follows when [AH-50] is set to (01) to (04) and (05) and (06).

(1) When [AH-50] is "Addition, Subtraction, Multiplication, Division ((01) to (04))":

- The calculation target is set-point 1 and set-point 2. Also, "Multiplication (03)" and "Division (04)" are calculated as follows. The operation result is limited within the range of-100.00 to 100.00 %.

  e.g.: When set-point 1 = 20 % and set-point 2 = 40 %
  Multiplication: 20 × 40 % = 20 × 0.4 = 8 %, Division: 20/40 % = 20/0.4 = 50 %

■ PID1 set-point selection block diagram when [AH-50] is 01 to 04



※ The values in [] in the figure are initial values. Input terminal functions that are not assigned to the "Input terminal function ([CA-01] to [CA-08])" will be OFF.

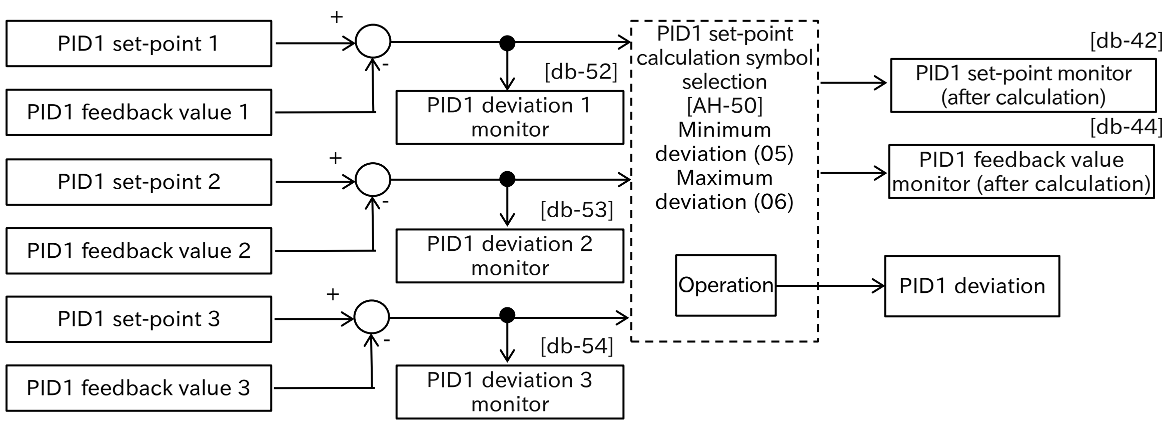
(2) When [AH-50] is "Minimum deviation (05)" and "Maximum deviation (06)":

- When [AH-50] is "Minimum deviation (05)" or "Maximum deviation (06)", deviation 1 to deviation 3 are calculated as follows, and then PID operation is performed using the minimum or maximum deviation.

  (Deviation 1) = (Set-point 1) - (Feedback value 1)
  (Deviation 2) = (Set-point 2) - (Feedback value 2)
  (Deviation 3) = (Set-point 3) - (Feedback value 3)

- PID1 set-point and PID1 feedback data used for PID1 related functions are the source data of the deviation selected in the operation. The "PID1 set-point monitor (after calculation) [db-42]" and "PID feedback value monitor (after calculation) [db-44]" are displayed, respectively.
- When 05 (Minimum deviation) or 06 (Maximum deviation) is selected in [AH-50], "PID1 feedback calculation symbol selection [AH-54]" is disabled.

■ PID1 set-point/feedback value selection block diagram when [AH-50] is 05 or 06



Code	Name	Description	Data
[FA-30]	PID1 set-point 1 setting (monitor)	Monitors the currently selected PID1 target or changes the settings.	-100.00 to 100.00 (%)*1
[FA-32]	PID1 set-point 2 setting (monitor)		
[FA-34]	PID1 set-point 3 setting (monitor)		
[db-42]	PID1 set-point monitor (after calculation)	Displays the target after calculation in [AH-50].	-100.00 to 100.00 (%)*1
[AH-07] [AH-42] [AH-46]	PID1 set-point 1/2/3 input source selection	Not used	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		Parameter setting	07
		RS485	08
		Option	09
		Pulse input	12
[AH-10]	PID1 set-point 1 setting	Set PID1 set-point when "Parameter setting (07)" is selected as PID1 set-point input source selection.	-100.00 to 100.00 (%)*1
[AH-44]	PID1 set-point 2 setting		
[AH-48]	PID1 set-point 3 setting		
[AH-50]	PID1 set-point calculation symbol selection	Addition	01
		Subtraction	02
		Multiplication	03
		Division	04
		Minimum deviation	05
		Maximum deviation	06

*1. "PID1 scale adjustment ([AH-04] to [AH-06]) will change the setting.
For more information, refer to "9.8.5 Unit Converter Function for PID Control".

PID multistage set-point function

- PID1 multistage set-point 1 to 15 can be selected by assigning "PID1 multi set-point selection ([SVC1] to [SVC4]) (051 to 054)" to "Input terminal function ([CA-01] to [CA-08])".

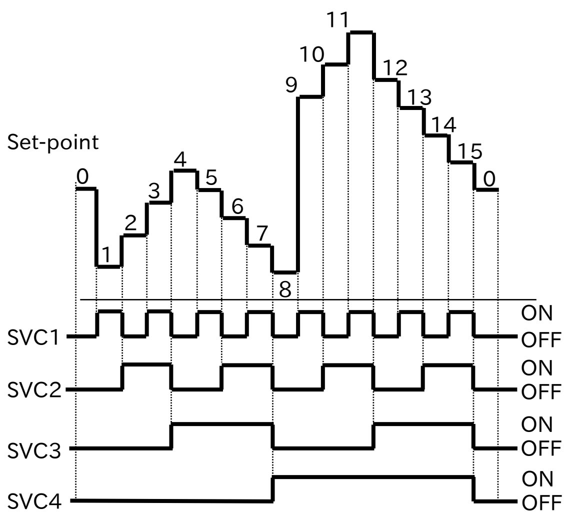
- The wait time until terminal input is confirmed can be set in "Multistage input determination time [CA-55]". The transition state during terminal switching operation can be prevented from being adopted.
- If there is no change, the setting of [CA-55] will elapse and the setting will be confirmed. Please note that the input response will be slower if the settling time is increased.

■ Operation table

Multistage set-point	SVC4	SVC3	SVC2	SVC1	Parameter
Set-point 0	OFF	OFF	OFF	OFF	[AH-10]*1
Set-point 1	OFF	OFF	OFF	ON	[AH-12]
Selection 2	OFF	OFF	ON	OFF	[AH-14]
Selection 3	OFF	OFF	ON	ON	[AH-16]
Selection 4	OFF	ON	OFF	OFF	[AH-18]
Set-point 5	OFF	ON	OFF	ON	[AH-20]
Set-point 6	OFF	ON	ON	OFF	[AH-22]
Set-point 7	OFF	ON	ON	ON	[AH-24]
Set-point 8	ON	OFF	OFF	OFF	[AH-26]
Set-point 9	ON	OFF	OFF	ON	[AH-28]
Set-point 10	ON	OFF	ON	OFF	[AH-30]
Set-point 11	ON	OFF	ON	ON	[AH-32]
Set-point 12	ON	ON	OFF	OFF	[AH-34]
Set-point 13	ON	ON	OFF	ON	[AH-36]
Set-point 14	ON	ON	ON	OFF	[AH-38]
Set-point 15	ON	ON	ON	ON	[AH-40]

*When 1. "PID1 set-point 1 input source selection [AH-07] = "Parameter setting (07)".
When [SVC1] to [SVC4] is set to all OFF, PID1 set-point 1 follows the setting of [AH-07].

■ Operation graph



Code	Name	Description	Data
[FA-30]	PID1 set-point 1 setting (Monitor)	Monitor or change the setting of the currently selected PID1 set-point 1. If [FA-30] is changed or saved when the input source selection of set-point 1 is parameter setting (=[AH-10]) or PID1 multistage set-point 1 to 15(=[AH-12] to [AH-40], the set value of the selected set-point of input source selection will also be changed or saved.	-100.00 to 100.00 (%)*1
[AH-10]	PID1 set-point 1 setting	When "Parameter setting (07)" is selected as PID1 set-point 1 input source selection, set PID1 set-point 1.	-100.00 to 100.00 (%)*1
[AH-12] to [AH-40]	PID1 Multistage set-point 1 to 15	Set the multistage set-point 1 to 15.	-100.00 to 100.00 (%)*1
[CA-01] to [CA-08]	Input terminal function	PID1 multi set-point 1 to 4 ([SVC1] to [SVC4]): By combining [SVC1] to [SVC4], PID1 set-point 1 is switched to multistage set-point 1 to 15.	051([SVC1]) 052([SVC2]) 053([SVC3]) 054([SVC4])
[CA-55]	Multistage input determination time	Set the time until the frequency is determined when a multi-speed, multistage positioning, or multi set-point is switched.	0 to 2000 (ms)

*1. "PID1 scale adjustment ([AH-04] to [AH-06]) will change the setting.
For more information, refer to "9.8.5 Unit Converter Function for PID Control".

A

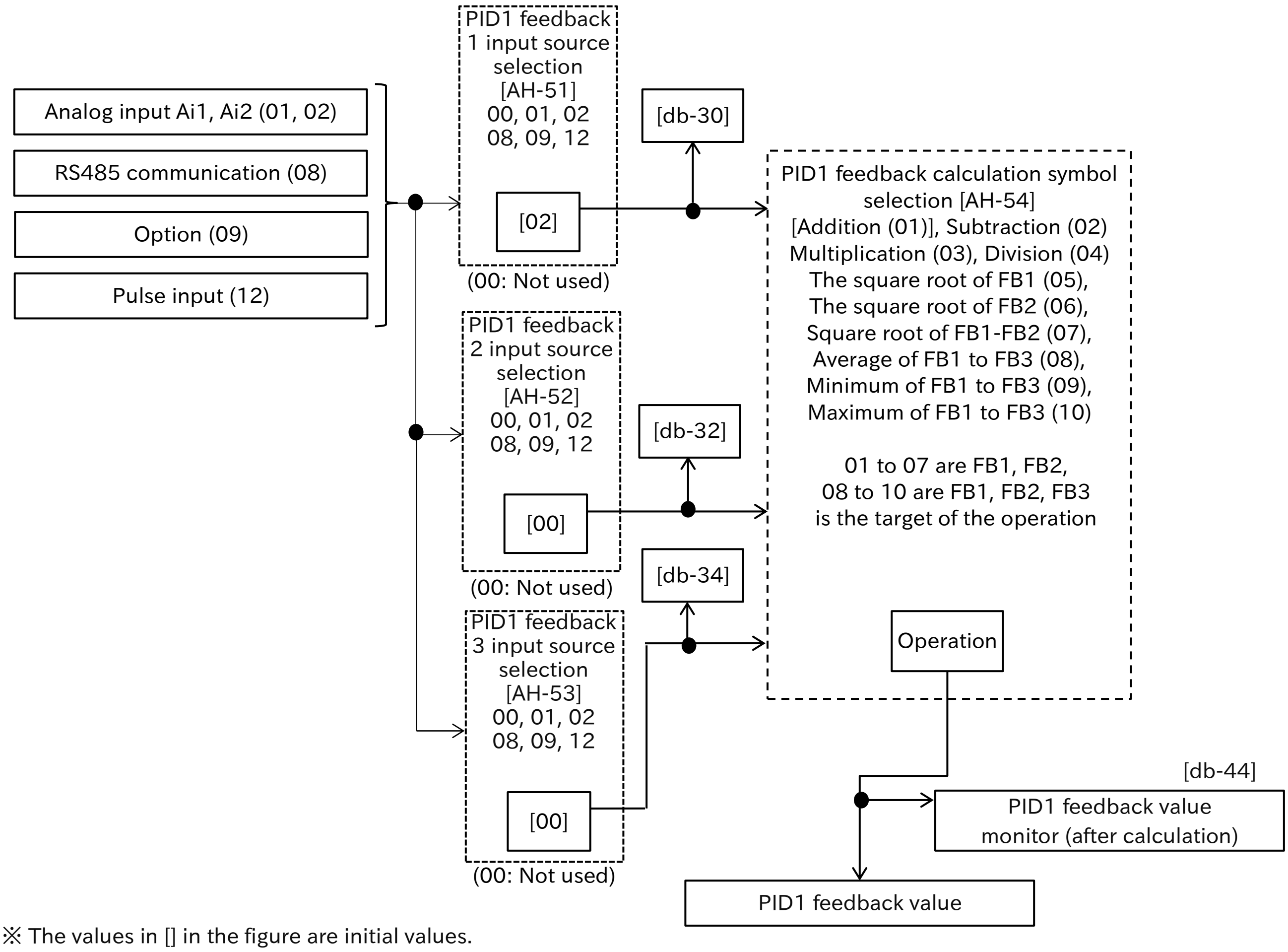
PID1 feedback data selection

- To set the feedback data input to PID1 feedback data 1 only, set "PID1 feedback 2/3 input source selection ([AH-52], [AH-53])" to "Not used (00)", and set "PID1 feedback calculation symbol selection [AH-54]" to "Addition (01)".
- When (01) to (07) is selected in [AH-54], feedback data 1 and feedback data 2 become calculation targets. When (08) to (10) is selected in [AH-54], feedback data 1 to 3 become calculation targets.
- The [AH-54] operation is limited to a range between -100.00% and 100.00%.

!

- Select "Not used (00)" for the set-point and feedback value that are not used.
- Data set to 00 (Not used) in the input source selection is excluded from the calculation target.
- The calculation of "PID1 feedback calculation symbol selection [AH-54]" is enabled only when (01) to (04) are selected in "PID1 set-point calculation symbol selection [AH-50]". When [AH-50] is set to (05) or (06), the calculation of [AH-54] is not executed.

Feedback data selection block diagram



※ The values in [] in the figure are initial values.

Code	Name	Description	Data
[db-30]	PID1 feedback value 1 monitor	Displays PID1 feedback value 1.	-100.00 to 100.00 (%)*1
[db-32]	PID1 feedback value 2 monitor	Displays PID1 feedback value 2.	
[db-34]	PID1 feedback value 3 monitor	Displays PID1 feedback value 3.	
[db-44]	PID1 feedback value monitor (after calculation)	Displays the feedback value after calculation in [AH-54].	-100.00 to 100.00 (%)*1
[AH-51] [AH-52] [AH-53]	PID1 feedback 1/2/3 input source selection	Not used	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		RS485	08
		Option	09
		Pulse input	12
[AH-54]	PID1 feedback calculation symbol selection	Addition	01
		Subtraction	02
		Multiplication	03
		Division	04
		Square root of FB1	05
		Square root of FB2	06
		Square root of FB1-FB2	07
		Average of the three inputs	08
		Minimum of the three inputs	09
		Maximum of the three inputs	10

*1. "PID1 scale adjustment ([AH-04] to [AH-06]) will change the setting.
For more information, refer to "9.8.5 Unit Converter Function for PID Control".

PID1 inverted output

- In normal PID control, if the PID operation result is negative, the inverter limits the frequency reference by 0 Hz without outputting it in negative. When "PID1 enable [AH-01]" is set to "Enable (with inverted output) (02)", the frequency reference can be output in the reverse direction if PID operation result is negative.

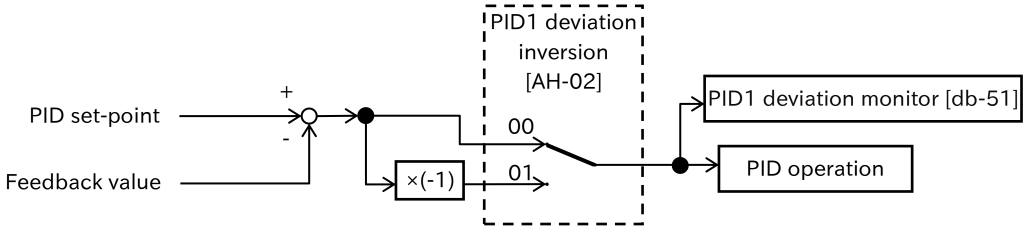
- If "PID1 enable [AH-01]" is set to "Enable (with inverted output) (02)", the output limit due to "PID1 output range [AH-71]" is extended to the minus direction.

Code	Name	Description	Data
[AH-01]	PID1 enable	Disable	00
		Enable: Even if the reference by PID operation becomes negative, it will not be outputting in the reverse direction.	01
		Enable (with inverted output): When the reference by PID operation becomes negative, it will be outputting in the reverse direction.	02

A PID1 deviation ± output switching

- The PID1 deviation can be switched ± before PID operation.
- When "PID1 deviation inversion [AH-02]" is "Disable (00)", PID1 deviation is calculated as (PID set-point - FB value). When [AH-02] is "Enable (01)", the PID1 deviation is the same as (FB value - PID set-point).
- This function is used when the polarity of deviation between the PID set-point and the FB value does not match the inverter reference due to the sensor's properties.

  e.g.) Controls refrigerator compressors with temperature sensor specifications of -20˜100˚C:
  When feedback data is received with analog voltage input 0 to 10 VDC and the set-point is 0˚C, if the current temperature is 10˚C (FB value) > (PID set-point), the speed will be reduced by normal PID control.
  In such cases, the inverter speed can be increased by setting [AH-02] =01.

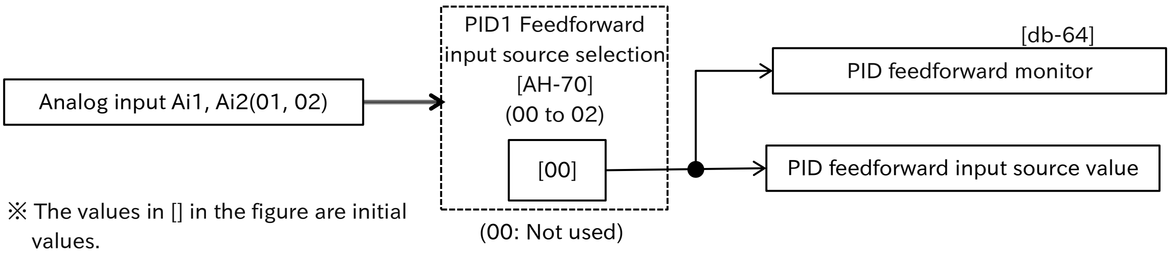


※ The position of the switch in the figure shows the initial values of the parameter.

Code	Name	Description	Data
[AH-02]	PID1 deviation inversion	Disable	00
		Enable: Deviation is the difference between the set-point and the feedback data multiplied by (-1).	01

A PID feedforward function

- By setting "PID1 feedforward input source selection [AH-70]" to other than "Not used (00)", can enable the feedforward input and select the input source.
- Feedforward control is only enabled on PID1.



※ The values in [] in the figure are initial values.

Code	Name	Description	Data
[AH-70]	PID1 feedforward input source selection	Not used: Feedforward disabled	00
		Terminal [Ai1]: Input from the [Ai1] terminal is used for feedforward.	01
		Terminal [Ai2]: Input from the [Ai2] terminal is used for feedforward.	02

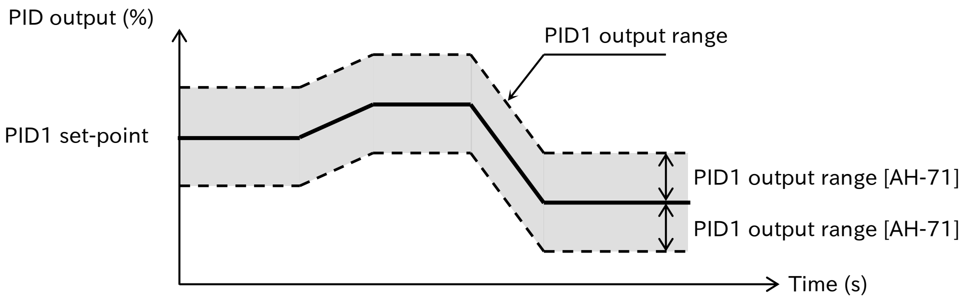
A

PID1 output range restriction

- Limits the PID1 output to a variable range relative to the PID1 set-point.
- The restriction function is disabled by setting "PID1 output range [AH-71]" to 0.00 %.

!

- Set "PID1 output range [AH-71]" with the maximum frequency setting to 100 %. PID1 output is limited within PID1 set-point ± [AH-71].



Code	Name	Description	Data
[AH-71]	PID1 output range	The output range of PID1 output is limited by PID1 set-point ± this setting. Set the maximum frequency as 100 %.	0.00 to 100.00 (%)

A

PID1 integration reset function

- This function clears the integral value of PID1 operation. To turn ON "PID1 integration reset [PIDC]" input terminal, perform this procedure when PID1 is not operating.

!

- If "PID1 integration reset [PIDC]" input terminal is turned ON during PID1 operation, the accumulated value added to PID1 output reference is cleared, and the PID1 output reference value changes rapidly, causing an overcurrent error, etc.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	PID1 integration reset [PIDC]: When this signal is turned ON, the integral value of PID control is cleared to 0.	042

A

PID1 disable function

- Turn ON "Disable PID1 [PID]" input terminal to temporarily disable the operation of PID1 and output according to the frequency reference.
- When PID1 is disabled, a 100 % of the PID1 set-point will be the maximum frequency for frequency reference setting.

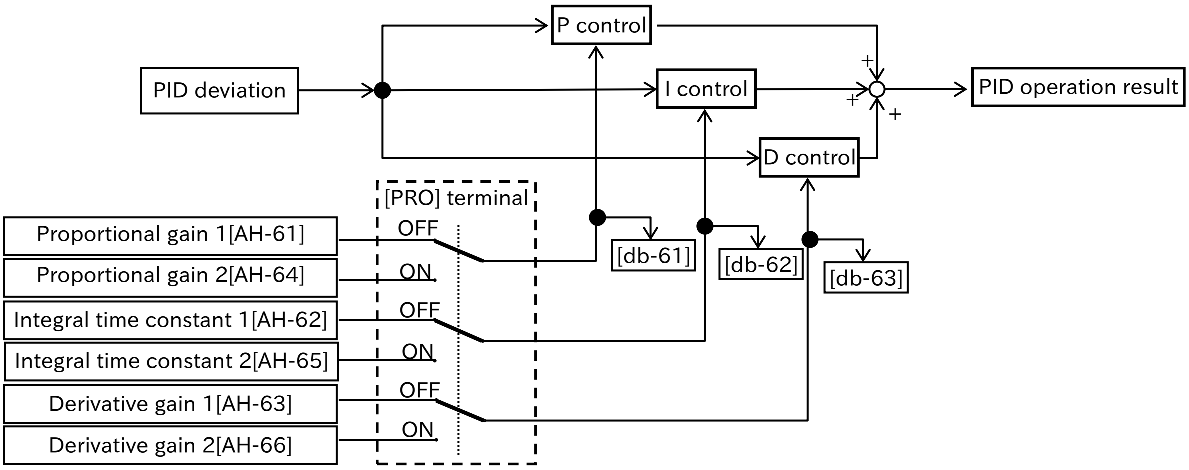
Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Disable PID1 [PID]: When this signal is turned ON, PID operation is disabled, and the normal frequency operation is performed.	041

A

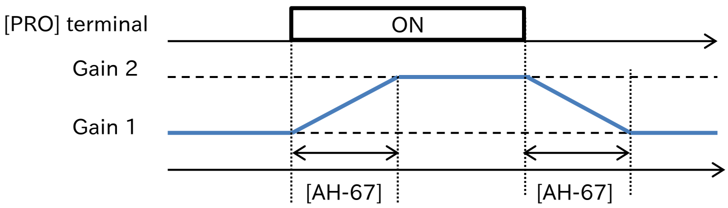
PID1 gain change / gain adjustment

Toggle and control the gain of PID1

- PID gain can be switched between gain 1 and gain 2 by turning ON/OFF "PID gain change [PRO]".
- To use the [PRO] input terminal, set "PID1 gain change method selection [AH-60]" to "[PRO] terminal (01)".



- PID gain is continuously switched at the time of "PID1 gain change time [AH-67]".
- Each gain of PID1 can be checked in "Current PID P/I/D-Gain monitor ([db-61] to [db-63])".



Adjust the operation of PID1

- When PID1 function does not respond stably, adjust as described below.

!

- If the acceleration/deceleration time setting is long, the output frequency tracking may be delayed and control may not work well. In this case, set the acceleration/deceleration time shorter.

Phenomena ▷	Example of remedy
• Even if PID set-point is changed, the output responses slowly and the feedback value changes slowly.	Increase "PID1 proportional gain 1/2 ([AH-61], [AH-64])".
• Feedback value changes quickly and does not stabilize. • Overshoot and hunting occur	Decrease "PID1 proportional gain 1/2 ([AH-61], [AH-64])".
• Feedback value oscillates slowly. • Operation takes long time to stabilize.	Increase "PID1 integral time constant 1/2 ([AH-62], [AH-65])".
• PID set-point and feedback value does not match easily.	Decrease "PID1 integral time constant 1/2 ([AH-62], [AH-65])".
• Slow response even when proportional gain is increased. • Small hunting occurs.	Increase "PID1 derivative gain 1/2 ([AH-63], [AH-66])".
• The disturbance reaction becomes large and takes time to stabilize.	Decrease "PID1 derivative gain 1/2 ([AH-63], [AH-66])".

Code	Name	Description	Data
[AH-60]	PID1 gain change method selection	Constant gain (Using gain-1 only)	00
		Switching by [PRO] input terminal	01
[AH-61]	PID1 proportional gain 1	Set PID proportional gain 1.	0.0 to 100.0
[AH-62]	PID1 integral time constant 1	Set PID integral time constant 1.	0.0 to 3600.0 (s)
[AH-63]	PID1 derivative gain 1	Set PID derivative gain 1.	0.00 to 100.00 (s)
[AH-64]	PID1 proportional gain 2	Set PID proportional gain 2.	0.0 to 100.0
[AH-65]	PID1 integral time constant 2	Set PID integral time constant 2.	0.0 to 3600.0 (s)
[AH-66]	PID1 derivative gain 2	Set PID derivative gain 2.	0.00 to 100.00 (s)
[AH-67]	PID1 gain change time	Set the time after [PRO] input terminal is activated before the gain switches.	0 to 10000 (ms)
[CA-01] to [CA-08]	Input terminal function	PID gain change [PRO]: The gain 1 and gain 2 of PID1 can be switched by ON/OFF this signal. The current PID gain can be checked on the monitor below. "Current PID P-Gain monitor [db-61]" "Current PID I-Gain monitor [db-62]" "Current PID D-Gain monitor [db-63]"	055

A

PID1 set-point 1 remote control function ([FUP]/[FDN]/[UDC] input terminal function)

- The remote control function increases or decreases the current PID1 set-point 1 by turning ON "Remote control Speed-Up function [FUP](020)" or "Remote control Speed-DOWN function [FDN](021)" input terminal.
- This function is enabled when PID1 set-point 1 input source is as follows.
  - When "PID1 set-point 1 input source selection [AH-07]" is "Parameter setting (07)".
  - When PID1 set-point 1 source is a multistage set-point reference.
  - When "PID1 set-point 1 input source selection [AH-07]" is "Terminal [Ai1] (01)" or "Terminal [Ai2] (02)" and "Analog command holding [AHD]" input terminal is ON.
- When "[FUP]/[FDN] data save selection [CA-61]" is set to "Save (01)", the PID1 set-point 1 after [FUP]/[FDN] is stored in the inverter when the power is turned off or the input source reference is switched.
- When [FUP]/[FDN] input terminal is ON, the acceleration/deceleration time follows "Acceleration time setting for [FUP]/[FDN] function [CA-64]"/"Deceleration time setting for [FUP]/[FDN] function [CA-66]".
- When "Remote control Speed data clearing [UDC] (022)" input terminal is turned ON, PID1 set-point 1 reference value adjusted by [FUP]/[FDN] input terminal will be the value originally stored prior to adjustment by [FUP]/[FDN] input terminal or 0Hz according to the setting of "FUP/FDN [UDC] selection [CA-62].

!

- Do not turn ON/OFF [FUP]/[FDN] input terminal or operate JOG dial on keypad immediately after turning off the power. The modified PID1 set-point 1 reference may not be stored correctly.
- Refer to "9.2.14 Increasing/Decreasing Frequency Reference by Input Terminal Function" for detailed information on the operations at input terminal functions "Remote control Speed-UP function [FUP]", "Remote control Speed-DOWN function [FDN]", "Remote control Speed data clearing [UDC]" and "Analog command hold [AHD]".

Code	Name	Description	Data
[CA-60]	FUP/FDN overwrite target selection	Override the frequency reference value.	00*1
		It is overwritten to PID1 set-point 1 (PID1 set-point 1 setting ([AH-10] or [FA-30]), multistage set-point 1 to 15 ([AH-12] to [AH-40]) and analog input holding value [AHD]*1 for analog input.	01
[CA-61]	FUP/FDN data save enable	Not save: When the power is turned off or the frequency input source is switched, PID1 set-point 1 that was accelerated/decelerated by [FUP]/[FDN] is not saved in the internal memory.	00
		Save: When the power is turned off or the frequency input source is switched, PID1 set-point 1 that was accelerated/decelerated by [FUP]/[FDN] is saved in the internal memory.	01
[CA-62]	FUP/FDN UDC selection	0Hz: Cleared to 0Hz.	00
		Saved data: Change to the data saved before using [FUP]/[FDN] input terminals.	01
[CA-64]	Acceleration time setting for FUP/FDN function	Set the acceleration time for [FUP]/[FDN] function.	0.00 to 3600.00 (s)
[CA-66]	Deceleration time setting for FUP/FDN function	Set the deceleration time for [FUP]/[FDN] function.	0.00 to 3600.00 (s)
[CA-01] to [CA-08]	Input terminal function	Remote control Speed-UP [FUP]: When this terminal is ON, PID1 set-point 1 reference is increased.	020
		Remote control Speed-DOWN [FDN]: When this terminal is ON, PID1 set-point 1 reference is decreased.	021
		Remote control Speed data clearing [UDC]: When this terminal is turned ON, PID1 target value1 command is cleared. The value at clearing follows the setting of [CA-62].	022

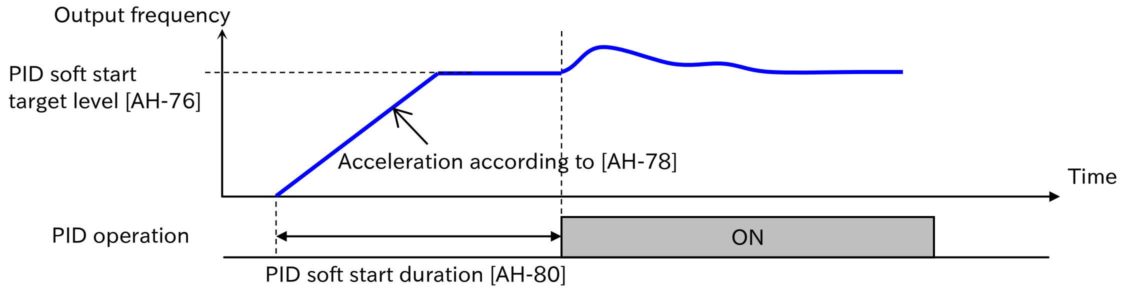
*1. For details, refer to "9.2.14 Increasing/Decreasing Frequency Reference by Input Terminal Function".

A

PID soft start function

PID soft start function

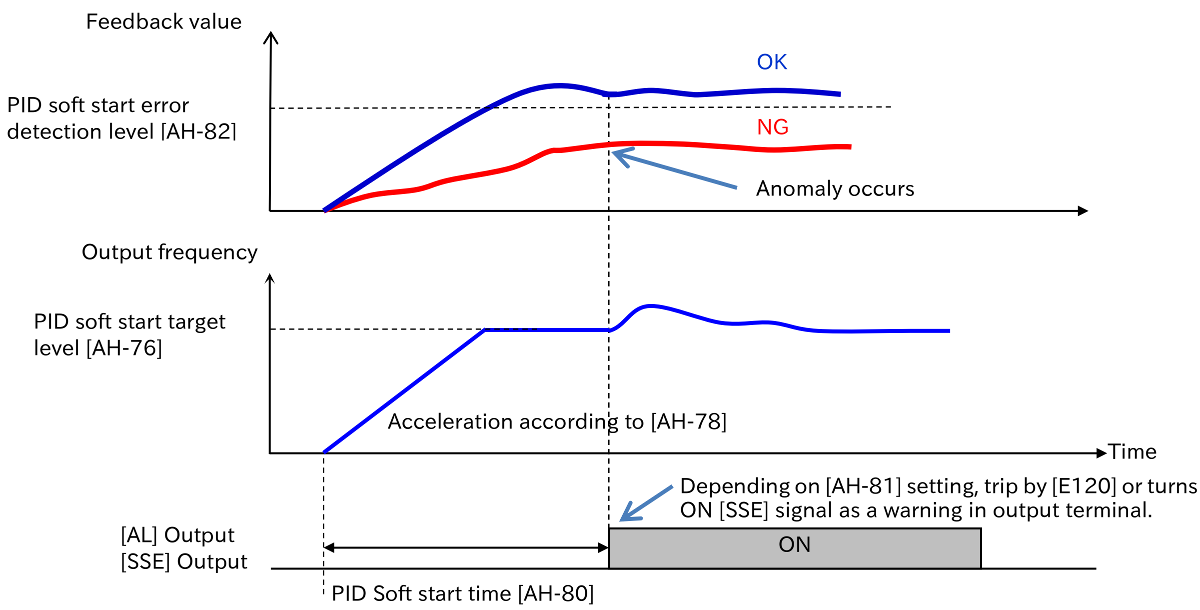
- To use this function, set PID1 control to Enable ([AH-01]=01,02]) and set "PID soft start function enable [AH-75]" to "Enable (01)".
- When this function is activated, accelerates at "Acceleration time setting for PID soft start function [AH-78]" until "PID soft start target level [AH-76]" is reached.
- PID control is automatically switched to PID control after the time set in "PID soft start time [AH-80]" has elapsed.
- PID soft start is only available in PID1.



Code	Name	Description	Data
[AH-75]	PID soft start function enable	Disable	00
		Enable	01
[AH-76]	PID soft start target level	Set the set-point in percentage for the soft-start section assuming that the maximum frequency is 100 %.	0.00 to 100.00 (%)
[AH-78]	Acceleration time setting for PID soft start function	Set the acceleration time at soft start.	0.00 to 3600.00 (s)
[AH-80]	PID soft start time	Set the duration of PID soft start function.	0.00 to 600.00 (s)

PID soft start error detection

- This function is intended to detect damage to the pipes such as water leaks.
- After the time set in "PID soft start time [AH-80]" has elapsed, if the FB value is lower than "PID soft start error detection level [AH-82]", it is judged as abnormal.
- When judged as abnormal, the abnormal behavior depends on the setting of "PID soft start error detection enable [AH-81]".
  - When [AH-81] is set to "Disable (00)":
    Do nothing.
  - When [AH-81] is set to Enable (Error) (01):
    Trip at "PID soft start error [E120]" when elapses the set time of [AH-80].
  - When [AH-81] is set to "Enabled (Warning) (02)":
    Turns ON the output terminal function "PID soft start error [SSE]" when the set time of [AH-80] has elapsed. The [SSE] signal remains ON while the inverter is running.



Code	Name	Description	Data
[AH-81]	PID soft start error detection enable	Disable	00
		Enable (Error): When the start error is judged, trips with "PID soft start error [E120]".	01
		Enable (Warning): When the start error is judged, "PID soft start error [SSE]" will be ON.	02
[AH-82]	PID soft start error detection level	Set the level at which PID soft start error is activated during PID soft start.	0.00 to 100.00 (%)
[CC-01] [CC-02] [CC-07]	Output terminal function	PID soft start error [SSE]: When "PID soft start error detection enable [AH-81]" is set to "Enable (Warning) (02)", turns ON the signal when detect abnormal startup on PID soft start.	093

A

PID sleep function

PID sleep function

- To use this function, set "PID sleep trigger selection [AH-85]" to "Low output (01)" or "[SLEP] terminal (02)".
- You can change the time to start and wake, and levels of sleep operations to suit your needs.
- To cancel PID sleep state, you can select "Deviation value (01)", "Low feedback (02)" or "[WAKE] terminal (03)" of "PID wake trigger selection [AH-93]".

!

- When canceling PID sleep with deviation, even if ± of PID deviation is switched by setting "PID1 deviation inversion [AH-02]" to "Enable (01)," it will be canceled only when PID deviation expands to plus and PID output becomes 0 or more. For example, if the set-point level is set to 0 during sleep and PID output=0 continues, the sleep state cannot be canceled.
- PID sleep function is available only in PID1.

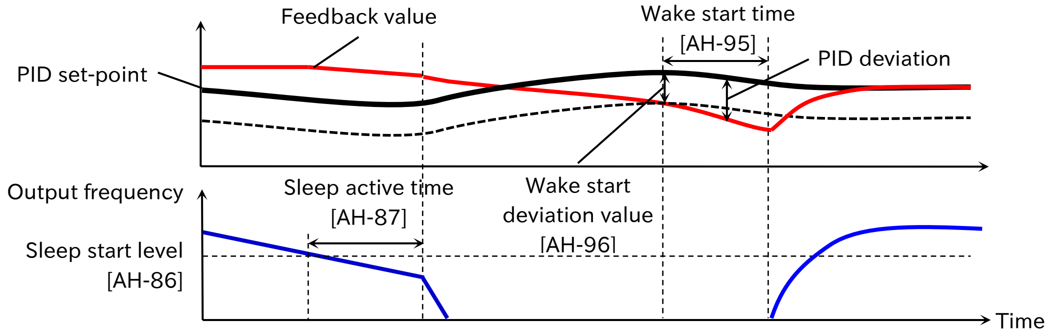
PID sleep setting

Code	Name	Description	Data
[AH-85]	PID sleep trigger selection	Disable	00
		Low output: Starts sleep operation when output drops	01
		[SLEP] terminal: Starts operation when rises edge of the [SLEP] input terminal.	02
[AH-86]	PID sleep start level	Set the frequency at which the sleep operation starts when [AH-85] is set to "Low output (01)".	0.00 to 590.00 (Hz)
[AH-87]	PID sleep active time	Set the waiting time before transitioning to sleep operation.	0.00 to 100.00 (s)
[CA-01] to [CA-08]	Input terminal function	SLEEP condition activation [SLEP]: When "PID sleep trigger selection [AH-85]" is set to "[SLEP] terminal (02)", the sleep function is started by this signal.	058

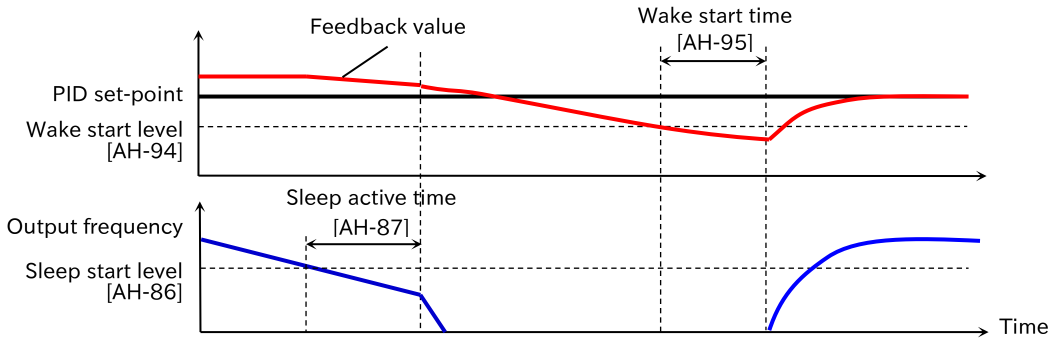
PID wake setting

Code	Name	Description	Data
[AH-93]	PID wake trigger selection	Deviation value: If the deviation value is [AH-96] or more and continues for [AH-95] or longer, the sleep state is canceled.	01
		Low feedback: If the feedback valueis below [AH-94] and continues for [AH-95] or longer, the sleep state is canceled.	02
		[WAKE] terminal: After the ON edge input of the [WAKE] input terminals, the sleep state is canceled when [AH-95] set time elapses.	03
[AH-94]	PID wake start level	Set the feedback level that cancel the sleep operation, when [AH-93] is set to "Low feedback (02)".	0.00 to 100.00 (%)
[AH-95]	PID wake start time	Set the standby time for canceling sleep operation.	0.00 to 100.00 (s)
[AH-96]	PID wake start deviation value	Set the deviation value between the set-point and feedback value that cancel the sleep operation, when [AH-93] is set to "Deviation value (01)".	0.00 to 100.00 (%)
[CA-01] to [CA-08]	Input terminal function	WAKE condition activation [WAKE]: When "PID wake trigger selection [AH-93]" is set to "[WAKE] terminal (03)", the sleep function is canceled by this signal.	059

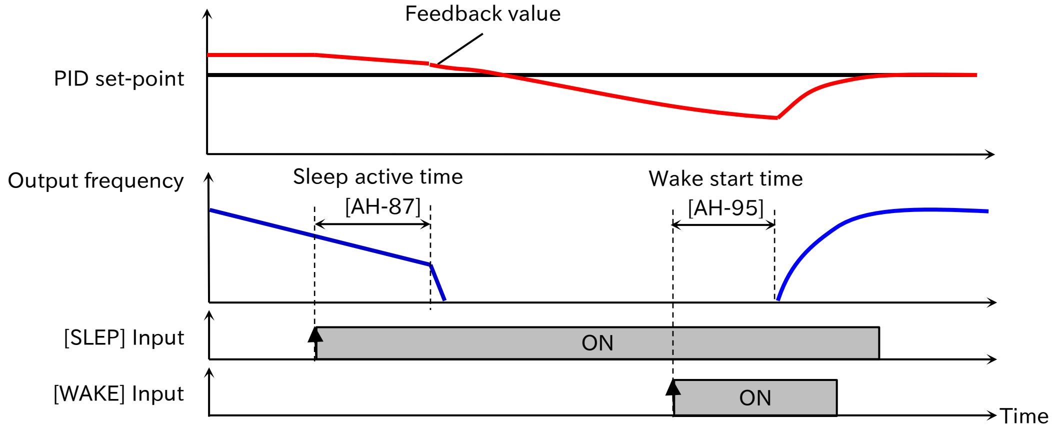
(e.g. 1)
- [AH-85] Sleep start: Low output (01)
  When the output frequency continuosly falls below the level of "PID sleep start level [AH-86]" for the time set in "PID sleep active time [AH-87]", enters to sleep operation.
- [AH-93] Sleep cancel: Deviation value (01)
  When PID deviation exceeds the "PID wake start deviation value [AH-96]" continuously for the time set in "PID wake start time [AH-95]", the sleep cancel operation will be started. Although the setting of [AH-02] works with either "Disable (00)" or "Enable (01)", be sure that the PID output expands in the positive direction in the relationship between the set-point and the feedback value.



(e.g. 2)
- [AH-85] Sleep start: Low output (01)
  If the output frequency falls below [AH-86] continuously for the time set to [AH-87], enters to sleep operation.
- [AH-93] Sleep cancel: Low feedback (02)
  If the feedback falls below [AH-94] continuously for the time set to [AH-95], enters to sleep cancel operation.

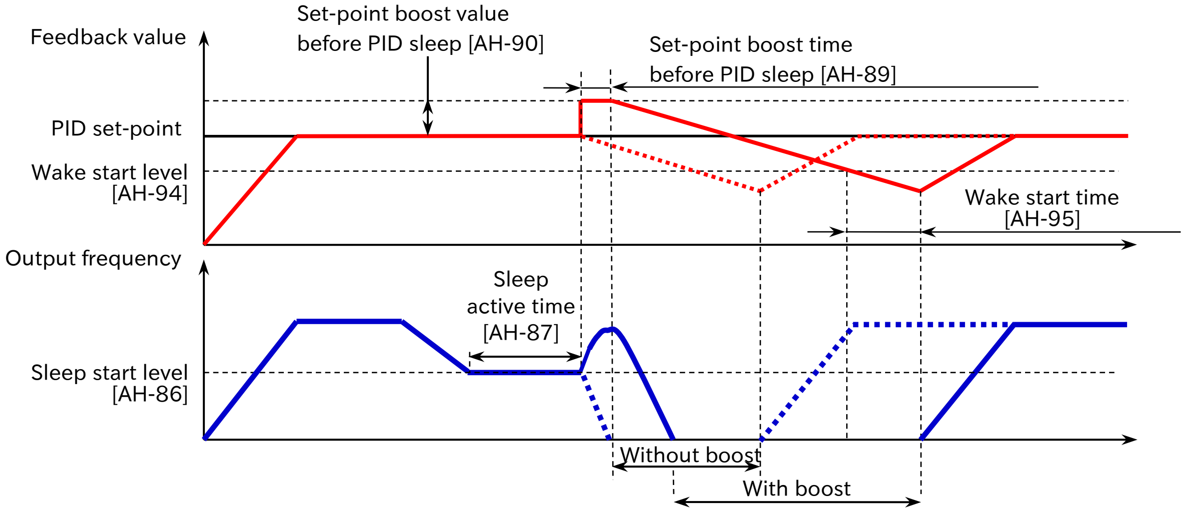


(e.g. 3)
- [AH-85] Sleep start: [SLEP] terminal (02)
  After the [AH-87] set time elapses from the ON edge of [SLEP] input terminal, enters to sleep operation.
- [AH-93] Sleep cancel: [WAKE] terminal (03)
  After the [AH-95] set time elapses from the ON edge of [WAKE] input terminal, enters to sleep cancel operation.



Boost function before sleep

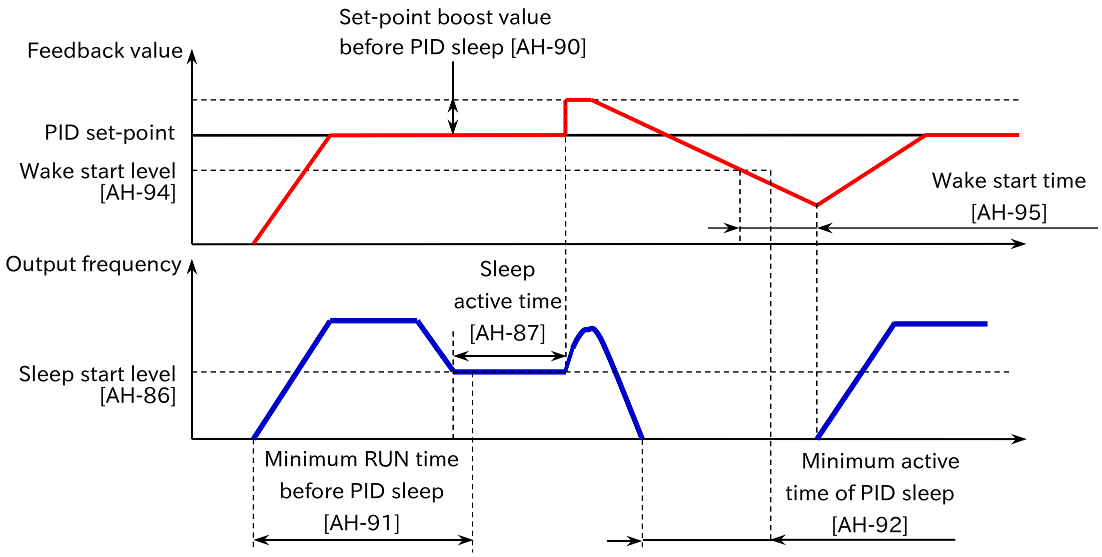
- Increase PID set-point before sleep to increase the feedback amount. This function allows to maintain the sleep state for a longer period of time.
- The following diagram shows an example of "PID sleep wake trigger selection [AH-85]" set to "Low output (01)" and "PID wake trigger selection [AH-93]" set to "Low feedback (02)".
- When "Enable set-point boost before PID sleep [AH-88]" is set to "Enable (01)," if the output frequency falls below "PID sleep start level [AH-86]" set to "PID sleep active time [AH-87]", the "Set-point boost value before PID sleep [AH-90]" will be added to PID set-point value during "Set-point boost time before PID sleep [AH-89]".



Code	Name	Description	Data
[AH-88]	Enable set-point boost before PID sleep	Disable	00
		Enable: Increase (boost) the set-point before the sleep operation starts.	01
[AH-89]	Set-point boost time before PID sleep	Set the time to perform the boost before the sleep operation starts.	0.00 to 100.00 (s)
[AH-90]	Set-point boost value before PID sleep	Set the amount of addition (boosting amount) to PID set-point before the sleep operation starts.	0.00 to 100.00 (%)

PID sleep function disable time

- You can prevent frequent switching between PID sleep state and PID wake state by specifying the "Minimum RUN time before PID sleep [AH-91]" and the "Minimum active time of PID sleep [AH-92]".



Code	Name	Description	Data
[AH-91]	Minimum RUN time before PID sleep	Until [AH-91] elapses after starting, will not go into sleep operation even if the conditions are met.	0.00 to 100.00 (s)
[AH-92]	Minimum active time of PID sleep	After enters to the sleep state, will remains in the sleep state until [AH-92] elapses, even if the conditions are met.	0.00 to 100.00 (s)

9.8.3 Using PID2 Control

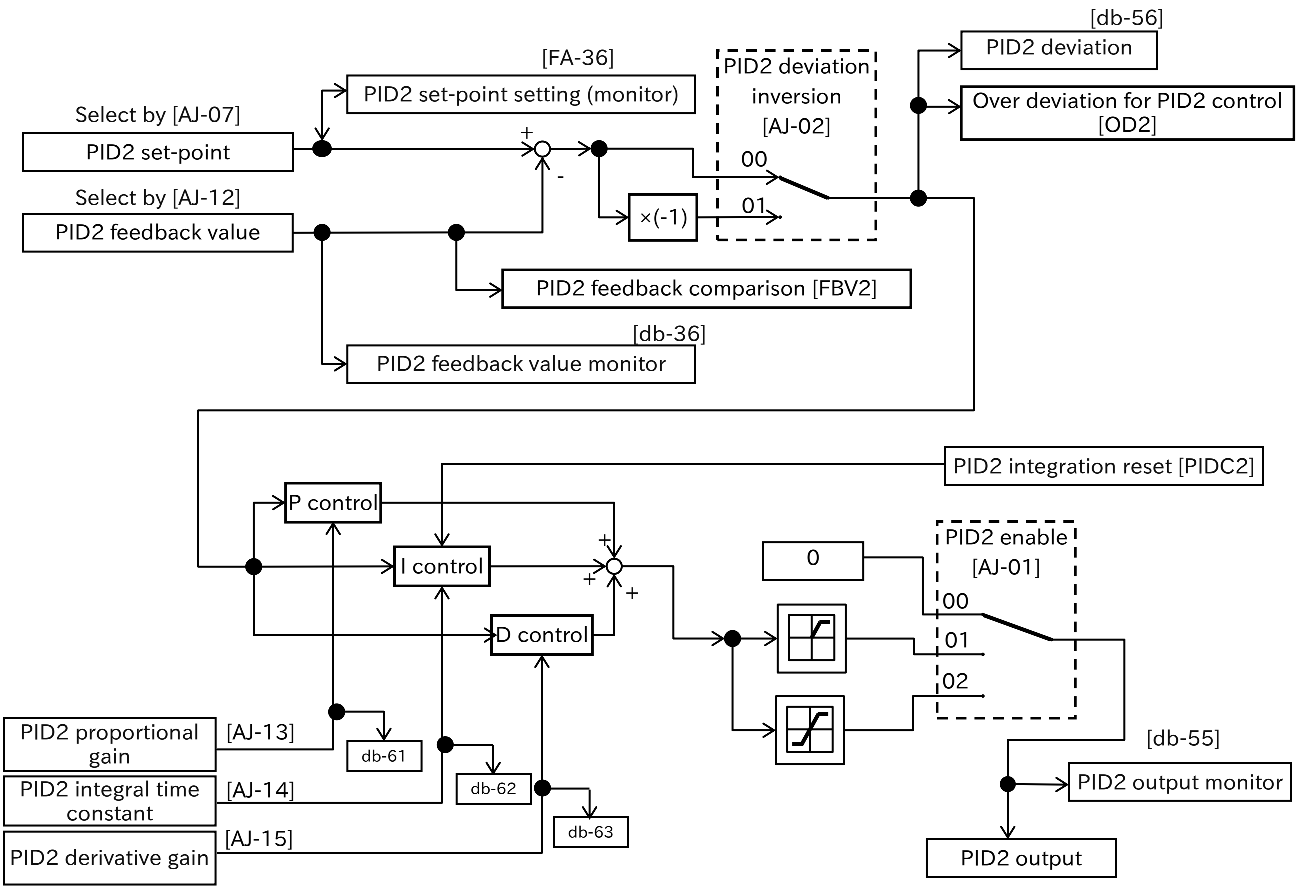
Q

- You want to switch between two types of PID control.
- You want to control considering the effects from multiple systems.

A

- PID1 and PID2 operate independently.
- Switching PID1, PID2 by input terminal, can be used for batch control switching, etc.
- PID2 can select the output of PID1 as the set-point. This allows cascade control considering the effects from the two systems.

■ PID2 block diagram

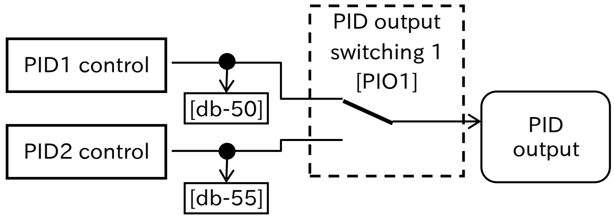


※ The switches of the parameters in the figure show the initial values.

Switching between PID1 and PID2

- PID1, PID2 can be switched by ON/OFF the input terminal function "PID output switching 1 [PIO1]".

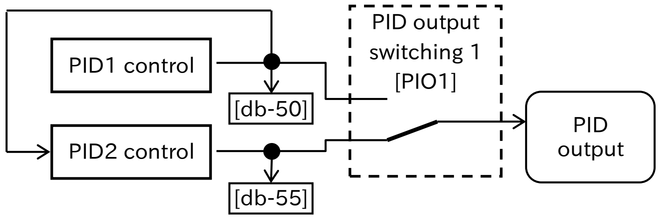
PID function	[PIO1]
PID1 enabled	OFF
PID2 enabled	ON



Connect PID1 and PID2

- PID2 can be cascaded with PID1 by setting PID2 set-point to PID1 output. ([AJ-07]=15)
- When cascading, set "PID2 set-point input source selection [AJ-07]" to "PID1 output (15)" and enable the output reference of PID2 at the "PID output switching 1 [PIO]" input terminal as shown below.

PID function	[PIO1]
PID2 enabled	ON



PID2 related monitor

Code	Name	Description	Data
[FA-36]	PID2 set-point setting (monitor)	Monitor or change the setting of the currently selected PID2 set-point. If the input source selection is set to parameter setting (=[AJ-10]), changing/saving [FA-36] will also change/save [AJ-10].	-100.00 to 100.00 (%)*1
[db-36]	PID2 feedback value monitor	Displays PID2 feedback value.	-100.00 to 100.00 (%)*1
[db-55]	PID2 output monitor	Displays PID2 output.	-100.00 to 100.00 (%)
[db-56]	PID2 deviation monitor	Displays PID2 deviation.	-200.00 to 200.00 (%)
[db-61]	Current PID P-Gain monitor	Displays the current P gain.	0.0 to 100.0
[db-62]	Current PID I-Gain monitor	Displays the current I gain.	0.0 to 3600.0 (s)
[db-63]	Current PID D-Gain monitor	Displays the current D gain.	0.00 to 100.00 (s)

*1. "PID2 scale adjustment ([AJ-04] to [AJ-06]) will change the setting.
For more information, refer to "9.8.5 Unit Converter Function for PID Control".

■ PID2 relevant parameters

Code	Name	Description	Data
[AJ-01]	PID2 enable	Disable	00
		Enable: Even if the refernce by PID operation becomes negative, it will not be outputting in the reverse direction.	01
		Enable (with inverted output): When the reference by PID calculation becomes negative, it will be outputting in the reverse direction.	02
[AJ-02]	PID2 deviation inversion	Disable	00
		Enable: Deviation is the difference between the set-point and the feedback data multiplied by (-1).	01
[AJ-03]	PID2 unit selection	Change the units and scale of some monitors/parameters of PID2. For more information, refer to "9.8.5 Unit Converter Function for PID Control".	00 to 58
[AJ-04]	PID2 scale adjustment (0%)		-10000 to 10000
[AJ-05]	PID2 scale adjustment (100%)		-10000 to 10000
[AJ-06]	PID2 scale adjustment (decimal point position)		0 to 4
[AJ-07]	PID2 set-point input source selection	Not used	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		Parameter setting	07
		RS485	08
		Option	09
		Pulse input	12
		PID1 output	15
[AJ-10]	PID2 set-point setting	When "Parameter setting (07)" is selected as PID2 set-point input source selection, set PID2 set-point.	-100.00 to 100.00 (%)*1
[AJ-12]	PID2 feedback Input source selection	Not used	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		RS485	08
		Option	09
		Pulse input	12
[AJ-13]	PID2 proportional gain	Set PID2 proportional gain.	0.0 to 100.0
[AJ-14]	PID2 integral time constant	Set PID2 integration time constant.	0.0 to 3600.0 (s)
[AJ-15]	PID2 derivative gain	Set PID2 derivative gain.	0.00 to 100.00 (s)
[AJ-16]	PID2 output range	The output range of PID2 output is limited by PID2 set-point ± this setting. Set the maximum frequency as 100 %.	0.00 to 100.00 (%)
[AJ-17]	PID2 over deviation level	Set the level at which the deviation between set-point of PID2 and feedback data is considered excessive. For more information, refer to "9.8.4 Output Terminal function Related to PID function".	0.00 to 100.00 (%)
[AJ-18]	Turn-off level for the PID2 feedback compare signal	Set the tolerance range for feedback data of PID2. For more information, refer to " 9.8.4 Output Terminal Function Related to PID Control".	0.00 to 100.00 (%)
[AJ-19]	Turn-on level for PID2 feedback compare signal		

*1. "PID2 scale adjustment ([AJ-04] to [AJ-06]) will change the setting.
For more information, refer to "9.8.5 Unit Converter Function for PID Control".

■ PID2 related input/output terminal functions

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Disable PID2 [PID2]: When this signal is turned ON, PID operation is disabled, and the normal frequency operation is performed.	043
		PID2 integration reset [PIDC2]: When this signal is turned ON, the integral value of PID control is cleared to 0.	044
		PID output switching 1[PIO1]: Between the PID1 and PID2 output can switch by turning ON / OFF this signal.	056
[CC-01] [CC-02] [CC-07]	Output terminal function	Over deviation for PID2 control [OD2]: When PID2 deviation exceeds the set level of "PID2 over deviation level [AJ-17]", this signal turns ON.	047*1
		PID2 feedback comparison [FBV2]: Compares the PID2 feedback value and "Turn-on/off level for the PID2 feedback compare signal ([AJ-18]/[AJ-19])" and turns the signal ON/OFF.	048*1

*1. For more information, refer to "9.8.4 Output Terminal Function Related to PID Control".

A

PID2 inverted output

- In normal PID control, if PID operation result is negative, the inverter limits the frequency reference by 0 Hz without outputting it in negative. When "PID2 enable [AJ-01]" is set to "Enable (with inverted output) (02)", the frequency reference can be output in the reverse direction if PID operation result is negative.

!

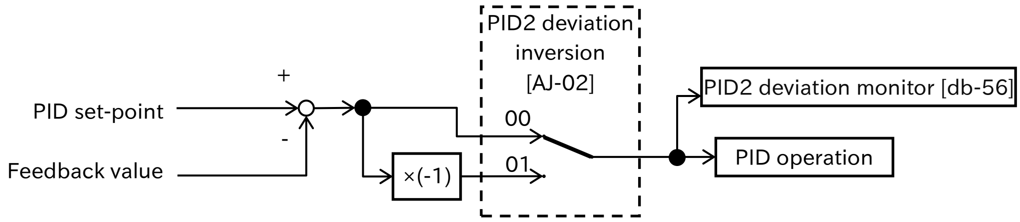
- If "PID2 enable [AJ-01]" is set to "Enable (with inverted output) (02)", the output limit due to "PID2 output range [AJ-16]" is extended to the minus direction.

Code	Name	Description	Data
[AJ-01]	PID2 enable	Disable	00
		Enable: Even if the reference by PID operation becomes negative, it will not be outputting in the reverse direction.	01
		Enable (with inverted output): When the reference by PID operation becomes negative, it will be outputting in the reverse direction.	02

A

PID2 deviation ± output switching

- The PID2 deviation can be switched ± before PID operation.
- When "PID2 deviation inversion [AJ-02]" is "Disable (00)", PID2 deviation is calculated as (PID set-point - FB value). When [AJ-02] is "Enable (01)", the PID2 deviation is the same as (FB - PID set-point).
- This function is used when the polarity of deviation between the PID set-point and FB value does not match the inverter reference due to the sensor's properties.



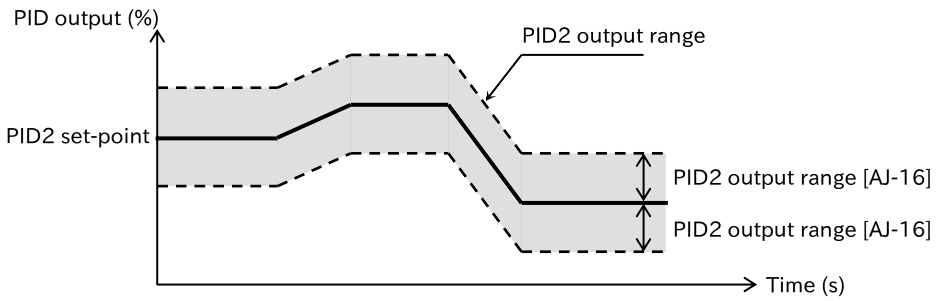
※ The position of the switch in the figure shows the initial values of the parameter.

Code	Name	Description	Data
[AJ-02]	PID2 deviation inversion	Disable	00
		Enable: Deviation is the difference between the set-point and the feedback data multiplied by (-1).	01

PID2 output range restriction

- Limits the PID2 output to a variable range relative to the PID1 set-point.
- The restriction function is disabled by setting "PID2 output range [AJ-16]" to 0.00 %.

- Set "PID2 output range [AJ-16]" with the maximum frequency setting to 100 %. PID2 output is limited within PID2 set-point ± [AJ-16].



Code	Name	Description	Data
[AJ-16]	PID2 output range	The output range of PID2 output is limited by PID2 set-point ± this setting. Set the maximum frequency as 100 %.	0.00 to 100.00 (%)

PID2 integration reset function

- This function clears the integral value of PID2 operation. To turn ON "PID2 integration reset [PIDC2]" input terminal, performs this procedure when PID2 is not operating.

- If "PID2 integration reset [PIDC2]" input terminal is turned ON during PID2 operation, the accumulated value added to PID2 output reference is cleared, and the PID2 output reference value changes rapidly, causing an overcurrent error, etc.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	PID2 integration reset [PIDC2]: When this signal is turned ON, the integral of PID control is cleared to 0.	044

PID2 disable function

- Turn ON "Disable PID2 [PID2]" input terminal to temporarily disable the operation of PID2 and output according to the frequency reference.
- When PID2 is disabled, a 100 % of the PID2 set-point will be the maximum frequency for frequency reference setting.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Disable PID2 [PID2]: When this signal is turned ON, PID operation is disabled, and the normal frequency operation is performed.	043

A

PID2 gain adjustment

Adjust the operation of PID2

- When PID2 function does not respond stably, adjust as described below.

!

- If the acceleration/deceleration time setting is long, the output frequency tracking may be delayed and control may not work well. In this case, set the acceleration/deceleration time shorter.

Phenomena ▷	Example of remedy
• Even if PID set-point is changed, the output responses slowly and the feedback value changes slowly.	Increase "PID2 proportional gain [AJ-13]".
• Feedback value changes quickly and does not stabilize. • Overshoot and hunting occur	Decrease "PID2 proportional gain [AJ-13]".
• The feedback value oscillates slowly. • Operation takes long time to stabilize.	Increase "PID2 integral time constant [AJ-14]".
• PID set-point and the feedback value does not match easily.	Decrease "PID2 integral time constant [AJ-14]".
• Slow response even when proportional gain is increased. • Small hunting occurs.	Increase "PID2 derivative gain [AJ-15]".
• The disturbance reaction becomes large and takes time to stabilize.	Decrease "PID2 derivative gain [AJ-15]".

Code	Name	Description	Data
[AJ-13]	PID2 proportional gain	Set PID2 proportional gain.	0.0 to 100.0
[AJ-14]	PID2 integral time constant	Set PID2 integral time constant.	0.0 to 3600.0 (s)
[AJ-15]	PID2 derivative gain	Set PID2 derivative gain.	0.00 to 100.00 (s)

9.8.4 Output Terminal Function Related to PID Control

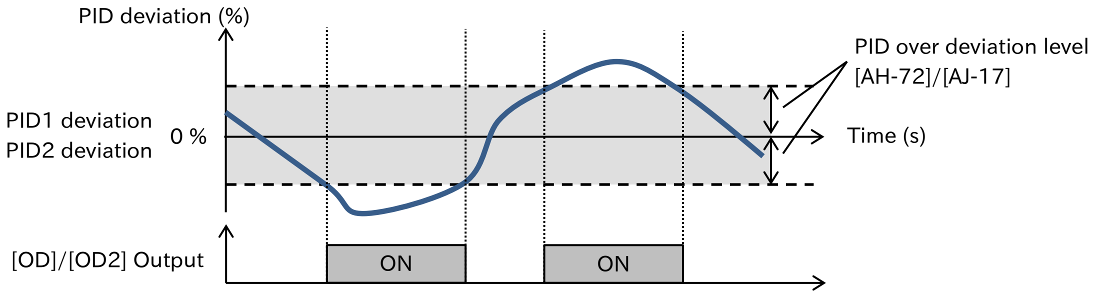
Q

- If the deviation between the set-point and the feedback value is too small or too large, you want to output a signal to the outside.
- If the feedback data shows an abnormal value, I would like to output a signal.

A

PID over deviation signal

- If PID deviation (difference between the set-point and the feedback value) exceeds the range set in "PID over deviation level ([AH-72], [AJ-17])", outputs "Over deviation for PID control ([OD], [OD2])" signal.

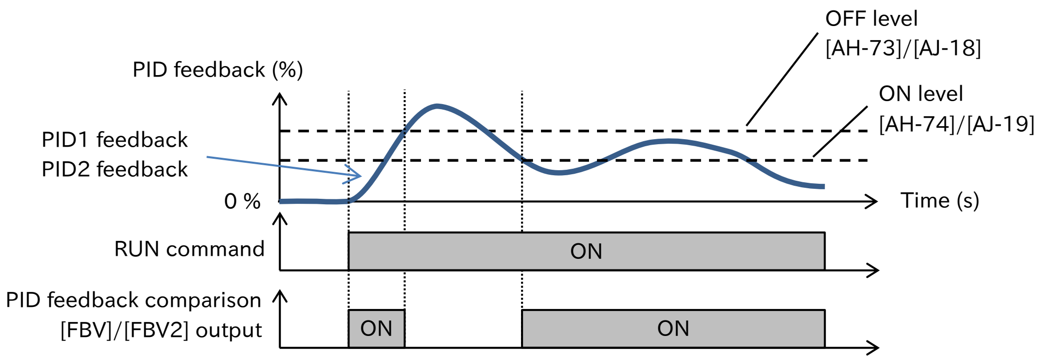


Code	Name	Description	Data
[db-51]	PID1 deviation monitor	Displays PID1 deviation.	-200.00 to 200.00 (%)
[db-56]	PID2 deviation monitor	Displays PID2 deviation.	-200.00 to 200.00 (%)
[AH-72]	PID1 over deviation level	Set the detecting level of over deviation signal [OD].	0.00 to 100.00 (%)
[AJ-17]	PID2 over deviation level	Set the detecting level of over deviation signal [OD2].	0.00 to 100.00 (%)
[CC-01] [CC-02] [CC-07]	Output terminal function	Over deviation for PID control [OD]: When PID1 deviation exceeds the set level of "PID1 over deviation level [AH-72]", this signal turns ON.	045
		Over deviation for PID2 control [OD2]: When PID2 deviation exceeds the set level of "PID2 over deviation level [AJ-17]", this signal turns ON.	047

PID feedback comparison

- If PID feedback data of PID1 or PID2 exceeds "Turn-off level for the PID feedback compare signal ([AH-73], [AJ-18])", turns OFF the respective "PID feedback comparison ([FBV], [FBV2])" signal.
- When the signal is turned OFF, the signal turns ON again if PID feedback data falls below "Turn-on level for the PID feedback compare signal ([AH-74], [AJ-19])".

- Set PID feedback compare signal ON/OFF level to OFF level ≧ ON level. When OFF level < ON level is set, OFF operation takes precedence.
- By setting ON level /OFF level to a value other than 0.00, the feedback compare signal output starts. In that case, "PID feedback comparison ([FBV], [FBV2])" signal remains ON until "Turn-off level for the PID feedback compare signal ([AH-73], [AJ-18])" is exceeded from the start of operation.



Code	Name	Description	Data
[db-36]	PID2 feedback value monitor	Displays PID2 feedback value.	-100.00 to 100.00 (%)*1
[db-44]	PID1 feedback value monitor (after calculation)	Displays PID1 feedback value after calculation.	-100.00 to 100.00 (%)*2
[AH-73]	Turn-off level for the PID1 feedback compare signal	Set PID1 feedback value at which the [FBV] signal is turned OFF.	0.00 to 100.00 (%)
[AH-74]	Turn-on level for the PID1 feedback compare signal	Set PID1 feedback value at which the [FBV] signal is turned ON.	0.00 to 100.00 (%)
[AJ-18]	Turn-off level for the PID2 feedback compare signal	Set PID2 feedback value at which the [FBV2] signal is turned OFF.	0.00 to 100.00 (%)
[AJ-19]	Turn-on level for the PID2 feedback compare signal	Set PID2 feedback value at which the [FBV2] signal is turned ON.	0.00 to 100.00 (%)
[CC-01] [CC-02] [CC-07]	Output terminal function	PID feedback comparison [FBV]: Compares the PID1 feedback value and [AH-73]/[AH-74]) and turns the signal ON/OFF. OFF: OFF level [AH-73] exceeded. ON: fell below ON level [AH-74].	046
		PID2 feedback comparison [FBV2]: Compares the PID2 feedback value and [AJ-18]/[AJ-19] and turns the signal ON/OFF. OFF: OFF level [AJ-18] exceeded. ON: fell below ON level [AJ-19].	048

*1. "PID2 scale adjustment ([AJ-04] to [AJ-06]) will change the setting.
For more information, refer to "9.8.5 Unit Converter Function for PID Control".
*2. "PID1 scale adjustment ([AH-04] to [AH-06]) will change the setting.
For more information, refer to "9.8.5 Unit Converter Function for PID Control".

9.8.5 Unit Converter Function for PID Control

Q

- You want PID set-point and feedback data to be displayed in any scale or units.

A

- The unit and scale of the following parameters can be changed using this function.

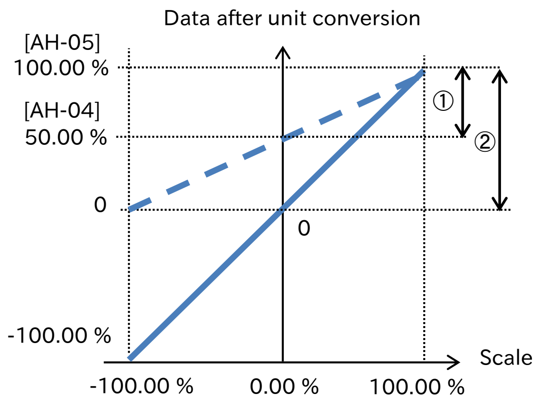
■ **PID units converter function target parameters**

PID function	Code	Name
PID1	[FA-30]	PID1 set-point 1 setting (monitor)
	[FA-32]	PID1 set-point 2 setting (monitor)
	[FA-34]	PID1 set-point 3 setting (monitor)
	[db-30]	PID1 feedback value 1 monitor
	[db-32]	PID1 feedback value 2 monitor
	[db-34]	PID1 feedback value 3 monitor
	[db-42]	PID1 set-point monitor (after calculation)
	[db-44]	PID1 feedback value monitor (after calculation)
	[AH-10]	PID1 set-point 1 setting
	[AH-12] to [AH-40]	PID1 set-point 1 setting 1 to 15
	[AH-44]	PID1 set-point 2 setting
	[AH-48]	PID1 set-point 3 setting
PID2	[FA-36]	PID2 set-point setting (monitor)
	[db-36]	PID2 feedback value monitor
	[AJ-10]	PID2 set-point setting

A

- For PID set-point setting and PID feedback monitor value can be converted to the internal scale -100.00 % to 100.00 % to the desired setting range and unit by the unit conversion parameter. The default factory settings for "PID1 set-point 1 setting (monitor) [FA-30]" are "PID1 unit selection [AH-03]" = "% (01)", "PID1 scale adjustment (0%) [AH-04]" = 0, and PID1 set-point 1 setting range is -100.00% to 100.00% from "PID1 scale adjustment (100%) [AH-05]" = 10000, "PID1 scale adjustment (decimal point) [AH-06]" = 2 (decimal point 2 digit). (Solid line part in the figure below)

e.g.) If [AH-04]=5000, [AH-05]=10000, [AH-06] = 2 (2 decimal places) is set, the converted range will be 0.00 to 100.00 as shown in the dashed line in the figure on right.
In this case, when the input source is analog input or pulse input, the range after conversion is 50.00 to 100.00 on the + side (range ①) as shown in the figure on right.
When the input source is parameter setting, the range ② is 0.00 to 100.00.



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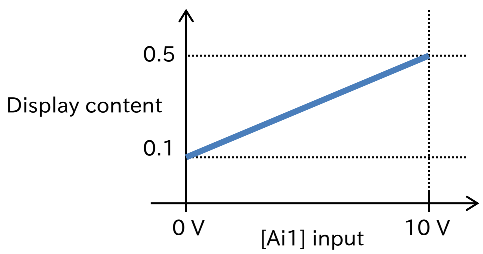
- When performing unit and scale conversion, note that [AH-04] sets the conversion value to 0 % (Internal scale -100.00 % and 100.00 % median point).

(Adjustment example)
When voltage feedback is applied to analog input 1 [Ai1] and 0 to 10 VDC (0 to 100 %) is displayed in [db-30] as 0.10 to 0.50 kPa.
- Unit selection [AH-03] = kPa (56)
- Scale adjustment (0 %) [AH-04] = 10
- Scale adjustment (100 %) [AH-05] = 50
- Scale adjustment (decimal point position) [AH-06] = 02



■ **Parameter**

Code	Name	Description	Data
[AH-03]	PID1 unit selection	Set the units of display conversion for target parameters of PID1. Refer to the table below for details.	00 to 58
[AH-04]	PID1 scale adjustment (0%)	Set the 0 % reference of display conversion for target parameters of PID1.	-10000 to 10000
[AH-05]	PID1 scale adjustment (100%)	Set the 100 % reference of display conversion for target parameters of PID1.	-10000 to 10000
[AH-06]	PID1 scale adjustment (decimal point position)	0: 00000. / 1: 0000.0 / 2: 000.00 3: 00.000 / 4: 0.0000	0 to 4
[AJ-03]	PID2 unit selection	Set the units of display conversion for target parameters of PID2. Refer to the table below for details.	00 to 58
[AJ-04]	PID2 scale adjustment (0%)	Set the 0% reference of display conversion for target parameters of PID2.	-10000 to 10000
[AJ-05]	PID2 scale adjustment (100%)	Set the 100 % reference of display conversion for target parameters of PID2.	-10000 to 10000
[AJ-06]	PID2 scale adjustment (decimal point position)	0: 00000. / 1: 0000.0 / 2: 000.00 3: 00.000 / 4: 0.0000	0 to 4

■ **List of units that can be set with [AH-03], [AJ-03]**

Data	Unit	Data	Unit	Data	Unit	Data	Unit
00	non	15	pls	30	m	45	gal/min
01	%	16	mH	31	cm	46	gal/h
02	A	17	Vdc	32	°F	47	ft^3/s
03	Hz	18	°C	33	l/s	48	ft^3/min
04	V	19	kWh	34	l/min	49	ft^3/h
05	kW	20	mF	35	l/h	50	lb/s
06	W	21	mVs/rad	36	m^3/s	51	lb/min
07	hr	22	Nm	37	m^3/min	52	lb/h
08	S	23	min^{-1}	38	m^3/h	53	mbar
09	kHz	24	m/s	39	kg/s	54	bar
10	ohm	25	m/min	40	kg/min	55	Pa
11	mA	26	m/h	41	kg/h	56	kPa
12	ms	27	ft/s	42	t/min	57	PSI
13	P	28	ft/min	43	t/h	58	mm
14	kgm^2	29	ft/h	44	gal/s		

9.9 Using Trip Prevention Functions

9.9.1 Overload Restriction Function

Q

- When the load becomes large, you want to reduce the output frequency automatically so that it does not become overload.
- I want to prevent stalling.
- How do I accelerate while suppressing the current flowing through the motor?
- How do I prevent an overcurrent trip due to sudden load fluctuation?

A

- The overload restriction function monitors the motor current at acceleration or at constant speed, and when it reaches "Overload restriction 1 active level [bA123]", it automatically lowers the output frequency according to "Overload restriction 1 action time [bA124]". Operation is as follows according to "Overload restriction 1 mode selection [bA122]".
- [bA124] is the duration to decelerate from "Async. Motor maximum frequency setting [Hb105]" to 0 Hz or to accelerate from 0 Hz to [Hb105].
- Two independent overload restriction function can be set. The overload restriction 1/2 can be switched by assigning "Overload restriction selection [OLR](038)" to the input terminal and ON/OFF the terminal. Refer to "Switching two types of overload restriction settings" in this section for details.

Overload restriction 1 mode selection [bA122]	Operation
Enable during accel. and constant speed (01)	Monitors the output current at acceleration or constant speed. Suppresses current by decelerating against excessive load during acceleration and rapid load fluctuation at constant speed.
Constant speed only (02)	Monitors the output current only at constant speed. Current suppression by deceleration is performed only for sudden load fluctuation at constant speed.
Enable during accel. and constant speed (Accel. during regeneration) (03)	Monitors the output current at acceleration or constant speed. In addition to the operation of "Enable during accel. and constant speed (01)", when a regenerative load is applied at constant speed, it is accelerated to prevent overload.

!

- If this function is activated during acceleration, the acceleration time until the frequency reference is reached becomes longer than the setting.
- If the overload restriction action time is shortened too much, an overvoltage trip may occur due to regenerative energy from the motor due to the automatic deceleration of this function.
- If this function is activated during acceleration and the output frequency does not reach the target frequency, the following adjustments may be made.
  - Increase the acceleration time
  - Adjust the torque boost
  - Increase the overload restriction action level

Code	Name	Description	Data
[bA122]	Overload restriction 1 mode selection	Disable	00
		Enable during accel. and constant speed	01
		Enable during constant speed only	02
		Enable during accel. and constant speed (accel. during regeneration)	03
[bA123]	Overload restriction 1 active level	Set the current value at which the overload restriction operates.	(0.20 to 2.00)× ND/LD Rated Output Current (A)
[bA124]	Overload restriction 1 action time	Set the deceleration time when the overload restriction operates, in the deceleration time from the maximum frequency to 0 Hz.	0.10 to 3600.00 (s)

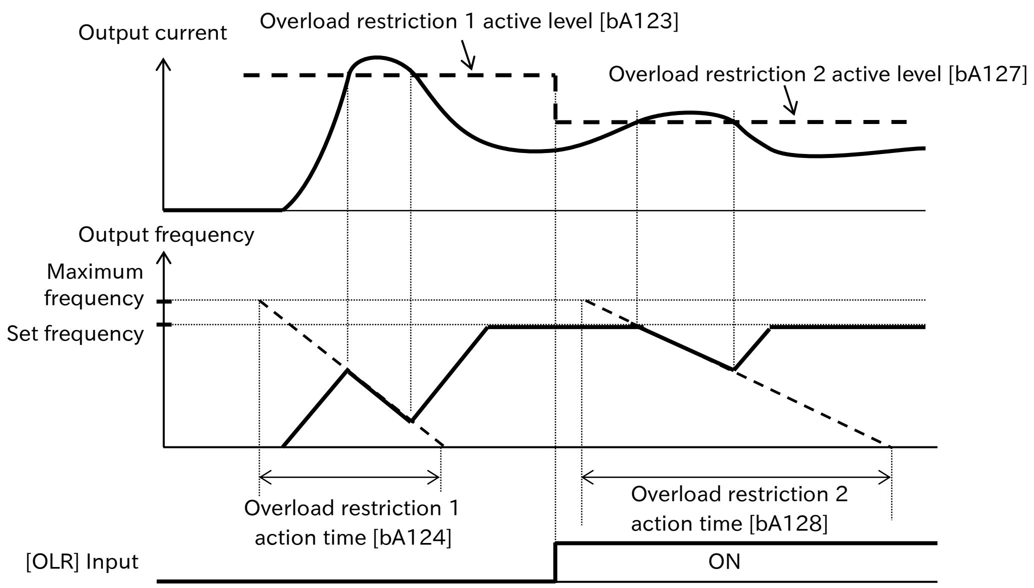
Switching two types of overload restriction settings

Q

- I want to switch the overload restriction function with terminal input.
- I want to switch the overload restriction action level according to the load because the weight of the load varies depending on the situation.

A

- Two independent settings of "Overload restriction 1 ([bA122] to [bA124])" and "Overload restriction 2 ([bA126] to [bA128])" can be set for the overload restriction function.
- Switching between Overload restriction 1 and Overload restriction 2 is performed by ON/OFF of the "Overload restriction selection [OLR]" input terminal. Overload restriction 2 is enabled by ON the [OLR] input terminal.



Code	Name	Description	Data
[bA126]	Overload restriction 2 mode selection	Set operation of overload restriction 2, which operates when the [OLR] input terminal is ON. The setting is the same as that of [bA122]/[bA123]/[bA124].	00 to 03
[bA127]	Overload restriction 2 active level		(0.20 to 2.00)× ND/LD Rated Output Current (A)
[bA128]	Overload restriction 2 action time		0.10 to 3600.00 (s)
[CA-01] to [CA-08]	Input terminal function	Overload restriction selection [OLR]: The overload restriction 1/2 is switched by ON/OFF of this signal. OFF: Overload restriction 1 enabled ON: Overload restriction 2 enabled	038

9.9.2 Overcurrent Suppression Function

Q

- Overcurrent trip at impact load.
- How do I prevent tripping when the current increases instantaneously?
- How do I accelerate while suppressing the current flowing through the motor?
- How do I prevent tripping due to sudden load fluctuation?

A

- The overcurrent suppression function suppresses overcurrent caused by steep current growth during rapid acceleration, etc.
- When "Overcurrent suppression enable [bA120]" is set to "Enable (01)" or "Enable (with voltage reduction) (02)", the overcurrent suppression function operates when the output current exceeds the setting of "Overcurrent suppression level [bA121]".
- Setting [bA120] to "Enable (with voltage reduction) (02)" reduces the output voltage during the overcurrent suppression function operation, increasing the current suppression effectiveness. Use this function when "Overload error ([E005], [E038], [E039])" or the like occurs when this function is operated with "Enable (01)". However, torque shortage is likely to occur because the output voltage is reduced.

!

- Disable this function when using this product for an elevator. Suppressing the current may cause insufficient torque, resulting in slippage of the load cage or lifted objects.
- Even if this function is enabled, an overcurrent trip may occur if the current grows steeply due to an impact load, etc.
- The output current at which overcurrent occurs can be set using the "Overcurrent detection level [bb160]". When using the overcurrent suppression function, be sure to set the "Overcurrent suppression level [bA121]" to a value lower than [bb160].
- This function is automatically enabled during DC braking or active frequency matching restart. However, the overcurrent suppression level at active frequency matching restart is set by "OC-suppress level at active frequency matching [bb-46]". For details, refer to "9.7.4 Active Frequency matching Restart Function".
- This function is automatically disabled during auto-tuning. [*1]

Code	Name	Description	Data
[bA120]	Overcurrent suppression enable	Disable	00
		Enable	01
		Enable (with voltage reduction)	02
[bA121]	Overcurrent suppression level	Set the operation level of the overcurrent suppression function.	(0.30 to 1.80)× ND rated output current (A)
[bb-46]	OC-suppress level at active frequency matching	Set the operation level of the overcurrent suppression function at the time of active frequency matching restart.	(0.30 to 1.80)× ND rated output current (A)
[bb160]	Overcurrent detection level	Set the level at which overcurrent is detected.	(0.30 to 2.20) × ND rated output current (A)

*1. SM(PMM) This function is automatically disabled during motor control. SM(PMM) Contact your dealer when using a motor.

9.9.3 Overvoltage Suppression by Output Frequency Control

Q

- When the motor is decelerated, an overvoltage error occurs.
- How do I automatically extend the deceleration time so as not to generate an overvoltage error?
- How do I avoid overvoltage errors caused by regenerative voltage during deceleration by temporarily accelerating them?

A

- The overvoltage suppression function can suppress the occurrence of an overvoltage trip during deceleration.
- Set "Overvoltage suppression enable setting [bA140]" to other than "Disable (00)", and when DC voltage between P-N of the inverter exceeds "Overvoltage suppression active level [bA141]", this function will operate.

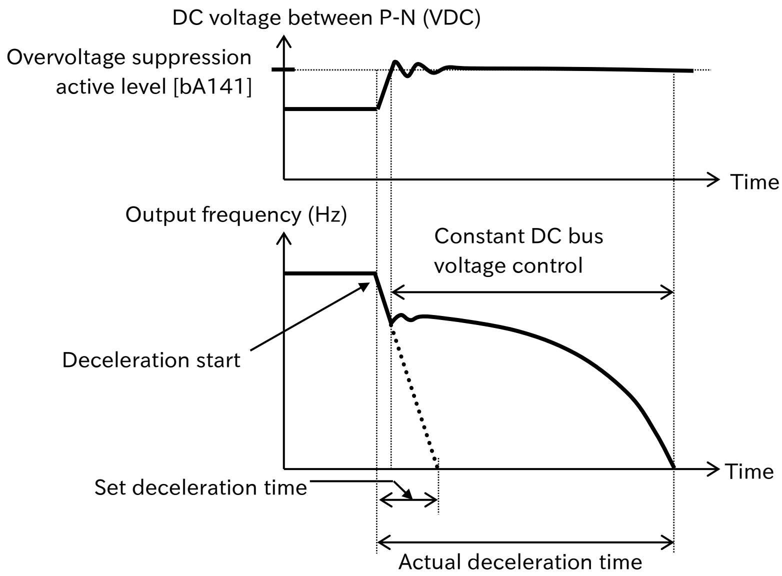
!

- Actual deceleration time is longer than the set value due to operation of this function.
- Depending on the moment of inertia of the load, it may take a long time to stop.
- Even if this function is enabled, overvoltage trip may occur depending on the deceleration rate and load conditions.
- Set "Overvoltage suppression active level [bA141]" so that the received power voltage × √2 × 1.1 or more. If a value lower than the DC voltage between P-N during operation is set, the motor may not be able to be stopped.

Code	Name	Description	Data
[bA140]	Overvoltage suppression enable setting	Disable	00
		Constant DC bus voltage control (deceleration stop)	01
		Enable acceleration (at deceleration)	02
		Enable acceleration (at constant speed and deceleration)	03
[bA141]	Overvoltage suppression active level	Set the operation level of the overvoltage suppression function.	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)
[bA142]	Overvoltage suppression active time	Acceleration time when overvoltage suppression function is activated.	0.00 to 3600.00 (s)
[bA144]	Constant DC bus voltage control P gain	Proportional gain for PI control of DC voltage-constant control.	0.00 to 5.00
[bA145]	Constant DC bus voltage control I gain	Integral gain for PI control of DC voltage-constant control.	0.00 to 150.00 (s)

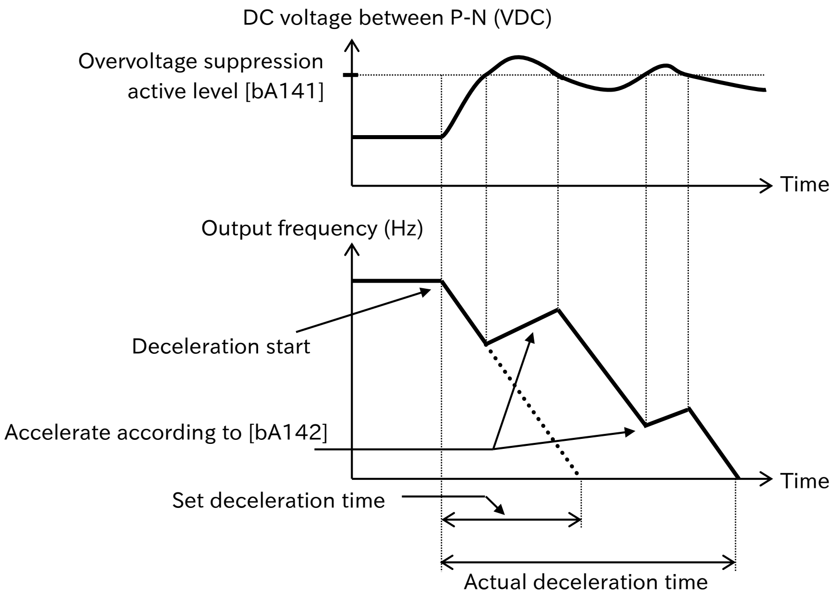
■ When "Overvoltage suppression enable setting [bA140]" = "Constant DC bus voltage control (deceleration stop) (01)"

- When "Constant DC bus voltage control (deceleration stop) (01)" is selected for [bA140], the motor decelerates automatically while performing PI control so that the DC voltage across P-N does not exceed the "Overvoltage suppression active level [bA141]" at deceleration.
- If "Constant DC bus voltage control P gain [bA144]" is set larger or "Constant DC bus voltage control I gain [bA145]" is set shorter, the response will be faster, but it will be easier to trip.



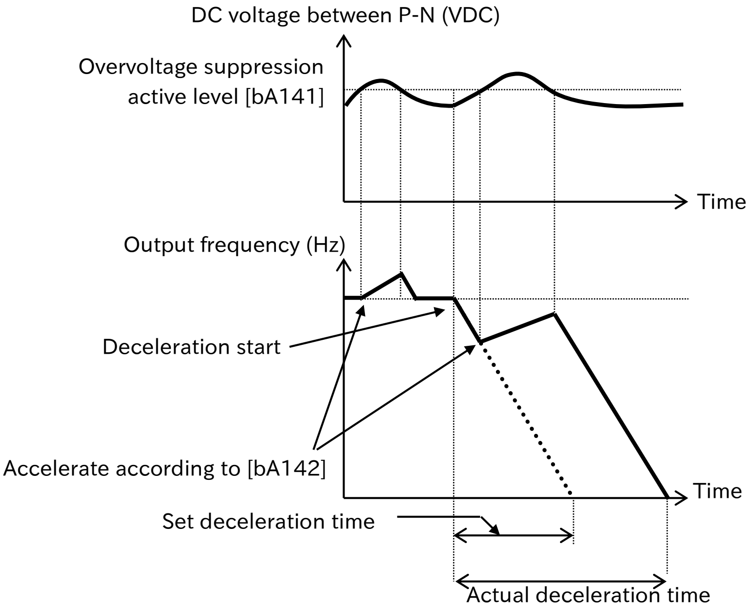
■ When "Overvoltage suppression enable setting [bA140]" = "Enable acceleration (at deceleration) (02)"

- When "Enable acceleration (at deceleration) (02)" is selected for [bA140], if the DC voltage across P-N exceeds the "Overvoltage suppression active level [bA141]" at deceleration, the acceleration operation is performed according to the "Overvoltage suppression active time [bA142]". After that, when DC voltage between P-N becomes less than [bA141], normal deceleration resumes.



■ When "Overvoltage suppression enable setting [bA140]" = "Enable acceleration (at constant speed and deceleration) (03)"

- When "Enable acceleration (at constant speed and deceleration) (03)" is selected for [bA140], if the DC voltage across P-N exceeds the "Overvoltage suppression active level [bA141]" at constant speed and deceleration, acceleration operation is performed according to the "Overvoltage suppression active time [bA142]". After that, when the DC voltage between P-N falls below the overvoltage suppression level, normal deceleration resumes.



!

- When "Overvoltage suppression enable setting [bA140]" is set to "Enable acceleration (at deceleration) (02)" or "Enable acceleration (at constant speed and deceleration) (03)", acceleration is controlled to the maximum frequency setting.
- If "Overvoltage suppression active time [bA142]" is shortened, the increase in the output frequency due to acceleration may exceed the decrease in the frequency due to deceleration, making it impossible to stop. In such cases, increase the setting of "Overvoltage suppression active level [bA141]".

9.9.4 Overvoltage Suppression by Output Voltage Control

Q

- When the motor is decelerated, an overvoltage error occurs.
- How do I increase the output voltage in response to the regenerative power during deceleration to avoid an overvoltage error and decelerate?
- How do I continue operation while preventing the occurrence of an overvoltage error when applying a regenerative load?

A

- The over-magnetization function increases the output voltage in response to an increase in the DC voltage between P-N to increase the loss of the motor and reduce the energy to be regenerated, thereby preventing the occurrence of overvoltage errors.
- Setting "Over-magnetization function selection [bA146]" to other than "Disable (00)" enables this function.

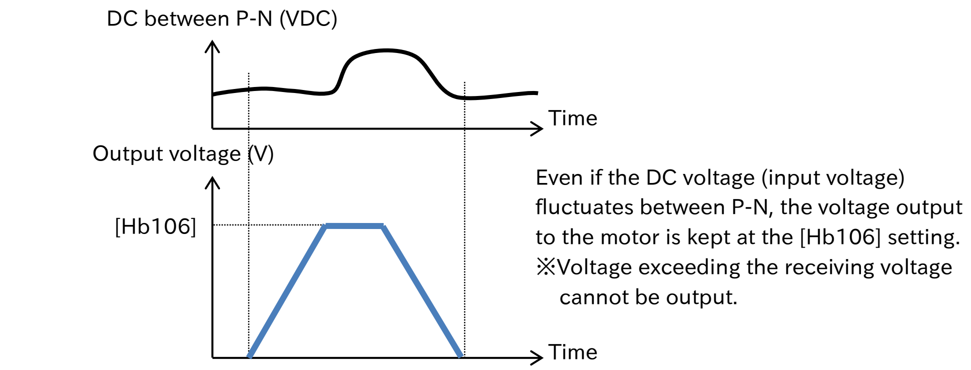
!

- Even if "Disable (00)" is set, a voltage exceeding the received power voltage cannot be output.
- When the over-magnetization function is enabled, the motor heat generation may increase due to an increase in the output current caused by an increase in the output voltage or due to overexcitation of the motor.
- Even if the over-magnetization function is enabled, the overvoltage may trip depending on the deceleration rate and load conditions.
- Over-magnetization function is enabled when "V/f control ((00) to (03))" is set to "Control mode selection [AA121]".
- When using AVR function OFF operation of the conventional model, set "Over-magnetization function selection [bA146]" as follows.

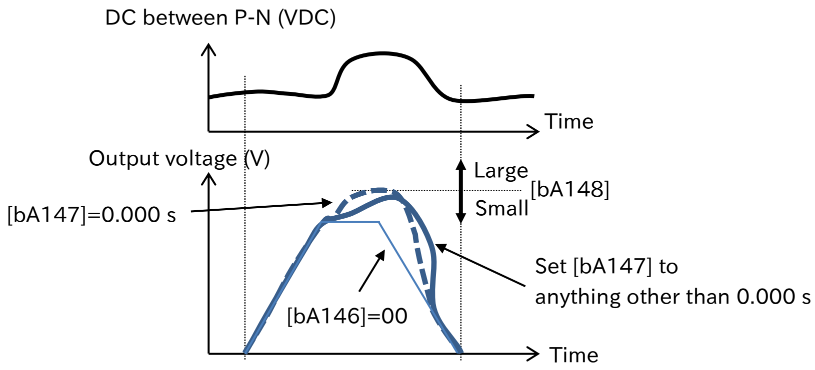
  - Always AVR OFF: [bA146] = 01
  - During decelerationAVR OFF: [bA146] = 02

Code	Name	Description	Data
[bA146]	Over-magnetization function selection	Disable	00
		Always enable	01
		Operation at deceleration only	02
		Operation at setting level only	03
		Operation at setting level at deceleration stop	04
[bA147]	Over-magnetization function output filter time constant	Filter time constant for the output voltage in the overexcitation status.	0.000 to 10.000 (s)
[bA148]	Over-magnetization function voltage gain	Gain with respect to the output voltage in the overexcitation status.	50 to 400 (%)
[bA149]	Over-magnetization function level setting	Set the operation level of the overvoltage suppression function.	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)
[Hb106]	Async. Motor rated voltage	Set the rated voltage of the motor.	1 to 1000 (V)

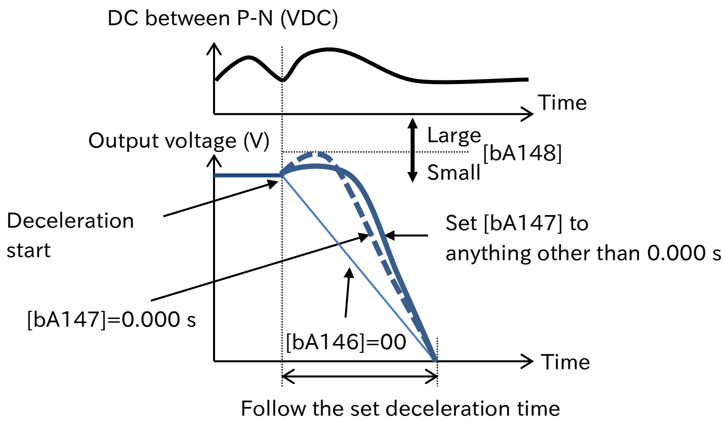
■ When "Over-magnetization function selection [bA146]" = "Disable (00)"



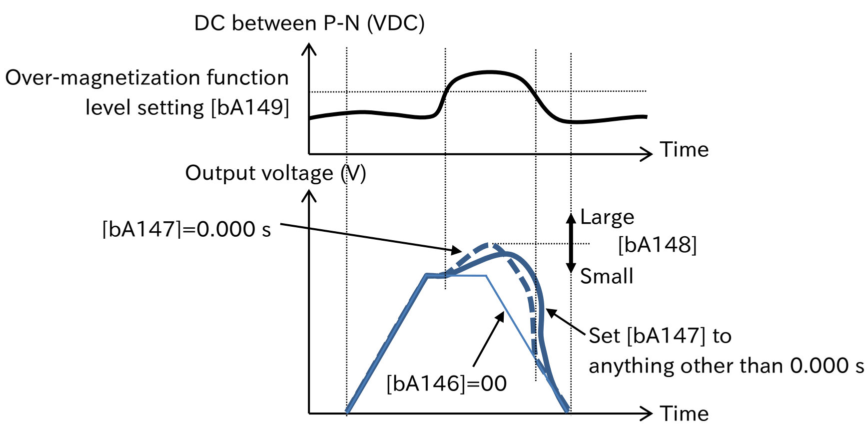
■ When "Over-magnetization function selection [bA146]" = "Always enable (01)"



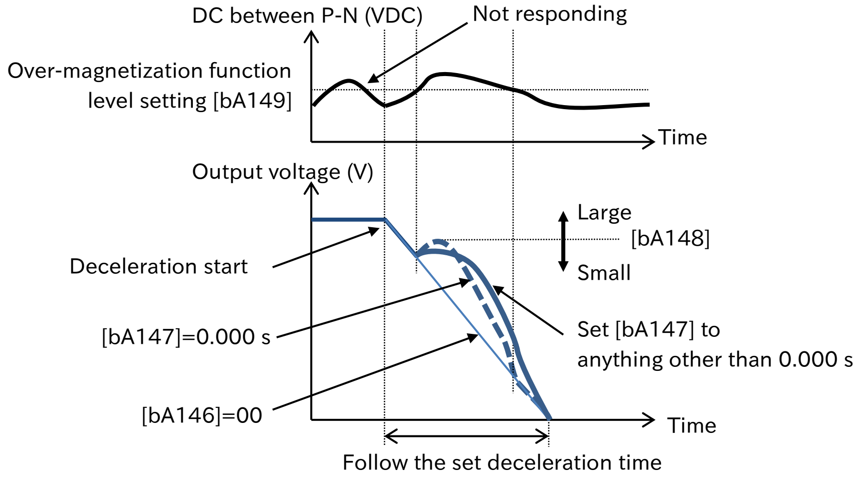
■ When "Over-magnetization function selection [bA146]" = "At deceleration only (02)"



■ When "Over-magnetization function selection [bA146]" = "Operation at setting level (03)"



When "Over-magnetization function selection [bA146]" = "Operation at setting level at deceleration stop (04)"



9.9.5 Overvoltage Suppression with Braking Resistor

Q

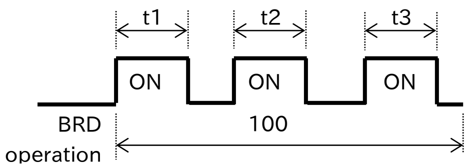
- If the motor is decelerated, an overvoltage error occurs.
- Overvoltage error due to regenerative load occurs.
- You want to use the motor for rapid deceleration.
- Overvoltage trips when winding down.

A

- During deceleration, the motor acts as a generator and energy is regenerated to the inverter. As a consequence, the DC voltage rises between P-N of the inverter and trips when the overvoltage is exceeded. To prevent this, BRD function uses an external resistor to dissipate regenerative power from the motor.
- When using this function, connect an external braking resistor referring to "5.3.5 Wiring of Braking Resistor and Regenerative Braking Unit" and set each parameter in the table below.

!

- It is also possible to obtain a larger regenerative torque by using the optional regenerative braking unit without using the built-in braking resistor operating circuit (BRD). If this happens, set "Dynamic brake activation selection [bA-61]" to "Disable (00)".
- The "Dynamic brake activation level [bA-62]" is the level setting of the main circuit DC smoothing capacitor in the inverter. Be sure to set a value exceeding √2 times the received voltage. It may lead to burnout of the braking resistor.
- The minimum resistance value that can be connected varies depending on the model. For details, refer to "Chapter 17 Specifications/Dimensions/Derating".

Code	Name	Description	Data
[dA-41]	BRD load factor monitor	Displays according to BRD use.	0.00 to 100.00 (%)
[bA-60]	Dynamic brake use ratio	When this setting is 0.0, BRD function does not operate. The upper limit of [bA-60] changes depending on the "Dynamic brake resistor value [bA-63]" setting. Be sure to set [bA-63] first. Then, set BRD duty cycle to the allowable %ED or less of the braking resistor to be connected, referring to the figure below.  BRD utilization (%) = $\frac{(t1+t2+t3)}{100\ \text{seconds}} \times 100$ If the set usage rate is exceeded, the motor trips due to "Braking resistor overload error [E006]".	0.0 to 10.0× ([bA-63]/(min. resistance)^2) (%)
[bA-61]	Dynamic brake activation selection	Disable	00
		Enable (Only while running)	01
		Enable (Enable during stop)	02
[bA-62]	Dynamic brake activation level	ON at which BRD operates. This function is used to adjust the operation of BRD function according to the power input of the inverter. Be sure to set a value exceeding √2 times the received voltage.	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)
[bA-63]	Dynamic brake resistor value	Set the actually connected braking resistance value. The upper limit of BRD utilization of the inverter is calculated automatically. This makes it better to set [bA-60] considering only the allowable %ED of the braking resistor.	Minimum connection resistance to 600.0 (Ω)

9.9.6 Restart after Instantaneous Power Failure/Undervoltage Error

Q

- Even if the main power is turned OFF for a moment due to a power failure, you want to continue operating the inverter.
- When restarting after an undervoltage occurs, you want to restart at the output frequency that matches the rotation of the motor.

A

- When DC voltage between P-N falls below the undervoltage level and power is restored afterwards, the inverter can be set to trip or restart without tripping by "Number of retries after under-voltage [bb-21]".
- If [bb-21] is set to 0 times, "Undervoltage error [E009]" will occur when undervoltage occurs, and restart will not be performed. When [bb-21] is set to 1 to 16 times, restarting is performed for the set number of times when power is restored from undervoltage, and then tripped. If [bb-21] is set to 255, the number of restarts is unlimited.
- The restart method can be selected by "Restart mode selection after instantaneous power failure/under-voltage error [bb-24]".
- When frequency matching restart is selected ([bb-24]=01, 04), the actual operation will be the active frequency marching restart from the output frequency at shut down. For details, refer to "9.7.3, Frequency Matching Restart Function".
- When active frequency matching restart is selected ([bb-24]=02), refer to "9.7.4 Active Frequency Matching Restart Function" for more information.
- When the power is turned off while the inverter is stopped for energy saving, etc., the undervoltage trip during stop can be avoided by setting "Enable instantaneous power failure/under-voltage error while in stop status [bb-27]" to "Disable (00)" or "Disable at stop and deceleration (02)".
- If the power failure time is long and the control microcomputer power is completely turned off, the operation at power on is performed at power restoration. In such cases, restart can be performed by setting "Restart mode after RS release [bb-41] ". For details, refer to "9.7.5 Restart after Trip Reset or Power-ON".

!

- When the DC voltage across P-N drops below the undervoltage level (approx. 345 VDC for 200 V class, approx. 173 VDC, 400 V class), the inverter shuts off the output and the motor become free run state. If the time until power restoration is "Undervoltage time", "Undervoltage error [E009]" will occur in the following cases.
  - [bb-21] = "0 times" and "Undervoltage time" ≦ "Instantaneous power failure allowed time [bb-25]"
  - [bb-21] ≠ 0 times" and "Undervoltage time" > "Instantaneous power failure allowed time [bb-25]"
  - "Undervoltage time" is about 40 seconds or more, "Undervoltage error [E009]" occurs without waiting for power restoration.
- If "Trip after deceleration stop (04)" is set for "Restart mode selection after instantaneous power failure/under-voltage error [bb-24]", if a trip such as overvoltage or overcurrent occurs during deceleration after restart, "Undervoltage error [E009]" will be displayed and the motor will be free-run state. In this case, increase the deceleration time.
- "Undervoltage [UV]" signal will be outputted in an undervoltage condition as well as with or without a trip. It also continues outputting while the inverter-controlled power supply remains (including external 24 VDC power supply).

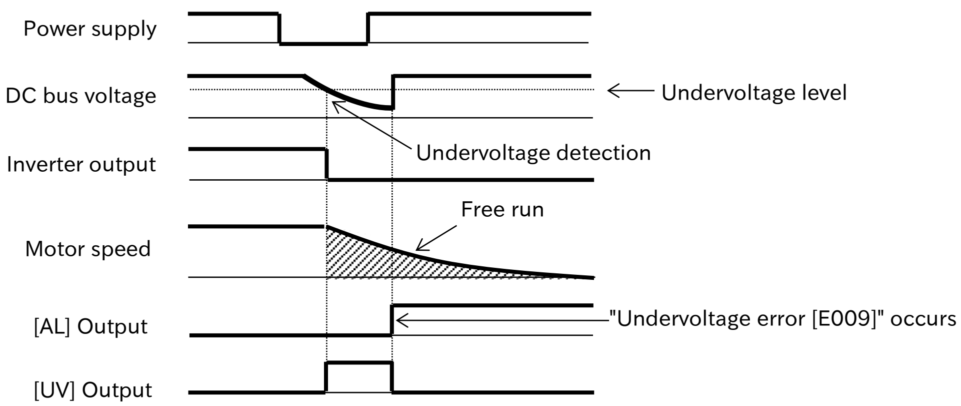
Code	Name	Description	Data
[bb-21]	Number of retries after under-voltage	Set the number of restarts when power is restored from undervoltage. 0 times: Tripped when undervoltage occurs. 1 to 16 times: Restart is performed by the set number of times, and then trips. 255:The number of restarts is unlimited.	0 to 16 (times) /255
[bb-24]	Restart mode selection after instantaneous power failure/under-voltage error	0 Hz restart is performed.	00
		Restart with the frequency matching (Restart with active frequency matching from the output frequency at shut down).	01
		Active frequency matching restart	02
		Restart is performed from the detected speed by encoder feedback.	03
		After the frequency matching restart (active frequency matching restart from the output frequency at shut down) is completed, the motor decelerates to a stop and trips.	04
[bb-25]	Instantaneous power failure allowed time	If the power is restored within this set time, the unit will restart. If the instantaneous power failure/undervoltage time is longer than this setting time, the motor trips regardless of the setting of [bb-21].	0.3 to 25.0 (s)
[bb-26]	Retry wait time after instantaneous power failure/under-voltage error	Set the waiting time from power restoration to restart.	0.3 to 100.0 (s)
[bb-27]	Enable instantaneous power failure/ under-voltage error while in stop status	Disable: Does not trip during stop.	00
		Enable: Trip also occurs during stop.	01
		Disable at stop and deceleration: Does not trip during stop or decelerating stop at RUN command OFF.	02
[CC-01] [CC-02] [CC-07]	Output terminal function	Undervoltage [UV]: This signal is turned ON when the DC voltage between P-N is below the undervoltage level.	021

A

Operation when power is restored from instantaneous power failure or undervoltage

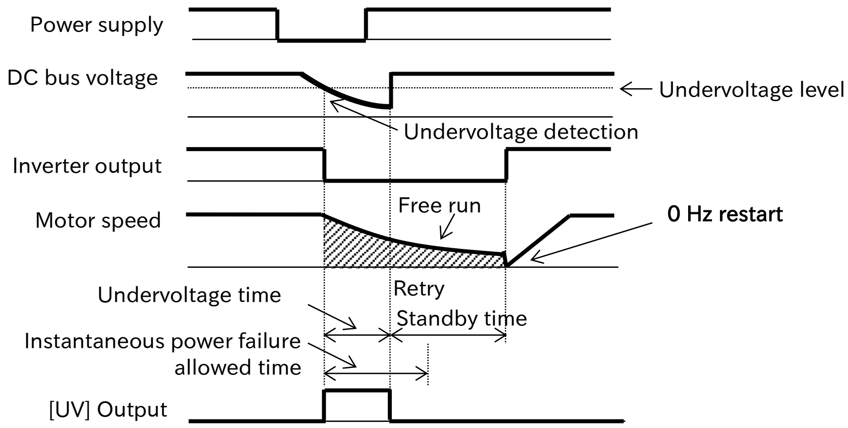
■ Trip ([bb-21]=0)

- When an instantaneous power failure or undervoltage is detected, the inverter output is shut off and the motor coasts. Then, if power is restored to [bb-25], "Undervoltage error [E009]" is generated and "Alarm [AL]" is outputted.



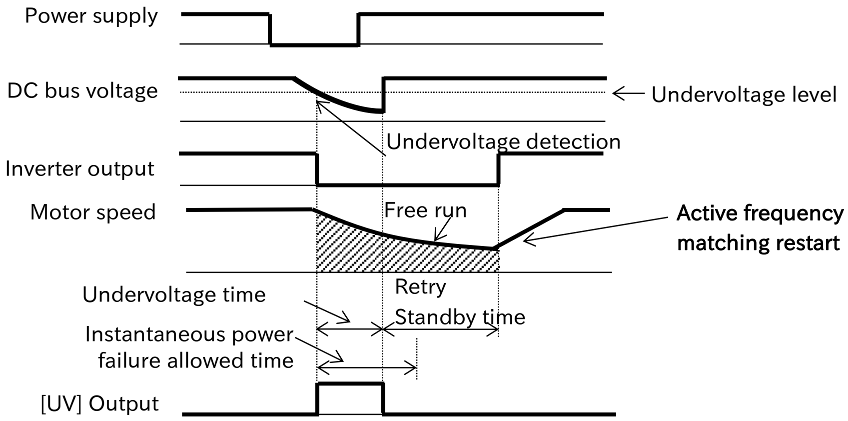
0Hz start ([bb-21]≠0, [bb-24]=00)

- When instantaneous power failure or undervoltage is detected, the inverter output is shut off and the motor become free run state. After the power is restored, the inverter starts restarting 0 Hz after the retry wait time of the [bb-26] setting. At this time, "Alarm [AL]" is not outputted.



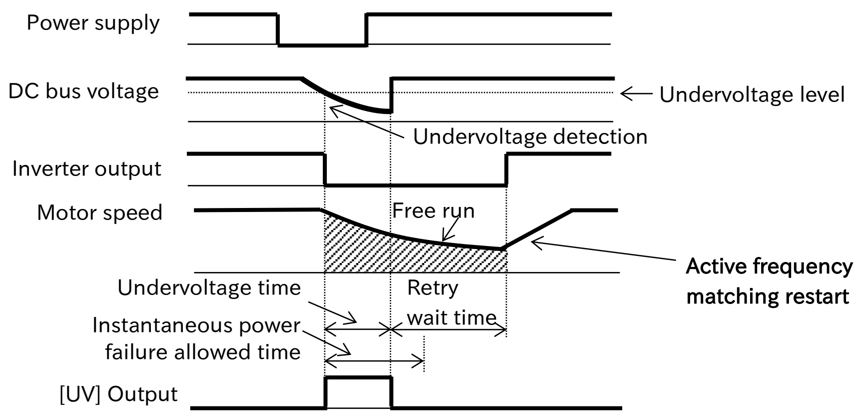
Frequency matching restart ([bb-21]≠0, [bb-24]=01)

- When instantaneous power failure or undervoltage is detected, the inverter output is shut off and the motor become free run state. After the power is restored, after the retry wait time of the [bb-26] setting, the inverter starts active frequency matching restart from the frequency at the time of shutdown. At this time, "Alarm [AL]" is not outputted.
- For details, refer to "9.7.3 Frequency Matching Restart Function".



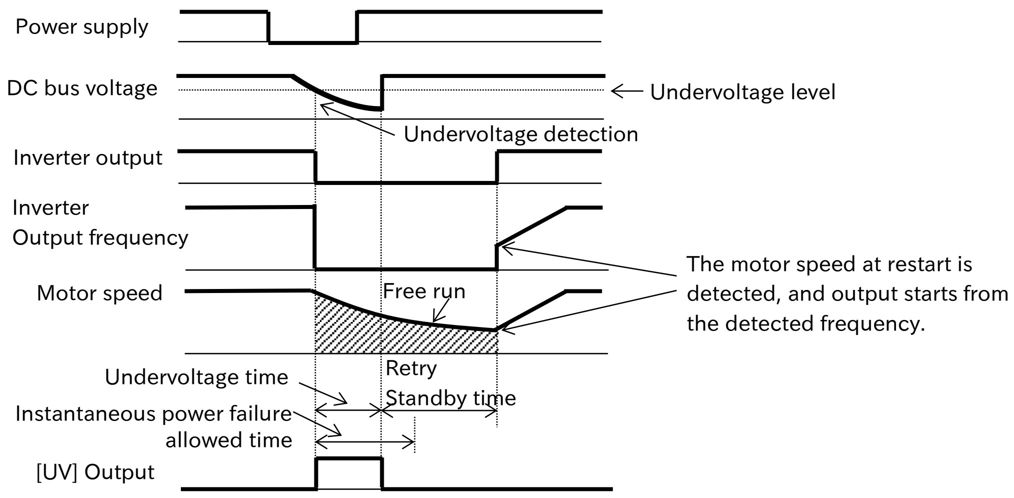
Active frequency matching restart ([bb-21]≠0, [bb-24]=02)

- When instantaneous power failure or undervoltage is detected, the inverter output is shut off and the motor become free run state. After the power is restored, the inverter starts active frequency matching restart after the retry wait time of [bb-26] setting. At this time, "Alarm [AL]" is not outputted.
- For details, refer to "9.7.4 Active Frequency Matching Restart Function".



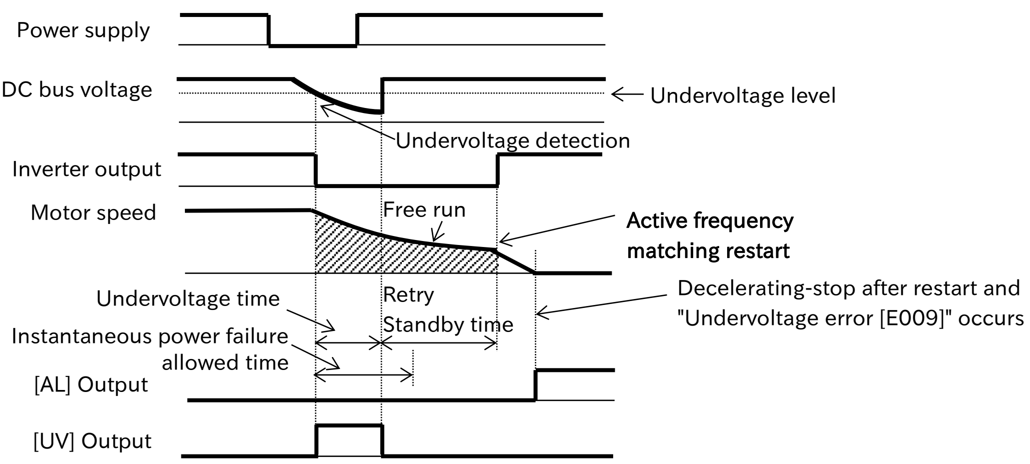
■ Detect speed ([bb-21]≠0, [bb-24]=03)

- When instantaneous power failure or undervoltage is detected, the inverter output is shut off and the motor become free run state. After the power is restored, the inverter starts outputting from the rotational speed detected by the encoder feedback after the retry standby time of the [bb-26] setting. At this time, "Alarm [AL]" is not outputted.
- When this setting is used, a setting related to encoder feedback is separately required. For details, refer to "9.5.11 Setting for Encoder Feedback".



■ Trip after deceleration stop with frequency matching ([bb-21]≠0, [bb-24]=04)

- Instantaneous power failure and undervoltage detection shut off the inverter output and the motor become free run state. After the power is restored, after the retry wait time of the [bb-26] setting, the inverter performs active frequency matching restart from the output frequency at shut down. Then, decelerating stop is performed, and "Alarm [AL]" is outputted after stop.
- For details, refer to "9.7.3 Frequency Matching Restart Function".

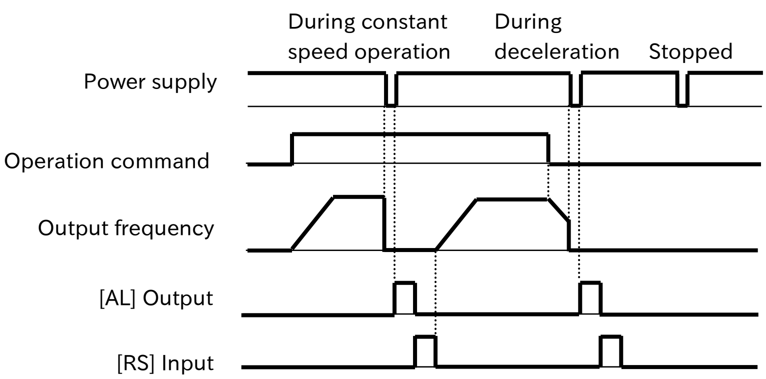


A

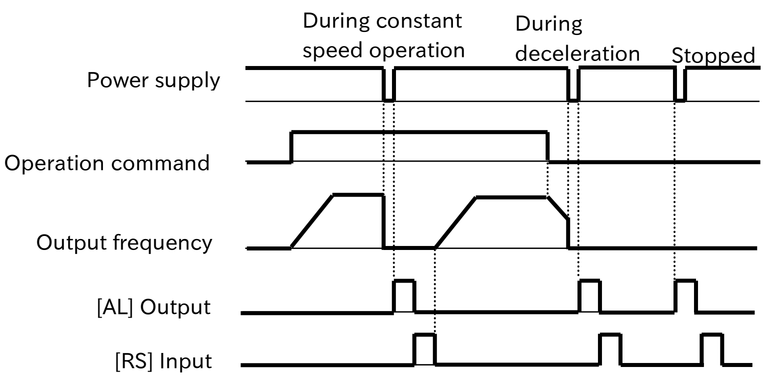
Operation of "Enable instantaneous power failure/under-voltage error while in stop status [bb-27]"

- Use [bb-27] to select whether or not a trip signal is output when an instantaneous power failure or undervoltage occurs during standstill.
- The trip signal is output while the inverter's control power remains.

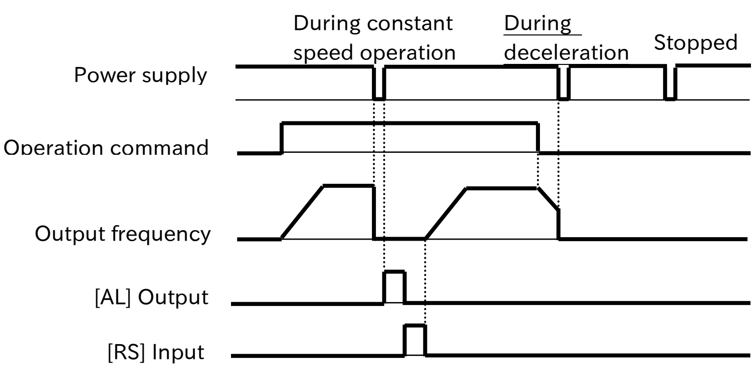
[bb-27] ="Disable (00)"



[bb-27] ="Enable (01)"



[bb-27] = "Disable at stop and deceleration (02)"



9.9.7 Restart after Overcurrent Error

Q

- Although overcurrent occasionally occurs, it is not a problem with the system, so we would like to restart it as it is.
- How do I continue to operate the system in the event of overcurrent?

A

- When overcurrent is detected, it can be set by "Number of retries after overcurrent [bb-22]" whether the inverter trips or restarts without tripping. If [bb-22] is set to 0 times, "Overcurrent error [E001]" will occur immediately when overcurrent is detected. When [bb-22] is set to 1 to 5 times, restart is performed according to the setting of "Restart mode selection after an overcurrent error [bb-28]" for the number of times set to [bb-22] at overcurrent detection, and when the overcurrent detection count exceeds [bb-22], trip is performed at [E001].
- The output current value that is judged as overcurrent can be set in "Overcurrent detection level [bb160]".
- When frequency matching restart is selected ([bb-28]=01, 04), refer to "9.7.3 Frequency Matching Restart Function" for more information.
- When active frequency matching function is selected ([bb-28]=02), refer to "9.7.4 Active Frequency Matching Restart Function" for more information.

!

- If an overcurrent error occurs continuously, it may be due to too short acceleration time, heavy load, or locked motor.

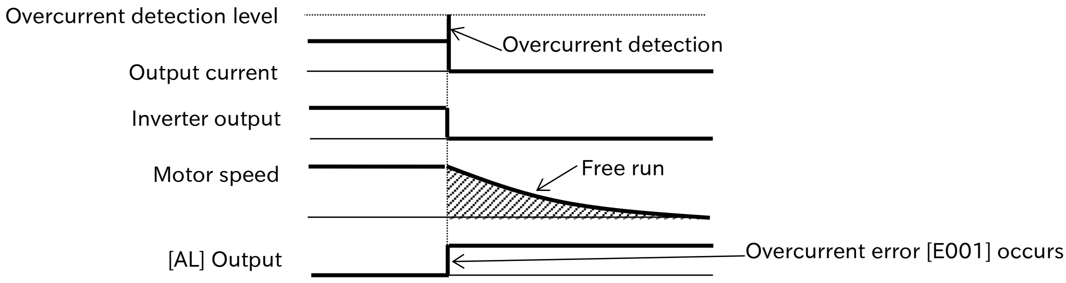
Code	Name	Description	Data
[bb-22]	Number of retries after overcurrent	Set the number of restarts in the event of an overcurrent. In case of 0 times, it trips immediately due to overcurrent error without restarting.	0 to 5 (times)
[bb-28]	Restart mode selection after an overcurrent error	0 Hz restart is performed.	00
		Restart with the frequency matching (Restart with active frequency matching from the output frequency at shut down).	01
		Active frequency matching restart	02
		Restart is performed from the detected speed by encoder feedback.	03
		After the frequency matching restart (active frequency matching restart from the output frequency at shut down) is completed, the motor decelerates to a stop and trips.	04
[bb-29]	Retry wait time after an overcurrent error	Set the waiting time from overcurrent detection to restart start.	0.3 to 100.0 (s)
[bb160]	Overcurrent detection level	Set the level at which overcurrent is detected.	(0.30 to 2.20)× ND rated output current (A)

A

Operation when overcurrent is detected

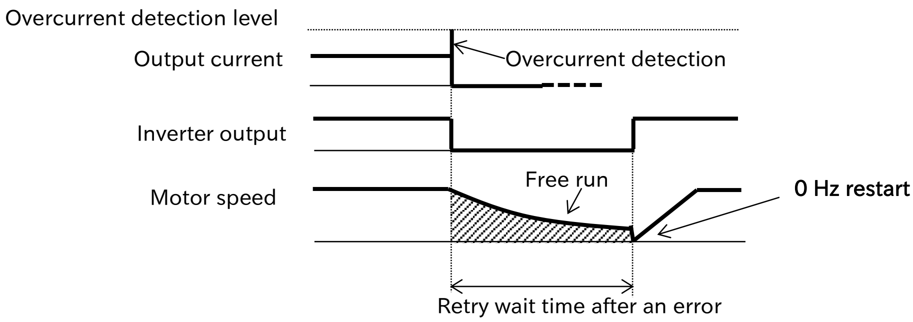
Trip ([bb-22]=0)

- When overcurrent is detected, the inverter output is shut off and the motor become free run state. "Overcurrent error [E001]" occurs and "Alarm [AL]" is outputted.



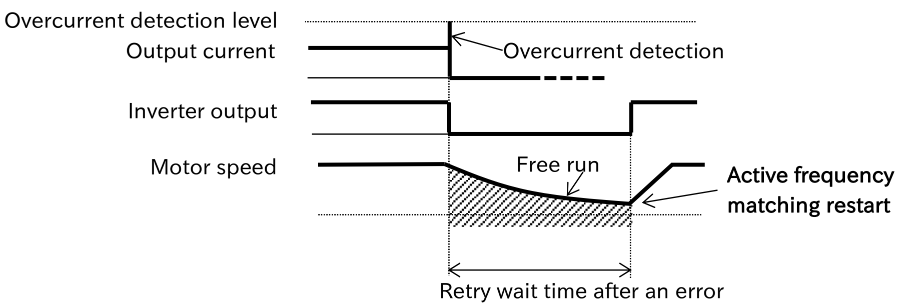
0 Hz start ([bb-22]≠0, [bb-28]=00)

- When overcurrent is detected, the inverter output is shut off and the motor become free run state. After that, the inverter starts restarting 0 Hz after the retry wait time of the [bb-29] setting. At this time, "Alarm [AL]" is not outputted.



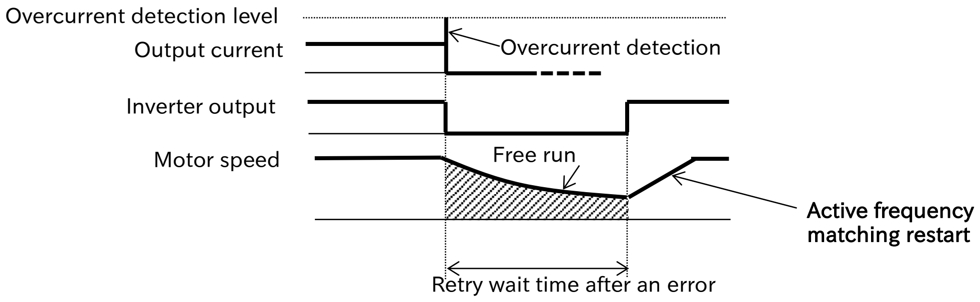
Frequency matching restart ([bb-22]≠0, [bb-28]=01)

- When overcurrent is detected, the inverter output is shut off and the motor become free run state. After that, after the retry standby time of the [bb-29] setting, the inverter starts active frequency matching restart from the output frequency at shut down. At this time, "Alarm [AL]" is not outputted.
- For detail of frequency matching restart, refer to "9.7.3 Frequency Matching Restart Function".



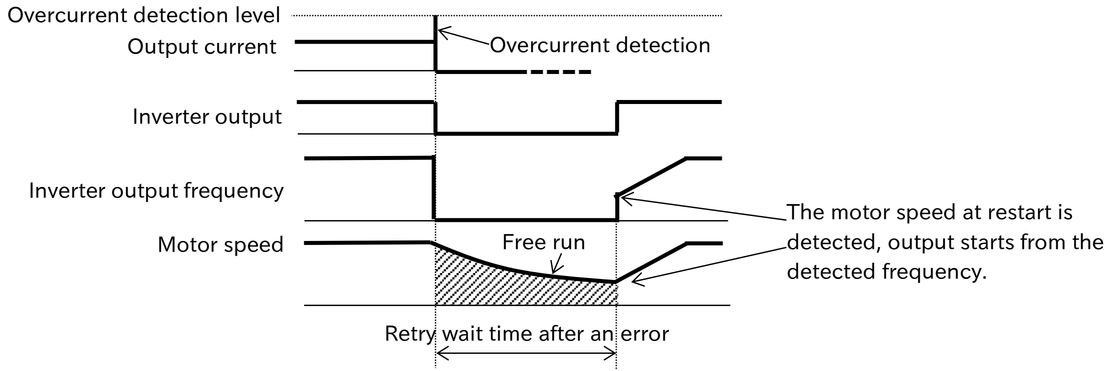
Active frequency matching restart ([bb-22]≠0, [bb-28]=02)

- When overcurrent is detected, the inverter output is shut off and the motor become free run state. After that, after the retry wait time of the [bb-29] setting, the inverter starts active frequency matching restart. At this time, "Alarm [AL]" is not outputted.
- For detail of active frequency matching restart, refer "9.7.4 Active Frequency Matching Restart Function".



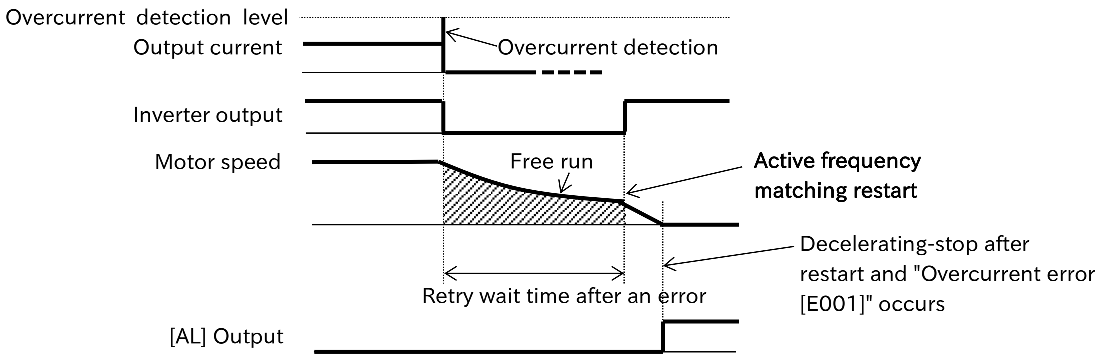
Detect speed ([bb-22]≠0, [bb-28]=03)

- When overcurrent is detected, the inverter output is shut off and the motor become free run state. Then, after the retry wait time of the [bb-29] setting, the inverter starts outputting from the rotational speed detected by the encoder feedback. At this time, "Alarm [AL]" is not outputted.
- When this setting is used, a setting related to encoder feedback is separately required. For details, refer to "9.5.11 Setting for Encoder Feedback".



Trip after decelerating stop ([bb-22]≠0, [bb-28]=04)

- When overcurrent is detected, the inverter output is shut off and the motor become free run state. After that, after the retry wait time of the [bb-29] setting, the inverter performs the active frequency matching restart from the output frequency at shut down. Then, decelerating stop is performed, and "Alarm [AL]" is outputted after stop.
- For details of frequency matching restart, refer to "9.7.3 Frequency Matching Restart Function".



9.9.8 Restart after Overvoltage Error

Q

- Overvoltage occurs occasionally, but there is no problem with the system, so we would like to restart it as it is.
- How do I continue to operate the system in the event of an overvoltage?

A

- When overvoltage is detected, it can be set by "Number of retries after overvoltage [bb-23]" whether the inverter trips or restarts without tripping. If [bb-23] is set to 0 times, an "overvoltage error [E007]" will immediately occur when overvoltage is detected. When [bb-23] is set to 1 to 5 times, at overvoltage detection, restart is performed according to the setting of "Overvoltage trip retry selection [bb-30]" by the number of times set to [bb-23]. If the overvoltage detection count exceeds [bb-23], it trips at [E007].
- When Frequency Adjustment Restart is selected ([bb-30]=01, 04), refer to "9.7.3 Frequency Matching Restart Function" for more information.
- When active frequency matching function is selected ([bb-28]=02), refer to "9.7.4 Active Frequency Matching Restart Function" for more information.

!

- If overvoltage is applied continuously, the deceleration time may be too short, the load may be heavy, or the motor may be turned by an external force.
- Even if Restart is selected, the inverter will detect a trip again if the trip factor has not been cleared after the "overvoltage retry wait time [bb-31]". In this case, increase the retry wait time.

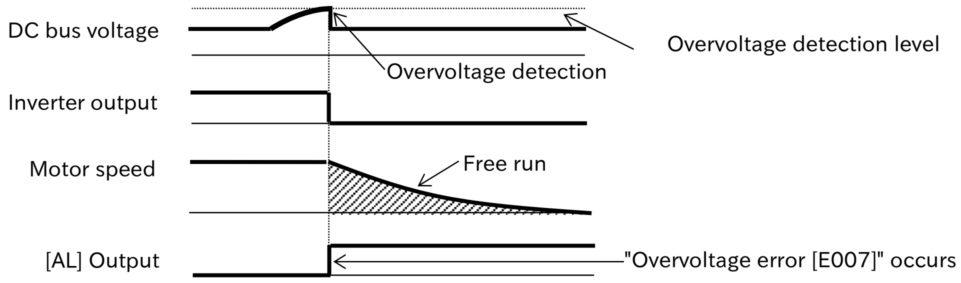
Code	Name	Description	Data
[bb-23]	Number of retries after over voltage	Set the number of restarts if an overvoltage occurs. In case of 0 times, it trips immediately due to overvoltage error without restarting.	0 to 5 (times)
[bb-30]	Restart mode selection after an overvoltage error	0 Hz restart is performed.	00
		Restart with the frequency matching (Restart with active frequency matching from the output frequency at shut down).	01
		Active frequency matching restart	02
		Restart is performed from the detected speed by encoder feedback.	03
		After the frequency matching restart (active frequency matching restart from the output frequency at shut down) is completed, the motor decelerates to a stop and trips.	04
[bb-31]	Retry wait time after an overvoltage error	Set the waiting time from overvoltage detection to restart start.	0.3 to 100.0 (s)

A

Overvoltage detection mode selection

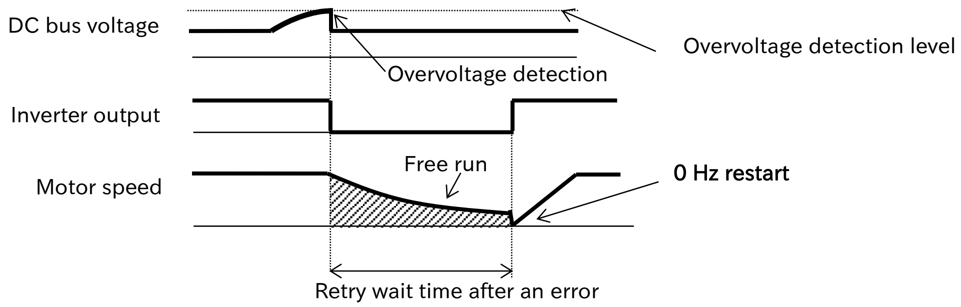
■ Trip ([bb-23]=0)

- The overvoltage detection shuts off the inverter output and the motor become free run state. "Overvoltage error [E007]" will occur and "Alarm [AL]" will be outputted respectively.



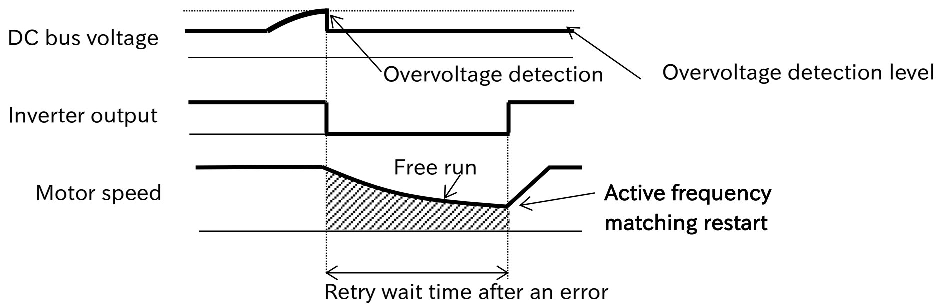
■ 0Hz start ([bb-23]≠0, [bb-30]=00)

- The overvoltage detection shuts off the inverter output and the motor become free run state. After that, after the retry wait time of the [bb-31] setting, the inverter starts 0 Hz restart. At this time, "Alarm [AL]" is not outputted.



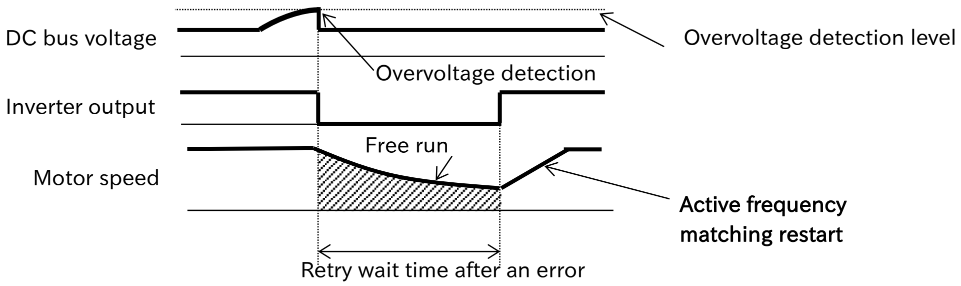
■ Frequency matching restart ([bb-23]≠0, [bb-30]=01)

- The overvoltage detection shuts off the inverter output and the motor become free run state. After that, after the retry wait time of the [bb-31] setting, the inverter starts active frequency matching restart from the output frequency at shut down. At this time, "Alarm [AL]" is not outputted.
- For details, refer to "9.7.3 Frequency Matching Restart Function".



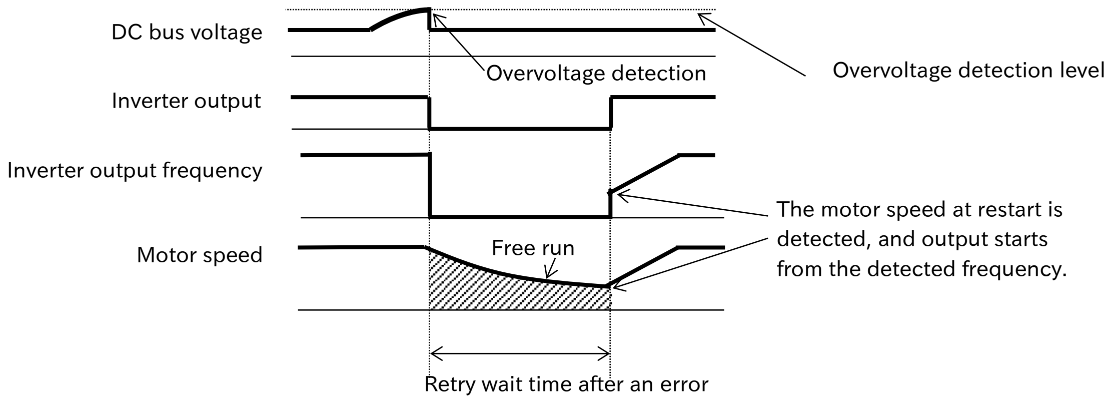
■ Active frequency matching restart ([bb-23]≠0, [bb-30]=02)

- When overcurrent or overvoltage is detected, the inverter output is shut off and the motor become free run state. After that, after the retry wait time of the [bb-31] setting, the inverter starts active frequency matching restart. At this time, "Alarm [AL]" is not outputted.
- For details, refer to "9.7.4 Active Frequency Matching Restart Function".



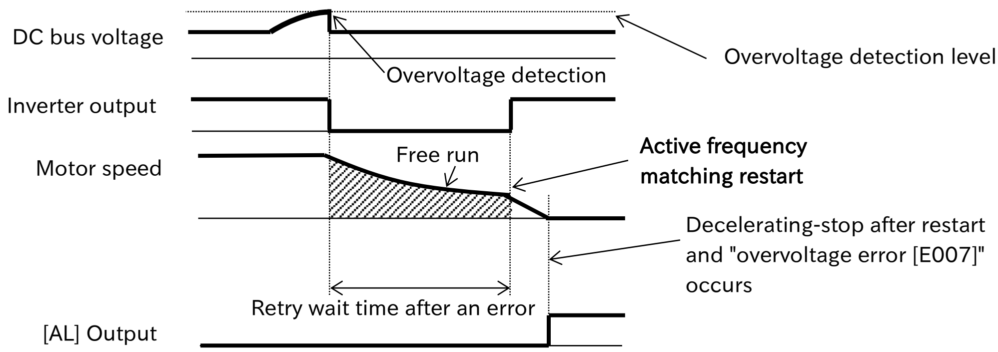
■ Detect speed ([bb-23]≠0, [bb-30]=03)

- When overcurrent or overvoltage is detected, the inverter output is shut off and the motor become free run state. Then, after the retry wait time of [bb-31] setting, the inverter starts outputting from the rotational speed detected by the encoder feedback. At this time, "Alarm [AL]" is not outputted.
- When this setting is used, a setting related to encoder feedback is separately required. For details, refer to "9.5.11 Setting for Encoder Feedback".



■ Trip after decelerating stop ([bb-23]≠0, [bb-30]=04)

- The overvoltage detection shuts off the inverter output and the motor become free run state. After that, after the retry wait time of [bb-31] setting, the inverter performs the active frequency matching restart from the output frequency at shut down. Then, decelerating stop is performed, and "Alarm [AL]" is outputted after stop.
- For details, refer to "9.7.4 Active Frequency Matching Restart Function".



9.9.9 Continuing Operation after Instantaneous Power Failure/Undervoltage Error

Q

- I want to decelerate and stop the motor even if the power supply does not recover after an instantaneous power failure or undervoltage occurs.
- After instantaneous power failure or undervoltage occurs, I want to restart operation when power is restored while maintaining the control of the motor.

A

- The instantaneous power failure non-stop function decelerates and stops the inverter without shutting off the output, while keeping the overvoltage level from being exceeded, even if a power shutdown occurs during operation. If the power is restored during this function, it is possible to return to the normal operation state in addition to decelerating stop.
- Three decelerating stop operation modes can be selected according to the setting of "Instantaneous power failure non-stop function, mode selection [bA-30]".
  Refer to the next page for details on the operation of each setting.
- When the instantaneous power failure non-stop function is operating, "IP-Non stop function is active [IPS]" is outputted.

!

- Instantaneous power failure non-stop function, DC voltage between P-N is "Instantaneous power failure non-stop function, start voltage level [bA-31]" operates when it falls below.
- [bA-31] and "Instantaneous power failure non-stop function, target voltage level [bA-32]" set bigger than the undervoltage level (200V class: approx. 172.5VDC, 400V class: approx. 345VDC) at least. This function does not operate when undervoltage occurs.
- If "Instantaneous power failure non-stop function, mode selection [bA-30]" is set to "Deceleration stop (01)" or "Deceleration stop at power failure (without resume) (02)", after this function operation, it will not be released until deceleration stop is completed. To restart operation, check that the power reception is restored after deceleration-stop by this function is completed, and turn OFF the RUN command once to ON again.
- When [bA-30] is set to "Deceleration stop at power failure (with resume) (03)", if DC voltage between P-N recovers during deceleration, it starts to accelerate to the original frequency again. However, if decelerating stop occurs prior to recovery, the RUN command must be turned OFF once and then ON again to restart operation.

Code	Name	Description	Data
[bA-30]	Instantaneous power failure non-stop function, mode selection	Disable	00
		Decelerating stop: Decelerates to a stop.	01
		Deceleration stop at power failure (without resume): Decelerates and stops at a constant DC voltage control. Even if the power is restored during this function, the decelerating stop will continue.	02
		Deceleration stop at power failure (with resume): Decelerates and stops at a constant DC voltage control. If the power is restored during this function operation, the unit will return to the operating state.	03
[bA-31]	Instantaneous power failure non-stop function, start voltage level	When DC between P-N becomes less than or equal to this setting, deceleration starts.	200V class: 0.0 to 400.0 (VDC) 400V class: 0.0 to 800.0 (VDC)
[bA-32]	Instantaneous power failure non-stop function, target voltage level	After deceleration starts, if DC between P-N exceeds this setting by regeneration, deceleration stops once.	200V class: 0.0 to 400.0 (VDC) 400V class: 0.0 to 800.0 (VDC)

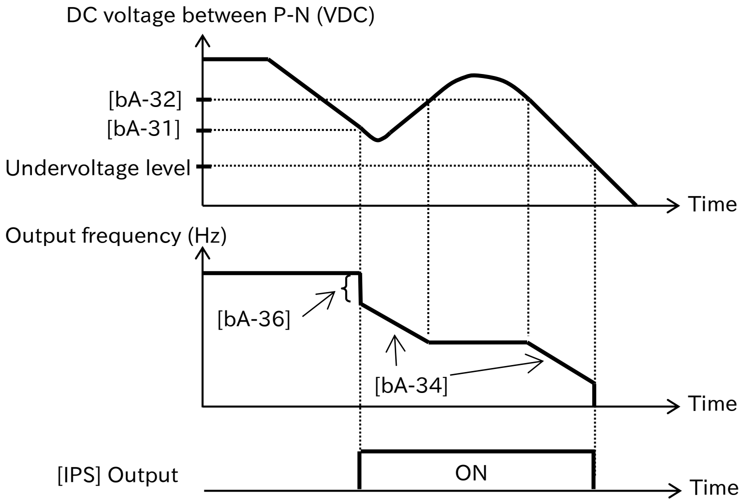
Code	Name	Description	Data
[bA-34]	Instantaneous power failure non-stop function, deceleration time	Set the deceleration time when this function is activated.	0.01 to 3600.00 (s)
[bA-36]	Instantaneous power failure non-stop function, start frequency decrement	Set the frequency to start deceleration by the difference from the output frequency.	0.00 to 10.00 (Hz)
[bA-37]	Instantaneous power failure non-stop function, DC bus voltage control P gain	Proportional gain for PI control of DC voltage-constant control.	0.00 to 5.00
[bA-38]	Instantaneous power failure non-stop function, DC bus voltage control I gain	Integral gain for PI control of DC voltage-constant control.	0.00 to 150.00 (s)
[CC-01] [CC-02] [CC-07]	Output terminal function	IP-Non stop function is active [IPS]: Outputs a signal during instantaneous power failure non-stop deceleration. OFF: The function is not working. ON: Instantaneous power failure non-stop deceleration function is active.	023

A

Instantaneous power failure non-stop function

■ Instantaneous power failure non-stop decelerating stop ([bA-30]=01)

- If the power is cut off during operation, once the DC voltage falls below the "Instantaneous power failure non-stop function, start voltage level [bA-31]" between P-N, the output frequency will be lowered to the "Instantaneous power failure non-stop function, start frequency decrement [bA-36]" and then the deceleration will start with the "Instantaneous power failure non-stop function, deceleration time [bA-34]". At that time, decelerating stop is performed while the DC between P-N does not exceed the "Instantaneous power failure non-stop function, target voltage level [bA-32]".
- During deceleration, when DC voltage between P-N exceeds [bA-32] due to regenerative energy, deceleration is stopped and constant speed operation is performed until DC voltage between P-N becomes less than [bA-32].



!

- Set "Instantaneous power failure non-stop function, start voltage level [bA-31]" so that it is smaller than "Instantaneous power failure non-stop function, target voltage level [bA-32]". If the [bA-31] setting is greater than [bA-32], the instantaneous power failure non-stop target level will internally operate as the same value as [bA-31]. However, the [bA-32] setting itself does not change.
- Be sure to set [bA-32] to a value greater than √2 times of the receiving voltage. If [bA-32] is less than √2 times of the incoming voltage, if power is duplicated during this function operation, the constant speed operation status is retained and deceleration cannot be performed. In this state, the change of stop command and frequency command is also not accepted. The power must be turned off and on again, or [bA-32] must be set again during operation.
- If "Instantaneous power failure non-stop function, start frequency decrement [bA-36]" is too large, sudden deceleration may occur during this function operation, causing an overcurrent error. In addition, if [bA-36] is too small or "Instantaneous power failure non-stop function, deceleration time [bA-34]" is too long, "Undervoltage error [E009]" may occur due to insufficient regenerative force.

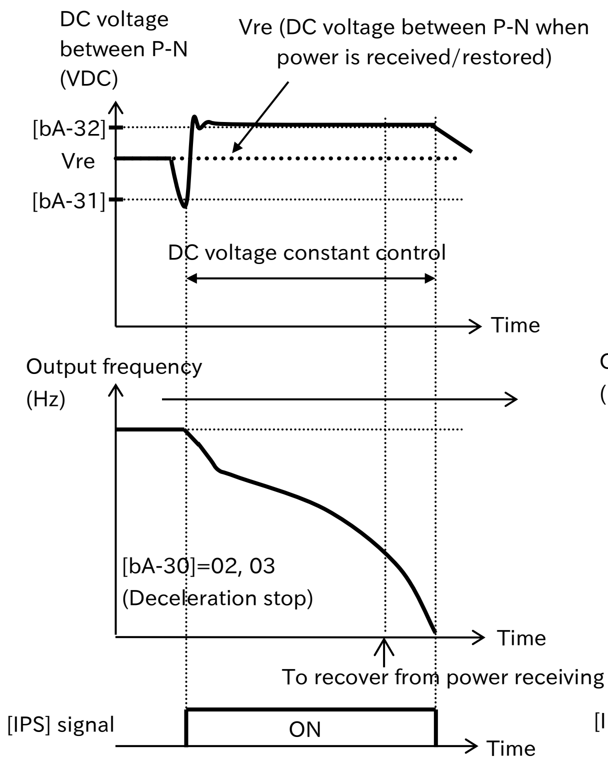
■ Instantaneous power failure non-stop DC voltage constant control ([bA-30]=02, 03)

- When the DC voltage drops during an instantaneous power failure or P-N, and the DC voltage falls below the "Instantaneous power failure non-stop function, start voltage level [bA-31]", the motor decelerates automatically while holding the DC voltage between P-N at the "Instantaneous power failure non-stop function, target voltage level [bA-32]".
- If the instantaneous power failure time is short, operation can be continued without output shutdown by this function. However, if an undervoltage occurs due to an instantaneous power failure, the output is immediately shut off and this function terminates operation. After that, the operation at recovery from an instantaneous power failure follows "Restart mode selection after instantaneous power failure/under-voltage error [bb-24]". For details, refer to "9.9.6 Restart after Instantaneous Power Failure/Undervoltage Error".
- If "Instantaneous power failure non-stop function, mode selection [bA-30]" is "Deceleration stop at power failure (with resume) (03)", if power is restored prior to power shutdown, normal operation can be resumed. However, depending on the setting of [bA-32], it will decelerate and stop. Details are as follows.

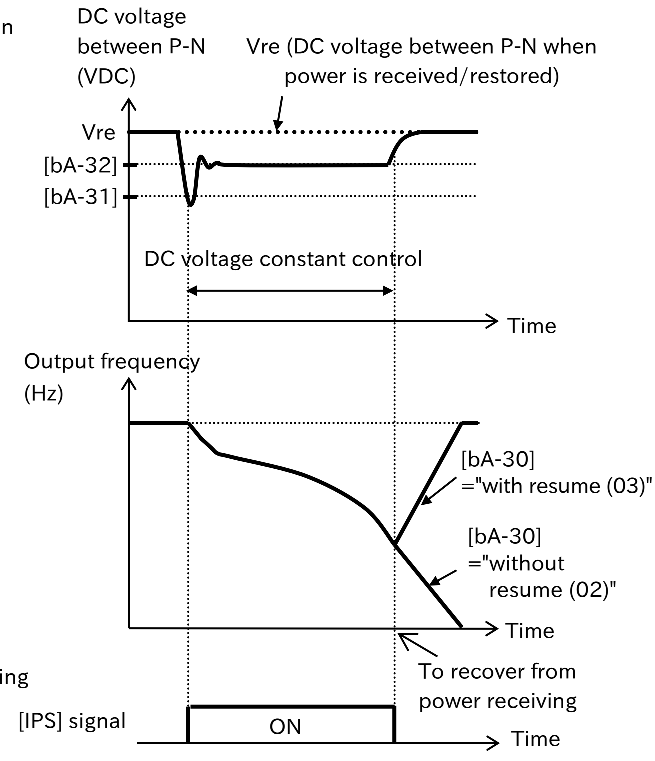
Instantaneous power failure non-stop function, mode selection [bA-30]	Instantaneous power failure non-stop function, target voltage level [bA-32]	Operation
Deceleration stop at power failure (without resume) (02)	[bA-32] > Vre*1	Deceleration stop (DC voltage constant control) (e.g. 1)
	[bA-32] < Vre*1	Deceleration stop (Normal operation) (e.g. 2)
Deceleration stop at power failure (with resume) (03)	[bA-32] > Vre*1	Deceleration stop (DC voltage constant control) (e.g. 1)
	[bA-32] < Vre*1	Operation (Normal operation) (e.g. 2)

*1. Vre: DC voltage between P-N when receiving power and restoring power

■"Instantaneous power failure non-stop function, target voltage level [bA-32]" is larger than DC voltage between P-N when power is received/restored



■"Instantaneous power failure non-stop function, target voltage level [bA-32]" is smaller than DC voltage between P-N at power receiving/restoring



*) Depending on the proportional (P) gain/integral (I) gain ([bA-37], [bA-38]) setting of DC voltage constant control for the instantaneous power failure non-stop function, the DC voltage between P-N may be lower than [bA-32].

!

- If the difference between the "Instantaneous power failure non-stop function, start voltage level [bA-31]" and the "Instantaneous power failure non-stop function, target voltage level [bA-32]" is large, if the "Constant DC bus voltage control P gain [bA144]" is made too large, rapid acceleration may occur immediately after this function starts operation, causing an overcurrent error.
- Adjust this function using "Instantaneous power failure non-stop function, DC bus voltage control P gain [bA-37]" and "Instantaneous power failure non-stop function, DC bus voltage control I gain [bA-38]". Setting a larger proportional (P) gain ([bA-37]) or an shorter integral (I) gain ([bA-38]) will make the answer faster, but will make it easier to trip. If [bA-37] is too low, "Undervoltage error [E009]" may occur due to a drop in voltage immediately after this function starts operation.

9.10 Using System Protection Functions

9.10.1 Setting Carrier Frequency

Q

- I want to reduce the electromagnetic sound heard from the motor.
- I want to reduce electromagnetic noise emitted by the inverter.
- I want to suppress the heat generation of the inverter.
- I want to suppress the leakage current.

A

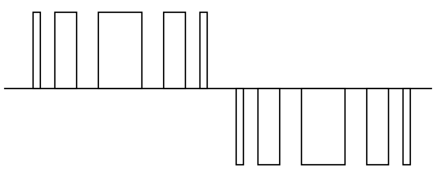
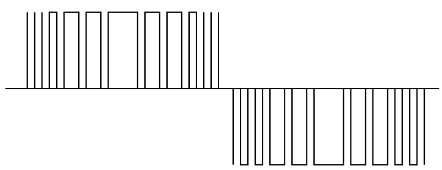
- The carrier frequency is the frequency of PWM wave outputting from the inverter.
- Metallic noise from the motor can be reduced by setting "Carrier frequency setting [bb101]" to a large value. However, electromagnetic noise and leakage current generated by the inverter may increase. Changing the carrier frequency may also be effective to avoid resonance in the mechanical system and the motor.

!

- The setting of "Load type selection [Ub-03]" automatically limits the carrier frequency setting.
- Carrier frequency may be automatically reduced by the setting of "Automatic carrier reduction selection [bb103]" or the DC braking function, etc.
- The higher the carrier frequency, the greater the heat generated by the inverter. Therefore, derating may be required for the rated output current. The relationship between the carrier frequency and the output current derating varies depending on the model. For details, refer to "17.3 Current Derating".
- When the "Control mode selection [AA121]" is set to "Sensorless vector control (IM) (08)", in order to secure the torque during operation in the low-speed range, even if the "Carrier frequency setting [bb101]" is set to a value exceeding 2.0 kHz, operation is performed by automatically lowering it to 2.0 kHz. In addition, since the carrier frequency increases with acceleration, electromagnetic noise, etc. from the motor may change depending on the output frequency.
- Set the carrier frequency to be 10 times or more of the "Async. Motor maximum frequency setting [Hb105]" or more.
  (e.g.) [bb101]=5.9 kHz or more for [Hb105]=590.00 Hz

Code	Name	Description	Data
[bb101]	Carrier frequency setting	Set the carrier frequency of PWM wave outputting from the inverter to the motor.	2.0 to 15.0 (kHz) (ND: Normal Duty) 2.0 to 10.0 (kHz) (LD: Light Duty)

■ **Carrier frequency and its influence range**

Carrier frequency	Low ⟺	High
Electromagnetic noise of the motor	Large	Small
Electromagnetic noise and leakage current	Small	Large
Heat generated by the inverter	Small	Large
Example of output voltage-waveform of inverter (PWM output)		

9.10.2 Automatically Reducing Carrier Frequency

Q
- I want to reduce the carrier frequency automatically according to the output current of the inverter.
- I want to reduce the carrier frequency automatically according to the inverter temperature.

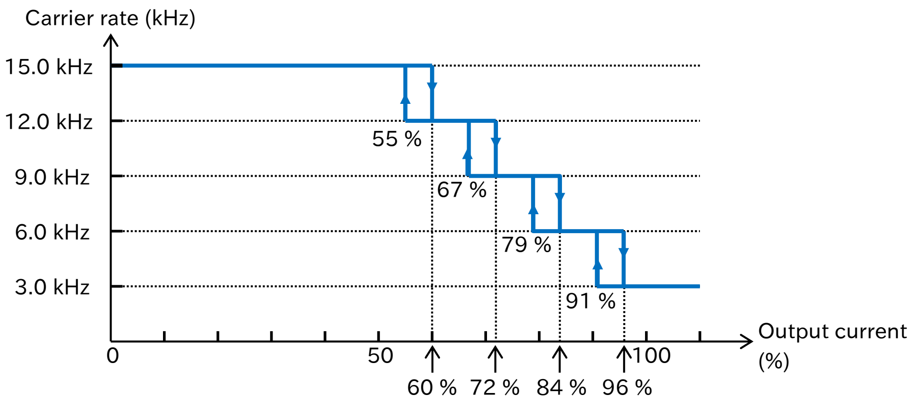
A
- The higher the carrier frequency, the higher the internal temperature rise of the inverter, which may result in shorter life or failure. The automatic carrier reduction function reduces automatically the carrier frequency according to the output current or the cooling fin temperature to reduce inverter life degradation.

!
- Depending on the current derating specification, it may be necessary to reduce the carrier frequency further than this function. In that case, reduce the "Carrier frequency setting [bb101]" or review the operation pattern or the system to reduce the maximum output current to meet the current derating specifications for each model. For details, refer to "17.3 Current Derating".
- The variation range of carrier frequency is within the upper limit "Carrier frequency setting [bb101]" to lower limit 3kHz. This function is disabled when [bb101] is less than or equal to 3kHz.
- This function is disabled regardless of the setting of "Automatic carrier reduction selection [bb103]" when "Sprinkle carrier pattern selection [bb102]" is set to other than "Disable (00)".
- When the carrier frequency is changed, the operation rate is 2 kHz per second.

Code	Name	Description	Data
[bb103]	Automatic carrier reduction selection	The automatic carrier reduction function does not work.	00
		Reduces the carrier according to the output current.	01
		Reduce the carrier according to the cooling fin temperature.	02

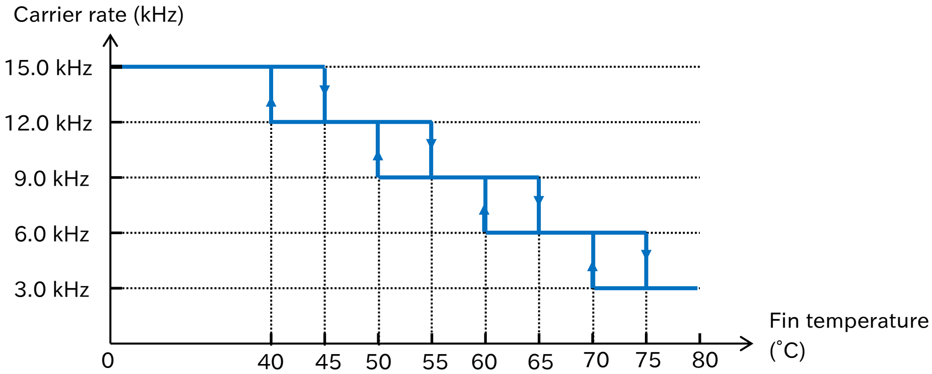
■ Reduction curve for output current dependence ([bb103]=01)

- If the output current exceeds a certain percentage of the rated output current, the carrier frequency is reduced.
- The carrier frequency automatically returns when the output current drops.



■ Reduction Curve for Cooling-Fin Temperature Dependence ([bb103]=02)

- When the cooling fin temperature exceeds a certain value, the carrier frequency is reduced.
- The carrier frequency automatically recovers when the temperature drops.



9.10.3 Reducing Electromagnetic Noise from Motor

Q

- I want to reduce the electromagnetic noise of the motor caused by the carrier frequency.

A

- Enabling "Sprinkle carrier pattern selection [bb102]" may reduce the electromagnetic noise of the motor due to low carrier frequency.
- When [bb102] is set to "Enable (Pattern-1) (01)", electromagnetic sound in a certain area can be cut and the electromagnetic sound from the motor can be changed.

!

- When "Sprinkle carrier pattern selection [bb102]" is set to "Enable (Pattern-1) (01)", the carrier frequency of the inverter is the same as when "Carrier frequency setting [bb101]" is set to 2.5 kHz.
- The electromagnetic noise reduction effect of the motor varies depending on the motor used. It may not be effective depending on the motor characteristics.

Code	Name	Description	Data
[bb102]	Sprinkle carrier pattern selection	Disable: Carrier frequency set in "Carrier frequency setting [bb101]" is used for operation.	00
		Enable (Pattern-1): Changing the carrier frequency at a fixed cycle may reduce electromagnetic noise from the motor.	01

9.10.4 External Trip Function

Q

- When an error occurs in the system, you want to forcibly shut off or output an alarm using an external signal.

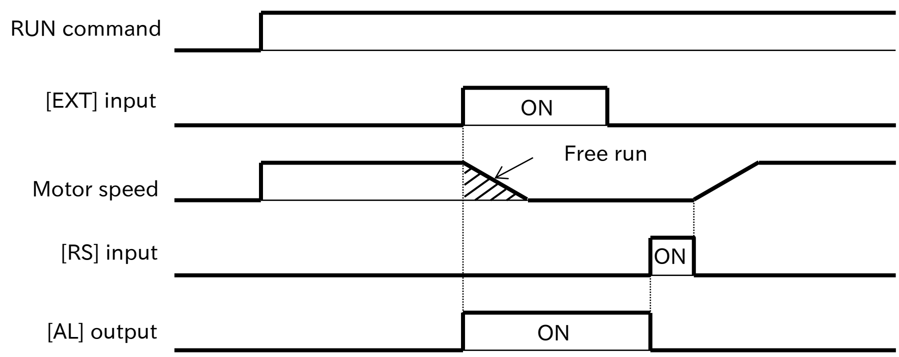
A

- The external trip function generates an "External trip [E012]" by assigning an "External fault [EXT] (033)" input terminal to the "Input terminal function ([CA-01] to [CA-08])" and ON that terminal.
- Use when the inverter needs to be tripped by an error (trip) signal generated by a peripheral system, etc.

!

- If "External trip [E012]" occurs, trip is not canceled even if the "External fault [EXT]" input terminal is turned OFF. Reset the trip by resetting or turning the power off and then on again.
- If the trip is released while the [EXT] input terminal remains ON, [E012] occurs again. Before releasing the trip, make sure that the [EXT] input terminal is turned OFF.
- Restart after reset follows the setting of "Restart mode after RS release [bb-41]". For details, refer to "9.7.5 Restart after Trip Reset or Power-ON".
- Even when the inverter output is stopped, [E012] occurs when the [EXT] input terminal is turned ON.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	External fault [EXT]: When this signal is turned ON, "External trip [E012]" will occur.	033



9.10.5 Preventing Unintended Start at Power-ON

Q

- I want to prevent the motor from suddenly starting to rotate when the inverter power is turned on.
- If the RUN command is ON when the power is turned ON again, trip the inverter to stop the operation.

A

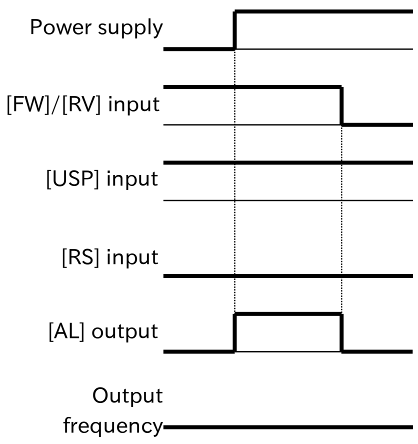
- The unintended start protection function prevents a sudden startup by generating a "USP error [E013]" when the power is turned on while the RUN command to the inverter remains ON. To use this function, assign "Unattended start protection [USP] (034)" to the input terminal or set "[USP] active selection [CA-73]" to "Enable (01)". When "Disable (00)" is selected, this function operates when the [USP] input terminal is ON, and when "Enable (01)", this function operates at all times regardless of the input terminal status.
- The "USP error [E013]" trip can also be released by turning OFF the RUN command in addition to the resetting operation. (e.g. 1)
- If the trip is released while the RUN command is ON, the inverter starts operation at the same time as the release. (e.g. 2)
- Normal operation occurs when the RUN command is ON after the power is turned on. (e.g. 3)

!

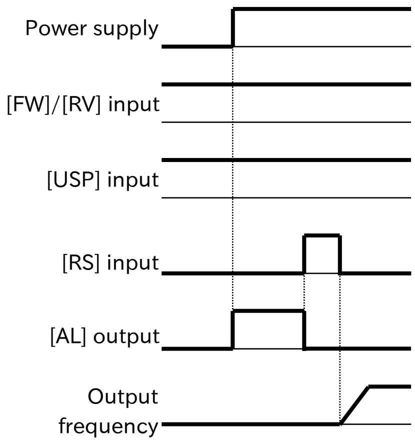
- Unlike other trips, "USP error [E013]" is automatically cancelled when the RUN command is turned OFF.
- This function makes a judgment for up to 2 seconds after the control power supply is established.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Unattended start protection [USP]: If the power is turned on while this signal and the RUN command are ON, a "USP error [E013]" will occur.	034
[CA-73]	[USP] active selection	Disable: [USP] input terminal function enabled	00
		Enable: Always enable the power restart prevention function	01

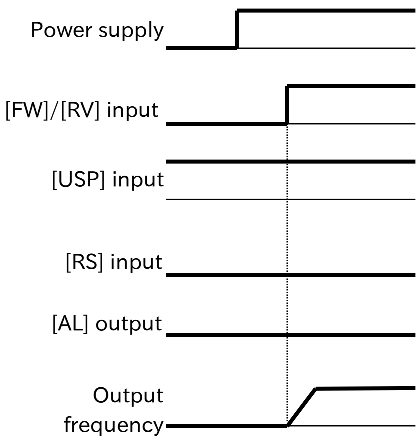
(e.g. 1) Turning the power ON with the RUN command ON
(Cancel by RUN command OFF)



e.g. 2) Turning the power ON with the RUN command ON
(Cancel by [RS] input terminal)



(e.g. 3) RUN command after power ON
(normal operation)



9.10.6 Avoiding Mechanical Resonance of Motor and Machine

Q

- Operating with the motor integrated into the system causes vibration at a specific speed.

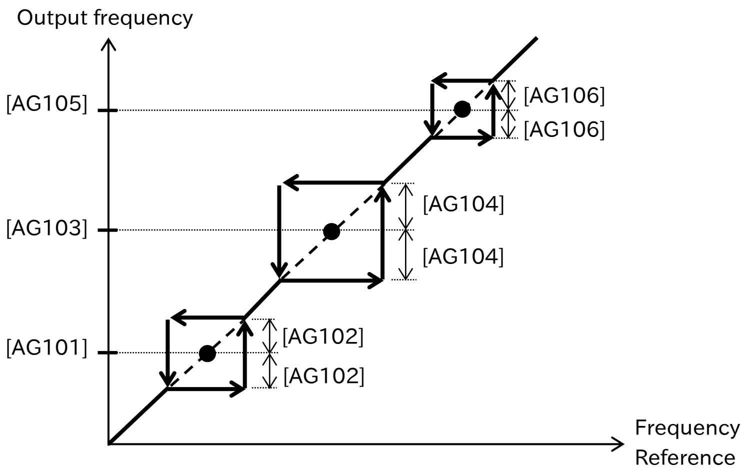
A

- The frequency jump function is used to avoid the resonance point of the load mechanical system.
- Three jump frequencies can be set.
- The output frequency outside the range of the jump reference, changes continuously according to normal acceleration/deceleration time.

!

- When this function is set, acceleration or deceleration stops at a frequency outside the jump frequency range when the output frequency is set within the jump frequency range to avoid constant speed operation within the jump frequency range. In addition, "Icon 2 LIM detail monitor [dC-37]" displays "Frequency limit (05)". For details on [dC-37], refer to "10.3.7 Checking the Detail of Warning Status".

Code	Name	Description	Data
[AG101]	Jump frequency 1	Set the center of the frequency range that you want to jump. For 0.00 Hz, the jump frequency function is disabled.	0.00 to 590.00 (Hz)
[AG103]	Jump frequency 2		
[AG105]	Jump frequency 3		
[AG102]	Jump frequency width 1	Set 1/2 of the frequency width to be jumped. Jump the range of ± jump frequency width from the jump frequency.	0.00 to 10.00 (Hz)
[AG104]	Jump frequency width 2		
[AG106]	Jump frequency width 3		



9.10.7 Selecting Cooling Fan Operation

Q

- The cooling fan of the inverter should be kept running at all times.
- You want to operate the cooling fan only while the inverter is running.
- Turning off the cooling fan while the inverter is stopped.
- I want the cooling fan to operate only when the inverter generates heat.

A

- The following cooling fan operations can be selected by the setting of "Cooling fan control method selection [bA-70]".
  - Always run the cooling fan.
  - Operate the cooling fan under any conditions when the cooling fin temperature reaches 60 ˚C or higher for 3 minutes during inverter operation and after shutdown.
  - Operate the cooling fan when the cooling fin temperature reaches approximately 40 ˚C or higher.

!

- If an undervoltage condition occurs due to a momentary power failure or power shutdown while the cooling fan is running, the cooling fan will pause and automatically recover after power is restored.
- Refer to "9.11.10 Lifetime Warning for Cooling Fan" and "10.3.3 Monitor the Life Assessment Results" and "16.2.6 Lifetime Warning Output" for more information on the cooling fan life diagnosis, "Cooling-fan life warning [WAF]" and "Accumulated cooling-fan run time monitor [dC-26]".
- The cooling fin temperature can be checked in "Cooling fin temperature monitor [dC-15]". For details, refer to "10.3.2 Monitor the Cooling Fin Temperature".

Code	Name	Description	Data
[bA-70]	Cooling fan control method selection	Always ON: The cooling fan operates at all times.	00
		While inverter operates: When the inverter enters the operating state, the cooling fan operates automatically. It also operates for 3 minutes after the inverter operation is stopped. However, if the cooling fin temperature still above 50 ˚C after 3 minutes, the cooling fan will continue to operate until the temperature drops below 50 ˚C, and then stop after a further 3 minutes. ※Even when operation is stopped, if the cooling fin temperature exceeds 60 ˚C, the cooling fan will start operating.	01
		Depends on temperature: When the cooling fin temperature of the inverter exceeds about 40 ˚C, the cooling fan operates. When the cooling fin temperature is below 40 ˚C for 3 minutes, stops the cooling fan.	02

9.10.8 Monitoring Motor Temperature

Q

- How do I perform thermal protection of the motor?
- You want to perform temperature protection with the thermistor installed on the motor.

A

- Thermistors installed in external devices such as motors can be wired to the inverter and set functions to protect the temperature of the external devices.
- When using an external thermistor, wire between the [5]-[L] terminals of the control terminal block after setting "Thermistor type selection [Cb-40]" to "PTC (01)". In this case, the common is the [L] terminal regardless of the sink/source logic.
- When the resistance value of the PTC thermistor exceeds "Thermistor error level [bb-70]" a "Thermistor error [E035]" occurs. Adjust [bb-70] or "Thermistor gain adjustment [Cb-41]" according to the characteristics of the thermistor to be used.

!

- When "Thermistor type selection [Cb-40]" is set to "PTC (01)", the setting of "Input terminal [5] function [CA-05]" is disabled.
- Separate the wiring of the external thermistor from other common wires as twisted wires. Keep the wire length within 20 m. For wiring, refer to "5.4 Control Circuit Terminal".
- Since the current flowing through the thermistor is a weak current, consider wiring separation so as not to be affected by noise caused by motor current, etc.

Code	Name	Description	Data
[bb-70]	Thermistor error level	Set the thermal resistance to generate "Thermistor error [E035]" according to the thermistor specifications. Enabled when "Thermistor type selection [Cb-40]" is "PTC (01)".	0 to 10000 (Ω)
[Cb-40]	Thermistor type selection	Disable	00
		PTC	01
[Cb-41]	Thermistor gain adjustment	Use this for gain adjustment.	0.0 to 1000.0

9.10.9 Ground Fault Detection Function

Q

- You want to detect a ground fault due to motor deterioration or a ground fault due to incorrect wiring.

A

- Set the ground fault detection protective function in "Detect ground fault selection [bb-64]".
- When the ground fault detection protective function is enabled, "Ground fault error [E014]" occurs when ground fault detection is performed during power-up and the output side of the inverter (between inverter output terminal and motor) is grounded faulted.

!

- If ground fault detection is performed when there is an induced voltage in the motor (which is running in free run state), "Ground fault error [E014]" may detect incorrectly. In this case, disable the ground fault detection selection or turn on the power with the induced voltage dropped sufficiently.
- If a trip has occurred, it will not operate even if the ground fault detection protection function is enabled.
- [E014] is a major failure error. It cannot be cleared by resetting operation. Shut off the power supply, check the insulation and wiring of the motor, and check that there is no problem before turning the power on again.
- This function detects a ground fault between the inverter output and the motor. It cannot detect a ground fault on the input side.

Code	Name	Description	Data
[bb-64]	Detect ground fault selection	Disable: Earth fault detection function is disabled.	00
		Enable: Earth fault detection function is enabled.	01

9.10.10 Input Phase Loss Detection Function

Q

- To prevent system damage due to unstable operation when the input power line is disconnected, and phase loss occurs.

A

- Set the input phase loss protection function with "Input phase loss detection enable [bb-65]".
- If [bb-65] is set to "Enable (01)", "Input phase loss [E024]" will occur if the input power line is disconnected or disconnected and the phase loss status continues.

!

- If "Input phase loss [E024]" occurs, the power supply to the inverter must be disconnected and the status of the wires and breakers must be checked ([E024] may also occur when the voltage imbalance of the three-phase input power supply is significant).
- If the "Input phase loss detection level [bb-77]" is set to a small value, false detection is likely to occur during normal operation, and if it is set to a large value, tends to be undetectable during phase loss. In addition, the detection accuracy will deteriorate when the motor is in the regenerative state or when the output current is very small with respect to the inverter rated current. If adjusting [bb-77] does not improve the problem, set "Input phase loss detection enable [bb-65]" to "Disable (00)".

Code	Name	Description	Data
[bb-65]	Input phase loss detection enable	Disable: Input phase loss function is disabled.	00
		Enable: Input phase loss function is enabled.	01
[bb-77]	Input phase loss detection level	Adjust the judgment level of the input phase loss.	0 to 200

9.10.11 Output Phase Loss Detection Function

Q

- I want to prevent the system from being damaged because the operation becomes unstable because the output wire to the motor is disconnected and the phase is open.

A

- Set the output phase loss protective function with "Output phase loss detection enable [bb-66]".
- If [bb-66] is set to "Enable (01)", "Output phase loss [E034]" occurs if the status of phase loss continues due to motor wire deficiency or disconnection, etc.

!

- This function operates when the output frequency is equal to or greater than 5 Hz and equal to or less than 100 Hz.
- Set "Output phase loss detection sensitivity [bb-67]" to a value less than or equal to the current that flows constantly, assuming that the rated current is 100 %.
- If the drive motor capacity is smaller than the inverter capacity or the "Carrier frequency setting [bb101]" is lower, an output phase loss may be incorrectly detected. Detection accuracy may also deteriorate depending on the environment of your system. Adjust [bb-67] and [bb101] according to your system to ensure that there are no problems. If adjusting [bb-67] or [bb101] does not improve the problem, set "Output phase loss detection enable [bb-66]" to "Disable (00)".

Code	Name	Description	Data
[bb-66]	Output phase loss detection enable	Disable: Output phase loss function is disabled.	00
		Enabled: Output phase loss function is enabled.	01
[bb-67]	Output phase loss detection sensitivity	Adjust the sensitivity of the output phase loss.	1 to 100 (%)
[bb101]	Carrier frequency	Set the carrier frequency of PWM wave outputting from the inverter to the motor.	2.0 to 15.0 (kHz) (ND: Normal duty) 2.0 to 10.0 (kHz) (LD: Light duty)

9.11 Outputting Warning Signals to Terminals

9.11.1 Alarm Signal

Q

- I want to notify the system by detecting an error condition in the inverter.

A

- By assigning "Alarm [AL](017)" to any of "Output terminal function ([CC-01]/[CC-02]/[CC-07])", a signal is output when the inverter trips.
- In the "Output terminal active state ([CC-11], [CC-12], and [CC-17])", the output specifications of the a-contact (NO: normally open) or b-contact (NC: normally closed) can be set individually for the output terminals [11]/[12] and the relay output terminals.
  - a-contact (NO): The contact closes at ON and the contact opens at OFF
  - b-contact (NC): The contact closes at OFF and the contact opens at ON
- In the default status, the "Alarm [AL]" signal is assigned to the c-contact relay of [AL1]-[AL0]/[AL2]-[AL0].
  -"Output terminal [AL] function [CC-07]" = "Alarm [AL](017)"
  -"Output terminal [AL] active state [CC-17]" = "Normally Closed (NC) (01)"

!

- If the system recognizes an error when the inverter power is cut off, this may be improved by changing the wiring and contact selection.
- In the default setting, [AL2]-[AL0] closes when the power is turned OFF and opens when there is no problem with the inverter at the power ON, as shown in the table below. To avoid this condition, set "Output terminal [AL] active state [CC-17]" to "Normally Open (NO) (00)", or change the error detecting wire.
- Refer to Section "5.4 Control Circuit Terminal" for the electric specifications of the relay contacts ([AL1]-[AL0] and [AL2]-[AL0]).

Output terminal [AL] active state [CC-17]	Power state	Inverter status	Status output terminal	
			[AL1]-[AL0]	[AL2]-[AL0]
00	ON	Abnormal condition	Close	Open
		Normal condition	Open	Close
	Off	-	Open	Close
01 (initial value)	ON	Abnormal condition	Open	Close
		Normal condition	Close	Open
	Off	-	Open	Close

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Alarm [AL]: This signal turns ON when a trip occurs.	017
[CC-11] [CC-12] [CC-17]	Output terminal active state	Operates as a-contact (NO: normally open).	00
		Operates as b-contact (NC: normally closed).	01

9.11.2 Major Failure Signal

Q

- I want to notify the system by detecting an error condition that cannot be cleared by the inverter.

A

- By assigning "Major failure [MJA](018)" to one of the output terminal function selections ([CC-01]/[CC-02]/[CC-07]), the output of a major failure signal is enabled.
- The trips judged as serious failures are as shown in the table below. If these conditions occur, the trip release by resetting cannot be performed.

!

- When this signal is output, the hardware of the inverter may have failed. Check the trip history and take appropriate action.

Error code	Name	Contents
[E008]	Memory error	There is an error in the storage element of the inverter.
[E011]	CPU error	There is an error in the inverter CPU of the drive.
[E014]	Ground fault error	The inverter has a ground fault.
[E030]	Driver error	There is an error in the main elements of the inverter.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Major failure [MJA]: This signal turns ON when an error (trip in the table above) that is judged to be a serious failure occurs.	018

9.11.3 Overload Warning

Q

- I want to know by warning signal that the output current of the motor has risen.
- I want to know the increase in the output current to the motor before tripping occurs.

A

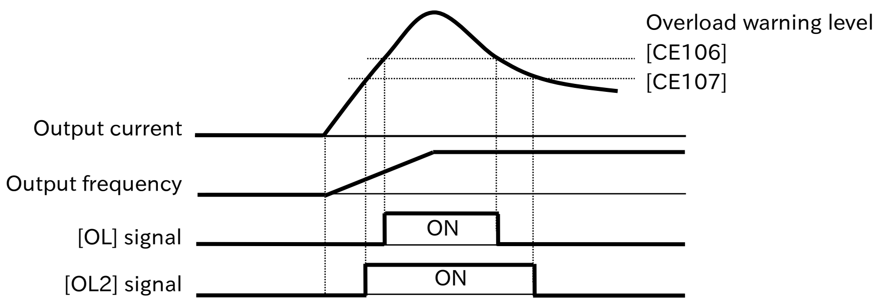
- The overload notice can be output by assigning "Overload warning notice [OL](035)"/"Overload warning notice 2 [OL2](036)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])".
- The [OL]/[OL2] signal is output when the output current exceeds the respective overload warning level.
- Signal can be output according to the operation status by changing "Overload signal output mode selection [CE105]".

!

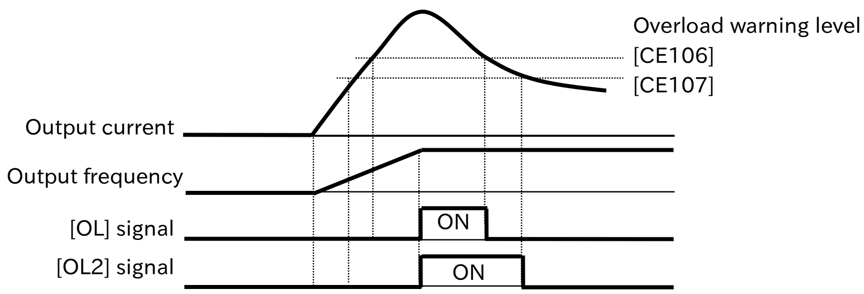
- If the overload notice level is set too high, an overcurrent error may occur before the overload notice signal is output. In this case, lower the overload forewarning level.
- When "Overload signal output mode selection [CE105]" is set to "During constant speed only (01)" and the output frequency reference input source is the analog input, if the frequency reference input fluctuates finely, it may not be judged as constant speed operation. In such cases, change [CE105] to "During accel./decel. and constant speed (00)" or increase "Output current related filter for terminal function [CE-61]".

Code	Name	Description	Data
[CE105]	Overload signal output mode selection	Enable during acceleration/ deceleration and constant speed	00
		Enable only during constant speed	01
[CE106]	Overload warning level 1	Set the current level at which the overload notice signal is output.	(0.00 to 2.00)× ND/LD Rated Output Current (A)
[CE107]	Overload warning level 2		
[CE-61]	Output current related filter for terminal function	Set the filter for the [LOC]/[LOC2]/[OL]/ [OL2] detection level.	0 to 2000 (ms)
[CC-01] [CC-02] [CC-07]	Output terminal function	Overload warning notice [OL]: This signal is turned ON when the output current exceeds the overload warning level 1.	035
		Overload warning notice 2[OL2]: This signal is turned ON when the output current exceeds the overload warning level 2.	036

■ When overload warning signal output mode is in acceleration/deceleration or enabled during constant speed ([CE105] = 00)



■ When overload warning signal output mode is enabled during constant speed only ([CE105] = 01)



9.11.4 Low Current Warning

Q

- I want to be notified by warning that the motor output current has dropped.
- How do I detect the current decrease of the motor when the load is disconnected?

A

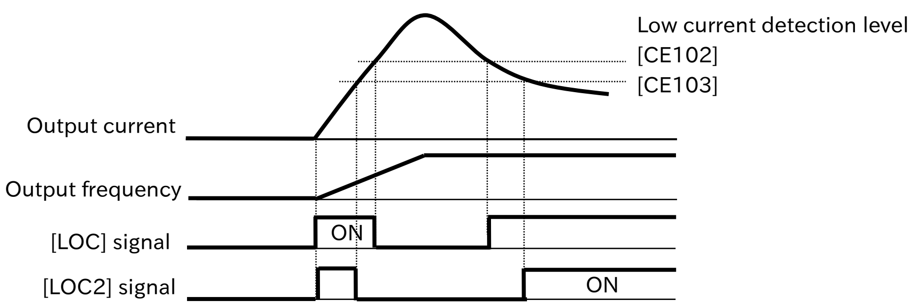
- Low current signals can be output by assigning "Low-current indication [LOC](033)"/ "Low-current indication 2 [LOC2](034)" to any of "Output terminal function ([CC-01], [CC-02], and [CC-07])".
- The [LOC]/[LOC2] signal is output when the load becomes lighter and the output current falls below "Low current detection level 1 [CE102]"/"Low current detection level 2 [CE103]."
- Signal can be output according to the operation status by changing "Low current signal output mode selection [CE101]".

!

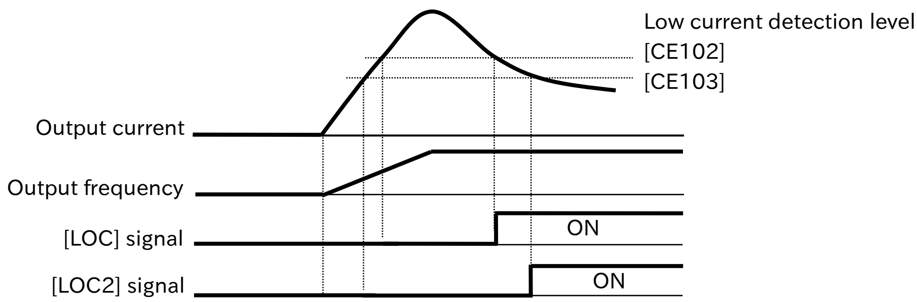
- If "Low current signal output mode selection [CE101]" is set to "During constant speed only (01)" and the output frequency reference input source is an analog input, the operation may not be judged as constant speed operation if the frequency reference input fluctuates finely. In such cases, change [CE101] to "During accel./decel. and constant speed (00)" or increase "Output current related filter for terminal function [CE-61]".

Code	Name	Description	Data
[CE101]	Low current signal output mode selection	Enable during acceleration/ deceleration and constant speed	00
		Enable during constant speed only	01
[CE102]	Low current detection level 1	Set the output current level at which the low current indication signal is output.	(0.00 to 2.00)× ND/LD Rated Output Current (A)
[CE103]	Low current detection level 2		
[CE-61]	Output current related filter for terminal function	Set the filter for the [LOC]/[LOC2]/[OL]/ [OL2] detection level.	0 to 2000 (ms)
[CC-01] [CC-02] [CC-07]	Output terminal function	Low-current indication [LOC]: This signal turns ON when the output current falls below the low current detection level.	033
		Low-current indication 2[LOC2]: This signal turns ON when the output current falls below the low current detection level 2.	034

■ When the low-current signal mode is enabled during acceleration/deceleration or constant speed ([CE101] = 00))



■ Low-current signal mode is enabled during constant speed only ([CE101] = 01)



9.11.5 Motor Electronic Thermal Warning

Q

- Looking at the electronic thermal load factor for the motor, you want to output a signal before tripping due to a motor overload error.
- I want to cool the system before a thermal error occurs.

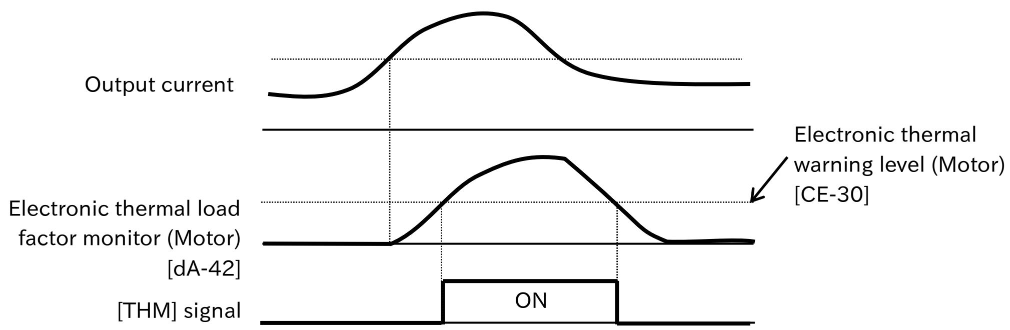
A

- Electronic thermal warning signal can be output by assigning "Electronic thermal alarm (motor) [THM](026)" to one of the output terminal function selections ([CC-01], [CC-02], and [CC-07]).
- Before "Motor overload error [E005]" occurs in the electronic thermal function, the status can be known by outputting a warning signal.

!

- "Motor overload error [E005]" occurs when the accumulated value of "Electronic thermal load factor monitor (Motor) [dA-42]" reaches 100.00 %.
- Refer to "8.1.4 Setting Electronic Thermal for Motor" for details of the electronic thermal setting for the motor.

Code	Name	Description	Data
[dA-42]	Electronic thermal load factor monitor (Motor)	If this monitor reaches 100.00 %, "Motor overload error [E005]" occurs.	0.00 to 100.00 (%)
[CE-30]	Electronic thermal warning level (Motor)	Set the level to turn ON the "electronic thermal alarm (motor) [THM]". When [dA-42] exceeds this setting, the [THM] signal turns ON. It does not work when set to 0.00%.	0.00 to 100.00 (%)
[CC-01] [CC-02] [CC-07]	Output terminal function	Electronic thermal alarm (motor) [THM]: When [dA-42] exceeds the [CE-30] setting, this signal turns ON.	026



9.11.6 Inverter Electronic Thermal Warning

Q

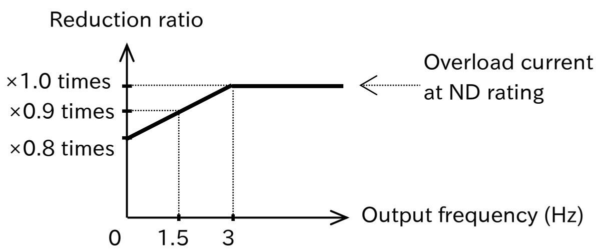
- Look at the electronic thermal load factor for the inverter and want to output a signal before tripping due to a controller overload error.
- I want to cool the system before a thermal error occurs.

A

- Electronic thermal warning signal can be output by assigning "Electronic thermal alarm (inverter) [THC](027)" to one of the output terminal function ([CC-01], [CC-02], and [CC-07]).
- Before "Controller overload error [E039]" occurs in the electronic thermal function, the status can be known by outputting a warning signal.

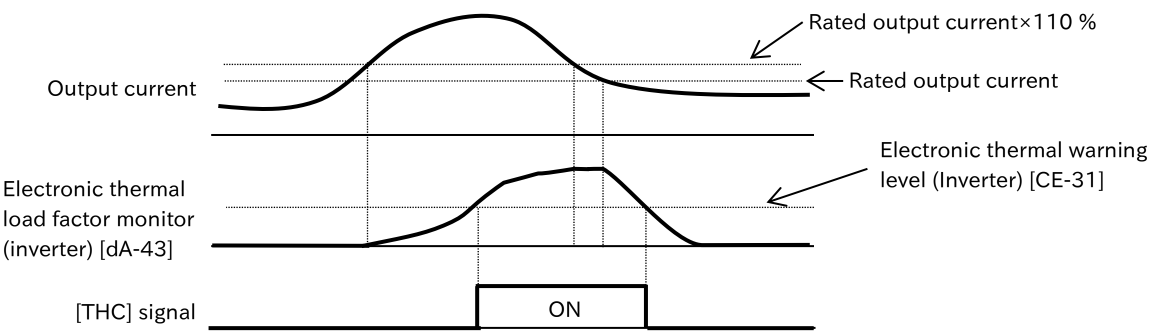
!

- The "Controller overload error [E039]" occurs when the accumulated value of "Electronic thermal load factor monitor (inverter) [dA-43]" reaches 100.00 %.
- The characteristics of the inverter electronic thermal are fixed for each type to protect the inverter. Adjustment by parameters is not possible.
- Regardless of the "Load type selection [Ub-03]" setting, the overload current rating at ND rating applies to the electronic thermal of the inverter. To protect the inverter, if it is less than 3.0 Hz, the reduction ratio is applied as shown in the figure below. Therefore, due to operation in the low-speed range, "Electronic thermal alarm (inverter) [THC]" may be outputted faster.



- When the output current is less than the rated output current of the inverter, the electronic thermal load factor of the inverter subtracts 0 % from 100 % at a rate that changes linearly in 10 seconds.

Code	Name	Description	Data
[dA-43]	Electronic thermal load factor monitor (Inverter)	If this monitor reaches 100.00 %, "Controller overload error [E039]" occurs.	0.00 to 100.00 (%)
[CE-31]	Electronic thermal warning level (Inverter)	Set the level to turn ON the "Electronic thermal alarm (inverter) [THC]". When [dA-43] exceeds this setting, the [THC] signal turns ON. It does not work when set to 0.00%.	0.00 to 100.00 (%)
[CC-01] [CC-02] [CC-07]	Output terminal function	Electronic thermal alarm (Inverter) [THC]: When [dA-43] exceeds the [CE-31] setting, this signal turns ON.	027



※Example of operation during constant speed operation at the maximum frequency

9.11.7 High Input Voltage Warning

Q

- I want to give a warning when the power supply voltage level is too high.

A

- By assigning "Overvoltage power supply [OVS](081)" to one of "Output terminal function ([CC-01], [CC-02], and [CC-07]), a signal is output when the power supply to the inverter is high.
- The power supply overvoltage signal is turned ON when the DC voltage across P-N continuously exceeds the voltage level set in "Power supply overvoltage level setting [bb-62]" for 100 seconds.
- When "Power supply overvoltage selection [bb-61]" is "Warning (00)", the [OVS] signal is outputted.
- When [bb-61] is "Error (01)", [OVS] signal is outputted, and tripped at "Input overvoltage error [E015]".

!

- This function does not operate during operation and is detected only when the inverter is stopped.
- Even if the power supply overvoltage state continues, the trip can be cancelled. However, if the power supply overvoltage status continues for 100 seconds after releasing the trip, the inverter trips again with "Input overvoltage error [E015]".

Code	Name	Description	Data
[bb-61]	Power supply overvoltage selection	Output the [OVS] signal.	00
		Output the [OVS] signal and trip by "Input overvoltage error [E015]".	01
[bb-62]	Power supply overvoltage level setting	Set the power supply overvoltage level.	200V class: 300.0 to 400.0 (VDC) 400V class: 600.0 to 800.0 (VDC)
[CC-01] [CC-02] [CC-07]	Output terminal function	Overvoltage power supply [OVS]: When [bb-62] setting or higher power supply voltage is maintained for 100 seconds while the inverter is stopped, [OVS] signal is output. OFF: Less than power supply overvoltage level ON: Power supply overvoltage level or higher	081

9.11.8 Cooling Fin Temperature Warning

Q

- How do I know the temperature rise of the cooling fin before tripping?
- You want to cool the system before a temperature error occurs.

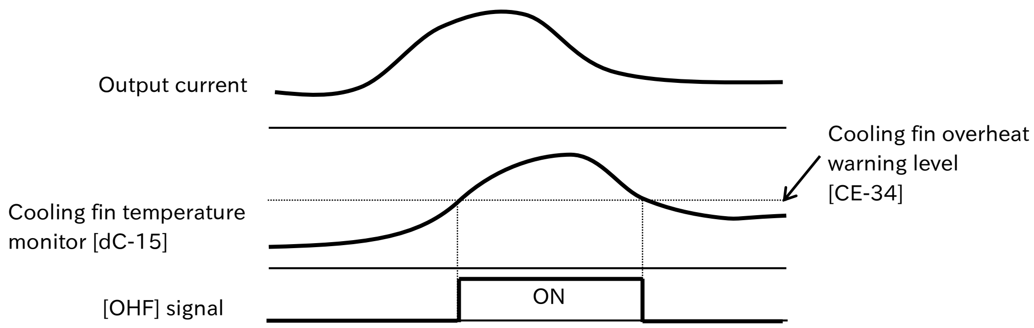
A

- Allocation of "Heat sink overheat warning [OHF](032)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])" enables output of a warning signal when the cooling fin overheats.
- Monitor the temperature of the cooling fins inside the inverter. Before "Temperature error [E021]" occurs, the inverter can be output this signal.

!

- If the cooling fin temperature exceeds 105˚C max, "Temperature error [E021]" will occur.

Code	Name	Description	Data
[dC-15]	Cooling fin temperature monitor	Monitors the temperature of the cooling fins.	-20.0 to 200.0 (℃)
[CE-34]	Cooling fin overheat warning level	Set the cooling fin temperature to turn ON the "Heat sink overheat warning [OHF]".	0 to 200 (℃)
[CC-01] [CC-02] [CC-07]	Output terminal function	Heat sink overheat warning [OHF]: When [dC-15] value exceeds [CE-34] setting, this signal is turned ON.	032



9.11.9 Lifetime Warning for Capacitor on the Board

Q

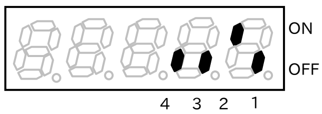
- I want to know before the electrolytic capacitor on the substrate reaches the end of its life.

A

- By assigning "Capacitor life warning [WAC](029)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])", a warning signal for the electrolytic capacitor life on the PCB can be output.
- The life of the capacitor on the board is diagnosed from the temperature inside the inverter and the ambient temperature set to "Ambient temperature [bA-72]".
- The status of this signal can also be monitored in "Life assessment monitor [dC-16]".

!

- When the warning of the electrolytic capacitor life occurs, it is recommended to replace the PCB or the inverter body.

Code	Name	Description	Data
[dC-16]	Life assessment monitor	Displays the life judgment of the electrolytic capacitor on the board, the cooling fan, the power module that is the main element of the inverter, and the internal circuit (inrush current prevention circuit) that suppresses inrush current to the inverter.	 ON: Life span 1: Capacitor on board OFF: Normal 2: Cooling fans 3:Power modules 4:Inrush current prevention circuit
[bA-72]	Ambient temperature	Set the ambient temperature of the operating environment.	-10 to 50 (℃)
[CC-01] [CC-02] [CC-07]	Output terminal function	Capacitor life warning [WAC]: Outputs a warning of the life of the electrolytic capacitor on the board. OFF: No warning ON: Circuit board or inverter replacement are recommended due to the life of the capacitor	029

9.11.10 Lifetime Warning for Cooling Fan

Q

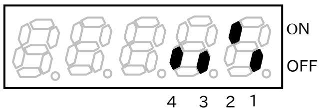
- I want to know before the cooling fan reaches the end of its life.

A

- By assigning "Cooling-fan life warning [WAF](030)" to any of the output terminal function selections ([CC-01], [CC-02], and [CC-07]), a warning signalfor the cooling fan life can be output.
- The life of the cooling fan is estimated from the cumulative operating hours of the cooling fan and the ambient temperature set to "Ambient temperature [bA-72]", and when it is time to replace the cooling fan, a signal is outputted.
- After replacing the cooling fan, the accumulated operating time is cleared by "Clear accumulated cooling fan run time monitor [bA-71]". This enables the life assessment of the cooling fan after replacement.
- The status of this signal can also be monitored in "Life assessment monitor [dC-16]".

!

- Check for clogging of the cooling fan when the "Cooling-fan life warning [WAF]" signal is output.
- Do not clear the cumulative operation time except when replacing the cooling fan, as the life diagnosis of the cooling fan will not work properly.
- When the fan is stopped in the "Cooling fan operation selection [bA-70]", the accumulated operation time of the cooling fan is not performed.

Code	Name	Description	Data
[dC-16]	Life assessment monitor	Displays the life judgment of the electrolytic capacitor on the board, the cooling fan, the power module that is the main element of the inverter, and the internal circuit (inrush current prevention circuit) that suppresses inrush current to the inverter.	 ON: Life span 1: Capacitor on board OFF: Normal 2: Cooling fans 3:Power modules 4:Inrush current prevention circuit
[bA-71]	Clear accumulated cooling fan run time monitor	Disable	00
		Clears the accumulated operating time of the cooling fan.	01
[bA-72]	Ambient temperature	Set the ambient temperature of the operating environment.	-10 to 50 (℃)
[CC-01] [CC-02] [CC-07]	Output terminal function	Cooling-fan life warning [WAF]: Outputs the life warning of the cooling fan. OFF: No warning ON: Cooling fan replacement is recommended due to the life of the cooling fan	030

9.11.11 Lifetime Warning for Power Module

Q

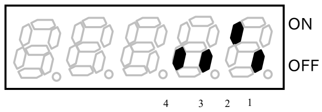
- I want to know before the main element of the inverter reaches the end of its life.

A

- By assigning "Power module life warning [WAP](097)" to any of the output terminal function selections ([CC-01], [CC-02], and [CC-07]), a signal can be output to warn that the life of the power module, which is the main element of the inverter, is approaching.
- By assigning "Inrush circuit life warning [WAIC](098)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])", a signal can be output to alert the user that the life of the internal circuit (inrush current prevention circuit) that suppresses inrush current flowing through the inverter is approaching.
- The status of this signal can also be monitored in "Life assessment monitor [dC-16]".

!

- When the warning of the power module life or the inrush current prevention circuit life occurs, it indicates that the replacement time of the inverter main unit is near. Consider early replacement.

Code	Name	Description	Data
[dC-16]	Life assessment monitor	Displays the life judgment of the electrolytic capacitor on the board, the cooling fan, the power module that is the main element of the inverter, and the internal circuit (inrush current prevention circuit) that suppresses inrush current to the inverter.	 ON: Life span 1: Capacitor on board OFF: Normal 2: Cooling fans 3:Power modules 4:Inrush current prevention circuit
[CC-01] [CC-02] [CC-07]	Output terminal function	Power module life warning [WAP]: Outputs the power module life indicator. OFF: No warning ON: The inverter replacement is recommended due to the life of the power module.	097
		Inrush circuit life warning [WAIC]: Outputs a warning of the life of the inrush current prevention circuit. OFF: No warning ON: The inverter replacement is recommended due to the life of the inrush current prevention circuit.	098

9.11.12 Time Over Warning for RUN Time or Power-ON Time

Q

- How do I know when the inverter operation time has elapsed for a certain period?
- How do I know when the inverter has been on for a certain period of time?
- I would like to output the operation time of the system incorporating the inverter by the signal.

A

- By assigning "Accumulated operation time over [RNT](024)" or "Accumulated power-on time over [ONT](025)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])", a signal can be output when the operation time or power ON time exceeds the set time.
- When the cumulative operation time of the inverter exceeds the setting time of "Accum. RUN time (RNT)/Accum. Power-on time (ONT) setting [CE-36]", the [RNT] signal is outputted. Cumulative operation time can be checked in "Cumulative time during RUN monitor [dC-22]".
- When the accumulated power ON time exceeds the set time of [CE-36], the [ONT] signal is issued. Accumulated power ON time can be checked in "Accumulated power-on time monitor [dC-24]".

!

- When setting the value as a guide for replacing the inverter, set it with a margin.
- The power ON times include not only the main-circuit power supply but also the power supply status of only the external 24 VDC power supply.

Code	Name	Description	Data
[dC-22]	Accumulated RUN time monitor	The inverter operation time is accumulated and stored for monitoring.	0 to 1,000,000 (hr)
[dC-24]	Accumulated power-on time monitor	The power ON hours of the inverter are accumulated and stored for monitoring.	0 to 1,000,000 (hr)
[CE-36]	Accum. RUN time (RNT) / Accum. Power-on time (ONT) setting	Set the elapsed time when the [RNT]/[ONT] signal is output.	0 to 100,000 (hr)
[CC-01] [CC-02] [CC-07]	Output terminal function	Accumulated operation time over [RNT]: RUN time-over signal is outputted. OFF: Less than setting time ON: Setting time or longer	024
		Accumulated power-on time over [ONT]: Power ON time-over signal is outputted. OFF: Less than setting tie ON: Setting time or longer	025

■ **Setting of RUN time over [RNT]/Power ON time over [ONT]**

Accumulated operation time over [RNT]/ Accumulated power-on time over [ONT]		Accum. RUN time (RNT) / Accum. Power-on time (ONT) setting [CE-36]
e.g. 1	When the inverter is operated for 250 days/year × 8 hours × 5 years = 10000 hours for the first time after shipping from the factory, a warning is issued.	10000
e.g. 2	After (e.g.1), when the inverter is operated for 250 days/year x 8 hours x 3 years = 6000 hours, a warning is issued.	16000 (10000+6000)
e.g. 3	When the inverter is turned ON for 300 days/year × 24 hours × 3 years = 21600 hours for the first time from the factory-shipped condition, an alarm is issued.	21600
e.g. 4	After (e.g.3), 250 days/year × 8 hours × 5 years = 10000 hours, a warning is issued when the inverter is turned ON.	31600 (21600+10000)

9.11.13 Detecting Analog Input Disconnection and Out of Range

Q

- I want to know whether the analog input value is within the specified range
- I want to perform disconnection detection of analog input.
- I want to move the inverter at a constant frequency even in the case of analog disconnection or short circuit failure.

A

- By assigning "Analog Ai1 disconnection detection [Ai1Dc] (050)" or "Analog Ai2 disconnection detection [Ai2Dc](051)" to any of "Output terminal function ([CC-01]/[CC-02]/[CC-07])", analog disconnection can be output. However, when "[Ai1] Operation set level implement timing [CE-51]" /"[Ai2] Operation set level implement timing [CE-53]" is "Disable (00)", this signal is not output. When used, it must be set to "Enable (at WCAi1/2 active) (01)" or "Enable (at WCAi1/2 de-active) (02)".
- Window comparator signal can be output by assigning "Window comparator Ai1 [WCAi1](056)" and "Window comparator Ai2 [WCAi2](057)" to any of "Output terminal function ([CC-01]/[CC-02]/[CC-07])".
- The [WCAi1]/[WCAi2] signal is output when the input value of the [Ai1]/[Ai2] analog input is within the range of "[Ai1] Window comparator higher limit [CE-40]" to "[Ai1] Window comparator lower limit [CE-41]" or "[Ai2] Window comparator higher limit [CE-43]" to "[Ai2] Window comparator lower limit [CE-44]". In addition, a hysteresis width can be provided at the higher/lower limit level.
- The window comparator signal output range is also applied to the analog disconnection signal. The signal ON/OFF status can be changed by setting [CE-51]/[CE-53]. Refer to the table below for details.
- The inverter can be operated with a specific frequency reference even when the analog input becomes maximum due to a short-circuit failure or when the analog input becomes 0% due to disconnection. If this happens, set [CE-51]/[CE-53] to "Enable (at WCAi1/2 active) (01)" or "Enable (at WCAi1/2 de-active) (02)", and set the analog input value (%) equivalent to the frequency reference that you want to output to "[Ai1] Operation set level at disconnection or compare event [CE-50]" or "[Ai2] Operation set level at disconnection or compare event [CE-52]". Refer to the table below for the analog input type according to the setting of [CE-51]/[CE-53].

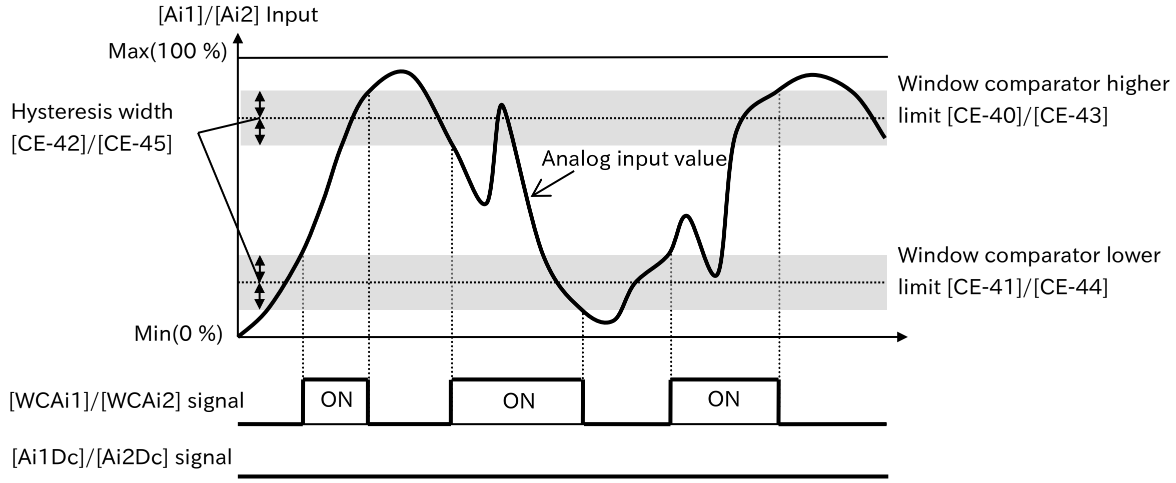
Operation set level implement timing [CE-51]/[CE-53]	Window comparator [WCAi1]/ [WCAi2]	Analog disconnection [Ai1Dc]/[Ai2Dc]	Analog input use value
Disable (00)	ON	OFF	The analog input value is used without change.
	OFF	OFF	The analog input value is used without change.
Enable (at WCAi1/2 active) (01)	ON	ON	The analog input value become the setting value in [CE-50]/[CE-52].
	OFF	OFF	The analog input value is used without change.
Enable (at WCAi1/2 de-active) (02)	ON	OFF	The analog input value is used without change.
	OFF	ON	The analog input value become the setting value in [CE-50]/[CE-52].

- When outputting [Ai1Dc]/[Ai2Dc] signal, "Operation set level at disconnection or compare event ([CE-50], [CE-52])" can be used as the analog input instead of the actual analog input. However, if "Analog command holding [AHD]" of the input terminal function is ON, the held frequency reference takes precedence.
- To use the analog disconnection signal as disconnection detection (analog input value: min.), set the analog input value to be judged as disconnection to "Window comparator higher limit ([CE-40], [CE-43])".
- To use the analog disconnection signal as short circuit detection (analog input value: max.), set the analog input value to be judged as short circuit to "Window comparator lower limit ([CE-41], [CE-44])".

Code	Name	Description	Data
[CE-40]	[Ai1] Window comparator higher limit	Set the higher limit level of the window comparator. The lowest value of [Ai1]/[Ai2] higher limit is as follows. [CE-41]+([CE-42]×2)、[CE-44]+([CE-45]×2)	0 to 100 (%)
[CE-43]	[Ai2] Window comparator higher limit		
[CE-41]	[Ai1] Window comparator lower limit	Set the lower limit level of the window comparator. The biggest value of [Ai1]/[Ai2] lower limit is as follows. [CE-40]-([CE-42]×2)、[CE-43]-([CE-45]×2)	0 to 100 (%)
[CE-44]	[Ai2] Window comparator lower limit		
[CE-42]	[Ai1] Window comparator hysteresis width	Set the hysteresis width for the higher/lower limit level. The biggest value of [Ai1]/[Ai2] hysteresis width is as follows. ([CE-40]-[CE-41])/2、([CE-43]-[CE-44])/2	0 to 10 (%)
[CE-45]	[Ai2] Window comparator hysteresis width		
[CE-50]	[Ai1] Operation set level at disconnection or compare event	For [WCAi1]/[WCAi2]/[Ai1Dc]/[Ai2Dc] signals, set the analog input value at disconnection or compare event.	0 to 100 (%)
[CE-52]	[Ai2] Operation set level at disconnection or compare event		
[CE-51]	[Ai1] Operation set level implement timing	Disable	00
		Enable (at WCAi1 active)	01
		Enable (at WCAi1 de-active)	02
[CE-53]	[Ai2] Operation set level implement timing	Disable	00
		Enable (at WCAi2 active)	01
		Enable (at WCAi2 de-active)	02
[CC-01] [CC-02] [CC-07]	Output terminal function	Analog Ai1 disconnection detection [Ai1Dc]/ Analog Ai2 disconnection detection [Ai2Dc]: Outputs analog disconnection signal	050/051
		Window comparator Ai1[WCAi1]/ Window comparator Ai2[WCAi2]: Outputs the window comparator signal.	056/057

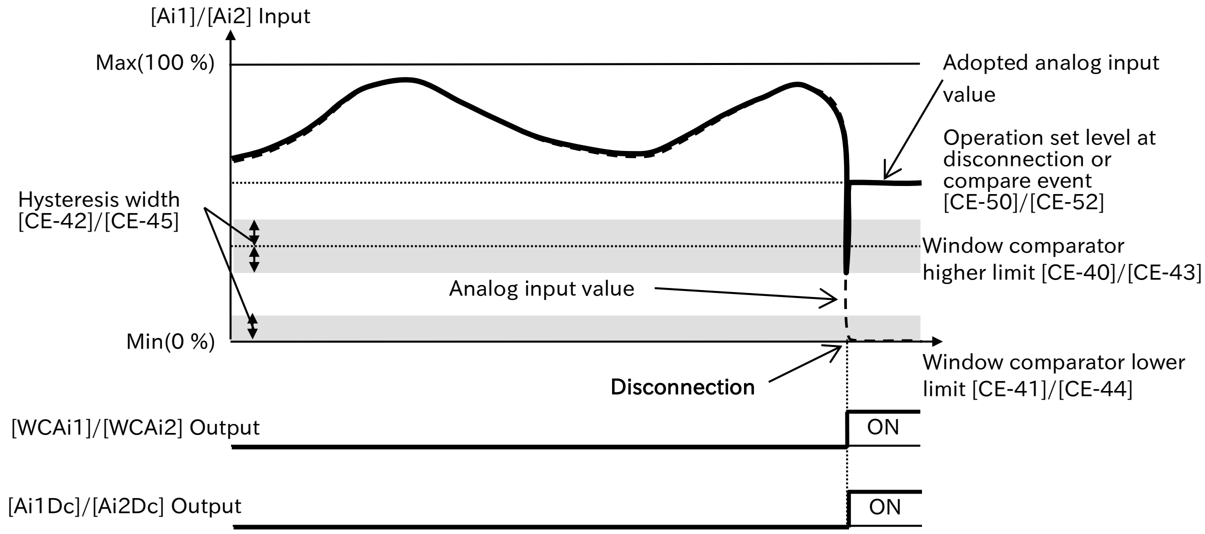
■ Window comparator operation example 1: Operation when [CE-51]/[CE-53] is set "Disable (00)"

- When [CE-51]/ [CE-53] is "Disable (00)", the [WCAi1]/[WCAi2] signal is outputted when the analog input is within the window comparator higher/lower limit level range. However, the [Ai1Dc]/[Ai2Dc] signal does not operate.



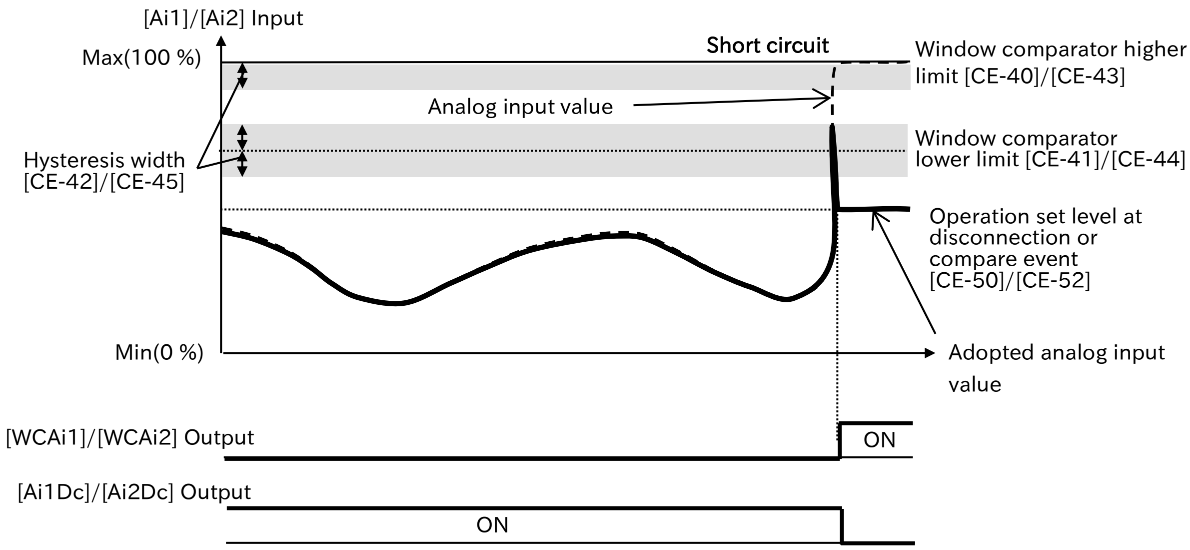
■ Window comparator operation example 2: Disconnection detection when [CE-51]/[CE-53] is set to "Enable (at WCAi1/2 active) (01)"

- If the lower limit level, upper limit level, or operating level at disconnection is set as shown in the figure below, if the analog input becomes the smallest value due to disconnection, the analog disconnection signal will be turned ON, and the operating level set value at disconnection will be adopted as the analog input value instead of the actual analog input value.
- When [CE-51]/ [CE-53] is "Enable (at WCAi1/2 active) (01)", the [Ai1Dc]/[Ai2Dc] signal has the same operation as the [WCAi1]/[WCAi2] signal.



■ Window comparator operation example 3: Short-circuit detection when [CE-51]/[CE-53] is set to "Enable (at WCAi1/2 de-active) (01)"

- If the lower limit level, upper limit level, or open circuit operating level is set as shown in the figure below, if the analog input reaches its max. value due to a short circuit, the analog disconnection signal becomes ON, and the operating level setting value at the break is adopted as the analog input value instead of the actual analog input value.
- When [CE-51]/ [CE-53] is set to "Enable (at WCAi1/2 de-active) (01)", [Ai1Dc]/[Ai2Dc] signal has the opposite action to the [WCAi1]/[WCAi2] signal.



9.11.14 Detecting Abnormal State of Inverter

Q

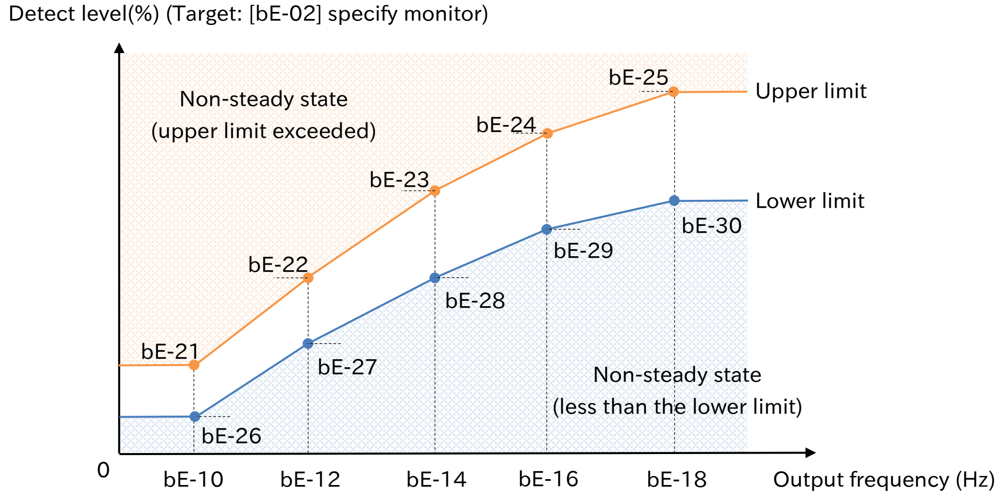
- We would like to provide an allowable range of output torque according to each output frequency, and to detect any deviations from that range as a sign of abnormality or failure. (Clogging of fan, idle operation of pump, etc.)
- I want to provide a steady range of output current according to a specific operation pattern (time) and to detect a state that is outside that range as a work defect.

A

- The abnormal detection function outputs and protects a signal when a specified monitor value such as output current or output torque deviates from the specified range (steady state) according to a specific operation pattern in advance.
- This function is enabled when "Abnormal detection selection [bE-01]" is "Enabled (Frequency mode) (01)" or "Enabled (Time mode) (02)". In "Enable (Frequency mode) (01)", the steady state of the monitor value is set according to the output frequency. On the other hand, in "Enable (time mode) (02)", it is set according to the elapsed time starting from the operation start point. In both modes, the upper and lower limit levels that define the steady range of the monitored object are set. When the upper limit is exceeded or less than the lower limit are detected, it is judged as non-steady state. (Refer to the next section for the setting of each mode and level.)
- Set the parameters of the monitor that you want to monitor for the "Abnormal detection target [bE-02]". For the parameters that can be set, see "9.16.3 Selecting Monitor Data for Analog/Pulse Output".
- By assigning "Abnormal exceeded Upper limit [ABU](082)" and " Abnormal fall below Lower limit [ABL](083)" to any of the "Output terminal function ([CC-01]/[CC-02]/[CC-07])", the state of exceeding the upper limit and the state of less than the lower limit can be output individually. However, these signals are not output if the [bE-01] is "Disable (00)".
- For [ABU] and [ABL], delay time can be set separately by "Abnormal upper level detecting time [bE-06]" and "Abnormal lower level detecting time [bE-08]".
- The motor can be tripped when [ABU] or [ABL] is outputted in the "Abnormal upper level detecting action [bE-05]" or "Abnormal lower level detecting action [bE-07]" sets. If [bE-05]/[bE-07] is set to "Trip (02)", the inverter trips at "Abnormal upper detecting error [E121]"/"Abnormal lower detecting error [E122]" at the same time as the outputting of [ABU]/[ABL]. In addition, if "Trip after deceleration stop (03)" is set, the inverter forcibly shifts to stop operation at the same time as outputting [ABU]/[ABL], and when it stops, it trips at [E121]/[E122].
- The upper and lower limits of abnormal detection can also be automatically obtained during operation by setting "Abnormal detection auto tuning selection [bE-03]" to "Enable (01)". Refer to the next section for details.

Abnormal detection, frequency mode (bE-01=01)

- This function specifies the abnormal detection frequency ([bE-10] to [bE-18]) and the upper and lower limit levels at the frequencies, and monitors the non-steady state according to the output frequency.



Correspondence table between set point (frequency) and upper and lower limit levels

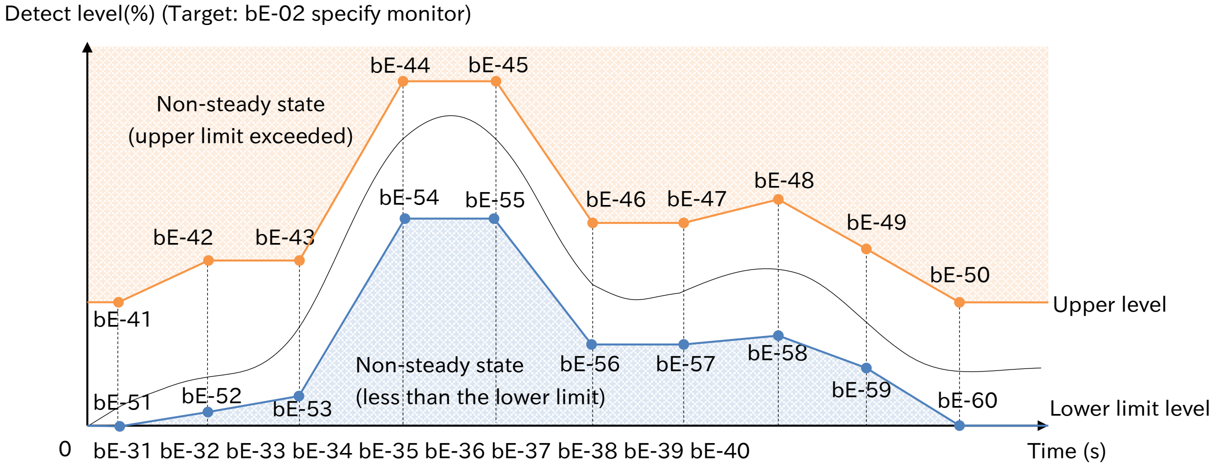
Set point		Upper limit at target parameter	Lower limit at target parameter
Abnormal detection minimum frequency	[bE-10]	[bE-21]	[bE-26]
Abnormal detection intermediate frequency 1	[bE-12]	[bE-22]	[bE-27]
Abnormal detection intermediate frequency 2	[bE-14]	[bE-23]	[bE-28]
Abnormal detection intermediate frequency 3	[bE-16]	[bE-24]	[bE-29]
Abnormal detection maximum frequency	[bE-18]	[bE-25]	[bE-30]

!

- Regarding the upper and lower limit levels from 0 Hz to "Abnormal detection minimum frequency [bE-10]", the "Upper limit at minimum frequency [bE-21]" and the "Lower limit at minimum frequency [bE-26]" are applied, and from "Abnormal detection maximum frequency [bE-18]", the "Upper limit at maximum frequency [bE-25]" and the "Lower limit at maximum frequency [bE-30]" are applied.
- The % criteria for the upper and lower limits are based on the full scale of 100 % of the target selected in [bE-02] for non-steady detection.

Abnormal detection, time mode (bE-01=02)

- This function specifies the "Abnormal time detection operating time ([bE-31] to [bE-40])" and the upper and lower limits at every time, and monitors the non-steady state according to the elapsed time from the start of operation.
- Does not operate while stopped. When operation is restarted after stopping once, monitoring restarts from zero seconds.



Correspondence table between set point (operation time) and upper and lower limit levels

Set point		Upper limit at target parameter	Lower limit at target parameter
Abnormal time detection operating time 1	[bE-31]	[bE-41]	[bE-51]
Abnormal time detection operating time 2	[bE-32]	[bE-42]	[bE-52]
Abnormal time detection operating time 3	[bE-33]	[bE-43]	[bE-53]
Abnormal time detection operating time 4	[bE-34]	[bE-44]	[bE-54]
Abnormal time detection operating time 5	[bE-35]	[bE-45]	[bE-55]
Abnormal time detection operating time 6	[bE-36]	[bE-46]	[bE-56]
Abnormal time detection operating time 7	[bE-37]	[bE-47]	[bE-57]
Abnormal time detection operating time 8	[bE-38]	[bE-48]	[bE-58]
Abnormal time detection operating time 9	[bE-39]	[bE-49]	[bE-59]
Abnormal time detection operating time 10	[bE-40]	[bE-50]	[bE-60]

!

- For the setting of "Abnormal time detection operating time 1 [bE-31]" to "Abnormal time detection operating time 10 [bE-40]", set the elapsed time with operation starting set to zero.
- Regarding the upper and lower limit levels, "Abnormal time detection upper level 1 [bE-41]" and "Abnormal time detection lower level 1 [bE-51]" are applied respectively for less than [bE-31], and "Abnormal time detection upper level 10 [bE-50]" and "Abnormal time detection lower level 10 [bE-60] are applied respectively for [bE-40] and later.
- Set the [bE-31] to [bE-40] as shown below. Otherwise, the subsequent settings are ignored and the end of the valid part is the terminal setting.

  0≦[bE-31]≦[bE-32]≦[bE-33]≦[bE-34]≦[bE-35]≦[bE-36]≦[bE-37]≦[bE-38]≦[bE-39]≦[bE-40]

- The % criteria for the upper and lower limits are based on the full scale of 100 % of the target selected in [bE-02] for abnormal detection.

Execution step of abnormal detection auto tuning

1 Pre-setting of parameters

(1) Set "Abnormal detection enable [bE-01]" to "Enable (Frequency mode) (01)" or "Enable (Time mode) (02)" according to the desired operation.

(2) Set "Abnormal detection target [bE-02]" to the data you want to monitor.

(3) Set each measurement point according to the mode set in (1) (see below). In operation, the monitor data specified in (2) is acquired when passing through these set points.

[bE-01]		Automatic measurement point
Disable	(00)	- (Disabled)
Enable (Frequency mode)	(01)	Measuring point (frequency): [bE-10] [bE-12] [bE-14] [bE-16] [bE-18]
Enable (Time mode)	(02)	Measuring point/time: [bE-31] to [bE-40]

(4) Set the allowable range for automatic-tuning in "Abnormal detection tuning tolerance [bE-04]". The value set here is reflected to the value of the upper and lower limit levels to be saved as the allowable range width based on the automatic acquisition value.

2 Implementation of automatic measurement (operation)

- Set "Abnormal detection auto tuning selection [bE-03]" to "Enable (01)".
- Start operation in the actual operating environment. During operation, pass the measurement point set in the previous section (3) several times. In the time mode, repeat the operation several times from the stop state.

3 Setting and Checking at End of Measurement

- Stop operation, and set "Abnormal detection auto tuning selection [bE-03]" to "Disable (00)".
- Check that the following parameters (upper limit and lower limit) have been updated. (If the measurement fails, it is not updated.)

[bE-01]		Automatic measurement point
Disable	(00)	- (Disabled)
Enable (Frequency mode)	(01)	Upper limit: [bE-21] to [bE-25] Lower limit: [bE-26] to [bE-30]
Enable (Time mode)	(02)	Upper limit: [bE-41] to [bE-50] Lower limit: [bE-51] to [bE-60]

!

- During auto tuning, the abnormal detection function is disabled.
- Automatically acquired data will be saved at the timing when "Abnormal detection auto tuning selection [bE-03]" is changed from "Enable (01)" to "Disable (00)". However, if the automatically acquired data is not confirmed, the value is not updated.

Abnormal detection related parameters

Code	Name	Description	Data
[bE-01]	Abnormal detection enable	Disable	00
		Enable (Frequency mode): Specifies the steady state according to the output frequency.	01
		Enable (Time mode): The steady state is specified according to the elapsed time of operation.	02
[bE-02]	Abnormal detection target	Select the data to be monitored by this function.	Refer to "9.16.3 Selecting Monitor Data for Analog/Pulse Output"
[bE-03]	Abnormal detection auto tuning selection	Disable	00
		Enable: Automatically acquires the value specified by [bE-02] according to the setting of [bE-01] during operation, and saves the value to the upper/lower limit.	01
[bE-04]	Abnormal detection tuning tolerance	At [bE-03]=(01), the obtained value ± [bE-04] is saved to the upper/lower limit.	0.00 to 100.00 (%)*1
[bE-05]	Abnormal upper level detecting action	Warning only	01
		Trip at "Abnormal upper detecting error [E121]"	02
		The stop command is forcibly issued. After the stop, the motor trips with "Abnormal upper detecting error [E121]".	03
[bE-06]	Abnormal upper level detecting time	Set the time from when the data specified in [bE-02] exceeds the upper limit of abnormal detection until the data is judged as non-steady.	0.00 to 600.00 (s)
[bE-07]	Abnormal lower level detecting action	Warning only	01
		Trip at "Abnormal lower detecting error [E122]"	02
		The stop command is forcibly issued. After the stop, the motor trips with "Abnormal lower detecting error [E122]".	03
[bE-08]	Abnormal lower level detecting time	Set the period from when the data specified in [bE-02] falls below the lower limit of abnormal detection until the data is judged as non-steady state.	0.00 to 600.00 (s)
[bE-10]	Abnormal detection minimum frequency	Set the fixed point of the steady state range in the frequency mode ([bE-01]=(01)).	0.00 to Maximum frequency (Hz)
[bE-12]	Abnormal detection intermediate frequency 1		
[bE-14]	Abnormal detection intermediate frequency 2		
[bE-16]	Abnormal detection intermediate frequency 3		
[bE-18]	Abnormal detection maximum frequency		

Code	Name	Description	Data
[bE-21]	Upper limit at minimum frequency	Set the upper limit of the steady state range in frequency mode ([bE-01]=(01)). Set point-by-point for [bE-10] to [bE-18].	-100.00 to 100.00 (%)[*1]
[bE-22]	Upper limit at intermediate frequency 1		
[bE-23]	Upper limit at intermediate frequency 2		
[bE-24]	Upper limit at intermediate frequency 3		
[bE-25]	Upper limit at maximum frequency		
[bE-26]	Lower limit at minimum frequency	Set the lower limit of the steady-state range in frequency mode ([bE-01]=(01)). Set point-by-point for [bE-10] to [bE-18].	-100.00 to 100.00 (%)[*1]
[bE-27]	Upper limit at intermediate frequency 1		
[bE-28]	Lower limit at intermediate frequency 2		
[bE-29]	Lower limit at intermediate frequency 3		
[bE-30]	Lower limit at maximum frequency		
[bE-31]	Abnormal time detection operating time 1	Set the stipulated points of the steady-state area in the time mode ([bE-01]=(02)). Set the operation start to zero and the elapsed time from there.	0.00 to 600.00 (s)
[bE-32]	Abnormal time detection operating time 2		
[bE-33]	Abnormal time detection operating time 3		
[bE-34]	Abnormal time detection operating time 4		
[bE-35]	Abnormal time detection operating time 5		
[bE-36]	Abnormal time detection operating time 6		
[bE-37]	Abnormal time detection operating time 7		
[bE-38]	Abnormal time detection operating time 8		
[bE-39]	Abnormal time detection operating time 9		
[bE-40]	Abnormal time detection operating time 10		
[bE-41]	Abnormal time detection upper level 1	Set the upper limit of the steady-state range in time mode ([bE-01]=(02)). Set point-by-point for [bE-31] to [bE-40].	-100.00 to 100.00 (%)[*1]
[bE-42]	Abnormal time detection upper level 2		
[bE-43]	Abnormal time detection upper level 3		
[bE-44]	Abnormal time detection upper level 4		
[bE-45]	Abnormal time detection upper level 5		
[bE-46]	Abnormal time detection upper level 6		
[bE-47]	Abnormal time detection upper level 7		
[bE-48]	Abnormal time detection upper level 8		
[bE-49]	Abnormal time detection upper level 9		
[bE-50]	Abnormal time detection upper level 10		

Code	Name	Description	Data
[bE-51]	Abnormal time detection lower level 1	Specifies the lower limit of the steady-state range in time mode ([bE-01]=(02)). Set point-by-point for [bE-31] to [bE-40].	-100.00 to 100.00 (%)*1
[bE-52]	Abnormal time detection lower level 2		
[bE-53]	Abnormal time detection lower level 3		
[bE-54]	Abnormal time detection lower level 4		
[bE-55]	Abnormal time detection lower level 5		
[bE-56]	Abnormal time detection lower level 6		
[bE-57]	Abnormal time detection lower level 7		
[bE-58]	Abnormal time detection lower level 8		
[bE-59]	Abnormal time detection lower level 9		
[bE-60]	Abnormal time detection lower level 10		
[CC-01] [CC-02] [CC-07]	Output terminal function	Abnormal exceeded Upper limit [ABU]: Output when the data specified in [bE-02] continuously exceeds the upper limit of abnormal detection for the period set to [bE-06].	082
		Abnormal fall below Lower limit [ABL]: Output when the data specified in [bE-02] when the specified value is continuously below the lower limit for abnormal detection for the period set to [bE-08].	083
[dC-31]	Abnormal detection value monitor	Displays the specified monitor value by [bE-02].	-100.00 to 100.00 (%)*1
[dC-32]	Abnormal detection upper level monitor	Displays the current value of the upper limit.	
[dC-33]	Abnormal detection lower level monitor	Displays the current value of the lower limit.	

*1. Assume that the full scale of the target selected in "Abnormal detection target [bE-02]" is 100 %.

9.12 Outputting Running Status to Terminals

9.12.1 Signal Output during Operation

Q

- I want to notify the system by detecting the inverter output status.

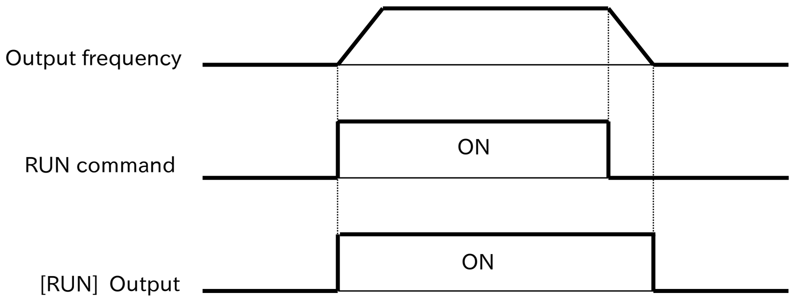
A

- By assigning "Running [RUN] (001)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])", the inverter in operation signal can be output.

!

- In addition to the normal operation of the motor, if the motor is in the status of outputting voltage during DC braking, etc., the "Running [RUN]" signal will ON.
- During retry wait or DC braking standby, the [RUN] signal is not output because no voltage is output to the motor.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Running [RUN]: This signal is output when the inverter is outputting to the motor.	001



9.12.2 Signal Output during Forward/Reverse Operation

Q

- I want to notify the system by detecting information during forward or reverse operation of the inverter.

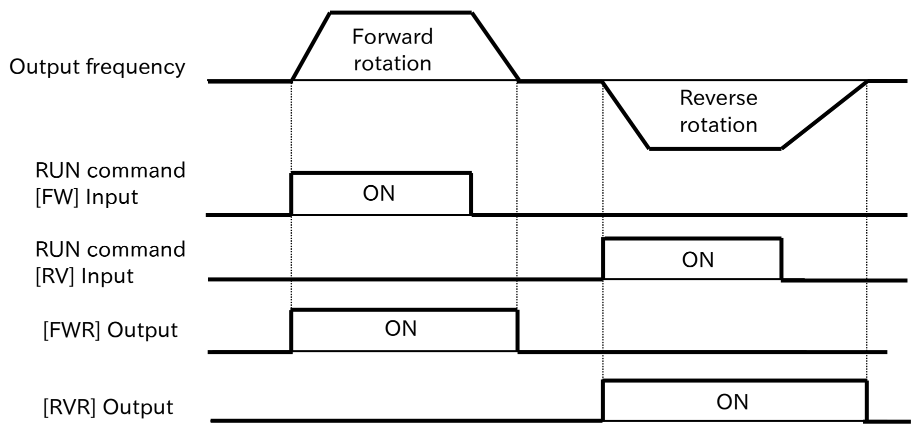
A

- By assigning "Forward rotation [FWR](008)" or "Reverse rotation [RVR](009)] to any of "Output terminal function ([CC-01], [CC-02], and [CC-07])" the output of the inverter forward run in progress/reverse run in progress signal is enabled.
- The [FWR] signal is outputted only during forward operation and the [RVR] signal is outputted only during reverse running.

!

- The "Forward rotation [FWR]"/ "Reverse rotation [RVR]" signal will not be output during DC voltage output to the motor by DC braking.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Forward rotation [FWR]: This signal is output during the inverter forward operation.	008
		Reverse rotation [RVR]: This signal is output during inverter reverse operation.	009



9.12.3 Signal Output during RUN Command Input

Q

- I want to notify the system by detecting information that an RUN command has entered into the inverter.

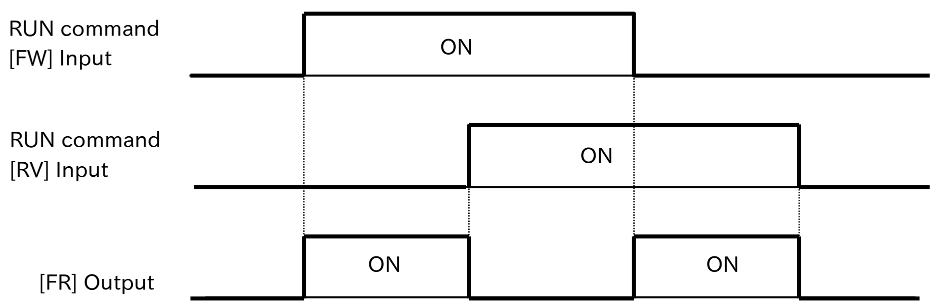
A

- RUN command signals can be output by assigning "RUN command active [FR] (031)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])".
- The [FR] signal is outputted while the inverter is accepting the RUN command.
- Even if the RUN command input source is other than the [FW]/[RV] input terminal, the [FR] signal is outputted according to the RUN command acceptance status.

!

- When an RUN command is input from the input terminal, if "Forward rotation [FW]" and "Reverse rotation [RV]" are input at the same time, a command mismatch will occur, and a stop command will be issued. In this situation, "RUN command active [FR]" will not be outputted.
- Besides the output for normal motor rotation, the [FR] signal is output even when DC voltage is being output to the motor by DC braking, etc.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	RUN command active [FR]: This signal is output when an RUN command is input.	031



9.12.4 Signal Output during Inverter Ready for Operation

Q

- I want to inform the system when the RUN command is put into the inverter, and it becomes ready to operate.

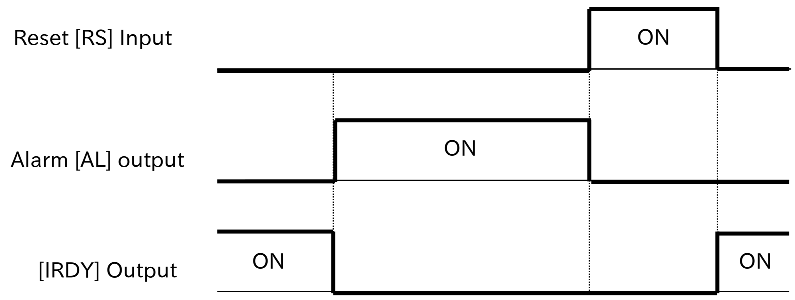
A

- The Ready for operation signal can be output by assigning "Inverter ready [IRDY] (007)" to one of the "Output terminal function ([CC-01], [CC-02], and [CC-07])".
- [IRDY] signal is issued when the inverter is ready to accept RUN commands.

!

- If "Inverter ready [IRDY]" signal is not output, the product will not operate even if the RUN command is input.
- [IRDY] signal is turned OFF when the unit is not ready to start when the power is turned on, when the input voltage is insufficient, when the unit is tripping, when the free run stop command is executed, or when STO is input.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Inverter ready [IRDY]: This signal is output when the inverter is ready to accept RUN commands.	007



9.13 Outputting Signals According to Output Frequency

9.13.1 Signal Output When the Output Frequency Reaches Set Value

Q

- I want to detect that the output frequency to the motor has accelerated to the set frequency and inform the system.

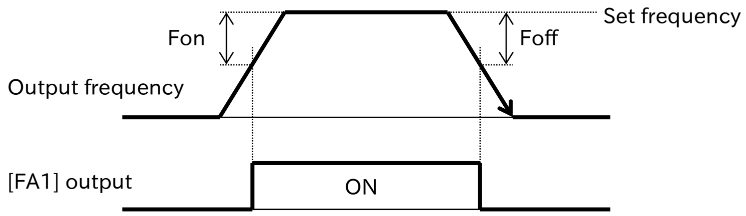
A

- By assigning "Constant-frequency reached [FA1] (002)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])", when the set output frequency is reached, a signal can be output.
- When the output frequency reaches the valid frequency reference, [FA1] signal is output.

!

- If the frequency reference is an analog input command, "Constant-frequency reached [FA1]" may not be output stably. This may be improved by ON/OFF delaying function of the output terminal. For details, refer to "9.16.2 Delaying and Holding Output Signals".

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Constant-frequency reached [FA1]: This signal turns ON when the output frequency reaches the set frequency.	002



Fon: 1 % of the maximum frequency
Foff: 2 % of the maximum frequency

(Operation example)
Maximum frequency 60 Hz
When set frequency = 50 Hz
・Fon = 60×0.01 = 0.6 Hz
・Foff = 60×0.02 = 1.2 Hz
・Acceleration: ON at 50-0.6 = 49.4 Hz
・Deceleration: OFF at 50-1.2 = 48.8 Hz

9.13.2 Signal Output When the Output Frequency Exceeds Set Value

Q

- The user wants to detect that the output frequency to the motor is greater than or equal to the set value and inform the system of it.

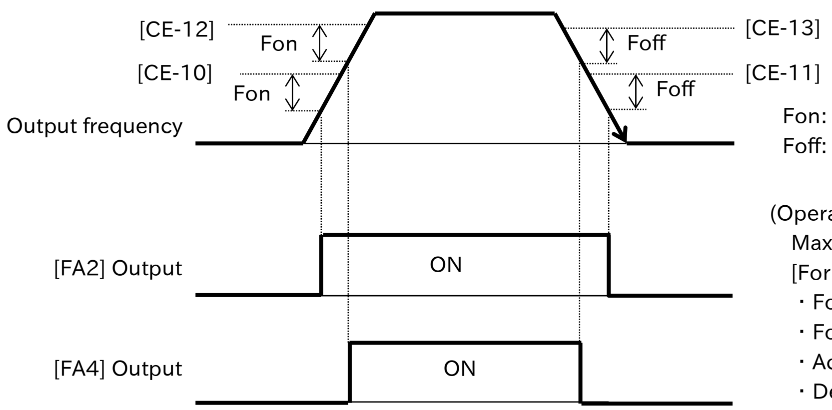
A

- Signals over the set frequency can be output by assigning "Set frequency overreached [FA2] (003)"/ "Set frequency overreached 2 [FA4] (005)" to any of "Output terminal function ([CC-01], [CC-02], or [CC-07])".
- This signal turns ON when the output frequency exceeds the setting of "Arrival frequency 1 value setting during acceleration [CE-10]" and turns OFF when the [FA2] signal falls below the setting of "Arrival frequency 1 value setting during deceleration [CE-11]."
- This signal turns ON when the output frequency exceeds the setting of "Arrival frequency 2 value setting during acceleration [CE-12]" and turns OFF when the [FA4] signal falls below the setting of "Arrival frequency 2 value setting during deceleration [CE-13]."

!

- Signals above two set frequencies "Set frequency overreached [FA2]"/" Set frequency overreached 2 [FA4]" are operated independently and can be outputted separately.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Set frequency overreached [FA2]: This signal turns ON when the output frequency exceeds the [CE-10] setting and turns OFF when the output frequency falls below [CE-11].	003
		Set frequency overreached 2[FA4]: This signal turns ON when the output frequency exceeds the [CE-12] setting and turns OFF when the output frequency falls below [CE-13].	005
[CE-10]	Arrival frequency 1 value setting during acceleration	Turns ON [FA2] when the output frequency exceeds this setting during acceleration.	0.00 to 590.00 (Hz)
[CE-11]	Arrival frequency 1 value setting during deceleration	Turns OFF [FA2] when the output frequency falls below this setting during deceleration.	0.00 to 590.00 (Hz)
[CE-12]	Arrival frequency 2 value setting during acceleration	Turns ON [FA4] when the output frequency exceeds this setting during acceleration.	0.00 to 590.00 (Hz)
[CE-13]	Arrival frequency 2 value setting during deceleration	Turns OFF [FA4] when the output frequency falls below this setting during deceleration.	0.00 to 590.00 (Hz)



Fon: 1 % of the maximum frequency
Foff: 2 % of the maximum frequency

(Operation example)
Maximum frequency 60 Hz、
[For CE-10] = [CE-11] = 50 Hz
・Fon = 60×0.01 = 0.6 Hz
・Foff = 60×0.02 = 1.2 Hz
・Acceleration: ON at 50-0.6 = 49.4 Hz
・Deceleration: OFF at 50-1.2 = 48.8 Hz

9.13.3 Signal Output When the Output Frequency Is Close to Set Value

Q

- I want to detect that the output frequency to the motor is near the set value and inform the system.

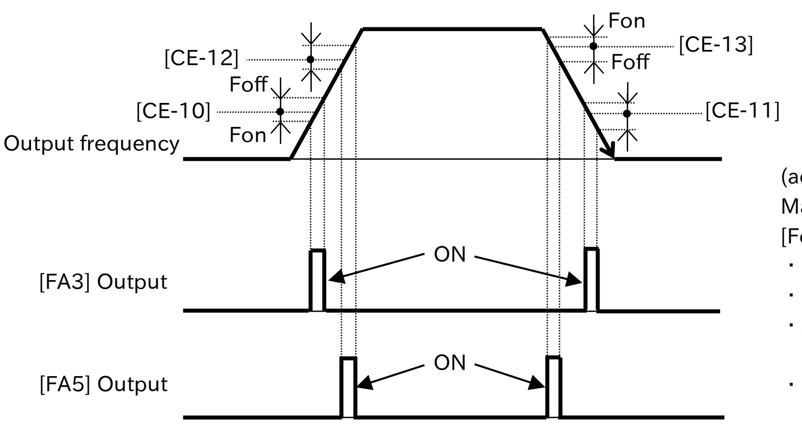
A

- By assigning "Set frequency reached [FA3] (004)"/ "Set frequency reached 2 [FA5](006)" to any of the "Output terminal function ([CC-01], [CC-02], and [CC-07])", it is possible to output a signal when the output frequency becomes near the set frequency.
- The [FA3] signal is turned ON when the output frequency reaches "Arrival frequency 1 value setting during acceleration [CE-10]" during acceleration or "Arrival frequency 1 value setting during deceleration [CE-11]" during deceleration. After that, it becomes OFF when the output frequency is away from [CE-10]/[CE-11] due to acceleration/deceleration.
- When the output frequency reaches "Arrival frequency 2 value setting during acceleration [CE-12]" during acceleration or reaches " Arrival frequency 2 value setting during deceleration [CE-13]" during deceleration, the [FA5] signal turns ON. After that, it becomes OFF when the output frequency is away from [CE-12]/[CE-13] due to acceleration/deceleration.

!

- The signals "Set frequency reached [FA3]"/ "Set frequency reached 2 [FA5]" output around the two set frequencies are operated independently and can be output separately.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Set frequency reached [FA3]: This signal turns ON when the output frequency reaches [CE-10] during acceleration or [CE-11] during deceleration.	004
		Set frequency reached 2 [FA5]: This signal turns ON when the output frequency reaches [CE-12] during acceleration or [CE-13] during deceleration.	006
[CE-10]	Arrival frequency 1 value setting during acceleration	Turns ON [FA3] signal when the output frequency reaches this setting during acceleration.	0.00 to 590.00 (Hz)
[CE-11]	Arrival frequency 1 value setting during deceleration	Turns ON [FA3] signal when the output frequency reaches this setting during deceleration.	0.00 to 590.00 (Hz)
[CE-12]	Arrival frequency 2 value setting during acceleration	Turns ON [FA5] signal when the output frequency reaches this setting during acceleration.	0.00 to 590.00 (Hz)
[CE-13]	Arrival frequency 2 value setting during deceleration	Turns ON [FA5] signal when the output frequency reaches this setting during deceleration.	0.00 to 590.00 (Hz)



Fon: 1 % of the maximum frequency
Foff: 2 % of the maximum frequency

(actual ON/OFF frequency)
Maximum frequency60 Hz
[For CE-10] = [CE-11] = 50 Hz
・Fon = 60×0.01 = 0.6 Hz
・Foff = 60×0.02 = 1.2 Hz
・Acceleration: ON at 50-0.6 = 49.4 Hz
OFF with 50+1.2 = 51.2 Hz
・Deceleration: ON at 50+0.6 = 50.6 Hz
OFF with 50-1.2 = 48.8 Hz

9.13.4 Signal Output When the Output Frequency Is Close to 0 Hz

Q

- I want to detect that the output frequency to the motor is near 0 Hz and notify it.

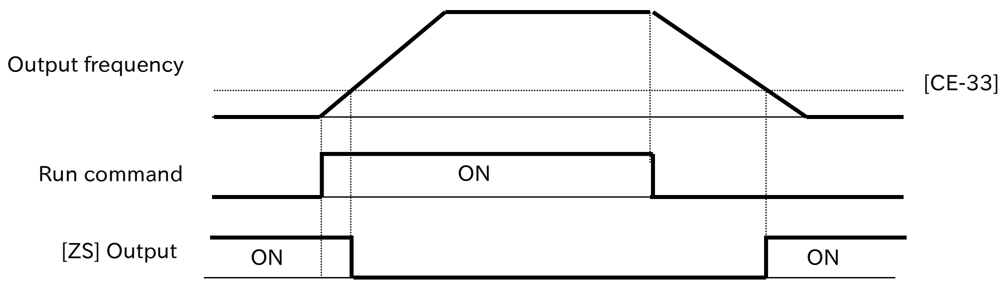
A

- 0 Hz detection signal can be output by assigning "Zero speed detection [ZS] (040)" to one of the "Output terminal function ([CC-01], [CC-02], and [CC-07])".
- When the output frequency of the inverter drops below the level set in "Zero speed detection level [CE-33]", the [ZS] signal is output.
- The time constant of the filter can be set in "Output frequency related filter for terminal function [CE-60]". If the output frequency fluctuates around the frequency set in [CE-33], adjust [CE-60].

!

- During 0 Hz operation such as when stopped or during DC braking, the "Zero speed detection [ZS]" signal becomes ON because frequency is 0 Hz.
- When encoder feedback is used, this signal is output after determining the actual motor speed. For details of encoder feedback, refer to "9.5.11 Setting for Encoder Feedback".

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Zero speed detection [ZS]: This signal turns ON when the output frequency falls below [CE-33] setting. When encoder feedback is used, the output of this signal is judged by the actual motor speed.	040
[CE-33]	Zero speed detection level	Turns ON [ZS] signal when the output frequency falls below this setting.	0.00 to 100.00 (Hz)
[CE-60]	Output frequency related filter for terminal function	Set the time constant for the [ZS] signal of the temporary delay filter for the signal.	0 to 2000 (ms)



9.13.5 Signal Output Calculated from Two Output Signals

Q

- I want to create a unique output signal that combines the output terminal functions.

A

- Since the logical operation of the output signal can be performed inside the inverter, various signals can be output by combining the operation of the output terminal function.
- There are three types of logical operators that can be selected: logical AND (AND), logical OR (OR), and exclusive OR (XOR).

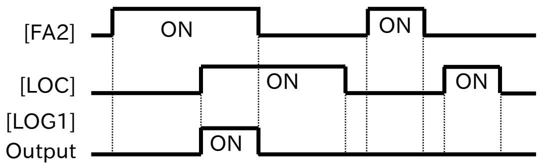
!

- Target all output signals. However, the logical operation result ([LOG1] to [LOG3]) cannot be the operation target.

Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	Logical operation results 1 to 3 ([LOG1] to [LOG3]): The logical operation of the output signal selected by the logical operation target 1 and the logical operation object 2 is performed, and the result is output.	062 063 064
[CC-40] [CC-43] [CC-46]	LOG1 to LOG3 operand-1 selection	Select logical operation target 1.	Select output terminal function. (except [LOG1] to [LOG3])
[CC-41] [CC-44] [CC-47]	LOG1 to LOG3 operand-2 selection	Select logical operation target 2.	
[CC-42] [CC-45] [CC-48]	LOG1 to LOG3 logical calculation selection	AND operation (logical AND) of target 1 and target 2 is outputted.	00
		OR operation (logical OR) of target 1 and target 2 is outputted.	01
		Outputs XOR operations (exclusive OR) of target 1 and target 2.	02

(e.g. 1) Operation example of logical AND (AND)

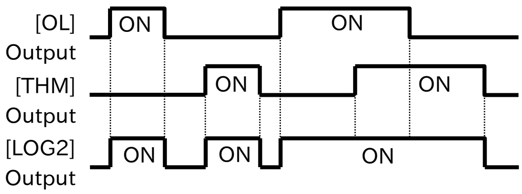
- Set "Signal that turns ON when the output current drops while the output frequency exceeds the set value" to [LOG1], and output from output terminal [11].



(Setting example)
- Output terminal function [11] selection [CC-01] = Logical operation result 1 [LOG1]
- LOG1 selection 1 [CC-40] = Set frequency overreached [FA2]
- LOG1 selection 2 [CC-41] = Low-current indication [LOC]
- LOG1 operator selection [CC-42]=AND(00)

(e.g. 2) Operation example of logical OR (OR)

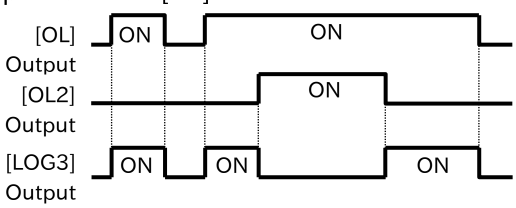
- Set "Signal that turns ON in either overload or electronic thermal overload condition when output current goes out of range" to [LOG2], and output from output terminal [11].



(Setting example)
- Output terminal function [11] selection [CC-01] = Logical operation result 2 [LOG2]
- LOG2 selection 1 [CC-43] = Overload warning notice [OL]
- LOG2 selection 2 [CC-44] = Electronic thermal alarm (Motor) [THM]
- LOG2 operator selection [CC-45]=OR(01)

(e.g. 3) Operation example of Exclusive OR (XOR)

- Set "Signal when the output current is within the specified range" to [LOG3], and output from output terminal [12].



(Setting example)
- Output terminal function [12] selection [CC-02] = Logical operation result 2 [LOG3]
- LOG3 selection 1 [CC-46] = Overload warning [OL]
- LOG3 selection 2 [CC-47] = Overload warning notice 2 [OL2]
- LOG3 operator selection [CC-48]=XOR(02)

9.14 Perform Positioning Operation

9.14.1 Using Absolute Position Control Function Based on Origin

Q

- How do I control the position with reference to the origin like a servo?
- How do I perform positioning operation that moves to a fixed distance with a conveyor or a carrier machine?

A

- WJ-C1 is equipped with an absolute position control function that enables simple positioning operation by feeding back pulse signals from external encoders and other devices to the drive.
- In absolute position control, the target position input source is set by the following methods.
  ① Position reference
  ② Speed reference (Frequency reference)
  ③ Acceleration time and deceleration time
  After moving to the target position according to the direction, it becomes a DC braking state. After that, the DC braking status is held until the RUN command is OFF.
- Frequency reference and acceleration/deceleration command in absolute position control follow those selected at that time.
- If the position reference is small, deceleration → positioning may occur without reaching the speed reference value.
- The direction of the RUN command (forward/reverse) has no meaning as the rotation direction in the absolute position control mode. Operates as a signal for operation and stop. The rotation direction is forward if (target position-current position) is positive, or reverse if negative.
- If the homing operation (described later) is not performed, if "Save current position at power off [AE-61]" is "Disable (00)", the position at power-on will be treated as the origin ("Current position monitor [dA-20]" = 0). When [AE-61] is "Enable (01)", the position at the last power-off ([dA-20]) is treated as the current position.
- When the deviation between the position reference and the current position ([dA-20]) is 0, the positioning operation is performed on the spot when the RUN command is ON.
- The position reference can be switched from "Multistage position settings selection 1 [CP1] (076)" to "Multistage position settings selection 4 [CP4] (079)" of the input terminal function in 16 steps of "Position reference 0 [AE-20]" to "Position reference 15 [AE-50]". You can also change/save the currently selected position reference by changing/saving "Position reference setting (monitor) [FA-20]".

!

- When using this function, set "Vector control mode selection [AA123]" to "Absolute position control (02)" or "High resolution absolute position control mode (03)".
- This function requires the use of encoder feedback.
- When "Vector control mode selection [AA123]" is set to "High-resolution absolute position control mode (03)", the number of pulses multiplied by 4 times used for internal calculation. Set the multistage position reference and position range designation with a 4 times multiplication accuracy.
- The current position counter is not cleared by trip reset or reset signal input.
- In absolute position control, if the input terminal function "Clearance of position deviation [PCLR]" is assigned, the current position counter is cleared by ON of the [PCLR] input terminal.
- In the absolute position control mode, the input terminal function "Permission of torque control [ATR]" does not function. (Torque control does not work.)
- When changing the position reference with [FA-20], simply change the value with JOG dial on the keypad, that value will be reflected as the command value. However, if the data is not saved by SET key, the power cycle returs the data to the previous change.

Code	Name	Description	Data
[dA-08]	Detect speed monitor	Monitors the feedback detection speed.	-590.00 to 590.00 (Hz)
[dA-20]	Current position monitor	Monitor the current position.	For AA123≠03 : -268435455 to 268435455 (pls) For AA123=03: -1073741823 to 1073741823 (pls)
[FA-20]	Position reference setting (monitor)	Monitors or changes the setting of the currently selected position reference input source. When you change or save [FA-20], the settings of the currently selected position references 0 to 15 are also changed/saved.	
[AA123]	Vector control mode selection	Absolute position control mode	02
		High-resolution absolute position control mode	03
[AE-04]	Positioning completed range setting	When the current position falls within the range of the target position ± [AE-04], [POK] signal will be outputted assuming that the positioning is complete. (multiplied by 4 setting)	0 to 10000 (pls)
[AE-05]	Positioning completed delay time setting	Specify how long it takes for the [POK] signal to be output after positioning is complete.	0.00 to 10.00 (s)
[AE-15]	Creep speed setting	Set the low-speed operation just before the completion of positioning.	Minimum frequency [Hb130] to 10.00 (Hz)
[AE-16]	Position displacement at creep speed	Set the move distance to operate at the [AE-15] speed.	0 to 16384 (pls)
[AE-17]	Positioning restart range	When the current position is out of the range of the target position ± [AE-17] after the completion of positioning, the positioning operation is performed again. (multiplied by 4 setting)	0 to 10000 (pls)
[AE-20]	Position reference 0	Set the position reference for the multistage position reference respectively.	[AE-54] to [AE-52]
[AE-22]	Position reference 1		
[AE-24]	Position reference 2		
[AE-26]	Position reference 3		
[AE-28]	Position reference 4		
[AE-30]	Position reference 5		
[AE-32]	Position reference 6		
[AE-34]	Position reference 7		
[AE-36]	Position reference 8		
[AE-38]	Position reference 9		
[AE-40]	Position reference 10		
[AE-42]	Position reference 11		
[AE-44]	Position reference 12		
[AE-46]	Position reference 13		
[AE-48]	Position reference 14		
[AE-50]	Position reference 15		
[AE-52]	Position control range setting (forward)	Set the position control range on the forward rotation side. If [AE-56] is "Limited (00)", the motor trips due to "Positioning range error [E104]" if the current position counter exceeds this setting.	For AA123≠03 : 0 to 268435455 (pls) For AA123=03: 0 to 1073741823 (pls)
[AE-54]	Position control range setting (reverse)	Set the position control range on the reverse side. If [AE-56] is "Limited (00)", the motor trips due to "Positioning range error [E104]" if the current position counter exceeds this setting.	For AA123≠03 : -268435455 to 0 (pls) For AA123=03: -1073741823 to 0 (pls
[AE-56]	Position control mode selection	Limited: Position control range settings ([AE-52], [AE-54]) are enabled.	00
		Not limited: Shortest position control is enabled.	01

Code	Name	Description	Data
[AE-64]	Deceleration stop distance calculation gain	Adjustment is made for the stop distance at deceleration stop.	50.00 to 200.00 (%)
[AE-65]	Deceleration stop distance calculation bias	Adjusts the output frequency during positioning operation.	0.00 to 655.35 (%)
[AF101]	DC braking selection	Set "Disable (00)". With the position control function, DC braking is automatically applied when positioning is complete even if "Disable (00)".	00
[AF105]	DC braking force setting	Set the DC braking force at completion of positioning.	0 to 100 (%)
[CA-55]	Multistage input determination time	This is the time until the position reference is determined when the multistage position reference switching is performed.	0 to 2000 (ms)
[CA-90]	Pulse input target function selection	Set "Speed feedback (02)".	02
[CA-01] to [CA-08]	Input terminal function	Multistage position settings selection 1 to 4 [CP1]/[CP2]/[CP3]/[CP4]: Select the position reference in the combination of ON/OFF of each input terminal function.	076([CP1]) 077([CP2]) 078([CP3]) 079([CP4])
[CC-01] [CC-02] [CC-07]	Output terminal function	Positioning completed [POK]: When the current position falls within ±[AE-04] of the target position, this signal is turned ON.	043

Operation procedure of absolute position control function

1 Pre-setting of parameters

(1) Wire the encoder and set the related parameters. For details, refer to "9.5.11 Setting for Encoder Feedback".

(2) To enable the absolute position control function, set "Pulse input target function selection [CA-90]" to "Speed feedback (02)", and "Vector control mode selection [AA123]" to "Absolute position control mode (02)" or "High resolution absolute position control mode (03)".

(3) Set "DC braking selection [AF101]" to "Disable (00)" (In absolute position control, DC braking is automatically activated when positioning is complete even if [AF101] is "Disable (00)"). Set "DC braking force setting [AF105]" so that the required braking force can be obtained when positioning is completed.

(4) The rotation direction in absolute position control is forward if the position deviation (target position-current position) is positive, or reverse if it is negative. Therefore, the input of "Forward rotation [FW]" or "Reverse rotation [RV]" does not mean the direction of rotation and operates only as the input signal for run/stop.

(5) Set "Creep speed setting [AE-15]" and "Position displacement at creep speed [AE-16]" according to the operation pattern. In addition, set 0.00 Hz for the frequency lower limit [bA103]. If it is not 0.00 Hz, that value is the lower limit value of [AE-15].

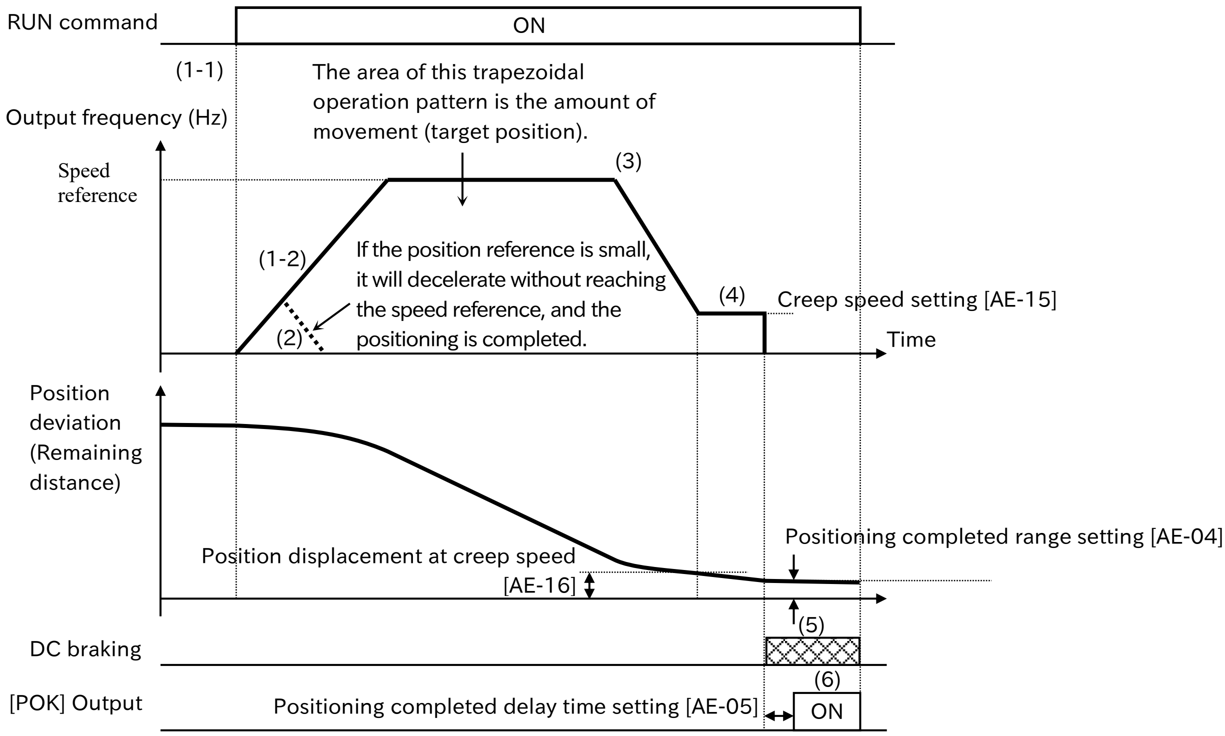
(6) Set "Positioning completed range setting [AE-04]" to 4 times number of pulses (A-phase 1 pulse cycle is 4 pulses). When the current position falls within ±[AE-04] of the target position, the "Positioning completed [POK]" signal turns ON. Assign [POK] signal to output terminals as required.

(7) Set the target position of positioning operation, speed reference (frequency reference), acceleration time and deceleration time. The target position is set to "Position reference 0 [AE-20]" to "Position reference 15 [AE-50]" and selected by the combination of ""Multistage position settings selection 1 to 4 ([CP1] to [CP4])" of the input terminal function. The speed reference (frequency reference) and acceleration/deceleration time follow the frequency reference and acceleration/deceleration time setting from each command input source selection when the RUN command is input.

(8) When "Limited (00)" is set to "Position control mode selection [AE-56]", the position range designation is enabled. Set the position control range to "Position control range setting (forward) [AE-52]" and "Position control range setting (reverse) [AE-54]". When the current position is out of the specified position range, the inverter trips due to "Positioning range error [E104]". When "Not limited (01)" is set to [AE-56], the position range designation is disabled, and the shortest position control function is enabled. For details, refer to "Minimum position control function" in this section.

2 Positioning operation

- The figure below shows the positioning operation when the RUN command is turned ON.



(1) When the RUN command is input (1-1), the positioning operation is automatically started in the trapezoidal operation pattern shown in the above figure according to the position reference, speed reference (frequency reference), acceleration time, and deceleration time selected from each command input source at that time (1-2). The rotation direction is forward if the position deviation (target position-current position) is positive, or reverse if it is negative.

(2) Accelerate according to the acceleration time until the speed reference (frequency reference) is reached. At this time, if the movement amount to the target position is small, the actuator decelerates before reaching the speed reference (broken line in the figure).
If the movement amount is smaller than "Position displacement at creep speed [AE-16]", it will move to the target position with "Creep speed setting [AE-15]", and if the movement amount is within "Positioning completed range setting [AE-04]", DC braking will operate on the spot.

(3) From the target position, deceleration starts before the move distance at deceleration + "Position displacement at creep speed [AE-16]".

(4) It decelerates and operates at that speed when the output frequency becomes "Creep speed setting [AE-15]".
If the rotation of the motor becomes unstable in the low-speed range, increase [AE-15].

(5) When the current position reaches within the target position ± "Positioning completed range setting [AE-04]", DC braking will operate. DC braking is released when the RUN command is OFF.
DC braking after stopping is not controlled to hold the position, so the stop position may be shifted when external force is applied. Use an external brake if position retention is required.

(6) After the current position reaches within the target position ± "Positioning completed range setting [AE-04]", after the "Positioning completed delay time setting [AE-05]" has elapsed, the "Positioning completed [POK]" will be outputted.

!

- For single-phase pulse ([CA-91]=03), the position is not counted if the motor is rotated while no RUN command is input. To prevent the position from shifting while the motor is stopped, prevent the motor shaft from rotating while the motor is stopped by braking or change to the 90° shifted pulse input or forward/reverse command and pulse so that the motor is counted even when the motor is stopped.
- For single-phase pulse ([CA-91]=03), if the rotation direction command is switched during operation, an error may occur in the position counting due to the time difference between the switching of the direction of the inverter's output frequency and the switching of the actual motor rotation direction. In position control with single-phase pulses, stop it securely and then change the rotation direction.

A

Multistage position reference switching function

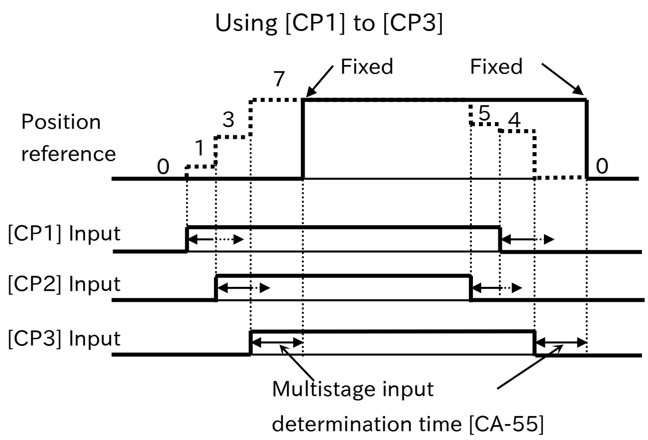
- The position reference can be selected from "Position reference 0 [AE-20]" to "Position reference 15 [AE-50]" by combining "Multistage position settings selection 1 [CP1] (076)" to "Multistage position settings selection 4 [CP4] (079)" of the input terminal function with the multistage position reference switching function.
- Position references 0 to 15 are set at an absolute position with reference to the origin.
- If there is no assignment of [CP1] to [CP4] to the input terminal, "Position reference 0 [AE-20]" is the position reference.

!

- When inputting position reference selection 1 to 4, the time until the input terminal status (position reference selection) is confirmed can be adjusted with "Multistage input determination time [CA-55]". Incorrect selection due to the input time difference of position reference selection 1 to 4 can be prevented. The selection will be confirmed after the [CA-55] setting has elapsed without any changes.
  Note that the input response will be worse if the settling time is increased.

Code	Name	Description	Data
[AE-20] to [AE-50]	Position reference 0 to 15	Set position reference 0 to 15. If the value is positive, it will be in the forward direction. If it is negative, it will be in the reverse direction. (The setting range is limited to "Position control range setting (reverse) [AE-54]" to "Position control range setting (forward) [AE-52]".)	[AE-54] to [AE-52]
[AE-52]	Position control range setting (forward)	Set the position control range on the forward rotation side. If [AE-56] is "Limited (00)", the motor trips due to "Positioning range error [E104]" if the current position counter exceeds this setting.	For AA123≠03 : 0 to 268435455 (pls) For AA123=03: 0 to 1073741823 (pls)
[AE-54]	Position control range setting (reverse)	Set the position control range on the reverse side. If [AE-56] is "Limited (00)", the motor trips due to "Positioning range error [E104]" if the current position counter exceeds this setting.	For AA123≠03 : -268435455 to 0 (pls) For AA123=03: -1073741823 to 0 (pls)
[CA-55]	Multistage input determination time	This is the time until the position reference is determined when the multistage position reference switching is performed.	0 to 2000 (ms)
[CA-01] to [CA-08]	Input terminal function	Multistage position settings selection 1 to 4 ([CP1]/[CP2]/[CP3]/[CP4]): Select the position reference in the combination of ON/OFF of each input terminal function.	076([CP1]) 077([CP2]) 078([CP3]) 079([CP4])

Position reference	CP4	CP3	CP2	CP1
Position reference 0	OFF	OFF	OFF	OFF
Position reference 1	OFF	OFF	OFF	ON
Position reference 2	OFF	OFF	ON	OFF
Position reference 3	OFF	OFF	ON	ON
Position reference 4	OFF	ON	OFF	OFF
Position reference 5	OFF	ON	OFF	ON
Position reference 6	OFF	ON	ON	OFF
Position reference 7	OFF	ON	ON	ON
Position reference 8	ON	OFF	OFF	OFF
Position reference 9	ON	OFF	OFF	ON
Position reference 10	ON	OFF	ON	OFF
Position reference 11	ON	OFF	ON	ON
Position reference 12	ON	ON	OFF	OFF
Position reference 13	ON	ON	OFF	ON
Position reference 14	ON	ON	ON	OFF
Position reference 15	ON	ON	ON	ON



A

Teaching operation function

- This function rotates and stops the motor arbitrarily and stores its position in any position reference as a arbitrary position reference.
- In position teaching, use "Teach-in function target selection [AE-60]" to store the "Current position monitor [dA-20]" to "Position reference 0 [AE-20]" to "Position reference 15 [AE-50].

■ Basic operation of teaching

(1) Move the workpiece to the position to be memorized by normal operation or manually to adjust the position.

(2) Select X00 to X15 in [AE-60], and then press SET key.
Thus, the position data of "Current position monitor [dA-20]" is stored in the corresponding position reference. (X00=[AE-20] to X15=[AE-50] is supported. Refer to the table below for details.)

■ Example of teaching procedure during absolute position control operation

(1) Select the position reference number to be set in "Teach-in function target selection [AE-60]" (No SET key is pressed).

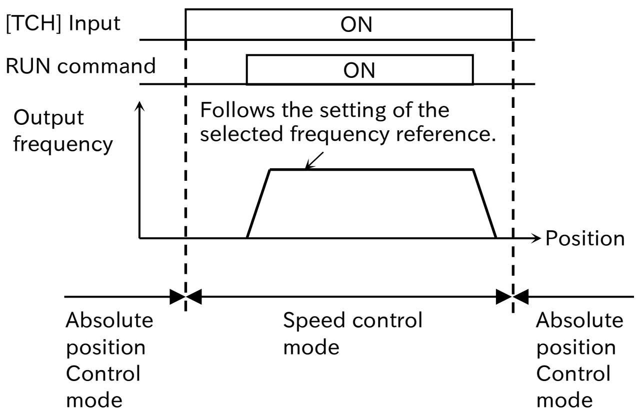
(2) Move the workpiece. Turn ON the input terminal function "Teach-in signal [TCH]" to enable speed control, and then input the RUN command. The speed reference and acceleration/deceleration time depend on the selection status at this time.

(3) When the workpiece reaches the target position, select the position reference to be set with [AE-60] and press SET key. Thus, the current position is saved in the position reference input source (see the table below) set in [AE-60] (the saving of the position itself is independent of ON/OFF status of the [TCH] input terminal).

(4) To store the position continuously, repeat from step (1).

*) The value of [AE-60] is not saved. If the power is shutdown or reset, "X00 (00)" will display.

[AE-60] Set value	Position reference to be set
00: X00	[AE-20]: Position reference 0
01: X01	[AE-22]: Position reference 1
02: X02	[AE-24]: Position reference 2
03: X03	[AE-26]: Position reference 3
04: X04	[AE-28]: Position reference 4
05: X05	[AE-30]: Position reference 5
06: X06	[AE-32]: Position reference 6
07: X07	[AE-34]: Position reference 7
08: X08	[AE-36]: Position reference 8
09: X09	[AE-38]: Position reference 9
10: X10	[AE-40]: Position reference 10
11: X11	[AE-42]: Position reference 11
12: X12	[AE-44]: Position reference 12
13: X13	[AE-46]: Position reference 13
14: X14	[AE-48]: Position reference 14
15: X15	[AE-50]: Position reference 15



Code	Name	Description	Data
[AE-60]	Teach-in function target selection	"Current position monitor [dA-20]" is stored in the corresponding position reference.	00 to 15
[CA-01] to [CA-08]	Input terminal function	Teach-in signal [TCH]: With this signal turned ON, the teaching operation function is activated by RUN command input.	110

!

- Regardless of the control mode or operation status, if you select "X00(00)" to "X15(15)" in "Teach-in function target selection [AE-60]" and press SET key, the corresponding "Position reference ([AE-20] to [AE-50])" will be changed with the content of "Current position monitor [dA-20]".
- Do not use [AE-60] for purposes other than position teaching.

A

Minimum position control function

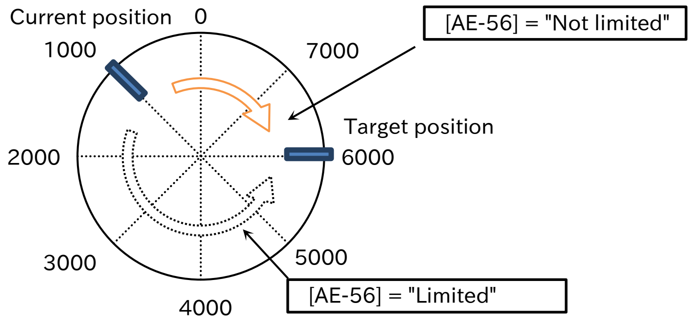
- When "Not limited (01)" is selected in "Position control mode selection [AE-56]", the rotational direction is determined so that the travel distance to the target position is the shortest for applications like the turntable shown in the figure below.

■ Application example) Turntable with 8 positioning points

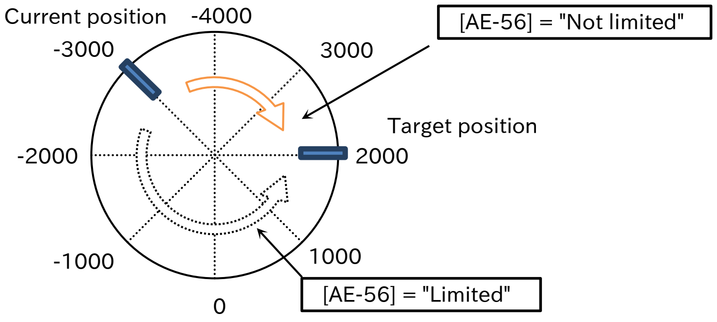
- Assume that an attempt is made to move from the current position (1000 pls) to the target position (6000 pls) of a turntable whose position area is set as shown below. (Be sure to set each positioning point within the position range.)

  Position control range setting (forward) [AE-52] = 7999
  Position control range setting (reverse) [AE-54] = 0

- [AE-56] = "Limited (00)"
  (Target position) - (Current position) = +5000 pls, so rotate in the forward direction.
- [AE-56] = "Not limited (01)"
  This setting will cause the actuator to move in the reverse direction in which the movement distance in the forward direction is smaller than that in the reverse direction.
  Forward move: + 5000pls
  Reverse move: -3000pls



※ Depending on the position range setting, the following settings can also be made.
[AE-52] = +3999
[AE-54] = -4000



!

- If "Position control mode selection [AE-56]" = "Not limited (01)", "Positioning range error [E104]" will not occur.
- In the above cases, when moving from 7000 pls position to 1000 pls position, the position 7999 pls will move from the current position counter to 1000 pls position instead of 8000 pls.

A

Positioning restart function

- With this function, positioning operation is performed automatically again if the position is misaligned due to external force during DC braking after positioning of the position control operation is completed.
- This function is activated when the current position is out of the range of the target position ± "Positioning restart range [AE-17]".
- When [AE-17] is set to other than 0 pls, this function is enabled. It does not work for [AE-17] = 0 pls.
- This function does not operate when the RUN command is turned OFF after the completion of positioning.
- Set [AE-17] in the same way as [AE-04] multiplied by 4 setting (A-phase 1 pulse cycle is 4 pulses).

!

- Depending on the setting of "Positioning restart range [AE-17]" and "Positioning completed range setting [AE-04]", the repositioning function may start and stop repeatedly. Set and adjust so that [AE-17]>[AE-04] is selected to prevent frequent start/stop operations.
- Do not use this function if the brake is used to hold the stop position. Brake opening and closing may become frequent and the load may drop or overload trip may occur.

Code	Name	Description	Data
[AE-04]	Positioning completed range setting	When the current position falls within the range of the target position ± [AE-04], the [POK] signal will be outputted assuming that the positioning is complete. (multiplied by 4 setting)	0 to 10000 (pls)
[AE-17]	Positioning restart range	When the current position is out of the range of the target position ± [AE-17] after the completion of positioning, the positioning operation is performed again. (multiplied by 4 setting)	0 to 10000 (pls)

A

Homing function

- Three types of homing function can be selected by "Homing function selection [AE-70]".
- When using the homing function, assign "Limit signal of Homing function [ORL] (080)" and "Start signal of Homing function [ORG] (081)" to the input terminals. Input a home signal using a limit sensor, etc. to the [ORL] input terminal.
- Homing function rotation direction is selected by "Direction of homing function [AE-71]". When homing operation ends, the current position is cleared to zero.
- The operation when the [ORG] input terminal is ON can be changed by setting "ORG action selection [AE-74]". If "Without RUN command (00)" is set, the [ORG] input terminal must be turned ON and the RUN command must be input further in order to initiate the homing function. When "With RUN command (01)" is set, turning ON the [ORG] input terminal will immediately initiate homing operation.
- In relation to homing function, please also use the current position clear function, current position preset function, and position data hold function at power shutdown, which are described below, in combination according to the application.

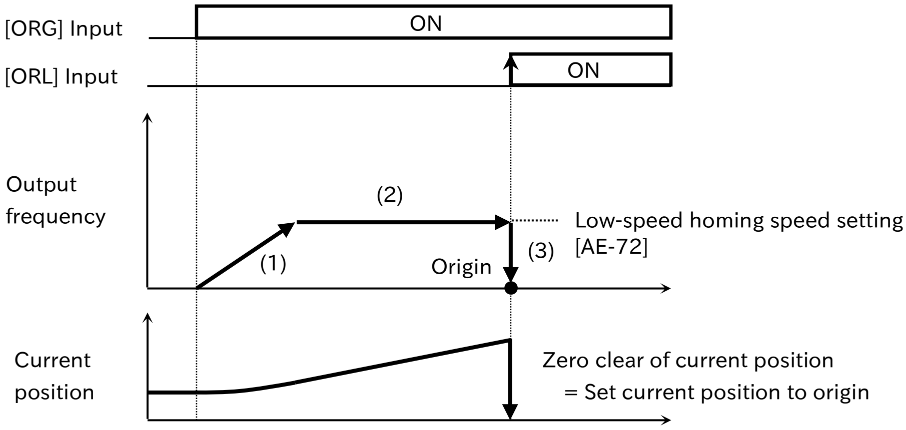
!

- Assign "Pulse input Z [PLZ] (109)" to "Input terminal [6] function [CA-06]" and input Z pulse of encoder to input terminal [6] when "Homing function selection [AE-70]" is set to "High-speed homing 2 (02)".

Code	Name	Description	Data
[dA-20]	Current position monitor	The value of this monitor is cleared to zero when the power is turned off and return to origin is completed. It is also possible to change to an arbitrary value by the current position preset function described later or save to the internal memory of the current position by the current position storage function when the power is turned off.	For AA123≠03 : -268435455 to +268435455 (pls) For AA123=03: -1073741823 to +1073741823 (pls)
[AE-70]	Homing function selection	Low-speed homing	00
		High-speed homing 1	01
		High-speed homing 2	02
[AE-71]	Direction of homing function	The direction of rotation when returning to the origin is taken as the forward direction.	00
		The direction of rotation when returning to the origin is assumed to be the reverse direction.	01
[AE-72]	Low-speed homing speed setting	Set the speed of the low-speed homing operation.	0.00 to 10.00 (Hz)
[AE-73]	High-speed homing speed setting	Set the speed of the high-speed homing operation.	0.00 to Maximum frequency (Hz)
[AE-74]	ORG action selection	Without RUN command	00
		With RUN command	01
[CA-01] to [CA-08]	Input terminal function	Limit signal of Homing function [ORL]: Input signal from the home limit switch, etc. during home return operation.	080
		Start signal of Homing function [ORG]: When this signal is turned ON in absolute position control, the homing operation starts.	081
		Pulse input Z [PLZ]: Accepts Z-phase pulse input.	109

Low-speed homing ([AE-70] = 00)

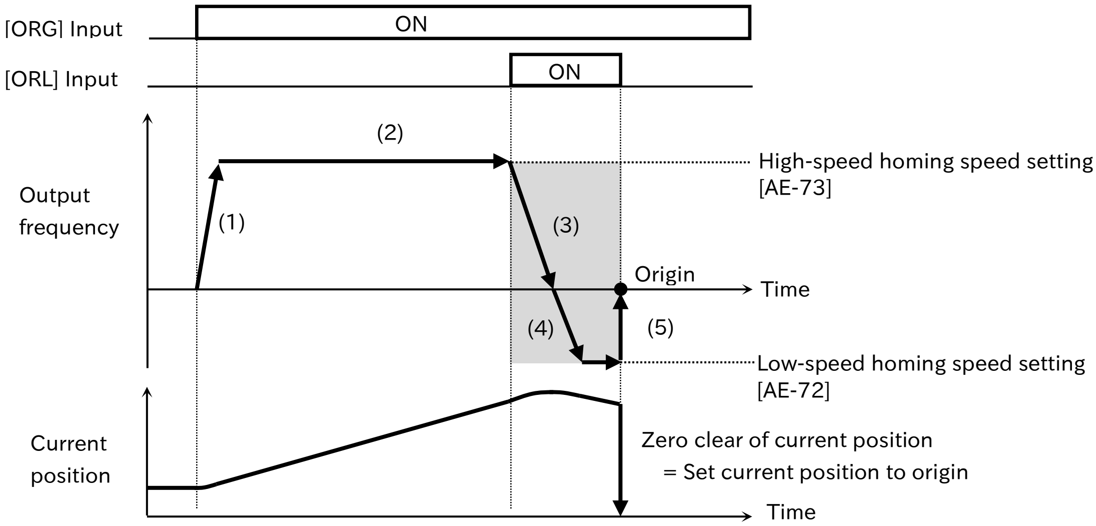
- The following figure explains the operation when "Homing function selection [AE-70]" is "Low speed homing (00)" and "ORG terminal operation selection [AE-74]" is "With RUN command (01)".



1. When the "Start signal of Homing function [ORG]" input terminal becomes ON, accelerates in the direction of "Direction of homing function [AE-71]". At this time, do not input the RUN command because the absolute position control starts.
2. Run at "Low-speed homing speed setting [AE-72]".
3. When the "Limit signal of Homing function [ORL]" input terminal is ON, the "Current position monitor [dA-20]" is cleared to zero and at the same time, DC braking operates. When turning OFF the [ORG] input terminal cancel DC braking.

High-speed homing 1 ([AE-70] = 01)

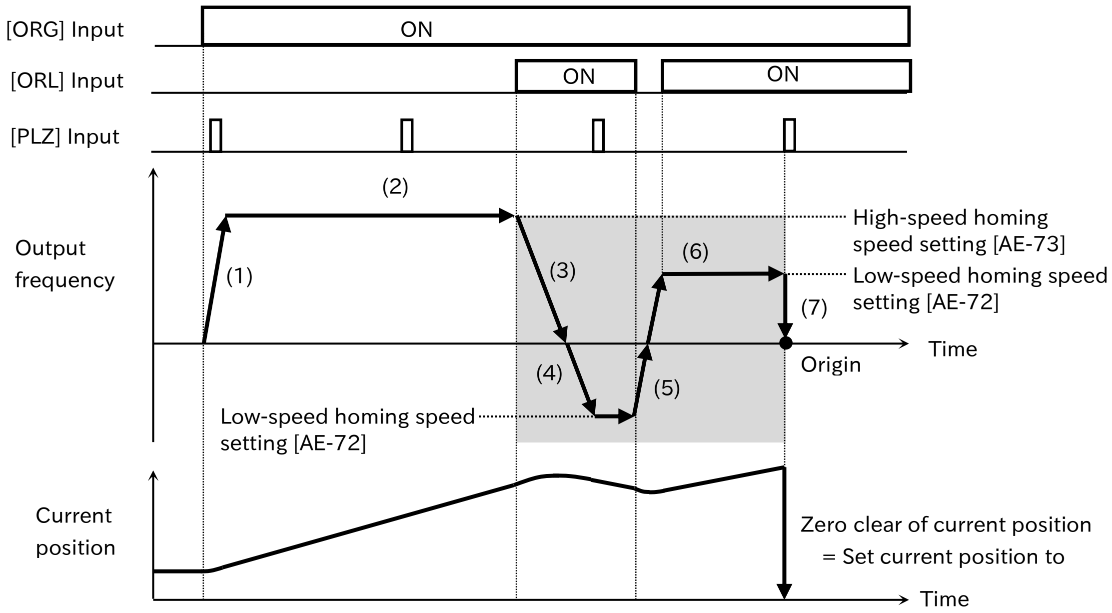
- The following figure shows the operation when "Homing function selection [AE-70]" is "High-speed homing 1 (01)" and "ORG action selection [AE-74]" is "With RUN command (01)".



1. When the "Start signal of Homing function [ORG]" input terminal becomes ON, accelerates in the direction of "Direction of homing function [AE-71]". At this time, do not input the RUN command because the absolute position control starts.
2. Run at "High-speed homing speed setting [AE-73]"
3. When the "Limit signal of Homing function [ORL]" input terminal is ON, decelerating starts.
4. After stopping, re-accelerate in the direction opposite to "Direction of homing function [AE-71]" and run at "Low-speed homing speed setting [AE-72]".
5. When the [ORL] input terminal is OFF, "Current Position Monitor [dA-20]" is cleared to zero and at the same time, DC braking operates. When turn OFF the [ORG] input terminal cancel DC braking.

■ High-speed homing 2 ([AE-70] = 02)

- The following figure shows the operation when "Homing function selection [AE-70]" is "High-speed homing 2 (02)" and "ORG action selection [AE-74]" is "With RUN command (01)".



1. When the "Start signal of Homing function [ORG]" input terminal becomes ON, the actuator accelerates in the direction of "Direction of homing function [AE-71]". At this time, do not input the RUN command because the absolute position control starts.
2. Run at "High-speed homing speed setting [AE-73]"
3. When the "Limit signal of Homing function [ORL]" input terminal is ON, decelerating starts.
4. After stopping, re-accelerate in the direction opposite to "Direction of homing function [AE-71]" and run at "Low-speed homing speed setting [AE-72]".
5. When the [ORL] terminal is OFF, decelerating starts.
6. Accelerate in the direction of "Direction of homing function [AE-71]" and run at "Low speed homing speed setting [AE-72]". To do this, turn ON the [ORL] input terminal again.
7. When the first Z pulse ("Pulse input Z [PLZ]" input terminal) is input after the [ORL] input terminal is turned ON, the "Current position monitor [dA-20]" is cleared to zero. At the same time, DC braking operates. When turn OFF the [ORG] input terminal cancel DC braking.

A

Home position setting by the current position clear function

- Assign "Clearance of position deviation [PCLR] (072)" to the input terminal and turn ON the terminal to clear "Current position monitor [dA-20]" to zero.
- Move to the home position in advance and set the [PCLR] terminal to ON to fix the home position.

!

- If "Pulse input target function selection [CA-90]" is set to "Speed feedback (02)", "Clearance of position deviation [PCLR]" will be enabled regardless of the "Vector control mode selection [AA123]" setting.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Clearance of position deviation [PCLR]: If "Pulse input target function selection [CA-90]" is "Speed feedback (02)", "Current position monitor [dA-20]" will be cleared to zero when this signal is turned ON.	072

A

Home position setting by current position preset function

- The current position preset function overwrites the position data set in "Pre-set position data [AE-62]" to the current position. It can be used to restart from the middle of the positioning process, etc.
- This function is used when the home position set by the "Limit signal of Homing function [ORL]" input terminal or the "Pulse input Z [PLZ]" input terminal and the actual home position are offset.
- By assigning "Position data presetting [PSET] (085)" to the input terminal and ON the terminal, "Current position monitor [dA-20]" can be set to [AE-62].
- Overwriting is performed at ON edge of the [PSET] input terminal.

!

- If "Pulse input target function selection [CA-90]" is set to "Speed feedback (02)", "Position data presetting [PSET]" will be enabled regardless of the "Vector control mode selection [AA123]" setting.

Code	Name	Description	Data
[AE-52]	Position control range setting (forward)	Set the position control range on the forward rotation side. When [AE-56] is "Limited (00)", if the current position counter exceeds this setting, it will trip due to "Positioning range error [E104]".	For AA123≠03 : 0 to 268435455 (pls) For AA123=03: 0 to 1073741823 (pls)
[AE-54]	Position control range setting (reverse)	Set the position control range on the reverse side. When [AE-56] is "Limited (00)", if the current position counter exceeds this setting, it will trip due to "Positioning range error [E104]".	For AA123≠03 : -268435455 to 0 (pls) For AA123=03: -1073741823 to 0 (pls)
[AE-62]	Pre-set position data	Set the position data preset value. (The setting range is limited to "Position control range setting (reverse) [AE-54]" to "Position control range setting (forward) [AE-52]".)	[AE-54] to [AE-52]
[CA-01] to [CA-08]	Input terminal function	Position data presetting [PSET]: When "Speed feedback (02)" is selected for "Pulse input target function selection [CA-90]", "Current position monitor [dA-20]" is set to [AE-62] when this signal is turned ON.	085

A

Current position saving function when the power is shut off

- When "Save current position at power off [AE-61]" is set to "Enable (01)", the value of "Current position monitor [dA-20]" is saved in the inverter internal memory when the power is shut down, and the value stored at the next power on is set as the current position.

!

- If the motor is rotated while the power is turned off, the position at that time will not be counted, resulting in a position shift. Therefore, when using this function, use a brake, etc. to prevent the motor from rotating when the power is cut off.
- Even if the motor is restrained by the brake when the power is cut off, the positional deviation may accumulate due to backlash of the rotating shaft, etc. Therefore, check the operation of the application, and eliminate the positional shift by the power supply restoration function, etc., if necessary.

Code	Name	Description	Data
[AE-61]	Save current position at power off	Disable: Do not save position data during power off.	00
		Enable: The current position is memorized when the power is turned off, and memorized position is set as current position, when the power is turned on next time.	01

A

Forward/reverse drive stopping function ([FOT]/[ROT])

- This function is used to prevent deviation from the operating range by a signal from the control range limit switch.
- When "Forward Over Travel [FOT] (082)" is ON, the torque limit on the forward side is limited to 10%, and when "Reverse Over Travel [ROT] (083)" is ON, the torque limit on the reverse side is limited to 10%. It can be applied as a limit switch at the mechanical end.

!

- [FOT]/[ROT] is enabled when "Control mode selection [AA121]" is "Sensorless vector control (IM) (08)".

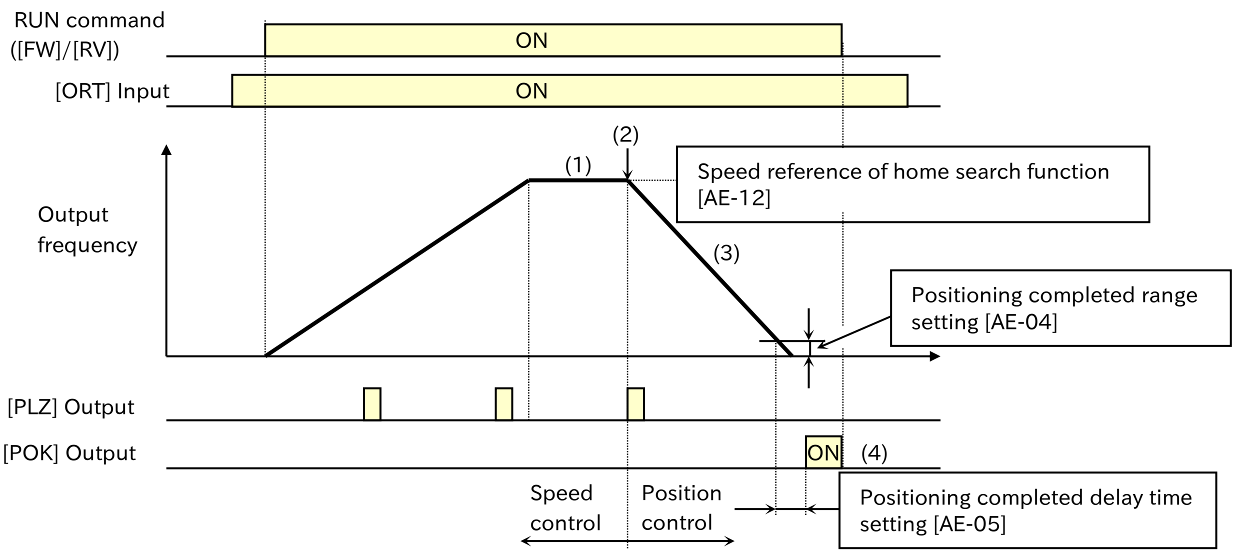
Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Forward Over Travel [FOT]: When "Control mode selection [AA121]" is "Sensorless vector control (IM) (08)", if this input terminal is turned ON, the torque limit on the forward side is limited to 10%.	082
		Reverse Over Travel [ROT]: When "Control mode selection [AA121]" is "Sensorless vector control (IM) (08)", if this input terminal is turned ON, the torque limit on the reverse side is limited to 10%.	083

9.14.2 Performing Home Search Function during Position Control

Q
- You want to stop the system at a predetermined position during maintenance.
- You want to use the orientation function.

A
- In absolute position control, orientation control can be performed.
- Set "Vector control mode selection [AA123]" to "Speed/Torque control mode (00)" and use it.
- This function allows positioning at any point during one rotation of the motor. It can be used for tool change of machine tool spindle, etc.

!
- For absolute position control and encoder feedback, refer to "9.14.1 Using Absolute Position Control Function Based on Origin" and "9.5.11 Setting for Encoder Feedback".
- The Z pulse (single rotation position signal) is used as the reference signal for positioning. When connecting an encoder to the control terminal, assign the input terminal function "Pulse input Z [PLZ] (109)" to the input terminal [6] and input Z pulses.



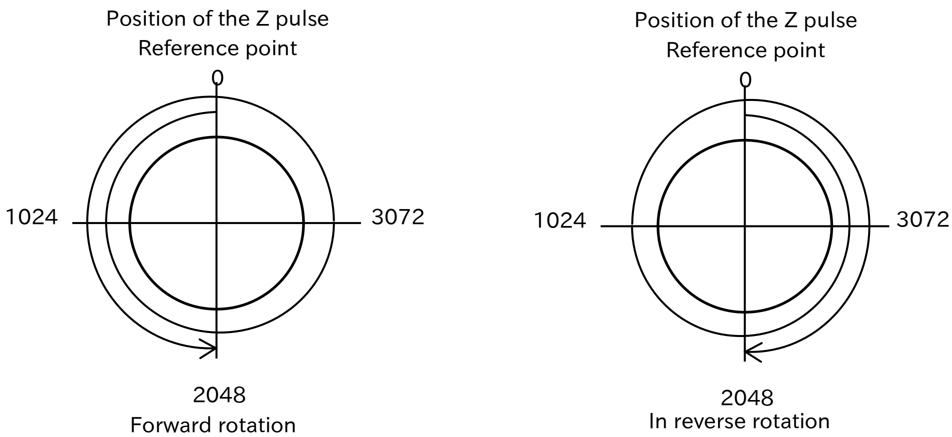
1. When RUN command is ON while the "Home search function [ORT]" input terminal is ON, accelerates to the "Speed reference of home search function [AE-12]" and enters to constant speed operation. In this case, the operation direction follows the "Direction of home search function [AE-13]".
   (If the driving direction is the same as the one set in [AE-13], the speed will change to the orientation speed when the [ORT] input terminal is turned ON, and if it is different, it will re-accelerate according to the setting of [AE-13] after decelerating stop.)
2. After reaching the orientation speed set in [AE-12], it will switch to position control when the first Z pulse is detected.
3. Position control will be performed with
   "Stop position of home search function [AE-11]" + one revolution for forward rotation and
   "Stop position of home search function [AE-11]" + one revolution for reverse rotation
   as the target. (Does not follow deceleration time setting.)
4. After "Positioning completed delay time setting [AE-05]" elapses after the remaining number of pulses falls within "Positioning completed range setting [AE-04]", the "Positioning completed [POK]" signal is outputted. DC braking operation is performed after positioning is completed. DC braking operation and [POK] will continue until the RUN command is OFF.

!
- If the "Speed reference of home search function [AE-12]" is large and the "Positioning completed range setting [AE-04]" is small, overshoot may occur and the "Positioning completed [POK]" signal may not be outputted. In this case, reduce the [AE-12] or increase the [AE-04].

Code	Name	Description	Data
[AA123]	Vector control mode selection	Speed control mode or torque control mode	00
[AE-04]	Positioning completed range setting	Set as a multiplied by 4 value of the encoder	0 to 10000 (pls)
[AE-05]	Positioning completed delay time setting	Specify how long it takes for the [POK] signal to be output after positioning is complete.	0.00 to 10.00 (s)
[AE-10]	Stop position selection of home search function	Parameter setting ([AE-11])	00
		Communication options	01
[AE-11]	Stop position of home search function*1	Set the stop position for orientation control.	0 to 4095
[AE-12]	Speed reference of home search function*2	Set the output frequency during orientation control.	0.00 to 120.00 (Hz)
[AE-13]	Direction of home search function	Start in the forward direction during orientation control.	00
		Start in the reverse direction during orientation control.	01
[CA-01] to [CA-05]	Input terminal function	Home search function [ORT]: Orientation control starts when the RUN command is turned ON while this signal is ON.	069
[CA-06]	Input terminal function [6] selection	Pulse input Z [PLZ]: Accepts Z-phase pulse input.	109
[CA-81]	Encoder constant setting	Set the number of pulses.	1 to 65535 (pls)
[CA-82]	Encoder phase sequence selection	Phase A lead	00
		Phase B lead	01
[CA-90]	Pulse input target function selection	Disable	00
		Pulse input frequency reference	01
		Speed feedback	02
		Pulse count	03
[CA-91]	Pulse input mode selection	90° shifted pulse input	00
		Forward/Reverse command and pulse input	01
		Single phase pulse input	03
[CC-01] [CC-02] [CC-07]	Output terminal function	Positioning completed [POK]: When the current position falls within ±[AE-04] of the target position, this signal is turned ON.	043

*1. The orientation stop position is set as one rotation 4096 division (0 to 4095) from the reference point in the forward direction, regardless of the number of pulses of the encoder. The reference point is the point where Z pulse is input, and the stop target position is arranged as shown in the figure below when viewed from the motor shaft load side. (For positive-phase connection)

*2. Do not set the orientation speed setting to a high frequency, as the deceleration operation will be in the positioning state within two rotations. Overvoltage protection may trip or overshoot.



※When looking at the motor shaft from the motor shaft load side

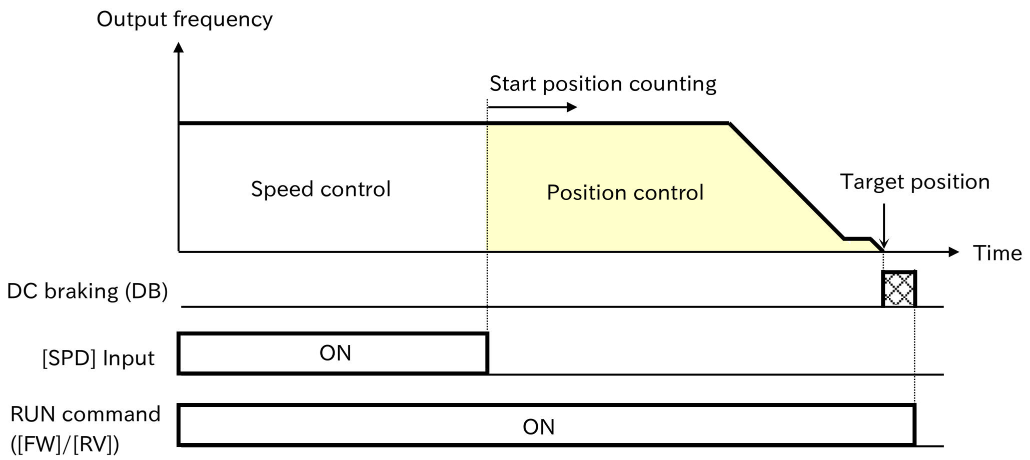
9.14.3 Switching between Speed Control and Position Control

Q How do I switch to position control and perform positioning stop during operation in speed control?

A
- In the absolute position control mode, when the "Speed/position switching [SPD] (084)" of the input terminal function is turned ON, the normal frequency operation (speed control operation) is performed. The rotation direction follows the direction command at the time of RUN command.
- While the [SPD] input terminal is ON, the current position counter is 0. If the [SPD] input terminal is turned OFF during operation, switches to position control operation from that point.
- If the position reference when switching from speed control to position control is 0, stop operation starts on the spot.

!
- While the [SPD] input terminal is ON, the actuator moves in the direction dependent on the RUN command. When switching from speed control to position control, pay attention to the sign of the RUN command.

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Speed/position switching [SPD]: When this signal is ON, it runs in speed control, and when it becomes OFF, it switches to position control operation.	084



9.14.4 Operating Position Control with Brake Control

Q

- How to interlock the external brake when positioning operation is completed
- I want to apply a brake to prevent positional shift after moving the workpiece with position control

A

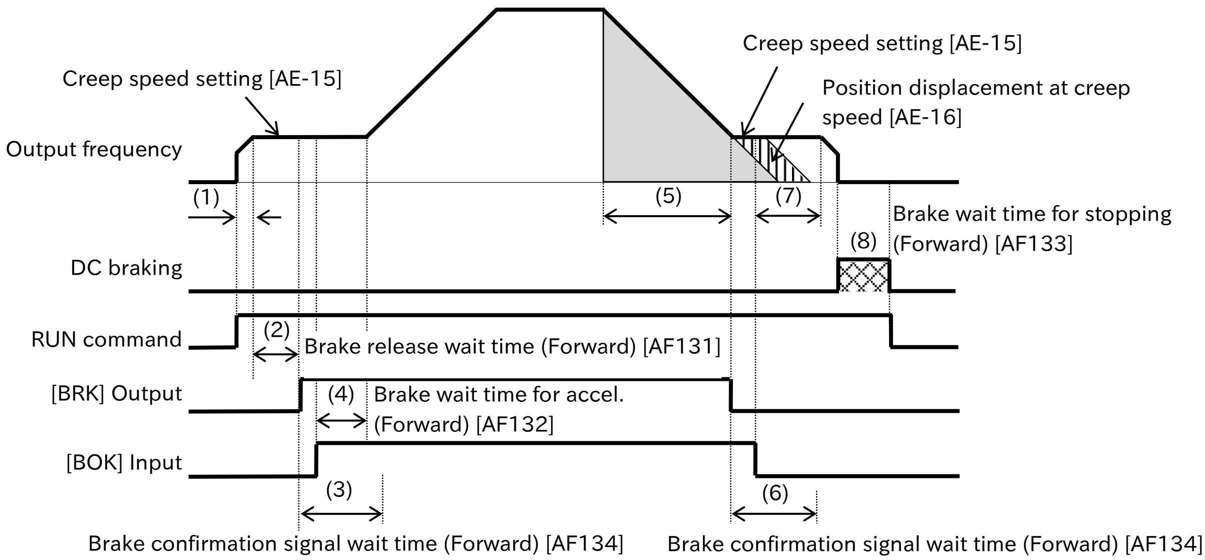
- If "Brake control enable [AF130]" = "Brake control enable (Common) (01)" or "Brake control enable (Separate for FWD/REV) (02)" is set in the absolute position control mode, the absolute position control and brake control are automatically linked.
- Setting [AF130] to "Brake control enable (Separate for FWD/REV) (02)" allows you to set a different operation between forward and reverse rotation. When "Brake control enable (Common) (01)" is set to [AF130], the forward settings ([AF131] to [AF137]) is enabled for both forward and reverse.
- This section describes when "Brake control enable [AF130]" = "Brake control enable (Common) (01)". When this function is used in reverse rotation with "Brake control enable [AF130]" = "Brake control enable (Separate for FWD/REV) (02)", replace the forward settings ([AF131] to [AF136]) with the reverse settings ([AF138] to [AF143]).
- When using this function, assign "Brake release [BRK] (037)" to the output terminals.
- When input a restraint/release confirmation signal from the external brake to the inverter to operate this function with interlock, assign "Answer back from Brake [BOK] (037)" to the input terminal and set "Brake confirmation signal wait time ([AF134]/[AF141])". Also, if necessary, assign "Brake error [BER] (038)" to the output terminal.
- Refers to "9.7.10 External Brake Control Function" and "9.14.1 Using Absolute Position Control Function Based on Origin" respectively and set related functions.

!

- During deceleration, when the "Creep speed setting [AE-15]" is reached, the "Brake release [BRK]" signal is turned OFF, and the brake is restrained and the motor is stopped. For this reason, it will be stopped before the "Position displacement at creep speed [AE-16]" at the largest from the actual target position. Set [AE-16] and "Positioning completed range setting [AE-04]" considering the accuracy of the stopping position.

Code	Name	Description	Data
[AE-14]	DC braking control selection for simple positioning	Simple positioning DB control disabled	00
		Simple positioning DB control enabled	01
[AF130]	Brake control enable	Brake control enabled (Common)	01
		Brake control enabled (Separate for FWD/REV)	02
[AF131]	Brake release wait time (Forward)	Set the time from when the brake release frequency is reached until the output current reaches the brake release current.	0.00 to 5.00 (s)
[AF138]	Brake release wait time (Reverse)		
[AF132]	Brake wait time for accel. (Forward)	Set the mechanical delay time from [BOK] input terminal ON (or [BRK] signal) until release the brake.	0.00 to 5.00 (s)
[AF139]	Brake wait time for accel. (Reverse)		
[AF133]	Brake wait time for stopping (Forward)	Set the mechanical delay time after turning OFF the [BRK] signal before the brake restrains.	0.00 to 5.00 (s)
[AF140]	Brake wait time for stopping (Reverse)		
[AF134]	Brake confirmation signal wait time (Forward)	After the [BRK] signal is output, set the time longer than the time until the release completion signal output from the brake turns ON the [BOK] input terminal of the inverter.	0.00 to 5.00 (s)
[AF141]	Brake confirmation signal wait time (Reverse)		

Code	Name	Description	Data
[AF136]	Brake release current setting (Forward)	Set the output current that enables brake release.	(0.00 to 2.00) × ND/LD rated output current (A)
[AF143]	Brake release current setting (Reverse)		
[AA123]	Vector control mode selection	Absolute position control mode	02
		High-resolution absolute position control mode	03
[AE-04]	Positioning completed range setting	When the current position falls within the range of the target position ± [AE-04], the [POK] signal will be outputted assuming that the positioning is complete. (multiplied by 4 setting)	0 to 10000 (pls)
[AE-15]	Creep speed setting	Set the low-speed operation just before the completion of positioning.	Minimum frequency [Hb130] to 10.00 (Hz)
[AE-16]	Position displacement at creep speed	Set the amount of move that operates at the speed of [AE-16].	0 to 16384 (pls)
[CA-01] to [CA-08]	Input terminal function	Answer back from Brake [BOK]: Check this input signal as an answerback of the [BRK] signal to the external brake.	037
[CC-01] [CC-02] [CC-07]	Output terminal function	Brake release [BRK]: This signal is for restraining/releasing the external brake.	037
		Brake error [BER]: Turns ON when a sequence error occurs in the brake control function. When turns ON this signal, the inverter trips with "Brake error [E036]".	038



(1) When RUN command is issued, the inverter accelerates to "Creep speed setting [AE-15]".
The rotation direction is forward if (current position-target position) is positive, and reverse if negative.
In addition, if the target position is within ± "Positioning completed range setting [AE-04]", it will be stopped on the spot without releasing the brakes. Whether to perform DC braking depends on the [AE-14] setup.

(2) After the output frequency reaches the "Creep speed setting [AE-15]" and the time "Brake release wait time (Forward) [AF131]" has elapsed, the "Brake release [BRK]" signal turns ON.
However, if the output current at this time is less than the "Brake release current setting (Forward) [AF136]", the [BRK] signal will not be ON, the "Brake error [E036]" trip will occur instead, and the "Brake error [BER]" signal will be turned ON.

(3) The operation differs depending on whether "Answer back from Brake [BOK]" is assigned to the input terminal.

With [BOK] assignment: After the [BRK] signal turns ON, the inverter does not accelerate and waits for the [BOK] input terminals to become ON during the "Brake confirmation signal wait time (Forward) [AF134]". If the [BOK] input terminal does not turn ON within the waiting time, a "Brake error [E036]" trip will occur and the "Brake error [BER]" signal will be ON.

No [BOK] assignment: After the [BRK] signal turns ON, go to step (4).

(4) When the time of "Brake wait time for accel. (Forward) [AF132]" has elapsed after the [BOK] input terminals ON (or after the [BRK] signal is turned ON), the motor accelerates to the set frequency again. If the movement to the target position is small, deceleration starts while reaching the set frequency.

(5) Deceleration starts at the position before (movement during deceleration + "Position displacement at creep speed [AE-16]") from the target position. The inverter decelerates to the "Creep speed setting [AE-15]" and OFF [BRK] signal.

(6) The operation differs depending on whether "Answer back from Brake [BOK]" is assigned to the input terminal.

With [BOK] assignment: After the [BRK] signal turns OFF, the inverter does not decelerate and waits for the [BOK] input terminals to become OFF during the "Brake confirmation signal wait time (Forward) [AF134]". If the [BOK] input terminal does not turn OFF within the waiting time, a "Brake error [E036]" trip will occur and the "Brake error [BER]" signal will be ON.

No [BOK] assignment: After the [BRK] signal turns OFF, proceed to step (7).

(7) After the [BOK] input terminal OFF (or [BRK] signal is turned OFF), the motor decelerates to 0 Hz again when the "Brake wait time for stopping (Forward)[AF133]" or the "Position displacement at creep speed [AE-16]" travel time elapses, whichever is longer.

(8) After stopping, the inverter follows the setting of "DC braking control selection for simple positining [AE-14]". If "Disable DB on simple positioning (00)", it will be shut off. When "Enable DB on simple positioning (01)" is selected, DC braking is activated, and when the RUN command is OFF, the output shuts off.

9.15 Functions with External Signal Input

9.15.1 Using Input Terminal Functions

Q

- Assign a function to the input terminal of the inverter and operate it with the signal input.
- I want to switch a/b contact (NO/NC) of the input terminal.

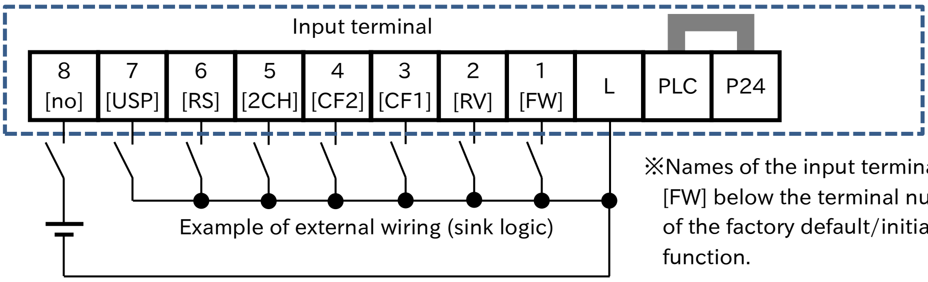
A

- Input terminals [1] through [8] are intelligent input terminals. By assigning the functions in the input terminal function list shown on the next page to "Input terminal function ([CA-01] to [CA-08])", the functions specified for input terminals [1] to [8] are assigned. For details of each function, refer to the chapter in the reference column of the input terminal function list.
- For input terminals [1] through [8], either a-contact (NO) input or b-contact (NC) input can be selected individually according to the setting of "Input terminal a/b (NO/NC) selection ([CA-21] to [CA-28])".
  - a-contact (NO): The contact closes at ON and the contact opens at OFF
  - b-contact (NC): The contact closes at OFF and the contact opens at ON

!

- The same function cannot be assigned to multiple input terminals. When multiple terminals are assigned, the last assigned terminal becomes valid, and the previous assignment becomes "Not use [no]".
- The electrical specifications of input terminal [8] differ from those of input terminals [1] through [7]. For details, refer to the table below and "5.4.1 Configuration of Control Circuit Terminal".
- When receiving encoder feedback or using an external thermistor, the input terminal function assigned to some terminals is disabled depending on the setting of the parameter related to each. For details, refer to "9.5.11 Setting for Encoder Feedback" or "9.10.8 Monitoring Motor Temperature".

Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Assign the input terminal function to input terminals [1] through [8]. The settings of [CA-01] to [CA-08] correspond to the input terminals [1] to [8], respectively.	Refer to "Table of input terminal functions" in this section.
[CA-21] to [CA-28]	Input terminal active state	Operates as a-contact (NO: normally open).	00
		Operates as b-contact (NC: normally closed).	01



※Names of the input terminal functions such as [FW] below the terminal number is an example of the factory default/initialization assignment function.

Input terminal [8] only voltage input (common is always [L] terminal.)

Input terminal	Electrical Characteristics
[1] to [5]	ON: Min. 18 VDC OFF: Max. 3 VDC Max. allowable voltage: 27 VDC Load current: 5 mA (24 VDC) Internal resistance: 4.7 kΩ

Input terminal	Electrical Characteristics
[6], [7]	Pulse input: min. 0.3 Hz to max. 32 kHz ON: Min. 18 VDC OFF: Max. 3 VDC Max. allowable voltage: 27 VDC Load current: 8 mA (24 VDC) Internal resistance: 3 kΩ
[8]	Input-pulse: min. 0.3 Hz to max. 32 kHz ON: Min. 4 VDC OFF: Max. 1 VDC Max. allowable voltage: 27 VDC Internal resistance: 11 kΩ

Table of input terminal functions

Function Code	Symbol	Function name	Page
000	No	Not use	—
001	FW	Forward rotation	9-1-3
002	RV	Reverse rotation	
003	CF1	Multi speed selection 1	9-2-5 9-3-8
004	CF2	Multi speed selection 2	
005	CF3	Multi speed selection 3	
006	CF4	Multi speed selection 4	
007	SF1	Multi speed Bit-1	9-2-5 9-3-8
008	SF2	Multi speed Bit-2	
009	SF3	Multi speed Bit-3	
010	SF4	Multi speed Bit-4	
011	SF5	Multi speed Bit-5	
012	SF6	Multi speed Bit-6	
013	SF7	Multi speed Bit-7	
014	ADD	Trigger for frequency addition	9-2-15
015	SCHG	Main/Sub speed reference change	9-2-13
016	STA	3-wire Start	9-1-4
017	STP	3-wire Stop	
018	F/R	3-wire forward/reverse	
019	AHD	Analog command holding	9-2-17
020	FUP	Remote control Speed-UP function	9-2-16
021	FDN	Remote control Speed-DOWN function	
022	UDC	Remote control Speed data clearing	
023	F-OP	Force operation	9-1-6 9-2-18
024	SET	2nd-motor control	9-7-28
028	RS	Reset	9-1-8
029	JG	Jogging	9-2-8
030	DB	External DC braking	9-7-11
031	2CH	2-stage acceleration/deceleration	9-3-3
032	FRS	Free run stop	9-7-10
033	EXT	External fault	9-10-4
034	USP	Unattended start protection	9-10-5
035	CS	Commercial power supply change	9-7-15
036	SFT	Soft-Lock	7-2-11
037	BOK	Answer back from Brake	9-7-16
038	OLR	Overload restriction selection	9-9-2
039	KHC	Accumulated input power clearance	10-1-7
040	OKHC	Accumulated output power clearance	10-1-8
041	PID	Disable PID1	9-8-15
042	PIDC	PID1 integration reset	9-8-15
043	PID2	Disable PID2	9-8-28
044	PIDC2	PID2 integration reset	9-8-28
051	SVC1	Multi set-point selection 1	9-8-11
052	SVC2	Multi set-point selection 2	
053	SVC3	Multi set-point selection 3	
054	SVC4	Multi set-point selection 4	

Function Code	Symbol	Function name	Page
055	PRO	PID gain change	9-8-16
056	PIO1	PID output switching 1	9-8-25
058	SLEP	SLEEP condition activation	9-8-20
059	WAKE	WAKE condition activation	
060	TL	Torque limit enable	9-6-6
061	TRQ1	Torque limit selection bit 1	9-6-8
062	TRQ2	Torque limit selection bit 2	
063	PPI	P/PI control mode selection	9-6-13
064	CAS	Control gain change	9-6-15
067	ATR	Permission of torque control	9-6-2
068	TBS	Torque Bias enable	9-6-11
069	ORT	Home search function	9-14-15
071	LAC	Acceleration/Deceleration cancellation	9-3-7
072	PCLR	Clearance of position deviation	9-14-13
076	CP1	Multistage position settings selection 1	9-14-6
077	CP2	Multistage position settings selection 2	
078	CP3	Multistage position settings selection 3	
079	CP4	Multistage position settings selection 4	
080	ORL	Limit signal of Homing function	9-14-10
081	ORG	Start signal of Homing function	9-14-10
082	FOT	Forward Over Travel	9-14-14
083	ROT	Reserve Over Travel	
084	SPD	Speed/position switching	9-14-17
085	PSET	Position data presetting	9-14-13
086	MI1	General-purpose input 1	12-2-4
087	MI2	General-purpose input 2	
088	MI3	General-purpose input 3	
089	MI4	General-purpose input 4	
090	MI5	General-purpose input 5	
091	MI6	General-purpose input 6	
092	MI7	General-purpose input 7	
093	MI8	General-purpose input 8	
097	PCC	Pulse counter clearing	9-15-10
098	ECOM	EzCOM activation	11-4-2
099	PRG	Program RUN	12-2-2
100	HLD	Acceleration/Deceleration disable	9-3-4
101	REN	RUN enable	9-4-4
102	DISP	Display lock	7-2-15
103	PLA	Pulse input A	9-15-10
104	PLB	Pulse input B	
105	EMF	Emergency-Force Drive activation	9-7-23
107	COK	Contactor check signal	9-7-19
108	DTR	Data trace start	12-3-3
109	PLZ	Pulse input Z	9-14-10 9-14-15
110	TCH	Teach-in signal	9-14-7

9.15.2 Adjusting Input Terminal Response

Q

- I want to slow down the response of input signal.
- Reducing fluctuation of input signal.
- Noise is present in input signal. I want to avoid the noise.

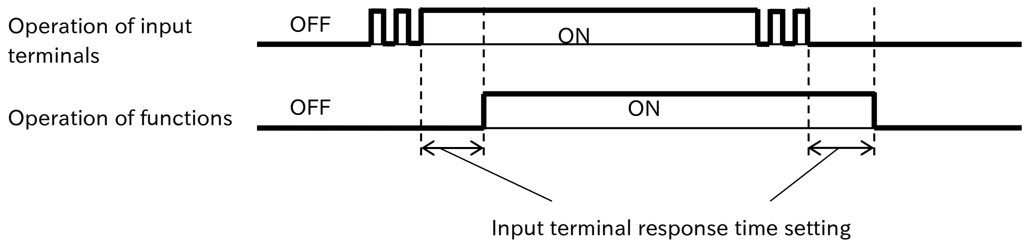
A

- Setting the response time to the input signal can prevent false input due to chattering or noise.
- Response time can be set for each input terminal.

!

- All input signals ON/OFF immediately depending on the conditions. However, chattering may occur depending on the selected signal. Use this for holding/delaying such signals.
- Response time is ignored at power ON and at resetting. For example, if the power is turned on with the "Forward rotation [FW]" input terminal turned ON, the operation starts immediately after the internal reset process, regardless of the response time setting.

Code	Name	Description	Data
[CA-41] to [CA-48]	Input terminal response time	Set the response teime (detection delay time) when the input terminal is ON and OFF. The settings of [CA-41] to [CA-48] correspond to the input terminals [1] to [8], respectively.	0 to 400 (ms)



9.15.3 Adjusting Analog Input

Q

- You want to perform frequency reference or torque reference by analog input.
- To set the analog voltage input 0 to 5 VDC to the frequency command 0 Hz to the maximum frequency.

- The WJ-C1 can provide analog input from the [Ai1] and [Ai2] terminals. The [Ai1] terminal can be switched between analog voltage input and analog current input by setting "[Ai1] terminal input switching [Cb-08]" and the [Ai2] terminal can be switched between analog voltage input and analog current input by setting "[Ai2] terminal input switching [Cb-18]".
- After factory default or initialization, the [Ai1] terminal is set to analog voltage input and the [Ai2] terminal is set to analog current input.
- The analog start-end function allows you to change any analog input range to any frequency reference range (or torque reference, PID feedback input, etc.).

!

- The full scale of the input reference is adjusted to 9.8 VDC for voltage input and to 19.8 mA for current input. Make fine adjustments as necessary.

■ [Ai1] Terminal analog input adjustment parameters

Code	Name	Description	Data
[Cb-01]	[Ai1] Filter time constant	Set the filter time constant for analog input.	1 to 500 (ms)
[Cb-03]	[Ai1] Start value	Set the frequency reference value when the analog input value is [Cb-05]. Set the maximum frequency as a percentage of 100 %.	0.00 to 100.00 (%)
[Cb-04]	[Ai1] End value	Set the frequency reference value when the analog input value is [Cb-06]. Set the maximum frequency as a percentage of 100 %.	0.00 to 100.00 (%)
[Cb-05]	[Ai1] Start rate	Set the start voltage/current of the analog reference input as a percentage of 10 VDC or 20 mA as 100 %.	0.0 to [Cb-06] (%)
[Cb-06]	[Ai1] End rate	Set the end voltage/current of the analog reference input as a percentage of 10 VDC or 20 mA as 100 %.	[Cb-05] to 100.0 (%)
[Cb-07]	[Ai1] Start value selection	Start value [Cb-03]: The reference value between 0.0 % and [Cb-05] is the [Cb-03] setting value.	00
		0%: The reference between 0.0 % to [Cb-05] is 0.00 Hz.	01
[Cb-08]	[Ai1] Input selection	Analog voltage input to the [Ai1] terminal is possible.	01
		Analog current input to the [Ai1] terminal is possible.	02
[Cb-30]	[Ai1] Voltage/current bias adjustment	Fine-adjust the input value by applying a bias to the analog input from the [Ai1] terminal.	-100.00 to 100.00 (%)
[Cb-31]	[Ai1] Voltage/current adjustment gain	Apply gain to the analog input from the [Ai1] terminal to fine-tune the input value.	0.00 to 200.00 (%)

■ [Ai2] Terminal analog input adjustment parameters

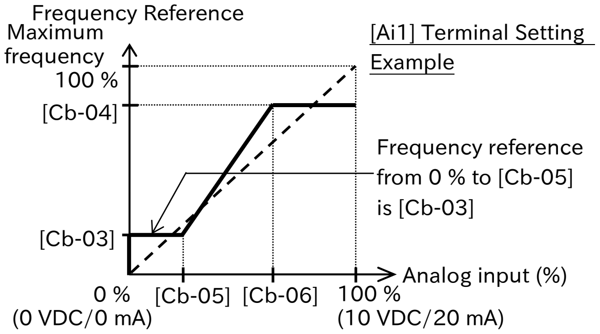
Code	Name	Description	Data
[Cb-11]	[Ai2] Filter time constant	Set the filter time constant for analog input.	1 to 500 (ms)
[Cb-13]	[Ai2] Start value	Set the frequency reference value when the analog input value is [Cb-15]. Set the maximum frequency as a percentage of 100 %.	0.00 to 100.00 (%)
[Cb-14]	[Ai2] End value	Set the frequency reference value when the analog input value is [Cb-16]. Set the maximum frequency as a percentage of 100 %.	0.00 to 100.00 (%)
[Cb-15]	[Ai2] Start rate	Set the start voltage/current of the analog reference input as a percentage of 10 VDC or 20 mA as 100 %.	0.0 to [Cb-16] (%)
[Cb-16]	[Ai2] End rate	Set the end voltage/current of the analog reference input as a percentage of 10 VDC or 20 mA as 100 %.	[Cb-15] to 100.0 (%)
[Cb-17]	[Ai2] Start value selection	Start value [Cb-13]: The reference value between 0.0 % to [Cb-15] is the [Cb-13] setting value.	00
		0%: The reference between 0.0 % to [Cb-15] is 0.00 Hz.	01
[Cb-18]	[Ai2] Input selection	Analog voltage input to the [Ai2] terminal is possible.	01
		Analog current input to the [Ai2] terminal is possible.	02
[Cb-32]	[Ai2] Voltage/current bias adjustment	Fine-adjust the input value by applying a bias to the analog input from the [Ai2] terminal.	-100.00 to 100.00 (%)
[Cb-33]	[Ai2] Voltage/current adjustment gain	Apply gain to the analog input from the [Ai2] terminal to fine-tune the input value.	0.00 to 200.00 (%)

A

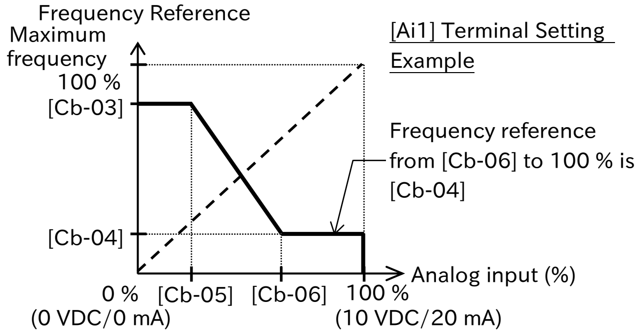
Setting example of analog input start selection

- By setting "[Ai1] terminal start selection [Cb-07]" or "[Ai2] terminal start selection [Cb-17]", it is possible to select the operation outside the setting of analog input.
- The operation selected in [Cb-07] or [Cb-17] differs depending on the relation between the starting quantity and the end quantity. For details of operation in each setting, see the example in the figure below.

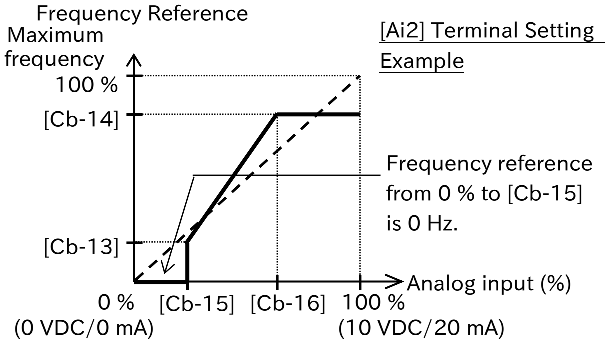
(e.g. 1-1) Start value selection = Start value (00)
Start value < End value



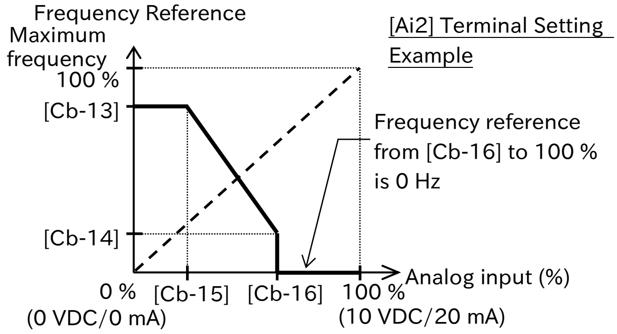
(e.g. 1-2) Start value selection = Start value (00)
Start value > End value



(e.g. 2-1) Start value selection = 0% (01)
Start value < End value



(e.g. 2-2) Start value selection = 0% (01)
Start value > End value



A

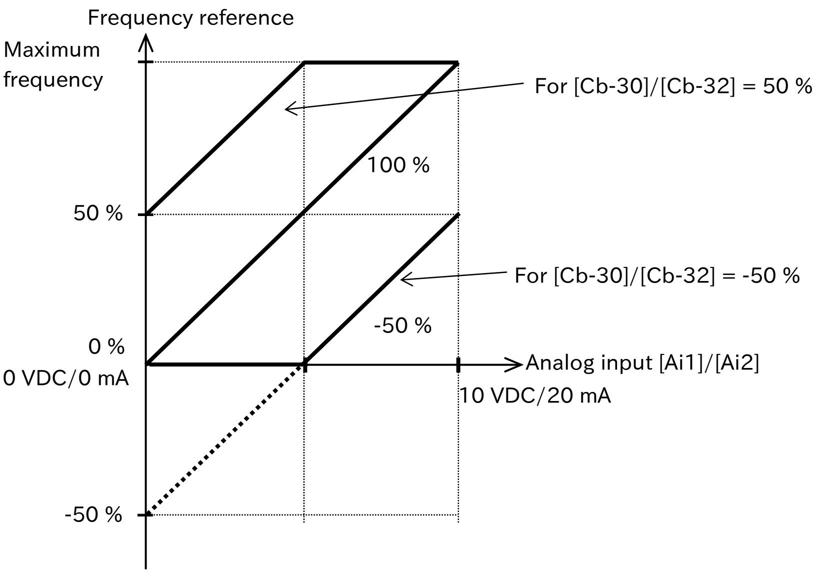
Fine adjustment by analog input adjustment gain

- If the reference value input is misaligned with respect to the analog input, it can performs a fine adjustment by adjusting the bias gain as follows.
- Use this function as a fine adjustment when the analog start-end function is misaligned.
- When performing fine adjustment of analog input, adjust the start value/end value/start rate/end rate setting of each analog input as the initial setting value. Fine adjustment may be difficult.

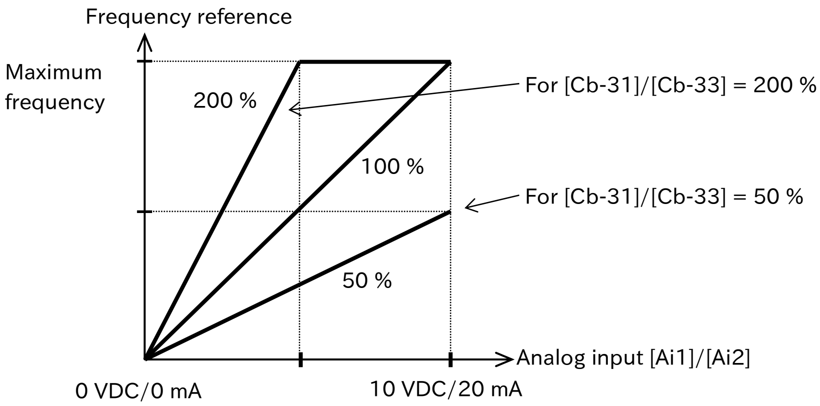
!

- The full scale of the input reference is adjusted to 9.8 VDC for voltage input and to 19.8 mA for current input. Make fine adjustments as necessary.

Analog input bias adjustment



Analog input gain adjustment



Code	Name	Description	Data
[Cb-30]	[Ai1] Voltage/Current bias adjustment	Apply a bias to the analog input value from input terminal [Ai1] for fine adjustment.	-100.00 to 100.00 (%)
[Cb-31]	[Ai1] Voltage/Current gain adjustment	Apply a gain to the analog input value from input terminal [Ai1] for fine adjustment.	0.00 to 200.00 (%)
[Cb-32]	[Ai2] Voltage/Current bias adjustment	Apply a bias to the analog input value from input terminal [Ai2] for fine adjustment.	-100.00 to 100.00 (%)
[Cb-33]	[Ai2] Voltage/Current gain adjustment	Apply a gain to the analog input value from input terminal [Ai2] for fine adjustment.	0.00 to 200.00 (%)

A

Reference selection and input scale at analog input

- The table below shows the reference selection parameters that can be used for analog input and the full-scale range when analog is input.
- The input ranges in the table below apply when the start value/start rate parameter is set to 0% and the end value/end rate is set to 100% for each analog input.

!

- The full scale of the input reference is adjusted to 9.8 VDC for voltage input and to 19.8 mA for current input. Make fine adjustments as necessary.
- Refer to the table for details of each function listed in the table below.

Code	Name	Full scale of each command at analog input	Reference
[AA101], [AA102] [AA201], [AA202]	Main/Sub speed input source selection	0.00 to Maximum frequency setting (Hz)	9-2-1
[Ad-01], [Ad-11]	Torque reference and torque bias input source selection	0.0 to 500.0 (%)	9-6-3 9-6-11
[Ad-40]	Speed limit input source selection at torque control	0.00 to Maximum frequency setting (Hz)	9-6-3
[AH-07], [AH-42] [AH-46], [AJ-07]	PID set-point input source selection	0.00 to 100.00 (%)	9-8-9 9-8-24
[AH-51], [AH-52] [AH-53], [AJ-12]	PID feedback input source selection	0.00 to 100.00 (%)	9-8-12 9-8-24
[AH-70]	PID1 feedforward input source selection	0.00 to 100.00 (%)	9-8-14
[bA101], [bA201]	Upper frequency limit source selection	0.00 to Maximum frequency setting (Hz)	9-4-1
[bA110], [bA210]	Torque limit selection	0.0 to 500.0 (%)	9-6-6
[CA-70]	Speed reference source selection when [F-OP] is active	0.00 to Maximum frequency setting (Hz)	9-2-18
[PA-22]	Simulation mode: Optional output selection for the output current monitor	(0.00 to 3.00) × ND/LD Rated Output Current (A)	
[PA-24]	Simulation mode: Optional output selection for the DC bus voltage monitor	0.0 to 450.0 (VDC) (200V class) 0.0 to 900.0 (VDC) (400V class)	
[PA-26]	Simulation mode: Optional output selection for the output voltage monitor	0.0 to 300.0 (V) (200V class) 0.0 to 600.0 (V) (400V class)	8-2-1
[PA-28]	Simulation mode: Optional output selection for the output torque monitor	0.0 to 500.0 (%)	
[PA-30]	Simulation mode: Optional frequency matching start enable setting	0.00 to Maximum frequency setting (Hz)	

A

Analog input filter

- When the frequency command is performed by an external analog signal, the analog input filter time constant can be set for voltage input or current input.
- This setting is effective for noise rejection of analog input signals. If stable operation cannot be achieved due to the influence of noise, increase the setting value.

!

- When using analog input for PID control system, please note that increasing this setting value slows down the response of the PID control and may not achieve the desired characteristics.

Code	Name	Description	Data
[Cb-01]	[Ai1] Filter time constant	Set the filter time constant for analog input [Ai1].	1 to 500 (ms)
[Cb-11]	[Ai2] Filter time constant	Set the filter time constant for analog input [Ai2].	1 to 500 (ms)

9.15.4 Adjusting Potentiometer on Remote Operator

Q

- I want to control the output frequency using the potentiometer of the remote operator (MOP-VR).

A

- WJ-C1 allows you to connect a potentiometer-equipped remote operator (MOP-VR). When a MOP-VR is connected, the potentiometer on the panel can be used for frequency commands.
- The start and end functions allow you to change the input of the potentiometer and the frequency reference range.

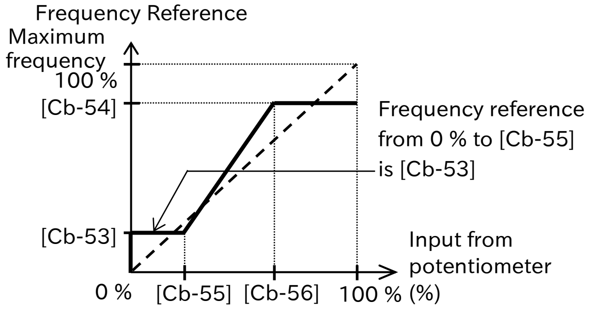
■ MOP-VR tuning parameter

Code	Name	Description	Data
[Cb-51]	MOP-VR input filter time constant	Set the filter time constant for analog input from the potentiometer of the remote operator.	1 to 500
[Cb-53]	MOP-VR start value	Set the frequency reference value when the analog input value from the potentiometer on the remote operator is [Cb-55]. Set the maximum frequency as a percentage of 100 %.	0.00 to 100.00 (%)
[Cb-54]	MOP-VR end value	Set the frequency reference value when the analog input value from the potentiometer on the remote operator is [Cb-56]. Set the maximum frequency as a percentage of 100 %.	0.00 to 100.00 (%)
[Cb-55]	MOP-VR start ratio	Set the start rate of analog input from the potentiometer on the remote operator as a percentage of 0 % when the potentiometer has been rotated to its minimum.	0.0 to [Cb-56] (%)
[Cb-56]	MOP-VR end ratio	Set the end rate of analog input from the potentiometer on the remote operator as a percentage of 100 % when the potentiometer has been rotated to the maximum.	[Cb-55] to 100.0 (%)
[Cb-57]	MOP-VR start selection	Start value [Cb-53]: The reference value between 0.0 % to [Cb-55] is the [Cb-53] setting value.	00
		0%: The reference between 0.0 % to [Cb-55] is 0.00 Hz.	01

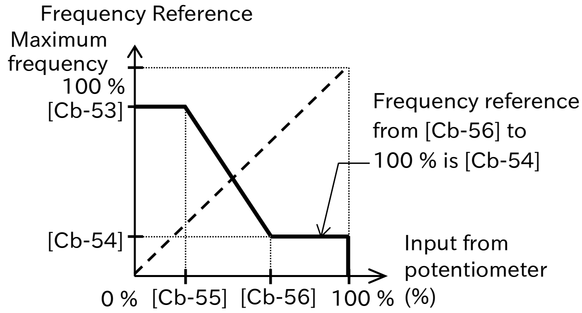
Setting of MOP-VR start selection

- Operation outside the analog input setting can be selected according to the "MOP-VR start selection [Cb-57]" setting.
- Depending on the magnitude of "MOP-VR start value [Cb-53]" and "MOP-VR end value [Cb-54]", the operation selected in [Cb-57] differs. For details of operation in each setting, see the example in the figure below.

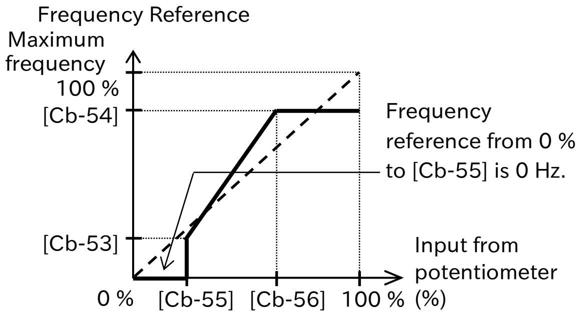
(e.g. 1-1) Start value selection = Start value (00)
Start value < End value



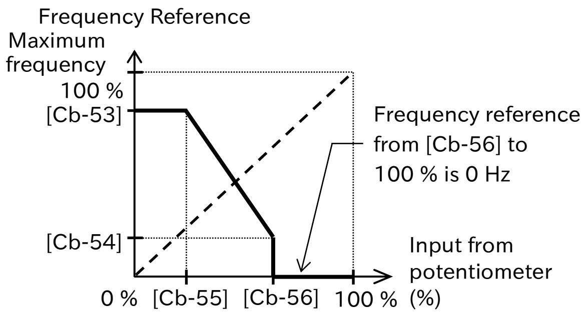
(e.g. 1-2) Start value selection = Start value (00)
Start value > End value



(e.g. 2-1) Start value selection = 0 % (01)
Start value < End value



(e.g. 2-2) Start value selection = 0 % (01)
Start value > End value



MOP-VR input filter

- When the frequency reference is input from the potentiometer on the remote operator, the filter time constant for the input can be set.

Code	Name	Description	Data
[Cb-51]	MOP-VR input filter time constant	Set the filter time constant for analog input from the potentiometer on the remote operator.	1 to 500

9.15.5 Counting the Number of Input Pulse

Q

- You want to count the number of input pulses and perform output according to the result.

A

- The pulse counting function includes a terminal input monitoring mode and quadrature pulse monitoring mode.
- When "Pulse input target function selection [CA-90]" is set to "Disable (00)" to "Speed feedback (02)", the terminal input monitoring mode is enabled. When [CA-90] is set to "Pulse count (03)", the quadrature pulse monitoring mode is enabled.
- To perform pulse counting in the terminal input monitoring mode, assign "Pulse input A [PLA]" and "Pulse input B [PLB]" to the intelligent input terminals. However, when "Frequency reference (01)" or "Speed feedback (02)" is selected for [CA-90], the input terminals [7] and [8] will be dedicated terminals for each function, so assign them to any of the input terminals [1] to [6].
- When performing pulse counting in quadrature pulse monitoring mode, connect the input terminal [7] to B-phase pulse input and the input terminal [8] to A-phase pulse input. In this case, it is not necessary to set [PLA] input terminal and [PLB] input terminal.
- The acquired pulses can be monitored by the pulse counter monitor as an acumulated counter.
- When the "Pulse counter clearing [PCC]" input terminal is turned ON, the accumulated counter can be cleared.

!

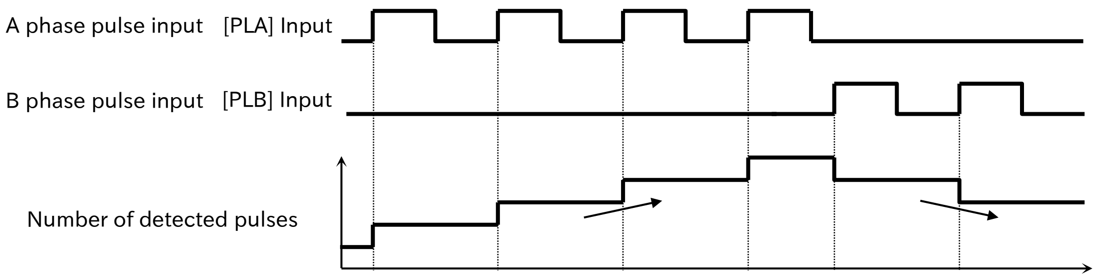
- Maximum input pulse in quadrature pulse monitoring mode is 32 kpps (approx. 50 % duty).
- The accumulated counter value cannot be memorized. After the power is turned on, it becomes zero.
- The maximum input pulse in terminal input monitoring mode depends on the setting of the input terminal response function [CA-41] to [CA-48].

Code	Name	Description	Data
[dA-28]	Pulse count monitor	Displays the counter accumulated value.	0 to 2147483647
[CA-01] to [CA-08]	Input terminal function	Pulse counter clearing [PCC]: Clears the accumulated value of pulse count.	097
		Pulse input A [PLA]: Accepts A-phase pulse input.	103
		Pulse input B [PLB]: Accepts B-phase pulse input.	104
[CC-01] [CC-02] [CC-07]	Output terminal function	Pulse count compare match output [PCMP]: Output pulse count compare match output signal.	044
[CA-90]	Pulse input target function selection	Disable	00
		Frequency reference	01
		Speed feedback	02
		Pulse count	03
[CA-91]	Pulse input mode selection	90˚ shift pulse input	00
		Forward and reverse command and pulse input	01
		Single phase pulse input	03
[CA-97]	Pulse counter compare match output ON value	The [PCMP] signal is turned ON when the pulse count reaches this setting.	0 to 65535
[CA-98]	Pulse counter compare match output OFF value	The [PCMP] signal is turned OFF when the pulse count reaches this setting.	0 to 65535
[CA-99]	Pulse counter compare match maximum value	When the number of pulses reaches the setting value, the internal counter is cleared. When this setting is 0, the pulse is one-shot.	0 to 65535

A

Terminal input monitoring ([CA-90]=00 to 02)

- Monitor ON of the "Pulse input A [PLA]" input terminal and the "Pulse input B [PLB]" input terminal.
- [PLA] input terminal and [PLB] input terminal can be set to respective terminals by "Input terminal function ([CA-01] to [CA-08])". However, if "Frequency reference (01)" or "Speed feedback (02)" is selected for [CA-90], the input terminals [7] and [8] will be dedicated terminals for each function, so assign them to any of the input terminals [1] to [6].

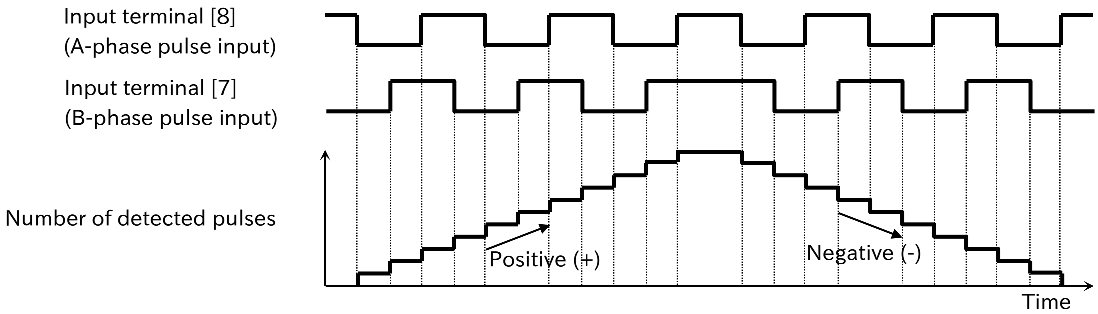


A

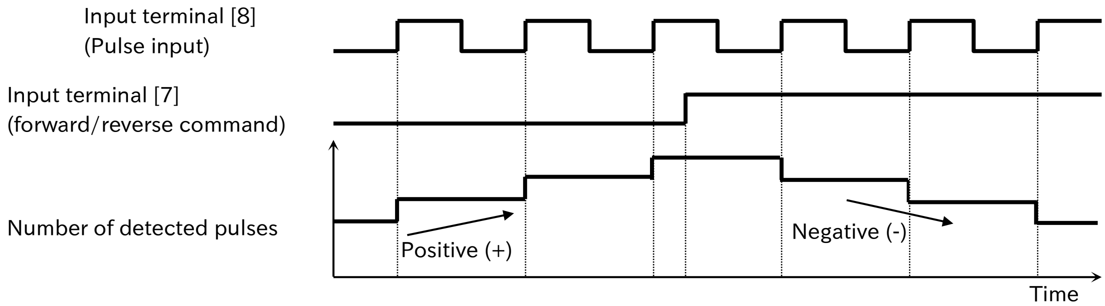
Quadrature pulse monitoring ([CA-90]=03)

- The input terminal [7] is the terminal for B-phase pulse input or forward/reverse command input, and the input terminal [8] is the terminal for A-phase pulse input or single-phase pulse input.

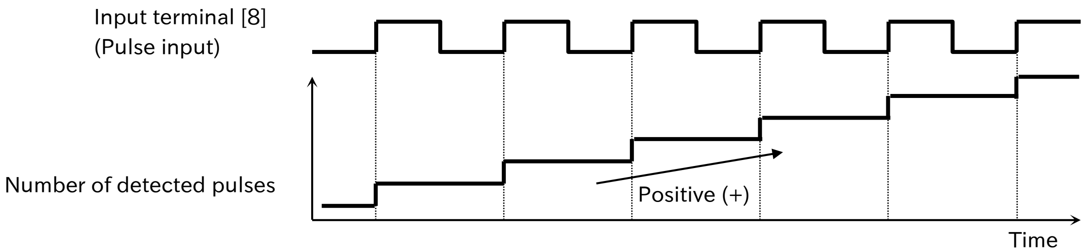
① Mode 0: 90° shift pulse ([CA-91]=00)



② Mode-1: Forward/reverse command and pulse input ([CA-91]=01)



② Mode-3: Single phase pulse input. ([CA-91]=03)

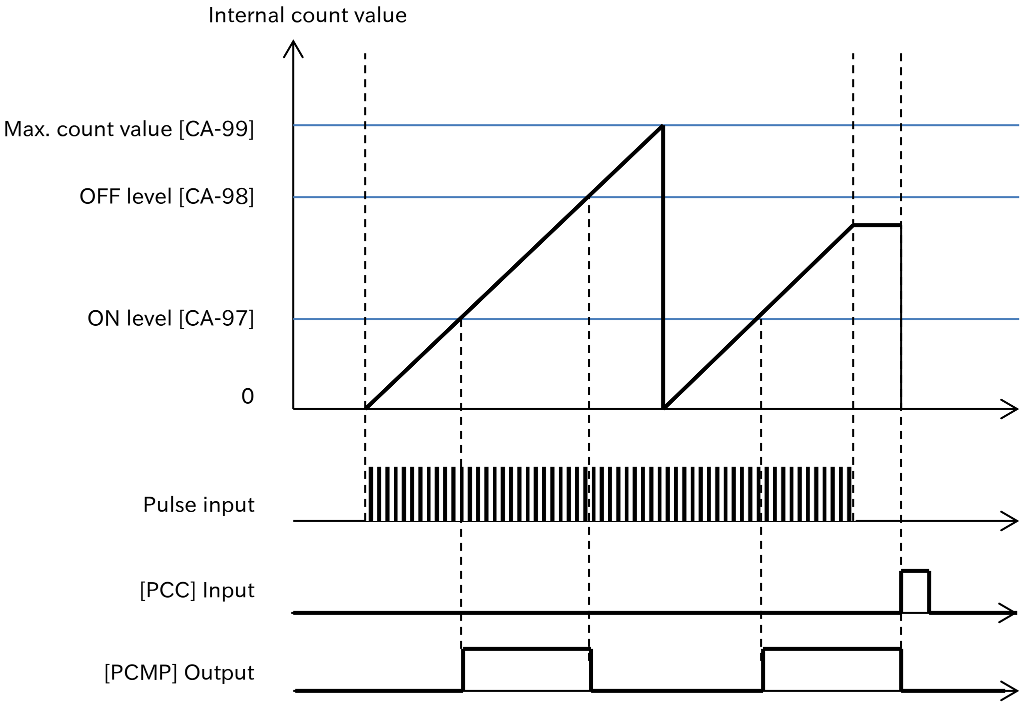


A

Compare match function

- The compare match function enables output of a signal corresponding to the number of counted pulses.
- When the number of pulses exceeds the "Pulse counter compare match output ON value [CA-97]", the "Pulse count compare match output [PCMP]" signal is turned ON. Then, the counter advances further and if the "Pulse counter compare match output OFF value [CA-98]" is exceeded, [PCMP] signal is turned OFF.
- The maximum value of pulse count can be set by "Pulse counter compare match output maximum value [CA-99]". When the pulse count reaches the maximum value, the count value starts counting from zero again.
- If the "Pulse counter clearing [PCC]" input terminal is turned ON during counting, the count value is cleared to zero.

Pulse count operation example



Code	Name	Description	Data
[CA-01] to [CA-08]	Input terminal function	Pulse counter clearing [PCC]: Clears the accumulated value of pulse count.	097
[CC-01] [CC-02] [CC-07]	Output terminal function	Pulse count compare match output [PCMP]: Output pulse count compare match output signal.	044
[CA-97]	Pulse counter compare match output ON value	The [PCMP] signal is turned ON when the pulse count reaches this setting.	0 to 65535
[CA-98]	Pulse counter compare match output OFF value	The [PCMP] signal is turned OFF when the pulse count reaches this setting.	0 to 65535
[CA-99]	Pulse counter compare match maximum value	When the number of pulses reaches the setting value, the internal counter is cleared. When this setting is 0, the pulse is one-shot.	0 to 65535

9.15.6 Alarm Resetting

Q

- How do I cancel the trip?
- I want to enable the reset operation by terminal input only when tripped.

A

- By turning ON "Reset [RS] (028)" input terminal or STOP/RESET key on the keypad, inverter trip release can be performed.
- [RS] input terminal operates with an NO contact (NO) regardless of the setting of "Input terminal active state a/b(NO/NC) selection ([CA-21] to [CA-28])".
- "Reset mode selection [CA-72]" allows you to select the timing for releasing the trip by the [RS] input terminal. The [RS] input terminal can also be enabled only at the trip release timing when an error occurs.
- Restart after reset operation can be selected in "Restart mode after RS release [bb-41]". For details, refer to "9.7.5 Restart after Trip Reset or Power-ON".

!

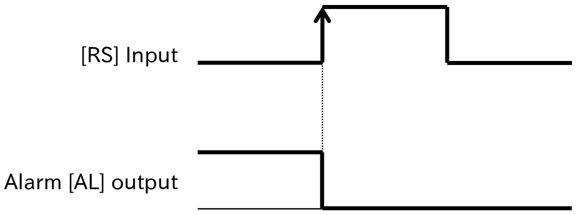
- Do not use the "Reset [RS]" input terminal to shut off the inverter output. When output cutoff of the inverter is performed by signal input, use "Free run stop [FRS]" of the input terminal function.
- Even if resetting by the [RS] input terminal, the internal data such as the electronic thermal load factor, BRD load factor, and current position counter are not cleared.
- If "Output frequency at shut down (00)" is set in "Active frequency matching restart speed selection [bb-47]", even if a reset signal is inputted during retry wait, the output frequency at shut down will not be cleared and restart will be performed.

Code	Name	Description	Data
[bb-41]	Restart mode after RS release*1	0 Hz restart is performed.	00
		Restart with the frequency matching	01
		Active frequency matching restart	02
		Restart is performed from the detected speed by encoder feedback.	03
[CA-72]	Reset mode selection	In case of ON, trip release (operation 1, 3) Normal: Output shutoff Abnormal: Release trip	00
		In OFF, trip release (Operation 2, 3) Normal: Output shutoff Abnormal: Release trip	01
		In ON, trip release (operation 1, 4) Normal: Disabled Abnormal: Release trip	02
		In OFF, trip release (Operation 2, 4) Normal: Disabled Abnormal: Release trip	03
[CA-01] to [CA-08]	Input terminal function	Reset [RS]: Performs a reset operation.	028

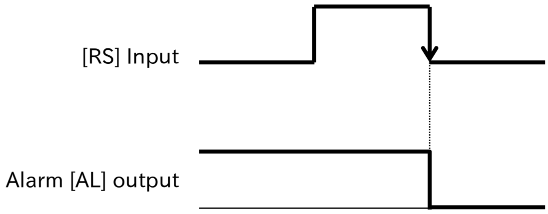
*1. For details, refer to "9.7.5 Restart after Trip Reset or Power-ON".

Reset operation example

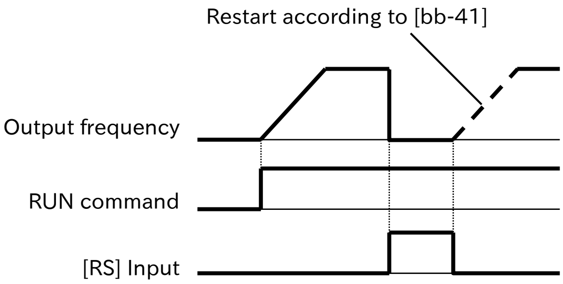
(e.g. 1) When tripping is canceled at ON
([CA-72] = 00, 02)



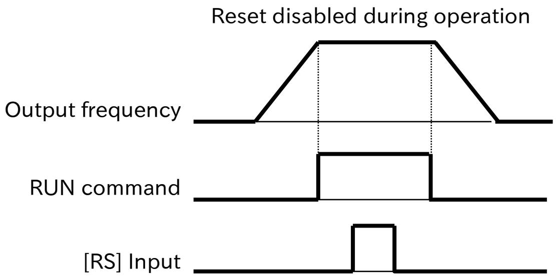
(e.g. 2) When tripping is canceled at OFF
([CA-72] = 01, 03)



(e.g. 3) When resetting is enabled in normal status
([CA-72] = 00, 01)



(e.g. 4) When normal reset is disabled
([CA-72] = 02, 03)



9.15.7 Automatic Alarm Resetting

Q

- How do I reset error in operation with OFF of RUN command?
- If an error that can be cleared occurs, you want to cancel the trip automatically and start it.

A

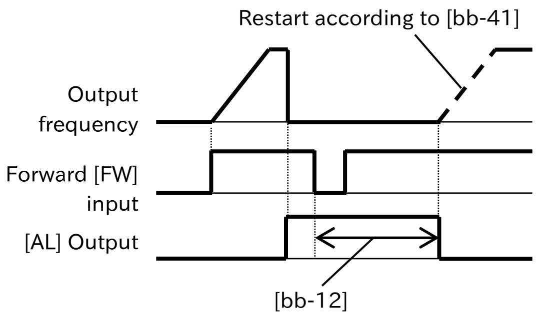
- When "Automatic error reset selection [bb-10]" is set to "If RUN command is OFF (01)", the reset is performed after the "Automatic error reset wait time [bb-12]" elapses from the time the RUN command is turned OFF.
- If [bb-10] is set to "After set time (02)", reset is performed after [bb-12] elapses from the time when an error occurs.
- By setting "Alarm signal selection at automatic error reset [bb-11]" to "Disable (01)", it is possible to disable the output of "Alarm [AL]" during automatic reset operation.
- If the automatic reset is performed the number of times set by the "Automatic error reset number [bb-13]", the error will not be cleared and will be in trip status.

!

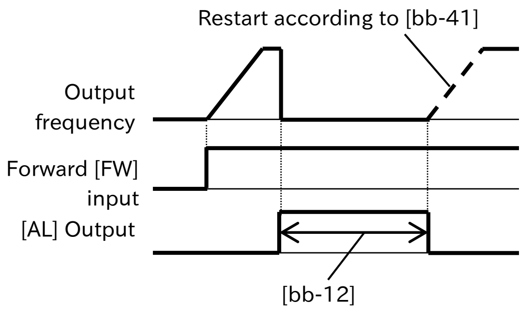
- When "Automatic error reset selection [bb-10]" is set to "If RUN command is OFF (01)" and "RUN command input source selection [AA111]" is set to "Keypad's RUN key (02)", the automatic reset waiting time count starts from the point when an error occurs.
- Errors that cannot be cleared by the reset operation, or errors that are optionally triggered cannot be cleared by the automatic reset function. For errors that cannot be cleared, see "List of errors not covered by the automatic reset function" in this section.
- When performing a manual reset, or when the control power supply is turned on again, the internal count of automatic resets is cleared.

Example of automatic reset operation

(e.g. 1) [bb-10] = 01



(e.g. 2) [bb-10] = 02



Code	Name	Description	Data
[bb-10]	Automatic error reset selection	Disable	00
		If RUN command is OFF starts resetting.	01
		Reset starts after set time	02
[bb-11]	Alarm signal selection at automatic error reset	Output enabled	00
		Output disabled	01
[bb-12]	Automatic error reset wait time	Set the amount of time to wait after the reset starts before the actual reset is occurs.	0 to 600 (s)
[bb-13]	Automatic error reset number	Set the number of times to reset automatically.	0 to 10 (times)
[bb-41]	Restart mode after RS release*1	0 Hz restart is performed.	00
		Restart with the frequency matching	01
		Active frequency matching restart	02
		Restart is performed from the detected speed by encoder feedback.	03

*1. For details, refer to "9.7.5 Restart after Trip Reset or Power-ON".

■ List of errors not covered by the automatic reset function

- For details of each error, see "15.2 Troubleshooting for Protection Functions Related Error".

Error code	Name
[E008]	Memory error
[E010]	Current detector error
[E011]	CPU error
[E012]	External trip
[E014]	Ground fault error
[E022]	CPU communication error
[E030]	Driver error
[E035]	Thermistor error
[E043]	EzSQ inappropriate command error
[E044]	EzSQ nesting error
[E045]	EzSQ command execution error
[E050] to [E059]	EzSQ user-assigned error 0 to 9
[E069]	Option error 9
[E090]	STO shutoff error
[E091]	STO internal error
[E092]	STO path 1 error
[E093]	STO path 2 error
[E100]	Encoder disconnection error

9.16 Functions with External Signal Output

9.16.1 Using Output Terminal Functions

Q

- I want to detect warning signals, error signals, and status signals from the inverter using an external system.

A

- The output terminals [11], [12], and [AL0]-[AL1]/[AL0]-[AL2] are intelligent output terminals. By assigning the functions in the output terminal list shown on the next page to [CC-01], [CC-02], and [CC-07], the specified functions are assigned to the corresponding output terminals.
- For output terminals [11], [12], and [AL0]-[AL1]/[AL0]-[AL2], either a-contact (NO) input or b-contact (NC) input can be selected individually according to the settings of [CC-11], [CC-12], and [CC-17].
- Output terminals [11] and [12] are open-collector outputs, and output terminals [AL0]-[AL1]/[AL0]-[AL2] are c-contact relay outputs.

!

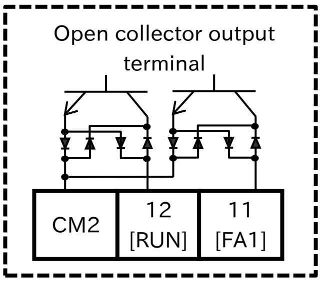
- When using c-contact relay, check the status of the power supply and open/close status of the relay output terminals.

Code	Name	Description	Data
[CC-01]	Output terminal [11] function	Assign the output terminal functions to the output terminals [11], [12], and [AL0]-[AL1]/[AL0]-[AL2]. [CC-01], [CC-02] and [CC-07] settings correspond to each output terminal.	Refer to "Table of output terminal functions" in this section.
[CC-02]	Output terminal [12] function		
[CC-07]	Output terminal [AL] function		
[CC-11]	Output terminal [11] active state	Operates as a-contact (NO: normally open).	00
		Operates as b-contact (NC: normally closed).	01
[CC-12]	Output terminal [12] active state	Operates as a-contact (NO: normally open).	00
		Operates as b-contact (NC: normally closed).	01
[CC-17]	Output terminal [AL] active state	Operates as a-contact (NO: normally open).	00
		Operates as b-contact (NC: normally closed).	01

■ Open collector output terminal specifications

Output terminal	Electrical Characteristics
[11]	Voltage-drop at ON: 4 VDC or less Allowable Max. voltage: 27 VDC Permissible current carrying capacity : 50 mA
[12]	
[CM2]	Common terminal of [11] and [12] Permissible current carrying capacity : 100 mA

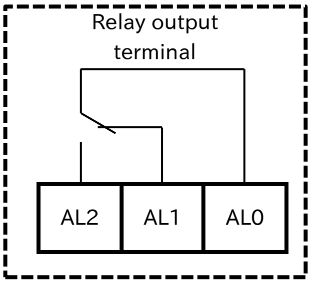
Output terminal active state	Power state	Output of terminal functions	Open Collector operation
00 (a-contact (NO))	ON	ON	Close
		OFF	Open
	Off	-	-
01 (b-contact (NC))	ON	ON	Open
		OFF	Close
	Off	-	-



※ The names of the output terminal functions such as [FA1] below the terminal numbers are an example of the assignment functions at the time of shipping/initialization.

Relay output terminal specifications

Output terminal		Electrical Characteristics	
		Resistive load	Inductive load
AL1-AL0	Max. contact capacity	250 VAC, 2 A 30 VDC, 3 A	250 VAC, 0.2 A 30 VDC, 0.6 A
	Minimum contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	
AL2-AL0	Max. contact capacity	250 VAC, 1 A 30 VDC, 1 A	250 VAC, 0.2 A 30 VDC, 0.2 A
	Minimum contact capacity	100 VAC, 10 mA 5 VDC, 100 mA	



※ The assignment function of the relay output terminals at the time of shipping/initialization is "Alarm [AL]".

Output terminal active state	Power state	Output of terminal functions (Inverter alarm status)	Status output terminal	
			AL1-AL0	AL2-AL0
00 (a-contact (NO))	ON	ON (Fault)	Close	Open
		OFF (Normal)	Open	Close
	Off	-	Open	Close
01 (b-contact (NC))	ON	ON (Fault)	Open	Close
		OFF (Normal)	Close	Open
	Off	-	Open	Close

■ Table of output terminal functions

Function Code	Symbol	Function name	Page
000	No	Not use	—
001	RUN	Running	9-12-1
002	FA1	Constant-frequency reached	9-13-1
003	FA2	Set frequency overreached	9-13-2
004	FA3	Set frequency reached	9-13-3
005	FA4	Set frequency overreached 2	9-13-2
006	FA5	Set frequency reached 2	9-13-3
007	IRDY	Inverter ready	9-12-4
008	FWR	Forward rotation	9-12-2
009	RVR	Reverse rotation	
010	FREF	Speed reference = Keypad is selected	9-2-3
011	REF	Run command = Keypad is selected	9-1-2
012	SETM	2nd-motor control is selected	9-7-28
016	OPO	Option output	—
017	AL	Alarm	9-11-1
018	MJA	Major failure	9-11-2
019	OTQ	Over-torque	9-6-10
021	UV	Undervoltage	9-9-9
022	TRQ	Torque limited	9-6-9
023	IPS	IP-Non stop function is active	9-9-20
024	RNT	Accumulated operation time over	9-11-12
025	ONT	Accumulated power-on time over	9-11-12
026	THM	Electronic thermal alarm (Motor)	9-11-5
027	THC	Electronic thermal alarm (Inverter)	9-11-6
029	WAC	Capacitor life warning	9-11-9
030	WAF	Cooling-fan life warning	9-11-10
031	FR	RUN command active	9-12-3
032	OHF	Heat sink overheat warning	9-11-8
033	LOC	Low-current indication	9-11-4
034	LOC2	Low-current indication 2	
035	OL	Overload warning notice	9-11-3
036	OL2	Overload warning notice 2	
037	BRK	Brake release	9-7-16
038	BER	Brake error	9-14-18
039	CON	Contactor control	9-7-19

Function Code	Symbol	Function name	Page
040	ZS	Zero speed detection	9-13-4
041	DSE	Speed over deviation	9-5-20
043	POK	Positioning completed	9-14-1
044	PCMP	Pulse count compare match output	9-15-11
045	OD	Over deviation for PID control	9-8-30
046	FBV	PID feedback comparison	9-8-31
047	OD2	Over deviation for PID2 control	9-8-30
048	FBV2	PID2 feedback comparison	9-8-31
049	NDc	Communication line disconnection	11-1-1
050	Ai1Dc	Analog Ai1 disconnection detection	9-11-13
051	Ai2Dc	Analog Ai2 disconnection detection	
056	WCAi1	Window comparator Ai1	9-11-13
057	WCAi2	Window comparator Ai2	
062	LOG1	Logical operation result 1	9-13-5
063	LOG2	Logical operation result 2	
064	LOG3	Logical operation result 3	
069	MO1	General-purpose output 1	12-2-4
070	MO2	General-purpose output 2	
071	MO3	General-purpose output 3	
076	EMFC	Emergency-Force Drive indicator	9-7-23
077	EMBP	Bypass mode indicator	9-7-23
078	WFT	Trace function waiting for trigger	12-3-3
079	TRA	Trace function data logging	
080	LBK	Low-battery of keypad	7-2-17
081	OVS	Over-Voltage power supply	9-11-7
082	ABU	Abnormal exceeded Upper limit	9-11-16
083	ABL	Abnormal fall below Lower limit	
088	FSC	STO input discrepancy	14-1-5
093	SSE	PID soft start error	9-8-19
094	SFM1	ST1 feedback monitor	14-1-5
095	SFM2	ST2 feedback monitor	
096	EDM	STO state monitor	14-1-3
097	WAP	Power module life warning	9-11-11
098	WAIC	Inrush circuit life warning	9-11-11

*1. The "Optional output [OPO]" is a future extension function and is not currently functioning. Do not assign this function.

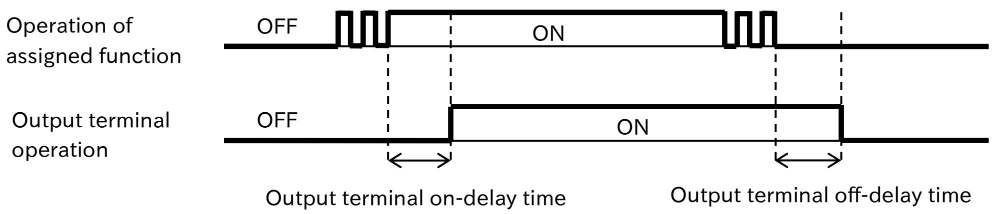
9.16.2 Delaying and Holding Output Signals

Q
- I want to slow down the response of the output signal.
- I want to suppress the flapping of the signal.

A
- An on-delay time and an off-delay time can be provided for each output terminal.

!
- All signals will ON/OFF immediately if the conditions are met. Depending on the selected signal, chattering may occur. Use this for holding/delaying such signals.

Code	Name	Description	Data
[CC-20]	Output terminal [11] on-delay time	Set the on-delay time to the output terminal.	0.00 to 100.00 (s)
[CC-22]	Output terminal [12] on-delay time		
[CC-32]	Output terminal [AL] on-delay time		
[CC-21]	Output terminal [11] off-delay time	Set the off-delay time to the output terminal.	0.00 to 100.00 (s)
[CC-23]	Output terminal [12] off-delay time		
[CC-33]	Output terminal [AL] off-delay time		



9.16.3 Selecting Monitor Data for Analog/Pulse Output

Q
- How do I output the value of the monitor externally as information of the inverter?

A
- The monitor parameter list in the table below can be externally outputted from the [Ao1] terminal or the [Ao2] terminal.
- Analog voltage output and analog current output are available from the [Ao1] terminal.
- Analog voltage output and pulse output are available from the [Ao2] terminal.
- For the data with "(±)" written in the remarks column of the following table, the output range can be changed by setting "[FM] Data type selection [Cd-12]", "[Ao1] Data type selection [Cd-22]" and "[Ao2] Data type selection [Cd-32]". When "Absolute value (00)" is set, output is performed with a positive value of the absolute value. When "Signed value (01)" is set, a negative value can also be output.
- To output a negative value by setting "Signed value (01)" to one of [Cd-12]/[Cd-22]/[Cd-32], the bias of the respective output needs to be adjusted with "[FM] Bias adjustment [Cd-13]", "[Ao1] Bias adjustment (Voltage/Current) [Cd-23]", or "[Ao2] Bias adjustment (Voltage) [Cd-33]".

!
- The output range shown in the table below assumes that the bias adjustment for each output is 0 % and the gain adjustment is 100 %.
- Switching between analog voltage output and analog current output of [Ao1] terminal is performed by setting "[Ao1] Output type selection [Cd-26]".
- Switching between analog voltage output and pulse output of [Ao2] terminal is performed by setting "[Ao2] Output type selection [Cd-36]".
- For details of analog voltage/current output, refer to "9.16.5 Monitor Data Output by Analog Output" and for details of pulse output, refer to "9.16.4 Monitor Data Output by Pulse Output".

List of Configurable Monitor Parameters

Code	Name	Output range (Corresponds to 0 to 10 VDC/ 0 to 20 mA / 0 to 100 %)	Remarks
[dA-01]	Output frequency monitor	0.00 to Maximum frequency (Hz)	-
[dA-02]	Output current monitor	(0.00 to 2.00)×ND/LD rated output current (A)	-
[dA-04]	Frequency reference monitor (after calculation) (signed) *1	0.00 to ± Maximum frequency (Hz)	Output possible in (±)
[dA-08]	Detect speed monitor	0.00 to ± Maximum frequency (Hz)	Output possible in (±)
[dA-12]	Output frequency monitor (signed)	0.00 to ± Maximum frequency (Hz)	Output possible in (±)
[dA-14]	Frequency upper limit monitor	0.00 to Maximum frequency (Hz)	-
[dA-15]	Torque reference monitor (after calculation) *1*2	Torque reference x (-500.0 to 500.0 (%)) *3*6	Output possible in (±)
[dA-16]	Torque limit monitor *2	Torque reference x (0.0 to 500.0 (%)) *3	-
[dA-17]	Output torque monitor *2	Torque reference x (-500.0 to 500.0 (%)) *3*6	Output possible in (±)
[dA-18]	Output voltage monitor (RMS)	0 to Rated voltage x 133% (V)	75% of full scale, equivalent to rating
[dA-30]	Input power monitor	0.00 to Inverter capacity x 200% (kW)	-
[dA-34]	Output power monitor	0.00 to Inverter capacity x 200% (kW)	-
[dA-40]	DC bus voltage monitor	200V class: 0.0 to 400.0 (VDC) 400V class: 0.0 to 800.0 (VDC)	-
[dA-41]	BRD load factor monitor	0.00 to 100.00 (%)	-
[dA-42]	Electronic thermal load factor monitor (Motor)	0.00 to 100.00 (%)	-
[dA-43]	Electronic thermal load factor monitor (Inverter)	0.00 to 100.00 (%)	-

Code	Name	Output range (Corresponds to 0 to 10 VDC/ 0 to 20 mA / 0 to 100 %)	Remarks
[dA-61]	Analog input [Ai1] monitor	0.00 to 100.00 (%)	-
[dA-62]	Analog input [Ai2] monitor	0.00 to 100.00 (%)	-
[dA-70]	Pulse input monitor	-100.00 to 100.00 (%)	Output possible in (±)
[db-18]	Analog output monitor YA0	0.00 to 100.00 (%)	Output possible in (±)
[db-19]	Analog output monitor YA1	0.00 to 100.00 (%)	Output possible in (±)
[db-30]	PID1 feedback value 1 monitor	-100.00 to 100.00 (%) *4	Output possible in (±)
[db-32]	PID1 feedback value 2 monitor	-100.00 to 100.00 (%) *4	Output possible in (±)
[db-34]	PID1 feedback value 3 monitor	-100.00 to 100.00 (%) *4	Output possible in (±)
[db-36]	PID2 feedback value monitor	-100.00 to 100.00 (%) *5	Output possible in (±)
[db-42]	PID1 set-point monitor (after calculation)	-100.00 to 100.00 (%) *4	Output possible in (±)
[db-44]	PID1 feedback value monitor (after calculation)	-100.00 to 100.00 (%) *4	Output possible in (±)
[db-50]	PID1 output monitor	-100.00 to 100.00 (%)	Output possible in (±)
[db-51]	PID1 deviation monitor	-200.00 to 200.00 (%)	Output possible in (±)
[db-52]	PID1 deviation 1 Monitor	-200.00 to 200.00 (%)	Output possible in (±)
[db-53]	PID1 deviation 2 monitor	-200.00 to 200.00 (%)	Output possible in (±)
[db-54]	PID1 deviation 3 monitor	-200.00 to 200.00 (%)	Output possible in (±)
[db-55]	PID2 output monitor	-100.00 to 100.00 (%)	Output possible in (±)
[db-56]	PID2 deviation monitor	-200.00 to 200.00 (%)	Output possible in (±)
[db-64]	PID feedforward monitor	0.00 to 100.00 (%)	Output possible in (±)
[dC-15]	Cooling fin temperature monitor	-20.0 to 200.0 (˚C)	-
[FA-01]	Main speed reference setting (monitor)	0.00 to Maximum frequency (Hz)	-
[FA-02]	Sub speed reference setting (monitor)	0.00 to Maximum frequency (Hz)	-
[FA-15]	Torque reference setting (monitor) *2	Torque reference x (-500.0 to 500.0 (%)) *3	Output possible in (±)
[FA-16]	Torque bias setting (monitor) *2	Torque reference x (-500.0 to 500.0 (%)) *3	Output possible in (±)
[FA-30]	PID1 set-point 1 setting (monitor)	0.00 to 100.00 (%) *4	Output possible in (±)
[FA-32]	PID1 set-point 2 setting (monitor)	0.00 to 100.00 (%) *4	Output possible in (±)
[FA-34]	PID1 set-point 3 setting (monitor)	0.00 to 100.00 (%) *4	Output possible in (±)
[FA-36]	PID2 set-point setting (monitor)	0.00 to 100.00 (%) *5	Output possible in (±)

*1. (After calculation) means that it is after calculation of sub speed, frequency addition, and torque bias.

*2. Torque control related function is enabled when the setting of "Control mode selection [AA121]" is "Sensorless vector control (IM) (08)".

*3. The torque reference (100 %) can be selected in "Torque conversion method selection [HC115]". Refer to "9.6.3 Operate by Torque Reference" for details.

*4. "PID1 scale adjustment ([AH-04] to [AH-06]) will change the setting. For more information, please refer to "9.8.5 Unit Converter Function for PID Control".

*5. "PID2 scale adjustment ([AJ-04] to [AJ-06]) will change the setting. For more information, please refer to "9.8.5 Unit Converter Function for PID Control".

*6. The data range of the monitor may exceed 500.0 % depending on the torque reference and torque bias settings. In this case, adjust the output gain and bias referring to "9.16.4 Monitor Data Output by Pulse Output" or "9.16.5 Monitor Data Output by Analog Output".

9.16.4 Monitor Data Output by Pulse Output

Q

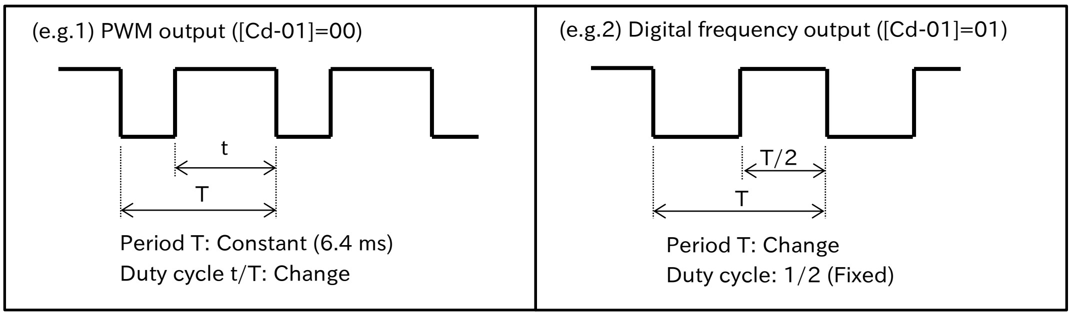
- How do I output the inverter monitor data externally with pulse output?
- How do I obtain data with a digital frequency counter?

A

- Monitored values such as output frequency and output current can be pulsed from the [Ao2] terminal. If this happens, set the parameter of the monitor you want to output to "[FM] Output monitor selection [Cd-03]". For the parameters that can be set, see "9.16.3 Selecting Monitor Data for Analog/Pulse Output".
- To perform pulse output, select "Pulse (03)" for "[Ao2] Output type selection [Cd-36]."
- PWM output (e.g. 1) or digital frequency output (e.g. 2) can be selected by setting "[FM] Output wave form selection [Cd-01]". Be sure to set the "[FM] Output base frequency (at frequency output) [Cd-02]" when using the digital frequency output.
- Use an analog meter when using PWM output. Use a digital frequency counter when using digital frequency output.
- The output characteristics when biasing is adjusted change according to the setting of "Analog adjust gain basis selection [Cd-06]". Refer to "PWM/Digital frequency output gain/bias adjustment" in this section for more information.
- When "Analog monitor adjustment mode enable [Cd-10]" is set to "Enable (01)", the pulse output function is in the adjustment mode, and the value set to "Adjustment mode [FM] output level [Cd-15]" is output. Please use it for checking the gain/bias setting of the pulse output and for adjusting the external device, etc.

!

- For digital frequency output, the output cannot exceed the max. output range (32 kHz) of the [Ao2] terminal.
- When using analog voltage output of [Ao2] terminal ("[Ao2] Output type selection [Cd-36]" = "Voltage (01)"), refer to "9.16.5 Monitor Data Output by Analog Output".



Code	Name	Description	Data
[Cd-01]	[FM] Output wave form selection	PWM Output (6.4 ms)	00
		Digital frequency output	01
[Cd-02]	[FM] Output base frequency (at frequency output)	Set the output frequency at full scale when "Frequency output (01)" is selected for [Cd-01].	0 to 32000 (Hz)
[Cd-03]	[FM] Output monitor selection	[Ao2] Select PWM or digital frequency output from the terminals.	Refer to "9.16.3 Selecting Monitor Data for Analog/ Pulse Output".
[Cd-06]	Analog adjust gain basis selection	Bias quantity standard	00
		Full scale fixed	01
[Cd-10]	Analog monitor adjustment mode enable	Adjustment mode of the analog monitor is disabled.	00
		Adjustment mode of the analog monitor is enabled.	01
[Cd-11]	[FM] Output filter time constant	Set filter time constant for PWM/digital frequency output from [Ao2] terminal.	1 to 500 (ms)
[Cd-12]	[FM] Data type selection	Outputs the absolute value of data.	00
		Signed data is output.	01
[Cd-13]	[FM] Bias adjustment	Adds bias to PWM/digital frequency data. Adjusts the zero-point.	-100.0 to 100.0 (%)
[Cd-14]	[FM] Gain adjustment	Apply gain to PWM/digital frequency data and adjust the data inclination.	1000.0 to 1000.0 (%)
[Cd-15]	Adjustment mode [FM] output level	When [Cd-10] is set to "Enable (01)" and "Pulse (03)" is selected in "[Ao2] Output type selection [Cd-36]", set the level output from the [Ao2] terminal.	-100.0 to 100.0 (%)
[Cd-16]	Pulse input/output scale conversion gain	When "Pulse input monitor [dA-70]" is selected in [Cd-03], the input pulse frequency is scaled and outputted.	0.01 to 100.00
[Cd-36]	[Ao2] Output type selection	PWM signal or digital frequency signal is output from the [Ao2] terminal.	03

PWM/Digital frequency output gain/bias adjustment

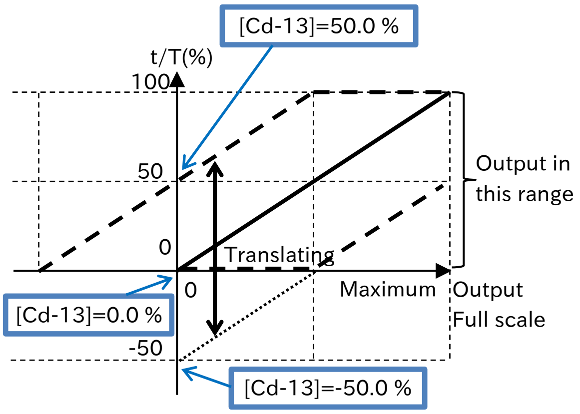
- When "Pulse (03)" is selected in "[Ao2] Output type selection [Cd-36]", you can set the addition of the bias by "[FM] Bias adjustment [Cd-13]" and the output gain by "[FM] Gain adjustment [Cd-14]" for the output from the [Ao2] terminal.
- The output characteristics when biasing is adjusted change according to the setting of "Analog adjust gain basis selection [Cd-06]".
- If the output of the parameter selected in "[FM] Output monitor selection [Cd-03]" is negative, you can select whether to use the absolute value or the signed value as it is in "[FM] Data type selection [Cd-12]."
- Adjustments made using [Cd-13] and [Cd-14] are valid regardless of the selection of "[FM] Output wave form selection [Cd-01]".

Code	Name	Description	Data
[Cd-01]	[FM] Output wave form selection	PWM output (6.4 ms)	00
		Digital frequency output	01
[Cd-06]	Analog adjust gain basis selection	Bias amount reference: The bias amount was adjusted.	00
		Full scale fixed	01
[Cd-12]	[FM] Data type selection	Outputs the absolute value of data.	00
		Signed data is output.	01
[Cd-13]	[FM] Bias adjustment	Add bias to PWM/digital frequency data. Adjust the zero-point.	-100.0 to 100.0 (%)
[Cd-14]	[FM] Gain adjustment	Apply gain to PWM/digital frequency data and adjust the data inclination.	-1000.0 to 1000.0 (%)

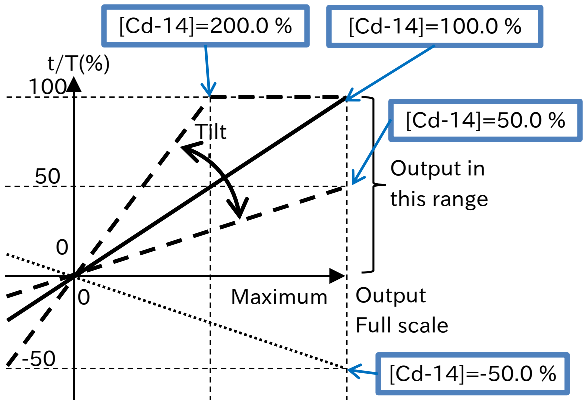
■ When [Cd-01] is set to "PWM output (00")

■ When "Analog adjust gain basis selection [Cd-06]" = "Bias value based full scale (00)"

- The output characteristic can be changed by adding "[FM] Bias adjustment [Cd-13]" to PWM output.
- Regardless of the bias setting value, if the gain setting value is the same, the slope of the output characteristics will be the same.
  The figure below shows the output characteristics when "[FM] gain adjustment [Cd-14]" is 100.0 %.

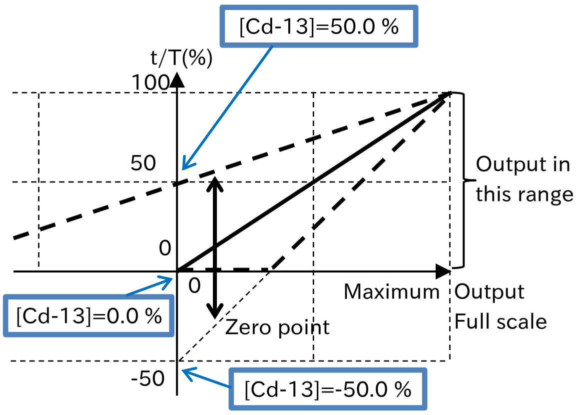


- The slope of the output characteristic can be changed by multiplying PWM output by "[FM] Gain adjustment [Cd-14]".
- If the gain settings are the same, the slope of the output characteristics will be the same even if the bias settings are changed.
  The figure below shows the output characteristics when "[FM] Bias adjustment [Cd-13]" is 0.0 %.

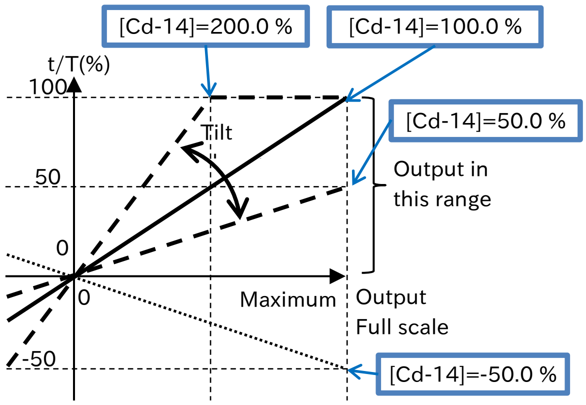


■ When "Analog adjust gain basis selection [Cd-06]"= "Fixed full scale (01)"

- "[FM] Bias adjustment [Cd-13]" can be added to the zero point of PWM outputting.
- Depending on the bias setting, the slope of the output characteristic changes so that 0 to 100 % of the output full scale becomes the bias setting to 100 % of the duty cycle.
  The figure below shows the output characteristics when "[FM] Gain adjustment [Cd-14]" is 100.0 %.



- The slope of the output characteristic can be changed by multiplying PWM output by "[FM] Gain adjustment [Cd-14]".
- Note that even if the gain setting value is the same, the slope of the output characteristics changes depending on the bias setting.
  The figure below shows the output characteristics when "[FM] Bias adjustment [Cd-13]" is 0.0 %.

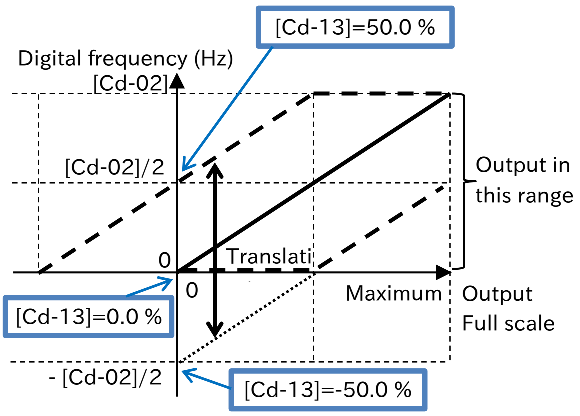


■ When [Cd-01] is set to "Frequency output (01)"

■ When "Analog adjust gain basis selection [Cd-06]" = "Bias value based full scale (00)"

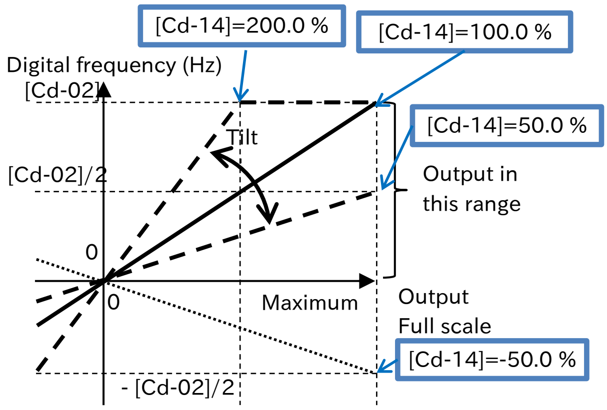
- The output characteristic can be translated by adding "[FM] Bias adjustment [Cd-13]" to the digital frequency output.
- Regardless of the bias setting value, if the gain setting value is the same, the slope of the output characteristics will be the same.

  The figure below shows the output characteristics when "[FM] Gain adjustment [Cd-14]" is 100.0 %.



- The slope of the output characteristic can be changed by multiplying the digital frequency output by "[FM] Gain adjustment [Cd-14]".
- If the gain settings are the same, the slope of the output characteristics will be the same even if the bias settings are changed.

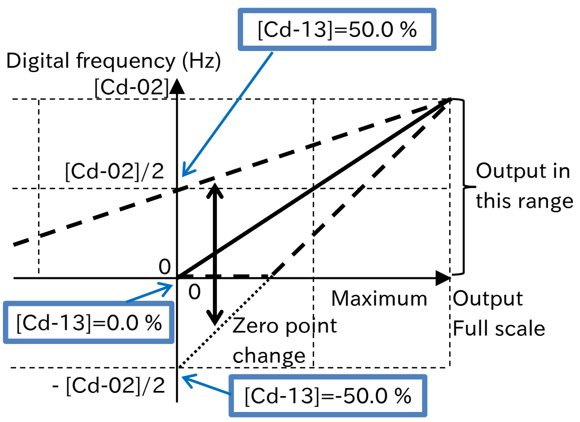
  The figure below shows the output characteristics when "[FM] Bias adjustment [Cd-13]" is 0.0 %.



■ When "Analog adjust gain basis selection [Cd-06]" = "Fixed full scale (01)"

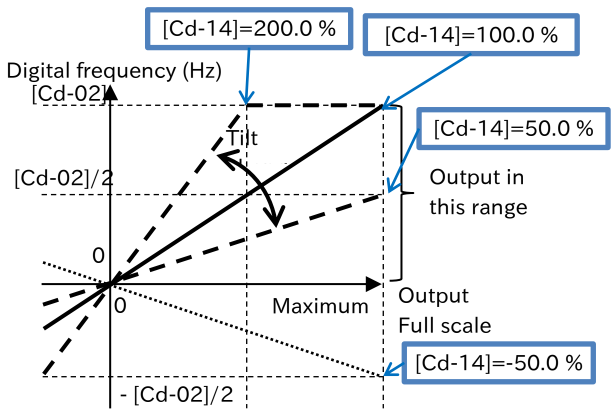
- It is possible to add "[FM] Bias adjustment [Cd-13]" to the zero point of digital frequency output.
- Depending on the bias setting, the slope of the output characteristic changes so that 0 to 100 % of the output full scale becomes the bias setting value of the digital frequency to [Cd-02].

  The figure below shows the output characteristics when "[FM] Gain adjustment [Cd-14]" is 100.0 %.



- The slope of the output characteristic can be changed by multiplying the digital frequency output by "[FM] Gain adjustment [Cd-14]".
- Note that even if the gain setting value is the same, the slope of the output characteristics changes depending on the bias setting.

  The figure below shows the output characteristics when "[FM] Bias adjustment [Cd-13]" is 0.0 %.

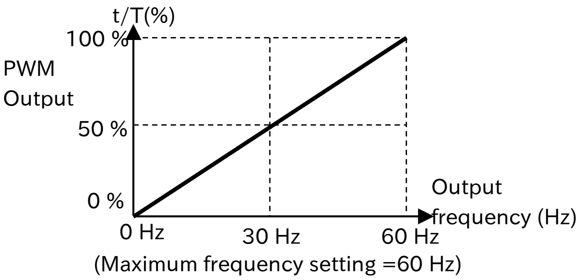


Typical adjustment

(e.g. 1) PWM output of
"Output frequency monitor [dA-01]"

- When the output frequency is the maximum frequency, PWM output is 100 %. Since the full scale of [dA-01] is the maximum frequency, the gain setting should remain at 100 % of the default setting.

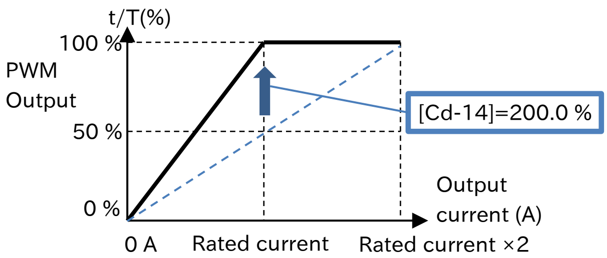
Setting: [Cd-13]=0.0 %, [Cd-14]=100.0 %



(e.g. 2) PWM output of
"Output current monitor [dA-02]"

- When the output current is the rated current, assume that PWM output is 100 %.
- Since the full scale of [dA-02] is 200 %, the rated current output = 100 % PWM output at the gain setting of 200 %.

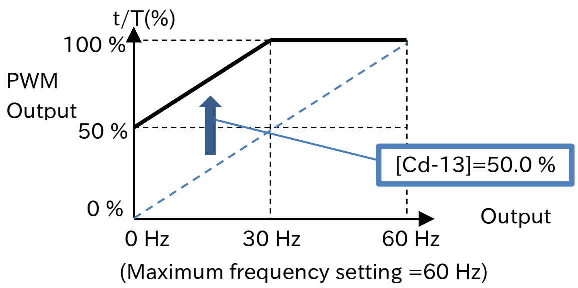
Setting: [Cd-13] = 0.0 %, [Cd-14] = 200.0 %



(e.g. 3-1) PWM output of
"Output frequency monitor [dA-01]"
(When [Cd-06] =
"Bias value based full scale (00)")

- 50 to 100 % of PWM power is specified as 0 Hz to maximum frequency/2.
- When the bias amount is set, there is no need to change the gain setting because the output characteristics are translated while maintaining the slope.

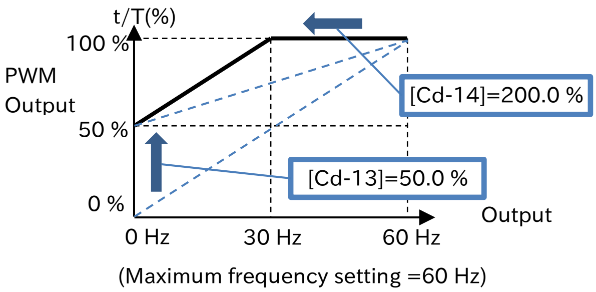
Setting: [Cd-13]=50.0 %, [Cd-14]=100.0 %



(e.g. 3-2) PWM output of "Output frequency monitor [dA-01]"
([Cd-06] = "Fixed full scale (01)")

- 50 to 100 % of PWM output is specified as 0 Hz to maximum frequency/2.
- The slope of the output characteristics changes according to the bias amount. If [Cd-13] is set to 50.0 %, 50 to 100 % of PWM output is the maximum frequency from 0 Hz, so set as follows.

Setting: [Cd-13]=50.0 %, [Cd-14]=200.0 %



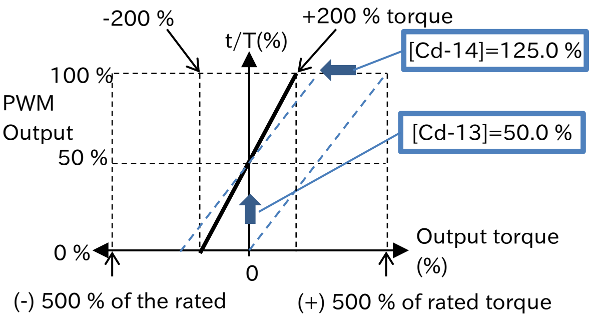
(e.g. 4-1) PWM output (signed value) of "Output torque monitor [dA-17]"

- When [Cd-06] is based on the bias quantity, the signed output torques are 0 to ±200 %, and PWM output is 0 to 100 %.
- In such cases, set the values so that -200 to 0 % and 0 to 200 % of the output torque are 0 to 50 % and 50 to 100 % of PWM output, respectively. Since the full scale of [dA-17] is ±500 %, set as shown below.

[Cd-13]: Since PWM power is 50 % at the center of the output torque range (-200 to 200 %, Output torque = 0 %), set 50 %.

[Cd-14]: Since gain value x 100 %/500 % = 50 %/200 %, set 125 %.

Setting: [Cd-12]=01, [Cd-13]=50.0 %, [Cd-14]=125.0 %



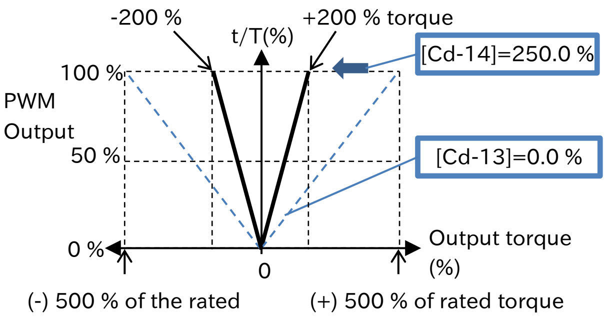
(e.g. 4-2) PWM output (absolute value) of "Output torque monitor [dA-17]"

- Assume that output torques of 0 % to ±200 % are absolute values. PWM output is 0 % to 100 %.
- In such cases, the output torques of -200 to 0% and 0 to 200% are both 0 to 100% of PWM output. Set them as shown below.

[Cd-13]: Since output torque 0% = PWM output 0%, set 0%.

[Cd-14]: Since gain value x 100 %/500 % = 100 %, set 250 %.

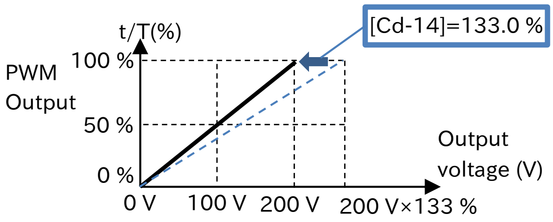
Setting: [Cd-12]=00, [Cd-13]=0.0 %, [Cd-14]=250.0 %



(e.g. 5) PWM output of "Output Voltage Monitor (RMS) [dA-18]"

- When the output voltage is the rated output voltage, assume that PWM output is 100 %. Since the full scale of [dA-18] is the rated output voltage x 133 %, set the gain to 133 % so that 100 %PWM output is obtained at the rated output voltage of 100 %, as shown in the figure below.

Setting: [Cd-13] = 0.0 %, [Cd-14] = 133.0 %

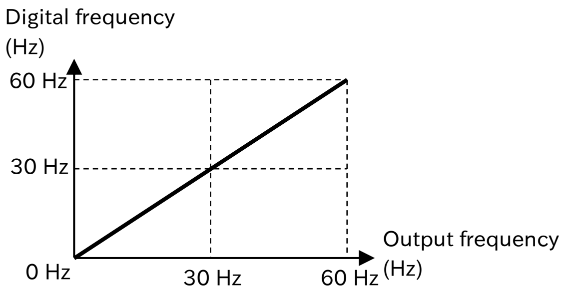


(When the rated output voltage =200 V)

(e.g. 6) Digital frequency output of "Output frequency monitor [dA-01]"

- Outputs the digital frequency output so that the maximum value corresponds to the maximum frequency. If the maximum frequency setting is 60 Hz, set it to [Cd-02]=60 Hz].

Setting: [Cd-02]=60 Hz, [Cd-13]=0.0 %, [Cd-14]=100.0 %

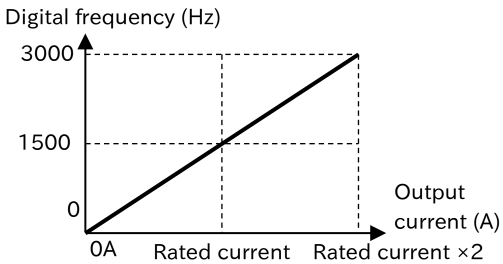


(e.g. 7) Digital frequency output of "Output current monitor [dA-02]"

- There are the following two methods when outputting in 1500 Hz when a current equivalent to the inverter rated current is flowing.

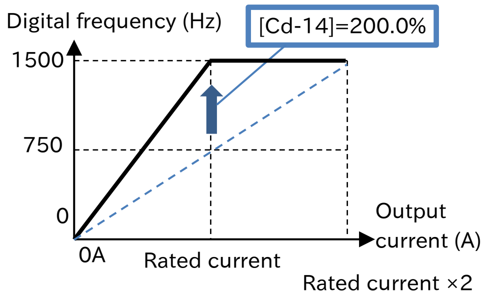
(1) Since the full scale of [dA-02] is the rated inverter current × 2, if it is [Cd-02]=3000 Hz], the output current is equivalent to the rated current and it becomes the digital frequency output 1500 Hz as shown in the figure below.

Setting: [Cd-02]=3000 Hz, [Cd-13]=0.0 %
[Cd-14]=100.0 %



(2) When the max. digital frequency output is [Cd-02]=1500 Hz], the [dA-02] full scale is set to 200 % of the gain setting because the inverter rated current × 2.

Setting: [Cd-02]=1500 Hz, [Cd-13]=0.0 %
[Cd-14]=200.0 %



A

Analog monitor adjustment mode (for pulse output)

- When "Analog monitor adjustment mode enable [Cd-10]" is set to "Enable (01)", the analog monitor adjustment mode is enabled. This function applies to all outputs from the [Ao1] and [Ao2] terminals.
- When "Pulse (03)" is selected in "[Ao2] Output type selection [Cd-36]", the output from the [Ao2] terminal is fixed at the output set in "Adjustment mode [FM] output level [Cd-15]" for the monitor full scale value selected in "[FM] Output monitor selection [Cd-03]".
- The minimum output of [Cd-15] changes according to the setting of "[FM] Data type selection [Cd-12]". The minimum output is 0.0% when "Absolute value (00)" is set, and -100.0% when "Signed (01)" is set.

Code	Name	Description	Data
[Cd-10]	Analog monitor adjustment mode enable	Adjustment mode of the analog monitor is disabled.	00
		Adjustment mode of analog monitor is enabled.	01
[Cd-12]	[FM] Data type selection	Outputs the absolute value of data.	00
		Signed data is output.	01
[Cd-15]	Adjustment mode [FM] output level	When [Cd-10] is set to "Enable (01)" and "Pulse (03)" is selected in "[Ao2] Output type selection [Cd-36]", set the level output from the [Ao2] terminal.	-100.0 to 100.0 (%)
[Cd-36]	[Ao2] Output type selection	PWM signal or digital frequency signal is output from the [Ao2] terminal.	03

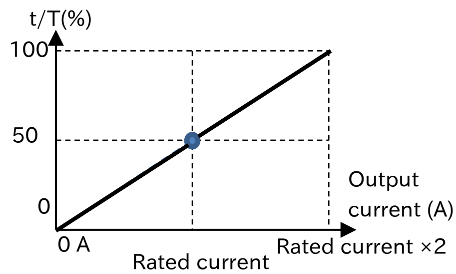
■ (e.g.) Adjusting PWM output of the output current monitor

- Adjust to output at 100 % PWM output at the rated inverter current.

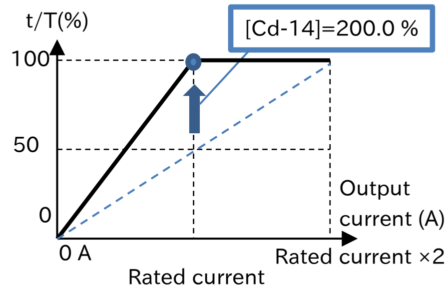
Code	Name	Output range (Corresponds to 0 to 10 VDC/0 to 20 mA/0 to 100 %)
[dA-02]	Output current monitor	(0.00 to 2.00)×ND/LD rated output current (A)

1 Set [Cd-01] to "PWM output (00)" and [Cd-03] to "Output current monitor [dA-02]". When [Cd-10] is set to "Enable (01)", the [Cd-15] setting value is outputted from the [Ao2] terminal in PWM form.

2 If the reference point you want to output is the rated current value, set the point at half of it because the full scale of [dA-02] is (0.00 to 2.00) × the inverter rated current.
First, by setting [Cd-15] to 50.0 % (equivalent to the rated inverter current), a PWM with a 50 % duty, which is the output when the rated current (= rated current × 2.00 × 50.0 %) is output from the [Ao2] terminal.



3 Then use [Cd-14] to adjust the tilt. Change the [Cd-14] to adjust PWM to the point where 100% duty is generated.
Under these conditions, if [Cd-14] is set to 200.0 %, the duty cycle is 100 % at the rated inverter current as shown in the figure on the right.



4 When [Cd-10] is returned to "Disable (00)", the analog monitor adjusting mode is finished, and PWM output based on the actual output current is started from the [Ao2] terminal.

A

Pulse input monitor scale conversion

- In "[FM] Output monitor selection [Cd-03]", "Pulse input monitor [dA-70]" can be selected.
- [dA-70] is valid only when "Pulse input detection target selection [CA-90]" is set to "Frequency reference (01)". For details, refer to "10.2.2 Monitor the Analog/Pulse Input.
- If "[FM] Output wave form selection [Cd-01]" is "PWM output (00)", PWM output is performed with the duty cycle equivalent to the value obtained by multiplying the monitored value (%) of [dA-70] by the "Pulse input/output scale conversion gain [Cd-16]."
- If [Cd-01] is set to "Frequency output (01)", digital frequency is output at the frequency of the value obtained by multiplying [Cd-16] and "[FM] Output base frequency (at frequency output) [Cd-02]" to the monitor value (%) of [dA-70].

Code	Name	Description	Data
[dA-70]	Pulse input monitor	The frequency of the input pulse is displayed with the value of "Pulse input frequency scale [CA-92]" as 100 %.	-100.00 to 100.00 (%)
[Cd-01]	[FM] Output wave form selection	PWM output (6.4 ms)	00
		Digital frequency output	01
[Cd-02]	[FM] Output base frequency (at frequency output)	Set the output frequency at full scale when "Frequency output (01)" is selected for [Cd-01].	0 to 32000 (Hz)
[Cd-03]	[FM] Output monitor selection	Select PWM or digital frequency output from the [Ao2] terminals.	[dA-70]
[Cd-16]	Pulse input/output scale conversion gain	When "Pulse input monitor [dA-70]" is selected in [Cd-03], the input pulse frequency is scaled and outputted. [Cd-01] = "PWM output (00)": Duty cycle (%) = [dA-70]×[Cd-02] [Cd-01] ="Frequency output (01)": Output pulse frequency(Hz) = [dA-70]×[Cd-02] ×[Cd-16]	0.01 to 100.00

A

Pulse output filter time constant

- A filter can be set for the pulse output from the [Ao2] terminal.
- Filter time constant of pulse output can be set by "[FM] Output filter time constant [Cd-11]".

Code	Name	Description	Data
[Cd-11]	[FM] Output filter time constant	Set the filter time constant for PWM/digital frequency output from [Ao2] terminal.	1 to 500 (ms)

!

- When using the analog voltage output from the [Ao2] terminal ("[Ao2] Output type selection [Cd-36]" = "Voltage (01)"), the filter can be set with "[Ao2] Output filter time constant [Cd-31]". For details, refer to "9.16.5 Monitor Data Output by Analog Output".

9.16.5 Monitor Data Output by Analog Output

Q

- How do I output the inverter monitor data externally via analog output?

A

- [Ao1] terminal can be switched between analog voltage output and analog current output by setting "[Ao1] Output type selection [Cd-26]". To use the analog voltage/current output from the [Ao1] terminal, set the parameters of the monitor you want to output to "[Ao1] Output monitor selection [Cd-04]". For the parameters that can be set, see "9.16.3 Selecting Monitor Data for Analog/Pulse Output".
- [Ao2] terminal can be switched between analog voltage output and pulse output by setting "[Ao2] Output type selection [Cd-36]". To use analog voltage output from the [Ao2] terminal, set the parameters of the monitor that you want to output to "[Ao2] Output monitor selection [Cd-05]". For the parameters that can be set, see "9.16.3 Selecting Monitor Data for Analog/Pulse Output".
- The output characteristics when biasing is adjusted change according to the setting of "Analog adjust gain basis selection [Cd-06]". For details, refer to "Analog output gain/bias adjustment" in this section.
- When "Analog monitor adjustment mode enable [Cd-10]" is set to "Enable (01)", the analog output function is in adjustment mode, and the value set to "Adjustment mode [Ao1] output level [Cd-25]" is output from the [Ao1] terminal, and the value set to "Adjustment mode [Ao2] output level [Cd-35]" is output from the [Ao2] terminal. Use this mode to check the analog output gain/bias setting or adjust the external device, etc.

!

- Analog output may not be stable immediately after power-on or power-off.
- Refer to "9.16.4 Monitor Data Output by Pulse Output" when using pulse output from [Ao2] terminal ("[Ao2] Output type selection [Cd-36]" = "Pulse (03)").

■ Parameters related to [Ao1] terminal analog output

Code	Name	Description	Data
[Cd-04]	[Ao1] Output monitor selection	Select the data to be analog output (voltage/current) from the [Ao1] terminal.	Refer to "9.16.3 Selecting Monitor Data for Analog/Pulse Output".
[Cd-06]	Analog adjust gain basis selection	Bias quantity standard	00
		Full scale fixed	01
[Cd-10]	Analog monitor adjustment mode enable	Adjustment mode of the analog monitor is disabled.	00
		Adjustment mode of analog monitor is enabled.	01
[Cd-21]	[Ao1] Output filter time constant	Apply a filter to the analog output (voltage/current) from the [Ao1] terminal.	1 to 500 (ms)
[Cd-22]	[Ao1] Data type selection	Outputs the absolute value of data.	00
		Signed data is output.	01
[Cd-23]	[Ao1] Bias adjustment (Voltage/Current)	The bias is added to the analog output (voltage/current) from the [Ao1] terminal and the zero point is adjusted.	-100.0 to 100.0 (%)
[Cd-24]	[Ao1] Gain adjustment (Voltage/Current)	Apply a gain to the analog output (voltage/current) from the [Ao1] terminal and adjust the data slope.	-1000.0 to 1000.0 (%)
[Cd-25]	Adjustment mode [Ao1] output level	With [Cd-10] set to "Enable (01)", set the [Ao1] terminal output level.	-100.0 to 100.0 (%)
[Cd-26]	[Ao1] Output type selection	The analog voltage is output from the [Ao1] terminal.	01
		The analog current is output from the [Ao1] terminal.	02

■ **Parameters related to [Ao2] terminal analog output**

Code	Name	Description	Data
[Cd-05]	[Ao2] Output monitor selection	Select the data to output analog voltage from the [Ao2] terminal.	Refer to "9.16.3 Selecting Monitor Data for Analog/Pulse Output".
[Cd-06]	Analog adjust gain basis selection	Bias quantity standard	00
		Full scale fixed	01
[Cd-10]	Analog monitor adjustment mode enable	Adjustment mode of the analog monitor is disabled.	00
		Adjustment mode of analog monitor is enabled.	01
[Cd-31]	[Ao2] Output filter time constant	Apply a filter to the analog voltage output from the [Ao2] terminal.	1 to 500 (ms)
[Cd-32]	[Ao2] Data type selection	Outputs the absolute value of data.	00
		Signed data is output.	01
[Cd-33]	[Ao2] Bias adjustment (voltage)	The bias is added to the analog voltage output from the [Ao2] terminal and the zero point is adjusted.	-100.0 to 100.0 (%)
[Cd-34]	[Ao2] Gain adjustment (voltage)	Apply a gain to the analog voltage output from the [Ao2] terminal and adjust the data inclination.	-1000.0 to 1000.0 (%)
[Cd-35]	Adjustment mode [Ao2] output level	With [Cd-10] set to "Enable (01)", set the [Ao2] terminal output level.	-100.0 to 100.0 (%)
[Cd-36]	[Ao2] Output type selection	The analog voltage is output from the [Ao2] terminal.	01

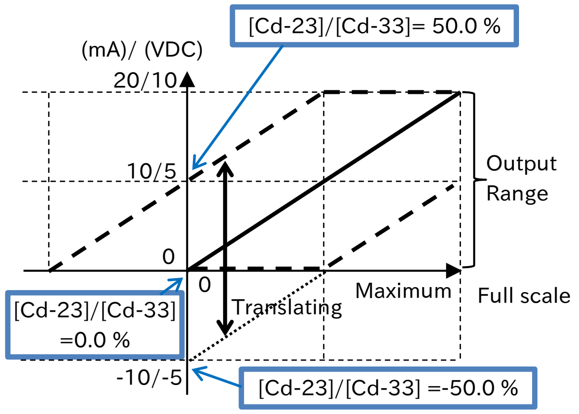
A Analog output gain/bias adjustment

- When analog voltage/current output is performed from the [Ao1] terminal or analog voltage output from the [Ao2] terminal is performed, the gain/bias of the analog output can be adjusted according to the connected meter.
- The output characteristics when biasing is adjusted change according to the setting of "Analog adjust gain basis selection [Cd-06]".
- If the output range of the parameter selected in "[Ao1] Output monitor selection [Cd-04]" or "[Ao2] Output monitor selection [Cd-05]" takes a negative value, you can select whether it should be an absolute value or treated as signed with "[Ao1] Data type selection [Cd-22]" or "[Ao2] Data type selection [Cd-32]".

Code	Name	Description	Data
[Cd-06]	Analog adjust gain basis selection	Bias quantity standard	00
		Full scale fixed	01
[Cd-22]	[Ao1] Data type selection	Outputs the absolute value of data.	00
		Signed data is output.	01
[Cd-23]	[Ao1] Bias adjustment (Voltage/Current)	The bias is added to the analog output (voltage/current) from the [Ao1] terminal and the zero point is adjusted.	-100.0 to 100.0 (%)
[Cd-24]	[Ao1] Gain adjustment (Voltage/Current)	Apply a gain to the analog output (voltage/current) from the [Ao1] terminal and adjust the data slope.	-1000.0 to 1000.0 (%)
[Cd-32]	[Ao2] Data type selection	Outputs the absolute value of data.	00
		Signed data is output.	01
[Cd-33]	[Ao2] Bias adjustment (voltage)	The bias is added to the analog voltage output from the [Ao2] terminal and the zero point is adjusted.	-100.0 to 100.0 (%)
[Cd-34]	[Ao2] Gain adjustment (voltage)	Apply a gain to the analog voltage output from the [Ao2] terminal and adjust the data inclination.	-1000.0 to 1000.0 (%)

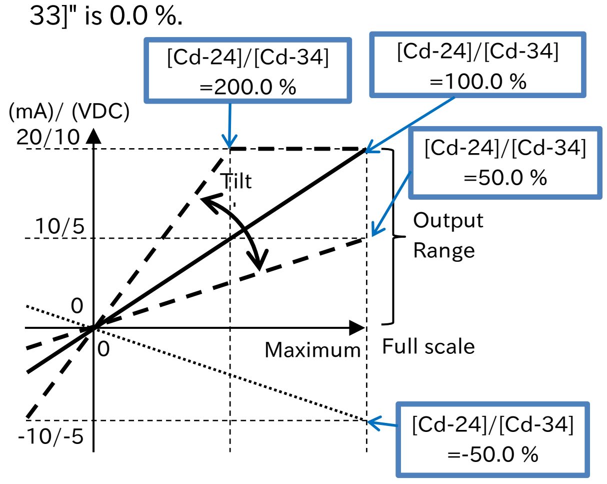
When "Analog adjust gain basis selection [Cd-06]" = "Bias value based full scale (00)"

- The output characteristic can be changed by adding "[Ao1] Bias adjustment (Voltage/Current) [Cd-23]" or "[Ao2] Bias adjustment (Voltage) [Cd-33]" to the analog output.
- Regardless of the bias setting value, if the gain setting value is the same, the slope of the output characteristics will be the same.
- The figure below shows the output characteristics when "[Ao1] Gain adjustment (Voltage/Current) [Cd-24]"/"[Ao2] Gain adjustment (Voltage) [Cd-34]" is 100.0 %.



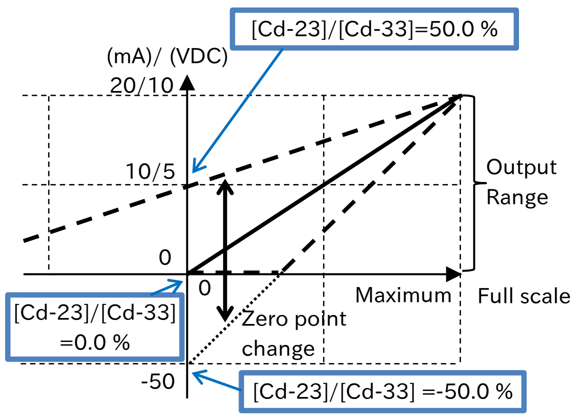
- The slope of the output characteristic can be changed by multiplying the analog output by "[Ao1] Gain adjustment (Voltage/Current) [Cd-24]" or "[Ao2] Gain adjustment (Voltage) [Cd-34]".
- If the gain settings are the same, the slope of the output characteristics will be the same even if the bias settings are changed.

The figure below shows the output characteristics when "[Ao1] Bias adjustment (Voltage/Current) [Cd-23]"/"[Ao2] Bias adjustment (Voltage) [Cd-33]" is 0.0 %.



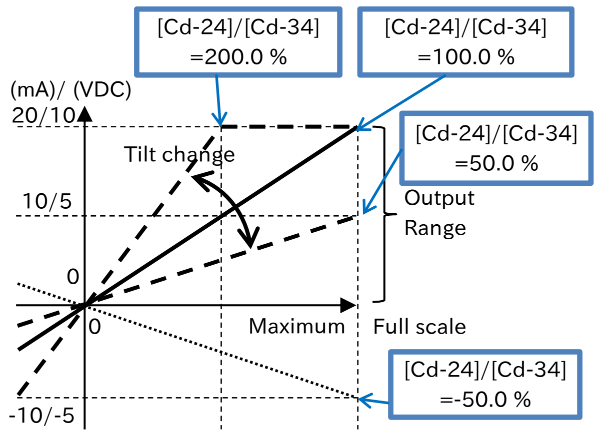
When "Analog adjust gain basis selection [Cd-06]" = "Fixed full scale (01)"

- "[Ao1] Bias adjustment (Voltage/Current) [Cd-23]" or "[Ao2] Bias adjustment (Voltage) [Cd-33]" can be added to the zero points of the analog output.
- Depending on the bias setting, the slope of the output characteristic changes so that 0 to 100 % of the output full scale becomes the bias setting to 100 % of the analog input.
- The figure below shows the output characteristics when "[Ao1] Gain adjustment (Voltage/Current) [Cd-24]"/"[Ao2] Gain adjustment (Voltage) [Cd-34]" is 100.0 %.



- The slope of the output characteristic can be changed by multiplying the analog output by "[Ao1] Gain adjustment (Voltage/Current) [Cd-24]" or "[Ao2] Gain adjustment (Voltage) [Cd-34]".
- Note that even if the gain setting value is the same, the slope of the output characteristics changes depending on the bias setting.

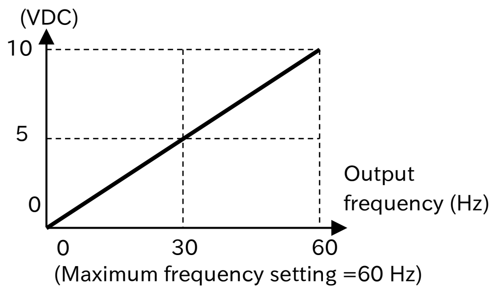
The figure below shows the output characteristics when "[Ao1] Bias adjustment (Voltage/Current) [Cd-23]"/"[Ao2] Bias adjustment (Voltage) [Cd-33]" is 0.0 %.



(e.g. 1) [Ao1] voltage output of "Output frequency monitor [dA-01]"

- When the output frequency is from 0 Hz to the maximum frequency, 0 to 10 VDC output is set from [Ao1].
- Since the full scale of [dA-01] is the maximum frequency, the gain setting should remain at 100 % of the default setting.

Setting: [Cd-23]=0.0 %, [Cd-24]=100.0 %

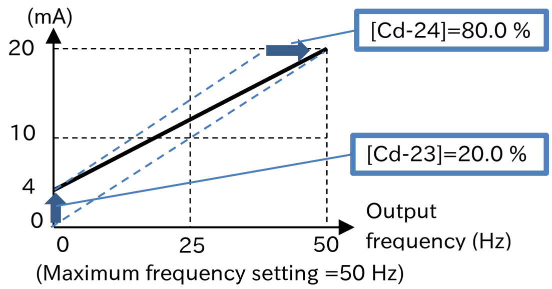


(e.g. 2) [Ao1] current output of "Output frequency monitor [dA-01]" ([Cd-06] = "Bias value based full scale (00)")

- When the output frequency is from 0 Hz to the maximum frequency, 4 to 20 mA current output from [Ao1].

[Cd-33]: When output frequency = 0 Hz, the output 4 mA is 20 % of 20 mA, so set 20 %.
[Cd-34]: Since the full scale of [dA-01] is the maximum frequency (100 %), set 80 % as (20-4) = 16 mA for 20 mA = 100 %.

Setting: [Cd-23]=20.0 %, [Cd-24]=80.0 %

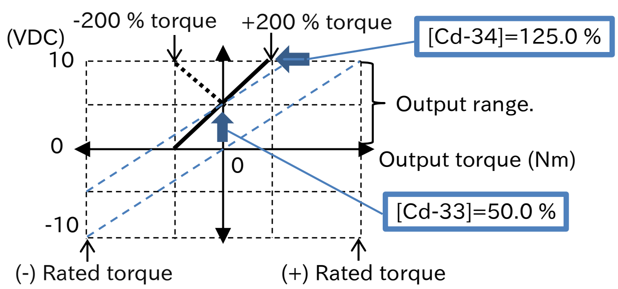


(e.g. 4) [Ao2] voltage output of "Output torque monitor [dA-17]"

- Assume that output torque of 0 to ±200 % is signed and that output is 0 to 10 VDC voltage from [Ao2]. In this case, set so that -200 to 0 % and 0 to 200 % of the output torque become 0 to 50 % and 50 to 100 % of the voltage output, respectively. Since the full scale of [dA-17] is ±500 %, set as shown below.

[Cd-33]: Since the voltage output is 5 VDC at the center of the output torque range (-200 to 200 %, Output torque = 0 %), set the value to 50 %.
[Cd-34]: Since gain setting value x 100 %/500 % = 50 %/200 %, set 125 %.

Setting: [Cd-32]=01, [Cd-13]=50.0 %, [Cd-14]=125.0 %



※ If [Cd-32] = "Absolute value (00)" is set in the above example, 5 to 10 VDC will be outputted for (-) torque side 0 to -200% (black dotted line in the above figure).

Analog monitor adjustment mode (for analog output)

- When "Analog monitor adjustment mode enable [Cd-10]" is set to "Enable (01)", the analog monitor adjustment mode is enabled. This setting applies to both the [Ao1] and [Ao2] terminals.
- The output from the [Ao1] terminal is fixed to the full scale value of the monitor selected by "[Ao1] Output monitor selection [Cd-04]" at the value set by "Adjustment mode [Ao1] output level [Cd-25]".
- When "Voltage (01)" is selected in "[Ao2] Output type selection [Cd-36]", the output from the "[Ao2] Output monitor selection [Cd-05]" is fixed at the value set in "Adjustment mode [Ao2] output level [Cd-35]" for the full scale value of the monitor selected in [Cd-05].
- The minimum output of [Cd-25] and [Cd-35] varies depending on the setting of "[Ao1] Data type selection [Cd-22]" or "[Ao2] Data type selection [Cd-32]". The minimum output value is 0.0% when "Absolute value (00)" is set, and -100.0% when "Signed (01)" is set.

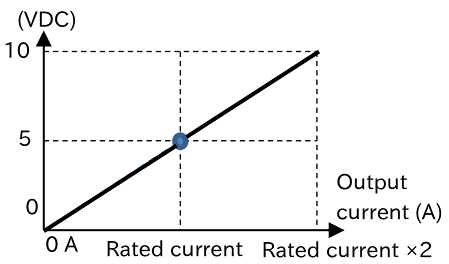
Code	Name	Description	Data
[Cd-10]	Analog monitor adjustment mode enable	Adjustment mode of the analog monitor is disabled.	00
		Adjustment mode of the analog monitor is enabled.	01
[Cd-22]	[Ao1] Data type selection	Outputs the absolute value.	00
		Outputs the signed value.	01
[Cd-32]	[Ao2] Data type selection	Outputs the absolute value.	00
		Outputs the signed value.	01
[Cd-25]	Adjustment mode [Ao1] output level	When [Cd-10] is set to "Enable (01)", this sets the analog voltage/current level output from the [Ao1] terminal.	-100.0 to 100.0 (%)
[Cd-35]	Adjustment mode [Ao2] output level	When [Cd-10] is set to "Enable (01)", and when "[Ao2] Output type selection [Cd-36]" is selected to "Voltage (01)," set the analog voltage level output from the [Ao2] terminal.	-100.0 to 100.0 (%)

■ (e.g.) Adjusting the analog voltage output from the [Ao1] terminal of the output current monitor

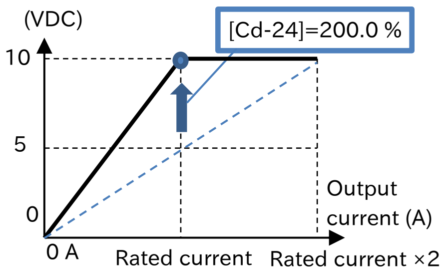
• Adjust the analog voltage output to 100 % output at the rated inverter current.

Code	Name	Output range (Corresponds to 0 to 10 VDC/0 to 20 mA/0 to 100 %)
[dA-02]	Output current monitor	(0.00 to 2.00)×ND/LD rated output current (A)

1 Set [Cd-04] to "Output current monitor [dA-02]". When [Cd-10] is set to "Enable (01)", the [Cd-25] setting is outputted from the [Ao1] terminal.



2 If the reference point you want to output is the rated current value, set the point at half of that since the full scale of [dA-02] is the rated current x 2.00.
First, by setting [Cd-25] to 50.0 % (equivalent to the rated inverter current), 5 VDC that is the output when the rated current (= rated current x 2.00 x 50.0 %) is output from the [Ao1] terminal.



3 Then use [Cd-24] to adjust the tilt. Change the [Cd-24] to adjust 10 VDC output.

4 When [Cd-10] is returned to "Disable (00)", the analog-voltage output of the adjusted [Ao1] starts.

A

Analog output filter

- Filters can be set for analog voltage/current output from the [Ao1] terminals or analog voltage output from the [Ao2] terminals.
- Filter time constant of analog output can be set by "[Ao1] Output filter time constant [Cd-21]" or "[Ao2] Output filter time constant [Cd-31]".

Code	Name	Description	Data
[Cd-21]	[Ao1] Output filter time constant	Set the filter to the data of analog voltage output and analog current output from the [Ao1] terminal.	1 to 500 (ms)
[Cd-31]	[Ao2] Output filter time constant	Set the filter to the data of analog voltage output from the [Ao2] terminal.	1 to 500 (ms)

!

- When using pulse output from the [Ao2] terminal ("[Ao2] Output type selection [Cd-36]" = "Pulse (03)"), the filter can be set with "[FM] Output filter time constant [Cd-11]". For details, refer to "9.16.4 Monitor Data Output by Pulse Output".

9.16.6 Synchronize External Signal Output and External Signal Input

Q

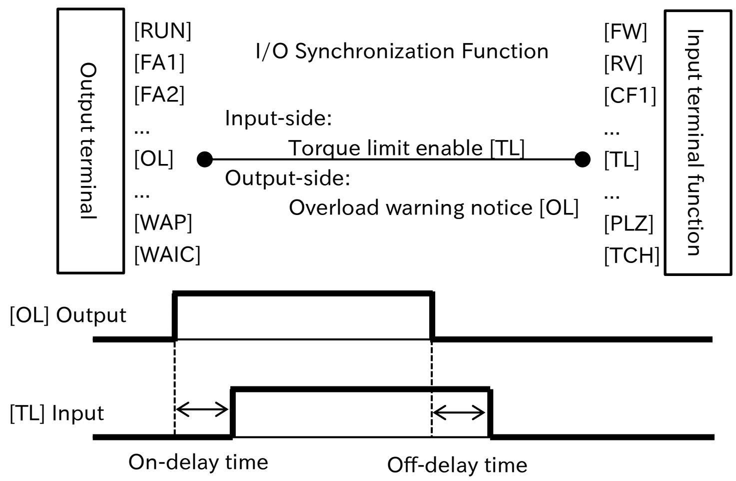
- How do I operate the input terminal function according to the operating status?
- I want to reduce physical wiring.

A

- With the contact input/output synchronization function, information on the output terminal function can be synchronized with the input terminal function without going through physical wiring. The input terminal function is set in "Sync input terminal function selection ([CH-01] to [CH-06])", and the output terminal function is set in "Sync output terminal function selection ([CH-11] to [CH-16])", and the channel (combined output terminal function and input terminal function) can be set in 6 ways.
- ON/OFF status of the output terminal function and the logical level of ON/OFF status of the input terminal function can be inverted. Settings can be made for each channel (combination of output and input terminal functions).
- Delay times for ON/OFF can be set for each channel. If the operation is unstable, setting a longer delay time may solve the problem.

!

- You cannot duplicate the function except for "Not use [no]". When the same function is selected, the channel that was selected first is changed to "Not use [no]", and the channel that was set last becomes enable.

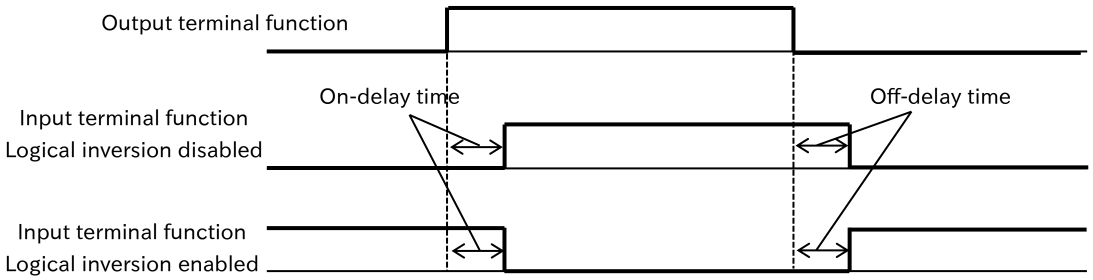


Code	Name	Description	Data
[CH-01] to [CH-06]	Sync input terminal function selection 1 to 6	Select the input function to be synchronized.	Refer to "Table of input terminal functions" in "9.15.1 Using Input Terminal Functions".
[CH-11] to [CH-16]	Sync output terminal function selection 1 to 6	Select the output function to be synchronized.	Refer to "Table of output terminal functions" in "9.16.1 Using Output Terminal Functions".
[CH-21] to [CH-26]	Sync terminal logic selection 1 to 6	Normally open: Logical inversion disabled	00
		Normally closed: Logical inversion enabled	01
[CH-30] [CH-32] [CH-34] [CH-36] [CH-38] [CH-40]	Sync terminal on-delay time 1 to 6	Set the duration until ON status is confirmed when the status of the output function selected during sync contact output selection changes to OFF→ON.	0.00 to 100.00 (s)
[CH-31] [CH-33] [CH-35] [CH-37] [CH-39] [CH-41]	Sync terminal off-delay time 1 to 6	Set the duration until OFF status is confirmed when the status of the output function selected during sync contact output selection changes to ON→OFF.	0.00 to 100.00 (s)

Logical inversion function

- The relation between the output terminal function and ON/OFF of the input terminal function can be inverted.
- The function can be set for each channel by "Sync terminal logic selection ([CH-21] to [CH-26])".

Code	Name	Description	Data
[CH-21] to [CH-26]	Sync terminal logic selection 1 to 6	Normally open: Logical inversion disabled	00
		Normally closed: Logical inversion enabled	01

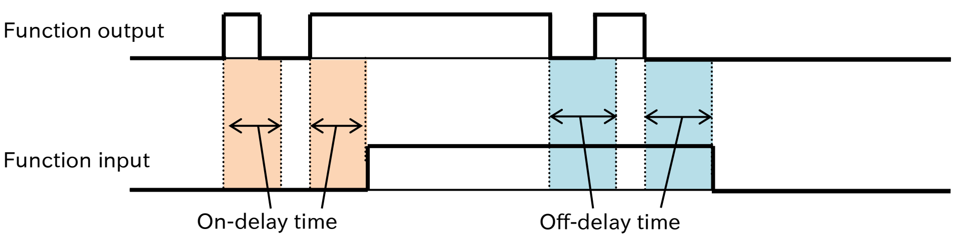


[CH-21] to [CH-26] Set value	ON/OFF status of output function	ON/OFF status of input function
Normally open (NO) (00)	OFF	OFF
	ON	ON
Normally closed (NC) (01)	OFF	ON
	ON	OFF

On-delay/Off-delay function

- A delay time can be set for each channel from the operation of the output terminal function to the operation of the input terminal function.
- The delay time can be set individually for the on-delay time from when the output terminal function changes to OFF→ON until the input terminal function turns ON (logical inversion: OFF) and for the off-delay time from when the output terminal function changes to ON→OFF until the input terminal function turns OFF (logical inversion: ON).

Code	Name	Description	Data
[CH-30] [CH-32] [CH-34] [CH-36] [CH-38] [CH-40]	Sync terminal on-delay time 1 to 6	Set the duration until ON status is confirmed when the status of the output function selected during sync contact output selection changes to OFF→ON.	0.00 to 100.00 (s)
[CH-31] [CH-33] [CH-35] [CH-37] [CH-39] [CH-41]	Sync terminal off-delay time 1 to 6	Set the duration until OFF status is confirmed when the status of the output function selected during sync contact output selection changes to ON→OFF.	0.00 to 100.00 (s)



10

Chapter 10 Monitor Functions

This chapter describes various types of data that can be monitored by the inverter's keypad or remote operator. For more information on using keypad to view the monitors, refer to "Chapter 7 Keypad and Related Functions".
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

10.1 Check the Operation Data

10.1.1 Monitor the Output Frequency

Q

- How to check the output frequency?
- How to arbitrarily convert the output frequency for display?
- How to adjust the frequency reference with keypad while monitoring the output frequency with keypad?

A

Output frequency monitor [dA-01]

- Displays the output frequency of the inverter. "0.00" is displayed during stop.
- When the content of "Output frequency monitor [dA-01]" is displayed, "Frequency monitor LED [Hz]" on the keypad lights.
- [dA-01] displays the absolute value of the output frequency regardless of whether the rotation is forward or reverse. When checking the present rotational direction with the display content of the monitor, refer to "Output frequency monitor (signed) [dA-12]".

Code	Name	Description	Data
[dA-01]	Output frequency monitor	Displays the output frequency of the inverter. "0.00" is displayed during stop. The "Frequency monitor LED [Hz]" of the keypad lights while this data is displayed.	0.00 to 590.00 (Hz)

A

Frequency reference monitor (after calculation) (signed) [dA-04]

- Displays the final frequency reference value based on the results of main speed reference, sub speed reference or calculation.
- This monitor displays the value before the upper/lower limiter or the maximum frequency limit is applied to the setting range.

Code	Name	Description	Data
[dA-04]	Frequency reference monitor (after calculation) (signed)	Displays the frequency reference value.	-590.00 to 590.00 (Hz)

A

Output frequency scale conversion monitor [dA-06]

- Displays the value obtained by converting "Output frequency monitor [dA-01]" with the factor set in "Frequency conversion gain [Ab-01]". Used when changing the display unit, such as changing the display from the output frequency to the motor rotation speed.

  (Example) Displays the motor rotation speed.

  Motor rotation speed N (min^{-1}) = (120 × f (Hz)) / P (number of motor poles)

  Therefore, when [Ab-01] = 30.0 for a 4-pole motor, 1800 is displayed at 60 Hz.

Code	Name	Description	Data
[dA-06]	Output frequency scale conversion monitor	Displays the [dA-01]×[Ab-01] setting.	0.00 to 59000.00
[Ab-01]	Frequency conversion gain	Set the conversion factor for [dA-06] display.	0.01 to 100.00

A

Output frequency monitor (signed) [dA-12]

- Displays the inverter output frequency in signed form.
- The positive value (+) is displayed for forward rotation and the negative value (-) is displayed for reverse rotation.

!

- "Output frequency monitor (signed) [dA-12]" is not subject to the frequency change during monitoring function. Even if "Enable frequency changes through monitor display [UA-93]" is "Enable (01)", you cannot change the frequency from the keypad while [dA-12] is displayed.

Code	Name	Description	Data
[dA-12]	Output frequency monitor (signed)	Displays the inverter output frequency in signed form. During stop, "0.00" is displayed. During forward rotation, the + value is displayed. During reverse rotation, the-value is displayed. "Frequency monitor LED [Hz]" on the keypad lights while this data is displayed.	-590.00 to 590.00 (Hz)

A

Frequency change function of monitor

- When "Enable frequency changes through monitor display [UA-93]" is "Enable (01), "Main speed input source selection [AA101]" is "Parameter setting (07)" and only during inverter operation, the frequency reference can be changed by keypad while "Output frequency monitor [dA-01]"/ "Output frequency scale conversion monitor [dA-06]" is displayed.
- By "Enable multi-speed frequency changes through monitor display [UA-94]", disable/enable of monitoring frequency change function for multi-speed operation can be selected. When "Disable (00)" is set, this function is enabled only when "Multi-speed 0 setting [Ab110]" is selected as the frequency reference. When set to "Enable (01)", this function is enabled for all multi-speed commands set to "Multi-speed 0 setting [Ab110]" to "Multi-speed 15 setting [Ab-25]".
- When SET key is pressed after the frequency reference is changed, the changed frequency reference is stored in the inverter's internal memory.

!

- "Output frequency monitor (signed) [dA-12]" is not subject to the frequency change during monitoring function. Even if "Enable frequency changes through monitor display [UA-93]" is "Enable (01)", you cannot change the frequency from the keypad while [dA-12] is displayed.
- If "FUP/FDN data save enable [CA-61]" is "Save (01)", after "Output frequency monitor [dA-01]"/ "Output frequency scale conversion monitor [dA-06]" is changed, please note that the changed frequency reference value will be stored in the inverter internal memory when the power is cut off. For details, refer to "9.2.14 Increasing/Decreasing Frequency Reference by Input Terminal Function".
- Since "Main speed reference setting (monitor) [FA-01]" is rewritten while displaying [dA-01]/[dA-06], there may be a time difference between key operation and display depending on acceleration/deceleration time setting.
- Frequency cannot be changed while the inverter is stopped, PID is operating, or in the individual input mode by pressing and holding SET key.
- When using the remote operator (VOP), the setting of this function is disabled.

Code	Name	Description	Data
[UA-93]	Enable frequency changes through monitor display	The frequency reference cannot be changed in Disable: [dA-01]/[dA-06].	00
		The frequency reference can be changed in Enable: [dA-01]/[dA-06].	01
[UA-94]	Enable multi-speed frequency changes through monitor display	Disable: Only "Multi-speed 0 setting [Ab110] can be edited.	00
		Enable: "Multi-speed 0 setting [Ab110]" to "Multi-speed 15 setting [Ab-25]" can be edited	01

10.1.2 Monitor the Output Current

Q
- How do I check the effective value of the current flowing through the motor?
- I want to see the output current movement.

A
Output current monitor [dA-02]
- Displays the output current flowing to the motor. The "Current monitor LED [A]" on the keypad lights while "Output current monitor [dA-02]" is displayed.
- First order lag filters can be set for the [dA-02] readout. If the display of [dA-02] is shaking in detail, adjust the time constant of the filter by referring to "Output current monitor filter [CF-61]".

!
- Depending on PWM type of the inverter, the lower the carrier frequency is, the more the value of the monitor may be shaken.
- "0.00" is displayed while output is stopped.

Code	Name	Description	Data
[dA-02]	Output current monitor	Displays the output current from the inverter. The data is displayed as the rms value of the output current.	0.00 to 655.35 (A)
[CF-61]	Output current monitor filter	Filters can be set for "Output current monitor [dA-02]".	0 to 1000 (ms)

10.1.3 Monitor the Rotation Direction

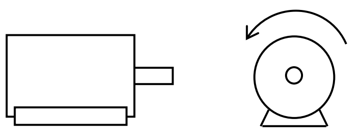
Q
- How do I check the operating direction of the inverter?

A
Rotation direction monitor [dA-03]
- Displays the inverter operation direction. When the inverter is operating (forward or reverse), "Running LED [RUN]" on the keypad lights.
- The rotation direction is determined by the RUN command method and the sign of the frequency reference.

!
- For 0Hz operation such as DC braking function, "0Hz output (01)" is displayed in "Rotation direction monitor [dA-03]".

Code	Name	Description	Data
[dA-03]	Rotation direction monitor	Displays the inverter operation direction.	o (Stop (00))
			d (0Hz output (01))
			F (Forward (02))
			r (Reverse (03))

Generally, the motor rotates counterclockwise in the forward direction when viewed from the axial direction.



Forward rotation

10.1.4 Monitor the Detected Motor Speed

Q

- I want to know the actual rotation speed fed back from the motor.

A

Detect speed monitor [dA-08]

- Displays the actual rotation frequency fed back from the motor when performing speed control with sensor or position control.
- This monitor is enabled when "Speed feedback (02)" is set to "Pulse input target function selection [CA-90]".

!

- When using this monitor, set "Async. Motor number of poles setting [Hb103]" and "Encoder constant setting [CA-81]" correctly. For details, refer to "9.5.11 Setting for Encoder Feedback".
- If the value of "Detect speed monitor [dA-08]" changes finely due to the effect of noises, etc., and the speed detection value is not stable, set "Speed feedback filter [CA-86]" larger.

Code	Name	Description	Data
[dA-08]	Detect speed monitor	Displays the actual rotation frequency during encoder feedback.	-590.00 to 590.00 (Hz)
[CA-81]	Encoder constant setting	Set the number of connected encoder pulses in the number of pulses (multiplied by 1) converted to one rotation of the motor.	1 to 65535 (pls)
[CA-86]	Speed feedback filter	Filter time constant for the detection speed by encoder pulse input.	0 to 1000 (ms)
[CA-90]	Pulse input target function selection	Speed feedback	02
[Hb103]	Async. Motor number of poles setting	Set the number of motor poles.	00 to 23 (2 to 48 poles)

10.1.5 Monitor the Torque Reference/Output Torque Related Data

Q

- How do I check the torque reference value and torque limit value during torque control?
- How do I check the output torque?

A

Torque reference monitor (after calculation) [dA-15]

- Displays the currently set torque reference value used in torque control.
- This monitor is enabled when "Permission of torque control [ATR]" of the input terminal function is ON and in torque control mode.
- The torque equivalent to 100 % of this monitor can be selected from the torque calculated by the motor constant, etc. or the torque equivalent to the rated current of the inverter by setting "Torque conversion method selection [HC115]". Refer to "9.6.3 Operate by Torque Reference" for details.
- This monitor displays the sum of the torque reference value and the torque bias value. For details of the torque bias function, refer to "9.6.5 Torque Bias Function".

Code	Name	Description	Data
[dA-15]	Torque reference monitor (after calculation)	Displays the current torque reference value.	-1000.0 to 1000.0 (%)

A

Torque limit monitor [dA-16]

- Displays the currently set torque limit value used in torque control.
- For details of the torque limit function, refer to "9.6.4 Limiting Output Torque".

Code	Name	Description	Data
[dA-16]	Torque limit monitor	Displays the current torque limit value.	0.0 to 500.0 (%)

A

Output torque monitor [dA-17]

- In sensorless vector control, the output torque estimate during speed control/torque control is displayed.
- In this monitor, the regeneration is a negative value (-) when the motor runs in the forward direction with a positive value (+), and the regeneration is a positive value (-) when the motor runs in the reverse direction with a negative value (-).
- First order lag filters can be set for "Output torque monitor [dA-17]" readout. If the display of [dA-17] is shaking in detail, adjust the time constant of the filter in "Output torque monitor filter [CF-62]".
- The torque equivalent to 100 % of this monitor can be selected from the torque calculated by the motor constant, etc. or the torque equivalent to the rated current of the inverter by setting "Torque conversion method selection [HC115]". Refer to "9.6.3 Operate by Torque Reference" for details.

Code	Name	Description	Data
[dA-17]	Output torque monitor	Displays the output torque estimate.	-1000.0 to 1000.0 (%)
[CF-62]	output torque monitor filter	Filters can be set for "Torque output monitor [dA-17]".	0 to 1000 (ms)

10.1.6 Monitor the Position Control Related Data

Q

- How do I check the current position and position command during position control?

A

Current position monitor [dA-20]

- Indicates the current position during position control. For details of the position control function, refer to "9.14 Perform Positioning Operation".
- When "Speed feedback (02)" is set to "Pulse input target function selection [CA-90]", this monitor is enabled. In addition, "Clearance of position deviation [PCLR]", "Position data presetting [PSET]" and "Save current position at power off [AE-61]" are also enabled. For details, refer to "9.14.1 Using Absolute Position Control Function Based on Origin".

Code	Name	Description	Data
[dA-20]	Current position monitor	Displays the current position during position control.	Absolute position control mode: -268435455 to 268435455 (pls) High-resolution absolute position control mode: -1073741823 to 1073741823 (pls)

10.1.7 Monitor the Output Voltage

Q

- How do I check the voltage being output to the motor?
- I want to see the output voltage movement.

A

Output-voltage monitor (RMS) [dA-18]

- The output voltage currently output to the motor can be checked in "Output Voltage Monitor (RMS) [dA-18]".
- The output-voltage displayed in [dA-18] is calculated.
- First order lag filters can be set for the [dA-18] readout. If the display of [dA-18] is shaking in detail, adjust the time constant of the filter by referring to "Output voltage monitor filter [CF-63]".

!

- When the input voltage is low or "Async. Motor rated voltage [Hb106]" is not set correctly, the correct value may not be displayed.

Code	Name	Description	Data
[dA-18]	Output voltage monitor (RMS)	Displays the voltage output to the motor.	0.0 to 800.0 (V)
[CF-63]	Output voltage monitor filter	Filters can be set for "Output voltage monitor (RMS) [dA-18]."	0 to 1000 (ms)

10.1.8 Monitor the Input Power/Accumulated Input Power to Inverter

Q
- How do I know the input power to the inverter?
- How do I know the accumulated input power of the inverter?

A

Input power monitor [dA-30]

- Displays the power (instantaneous value) currently input to the inverter.
- First order lag filters can be set for the readout of "Input power monitor [dA-30]". If the display of [dA-30] is shaking finely, adjust the time constant of the filter using the "Input/Output power filter [CF-64]".

Code	Name	Description	Data
[dA-30]	Input power monitor	Displays the input power (instantaneous value). The displayed value varies depending on the input power factor.	0.00 to 655.35 (kW)
[CF-64]	Input/Output power filter	Filters can be set for "Input power monitor [dA-30]" and "Output power monitor [dA-34]".	0 to 1000 (ms)

A

Accumulated input power monitor [dA-32]

- Displays the accumulated data of the input power to the inverter.
- "Display gain for the accumulated input power monitor [UA-13]" can be used to convert the displayed content to gain.
  [dA-32] = [Actual accumulated input power (kWh)] /[UA-13]
  (e.g.) When [UA-13] is 100 and [dA-32] is 1000, the actual accumulated input power is 100,000 kWh.
- This monitor value is stored in the internal memory of the inverter when the power supply is cut off. To clear the data, use one of the following methods.
  - "Accumulated input power monitor clear [UA-12]" is changed to "Clear (01)", and the [dA-32] setting is cleared by pressing SET key on the keypad.
  - Assign "Accumulated input power clearance [KHC]" to the input terminal and ON the terminal to clear [dA-32] to zero.

Code	Name	Description	Data
[dA-32]	Accumulated input power monitor	Displays the integrated value of input power.	0.0 to 1000000.0 (kWh)
[CA-01] to [CA-08]	Input terminal function	Accumulated input power clearance[KHC]: When this signal is turned ON, [dA-32] is cleared to 0.	039
[UA-12]	Accumulated input power monitor clear	Disable: Clear Disable	00
		Clear: Pressing SET key on the keypad with this setting clears [dA-32] to 0. (This setting becomes "Disable (00)" after clearing is executed.)	01
[UA-13]	Display gain for the accumulated input power monitor	Choose the gain used for [dA-32].	1 to 1000

10.1.9 Monitor the Output Power/Accumulated Output Power from Inverter

Q
- How do I know the output power to the motor?
- How do I know the accumulated output power to the motor?

A
Output power monitor [dA-34]
- Displays the power (instantaneous value) currently output from the inverter to the motor.
- First order lag filters can be set as displayed in "Output power monitor [dA-34]". If the display of [dA-34] is shaking finely, adjust the time constant of the filter using the "Input/Output power filter [CF-64]".

Code	Name	Description	Data
[dA-34]	Output power monitor	Displays the output power (instantaneous value).	0.00 to 655.35 (kW)
[CF-64]	Input/Output power filter	Filters can be set for "Input-power monitor [dA-30]" and "Output-power monitor [dA-34]".	0 to 1000 (ms)

A
Accumulated output power monitor [dA-36]
- Displays the accumulated output power from the inverter to the motor.
- "Display gain for the accumulated output power monitor [UA-15]" can be used to convert the displayed gain.

  [dA-36] = [Actual accumulated output power (kWh)] /[UA-15]

  (e.g.) When [UA-15] is 100 and [dA-36] is 1000, the actual accumulated output power is 100,000 (kWh.)
- This monitor value is stored in the internal memory of the inverter when the power supply is cut off. To clear the data, use one of the following methods.
  - "Accumulated output power monitor clear [UA-14]" is changed to "Clear (01)", and the [dA-36] is cleared by pressing SET key.
  - When "Accumulated output power clearance [OKHC]" is assigned to the input terminal and the terminal is turned ON, the [dA-36] value is cleared to zero.

Code	Name	Description	Data
[dA-36]	Accumulated output power monitor	Displays the accumulated output power.	0.0 to 1000000.0 (kWh)
[CA-01] to [CA-08]	Input terminal function	Accumulated output power clearance [OKHC]: When this signal is turned ON, [dA-36] is cleared to 0.	040
[UA-14]	Accumulated output power monitor clear	Disable: Clear disable	00
		Clear: When this setting is selected and SET key on the keypad is pressed, [dA-36]" is cleared to 0. (This setting becomes "Disable (00)" after clearing is executed.)	01
[UA-15]	Display gain for the accumulated output power monitor	Choose the gain used for [dA-36].	1 to 1000

10.1.10 Monitor the Internal DC Voltage (P-N Voltage)

Q

- I want to see the DC-voltage movement between P-N of the inverters.
- How do I monitor DC between P-N when the motor is in regenerative mode?

A

DC bus voltage monitor [dA-40]

- Displays the DC voltage charged in the main circuit capacitor of the inverter (DC voltage between the [P] and [N] terminals of the inverter main circuit terminal block).
- During operation, the monitored value also fluctuates according to the actual DC voltage.

!

- If the DC voltage between P-N exceeds approx. 400 VDC(200 V class)/approx. 800 VDC (400 V class, "Overvoltage error [E007]" occurs.
- For more information on troubleshooting in case of [E007] occurrence, refer to "15.2 Troubleshooting for Protection Functions Related Error".

Code	Name	Description	Data
[dA-40]	DC bus voltage monitor	Displays the DC voltage between [P] and [N] terminals of the inverter.	0.0 to 1000.0 (VDC)

10.1.11 Monitor the Braking Resistor Load Factor

Q

- How do I check the usage rate of the optional braking resistor?

A

BRD load factor monitor [dA-41]

- Displays the load factor of the braking resistor operation circuitry (BRD).
- To use the braking resistor operation circuit (BRD), the "Dynamic brake use ratio [bA-60]" and "Dynamic brake activation selection [bA-61]" sets are required. For details, refer to "9.9.5 Overvoltage Suppression with Braking Resistor".

!

- If this monitor value exceeds the value set in "Dynamic brake use ratio [bA-60]", "Braking resistor overload error [E006]" will occur.
- For details on troubleshooting when "Braking resistor overload error [E006]" occurs, refer to "15.2 Troubleshooting for Protection Functions Related Error".

Code	Name	Description	Data
[dA-41]	BRD load factor monitor	Displays the load factor of the braking resistor.	0.00 to 100.00 (%)

10.1.12 Monitor the Electronic Thermal Load Factor

Q
- How do I check the motor overheat protection status?
- How do I check the inverter overheat protection status?

A
Electronic thermal load factor monitor (Motor) [dA-42]
- Displays the electronic thermal load factor of the motor. If this monitor exceeds 100 %, "Motor overload error [E005]" will occur.
- In order to perform the overload protection of the motor correctly, perform the basic setting of the motor and the electronic thermal function setting properly. For details, refer to "8.1.3 Setting Motor Specification Label Data to Parameters" and "8.1.4 Setting Electronic Thermal for Motor".

!
- For details on troubleshooting when "Motor overload error [E005]" occurs, refer to "15.2 Troubleshooting for Protection Functions Related Error".

Code	Name	Description	Data
[dA-42]	Electronic thermal load factor monitor (Motor)	Displays the electronic thermal load factor of the motor.	0.00 to 100.00 (%)

A
Electronic thermal load factor monitor (Inverter) [dA-43]
- Displays the electronic thermal load factor of the inverter. If this monitor exceeds 100 %, "Controller overload error [E039]" will occur.

!
- The electronic thermal function of the inverter is to protect the inverter itself. It is operating separately from the thermal function of the motor.
- The characteristics of the inverter electronic thermal are fixed for each inverter model, and there are no parameters for adjustment. Regardless of the setting, the rated current at ND rating is used as a reference. Even when "Light duty (LD) (01)" is set to "Load type selection [Ub-03]", the increment of [dA-43] to the output current does not change.
- For details on troubleshooting when "Controller overload error [E039]" occurs, refer to "15.2 Troubleshooting for Protection Functions Related Error".

Code	Name	Description	Data
[dA-43]	Electronic thermal load factor monitor (Inverter)	Displays the electronic thermal load factor of the inverter.	0.00 to 100.00 (%)

10.2 Check the Input/Output Terminal Related Data

10.2.1 Monitor the Input/Output Terminal Status

Q

- I want to know ON/OFF status of I/O terminals and I/O terminals.
- I want to know if the I/O terminal wiring is broken.

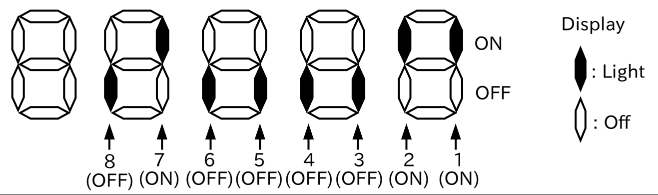
A

Input terminal monitor [dA-51]

- LED on the keypad lights up to indicate the input status of the input terminals.
- This monitor displays ON/OFF of the physical terminals. a/b(NO/NC) Not affected by selection.
- The response of this monitor is slow depending on the setting of "Input terminal response time ([CA-41] to [CA-48])".

!

- If the monitoring status does not change even when the terminal is turned ON/OFF, the control wire may be disconnected.
- When "Thermistor type selection [Cb-40]" is set to "PTC (01)", OFF is maintained at all times regardless of the input status.
- The operation of the output terminal [11] when the safety function STO input terminal [ST1]/[ST2] and EDM switch are ON can be checked in "Safety STO terminal monitor [dA-44]". For details, refer to "14.1.3 STO Status Indication".

Code	Name	Description	Data
[dA-51]	Input terminal monitor	The 7-segment LED on the keypad indicates ON/OFF status of the terminals. (e.g.) Input terminal 7, 2, 1 :ON Input terminal 8, 6, 5, 4, 3 :OFF  	—

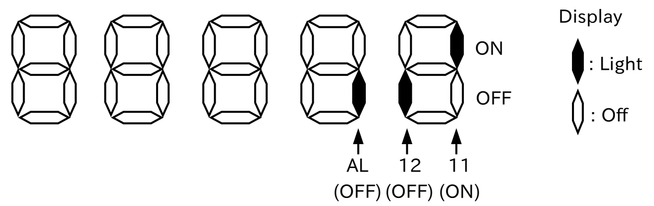
A

Output terminal monitor [dA-54]

- Indicates the output status of the output terminals with the positions of LED on the keypad.
- This monitor displays ON/OFF of the physical terminals. a/b(NO/NC) Not affected by selection.
- The response of this monitor is slow depending on the setting of "Output terminal on-delay time ([CC-20]/[CC-22]/[CC-32])" and "Output terminal off-delay time ([CC-21]/[CC-23]/[CC-33])".

!

- If the monitoring status does not change after the terminal is turned ON/OFF, the control wire may be disconnected.

Code	Name	Description	Data
[dA-54]	Output terminal monitor	The 7-segment LED on the keypad indicates ON/OFF status of the OUTPUT terminal. (e.g.) Output terminal 11 :ON Output terminal 12, AL :OFF  	—

10.2.2 Monitor the Analog/Pulse Input

Q

- How do I check whether the [Ai1] terminal or the [Ai2] terminal selects analog voltage or analog current?
- I want to see the movement of the pulse input terminal.

A

Analog input [Ai1] monitor [dA-61]/Analog input [Ai2] monitor [dA-62]

- The analog voltage/current (0 to 10 VDC/4 to 20 mA) input to the [Ai1]/[Ai2] terminal is displayed as 0.00 to 100.00 %.
- You can monitor A/D immediately after converting the analog signal.

!

- The unit is factory-adjusted so that MAX is slightly smaller than 10 VDC/20 mA, taking into account variations in the input circuitry.

Code	Name	Description	Data
[dA-61]	Analog input [Ai1] monitor	[Ai1] Indicates the analog input 0 to MAX of the terminal as 0.00 to 100.00 %.	0.00 to 100.00 (%)
[dA-62]	Analog input [Ai2] monitor	[Ai2] Indicates the analog input 0 to MAX of the terminal as 0.00 to 100.00 %.	0.00 to 100.00 (%)

A

Pulse input monitor [dA-70]

- This monitor operates only when "Pulse input target function selection [CA-90]" is "Frequency reference (01)" and displays the frequency of pulses input to input terminal [7] (B-phase) and input terminal [8] (A-phase) in %, where "Pulse input frequency scale [CA-92]" is 100 %.
- When "Pulse input target function selection [CA-90]" is "Disable (00)", the operation will not be performed.
- For details, refer to "9.2.8 Setting Frequency Reference by Pulse Input".

!

- When "Speed feedback (02)" is set to "Pulse input target function selection [CA-90]", confirmation "Detect speed monitor [dA-08]" or "Current position monitor [dA-20]".
- If [CA-90] is set to "Pulse count (03)", or if pulse is input to the input terminal function "Pulse input A [PLA]" or "Pulse input B [PLB]" assigned to any input terminal by setting [CA-90] to other than (03), confirmation "Pulse count monitor [dA-28]".

Code	Name	Description	Data
[dA-70]	Pulse input monitor	Displays the entered pulse frequency as a percentage of [CA-92] as 100 %.	-100.00 to 100.00 (%)
[CA-90]	Pulse input target function selection	Setting when pulse input is used as frequency reference.	01
[CA-92]	Pulse input frequency scale	Enter the pulse frequency equivalent to the maximum frequency.	0.05 to 32.00 (kHz)

10.2.3 Monitor the Analog Input/Output Status

Q

- How do I check whether the voltage input or current input is set to the analog input terminal?
- How do I check whether the output from the analog output terminal is set to voltage or current?

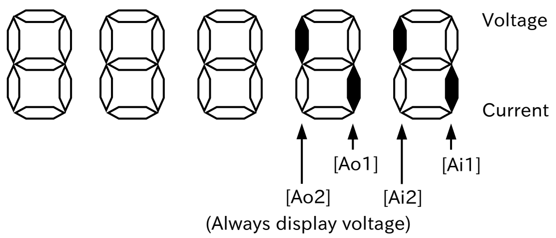
A

Analog input/output status monitor [dA-60]

- The setting status of analog input and analog output can be checked.

!

- For the [Ao2] terminal, pulse output and analog voltage output can be selected, but the voltage is always displayed on this monitor.
- The analog input terminal [Ai1]/[Ai2] and analog output terminal [Ao1]/[Ao2] can be changed in the selection status by "[Ai1] Input selection [Cb-08]", "[Ai2] Input selection [Cb-18]", "[Ao1] Output type selection [Cd-26]", and "[Ao2] Output type selection [Cd-36]". For details, refer to "9.15.3 Adjust Analog Input", "9.16.4 Monitor Data Output by Pulse Output", and "9.16.5 Monitor Data Output by Analog Output".

Code	Name	Description	Data
[dA-60]	Analog input/output status monitor	The 7-segment LED on the keypad indicates the selection status of the analog input terminal [Ai1]/[Ai2] and analog output terminal [Ao1].  	-

10.2.4 Monitor the Analog Output Abnormal State

Q
- How do I check the current value of the target monitor for the non-stationary detection function?
- How do I check the upper and lower limits of the steady state in the current output state?

A
Abnormal detection value monitor [dC-31]
- When the non-stationary detection function is used, the monitor data specified in "Abnormal detection target [bE-02]" can be checked in "Abnormal detection value monitor [dC-31]".

!
- For details of the non-stationary detection function, refer to "9.11.14 Detecting Abnormal State of Inverter".

Code	Name	Description	Data
[dC-31]	Abnormal detection value monitor	The monitor data specified in [bE-02] is displayed.	-100.00 to 100.00 (%)*1
[bE-02]	Abnormal detection target	Select the data to be monitored by the non-stationary detection function.	Refer to "9.16.3 Selecting Monitor Data for Analog/Pulse Output"

*1. Assume that the full scale of the target selected in "Abnormal detection target [bE-02]" is 100 %.

A
Abnormal detection upper level monitor [dC-32]
- It is possible to check the upper limit of the unsteady detection function in the current operation state.

!
- For details of the non-stationary detection function, refer to "9.11.14 Detecting Abnormal State of Inverter".

Code	Name	Description	Data
[dC-32]	Abnormal detection upper level monitor	Displays the current value of the upper limit level for the non-stationary detection function.	-100.00 to 100.00 (%)*1

*1. Assume that the full scale of the target selected in "Abnormal detection target [bE-02]" is 100 %.

A
Abnormal detection lower level monitor [dC-33]
- The lower limit of the unsteady detection function can be checked in the current operation state.

!
- For details of the non-stationary detection function, refer to "9.11.14 Detecting Abnormal State of Inverter".

Code	Name	Description	Data
[dC-33]	Abnormal detection lower level monitor	Displays the current value of the lower limit level of the non-stationary detection function.	-100.00 to 100.00 (%)*1

*1. Assume that the full scale of the target selected in "Abnormal detection target [bE-02]" is 100 %.

10.3 Check the Inverter Internal Status Related Data

10.3.1 Monitor the Accumulated Run Time/Power-ON Time

Q

- How much the inverter repeatedly runs and stops.
- I want to check the number of times the inverter has been turned on.
- How do I check the total operation time of the inverter?
- How do I check the total power-on time of the inverter?
- How long was the cooling fan running during startup?

A

Accumulated number of starts monitor [dC-20]

- Displays the number of times the inverter has started outputting to the motor from the stop state to the operation state.
- This data is stored in the internal memory of the inverter when the power supply is cut off.

Code	Name	Description	Data
[dC-20]	Accumulated number of starts monitor	Displays the number of times the inverter has started outputting to the motor from the stop state to the operation state.	1 to 65535 (times)

A

Accumulated number of power-on times monitor [dC-21]

- Displays the number of times the inverter has been turned on.
- This data is stored in the internal memory of the inverter when the power supply is cut off.

!

- It does not count when restarting due to an instantaneous power failure.

Code	Name	Description	Data
[dC-21]	Accumulated number of power-on times monitor	Displays the number of times the inverter has been turned on.	1 to 65535 (times)

A

Accumulated RUN time monitor [dC-22]

- The inverter enters the operating state and displays the accumulated time output to the motor.
- This data is stored in the internal memory of the inverter when the power supply is cut off.

Code	Name	Description	Data
[dC-22]	Accumulated RUN time monitor	Displays the total operation time of the inverter after shipment from the factory. This data is stored in the internal memory when the power supply is cut off.	0 to 1000000 (hr)

A

Accumulated power-on time monitor [dC-24]

- Displays the time the inverter has been powered on.
- This data is stored in the internal memory of the inverter when the power supply is cut off.

Code	Name	Description	Data
[dC-24]	Accumulated power-on time monitor	Displays the total energizing time of the inverter after shipping from the factory. This data is stored in the internal memory when the power supply is cut off.	0 to 1000000 (hr)

A

Accumulated cooling-fan run time monitor [dC-26]

- Displays the amount of time the inverter cooling fan has been running.
- This data is stored in the internal memory of the inverter when the power supply is cut off.

!

- "Accumulated cooling-fan run time monitor [dC-26]" can be cleared by setting "clear accumulated cooling fan run time monitor [bA-71]". For details, refer to "9.11.10 Lifetime Warning for Cooling Fan".

Code	Name	Description	Data
[dC-26]	Accumulated cooling-fan run time monitor	Displays the accumulated operating time of the cooling fans.	0 to 1000000 (hr)

!

- [dC-20]/[dC-21]/[dC-22]/[dC-24]/[dC-26] is not cleared even if the parameter is initialized.

10.3.2 Monitor the Cooling Fin Temperature

- How do I know the temperature of the inverter cooling fins?

Cooling fin temperature monitor [dC-15]

- Displays the cooling fin temperature near the main element of the inverter.

- When the cooling fin temperature exceeds 120˚C max, "Temperature error [E021]" will occur.

Code	Name	Description	Data
[dC-15]	Cooling fin temperature monitor	Displays the temperature of the cooling fins.	−20.0 to 200.0 (℃)

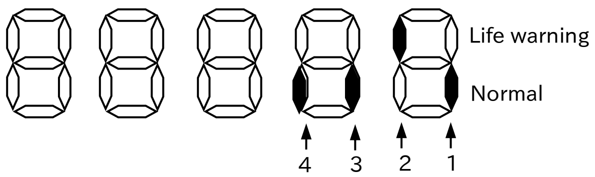
10.3.3 Monitor the Life Assessment Results

- I worry about the life of the inverter.
- I want to know the timing of maintenance.

Life assessment monitor [dC-16]

- This indicator lights up on 7-segment LED of the keypad. It indicates the status of the life part.
- The following four conditions can be checked on the life diagnosis monitor.
  1:Life of the electrolytic capacitor on the substrate
  2:Cooling fan life
  3:Power module life
  4:Life of the inrush current prevention circuit
- The life can be diagnosed by "Capacitor life warning [WAC]", "Cooling-fan life warning [WAF]", "Power module life warning [WAP]" and "Inrush circuit life warning [WAIC]" of the output terminal function. For details, refer to "9.11.9 Lifetime Warning for Capacitor on the Board", "9.11.10 Lifetime Warning for Cooling Fan", and "9.11.11 Lifetime Warning for Power Module".

- The life of the electrolytic capacitor on the board is calculated once every 10 minutes. If the power is turned ON/OFF repeatedly in this period or less, the service life cannot be diagnosed normally.
- When "Cooling fan control method selection [bA-70]" is set to other than "Always ON(00)", the fan is automatically stopped due to failure. Lifetime diagnostics are not performed while the fan is stopped. For details on cooling fan operation, refer to "9.10.7 Selecting Cooling Fan Operation".
- Models of single-phase 200V class 0.75kW or lower, three-phase 200V class 0.75kW or lower and three-phase 400V class 0.4kW are not installed the cooling fan, however the life diagnostic function of the cooling fan operates according to operating time and cooling fin temperature.

Code	Name	Description	Data
[dC-16]	Life assessment monitor	The 7-segment LED on the keypad indicates the status of the life components. 1:Electrolytic capacitor on the substrate 2:Cooling fan 3:Power modules 4:Inrush current prevention circuit 	–

10.3.4 Monitor the Operating Mode

Q

- How do I check the current load specifications and its rated current?
- I want to confirm which of induction motor (IM)/synchronous (permanent magnet) motor (SM(PMM)) can be operated.
- How do I check if the current motor constant is due to the latest auto-tuning?

A

Inverter load type status [dC-01]

- Displays the current load specification selection status.
- The load specification of the inverter is changed in "Load type selection [Ub-03]". For details, refer to "8.1.2 Changing Load Type of the Inverter".

!

- The rated current and current derating characteristics vary depending on the selection of the load specifications. Please also check them.

Code	Name	Description	Data
[dC-01]	Inverter load type status	Light duty rating (LD) selected	01
		Normal duty rating (ND) selected	02

A

Rated current monitor [dC-02]

- Displays the rated output current for the currently selected load specification.
- The load specification of the inverter is changed in "Load type selection [Ub-03]". For details, refer to "8.1.2 Changing Load Type of the Inverter".

!

- The rated current and current derating characteristics vary depending on the selection of the load specifications. Please also check them.

Code	Name	Description	Data
[dC-02]	Rated current monitor	Displays the rated output current of the inverter in the currently selected load specification.	0.0 to 6553.5 (A)

A

IM/SM monitor [dC-45]

- Indicates whether the drive is set to run induction motor (IM) or synchronous (permanent magnet) motor (SM(PMM)).
- The motor to be operated is changed by "Control mode selection [AA121]". For details, refer to "9.5.1 Select Control Mode".

!

- Correct the motor using an inverter for operation, parameters related to motor specifications must be set before operation. Refer to "Chapter 8 Mandatory Setting for Motor Drive and Test Run" for details.
- For more information about SM/PMM motor control, contact your supplier.

Code	Name	Description	Data
[dC-45]	IM/SM monitor	Induction motor (IM) selected	00
		Synchronous (permanent magnet) motor (SM(PMM)) being selected	01

A

Auto-tuning monitor [dC-47]

- It is possible to check whether the executed auto-tuning was completed normally or aborted due to some factor.

!

- For details on auto-tuning, refer to "8.3 Carrying Out Motor Auto-tuning".

Code	Name	Description	Data
[dC-47]	Auto-tuning monitor	Auto-tuning complete: The previous auto-tuning was successful, or auto-tuning has not been executed.	01
		Auto-tuning failure: Last auto-tuning is finished in the middle.	02

A

Emergency-force drive mode monitor [dC-49]

- You can check whether the emergency force drive mode (Em-force mode) or the commercial power supply operation mode (bypass mode) is operating.

!

- For details of the forced operation mode or bypass mode, refer to "9.7.12 Emergency Force Operation".

Code	Name	Description	Data
[dC-49]	Emergency-force drive mode monitor	Disabled: Not in Em-force mode and bypass mode.	00
		EMF active: Operation is in progress in EM-force mode.	01
		BYP active: Operation in progress in Bypass mode.	02

10.3.5 Monitor the Frequency Reference Source and RUN Command Source

Q

- I want to check whether the command input source of main speed and sub speed are incorrect with the contents set by my own.
- I want to check whether the RUN command input source is incorrect with the contents set by my own.

A

Main speed input source monitor [dC-07]

- The currently enabled main speed input source can be checked.

!

- The main speed input source changes according to the status of the input terminal function and other functions in addition to the setting of "Main speed input source selection [AA101]". For details, refer to "9.2 Selecting Frequency Reference Source".

Code	Name	Description	Data
[dC-07]	Main speed input source monitor	Terminal [Ai1]	01
		Terminal [Ai2]	02
		Keypad (Multi-Speed 0 [Ab110])	07
		Multi-speed 1 to 15 ([Ab-11] to [Ab-25])	09 to 23
		Jogging [AG-20]	24
		RS485 Setting	25
		Communication options	26
		Pulse input	29
		Program operation function (EzSQ)	31
		PID operation	32
		Potentiometer on the remote operator (MOP-VR)	33
		Holding frequency by analog command holding function	34

A

Sub speed input source monitor [dC-08]

- The currently enabled sub speed input source can be checked.

!

- The sub speed input source changes according to the status of the input terminal function and other functions in addition to the setting of "Sub speed input source selection [AA102]". For details, refer to "9.2 Selecting Frequency Reference".

Code	Name	Description	Data
[dC-08]	Sub speed input source monitor	Disable	00
		Terminal [Ai1]	01
		Terminal [Ai2]	02
		Keypad (Sub speed setting [AA104])	08
		RS485 setting	25
		Communication options	26
		Pulse input	29
		Program operation function (EzSQ)	31
		PID operation	32
		Potentiometer on the remote operator (MOP-VR)	33

A

RUN command input source monitor [dC-10]

- The RUN command input source currently enabled can be checked.

!

- The RUN command input source varies depending on the status of the input terminal function and other functions in addition to the setting of "RUN command input source selection [AA111]". Refer to "9.1 Selecting RUN Command and Alarm Reset" for details.

Code	Name	Description	Data
[dC-10]	RUN command input source monitor	[FW]/[RV] terminal	00
		3 Wire ([STA]/[STP]/[F/R] terminal)	01
		Keypad (RUN-key)	02
		RS485 Setting	03
		Option	04

10.3.6 Monitor Two Types of Data on One Monitor Screen

Q

- I want to switch between two types of data on one monitor parameter.

A

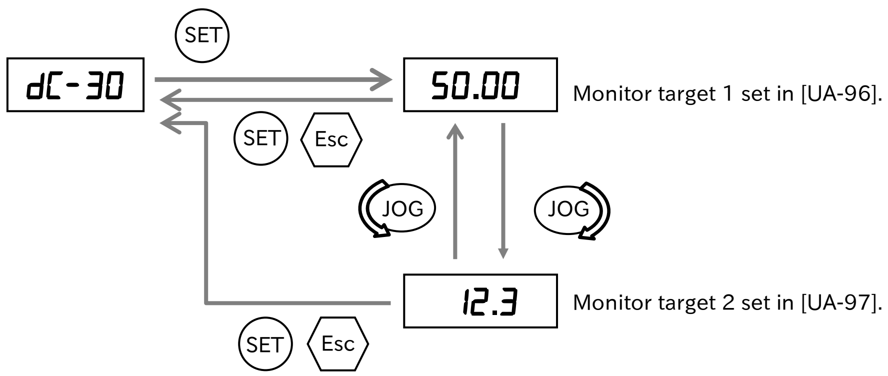
Dual monitor [dC-30]

- You can set any two monitor items and switch between monitors by turning JOG dialing left and right.
- Set the function code of the monitor target to "Dual monitor target 1 selection [UA-96]" and "Dual monitor target 2 selection [UA-97]".

!

- Even if "Output frequency monitor [dA-01]" or "Output frequency scale conversion monitor [dA-06]" is set to "Dual monitor target 1 selection [UA-96]" and "Dual monitor target 2 selection [UA-97]" and "Enable frequency changes through monitor display [UA-93]" is set to "Enable (01)", the frequency can not be changed from [dC-30].

Code	Name	Description	Data
[dC-30]	Dual monitor	Monitor the two items set in [UA-97] and [UA-96].	—
[UA-96]	Dual monitor target 1 selection	Except [dC-30], you can set the parameters of the function grouping dA/db/dC/FA.	dA-**, db-**, dC-**, FA-** (excluding dC-30)
[UA-97]	Dual monitor target 2 selection		



10.3.7 Checking the Detail of Warning Status

Q

- The inverter outputs by some function. It is limited, so we would like to check the factor.
- How do I check the timing when an overload warning is issued?

A

Icon 2 LIM detail monitor [dC-37]

- Displays the currently operating motor drive limit function.

!

- For details of each restricted function, refer to the items of each function in this guide.

Code	Name	Description	Data
[dC-37]	Icon 2 LIM detail monitor	This is not a motor drive limit state.	00
		The overcurrent suppression function is operating.	01
		The overload restriction function is operating.	02
		The overvoltage suppression function is operating.	03
		The torque limit function is operating.	04
		The upper/lower limit function and frequency jump function are operating.	05
		The output frequency is set to less than the minimum frequency.	06

A

Icon 2 ALT detail monitor [dC-38]

- Displays the advance notice function that is currently operating.

!

- For details of each notice function, refer to the items of each function in this guide.

Code	Name	Description	Data
[dC-38]	Icon 2 ALT detail monitor	This is not the operation status of the advance notice function.	00
		An overload warning is output.	01
		Motor thermal warning is output.	02
		Controller thermal warning is output.	03
		Motor overheat warning is output.	04

A

Icon 2 RETRY detail monitor [dC-39]

- Displays the current retry/restart status.

!

- For details of the retry function, see "9.7 Selecting Start/Stop Modes" and "9.9 Using Trip Prevension Functions".

Code	Name	Description	Data
[dC-39]	Icon 2 RETRY detail monitor	No retry or restart is in progress.	00
		Retry operation is waiting.	01
		Waiting for a restart operation.	02

A

Icon 2 NRDY detail monitor [dC-40]

- If the inverter cannot be operated, the cause is displayed.
- When "Icon 2 NRDY detail monitor [dC-40]" displays "Ready (00)", at the same time "Inverter ready [IRDY]" is ON.

!

- To start operation, the displayed abnormal condition must be cleared. If multiple sources are occurring at the same time, the smaller number is displayed first.
  e.g.: When the "Free run stop [FRS]" input terminal is turned ON during trip.
  = "Trip occurrence (01)" is displayed in [dC-40].
  When the trip state is released, "Free run (08)" is displayed.

Code	Name	Description	Data
[dC-40]	Icon 2 NRDY detail monitor	Operation preparation is complete. "Inverter ready [IRDY]" signal is ON.	00
		A trip has occurred.	01
		Power is lost or undervoltage.	02
		It is in the reset state or the reset release wait state.	03
		STO is enabled.	04
		Waiting until the internal processing of the inverter is completed.	05
		There is an inconsistency in the set data. (Warning)	06
		Abnormalities exist in sequence operation.	07
		Free Run Stop is Enabled.	08
		Operation is prohibited by the input terminal function "RUN enable [REN]".	09

10.4 Check the EzSQ Function/PID Function Related Data

10.4.1 Monitor the EzSQ Function Related Data

Q

• How do I check EzSQ related data?

A

EzSQ related monitor [db-01] to [db-29]

• The following EzSQ related data can be monitored. For more information, see "Chapter 12 ProDriveNext/EzSQ".

Code	Name	Description	Data
[db-01]	Program download monitor	Program is not installed: EzSQ program has not been downloaded.	00
		Program is installed: EzSQ program has been downloaded.	01
[db-02]	Program No. monitor	Displays the program No. that was set when the program was created.	0000 to 9999
[db-03]	Program counter (Task-1)	Displays the program line number being executed by Task-1.	0 to 1024
[db-04]	Program counter (Task-2)	Displays the program line number being executed by Task-2.	
[db-05]	Program counter (Task-3)	Displays the program line number being executed by Task-3.	
[db-06]	Program counter (Task-4)	Displays the program line number being executed by Task-4.	
[db-07]	Program counter (Task-5)	Displays the program line number being executed by Task-5.	
[db-08]	User monitor-0	This displays the value assigned to Umon(00) in the program.	-2147483648 to 2147483647
[db-10]	User monitor-1	This displays the value assigned to Umon(01) in the program.	
[db-12]	User monitor-2	This displays the value assigned to Umon(02) in the program.	
[db-14]	User monitor-3	This displays the value assigned to Umon(03) in the program.	
[db-16]	User monitor-4	This displays the value assigned to Umon(04) in the program.	
[db-18]	Analog output monitor YA0	EzSQ program displays the output to the general-purpose analog-output YA (0) and YA (1).	0.00 to 100.00 (%)
[db-19]	Analog output monitor YA1		
[db-28]	Program status	Program wait in progress	00
		Program running	01
		During a break	02
		Stopped	03
		Trip in progress	04
[db-29]	Error task number	Displays the number of the task where the error occurred when an error occurred in EzSQ program. If no error has occurred, 0 is displayed.	0 to 5

10.4.2 Monitor the PID Function Related Data

Q

• How to check the PID function related data?

A

PID related monitors ([db-30] to [db-64])

• The following PID related data can be monitored. For details, refer to "9.8 Driving by PID Process Control".

Code	Name	Description	Data
[db-30]	PID1 feedback value 1 monitor	Displays the feedback data 1/2/3 of PID1. The data range and unit vary depending on the parameter setting.	-100.00 to 100.00 (%)*1
[db-32]	PID1 feedback value 2 monitor		
[db-34]	PID1 feedback value 3 monitor		
[db-36]	PID2 feedback value monitor	Displays the feedback data value of PID2. The data range and unit vary depending on the parameter setting.	-100.00 to 100.00 (%)*2
[db-42]	PID1 set-point monitor (after calculation)	Displays PID1 target value after the calculation performed according to the setting of "PID1 set-point calculation symbol selection [AH-50]". The data range and unit vary depending on the parameter setting.	-100.00 to 100.00 (%)*1
[db-44]	PID1 feedback value monitor (after calculation)	Displays PID1 feedback data after the calculation performed according to the setting of "PID1 feedback calculation symbol selection [AH-54]". The data range and unit vary depending on the parameter setting.	-100.00 to 100.00 (%)*1
[db-50]	PID1 output monitor	Displays PID after the limiter as a percentage of the maximum frequency as 100%.	-100.00 to 100.00 (%)
[db-51]	PID1 deviation monitor	Displays the final deviations used to control PID1.	-200.00 to 200.00 (%)
[db-52]	PID1 deviation 1 monitor	Displays the deviation between the target setpoint 1 of PID1 and the feedback data1.	-200.00 to 200.00 (%)
[db-53]	PID1 deviation 2 monitor	Displays the deviation between the target setpoint 2 of PID1 and the feedback data2.	-200.00 to 200.00 (%)
[db-54]	PID1 deviation 3 monitor	Displays the deviation between the target value-3 of PID1 and the feedback data-3.	-200.00 to 200.00 (%)
[db-55]	PID2 output monitor	Displays PID2 output.	-100.00 to 100.00 (%)
[db-56]	PID2 deviation monitor	Displays the deviations used to control PID2.	-200.00 to 200.00 (%)
[db-61]	Current PID P-Gain monitor	Displays the current P gain.	0.0 to 100.0
[db-62]	Current PID I-Gain monitor	Displays the current I gain.	0.0 to 3600.0 (s)
[db-63]	Current PID D-Gain monitor	Displays the current D gain.	0.00 to 100.00 (s)
[db-64]	PID feedforward monitor	Displays the feedforward command value.	0.00 to 100.00 (%)

*1. "PID1 scale adjustment ([AH-04] to [AH-06])" changes the data-range.
For more information, please refer to "9.8.5 Unit Converter Function for PID Control".

*2. "PID2 scale adjustment ([AJ-04] to [AJ-06]) will change the setting.
For more information, please refer to "9.8.5 Unit Converter Function for PID Control".

10.5 Check Trip, Retry and Warning Related Data

10.5.1 Monitor the Number of Trips and Trip History

Q

- How to check the number of times the inverter has tripped?
- How to check the information when errors occurred?

A

Trip counter [dE-01]

- Displays the number of times the inverter has tripped.
- This data is stored in the internal memory of the inverter when the power is shut off.

Code	Name	Description	Data
[dE-01]	Trip counter	Displays the number of times the inverter has tripped. This data is stored in the internal memory when the power is shut off.	0 to 65535 (times)

A

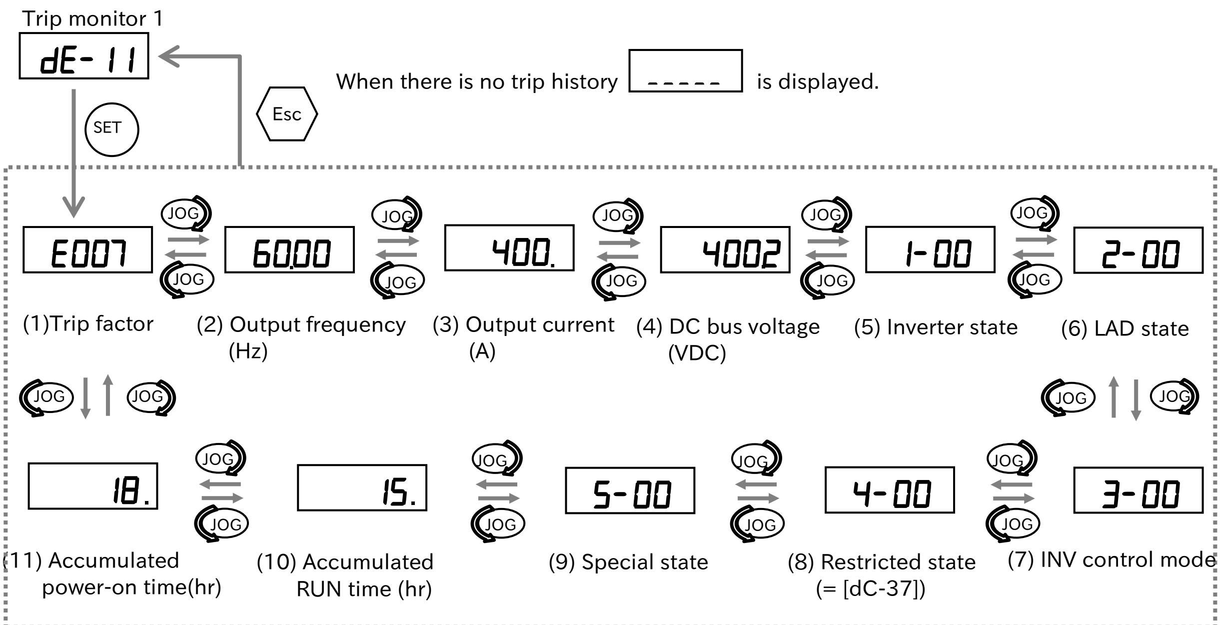
Trip monitor 1 to 10 ([dE-11] to [dE-20])

- The trip history data up to the past 10 times is displayed.
- This data is stored in the internal memory of the inverter when the power is shut off.
- The latest trip information can be monitored in "Trip monitor 1 [dE-11]".

!

- For details about what is displayed in "Trip monitor 1 to 10 ([dE-11] to [dE-20])", refer to "15.2 Troubleshooting for Protection Functions Related Error".

Code	Name	Description	Data
[dE-11] to [dE-20]	Trip monitor 1 to Trip monitor 10	Displays the following information when the inverter trips. (1) Trip factor (2) Output frequency (signed) (3) Output current (4) DC bus voltage (5) Inverter state (6) LAD state (7) Inverter control mode (8) Restricted state (=[dC-37]) (9) Special state (10) Accumulated RUN time (11) Accumulated power-on time This data is stored in the internal memory when the power is shut off.	–



10.5.2 Monitor the Retry History

Q

- How to check the information when inverter re-try to operation?

A

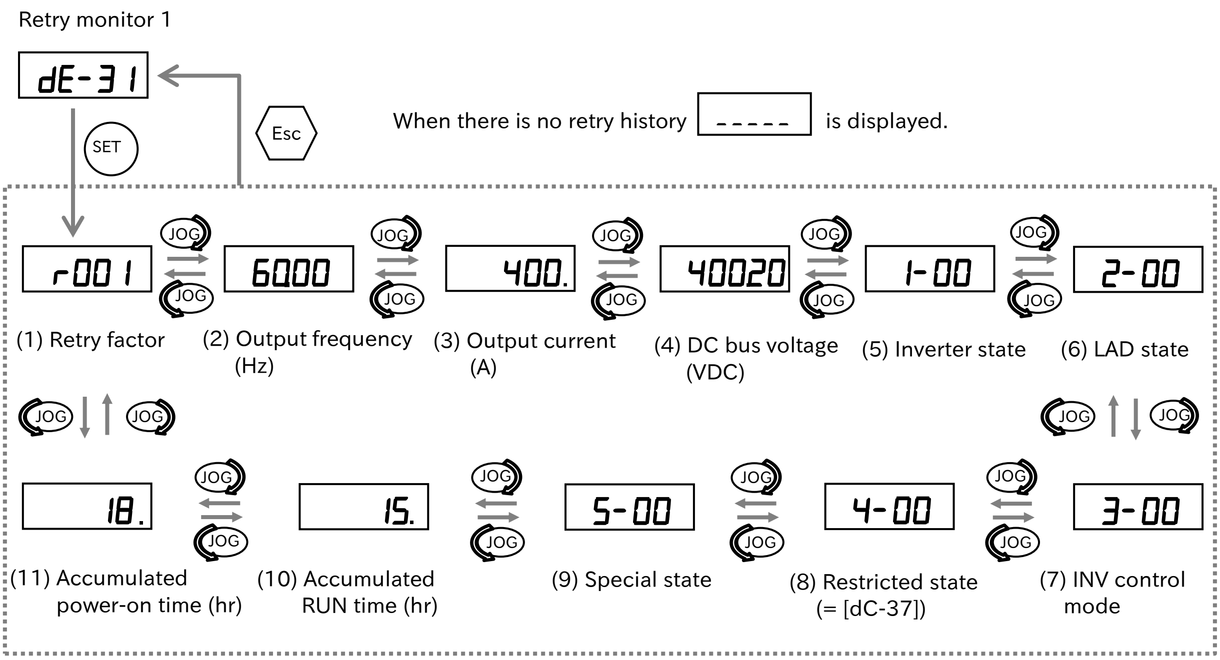
Retry monitor 1 to 10 ([dE-31] to [dE-40])

- The trip history data up to the past 6 times is displayed.
- This data is stored in the internal memory of the inverter when the power is shut off.
- The latest trip information can be monitored in "Retry monitor 1 [dE-31]".

!

- For details about what is displayed in "Retry monitor 1 to 10 ([dE-31] to [dE-40])", refer to "15.2 Troubleshooting for Protection Functions Related Error".

Code	Name	Description	Data
[dE-31] to [dE-40]	Retry monitor 1 to Retry monitor 10	Displays the following information when the inverter retry. (1) Retry factor (2) Output frequency (signed) (3) Output current (4) DC bus voltage (5) Inverter state (6) LAD state (7) Inverter control mode (8) Restricted state (=[dC-37]) (9) Special state (10) Accumulated RUN time (11) Accumulated power-on time This data is stored in the internal memory when the power is shut off.	–



10.5.3 Monitor the Warning Information

Q

- How to check the detailed information when a warning occurs?

A

Warning monitor [dE-50]

- A warning is displayed when the set parameter is inconsistent with other settings.
- During a warning, "Program LED [PRG]" on the keypad blinks until the data is corrected.

!

- Refer to "15.3.1 Warning Displays" for details of the warning display.

Code	Name	Description	Data
[dE-50]	Warning monitor	A warning is displayed when the set parameter is inconsistent with other settings.	—

(Memo)

11

Chapter 11 RS485 Communication

WJ-C1 supports RTU for Modbus communication mode the physical layer as RS485. This chapter describes the communication methods that can operate in RS485 communication.
Hitachi's original inter-inverter communication EzCOM function using Modbus protocol can also be used. Select the communication function that you want to use and configure the settings.
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

11.1 Modbus-RTU Communication

11.1.1 Communication Specifications and Setting Parameters

Q
- Finding the standard-equipped Modbus communication specs.

A
- WJ-C1 is standard-equipped with a RS485 compliant Modbus-RTU port. It can communicate with external networked control devices. The basic specifications and setting parameters of communication are as follows.

!
- In Modbus communication of WJ-C1, the data which does not fit in 1 word is set as "2 register length parameter", and there is the data which is constrained when accessing. For more information, see the exception code [27h] in "11.2.9 Exceptional Responses".

■ Modbus communication protocol

Item	Specifications	Remarks
Protocol	Modbus-RTU (Slaves)	
Transmission speed	2400/4800/9600/19.2k/38.4k/57.6k/76.8k/115.2k bps	Set by parameter
Communication method	Half-duplex communications.	
Synchronous system	Asynchronous method	
Transmission code	Binary	
Transmission method	Transmit from low bit (LSB first)	
Compliant interface	RS485	
Data bit length	8 bits	
Parity	None/Even/Odd	Set by parameter
Stop bit length	1 bit/2 bits	Set by parameter
Starting method	One-Sided Activation by Host-Side Commands	
Wait time	Silent interval + 0 to 1000 ms	Set by parameter
Connection type	1: N (N=max. 247) (Up to 32 units can be connected without repeaters (including master))	Set by parameter
Error checking	Overrun/Framing /CRC-16/ Horizontal Parity	

■ Parameters related to Modbus communication

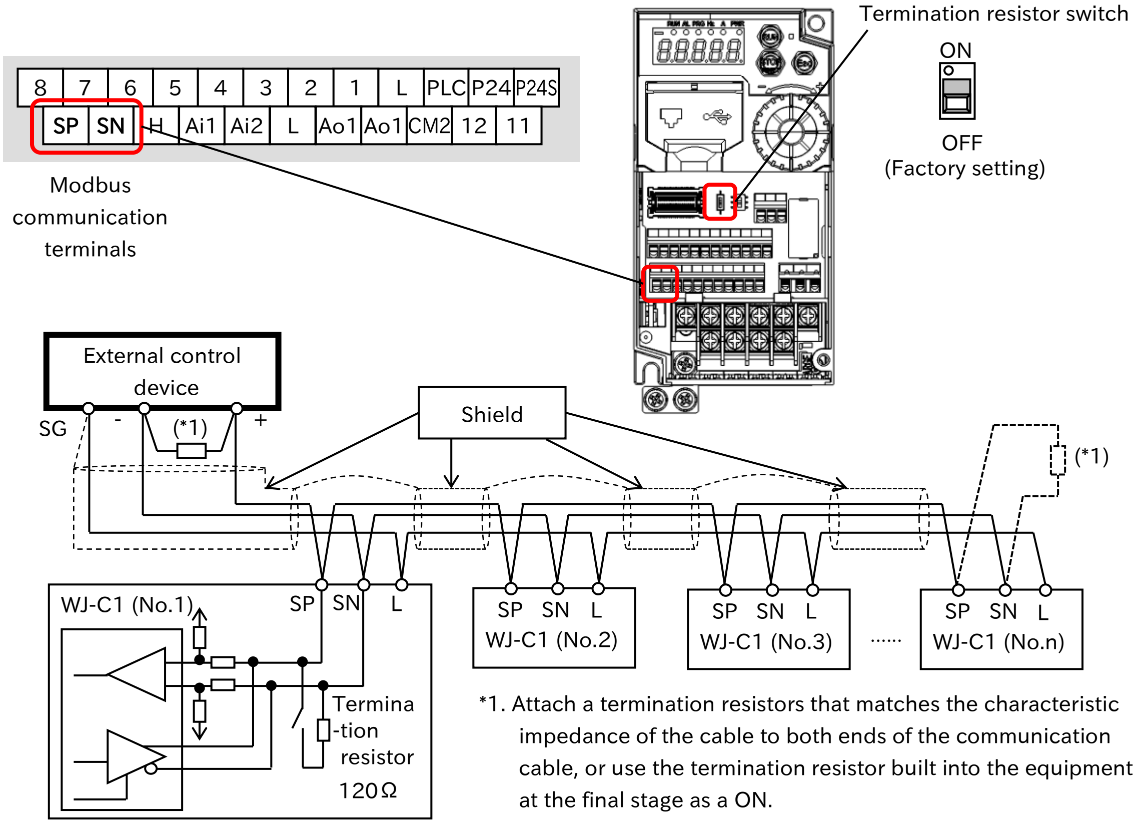
Code	Name	Description	Data
[AA101]	Main speed input source selection	Set to Modbus communication	08
[AA111]	RUN command input source selection	Set to Modbus communication	03
[CC-01] [CC-02] [CC-07]	Output terminal function	Communication line disconnection [NDc]: This signal is turned ON when a communication error occurs.	049
[CF-01]	RS485 communication baud rate selection	Set the communication transmission speed.	03 (2400 bps) 04 (4800 bps) 05 (9600 bps) 06 (19.2 kbps) 07 (38.4 kbps) 08 (57.6 kbps) 09 (76.8 kbps) 10 (115.2 kbps)
[CF-02]	RS485 communication node address	Assign the inverter station number.	1 to 247

Code	Name	Description	Data
[CF-03]	RS485 communication parity selection	No parity	00
		Even parity	01
		Odd parity	02
[CF-04]	RS485 communication stop bit selection	1 bit	01
		2 bits	02
[CF-05]	RS485 communication error selection	When communication error occurs, it trips at "RS485 communication error [E041]".	00
		When communication error occurs, after decelerating stop, trip at "RS485 communication error [E041]".	01
		Ignore communication errors. No trip occurs.	02
		Free-run stop will be performed in case of communication error. No trip occurs.	03
		Decelerates to a stop when communication error occurs. No trip occurs.	04
[CF-06]	RS485 communication timeout setting	If communication is interrupted and this set time has elapsed, the motor trips due to "RS485 communication error [E041]". When 0.00 s, timeout is not judged.	0.00 to 100.00 (s)
[CF-07]	RS485 communication wait time setting	Set the time until the inverter responds.	0 to 1000 (ms)
[CF-08]	RS485 communication mode selection	Use Modbus-RTU	01
		Use inter-inverter communication (EzCOM)	02
		Use inter-inverter communication (EzCOM) (controlling inverter)	03
[CF-11]	Register data AV<=>% conversion function	Set the response data unit to A (current) and V (voltage).	00
		Set the response data unit as a percentage of the rated value.	01
[CF-12]	RS485 endianness selection	Big endian	00
		Little Endian	01
		Special endian	02
[CF-20]	EzCOM start node No.	Parameters related to inter-inverter communication (EzCOM) function. Refer to "11.4 Inter-Inverter Communication Function EzCOM" for more information.	1 to 8
[CF-21]	EzCOM end node No.		1 to 8
[CF-22]	EzCOM start method selection		00, 01
[CF-23]	EzCOM data size		1 to 5
[CF-24] [CF-27] [CF-30] [CF-33] [CF-36]	EzCOM destination address 1 to 5		1 to 247
[CF-25] [CF-28] [CF-31] [CF-34] [CF-37]	EzCOM destination register 1 to 5		0000h to FFFFh
[CF-26] [CF-29] [CF-32] [CF-35] [CF-38]	EzCOM source register 1 to 5		0000h to FFFFh
[CG-01]	Register mapping function selection	Parameters related to Modbus mapping function. For more information, see "11.3 Modbus Mapping Function".	00, 01
[CG-11] to [CG-20]	External register 1 to 10		0000h to FFFFh
[CG-31] to [CG-40]	External register 1 to 10 format		00, 01
[CG-51] to [CG-60]	External register 1 to 10 scaling		0.001 to 65.535
[CG-71] to [CG-80]	Internal register 1 to 10		0000h to FFFFh

11.1.2 Communication Wiring and Connection

A

- The figure below shows an example of connecting Modbus communication wires. When multiple units are connected, each inverter is connected in parallel.
- Use a 3-wire shielded cable for connection between the twisted-pair cable for communication and ground. Connect the signal ground (SG) of the external control device to the [L] terminal of the inverter.
- Attach termination resistors that match the characteristic impedance of the cable to both ends of the communication cable. If the last stage is WJ-C1, turn ON the termination resistor switch. When Modbus communication is performed with one inverter, turn ON the termination resistor switch of that inverter. (The termination resistor built into WJ-C1 is 120 Ω.)



*1. Attach a termination resistors that matches the characteristic impedance of the cable to both ends of the communication cable, or use the termination resistor built into the equipment at the final stage as a ON.

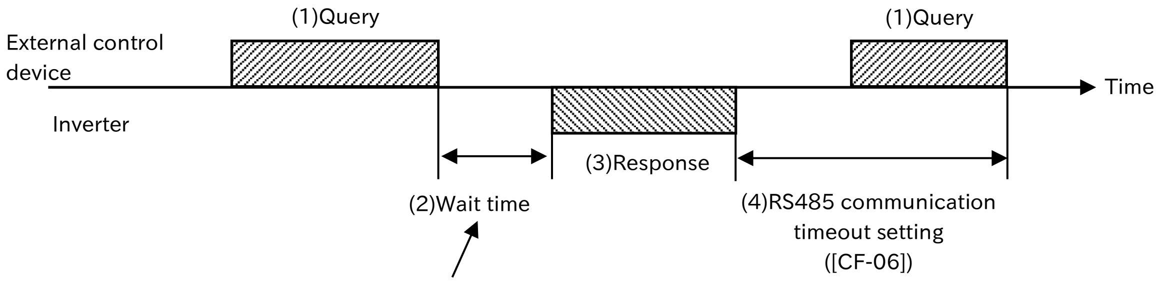
!

- Communication is possible using only a 2-wire twisted pair cable. However, communication may become unstable due to noise, which is not recommended.
- The communication cable must be separated from the high-voltage circuit such as the power line and alarm relay wiring, and must not be laid in parallel.
- Communication may become unstable depending on the operating environment of the inverter, cables used for communication lines, and wiring conditions. In such a case, follow the instructions below.
  - Check that the termination resistors are connected to both ends of the communication cable. Or, use a termination resistor that matches the characteristic impedance of the cable.
  - Check the connection between the signal ground (SG) of the external control device (master) and the [L] terminal of the inverters.
  - Normally, wire shields should be grounded at a single point SG the external control device. Or, change the grounding method of the wiring shield while checking whether communication is stable. (For example, grounding to the [L] terminal of any inverter, wiring shield grounding, etc.)
  - If the communication range is long (more than 100 m), lower the transfer rate or insert a repeater.

11.1.3 Communication Procedure

Communication procedure

- Modbus-RTU communication between the external control device and the inverter is performed as follows.



Silent interval (3.5 characters) + "RS485 communication wait time setting [CF-07]"
(Modbus-RTU: 1 character =11bit)

(1) A query message is sent from the external control device to the inverter.

(2) The inverter waits for the silent interval time and the setting time of "RS485 communication wait time setting [CF-07]" after receiving a query message.
(The silent interval is 3.5 characters long as the wait time determined in Modbus-RTU communication. For Modbus-RTU communication, 1 character is 11 bit.)

(3) The response message is returned from the inverter to the external control device.

(4) After sending the response message, the inverter waits for the completion of receiving the following query message during the time set in "RS485 communication timeout setting [CF-06]". (If [CF-06] is 0.00 seconds, timeout judgment is not performed.) When a query message is received, the inverter performs processing according to the message, and then the operation shown in (2) is performed. When timeout occurs, the inverter will wait for the reception of a query message and will operate according to the setting of "RS485 communication error selection [CF-05]".

- Monitoring of communication time-out starts after the first transmission/reception is established after power-on or reset. If transmission/reception has never been established, a communication timeout does not occur.

11.1.4 Message Configuration

A

- A command message sent from the master to the slave is called a query, and a response message from the slave is called a response. The following shows the transmission format for queries and responses.

Query
Slave address
Function code
Query data
Error checking (CRC-16)

Response
Slave address for checking
Function code for checking
Response data
Error checking (CRC-16)

(1) Slave address (communication station number)

- The slave address is a number in the range of 1 to 247 that is set in advance for each inverter (slave). (Only the inverter matching the slave address of the query will fetch the query.)
- If "0" is specified for the slave address of the transmission destination on the master side, broadcasting (simultaneous broadcasting) to all stations can be performed. In the case of broadcast, all slaves receive data but do not return a response.
- Data cannot be read or looped back during a broadcast.
- In Modbus specification, the slave address is 1 to 247. However, if the slave address 250 to 254 is used in the master, broadcasting can be performed only for a particular slave address. (The slave does not return a response. The broadcast is valid only for the write command (05h, 06h, 0Fh, 10h).)

Slave address	Destination
250 (FAh)	Broadcast to slave addresses 01 to 09
251 (FBh)	Broadcast to slave addresses 10 to 19
252 (FCh)	Broadcast to slave addresses 20 to 29
253 (FDh)	Broadcast to slave addresses 30 to 39
254 (FEh)	Broadcast to slave addresses 40 to 247

(2) Function code

- Specifies the function to be executed by the inverter in function code.
- The corresponding function code is shown below.

Function code	Function	Maximum number of data bytes that can be handled by a message	Maximum number of data items that can be handled by a message
01h	Read coil status	4	32 Coils (in bits)
03h	Read holding registers	32	16 registers (in byte)
05h	Write to single coil	2	1 Coil (in bits)
06h	Write to holding register	2	1 register (in byte)
08h	Loop-back Test	-	-
0Fh	Write to multiple coils	4	32 Coils (in bits)
10h	Write to multiple registers	32	16 registers (in byte)
17h	Read/Write to multiple holding registers	32/32	16/16 Registers (in Byte)

(3) Data

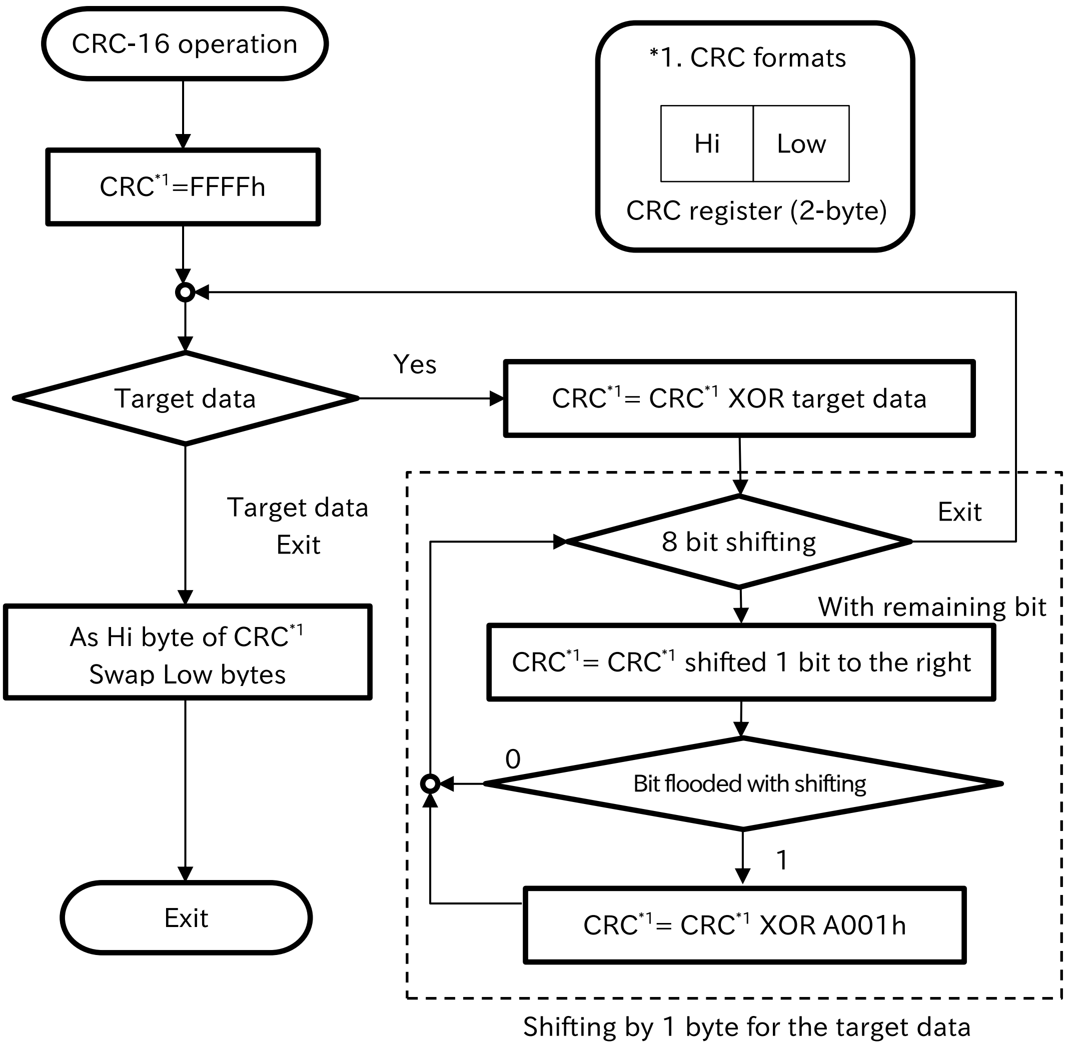
- Sends data related to function codes.
- The data transmission format varies depending on the function code.
- The following data formats are supported among the data used for Modbus communication.

Data name	Description
Coil	2-value data that can be read/written (1-bit length)
Holding register	16-bit data that can be read/written

- In Modbus communication of WJ-C1, there is a restriction on writing to "2 register length parameter". For more information, see the exception code [27h] in "11.2.9 Exceptional Responses".

(4) Error checking

- Modbus-RTU error checking uses CRC(Cyclic Redundancy Check).
- Generation polynomials of CRC-16 ($X^{16}+X^{15}+X^2+1$) are used to generate CRC.
- A CRC is a 16bit of data generated for a block of any length of data in 8bit.



(5) Communication time

- The response of the inverter after the inverter receives a query is as follows: Silent interval (3.5 characters) + "RS485 communication wait time setting [CF-07]" + "Processing time (several msec) for response messaging etc.
- Always allow an interval of at least the silent interval (3.5 characters or more) between the reception of a response from the inverter and the transmission of the next query by the external control device.

(6) Normal response

- Responses are returned in the format-for-query format description in "11.2 Modbus-RTU Function Codes".

(7) Exceptional response

- If there is a fault (except communication error) in the content of the query, the inverter returns an exception response without performing anything.
- Check the function code of the response for error judgment. The function code of the exception response is 80h added to the function code of the query.
- For details on the error details, see "11.2.9 Exceptional Responses".

Configuring Exception Response Fields

Slave address
Function code
Exception code
CRC-16

(8) No response

- The inverter ignores the query and does not return a response in the following cases:
  - When a broadcast (a query with a slave address of "0") is received.
  - When a communication error is detected in the query reception processing.
  - When the slave address of the query and the inverter setting slave address do not match.
  - When the time interval between the data comprising the message and the data is 3.5 characters or less.
  - When the data length of a query is invalid.
  - When the reception interval exceeds 1.5 characters in a frame.
  - When the error check code of the query does not match (CRC error).
  - When a group-based broadcast (a query with a slave address in the range of 250 to 254) is received.

!

- In the external control device, provide a timer to monitor response messages from the inverter, and provide retransmission processing or abnormality processing such as sending the same query again if there is no response message reply within a specific time.

11.2 Modbus-RTU Function Codes

11.2.1 Read Coil Status [01h]

Q

- I want to read out several coil-state by Modbus communication.

A

- External control device can read the status of the coil (ON/OFF).
- The following shows an example when reading the status of the input terminals [1] to [8] of the inverter for slave address 1. The status of input terminals [1] through [8] are as follows.

Input terminal number	1	2	3	4	5	6	7	8
Coil No.	0005h	0006h	0007h	0008h	0009h	000Ah	000Bh	000Ch
Terminal status	ON	OFF	ON	OFF	OFF	OFF	ON	OFF

Query

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	01
3	Coil starting number (higher) *2	00
4	Coil starting number (lower) *2	04
5	Number of coils (higher) *3	00
6	Number of coils (lower) *3	08
7	CRC-16 (higher)	7C
8	CRC-16 (lower)	0D

Coil start number = coil number-1

Response

No.	Field Name	e.g. (HEX)
1	Slave address	01
2	Function code	01
3	Number of data bytes	01
4	Read coil data *4	45
5	CRC-16 (higher)	90
6	CRC-16 (lower)	7B

Input terminal [7]
Input terminal [3]
Input terminal [1]
45h=0100 0101

*1. Broadcast is not possible.
*2. Note that the start number has a value of 1 less. (Start Number)-Specifies the value of 1.
*3. When the number of read-out coils exceeds 0 or 32, the exception response of the exception code [03h] is returned.
*4. Data of the number of data bytes is transferred.

- The coil data of the response is the status of the coil number 0005h to 000Ch with the coil 0005h as LSB(0 bit. If the coil data is not 1byte(8 bit) units, the higher bit is extended by zeros to 1byte(8 bit) units.

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Coil No.	000Ch	000Bh	000Ah	0009h	0008h	0007h	0006h	0005h
Coil status	OFF	ON	OFF	OFF	OFF	ON	OFF	ON
45h	0	1	0	0	0	1	0	1

- When reading the status of 16 consecutive coils from the coil number 0001h, the order of datum is as follows. Byte data in which data 1 is sent first.

	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

- When the read coil extends outside the range of the defined coil number, the coil data outside the range is sent as "0".
- If the command cannot be executed successfully, an exception response is returned. For details, see section "11.2.9 Exceptional Responses ".
- Reading 0000h to 004Fh of the coil number can also be substituted by reading the holding register of the register number 3EBCh to 3EC0h. The following shows the bit-structure of a holding register 3EBCh. Refer to the "18.1.1 List of Modbus Coil Numbers" for more information.

■ (Example) Holding register 3EBCh bit-structure

(Holding register assignment status of coil number 0000h to 000Fh)

Bit	Item	Bit	Item
15	-	7	Input terminal 3
14	-	6	Input terminal 2
13	-	5	Input terminal 1
12	Input terminal 8	4	Reset [RS]
11	Input terminal 7	3	External fault [EXT]
10	Input terminal 6	2	Rotation direction command
9	Input terminal 5	1	RUN command
8	Input terminal 4	0	-

11.2.2 Read Holding Register [03h]

Q

- I want to read a plurality of holding register data by Modbus communication.

A

- External control device can read the specified number of consecutive holding registers from the specified holding register number.
- The following shows an example of reading the factor and output frequency (Holding register number =03E9h to 03EBh) of the latest trip information from the inverter of slave address 5.

Query

No.	Field Name	e.g. (HEX)
1	Slave address *1	05
2	Function code	03
3	Register starting number (higher) *2	03
4	Register starting number (lower) *2	E8
5	Number of holding registers (higher) *3	00
6	Number of holding registers (lower) *3	03
7	CRC-16 (higher)	84
8	CRC-16 (lower)	3F

Nos. 3–4: Register start number = Register number-1

Nos. 5–6: 3 registers

Response

No.	Field Name	e.g. (HEX)
1	Slave address	05
2	Function code	03
3	Number of data bytes*4	06
4	Read register data 1 (higher)	00
5	Read register data 1 (lower)	07
6	Read register data 2 (higher)	00
7	Read register data 2 (lower)	00
8	Read register data 3 (higher)	17
9	Read register data 3 (lower)	70
16	CRC-16 (higher)	A8
17	CRC-16 (lower)	61

Nos. 4–5: 0007h→07d→E07 (factor = overvoltage [E007])

Nos. 6–9: 0000 1770h→6000d→60.00 (Hz) (frequency)

"h" = hexadecimal "d" = decimal

*1. Broadcast is not possible.

*2. Note that the start number has a value of 1 less. (Start Number)-Specifies the value of 1.

*3. Up to 16 registers (32 byte) can be read. Otherwise, an exception response with exception code [03h] is returned.

*4. Data of the number of data bytes is transferred. In this example, there are 6 bytes for the three holding registers.

!

- If the command cannot be executed successfully, an exception response is returned. For details, see section "11.2.9 Exceptional Responses".

11.2.3 Write to Single Coil [05h]

Q

- I want to write one coil-state by Modbus communication.

A

- External control device can write to one coil. The following table shows the coil status changes.

Data	OFF to ON coiling	ON to OFF coiling
Change data (higher)	FFh	00h
Change data (lower)	00h	00h

- The following shows an example of issuing the RUN command to the inverter of the slave address 10.
- In order to operate by a command from Modbus communication, "RUN command input source selection [AA111]" must be set to "RS485 (03)" in advance. Coil No. of RUN command is 0001h.

Query

No.	Field Name	e.g. (HEX)	
1	Slave address *1	0A	
2	Function code	05	
3	Coil address (higher) *2	00	Coil start number = coil number-1
4	Coil address (lower) *2	00	
5	Change data (higher)	FF	OFF to ON : FF00h
6	Change data (lower)	00	
7	CRC-16 (higher)	8D	
8	CRC-16 (lower)	41	

Response

No.	Field Name	e.g. (HEX)
1	Slave address *1	0A
2	Function code	05
3	Coil address (higher) *2	00
4	Coil address (lower) *2	00
5	Change data (higher)	FF
6	Change data (lower)	00
7	CRC-16 (higher)	8D
8	CRC-16 (lower)	41

*1. For broadcast, there is no response.
*2. Note that the start number has a value of 1 less. (Start Number)-Specifies the value of 1.

!

- If the command cannot be executed successfully, an exception response is returned. For details, see section "11.2.9 Exceptional Responses".

11.2.4 Write to Holding Register [06h]

Q

- I want to write one holding register data with Modbus communication.

A

- External control device can write data to one specified holding register.
- The following shows an example of writing 50.00 Hz to "Multi-speed 0 setting [Ab110]" of the inverter of slave address 1.
- Since the data resolution is 0.01 Hz for the holding register "2F4Eh" of [Ab110], the write data will be "5000 (1388h)" to set 50.00 Hz.

Query

No.	Field Name	e.g. (HEX)	
1	Slave address *1	01	
2	Function code	06	
3	Register address (higher) *2	2F	Register start number = Register number-1
4	Register address (lower) *2	4D	
5	Change data (higher)	13	1388h = 5000d → 50.00 (Hz)
6	Change data (lower)	88	
7	CRC-16 (higher)	1C	
8	CRC-16 (lower)	5F	

Response

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	06
3	Register address (higher) *2	2F
4	Register address (lower) *2	4D
5	Change data (higher)	13
6	Change data (lower)	88
7	CRC-16 (higher)	1C
8	CRC-16 (lower)	5F

*1. For broadcast, there is no response.
*2. Note that the start number has a value of 1 less. (Start Number)-Specifies the value of 1.

!

- Some parameters such as "Acceleration time 1 [AC120]" are "2-register length parameter" consisting of two holding register numbers (higher and lower). If the setting value falls within the range of the lower register, writing only one register does not matter. If the setting value does not fall within the lower register range, write two registers at the same time with the write command [10h] of multiple holding registers. For more information on 2-register length parameter, see Exception code [27h] in "11.2.9 Exceptional Responses".
- If the command cannot be executed successfully, an exception response is returned. For details, see section "11.2.9 Exceptional Responses".

11.2.5 Loop-back Test [08 h]

Q

- I want to check whether Modbus (I/O) messages can be sent and received normally.

A

- External control device can check communication between master and slave. Any value can be used for test data.
- An example of a loopback test to the inverter at slave address 1 is shown below.

Query

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	08
3	Test subcode (higher)	00
4	Test subcode (lower)	00
5	Data (higher)	Optional
6	Data (Lower)	Optional
7	CRC-16 (higher)	CRC
8	CRC-16 (lower)	CRC

Response

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	08
3	Test subcode (higher)	00
4	Test subcode (lower)	00
5	Data (higher)	Optional
6	Data (Lower)	Optional
7	CRC-16 (higher)	CRC
8	CRC-16 (lower)	CRC

*1. Broadcast is not possible.

!

- The test subcode supports only echoing (00h, 00h) query data. Other commands are not supported.

11.2.6 Write to Multiple Coils [0Fh]

Q

- Write more than one coil-state in Modbus communication.

A

- External control device can write multiple consecutive coils.
- An example of changing the state of the input terminals [1] through [8] of the inverter at slave address 1 is shown below. The status of input terminals [1] through [8] are as follows.

Input terminal number	1	2	3	4	5	6	7	8
Coil No.	0005h	0006h	0007h	0008h	0009h	000Ah	000Bh	000Ch
Terminal status	ON	ON	ON	OFF	ON	OFF	OFF	OFF

Query

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	0F
3	Coil starting number (higher) *2	00
4	Coil starting number (lower) *2	04
5	Number of coils (higher) *3	00
6	Number of coils (lower) *3	08
7	Number of data bytes *3	02
8	Written data (higher) *4	17
9	Written data (lower) *4	00
10	CRC-16 (higher)	EA
11	CRC-16 (lower)	F4

Coil start number = coil number-1

17h = 0001 0111

↑ Input terminal [8] ↑ Input terminal [1]

Response

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	0F
3	Coil starting number (higher) *2	00
4	Coil starting number (lower) *2	06
5	Number of coils (higher)	00
6	Number of coils (lower)	07
7	CRC-16 (higher)	F4
8	CRC-16 (lower)	08

*1. For broadcast, there is no response.
*2. Note that the start number has a value of 1 less. (Start Number)-Specifies the value of 1.
*3. The "number of data bytes" is not the number of cores, but the actual number of bytes to be written. The maximum number of data that can be written is 32 coils (4byte). Otherwise, an exception response with exception code [03h] is returned.
*4. Write data is set in the higher and lower bits, so even if the number of bytes that actually need to be changed is odd, add one byte of zero data to make it even.

!

- Input terminal function is internally processed by "OR" of terminal input and communication input. However, "Input terminal monitor [dA-51]" only displays the data of the control terminal.
- If the command cannot be executed successfully, an exception response is returned. For details, see section "11.2.9 Exceptional Responses".

11.2.7 Write to Multiple Holding Registers [10 h]

Q

- I want to write more than one holding register data with Modbus communication.

A

- External control device can write data to multiple consecutive holding registers.
- The following shows an example of writing 10.00 seconds to "Acceleration time setting (monitor) [FA-10]" of the inverter of slave address 1.
- Since the data resolution of the holding register "2B02h, 2B03h" of [FA-10] is 0.01 seconds, write data is set to "1000 (0000 03E8h)" to set 10 seconds.

Query

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	10
3	Register starting number (higher) *2	2B
4	Register starting number (lower) *2	01
5	Number of registers (higher) *3	00
6	Number of registers (lower) *3	02
7	Number of data bytes*3	04
8	Change data 1 (higher)	00
9	Change data 1 (lower)	00
10	Change data 2 (higher)	03
11	Change data 2 (lower)	E8
12	CRC-16 (higher)	D8
13	CRC-16 (lower)	2C

Register start number = Register number-1

0000 03E8h= 1000d → 10.00 (seconds)

Response

No.	Field Name	e.g. (HEX)
1	Slave address *1	01
2	Function code	10
3	Register starting number (higher) *2	2B
4	Register starting number (lower) *2	01
5	Number of registers (higher)	00
6	Number of registers (lower)	02
7	CRC-16 (higher)	19
8	CRC-16 (lower)	EC

*1. For broadcast, there is no response.

*2. Note that the start number has a value of 1 less. (Start Number)-Specifies the value of 1.

*3. The "number of data bytes" is not the number of holding registers but the actual number of bytes to be written. The largest number of data that can be written is 16 registers (32 byte). Otherwise, an exception response with exception code [03h] is returned.

!

- If the command cannot be executed successfully, an exception response is returned. For details, see section "11.2.9 Exceptional Responses".
- In Modbus communication of WJ-C1, there is a restriction on writing to "2 register length parameter". For more information, see the exception code [27h] in "11.2.9 Exceptional Responses".

11.2.8 Read/Write to Multiple Holding Registers [17h]

Q

- I want to write and read a plurality of holding register data by Modbus communication.

A

- External control device can write to and read from multiple holding registers continuously.
- The following shows an example of reading "Output frequency monitor [dA-01]" and writing 50.00 Hz in "Main speed reference setting (monitor) [FA-01]" of the inverter of slave address 1.

Query

No.	Field Name	e.g. (HEX)	
1	Slave address	01	
2	Function code	17	
3	Read register start number (higher) [*1]	27	
4	Read register start number (lower) [*1]	10	Register start number = Register number-1
5	Number of read registers (higher) [*2]	00	
6	Number of read registers (lower) [*2]	01	
7	Write register start number (higher) [*1]	2A	
8	Write register start number (lower) [*1]	F8	Register start number = Register number-1
9	Number of write registers (higher) [*2]	00	
10	Number of write registers (lower) [*2]	01	
11	Number of write data bytes	02	
12	Written data 1 (higher)	13	
13	Written data 1 (lower)	88	1388h= 5000d → 50.00 (Hz)
14	CRC-16 (higher)	77	
15	CRC-16 (lower)	A3	

Response

No.	Field Name	e.g. (HEX)	
1	Slave address	01	
2	Function code	17	
3	Number of read data bytes [*2]	04	
4	Read data 1 (higher)	13	
5	Read data 1 (lower)	88	1388h= 5000d → 50.00 (Hz)
6	CRC-16 (higher)	50	
7	CRC-16 (lower)	E3	

*1. Note that the start number has a value of 1 less. (Start Number)-Specifies the value of 1.
*2. The "number of data bytes" is not the number of holding registers but the actual number of bytes to be written/read. The largest number of data items that can be written/read is 16 registers (32 byte). Otherwise, an exception response with exception code [03h] is returned.

!

- If the command cannot be executed successfully, an exception response is returned. For details, see section "11.2.9 Exceptional Responses".
- In Modbus communication of WJ-C1, there is a restriction on writing to "2 register length parameter". For more information, see the exception code [27h] in "11.2.9 Exceptional Responses".

11.2.9 Exceptional Responses

A

- If an error occurs in the query, an exception response is returned.
- For non-broadcast queries, the master is requesting a response. The inverter must return a response corresponding to the query, but if an error occurs in the query, it returns an exception response.
- Exception responses are organized in the field configuration shown in the table below.

Field configuration

Slave address
Function code
Exception code
CRC-16

- The details of the field configuration are shown in the tables below. The function code is 80h added to the query in response to an exception. The exception code indicates the cause of the exception response.

Function code

Query	Exception response
01h	81h
03h	83h
05h	85h
06h	86h
0Fh	8Fh
10h	90h
17h	97h

■ Exception code details

Code	Description
[01h]	An unsupported function was specified.
[02h]	The specified parameter address does not exist.
[03h]	The specified data is in an unacceptable format.
[21h]	Data is out of the setting range when writing to the holding register.
[22h]	The inverter is not permitting the function. ・An attempt was made to change the holding register for which change during operation is prohibited. ・Writing is performed to the holding register that is soft-locked. ・An attempt was made to change an input/output terminal function that cannot be changed. ・An attempt was made to change a/b contact of the terminal assigned the "Reset [RS]" input terminal function. ・An attempt was made to write to a register when auto-tuning was enabled. ・Attempted to write to the locked register while setting the password. and etc.
[23h]	A read-only holding register coil was written.
[26h]	Writing is performed during data writing or during data initialization.
[27h]	Only the higher side register of "2-register length parameter" was accessed. In Modbus communication of WJ-C1, large data which does not fit in 1 word is set as "2 register length parameter", and there is a holding register which is constrained when accessing. For the target register of "2 register length parameter", refer to "18.2 List of Parameters/Register Numbers". (e.g.) "Acceleration time setting (monitor)[FA-10]" is "2 register length parameter" of register number 2B02h, 2B03h. Only 2B03h of the lower word can be read/written to this register, but reading/writing only 2B02h of the higher word will fail.
[31h]	Error related to Modbus mapping function.
[32h]	For more information, see "11.3 Modbus Mapping Function".

11.2.10 Storing Changes to Holding Registers

Q

- The write data to the holding register is stored in the non-volatile memory of the inverter.

A

- When the write command (06h, 10h, 17h) to the holding register is executed, the written value becomes valid, but it is not memorized in the non-volatile memory inside the inverter, and the changed content disappears due to the power-off. To store the changes to the holding register in the non-volatile memory, execute the "Enter command" below or execute the "1-register write mode instruction".
- When changing motor control related parameters such as motor constants shown below, it is also necessary to execute enter command or motor constant recalculation command. If these instructions are not executed, the recalculate of the internal control variables by changing parameters will not be performed, so the motor operating characteristics will not change.

■ List of parameters requiring internal control variable recalculate

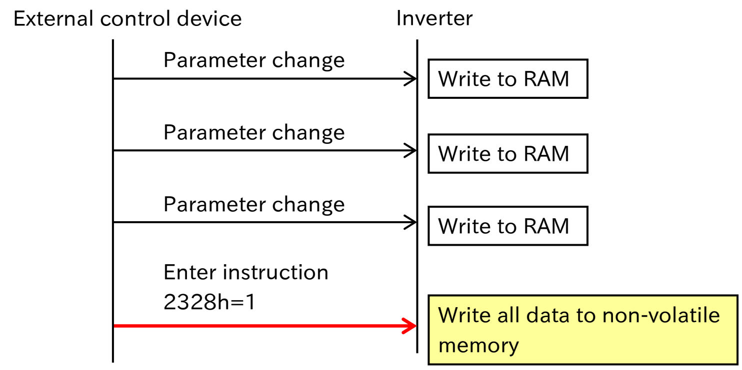
Code	Name	Code	Name
[AA121]	Control mode selection	[Hb105]	Async. Motor maximum frequency setting
[HA115]	Speed response	[Hb106]	Async. Motor rated voltage
[Hb102]	Async. Motor capacity setting	[Hb108]	Async. Motor rated current
[Hb103]	Async. Motor number of poles setting	[Hb162]	Free-V/f frequency 7 setting
[Hb104]	Async. Motor base frequency setting	[Hb110] to [Hb118]	Various Async. Motor constant

Storage of changed data in the non-volatile memory by the Enter command

- Execute the enter command when the changed data is stored collectively in the non-volatile memory, or when recalculation of the internal control variable by changing the motor constant, etc.
- All parameters are stored in the non-volatile memory by writing (0001h) to the holding register "Enter instruction (Write to Data Flash) [2328h]" using the holding register write command [06h], etc.
- The completion of the enter command should be judged by monitoring the "Data writing in progress [0049h]".

Holding register	Write command	R/W	Operation details	Resolution
2328h	Enter instruction (Write to Data Flash)	W	01:Write all parameters	1

■ **Enter command**

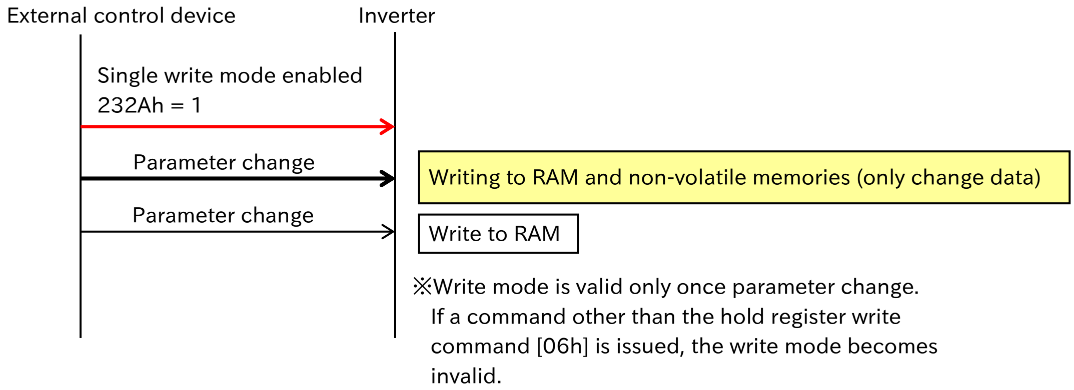


Storage of changed data in non-volatile memory by single write mode command

- Writing (0001h) to the "Single write mode [232Ah]" sets the data write mode.
- The data changed by the write to holding register command [06h] after shifting to the data write mode is written to both the temporary memory (RAM) and the non-volatile memory.
- The data write mode is released when a command other than the write command [06h] to the holding register is received after the data write mode is shifted.
- Determine the completion of the single write-mode command by monitoring the "data-writing in progress signal (coil-number 0049h)".

Holding register	Write command	R/W	Operation details	Resolution
232Ah	Single write mode	W	01:Enable	1

■ Single write mode command



Changing the internal control constant by the Motor constants re-calculation command

- By writing (0001h) in the holding register "Motor constants re-calculation command [2332h]" using the write command to the holding register [06h], etc., the recalculation of the internal control constants may be performed and the motor operating characteristics may be changed.

Holding register	Write command	R/W	Operation details	Resolution
2332h	Motor constants re-calculation (No motor constant standard data expansion)	W	01: Enable	1

Note
Failure

Prohibition

Do

- Do not turn off the inverter during writing to the non-volatile memory by the "Enter command" and the "single write mode command". Data will not be stored correctly if the power is turned off. Whether or not data is being written should be judged by monitoring "data writing in progress signal (coil-number 0049h)".
- Since the storage element of the inverter has a limit on the number of rewrites, the life of the inverter may be shortened if the above-mentioned writing command is used abundantly. Write commands should be minimized. In particular, please be careful not to execute this command periodically and continuously due to loop processing of external control equipment, etc.

11.2.11 Endianness Selection of Holding Registers

Q

- I want to change the endianness (order of byte data) of Modbus communication data.

A

- The endianness of communication is the byte data sequence of communication 1-word data to be transmitted and received. In WJ-C1, the endianness can be set for the data part of the transmit/receive frame.
- Depending on the specifications of the external control device, it may be necessary to swap the higher and lower bytes of word data when reading/writing holding registers. Changing the endianness selection may eliminate the need for these processes. Refer to the operation manual of the external control device for details.

!

- Endianness selection is enabled only for holding register read/write function codes ([03h], [06h], [10h], [17h]) and option commands for optional communication ([03h], [06h], [10h], [51h], [52h], and [53h]). In addition, only the data part of the query/response is affected.
- When using the inverter configuration software ProDriveNext, select "Big endian (00)" (default). Other settings will not work properly.
- Endianness selection does not function in trip history monitor (register number 03E9h to 04AEh), and it is read as big endian. When using the trip history monitor, set [CF-12] to "Big endian". When "Little endian" or "Special endian" is selected, perform data sorting properly when reading data with an external control device, etc.

Code	Name	Description	Data
[CF-12]	RS485 endianness selection	The order of byte data in the data section is big endian.	00
		Byte data in the data section is lined up with little endian.	01
		The order of byte data in the data part is special endian. Byte datum array for Hitachi PLC.	02

Order of byte data for each endianness setting

- The following shows the data order for Modbus (I/O) communication with 1-word data =0102h and 2-word data =0102 0304h.

■ For 1-register length data

Byte order of transmission and reception	Big endian	Little Endian	Special endian
1	01	02	01
2	02	01	02

■ For 2-register length parameter

Byte order of transmission and reception	Big endian	Little Endian	Special endian
1	01	04	03
2	02	03	04
3	03	02	01
4	04	01	02

Example of holding registry write query/response for each endianness selection

- When big endian, little endian, or special endian is set to "RS485 endianness selection [CF-12]", "Overload restriction 1 action time [bA124]"= "3000.00 s" in "2 Register Length Parameter" and the "Overload restriction 2 mode selection [bA126]"= "Enable during accel. and constant speed (01)" in "1 Register Length Data" are written by function code [10h]. The following are examples of queries.

Query		Endianness			
No.	Field Name	Big	Little	Special	
1	Slave address	01	01	01	
2	Function code	10	10	10	
3	Register starting number (higher)	32	32	32	
4	Register starting number (lower)	DF	DF	DF	
5	Number of registers (higher)	00	00	00	
6	Number of Registers (lower)	03	03	03	
7	In bytes	06	06	06	
8	Write data 1 (higher)	00	E0	93	[bA124] is "2 register length parameter" and the resolution is 0.01 seconds. Therefore, write data is 3000.00 s = 300000d = 000493E0h.
9	Write data 1 (lower)	04	93	E0	
10	Write data 2 (higher)	93	04	00	
11	Write data 2 (lower)	E0	00	04	
12	Write data 3 (higher)	00	01	00	[bA126] = 0001h writing when in "Enable during accel. and constant speed".
13	Write data 3 (lower)	01	00	01	
14	CRC-16 (higher)	EB	65	EB	
15	CRC-16 (lower)	DB	B4	DD	

11.3 Modbus Mapping Function

11.3.1 Setting Modbus Mapping Function

Q

- I want to replace the inverter without changing the communication program of the host device.

A

- With Modbus mapping function, register numbers, data types, and data scales specified by communication commands from external control devices can be converted to any register numbers and data scales in WJ-C1 inverters. This enables replacement of the inverter without changing the communication program on the external control device side.
- The register number and data of up to 10 registers can be converted.

!

- If the external register number is already used as the internal register number of the inverter, Modbus mapping setting takes precedence. When accessing the disabled internal registers of the drive, perform Modbus mapping settings separately to indirectly access the registers.

Code	Name	Description	Data
[CG-01]	Register mapping function selection	Register mapping function disable	00
		Enable Modbus Register map function enables	01
[CG-11] to [CG-20]	External register 1 to 10	Set the register number used in the communication program of the external control device, etc. 0000h is judged as not being set.	0000h to FFFFh
[CG-31] to [CG-40]	External register 1 to 10 format	The data type of the external register is unsigned word data.	00
		The data type of the external register is signed word data.	01
[CG-51] to [CG-60]	External register 1 to 10 scaling	Data specified from the external control device x this setting value = Inverter internal data. Writing: External data × Write this setting to the internal register Read: Internal data/Read this setting as external data	0.001 to 65.535
[CG-71] to [CG-80]	Internal register 1 to 10	Set Modbus register number of the inverter. 0000h is judged as not being set.	0000h to FFFFh

Setting Up Modbus Mapping

(1) Set the register number of the external control device in "External register 1 to 10 ([CG-11] to [CG-20])". If "0000" is set, no processing is performed.

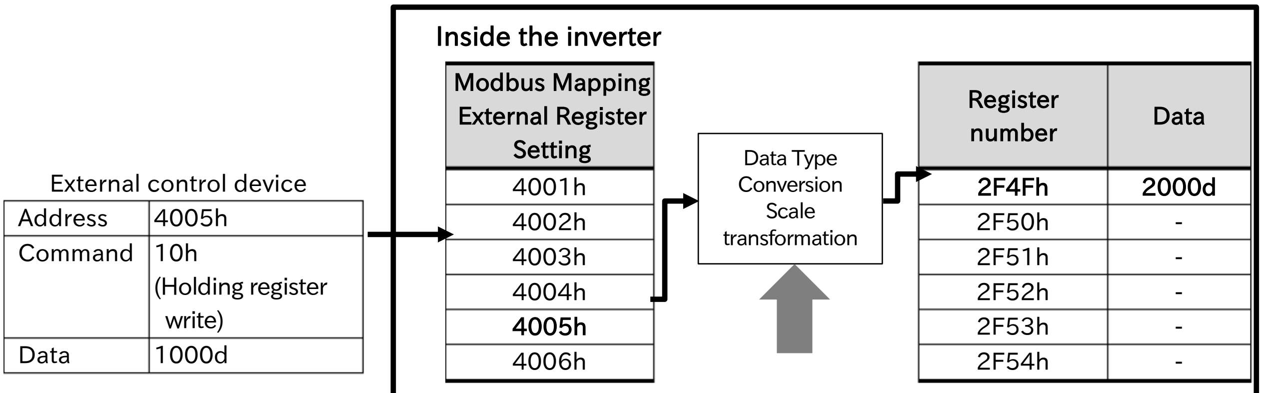
(2) Set the data type of the external control device in "External register 1 to 10 format ([CG-31] to [CG-40]."

(3) In "External register 1 to 10 scaling ([CG-51] to [CG-60])", set the magnification when receiving from an external control device and loading it into the inverter. Conversely, it is divided when reading internal data.

(4) Set Modbus register number in the inverter to be actually accessed in "Internal register 1 to 10 ([CG-71] to [CG-80])".
※ Refer to "18.2 List of Parameters/Register Numbers" for Modbus register number of the inverter.

(5) Set "RS485 endianness selection [CF-12]" as required. For details, see section "11.2.11 Endianness Selection of Holding Register".

(6) Set "Register mapping function selection [CG-01]" to "Enable (01)". When the parameters related to Modbus mapping function have been set or changed, be sure to turn the power OFF and then ON again. If the power is not turned on again, the settings and changes made by Modbus mapping function will not be reflected.



Mapping 1 Setting Example

Code	Name	Setting example
[CG-11]	External register 1	4005h
[CG-31]	External register 1 format	00(unsigned word)
[CG-51]	External register 1 scaling	2.00
[CG-71]	Internal register 1	2F4Fh

- An external register 4005h is mapped to an inverter-internal register 2F4Fh and an external data 1000d is written. The data type of the external data is regarded as unsigned, and 2000d obtained by multiplying the scale by 2.00 is written to the internal register. (In the case of data reading, internal data is returned to the external control device at 1/2.)

Handling Modbus Mapping Function Errors

- If there is an error in Modbus mapping setting, the exception response of the exception code below is returned. If an exception response occurs, review the external or internal register settings.

Code	Description
31h	· When the external register is set but the internal register setting is not set to "0000". · A holding register number that does not exist in the internal address is set. · The external register settings are duplicated.

- As shown in the figure below, if the register number already used in the inverter is set as an external register, the same register number used in the inverter cannot be accessed.

  Example: When 2EEFh is set to an external register, the "Stop mode selection, 1st-motor [AA115]" whose internal register number is 2EEFh from another external register (3000h in the following table) cannot be accessed.

External register [CG-11] to [CG-20]	Internal register [CG-71] to [CG-80]
—	—
2EEFh	2EECh
—	—
—	—
3000h	2EEFh
—	—

Internal register	Parameter	
2EEBh	[AA111]	RUN command input source selection, 1st-motor
2EECh	[AA-12]	RUN-key command rotation direction
2EEDh	[AA-13]	STOP-key enable
2EEEh	[AA114]	RUN direction restriction selection, 1st-motor
2EEFh	[AA115]	STOP mode selection, 1st-motor
2EF5h	[AA121]	Control mode selection, 1st-motor

11.4 Inter-Inverter Communication Function EzCOM

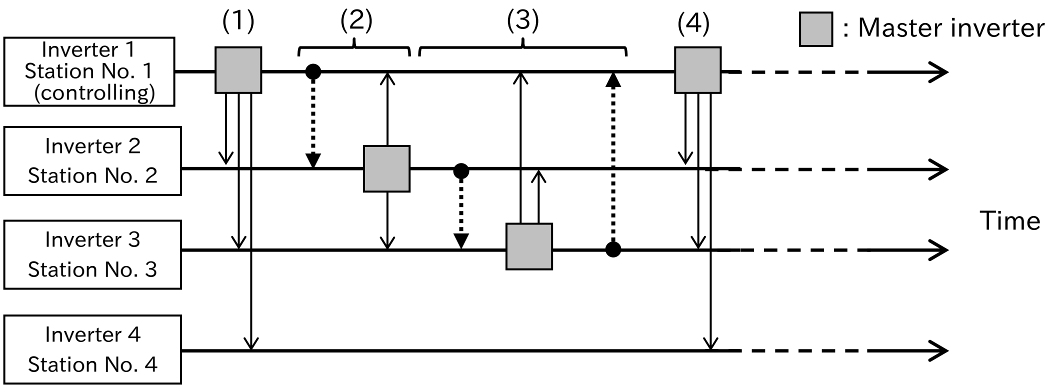
11.4.1 What is EzCOM?

Q

- What is the Inter-inverter Communication Function EzCOM?

A

- Inter-inverter communication function EzCOM is a function that uses Modbus-RTU communication to perform inter-communication between Hitachi Inverters (WJ-C1, WJ200, SJ Series P1) without external control devices such as PC and PLC.
- By issuing a notification from one inverter to another, such as changing the frequency reference or changing the operation/stop status, coordinated operation between the inverters is enabled without external control devices.
- Combined with the program operation function (EzSQ), it can be further expected to find applications such as unique operation tailored to the user application. For the program operation function (EzSQ), refer to section "12.2 Program Operation Function "EzSQ"".
- The operation of EzCOM is outlined below. (When four inverters are connected)
- During EzCOM communication, the inverters share the roles of "Controlling inverter", "Master inverter" and "Slave inverter". Be sure to install the inverter of station number 1. The inverter becomes "Controlling inverter".
- When EzCOM communication starts, "Controlling inverter" will gradually switch "Master inverter". At this time, all other than "Master inverter" are set to "Slave inverter".



(1) When EzCOM communication starts, the inverter specified by "Controlling inverter" becomes the "Master inverter". In the example above, Inverter 1 = Controlling inverter = Latest master inverter.
"Master inverter (inverter 1)" writes its own holding register data into the holding registers of other inverters according to the setting. Up to five writes can be set.

(2) When writing of inverter 1 is completed, "Master inverter" switches to inverter 2. Like the "Master inverter (inverter 1)", "Master inverter (inverter 2)" writes its own holding register data into the holding registers of other inverters according to the setting.

(3) When the switching of "Master inverter" is one cycle for all specified inverters, the inverter 1 is switched to "Master inverter" again.
(Up to eight master inverters can be set.)

(4) (1) to (3) is repeated.

!

- Like normal Modbus communication (RS485), connect the [SP]/[SN]/[L] terminals of the inverters for EzCOM communication (the [CM1] terminals of SJ series P1) respectively. (Turn ON the termination resistors of the inverters at both ends that constitute EzCOM communication.)
- Up to eight master inverters can be set for EzCOM communication.
- Up to five written data can be set from each master inverter.
(Data can also be written to the inverter that does not become "Master inverter" (inverter 4 in the example of the above figure).)

11.4.2 Setting EzCOM

Q
- I would like to know the specific setting of the inter-inverter communication function EzCOM.

A
- In the inverter-to-inverter communication function EzCOM, each inverter connected by communication is switched to "Master inverter", so that mutual communication can be performed by only multiple inverters without external control equipment such as PC and PLC.
- During EzCOM communication, the inverters share the roles of "Controlling inverter", "Master inverter" and "Slave inverter". The setting items change in "Controlling Inverter" and other cases. Refer to the following section and set the appropriate settings for each of the inverters that make up EzCOM.

■ Common setting parameters of inverters for EzCOM

Code	Name	Description	Data
[CF-01]	RS485 communication baud rate selection	Use the same setting for the inverters for EzCOM.	-
[CF-03]	RS485 communication parity selection		
[CF-04]	RS485 communication stop bit selection		
[CF-05]	RS485 communication error selection	Refer to the sample EzCOM communication time chart in this section for setting.	-
[CF-06]	RS485 communication timeout setting		
[CF-07]	RS485 communication wait time setting		

■ Setting parameters of "Controlling inverter" (station No.1)

Code	Name	Description	Data
[CF-02]	RS485 communication node address	Set station No. 1 to "Controlling inverter".	1
[CF-08]	RS485 communication mode selection	Inter-inverter communication (EzCOM) is used (Controlling inverter)	03
[CF-20]	EzCOM start node No.	Set the start station number of "Master inverter".	1 to 8
[CF-21]	EzCOM end node No.	Set the finish station number of "Master inverter".	1 to 8
[CF-22]	EzCOM start method selection	Activation via the "EzCOM activation [ECOM]" input terminal.	00
		Always EzCOM communication enabled	01
[CF-23] to [CF-38]	EzCOM Write Data-Related Parameter	"Controlling inverter" can also send data as a "Master inverter." Refer to the next table "Setting parameters of "Master inverter"".	-
[CA-01] to [CA-08]	Input terminal function	EzCOM activation [ECOM]: When the "[ECOM] terminal (00)" is set to [CF-22], EzCOM communication is performed when this terminal is turned ON.	098

■ Setting parameters of "Master inverter" (station No. 1 to 8)

Code	Name	Description	Data
[CF-02]	RS485 communication node address	For the station number setting of the master inverter for EzCOM communication, set the station number set in [CF-20] to [CF-21] of the controlling inverter.	1 to 247
[CF-08]	RS485 communication mode selection	Use inter-inverter communication (EzCOM)	02
[CF-23]	EzCOM data size	Set the number of writes to the holding register.	1 to 5
[CF-24]	EzCOM destination address 1	Set the station number and holding register number of the station to write data to, and the holding register number of the write data of the own station. Maximum 5 sets can be set. ※In the destination register and the source register, specify a register address of-1 from the register number.	1 to 247
[CF-25]	EzCOM destination register 1		0000h to FFFFh
[CF-26]	EzCOM source register 1		0000h to FFFFh
[CF-27]	EzCOM destination address 2		1 to 247
[CF-28]	EzCOM destination register 2		0000h to FFFFh
[CF-29]	EzCOM source register 2		0000h to FFFFh
[CF-30]	EzCOM destination address 3		1 to 247
[CF-31]	EzCOM destination register 3		0000h to FFFFh
[CF-32]	EzCOM source register 3		0000h to FFFFh
[CF-33]	EzCOM destination address 4		1 to 247
[CF-34]	EzCOM destination register 4		0000h to FFFFh
[CF-35]	EzCOM source register 4		0000h to FFFFh
[CF-36]	EzCOM destination address 5		1 to 247
[CF-37]	EzCOM destination register 5		0000h to FFFFh
[CF-38]	EzCOM source register 5		0000h to FFFFh

EzCOM communication settings

1 Common setting of inverters for EzCOM communication

(1) Set modbus communication settings ([CF-01], [CF-03], and [CF-04]) of the inverters to the same setting.

(2) Set [CF-05], [CF-06], and [CF-07] by referring to EzCOM communication time chart and notes in this section.

2 Setting of "Controlling inverter" (station No.1)

(3) To perform EzCOM communication, set "RS485 communication node address [CF-02]" to (1), and provide an inverter with "Inter-inverter communication (EzCOM Administrator) (03)" set to "RS485 communication mode selection [CF-08]". This inverter becomes "Controlling inverter".

(4) Set the first and last station numbers of the inverter to be operated as "Master inverter" to "EzCOM start node No. [CF-20]" and "EzCOM end node No. [CF-21]", respectively. Also, set it so that [CF-20] ≦ [CF-21] is set.
(In EzCOM communication time chart, [CF-20]=01, [CF-21]=04.)

(5) EzCOM communication start timing can be selected in "EzCOM start method selection [CF-22]". When "Always enable (01)" is set, "Controlling inverter" starts EzCOM communication as soon as the power is turned on. If the power-on of another inverter is delayed, communication time-out occurs in "Controlling inverter", so please ensure that the start-up timing of the other inverter comes first so that it does not happen. When the "[ECOM] terminal (00)" is set, EzCOM communication starts when the "EzCOM activation [ECOM]" input terminal is turned ON.

3 Setting of "Master inverter" and "Slave inverter"

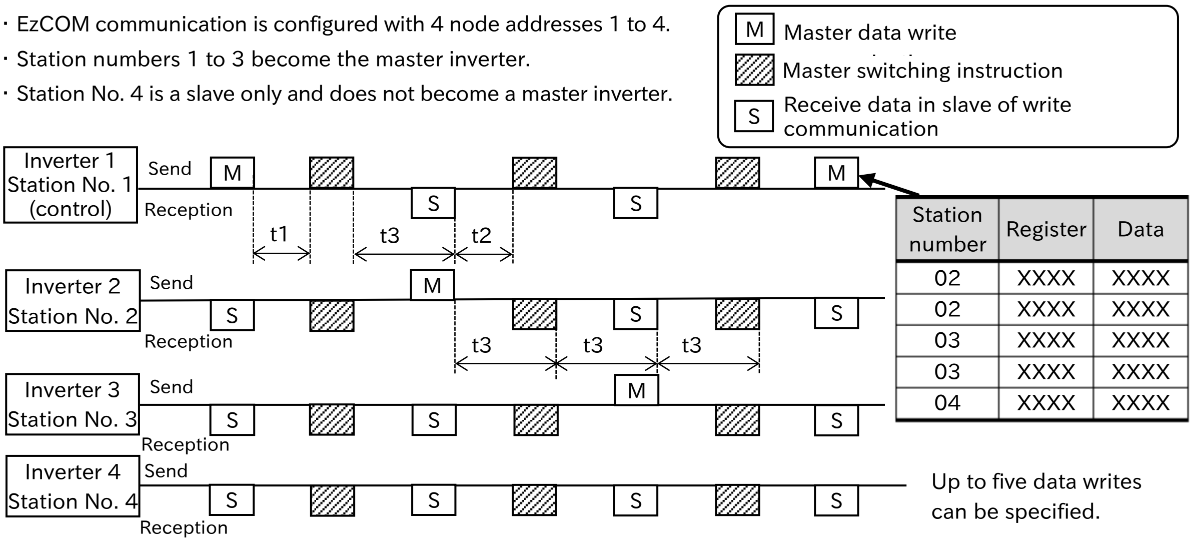
(6) For the inverter that becomes the "Master inverter", it is necessary to set a continuous station number out of 1 to 8. Set the station number set in [CF-20] to [CF-21] of the "Controlling inverter" in order in the "RS485 communication node address [CF-02]" of the inverter which becomes the "Master inverter". The station No. of the inverter that does not become the "Master inverter" should be a station No. other than [CF-20] to [CF-21] of the "Controlling inverter".

(7) Set "Communication between Inverters (EzCOM) (02)" to "RS485 communication mode selection [CF-08]" of all the inverters participating in EzCOM communication, except for "Controlling Inverter".

(8) Set the data-information ([CF-23] to [CF-38]) to be written from "Master inverter" to the "Slave inverter" for each of "Master inverter".

■ Sample EzCOM Communication Time Chart

- EzCOM communication is configured with 4 node addresses 1 to 4.
- Station numbers 1 to 3 become the master inverter.
- Station No. 4 is a slave only and does not become a master inverter.



Station number	Register	Data
02	XXXX	XXXX
02	XXXX	XXXX
03	XXXX	XXXX
03	XXXX	XXXX
04	XXXX	XXXX

t1: Silent interval + "RS485 communication wait time setting [CF-07]"
t2: Silent interval + "RS485 communication wait time setting [CF-07]"
t3: "RS485 communication timeout setting [CF-06]"

!

- The master switching command is sent from "Controlling inverter" at the timing shown below.
  - When "Controlling inverter" is "Master inverter", after t1 shown in the figure above has elapsed since data write communication was completed.
  - When "Controlling inverter" is "Slave inverter", after a lapse of t2 shown in the above figure after completion of receiving data transmission communication.
- If data reception cannot be completed within the "RS485 communication timeout setting [CF-06]" setting time, the timeout will be calculated from the start of reception wait (in t3 above). The operation at that time follows "RS485 communication error selection [CF-05]".
- If a setting other than "Ignore (02)" is set to [CF-05] in "Controlling inverter", communication between the inverters will be stopped when a communication time-out occurs in the "Controlling inverter". In this case, turn the power supply of "Controlling inverter" OFF and then ON again.
- Be sure to set the [CF-06] of "Controlling inverter" to a value other than 0.00 (recommended 1 second or longer). If 0.00 is set, EzCOM function will be stopped if data cannot be received from "Master inverter" due to timeout. If it stops, turn the power supply of "Controlling inverter" OFF and then ON again, or reset it using the "Reset [RS]" input terminal.
- Do not set 2327h (enter command (2328h-1)) and 2329h (single write mode (232Ah-1)) in the destination register.
- In data write communication by "Master inverter", the destination slave station number is set, but it is actually transmitted to all stations by broadcast communication. A slave that is not specified as a transmission destination on the master side will receive data once, but the received data will be discarded internally.

(Memo)

12

Chapter 12 ProDriveNext/EzSQ

This chapter describes an outline of the "Inverter Configuration Software "ProDriveNext"" and "Program Operation Function "EzSQ"", as well as parameter descriptions of the Inverter. For more information, refer to "Inverter Configuration Software ProDriveNext Instruction Manual (NT8001*X)" and "Easy-Sequence Function Programming Guide (NT252*X)".
Before conducting a test run, please read "Chapter 1 Safety Instructions/Risks" carefully and pay attention to safety.

12.1 Inverter Configuration Software "ProDriveNext"

12.1.1 What Is ProDriveNext?

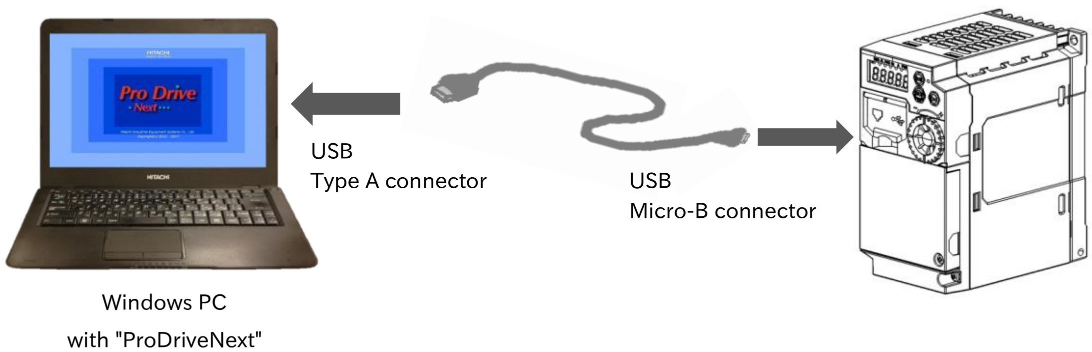
Q
- You want to manage parameters with PC.
- You want to perform automatic operation with the program operation function.
- I want to check the monitor data in the graph.

!
- In the Inverter Configuration Software "ProDriveNext", parameter setting and management of the inverter, graph-display of the monitor data, program editing and management of the Program Operation Function "EzSQ", etc. are performed. The main functions are listed below.

Item	Description
Operation Screen	Set the frequency command and starts/stops operation. The state of the intelligent terminal can also be checked.
Parameters set function	Various parameter settings can be made, such as setting parameters individually and searching for changed parameters from the factory default settings. Parameters can be saved and read in CSV format.
Monitor function	The specified monitor data can be displayed in a table format or in a graph format with the horizontal axis as the time. Monitor data can be saved and read in PMG format or CSV format file.
EzSQ programming function	EzSQ programs can be edited, debugged, uploaded and downloaded to the inverter, and programs can be saved and read in CSV format files.
Trace function	Parameters and triggers can be set to graph the data when the trigger is activated. The recorded trace data can be saved and read in a CSV format file.

- Refer to the "Inverter Configuration Software ProDriveNext Instruction Manual (NT8001*X)" for detailed information about ProDriveNext functions. When using EzSQ, also refer to the "Easy-Sequence Function Programming Guide (NT252*X)".
- The most recent version of ProDriveNext, EzSQ and the User's Manual can be downloaded from the "Web Members" (https://library.hitachi-ies.co.jp/top/index) page of our website.
(Note that member registration is required in advance for downloading.)

Connecting PC and Inverter



(NOTE) The USB connector of WJ200 series is a Mini-B terminal.
Be careful when using both series.

!
- The USB connector of WJ200 series is Mini-B connector. If you are using both series for replacement or other purposes, prepare a USB cable/conversion connector for Micro-B connector for C1 separately.

12.2 Program Operation Function "EzSQ"

12.2.1 What Is EzSQ?

Q

- How do I know what I can do with the program operation function EzSQ?

A

- EzSQ is a simple sequential control function based on BASIC like program language for Hitachi INVERTER Drives.
- When using EzSQ, refer to the "Inverter Configuration Software ProDriveNext Instruction Manual (NT8001*X)" and "Easy-Sequence Function Programming Guide (NT252*X)" for more information.

■ Flow to EzSQ Program Run

No.	Description	Remarks
1	Use ProDriveNext to create a EzSQ program.	
2	Compiles and places them in a form that can be executed by the inverter. At the same time, the syntax of the created EzSQ program is checked. If an error occurs, compilation is interrupted, and an error message is displayed.	ProDriveNext is required.
3	The compiled EzSQ program is downloaded to the inverter and saved to the storage device of the inverter. *1	
4	Set the parameters of the required inverter main unit.	
5	Enable EzSQ function by setting "EzSQ Function enable selection [UE-02]" to "[PRG] terminal (01)", "Always enable (02)", and "Debug (03)".	
6	EzSQ program is executed when "EzSQ Function enable selection [UE-02]" is "[PRG] terminal (01)" and the [PRG] input terminal is turned ON. When "EzSQ Function enable selection [UE-02]" is set to "Always enable (02)", EzSQ programming is executed automatically when the power is turned on. When "EzSQ Function enable selection [UE-02]" is set to "Debug (03)", execute EzSQ programming according to the setting of "EzSQ Debug start selection [UG-01]". In this case, EzSQ program can be broken at any point or executed step-by-step. For more information, refer to "12.2.3 Debug Function for EzSQ".	Refer to "12.2.2 EzSQ Related Parameters" in the next section.
7	The operating status of EzSQ can be checked on the inverter panel of the operation.	

*1. By storing the program in the internal memory of the inverter, the program can be executed even after the power is turned on again. If not saved to the internal memory, the downloaded program will be erased when the inverter power supply is cut off. When debugging such as checking program operation, it is recommended not to store in the internal memory but to store after debugging is completed.

!

- If a reset or trip reset is performed by the "Reset [RS]" input terminal while EzSQ program is running, the output to the motor will be shut off, but EzSQ program will continue to operate.
- After the program is downloaded to the inverter main unit, the inverter can be separated from the PC to execute EzSQ program.

12.2.2 EzSQ Related Parameters

Q

- How do I start EzSQ program?
- How do I know the reserved variables and related parameters of EzSQ program?
- How do I change and monitor the parameters in EzSQ program from the keypad or terminals?

A

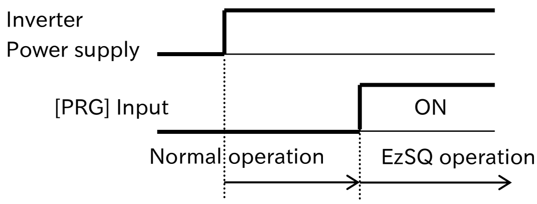
EzSQ program starting method selection

- To enable EzSQ function, set "EzSQ Function enable selection [UE-02]" to "[PRG] terminal (01)" or "Always enable (02)".

Code	Name	Description	Data
[UE-02]	EzSQ Function enable selection	EzSQ function is disabled.	00
		EzSQ program operates when the [PRG] input terminal is ON.	01
		EzSQ program will operate at all times when the inverter is powered up.	02
		The debugging function of EzSQ program can be used. For more information, refer to "12.2.3 Debug Function for EzSQ".	03
[CA-01] to [CA-08]	Input terminal function	Starting EzSQ Programming [PRG]: When [UE-02] is set to the "[PRG] terminal (01)", EzSQ programming starts when this terminal is turned ON.	099

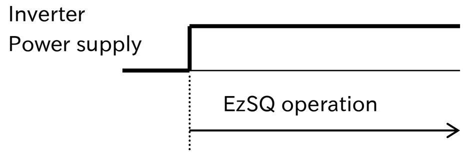
[UE-02] ="[PRG] terminal (01)"

- EzSQ program starts operation when "EzSQ program start [PRG]" is assigned to one of the input terminals and ON is made to that terminal.



[UE-02] = "Always enable (02)"

- Turning on the power supply to the inverter starts EzSQ programming operation.



A

Inverter control by EzSQ program

- To set the inverter operation/stop command, frequency reference, and acceleration/deceleration time using the reserved variables of EzSQ function, set the RUN command to "Control circuit terminal" and the frequency reference and acceleration/deceleration time to "Program function". However, if you want to use Modbus communication as the frequency reference input source, set the source as the desired setting for operation. (EzSQ operation is available even if the respective command input source is not set to "Program function".)

Code	Name	Description	Data
[AA101]	Main speed input source selection	When "Program function (14)" is set, reserved variable <SET-Freq> is enabled, and reading/writing from [FA-01] on the keypad is also enabled. For details, refer to "9.2.9 Setting Frequency Reference by Program Operation Function EzSQ".	14
[AA111]	RUN command input source selection	When the "[FW]/[RV] terminal (00)" is set, the reserved variable <FW>/<RV> on EzSQ is enabled, and when the "3 wire (01)" is set, the <STA>/<STP>/<F/R> is enabled. For details, refer to "9.1.3 Operation by Forward/Reverse Input Terminals" and "9.1.4 Operation by Momentary Switch".	00/01
[AC-01]	Acceleration/Deceleration time input source selection	When "Program function (04)" is set, the reserved variable <ACCEL>/ <DECEL> on EzSQ is enabled. (When <ACCEL>/ <DECEL> is 0, the acceleration/deceleration times follow the [FA-10]/ [FA-12].) For details, refer to "9.3.1 Changing Acceleration/Deceleration Time".	04

A

EzSQ program-reserved variables and parameters/I/O terminals

- Additional parameters related to EzSQ function are listed below. For I/O terminals, analog I/O, parameters and monitors of the inverter, EzSQ program and I/O are executed according to the following reserved variables.

■ EzSQ function-related monitor

Code	Name	Description	Data
[db-01]	Program Download Monitor	EzSQ program has not been downloaded.	00
		EzSQ program has been downloaded.	01
[db-02]	Program No. monitor	Displays the program No. that was set when the program was created.	0000 to 9999
[db-03]	Program counter (Task-1)	Displays the program line number being executed by Task-1.	1 to 1024
[db-04]	Program counter (Task-2)	Displays the program line number being executed by Task-2.	
[db-05]	Program counter (Task-3)	Displays the program line number being executed by Task-3.	
[db-06]	Program counter (Task-4)	Displays the program line number being executed by Task-4.	
[db-07]	Program counter (Task-5)	Displays the program line number being executed by Task-5.	
[db-08]	User monitor-0	This displays the value assigned to Umon(00) in the program.	-2147483648 to 2147483647
[db-10]	User monitor-1	This displays the value assigned to Umon(01) in the program.	
[db-12]	User monitor-2	This displays the value assigned to Umon(02) in the program.	
[db-14]	User monitor-3	This displays the value assigned to Umon(03) in the program.	
[db-16]	User monitor-4	This displays the value assigned to Umon(04) in the program.	
[db-18]	Analog output monitor YA0	This displays the value assigned to YA (0) in the program.	0.00 to 100.00 (%)
[db-19]	Analog output monitor YA1	This displays the value assigned to YA (1) in the program.	
[db-28]	Program status	Program wait in progress	00
		Program running	01
		During a break	02
		Stopped	03
		Trip in progress	04
[db-29]	Error task number	Displays the number of the task where the error occurred when an error occurred in EzSQ program. If no error has occurred, 0 is displayed.	0 to 5

■ EzSQ function related parameters

Code	Name	Description	Data
—	[Ai1] Terminal analog input	[Ai1] The analog input to the terminal is loaded into the general-purpose analog input XA (0). Parameter setting, etc. is not required. Input characteristics follow the start-end function ([Cb-03] to [Cb-07]). When the parameter is initialized, 0 to 10 VDC is 0 to 10000.	0 to 10000
—	[Ai2] Terminal analog input	[Ai2] The analog input to the terminal is loaded into the general-purpose analog input XA (1). Parameter setting, etc. is not required. Input characteristics follow the start-end function ([Cb-13] to [Cb-17]). When the parameter is default, 4 to 20 mA is 0 to 10000.	0 to 10000
[CA-01] to [CA-08]	Input terminal function	General-purpose input 1 to 8 ([MI1] to [MI8]): When [MI1] to [MI8] is assigned to an input terminal, the status of each terminal is input to the internal variable X(00) to X(08) (or Xw).	086 to 093
[CC-01] [CC-02] [CC-07]	Output terminal function	General-purpose output 1 to 3 ([MO1] to [MO3]): When [MO1] to [MO3] is assigned to an output terminal, the status of the internal variable Y(00) to Y(02) (or Yw) is output to the respective terminal.	069 to 071
[Cd-03]	[FM] Output monitor selection	If "Pulse (03)" is set to "[Ao2] Output type selection [Cd-36]" and "Analog output monitor YA0 [db-18]" /"Analog output monitor YA1 [db-19]" is set, the reserved variable YA (0)/YA (1) will be output from the [Ao2] terminal.	
[Cd-04]	[Ao1] Output monitor selection	When "Analog output monitor YA0 [db-18]" /"Analog output monitor YA1[db-19]" is set, the reserved variable YA (0)/YA (1) is output from the [Ao1] terminal.	db-18/db-19
[Cd-05]	[Ao2] Output monitor selection	If "Voltage (01)" is set to "[Ao2] Output type selection [Cd-36]" and "Analog output monitor YA0 [db-18]/"Analog output monitor YA1 [db-19]" is set, the reserved variable YA (0)/YA (1) will be output from the [Ao2] terminal.	
[CF-50]	USB communication node address	Assign the station number to be used when connecting to ProDriveNext.	1 to 247
[UE-01]	EzSQ Execution cycle	EzSQ programming is executed at 1 ms/step intervals.	00
		EzSQ programming is executed at 2 ms/step intervals.	01
[UE-02]	EzSQ Function enable selection	For more information, see "EzSQ program starting method selection" in this section.	00 to 03
[UE-03]	EzSQ Program continue selection	Program restart at trip: When all trips occur, if the <on trip goto> command does not exist in EzSQ program, the program is stopped, and after the error is cleared, operation starts from the beginning of the program.	00
		Program continues at trip: If a trip other than "CPU error [E011]", "EzSQ inappropriate command error [E043]", "EzSQ nesting error [E044]", or "EzSQ command execution error [E045]" occurs, the program continues running even if the <on trip goto> instruction does not exist in EzSQ program.	01

<table>
<tr><th>Code</th><th>Name</th><th>Description</th><th>Data</th></tr>
<tr><td>[UE-10] to [UE-73]</td><td>EzSQ user parameter U(00) to U(63)</td><td>User parameters U(00) to U(63) can be read /written from the keypad using [UE-10] to [UE-73].</td><td>0 to 65535</td></tr>
<tr><td>[UF-02] to [UF-64]</td><td>EzSQ user parameter UL(00) to UL(31)</td><td>User parameter UL(00) to UL(31) can be read /written from the keypad using [UF-02] to [UF-64].</td><td>-2147483647 to 2147483647</td></tr>
<tr><td>[UG-01]</td><td>EzSQ Debug start selection</td><td rowspan="6">For more information on this parameter, refer to "12.2.3 Debug Function for EzSQ".</td><td rowspan="6">—</td></tr>
<tr><td>[UG-02]</td><td>EzSQ Program execute</td></tr>
<tr><td>[UG-03]</td><td>EzSQ Execute STEP action</td></tr>
<tr><td>[UG-10]
[UG-12]
[UG-14]
[UG-16]
[UG-18]</td><td>EzSQ break task selection 1 to 5</td></tr>
<tr><td>[UG-11]
[UG-13]
[UG-15]
[UG-17]
[UG-19]</td><td>EzSQ break line 1 to 5</td></tr>
</table>

■ User trip 0 to 9

Error code	Name	Description
[E050] to [E059]	EzSQ user-assigned error	A user trip can be generated at any given timing by executing a trip command in EzSQ program. [E050] to [E059] occurs corresponding to trip 0 to trip 9.

12.2.3 Debug Function for EzSQ

Q

- How do I check whether the operation of the created EzSQ program is as assumed?
- I want to pause the program for checking the operation of EzSQ program.
- I want to check the operation of EzSQ program, proceed the program one step at a time.

A

Enable debug function of EzSQ program

- To enable the debug function of EzSQ program, set "EzSQ Function enable selection [UE-02]" to "Debug (03)".
- When "Debug (03)" is set for [UE-02], you can select EzSQ programming operation starting mode from "[PRG] terminal (00)" and "Always enable (01)" in "EzSQ Debug start selection [UG-01]". The operation when each setting is selected is the same as when the same name is set in [UE-02]. Refer to "12.2.2 EzSQ Related Parameters" for more information.

Code	Name	Description	Data
[UE-02]	EzSQ Function enable selection	Debug: Enables the break function and the step-execution function of EzSQ program.	03
[UG-01]	EzSQ Debug start selection	When "Debug (03)" is selected for [UE-02], EzSQ program is enabled when "EzSQ program start [PRG]" is ON.	00
		If "Debug (03)" is selected for [UE-02], EzSQ program will run whenever the debug function is enabled.	01

A

Pause EzSQ program

- When "Debug (03)" is set for "EzSQ Function enable selection [UE-02]", EzSQ programming can be paused at any timing.
- EzSQ program is paused by changing the "EzSQ Program execute [UG-02]" from "Start (01)" to "Stop (00)".
- If the program reaches the designated line by specifying a task number and program line in the break function ([UG-10] to [UG-19]), EzSQ program is paused.
- The suspended EzSQ program restarts from the line following the stopped program line by changing [UG-02] from "Stop (00)" to "Start (01)".

!

- Some EzSQ programming instructions have two lines that are executed simultaneously. Therefore, even if the break line is set, it may not be paused. Be careful when you want to pause EzSQ program near the commands below.
  - <select> to <case> to <case else> to <end select>
    - You cannot pause on the following lines of <case> or <case else>:
  - <ifs> to <then> to <else> to <end if>
    - The <then> line cannot be paused.
    - You cannot pause on the following lines of <else>:
- If a blank line exists in EzSQ program, it is automatically converted to a padded blank line when writing to the inverter. Therefore, the number of lines to be broken should be specified by justifying blank lines in EzSQ program.

Code	Name	Description	Data
[UG-02]	EzSQ Program execute	When "Debug (03)" is selected for [UE-02], changing [UG-02] to "Start (01)" -> "Stop (00)" pauses EzSQ program at the line currently being executed.	00
		When "Debug (03)" is selected for [UE-02], by changing [UG-02] to "Stop (00)" -> "Start (01)", the setting change of "Start (01)" -> "Stop (00)" or EzSQ program that was stopped by the break function will be re-executed from the following line.	01
[UG-10] [UG-12] [UG-14] [UG-16] [UG-18]	EzSQ break task selection 1 to 5	Selects the task to be subject to the break function. If set to 0, the break function is disabled.	0, 1 to 5
[UG-11] [UG-13] [UG-15] [UG-17] [UG-19]	EzSQ break line 1 to 5	Selects the program line to break for the selected task. If set to 0, the break function is disabled.	0, 1 to 1024

Advance EzSQ program one step at a time

- EzSQ programs that have been stopped by either the "EzSQ Program execute [UG-02]" or the break function can be executed one step at a time by using the step function.
- After pausing, select "Execute STEP action (01)" in "EzSQ Execute STEP action [UG-03]" and save, EzSQ program will be executed one step immediately. At this time, [UG-03] will automatically return to "Disable (00)". To advance EzSQ program one step at a time, repeat the above operation.
- The suspended EzSQ program restarts from the line following the stopped program line by changing [UG-02] from "Stop (00)" to "Start (01)".

- Some EzSQ programming instructions have two lines that are executed simultaneously. Therefore, even if the step function is used, two rows may be updated. Be careful when you want to use the step function near the following command.
  - <select> to <case> to <case else> to <end select>
    - The next line following <case> or <case else> will be skipped.
  - <ifs> to <then> to <else> to <end if>
    - The next line following <ifs> or <else> will be skipped.
- Some of EzSQ program instructions do not proceed to the next line unless the specific condition is satisfied. Therefore, even if the step function is used, the program does not proceed while the condition is not met, and it must be executed again after the condition is met. Be careful when you want to use the step function near the following command.
  - <wait> command
    - If the step function is used while the <wait> line is stopped, the condition check of <wait> is started at the first time, and if the condition is satisfied after the second time, it moves to the next line.

Code	Name	Description	Data
[UG-03]	EzSQ Execute STEP action	The step execution function is disabled.	00
		When [UG-03] is changed to "Execute STEP action (01)", EzSQ program that was stopped by [UG-02] or the break function is executed by one step. After one step is executed, it is automatically changed to "Disable (00)".	01

12.3 Trace function

12.3.1 What Is Trace Function?

Q

- How do I know what I can do with the trace function?

A

- The trace function is used to acquire and accumulate the inverter monitor data under the set conditions.
- The accumulated data (trace accumulated data) can be uploaded to PC using ProDriveNext for graphing and saving.
- When using the trace function, refer to the "Inverter Configuration Software ProDriveNext Instruction Manual (NT8001*X)" for more information.

■ Specifications

Item	Description
Number of trace data	Monitor data: Up to 8 data I/O signal: Up to 8 signals (selected from input/output terminal functions)
Trace accumulated data size	8 KBytes
Sampling time (cycle)	Select from 0.2, 0.5, 1, 2, 5, 10, 50, 100, 500, 1000 (ms)
Number of sampling points	It varies depending on the number of trace data, the number of signals, and the data size of the parameter to be traced. 953 points for ex. "Number of traced data: 4, Number of signals: 1, Data size: all 2 bytes"
Trace start methods	ProDriveNext, parameter setting, input terminal function "Data trace start [DTR]"
Trigger condition	・2 conditions (4 conditions in combination) settable ・Select from trip and trace data (monitor data and signal) ・Trigger level and trigger point can be set.
Other	・Output terminal function "Trace function waiting for trigger [WFT]" ・Output terminal function "Trace function data logging [TRA]" ・Graphing and saving of accumulated data by ProDriveNext

■ Flow up to execute of trace function

No.	Description	Remarks
1	Enable the trace function. "Trace function enable [Ud-01]" = "Enable (01)"	Refer to "12.3.2 Trace Function Related Parameters".
2	Set the monitor data count and I/O signal count to be traced. "Number of trace data setting [Ud-03]" "Number of trace signals setting [Ud-04]"	
3	Select the parameter code of the monitor data to be traced. "Trace data selection ([Ud-10] to [Ud-17])"	
4	Select whether the traced I/O is an input terminal or an output terminal function. "Trace signal input/output selection ([Ud-20], [Ud-23], [Ud-26], [Ud-29], [Ud-32], [Ud-35], [Ud-38], [Ud-41])"	
5	Select input/output terminal function to be traced. Input: "Trace signal input terminal selection" ([Ud-21], [Ud-24], [Ud-27], [Ud-30], [Ud-33], [Ud-36], [Ud-39], [Ud-42]) Output: "Trace signal output terminal selection" ([Ud-22], [Ud-25], [Ud-28], [Ud-31], [Ud-34], [Ud-37], [Ud-40], [Ud-43])	
6	Select and set the trigger condition. "Trace trigger selection ([Ud-50], [Ud-54])" "Trigger activation selection at trace data trigger ([Ud-51], [Ud-55])" "Trigger level setting at trace data trigger ([Ud-52], [Ud-56])" "Trigger activation selection at trace signal trigger ([Ud-53], [Ud-57])" "Trigger condition selection [Ud-58]"	
7	Select the sampling time (cycle). "Sampling time setting [Ud-60]"	
8	Start tracing. "Trace start [Ud-02]" = "Start (01)" (Tracing can also be started from the input terminal function "Data trace start [DTR]" or ProDriveNext.)	
9	When tracing is completed, the trace stop status [*1*2] is entered, and [Ud-02] is automatically changed to "Stop (00)".	
10	Use ProDriveNext to read, graph, and save trace accumulated data.	ProDriveNext is required.

*1. When the inverter power supply is cut off, the trace accumulation data is erased.
*2. Do not stop the operation during tracing because tracing may not be performed normally.

12.3.2 Trace Function Related Parameters

Q
- I want to check the parameters related to the trace function.

A
- When using the trace function, refer to the "Inverter Configuration Software ProDriveNext Operation Manual (NT8001*X)" for more information.

Code	Name	Description	Data
[Ud-01]	Trace function enable	Disable	00
		Enable	01
[Ud-02]	Trace start	Stop tracing.	00
		Start tracing and wait for a trigger.	01
[Ud-03]	Number of trace data setting	Select the number of data to trace.	0 to 8
[Ud-04]	Number of trace signals setting	Selects how many I/O are traced.	0 to 8
[Ud-10] to [Ud-17]	Trace data 0 to 7 selection	Select the monitor parameter to be traced.	Reference trace object data
[Ud-20], [Ud-23] [Ud-26], [Ud-29] [Ud-32], [Ud-35] [Ud-38], [Ud-41]	Trace signal 0 to 7 Input/output selection	The input terminals are tracing targets. When "Input (00)" is selected, the following parameters are enabled. [Ud-21], [Ud-24], [Ud-27], [Ud-30] [Ud-33], [Ud-36], [Ud-39], [Ud-42]	00
		The output terminal is the tracing target. When "Output (01)" is selected, the following parameters are enabled. [Ud-22], [Ud-25], [Ud-28], [Ud-31] [Ud-34], [Ud-37], [Ud-40], [Ud-43]	01
[Ud-21], [Ud-24] [Ud-27], [Ud-30] [Ud-33], [Ud-36] [Ud-39], [Ud-42]	Trace signal 0 to 7 input terminal selection	Set the input terminal function to be traced.	Refer to "18.2.6 List of Intelligent Input Terminal Functions".
[Ud-22], [Ud-25] [Ud-28], [Ud-31] [Ud-34], [Ud-37] [Ud-40], [Ud-43]	Trace signal 0 to 7 output terminal selection	Set the output terminal functions to be traced.	Refer to "18.2.7 List of Intelligent Output Terminal Functions".
[Ud-50] [Ud-54]	Trace trigger 1/2 selection	Trip generation is triggered.	00
		Triggers trace data.	01 to 08
		Trigger the trace signal.	09 to 16
[Ud-51] [Ud-55]	Trigger 1/2 activation selection at trace data trigger	When "Trace data (01 to 08)" is selected for [Ud-50]/[Ud-54], the trace data is recorded when a rising trigger is detected.	00
		When "Trace data (01 to 08)" is selected for [Ud-50]/[Ud-54], the trace data is recorded when a falling trigger is detected.	01
[Ud-52] [Ud-56]	Trigger 1/2 level setting at trace data trigger	When "Tracing data (01 to 08)" is selected for [Ud-50]/[Ud-54], adjust the trigger level with the max. value of each selected monitor parameter set to 100%.	0 to 100(%)
[Ud-53] [Ud-57]	Trigger 1/2 activation selection at trace signal trigger	When "Trace signal (09 to 16)" is selected for [Ud-50]/[Ud-54], trace data is recorded with the signal ON.	00
		When "Trace signal (09 to 16)" is selected for [Ud-50]/[Ud-54], trace data is recorded with the signal OFF.	01

Code	Name	Description	Data
[Ud-58]	Trigger condition selection	Trace data is recorded when trace trigger 1 is met.	00
		Trace data is recorded when trace trigger 2 is met.	01
		Recording when either of Trigger 1 or Trigger 2 is satisfied	02
		Recording when both trigger 1 and trigger 2 are met	03
[Ud-59]	Trigger point setting	Determine the trigger point for tracing data recording.	0 to 100(%)
[Ud-60]	Sampling time setting	Inverter get the data at the set interval. 02 (0.5 ms), 03 (1 ms), 04 (2 ms), 05 (5 ms) 06 (10 ms), 07 (50 ms), 08 (100 ms) 09 (500 ms), 10 (1,000 ms)	02 to 10
[CA-01] to [CA-08]	Input terminal function	Data tracing start [DTR]: When the input terminal [DTR] becomes ON, data tracing starts regardless of the trigger setting.	108
[CC-01] to [CC-07]	Output terminal function	Trace function waiting for trigger [WFT]: When the trace function is enabled and is in trigger wait status, this signal is turned ON.	078
		Trace function data logging [TRA]: When data tracing is started and operating, this signal is turned ON.	079

■ Data to be traced

• Set the monitor parameters below to "Trace data 0 to 7 selection ([Ud-10] to [Ud-17])".

Code	Name	Size of the data (bytes)	Code	Name	Size of the data (bytes)
[dA-01]	Output frequency monitor	4	[db-36]	PID2 feedback value monitor	4
[dA-02]	Output current monitor	2	[db-42]	PID1 set-point monitor (after calculation)	4
[dA-04]	Frequency reference (after calculation) (signed)	4	[db-44]	PID1 feedback value monitor (after calculation)	4
[dA-08]	Detect speed monitor	4	[db-50]	PID1 output monitor	2
[dA-12]	Output frequency monitor (signed)	4	[db-51]	PID1 deviation monitor	2
[dA-14]	Frequency upper limit monitor	4	[db-52]	PID1 deviation 1 Monitor	2
[dA-15]	Torque reference monitor (after calculation)	2	[db-53]	PID1 deviation 2 monitor	2
[dA-16]	Torque limit monitor	2	[db-54]	PID1 deviation 3 monitor	2
[dA-17]	Output torque monitor	4	[db-55]	PID2 output monitor	2
[dA-30]	Input power monitor	2	[db-56]	PID2 deviation monitor	2
[dA-34]	Output power monitor	2	[db-64]	PID feedforward monitor	4
[dA-40]	DC bus voltage monitor	2	[dC-15]	Cooling fin temperature monitor	2
[dA-41]	BRD load factor monitor	2	[FA-01]	Main speed reference setting (monitor)	4
[dA-42]	Electronic thermal load factor monitor (Motor)	2	[FA-02]	Sub speed reference setting (monitor)	4
[dA-43]	Electronic thermal load factor monitor (Inverter)	2	[FA-15]	Torque reference setting (monitor)	2
[dA-61]	Analog input [Ai1] monitor	2	[FA-16]	Torque bias setting (monitor)	2
[dA-62]	Analog input [Ai2] monitor	2	[FA-30]	PID1 set-point 1 setting (monitor)	4
[dA-70]	Pulse input monitor	2	[FA-32]	PID1 set-point 2 setting (monitor)	4
[db-18]	Analog output monitor YA0	2	[FA-34]	PID1 set-point 3 setting (monitor)	4
[db-19]	Analog output monitor YA1	2	[FA-36]	PID2 set-point setting (monitor)	4
[db-30]	PID1 feedback value 1 monitor	4			
[db-32]	PID1 feedback value 2 monitor	4			
[db-34]	PID1 feedback value 3 monitor	4			

■ Time of trace data

- The time of trace data depends on the "Number of trace data setting [Ud-03]", "Number of trace signals setting [Ud-04]", "Sampling time setting [Ud-60]" and the data size of the monitor parameter to be traced.

[Ud-03]	Time of data tracing *1*2			
	[Ud-60]: 01(0.2ms) (Min.)		[Ud-60]: 10(1,000ms) (Max.)	
	For all 4 bytes	For all 2 bytes	For all 4 bytes	For all 2 bytes
1	344 ms (1,724 point)	576 ms (2,880 point)	1,724 s (1,724 point)	2,880 s (2,880 point)
2	190 ms (953 point)	344 ms (1,724 point)	953 s (953 point)	1,724 s (1,724 point)
3	131 ms (656 point)	245 ms (1,228 point)	656 s (656 point)	1,228 s (1,228 point)
4	100 ms (500 point)	190 ms (953 point)	500 s (500 point)	953 s (953 point)
5	80 ms (402 point)	155 ms (778 point)	402 s (402 point)	778 s (778 point)
6	67 ms (336 point)	131 ms (656 point)	336 s (336 point)	656 s (656 point)
7	57 ms (288 point)	113 ms (568 point)	288 s (288 point)	568 s (568 point)
8	50 ms (252 point)	100 ms (500 point)	252 s (252 point)	500 s (500 point)

*1. When "Number of trace signals setting [Ud-04]" is other than 0.

*2. (**** point) indicates the number of sampling points.

13

Chapter 13 Communication Option

When using the WJ-C1 in basic mode, various communication options for the WJ200 series are available. This chapter describes the precautions for using the communication options。 For details on using the communication options for the WJ200 series, refer to the "WJ Series C1 User's Guide (NT361*X)" and the instruction manuals for the respective communication options.
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

13.1 Communication Option for WJ200 Series

13.1.1 Using Communication Option for WJ200 Series

Q
- What are available communication options?
- How to mount and configure communication option?

A
- The following communication option for WJ200 series are available on WJ-C1 in basic mode.

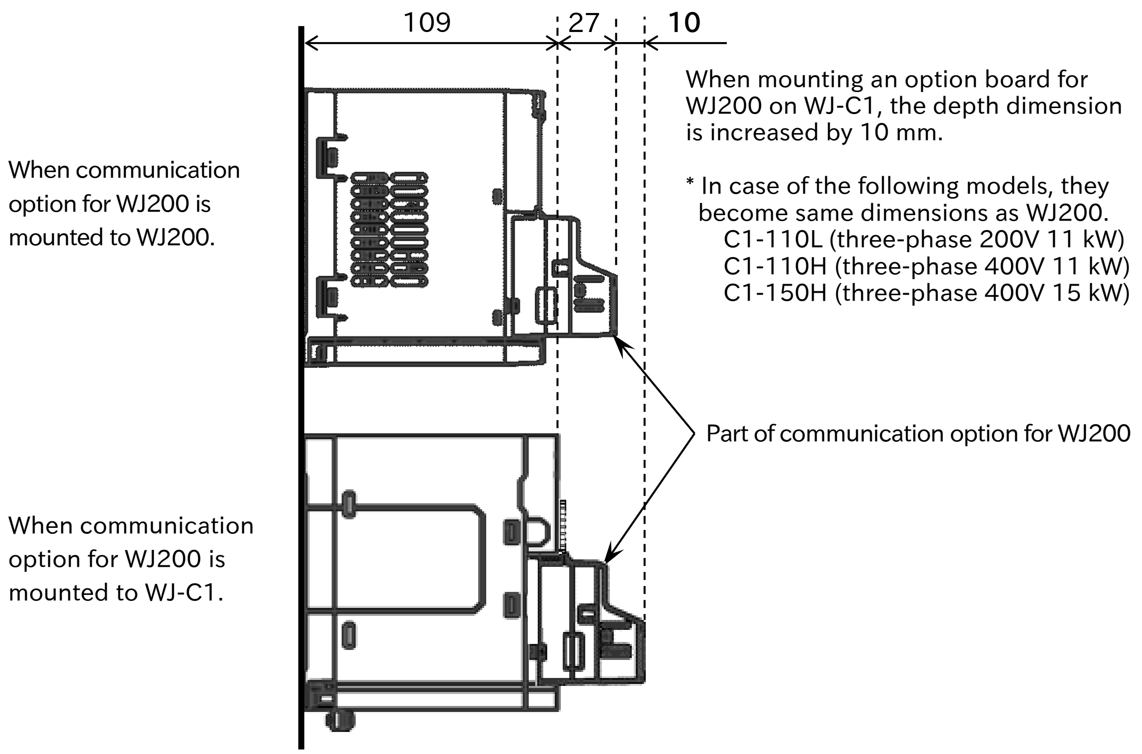
Product Name	Content
WJ-CCL	CC-Link communication option
WJ-ECT	EtherCAT communication option
WJ-PB	PROFIBUS communication option
WJ-PN	PROFINET communication option

!
- Communication options for the WJ200 series cannot be used in the extended mode of WJ-C1. Communication options for extended mode will be supported in the future.
- For details on switching between basic mode and extended mode, refer to "8.1.6 Changing Inverter Operation Mode". Also, for details on basic mode, refer to "WJ Series C1 User's Guide (NT361*X)".
- For details on how to install the communication option, refer to each instruction manual.
- The instruction manuals for each option are based on the WJ200 series, but the removal of the control terminal cover and terminal block cover, etc. are the same for the WJ-C1.

Notes on depth dimensions

- When mounting an option for WJ200 series on a WJ-C1, the depth dimensions change as shown below. Pay attention especially when replacing from WJ200 series.

e.g.) C1-002LF2 (Three-phase 200 V class 0.2 kW)



14

Chapter 14 Safety Function STO

This chapter describes the safety function STO (Safe Torque Off) defined in the functional safety EN 61800-5-2.
For further information on functional safety, refer to the separate "WJ Series C1 Safety Function Guide for Extended Mode (NT3632*X)".
For details of the installation, wiring, and the various functions of the inverter, refer to the corresponding chapters.
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks", the corresponding chapters, and pay attention to safety.

14.1 Using the Safety Function STO (Safe Torque Off)

14.1.1 STO Function

Q

- How to use the safety function defined in the functional safety EN 61800-5-2?

A

- The WJ-C1 is equipped with the STO (Safe Torque Off) function defined in EN 61800-5-2. This function is equivalent to stop category 0 defined in IEC 60204-1.
- STO function is enabled by turning on the WJ-C1 and starting the inverter. Special operations such as switches are not required.

Standard	Remarks
EN ISO 13849-1	CAT. 3, PL e
EN 61800-5-2	SIL 3
UL 1998	Diagnostic software class 1
IEC 60204-1	Stop Cat. 0

This guide explains only the outline of the STO function. When this product is handled as a functional safety certified product, be sure to check the separate "WJ Series C1 Safety Function Guide for Extended Mode (NT3632*X)" and implement the items required as a functional safety system (verification, validation, etc.).
The information given in safety function guide takes precedence.

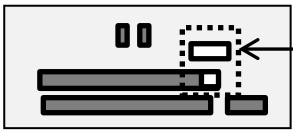
Wiring and operation procedure of safety function

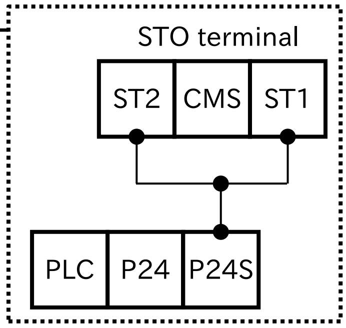
- Input of STO signal is performed by redundant input of STO input terminals [ST1] and [ST2]. When voltage is applied to each input terminal and current flows, operation of safety path is enabled. (When shipped from the factory, operation is always enabled.)
- The voltage for inputting STO signal can be selected from the inverter's internal power supply ([P24S] terminal) or an external 24 VDC power supply.
- STO function is enabled and the output to the motor is shut off by turning OFF either of the external switches for STO signal input as shown in the wiring diagram on the next page.

Symbol	Name	Description	Electrical characteristics
P24S	24 VDC output power supply terminal (STO dedicated terminal)	24 VDC power supply dedicated for [ST1]/[ST2] input. Not used when the STO input voltage is supplied from an external power supply.	Maximum output current: 100 mA
CMS	Common for 24 VDC output power supply terminal (STO dedicated terminal)	Common terminal for [P24S].	
ST1/ST2	STO input terminal*1	Input terminal for STO signal.	[ST1]/[ST2] – [CMS] voltage: ON voltage Min. 15 VDC OFF voltage Max. 5 VDC Max. allowable voltage 27 VDC Load current 5.8 mA (at 27 VDC) Internal resistance : 4.7 kΩ
11	Output terminal [11]	When EDM switch is turned ON, output terminal [11] becomes "STO state monitor [EDM]".	Open collector output ([11] to [CM2]) Max. allowable voltage: 27 VDC Max. allowable current: 50 mA Voltage drop when turned on: 4 VDC or less
CM2	Common for output terminal	Common terminal for output terminal [11].	

*1. Corresponding to "Digital input type 1" defined in IEC 61131-2.

Control circuit terminal

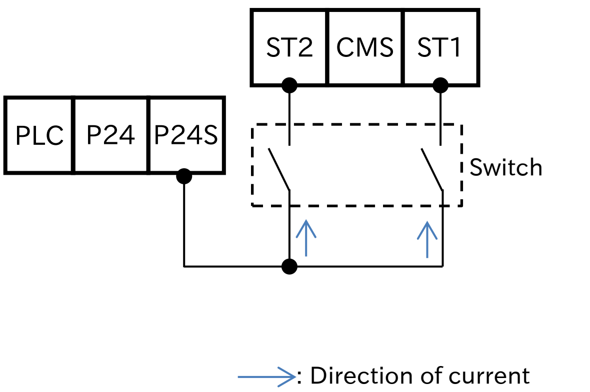




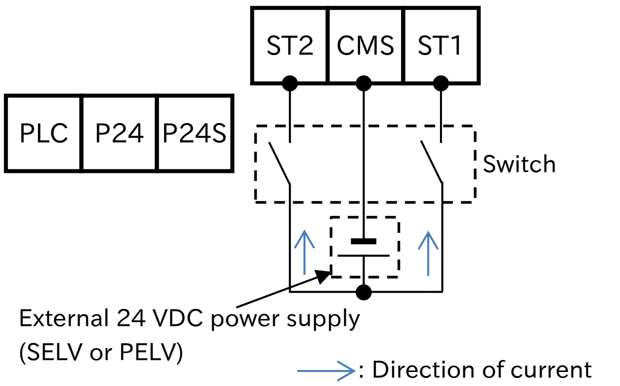
Connection of STO input terminal

- STO function is disabled by the short-circuit wire when shipped from the factory.
- Always activate the STO function using both STO inputs ([ST1]/[ST2]).

When using internal power supply



When using external power supply



STO Status Retention Function (not supported as the safety function)

- The retention function that retains the STO status of internal safety path even if STO input is canceled is not implemented as a safety circuit. Therefore, if a RUN command is given after cancellation of STO input or STO input is canceled while the command is given, the inverter starts output to the motor.
- Hence, to satisfy the requirements about cancellation of emergency stop specified in IEC 60204-1, either of the following measures has to be taken.
  (1) At the same time as STO input, set the RUN command to the inverter to stopped status.
  (2) Configure the system so that STO input to WJ-C1 is canceled when system reboot is required by the user.

By parameter settings, display of the keypad depending on ON/OFF status of [ST1]/[ST2] terminals, the error display at trip, etc. can be selected. For details, refer to "14.1.3 STO Status Indication".

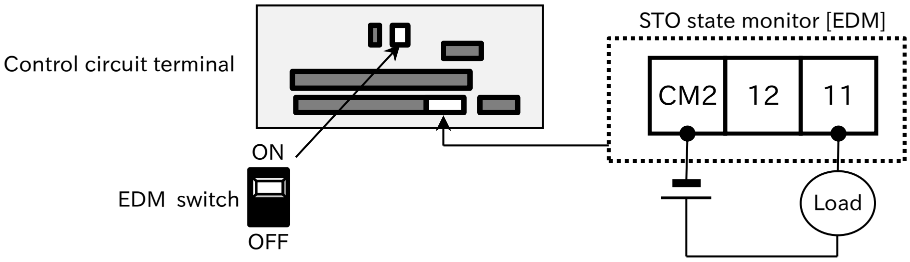
14.1.2 STO State Monitor Output (EDM Signal)

Q

- How to check the operation of STO function by enabling STO state monitor output (EDM signal)?

A

- When using STO state monitor output (EDM signal), turn ON EDM switch near the control circuit terminal. "Output terminal [11] function [CC-01]" is automatically changed to "STO state monitor [EDM](096)". At the same time, "Output terminal [11] active state [CC-11]" become "Normally Open (00)".
- "STO state monitor [EDM]" is the output signal for monitoring the input status of STO signal and failure detection status on the internal safety path. It is not permitted to activate the safety function using this signal.



Code	Name	Description	Data
[CC-01] [CC-02] [CC-07]	Output terminal function	STO state monitor [EDM] : Monitors the input status of STO signals and the fault output status on the internal safety path.	096

- For operation of [ST1]/[ST2] terminals and [EDM] signal against failure detection status, refer to the matrix below. [EDM] signal turns ON only when both STO inputs are correctly input, and internal failure is not detected.

Signal	Status 1	Status 2	Status 3	Status 4	Status 5
[ST1] terminal*1	STO	Operation permitted	STO	Operation permitted	STO or Operation permitted
[ST2] terminal*1	STO	STO	Operation permitted	Operation permitted	STO or Operation permitted
Failure detection	None	None	None	None	Detected
[EDM] signal	ON	OFF	OFF	OFF	OFF
Output to the motor	OFF	OFF	OFF	Operation permitted	OFF

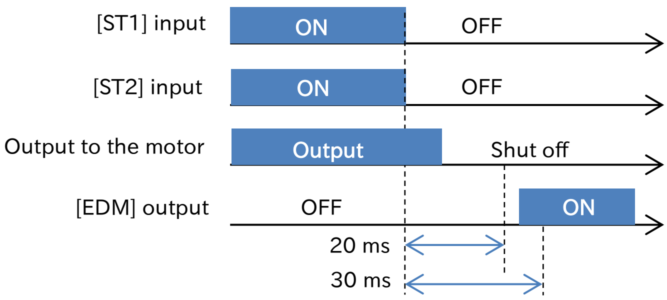
*1. [ST1]/[ST2] terminal input state and contact state: Operation permitted = Contact ON, STO = Contact OFF

!

- The operation of the safety function STO input terminals [ST1]/[ST2] and the output terminal [11] when the EDM switch is ON can be checked with the "Safety STO terminal monitor [dA-44]". For details, refer to "14.1.3 STO Status Indication".
- When EDM switch is turned OFF from ON, "Output terminal [11] function [CC-01]" is automatically changed to "Not use [no]".

STO Timing chart

- The timing chart of the output to the motor and [EDM] signal for STO input terminals [ST1]/[ST2] is shown below. The output to the motor is shut off within 20 ms after [ST1] and [ST2] are turned off.



14.1.3 STO Status Indication

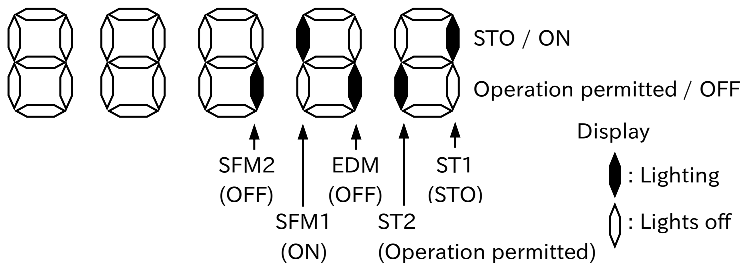
Q

- How to display STO terminal input status on the keypad?
- How to change the error that is occurred by STO depending on the setting?

A

- The indication of the keypad according to [ST1]/[ST2] input status or errors can be changed by "STO input display selection [bd-01]" setting.
- The function shown below is a referenced signal to monitor the input status of STO signal and the failure detection status of the internal safety path. It is not permitted to activate the safety function using this signal.

■ STO related monitors

Code	Name	Description	Data
[dA-44]	Safety STO terminal monitor	The 7-segment LED on the keypad indicates the input status of the [ST1]/[ST2] terminals and the ON/OFF status of the output terminal functions [EDM]/[SFM1]/[SFM2]. (e.g.) [ST1] terminal: STO [SFM1] output: ON [ST2] terminal: Operation permitted [EDM], [SFM2] output: OFF 	-
[dA-45]	Safety STO monitor	Displays the input status of the STO terminal input.For details, refer to the table in this section "Safety STO monitor [dA-45]" and status indication the keypad".	-

■ STO related parameters

Code	Name	Description	Data
[bd-01]	STO input display selection	Warning (display): When input of both [ST1] and [ST2] is STO (input contact point is OFF), "StO" is shown on the keypad.	00
		Warning (without display): When input of both [ST1] and [ST2] is STO (input contact point is OFF), any warnings are not shown on the keypad.	01
		Trip: When input of both [ST1] and [ST2] is STO (input contact point is OFF), "STO shutoff error [E090]" occurs. *) Even if either [ST1] or [ST2] is STO, [E090] error does not occur.	02
[bd-02]	STO input change time (release)	Set the allowable time for which input status when either [ST1] or [ST2] is released from STO is different. (e.g.: [ST1]=ON, [ST2]=OFF) When there is a difference between the switching time of [ST1] and [ST2], set the time that the system can allow the difference. When it is set to 0.00, the determination of allowable change time becomes disabled.	0.00 to 60.00 (s)
[bd-03]	Display selection during STO input change time	Warning (display): Displays a warning during [bd-02]/[bd-05] after the difference between the states of [ST1] and [ST2] occurs.	00
		Warning (without display): Does not display a warning during [bd-02]/[bd-05] after the difference between the states of [ST1] and [ST2] occurs.	01

Code	Name	Description	Data
[bd-04]	Action selection after STO input change time	Maintain current status: When the allowable time set in [bd-02]/[bd-05] is exceeded after the difference between the states of [ST1] and [ST2] occurs, display a warning.	00
		Disable: When the allowable time set in [bd-02]/[bd-05] is exceeded after the difference between the states of [ST1] and [ST2] occurs, does not display a warning.	01
		Trip: When the allowable time set in [bd-02]/[bd-05] is exceeded after the difference between the states of [ST1] and [ST2] occurs, "STO path 1 error [E092]" or "STO path 2 error [E093]" occurs.	02
[bd-05]	STO input change time (shutoff)	Set the allowable time for which input status when either [ST1] or [ST2] is shutted off from operation permission state is different. (e.g.: [ST1]=OFF, [ST2]=ON) When there is a difference between the switching time of [ST1] and [ST2], set the time that the system can allow the difference. When it is set to 0.00, the determination of allowable change time becomes disabled.	0.00 to 60.00 (s)
[bd-06]	Warning release mode selection	Keep warning display	00
		Release warning display	01
[bd-07]	Warning re-display time	Set the time displayed a waring again after release a warning.	1 to 30 (s)
[CC-01] [CC-02] [CC-07]	Output terminal funciton	STO input discrepancy [FSC]: When the input states of [ST1]/[ST2] does not match, [FSC] signal is turned off.	088*1
		ST1 feedback monitor [SFM1]: The input state of [ST1] terminal can be checked with [SFM1] signal. When [ST1] terminal is turned on, [SFM1] signal also turn on. When [ST1] terminal is turned off, [SFM1] signal also turn off.	094*1
		ST2 feedback monitor [SFM2]: The input state of [ST2] terminal can be checked with [SFM2] signal. When [ST2] terminal is turned on, [SFM2] signal also turn on. When [ST2] terminal is turned off, [SFM2] signal also turn off.	095*1

*1. For details of functions, refer to the separate "WJ series C1 Safety Function Guide for Extended Mode (NT3632*X)".

"Safety STO monitor [dA-45]" and status indication the keypad

[dA-45][*1]	Keypad status display[*1]	Condition[*2]	Description
00	(No indication)	<1>	Both [ST1] and [ST2] are operation permission state (contact point is ON) and inverter output is available.
01	P-1A	<2>	When both [ST1] and [ST2] are operation permission state (contact point is ON), only [ST2] changes to STO state (contact point is OFF). Then, [ST1] remains operation permission state during "STO input change time (shutoff) [bd-05]".
02	P-2A	<3>	When both [ST1] and [ST2] are operation permission state (contact point is ON), only [ST1] changes to STO state (contact point is OFF). Then, [ST2] remains operation permission state during "STO input change time (shutoff) [bd-05]".
03	P-1b	<5>	(1) This status is displayed when "P-1C" or "P-1A" status is continue for the time set in "STO input change time ([bd-02]/[bd-05])". (2) When both [ST1] and [ST2] are "Operation permitted" state (contact point is ON), only [ST2] changes to STO state (contact point is OFF). Then [ST2] is operation permission state (contact point is ON) again.
04	P-2b	<6>	(1) This status is displayed in the P-2C or P-2A status after "STO input change time ([bd-02]/[bd-05])". (2) When both [ST1] and [ST2] are operation permission state (contact point is ON), only [ST1] changes to STO state (contact point is OFF). Then [ST1] operation permission state (contact point is ON) again.
05	P-1C	<7>	From the status that both [ST1] and [ST2] is STO state (contact point is OFF), only [ST2] changes to operation permission state (contact point is ON). Then, [ST1] remains STO state (contact point is OFF) during "STO input change time (release) [bd-02]".
06	P-2C	<8>	From the status that both [ST1] and [ST2] is STO state (contact point is OFF), only [ST1] changes to operation permission state (contact point is ON). Then, [ST2] remains STO state (contact point is OFF) during "STO input change time (release) [bd-02]".
07	StO	<4>	Both [ST1] and [ST2] are "STO" state (contact point is OFF).

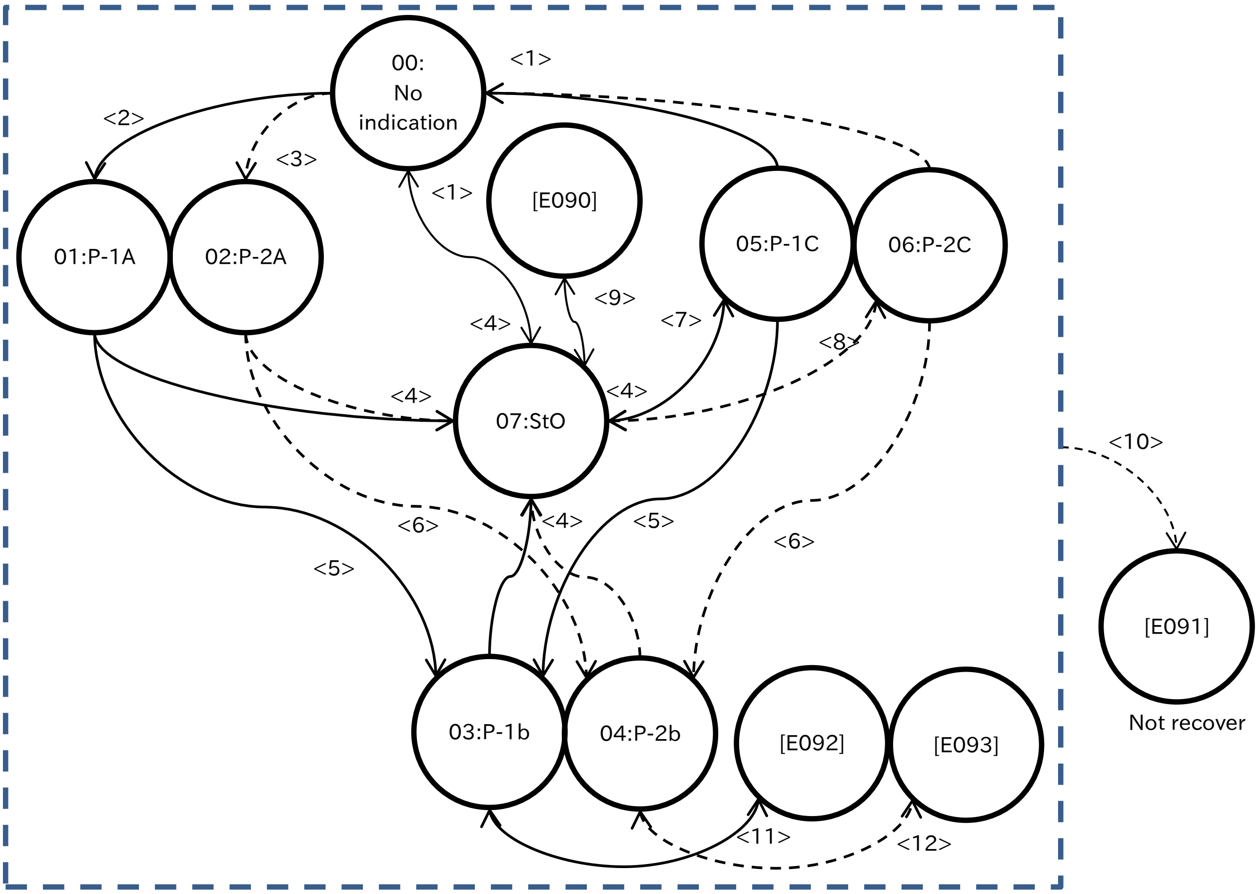
*1. "Safety STO monitor [dA-45]" and status indication of keypad can be displayed or hidden by the parameter settings of [bd-01], [bd-03], and [bd-04].
*2. For details, refer to the figure in this section "State transition diagram".

STO related error

Error code	Name	Condition[*1]	Description
[E090]	STO shutoff error	<9>	When "STO input display selection [bd-01]" is set to "Trip (02)", the error occurs when both [ST1] and [ST2] terminals become STO state.
[E091]	STO internal error	<10>	The error occurs when internal failure is found. It cannot be canceled by reset operation.
[E092]	STO path 1 error	<11>	When "Action selection after STO input change time [bd-04]" is set to "Trip (02)", the error occurs when the inverter state is changed to "P-1b".
[E093]	STO path 2 error	<12>	When "Action selection after STO input change time [bd-04]" is set to "Trip (02)", the error occurs when the inverter state is changed to "P-2b".

*1. For details, refer to the figure in this section "State transition diagram".

■ State transition diagram



15

Chapter 15 Tips/FAQ/Troubleshooting

This chapter describes errors caused by the protection function, warnings caused by the warning function, and troubleshooting when something is wrong.
Read this chapter first when the inverter does not operate as intended or a problem occurred.
Address these issues according to the circumstances by referring to the next and subsequent sections.

15.1 Self Diagnosis of Problems

15.1.1 Procedure for Checking When Problem Occurs

Q

- I want to know the confirmation procedure when a trip occurs or other trouble occurs.

▼

- If a trip, warning, or trip has not occurred, but the display is different from the normal display, or if it does not operate as intended, follow the procedure below to perform troubleshooting.

Descriptions of the trouble	References
✔ When a trip occurs and an error such as "E001" is displayed on the keypad. ✔ When a trip occurs and the inverter restarts.	See "15.2 Troubleshooting for Protection Functions Related Error" to resolve the cause.
✔ When a warning occurs and a warning such as "102" is displayed on the keypad.	Refer to "15.3.1 Warning Displays" and eliminate the cause.
✔ When an unusual display or unusual content is displayed on the keypad.	Refer to "15.3.2 Other Displays" and eliminate the cause.
✔ If it does not work well as the above-mentioned trip, warning, other indications, etc. as follows. "Some parameters are not displayed" "Cannot be set" "Operation does not start even if operation or frequency reference is input" "Operation is possible, but frequency does not increase" "The motor vibrates and distorts" and etc.	See "15.4 How to Check When Something Is Wrong" to solve the cause.

If the above does not solve the problem!

- Consult the dealer whom this inverter was purchased or our office.
- When making an inquiry, please contact us after confirming the following items.
  (1) Inverter model
  (2) Manufacturing Number (MFG No.)
  (3) Time of purchase
  (4) Descriptions of inquiries

15.2 Troubleshooting for Protection Functions Related Error

15.2.1 Checking Trip Information

Q

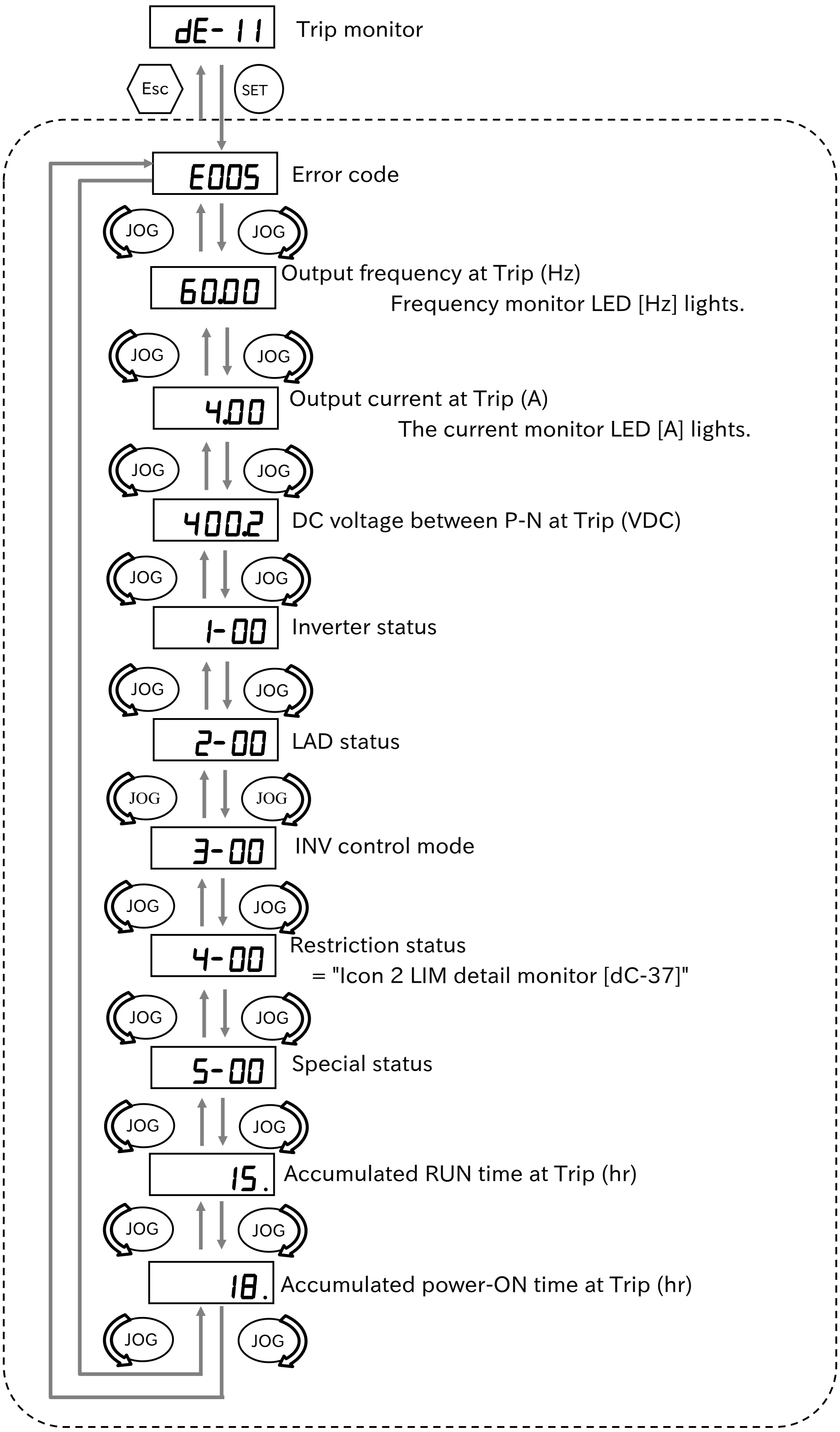
- I would like to know the details of the trip that occurred in the inverter.

A

- The inverter trip history can be displayed up to the last 10 times.
- "Trip monitor ([dE-11] to [dE-20])" allows you to refer to the error code and detailed information such as the output frequency at trip, output current, DC voltage between P-N, and inverter status. In addition, the latest trip history is displayed in "Trip Monitor 1 [dE-11]".
- Refer to the table below for the trip status (inverter status, LAD status, INV control mode, restriction status (="Icon 2 LIM detail monitor [dC-37]"), and special status).
- Release the trip (reset), (a) by pressing the STOP/RESET key, (b) turning ON→OFF the "Reset [RS]" input terminal assigned to the input terminal, or (c) turn the power OFF and ON again. (Some error causes cannot be reset by (a) or (b). For details, refer to the remedy for each error.)

Code	Name	Description	Data
—	Inverter status	Displays the inverter operation management status when an error occurs. Initialization (00), Earth fault detection (01), Stop (02) Operation standby (03), operation preparation (04), Operation (05), Stop standby (06), Retry standby (07), Retry (08)	
—	LAD status	Displays LAD (acceleration/deceleration) status when an error occurs. Cut-off (00), Min. speed (01), Accelerate (02), Decelerate (03), Constant speed (04), Restart (05)	
—	INV control	Displays the inverter control status when an error occurs. Interruption (00), Speed Control (01), Start (02), DC Braking (03), Position Control (06), Torque Control (07), Restart (08), Magnetic Pole Position Detection (09), Earth Fault Detection (10), Non-rotation Measurement (11)	
[dC-37]	Icon 2 LIM detail monitor (= Restriction status)	Not in the motor drive limit state	00
		Overcurrent suppression in progress	01
		Overload restriction in progress	02
		Overvoltage suppression in progress	03
		Torque limited	04
		Upper/Lower frequency limit, jump frequency, setting limit in progress	05
		Minimum frequency setting limit in progress	06
—	Special status	Indicates the special functions that were operating when an error occurred. Not in special function state (00), During auto-tuning (01) During simulation mode (02), During EMF mode (04), BYP mode (05)	
[dE-01]	Trip counter	Monitors the number of trips.	0 to 65535 (times)
[dE-11] to [dE-20]	Trip monitor 1 to Trip monitor 10	The following information is displayed when an error occurs. (1) Trip factor, (2) output frequency (signed), (3) output current (4) DC voltage between P-N, (5) Inverter status, (6) LAD status (7) INV control mode., (8) Limit state., (9) Special state. (10) Accumulated RUN time, (11) Accumulated power-ON time This data is stored in the internal memory when the power supply is cut off.	—
[CA-01] to [CA-08]	Input terminal function	Reset [RS]: Resetting operation is performed with ON of this signal. If tripped, trip state is canceled.	028

A Trip monitor display



!

- When forced shutdown by hardware of the inverter occurs, information at the time of error occurrence may not be acquired accurately.
- If an error occurs during output shutdown and a trip condition occurs, the value of each data may become 0.
- In case of a ground fault or instantaneous overcurrent, the current value may be recorded low.
- Trip monitor and trip count monitor can be cleared by historical initialization.
- A negative value for the output frequency indicates that an error occurred during reverse rotation.

15.2.2 Checking Retry Information

Q

- I would like to know the cause of the error and restart the inverter.

A

- Retry history of the invertor can be displayed up to 10 times in the past.
- "Retry Monitor ([dE-31] to [dE-40])" allows you to refer to the error code that caused the retry and the detailed information such as the output frequency, output current, DC voltage between P-N, and the status of the drive during the retry. Also, the most recent retry history is displayed in "Retry monitor 1 [dE-31]".
- Refer to the table below for the status at retry (inverter status, LAD status, INV control mode, restriction status (= "Icon 2 LIM detail monitor [dC-37]") and special status).

Code	Name	Description	Data
—	Inverter status	Displays the inverter operation management status when a retry occurs. Initialization (00), Earth fault detection (01), Stop (02) Operation standby (03), operation preparation (04), Operation (05), Stop standby (06), Retry standby (07), Retry (08)	—
—	LAD status	Displays LAD (acceleration/deceleration) status when a retry occurs. Cut-off (00), Min. speed (01), Accelerate (02), Decelerate (03), Constant speed (04), Restart (05)	—
—	INV control	Displays the inverter control status when an error occurs. Interruption (00), Speed Control (01), Start (02), DC Braking (03), Position Control (06), Torque Control (07), Restart (08), Magnetic Pole Position Detection (09), Earth Fault Detection (10), Non-rotation Measurement (11)	—
[dC-37]	Icon 2 LIM detail monitor (= Restriction status)	Not in the motor drive limit state	00
		Overcurrent suppression in progress	01
		Overload restriction in progress	02
		Overvoltage suppression in progress	03
		Torque limited	04
		Upper/Lower frequency limit, jump frequency, setting limit in progress	05
		Minimum frequency setting limit in progress	06
—	Special status	Displays the special function that was operating when the retry occurred. Not in special function state (00), During auto-tuning (01) During simulation mode (02), During EMF mode (04), BYP mode (05)	—
[dE-31] to [dE-40]	Retry monitor 1 to Retry monitor 10	Displays the following information when a retry occurs. (1) Trip factor, (2) Output frequency (signed), (3) Output current (4) DC voltage between P-N, (5) Inverter status, (6) LAD status (7) INV control mode., (8) Limit state., (9) Special state. (10) Accumulated RUN time, (11) Accumulated power-ON time This data is stored in the internal memory when the power supply is cut off.	—

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- The contents of the retry monitor display are the same as the trip monitor. Refer to "15.2.1 Checking Trip Information".

15.2.3 Error/Retry Code and Countermeasure

Q

- An error occurred, so I would like to check the cause and the remedy.
- The inverter performed a retry, so we would like to confirm which factor was the retry.

A

Error code and Retry code list

- Refer to the table below for the error code and retry code and the corresponding error content.
- Refer to the relevant section in this section for details of each error.

Error code	Retry code	Error name	Page
E001	r001	Overcurrent error	15-2-5
E005	—	Motor overload error	15-2-6
E006	—	Braking resistor overload error	15-2-7
E007	r007	Overvoltage error	15-2-8
E008	—	Memory error *1	15-2-9
E009	r009	Undervoltage error	15-2-9
E010	—	Current detector error	15-2-10
E011	—	CPU error *1	15-2-10
E012	—	External trip	15-2-11
E013	—	USP error	15-2-11
E014	—	Ground fault error *1	15-2-12
E015	—	Input overvoltage error	15-2-12
E019	—	Temperature detector error	15-2-12
E021	—	Temperature error	15-2-13
E022	—	CPU communication error	15-2-13
E024	—	Input phase loss	15-2-14
E025	—	Main circuit error	15-2-14
E026	—	Analog input level over error	15-2-15
E030	—	Driver error *1	15-2-15
E034	—	Output phase loss	15-2-16
E035	—	Thermistor error	15-2-16
E036	—	Brake error	15-2-17
E038	—	Overload error at low speed	15-2-17
E039	—	Controller overload error	15-2-18
E040	—	Operator keypad disconnection error	15-2-19
E041	—	RS485 communication error	15-2-19
E042	—	RTC error	15-2-19
E043	—	EzSQ inappropriate command error	15-2-20
E044	—	EzSQ nesting error	15-2-20
E045	—	EzSQ command execution error	15-2-20

Error code	Retry code	Error name	Page
E050	—	EzSQ user-assigned error 0	15-2-21
E051	—	EzSQ user-assigned error 1	
E052	—	EzSQ user-assigned error 2	
E053	—	EzSQ user-assigned error 3	
E054	—	EzSQ user-assigned error 4	
E055	—	EzSQ user-assigned error 5	
E056	—	EzSQ user-assigned error 6	
E057	—	EzSQ user-assigned error 7	
E058	—	EzSQ user-assigned error 8	
E059	—	EzSQ user-assigned error 9	
E060	—	Option error 0	15-2-21
E061	—	Option error 1	
E062	—	Option error 2	
E063	—	Option error 3	
E064	—	Option error 4	
E065	—	Option error 5	
E066	—	Option error 6	
E067	—	Option error 7	
E068	—	Option error 8	
E069	—	Option error 9	
E090	—	STO shutoff error	15-2-21
E091	—	STO internal error	15-2-22
E092	—	STO path 1 error	15-2-22
E093	—	STO path 2 error	15-2-22
E100	—	Encoder disconnection error	15-2-23
E104	—	Positioning range error	15-2-23
E105	—	Speed deviation error	15-2-24
E107	—	Excessive speed error	15-2-24
E110	—	Contactor error	15-2-24
E120	—	PID soft start error	15-2-25
E121	—	Abnormal upper detecting error	15-2-25
E122	—	Abnormal lower detecting error	

*1. These errors are major failure, and these errors could not be canceled with keypad and input terminal function "Reset [RS]". When major failure is occurred, the output terminal function "Major failure [MJA]" turns ON. For details, see "9.11.2 Major Failure Signal".

List of trip codes and their contents, possible causes and remedies

E001 Overcurrent error

E001

- When a large output current flows through the inverter exceeding the overcurrent level, the inverter shuts off the output.
- Overcurrent level can be set by "Overcurrent detection level [bb160]". In factory setting, [bb160] is set to 2.2 times the rated output current at ND rating regardless of ND/LD rating setting.
- By setting the parameters for the retry function, the inverter is possible to retry a certain number of times without error.

Generation status ▷	Possible causal ▷	Example of remedy
Sudden occurrence during operation	Steep load fluctuation occurs	• The overcurrent suppression function and the overload restriction function are enabled to suppress the overcurrent. • When using vector control, it may be improved by adjusting "Speed response [HA115]".
	Motor hunting	• It may be improved by setting "Async. Motor capacity setting [Hb102]", "Async. Motor number of poles setting [Hb103]" correctly or by performing auto-tuning. • It may be improved by adjusting the "Stabilization constant [HA110]".
Occurred during acceleration	• The acceleration time is short. • Insufficient acceleration torque • Load inertia is large • High friction torque	• Acceleration torque failure can be alleviated by increasing the acceleration time. • If acceleration torque is required, you may improve it by adjusting "Manual torque boost value [Hb141]", or changing the control method with "Control mode selection [AA121]", etc. • It may be improved by reviewing the load conditions.
Occurred during deceleration	• Deceleration time is short • Failure regenerative torque • Load inertia is large	• Lengthening the deceleration time can alleviate failure regenerative torque. • If regenerative torque is required, you may need to adjust "Manual torque boost value [Hb141]", change the control method with "Control mode selection [AA121]", etc. • It may be improved by reviewing the load conditions.
Occurred immediately after RUN command input	• Occurrence of a ground fault • Motor output wire is short-circuited or out of phase. • Output element failure	• If this happens even when the power is turned on by the inverter alone after disconnecting the output line to the motor, there is a possibility of failure. • If the output line to the motor is disconnected and no longer occurs, the wiring and motor must be checked.
	• Motor is captive • Load inertia is large	• It may occur if the rotation of the motor is restricted. • The above countermeasures for "Occurred during acceleration" may be improved.
Occurred immediately after power-on	• Output element failure • Current detector failure	• The output element or current detector may be faulty. • Investigation and repair are required.
Occurred after prolonged use	Changes in the system environment	It may also reduce the motor load and improve system maintenance, for example, by cleaning the fan being driven or by removing clogged ducts.
	Aging degradation	If the problem is not solved by reducing the load, etc., the finite life parts may have reached the end of their life. Replacing the inverter is required.

E005 Motor overload error

E005

- Shuts off the inverter output and trips when the electronic thermal function detects a motor overload monitoring the inverter output current.
- Time until motor overload error and the behavior after motor overload error is changed according to the setting of the motor rated current and the electronic thermal function.*1)

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during a certain period of operation	Heavy load continued	• It may be improved by reviewing the operating conditions and improving the load conditions. • If the "Electronic thermal level setting [bC110]" is not appropriate, it may be improved by reviewing the setting.
	The thermal setting is high.	• It may be improved by performing auto-tuning to set "Async. Motor capacity setting [Hb102]", "Async. Motor number of poles setting [Hb103]", etc. • It may be improved by adjusting "Stabilization constant [HA110]".
Occurred during acceleration	• Insufficient acceleration torque • Load inertia is large • High friction torque	• Acceleration torque failure can be alleviated by increasing the acceleration time. • If acceleration torque is required, you may improve it by adjusting "Manual torque boost value [Hb141]", or changing the control method with "Control mode selection [AA121]", etc. • It may be improved by reviewing the load conditions.
	The function to suppress the overcurrent is activated.	An overcurrent may have occurred. Review the acceleration time and load conditions.
Occurred during deceleration	• Load inertia is large	• Lengthening the deceleration time can alleviate failure regenerative torque. • If regenerative torque is required, you may need to adjust "Manual torque boost value [Hb141]", change the control method with "Control mode selection [AA121]", etc.
	Overvoltage suppression function is activated.	As a result of suppressing overvoltage, current may grow. Review the deceleration time and load conditions.
Occurred after prolonged use	Changes in the system environment	It may also reduce the motor load and improve system maintenance, for example, by cleaning the fan being driven or by removing clogged ducts.
	Aging degradation	If the problem is not solved by reducing the load, etc., the parts that have reached the end of their life may deteriorate over time. Repair is required.

*1) Note

When "Electronic thermal decrease function enable [bC112]" is "Disable (00)", the inverter does not accept a reset operation for 10 seconds. Wait for a while before performing a reset operation.

When [bC112] is "Enable (Linear decrement) (01)" or " Enable (Time constant decrement) (02)", it can be reset immediately after error occurs. However, the overload accumulated value is not cleared and the value continue to decrease after reset operation.

Therefore, when the inverter is restarted immediately after reset operation, the overload accumulated value may quickly reach 100% and the error may occur again. In this case, wait for a while before restarting.

E006 Braking resistor overload error

E006

- Shuts off the inverter output and trips, when the braking resistor operation circuit (BRD) usage rate exceeds the usage rate specified in "Dynamic brake use ratio [bA-60]".

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during deceleration	• Deceleration time is short • Load inertia is large • Braking resistor capacity is small	• If the inertia of the load is suddenly decelerated, it may be improved by increasing the deceleration time. • If the deceleration time cannot be shortened, the selection of the resistor must be reviewed.
Generated when driving	• Continuation of regenerative operation • Braking resistor capacity is small	The resistor may not be fully consumed due to the high regenerative power returned from the motor. The load conditions must only be reviewed and the resistor selection must be reviewed.
	Be turned by external force	The resistor may not be fully consumed because the regenerative power returned from the motor increases when the fan is driven by a strong wind or a load is unloaded by a crane. The load conditions must only be reviewed and the resistor selection must be reviewed.
Occurred by repeated operation	Frequent operation cycles	• There is a possibility of improvement by reducing the frequency of operation cycles. • Adjusting the deceleration time or reviewing the selection of the resistor may also improve the performance.

E007 Overvoltage error

E007

- Shuts off the inverter output and trips, when detecting a high DC bus voltage exceeding the overvoltage level.
- Overvoltage level is approx. 400 VDC (200 V class) or approx. 800 VDC (400 V class).
- When a high DC bus voltage exceeding the overvoltage level is detected, the inverter can perform to retry for a certain number of times without tripping by the parameter setting for the retry function.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during deceleration	• Deceleration time is short • Load inertia is large	• If the load is decelerating rapidly, it may be improved by increasing the deceleration time. • If the deceleration time cannot be shortened, it is necessary to review the load conditions, enable the overvoltage suppression function or the over-magnetization function, use a braking resistor, a regenerative braking unit, or a regenerative converter, etc.
Occurred when driving	Load inertia is large	If the inertia of the load is large, the regenerative power returned from the motor is high, so it is likely to be overvoltage. It is necessary to review the load conditions, enable the overvoltage suppression function or the over-magnetization function, use a braking resistor, regenerative braking unit, or a regenerative converter.
	Motor is running by external force (fan, crane)	If the motor speed is higher than the inverter output frequency (rotational speed), it is liable to become overvoltage. It is necessary to review the load conditions, enable the overvoltage suppression function or the over-magnetization function, use a braking resistor, regenerative braking unit, or a regenerative converter.
Occurred during the stop	Abnormal power voltage	The power supply voltage may be rising or fluctuating. It may be improved by reviewing the power supply environment or by inserting the input-side AC reactor.
Occurred during the droop control	Mutual interference caused by two motors strictly controlling each other	When two motors driving the same axis are controlled by two inverters, the control may diverge because they attempt to output torque from each other. One control may be improved by P control. See "9.6.7 Operate a Load with Multiple Motors (Droop Control).

E008 Memory error

E008

- Shuts off the inverter output and trips, when the internal memory has problems.
- "CPU error [E011]" may be issued instead.
- The reset operation is not accepted. A power on reset is required.
- When the inverter recovers by a power on reset, make sure the parameter setting is correct.

Generation status ▷	Possible causal ▷	Example of remedy
Occurs some time after the power is turned on	Noise contamination	To prevent external noise, it may be necessary to take noise countermeasures such as moving the noise source away or inserting a shielding plate.
Occurred after unintentional power shutdown (main power supply, external 24 VDC power supply)	Power shutdown during memory access	• Data must be recovered using data backed up beforehand by the remote operator (VOP) or inverter configuration software ProDriveNext. • If you cannot recover, you must initialize the data. Refer to "7.2.2 Initialize Parameters". • If it cannot be restored by initialization, repair is required.

E009 Undervoltage error

E009

- Shuts off the inverter output and trips, when detecting a low DC bus voltage below the undervoltage level to prevent the temperamental circuit operation.
- Undervoltage level is approx. 173 VDC (200 V class) or approx. 345 VDC (400 V class).
- When a low DC bus voltage below the undervoltage level is detected, the inverter can perform to retry for a certain number of times without tripping by the parameter setting for the retry function.
- Undervoltage error during stop can be disabled by the parameter setting for the overvoltage suppression function.

Generation status ▷	Possible causal ▷	Example of remedy
There was a power failure.	The power supply voltage dropped.	If the internal power supply does not completely turn off, you can restart after power is restored by setting the retry function.
Occurred by driving	• The power supply voltage dropped. • Insufficient power capacity	If the power supply voltage drops or the power supply capacity is insufficient, the power supply environment must be reviewed.
Inverter does not start	Insufficient power supply voltage	Supply power according to the voltage class of the inverter.
Occurred after prolonged use	• Changes in the system environment • Deterioration of the capacitor • Circuit failure	If undervoltage occurs frequently, it may be of life or malfunction. Replacing the inverter is required.

E010 Current detector error

- Shuts off the inverter output and trips, when detects abnormally on the built-in current sensor.

E010

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after power-on	The current detection circuit is broken.	If this happens again even after resetting the error, the current detection circuit may be faulty. Replacing the inverter is required.
	Have a noise source nearby	If there is a noise source nearby, it may be improved by taking measures against noise, such as moving the noise source away or inserting a shielding plate.
Occurred after prolonged use	The current detection circuit is broken.	If this happens again even after resetting the error, the current detection circuit may be faulty. Replacing the inverter is required.

E011 CPU error

- Shuts off the inverter output and trips, when the internal CPU has problems or malfunction.

E011

Generation status ▷	Possible causal ▷	Example of remedy
Suddenly occurred	Internal CPU is corrupted.	• It may be recovered by turning on the power supply again. When it is restored, initialization must be executed. See "7.2.2 Initialize Parameters". • If it does not recover, it may be malfunctioning. Repair is required.
	Have a noise source nearby	If there is a noise source nearby, it may be improved by taking measures against noise, such as moving the noise source away or inserting a shielding plate.
Occurs during data writing.	Inconsistent data	It may be recovered by turning on the power supply again. When it is restored, initialization must be executed. See "7.2.2 Initialize Parameters".

E012 External trip

E012

- Shuts off the inverter output and trips, when the inverter receive an signal from an external equipment to input terminal which is assigned "External fault [EXT]".

Generation status ▷	Possible causal ▷	Example of remedy
Unintentionally occurred	• The terminal logical is reversed. • Wrong wiring	• The operation status from the external device and external device must be checked, and the "External fault [EXT]" terminal assignment to the input terminal function, setting of a/b contact, external trip command by communication, etc. must be reviewed. • a/b contacts of the terminals can be changed in the settings of the inverters.

E013 USP error

E013

- Shuts off the inverter output and trips, when the inverter power is turned on while applied an RUN command.
  - Unattended start protection function is enabled when input terminal function "Unattended start protection [USP]" is turned on or "[USP] active selection [CA-73]" is "Enable (01)".
  - RUN command detection is executed for 2 second after the power is turned on.

Generation status ▷	Possible causal ▷	Example of remedy
Unintentionally occurred	Timing of entering RUN command is fast.	Review the sequence for entering the RUN command. After the power is turned on, it is necessary to wait for at least 2 seconds before turning on the RUN command.
	RUN command is not released	RUN command must be released when the power is turned on.
	Attempting to move by a command other than a terminal	When the power restoration restart prevention function is enabled, commands such as keypad and communication commands are also subject to errors. After the power is turned on, it is necessary to wait for at least 2 seconds before turning on the RUN command.

E014 Ground fault error

E014

- The inverter instantly protects from ground-fault, when detects the ground fault between the inverter output and the motor on power up.
- The function does not work while inverter trips.
- Enable/disable of the ground fault detection can be selected by "Detect ground fault selection [bb-64]" setting.
- When the external 24 VDC power supply has been turned on prior to the main power supply (R, S, T), the ground fault detection function is activated at the time the main power supply is turned on.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred by turning on the power	• Ground fault in wiring and motor • Insulation deterioration of motor	• Disconnect the wires to the motor and check the motor and wiring after shutting off the power. Ground fault or insulation degradation is suspected. • Turning on the power with the ground fault condition may cause a failure. Check the motor and motor wiring without turning on the power.

E015 Input overvoltage error

E015

- When "Power supply overvoltage selection [bb-61]" is "Error (01)", the inverter trips when persist overvoltage condition for more than 100 seconds while the inverter is in stop status.
- Input overvoltage level can be set by "Power supply overvoltage level setting [bb-62]".

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after power-on	Receiving voltage is high	Review of the power supply environment is required.
Occurred after prolonged use	The power supply becomes unstable.	The power supply environment may have changed due to equipment replacement, etc. Review of the power supply environment is required.

E019 Temperature detector error

E019

- The inverter trips when there is a problem in the temperature detector circuit such as disconnection.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after power-on	The temperature detection circuit is disconnected or has failed.	The temperature detection circuit has failed. Replacing the inverter is required.

E021 Temperature error

- Shuts off the inverter output and trips, when the internal temperature is above the threshold.

E021

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during operation	Have a high carrier frequency	When the carrier frequency is high, the internal temperature of the inverter rises easily. Decrease the setting of "Carrier frequency setting [bb101]".
	Fins are clogged	If the fins are clogged, cooling performance will be reduced. Cleaning the fins may improve them.
	• Use in high-temperature environments • Poor ambient cooling	It may be improved by improving the operating environment and cooling environment.
	Not satisfying normal installation conditions	Incorrect installation of the inverter may cause a failure. Install the product correctly according to this guide.
Occurred after prolonged use	The temperature detection circuit has failed.	If an error occurs continuously after resetting, the temperature detection circuit has failed. Repair is required.

E022 CPU communication error

- Shuts off the inverter output and trips, when occurs a communication error in an internal CPU.

E022

Generation status ▷	Possible causal ▷	Example of remedy
Suddenly began to occur	Internal CPU is corrupted.	• Reset operation, power restoration, or initialization operation may recover the unit. When it is restored, initialization must be executed. See "7.2.2 Initialize Parameters". • If it does not recover, it may be malfunctioning. Repair is required.
	Have a noise source nearby	If there is a noise source nearby, it may be improved by taking measures against noise, such as moving the noise source away or inserting a shielding plate.

E024 Input phase loss

E024

- Shuts off the inverter output and trips, when detects a phase loss of input side of main circuitry.
- Enable/disable of the input phase loss detection can be selected by "Input phase loss detection enable [bb-65]" setting.
- The single-phase inverters shut off the power when input phase loss. In this case, set [bb-65] to "Disable (00)".

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after power-on	Poor contact or disconnection of the power input line	It is necessary to shut off the power supply and check the wiring condition of the power input line and the breaker. This can also occur if the power supply voltage is defective, the contact is defective, or the screw is not tightened properly.
	A model using three-phase power supply and single-phase input.	For models using a three-phase power supply, connect all three phases of the power input wires.
Occurred after prolonged use	Poor contact or disconnection of the power input line	Improvements may be made due to poor contact caused by loose screws or by improving abnormalities in the circuit breaker.

E025 Main circuit error

E025

- Shuts off the inverter output and trips, when occurs a malfunction on the main circuit board.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after power-on	Have a noise source nearby	If there is a noise source nearby, it may be improved by taking measures against noise, such as moving the noise source away or inserting a shielding plate.
	The main circuit board is faulty.	Repair is required if the main circuit board is faulty.

E026 Analog input level over error

E026

- When "[Ai1] input selection [Cb-08]" or "[Ai2] input selection [Cb-18]" is "Current (02)", the inverter trips when excessive current come into the analog input terminal [Ai1]/[Ai2].
- Power off the inverter when occurs this error and check the wiring connection of analog input.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred when a command is issued by analog current input.	Miswiring to the control terminal	Check the wiring of the analog current input after the power is turned off.

E030 Driver error

E030

- At the time of an instantaneous overcurrent from motor or external braking resistor, or the main element failure the inverter turns off the output to protect the main element.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred immediately after operation	• Occurrence of a ground fault • Motor output wire is short-circuited.	After the power is cut off, it is necessary to check the output line to the motor, disconnection of the motor, etc. If this happens when the motor wiring is removed, it is malfunctioning, and the inverter needs to be replaced.
	Motor rotation constrained	If the motor is restrained during operation, a large current may flow. You need to eliminate the cause.
	The output element is defective.	Repair is required if the output element fails.
Occurred immediately after power-on	The output element is defective.	Repair is required if the output element fails.
Occurred during operation	The external braking resistor connection terminal is short-circuited or a braking resistor less than the minimum connection resistance value is connected.	After shutting off the power supply, it is necessary to check the braking resistor wiring and resistance. If this happens even when the braking resistor and motor output wire are disconnected, it is malfunctioning and must be repaired.
	Motor rotation constrained	If the motor is restrained during operation, a large current may flow. You need to eliminate the cause.

E034 Output phase loss

E034

- Shuts off the inverter output and trips, when a loose connection, disconnection of output line, disconnection inside the motor, etc., are detected.
- Enable/disable of the output phase loss detection can be selected by "Output phase loss detection enable [bb-66]" setting.
- Detection of output phase loss is executed in the section of output frequency 5 Hz to 100 Hz.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred immediately after operation	Contact or disconnection of motor output wire or motor has occurred.	• It is necessary to shut off the power supply and check the wiring condition of the output wire and the motor. This can also occur due to dielectric breakdown of the motor or improper screw tightening. • Be sure to connect all three phases of the motor output wire.
Occurred after long-time operation	Contact or disconnection of motor output wire or motor has occurred.	It is necessary to shut off the power supply and check the wiring condition of the motor output wire and motor. If any of the screws are loose, retighten them to improve the problem.

E035 Thermistor error

E035

- Shuts off the inverter output and trips, when an abnormal temperature is observed with an external thermistor.
- When "Thermistor type selection [Cb-40]" is "PTC (01)", the input terminal [5] become for external PTC type thermistor. In this case, "Input terminal [5] function [CA-05]" setting is disabled.
- The threshold of abnormal temperature can be set by "Thermistor error level [bb-70]" and "Thermistor gain adjustment [Cb-41]".
- When [Cb-40] is "PTC (01)", this error is occurred when the external thermistor is disconnected and re-generated after trip reset. In this case, it is required to connect the thermistor or short between [5] terminal and [L] terminal.

Generation status ▷	Possible causal ▷	Example of remedy
The motor is generating heat.	Motor is not cooling well	Cooling environment should be improved
	Heavy load conditions continue	The drive environment of the motor must be reviewed.
Motor does not generate heat	Incorrect setting of thermistor function	It may be improved by reviewing the "Thermistor error level [bb-70]" and "Thermistor gain adjustment [Cb-41]" settings.
	Thermistor is defective	The thermistor must be repaired.
	Malfunction due to noise	This may be improved by noise suppression measures such as wiring separation.

E036 Brake error

E036

- Shuts off the inverter output and trips, when the inverter can not detect whether the input function "Answer back from Brake [BOK]" is ON or OFF during "Brake release wait time ([AF131], [AF138])" after the inverter has output a "Brake release [BRK]" signal.
- When [BOK] is not assigned to "Input terminal function ([CA-01] to [CA-08])", this error is not occurred.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after operation	Break in the signal wire	Check the wires of the "Answer back from Brake [BOK]" input terminals and whether signals are present.
	Setting the brake function	Reconsider the brake confirmation wait time and input terminal logical according to the signal sequence.

E038 Overload error at low speed

E038

- When the inverter operate lower than 0.2 Hz, shuts off the inverter output and trips when the electronic thermal function detects a motor overload monitoring the inverter output current to prevent the main element failure.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred at low-speed output	Heavy motor load	It is necessary to reduce the load in the low-speed range. If the error occurs frequently, it is necessary to select an inverter with a larger capacity for the motor.

E039 Controller overload error

E039

- Shuts off the inverter output and trips when the thermal electronic function detects an inverter (controller) overload monitoring the inverter output current.
- When the controller overload error occurs, reset command can not be accepted for 10 seconds.
- There is no user parameter for controller overload protection. The controller overload detection is according to the rated output current at ND rating. It is impossible to change the time until controller overload error and the behavior after controller overload error like "Motor overload error [E005]".
- Regardless the setting of "Load type selection [Ub-03]", ND rated derating is applied. For detail, see "17.3 Current Derating".

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during a certain period of operation (or during acceleration)	Heavy load continued	It may be improved by reviewing the operating conditions and improving the load conditions.
	The load (ND/LD) was changed, and the carrier frequency was changed, resulting in an overload due to current derating.	Improvements may be made by lowering the carrier frequency setting, overload restriction, overcurrent suppression or other operating conditions, or by improving the load conditions.
Occurred during acceleration	• Insufficient acceleration torque • Load inertia is large • High friction torque	• Acceleration torque failure can be alleviated by increasing the acceleration time. • If acceleration torque is required, you may improve it by adjusting "Manual torque boost value [Hb141]", or changing the control mode with "Control mode selection [AA121]", etc.
	The function to suppress the overcurrent is activated.	An overcurrent may have occurred. Review the acceleration time and load conditions.
Occurred during deceleration	Failure regenerative torque	• Lengthening the deceleration time can alleviate failure regenerative torque. • If regenerative torque is required, you may need to adjust "Manual torque boost value [Hb141]", change the control method with "Control mode selection [AA121]", etc.
	Overvoltage suppression function is activated.	As a result of suppressing overvoltage, current may grow. Review the deceleration time and load conditions.
Occurred after prolonged use	Changes in the system environment	It may also reduce the motor load and improve system maintenance, for example, by cleaning the fan being driven or by removing clogged ducts.
	Aging degradation	If the problem is not solved by reducing the load, etc., the parts that have reached the end of their life may deteriorate over time. Replacing the inverter is required.

E040 Operator keypad disconnection error

E040

- Shuts off the inverter output and trips, when occurs this error between optional remote operator and inverter due to noises, loose connection or disconnection.
- Enable/disable of the timeout detection between optional remote operator and inverter can be selected by "Action selection at keypad disconnection [UA-20]" setting.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after communication starts	• Poor contact • Disconnection	Check the wiring to see if the connection is correct.
	Noise contamination	Noise suppression measures such as wiring separation may improve the wiring.

E041 RS485 communication error

E041

- Shuts off the inverter output and trips, when RS485 communication timeout occurs because of a malfunction due to noises, loose wire connection, wiring disconnection, etc.
- Enable/disable of the RS485 communication timeout detection can be selected by "RS485 communication error selection [CF-05]" setting.
  - This error may occur even if the communication settings with the connected control device do not match. In this case, the connection is not normally established and an error occurs in the host device. It is required to check the RS485 communication setting ([CF-01] to [CF-08]).

Generation status ▷	Possible causal ▷	Example of remedy
Occurred after communication starts	• Poor contact • Disconnection	Check the wiring to see if the connection is correct.
	Noise contamination	Noise suppression measures such as wiring separation may improve the wiring.

E042 RTC error

E042

- Shuts off the inverter output and trips, when the RTC data incorporated in the remote operator(VOP) has returned to the initial data.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred at power-on	The remote operator (VOP) batteries run out.	This error occurs when the inverter power is turned on again if the battery is exhausted. It is canceled by changing the battery and setting the date and time.

E043 EzSQ inappropriate command error

E043

- Shuts off the inverter output and trips, when there is an inappropriate command in EzSQ program.
- This error is also occurred when the EzSQ program is executed despite it is not downloaded.

Generation status ▷	Possible causal ▷	Example of remedy
When an attempt was made to operate a program, it occurred.	Write error due to noise	Programming of EzSQ may have failed. If there is a noise source nearby, it may be improved by taking measures against noise such as moving the noise source away or inserting a shield plate before writing.
	There is no program.	EzSQ must be programmed after factory-set and initialization. Write the program.

E044 EzSQ nesting error

E044

- Shuts off the inverter output and trips, when the nesting like subroutine, "for", "next", etc. exceeds 8 times in EzSQ program.

Generation status ▷	Possible causal ▷	Example of remedy
After running the program As it occurred	The structure of the program is too complex	The hierarchy of subroutines, for statements, and next statements is deep, and the number of nesting times exceeds eight. Improvement of program structure is required.

E045 EzSQ command execution error

E045

- Shuts off the inverter output and trips, when command cannot be processed appropriately while EzSQ program is executed such as overflow and 0-division.

Generation status ▷	Possible causal ▷	Example of remedy
The alarm was generated when the program was operated.	Program flow is unreasonable	If there is no beginning of nesting, such as <for>, or if the end of nesting, such as <next>, precedes the jump of <goto>, an error is printed. Check and correct the structure of the <for> and <next> statements.
	Data is abnormal.	Overflow, underflow, or division by zero may have occurred in the arithmetic operation. Check and correct the operation result.
		If a parameter that does not exist in the <chg param>, <mon param> command is referenced or out of the setting range, an error occurs. Check and correct the contents described in the command.

E050 to E059
EzSQ user-assigned error 0 to 9

- Shuts off the inverter output and trips, when the user-assigned trip command is executed in EzSQ program.

E050 to E059

Generation status ▷	Possible causal ▷	Example of remedy
The alarm was generated when the program was operated.	The program contains an error command.	If a user-specified error occurs unintentionally, check and correct the content of trip command in the program.

E060 to E069 Option error 0 to 9

- Shuts off the inverter output and trips, when the inverter detects errors in the option mounted on the option board connector.

E060 to E069

Generation status ▷	Possible causal ▷	Example of remedy
Occurred when option was installed.	The connector is not firmly engaged.	The option may not be installed correctly. Make sure that the option is installed properly.
	There is a mistake in the use.	The details of the error differ for each option. For details, refer to the user's guide for each option.

E090 STO shutoff error

- When "STO input display selection [bd-01]" is "Trip (02)", shuts off the inverter output and trips when both [ST1] terminal and [ST2] terminal are off (=STO state).
- When it is not required to trip at STO state, [bd-01] should be set to "Warning (display) (00)" or "Warning (without display) (01)".
- For details of safety function related error, see "WJ series C1 Safety Function Guide for Extended Mode (NT3632*X)".

E090

Generation status ▷	Possible causal ▷	Example of remedy
Safety function is used.	The safety function system is faulty.	• If the error is not cleared even when the contact is turned ON, check that the wiring and STO signal input are normal. • If this occurs in an unexpected situation, execute a function confirmation test (proof test). For more information, refer to the separate volume, "WJ series C1 Safety Function Guide for Extended Mode (NT3632*X)".

E091 STO internal error

E091

- Shuts off the inverter output and trips when a failure is detected in the safety path inside WJ-C1.
  - After this error occurs, the internal safety path keeps STO state until power off.
- For details of safety function related error, see "WJ series C1 Safety Function Guide Extended Mode (NT3632*X)".

Generation status ▷	Possible causal ▷	Example of remedy
Safety function is used.	The safety function system is faulty.	A dangerous failure may have occurred in the safety path inside the inverter. Stop the system, shut off the output to the motor, and then execute a function check test (proof test). For more information, refer to the separate volume, "WJ series C1 Safety Function Guide for Extended Mode (NT3632*X)".

E092 STO path 1 error
E093 STO path 2 error

E092
E093

- When "Action selection after STO input change time [bd-04]" is "Trip (02)", shuts off the inverter output and trips when either [ST1] terminal or [ST2] terminal is off.
- When it is not required to trip at STO state, [bd-04] should be set to "Maintain current status (00)" or "Disable (01)".
- For details of safety function related error, see "WJ series C1 Safety Function Guide for Extended Mode (NT3632*X)".

Generation status ▷	Possible causal ▷	Example of remedy
Safety function is used.	The safety function system is faulty.	• Check that the wiring and STO signal input are normal. • Check that "STO input change time (release) [bd-02]", and "STO input change time (shutoff) [bd-05]" sets are appropriate.

E100 Encoder disconnection error

E100

- Shuts off the inverter output and trips, when the inverter detect an encoder wiring disconnection.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred by turning on the power	Encoder wire or encoder error	• Check the encoder signal and wiring for any abnormality. • Check whether the power-on and startup of the encoder are not delayed with respect to the power-on of the inverter.
Sudden occurrence during operation	Encoder wire or encoder error	Check the encoder signal and wiring for any abnormality.
Occurred when the power is cut off. Or, [E100] is added to the error history every time the power is turned on.	Encoder power supply error	Check whether the encoder power is lost before the inverter.

E104 Positioning range error

E104

- Shuts off the inverter output and trips, when he actual position exceeds the preset position range set by "Position control range setting (forward) [AE-52]" and "Position control range setting (reverse) [AE-54]".

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during operation	Insufficient torque	It may be improved by reviewing the operating conditions and improving the load conditions.
	Sliding due to faulty encoder setting	Check the installation of the encoder. Review any factors that may cause slippage.
	Encoder setting error	Check the encoder constant and other settings.
	Electronic gear setting error	Check the electronic gear setting again.

E105 Speed deviation error

E105

- When "Speed deviation error mode selection [bb-82]" is "Error (01)", shuts off the inverter output and trips when the deviation between the frequency reference and the feedback speed exceeds the deviation specified in "Speed deviation error detection level [bb-83]".
- When this error is occurred, output terminal function "Speed over deviation [DSE]" is turned on.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during operation	Insufficient torque	It may be improved by reviewing the operating conditions and improving the load conditions.
	Sliding due to faulty encoder setting	Check the installation of the encoder. Review any factors that may cause slippage.
	Encoder setting error	Check the encoder constant and other settings.
	Electronic gear setting error	Check the electronic gear setting again.

E107 Excessive speed error

E107

- Shuts off the inverter output and trips when the motor speed rises over a preset value set by "Over-speed detection level [bb-80]" for the time set by "Over-speed detection time [bb-81]".

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during operation	Insufficient torque	It may be improved by reviewing the operating conditions and improving the load conditions.
	Encoder setting error	Check the encoder constant and other settings.
	Electronic gear setting error	Check the electronic gear setting again.

E110 Contactor error

E110

- When "Contactor check signal [COK]" is assigned to one of "Input terminal function ([CA-01] to [CA-08])", shuts off the inverter output and trips when [COK] is not turned on/off for the time set by "Contactor response check time [AF123]" after operation of "Contactor control [CON]" signal.

Generation status ▷	Possible causal ▷	Example of remedy
[COK] did not ON during the contactor check period when starting	Incorrect wiring	Check the intelligent input setting and wiring.
	Contactor response failure	Check the operation including the contactor response time.
[COK] did not OFF during contactor check when stopped	Incorrect wiring	Check the intelligent input setting and wiring.
	Contactor response failure	Check the operation including the contactor response time.

E120 PID soft start error

E120

- When "PID soft start error detection enable [AH-81]" is "Enable(Error)(01)", shuts off the inverter output and trips when a PID feedback value is not achieved a threshold level within the determined time.
- The time until trip can be set by "PID soft start time [AH-80]", and The threshold level of PID feedback value can be set by "PID soft start error detection level [AH-82]".

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during operation	Target value too low	It may be improved by reviewing the setting of "PID soft start target level [AH-76]".
	The wire is broken.	PID feedback may not be entered properly. Check the wires and check "PID1 feedback value monitor (after calculation) [db-44]".

E121 Abnormal upper detecting error
E122 Abnormal lower detecting error

E121
E122

- When "Abnormal upper level detecting action [bE-05]" and "Abnormal lower level detecting action [bE-07]" are "Trip (02)" or "Trip after deceleration stop (03)", shuts off the inverter output and trips when the value displayed on monitor function specified in "Abnormal detection target [bE-02]" exceeds or falls below the steady operation range.
- When the value exceeds the range, "Abnormal upper detecting error [E121]" is generated.
- When the value falls below the range, "Abnormal lower detecting error [E122]" is generated.

Generation status ▷	Possible causal ▷	Example of remedy
Occurred during normal operation	The setting of the steady-state operation range is incorrect.	The range setting of the monitor value considered to be abnormal may be incorrect. The setting parameters of the detection area differ depending on the setting of "Abnormal detection enable [bE-01]", so check whether the setting is correct.

15.3 Troubleshooting for Warning Functions

15.3.1 Warning Displays

Q

- Because a warning has occurred, you want to identify the cause or troubleshoot the problem.

A

- If the set parameter is inconsistent with other settings, a warning is displayed and "Program LED [PRG]" flashes.
- The warning display and warning display conditions are shown below. When a warning is displayed, refer to the contents of the table to correct the parameter. (Even if RUN command is input, it will not automatically rewrite to the correct value.)
- The latest warning is stored in "Warning monitor [dE-50]". If no warning occurs, "_ _ _ _ _" is displayed.

Warning code	Warning reconditions		
102	Async. Motor maximum frequency setting, 1st-motor [Hb105]	<	Upper frequency limit, 1st-motor [bA102]
103	Async. Motor maximum frequency setting, 1st-motor [Hb105]	<	Lower frequency limit, 1st-motor [bA103]
106	Async. Motor maximum frequency setting, 1st-motor [Hb105]	<	Main speed reference setting (monitor) [FA-01]
107	Async. Motor maximum frequency setting, 1st-motor [Hb105]	<	Sub speed reference setting (monitor) [FA-02]
202	Async. Motor maximum frequency setting, 2nd-motor [Hb205]	<	Upper frequency limit, 2nd-motor [bA202]
203	Async. Motor maximum frequency setting, 2nd-motor [Hb205]	<	Lower frequency limit, 2nd-motor [bA203]
206	Async. Motor maximum frequency setting, 2nd-motor [Hb205]	<	Main speed reference setting (monitor) [FA-01]
207	Async. Motor maximum frequency setting, 2nd-motor [Hb205]	<	Sub speed reference setting (monitor) [FA-02]

15.3.2 Other Displays

Q

- I want to check the display of the keypad when a trip occurs and when a warning occurs.

A

- During reset, undervoltage condition, or while the restart function is standby for retrying, the keypad is displayed as follows.

Name	Description	Display Operators
During reset	This is displayed during reset (when the "Reset [RS]" input terminal is ON or when the trip status is reset by pressing STOP/RESET key).	Rotate SSSSS
Undervoltage standby	Displayed during undervoltage standby and power shutdown.	-----
External 24 VDC power is being supplied	Appears when only the external 24 VDC power supply is operating.	24u
Retry wait in progress	Displayed when the restart function is running.	00000
Restricting RUN command	This message is displayed when the restricted RUN command is input while the operation direction is restricted by the "RUN direction restriction selection [AA114]".	00000
Data initializing	When "Mode 0" is set for "Initialize data selection [Ub-02]", this item is displayed during data initialization.	', 00
	When "Mode 1" is set for "Initialize data selection [Ub-02]", this item is displayed during data initialization.	', 01
	When "Mode 3" is set for "Initialize data selection [Ub-02]", this item is displayed during data initialization.	', 03
	Displayed during initialization of the trip history.	', HC
	⇕ Displayed alternately	
	When "Light duty (LD)" is set to "Load type selection [Ub-03]", it is displayed during initialization.	',-L-
	When "Normal duty (ND)" is set to "Load type selection [Ub-03]", it is displayed during initialization.	',-n-
No data	This is displayed when there is no relevant data. (Trip monitor, Warning monitor)	_ _ _ _ _
Communication error	Appears when a problem occurs between the remote operator and the inverter.	Blink ‾ ‾ ‾ ‾ ‾
Auto-tuning OK	Appears when auto-tuning ends normally.	_ _ _ _o
Auto-tuning NG	Displayed when auto-tuning fails.	_ _ _ _ɹ
Functional safety STO shut-off	Displayed when "STO input display selection [bd-01]" is "Warning (display) (00)", and when [ST1]/[ST2] terminals are both open and "STO" state.	StO
Functional safety ST1/ST2 mismatch	Depending on ON/OFF timing of [ST1]/[ST2], one of [P-1A]/[P-1b]/[P-2A]/[P-2b]/[P-1C]/[P-2C] is displayed depending on the settings of "Display selection during STO input change time [bd-03]" and "Action selection after STO input change time [bd-04]". For more information, refer to "14.1 Using the Safety Function STO (Safe Torque Off)".	P-1A P-2A P-1b P-2b P-1C P-2C

15.4 How to Check When Something Is Wrong

15.4.1 Troubleshooting Other Than Trip and Warning

Q

- I thought it was strange.
- Doesn't work as expected.
- There is no problem with the inverter, but it does not work well.

A

- The inverter has not tripped, but we gathered examples of remedies when it does not operate as expected.
- If there are any events in the "Current problems" column, refer to the respective chapters in the "Confirmation details" column or the next page for the remedies.

	Current problems	Confirmation details
1	A trip or warning has occurred. The display of the keypad is different from normal.	Refer to "15.2 Troubleshooting for Protection Functions Related Error" and "15.3 Troubleshooting for Warning Functions" to clear the cause of the trip or warning.
2	The keypad does not light even when the main power is turned on. ("Power LED [PWR]" does not light.)	Check "S1: The power does not turn on. ("Power LED [PWR]" on the main unit does not light.)"
3	"Running LED [RUN]" on the keypad does not light even when the RUN command is inputted.	Check "S2: RUN command setting or RUN command is incorrect".
4	When the RUN command is ON, "Running LED [RUN]" lights up to indicate the operation status, but it does not operate according to the intended frequency reference. ([FA-01] display is 0Hz, does not operate at the intended frequency for the analog voltage/current that is actually being inputted, etc.)	Check "S3: Frequency reference setting or frequency reference is incorrect".
5	The RUN command and frequency reference are input correctly, but the motor does not drive.	Check "S4: Frequency-output cutoff/limit function is activated".
6	The motor is driven but not driven at the intended frequency. ([FA-01] indicates the frequency reference value actually entered, but the motor speed is not the intended output, the output frequency becomes oscillatory or unstable, etc.)	Depending on the situation, check the below remedies. "S5: The motor speed does not increase.", "S6: Motor rotates in reverse.", "S7: Output-frequency becomes unstable", "S8: Torque is not generated"
7	The parameter to be set is not displayed or the parameter cannot be set.	Check "S9: The parameter to be set is not displayed" or "S10: The keypad cannot be operated or the parameter cannot be set."
8	Other problems other than the above have occurred.	Check "S11: Noise from motors and machines is noisy" and then deal with the problem. If the problem persists, contact your dealer or our sales office.

S1: The power does not turn on. ("Power LED [PWR]" on the main unit does not light.)

Possible causal ▶	Example of remedy	Reference
Power is not turned on.	Check that the power supply satisfying the specifications is supplied to the inverter power input side.	17-1-1 17-1-2 17-1-3
The short-circuit bar or DC link choke between the terminals [P+], [PD/+1] is disconnected.	Connect the short-circuit bar or DC link choke between the terminals [P+], [PD/+1] correctly.	5-2-1
The power input wiring is broken or the connection terminals are loose.	Review the wiring status.	-
External power 24 VDC is input, but main power is not input.	When the external power 24 VDC is applied, the parameter settings can be changed, but the motor cannot be driven. Input the main circuit power supply.	5-2-1 5-4-1

S2: RUN command setting or RUN command is incorrect.

Possible causal ▶	Example of remedy	Reference
The motor does not drive even when an RUN command is input.	If "Running LED [RUN]" on the keypad does not light up when an RUN command is inputted, the RUN command is not recognized. Check the contents of this table.	-
You want to drive the motor by pressing RUN key. However, the setting, etc. is incorrect.	Check that the setting of "RUN command input source selection [AA111]" is "Keypad's RUN-key (02)". The LED to the right of RUN key lights when the inverter can be operated using RUN key on the keypad.	9-1-2
	STOP/RESET keys on the keypad can be enabled or disabled using the "STOP-key enable [AA-13]". Check this parameter.	9-1-7
You want to operate the inverter by the input terminals [FW]/[RV] or the input terminals [STA]/[STP]/[F/R], however, the setting is wrong.	Check that the setting of "RUN command input source selection [AA111]" is "[FW]/[RV] terminal (00)" or "3-wire (01)".	9-1-3 9-1-4
	ON either of them when the RUN command is executed at the [FW]/[RV] input terminal. (If both are ON, it is judged as a stopping command.)	9-1-3
	Check if the [CA-01] to [CA-08] setting is correct.	9-15-1
	Monitor the status of the input terminals in "Input terminal monitor [dA-51]" and confirm that there is no problem with the wiring.	10-2-1
"Force operation [F-OP]" input terminal is ON.	If the "Force operation [F-OP]" function is not required, turn OFF the input.	9-1-6 9-2-18
Settings or wiring other than the above are incorrect.	Check the setting of "RUN command input source selection [AA111]", the setting of input terminal function assignment and the wiring. For details, refer to "9.1 Selecting RUN Command and Alarm Reset".	-

S3: Frequency reference setting or frequency reference is incorrect.

Possible causal ▶	Example of remedy	Reference
The frequency reference is not recognized.	If the setting of the frequency reference cannot be changed with [FA-01] or the set frequency reference is not displayed in [FA-01], the frequency reference is not recognized correctly. Check the contents of this table.	-
The frequency reference input source is incorrect.	Check if "Main speed input source selection [AA101]" is set correctly.	9-2-1
Frequency reference is 0 Hz.	When "Main speed input source selection [AA101]" is "[Ai1] terminal (01)" or "[Ai2] terminal (02)", measure the voltage/ current input to the [Ai1]/[Ai2] terminal with a multimeter, etc., and check whether the input voltage/current and wires are correct.	5-4-1
	When "Main speed input source selection [AA101]" is "Parameter setting (07)", set the frequency reference in [FA-01].	9-2-3
	When performing multi-speed operation ([CF1] to [CF4] and [SF1] to [SF7]), set the frequency reference correctly to [Ab110]/ [Ab-11] to [Ab-25].	9-2-5
When the frequency reference is analog input or pulse input, the motor drives at a value different from the input command value.	Check whether the settings of "Main speed input source selection [AA101]", [Ai1]/[Ai2] terminal analog input adjustment parameter ([Cb-01] to [Cb-33]), pulse input adjustment parameter ([CA-90] to [CA-96]), etc. are correct.	9-2-4 9-2-10 9-15-4
"Force operation [F-OP]" input terminal is ON.	If the "Force operation [F-OP]" function is not required, turn OFF the input.	9-1-6 9-2-18
The main circuit wiring is disconnected or incorrect.	Check the main circuit wiring for disconnection or incorrect connection.	-
Settings or wiring other than the above are incorrect.	Check if there is any mistake in the function assignment and wiring of the control circuit terminal block. For details, refer to "9.2 Selecting Frequency Reference Source".	-

S4: Frequency-output cutoff/limit function is activated.

Possible causal ▶	Example of remedy	Reference
"Reset [RS]" terminal is ON.	If the input terminal [RS] is ON, the inverter will be in the reset-state and RUN commands will not be accepted. The input terminal [RS] must be OFF.	9-15-13
"Free run stop [FRS]" input terminal is ON.	If the input terminal [FRS] is ON, it will be in the free-run stop status and the RUN command will not be accepted. The input terminal [FRS] must be OFF.	9-7-10
"Commercial power supply change [CS]" input terminal is ON.	If the terminal [CS] is ON, the commercial power supply is shut off and RUN commands are not received. Check the commercial power supply change.	9-7-15
"RUN enable [REN]" input terminal is assigned and OFF.	If the terminal function [REN] is OFF when using the input terminal, the RUN command will not be accepted. Check the RUN enable signal.	9-4-4
"RUN direction restriction selection [AA114]" is set.	Set [AA114] correctly.	9-4-2
"Direction reversal protection [HC114]" is set.	Set [HC114] correctly.	9-4-3
The short-circuit wire of the [ST1]/[ST2] terminal of the safety function is disconnected or in OFF status.	The terminals [ST1]/[ST2] are for functional safety. When this function is not used, a short-circuit wire must be connected.	14-1-1
Wrong or broken wiring, etc.	Check if there is any abnormality such as an output wire to the motor or a broken wire inside the motor.	-

S5: The motor speed does not increase.

Possible causal ▶	Example of remedy	Reference
The overload restriction function or the overcurrent suppression function is activated.	The overcurrent suppression function or the overload restriction function limits the output current by stopping acceleration or lowering the output frequency when the output current exceeds the operating level. Increasing the operating level may improve the performance.	9-9-1 9-9-3
Frequency reference is limited	If the upper frequency limit and maximum frequency settings are low, the motor speed can be improved by raising the settings. To limit the frequency, use the upper frequency limit rather than the maximum frequency.	9-4-1
Frequency reference value is overwritten by another frequency reference method.	If a high-priority frequency reference is input such as jogging, multi-speed command, etc. is input, the actual frequency reference may be lower. Review of terminal function and frequency reference source is required.	9-2-1 9-2-5 9-2-8
Long acceleration time	If the acceleration time setting is long, it will accelerate slowly. Reduce the acceleration time.	9-3-1
Motor is constrained.	If the motor shaft is constrained by something that obstructs the brake or motor rotation (such as a jam), the cause must be removed.	-

S6: Motor rotates in reverse.

Possible causal ▶	Example of remedy	Reference
The phase order of the wiring to the motor is incorrect.	The rotation is reversed by replacing the two phases in the wiring to the motor.	-
For operation with RUN key on the keypad, the rotational direction setting is incorrect.	Check the setting of "RUN-key command rotation direction [AA-12]".	9-1-2
When using the 3-wire function, the input of the "3-wire forward /reverse [F/R]" input terminal is reversed.	Check the input logic of the input terminal [F/R].	9-1-4 9-15-1
In the case of sensorless vector control, the motor reverses for a moment in the low-speed range,	Enable "Direction reversal protection [HC114]".	9-4-3

S7: Output-frequency becomes unstable.

Possible causal ▶	Example of remedy	Reference
Various parameters are not appropriate.	Check the basic setting parameters of the motor. This may be improved by adjusting the stabilization constant or by removing the output frequency slightly from the power supply frequency.	8-1-4 8-1-11 9-5-12
Load fluctuation is large.	It may be necessary to review the capacity of both the motor and the inverter.	-
The input power supply voltage fluctuates.	Option reactors (DCL or ALI) or input-side noise filters may be used to reduce power supply fluctuations.	5-3-1

S8: Torque is not generated.

Possible causal ▶	Example of remedy	Reference
The various parameters are not appropriate and the acceleration torque is not.	Adjust by setting the torque boost or switching to sensorless vector control.	9-5-6 9-5-8 9-5-13
The inverter is used for winding down.	When the torque is insufficient in regenerative operation, perform the following adjustment. - The deceleration time is increased. - Set "Over-magnetization function selection [bA146]" to "Always enable (01)". - Braking resistor or regenerative braking unit is used.	9-3-1 9-9-6 9-9-8
Too heavy load	It may be necessary to review the capacity of both the motor and the inverter.	-

S9: The parameter to be set is not displayed.

Possible causal ▶	Example of remedy	Reference
Display restrictions are set	The display limit function may be activated. Review "Display restriction selection [UA-10]". If [UA-10] cannot be changed, it may be protected by "Password for display [UA-01]". If this happens, cancel the password.	7-2-1 7-2-12
The display is fixed.	Operations by the keypad are unavailable when "Display lock [DISP]" input terminal is ON. [DISP] input terminal must be OFF for operation.	7-2-15

S10: The keypad cannot be operated or the parameters cannot be set.

Possible causal ▶	Example of remedy	Reference
The display is fixed.	Operations by the keypad are unavailable when "Display lock [DISP]" input terminal is ON. [DISP] input terminal must be OFF for operation.	7-2-15
The inverter is running.	Some parameters cannot be changed during operation. If it cannot be changed, stop the inverter once.	7-1-1
The soft lock function is activated.	Disable the soft lock function.	7-2-11
The parameter setting range, etc. has changed due to a change in the load specification setting.	The setting range of some parameters is changed by changing "Load type selection [Ub-03]", and some parameters are hidden. The load specification selection status of the inverter can be checked by "Inverter load type status [dC-01]". It is necessary to change the load specifications or review the setting within the settable range.	8-1-2 10-3-4

S11: Noise from motors and machines is noisy.

Possible causal ▶	Example of remedy	Reference
Carrier frequency is set low	Increase "Carrier frequency setting [bb101]". However, noise generated from the inverter and leakage current may increase. Derating may also be required for the output current depending on the model.	9-10-1 17-3-1
The rotation frequency of the motor and the natural frequency of the machine are resonant.	Change the set frequency. If resonance occurs during acceleration/deceleration, avoid the resonance frequency with the frequency jump function ([AG101] to [AG106]).	9-2-1 9-10-6
The motor is over-excited.	Match the "Async. Motor base frequency setting [Hb104]" and "Async. Motor rated voltage [Hb106]" with the motor rating. If this does not improve, slightly lower the "Output voltage gain [Hb180]" or adjust the control method with free V/f response.	8-1-4 9-5-4 9-5-12 9-9-6

S12: Cannot operate/set via Modbus communication.

Possible causal ▶	Example of remedy	Reference
The communication parameter settings (station number, communication speed, and parity settings) are incorrect or changes have not been reflected.	Check the setting of Modbus communication related parameters ([CF-01] to [CF-12]). If you change the setting, you must restart the communication by selecting "Restart communication [Ub-06]" or turn the power off and on again. For details, see "7.2.3 Restart Communication Settings".	11-1-1
RUN command selection is not "RS485 setting (03)".	Check if "RUN command input source selection [AA111]" is set to "RS485 (03)".	9-1-5
Main speed input source selection is not "RS485 (08)".	Check if "Main speed input source selection [AA101]" is set to "RS485 (08)".	9-2-9
Wrong wiring	Check that the communication cable is correctly wired.	11-1-3
The termination resistor is connected incorrectly.	Termination resistors must be connected to both ends of the devices connected by RS485 communication. Connect the termination resistor correctly. If the last stage is WJ-C1, turn ON the termination resistor switch.	11-1-3
There is a lot of noise and there is a communication error.	Review the wiring, such as changing the wiring to a shielded cable, and review the grounding to the signal ground.	1-3-3

S13: Earth leakage breaker trips when operating

Possible causal ▶	Example of remedy	Reference
Large leakage current of inverter	Decrease "Carrier frequency setting [bb101]".	9-10-1
	Increase the sensitivity current of the earth leakage breaker or consider replacing the earth leakage breaker with a one with high sensitivity current.	5-3-1

S14: DC braking does not work.

Possible causal ▶	Example of remedy	Reference
DC braking force, DC braking time, etc. are not set or are incorrect.	Check the setting of the DC braking-related parameter ([AF101] to [AF109]).	9-7-2 9-7-11
"External DC braking [DB]" is not assigned to the input terminal function. Or incorrect wiring.	When performing DC braking with signal-input, check with the above sets whether "External DC braking [DB]" is assigned. Also check [DB] input terminal.	9-7-11 9-15-1

S15: Noises may occur in devices near inverters, TV/radios etc.

Possible causal ▶	Example of remedy	Reference
Conducted/radiated noise from the inverter	Keep the inverter as far away from nearby devices, TV/radio, etc. as possible.	1-3-3
	Insert a zero-phase noise filter (ZCL) into the power input /output of the inverter.	5-3-1

S16: Cannot operate/set from optional communication board.

Possible causal ▶	Example of remedy	Reference
RUN command input source selection or main speed input source selection is not "option".	"Option (09)" may not be set for "Main speed input source selection [AA101]" and "Option (04)" may not be set for "RUN command input source selection [AA111]". Check [AA101] and [AA111] settings.	9-1-5 9-2-9

S17: Cannot connect to inverter configuration software ProDriveNext.

Possible causal ▶	Example of remedy	Reference
The communication cable is disconnected or incorrect.	Check that there is no disconnection or contact failure at the communication cable or connection terminal, or that the cable specifications are not incorrect, etc.	12-1-1

16

Chapter 16 Maintenance and Inspection

This chapter describes how to perform maintenance and inspection on the product.
When performing each work, carefully read "Chapter 1 Safety Instructions/Risks" and the corresponding chapters, and pay attention to safety.

16.1 Cautions for Maintenance and Inspection

DANGER

Electric shock	● **Risk of electric shock!**
Do	Before inspecting the inverter, be sure to turn off the power supply and wait for 10 minutes or more. (Confirm that the charge lamp on the inverter is turned off and the DC voltage between terminals [P/+] and [N/-] (Single-phase model: terminal [+] and [-]) is 45 VDC or less.)
Prohibited	Entrust only a designated person for maintenance, inspection, and replacement of parts. (Be sure to remove wristwatches and metal accessories, e.g., bracelets, before maintenance and inspection work. Be sure to use insulated tools for the work.)
Prohibited	Do not perform withstand voltage test.

DANGER

Electric shock Fire Injury	● **Risk of electric shock, fire and injury!**
Prohibited	・ Never modify the unit.

16.1.1 Daily Inspection

• Check that the following abnormalities are not observed during operation.

No.	Description	☑
1	Motor operation is not abnormal.	☐
2	There is no abnormality in the environment where the device is installed.	☐
3	There is no abnormality in the cooling system.	☐
4	No abnormal vibration or sound is observed.	☐
5	No abnormal overheat or discoloration is observed.	☐
6	No abnormal smell is observed.	☐

• While the inverter is running, check the input voltage of inverter using a multimeter, etc.

No.	Description	☑
1	There is no frequent occurrence of variation of power supply voltage.	☐
2	Three-phase AC voltage keeps a good balance.	☐

16.1.2 Cleaning

- Keep the inverter in a clean condition.

No.	Description	☑
1	When cleaning the inverter, use a soft cloth soaked in neutral detergent to gently wipe up the dirtied parts.	☐
2	Do not use solvents such as acetone, benzene, toluene, or alcohol as they may melt the surface or strip the coating of the inverter.	☐
3	Do not use detergents or alcoholic cleaners to clean the keypad displays.	☐

16.1.3 Periodic Inspection

- Check sections that cannot be inspected unless operation is stopped and sections requiring periodic inspection.
- Contact your supplier or local Hitachi inverter sales office for periodic inspection.

No.	Description	☑
1	Check that there is no abnormality in the cooling system and clean the air filter, etc.	☐
2	Check the tightness and retighten if necessary. Due to effects of vibration or temperature change, tightened portions of screws or bolts may loosen. Be sure to carefully check and perform the work.	☐
3	No corrosion or damage is observed on the conductors and insulators.	☐
4	Measurement of insulation resistance	☐
5	Checking and replacing the cooling fan.	☐

16.1.4 Periodic Function Test for Safety Function (STO)

- When handling the WJ-C1 as a functional safety certified product, be sure to perform the following items. For details, refer to the separate "WJ series C1 Safety Function Guide Extended Mode (NT3632*X)".
- A periodical STO functional test must be performed at least once in a year to maintain the intended safety performance level of the STO function. This periodical STO function test is one of the conditions for the STO function of WJ-C1 to meet PL e of ISO13849-1 and SIL 3 of EN 61800-5-2.

16.2 Daily Inspection and Periodic Inspection

16.2.1 Inverter Inspection List

Inspection part	Inspection items	Details of inspection	Inspection cycle: Daily	Inspection cycle: Every 1 year	Inspection cycle: Every 2 year	Inspection method	Criterion	Tester device
General	Surrounding environment	Check the ambient temperature, level of humidity, dust, ··· etc..	✓			Refer to "Chapter 4 Installation".	The ambient temperature and level of humidity are within the operating range. There are no freeze, condensation, dust, corrosive gas, explosive gas, flammable gas, grinding fluid mist, hydrogen sulfide and salt.	Thermo-meter, Hygro-meter, Data logger
General	Whole inverter	Check that there are no abnormal vibrations or noises.	✓			Check visually and auditorily.	No abnormality.	
General	Power supply voltage	Check that the main circuit voltage is normal.	✓			Measure the line-to-line voltage of the inverter main circuit terminals [R/L1], [S/L2], and [T/L3].	Within the allowable AC voltage fluctuation.	Multimeter, Digital multimeter
Main circuit	General check	Check the resistance between the main circuit and the ground terminals. (between main circuit and ground terminals)		✓		Remove all wires from the main circuit terminal and control circuit terminal of the inverter. Then, shortcircuit all terminals of the main circuit terminal, and measure between this shortcircuited part and the ground terminal.	Resistance no less than 5 MΩ.	500 VDC class ohmmeter (megger®)
Main circuit	General check	Check looseness in tightening parts.		✓		Check tighten.	No abnormality.	
Main circuit	General check	Check for overheating traces.		✓		Check visually.	No abnormality.	
Main circuit	Conductors and cables	Check for straining in conductors.		✓		Check visually.	No abnormality.	
Main circuit	Conductors and cables	Check for cable coating damage.		✓		Check visually.	No abnormality.	
Main circuit	Terminal block	Check for any damage.		✓		Check visually.	No abnormality.	
Main circuit	Inverter and converter circuits (including resistors)	Check the resistance between all the terminals.			✓	Remove all wires from the main circuit terminal of the inverter. Then measure between main power supply terminals and DC bus voltage terminals [P/+]/[N/-] or [+]/[-], and between motor output terminals and DC bus voltage terminals [P/+]/[N/-] or [+]/[-] in the 1 Ω range.	Refer to "16.2.4 Checking the Inverter and Converter Section". Reference for replacement of the inverter and converter Start/Stop: 10^6 cycles[*3]	Analog multimeter
Main circuit	Smoothing capacitor	Check for capacitor fluid leakage.	✓			Check visually.	No abnormality. Approximate replacement period: 10 years[*1*3*4]	
Main circuit	Smoothing capacitor	Check that the relief valve does not swell or protude.		✓		Check visually.	No abnormality. Approximate replacement period: 10 years[*1*3*4]	
Main circuit	Relay	No chatter sound while operating.		✓		Check auditorily.	No abnormality.	
Main circuit	Relay	Check contacts for damage.		✓		Check visually.	No abnormality.	

Inspection part	Inspection items	Details of inspection	Inspection cycle Daily	Every 1 year	Every 2 year	Inspection method	Criterion	Tester device
Control circuit Protection circuit	Operation check	While performing a unit operation of the inverter, check the balance of the output voltage among the individual phases.		✓		Measure the line voltages between the [U/T1], [V/T2], and [W/T3] terminals of the inverter main circuit.	Phase-to-phase voltage balance 200 V class: within 4 V 400 V class: within 8 V	Digital multimeter, Ammeter, Voltmeter
		Carry out a sequential protection test, and check the protective and display circuits for any abnormality.		✓		Simulate a shortcircuit or open of the inverter output protection circuit.	An error must be detected according to the sequence.	
Cooling system	Cooling fan	Check that there are no abnormal vibrations or noises.	○			Check auditorily and visually.	Smooth operation. No abnormality. Wind flows to the top. Approximate replacement period: 10 years*2*3*5	
		Check for loose connections.		○		Check visually.		
	Cooling fin	Check for obstrutions/ clogging.		○		Check visually.	No clogging.	
Display	Display	Check if the charge lamp and the keypad's LEDs light up.	○			Check visually.	Check the lighting.	
		Display cleaning.		○		With cleaning rag.		
	External meter	Check that Indicated values are normal.	○			Check the meters readings on the keypad.	Regulation and control value are satisfactory.	Voltmeter, Ammeter, etc.
Motor	General	Check that there are no abnormal vibrations or noises.	○			Check visually,auditorily, and by touch.	No abnormality.	
		Check that there is no odour.	○			Check for abnormal superheating, damages and so on.	No abnormality.	
	Insulation resistance	Check the resistance between the main circuit and the ground terminals.			*6	Remove the wiring from the main circuit terminals [U/T1], [V/T2] and [W/T3] of the inverter, shortcircuit the motor wire (for 3 phases), and measure with a megger® between the motor wire and the ground terminal.	No less than 5 MΩ.	500 VDC class ohmmeter (megger®)

*1. The life span of the smoothing capacitor is influenced by the ambient temperature. Refer to "16.2.5 Smoothing Capacitor Life Curve" for replacing measures.

*2. The life span of the cooling fan is influenced by the ambient temperature, the dirt and the change in its environmental conditions. Check these circumstances on the usual inspection.

*3. The estimated time before replacement (Number of years/cycle) and the "16.2.5 Smoothing Capacitor Life Curve" are based on the design lifespan, not guaranteed.

*4. In case using an inverter with a long storage period, perform the following aging before use. (Aging is not required if the storage temperature is 5 to 35 ˚C and within 2 years.)

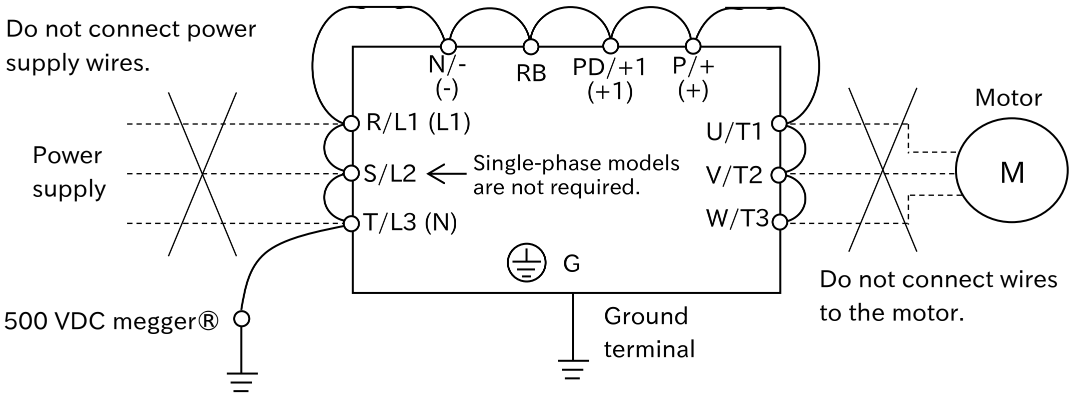
- If the input voltage can be adjusted: Input about 150 VAC for 200 V class and about 300 VAC for 400 V class for about 10 minutes, then gradually input higher value and operate while checking the functions.
- If the input voltage cannot be adjusted: Input the inverter rated voltage and run for about 30 minutes to check for any problems with the functions. Then, turn on the power again to perform full-scale operation.

*5. If the cooling fan is locked due to dust, etc., it takes about 5 to 10 seconds to restart even if dust is removed.

*6. Follow the instruction manual for the motor.

16.2.2 Megger® Test

- When testing an external circuit with a megger®, disconnect all the external circuit cables from the inverter to prevent it from being exposed to the test voltage.
- In the control circuit carry out a conduction test, use a tester (with high resistance range), do not use a megger® or buzzer/continuity tester.
- Use a 500 VDC megger® for the megger® test.
- For the megger® test of the inverter main circuit, short-circuit the terminals with wires as shown in the figure below.
- As a result of the megger® test, if the resistance value is 5 MΩ or higher, it is normal.



16.2.3 Withstand Voltage Test

- Do not carry out a withstand voltage test for the inverter. The test may damage its internal parts, deteriorating the inverter.

16.2.4 Checking Inverter and Converter Section

Checking method of inverter section and converter section

Using the analog multimeter, it can be checked if the inverter or converter section are defective or non-defective.

1 Preparation

(1) Disconnect all wires to the main circuit terminal (wires to [R/L1] ([L1]), [S/L2], [T/L3] ([N]), [U/T1], [V/T2], [W/T3], [P/+] ([+]), [PD/+1] ([+1]), [N/-] ([-]), [RB] terminals).

(2) Prepare an analog multimeter. (The use range is 1 Ω resistance measurement range.)

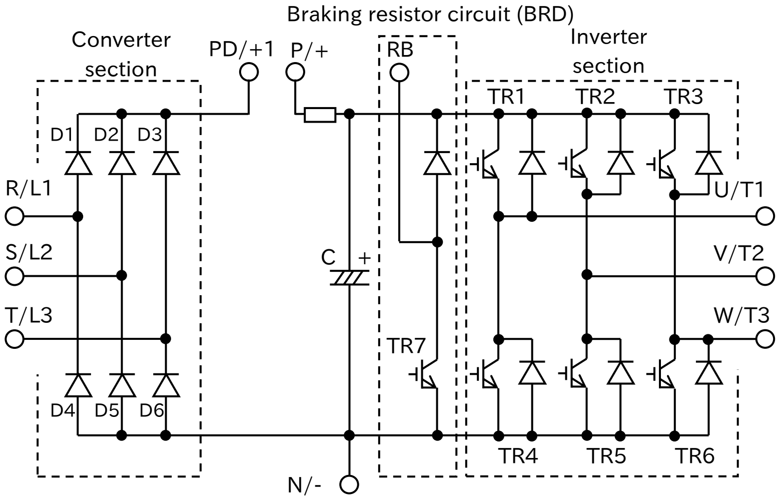
2 Checking method

The good-or-bad condition of conduction status of terminals on the inverter main circuit terminal can be judged by alternately changing the polarity of multimeter for measurement.

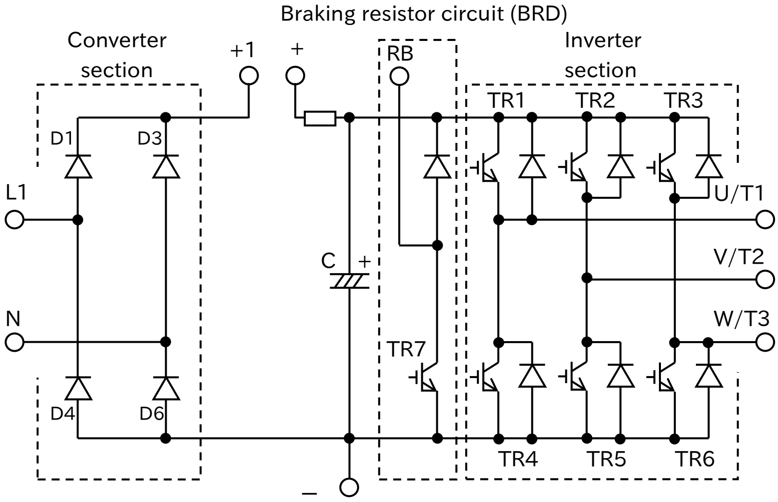
- By measuring the DC bus voltage between terminal [P/+] and [N/-], or terminal [+] and [-] in the DC voltage range, check that electricity is fully discharged from the smoothing capacitor before performing check.
- When electricity is not conducted, the value is almost infinite. When conducting, it indicates several ohms to several tens of ohms. Due to effects of the smoothing capacitor, electricity may be conducted instantly and may not show infinity value. The measured values vary depending on the element type, multimeter type, etc., but it is acceptable if the values in each section are nearly equal. The measured value may be shifted by several ohms due to the current limiting resistance for preventing inrush current.

		Multimeter polarity		Measured value
		⊕ (Red)	⊖(Black)	
Converter	D1	R/L1	PD/+	Non-conductive
		PD/+	R/L1	Conductive
	D2	S/L2	PD/+	Non-conductive
		PD/+	S/L2	Conductive
	D3	T/L3	PD/+	Non-conductive
		PD/+	T/L3	Conductive
	D4	R/L1	N/-	Conductive
		N/-	R/L1	Non-conductive
	D5	S/L2	N/-	Conductive
		N/-	S/L2	Non-conductive
	D6	T/L3	N/-	Conductive
		N/-	T/L3	Non-conductive
Inverter	TR1	U/T1	P/+	Non-conductive
		P/+	U/T1	Conductive
	TR2	V/T2	P/+	Non-conductive
		P/+	V/T2	Conductive
	TR3	W/T3	P/+	Non-conductive
		P/+	W/T3	Conductive
	TR4	U/T1	N/-	Conductive
		N/-	U/T1	Non-conductive
	TR5	V/T2	N/-	Conductive
		N/-	V/T2	Non-conductive
	TR6	W/T3	N/-	Conductive
		N/-	W/T3	Non-conductive
BRD	TR7	RB	P/+	Non-conductive
		P/+	RB	Conductive
		RB	N/-	Uncertainty
		N/-	RB	Non-conductive

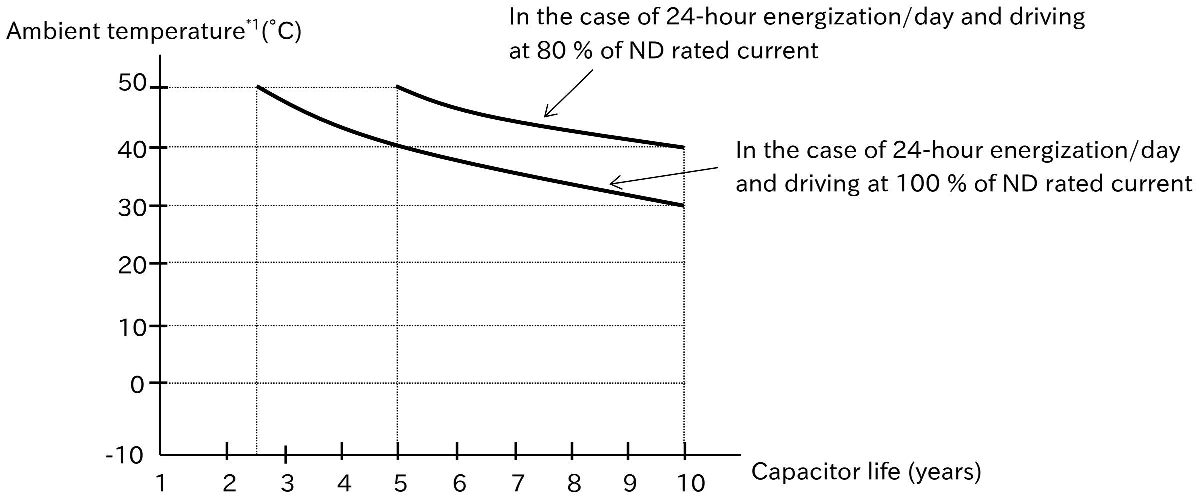
■ Three-phase models



■ Single-phase models



16.2.5 Smoothing Capacitor Life Curve



*1. The ambient temperature is a temperature measured at a position about 5 cm from the bottom center of the inverter (atmospheric temperature). When the inverter is installed in the cabinet, it is the temperature inside the cabinet.

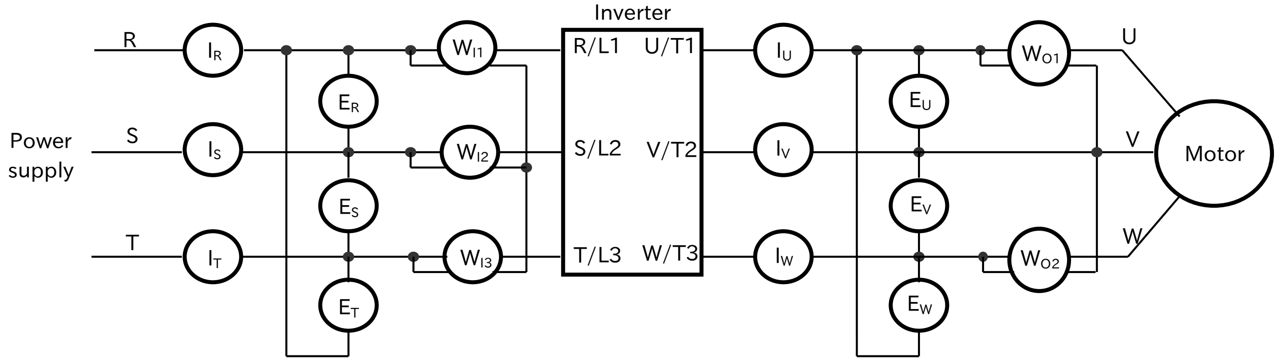
*2. The smoothing capacitor is a finite life component which occurs chemical reaction inside, inverter replacement is required after 10 years of use (It is a designed expected life, not a guaranteed value). However, if the inverter is used in an environment at high temperature or in a heavy-load environment where its rated current is exceeded, the life is significantly shortened.

16.2.6 Life Warning Output

- By the self-diagnostic, it is possible to output an alarm in regards of the inverter own internal components lifespan when the lifespan is nearing to its end (the cooling fan, the circuit board electrolytic capacitor, the power module and the inrush current prevention circuit). Use this to get a reference for when the components should be replaced.
- The life diagnosis of each life component can be checked using the output terminal functions "Capacitor life warning [WAC]", "Cooling-fan life warning [WAF]", "Power module life warning [WAP]", "Inrush circuit life warning [WAIC]", or "Life assessment monitor [dC-16]".
- For details of each life diagnosis functions, refer to "9.11.9 Lifetime Warning for Capacitor on the Board", "9.11.10 Lifetime Warning for Cooling Fan", "9.11.11 Lifetime Warning for Power Module", "10.3.3 Monitor the Life Assessment Results", respectively. Since these alarms are based on the design lifespan (not guaranteed values), problems may arise depending on the environment, the operation conditions, etc. It is recommended an early maintenance.

16.2.7 Measurement Methods of I/O Voltage, Current, and Power

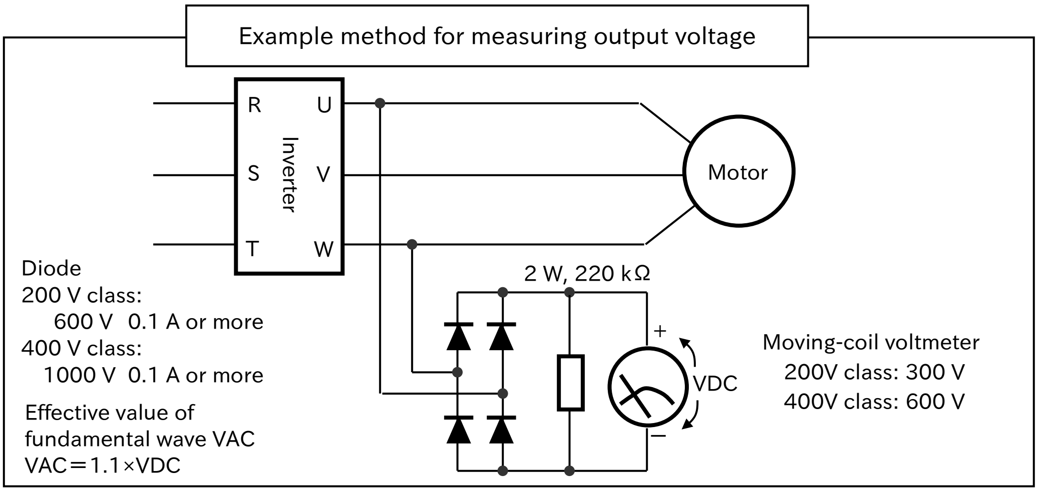
- Typical instruments for measuring input/output voltage, current, and power are shown below.



Measurement data	Measurement point	Measuring instrument	Remarks	Standard reference values
Input voltage E_{IN}	R-S, S-T, T-R (E_R), (E_S), (E_T)	Moving-iron voltmeter or Rectifier-type voltmeter	Effective value of full waves	200 V class: 200 to 240 V, 50/60 Hz 400 V class: 380 to 480 V, 50/60 Hz
Input current I_{IN}	R, S, T current (I_R)、(I_S)、(I_T)	Moving-iron ammeter	Effective value of full waves	When there is unbalance in the input supply $I_{IN} = (I_R + I_S + I_T)/3$
Input power W_{IN}	R-S, S-T, T-R (W_{I1})+(W_{I2})+(W_{I3})	Electrodynamometer-type wattmeter*1	Effective value of full waves	Three-wattmeter method
Input power factor P_{fIN}	Calculated from the measured values of the input voltage (E_{IN}), input current (I_{IN}), and input power (W_{IN}).	$P_{fIN} = \dfrac{W_{IN}}{\sqrt{3} \times E_{IN} \times I_{IN}} \times 100$		
Output voltage E_{OUT}	U-V, V-W, W-U (E_U), (E_V), (E_W)	See the figure below or Rectifier-type voltmeter*1*2	Effective value of fundamental wave	
Output current I_{OUT}	U, V, W current (I_U), (I_V), (I_W)	Moving-iron ammeter *1*2	Effective value of full waves	
Output power W_{OUT}	U-V, V-W (W_{O1})+(W_{O2})	Electrodynamometer-type wattmeter *1*2	Effective value of full waves	Two-wattmeter method (Or three-wattmeter method)
Output power factor P_{fOUT}	Calculated from the measured values of the output voltage (E_{OUT}), output current (I_{OUT}), and output power (W_{OUT}).	$P_{fOUT} = \dfrac{W_{OUT}}{\sqrt{3} \times E_{OUT} \times I_{OUT}} \times 100$		

*1. Use instruments that show the effective value of the fundamental wave for the output voltage and the effective value of full waves for the current and power.

*2. Since the inverter output waveform is controlled by PWM, it has a large margin of error, especially at low frequencies. In many cases, general multimeters may be defective for the measurement, because of the adverse effects of the noise.



(Memo)

17

Chapter 17 Specifications/Dimensions/Derating

This chapter describes product specifications, external dimensions and current deratings. The abbreviations used in the product specifications show the following meanings.

- Load rating: ND = Normal duty rating
  LD = Light duty rating
  (For details, refer to "8.1.2 Changing Load Type of the Inverter".)
- Motor type: IM = induction motor
  SM/PMM = synchronous motor/permanent magnet motor

17.1 Standard Specifications

17.1.1 Single-phase 200 V Class

Model name C1-**** *1)		001S	002S	004S	007S	015S	022S
Applicable motor capacity (4 poles) (kW)	LD	0.2	0.4	0.55	1.1	2.2	3.0
	ND	0.1	0.2	0.4	0.75	1.5	2.2
Output: Rated output current (A) *2)	LD	1.3	2.0	3.5	6.0	9.8	12.2
	ND	1.0	1.6	3.2	5.0	8.0	11.0
Output: Overload current rating	LD	120 % / 60 s					
	ND	150 % / 60 s					
Output: Rated output voltage		Three-phase 200 to 240 V (Output above the incoming voltage is not possible.)					
Output: Rated power (kVA) 200 V	LD	0.4	0.7	1.2	2.0	3.4	4.2
	ND	0.2	0.5	1.1	1.7	2.7	3.8
Output: Rated power (kVA) 240 V	LD	0.5	0.8	1.4	2.4	4.0	5.0
	ND	0.3	0.6	1.3	2.0	3.3	4.5
Input: Rated input current (A) *3)	LD	2.5	3.6	7.3	13.8	20.2	24.0
	ND	1.8	3.0	6.3	11.5	16.8	22.0
Input: Rated input AC voltage *4)		Single-phase 200 to 240 V/allowable range of variation 170 to 264 V 50 Hz (allowable range of variation 47.5 to 52.5 Hz) 60 Hz (allowable range of variation 57 to 63 Hz)					
Input: Power supply capacity (kVA) *5)	LD	10.0	10.0	10.0	10.0	10.0	10.0
	ND	10.0	10.0	10.0	10.0	10.0	10.0
Carrier frequency variation *6)	LD	2.0 to 10.0 kHz					
	ND	2.0 to 15.0 kHz					
Starting torque *7)		200 % / 0.5 Hz					
Braking torque: Without braking resistor *8)		100 %:≤50 Hz 50 %:≤60 Hz				70 %:≤50 Hz 50 %:≤60 Hz	20 %:≤50 Hz 20 %:≤60 Hz
Braking torque: With braking resistor		150 %					100 %
Minimum resistance value of connectable braking resistor (Ω)		100	100	100	50	50	35
Cooling method		Self-cooling (without FAN)				Forced air cooling (with FAN)	
Dimensions: H (height) (mm)		128	128	128	128	128	128
Dimensions: W (width) (mm)		68	68	68	108	108	108
Dimensions: D (depth) (mm)		109	109	122.5	170.5	170.5	170.5
Protective structure		IP20 / UL open type					
Approximate weight (kg)		1.0	1.0	1.1	1.6	1.8	1.8

*1) The capacity code and voltage class are indicated on the model name. Others are omitted.

*2) Some models require current derating depending on the carrier frequency setting and ambient temperature. For details, refer to "17.3 Current Derating". (Please contact us for models not described.)

*3) The rated input current is the value at the rated output current. The value changes according to the impedance on the power supply side (wiring, breaker, input reactor option, etc.). The input current on the specification label indicates the UL-certified current.

*4) Compliance with the Low Voltage Directive (LVD) is as follows. -Pollution degree 2, -Overvoltage category 3

*5) Power supply capacity is the value of the rated output current at 220 V output voltage. The value changes according to the impedance on the power supply side (wiring, breaker, input reactor option, etc.).

*6) The setting range of "Carrier frequency setting [bb101]" is limited according to "Load type selection [Ub-03]". It is recommended to set the carrier frequency setting equal or greater than the (maximum output frequency × 10) Hz.

*7) The value is specified for the Hitachi standard motor controlled by the sensorless vector control at ND rating. Torque characteristics may vary depending on the control mode and the motor used.

*8) The braking torque during regeneration is the average deceleration torque for the shortest deceleration. It is not continuous regenerative torque by the external force. The braking torque varies depending on the loss of the motor. This value decreases when operating beyond the base frequency.

17.1.2 Three-phase 200 V Class

Model name C1-**** *1)			001L	002L	004L	007L	015L	022L	037L	055L	075L	110L	150L
Applicable motor capacity (4 poles) (kW)		LD	0.2	0.4	0.75	1.1	2.2	3.0	5.5	7.5	11	15	18.5
		ND	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
Output	Rated output current (A) *2)	LD	1.3	2.0	3.5	6.0	9.8	12.2	19.6	30.0	45.0	60.0	70.0
		ND	1.0	1.6	3.2	5.0	8.0	11.0	17.5	25.0	33.5	47.0	62.5
	Overload current rating	LD	120 % / 60 s										
		ND	150 % / 60 s										
	Rated output voltage		Three-phase 200 to 240 V (Output above the incoming voltage is not possible.)										
	Rated power (kVA) 200 V	LD	0.4	0.7	1.2	2.0	3.4	4.2	6.7	10.3	15.6	20.7	24.2
		ND	0.2	0.5	1.1	1.7	2.7	3.8	6.0	8.6	11.6	16.2	21.6
	Rated power (kVA) 240 V	LD	0.5	0.8	1.4	2.4	4.0	5.0	8.1	12.4	18.7	24.9	29.1
		ND	0.3	0.6	1.3	2.0	3.3	4.5	7.2	10.3	13.9	19.5	26.0
Input	Rated input current (A) *3)	LD	1.4	2.0	3.9	7.2	10.8	13.9	23.2	37.0	48.0	68.0	73.5
		ND	1.0	1.6	3.3	6.0	9.0	12.7	20.5	30.8	39.6	57.1	68.6
	Rated input AC voltage *4)		Three-phase 200 to 240 V/allowable range of variation 170 to 264 V, 50 Hz (allowable range of variation 47.5 to 52.5 Hz) 60Hz (allowable range of variation 57 to 63 Hz)										
	Power supply capacity (kVA) *5)	LD	10.0	10.0	10.0	10.0	10.0	10.0	20.0	30.0	50.0	50.0	75.0
		ND	10.0	10.0	10.0	10.0	10.0	10.0	20.0	20.0	30.0	50.0	50.0
Carrier frequency variation *6)		LD	2.0 to 10.0 kHz										
		ND	2.0 to 15.0 kHz										
Starting torque *7)			200 % / 0.5 Hz										
Braking torque	Without braking resistor *8)		100 %:≤50 Hz 50 %:≤60 Hz				70 %: ≤50 Hz 50 %: ≤60 Hz	20 %:≤50 Hz 20 %:≤60 Hz					
	With braking resistor		150 %					100 %		80 %			
Minimum resistance value of connectable braking resistor (Ω)			100	100	100	50	50	35	35	20	17	17	10
Cooling method			Self-cooling (without FAN)				Forced air cooling (with FAN)						
Dimensions	H (height) (mm)		128	128	128	128	128	128	128	260	260	296	350
	W (width) (mm)		68	68	68	68	108	108	140	140	140	180	220
	D (depth) (mm)		109	109	122.5	145.5	170.5	170.5	170.5	155	155	165	175
Degree of protection			IP20 / UL open type										
Approximate weight (kg)			1.0	1.0	1.1	1.2	1.6	1.8	2.0	3.5	3.5	4.5	6.5

*1) The capacity code and voltage class are indicated on the model name. Others are omitted.

*2) Some models require current derating depending on the carrier frequency setting and ambient temperature. For details, refer to "17.3 Current Derating". (Please contact us for models not described.)

*3) The rated input current is the value at the rated output current. The value changes according to the impedance on the power supply side (wiring, breaker, input reactor option, etc.). The input current on the specification label indicates the UL-certified current.

*4) Compliance with the Low Voltage Directive (LVD) is as follows. -Pollution degree 2, -Overvoltage category 3

*5) Power supply capacity is the value of the rated output current at 220 V output voltage. The value changes according to the impedance on the power supply side (wiring, breaker, input reactor option, etc.).

*6) The setting range of "Carrier frequency setting [bb101]" is limited according to "Load type selection [Ub-03]". It is recommended to set the carrier frequency setting equal or greater than the (maximum output frequency × 10) Hz.

*7) The value is specified for the Hitachi standard motor controlled by the sensorless vector control at ND rating. Torque characteristics may vary depending on the control mode and the motor used.

*8) The braking torque during regeneration is the average deceleration torque for the shortest deceleration. It is not continuous regenerative torque by the external force. The braking torque varies depending on the loss of the motor. This value decreases when operating beyond the base frequency.

17.1.3 Three-phase 400 V Class

Model name C1-**** *1)			004H	007H	015H	022H	030H	040H	055H	075H	110H	150H
Applicable motor capacity (4 poles) (kW)		LD	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5
		ND	0.4	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15
Output	Rated output current (A) *2)	LD	2.1	4.1	5.5	7.1	8.9	11.9	17.5	24.0	31.0	38.0
		ND	1.8	3.4	4.8	6.0	7.2	9.2	14.8	19.0	25.0	32.0
	Overload current rating	LD	120 % / 60 s									
		ND	150 % / 60 s									
	Rated output voltage		Three-phase 380 to 480 V (Output above the incoming voltage is not possible.)									
	Rated power (kVA) 380 V	LD	1.3	2.6	3.6	4.6	5.8	7.8	11.5	15.7	20.4	25.0
		ND	1.1	2.2	3.1	3.9	4.7	6.0	9.7	12.5	16.4	21.0
	Rated power (kVA) 480 V	LD	1.7	3.4	4.5	5.9	7.3	9.8	14.5	19.9	25.7	31.5
		ND	1.4	2.8	3.9	4.9	5.9	7.6	12.3	15.7	20.7	26.6
Input	Rated input current (A) *3)	LD	2.1	4.3	5.9	8.1	9.4	13.3	20.0	24.0	38.0	44.0
		ND	1.8	3.6	5.2	6.5	7.7	11.0	16.9	19.0	29.4	35.9
	Rated input AC voltage *4)		Three-phase 380 to 480 V/allowable range of variation 323 to 528 V, 50 Hz (allowable range of variation 47.5 to 52.5 Hz) 60 Hz (allowable range of variation 57 to 63 Hz)									
	Power supply capacity (kVA) *5)	LD	10.0	10.0	10.0	10.0	20.0	20.0	30.0	30.0	50.0	50.0
		ND	10.0	10.0	10.0	10.0	10.0	20.0	20.0	30.0	30.0	50.0
Carrier frequency variation *6)		LD	2.0 to 10.0 kHz									
		ND	2.0 to 15.0 kHz									
Starting torque *7)			200 % / 0.5 Hz									
Braking torque	Without braking resistor *8)		100 %:≤50 Hz 50 %:≤60 Hz			70 %:≤ 50 Hz 20 %:≤ 60 Hz	20 %:≤50 Hz 20 %:≤60 Hz					
	With braking resistor		150 %			100 %			80 %			
Minimum resistance value of connectable braking resistor (Ω)			180	180	180	100	100	100	70	70	70	35
Cooling method			Self-cooling (without FAN)	Forced air cooling (with FAN)								
Dimensions	H (height) (mm)		128	128	128	128	128	128	260	260	296	296
	W (width) (mm)		108	108	108	108	108	140	140	140	180	180
	D (depth) (mm)		143.5	170.5	170.5	170.5	170.5	170.5	155	155	165	165
Degree of protection			IP20 / UL open type									
Approximate weight (kg)			1.5	1.8	1.8	1.8	2.0	2.0	3.5	3.5	4.5	4.5

*1) The capacity code and voltage class are indicated on the model name. Others are omitted.

*2) Some models require current derating depending on the carrier frequency setting and ambient temperature. For details, refer to "17.3 Current Derating". (Please contact us for models not described.)

*3) The rated input current is the value at the rated output current. The value changes according to the impedance on the power supply side (wiring, breaker, input reactor option, etc.). The input current on the specification label indicates the UL-certified current.

*4) Compliance with the Low Voltage Directive (LVD) is as follows. -Pollution degree 2, -Overvoltage category 3

*5) Power supply capacity is the value of the rated output current at 440 V output voltage. The value changes according to the impedance on the power supply side (wiring, breaker, input reactor option, etc.).

*6) The setting range of "Carrier frequency setting [bb101]" is limited according to "Load type selection [Ub-03]". It is recommended to set the carrier frequency setting equal or greater than the (maximum output frequency × 10) Hz.

*7) The value is specified for the Hitachi standard motor controlled by the sensorless vector control at ND rating. Torque characteristics may vary depending on the control mode and the motor used.

*8) The braking torque during regeneration is the average deceleration torque for the shortest deceleration. It is not continuous regenerative torque by the external force. The braking torque varies depending on the loss of the motor. This value decreases when operating beyond the base frequency.

17.1.4 Common Specifications

<table>
<tr><th colspan="3">Item</th><th colspan="2">Specifications</th></tr>
<tr><td colspan="3">Control method</td><td colspan="2">PWM control (Switch between 3-phase modulation and 2-phase modulation)</td></tr>
<tr><td colspan="3">Output frequency range *1)</td><td colspan="2">0.01 to 590.00 Hz</td></tr>
<tr><td colspan="3">Frequency accuracy</td><td colspan="2">For the maximum frequency, digital ± 0.01%, analog ± 0.2% (25 ± 10˚C)</td></tr>
<tr><td colspan="3">Frequency resolution</td><td colspan="2">Digital: 0.01Hz, analog: maximum frequency/1000</td></tr>
<tr><td colspan="3" rowspan="2">Control mode
(Voltage/frequency calculation)
*2)</td><td>IM</td><td>V/f control (Constant torque, Reduce torque, Free-V/f, Automatic torque boost)
Sensorless vector control (With carrier frequency derating at low sepeed)</td></tr>
<tr><td>SM/PMM</td><td>PM sensorless vector control *3)</td></tr>
<tr><td colspan="3">Acceleration/deceleration time</td><td colspan="2">0.00 to 3600.00 s (linear, S-curve, U-curve, inverted U-curve, EL-S-curve)</td></tr>
<tr><td colspan="3">Starting torque</td><td colspan="2">200 % / 0.5 Hz (at IM sensorless vector control)</td></tr>
<tr><td colspan="3">Monitor function</td><td colspan="2">Output frequency, Output current, Output torque, Trip history, Input/Output terminal status, Input power *4), Output power *4), etc.
For details of monitor function, refer to "Chapter 10 Monitor Functions".</td></tr>
<tr><td colspan="3">Starting function</td><td colspan="2">Starting after DC braking, Active frequency matching, Reduced voltage start, Trip retry restart</td></tr>
<tr><td colspan="3">Stop function</td><td colspan="2">DC braking after deceleration stop or free run stop, DC braking by input terminal
(Braking force, time, and operating speed are adjustable.)</td></tr>
<tr><td colspan="3">Stall prevention function</td><td colspan="2">Overload restriction, Overcurrent suppression, Overvoltage suppression</td></tr>
<tr><td colspan="3">Protection function *5)</td><td colspan="2">Overcurrent error, Motor overload error, Braking resistor overload error, Overvoltage error, Memory error, Undervoltage error, Current detector error, CPU error, External trip, USP error, Ground fault, Input overvoltage error, Temperature detector error, Temperature error, CPU communication error, Input phase loss, Main circuit error, Analog input level over error, Driver error, Output phase loss, Thermistor error, Brake error, Overload error at low speed, Controller overload error, Operator keypad disconnection error, RTC error, EzSQ related errors, Option related errors, Functional safety related errors, Encoder disconnection, Positioning range error, Speed deviation error, Excessive speed error, Contactor error, PID soft start error, Abnormal upper/lower detecting error
For details of protection function, refer to "15.2 Troubleshooting for Protection Functions Related Error".</td></tr>
<tr><td colspan="3">Other functions</td><td colspan="2">Free-V/f, Manual torque boost, Output voltage gain, Over-magnetization, Braking resistor circuit (BRD), PID control,Motor constant selection, Auto-tuning, Stabilization control, Direction reversal protection, Position control, Torque control, Torque limit, Automatic carrier reduction, Eco drive, Brake control, Instantaneous power failure non-stop, Commercial power supply switching, Minimum frequency, Upper/lower frequency limit, Window comparator, Frequency jump, Acceleration/deceleration stop, Frequency calculation/addition, 2-stage acceleration/deceleration, External start/end, Multi-speed, Analog output adjustment, Stop selection, Input terminal response, Output signal delay, Soft-Lock, Operation direction limit, STOP/RESET key selection, Scaling function, Cooling-fan ON/OFF, Display restriction, Password function, Initial display selection
For details of each function, refer to chapter 7 to 10.</td></tr>
<tr><td rowspan="19">Input</td><td rowspan="7">Frequency reference</td><td>Keypad</td><td colspan="2">The parameters for the command value set by JOG dial, Esc key and SET key on the keypad</td></tr>
<tr><td rowspan="5">External signal *6)</td><td rowspan="2">Analog input (Terminal [Ai1]/[Ai2])
(Switch between voltage and current input by parameter setting.)</td><td>0 to 10 VDC voltage input (Input impedance: 10 kΩ)</td></tr>
<tr><td>4 to 20 mA current input (Input impedance: 100 Ω)</td></tr>
<tr><td>Multi-speed terminal
(input terminal function used.)</td><td>Maximum 16 speeds</td></tr>
<tr><td>Pulse input (Input terminal [7]/[8])</td><td>Maximum 32 kHz x 2</td></tr>
<tr><td colspan="2" style="display:none"></td></tr>
<tr><td>External port</td><td colspan="2">RS485 serial communication (Modbus-RTU), USB (ProDriveNext), Remote operator, Communication option</td></tr>
<tr><td rowspan="3">Forward/ Reverse Run/Stop</td><td>Keypad</td><td colspan="2">RUN and STOP/RESET key on the keypad (Forward/Reverse can be switched by parameter setting.)</td></tr>
<tr><td>External signal</td><td colspan="2">"Forward [FW]"/"Reverse [RV]", 3-wire input (When input termnal functions are asigned)</td></tr>
<tr><td>External port</td><td colspan="2">RS485 serial communication (Modbus-RTU), USB (ProDriveNext), Remote operator, Communication option</td></tr>
<tr><td colspan="2">Input terminal function</td><td colspan="2">Input terminal function can be indivisually assiegned to input terminal [1] to [8].
For details of types of input terminal function, refer to "9.15.1 Using Input Terminal Functions".</td></tr>
<tr><td colspan="2">Analog input</td><td colspan="2">2 terminals (Terminal [Ai1]/[Ai2]: 0 to 10 VDC voltage input, 4 to 20 mA current input)
(Switch between voltage and current input by parameter setting.)</td></tr>
<tr><td colspan="2">Backup power supply terminal</td><td colspan="2">External 24 VDC power supply can be input from [P24] terminal.
(Installation of a reverse current prevention diode is mandatory.)</td></tr>
<tr><td colspan="2">Safety function STO input terminal</td><td colspan="2">2 terminals (Terminal [ST1]/[ST2])</td></tr>
<tr><td colspan="2">Thermistor input terminal</td><td colspan="2">1 terminal (PTC type thermistor can be connected to input terminal [5].)</td></tr>
<tr><td colspan="2">Pulse input terminal</td><td colspan="2">Input terminal [8] (A-phase), [7] (B-phase), [6] (Z-phase [PLZ]), or amy input terminals assigned input terminal functions [PLA]/[PLB].
(Terminals differ depending on parameter settings and functions used. For details, refer to the related pages of following functions: Frequency reference, Pulse counter, PID feedback, PID target value, Control with encoder, and Position control functions)</td></tr>
</table>

Item		Specifications
Output	Output terminal function	Output terminal function can be indivisually assigned to 2 open collector output terminals (Output terminal [11]/[12]) and a relay output terminal [AL]. For details of types of output terminal function, refer to "9.16.1 Using Output Terminal Functions".
Output	Functional safety EDM output	STO state monitor (Output terminal 11 is switched to [EDM] by slide switch)
Output	Monitor output *7)	2 terminals Terminal [Ao1]: 0 to 10 VDC analog voltage output / 4 to 20 mA analog current output Terminal [Ao2]: Pulse output (max. 32 kHz)/10 VDC output) / 0 to 10 VDC analog voltage output
EMC noise filter		Not built-in (optional external filter can be connected)
PC external access		USB Micro-B
Operating environment	Ambient temperature	ND (Normal duty): -10 to 50 ℃ / LD (Light duty): -10 to 40 ℃
Operating environment	Storage temperature *8)	-20 to 65 ℃
Operating environment	Humidity	20 to 90% RH (non-condensing)
Operating environment	Vibration	10 to 57 Hz: amplitude 0.075 mm 57 to 150 Hz: 9.8 m/s^2 (1.0 G)
Operating environment	Installation place *9)	Altitude: 1000 m or less, indoors (free from corrosive gases, oil mist, and dust)
Components life span		The design life of the electrolytic capacitor on the board and the main circuit smoothing capacitor is 10 years.
Components life span		The design life of cooling fan is 10 years (models with cooling fan) with no dust.
Components life span		Non-volatile memory parts on control circuit board.
Conformity standards *10) *11) *12)		CE: EN IEC 61800-3: 2018 (EMC-filter option required) EN 61800-5-1: 2007, EN 61800-5-1: 2007/A1: 2017, EN 61800-5-1: 2007/A11: 2021 EN 61800-9-2: 2017 EN IEC 63000: 2018 UL: UL 61800-5-1, 1st Ed., Issue Date 2012-06-08, Revision Date 2021-02-11, -Overvoltage Category 3, -Pollution Degree 2 Others: CSA C22.2 No.274, 2nd Ed., Issue Date 2017-04-01 Functional safety: STO(Safe torque off) function / EN 61800-5-2: SIL3、 EN ISO 13849-1: Cat.3 PLe EN 61508-1 to 7
Option board connector		One unit can be mounted (existing communication options for WJ200 can be mounted)
Other optional components		Noise Filter, DC link choke, AC reactor, Braking resistor, Regenerative braking unit, Remote operator (VOP/MOP/MOP-VR), Inverter configuration software ProDriveNext, etc.

*1) The output frequency range depends on the control mode and the motor used. Consult the motor manufacturer for the maximum allowable frequency of the motor when operating beyond 60Hz.

*2) In case that the control mode is changed and the motor constant settings are not appropriate, the desired starting torque cannot be obtained and also exists the possibility of tripping.

*3) Contact your supplier or local Hitachi sales office when driving SM/PMM.

*4) Input power monitor and output power monitor are reference values. They are not suitable for calculation of efficiency values, etc. To obtain an accurate value, use an external device.

*5) When "Driver error [E030]" occurs by the protective function, it may have happened by the short-circuit protection, but also can occur when the IGBT is damaged. Depending on the operating conditions of the inverter, "Overcurrent error [E001]" may occur instead of [E030].

*6) At factory setting, the maximum output frequency for analog input [Ai1] is adjusted to 9.8 VDC for voltage input and [Ai2] is adjusted to 19.8 mA for current input. To change the characteristics, refer to the analog start/end function.

*7) Analog monitor output is a reference output for analog meter or digital frequency meter connection. The maximum output value may deviate slightly due to variations in the connected meters and analog output circuits. To change the characteristics, use [Ao1]/[Ao2] adjust function.

*8) The storage temperature is the temperature during transportation.

*9) In case of installing at an altitude of 1000m or more, the atmospheric pressure decreases by approximately 1% for every 100 m altitude increase. Apply 1% current derating from the rated current by increasing every 100 m, and conduct an evaluation test. When using at an altitude of 2500 m, please contact your supplier or local Hitachi sales office.

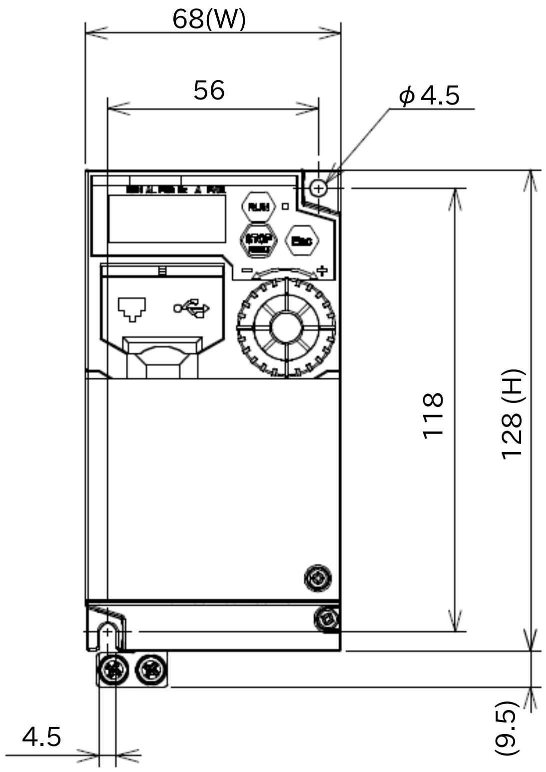
*10) Insulation distance conforms to UL and CE standards.

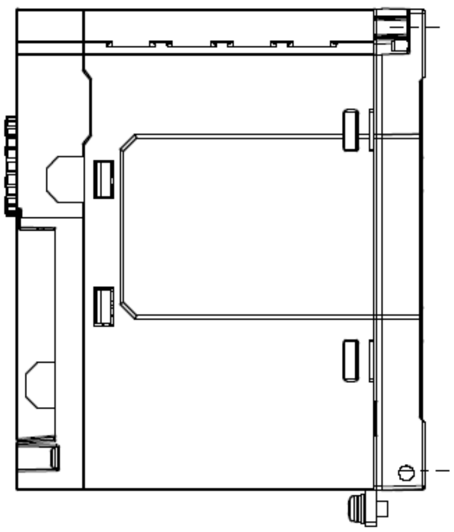
*11) For details of standards of functional safety, refer to the separate "WJ Series C1 Safety Function Guide for Extended Mode (NT3632*X)".

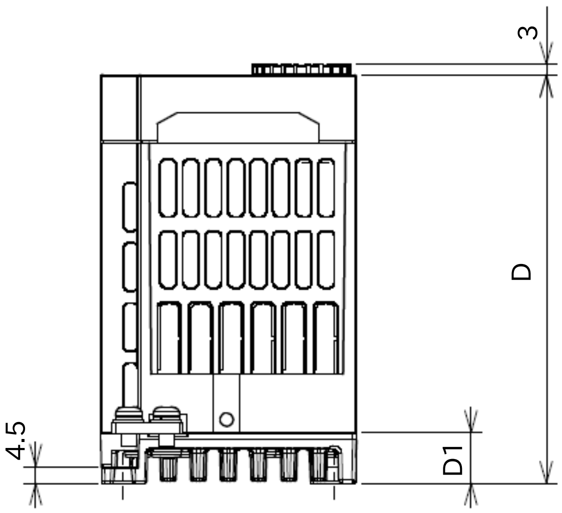
*12) The standards information on this document is as of June 2023.

17.2 External Dimensions

<table>
<tr><th>Power supply</th><th>Model</th><th>W (mm)</th><th>H (mm)</th><th>D (mm)</th><th>D1 (mm)</th></tr>
<tr><td rowspan="3">Single-phase 200 V</td><td>C1-001S</td><td rowspan="7">68</td><td rowspan="7">128</td><td>109</td><td>13.5</td></tr>
<tr><td>C1-002S</td><td>109</td><td>13.5</td></tr>
<tr><td>C1-004S</td><td>122.5</td><td>27</td></tr>
<tr><td rowspan="4">Three-phase 200 V</td><td>C1-001L</td><td>109</td><td>13.5</td></tr>
<tr><td>C1-002L</td><td>109</td><td>13.5</td></tr>
<tr><td>C1-004L</td><td>122.5</td><td>27</td></tr>
<tr><td>C1-007L</td><td>145.5</td><td>50</td></tr>
</table>







<table>
<tr><th>Power supply</th><th>Model</th><th>W (mm)</th><th>H (mm)</th><th>D (mm)</th><th>D1 (mm)</th></tr>
<tr><td rowspan="3">Single-phase 200 V</td><td>C1-007S</td><td rowspan="10">108</td><td rowspan="10">128</td><td rowspan="5">170.5</td><td rowspan="5">55.5</td></tr>
<tr><td>C1-015S</td></tr>
<tr><td>C1-022S</td></tr>
<tr><td rowspan="2">Three-phase 200 V</td><td>C1-015L</td></tr>
<tr><td>C1-022L</td></tr>
<tr><td rowspan="5">Three-phase 400V</td><td>C1-004H</td><td>143.5</td><td>28.5</td></tr>
<tr><td>C1-007H</td><td rowspan="4">170.5</td><td rowspan="4">55.5</td></tr>
<tr><td>C1-015H</td></tr>
<tr><td>C1-022H</td></tr>
<tr><td>C1-030H</td></tr>
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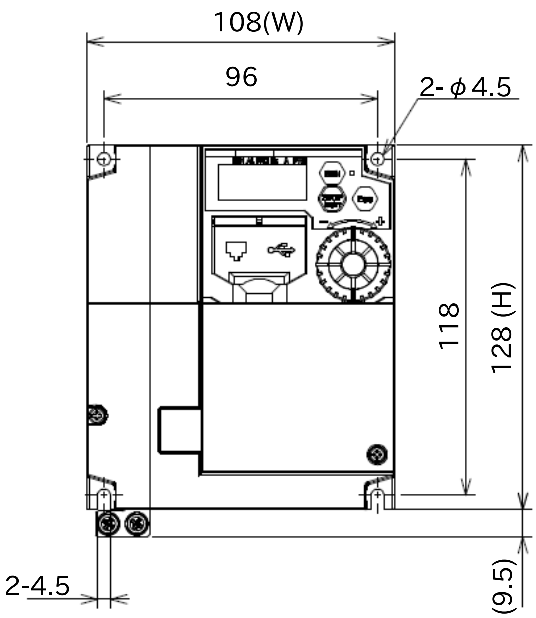
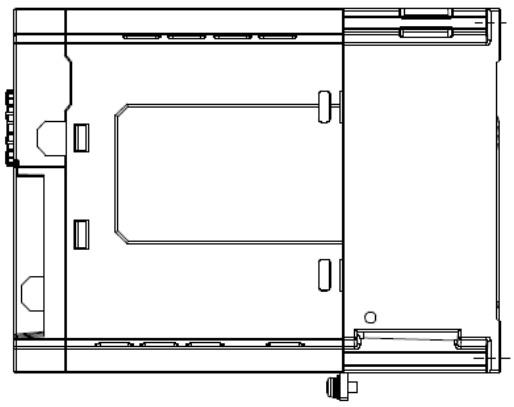
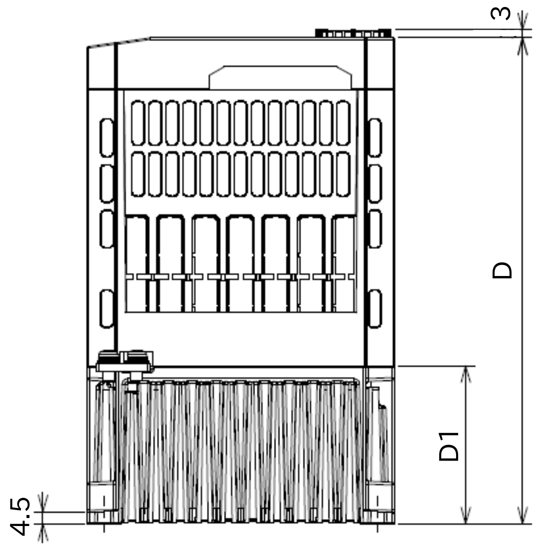
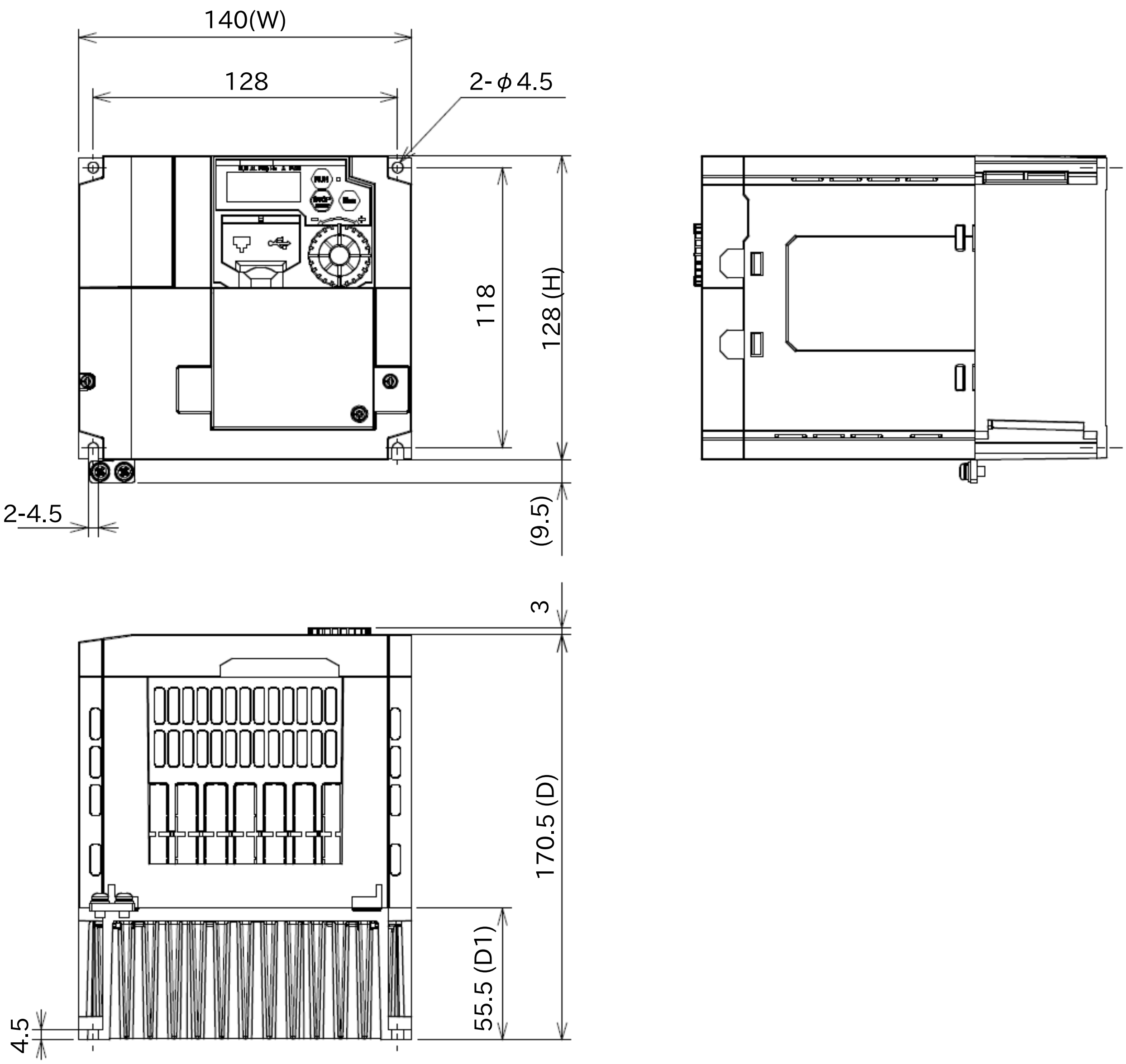


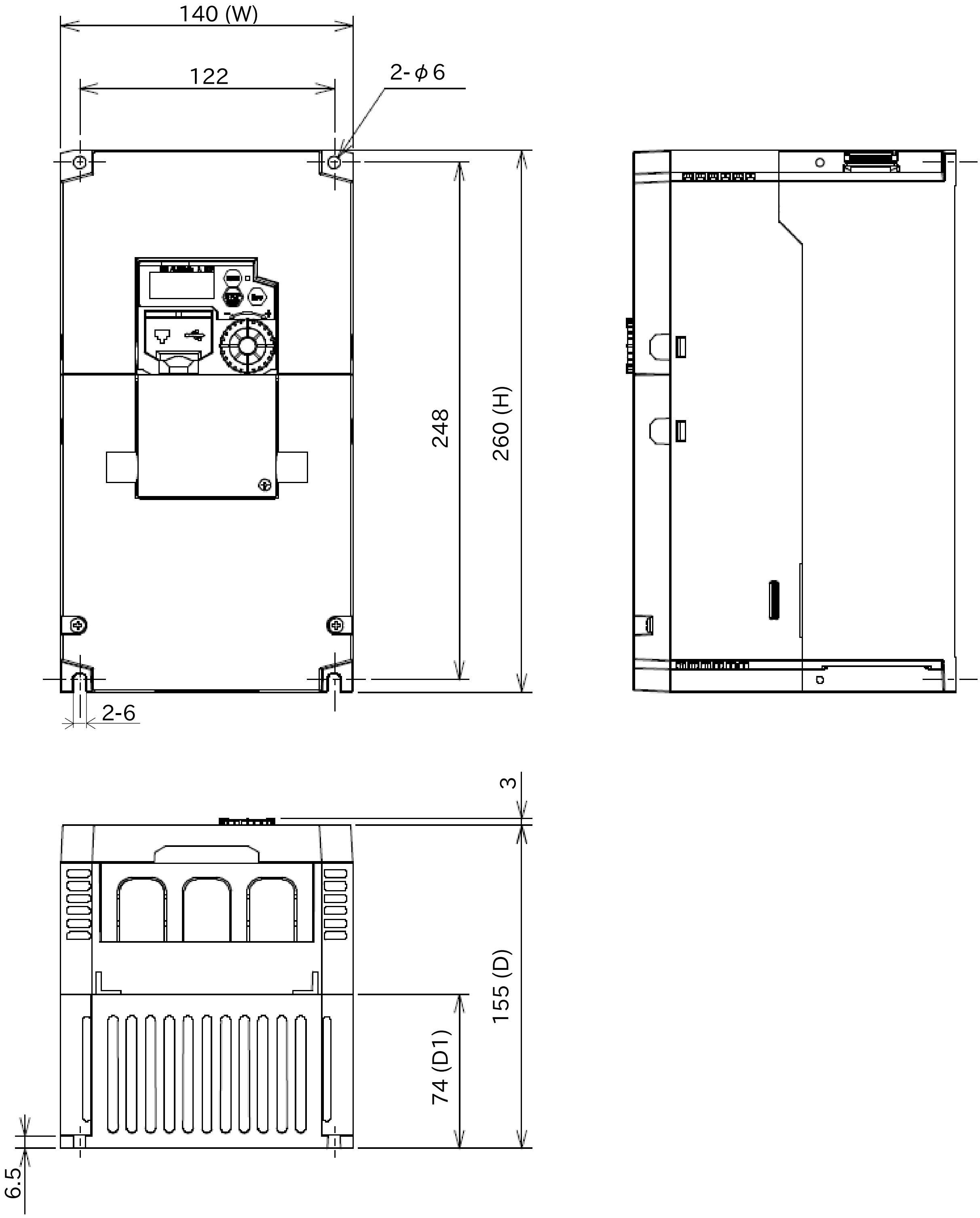




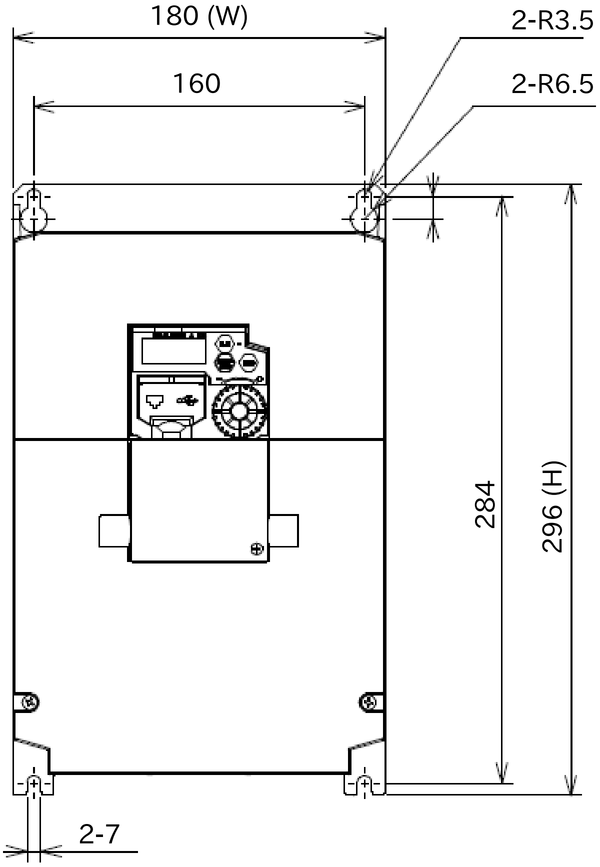
Power supply	Model	W (mm)	H (mm)	D (mm)	D1 (mm)
Three-phase 200 V	C1-037L	140	128	170.5	55.5
Three-phase 400 V	C1-040H				

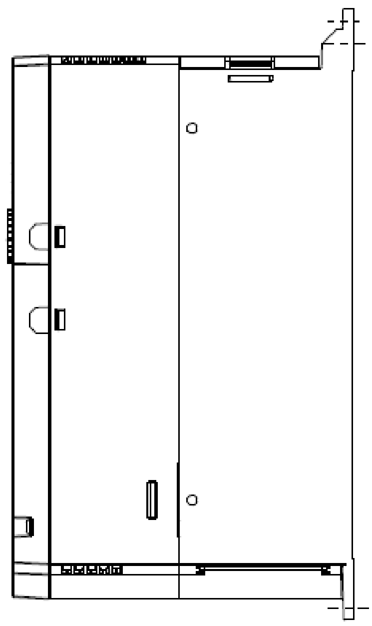


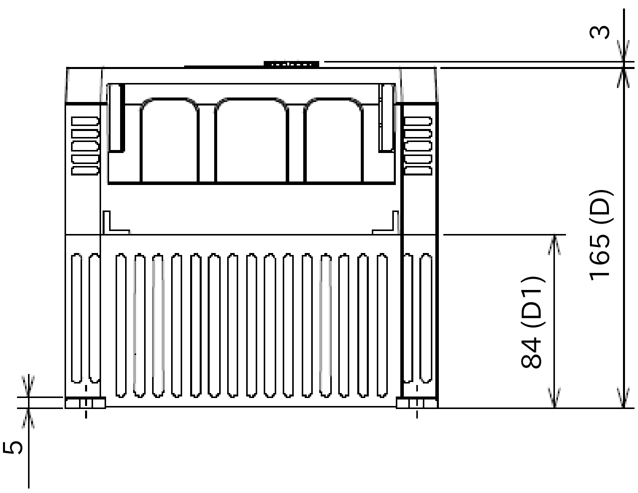
Power supply	Model	W (mm)	H (mm)	D (mm)	D1 (mm)
Three-phase 200 V	C1-055L	140	260	155	74
	C1-075L				
Three-phase 400 V	C1-055H				
	C1-075H				



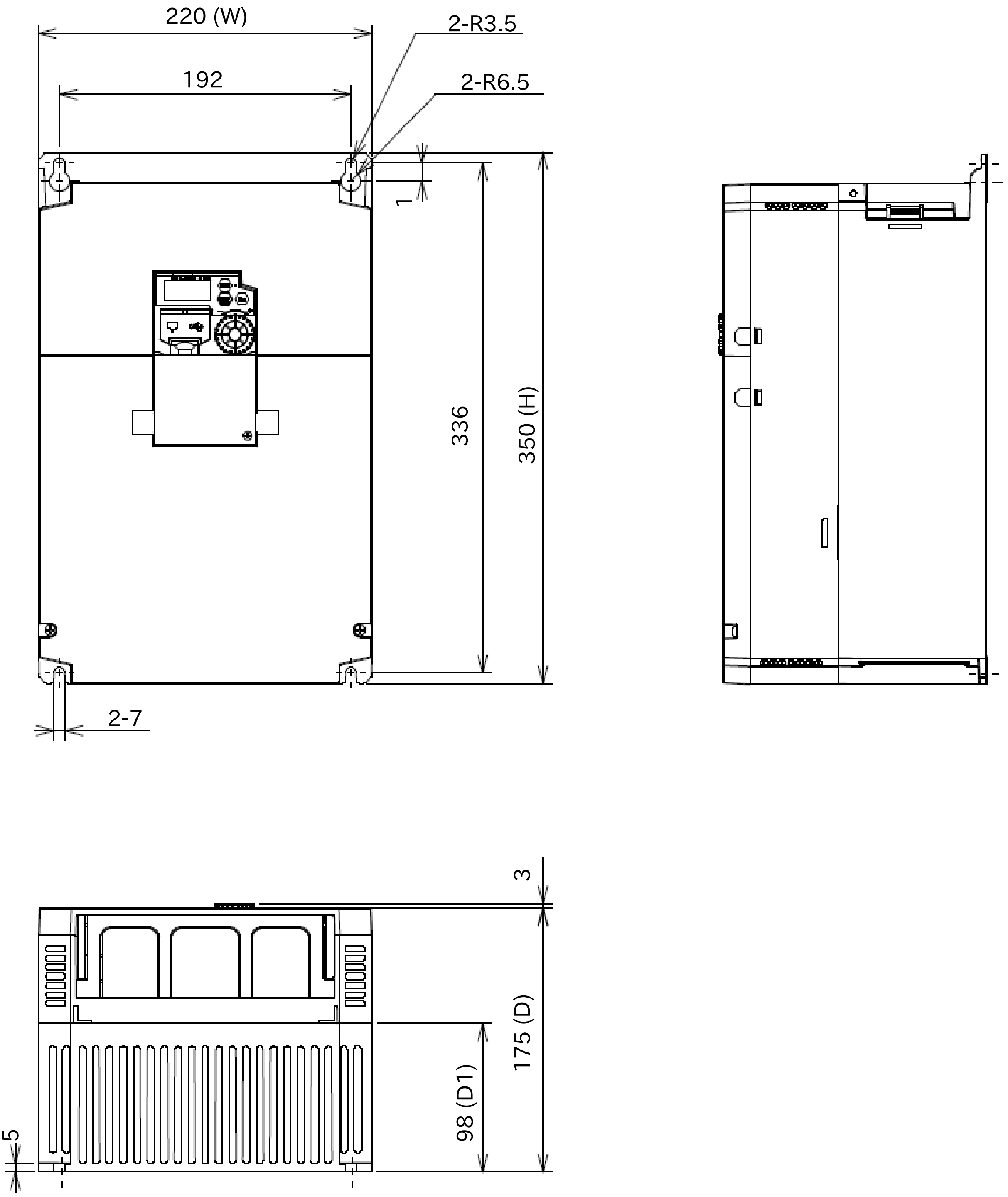
Power supply	Model	W (mm)	H (mm)	D (mm)	D1 (mm)
Three-phase 200 V	C1-110L	180	296	165	84
Three-phase 400 V	C1-110H				
	C1-150H				







Power supply	Model	W (mm)	H (mm)	D (mm)	D1 (mm)
Three-phase 200 V	C1-150L	220	350	175	98



17.3 Current Derating

Q

- How do I derate the current?
- What are the current derating characteristics according to ambient temperature and installation conditions?

A

- When using a model that is checked with "✓" in the "Required" column in the table below, perform current derating as shown in the graph below.
- Set the output current value to be derated in "Electronic thermal level setting [bC110]". For details, refer to "8.1.4 Setting Electronic Thermal for Motor".

!

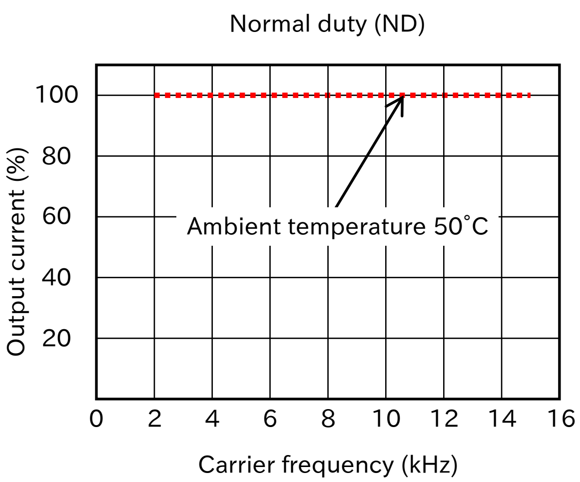
- When the product is used beyond the derating, it may cause damage to the inverter and shorten the product life.
- When installing WJ200 and WJ-C1 by side-by-side, follow the current derating of the respective models. Note that the ambient temperature specification when installing side-by-side is -10 to +40˚C for WJ200.

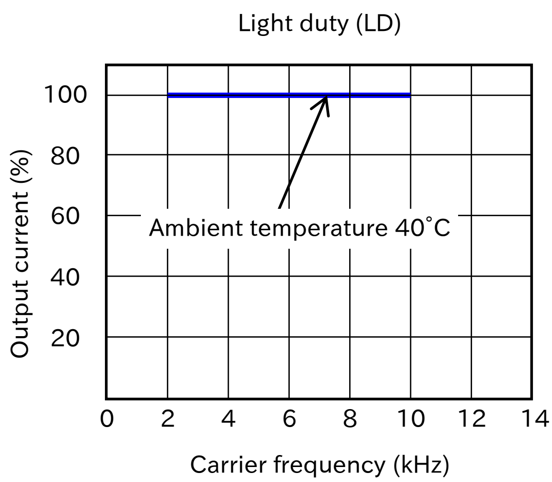
■ Derating necessity table

Single-phase 200 V	Required	Three-phase 200 V	Required	Three-phase 400 V	Required
C1-001S	-	C1-001L	-	C1-004H	✓
C1-002S	-	C1-002L	✓	C1-007H	✓
C1-004S	✓	C1-004L	-	C1-015H	-
C1-007S	✓	C1-007L	-	C1-022H	-
C1-015S	-	C1-015L	-	C1-030H	-
C1-022S	-	C1-022L	-	C1-040H	✓
-	-	C1-037L	✓	C1-055H	-
-	-	C1-055L	-	C1-075H	-
-	-	C1-075L	-	C1-110H	-
-	-	C1-110L	✓	C1-150H	✓
-	-	C1-150L	✓	-	-

✓: Derating required -: Derating not required

Models that do not require current derating (common)

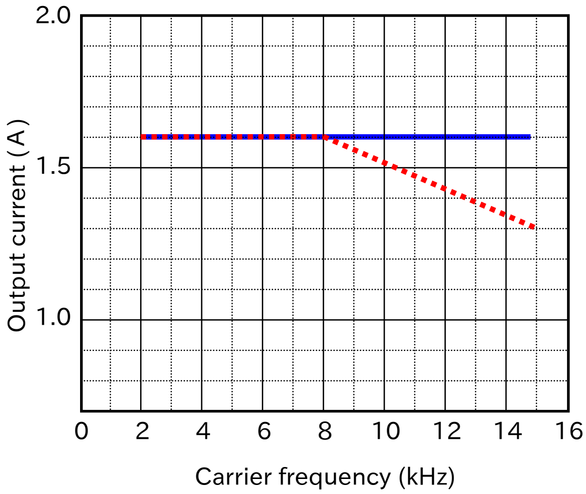


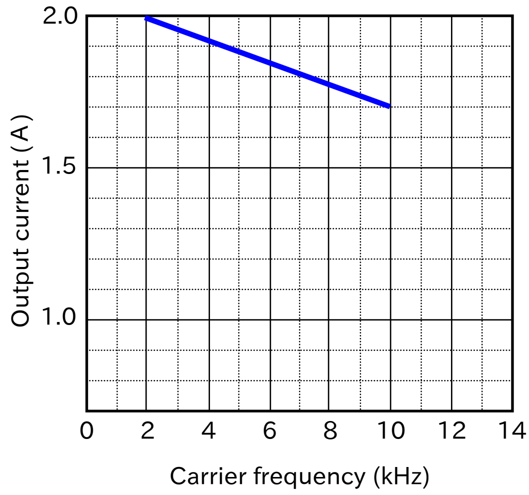


Models requiring current derating

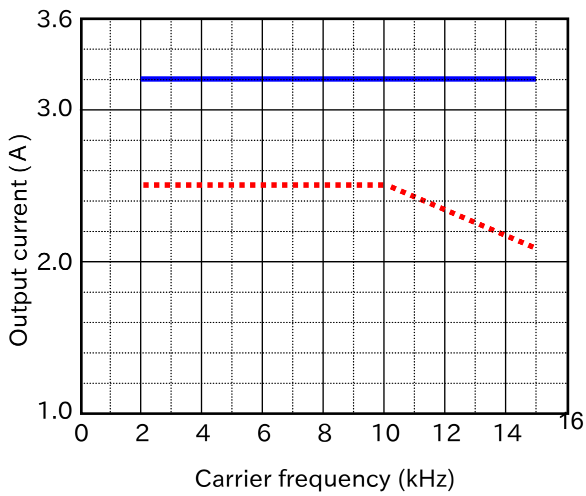
Ambient temperature 40℃
Ambient temperature 50℃

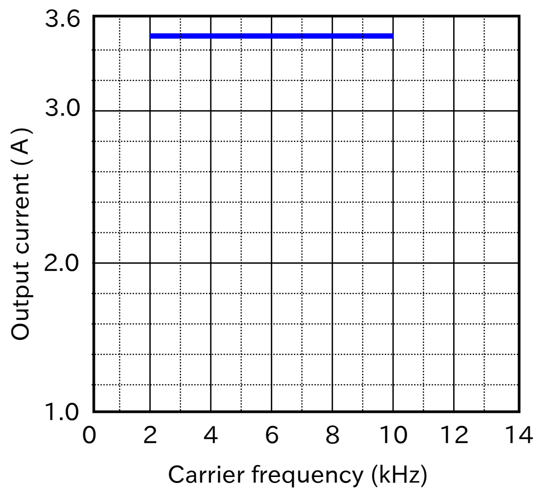
■ C1-002L



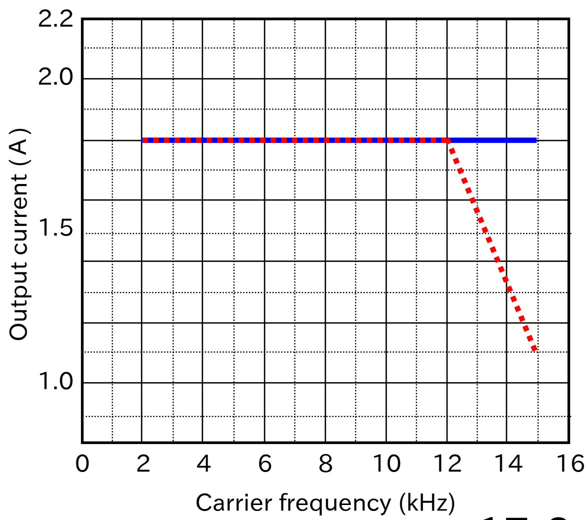


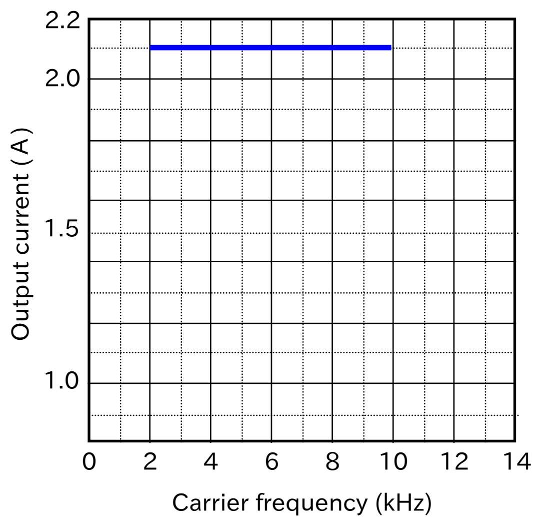
■ C1-004S



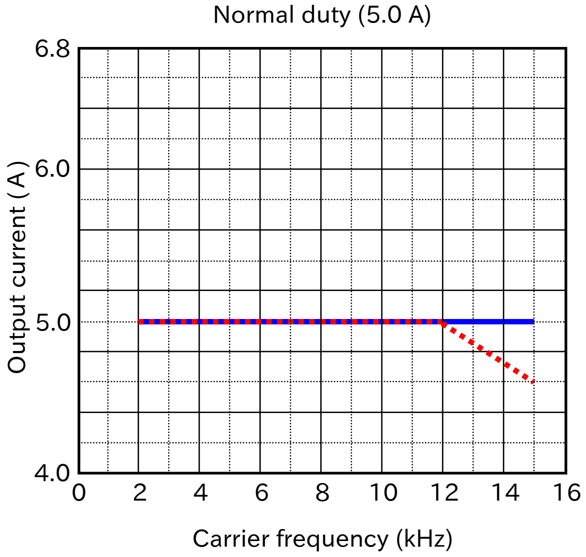


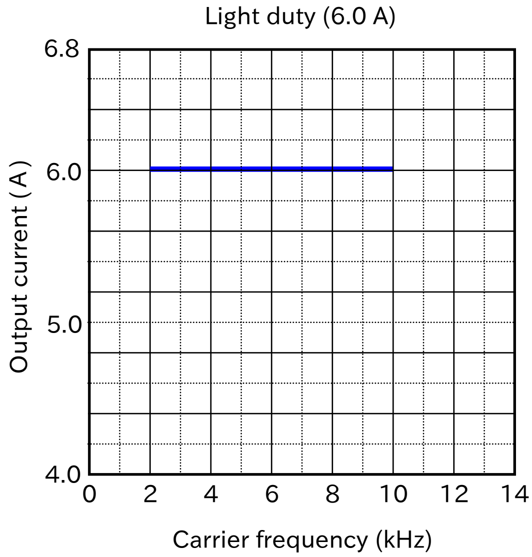
■ C1-004H



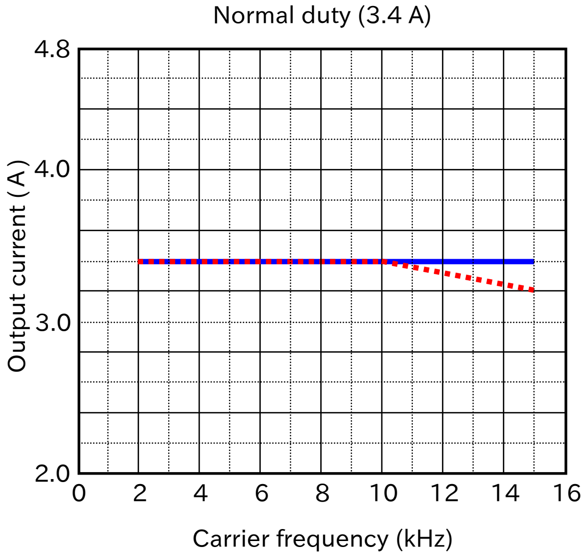


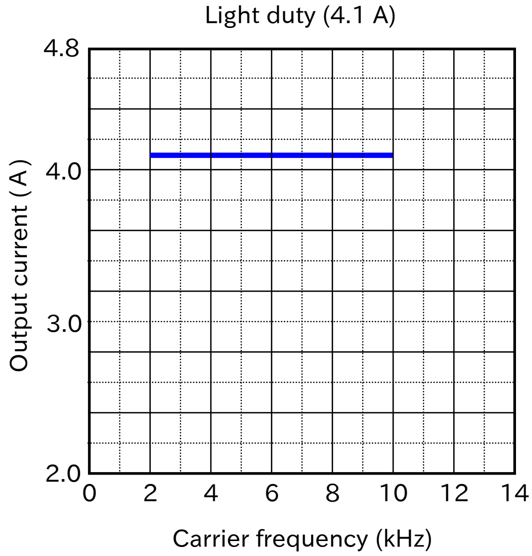
C1-007S



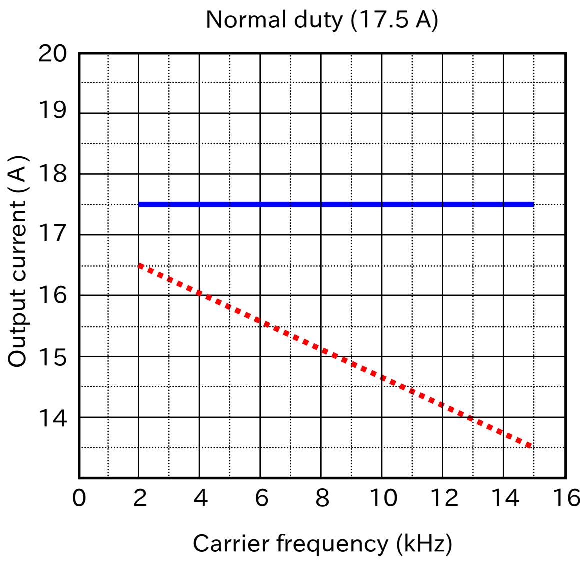


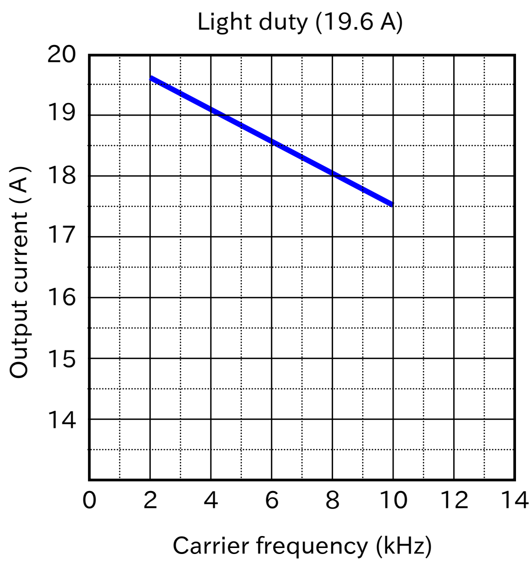
C1-007H





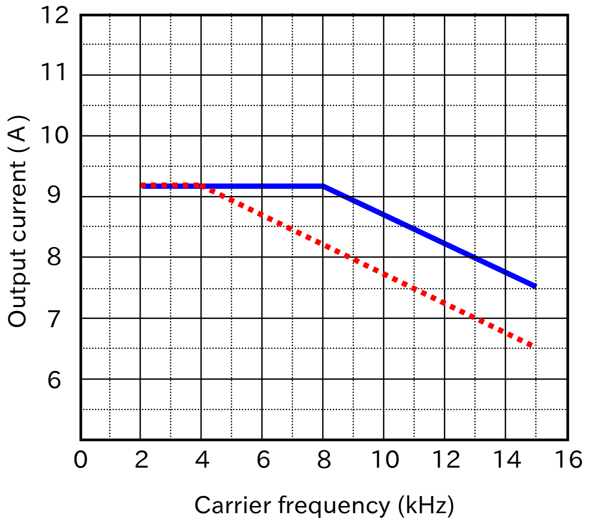
C1-037L



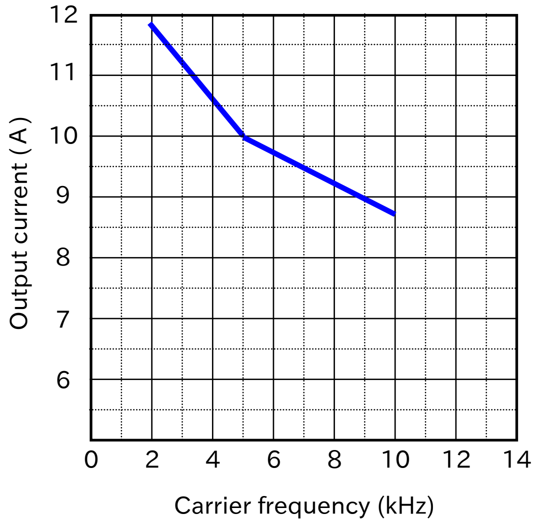


C1-040H

Normal duty (9.2 A)

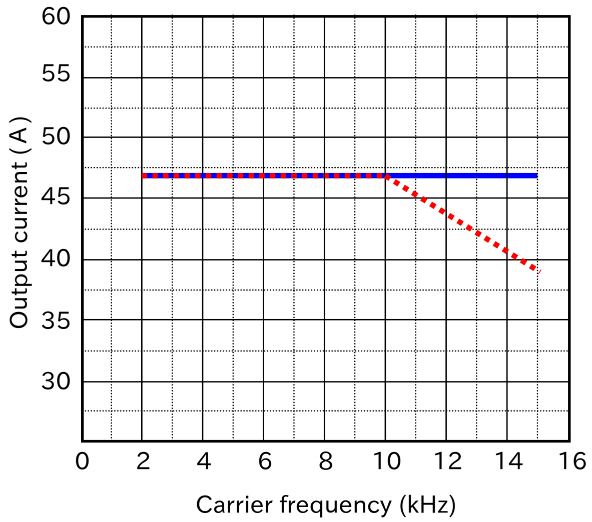


Light duty (11.9 A)

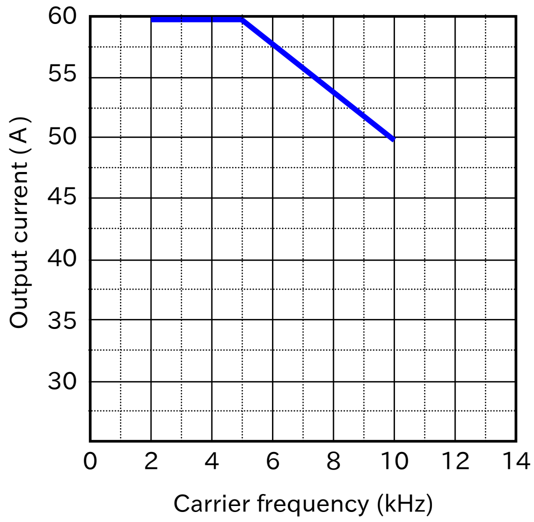


C1-110L

Normal duty (47.0 A)

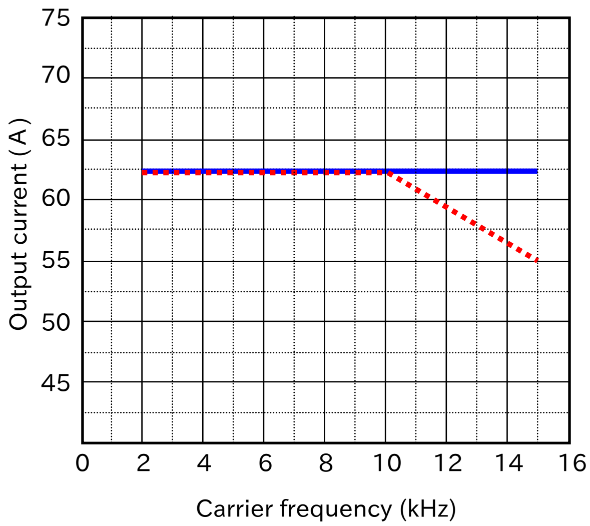


Light duty (60.0 A)

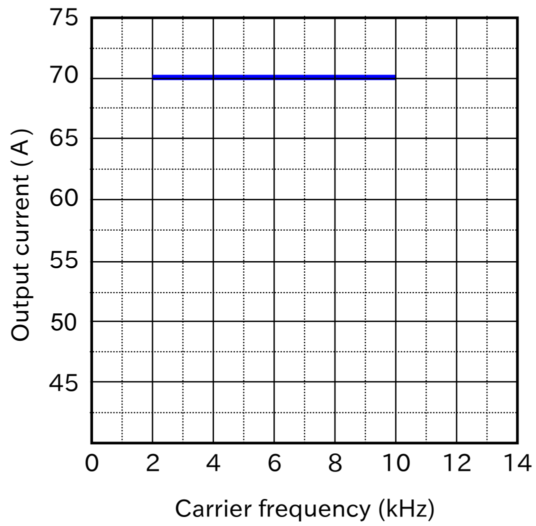


C1-150L

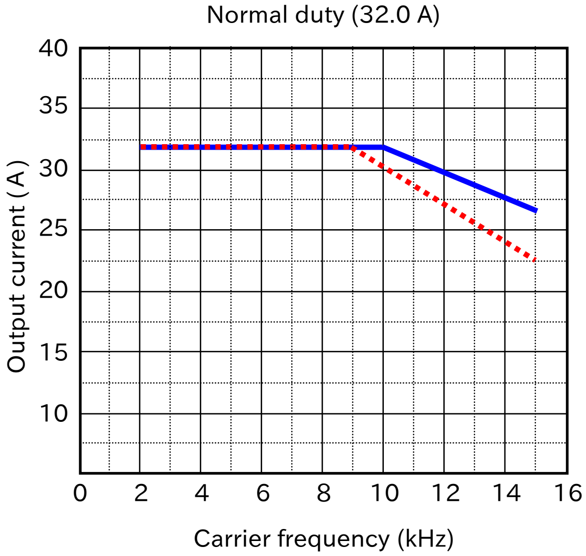
Normal duty (62.5 A)

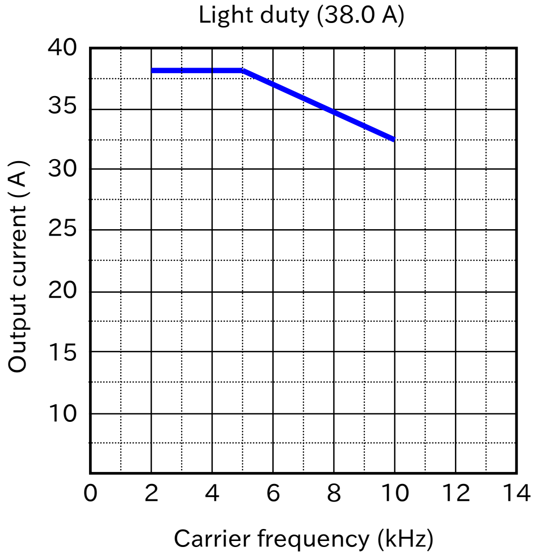


Light duty (70.0 A)



C1-150H


Normal duty (32.0 A)
Output current (A)
40
35
30
25
20
15
10
0
2
4
6
8
10
12
14
16
Carrier frequency (kHz)


Light duty (38.0 A)
Output current (A)
40
35
30
25
20
15
10
0
2
4
6
8
10
12
14
Carrier frequency (kHz)

(Memo)

18

Chapter 18 List of Parameters/Modbus Coil/Register Numbers

This chapter provides a list of monitor parameters, setting parameters, Modbus communication coils and register numbers. Monitor parameters and setting parameters accessible by Modbus communication are listed together with the holding register number.

Some parameters may not be displayed on the keypad due to display restrictions or the password function, or the settings may not be changed due to the soft lock function. In such a case, check "7.2 Keypad Related Functions" or "15.4 How to Check When Something Is Wrong".

18.1 List of Modbus Coil Numbers/Special Register Numbers

18.1.1 List of Modbus Coil Numbers

Coil No.	Name	R/W	Setting
0000h	(Reserved)		
0001h	RUN command	R/W	1: Run / 0: Stop (Enable when [AA111]/[AA211]=RS485 (03))
0002h	Rotation direction command	R/W	1: Reverse / 0: Forward (Enable when [AA111]/[AA211]=RS485 (03))
0003h	External trip [EXT]	R/W	1: Trip / 0: no
0004h	Reset [RS]	R/W	1: Reset / 0: no
0005h	Intelligent input terminal [1]*1	R/W	1: ON / 0: OFF
0006h	Intelligent input terminal [2]*1	R/W	1: ON / 0: OFF
0007h	Intelligent input terminal [3]*1	R/W	1: ON / 0: OFF
0008h	Intelligent input terminal [4]*1	R/W	1: ON / 0: OFF
0009h	Intelligent input terminal [5]*1	R/W	1: ON / 0: OFF
000Ah	Intelligent input terminal [6]*1	R/W	1: ON / 0: OFF
000Bh	Intelligent input terminal [7]*1	R/W	1: ON / 0: OFF
000Ch	Intelligent input terminal [8]*1	R/W	1: ON / 0: OFF
000Dh	(Reserved)		
|	(Reserved)		
0014h	(Reserved)		
0015h	Operation status	R	1: Forward or Reverse / 0: Stop or 0Hz output (Linked to [dA-03])
0016h	Rotation direction	R	1: Reverse / 0: Forward (Linked to [dA-03])
0017h	Inverter ready	R	1: Ready / 0: Not ready
0018h	(Reserved)		
0019h	Intelligent output terminal [11]	R	1: ON / 0: OFF
001Ah	Intelligent output terminal [12]	R	1: ON / 0: OFF
001Bh	(Reserved)		
|	(Reserved)		
001Eh	(Reserved)		
001Fh	Intelligent relay output terminal [AL]	R	1: ON / 0: OFF
0020h	(Reserved)		
|	(Reserved)		
0048h	(Reserved)		
0049h	Data writing in progress	R	1: Writing in progress / 0: Normal state
004Ah	CRC error	R	1: With error / 0: No error
004Bh	Overrun error	R	1: With error / 0: No error
004Ch	Framing error	R	1: With error / 0: No error
004Dh	Parity error	R	1: With error / 0: No error
004Eh	Sum check error	R	1: With error / 0: No error
004Fh	(Reserved)		
|	(Reserved)		

*1. The input terminal can be turned on/off by Modbus communication. The inverter recognizes that the input terminal is in the ON state if either the input terminal by communication or the input signal by control terminal is on. However, as "Input terminal monitor [dA-51]" is a monitor of control terminal's input signal, input status via communication is not displayed.

18.1.2 List of Modbus Special Holding Registers

- The following table lists Modbus register numbers that do not directly correspond to monitor parameters and setting parameters.
- For the number of the holding register corresponding to the monitor parameter/setting parameter that can be R/W from keypad, refer to "18.2 List of Parameters/Register Numbers".

Register No.	Name	R/W	Setting	Resolution
2328h	Enter instruction (Write to Data Flash)	W	01: Write all parameters	1
232Ah	Single write mode	W	01: Enable	1
2332h	Motor constants re-calculation	W	01: Enable	1
2906h 2907h	RS485 speed reference (Signed) (For main/sub speed)	R/W	-59000 to 59000	0.01 Hz
291Eh	RS485 torque reference	R/W	-5000 to 5000	0.1 %
2922h	RS485 torque bias	R/W	-5000 to 5000	0.1 %
2926h	RS485 speed limit at torque control (at Forward rotation)	R/W	0 to 59000	0.01 Hz
2927h	RS485 speed limit at torque control (at Reverse rotation)	R/W	0 to 59000	0.01 Hz
2932h 2933h	RS485 PID set point	R/W	-10000 to 10000	0.01 %
293Ah 293Bh	RS485 PID feedback	R/W	-10000 to 10000	0.01 %
2946h	RS485 torque limit	R/W	0 to 5000	0.1 %
3EB5h	Output terminal function Option output [OPO]	R/W	0 to 0x7F	1
3EBCh	Coil data 0 (Coil No. 0000h to 000Fh)	R/W	0 to 0xFFFF	1
3EBDh	Coil data 1 (Coil No. 0010h to 001Fh)	R	0 to 0xFFFF	1
3EBEh	Coil data 2 (Coil No. 0020h to 002Fh)	R	0 to 0xFFFF	1
3EBFh	Coil data 3 (Coil No. 0030h to 003Fh)	R	0 to 0xFFFF	1
3EC0h	Coil data 4 (Coil No. 0040h to 004Fh)	R	0 to 0xFFFF	1

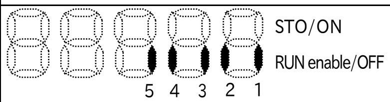
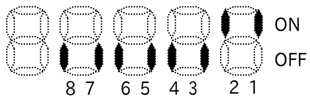
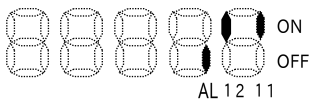
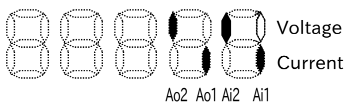
18.2 List of Parameters/Register Numbers

!

- When the data range or initial value has a description regarding the rated current and is marked as CTL rated current, refer to the rated output current of the currently selected normal duty (ND) or light duty (LD). For those marked ND rated current, refer to the rated output current of the normal duty (ND), even if light duty (LD) is selected. The currently selected load type can be checked on the "Inverter load type status [dC-01].
- In the default condition, the data part (0.00 Hz in the case of stopped state) of [dA-01] is always displayed after the power is turned on. To change the monitor at power-on, change the setting of "Initial display selection [UA-91]".
- If the parameter code cannot be displayed, or if the code and setting data can be displayed but cannot be changed, the display restrictions or soft-lock may be activated. For more information, refer to "7.2 Keypad Related Functions" or "15.4.1 Troubleshooting Other Than Trip and Warning".
- The d parameter group can only be "Read", and the rest of the parameters can be R/W unless otherwise noted.
- In the table below, Modbus holding register numbers may be discontinuous, but do not access the holding registers that is not listed.

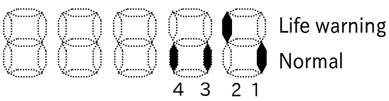
18.2.1 d Monitor Group

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dA-01	Output frequency monitor	0.00 to 590.00 (Hz)	○	2711h	0 to 59000	0.01	10-1-1
dA-02	Output current monitor	0.00 to 655.35 (A)	–	2712h	0 to 65535	0.01	10-1-3
dA-03	Rotation direction monitor	o: Stop d: 0Hz output F: Forward r: Reverse	–	2713h	0 to 3	–	10-1-3
dA-04	Frequency reference monitor (after calculation) (signed)	-590.00 to 590.00 (Hz)	–	2714h 2715h	-59000 to 59000	0.01	10-1-1
dA-06	Output frequency scale conversion monitor	0.00 to 59000.00	○	2716h 2717h	-59000 to 59000	0.01	10-1-1
dA-08	Detect speed monitor	-590.00 to 590.00 (Hz)	–	2718h 2719h	-59000 to 59000	0.01	10-1-4
dA-12	Output frequency monitor (signed)	-590.00 to 590.00 (Hz)	–	271Ch 271Dh	-59000 to 59000	0.01	10-1-2
dA-14	Frequency upper limit monitor	0.00 to 590.00 (Hz)	–	271Eh	0 to 59000	0.01	9-4-1
dA-15	Torque reference monitor (after calculation)	-1000.0 to 1000.0 (%)	–	271Fh	-10000 to 10000	0.1	10-1-5
dA-16	Torque limit monitor	0.0 to 500.0 (%)	–	2720h	0 to 5000	0.1	9-6-9 10-1-5
dA-17	Output torque monitor	-1000.0 to 1000.0 (%)	–	2721h	-10000 to 10000	0.1	10-1-5
dA-18	Output voltage monitor (RMS)	0.0 to 800.0 (V)	–	2722h	0 to 8000	0.1	10-1-6
dA-20	Current position monitor	Absolute position control mode: -268435455 to 268435455 (pls) High resolution absolute position control mode: -1073741823 to 1073741823 (pls)	–	2724h 2725h	Absolute: -268435455 to 268435455 High resolution: -1073741823 to 1073741823	1	9-14-1 10-1-6

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dA-28	Pulse count monitor	0 to 2147483647	−	272Ch 272Dh	0 to 2147483647	1	9-15-10
dA-30	Input power monitor	0.00 to 655.35 (kW)	−	272Eh	0 to 65535	0.01	10-1-7
dA-32	Accumulated input power monitor	0.0 to 1000000.0 (kWh)	−	2730h 2731h	0 to 10000000	0.1	10-1-7
dA-34	Output power monitor	0.00 to 655.35 (kW)	−	2732h	0 to 65535	0.01	10-1-8
dA-36	Accumulated output power monitor	0.0 to 1000000.0 (kWh)	−	2734h 2735h	0 to 10000000	0.1	10-1-8
dA-40	DC bus voltage monitor	0.0 to 1000.0 (VDC)	−	2738h	0 to 10000	0.1	10-1-9
dA-41	BRD load factor monitor	0.00 to 100.00 (%)	−	2739h	0 to 10000	0.01	9-9-8 10-1-9
dA-42	Electronic thermal load factor monitor (Motor)	0.00 to 100.00 (%)	−	273Ah	0 to 10000	0.01	9-11-5 10-1-10
dA-43	Electronic thermal load factor monitor (Inverter)	0.00 to 100.00 (%)	−	273Bh	0 to 10000	0.01	9-11-6 10-1-10
dA-44	Safety STO terminal monitor	 1: Terminal [ST1] (STO / RUN enable) 2: Terminal [ST2] (STO / RUN enable) 3: Terminal [EDM] (OFF / ON) 4: [SFM1] signal (OFF / ON) 5: [SFM2] signal (OFF / ON)	−	273Ch	2^0 : Terminal [ST1] 2^1 : Terminal [ST2] 2^2 : Terminal [EDM] 2^3 : [SFM1] signal 2^4 : [SFM2] signal	−	14-1-4
dA-45	Safety STO monitor	00: no input 01: P-1A 02: P-2A 03: P-1b 04: P-2b 05: P-1C 06: P-2C 07: StO	−	273Dh	0 to 7	1	14-1-4
dA-51	Input terminal monitor	 (例) 1, 2: ON 3～8: OFF	−	2743h	2^0 - : (Terminal[1]) 2^7 : (Terminal[8])	−	10-2-1
dA-54	Output terminal monitor	 (例)11, 12: ON AL: OFF	−	2746h	2^0 : (11) 2^1 : (12) 2^2 : (AL)	−	10-2-1
dA-60	Analog input/output status monitor	 (例) Ai1：Analog current input Ai2：Analog voltage input Ao1：Analog current output Ao2：Always voltage position	−	274Ch	00h to FFh	−	10-2-3
dA-61	Analog input [Ai1] monitor	0.00 to 100.00 (%)	−	274Dh	0 to 10000	1	10-2-2
dA-62	Analog input [Ai2] monitor	0.00 to 100.00 (%)	−	274Eh	0 to 10000	1	10-2-2
dA-70	Pulse input monitor	-100.00 to 100.00 (%)	−	2756h	-10000 to 10000	0.01	10-2-2

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dA-81	Option mounting status[*1]	00: (0x00) None 02: (0x02) EtherCAT 03: (0x03) PROFINET 06: (0x06) PROFIBUS-DP 07: (0x07) CC-Link	–	2761h	0 to 7	1	13-1-1
dB Parameter							
db-01	Program download monitor	00: Program is not installed 01: Program is installed	–	2775h	0 to 1	1	10-4-1
db-02	Program No. monitor	0000 to 9999	–	2776h	0 to 9999	1	10-4-1
db-03	Program counter (Task-1)	0 to 1024	–	2777h	0 to 1024	1	10-4-1
db-04	Program counter (Task-2)	0 to 1024	–	2778h	0 to 1024	1	10-4-1
db-05	Program counter (Task-3)	0 to 1024	–	2779h	0 to 1024	1	10-4-1
db-06	Program counter (Task-4)	0 to 1024	–	277Ah	0 to 1024	1	10-4-1
db-07	Program counter (Task-5)	0 to 1024	–	277Bh	0 to 1024	1	10-4-1
db-08	User monitor-0	-2147483648 to 2147483647	–	277Ch 277Dh	-2147483648 to 2147483647	1	10-4-1
db-10	User monitor-1	-2147483648 to 2147483647	–	277Eh 277Fh	-2147483648 to 2147483648	1	10-4-1
db-12	User monitor-2	-2147483648 to 2147483647	–	2780h 2781h	-2147483648 to 2147483647	1	10-4-1
db-14	User monitor-3	-2147483648 to 2147483647	–	2782h 2783h	-2147483648 to 2147483647	1	10-4-1
db-16	User monitor-4	-2147483648 to 2147483647	–	2784h 2785h	-2147483648 to 2147483647	1	10-4-1
db-18	Analog output monitor YA0	0.00 to 100.00 (%)	–	2786h	0 to 10000	0.01	10-4-1
db-19	Analog output monitor YA1	0.00 to 100.00 (%)	–	2787h	0 to 10000	0.01	10-4-1
db-28	Program status	00: Standby 01: Running 02: Break stop 03: Stopped 04: Error stop	–	2790h	0 to 4	1	10-4-1
db-29	Error task number	0 to 5	–	2791h	0 to 5	1	10-4-1
db-30	PID1 feedback value 1 monitor	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	–	2792h 2793h	-10000 to 10000	Depends on AH-06	9-8-12 10-4-2
db-32	PID1 feedback value 2 monitor	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	–	2794h 2795h	-10000 to 10000	Depends on AH-06	9-8-12 10-4-2
db-34	PID1 feedback value 3 monitor	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	–	2796h 2797h	-10000 to 10000	Depends on AH-06	9-8-12 10-4-2
db-36	PID2 feedback value monitor	-100.00 to 100.00 (%) Data range depends on PID2 scale adjustment (AJ-04, 05, 06)	–	2798h 2799h	-10000 to 10000	Depends on AJ-06	9-8-31 10-4-2
db-42	PID1 set-point monitor (after calculation)	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	–	279Eh 279Fh	-10000 to 10000	Depends on AH-06	9-8-9 10-4-2
db-44	PID1 feedback value monitor (after calculation)	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	–	27A0h 27A1h	-10000 to 10000	Depends on AH-06	9-8-12 9-8-31 10-4-2

*1. Communication options for WJ-C1 extended mode are under development. When you need a communication option, you can use the communication option for the WJ200 series by changing to the basic mode. For details, refer to "Chapter 13 Communication Option".

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
db-50	PID1 output monitor	-100.00 to 100.00 (%)	–	27A6h	-10000 to 10000	0.01	10-4-2
db-51	PID1 deviation monitor	-200.00 to 200.00 (%)	–	27A7h	-20000 to 20000	0.01	9-8-30 10-4-2
db-52	PID1 deviation 1 monitor	-200.00 to 200.00 (%)	–	27A8h	-20000 to 20000	0.01	10-4-2
db-53	PID1 deviation 2 monitor	-200.00 to 200.00 (%)	–	27A9h	-20000 to 20000	0.01	10-4-2
db-54	PID1 deviation 3 monitor	-200.00 to 200.00 (%)	–	27AAh	-20000 to 20000	0.01	10-4-2
db-55	PID2 output monitor	-100.00 to 100.00 (%)	–	27ABh	-10000 to 10000	0.01	10-4-2
db-56	PID2 deviation monitor	-200.00 to 200.00 (%)	–	27ACh	-20000 to 20000	0.01	9-8-30 10-4-2
db-61	Current PID P-Gain monitor	0.0 to 100.0	–	27B1h	0.0 to 1000	0.1	10-4-2
db-62	Current PID I-Gain monitor	0.0 to 3600.0 (s)	–	27B2h	0 to 36000	0.1	10-4-2
db-63	Current PID D-Gain monitor	0.00 to 100.00 (s)	–	27B3h	0 to 10000	0.01	10-4-2
db-64	PID feedforward monitor	0.00 to 100.00 (%)	–	27B4h	0 to 10000	0.01	10-4-2
dC Parameter							
dC-01	Inverter load type status	01：Light Duty (LD) 02：Normal Duty (ND)	–	27D9h	1 to 2	1	10-3-4
dC-02	Rated current monitor	0.0 to 6553.5 (A)	–	27DAh	0 to 65535	0.1	10-3-4
dC-07	Main speed input source monitor	01: Terminal [Ai1] 02: Terminal [Ai2] 07: Multi-speed 0 / 09: Multi-speed 1 10: Multi-speed 2 / 11: Multi-speed 3 12: Multi-speed 4 / 13: Multi-speed 5 14: Multi-speed 6 / 15: Multi-speed 7 16: Multi-speed 8 / 17: Multi-speed 9 18: Multi-speed 10 / 19: Multi-speed 11 20: Multi-speed 12 / 21: Multi-speed 13 22: Multi-speed 14 / 23: Multi-speed 15 24: Jogging / 25: RS485 26: Option / 29: Pulse input 31: Program function 32: PID function 33: VR (MOP-VR) 34: AHD retention speed	–	27DFh	1 to 34	1	10-3-6
dC-08	Sub speed input source monitor	00: Disabled 01: Terminal [Ai1] 02: Terminal [Ai2] 08: Sub speed (Parameter setting) 25: RS485 / 26: Option 29: Pulse input / 31: Program function 32: PID function / 33: VR (MOP-VR)	–	27E0h	0 to 33	1	10-3-6
dC-10	RUN command input source monitor	00: [FW]/[RV] terminal 01: 3-Wire 02: Keypad's RUN key 03: RS485 04: Option	–	27E2h	0 to 4	1	10-3-7
dC-15	Cooling fin temperature monitor	-20.0 to 200.0 (℃)	–	27E7h	-200 to 2000	0.1	9-11-8 10-3-3
dC-16	Life assessment monitor	 1: WAC (Capacitor life warning) 2: WAF (Cooling-fan life warning) 3: WAP (Power module life warning) 4: WAIC (Inrush circuit life warning)	–	27E8h	2^0 : WAC 2^1 : WAF 2^2 : WAP 2^3 : WAIC	1	9-11-9 9-11-10 9-11-11 10-3-3

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dC-20	Accumulated number of starts monitor	1 to 65535	–	27ECh	1 to 65535	1	10-3-1
dC-21	Accumulated number of power-on times monitor	1 to 65535	–	27EDh	1 to 65535	1	10-3-1
dC-22	Accumulated RUN time monitor	0 to 1000000 (hr)	–	27EEh 27EFh	0 to 1000000	1	9-11-12 10-3-1
dC-24	Accumulated power-on time monitor	0 to 1000000 (hr)	–	27F0h 27F1h	0 to 1000000	1	9-11-12 10-3-2
dC-26	Accumulated cooling-fan run time monitor	0 to 1000000 (hr)	–	27F2h 27F3h	0 to 1000000	1	10-3-2
dC-30	Dual monitor	Monitor data selected by [UA-96], [UA-97]	–	27F6h	–	–	10-3-8
dC-31	Abnormal detection value monitor	-100.00 to 100.00 (%)	–	27F7h	-10000 to 10000	0.01	10-2-4
dC-32	Abnormal detection upper level monitor	-100.00 to 100.00 (%)	–	27F8h	-10000 to 10000	0.01	10-2-4
dC-33	Abnormal detection lower level monitor	-100.00 to 100.00 (%)	–	27F9h	-10000 to 10000	0.01	10-2-4
dC-37	Icon 2 LIM detail monitor	00: Motor RUN not restricted 01: OC suppress 02: OL restriction 03: OV suppress 04: Torque limit 05: Frequency limit 06: Minimum frequency	–	27FDh	0 to 6	1	10-3-9
dC-38	Icon 2 ALT detail monitor	00: No warning notice 01: OL notice 02: Motor thermal notice 03: Controller thermal notice 04: Motor overheating notice	–	27FEh	0 to 4	1	10-3-9
dC-39	Icon 2 RETRY detail monitor	00: Not in retry status 01: Waiting for retry 02: Waiting for restart	–	27FFh	0 to 2	1	10-3-10
dC-40	Icon 2 NRDY detail monitor	00: Ready 01: Trip occurrence 02: Power supply error 03: Resetting 04: STO 05: Standby 06: Data warning, etc. 07: EzSQ sequence error 08: Free run 09: Forced stop	–	2800h	0 to 9	1	10-3-10
dC-45	IM/SM monitor	00: IM selected 01: SM selected	–	2805h	0 to 1	1	10-3-4
dC-47	Auto-tuning monitor	00: -- 01: Auto-tuning completed 02: Auto-tuning failed	–	2807h	0 to 2	1	10-3-5
dC-49	Emergency-force drive mode monitor	00: Disabled 01: EMF Active 02: BYP Active	–	2809h	0 to 2	1	9-7-23 10-3-5
dC-50	Firmware Ver. monitor (I/O)	00.00 to 99.99 (MM.mm) MM：Major, mm：Minor	–	280Ah	0000h to FFFFh Upper digits: Major Lower digits: Minor	1	–
dC-53	Firmware Gr. monitor	00: Standard	–	280Dh	0	1	–
dC-87	Firmware Ver. monitor (Core)	00.00 to 99.99 (MM.mm) MM：Major, mm：Minor	–	282Fh	0000h to FFFFh Upper digits: Major Lower digits: Minor	1	–

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-01	Trip counter	0 to 65535 (times)	–	03E8h	0 to 65535	1	10-5-1
dE-11	Trip monitor 1 Factor	E001 to E122	–	03E9h	0 to 122	1	10-5-1
	Trip monitor 1 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	03EAh 03EBh	-59000 to 59000	0.01	
	Trip monitor 1 Output current	0.00 to 655.35 (A)	–	03ECh	0 to 65535	0.01	
	Trip monitor 1 P-N DC voltage	0.0 to 1000.0 (VDC)	–	03EDh	0 to 10000	0.1	
	Trip monitor 1 Inverter status	0 to 8	–	03EEh	0 to 8	1	
	Trip monitor 1 LAD status	0 to 5	–	03EFh	0 to 5	1	
	Trip monitor 1 INV control mode	0 to 11	–	03F0h	0 to 11	1	
	Trip monitor 1 Limit status	0 to 6	–	03F1h	0 to 6	1	
	Trip monitor 1 Special status	0 to 5	–	03F2h	0 to 5	1	
	Trip monitor 1 RUN time	0 to 1000000 (hr)	–	03F4h 03F5h	0 to 1000000	1	
	Trip monitor 1 Power-on time	0 to 1000000 (hr)	–	03F6h 03F7h	0 to 1000000	1	
	Trip monitor 1 Time Year/Month	YY/MM	–	03F8h	YYMM	1	
	Trip monitor 1 Time Day/Day of week	DD/WW	–	03F9h	DDWW	1	
	Trip monitor 1 Time Hour/Minute	HH/mm		03FAh	HHmm	1	
dE-12	Trip monitor 2 Factor	E001 to E122	–	03FDh	0 to 122	1	10-5-1
	Trip monitor 2 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	03FEh 03FFh	-59000 to 59000	0.01	
	Trip monitor 2 Output current	0.00 to 655.35 (A)	–	0400h	0 to 65535	0.01	
	Trip monitor 2 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0401h	0 to 10000	0.1	
	Trip monitor 2 Inverter status	0 to 8	–	0402h	0 to 8	1	
	Trip monitor 2 LAD status	0 to 5	–	0403h	0 to 5	1	
	Trip monitor 2 INV control mode	0 to 11	–	0404h	0 to 11	1	
	Trip monitor 2 Limit status	0 to 6	–	0405h	0 to 6	1	
	Trip monitor 2 Special status	0 to 5	–	0406h	0 to 5	1	
	Trip monitor 2 RUN time	0 to 1000000 (hr)	–	0408h 0409h	0 to 1000000	1	
	Trip monitor 2 Power-on time	0 to 1000000 (hr)	–	040Ah 040Bh	0 to 1000000	1	
	Trip monitor 2 Time Year/Month	YY/MM	–	040Ch	YYMM	1	
	Trip monitor 2 Time Day/Day of week	DD/WW	–	040Dh	DDWW	1	
	Trip monitor 2 Time Hour/Minute	HH/mm	–	040Eh	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-13	Trip monitor 3 Factor	E001 to E122	–	0411h	0 to 122	1	10-5-1
	Trip monitor 3 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0412h 0413h	-59000 to 59000	0.01	
	Trip monitor 3 Output current	0.00 to 655.35 (A)	–	0414h	0 to 65535	0.01	
	Trip monitor 3 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0415h	0 to 10000	0.1	
	Trip monitor 3 Inverter status	0 to 8	–	0416h	0 to 8	1	
	Trip monitor 3 LAD status	0 to 5	–	0417h	0 to 5	1	
	Trip monitor 3 INV control mode	0 to 11	–	0418h	0 to 11	1	
	Trip monitor 3 Limit status	0 to 6	–	0419h	0 to 6	1	
	Trip monitor 3 Special status	0 to 5	–	041Ah	0 to 5	1	
	Trip monitor 3 RUN time	0 to 1000000 (hr)	–	041Ch 041Dh	0 to 1000000	1	
	Trip monitor 3 Power-on time	0 to 1000000 (hr)	–	041Eh 041Fh	0 to 1000000	1	
	Trip monitor 3 Time Year/Month	YY/MM	–	0420h	YYMM	1	
	Trip monitor 3 Time Day/Day of week	DD/WW	–	0421h	DDWW	1	
	Trip monitor 3 Time Hour/Minute	HH/mm	–	0422h	HHmm	1	
dE-14	Trip monitor 4 Factor	E001 to E122	–	0425h	0 to 122	1	10-5-1
	Trip monitor 4 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0426h 0427h	-59000 to 59000	0.01	
	Trip monitor 4 Output current	0.00 to 655.35 (A)	–	0428h	0 to 65535	0.01	
	Trip monitor 4 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0429h	0 to 10000	0.1	
	Trip monitor 4 Inverter status	0 to 8	–	042Ah	0 to 8	1	
	Trip monitor 4 LAD status	0 to 5	–	042Bh	0 to 5	1	
	Trip monitor 4 INV control mode	0 to 11	–	042Ch	0 to 11	1	
	Trip monitor 4 Limit status	0 to 6	–	042Dh	0 to 6	1	
	Trip monitor 4 Special status	0 to 5	–	042Eh	0 to 5	1	
	Trip monitor 4 RUN time	0 to 1000000 (hr)	–	0430h 0431h	0 to 1000000	1	
	Trip monitor 4 Power-on time	0 to 1000000 (hr)	–	0432h 0433h	0 to 1000000	1	
	Trip monitor 4 Time Year/Month	YY/MM	–	0434h	YYMM	1	
	Trip monitor 4 Time Day/Day of week	DD/WW	–	0435h	DDWW	1	
	Trip monitor 4 Time Hour/Minute	HH/mm	–	0436h	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-15	Trip monitor 5 Factor	E001 to E122	–	0439h	0 to 122	1	10-5-1
	Trip monitor 5 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	043Ah 043Bh	-59000 to 59000	0.01	
	Trip monitor 5 Output current	0.00 to 655.35 (A)	–	043Ch	0 to 65535	0.01	
	Trip monitor 5 P-N DC voltage	0.0 to 1000.0 (VDC)	–	043Dh	0 to 10000	0.1	
	Trip monitor 5 Inverter status	0 to 8	–	043Eh	0 to 8	1	
	Trip monitor 5 LAD status	0 to 5	–	043Fh	0 to 5	1	
	Trip monitor 5 INV control mode	0 to 11	–	0440h	0 to 11	1	
	Trip monitor 5 Limit status	0 to 6	–	0441h	0 to 6	1	
	Trip monitor 5 Special status	0 to 5	–	0442h	0 to 5	1	
	Trip monitor 5 RUN time	0 to 1000000 (hr)	–	0444h 0445h	0 to 1000000	1	
	Trip monitor 5 Power-on time	0 to 1000000 (hr)	–	0446h 0447h	0 to 1000000	1	
	Trip monitor 5 Time Year/Month	YY/MM	–	0448h	YYMM	1	
	Trip monitor 5 Time Day/Day of week	DD/WW	–	0449h	DDWW	1	
	Trip monitor 5 Time Hour/Minute	HH/mm	–	044Ah	HHmm	1	
dE-16	Trip monitor 6 Factor	E001 to E122	–	044Dh	0 to 122	1	10-5-1
	Trip monitor 6 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	044Eh 044Fh	-59000 to 59000	0.01	
	Trip monitor 6 Output current	0.00 to 655.35 (A)	–	0450h	0 to 65535	0.01	
	Trip monitor 6 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0451h	0 to 10000	0.1	
	Trip monitor 6 Inverter status	0 to 8	–	0452h	0 to 8	1	
	Trip monitor 6 LAD status	0 to 5	–	0453h	0 to 5	1	
	Trip monitor 6 INV control mode	0 to 11	–	0454h	0 to 11	1	
	Trip monitor 6 Limit status	0 to 6	–	0455h	0 to 6	1	
	Trip monitor 6 Special status	0 to 5	–	0456h	0 to 5	1	
	Trip monitor 6 RUN time	0 to 1000000 (hr)	–	0458h 0459h	0 to 1000000	1	
	Trip monitor 6 Power-on time	0 to 1000000 (hr)	–	045Ah 045Bh	0 to 1000000	1	
	Trip monitor 6 Time Year/Month	YY/MM	–	045Ch	YYMM	1	
	Trip monitor 6 Time Day/Day of week	DD/WW	–	045Dh	DDWW	1	
	Trip monitor 6 Time Hour/Minute	HH/mm	–	045Eh	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-17	Trip monitor 7 Factor	E001 to E122	–	0461h	0 to 122	1	10-5-1
	Trip monitor 7 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0462h 0463h	-59000 to 59000	0.01	
	Trip monitor 7 Output current	0.00 to 655.35 (A)	–	0464h	0 to 65535	0.01	
	Trip monitor 7 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0465h	0 to 10000	0.1	
	Trip monitor 7 Inverter status	0 to 8	–	0466h	0 to 8	1	
	Trip monitor 7 LAD status	0 to 5	–	0467h	0 to 5	1	
	Trip monitor 7 INV control mode	0 to 11	–	0468h	0 to 11	1	
	Trip monitor 7 Limit status	0 to 6	–	0469h	0 to 6	1	
	Trip monitor 7 Special status	0 to 5	–	046Ah	0 to 5	1	
	Trip monitor 7 RUN time	0 to 1000000 (hr)	–	046Ch 046Dh	0 to 1000000	1	
	Trip monitor 7 Power-on time	0 to 1000000 (hr)	–	046Eh 046Fh	0 to 1000000	1	
	Trip monitor 7 Time Year/Month	YY/MM	–	0470h	YYMM	1	
	Trip monitor 7 Time Day/Day of week	DD/WW	–	0471h	DDWW	1	
	Trip monitor 7 Time Hour/Minute	HH/mm	–	0472h	HHmm	1	
dE-18	Trip monitor 8 Factor	E001 to E122	–	0475h	0 to 122	1	10-5-1
	Trip monitor 8 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0476h 0477h	-59000 to 59000	0.01	
	Trip monitor 8 Output current	0.00 to 655.35 (A)	–	0478h	0 to 65535	0.01	
	Trip monitor 8 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0479h	0 to 10000	0.1	
	Trip monitor 8 Inverter status	0 to 8	–	047Ah	0 to 8	1	
	Trip monitor 8 LAD status	0 to 5	–	047Bh	0 to 5	1	
	Trip monitor 8 INV control mode	0 to 11	–	047Ch	0 to 11	1	
	Trip monitor 8 Limit status	0 to 6	–	047Dh	0 to 6	1	
	Trip monitor 8 Special status	0 to 5	–	047Eh	0 to 5	1	
	Trip monitor 8 RUN time	0 to 1000000 (hr)	–	0480h 0481h	0 to 1000000	1	
	Trip monitor 8 Power-on time	0 to 1000000 (hr)	–	0482h 0483h	0 to 1000000	1	
	Trip monitor 8 Time Year/Month	YY/MM	–	0484h	YYMM	1	
	Trip monitor 8 Time Day/Day of week	DD/WW	–	0485h	DDWW	1	
	Trip monitor 8 Time Hour/Minute	HH/mm	–	0486h	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-19	Trip monitor 9 Factor	E001 to E122	–	0489h	0 to 122	1	10-5-1
	Trip monitor 9 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	048Ah 048Bh	-59000 to 59000	0.01	
	Trip monitor 9 Output current	0.00 to 655.35 (A)	–	048Ch	0 to 65535	0.01	
	Trip monitor 9 P-N DC voltage	0.0 to 1000.0 (VDC)	–	048Dh	0 to 10000	0.1	
	Trip monitor 9 Inverter status	0 to 8	–	048Eh	0 to 8	1	
	Trip monitor 9 LAD status	0 to 5	–	048Fh	0 to 5	1	
	Trip monitor 9 INV control mode	0 to 11	–	0490h	0 to 11	1	
	Trip monitor 9 Limit status	0 to 6	–	0491h	0 to 6	1	
	Trip monitor 9 Special status	0 to 5	–	0492h	0 to 5	1	
	Trip monitor 9 RUN time	0 to 1000000 (hr)	–	0494h 0495h	0 to 1000000	1	
	Trip monitor 9 Power-on time	0 to 1000000 (hr)	–	0496h 0497h	0 to 1000000	1	
	Trip monitor 9 Time Year/Month	YY/MM	–	0498h	YYMM	1	
	Trip monitor 9 Time Day/Day of week	DD/WW	–	0499h	DDWW	1	
	Trip monitor 9 Time Hour/Minute	HH/mm	–	049Ah	HHmm	1	
dE-20	Trip monitor 10 Factor	E001 to E122	–	049Dh	0 to 122	1	10-5-1
	Trip monitor 10 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	049Eh 049Fh	-59000 to 59000	0.01	
	Trip monitor 10 Output current	0.00 to 655.35 (A)	–	04A0h	0 to 65535	0.01	
	Trip monitor 10 P-N DC voltage	0.0 to 1000.0 (VDC)	–	04A1h	0 to 10000	0.1	
	Trip monitor 10 Inverter status	0 to 8	–	04A2h	0 to 8	1	
	Trip monitor 10 LAD status	0 to 5	–	04A3h	0 to 5	1	
	Trip monitor 10 INV control mode	0 to 11	–	04A4h	0 to 11	1	
	Trip monitor 10 Limit status	0 to 6	–	04A5h	0 to 6	1	
	Trip monitor 10 Special status	0 to 5	–	04A6h	0 to 5	1	
	Trip monitor 10 RUN time	0 to 1000000 (hr)	–	04A8h 04A9h	0 to 1000000	1	
	Trip monitor 10 Power-on time	0 to 1000000 (hr)	–	04AAh 04ABh	0 to 1000000	1	
	Trip monitor 10 Time Year/Month	YY/MM	–	04ACh	YYMM	1	
	Trip monitor 10 Time Day/Day of week	DD/WW	–	04ADh	DDWW	1	
	Trip monitor 10 Time Hour/Minute	HH/mm	–	04AEh	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication Register No.	Modbus communication Data range	Modbus communication Resolution	Page
dE-31	Retry monitor 1 Factor	r001 to r009	–	04B1h	0 to 9	1	10-5-2
	Retry monitor 1 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	04B2h 04B3h	-59000 to 59000	0.01	
	Retry monitor 1 Output current	0.00 to 655.35 (A)	–	04B4h	0 to 65535	0.01	
	Retry monitor 1 P-N DC voltage	0.0 to 1000.0 (VDC)	–	04B5h	0 to 10000	0.1	
	Retry monitor 1 Inverter status	0 to 8	–	04B6h	0 to 8	1	
	Retry monitor 1 LAD status	0 to 5	–	04B7h	0 to 5	1	
	Retry monitor 1 INV control mode	0 to 11	–	04B8h	0 to 11	1	
	Retry monitor 1 Limit status	0 to 6	–	04B9h	0 to 6	1	
	Retry monitor 1 Special status	0 to 5	–	04BAh	0 to 5	1	
	Retry monitor 1 RUN time	0 to 1000000 (hr)	–	04BCh 04BDh	0 to 1000000	1	
	Retry monitor 1 Power-on time	0 to 1000000 (hr)	–	04BEh 04BFh	0 to 1000000	1	
	Retry monitor 1 Time Year/Month	YY/MM	–	04C0h	YYMM	1	
	Retry monitor 1 Time Day/Day of week	DD/WW	–	04C1h	DDWW	1	
	Retry monitor 1 Time Hour/Minute	HH/mm	–	04C2h	HHmm	1	
dE-32	Retry monitor 2 Factor	r001 to r009	–	04C5h	0 to 9	1	10-5-2
	Retry monitor 2 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	04C6h 04C7h	-59000 to 59000	0.01	
	Retry monitor 2 Output current	0.00 to 655.35 (A)	–	04C8h	0 to 65535	0.01	
	Retry monitor 2 P-N DC voltage	0.0 to 1000.0 (VDC)	–	04C9h	0 to 10000	0.1	
	Retry monitor 2 Inverter status	0 to 8	–	04CAh	0 to 8	1	
	Retry monitor 2 LAD status	0 to 5	–	04CBh	0 to 5	1	
	Retry monitor 2 INV control mode	0 to 11	–	04CCh	0 to 11	1	
	Retry monitor 2 Limit status	0 to 6	–	04CDh	0 to 6	1	
	Retry monitor 2 Special status	0 to 5	–	04CEh	0 to 5	1	
	Retry monitor 2 RUN time	0 to 1000000 (hr)	–	04D0h 04D1h	0 to 1000000	1	
	Retry monitor 2 Power-on time	0 to 1000000 (hr)	–	04D2h 04D3h	0 to 1000000	1	
	Retry monitor 2 Time Year/Month	YY/MM	–	04D4h	YYMM	1	
	Retry monitor 2 Time Day/Day of week	DD/WW	–	04D5h	DDWW	1	
	Retry monitor 2 Time Hour/Minute	HH/mm	–	04D6h	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-33	Retry monitor 3 Factor	r001 to r009	–	04D9h	0 to 9	1	10-5-2
	Retry monitor 3 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	04DAh 04DBh	-59000 to 59000	0.01	
	Retry monitor 3 Output current	0.00 to 655.35 (A)	–	04DCh	0 to 65535	0.01	
	Retry monitor 3 P-N DC voltage	0.0 to 1000.0 (VDC)	–	04DDh	0 to 10000	0.1	
	Retry monitor 3 Inverter status	0 to 8	–	04DEh	0 to 8	1	
	Retry monitor 3 LAD status	0 to 5	–	04EFh	0 to 5	1	
	Retry monitor 3 INV control mode	0 to 11	–	04E0h	0 to 11	1	
	Retry monitor 3 Limit status	0 to 6	–	04E1h	0 to 6	1	
	Retry monitor 3 Special status	0 to 5	–	04E2h	0 to 5	1	
	Retry monitor 3 RUN time	0 to 1000000 (hr)	–	04E4h 04E5h	0 to 1000000	1	
	Retry monitor 3 Power-on time	0 to 1000000 (hr)	–	04E6h 04E7h	0 to 1000000	1	
	Retry monitor 3 Time Year/Month	YY/MM	–	04E8h	YYMM	1	
	Retry monitor 3 Time Day/Day of week	DD/WW	–	04E9h	DDWW	1	
	Retry monitor 3 Time Hour/Minute	HH/mm	–	04EAh	HHmm	1	
dE-34	Retry monitor 4 Factor	r001 to r009	–	04EDh	0 to 9	1	10-5-2
	Retry monitor 4 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	04EEh 04EFh	-59000 to 59000	0.01	
	Retry monitor 4 Output current	0.00 to 655.35 (A)	–	04F0h	0 to 65535	0.01	
	Retry monitor 4 P-N DC voltage	0.0 to 1000.0 (VDC)	–	04F1h	0 to 10000	0.1	
	Retry monitor 4 Inverter status	0 to 8	–	04F2h	0 to 8	1	
	Retry monitor 4 LAD status	0 to 5	–	04F3h	0 to 5	1	
	Retry monitor 4 INV control mode	0 to 11	–	04F4h	0 to 11	1	
	Retry monitor 4 Limit status	0 to 6	–	04F5h	0 to 6	1	
	Retry monitor 4 Special status	0 to 5	–	04F6h	0 to 5	1	
	Retry monitor 4 RUN time	0 to 1000000 (hr)	–	04F8h 04F9h	0 to 1000000	1	
	Retry monitor 4 Power-on time	0 to 1000000 (hr)	–	04FAh 04FBh	0 to 1000000	1	
	Retry monitor 4 Time Year/Month	YY/MM	–	04FCh	YYMM	1	
	Retry monitor 4 Time Day/Day of week	DD/WW	–	04FDh	DDWW	1	
	Retry monitor 4 Time Hour/Minute	HH/mm	–	04FEh	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-35	Retry monitor 5 Factor	r001 to r009	–	0501h	0 to 9	1	10-5-2
	Retry monitor 5 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0502h 0503h	-59000 to 59000	0.01	
	Retry monitor 5 Output current	0.00 to 655.35 (A)	–	0504h	0 to 65535	0.01	
	Retry monitor 5 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0505h	0 to 10000	0.1	
	Retry monitor 5 Inverter status	0 to 8	–	0506h	0 to 8	1	
	Retry monitor 5 LAD status	0 to 5	–	0507h	0 to 5	1	
	Retry monitor 5 INV control mode	0 to 11	–	0508h	0 to 11	1	
	Retry monitor 5 Limit status	0 to 6	–	0509h	0 to 6	1	
	Retry monitor 5 Special status	0 to 5	–	050Ah	0 to 5	1	
	Retry monitor 5 RUN time	0 to 1000000 (hr)	–	050Ch 050Dh	0 to 1000000	1	
	Retry monitor 5 Power-on time	0 to 1000000 (hr)	–	050Eh 050Fh	0 to 1000000	1	
	Retry monitor 5 Time Year/Month	YY/MM	–	0510h	YYMM	1	
	Retry monitor 5 Time Day/Day of week	DD/WW	–	0511h	DDWW	1	
	Retry monitor 5 Time Hour/Minute	HH/mm	–	0512h	HHmm	1	
dE-36	Retry monitor 6 Factor	r001 to r009	–	0515h	0 to 9	1	10-5-2
	Retry monitor 6 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0516h 0517h	-59000 to 59000	0.01	
	Retry monitor 6 Output current	0.00 to 655.35 (A)	–	0518h	0 to 65535	0.01	
	Retry monitor 6 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0519h	0 to 10000	0.1	
	Retry monitor 6 Inverter status	0 to 8	–	051Ah	0 to 8	1	
	Retry monitor 6 LAD status	0 to 5	–	051Bh	0 to 5	1	
	Retry monitor 6 INV control mode	0 to 11	–	051Ch	0 to 11	1	
	Retry monitor 6 Limit status	0 to 6	–	051Dh	0 to 6	1	
	Retry monitor 6 Special status	0 to 5	–	051Eh	0 to 5	1	
	Retry monitor 6 RUN time	0 to 1000000 (hr)	–	0520h 0521h	0 to 1000000	1	
	Retry monitor 6 Power-on time	0 to 1000000 (hr)	–	0522h 0523h	0 to 1000000	1	
	Retry monitor 6 Time Year/Month	YY/MM	–	0524h	YYMM	1	
	Retry monitor 6 Time Day/Day of week	DD/WW	–	0525h	DDWW	1	
	Retry monitor 6 Time Hour/Minute	HH/mm	–	0526h	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-37	Retry monitor 7 Factor	r001 to r009	–	0529h	0 to 9	1	10-5-2
	Retry monitor 7 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	052Ah 052Bh	-59000 to 59000	0.01	
	Retry monitor 7 Output current	0.00 to 655.35 (A)	–	052Ch	0 to 65535	0.01	
	Retry monitor 7 P-N DC voltage	0.0 to 1000.0 (VDC)	–	052Dh	0 to 10000	0.1	
	Retry monitor 7 Inverter status	0 to 8	–	052Eh	0 to 8	1	
	Retry monitor 7 LAD status	0 to 5	–	052Fh	0 to 5	1	
	Retry monitor 7 INV control mode	0 to 11	–	0530h	0 to 11	1	
	Retry monitor 7 Limit status	0 to 6	–	0531h	0 to 6	1	
	Retry monitor 7 Special status	0 to 5	–	0532h	0 to 5	1	
	Retry monitor 7 RUN time	0 to 1000000 (hr)	–	0534h 0535h	0 to 1000000	1	
	Retry monitor 7 Power-on time	0 to 1000000 (hr)	–	0536h 0537h	0 to 1000000	1	
	Retry monitor 7 Time Year/Month	YY/MM	–	0538h	YYMM	1	
	Retry monitor 7 Time Day/Day of week	DD/WW	–	0539h	DDWW	1	
	Retry monitor 7 Time Hour/Minute	HH/mm	–	053Ah	HHmm	1	
dE-38	Retry monitor 8 Factor	r001 to r009	–	053Dh	0 to 9	1	10-5-2
	Retry monitor 8 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	053Eh 053Fh	-59000 to 59000	0.01	
	Retry monitor 8 Output current	0.00 to 655.35 (A)	–	0540h	0 to 65535	0.01	
	Retry monitor 8 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0541h	0 to 10000	0.1	
	Retry monitor 8 Inverter status	0 to 8	–	0542h	0 to 8	1	
	Retry monitor 8 LAD status	0 to 5	–	0543h	0 to 5	1	
	Retry monitor 8 INV control mode	0 to 11	–	0544h	0 to 11	1	
	Retry monitor 8 Limit status	0 to 6	–	0545h	0 to 6	1	
	Retry monitor 8 Special status	0 to 5	–	0546h	0 to 5	1	
	Retry monitor 8 RUN time	0 to 1000000 (hr)	–	0548h 0549h	0 to 1000000	1	
	Retry monitor 8 Power-on time	0 to 1000000 (hr)	–	054Ah 054Bh	0 to 1000000	1	
	Retry monitor 8 Time Year/Month	YY/MM	–	054Ch	YYMM	1	
	Retry monitor 8 Time Day/Day of week	DD/WW	–	054Dh	DDWW	1	
	Retry monitor 8 Time Hour/Minute	HH/mm	–	054Eh	HHmm	1	

Code	Name	Data range	Changing during running	Modbus communication			Page
				Register No.	Data range	Resolution	
dE-39	Retry monitor 9 Factor	r001 to r009	–	0551h	0 to 9	1	10-5-2
	Retry monitor 9 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0552h 0553h	-59000 to 59000	0.01	
	Retry monitor 9 Output current	0.00 to 655.35 (A)	–	0554h	0 to 65535	0.01	
	Retry monitor 9 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0555h	0 to 10000	0.1	
	Retry monitor 9 Inverter status	0 to 8	–	0556h	0 to 8	1	
	Retry monitor 9 LAD status	0 to 5	–	0557h	0 to 5	1	
	Retry monitor 9 INV control mode	0 to 11	–	0558h	0 to 11	1	
	Retry monitor 9 Limit status	0 to 6	–	0559h	0 to 6	1	
	Retry monitor 9 Special status	0 to 5	–	055Ah	0 to 5	1	
	Retry monitor 9 RUN time	0 to 1000000 (hr)	–	055Ch 055Dh	0 to 1000000	1	
	Retry monitor 9 Power-on time	0 to 1000000 (hr)	–	055Eh 055Fh	0 to 1000000	1	
	Retry monitor 9 Time Year/Month	YY/MM	–	0560h	YYMM	1	
	Retry monitor 9 Time Day/Day of week	DD/WW	–	0561h	DDWW	1	
	Retry monitor 9 Time Hour/Minute	HH/mm	–	0562h	HHmm	1	
dE-40	Retry monitor 10 Factor	r001 to r009	–	0565h	0 to 9	1	10-5-2
	Retry monitor 10 Output frequency (signed)	-590.00 to 590.00 (Hz)	–	0566h 0567h	-59000 to 59000	0.01	
	Retry monitor 10 Output current	0.00 to 655.35 (A)	–	0568h	0 to 65535	0.01	
	Retry monitor 10 P-N DC voltage	0.0 to 1000.0 (VDC)	–	0569h	0 to 10000	0.1	
	Retry monitor 10 Inverter status	0 to 8	–	056Ah	0 to 8	1	
	Retry monitor 10 LAD status	0 to 5	–	056Bh	0 to 5	1	
	Retry monitor 10 INV control mode	0 to 11	–	056Ch	0 to 11	1	
	Retry monitor 10 Limit status	0 to 6	–	056Dh	0 to 6	1	
	Retry monitor 10 Special status	0 to 5	–	056Eh	0 to 5	1	
	Retry monitor 10 RUN time	0 to 1000000 (hr)	–	0570h 0571h	0 to 1000000	1	
	Retry monitor 10 Power-on time	0 to 1000000 (hr)	–	0572h 0573h	0 to 1000000	1	
	Retry monitor 10 Time Year/Month	YY/MM	–	0574h	YYMM	1	
	Retry monitor 10 Time Day/Day of week	DD/WW	–	0575h	DDWW	1	
	Retry monitor 10 Time Hour/Minute	HH/mm	–	0576h	HHmm	1	
dE-50	Warning monitor	Warning code (Refer to "15.3.1 Warning display")	–	05DCh	Waning code	–	10-5-3

18.2.2 F Parameter Group

Code	Name	Data range	Initial value	Change during running	Modbus 通信 register No.	Modbus 通信 Data range	Modbus 通信 Resolution	参照
FA-01	Main speed reference setting (monitor)	0.00 to 590.00 (Hz)	0.00	○	2AF9h	0 to 59000	0.01	9-2-1 9-2-3 9-2-4 9-2-5
FA-02	Sub speed reference setting (monitor)	0.00 to 590.00 (Hz)	0.00	○	2AFAh 2AFBh	0 to 59000	0.01	9-2-1 9-2-3
FA-10	Acceleration time setting (monitor)	0.00 to 3600.00 (s)	10.00	○	2B02h 2B03h	0 to 360000	0.01	9-3-2
FA-12	Deceleration time setting (monitor)	0.00 to 3600.00 (s)	10.00	○	2B04h 2B05h	0 to 360000	0.01	9-3-2
FA-15	Torque reference setting (monitor)	-500.0 to 500.0 (%)	0.0	○	2B07h	-5000 to 5000	0.1	9-6-3
FA-16	Torque bias setting (monitor)	-500.0 to 500.0 (%)	0.0	○	2B08h	-5000 to 5000	0.1	9-6-11
FA-20	Position reference setting (monitor)	Absolute position control mode: -268435455 to 268435455 (pls) High resolution absolute position control mode: -1073741823 to 1073741823 (pls)	0	○	2B0Ch 2B0Dh	Absolute: -268435455 to 268435455 High resolution: -1073741823 to 1073741823	1	9-14-1
FA-30	PID1 set-point 1 setting (monitor)	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	2B16h 2B17h	-10000 to 10000	Depends on AH-06	9-8-9
FA-32	PID1 set-point 2 setting (monitor)	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	2B18h 2B19h	-10000 to 10000	Depends on AH-06	9-8-9
FA-34	PID1 set-point 3 setting (monitor)	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	2B1Ah 2B1Bh	-10000 to 10000	Depends on AH-06	9-8-9
FA-36	PID2 set-point setting (monitor)	-100.00 to 100.00 (%) Data range depends on PID2 scale adjustment (AJ-04, 05, 06)	0.00	○	2B1Ch 2B1Dh	-10000 to 10000	Depends on AJ-06	9-8-24

18.2.3 A Parameter Group

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AA101	Main speed input source selection, 1st-motor	01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 14: Program function 15: PID function 16: VR (MOP-VR)	07/ 01/ 01*1	×	2EE1h	1 to 16	1	9-2-1
AA102	Sub speed input source selection, 1st-motor	00: Disable 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 14: Program function 15: PID function 16: VR (MOP-VR)	00	×	2EE2h	0 to 16	1	9-2-13
AA104	Sub speed setting, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	2EE4h	0 to 59000	0.01	9-2-13
AA105	Speed reference calculation symbol selection, 1st-motor	00: Disable 01: Addiction [ADD] 02: Subtraction [SUB] 03: Multiplication [MUL]	00	○	2EE5h	0 to 3	1	9-2-13
AA106	Add frequency setting, 1st-motor	-590.00 to 590.00 (Hz)	0.00	○	2EE6h 2EE7h	-59000 to 59000	0.01	9-2-15
AA111	RUN command input source selection, 1st-motor	00: [FW]/[RV] terminal 01: 3-wire 02: Keypad's RUN-key 03: RS485 04: Option	02/ 00/ 00*1	×	2EEBh	0 to 4	1	9-1-1
AA-12	RUN-key command rotation direction	00: Forward 01: Reverse	00	○	2EECh	0 to 1	1	9-1-2
AA-13	STOP-key enable	00: Disable 01: Enable 02: Enable at only trip reset	01	○	2EEDh	0 to 2	1	9-1-7
AA114	RUN direction restriction selection, 1st-motor	00: No restriction 01: Only Forward 02: Only Reverse	00	×	2EEEh	0 to 2	1	9-4-2
AA115	STOP mode selection, 1st-motor	00: Deceleration stop 01: Free-run stop	00	○	2EEFh	0 to 1	1	9-7-10
AA121	Control mode selection, 1st-motor	00: V/f control (Constant torque) (IM) 01: V/f control (Reduce torque) (IM) 02: V/f control (Free-V/f) (IM) 03: V/f control (Automatic torque boost) (IM) 08: Sensorless vector control (IM) 11: Sensorless vector control (SM/PMM)	00	×	2EF5h	0 to 11	1	9-5-1
AA123	Vector control mode selection, 1st-motor	00: Speed/Torque control mode 02: Absolute position control mode 03: High resolution absolute position control mode	00	×	2EF7h	0 to 3	1	9-5-16 9-14-1

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AA124	Speed compensation with encoder selection, 1st-motor	00: Disable 01: Enable	00	×	2EF8h	0 to 1	1	9-5-10 9-5-16
AA201	Main speed input source selection, 2nd-motor	01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 14: Program function 15: PID function 16: VR (MOP-VR)	07/ 01/ 01*1	×	55F1h	1 to 16	1	9-2-1 9-7-28
AA202	Sub speed input source selection, 2nd-motor	00: Disable 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 14: Program function 15: PID function 16: VR (MOP-VR)	00	×	55F2h	0 to 16	1	9-2-13 9-7-28
AA204	Sub speed setting, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	55F4h	0 to 59000	0.01	9-2-13 9-7-28
AA205	Speed reference calculation selection, 2nd-motor	00: Disable 01: Addiction [ADD] 02: Subtraction [SUB] 03: Multiplication [MUL]	00	○	55F5h	0 to 3	1	9-2-13 9-7-28
AA206	Add frequency setting, 2nd-motor	-590.00 to 590.00 (Hz)	0.00	○	55F6h 55F7h	-59000 to 59000	0.01	9-2-15 9-7-28
AA211	RUN command input source selection, 2nd-motor	00: [FW]/[RV] terminal 01: 3-wire 02: Keypad's RUN-key 03: RS485 04: Option	02/ 00/ 00*1	×	55FBh	0 to 4	1	9-1-1 9-7-28
AA214	RUN direction restriction selection, 2nd-motor	00: No restriction 01: Only Forward 02: Only Reverse	00	×	55FEh	0 to 2	1	9-4-2 9-7-28
AA215	STOP mode selection, 2nd-motor	00: Deceleration stop 01: Free-run stop	00	○	55FFh	0 to 1	1	9-7-10 9-7-28
AA221	Control mode selection, 2nd-motor	00: V/f control (Constant torque) (IM) 01: V/f control (Reduce torque) (IM) 02: V/f control (Free-V/f) (IM) 03: V/f control (Automatic torque boost) (IM) 08: Sensorless vector control (IM) 11: Sensorless vector control (SM/PMM)	00	×	5605h	0 to 11	1	9-5-1 9-7-28
AA223	Vector control mode selection, 2nd-motor	00: Speed/Torque control mode 02: Absolute position control mode 03: High resolution absolute position control mode	00	×	5607h	0 to 3	1	9-5-16 9-7-28 9-14-1
AA224	Speed compensation with encoder selection, 2nd-motor	00: Disable 01: Enable	00	×	5608h	0 to 1	1	9-5-10 9-5-16 9-7-28

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
Ab-01	Frequency conversion gain	0.01 to 100.00	1.00	○	2F45h	1 to 10000	0.01	10-1-1
Ab-03	Multi-speed operation selection	00: Binary (16-speeds) 01: Bit (8-speeds)	00	×	2F47h	0 to 1	1	9-2-5 9-3-8
Ab110	Multi-speed 0 setting, 1st-motor	0.00 to Maximum frequency, 1st-motor (Hz)	0.00/ 6.00/ 0.00*1	○	2F4Eh	0 to 59000	0.01	9-2-5
Ab-11	Multi-speed 1 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F4Fh	0 to 59000	0.01	9-2-5
Ab-12	Multi-speed 2 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F50h	0 to 59000	0.01	9-2-5
Ab-13	Multi-speed 3 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F51h	0 to 59000	0.01	9-2-5
Ab-14	Multi-speed 4 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F52h	0 to 59000	0.01	9-2-5
Ab-15	Multi-speed 5 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F53h	0 to 59000	0.01	9-2-5
Ab-16	Multi-speed 6 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F54h	0 to 59000	0.01	9-2-5
Ab-17	Multi-speed 7 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F55h	0 to 59000	0.01	9-2-5
Ab-18	Multi-speed 8 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F56h	0 to 59000	0.01	9-2-5
Ab-19	Multi-speed 9 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F57h	0 to 59000	0.01	9-2-5
Ab-20	Multi-speed 10 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F58h	0 to 59000	0.01	9-2-5
Ab-21	Multi-speed 11 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F59h	0 to 59000	0.01	9-2-5
Ab-22	Multi-speed 12 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F5Ah	0 to 59000	0.01	9-2-5
Ab-23	Multi-speed 13 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F5Bh	0 to 59000	0.01	9-2-5
Ab-24	Multi-speed 14 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F5Ch	0 to 59000	0.01	9-2-5
Ab-25	Multi-speed 15 setting	0.00 to Maximum frequency (Hz)	0.00	○	2F5Dh	0 to 59000	0.01	9-2-5
Ab210	Multi-speed 0 setting, 2nd-motor	0.00 to Maximum frequency, 2nd-motor (Hz)	0.00/ 6.00/ 0.00*1	○	565Eh	0 to 59000	0.01	9-2-5 9-7-28
AC Parameter								
AC-01	Acceleration/ Deceleration time input source selection	00: Parameter setting 01: Option 04: Program function	00	×	2FA9h	0 to 4	1	9-3-1
AC-02	Acceleration/ Deceleration selection	00: Common setting 01: Multi stage accel./decel.	00	×	2FAAh	0 to 1	1	9-3-8
AC-03	Acceleration curve selection	00: Linear acceleration 01: S-curve acceleration 02: U-curve acceleration 03: Reverse U-curve acceleration 04: Elevator S-curve acceleration	01	×	2FABh	0 to 4	1	9-3-5
AC-04	Deceleration curve selection	00: Linear deceleration 01: S-curve deceleration 02: U-curve deceleration 03: Reverse U-curve deceleration 04: Elevator S-curve deceleration	01	×	2FACh	0 to 4	1	9-3-5
AC-05	Acceleration curve constant setting	1 to 10	2	○	2FADh	1 to 10	1	9-3-5
AC-06	Deceleration curve constant setting	1 to 10	2	○	2FAEh	1 to 10	1	9-3-5
AC-08	EL-S-curve ratio at start of acceleration	0 to (100 - [AC-09]) (%)	10	×	2FB0h	0 to 100	1	9-3-5
AC-09	EL-S-curve ratio at end of acceleration	0 to (100 - [AC-08]) (%)	10	×	2FB1h	0 to 100	1	9-3-5
AC-10	EL-S-curve ratio at start of deceleration	0 to (100 - [AC-11]) (%)	10	×	2FB2h	0 to 100	1	9-3-5
AC-11	EL-S-curve ratio at end of deceleration	0 to (100 - [AC-10]) (%)	10	×	2FB3h	0 to 100	1	9-3-5
AC115	Accel/Decel change trigger, 1st-motor	00: Switching by [2CH] terminal 01: Switching by setting 02: Switching only when rotation is reversed	00	×	2FB7h	0 to 2	1	9-3-3

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AC116	Accel 1 to Accel 2 frequency transition point, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	2FB8h	0 to 59000	0.01	9-3-3
AC117	Decel 1 to Decel 2 frequency transition point, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	2FB9h	0 to 59000	0.01	9-3-3
AC120	Acceleration time 1, 1st-motor	0.00 to 3600.00 (s)	10.00	○	2FBCh 2FBDh	0 to 360000	0.01	9-3-2
AC122	Deceleration time 1, 1st-motor	0.00 to 3600.00 (s)	10.00	○	2FBEh 2FBFh	0 to 360000	0.01	9-3-2
AC124	Acceleration time 2, 1st-motor	0.00 to 3600.00 (s)	10.00	○	2FC0h 2FC1h	0 to 360000	0.01	9-3-3
AC126	Deceleration time 2, 1st-motor	0.00 to 3600.00 (s)	10.00	○	2FC2h 2FC3h	0 to 360000	0.01	9-3-3
AC-30	Acceleration time for Multi-speed 1	0.00 to 3600.00 (s)	0.00	○	2FC6h 2FC7h	0 to 360000	0.01	9-3-8
AC-32	Deceleration time for Multi-speed 1	0.00 to 3600.00 (s)	0.00	○	2FC8h 2FC9h	0 to 360000	0.01	9-3-8
AC-34	Acceleration time for Multi-speed 2	0.00 to 3600.00 (s)	0.00	○	2FCAh 2FCBh	0 to 360000	0.01	9-3-8
AC-36	Deceleration time for Multi-speed 2	0.00 to 3600.00 (s)	0.00	○	2FCCh 2FCDh	0 to 360000	0.01	9-3-8
AC-38	Acceleration time for Multi-speed 3	0.00 to 3600.00 (s)	0.00	○	2FCEh 2FCFh	0 to 360000	0.01	9-3-8
AC-40	Deceleration time for Multi-speed 3	0.00 to 3600.00 (s)	0.00	○	2FD0h 2FD1h	0 to 360000	0.01	9-3-8
AC-42	Acceleration time for Multi-speed 4	0.00 to 3600.00 (s)	0.00	○	2FD2h 2FD3h	0 to 360000	0.01	9-3-8
AC-44	Deceleration time for Multi-speed 4	0.00 to 3600.00 (s)	0.00	○	2FD4h 2FD5h	0 to 360000	0.01	9-3-8
AC-46	Acceleration time for Multi-speed 5	0.00 to 3600.00 (s)	0.00	○	2FD6h 2FD7h	0 to 360000	0.01	9-3-8
AC-48	Deceleration time for Multi-speed 5	0.00 to 3600.00 (s)	0.00	○	2FD8h 2FD9h	0 to 360000	0.01	9-3-8
AC-50	Acceleration time for Multi-speed 6	0.00 to 3600.00 (s)	0.00	○	2FDAh 2FDBh	0 to 360000	0.01	9-3-8
AC-52	Deceleration time for Multi-speed 6	0.00 to 3600.00 (s)	0.00	○	2FDCh 2FDDh	0 to 360000	0.01	9-3-8
AC-54	Acceleration time for Multi-speed 7	0.00 to 3600.00 (s)	0.00	○	2FDEh 2FDFh	0 to 360000	0.01	9-3-8
AC-56	Deceleration time for Multi-speed 7	0.00 to 3600.00 (s)	0.00	○	2FE0h 2FE1h	0 to 360000	0.01	9-3-8
AC-58	Acceleration time for Multi-speed 8	0.00 to 3600.00 (s)	0.00	○	2FE2h 2FE3h	0 to 360000	0.01	9-3-8
AC-60	Deceleration time for Multi-speed 8	0.00 to 3600.00 (s)	0.00	○	2FE4h 2FE5h	0 to 360000	0.01	9-3-8
AC-62	Acceleration time for Multi-speed 9	0.00 to 3600.00 (s)	0.00	○	2FE6h 2FE7h	0 to 360000	0.01	9-3-8
AC-64	Deceleration time for Multi-speed 9	0.00 to 3600.00 (s)	0.00	○	2FE8h 2FE9h	0 to 360000	0.01	9-3-8
AC-66	Acceleration time for Multi-speed 10	0.00 to 3600.00 (s)	0.00	○	2FEAh 2FEBh	0 to 360000	0.01	9-3-8
AC-68	Deceleration time for Multi-speed 10	0.00 to 3600.00 (s)	0.00	○	2FECh 2FEDh	0 to 360000	0.01	9-3-8
AC-70	Acceleration time for Multi-speed 11	0.00 to 3600.00 (s)	0.00	○	2FEEh 2FEFh	0 to 360000	0.01	9-3-8
AC-72	Deceleration time for Multi-speed 11	0.00 to 3600.00 (s)	0.00	○	2FF0h 2FF1h	0 to 360000	0.01	9-3-8
AC-74	Acceleration time for Multi-speed 12	0.00 to 3600.00 (s)	0.00	○	2FF2h 2FF3h	0 to 360000	0.01	9-3-8
AC-76	Deceleration time for Multi-speed 12	0.00 to 3600.00 (s)	0.00	○	2FF4h 2FF5h	0 to 360000	0.01	9-3-8

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AC-78	Acceleration time for Multi-speed 13	0.00 to 3600.00 (s)	0.00	○	2FF6h 2FF7h	0 to 360000	0.01	9-3-8
AC-80	Deceleration time for Multi-speed 13	0.00 to 3600.00 (s)	0.00	○	2FF8h 2FF9h	0 to 360000	0.01	9-3-8
AC-82	Acceleration time for Multi-speed 14	0.00 to 3600.00 (s)	0.00	○	2FFAh 2FFBh	0 to 360000	0.01	9-3-8
AC-84	Deceleration time for Multi-speed 14	0.00 to 3600.00 (s)	0.00	○	2FFCh 2FFDh	0 to 360000	0.01	9-3-8
AC-86	Acceleration time for Multi-speed 15	0.00 to 3600.00 (s)	0.00	○	2FFEh 2FFFh	0 to 360000	0.01	9-3-8
AC-88	Deceleration time for Multi-speed 15	0.00 to 3600.00 (s)	0.00	○	3000h 3001h	0 to 360000	0.01	9-3-8
AC215	Accel/Decel change trigger, 2nd-motor	00: Switching by [2CH] terminal 01: Switching by setting 02: Switching only when rotation is reversed	00	×	56C7h	0 to 2	1	9-3-3 9-7-28
AC216	Accel1 to Accel2 frequency transition point, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	56C8h	0 to 59000	0.01	9-3-3 9-7-28
AC217	Decel1 to Decel2 frequency transition point, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	56C9h	0 to 59000	0.01	9-3-3 9-7-28
AC220	Acceleration time 1, 2nd-motor	0.00 to 3600.00 (s)	10.00	○	56CCh 56CDh	0 to 360000	0.01	9-3-2 9-7-28
AC222	Deceleration time 1, 2nd-motor	0.00 to 3600.00 (s)	10.00	○	56CEh 56CFh	0 to 360000	0.01	9-3-2 9-7-28
AC224	Acceleration time 2, 2nd-motor	0.00 to 3600.00 (s)	10.00	○	56D0h 56D1h	0 to 360000	0.01	9-3-3 9-7-28
AC226	Deceleration time 2, 2nd-motor	0.00 to 3600.00 (s)	10.00	○	56D2h 56D3h	0 to 360000	0.01	9-3-3 9-7-28
Ad Parameter								
Ad-01	Torque reference input source selection	01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 15: PID function	01	×	300Dh	1 to 15	1	9-6-3
Ad-02	Torque reference value setting	-500.0 to 500.0 (%)	0.0	○	300Eh	-5000 to 5000	0.1	9-6-3
Ad-03	Torque reference polarity selection	00: According to sign 01: Depending on the operation direction	01	×	300Fh	0 to 1	1	9-6-3
Ad-04	Switching time of speed control to torque control	0 to 1000 (ms)	100	×	3010h	0 to 1000	1	9-6-2
Ad-11	Torque bias input source selection	00: Disable 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 15: PID function	00	×	3017h	0 to 15	1	9-6-11
Ad-12	Torque bias value setting	-500.0 to 500.0 (%)	0.0	○	3018h	-5000 to 5000	0.1	9-6-11
Ad-13	Torque bias polarity selection	00: According to sign 01: Depending on the operation direction	00	×	3019h	0 to 1	1	9-6-11
Ad-14	Enable terminal [TBS]	00: Disable 01: Enable	00	×	301Ah	0 to 1	1	9-6-11

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
Ad-40	Speed limit input source selection at torque control	01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input	07	×	3034h	1 to 12	1	9-6-3
Ad-41	Speed limit at torque control (at Forward rotation)	0.00 to Maximum frequency (Hz)	0.00	○	3035h	0 to 59000	0.01	9-6-3
Ad-42	Speed limit at torque control (at Reverse rotation)	0.00 to Maximum frequency (Hz)	0.00	○	3036h	0 to 59000	0.01	9-6-3
AE Parameter								
AE-04	Positioning completed range setting	0 to 10000 (pls)	50	○	3074h	0 to 10000	1	9-14-1
AE-05	Positioning completed delay time setting	0.00 to 10.00 (s)	0.00	○	3075h	0 to 1000	0.01	9-14-1
AE-10	Stop position selection of home search function	00: Parameter setting 01: Option	00	×	307Ah	0 to 1	1	9-14-15
AE-11	Stop position of home search function	0 to 4095	0	○	307Bh	0 to 4095	1	9-14-15
AE-12	Speed reference of home search function	0.00 to 120.00 (Hz)	5.00	○	307Ch	0 to 12000	0.01	9-14-15
AE-13	Direction of home search function	00: Forward 01: Reverse	00	×	307Dh	0 to 1	1	9-14-15
AE-14	DC braking control selection for simple positioning	00: Disable DB on simple positioning 01: Enable DB on simple positioning	00	×	307Eh	0 to 1	1	9-14-18
AE-15	Creep speed setting	[Hb*30] to 10.00 (Hz)	5.00	○	307Fh	[Hb*30] to 1000	0.01	9-5-20 9-14-1
AE-16	Position displacement at creep speed	0 to 16384 (pls)	2560	×	3080h	0 to 16384	1	9-14-1
AE-17	Positioning restart range	0 to 10000 (pls)	0	○	3081h	0 to 10000	1	9-14-9
AE-20	Position reference 0	Absolute position control mode: -268435455 to 268435455 (pls) High resolution absolute position control mode: -1073741823 to 1073741823 (pls) (Data range is limited [AE-54] to [AE-52] by parameter setting)	0	○	3084h 3085h	Absolute: -268435455 to 268435455 High resolution: -1073741823 to 1073741823 ([AE-54] to [AE-52])	1	9-14-6
AE-22	Position reference 1		0	○	3086h 3087h		1	9-14-6
AE-24	Position reference 2		0	○	3088h 3089h		1	9-14-6
AE-26	Position reference 3		0	○	308Ah 308Bh		1	9-14-6
AE-28	Position reference 4		0	○	308Ch 308Dh		1	9-14-6
AE-30	Position reference 5		0	○	308Eh 308Fh		1	9-14-6
AE-32	Position reference 6		0	○	3090h 3091h		1	9-14-6
AE-34	Position reference 7		0	○	3092h 3093h		1	9-14-6
AE-36	Position reference 8		0	○	3094h 3095h		1	9-14-6
AE-38	Position reference 9		0	○	3096h 3097h		1	9-14-6
AE-40	Position reference 10		0	○	3098h 3099h		1	9-14-6
AE-42	Position reference 11		0	○	309Ah 309Bh		1	9-14-6

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
AE-44	Position reference 12	Absolute position control mode: -268435455 to 268435455 (pls) High resolution absolute position control mode: -1073741823 to 1073741823 (pls) (Data range is limited [AE-54] to [AE-52] by parameter setting)	0	○	309Ch 309Dh	Absolute: -268435455 to 268435455 High resolution: -1073741823 to 1073741823 ([AE-54] to [AE-52])	1	9-14-6
AE-46	Position reference 13		0	○	309Eh 309Fh		1	9-14-6
AE-48	Position reference 14		0	○	30A0h 30A1h		1	9-14-6
AE-50	Position reference 15		0	○	30A2h 30A3h		1	9-14-6
AE-52	Position control range setting (forward)	Absolute position control mode: 0 to 268435455 (pls) High resolution absolute position control mode: 0 to 1073741823 (pls)	268435455	○	30A4h 30A5h	Absolute: 0 to 268435455 High resolution: 0 to 1073741823	1	9-14-1 9-14-6 9-14-13
AE-54	Position control range setting (reverse)	Absolute position control mode: -268435455 to 0 (pls) High resolution absolute position control mode: -1073741823 to 0 (pls)	-268435455	○	30A6h 30A7h	Absolute: -268435455 to 0 High resolution: -1073741823 to 0	1	9-14-1 9-14-6 9-14-13
AE-56	Position control mode selection	00: Limited 01: Not limited	00	×	30A8h	0 to 1	1	9-14-8
AE-60	Teach-in function target selection	00: X00 / 01: X01 02: X02 / 03: X03 04: X04 / 05: X05 06: X06 / 07: X07 08: X08 / 09: X09 10: X10 / 11: X11 12: X12 / 13: X13 14: X14 / 15: X15	00	○	30ACh	0 to 15	1	9-14-7
AE-61	Save current position at power off	00: Disable 01: Enable	00	○	30ADh	0 to 1	1	9-14-14
AE-62	Pre-set position data	Absolute position control mode: -268435455 to 268435455 (pls) High resolution absolute position control mode: -1073741823 to 1073741823 (pls) (Data range is limited [AE-54] to [AE-52] by parameter setting)	0	○	30AEh 30AFh	Absolute: -268435455 to 268435455 High resolution: -1073741823 to 1073741823 ([AE-54] to [AE-52])	1	9-14-13
AE-64	Deceleration stop distance calculation gain	50.00 to 200.00 (%)	100.00	○	30B0h	5000 to 20000	0.01	9-14-1
AE-65	Deceleration stop distance calculation bias	0.00 to 655.35 (%)	0.00	○	30B1h	0 to 65535	0.01	9-14-1
AE-70	Homing function selection	00: Low speed homing 01: High speed homing 1 02: High speed homing 2	00	○	30B6h	0 to 2	1	9-14-10
AE-71	Direction of homing function	00: Forward 01: Reverse	01	○	30B7h	0 to 1	1	9-14-10
AE-72	Low-speed homing speed setting	0.00 to 10.00 (Hz)	5.00	○	30B8h	0 to 1000	0.01	9-14-10
AE-73	High-speed homing speed setting	0.00 to Maximum frequency (Hz)	5.00	○	30B9h	0 to 59000	0.01	9-14-10
AE-74	ORG action selection	00: Without RUN command 01: With RUN command	01	○	30BAh	0 to 1	1	9-14-10

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AF101	DC braking selection, 1st-motor	00: Disable 01: Enable 02: Enable (by frequency reference)	00	○	30D5h	0 to 2	1	9-7-2 9-7-11
AF103	DC braking frequency, 1st-motor	0.00 to 590.00 (Hz)	0.50	○	30D7h	0 to 59000	0.01	9-7-11
AF104	DC braking delay time, 1st-motor	0.00 to 5.00 (s)	0.00	○	30D8h	0 to 500	0.01	9-7-11
AF105	DC braking force setting, 1st-motor	0 to 100 (%)	50	○	30D9h	0 to 100	1	9-7-11
AF106	DC braking active time at stop, 1st-motor	0.00 to 60.00 (s)	0.50	○	30DAh	0 to 6000	0.01	9-7-11
AF107	DC braking operation method selection, 1st-motor	00: Edge 01: Level	01	○	30DBh	0 to 1	1	9-7-11
AF108	DC braking force at start, 1st-motor	0 to 100 (%)	0	○	30DCh	0 to 100	1	9-7-2
AF109	DC braking active time at start, 1st-motor	0.00 to 60.00 (s)	0.00	○	30DDh	0 to 6000	0.01	9-7-2
AF120	Contactor control enable, 1st-motor	00: Disable 01: Enable (Primary side) 02: Enable (Secondary side)	00	×	30E8h	0 to 2	1	9-7-19
AF121	Run delay time, 1st-motor	0.00 to 2.00 (s)	0.20	○	30E9h	0 to 200	0.01	9-7-19
AF122	Contactor off delay time, 1st-motor	0.00 to 2.00 (s)	0.10	○	30EAh	0 to 200	0.01	9-7-19
AF123	Contactor response check time, 1st-motor	0.00 to 5.00 (s)	0.10	○	30EBh	0 to 500	0.01	9-7-19
AF130	Brake control enable, 1st-motor	00: Disable 01: Brake control enable (Common) 02: Brake control enable (Separate for FWD/REV)	00	○	30F2h	0 to 2	1	9-7-16
AF131	Brake release wait time (Forward), 1st-motor	0.00 to 5.00 (s)	0.00	○	30F3h	0 to 500	0.01	9-7-16
AF132	Brake wait time for accel. (Forward), 1st-motor	0.00 to 5.00 (s)	0.00	○	30F4h	0 to 500	0.01	9-7-16
AF133	Brake wait time for stopping (Forward), 1st-motor	0.00 to 5.00 (s)	0.00	○	30F5h	0 to 500	0.01	9-7-16
AF134	Brake confirmation signal wait time (Forward), 1st-motor	0.00 to 5.00 (s)	0.00	○	30F6h	0 to 500	0.01	9-7-16
AF135	Brake release frequency setting (Forward), 1st-motor	0.00 to 590.00 (Hz)	0.00	○	30F7h	0 to 59000	0.01	9-7-16
AF136	Brake release current setting (Forward), 1st-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	30F8h	(0.00 to 2.00) ×CTL rated current	0.1	9-7-16
						0 to 20000*2	0.01	
AF137	Braking frequency (Forward), 1st-motor	0.00 to 590.00 (Hz)	0.00	○	30F9h	0 to 59000	0.01	9-7-16
AF138	Brake release wait time (Reverse), 1st-motor	0.00 to 5.00 (s)	0.00	○	30FAh	0 to 500	0.01	9-7-16
AF139	Brake wait time for accel. (Reverse), 1st-motor	0.00 to 5.00 (s)	0.00	○	30FBh	0 to 500	0.01	9-7-16

*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AF140	Brake wait time for stopping (Reverse), 1st-motor	0.00 to 5.00 (s)	0.00	○	30FCh	0 to 500	0.01	9-7-16
AF141	Brake confirmation signal wait time (Reverse), 1st-motor	0.00 to 5.00 (s)	0.00	○	30FDh	0 to 500	0.01	9-7-16
AF142	Brake release frequency setting (Reverse), 1st-motor	0.00 to 590.00 (Hz)	0.00	○	30FEh	0 to 59000	0.01	9-7-16
AF143	Brake release current setting (Reverse), 1st-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	30FFh	(0.00 to 2.00) ×CTL rated current	0.1	9-7-16
						0 to 20000*2	0.01	
AF144	Braking frequency (Reverse), 1st-motor	0.00 to 590.00 (Hz)	0.00	○	3100h	0 to 59000	0.01	9-7-16
AF201	DC braking selection, 2nd-motor	00: Disable 01: Enable 02: Enable (by frequency reference)	00	○	57E5h	0 to 2	1	9-7-2 9-7-11 9-7-28
AF203	DC braking frequency, 2nd-motor	0.00 to 590.00 (Hz)	0.50	○	57E7h	0 to 59000	0.01	9-7-11 9-7-28
AF204	DC braking delay time, 2nd-motor	0.00 to 5.00 (s)	0.00	○	57E8h	0 to 500	0.01	9-7-11 9-7-28
AF205	DC braking force setting, 2nd-motor	0 to 100 (%)	50	○	57E9h	0 to 00	1	9-7-11 9-7-28
AF206	DC braking active time at stop, 2nd-motor	0.00 to 60.00 (s)	0.50	○	57EAh	0 to 6000	0.01	9-7-11 9-7-28
AF207	DC braking operation method selection, 2nd-motor	00: Edge 01: Level	01	○	57EBh	0 to 1	1	9-7-2 9-7-28
AF208	DC braking force at start, 2nd-motor	0 to 100 (%)	0	○	57ECh	0 to 100	1	9-7-2 9-7-28
AF209	DC braking active time at start, 2nd-motor	0.00 to 60.00 (s)	0.00	○	57EDh	0 to 6000	0.01	9-7-2 9-7-11 9-7-28
AF220	Contactor control enable, 2nd-motor	00: Disable 01: Enable (Primary side) 02: Enable (Secondary side)	00	×	57F8h	0 to 2	1	9-7-19 9-7-28
AF221	Run delay time, 2nd-motor	0.00 to 2.00 (s)	0.20	○	57F9h	0 to 200	0.01	9-7-19 9-7-28
AF222	Contactor off delay time, 2nd-motor	0.00 to 2.00 (s)	0.10	○	57FAh	0 to 200	0.01	9-7-19 9-7-28
AF223	Contactor response check time, 2nd-motor	0.00 to 5.00 (s)	0.10	○	57FBh	0 to 500	0.01	9-7-19 9-7-28
AF230	Brake control enable, 2nd-motor	00: Disable 01: Brake control enable (Common) 02: Brake control enable (Separate for FWD/REV)	00	○	5802h	0 to 2	1	9-7-16 9-7-28
AF231	Brake release wait time (Forward), 2nd-motor	0.00 to 5.00 (s)	0.00	○	5803h	0 to 500	0.01	9-7-16 9-7-28
AF232	Brake wait time for accel. (Forward), 2nd-motor	0.00 to 5.00 (s)	0.00	○	5804h	0 to 500	0.01	9-7-16 9-7-28
AF233	Brake wait time for stopping (Forward), 2nd-motor	0.00 to 5.00 (s)	0.00	○	5805h	0 to 500	0.01	9-7-16 9-7-28

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Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AF234	Brake confirmation signal wait time (Forward), 2nd-motor	0.00 to 5.00 (s)	0.00	○	5806h	0 to 500	0.01	9-7-16 9-7-28
AF235	Brake release frequency setting (Forward), 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	5807h	0 to 59000	0.01	9-7-16 9-7-28
AF236	Brake release current setting (Forward), 2nd-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	5808h	(0.00 to 2.00) ×CTL rated current	0.1	9-7-16 9-7-28
						0 to 20000[*2]	0.01	
AF237	Braking frequency (Forward), 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	5809h	0 to 59000	0.01	9-7-16 9-7-28
AF238	Brake release wait time (Reverse), 2nd-motor	0.00 to 5.00 (s)	0.00	○	580Ah	0 to 500	0.01	9-7-16 9-7-28
AF239	Brake wait time for accel. (Reverse), 2nd-motor	0.00 to 5.00 (s)	0.00	○	580Bh	0 to 500	0.01	9-7-16 9-7-28
AF240	Brake wait time for stopping (Reverse), 2nd-motor	0.00 to 5.00 (s)	0.00	○	580Ch	0 to 500	0.01	9-7-16 9-7-28
AF241	Brake confirmation signal wait time (Reverse), 2nd-motor	0.00 to 5.00 (s)	0.00	○	580Dh	0 to 500	0.01	9-7-16 9-7-28
AF242	Brake release frequency setting (Reverse), 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	580Eh	0 to 59000	0.01	9-7-16 9-7-28
AF243	Brake release current setting (Reverse), 2nd-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	580Fh	(0.00 to 2.00) ×CTL rated current	0.1	9-7-16 9-7-28
						0 to 20000[*2]	0.01	
AF244	Braking frequency (Reverse), 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	5810h	0 to 59000	0.01	9-7-16 9-7-28
AG Parameter								
AG101	Jump frequency 1, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	3139h	0 to 59000	0.01	9-10-6
AG102	Jump frequency width 1, 1st-motor	0.00 to 10.00 (Hz)	0.50	○	313Ah	0 to 1000	0.01	9-10-6
AG103	Jump frequency 2, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	313Bh	0 to 59000	0.01	9-10-6
AG104	Jump frequency width 2, 1st-motor	0.00 to 10.00 (Hz)	0.50	○	313Ch	0 to 1000	0.01	9-10-6
AG105	Jump frequency 3, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	313Dh	0 to 59000	0.01	9-10-6
AG106	Jump frequency width 3, 1st-motor	0.00 to 10.00 (Hz)	0.50	○	313Eh	0 to 1000	0.01	9-10-6
AG110	Acceleration stop frequency setting, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	3142h	0 to 59000	0.01	9-3-4
AG111	Acceleration stop time setting, 1st-motor	0.0 to 60.0 (s)	0.0	○	3143h	0 to 600	0.1	9-3-4
AG112	Deceleration stop frequency setting, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	3144h	0 to 59000	0.01	9-3-4
AG113	Deceleration stop time setting, 1st-motor	0.0 to 60.0 (s)	0.0	○	3145h	0 to 600	0.1	9-3-4
AG-20	Jogging frequency	0.00 to 10.00 (Hz)	6.00	○	314Ch	0 to 1000	0.01	9-2-8

*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AG-21	Jogging stop mode selection	(Disable at RUN) 00: Free run at jogging stop 01: Deceleration stop at jogging stop 02: DC braking at jogging stop (Enable at RUN) 03: Free run at jogging stop 04: Deceleration stop at jogging stop 05: DC braking at jogging stop	04	○	314Dh	0 to 5	1	9-2-8
AG201	Jump frequency 1, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	5849h	0 to 59000	0.01	9-10-6 9-7-28
AG202	Jump frequency width 1, 2nd-motor	0.00 to 10.00 (Hz)	0.50	○	584Ah	0 to 1000	0.01	9-10-6 9-7-28
AG203	Jump frequency 2, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	584Bh	0 to 59000	0.01	9-10-6 9-7-28
AG204	Jump frequency width 2, 2nd-motor	0.00 to 10.00 (Hz)	0.50	○	584Ch	0 to 1000	0.01	9-10-6 9-7-28
AG205	Jump frequency 3, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	584Dh	0 to 59000	0.01	9-10-6 9-7-28
AG206	Jump frequency width 3, 2nd-motor	0.00 to 10.00 (Hz)	0.50	○	584Eh	0 to 1000	0.01	9-10-6 9-7-28
AG210	Acceleration stop frequency setting, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	5852h	0 to 59000	0.01	9-3-4 9-7-28
AG211	Acceleration stop time setting, 2nd-motor	0.0 to 60.0 (s)	0.0	○	5853h	0 to 600	0.1	9-3-4 9-7-28
AG212	Deceleration stop frequency setting, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	5854h	0 to 59000	0.01	9-3-4 9-7-28
AG213	Deceleration stop time setting, 2nd-motor	0.0 to 60.0 (s)	0.0	○	5855h	0 to 600	0.1	9-3-4 9-7-28
AH Parameter								
AH-01	PID1 enable	00: Disable 01: Enable 02: Enable (with inverted output)	00	○	319Dh	0 to 2	1	9-8-3 9-8-13
AH-02	PID1 deviation inversion	00: Disable 01: Enable	00	○	319Eh	0 to 1	1	9-8-14
AH-03	PID1 unit selection	00: (non) / 01: (%) / 02: (A) 03: (Hz) / 04: (V) / 05: (kW) 06: (W) / 07: (hr) / 08: (s) 09 (kHz) / 10: (ohm) / 11: (mA) 12: (ms) / 13: (P) / 14: (kgm2) 15: (pls) / 16: (mH) / 17: (Vdc) 18: (˚C) / 19: (kWh) / 20: (mF) 21: (mVs/rad) / 22: (Nm) 23: (min-1) / 24: (m/s) 25: (m/min) / 26: (m/h) 27: (ft/s) / 28: (ft/min) 29: (ft/h) / 30: (m) / 31: (cm) 32: (˚F) / 33: (l/s) / 34: (l/min) 35: (l/h) / 36: (m3/s) 37: (m3/min) / 38: (m3/h) 39: (kg/s) / 40: (kg/min) 41: (kg/h) / 42: (t/min) 43: (t/h) / 44 (gal/s) 45: (gal/min) / 46: (gal/h) 47: (ft3/s) / 48: (ft3/min) 49: (ft3/h) / 50: (lb/s) 51: (lb/min) / 52: (lb/h) 53: (mbar) / 54: (bar) / 55: (Pa) 56: (kPa) / 57: (PSI) / 58: (mm)	01	○	319Fh	0 to 58	1	9-8-32

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AH-04	PID1 scale adjustment (0%)	-10000 to 10000	0	○	31A0h	-10000 to 10000	1	9-8-32
AH-05	PID1 scale adjustment (100%)	-10000 to 10000	10000	○	31A1h	-10000 to 10000	1	9-8-32
AH-06	PID1 scale adjustment (decimal point position)	0 to 4	2	○	31A2h	0 to 4	1	9-8-32
AH-07	PID1 set-point 1 input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input	07	×	31A3h	0 to 12	1	9-8-9
AH-10	PID1 set-point 1 setting	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31A6h 31A7h	-10000 to 10000	1	9-8-9
AH-12	PID1 multistage set-point 1	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31A8h 31A9h	-10000 to 10000	1	9-8-11
AH-14	PID1 multistage set-point 2	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31AAh 31ABh	-10000 to 10000	1	9-8-11
AH-16	PID1 multistage set-point 3	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31ACh 31ADh	-10000 to 10000	1	9-8-11
AH-18	PID1 multistage set-point 4	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31AEh 31AFh	-10000 to 10000	1	9-8-11
AH-20	PID1 multistage set-point 5	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31B0h 31B1h	-10000 to 10000	1	9-8-11
AH-22	PID1 multistage set-point 6	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31B2h 31B3h	-10000 to 10000	1	9-8-11
AH-24	PID1 multistage set-point 7	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31B4h 31B5h	-10000 to 10000	1	9-8-11
AH-26	PID1 multistage set-point 8	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31B6h 31B7h	-10000 to 10000	1	9-8-11
AH-28	PID1 multistage set-point 9	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31B8h 31B9h	-10000 to 10000	1	9-8-11
AH-30	PID1 multistage set-point 10	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31BAh 31BBh	-10000 to 10000	1	9-8-11
AH-32	PID1 multistage set-point 11	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31BCh 31BDh	-10000 to 10000	1	9-8-11
AH-34	PID1 multistage set-point 12	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31BEh 31BFh	-10000 to 10000	1	9-8-11
AH-36	PID1 multistage set-point 13	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31C0h 31C1h	-10000 to 10000	1	9-8-11
AH-38	PID1 multistage set-point 14	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31C2h 31C3h	-10000 to 10000	1	9-8-11
AH-40	PID1 multistage set-point 15	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31C4h 31C5h	-10000 to 10000	1	9-8-11

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
AH-42	PID1 set-point 2 input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input	00	×	31C6h	0 to 12	1	9-8-9
AH-44	PID1 set-point 2 setting	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31C8h 31C9h	-10000 to 10000	1	9-8-9
AH-46	PID1 set-point 3 input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input	00	×	31CAh	0 to 12	1	9-8-9
AH-48	PID1 set-point 3 setting	-100.00 to 100.00 (%) Data range depends on PID1 scale adjustment (AH-04, 05, 06)	0.00	○	31CCh 31CDh	-10000 to 10000	1	9-8-9
AH-50	PID1 set-point calculation symbol selection	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Minimum deviation 06: Maximum deviation	01	○	31CEh	1 to 6	1	9-8-9
AH-51	PID1 feedback 1 input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 08: RS485 09: Option 12: Pulse input	02	○	31CFh	0 to 12	1	9-8-12
AH-52	PID1 feedback 2 input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 08: RS485 09: Option 12: Pulse input	00	×	31D0h	0 to 12	1	9-8-12
AH-53	PID1 feedback 3 input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 08: RS485 09: Option 12: Pulse input	00	×	31D1h	0 to 12	1	9-8-12
AH-54	PID1 feedback calculation symbol selection	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Square root of FB1 06: Square root of FB2 07: Square root of FB1-FB2 08: Average of the three inputs 09: Minimum of the three inputs 10: Maximum of the three inputs	01	○	31D2h	1 to 10	1	9-8-12
AH-60	PID1 gain change method selection	00: Using gain-1 only 01: [PRO] terminal	00	×	31D8h	0 to 1	1	9-8-16
AH-61	PID1 proportional gain 1	0.0 to 100.0	1.0	○	31D9h	0 to 1000	0.1	9-8-16
AH-62	PID1 integral time constant 1	0.0 to 3600.0 (s)	1.0	○	31DAh	0 to 36000	0.1	9-8-16
AH-63	PID1 derivative gain 1	0.00 to 100.00 (s)	0.00	○	31DBh	0 to 10000	0.01	9-8-16
AH-64	PID1 proportional gain 2	0.0 to 100.0	0.0	○	31DCh	0 to 1000	0.1	9-8-16

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AH-65	PID1 integral time constant 2	0.0 to 3600.0 (s)	0.0	○	31DDh	0 to 36000	0.1	9-8-16
AH-66	PID1 derivative gain 2	0.00 to 100.00 (s)	0.00	○	31DEh	0 to 10000	0.01	9-8-16
AH-67	PID1 gain change time	0 to 10000 (ms)	100	○	31DFh	0 to 10000	1	9-8-16
AH-70	PID1 feedforward input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2]	00	○	31E2h	0 to 2	1	9-8-14
AH-71	PID1 output range	0.00 to 100.00 (%)	0.00	○	31E3h	0 to 10000	0.01	9-8-15
AH-72	PID1 over deviation level	0.00 to 100.00 (%)	3.00	○	31E4h	0 to 10000	0.01	9-8-30
AH-73	Turn-off level for the PID1 feedback compare signal	0.00 to 100.00 (%)	100.00	○	31E5h	0 to 10000	0.01	9-8-31
AH-74	Turn-on level for the PID1 feedback compare signal	0.00 to 100.00 (%)	0.00	○	31E6h	0 to 10000	0.01	9-8-31
AH-75	PID soft start function enable	00: Disable 01: Enable	00	×	31E7h	0 to 1	1	9-8-18
AH-76	PID soft start target level	0.00 to 100.00 (%)	100.00	○	31E8h	0 to 10000	0.01	9-8-18
AH-78	Acceleration time setting for PID soft start function	0.00 to 3600.00 (s)	30.00	○	31EAh 31EBh	0 to 360000	0.01	9-8-18
AH-80	PID soft start time	0.00 to 600.00 (s)	0.00	○	31ECh	0 to 60000	0.01	9-8-18
AH-81	PID soft start error detection enable	00: Disable 01: Enable (Error) 02: Enable (Warning)	00	×	31EDh	0 to 2	1	9-8-19
AH-82	PID soft start error detection level	0.00 to 100.00 (%)	0.00	○	31EEh	0 to 10000	0.01	9-8-19
AH-85	PID sleep trigger selection	00: Disable 01: Low output 02: [SLEP] terminal	00	×	31F1h	0 to 2	1	9-8-20
AH-86	PID sleep start level	0.00 to 590.00 (Hz)	0.00	○	31F2h	0 to 59000	0.01	9-8-20
AH-87	PID sleep active time	0.00 to 100.00 (s)	0.00	○	31F3h	0 to 10000	0.01	9-8-20
AH-88	Enable set-point boost before PID sleep	00: Disable 01: Enable	00	×	31F4h	0 to 1	1	9-8-22
AH-89	Set-point boost time before PID sleep	0.00 to 100.00 (s)	0.00	○	31F5h	0 to 10000	0.01	9-8-22
AH-90	Set-point boost value before PID sleep	0.00 to 100.00 (%)	0.00	○	31F6h	0 to 10000	0.01	9-8-22
AH-91	Minimum RUN time before PID sleep	0.00 to 100.00 (s)	0.00	○	31F7h	0 to 10000	0.01	9-8-23
AH-92	Minimum active time of PID sleep	0.00 to 100.00 (s)	0.00	○	31F8h	0 to 10000	0.01	9-8-23
AH-93	PID wake trigger selection	01: Deviation value 02: Low feedback 03: [WAKE] terminal	01	×	31F9h	1 to 3	1	9-8-20
AH-94	PID wake start level	0.00 to 100.00 (%)	0.00	○	31FAh	0 to 10000	0.01	9-8-20
AH-95	PID wake start time	0.00 to 100.00 (s)	0.00	○	31FBh	0 to 10000	0.01	9-8-20
AH-96	PID wake start deviation value	0.00 to 100.00 (%)	0.00	○	31FCh	0 to 10000	0.01	9-8-20
AJ Parameter								
AJ-01	PID2 enable	00: Disable 01: Enable 02: Enable (with inverted output)	00	×	3201h	0 to 2	1	9-8-24 9-8-27
AJ-02	PID2 deviation inversion	00: Disable 01: Enable	00	×	3202h	0 to 1	1	9-8-27
AJ-03	PID2 unit selection	00 to 58 (Same as AH-03)	01	○	3203h	0 to 58	1	9-8-32

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
AJ-04	PID2 scale adjustment (0%)	-10000 to 10000	0	○	3204h	-10000 to 10000	1	9-8-32
AJ-05	PID2 scale adjustment (100%)	-10000 to 10000	10000	○	3205h	-10000 to 10000	1	9-8-32
AJ-06	PID2 scale adjustment (decimal point position)	0 to 4	2	○	3206h	0 to 4	1	9-8-32
AJ-07	PID2 set-point input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 15: PID1 output	07	×	3207h	0 to 15	1	9-8-24
AJ-10	PID2 set-point setting	-100.00 to 100.00 (%) Data range depends on PID2 scale adjustment (AJ-04, 05, 06)	0.00	○	320Ah	-10000 to 10000	1	9-8-24
AJ-12	PID2 feedback input source selection	00: Not used 01: Terminal [Ai1] 02: Terminal [Ai2] 08: RS485 09: Option 12: Pulse input	02	×	320Ch	0 to 12	1	9-8-24
AJ-13	PID2 proportional gain	0.0 to 100.0	1.0	○	320Dh	0 to 1000	0.1	9-8-24 9-8-29
AJ-14	PID2 integral time constant	0.0 to 3600.0 (s)	1.0	○	320Eh	0 to 36000	0.1	9-8-24 9-8-29
AJ-15	PID2 derivative gain	0.00 to 100.00 (s)	0.00	○	320Fh	0 to 10000	0.01	9-8-24 9-8-29
AJ-16	PID2 output range	0.00 to 100.00 (%)	0.00	○	3210h	0 to 10000	0.01	9-8-28
AJ-17	PID2 over deviation level	0.00 to 100.00 (%)	3.00	○	3211h	0 to 10000	0.01	9-8-30
AJ-18	Turn-off level for the PID2 feedback compare signal	0.00 to 100.00 (%)	100.00	○	3212h	0 to 10000	0.01	9-8-31
AJ-19	Turn-on level for the PID2 feedback compare signal	0.00 to 100.00 (%)	0.00	○	3213h	0 to 10000	0.01	9-8-31

18.2.4 b Parameter Group

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Modbus communication Data range	Modbus communication Resolution	Page
bA101	Upper frequency limit source selection, 1st-motor	00: Disable 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input	00	×	32C9h	0 to 12	1	9-4-1
bA102	Upper frequency limit, 1st-motor	0.00 to Maximum frequency, 1st-motor (Hz)	0.00	○	32CAh	0 to 59000	0.01	9-4-1
bA103	Lower frequency limit, 1st-motor	0.00 to Upper frequency limit, 1st-motor (Hz)	0.00	○	32CBh	0 to 59000	0.01	9-4-1
bA110	Torque limit selection, 1st-motor	00: Disable 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option	07	○	32D2h	0 to 9	1	9-6-6
bA111	Torque limiting parameters mode selection, 1st-motor	00: 4 quadrants 01: Switched by [TRQ1][TRQ2] terminals	00	×	32D3h	0 to 1	1	9-6-6
bA112	Torque limit 1 (Forward drive), 1st-motor	0.0 to 500.0 (%)	200.0	○	32D4h	0 to 5000	0.1	9-6-6
bA113	Torque limit 2 (Reverse regenerative), 1st-motor	0.0 to 500.0 (%)	200.0	○	32D5h	0 to 5000	0.1	9-6-6
bA114	Torque limit 3 (Reverse drive), 1st-motor	0.0 to 500.0 (%)	200.0	○	32D6h	0 to 5000	0.1	9-6-6
bA115	Torque limit 4 (Forward regenerative), 1st-motor	0.0 to 500.0 (%)	200.0	○	32D7h	0 to 5000	0.1	9-6-6
bA116	Torque limit LADSTOP selection, 1st-motor	00: Disable 01: Enable	00	○	32D8h	0 to 1	1	9-6-9
bA120	Overcurrent suppression enable, 1st-motor	00: Disable 01: Enable 02: Enable (with voltage reduction)	01/ 00/ 01*1	○	32DCh	0 to 2	1	9-9-3
bA121	Overcurrent suppression level, 1st-motor	(0.30 to 1.80)× ND rated current (A)	1.80×ND rated current	×	32DDh	(0.30 to 1.80) ×ND rated current	0.1	9-9-3
						3000 to 18000*2	0.01	
bA122	Overload restriction 1 mode selection, 1st-motor	00: Disable 01: Enable during accel. and constant speed 02: Constant speed only 03: Enable during accel. and constant speed (Accel. during regeneration)	01	○	32DEh	0 to 3	1	9-9-1
bA123	Overload restriction 1 active level, 1st-motor	(0.20 to 2.00)× CTL rated current (A)	1.50×CTL rated current	○	32DFh	(0.20 to 2.00) ×CTL rated current	0.1	9-9-1
						2000 to 20000*2	0.01	

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Modbus communication Data range	Modbus communication Resolution	Page
bA124	Overload restriction 1 action time, 1st-motor	0.10 to 3600.00 (s)	1.00	○	32E0h 32E1h	10 to 360000	0.01	9-9-1
bA126	Overload restriction 2 mode selection, 1st-motor	00: Disable 01: Enable during accel. and constant speed 02: Constant speed only 03: Enable during accel. and constant speed (Accel. during regeneration)	01	○	32E2h	0 to 3	1	9-9-2
bA127	Overload restriction 2 active level, 1st-motor	(0.20 to 2.00)× CTL rated current (A)	1.50×CTL rated current	○	32E3h	(0.20 to 2.00) ×CTL rated current 2000 to 20000*2	0.1 0.01	9-9-2
bA128	Overload restriction 2 action time, 1st-motor	0.10 to 3600.00 (s)	1.00	○	32E4h 32E5h	10 to 360000	0.01	9-9-2
bA-30	Instantaneous power failure non-stop function, mode selection	00: Disable 01: Deceleration stop 02: Deceleration stop at power failure (without resume) 03: Deceleration stop at power failure (with resume)	00	×	32E6h	0 to 3	1	9-9-20
bA-31	Instantaneous power failure non-stop function, start voltage level	200V class: 0.0 to 400.0 (VDC) 400V class: 0.0 to 800.0 (VDC)	220.0/ 440.0	○	32E7h	200V class: 0 to 4000 400V class: 0 to 8000 0 to 20000*2	0.1 0.01	9-9-20
bA-32	Instantaneous power failure non-stop function, target voltage level	200V class: 0.0 to 400.0 (VDC) 400V class: 0.0 to 800.0 (VDC)	360.0/ 720.0	○	32E8h	200V class: 0 to 4000 400V class: 0 to 8000 0 to 20000*2	0.1 0.01	9-9-20
bA-34	Instantaneous power failure non-stop function, deceleration time	0.01 to 3600.00 (s)	1.00	○	32EAh 32EBh	1 to 360000	0.01	9-9-20
bA-36	Instantaneous power failure non-stop function, start frequency decrement	0.00 to 10.00 (Hz)	0.00	○	32ECh	0 to 1000	0.01	9-9-20
bA-37	Instantaneous power failure non-stop function, DC bus voltage control P gain	0.00 to 5.00	0.20	○	32EDh	0 to 500	0.01	9-9-20
bA-38	Instantaneous power failure non-stop function, DC bus voltage control I gain	0.00 to 150.00 (s)	1.00	○	32EEh	0 to 15000	0.01	9-9-20
bA140	Overvoltage suppression enable setting, 1st-motor	00: Disable 01: Constant DC bus voltage control (deceleration stop) 02: Enable acceleration (at deceleration) 03: Enable acceleration (at constant speed and deceleration)	00	○	32F0h	0 to 3	1	9-9-4

*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
bA141	Overvoltage suppression active level, 1st-motor	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)	380.0/ 760.0	○	32F1h	200V class: 3300 to 4000 400V class: 6600 to 8000	0.1	9-9-4
						16500 to 20000*2	0.01	
bA142	Overvoltage suppression active time, 1st-motor	0.00 to 3600.00 (s)	1.00	○	32F2h 32F3h	0 to 360000	0.01	9-9-4
bA144	Constant DC bus voltage control P gain, 1st-motor	0.00 to 5.00	0.20	○	32F4h	0 to 500	0.01	9-9-4
bA145	Constant DC bus voltage control I gain, 1st-motor	0.00 to 150.00 (s)	1.00	○	32F5h	0 to 15000	0.01	9-9-4
bA146	Over-magnetization function selection, 1st-motor	00: Disable 01: Always enable 02: At deceleration only 03: Operation at setting level 04: Operation at setting level at deceleration stop	02/ 02/ 01*1	○	32F6h	0 to 4	1	9-9-6
bA147	Over-magnetization function output filter time constant, 1st-motor	0.000 to 10.000 (s)	0.300	○	32F7h	0 to 10000	0.001	9-9-6
bA148	Over-magnetization function voltage gain, 1st-motor	50 to 400 (%)	100	○	32F8h	50 to 400	1	9-9-6
bA149	Over-magnetization function level setting, 1st-motor	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)	360.0/ 720.0	○	32F9h	200V class: 3300 to 4000 400V class: 6600 to 8000	0.1	9-9-6
						16500 to 20000*2	0.01	
bA-60	Dynamic brake use ratio	0.0 to 10.0× ([bA-63]/Minimum resistance)^2 (%)	10.0	○	3304h	0 to 1000	0.1	9-9-8
bA-61	Dynamic brake activation selection	00: Disable 01: Only while running 02: Enable during stop	00	○	3305h	0 to 2	1	9-9-8
bA-62	Dynamic brake activation level	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)	360.0/ 720.0	○	3306h	200V class: 3300 to 4000 400V class: 6600 to 8000	0.1	9-9-8
						16500 to 20000*2	0.01	
bA-63	Dynamic brake resistor value	Minimum connection resistance to 600.0 (Ω)	Minimum connection resistance	○	3307h	Minimum connection resistance to 6000	0.1	9-9-8
bA-70	Cooling fan control method selection	00: Always ON 01: While inverter operates 02: Depends on temperature	01	○	330Eh	0 to 2	1	9-10-7
bA-71	Clear accumulated cooling fan run time monitor	00: Disable 01: Clear	00	○	330Fh	0 to 1	1	9-11-10
bA-72	Ambient temperature	-10 to 50 (℃)	40	○	3310h	-10 to 50	1	9-11-10

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
bA201	Upper frequency limit source selection, 2nd-motor	00: Disable 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input	00	×	59D9h	0 to 12	1	9-4-1 9-7-28
bA202	Upper frequency limit, 2nd-motor	0.00 to Maximum frequency, 2nd-motor (Hz)	0.00	○	59DAh	0 to 59000	0.01	9-4-1 9-7-28
bA203	Lower frequency limit, 2nd-motor	0.00 to Upper frequency limit, 2nd-motor (Hz)	0.00	○	59DBh	0 to 59000	0.01	9-4-1 9-7-28
bA210	Torque limit selection, 2nd-motor	00: Disable 01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option	07	○	59E2h	0 to 9	1	9-6-6 9-7-28
bA211	Torque limiting parameters mode selection, 2nd-motor	00: 4 quadrants 01: Switched by [TRQ1][TRQ2] terminals	00	×	59E3h	0 to 1	1	9-6-6 9-7-28
bA212	Torque limit 1 (Forward drive), 2nd-motor	0.0 to 500.0 (%)	200.0	○	59E4h	0 to 5000	0.1	9-6-6 9-7-28
bA213	Torque limit 2 (Reverse regenerative), 2nd-motor	0.0 to 500.0 (%)	200.0	○	59E5h	0 to 5000	0.1	9-6-6 9-7-28
bA214	Torque limit 3 (Reverse drive), 2nd-motor	0.0 to 500.0 (%)	200.0	○	59E6h	0 to 5000	0.1	9-6-6 9-7-28
bA215	Torque limit 4 (Forward regenerative), 2nd-motor	0.0 to 500.0 (%)	200.0	○	59E7h	0 to 5000	0.1	9-6-6 9-7-28
bA216	Torque limit LADSTOP selection, 2nd-motor	00: Disable 01: Enable	00	○	59E8h	0 to 1	1	9-6-9 9-7-28
bA220	Overcurrent suppression enable, 2nd-motor	00: Disable 01: Enable 02: Enable (with voltage reduction)	01/ 00/ 01*1	○	59ECh	0 to 2	1	9-9-3 9-7-28
bA221	Overcurrent suppression level, 2nd-motor	(0.30 to 1.80)× ND rated current (A)	1.80×ND rated current	×	59EDh	(0.30 to 1.80) ×ND rated current 3000 to 18000*2	0.1 0.01	9-9-3 9-7-28
bA222	Overload restriction 1 mode selection, 2nd-motor	00: Disable 01: Enable during accel. and constant speed 02: Constant speed only 03: Enable during accel. and constant speed (Accel. during regeneration)	01	○	59EEh	0 to 3	1	9-9-1 9-7-28
bA223	Overload restriction 1 active level, 2nd-motor	(0.20 to 2.00)× CTL rated current (A)	1.50×CTL rated current	○	59EFh	(0.20 to 2.00) ×CTL rated current 2000 to 20000*2	0.1 0.01	9-9-1 9-7-28
bA224	Overload restriction 1 action time, 2nd-motor	0.10 to 3600.00 (s)	1.00	○	59F0h 59F1h	10 to 360000	0.01	9-9-1 9-7-28

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication: Register No.	Modbus communication: Data range	Modbus communication: Resolution	Page
bA226	Overload restriction 2 mode selection, 2nd-motor	00: Disable 01: Enable during accel. and constant speed 02: Constant speed only 03: Enable during accel. and constant speed (Accel. during regeneration)	01	○	59F2h	0 to 3	1	9-9-2 9-7-28
bA227	Overload restriction 2 active level, 2nd-motor	(0.20 to 2.00)× CTL rated current (A)	1.50×CTL rated current	○	59F3h	(0.20 to 2.00) ×CTL rated current 2000 to 20000[*2]	0.1 0.01	9-9-2 9-7-28
bA228	Overload restriction 2 action time, 2nd-motor	0.10 to 3600.00 (s)	1.00	○	59F4h 59F5h	10 to 360000	0.01	9-9-2 9-7-28
bA240	Overvoltage suppression enable, 2nd-motor	00: Disable 01: Constant DC bus voltage control (deceleration stop) 02: Enable acceleration (at deceleration) 03: Enable acceleration (at constant speed and deceleration)	00	○	5A00h	0 to 3	1	9-9-4 9-7-28
bA241	Overvoltage suppression active level, 2nd-motor	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)	380.0/ 760.0	○	5A01h	200V class: 3300 to 4000 400V class: 6600 to 8000 16500 to 20000[*2]	0.1 0.01	9-9-4 9-7-28
bA242	Overvoltage suppression active time, 2nd-motor	0.00 to 3600.00 (s)	1.00	○	5A02h 5A03h	0 to 360000	0.01	9-9-4 9-7-28
bA244	Constant DC bus voltage control P gain, 2nd-motor	0.00 to 5.00	0.20	○	5A04h	0 to 500	0.01	9-9-4 9-7-28
bA245	Constant DC bus voltage control I gain, 2nd-motor	0.00 to 150.00 (s)	1.00	○	5A05h	0 to 15000	0.01	9-9-4 9-7-28
bA246	Over-magnetization function selection, 2nd-motor	00: Disable 01: Always enable 02: At deceleration only 03: Operation at setting level 04: Operation at setting level at deceleration stop	02/ 02/ 01[*1]	○	5A06h	0 to 4	1	9-9-6 9-7-28
bA247	Over-magnetization function output filter time constant, 2nd-motor	0.000 to 10.000 (s)	0.300	○	5A07h	0 to 10000	0.001	9-9-6 9-7-28
bA248	Over-magnetization function voltage gain, 2nd-motor	50 to 400 (%)	100	○	5A08h	50 to 400	1	9-9-6 9-7-28
bA249	Over-magnetization function level setting, 2nd-motor	200V class: 330.0 to 400.0 (VDC) 400V class: 660.0 to 800.0 (VDC)	360.0/ 720.0	○	5A09h	200V class: 3300 to 4000 400V class: 6600 to 8000 16500 to 20000[*2]	0.1 0.01	9-9-6 9-7-28

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
bb101	Carrier frequency setting, 1st-motor	ND: 2.0 to 15.0 (kHz) LD: 2.0 to 10.0 (kHz)	2.0/ 10.0/ 2.0[*1]	○	332Dh	ND: 20 to 150 LD: 20 to 100	0.1	9-10-1
bb102	Sprinkle carrier pattern selection, 1st-motor	00: Disable 01: Enable (Pattern-1)	00	×	332Eh	0 to 1	1	9-10-3
bb103	Automatic carrier reduction selection, 1st-motor	00: Disable 01: Enable (Current) 02: Enable (Temperature)	01	○	332Fh	0 to 2	1	9-10-2
bb-10	Automatic error reset selection	00: Disable 01: If RUN command is OFF 02: After set time	00	×	3336h	0 to 2	1	9-7-25 9-15-15
bb-11	Alarm signal selection at automatic error reset	00: Enable 01: Disable	00	×	3337h	0 to 1	1	9-7-25 9-15-15
bb-12	Automatic error reset wait time	0 to 600 (s)	2	○	3338h	0 to 600	1	9-7-25 9-15-15
bb-13	Automatic error reset number	0 to 10	3	×	3339h	0 to 10	1	9-7-25 9-15-15
bb-21	Number of retries after under-voltage	0 (Trip) to 16 / 255 (Unlimited)	0	○	3341h	0 to 16 /255	1	9-9-9
bb-22	Number of retries after overcurrent	0 to 5	0	○	3342h	0 to 5	1	9-9-14
bb-23	Number of retries after overvoltage	0 to 5	0	○	3343h	0 to 5	1	9-9-17
bb-24	Restart mode selection after instantaneous power failure/ under-voltage error	00: Restart at 0 Hz 01: Restart with frequency matching 02: Restart with active frequency matching 03: Detect speed 04: Trip after deceleration stop with frequency matching	01	○	3344h	0 to 4	1	9-9-9
bb-25	Instantaneous power failure allowed time	0.3 to 25.0 (s)	1.0	○	3345h	3 to 250	0.1	9-9-9
bb-26	Retry wait time after instantaneous power failure/under-voltage error	0.3 to 100.0 (s)	0.3	○	3346h	3 to 1000	0.1	9-7-8 9-9-9
bb-27	Enable instantaneous power failure/ under-voltage error while in stop status	00: Disable 01: Enable 02: Disable at stop and deceleration	00	○	3347h	0 to 2	1	9-9-9
bb-28	Restart mode selection after an overcurrent error	00: Restart at 0 Hz 01: Restart with frequency matching 02: Restart with active frequency matching 03: Detect speed 04: Trip after deceleration stop with frequency matching	01	○	3348h	0 to 4	1	9-9-14
bb-29	Retry wait time after an overcurrent error	0.3 to 100.0 (s)	0.3	○	3349h	3 to 1000	0.1	9-9-14
bb-30	Restart mode selection after an overvoltage error	00: Restart at 0 Hz 01: Restart with frequency matching 02: Restart with active frequency matching 03: Detect speed 04: Trip after deceleration stop with frequency matching	01	○	334Ah	0 to 4	1	9-9-17
bb-31	Retry wait time after an overvoltage error	0.3 to 100.0 (s)	0.3	○	334Bh	3 to 1000	0.1	9-9-17

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
bb-40	Restart mode after FRS release	00: Restart at 0 Hz 01: Restart with frequency matching 02: Restart with active frequency matching 03: Detect speed	00	○	3354h	0 to 3	1	9-7-10
bb-41	Restart mode after RS release	00: Restart at 0 Hz 01: Restart with frequency matching 02: Restart with active frequency matching 03: Detect speed	00	○	3355h	0 to 3	1	9-7-8 9-7-25
bb-42	Frequency matching minimum restart frequency	0.00 to 590.00 (Hz)	0.00	○	3356h	0 to 59000	0.01	9-7-4
bb-43	Active frequency matching restart level	(0.00 to 2.00)× CTL rated current (A)	1.00×CTL rated current	○	3357h	(0.00 to 2.00) ×CTL rated current	0.1	9-7-4
						0 to 20000*2	0.01	
bb-44	Restart constant (speed) of Active frequency matching	0.10 to 30.00 (s)	0.50	○	3358h	10 to 3000	0.01	9-7-4
bb-45	Active frequency matching restart constant (voltage)	0.10 to 30.00 (s)	1.20	○	3359h	10 to 3000	0.01	9-7-4
bb-46	OC-suppress level at active frequency matching	(0.30 to 1.80)× ND rated current (A)	1.80×ND rated current	○	335Ah	(0.30 to 1.80) ×ND rated current	0.1	9-7-4
						3000 to 18000*2	0.01	
bb-47	Active frequency matching restart speed selection	00: Output frequency at shut down 01: Maximum frequency 02: Setting frequency	00	○	335Bh	0 to 2	1	9-7-4
bb160	Overcurrent detection level, 1st-motor	(0.30 to 2.20)× ND rated current (A)	2.20×ND rated curent	×	3368h	(0.30 to 2.20) ×ND rated current	0.1	15-2-5
						3000 to 22000*2	0.01	
bb-61	Power supply overvoltage selection	00: Warning 01: Error	00	○	3369h	0 to 1	1	9-11-7
bb-62	Power supply overvoltage level setting	200V class: 300.0 to 400.0 (VDC) 400V class: 600.0 to 800.0 (VDC)	390.0/ 780.0	○	336Ah	200V class: 3000 to 4000 400V class: 6000 to 8000	0.1	9-11-7
						15000 to 20000*2	0.01	
bb-64	Detect ground fault selection	00: Disable 01: Enable	00	×	336Ch	0 to 1	1	9-10-9
bb-65	Input phase loss detection enable	00: Disable 01: Enable	00	○	336Dh	0 to 1	1	9-10-10
bb-66	Output phase loss detection enable	00: Disable 01: Enable	00	○	336Eh	0 to 1	1	9-10-11
bb-67	Output phase loss detection sensitivity	1 to 100 (%)	10	○	336Fh	1 to 100	1	9-10-11
bb-70	Thermistor error level	0 to 10000 (Ω)	3000	○	3372h	0 to 10000	1	9-10-8
bb-77	Input phase loss detection level	0 to 200	50	○	3379h	0 to 200	1	9-10-10
bb-80	Over-speed detection level	0.0 to 150.0 (%)	115.0	○	337Ch	0 to 1500	0.1	9-5-20

*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
bb-81	Over-speed detection time	0.0 to 5.0 (s)	0.5	○	337Dh	0 to 50	0.1	9-5-20
bb-82	Speed deviation error mode selection	00: Warning 01: Error	00	×	337Eh	0 to 1	1	9-5-20
bb-83	Speed deviation error detection level	0.00 to 100.00 (%)	15.00	○	337Fh	0 to 10000	0.01	9-5-20
bb-84	Speed deviation error detection time	0.0 to 5.0 (s)	0.5	×	3380h	0 to 50	0.1	9-5-20
bb201	Carrier frequency setting, 2nd-motor	ND: 2.0 to 15.0 (kHz) LD: 2.0 to 10.0 (kHz)	2.0/ 10.0/ 2.0*1	○	5A3Dh	ND: 20 to 150 LD: 20 to 100	0.1	9-7-25 9-10-1
bb202	Sprinkle carrier pattern selection, 2nd-motor	00: Disable 01: Enable (Pattern-1)	00	×	5A3Eh	0 to 1	1	9-7-25 9-10-3
bb203	Automatic carrier reduction selection, 2nd-motor	00: Disable 01: Enable (Current) 02: Enable (Temperature)	01	○	5A3Fh	0 to 2	1	9-7-25 9-10-2
bb260	Overcurrent detection level, 2nd-motor	(0.30 to 2.20)× ND rated current (A)	2.20× ND rated current	×	5A78h	(0.30 to 2.20) ×ND rated current	0.1	9-7-25 15-2-5
						3000 to 22000*2	0.01	
bC Parameter								
bC110	Electronic thermal level setting, 1st-motor	(0.00 to 3.00)× CTL rated current (A)	1.00× CTL rated current	○	339Ah	(0.00 to 3.00) ×CTL rated current	0.1	8-1-6
						0 to 30000*2	0.01	
bC111	Electronic thermal characteristic selection, 1st-motor	00: Reduce torque (VT) 01: Constant torque (CT) 02: Free setting (FREE)	01	○	339Bh	0 to 2	1	8-1-7
bC112	Electronic thermal decrease function enable, 1st-motor	00: Disable 01: Enable (Linear decrement) 02: Enable (Time constant decrement)	00/ 02/ 00*1	○	339Ch	0 to 2	1	8-1-9
bC113	Electronic thermal decreasing time, 1st-motor	1 to 65535 (s)	600	○	339Dh	1 to 65535	1	8-1-9
bC-14	Electronic thermal counter memory selection at power-off	00: Disable 01: Enable	01	○	339Eh	0 to 1	1	8-1-10
bC115	Electronic thermal accumulation gain, 1st-motor	1.0 to 200.0 (%)	100.0	○	339Fh	10 to 2000	0.1	8-1-6 8-1-9
bC120	Free electronic thermal frequency-1, 1st-motor	0.00 to [bC122] (Hz)	0.00	○	33A4h	0 to 59000	0.01	8-1-8
bC121	Free electronic thermal current-1, 1st-motor	(0.00 to 3.00)× CTL rated current (A)	0.00× CTL rated current	○	33A5h	(0.00 to 3.00) ×CTL rated current	0.1	8-1-8
						0 to 30000*2	0.01	
bC122	Free electronic thermal frequency-2, 1st-motor	[bC120] to [bC124] (Hz)	0.00	○	33A6h	0 to 59000	0.01	8-1-8
bC123	Free electronic thermal current-2, 1st-motor	(0.00 to 3.00)× CTL rated current (A)	0.00× CTL rated current	○	33A7h	(0.00 to 3.00) ×CTL rated current	0.1	8-1-8
						0 to 30000*2	0.01	

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
bC124	Free electronic thermal frequency-3, 1st-motor	[bC122] to 590.00 (Hz)	0.00	○	33A8h	0 to 59000	0.01	8-1-8
bC125	Free electronic thermal current-3, 1st-motor	(0.00 to 3.00)× CTL rated current (A)	0.00× CTL rated current	○	33A9h	(0.00 to 3.00) ×CTL rated current 0 to 30000*2	0.1 0.01	8-1-8
bC210	Electronic thermal level setting, 2nd-motor	(0.00 to 3.00)× CTL rated current (A)	1.00× CTL rated current	○	5AAAh	(0.00 to 3.00) ×CTL rated current 0 to 30000*2	0.1 0.01	8-1-6 9-7-25
bC211	Electronic thermal characteristic selection, 2nd-motor	00: Reduce torque (VT) 01: Constant torque (CT) 02: Free setting (FREE)	01	○	5AABh	0 to 2	1	8-1-7 9-7-25
bC212	Electronic thermal decrease function selection, 2nd-motor	00: Disable 01: Enable (Linear decrement) 02: Enable (Time constant decrement)	00/ 02/ 00*1	○	5AACh	0 to 2	1	8-1-9 9-7-25
bC213	Electronic thermal decreasing time, 2nd-motor	1 to 65535 (s)	600	○	5AADh	1 to 65535	1	8-1-9 9-7-25
bC215	Electronic thermal accumulation gain, 2nd-motor	1.0 to 200.0 (%)	100.0	○	5AAFh	10 to 2000	0.1	8-1-6 8-1-9 9-7-25
bC220	Free electronic thermal frequency-1, 2nd-motor	0.00 to [bC222] (Hz)	0.00	○	5AB4h	0 to 59000	0.01	8-1-8 9-7-25
bC221	Free electronic thermal current-1, 2nd-motor	(0.00 to 3.00)× CTL rated current (A)	0.00× CTL rated current	○	5AB5h	(0.00 to 3.00) ×CTL rated current 0 to 30000*2	0.1 0.01	8-1-8 9-7-25
bC222	Free electronic thermal frequency-2, 2nd-motor	[bC220] to [bC224] (Hz)	0.00	○	5AB6h	0 to 59000	0.01	8-1-8 9-7-25
bC223	Free electronic thermal current-2, 2nd-motor	(0.00 to 3.00)× CTL rated current (A)	0.00× CTL rated current	○	5AB7h	(0.00 to 3.00) ×CTL rated current 0 to 30000*2	0.1 0.01	8-1-8 9-7-25
bC224	Free electronic thermal frequency-3, 2nd-motor	[bC222] to 590.00 (Hz)	0.00	○	5AB8h	0 to 59000	0.01	8-1-8 9-7-25
bC225	Free electronic thermal current-3, 2nd-motor	(0.00 to 3.00)× CTL rated current (A)	0.00× CTL rated current	○	5AB9h	(0.00 to 3.00) ×CTL rated current 0 to 30000*2	0.1 0.01	8-1-8 9-7-25
bd Parameter								
bd-01	STO input display selection	00: Warning (display) 01: Warning (without display) 02: Trip	01	○	33F5h	0 to 2	1	14-1-4
bd-02	STO input change time (release)	0.00: Disable, 0.01 to 60.00 (s)	0.01	○	33F6h	0 to 6000	0.01	14-1-4
bd-03	Display selection during STO input change time	00: Warning (display) 01: Warning (without display)	01	○	33F7h	0 to 1	1	14-1-4
bd-04	Action selection after STO input change time	00: Maintain current status 01: Disable 02: Trip	01	○	33F8h	0 to 2	1	14-1-4

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
bd-05	STO input change time (shutoff)	0.00: Disable, 0.01 to 60.00 (s)	0.01	○	33F9h	0 to 6000	0.01	14-1-4
bd-06	Warning release mode selection	00: Keep warning display 01: Release warning display	00/ 01/ 00*1	○	33FAh	0 to 1	1	14-1-4
bd-07	Warning re-display time	1 to 30 (s)	30	○	33FBh	1 to 30	1	14-1-4
bE Parameter								
bE-01	Abnormal detection enable	00: Disable 01: Enable (Frequency mode) 02: Enable (Time mode)	00	×	3459h	0 to 2	1	9-11-16
bE-02	Abnormal detection target	dA-**, db-**, dC-**, FA-**	dA-01	×	345Ah	0 to 65535 (Register No.)	—	9-11-16
bE-03	Abnormal detection auto tuning selection	00: Disable 01: Enable	00	×	345Bh	0 to 1	1	9-11-16
bE-04	Abnormal detection tuning tolerance	0.00 to 100.00 (%)	0.10	○	345Ch	0 to 10000		9-11-16
bE-05	Abnormal upper level detecting action	01: Warning 02: Trip 03: Trip after deceleration stop	01	×	345Dh	1 to 3	1	9-11-16
bE-06	Abnormal upper level detecting time	0.00 to 600.00 (s)	0.00	○	345Eh	0 to 60000	0.01	9-11-16
bE-07	Abnormal lower level detecting action	01: Warning 02: Trip 03: Trip after deceleration stop	01	×	345Fh	1 to 3	1	9-11-16
bE-08	Abnormal lower level detecting time	0.00 to 600.00 (s)	0.00	○	3460h	0 to 60000	0.01	9-11-16
bE-10	Abnormal detection minimum frequency	0.00 to Maximum frequency (Hz)	0.00	○	3462h 3463h	0 to 59000	0.01	9-11-16
bE-12	Abnormal detection intermediate frequency 1	0.00 to Maximum frequency (Hz)	0.00	○	3464h 3465h	0 to 59000	0.01	9-11-16
bE-14	Abnormal detection intermediate frequency 2	0.00 to Maximum frequency (Hz)	0.00	○	3466h 3467h	0 to 59000	0.01	9-11-16
bE-16	Abnormal detection intermediate frequency 3	0.00 to Maximum frequency (Hz)	0.00	○	3468h 3469h	0 to 59000	0.01	9-11-16
bE-18	Abnormal detection maximum frequency	0.00 to Maximum frequency (Hz)	0.00	○	346Ah 346Bh	0 to 59000	0.01	9-11-16
bE-21	Upper limit at minimum frequency	-100.00 to 100.00 (%)	0.00	○	346Dh	-10000 to 10000	0.01	9-11-16
bE-22	Upper limit at intermediate frequency 1	-100.00 to 100.00 (%)	0.00	○	346Eh	-10000 to 10000	0.01	9-11-16
bE-23	Upper limit at intermediate frequency 2	-100.00 to 100.00 (%)	0.00	○	346Fh	-10000 to 10000	0.01	9-11-16
bE-24	Upper limit at intermediate frequency 3	-100.00 to 100.00 (%)	0.00	○	3470h	-10000 to 10000	0.01	9-11-16
bE-25	Upper limit at maximum frequency	-100.00 to 100.00 (%)	0.00	○	3471h	-10000 to 10000	0.01	9-11-16
bE-26	Lower limit at minimum frequency	-100.00 to 100.00 (%)	0.00	○	3472h	-10000 to 10000	0.01	9-11-16
bE-27	Lower limit at intermediate frequency 1	-100.00 to 100.00 (%)	0.00	○	3473h	-10000 to 10000	0.01	9-11-16

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
bE-28	Lower limit at intermediate frequency 2	-100.00 to 100.00 (%)	0.00	○	3474h	-10000 to 10000	0.01	9-11-16
bE-29	Lower limit at intermediate frequency 3	-100.00 to 100.00 (%)	0.00	○	3475h	-10000 to 10000	0.01	9-11-16
bE-30	Lower limit at maximum frequency	-100.00 to 100.00 (%)	0.00	○	3476h	-10000 to 10000	0.01	9-11-16
bE-31	Abnormal time detection operating time 1	0.00 to [bE-32] (s)	0.00	○	3477h	0 to 60000	0.01	9-11-16
bE-32	Abnormal time detection operating time 2	[bE-31] to [bE-33] (s)	0.00	○	3478h	0 to 60000	0.01	9-11-16
bE-33	Abnormal time detection operating time 3	[bE-32] to [bE-34] (s)	0.00	○	3479h	0 to 60000	0.01	9-11-16
bE-34	Abnormal time detection operating time 4	[bE-33] to [bE-35] (s)	0.00	○	347Ah	0 to 60000	0.01	9-11-16
bE-35	Abnormal time detection operating time 5	[bE-34] to [bE-36] (s)	0.00	○	347Bh	0 to 60000	0.01	9-11-16
bE-36	Abnormal time detection operating time 6	[bE-35] to [bE-37] (s)	0.00	○	347Ch	0 to 60000	0.01	9-11-16
bE-37	Abnormal time detection operating time 7	[bE-36] to [bE-38] (s)	0.00	○	347Dh	0 to 60000	0.01	9-11-16
bE-38	Abnormal time detection operating time 8	[bE-37] to [bE-39] (s)	0.00	○	347Eh	0 to 60000	0.01	9-11-16
bE-39	Abnormal time detection operating time 9	[bE-38] to [bE-40] (s)	0.00	○	347Fh	0 to 60000	0.01	9-11-16
bE-40	Abnormal time detection operating time 10	[bE-39] to 600.00 (s)	0.00	○	3480h	0 to 60000	0.01	9-11-16
bE-41	Abnormal time detection upper level 1	-100.00 to 100.00 (%)	0.00	○	3481h	-10000 to 10000	0.01	9-11-16
bE-42	Abnormal time detection upper level 2	-100.00 to 100.00 (%)	0.00	○	3482h	-10000 to 10000	0.01	9-11-16
bE-43	Abnormal time detection upper level 3	-100.00 to 100.00 (%)	0.00	○	3483h	-10000 to 10000	0.01	9-11-16
bE-44	Abnormal time detection upper level 4	-100.00 to 100.00 (%)	0.00	○	3484h	-10000 to 10000	0.01	9-11-16
bE-45	Abnormal time detection upper level 5	-100.00 to 100.00 (%)	0.00	○	3485h	-10000 to 10000	0.01	9-11-16
bE-46	Abnormal time detection upper level 6	-100.00 to 100.00 (%)	0.00	○	3486h	-10000 to 10000	0.01	9-11-16
bE-47	Abnormal time detection upper level 7	-100.00 to 100.00 (%)	0.00	○	3487h	-10000 to 10000	0.01	9-11-16
bE-48	Abnormal time detection upper level 8	-100.00 to 100.00 (%)	0.00	○	3488h	-10000 to 10000	0.01	9-11-16

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
bE-49	Abnormal time detection upper level 9	-100.00 to 100.00 (%)	0.00	○	3489h	-10000 to 10000	0.01	9-11-16
bE-50	Abnormal time detection upper level 10	-100.00 to 100.00 (%)	0.00	○	348Ah	-10000 to 10000	0.01	9-11-16
bE-51	Abnormal time detection lower level 1	-100.00 to 100.00 (%)	0.00	○	348Bh	-10000 to 10000	0.01	9-11-16
bE-52	Abnormal time detection lower level 2	-100.00 to 100.00 (%)	0.00	○	348Ch	-10000 to 10000	0.01	9-11-16
bE-53	Abnormal time detection lower level 3	-100.00 to 100.00 (%)	0.00	○	348Dh	-10000 to 10000	0.01	9-11-16
bE-54	Abnormal time detection lower level 4	-100.00 to 100.00 (%)	0.00	○	348Eh	-10000 to 10000	0.01	9-11-16
bE-55	Abnormal time detection lower level 5	-100.00 to 100.00 (%)	0.00	○	348Fh	-10000 to 10000	0.01	9-11-16
bE-56	Abnormal time detection lower level 6	-100.00 to 100.00 (%)	0.00	○	3490h	-10000 to 10000	0.01	9-11-16
bE-57	Abnormal time detection lower level 7	-100.00 to 100.00 (%)	0.00	○	3491h	-10000 to 10000	0.01	9-11-16
bE-58	Abnormal time detection lower level 8	-100.00 to 100.00 (%)	0.00	○	3492h	-10000 to 10000	0.01	9-11-16
bE-59	Abnormal time detection lower level 9	-100.00 to 100.00 (%)	0.00	○	3493h	-10000 to 10000	0.01	9-11-16
bE-60	Abnormal time detection lower level 10	-100.00 to 100.00 (%)	0.00	○	3494h	-10000 to 10000	0.01	9-11-16

18.2.5 C Parameter Group

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CA-01	Input terminal [1] function	Refer to "18.2.6 List of Intelligent Input Terminal Functions"	[FW]	○	36B1h	0(no)/ 1 to 110	–	9-15-1
CA-02	Input terminal [2] function		[RV]	○	36B2h		–	9-15-1
CA-03	Input terminal [3] function		[CF1]/ [EXT]/ [CF1]*1	○	36B3h		–	9-15-1
CA-04	Input terminal [4] function		[CF2]/ [RS]/ [CF2]*1	○	36B4h		–	9-15-1
CA-05	Input terminal [5] function		[2CH]/ [CF1]/ [2CH]*1	○	36B5h		–	9-15-1
CA-06	Input terminal [6] function		[RS]/ [CF2]/ [RS]*1	○	36B6h		–	9-15-1
CA-07	Input terminal [7] function		[USP]/ [JG]/ [USP]*1	○	36B7h		–	9-15-1
CA-08	Input terminal [8] function		[no]	○	36B8h		–	9-15-1
CA-21	Input terminal [1] active state	00: Normally Open (NO) 01: Normally Closed (NC)	00	○	36C5h	0 to 1	–	9-15-1
CA-22	Input terminal [2] active state		00	○	36C6h		–	9-15-1
CA-23	Input terminal [3] active state		00	○	36C7h		–	9-15-1
CA-24	Input terminal [4] active state		00	○	36C8h		–	9-15-1
CA-25	Input terminal [5] active state		00	○	36C9h		–	9-15-1
CA-26	Input terminal [6] active state		00	○	36CAh		–	9-15-1
CA-27	Input terminal [7] active state		00	○	36CBh		–	9-15-1
CA-28	Input terminal [8] active state		00	○	36CCh		–	9-15-1
CA-41	Input terminal [1] response time	0 to 400 (ms)	2	○	36D9h	0 to 400	1	9-15-3
CA-42	Input terminal [2] response time		2	○	36DAh		1	9-15-3
CA-43	Input terminal [3] response time		2	○	36DBh		1	9-15-3
CA-44	Input terminal [4] response time		2	○	36DCh		1	9-15-3
CA-45	Input terminal [5] response time		2	○	36DDh		1	9-15-3
CA-46	Input terminal [6] response time		2	○	36DEh		1	9-15-3
CA-47	Input terminal [7] response time		2	○	36DFh		1	9-15-3
CA-48	Input terminal [8] response time		2	○	36E0h		1	9-15-3
CA-55	Multistage input determination time	0 to 2000 (ms)	0	○	36E7h	0 to 2000	1	9-2-5 9-8-11 9-14-6

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CA-60	FUP/FDN overwrite target selection	00: Speed reference 01:PID1 Set-point 1	00	○	36ECh	0 to 1	–	9-2-16 9-8-17
CA-61	FUP/FDN data save enable	00: Not save 01: Save	00	○	36EDh	0 to 1	–	9-2-16 9-8-17
CA-62	FUP/FDN UDC selection	00: 0Hz 01: Saved data	00	○	36EEh	0 to 1	–	9-2-16 9-8-17
CA-64	Acceleration time setting for FUP/FDN function	0.00 to 3600.00 (s)	10.00	○	36F0h 36F1h	0 to 360000	0.01	9-2-16 9-8-17
CA-66	Deceleration time setting for FUP/FDN function	0.00 to 3600.00 (s)	10.00	○	36F2h 36F3h	0 to 360000	0.01	9-2-16 9-8-17
CA-70	Speed reference source selection when [F-OP] is active	01: Terminal [Ai1] 02: Terminal [Ai2] 07: Parameter setting 08: RS485 09: Option 12: Pulse input 14: Program function 15: PID function 16: VR (MOP-VR)	01	○	36F6h	1 to 16	–	9-2-18
CA-71	RUN command source selection when [F-OP] is active	00: [FW]/[RV] terminal 01: 3-wire 02: Keypad's RUN-key 03: RS485 04: Option	00	○	36F7h	0 to 4	–	9-1-6
CA-72	Reset mode selection	00: Always enabled (Trip release at turn-ON) 01: Always enabled (Trip release at turn-OFF) 02: Only enabled in trip status (Trip release at turn-ON) 03: Only enabled in trip status (Trip release at turn-OFF)	00	○	36F8h	0 to 3	–	9-15-13
CA-73	[USP] active selection	00: Disable 01: Enable	00	○	36F9h	0 to 1	–	9-10-5
CA-81	Encoder constant setting	1 to 65535 (pls)	512	×	3701h	1 to 65535	1	9-5-16 10-1-4
CA-82	Encoder phase sequence selection	00: Phase-A Lead 01: Phase-B Lead	00	×	3702h	0 to 1	–	9-5-16
CA-83	Motor gear ratio numerator	1 to 10000	1	×	3703h	1 to 10000	1	9-5-16
CA-84	Motor gear ratio denominator	1 to 10000	1	×	3704h	1 to 10000	1	9-5-16
CA-85	Encoder disconnection time	0.0 to 10.0 (s)	1.0	○	3705h	0 to 100	0.1	9-5-20
CA-86	Speed feedback filter	0 to 1000 (ms)	20	○	3706h	0 to 1000	1	9-5-16 10-1-4
CA-90	Pulse input target function selection	00: Disable 01: Frequency reference 02: Speed feedback 03: Pulse count	01	×	370Ah	0 to 3	–	9-2-10 9-5-16 9-15-10 10-1-4
CA-91	Pulse input mode selection	00: 90 degrees shift pulse input 01: Forward/Reverse command and pulse input 03: Single phase pulse input	03	×	370Bh	0 to 3	–	9-5-16 9-15-10
CA-92	Pulse input frequency scale	0.05 to 32.00 (kHz)	25.00/ 1.50/ 25.00*1	○	370Ch	5 to 3200	0.01	10-2-2

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CA-93	Pulse input frequency filter time constant	0.01 to 2.00 (s)	0.10	○	370Dh	1 to 200	0.01	9-2-10
CA-94	Pulse input frequency bias value	-100.0 to 100.0 (%)	0.0	○	370Eh	-1000 to 1000	0.1	9-2-10
CA-95	Pulse input upper frequency detection level	0.0 to 100.0 (%)	100.0	○	370Fh	0 to 1000	0.1	9-2-10
CA-96	Pulse input lower frequency detection level	0.0 to 100.0 (%)	1.0	○	3710h	0 to 1000	0.1	9-2-10
CA-97	Pulse counter compare match output ON value	0 to 65535	0	○	3711h	0 to 65535	1	9-15-10
CA-98	Pulse counter compare match output OFF value	0 to 65535	0	○	3712h	0 to 65535	1	9-15-10
CA-99	Pulse counter compare match maximum value	0 to 65535	65535	○	3713h	0 to 65535	1	9-15-10
Cb Parameter								
Cb-01	[Ai1] Filter time constant	1 to 500 (ms)	16	○	3715h	1 to 500	1	9-15-4
Cb-03	[Ai1] Start value	0.00 to 100.00 (%)	0.00	○	3717h	0 to 10000	0.01	9-15-4
Cb-04	[Ai1] End value	0.00 to 100.00 (%)	100.00	○	3718h	0 to 10000	0.01	9-15-4
Cb-05	[Ai1] Start rate	0.0 to [Cb-06] (%)	0.0	○	3719h	0 to 1000	0.1	9-15-4
Cb-06	[Ai1] End rate	[Cb-05] to 100.0 (%)	100.0	○	371Ah	0 to 1000	0.1	9-15-4
Cb-07	[Ai1] Start value selection	00: Start value [Cb-03] 01: 0%	01	○	371Bh	0 to 1	–	9-15-4
Cb-08	[Ai1] Input selection	01: Voltage 02: Current	01	○	371Ch	1 to 2	–	9-15-4
Cb-11	[Ai2] Filter time constant	1 to 500 (ms)	16	○	371Fh	1 to 500	1	9-15-4
Cb-13	[Ai2] Start value	0.00 to 100.00 (%)	0.00	○	3721h	0 to 10000	0.01	9-15-4
Cb-14	[Ai2] End value	0.00 to 100.00 (%)	100.00	○	3722h	0 to 10000	0.01	9-15-4
Cb-15	[Ai2] Start rate	0.0 to [Cb-16] (%)	20.0	○	3723h	0 to 1000	0.1	9-15-4
Cb-16	[Ai2] End rate	[Cb-15] to 100.0 (%)	100.0	○	3724h	0 to 1000	0.1	9-15-4
Cb-17	[Ai2] Start value selection	00: Start value[Cb-13] 01: 0%	01	○	3725h	0 to 1	–	9-15-4
Cb-18	[Ai2] Input selection	01: Voltage 02: Current	02	○	3726h	1 to 2	–	9-15-4
Cb-30	[Ai1] Voltage/Current bias adjustment	-100.00 to 100.00 (%)	0.00	○	3732h	-10000 to 10000	0.01	9-15-4
Cb-31	[Ai1] Voltage/Current gain adjustment	0.00 to 200.00 (%)	100.00	○	3733h	0 to 20000	0.01	9-15-4
Cb-32	[Ai2] Voltage/Current bias adjustment	-100.00 to 100.00 (%)	0.00	○	3734h	-10000 to 10000	0.01	9-15-4
Cb-33	[Ai2] Voltage/Current gain adjustment	0.00 to 200.00 (%)	100.00	○	3735h	0 to 20000	0.01	9-15-4
Cb-40	Thermistor type selection	00: Disable 01: PTC	00		373Ch	0 to 1	1	9-10-8
Cb-41	Thermistor gain adjustment	0.0 to 1000.0	100.0	○	373Dh	0 to 10000	0.1	9-10-8
Cb-51	MOP-VR input filter time constant	1 to 500	100	○	3747h	1 to 500	1	9-15-9
Cb-53	MOP-VR start value	0.00 to 100.00 (%)	0.00	○	3749h	0 to 10000	0.01	9-15-8
Cb-54	MOP-VR end value	0.00 to 100.00 (%)	100.00	○	374Ah	0 to 10000	0.01	9-15-8
Cb-55	MOP-VR start ratio	0.0 to [Cb-56] (%)	0.0	○	374Bh	0 to 1000	0.1	9-15-8
Cb-56	MOP-VR end ratio	[Cb-55] to 100.0 (%)	100.0	○	374Ch	0 to 1000	0.1	9-15-8
Cb-57	MOP-VR start selection	00: Start value [Cb-53] 01: 0%	01	○	374Dh	0 to 1	–	9-15-8

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CC-01	Output terminal [11] function	Refer to "18.2.7 List of Intelligent Output Terminal Functions"	[FA1]/ [RUN]/ [FA1]*1	○	3779h	0 to 98	1	9-16-1
CC-02	Output terminal [12] function		[RUN]/ [FA1]/ [RUN]*1	○	377Ah		1	9-16-1
CC-07	Output terminal [AL] function		[AL]	○	377Fh		1	9-16-1
CC-11	Output terminal [11] active state	00: Normally Open (NO) 01: Normally Closed (NC)	00	○	3783h	0 to 1	–	9-16-1
CC-12	Output terminal [12] active state		00	○	3784h		–	9-16-1
CC-17	Output terminal [AL] active state		01	○	3789h		–	9-16-1
CC-20	Output terminal [11] on-delay time	0.00 to 100.00 (s)	0.00	○	378Ch	0 to 10000	0.01	9-16-4
CC-21	Output terminal [11] off-delay time		0.00	○	378Dh		0.01	9-16-4
CC-22	Output terminal [12] on-delay time		0.00	○	378Eh		0.01	9-16-4
CC-23	Output terminal [12] off-delay time		0.00	○	378Fh		0.01	9-16-4
CC-32	Output terminal [AL] on-delay time		0.00	○	3798h		0.01	9-16-4
CC-33	Output terminal [AL] off-delay time		0.00	○	3799h		0.01	9-16-4
CC-40	LOG1 operand-1 selection	Same as [CC-01] to [CC-07] (Except [LOG1] to [LOG3])	000	○	37A0h	0 to 98	–	9-13-5
CC-41	LOG1 operand-2 selection	Same as [CC-01] to [CC-07] (Except [LOG1] to [LOG3])	000	○	37A1h	0 to 98	–	9-13-5
CC-42	LOG1 logical calculation selection	00: AND 01: OR 02: XOR	00	○	37A2h	0 to 2	–	9-13-5
CC-43	LOG2 operand-1 selection	Same as [CC-01] to [CC-07] (Except [LOG1] to [LOG3])	000	○	37A3h	0 to 98	–	9-13-5
CC-44	LOG2 operand-2 selection	Same as [CC-01] to [CC-07] (Except [LOG1] to [LOG3])	000	○	37A4h	0 to 98	–	9-13-5
CC-45	LOG2 logical calculation selection	00: AND 01: OR 02: XOR	00	○	37A5h	0 to 2	–	9-13-5
CC-46	LOG3 operand-1 selection	Same as [CC-01] to [CC-07] (Except [LOG1] to [LOG3])	000	○	37A6h	0 to 98	–	9-13-5
CC-47	LOG3 operand-2 selection	Same as [CC-01] to [CC-07] (Except [LOG1] to [LOG3])	000	○	37A7h	0 to 98	–	9-13-5
CC-48	LOG3 logical calculation selection	00: AND 01: OR 02: XOR	00	○	37A8h	0 to 2	–	9-13-5
Cd Parameter								
Cd-01	[FM] Output wave form selection	00: PWM output 01: Frequency output	00	○	37DDh	0 to 1	–	9-16-8
Cd-02	[FM] Output base frequency (at frequency output)	0 to 32000 (Hz)	2880	○	37DEh	0 to 32000	1	9-16-8
Cd-03	[FM] Output monitor selection	Monitor parameters (Refer to "9.16.3 Selecting Monitor Data for Analog/Pulse Output")	dA-01	○	37DFh	0 to 65535 (Register No.)	–	9-16-7

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
Cd-04	[Ao1] Output monitor selection	Monitor parameters (Refer to "9.16.3 Selecting Monitor Data for Analog/Pulse Output ")	dA-01	○	37E0h	0 to 65535 (Register No.)	–	9-16-15
Cd-05	[Ao2] Output monitor selection	Monitor parameters (Refer to "9.16.3 Selecting Monitor Data for Analog/Pulse Output ")	dA-01	○	37E1h	0 to 65535 (Register No.)	–	9-16-15
Cd-06	Analog adjust gain basis selection	00: Bias value based full scale 01: Fixed full scale	00	○	37E2h	0 to 1	–	9-16-8 9-16-16
Cd-10	Analog monitor adjustment mode enable	00: Disable 01: Enable	00	○	37E6h	0 to 1	–	9-16-13 9-16-19
Cd-11	[FM] Output filter time constant	1 to 500 (ms)	10	○	37E7h	1 to 500	1	9-16-14
Cd-12	[FM] Data type selection	00: Absolute value 01: Signed value	00	○	37E8h	0 to 1	–	9-16-8 9-16-13
Cd-13	[FM] Bias adjustment	-100.0 to 100.0 (%)	0.0	○	37E9h	-1000 to 1000	0.1	9-16-8
Cd-14	[FM] Gain adjustment	-1000.0 to 1000.0 (%)	100.0	○	37EAh	-10000 to 10000	0.1	9-16-8
Cd-15	Adjustment mode [FM] output level	-100.0 to 100.0 (%)	100.0	○	37EBh	-1000 to 1000	0.1	9-16-13
Cd-16	Pulse input/output scale conversion gain	0.01 to 100.00	1.00	○	37ECh	1 to 10000	0.01	9-16-14
Cd-21	[Ao1] Output filter time constant	1 to 500 (ms)	10	○	37F1h	1 to 500	1	9-16-20
Cd-22	[Ao1] Data type selection	00: Absolute value 01: Signed value	00	○	37F2h	0 to 1	–	9-16-16 9-16-19
Cd-23	[Ao1] Bias adjustment (Voltage/Current)	-100.0 to 100.0 (%)	0.0	○	37F3h	-1000 to 1000	0.1	9-16-16
Cd-24	[Ao1] Gain adjustment (Voltage/Current)	-1000.0 to 1000.0 (%)	100.0	○	37F4h	-10000 to 10000	0.1	9-16-16
Cd-25	Adjustment mode [Ao1] output level	-100.0 to 100.0 (%)	100.0	○	37F5h	-1000 to 1000	0.1	9-16-19
Cd-26	[Ao1] Output type selection	01: Voltage 02: Current	01	○	37F6h	1 to 2	–	9-16-15
Cd-31	[Ao2] Output filter time constant	1 to 500 (ms)	10	○	37FBh	1 to 500	1	9-16-20
Cd-32	[Ao2] Data type selection	00: Absolute value 01: Signed value	00	○	37FCh	0 to 1	–	9-16-16 9-16-19
Cd-33	[Ao2] Bias adjustment (Voltage)	-100.0 to 100.0 (%)	0.0	○	37FDh	-1000 to 1000	0.1	9-16-16
Cd-34	[Ao2] Gain adjustment (Voltage)	-1000.0 to 1000.0 (%)	100.0	○	37FEh	-10000 to 10000	0.1	9-16-16
Cd-35	Adjustment mode [Ao2] output level	-100.0 to 100.0 (%)	100.0	○	37FFh	-1000 to 1000	0.1	9-16-19
Cd-36	[Ao2] Output type selection	01: Voltage 03: Pulse	03	○	3800h	1 to 3	–	9-16-7 9-16-15
CE Parameter								
CE101	Low current signal output mode selection, 1st-motor	00: During accel./decel. and constant speed 01: During constant speed only	01	○	3841h	0 to 1	–	9-11-4
CE102	Low current detection level 1, 1st-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	3842h	(0.00 to 2.00) ×CTL rated current	0.1	9-11-4
						0 to 20000*2	0.01	

*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CE103	Low current detection level 2, 1st-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	3843h	(0.00 to 2.00) ×CTL rated current	0.1	9-11-4
						0 to 20000[*2]	0.01	
CE105	Overload signal output mode selection, 1st-motor	00: During accel./decel. and constant speed 01: During constant speed only	01	○	3845h	0 to 1	–	9-11-3
CE106	Overload warning level 1, 1st-motor	(0.00 to 2.00)× CTL rated current (A)	1.15× CTL rated current	○	3846h	(0.00 to 2.00) ×CTL rated current	0.1	9-11-3
						0 to 20000[*2]	0.01	
CE107	Overload warning level 2, 1st-motor	(0.00 to 2.00)× CTL rated current (A)	1.15× CTL rated current	○	3847h	(0.00 to 2.00) ×CTL rated current	0.1	9-11-3
						0 to 20000[*2]	0.01	
CE-10	Arrival frequency 1 value setting during acceleration	0.00 to 590.00 (Hz)	0.00	○	384Ah	0 to 59000	0.01	9-13-2
CE-11	Arrival frequency 1 value setting during deceleration	0.00 to 590.00 (Hz)	0.00	○	384Bh	0 to 59000	0.01	9-13-2
CE-12	Arrival frequency 2 value setting during acceleration	0.00 to 590.00 (Hz)	0.00	○	384Ch	0 to 59000	0.01	9-13-2
CE-13	Arrival frequency 2 value setting during deceleration	0.00 to 590.00 (Hz)	0.00	○	384Dh	0 to 59000	0.01	9-13-2
CE120	Over-torque level (Forward drive), 1st-motor	0.0 to 500.0 (%)	100.0	○	3854h	0 to 5000	0.1	9-6-6
CE121	Over-torque level (Reverse regenerative), 1st-motor	0.0 to 500.0 (%)	100.0	○	3855h	0 to 5000	0.1	9-6-6
CE122	Over-torque level (Reverse drive), 1st-motor	0.0 to 500.0 (%)	100.0	○	3856h	0 to 5000	0.1	9-6-6
CE123	Over-torque level (Forward regenerative), 1st-motor	0.0 to 500.0 (%)	100.0	○	3857h	0 to 5000	0.1	9-6-6
CE124	Over/Under torque output signal mode, 1st-motor	00: During accel./decel. and constant speed 01: During constant speed only	01	○	3858h	0 to 1	–	9-6-10
CE125	Over/Under torque selection, 1st-motor	00: Over torque 01: Under torque	00	○	3859h	0 to 1	–	9-6-10
CE-30	Electronic thermal warning level (Motor)	0.00 to 100.00 (%)	90.00	○	385Eh	0 to 10000	0.01	9-11-5
CE-31	Electronic thermal warning level (Inverter)	0.00 to 100.00 (%)	90.00	○	385Fh	0 to 10000	0.01	9-11-6
CE-33	Zero speed detection level	0.00 to 100.00 (Hz)	0.00	○	3861h	0 to 10000	0.01	9-13-4
CE-34	Cooling fin overheat warning level	0 to 200 (℃)	100	○	3862h	0 to 200	1	9-11-8
CE-36	Accum. RUN time (RNT) / Accum. Power-on time (ONT) setting	0 to 100000 (hr)	0	○	3864h 3865h	0 to 100000	1	9-11-12
CE-40	[Ai1] Window comparator higher limit	0 to 100 (%) Min. : ([CE-41]+[CE-42])×2	100	○	3868h	0 to 100	1	9-11-13

*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CE-41	[Ai1] Window comparator lower limit	0 to 100 (%) Max. : ([CE-40]-[CE-42])×2	0	○	3869h	0 to 100	1	9-11-13
CE-42	[Ai1] Window comparator hysteresis width	0 to 10 (%) Max. : ([CE-40]-[CE-41])/2	0	○	386Ah	0 to 10	1	9-11-13
CE-43	[Ai2] Window comparator higher limit	0 to 100 (%) Min. : ([CE-44]+[CE-45])×2	100	○	386Bh	0 to 100	1	9-11-13
CE-44	[Ai2] Window comparator lower limit	0 to 100 (%) Max. : ([CE-43]-[CE-45])×2	0	○	386Ch	0 to 100	1	9-11-13
CE-45	[Ai2] Window comparator hysteresis width	0 to 10 (%) Max. : ([CE-43]-[CE-44])/2	0	○	386Dh	0 to 10	1	9-11-13
CE-50	[Ai1] Operation set level at disconnection or compare event	0 to 100 (%)	0	○	3872h	0 to 100	1	9-11-13
CE-51	[Ai1] Operation set level implement timing	00: Disable 01: Enable (at WCAi1 active) 02: Enable (at WCAi1 de-active)	00	○	3873h	0 to 2	–	9-11-13
CE-52	[Ai2] Operation set level at disconnection or compare event	0 to 100 (%)	0	○	3874h	0 to 100	1	9-11-13
CE-53	[Ai2] Operation set level implement timing	00: Disable 01: Enable (at WCAi2 active) 02: Enable (at WCAi2 de-active)	00	○	3875h	0 to 2	–	9-11-13
CE-60	Output frequency related filter for terminal function	0 to 2000 (ms)	20	○	387Ch	0 to 2000	1	9-13-4
CE-61	Output current related filter for terminal function	0 to 2000 (ms)	300	○	387Dh	0 to 2000	1	9-11-3 9-11-4
CE-62	Output torque related filter for terminal function	0 to 2000 (ms)	100	○	387Eh	0 to 2000	1	9-6-9
CE201	Low current signal output mode selection, 2nd-motor	00: During accel./decel. and constant speed 01: During constant speed only	01	○	5F51h	0 to 1	–	9-7-25 9-11-4
CE202	Low current detection level 1, 2nd-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	5F52h	(0.00 to 2.00) ×CTL rated current 0 to 20000*2	0.1 0.01	9-7-25 9-11-4
CE203	Low current detection level 2, 2nd-motor	(0.00 to 2.00)× CTL rated current (A)	1.00× CTL rated current	○	5F53h	(0.00 to 2.00) ×CTL rated current 0 to 20000*2	0.1 0.01	9-7-25 9-11-4
CE205	Overload signal output mode selection, 2nd-motor	00: During accel./decel. and constant speed 01: During constant speed only	01	○	5F55h	0 to 1	–	9-7-25 9-11-3
CE206	Overload warning level 1, 2nd-motor	(0.00 to 2.00)×CTL rated current (A)	1.15× CTL rated current	○	5F56h	(0.00 to 2.00) ×CTL rated current 0 to 20000*2	0.1 0.01	9-7-25 9-11-3
CE207	Overload warning level 2, 2nd-motor	(0.00 to 2.00)×CTL rated current (A)	1.15× CTL rated current	○	5F57h	(0.00 to 2.00) ×CTL rated current 0 to 20000*2	0.1 0.01	9-7-25 9-11-3
CE220	Over-torque level (Forward drive), 2nd-motor	0.0 to 500.0 (%)	100.0	○	5F64h	0 to 5000	0.1	9-7-25 9-6-6

*2. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CE221	Over-torque level (Reverse regenerative), 2nd-motor	0.0 to 500.0 (%)	100.0	○	5F65h	0 to 5000	0.1	9-7-25 9-6-6
CE222	Over-torque level (Reverse drive), 2nd-motor	0.0 to 500.0 (%)	100.0	○	5F66h	0 to 5000	0.1	9-7-25 9-6-6
CE223	Over-torque level (Forward regenerative), 2nd motor	0.0 to 500.0 (%)	100.0	○	5F67h	0 to 5000	0.1	9-7-25 9-6-6
CE224	Over/Under torque output signal mode, 2nd-motor	00: During accel./decel. and constant speed 01: During constant speed only	01	○	5F68h	0 to 1	–	9-7-25 9-6-10
CE225	Over/Under torque selection, 2nd-motor	00: Over torque 01: Under torque	00	○	5F69h	0 to 1	–	9-7-25 9-6-10
CF Parameter								
CF-01	RS485 communication baud rate selection	03: 2400bps 04: 4800bps 05: 9600bps 06: 19.2kbps 07: 38.4kbps 08: 57.6kbps 09: 76.8kbps 10: 115.2kbps	05	○	38A5h	3 to 10	–	11-1-1
CF-02	RS485 communication node address	1 to 247	1	○	38A6h	1 to 247	1	11-1-1
CF-03	RS485 communication parity selection	00: no parity 01: Even parity 02: Odd parity	00	○	38A7h	0 to 2	–	11-1-1
CF-04	RS485 communication stop bit selection	01: 1-bit 02: 2-bit	01	○	38A8h	1 to 2	–	11-1-1
CF-05	RS485 communication error selection	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run stop 04: Deceleration stop	02	○	38A9h	0 to 4	–	11-1-1
CF-06	RS485 communication timeout setting	0.00 to 100.00 (s)	0.00	○	38AAh	0 to 10000	0.01	11-1-1
CF-07	RS485 communication wait time setting	0 to 1000 (ms)	0	○	38ABh	0 to 1000	1	11-1-1
CF-08	RS485 communication mode selection	01: Modbus-RTU 02: Communication between inverters (EzCOM) 03: Communication between inverters (EzCOM Administrator)	01	○	38ACh	1 to 3	–	11-1-1
CF-11	Register data AV<=>% conversion function	00: A, V 01: %	00	×	38AFh	0 to 1	–	11-1-1
CF-12	RS485 endianness selection	00: Big endian 01: Little endian 02: Special endian	00	○	38B0h	0 to 2	–	11-1-1
CF-20	EzCOM start node No.	1 to 8	1	×	38B8h	1 to 8	1	11-4-2
CF-21	EzCOM end node No.	1 to 8	1	×	38B9h	1 to 8	1	11-4-2
CF-22	EzCOM start method selection	00: [ECOM] terminal 01: Always enable	00	×	38BAh	0 to 1	–	11-4-2
CF-23	EzCOM data size	1 to 5	5	○	38BBh	1 to 5	1	11-4-2
CF-24	EzCOM destination address 1	1 to 247	1	○	38BCh	1 to 247	1	11-4-2
CF-25	EzCOM destination register 1	0000h to FFFFh	0000h	○	38BDh	0000h to FFFFh	1	11-4-2
CF-26	EzCOM source register 1	0000h to FFFFh	0000h	○	38BEh	0000h to FFFFh	1	11-4-2

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Modbus communication Data range	Modbus communication Resolution	Page
CF-27	EzCOM destination address 2	1 to 247	2	○	38BFh	1 to 247	1	11-4-2
CF-28	EzCOM destination register 2	0000h to FFFFh	0000h	○	38C0h	0000h to FFFFh	1	11-4-2
CF-29	EzCOM source register 2	0000h to FFFFh	0000h	○	38C1h	0000h to FFFFh	1	11-4-2
CF-30	EzCOM destination address 3	1 to 247	3	○	38C2h	1 to 247	1	11-4-2
CF-31	EzCOM destination register 3	0000h to FFFFh	0000h	○	38C3h	0000h to FFFFh	1	11-4-2
CF-32	EzCOM source register 3	0000h to FFFFh	0000h	○	38C4h	0000h to FFFFh	1	11-4-2
CF-33	EzCOM destination address 4	1 to 247	4	○	38C5h	1 to 247	1	11-4-2
CF-34	EzCOM destination register 4	0000h to FFFFh	0000h	○	38C6h	0000h to FFFFh	1	11-4-2
CF-35	EzCOM source register 4	0000h to FFFFh	0000h	○	38C7h	0000h to FFFFh	1	11-4-2
CF-36	EzCOM destination address 5	1 to 247	5	○	38C8h	1 to 247	1	11-4-2
CF-37	EzCOM destination register 5	0000h to FFFFh	0000h	○	38C9h	0000h to FFFFh	1	11-4-2
CF-38	EzCOM source register 5	0000h to FFFFh	0000h	○	38CAh	0000h to FFFFh	1	11-4-2
CF-50	USB communication node address	1 to 247	1	×	38D6h	1 to 247	1	12-2-2
CF-61	Output current monitor filter	0 to 1000 (ms)	300	○	38E1h	0 to 1000	1	10-1-3
CF-62	Output torque monitor filter	0 to 1000 (ms)	100	○	38E2h	0 to 1000	1	10-1-5
CF-63	Output voltage monitor filter	0 to 1000 (ms)	100	○	38E3h	0 to 1000	1	10-1-6
CF-64	Input/Output power filter	0 to 1000 (ms)	400	○	38E4h	0 to 1000	1	10-1-7 10-1-8
CG Parameter								
CG-01	Register mapping function selection	00:Disable 01:Enable	00	○	3909h	0 to 1	–	11-3-1
CG-11	External register 1	0000h to FFFFh	0000h	○	3913h	0000h to FFFFh	1	11-3-1
CG-12	External register 2	0000h to FFFFh	0000h	○	3914h		1	11-3-1
CG-13	External register 3	0000h to FFFFh	0000h	○	3915h		1	11-3-1
CG-14	External register 4	0000h to FFFFh	0000h	○	3916h		1	11-3-1
CG-15	External register 5	0000h to FFFFh	0000h	○	3917h		1	11-3-1
CG-16	External register 6	0000h to FFFFh	0000h	○	3918h		1	11-3-1
CG-17	External register 7	0000h to FFFFh	0000h	○	3919h		1	11-3-1
CG-18	External register 8	0000h to FFFFh	0000h	○	391Ah		1	11-3-1
CG-19	External register 9	0000h to FFFFh	0000h	○	391Bh		1	11-3-1
CG-20	External register 10	0000h to FFFFh	0000h	○	391Ch		1	11-3-1
CG-31	External register 1 format	00: Unsigned word 01: Signed word	00	○	3927h	0 to 1	–	11-3-1
CG-32	External register 2 format	00: Unsigned word 01: Signed word	00	○	3928h	0 to 1	–	11-3-1
CG-33	External register 3 format	00: Unsigned word 01: Signed word	00	○	3929h	0 to 1	–	11-3-1
CG-34	External register 4 format	00: Unsigned word 01: Signed word	00	○	392Ah	0 to 1	–	11-3-1
CG-35	External register 5 format	00: Unsigned word 01: Signed word	00	○	392Bh	0 to 1	–	11-3-1
CG-36	External register 6 format	00: Unsigned word 01: Signed word	00	○	392Ch	0 to 1	–	11-3-1
CG-37	External register 7 format	00: Unsigned word 01: Signed word	00	○	392Dh	0 to 1	–	11-3-1

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CG-38	External register 8 format	00: Unsigned word 01: Signed word	00	○	392Eh	0 to 1	–	11-3-1
CG-39	External register 9 format	00: Unsigned word 01: Signed word	00	○	392Fh	0 to 1	–	11-3-1
CG-40	External register 10 format	00: Unsigned word 01: Signed word	00	○	3930h	0 to 1	–	11-3-1
CG-51	External register 1 scaling	0.001 to 65.535	1.000	○	393Bh	1 to 65535	0.001	11-3-1
CG-52	External register 2 scaling	0.001 to 65.535	1.000	○	393Ch	1 to 65535	0.001	11-3-1
CG-53	External register 3 scaling	0.001 to 65.535	1.000	○	393Dh	1 to 65535	0.001	11-3-1
CG-54	External register 4 scaling	0.001 to 65.535	1.000	○	393Eh	1 to 65535	0.001	11-3-1
CG-55	External register 5 scaling	0.001 to 65.535	1.000	○	393Fh	1 to 65535	0.001	11-3-1
CG-56	External register 6 scaling	0.001 to 65.535	1.000	○	3940h	1 to 65535	0.001	11-3-1
CG-57	External register 7 scaling	0.001 to 65.535	1.000	○	3941h	1 to 65535	0.001	11-3-1
CG-58	External register 8 scaling	0.001 to 65.535	1.000	○	3942h	1 to 65535	0.001	11-3-1
CG-59	External register 9 scaling	0.001 to 65.535	1.000	○	3943h	1 to 65535	0.001	11-3-1
CG-60	External register 10 scaling	0.001 to 65.535	1.000	○	3944h	1 to 65535	0.001	11-3-1
CG-71	Internal register 1	0000h to FFFFh	0000h	○	394Fh	0000h to FFFFh	1	11-3-1
CG-72	Internal register 2	0000h to FFFFh	0000h	○	3950h		1	11-3-1
CG-73	Internal register 3	0000h to FFFFh	0000h	○	3951h		1	11-3-1
CG-74	Internal register 4	0000h to FFFFh	0000h	○	3952h		1	11-3-1
CG-75	Internal register 5	0000h to FFFFh	0000h	○	3953h		1	11-3-1
CG-76	Internal register 6	0000h to FFFFh	0000h	○	3954h		1	11-3-1
CG-77	Internal register 7	0000h to FFFFh	0000h	○	3955h		1	11-3-1
CG-78	Internal register 8	0000h to FFFFh	0000h	○	3956h		1	11-3-1
CG-79	Internal register 9	0000h to FFFFh	0000h	○	3957h		1	11-3-1
CG-80	Internal register 10	0000h to FFFFh	0000h	○	3958h		1	11-3-1
CH Parameter								
CH-01	Sync input terminal function selection 1	Refer to "18.2.6 List of Intelligent Input Terminal Functions"	000	○	396Dh	0 to 110	1	9-16-21
CH-02	Sync input terminal function selection 2		000	○	396Eh	0 to 110	1	9-16-21
CH-03	Sync input terminal function selection 3		000	○	396Fh	0 to 110	1	9-16-21
CH-04	Sync input terminal function selection 4		000	○	3970h	0 to 110	1	9-16-21
CH-05	Sync input terminal function selection 5		000	○	3971h	0 to 110	1	9-16-21
CH-06	Sync input terminal function selection 6		000	○	3972h	0 to 110	1	9-16-21
CH-11	Sync output terminal function selection 1	Refer to "18.2.7 List of Intelligent Output Terminal Functions"	00	○	3977h	0 to 98	1	9-16-21
CH-12	Sync output terminal function selection 2		00	○	3978h	0 to 98	1	9-16-21
CH-13	Sync output terminal function selection 3		00	○	3979h	0 to 98	1	9-16-21
CH-14	Sync output terminal function selection 4		00	○	397Ah	0 to 98	1	9-16-21
CH-15	Sync output terminal function selection 5		00	○	397Bh	0 to 98	1	9-16-21
CH-16	Sync output terminal function selection 6		00	○	397Ch	0 to 98	1	9-16-21

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
CH-21	Sync terminal logic selection 1	00: Normally Open (NO) 01: Normally Closed (NC)	00	○	3981h	0 to 1	–	9-16-22
CH-22	Sync terminal logic selection 2		00	○	3982h	0 to 1	–	9-16-22
CH-23	Sync terminal logic selection 3		00	○	3983h	0 to 1	–	9-16-22
CH-24	Sync terminal logic selection 4		00	○	3984h	0 to 1	–	9-16-22
CH-25	Sync terminal logic selection 5		00	○	3985h	0 to 1	–	9-16-22
CH-26	Sync terminal logic selection 6		00	○	3986h	0 to 1	–	9-16-22
CH-30	Sync terminal on-delay time 1	0.00 to 100.00 (s)	0.00	○	398Ah	0 to 10000	0.01	9-16-21 9-16-22
CH-31	Sync terminal off-delay time 1	0.00 to 100.00 (s)	0.00	○	398Bh	0 to 10000	0.01	9-16-21 9-16-22
CH-32	Sync terminal on-delay time 2	0.00 to 100.00 (s)	0.00	○	398Ch	0 to 10000	0.01	9-16-21 9-16-22
CH-33	Sync terminal off-delay time 2	0.00 to 100.00 (s)	0.00	○	398Dh	0 to 10000	0.01	9-16-21 9-16-22
CH-34	Sync terminal on-delay time 3	0.00 to 100.00 (s)	0.00	○	398Eh	0 to 10000	0.01	9-16-21 9-16-22
CH-35	Sync terminal off-delay time 3	0.00 to 100.00 (s)	0.00	○	398Fh	0 to 10000	0.01	9-16-21 9-16-22
CH-36	Sync terminal on-delay time 4	0.00 to 100.00 (s)	0.00	○	3990h	0 to 10000	0.01	9-16-21 9-16-22
CH-37	Sync terminal off-delay time 4	0.00 to 100.00 (s)	0.00	○	3991h	0 to 10000	0.01	9-16-21 9-16-22
CH-38	Sync terminal on-delay time 5	0.00 to 100.00 (s)	0.00	○	3992h	0 to 10000	0.01	9-16-21 9-16-22
CH-39	Sync terminal off-delay time 5	0.00 to 100.00 (s)	0.00	○	3993h	0 to 10000	0.01	9-16-21 9-16-22
CH-40	Sync terminal on-delay time 6	0.00 to 100.00 (s)	0.00	○	3994h	0 to 10000	0.01	9-16-21 9-16-22
CH-41	Sync terminal off-delay time 6	0.00 to 100.00 (s)	0.00	○	3995h	0 to 10000	0.01	9-16-21 9-16-22

18.2.6 List of Intelligent Input Terminal Functions

Function Code	Symbol	Name	Page
000	no	Not use	—
001	FW	Forward rotation	9-1-3
002	RV	Reverse rotation	9-1-3
003	CF1	Multi speed selection 1	9-2-5 9-3-8
004	CF2	Multi speed selection 2	
005	CF3	Multi speed selection 3	
006	CF4	Multi speed selection 4	
007	SF1	Multi speed Bit-1	
008	SF2	Multi speed Bit-2	
009	SF3	Multi speed Bit-3	
010	SF4	Multi speed Bit-4	
011	SF5	Multi speed Bit-5	
012	SF6	Multi speed Bit-6	
013	SF7	Multi speed Bit-7	
014	ADD	Trigger for frequency addition	9-2-15
015	SCHG	Main/Sub speed reference change	9-2-13
016	STA	3-wire start	9-1-4
017	STP	3-wire stop	
018	F/R	3-wire forward/reverse	
019	AHD	Analog command holding	9-2-17
020	FUP	Remote control Speed-UP function	9-2-16 9-8-17
021	FDN	Remote control Speed-DOWN function	
022	UDC	Remote control Speed data clearing	
023	F-OP	Force operation	9-1-6 9-2-18
024	SET	2nd-motor control	9-7-28
028	RS	Reset	9-15-13
029	JG	Jogging	9-2-8
030	DB	External DC braking	9-7-11
031	2CH	2-stage acceleration/deceleration	9-3-3
032	FRS	Free run stop	9-7-10
033	EXT	External fault	9-10-4
034	USP	Unattended start protection	9-10-5
035	CS	Commercial power supply change	9-7-15
036	SFT	Soft-Lock	7-2-11
037	BOK	Answer back from Brake	9-7-16
038	OLR	Overload restriction selection	9-9-2
039	KHC	Accumulated input power clearance	10-1-7
040	OKHC	Accumulated output power clearance	10-1-8
041	PID	Disable PID1	9-8-15
042	PIDC	PID1 integration reset	9-8-15
043	PID2	Disable PID2	9-8-28
044	PIDC2	PID2 integration reset	9-8-28
051	SVC1	Multi set-point selection 1	9-8-11
052	SVC2	Multi set-point selection 2	
053	SVC3	Multi set-point selection 3	
054	SVC4	Multi set-point selection 4	

Function Code	Symbol	Name	Page
055	PRO	PID gain change	9-8-16
056	PIO1	PID output switching 1	9-8-25
058	SLEP	SLEEP condition activation	9-8-20
059	WAKE	WAKE condition activation	9-8-20
060	TL	Torque limit enable	9-6-6
061	TRQ1	Torque limit selection bit 1	9-6-8
062	TRQ2	Torque limit selection bit 2	
063	PPI	P/PI control mode selection	9-6-13
064	CAS	Control gain change	9-6-15
067	ATR	Permission of torque control	9-6-2
068	TBS	Torque Bias enable	9-6-11
069	ORT	Home search function	9-14-15
071	LAC	Acceleration/Deceleration cancellation	9-3-7
072	PCLR	Clearance of position deviation	9-14-13
076	CP1	Multistage position settings selection 1	9-14-6
077	CP2	Multistage position settings selection 2	
078	CP3	Multistage position settings selection 3	
079	CP4	Multistage position settings selection 4	
080	ORL	Limit signal of Homing function	9-14-10
081	ORG	Start signal of Homing function	9-14-10
082	FOT	Forward Over Travel	9-14-14
083	ROT	Reserve Over Travel	
084	SPD	Speed/Position switching	9-14-17
085	PSET	Position data presetting	9-14-13
086	MI1	General-purpose input 1	12-2-4
087	MI2	General-purpose input 2	
088	MI3	General-purpose input 3	
089	MI4	General-purpose input 4	
090	MI5	General-purpose input 5	
091	MI6	General-purpose input 6	
092	MI7	General-purpose input 7	
093	MI8	General-purpose input 8	
097	PCC	Pulse counter clearing	9-15-10
098	ECOM	EzCOM activation	11-4-2
099	PRG	Program RUN	12-2-2
100	HLD	Acceleration/Deceleration disable	9-3-4
101	REN	RUN enable	9-4-4
102	DISP	Display lock	7-2-15
103	PLA	Pulse input A	9-15-10
104	PLB	Pulse input B	
105	EMF	Emergency-Force Drive activation	9-7-23
107	COK	Contactor check signal	9-7-19
108	DTR	Data trace start	12-3-3
109	PLZ	Pulse input Z	9-14-10 9-14-15
110	TCH	Teach-in signal	9-14-7

18.2.7 List of Intelligent Output Terminal Functions

Function Code	Symbol	Name	Page
000	no	Not use	—
001	RUN	Running	9-12-1
002	FA1	Constant-frequency reached	9-13-1
003	FA2	Set frequency overreached	9-13-2
004	FA3	Set frequency reached	9-13-3
005	FA4	Set frequency overreached 2	9-13-2
006	FA5	Set frequency reached 2	9-13-3
007	IRDY	Inverter ready	9-12-4
008	FWR	Forward rotation	9-12-2
009	RVR	Reverse rotation	9-12-2
010	FREF	Frequency reference = Keypad is selected	9-2-3
011	REF	Run command = Keypad is selected	9-1-2
012	SETM	2nd-motor control is selected	9-7-28
016	OPO	Option output *1	—
017	AL	Alarm	9-11-1
018	MJA	Major failure	9-11-2
019	OTQ	Over-torque	9-6-10
021	UV	Under-voltage	9-9-9
022	TRQ	Torque limited	9-6-9
023	IPS	IP-Non stop function is active	9-9-20
024	RNT	Accumulated operation time over	9-11-12
025	ONT	Accumulated power-on time over	9-11-12
026	THM	Electronic thermal alarm (Motor)	9-11-5
027	THC	Electronic thermal alarm (Inverter)	9-11-6
029	WAC	Capacitor life warning	9-11-9
030	WAF	Cooling-fan life warning	9-11-10
031	FR	RUN command active	9-12-3
032	OHF	Heat sink overheat warning	9-11-8
033	LOC	Low-current indication	9-11-4
034	LOC2	Low-current indication 2	9-11-4
035	OL	Overload warning notice	9-11-3
036	OL2	Overload warning notice 2	9-11-3
037	BRK	Brake release	9-7-16
038	BER	Brake error	9-14-18
039	CON	Contactor control	9-7-19

Function Code	Symbol	Name	Page
040	ZS	Zero speed detection	9-13-4
041	DSE	Speed over deviation	9-5-20
043	POK	Positioning completed	9-14-1
044	PCMP	Pulse count compare match output	9-15-11
045	OD	Over deviation for PID control	9-8-30
046	FBV	PID feedback comparison	9-8-31
047	OD2	Over deviation for PID2 control	9-8-30
048	FBV2	PID2 feedback comparison	9-8-31
049	NDc	Communication line disconnection	11-1-1
050	Ai1Dc	Analog Ai1 disconnection detection	9-11-13
051	Ai2Dc	Analog Ai2 disconnection detection	9-11-13
056	WCAi1	Window comparator Ai1	9-11-13
057	WCAi2	Window comparator Ai2	9-11-13
062	LOG1	Logical operation result 1	9-13-5
063	LOG2	Logical operation result 2	9-13-5
064	LOG3	Logical operation result 3	9-13-5
069	MO1	General-purpose output 1	12-2-4
070	MO2	General-purpose output 2	12-2-4
071	MO3	General-purpose output 3	12-2-4
076	EMFC	Emergency-Force Drive indicator	9-7-23
077	EMBP	Bypass mode indicator	9-7-23
078	WFT	Trace function waiting for trigger	12-3-3
079	TRA	Trace function data logging	12-3-3
080	LBK	Low-battery of keypad *2	7-2-17
081	OVS	Overvoltage power supply	9-11-7
082	ABU	Abnormal exceeded Upper limit	9-11-16
083	ABL	Abnormal fall below Lower limit	9-11-16
088	FSC	STO input discrepancy	14-1-5
093	SSE	PID soft start error	9-8-19
094	SFM1	ST1 feedback monitor	14-1-5
095	SFM2	ST2 feedback monitor	14-1-5
096	EDM	STO state monitor	14-1-3
097	WAP	Power module life warning	9-11-11
098	WAIC	Inrush circuit life warning	9-11-11

*1. "Option output [OPO]" function is not currently functioning for future expansion. Therefore, do not assign.
*2. Valid when using remote operator VOP.

18.2.8 H Parameter Group

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
HA-01	Auto-tuning selection	00: Disable 01: No-rotation 02: Rotation	00	×	3A99h	0 to 2	–	8-3-1
HA-02	Auto-tuning RUN command source selection	00: Keypad's RUN-key 01: Setting by [AA111]/[AA211]	00	×	3A9Ah	0 to 1	–	8-3-1
HA110	Stabilization constant, 1st-motor	0 to 1000 (%)	100	○	3AA2h	0 to 1000	1	9-5-12
HA112	Stabilization ramp function end ratio, 1st-motor	0 to 100 (%)	30	×	3AA4h	0 to 100	1	9-5-12
HA113	Stabilization ramp function start ratio, 1st-motor	0 to 100 (%)	10	×	3AA5h	0 to 100	1	9-5-12
HA115	Speed response, 1st-motor	0 to 1000 (%)	100	○	3AA7h	0 to 1000	1	9-5-13
HA120	ASR gain switching mode selection, 1st-motor	00: [CAS] terminal 01: Parameter setting	00	○	3AACh	0 to 1	–	9-6-2
HA121	ASR gain switching time setting, 1st-motor	0 to 10000 (ms)	100	○	3AADh	0 to 10000	1	9-6-2
HA122	ASR gain mapping intermediate speed 1, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	3AAEh	0 to 59000	0.01	9-6-2
HA123	ASR gain mapping intermediate speed 2, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	3AAFh	0 to 59000	0.01	9-6-2
HA124	ASR gain mapping maximum speed, 1st-motor	0.00 to 590.00 (Hz)	0.00	○	3AB0h	0 to 59000	0.01	9-6-2
HA125	ASR gain mapping P-gain 1, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB1h	0 to 10000	0.1	9-6-2
HA126	ASR gain mapping I-gain 1, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB2h	0 to 10000	0.1	9-6-2
HA127	ASR gain mapping P control P-gain 1, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB3h	0 to 10000	0.1	9-6-2
HA128	ASR gain mapping P-gain 2, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB4h	0 to 10000	0.1	9-6-2
HA129	ASR gain mapping I-gain 2, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB5h	0 to 10000	0.1	9-6-2
HA130	ASR gain mapping P control P-gain 2, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB6h	0 to 10000	0.1	9-6-2
HA131	ASR gain mapping P-gain 3, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB7h	0 to 10000	0.1	9-6-2
HA132	ASR gain mapping I-gain 3, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB8h	0 to 10000	0.1	9-6-2
HA133	ASR gain mapping P-gain 4, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3AB9h	0 to 10000	0.1	9-6-2
HA134	ASR gain mapping I-gain 4, 1st-motor	0.0 to 1000.0 (%)	100.0	○	3ABAh	0 to 10000	0.1	9-6-2
HA181	Cable length parameter, 1st-motor	5 to 20	10	○	3AE9h	5 to 20	1	8-1-1 8-3-1
HA210	Stabilization constant, 2nd-motor	0 to 1000 (%)	100	○	61B2h	0 to 1000	1	9-5-12 9-7-28

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
HA212	Stabilization ramp function end ratio, 2nd-motor	0 to 100	30	×	61B4h	0 to 100	1	9-5-12 9-7-28
HA213	Stabilization ramp function start ratio, 2nd-motor	0 to 100	10	×	61B5h	0 to 100	1	9-5-12 9-7-28
HA215	Speed response, 2nd-motor	0 to 1000 (%)	100	○	61B7h	0 to 1000	1	9-5-13 9-7-28
HA220	ASR gain switching mode selection, 2nd-motor	00: [CAS] terminal 01: Parameter setting	00	○	61BCh	0 to 1	–	9-6-2 9-7-28
HA221	ASR gain switching time setting, 2nd-motor	0 to 10000 (ms)	100	○	61BDh	0 to 10000	1	9-6-2 9-7-28
HA222	ASR gain mapping intermediate speed 1, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	61BEh	0 to 59000	0.01	9-6-2 9-7-28
HA223	ASR gain mapping intermediate speed 2, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	61BFh	0 to 59000	0.01	9-6-2 9-7-28
HA224	ASR gain mapping maximum speed, 2nd-motor	0.00 to 590.00 (Hz)	0.00	○	61C0h	0 to 59000	0.01	9-6-2 9-7-28
HA225	ASR gain mapping P-gain 1, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C1h	0 to 10000	0.1	9-6-2 9-7-28
HA226	ASR gain mapping I-gain 1, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C2h	0 to 10000	0.1	9-6-2 9-7-28
HA227	ASR gain mapping P control P-gain 1, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C3h	0 to 10000	0.1	9-6-2 9-7-28
HA228	ASR gain mapping P-gain 2, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C4h	0 to 10000	0.1	9-6-2 9-7-28
HA229	ASR gain mapping I-gain 2, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C5h	0 to 10000	0.1	9-6-2 9-7-28
HA230	ASR gain mapping P control P-gain 2, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C6h	0 to 10000	0.1	9-6-2 9-7-28
HA231	ASR gain mapping P-gain 3, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C7h	0 to 10000	0.1	9-6-2 9-7-28
HA232	ASR gain mapping I-gain 3, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C8h	0 to 10000	0.1	9-6-2 9-7-28
HA233	ASR gain mapping P-gain 4, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61C9h	0 to 10000	0.1	9-6-2 9-7-28
HA234	ASR gain mapping I-gain 4, 2nd-motor	0.0 to 1000.0 (%)	100.0	○	61CAh	0 to 10000	0.1	9-6-2 9-7-28
HA281	Cable length parameter, 2nd-motor	5 to 20	10	○	61F9h	5 to 20	1	8-1-1 8-3-1 9-7-28
Hb Parameter								
Hb102	Async. Motor capacity setting, 1st-motor	0.01 to 30.00 (kW)	Depends on inverter model and load type	×	3AFEh	1 to 3000	0.01	8-1-4

Code	Name	Data Range		Initial value	Change during running	Modbus communication			Page
						Register No.	Data range	Resolution	
Hb103	Async. Motor number of poles setting, 1st-motor	00:2P 01:4P 02:6P 03:8P 04:10P 05:12P 06:14P 07:16P 08:18P 09:20P 10:22P 11:24P	12:26P 13:28P 14:30P 15:32P 16:34P 17:36P 18:38P 19:40P 20:42P 21:44P 22:46P 23:48P	01	×	3AFFh	0 to 23	–	8-1-4
Hb104	Async. Motor base frequency setting, 1st-motor	30.00 to [Hb105] (Hz)		60.00/ 50.00/ 50.00*1	×	3B00h	3000 to 59000	0.01	8-1-4
Hb105	Async. Motor maximum frequency setting, 1st-motor	[Hb104] to 590.00 (Hz)		60.00/ 50.00/ 50.00*1	×	3B01h	3000 to 59000	0.01	8-1-4
Hb106	Async. Motor rated voltage, 1st-motor	1 to 1000 (V)		200/400 230/400 220/380*1	×	3B02h	1 to 1000	1	8-1-4
Hb108	Async. Motor rated current, 1st-motor	0.01 to 10000.00 (A)		Depends on inverter model and load type	×	3B04h 3B05h	1 to 1000000	0.01	8-1-4
Hb110	Async. Motor constant R1, 1st-motor	0.000001 to 1000.000000 (Ω)			×	3B06h 3B07h	1 to 1000000000	0.000001	8-1-1
Hb112	Async. Motor constant R2, 1st-motor	0.000001 to 1000.000000 (Ω)			×	3B08h 3B09h	1 to 1000000000	0.000001	8-1-1
Hb114	Async. Motor constant L, 1st-motor	0.000001 to 1000.000000 (mH)			×	3B0Ah 3B0Bh	1 to 1000000000	0.000001	8-1-1
Hb116	Async. Motor constant I0, 1st-motor	0.01 to 10000.00 (A)			×	3B0Ch 3B0Dh	1 to 1000000	0.01	8-1-1
Hb118	Async. Motor constant J, 1st-motor	0.00001 to 10000.00000 (kgm^2)			×	3B0Eh 3B0Fh	1 to 1000000000	0.00001	8-1-1
Hb130	Minimum frequency adjustment, 1st-motor	0.01 to 10.00 (Hz)		0.50	○	3B1Ah	0 to 1000	0.01	9-7-1
Hb131	Reduced voltage start time setting, 1st-motor	0 to 2000 (ms)		12	○	3B1Bh	0 to 2000	1	9-7-1
Hb140	Manual torque boost operation mode selection, 1st-motor	00: Disable 01: Always enable 02: Enable at Forward rotation 03: Enable at Reverse rotation		01	×	3B24h	0 to 3	–	9-5-8
Hb141	Manual torque boost value, 1st-motor	0.0 to 20.0 (%)		0.0	○	3B25h	0 to 200	0.1	9-5-8
Hb142	Manual torque boost peak speed, 1st-motor	0.0 to 50.0 (%)		0.0	○	3B26h	0 to 500	0.1	9-5-8
Hb145	Eco drive enable, 1st-motor	00: Disable 01: Enable		00	×	3B29h	0 to 1	–	9-5-9
Hb146	Eco drive response adjustment, 1st-motor	0 to 100 (%)		50	○	3B2Ah	0 to 100	1	9-5-9
Hb150	Free-V/f frequency 1 setting, 1st-motor	0.00 to [Hb152] (Hz)		0.00	×	3B2Eh	0 to 59000	0.01	9-5-4
Hb151	Free-V/f voltage 1 setting, 1st-motor	0.0 to 1000.0 (V)		0.0	×	3B2Fh	0 to 10000	0.1	9-5-4
Hb152	Free-V/f frequency 2 setting, 1st-motor	[Hb150] to [Hb154] (Hz)		0.00	×	3B30h	0 to 59000	0.01	9-5-4
Hb153	Free-V/f voltage 2 setting, 1st-motor	0.0 to 1000.0 (V)		0.0	×	3B31h	0 to 10000	0.1	9-5-4
Hb154	Free-V/f frequency 3 setting, 1st-motor	[Hb152] to [Hb156] (Hz)		0.00	×	3B32h	0 to 59000	0.01	9-5-4

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
Hb155	Free-V/f voltage 3 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	×	3B33h	0 to 10000	0.1	9-5-4
Hb156	Free-V/f frequency 4 setting, 1st-motor	[Hb154] to [Hb158] (Hz)	0.00	×	3B34h	0 to 59000	0.01	9-5-4
Hb157	Free-V/f voltage 4 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	×	3B35h	0 to 10000	0.1	9-5-4
Hb158	Free-V/f frequency 5 setting, 1st-motor	[Hb156] to [Hb160] (Hz)	0.00	×	3B36h	0 to 59000	0.01	9-5-4
Hb159	Free-V/f voltage 5 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	×	3B37h	0 to 10000	0.1	9-5-4
Hb160	Free-V/f frequency 6 setting, 1st-motor	[Hb158] to [Hb162] (Hz)	0.00	×	3B38h	0 to 59000	0.01	9-5-4
Hb161	Free-V/f voltage 6 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	×	3B39h	0 to 10000	0.1	9-5-4
Hb162	Free-V/f frequency 7 setting, 1st-motor	[Hb160] to [Hb164] (Hz)	0.00	×	3B3Ah	0 to 59000	0.01	9-5-4
Hb163	Free-V/f voltage 7 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	×	3B3Bh	0 to 10000	0.1	9-5-4
Hb170	Slip compensation P-gain with encoder, 1st-motor	0 to 1000 (%)	100	○	3B42h	0 to 1000	1	9-5-10
Hb171	Slip compensation I-gain with encoder, 1st-motor	0 to 1000 (%)	100	○	3B43h	0 to 1000	1	9-5-10
Hb180	Output voltage gain, 1st-motor	0 to 255 (%)	100	○	3B4Ch	0 to 255	1	9-5-12
Hb202	Async. Motor capacity setting, 2nd-motor	0.01 to 30.00	Depends on inverter model and load type	×	620Eh	1 to 3000	0.01	8-1-4 9-7-28
Hb203	Async. Motor number of poles setting, 2nd-motor	00:2P 01:4P 02:6P 03:8P 04:10P 05:12P 06:14P 07:16P 08:18P 09:20P 10:22P 11:24P 12:26P 13:28P 14:30P 15:32P 16:34P 17:36P 18:38P 19:40P 20:42P 21:44P 22:46P 23:48P	01	×	620Fh	0 to 23	–	8-1-4 9-7-28
Hb204	Async. Motor base frequency setting, 2nd-motor	30.00 to [Hb205] (Hz)	60.00/ 50.00/ 50.00*1	×	6210h	3000 to 59000	0.01	8-1-4 9-7-28
Hb205	Async. Motor maximum frequency setting, 2nd-motor	[Hb204] to 590.00 (Hz)	60.00/ 50.00/ 50.00*1	×	6211h	3000 to 59000	0.01	8-1-4 9-7-28
Hb206	Async. Motor rated voltage, 2nd-motor	1 to 1000 (V)	200/400 230/400 220/380*1	×	6212h	1 to 1000	1	8-1-4 9-7-28
Hb208	Async. Motor rated current, 2nd-motor	0.01 to 10000.00 (A)	Depends on inverter model and load type	×	6214h 6215h	1 to 1000000	0.01	8-1-4 9-7-28
Hb210	Async. Motor constant R1, 2nd-motor	0.000001 to 1000.000000 (Ω)		×	6216h 6217h	1 to 1000000000	0.000001	8-1-1 9-7-28
Hb212	Async. Motor constant R2, 2nd-motor	0.000001 to 1000.000000 (Ω)		×	6218h 6219h	1 to 1000000000	0.000001	8-1-1 9-7-28
Hb214	Async. Motor constant L, 2nd-motor	0.000001 to 1000.000000 (mH)		×	621Ah 621Bh	1 to 1000000000	0.000001	8-1-1 9-7-28

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Modbus communication Data range	Modbus communication Resolution	Page
Hb216	Async. Motor constant I0, 2nd-motor	0.01 to 10000.00 (A)		×	621Ch 621Dh	1 to 1000000	0.01	8-1-1 9-7-28
Hb218	Async. Motor constant J, 2nd-motor	0.00001 to 10000.00000 (kgm^2)		×	621Eh 621Fh	1 to 1000000000	0.00001	8-1-1 9-7-28
Hb230	Minimum frequency adjustment, 2nd-motor	0.00 to 10.00 (Hz)	0.50	○	622Ah	0 to 1000	0.01	9-7-1 9-7-28
Hb231	Reduced voltage start time setting, 2nd-motor	0 to 2000 (ms)	12	○	622Bh	0 to 2000	1	9-7-1 9-7-28
Hb240	Manual torque boost operation mode selection, 2nd-motor	00: Disable 01: Always enable 02: Enable at Forward rotation 03: Enable at Reverse rotation	01	×	6234h	0 to 3	–	9-5-8 9-7-28
Hb241	Manual torque boost value, 2nd-motor	0.0 to 20.0 (%)	0.0	○	6235h	0 to 200	0.1	9-5-8 9-7-28
Hb242	Manual torque boost peak speed, 2nd-motor	0.0 to 50.0 (%)	0.0	○	6236h	0 to 500	0.1	9-5-8 9-7-28
Hb245	Eco drive enable, 2nd-motor	00: Disable 01: Enable	00	×	6239h	0 to 1	–	9-5-9 9-7-28
Hb246	Eco drive response adjustment, 2nd-motor	0 to 100 (%)	50	○	623Ah	0 to 100	1	9-5-9 9-7-28
Hb250	Free-V/f frequency 1 setting, 2nd-motor	0.00 to [Hb252] (Hz)	0.00	×	623Eh	0 to 59000	0.01	9-5-4 9-7-28
Hb251	Free-V/f voltage 1 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	×	623Fh	0 to 10000	0.1	9-5-4 9-7-28
Hb252	Free-V/f frequency 2 setting, 2nd-motor	[Hb250] to [Hb254] (Hz)	0.00	×	6240h	0 to 59000	0.01	9-5-4 9-7-28
Hb253	Free-V/f voltage 2 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	×	6241h	0 to 10000	0.1	9-5-4 9-7-28
Hb254	Free-V/f frequency 3 setting, 2nd-motor	[Hb252] to [Hb256] (Hz)	0.00	×	6242h	0 to 59000	0.01	9-5-4 9-7-28
Hb255	Free-V/f voltage 3 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	×	6243h	0 to 10000	0.1	9-5-4 9-7-28
Hb256	Free-V/f frequency 4 setting, 2nd-motor	[Hb254] to [Hb258] (Hz)	0.00	×	6244h	0 to 59000	0.01	9-5-4 9-7-28
Hb257	Free-V/f voltage 4 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	×	6245h	0 to 10000	0.1	9-5-4 9-7-28
Hb258	Free-V/f frequency 5 setting, 2nd-motor	[Hb256] to [Hb260] (Hz)	0.00	×	6246h	0 to 59000	0.01	9-5-4 9-7-28
Hb259	Free-V/f voltage 5 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	×	6247h	0 to 10000	0.1	9-5-4 9-7-28
Hb260	Free-V/f frequency 6 setting, 2nd-motor	[Hb258] to [Hb262] (Hz)	0.00	×	6248h	0 to 59000	0.01	9-5-4 9-7-28
Hb261	Free-V/f voltage 6 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	×	6249h	0 to 10000	0.1	9-5-4 9-7-28
Hb262	Free-V/f frequency 7 setting, 2nd-motor	[Hb260] to [Hb264] (Hz)	0.00	×	624Ah	0 to 59000	0.01	9-5-4 9-7-28
Hb263	Free-V/f voltage 7 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	×	624Bh	0 to 10000	0.1	9-5-4 9-7-28
Hb270	Slip compensation P-gain with encoder, 2nd-motor	0 to 1000 (%)	100	○	6252h	0 to 1000	1	9-5-10 9-7-28
Hb271	Slip compensation I-gain with encoder, 2nd-motor	0 to 1000 (%)	100	○	6253h	0 to 1000	1	9-5-10 9-7-28
Hb280	Output voltage gain, 2nd-motor	0 to 255 (%)	100	○	625Ch	0 to 255	1	9-5-12 9-7-28
HC Parameter								
HC101	Automatic torque boost voltage compensation gain, 1st-motor	0 to 255 (%)	100	○	3B61h	0 to 255	1	9-5-6

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
HC102	Automatic torque boost slip compensation gain, 1st-motor	0 to 255 (%)	100	○	3B62h	0 to 255	1	9-5-6
HC111	Boost value at start, 1st-motor (IM-SLV)	0 to 50 (%)	0	○	3B6Bh	0 to 50	1	9-5-13
HC114	Direction reversal protection, 1st-motor	00: Disable 01: Enable	01/ 00/ 01*1	○	3B6Eh	0 to 1	–	9-4-3
HC115	Torque conversion method selection, 1st-motor	00: Torque 01: Current	00	○	3B6Fh	0 to 1	–	9-6-3
HC120	Torque current reference filter time constant, 1st-motor	0 to 100 (ms)	2	○	3B74h	0 to 100	1	9-5-13
HC121	Speed feedforward compensation gain, 1st-motor	0 to 1000 (%)	0	○	3B75h	0 to 1000	1	9-5-13
HC137	Flux settling level, 1st-motor	0.0 to 100.0 (%)	80.0	×	3B85h	0 to 1000	0.1	9-5-13
HC141	Modulation threshold 1, 1st-motor	0 to 133 (%)	115	○	3B89h	0 to 133	1	9-5-13
HC142	Modulation threshold 2, 1st-motor	0 to 133 (%)	115	○	3B8Ah	0 to 133	1	9-5-13
HC201	Automatic torque boost voltage compensation gain, 2nd-motor	0 to 255 (%)	100	○	6271h	0 to 255	1	9-5-6 9-7-28
HC202	Automatic torque boost slip compensation gain, 2nd-motor	0 to 255 (%)	100	○	6272h	0 to 255	1	9-5-6 9-7-28
HC211	Boost value at start, 2nd-motor (IM-SLV)	0 to 50 (%)	0	○	627Bh	0 to 50	1	9-5-13 9-7-28
HC214	Direction reversal protection, 2nd-motor	00: Disable 01: Enable	01/ 00/ 01*1	○	627Eh	0 to 1	–	9-4-3 9-7-28
HC215	Torque conversion method selection, 2nd-motor	00: Torque 01: Current	00	○	627Fh	0 to 1	–	9-6-3 9-7-28
HC220	Torque current reference filter time constant, 2nd-motor	0 to 100 (ms)	2	○	6284h	0 to 100	1	9-5-13 9-7-28
HC221	Speed feedforward compensation gain, 2nd-motor	0 to 1000 (%)	0	○	6285h	0 to 1000	1	9-5-13 9-7-28
HC237	Flux settling level, 2nd-motor	0.0 to 100.0	80.0	×	6295h	0 to 1000	0.1	9-5-13 9-7-28
HC241	Modulation threshold 1, 2nd-motor	0 to 133	115	○	6299h	0 to 133		9-5-13 9-7-28
HC242	Modulation threshold 2, 2nd-motor	0 to 133	115	○	629Ah	0 to 133		9-5-13 9-7-28
Hd Parameter								
Hd102	Sync. Motor capacity setting, 1st-motor*2	0.01 to 30.00 (kW)	Depends on inverter model and load type	×	3BC6h	1 to 3000	0.01	—

*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*1. The default settings when initialize by setting 00/01/03 to "Initialize data selection [Ub-02]".
*2. These parameters are SM/PMM related functions. For details, contact your supplier or local Hitachi sales office.

Code	Name	Data Range	Initial value	Change during running	Modbus communication Register No.	Data range	Resolution	Page
Hd103	Sync. Motor number of poles setting, 1st-motor*2	00:2P 01:4P 02:6P 03:8P 04:10P 05:12P 06:14P 07:16P 08:18P 09:20P 10:22P 11:24P 12:26P 13:28P 14:30P 15:32P 16:34P 17:36P 18:38P 19:40P 20:42P 21:44P 22:46P 23:48P	Depends on inverter model and load type	×	3BC7h	0 to 23	–	–
Hd104	Sync. Motor base frequency setting, 1st-motor *2	30.00 to [Hd105] (Hz)		×	3BC8h	3000 to 59000	0.01	–
Hd105	Sync. Motor maximum frequency setting, 1st-motor *2	[Hd104] to 590.00 (Hz)		×	3BC9h	3000 to 59000	0.01	–
Hd106	Sync. Motor rated voltage, 1st-motor *2	1 to 1000 (V)		×	3BCAh	1 to 1000	1	–
Hd108	Sync. Motor rated current, 1st-motor *2	0.01 to 10000.00 (A)		×	3BCCh 3BCDh	1 to 1000000	0.01	–
Hd110	Sync. Motor constant R, 1st-motor *2	0.000001 to 1000.000000 (Ω)		×	3BCEh 3BCFh	1 to 1000000000	0.000001	–
Hd112	Sync. Motor constant Ld, 1st-motor *2	0.000001 to 1000.000000 (mH)		×	3BD0h 3BD1h	1 to 1000000000	0.000001	–
Hd114	Sync. Motor constant Lq, 1st-motor *2	0.000001 to 1000.000000 (mH)		×	3BD2h 3BD3h	1 to 1000000000	0.000001	–
Hd116	Sync. Motor constant Ke, 1st-motor *2	0.1 to 100000.0 (mVs/rad)		×	3BD4h 3BD5h	1 to 1000000	0.1	–
Hd118	Sync. Motor constant J, 1st-motor *2	0.00001 to 10000.00000 (kgm^2)		×	3BD6h 3BD7h	1 to 1000000000	0.00001	–
Hd130	Sync. Motor minimum frequency adjustment, 1st-motor *2	0 to 50 (%)	8	○	3BE2h	0 to 50	1	–
Hd131	Sync. Motor No-Load current, 1st-motor *2	0 to 100 (%)	10	○	3BE3h	0 to 100	1	–
Hd132	Sync. Motor starting method, 1st-motor *2	00: IMPE Disable 01: IMPE Enable	00	×	3BE4h	0 to 1	–	–
Hd133	Sync. Motor IMPE 0V wait number, 1st-motor *2	0 to 255	10	×	3BE5h	0 to 255	1	–
Hd134	Sync. Motor IMPE detect wait number, 1st-motor *2	0 to 255	10	×	3BE6h	0 to 255	1	–
Hd135	Sync. Motor IMPE detect number, 1st-motor *2	0 to 255	30	×	3BE7h	0 to 255	1	–
Hd136	Sync. Motor IMPE voltage gain, 1st-motor *2	0 to 200 (%)	100	×	3BE8h	0 to 200	1	–
Hd137	Sync. Motor IMPE Mg-pole position offset, 1st-motor *2	0 to 359 (deg)	0	×	3BE9h	0 to 359	1	–
Hd202	Sync. Motor capacity setting, 2nd-motor *2	0.01 to 30.00 (kW)	Depends on inverter model and load type	×	62D6h	1 to 3000	0.01	–

*2. These parameters are SM/PMM related functions. For details, contact your supplier or local Hitachi sales office.

Code	Name	Data Range		Initial value	Change during running	Modbus communication			Page
						Register No.	Data range	Resolution	
Hd203	Sync. Motor number of poles setting, 2nd-motor *2	00:2P 01:4P 02:6P 03:8P 04:10P 05:12P 06:14P 07:16P 08:18P 09:20P 10:22P 11:24P	12:26P 13:28P 14:30P 15:32P 16:34P 17:36P 18:38P 19:40P 20:42P 21:44P 22:46P 23:48P	Depends on inverter model and load type	×	62D7h	0 to 23	–	–
Hd204	Sync. Motor base frequency setting, 2nd-motor *2	30.00 to [Hd205] (Hz)			×	62D8h	3000 to 59000	0.01	–
Hd205	Sync. Motor maximum frequency setting, 2nd-motor *2	[Hd204] to 590.00 (Hz)			×	62D9h	3000 to 59000	0.01	–
Hd206	Sync. Motor rated voltage, 2nd-motor *2	1 to 1000 (V)			×	62DAh	1 to 1000	1	–
Hd208	Sync. Motor rated current, 2nd-motor *2	0.01 to 10000.00 (A)			×	62DCh 62DDh	1 to 1000000	0.01	–
Hd210	Sync. Motor constant R, 2nd-motor *2	0.000001 to 1000.000000 (Ω)			×	62DEh 62DFh	1 to 1000000000	0.000001	–
Hd212	Sync. Motor constant Ld, 2nd-motor *2	0.000001 to 1000.000000 (mH)			×	62E0h 62E1h	1 to 1000000000	0.000001	–
Hd214	Sync. Motor constant Lq, 2nd-motor *2	0.000001 to 1000.000000 (mH)			×	62E2h 62E3h	1 to 1000000000	0.000001	–
Hd216	Sync. Motor constant Ke, 2nd-motor *2	0.1 to 100000.0 (mVs/rad)			×	62E4h 62E5h	1 to 1000000	0.1	–
Hd218	Sync. Motor constant J, 2nd-motor *2	0.00001 to 10000.00000 (kgm^2)			×	62E6h 62E7h	1 to 1000000000	0.00001	–
Hd230	Sync. Motor minimum frequency adjustment, 2nd-motor *2	0 to 50 (%)		8	○	62F2h	0 to 50	1	–
Hd231	Sync. Motor No-Load current, 2nd-motor *2	0 to 100 (%)		10	○	62F3h	0 to 100	1	–
Hd232	Sync. Motor starting method, 2nd-motor *2	00: IMPE Disable 01: IMPE Enable		00	×	62F4h	0 to 1	–	–
Hd233	Sync. Motor IMPE 0V wait number, 2nd-motor *2	0 to 255		10	×	62F5h	0 to 255	1	–
Hd234	Sync. Motor IMPE detect wait number, 2nd-motor *2	0 to 255		10	×	62F6h	0 to 255	1	–
Hd235	Sync. Motor IMPE detect number, 2nd-motor *2	0 to 255		30	×	62F7h	0 to 255	1	–
Hd236	Sync. Motor IMPE voltage gain, 2nd-motor *2	0 to 200 (%)		100	×	62F8h	0 to 200	1	–
Hd237	Sync. Motor IMPE Mg-pole position offset, 2nd-motor *2	0 to 359 (deg)		0	×	62F9h	0 to 359	1	–

*2. These parameters are SM/PMM related functions. For details, contact your supplier or local Hitachi sales office.

18.2.9 o Parameter Group

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
oA-10	Operation selection at an option error *1	00: Error 01: Ignore error (keep running)	00	○	3E8Ah	0 to 1	1	13-1-1
oA-11	Communication Watch Dog Timer *1	0.00 to 100.00	1.00	×	3E8Bh	0 to 10000	0.01	13-1-1
oA-12	Action selection at a communication error*1	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run stop 04: Deceleration stop	01	×	3E8Ch	0 to 4	1	13-1-1
oA-13	RUN command selection at start up *1	00: Disable 01: Enable	00	×	3E8Dh	0 to 1	1	13-1-1
oJ Parameter								
oJ-01	Writing register 1, Gr. A *1	0000h to FFFFh	0000h	○	41A1h	0000h to FFFFh	1	13-1-1
oJ-02	Writing register 2, Gr. A *1	0000h to FFFFh	0000h	○	41A2h	0000h to FFFFh	1	13-1-1
oJ-03	Writing register 3, Gr. A *1	0000h to FFFFh	0000h	○	41A3h	0000h to FFFFh	1	13-1-1
oJ-04	Writing register 4, Gr. A *1	0000h to FFFFh	0000h	○	41A4h	0000h to FFFFh	1	13-1-1
oJ-05	Writing register 5, Gr. A *1	0000h to FFFFh	0000h	○	41A5h	0000h to FFFFh	1	13-1-1
oJ-06	Writing register 6, Gr. A *1	0000h to FFFFh	0000h	○	41A6h	0000h to FFFFh	1	13-1-1
oJ-07	Writing register 7, Gr. A *1	0000h to FFFFh	0000h	○	41A7h	0000h to FFFFh	1	13-1-1
oJ-08	Writing register 8, Gr. A *1	0000h to FFFFh	0000h	○	41A8h	0000h to FFFFh	1	13-1-1
oJ-09	Writing register 9, Gr. A *1	0000h to FFFFh	0000h	○	41A9h	0000h to FFFFh	1	13-1-1
oJ-10	Writing register 10, Gr. A *1	0000h to FFFFh	0000h	○	41AAh	0000h to FFFFh	1	13-1-1
oJ-11	Reading register 1 Gr. A *1	0000h to FFFFh	0000h	○	41ABh	0000h to FFFFh	1	13-1-1
oJ-12	Reading register 2 Gr. A *1	0000h to FFFFh	0000h	○	41ACh	0000h to FFFFh	1	13-1-1
oJ-13	Reading register 3 Gr. A *1	0000h to FFFFh	0000h	○	41ADh	0000h to FFFFh	1	13-1-1
oJ-14	Reading register 4 Gr. A *1	0000h to FFFFh	0000h	○	41AEh	0000h to FFFFh	1	13-1-1
oJ-15	Reading register 5 Gr. A *1	0000h to FFFFh	0000h	○	41AFh	0000h to FFFFh	1	13-1-1
oJ-16	Reading register 6 Gr. A *1	0000h to FFFFh	0000h	○	41B0h	0000h to FFFFh	1	13-1-1
oJ-17	Reading register 7 Gr. A *1	0000h to FFFFh	0000h	○	41B1h	0000h to FFFFh	1	13-1-1
oJ-18	Reading register 8 Gr. A *1	0000h to FFFFh	0000h	○	41B2h	0000h to FFFFh	1	13-1-1
oJ-19	Reading register 9 Gr. A *1	0000h to FFFFh	0000h	○	41B3h	0000h to FFFFh	1	13-1-1
oJ-20	Reading register 10 Gr. A *1	0000h to FFFFh	0000h	○	41B4h	0000h to FFFFh	1	13-1-1

*1. Communication options for WJ-C1 extended mode are under development. When you need a communication option, you can use the communication option for the WJ200 series by changing to the basic mode. For details, refer to "Chapter 13 Communication Option".

18.2.10 P Parameter Group

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
PA-01	Enable Emergency-force drive mode	00: Disable 01: Enable	00	×	4269h	0 to 1	1	9-7-23
PA-02	Emergency-force drive frequency reference	0.00 to 590.00 (Hz)	0.00	×	426Ah	0 to 59000	0.01	9-7-23
PA-03	Emergency-force drive direction command	00: Forward rotation 01: Reverse rotation	00	×	426Bh	0 to 1	1	9-7-23
PA-04	Commercial power supply bypass function selection	00: Disable 01: Enable	00	×	426Ch	0 to 1	1	9-7-26
PA-05	Commercial power supply bypass function delay time	0.0 to 1000.0 (s)	5.0	×	426Dh	0 to 10000	0.1	9-7-26
PA-20	Simulation mode enable	00: Disable 01: Enable	00	×	427Ch	0 to 1	1	8-2-1
PA-21	Error code selection for alarm test	0 to 255 (Error code)	0	○	427Dh	0 to 255	–	8-2-1
PA-22	Simulation mode: Optional output selection for the output current monitor	00: Disable 01: Parameter [PA-23] 02: Setting by Terminal [Ai1] 03: Setting by Terminal [Ai2]	01	○	427Eh	0 to 3	1	8-2-1
PA-23	Optional output value setting for the output current monitor	(0.00 to 3.00)× CTL rated current (A)	0.00	○	427Fh	(0.00 to 3.00) ×CTL rated current 0 to 30000*1	0.1 0.01	8-2-1
PA-24	Simulation mode: Optional output selection for the DC bus voltage monitor	00: Disable 01: Parameter [PA-25] 02: Setting by Terminal [Ai1] 03: Setting by Terminal [Ai2]	01	○	4280h	0 to 3	0.01	8-2-1
PA-25	Optional output value setting for the DC bus voltage monitor	200V class: 0.0 to 450.0 (VDC) 400V class: 0.0 to 900.0 (VDC)	270.0/ 540.0	○	4281h	200V class: 0 to 4500 400V class: 0 to 9000 0 to 22500*1	0.1 0.01	8-2-1
PA-26	Simulation mode: Optional output selection for the output voltage monitor	00: Disable 01: Parameter [PA-27] 02: Setting by Terminal [Ai1] 03: Setting by Terminal [Ai2]	01	○	4282h	0 to 3	1	8-2-1
PA-27	Optional output value setting for the output voltage monitor	200V class: 0.0 to 300.0 (V) 400V class: 0.0 to 600.0 (V)	0.0	○	4283h	200V: 0 to 3000 400V: 0 to 6000 0 to 15000*1	0.1 0.01	8-2-1
PA-28	Simulation mode: Optional output selection for the output torque monitor	00: Disable 01: Parameter [PA-29] 02: Setting by Terminal [Ai1] 03: Setting by Terminal [Ai2]	01	○	4284h	0 to 3	1	8-2-1
PA-29	Optional output value setting for the output torque monitor	-500.0 to 500.0 (%)	0.0	○	4285h	-5000 to 5000	0.1	8-2-1
PA-30	Simulation mode: Optional frequency matching start enable setting	00: Disable 01: Parameter [PA-31] 02: Setting by Terminal [Ai1] 03: Setting by Terminal [Ai2]	01	○	4286h	0 to 3	1	8-2-1
PA-31	Optional frequency matching start setting value	0.00 to 590.00 (Hz)	0.00	○	4287h	0 to 59000	0.01	8-2-1

*1. When the "Register data AV<=>% conversion function [CF-11]" is set to "A, V(00)", the upper row is the data range for Modbus communication, and when set to "%(01)", the lower row is the data range for Modbus communication.

18.2.11 U Parameter Group

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
UA-01	Password for display	0000h to FFFFh	0000h	×	4651h	0000h to FFFFh	1	7-2-12
UA-02	Password for softlock	0000h to FFFFh	0000h	×	4652h	0000h to FFFFh	1	7-2-12
UA-10	Display restriction selection	00: Full display 01: Function-specific display 02: User setting display 03: Data compare display 04: Monitor only	00	○	465Ah	0 to 4	1	7-2-1
UA-12	Accumulated input power monitor clear	00: Disable 01: Clear	00	○	465Ch	0 to 1	1	10-1-7
UA-13	Display gain for the accumulated input power monitor	1 to 1000	1	○	465Dh	1 to 1000	1	10-1-7
UA-14	Accumulated output power monitor clear	00: Disable 01: Clear	00	○	465Eh	0 to 1	1	10-1-8
UA-15	Display gain for the accumulated output power monitor	1 to 1000	1	○	465Fh	1 to 1000	1	10-1-8
UA-16	Soft-Lock selection	00: [SFT] terminal 01: Always enable	00	○	4660h	0 to 1	1	7-2-11
UA-17	Soft-Lock target selection	00: All data 01: All data, except frequency related parameters	00	○	4661h	0 to 1	1	7-2-11
UA-18	Data R/W selection *1	00: Enable R/W by remote operator 01: Disable R/W by remote operator	00	○	4662h	0 to 1	1	7-2-17
UA-19	Low battery warning enable *1	00: Disable 01: Warning 02: Error	00	×	4663h	0 to 2	1	7-2-17
UA-20	Action selection at keypad disconnection *2	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run stop 04: Deceleration stop	02	○	4664h	0 to 4	1	7-2-17
UA-21	2nd-motor parameter display selection	00: Hidden 01: Display	01	×	4665h	0 to 1	1	7-2-1
UA-22	Option parameter display selection	00: Hidden 01: Display	01	×	4666h	0 to 1	1	7-2-1
UA-30	User-parameter auto setting function enable	00: Disable 01: Enable	00	○	466Eh	0 to 1	1	7-2-14
UA-31	User-parameter 1 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	466Fh	0 to 65535/ no: FFFFh (Register No.)	1	7-2-1 7-2-14
UA-32	User-parameter 2 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4670h		1	7-2-1 7-2-14
UA-33	User-parameter 3 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4671h		1	7-2-1 7-2-14
UA-34	User-parameter 4 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4672h		1	7-2-1 7-2-14
UA-35	User-parameter 5 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4673h		1	7-2-1 7-2-14
UA-36	User-parameter 6 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4674h		1	7-2-1 7-2-14
UA-37	User-parameter 7 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4675h		1	7-2-1 7-2-14

*1 Valid when using remote operator VOP.
*2 Not only VOP, also valid for any other externally connected remote operator.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
UA-38	User-parameter 8 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4676h		1	7-2-1 7-2-14
UA-39	User-parameter 9 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4677h		1	7-2-1 7-2-14
UA-40	User-parameter 10 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4678h		1	7-2-1 7-2-14
UA-41	User-parameter 11 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4679h		1	7-2-1 7-2-14
UA-42	User-parameter 12 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	467Ah		1	7-2-1 7-2-14
UA-43	User-parameter 13 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	467Bh		1	7-2-1 7-2-14
UA-44	User-parameter 14 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	467Ch		1	7-2-1 7-2-14
UA-45	User-parameter 15 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	467Dh		1	7-2-1 7-2-14
UA-46	User-parameter 16 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	467Eh		1	7-2-1 7-2-14
UA-47	User-parameter 17 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	467Fh		1	7-2-1 7-2-14
UA-48	User-parameter 18 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4680h		1	7-2-1 7-2-14
UA-49	User-parameter 19 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4681h		1	7-2-1 7-2-14
UA-50	User-parameter 20 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4682h		1	7-2-1 7-2-14
UA-51	User-parameter 21 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4683h	0 to 65535/ no: FFFFh (Register No.)	1	7-2-1 7-2-14
UA-52	User-parameter 22 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4684h		1	7-2-1 7-2-14
UA-53	User-parameter 23 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4685h		1	7-2-1 7-2-14
UA-54	User-parameter 24 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4686h		1	7-2-1 7-2-14
UA-55	User-parameter 25 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4687h		1	7-2-1 7-2-14
UA-56	User-parameter 26 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4688h		1	7-2-1 7-2-14
UA-57	User-parameter 27 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	4689h		1	7-2-1 7-2-14
UA-58	User-parameter 28 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	468Ah		1	7-2-1 7-2-14
UA-59	User-parameter 29 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	468Bh		1	7-2-1 7-2-14
UA-60	User-parameter 30 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	468Ch		1	7-2-1 7-2-14
UA-61	User-parameter 31 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	468Dh		1	7-2-1 7-2-14
UA-62	User-parameter 32 selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	no	○	468Eh		1	7-2-1 7-2-14
UA-76	JOG sensitivity	1 to 24	1	○	469Ch	1 to 24	1	7-1-7
UA-77	JOG carry sensitivity	1 to 100	20	○	469Dh	1 to 100	1	7-1-7
UA-90	Waiting time for turning off the display	0 to 60 (min)	0	×	46AAh	0 to 60	1	7-2-18
UA-91	Initial display selection	no / dA-01 or other parameters (Except [UA-31] to [UA-62])	dA-01	○	46ABh	–	1	7-2-14
UA-92	Enable auto-return to the initial display	00: Disable 01: Enable	00	○	46ACh	0 to 1	1	7-2-14
UA-93	Enable frequency changes through monitor display	00: Disable 01: Enable	00	○	46ADh	0 to 1	1	10-1-2

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
UA-94	Enable multi-speed frequency changes through monitor display	00: Disable 01: Enable	00	×	46AEh	0 to 1	1	10-1-2
UA-95	Display while external operator connected	dA-**, db-**, dC-**, FA-**	dA-01	○	46AFh	0 to 65535 (Register No.)	—	7-2-18
UA-96	Dual monitor target 1 selection	dA-**, db-**, dC-**, FA-** (Except [dC-30])	dA-01	○	46B0h	0 to 65535 (Register No.)	—	10-3-8
UA-97	Dual monitor target 2 selection	dA-**, db-**, dC-**, FA-** (Except [dC-30])	dA-02	○	46B1h	0 to 65535 (Register No.)	—	10-3-8
Ub Parameter								
Ub-01	Initialize mode selection	00: Disable 01: Trip history clear 02: Parameter initialize 03: Trip history clear & Parameter initialize 04: Trip history clear & Parameter initialize & EzSQ clear 05: All parameter except terminal configuration 06: All parameter except communication configuration 07: All parameter except terminal & communication configuration 08: EzSQ only 10: User parameters 11: All parameter except user parameters	00	×	46B5h	0 to 11	1	7-2-7 8-1-12
Ub-02	Initialize data selection	00: Mode 0 (JP/USA) 01: Mode 1 (EU) 03: Mode 3 (CN)	00/ 01/ 03	×	46B6h	0 to 3	1	7-2-7
Ub-03	Load type selection	01: Light duty (LD) 02: Normal duty(ND)	02	×	46B7h	1 to 2	1	8-1-2
Ub-04	Code type selection	00: Extended 01: Basic	00	×	46B8h	0 to 1	1	8-1-12
Ub-05	Enable initialization	00: Disable 01: Execute initialization	00	×	46B9h	0 to 1	1	7-2-7 8-1-12
Ub-06	Restart communication	00: Disable 01: Execute communication restart	00	×	46BAh	0 to 1	1	7-2-9
UC Parameter								
UC-01	Debug mode selection*1	For factory adjustment (Do not change from initial value.)	00	○	4719h	—	1	—
Ud Parameter								
Ud-01	Trace function enable	00: Disable 01: Enable	00	○	477Dh	0 to 1	1	12-3-3
Ud-02	Trace start	00: Stop 01: Start	00	○	477Eh	0 to 1	1	12-3-3
Ud-03	Number of trace data setting	0 to 8	1	○	477Fh	0 to 8	1	12-3-3
Ud-04	Number of trace signals setting	0 to 8	1	○	4780h	0 to 8	1	12-3-3
Ud-10	Trace data 0 selection	Monitor parameters (Refer to "12.3.2 Trace Function Related Parameters")	dA-01	○	4786h	0 to 65535/ no: FFFFh (Register No.)	1	12-3-3
Ud-11	Trace data 1 selection		dA-01	○	4787h		1	12-3-3
Ud-12	Trace data 2 selection		dA-01	○	4788h		1	12-3-3
Ud-13	Trace data 3 selection		dA-01	○	4789h		1	12-3-3
Ud-14	Trace data 4 selection		dA-01	○	478Ah		1	12-3-3
Ud-15	Trace data 5 selection		dA-01	○	478Bh		1	12-3-3
Ud-16	Trace data 6 selection		dA-01	○	478Ch		1	12-3-3
Ud-17	Trace data 7 selection		dA-01	○	478Dh		1	12-3-3

*1. This parameter is for factory settings. Do not change the setting from initial value.

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
Ud-20	Trace signal 0 input/output selection	00: Input [Ud-21] 01: Output [Ud-22]	00	○	4790h	0 to 1	1	12-3-3
Ud-21	Trace signal 0 input terminal selection	Same as [CA-01] to [CA-08]	001	○	4791h	0 to 110	1	12-3-3
Ud-22	Trace signal 0 output terminal selection	Same as [CC-01] to [CC-07]	001	○	4792h	0 to 98	1	12-3-3
Ud-23	Trace signal 1 input/output selection	00: Input [Ud-24] 01: Output [Ud-25]	00	○	4793h	0 to 1	1	12-3-3
Ud-24	Trace signal 1 input terminal selection	Same as [CA-01] to [CA-08]	001	○	4794h	0 to 110	1	12-3-3
Ud-25	Trace signal 1 output terminal selection	Same as [CC-01] to [CC-07]	001	○	4795h	0 to 98	1	12-3-3
Ud-26	Trace signal 2 input/output selection	00: Input [Ud-27] 01: Output [Ud-28]	00	○	4796h	0 to 1	1	12-3-3
Ud-27	Trace signal 2 input terminal selection	Same as [CA-01] to [CA-08]	001	○	4797h	0 to 110	1	12-3-3
Ud-28	Trace signal 2 output terminal selection	Same as [CC-01] to [CC-07]	001	○	4798h	0 to 98	1	12-3-3
Ud-29	Trace signal 3 input/output selection	00: Input [Ud-30] 01: Output [Ud-31]	00	○	4799h	0 to 1	1	12-3-3
Ud-30	Trace signal 3 input terminal selection	Same as [CA-01] to [CA-08]	001	○	479Ah	0 to 110	1	12-3-3
Ud-31	Trace signal 3 output terminal selection	Same as [CC-01] to [CC-07]	001	○	479Bh	0 to 98	1	12-3-3
Ud-32	Trace signal 4 input/output selection	00: Input [Ud-33] 01: Output [Ud-34]	00	○	479Ch	0 to 1	1	12-3-3
Ud-33	Trace signal 4 input terminal selection	Same as [CA-01] to [CA-08]	001	○	479Dh	0 to 110	1	12-3-3
Ud-34	Trace signal 4 output terminal selection	Same as [CC-01] to [CC-07]	001	○	479Eh	0 to 98	1	12-3-3
Ud-35	Trace signal 5 input/output selection	00: Input [Ud-36] 01: Output [Ud-37]	00	○	479Fh	0 to 1	1	12-3-3
Ud-36	Trace signal 5 input terminal selection	Same as [CA-01] to [CA-08]	001	○	47A0h	0 to 110	1	12-3-3
Ud-37	Trace signal 5 output terminal selection	Same as [CC-01] to [CC-07]	001	○	47A1h	0 to 98	1	12-3-3
Ud-38	Trace signal 6 input/output selection	00: Input [Ud-39] 01: Output [Ud-40]	00	○	47A2h	0 to 1	1	12-3-3
Ud-39	Trace signal 6 input terminal selection	Same as [CA-01] to [CA-08]	001	○	47A3h	0 to 110	1	12-3-3
Ud-40	Trace signal 6 output terminal selection	Same as [CC-01] to [CC-07]	001	○	47A4h	0 to 98	1	12-3-3
Ud-41	Trace signal 7 input/output selection	00: Input [Ud-42] 01: Output [Ud-43]	00	○	47A5h	0 to 1	1	12-3-3
Ud-42	Trace signal 7 input terminal selection	Same as [CA-01] to [CA-08]	001	○	47A6h	0 to 110	1	12-3-3
Ud-43	Trace signal 7 output terminal selection	Same as [CC-01] to [CC-07]	001	○	47A7h	0 to 98	1	12-3-3
Ud-50	Trace trigger 1 selection	00: Trip 01: Trace data 0 02: Trace data 1 03: Trace data 2 04: Trace data 3 05: Trace data 4 06: Trace data 5 07: Trace data 6 08: Trace data 7 09: Trace signal 0 10: Trace signal 1 11: Trace signal 2 12: Trace signal 3 13: Trace signal 4 14: Trace signal 5 15: Trace signal 6 16: Trace signal 7	00	○	47AEh	0 to 16	1	12-3-3

Code	Name	Data Range	Initial value	Change during running	Modbus communication: Register No.	Modbus communication: Data range	Modbus communication: Resolution	Page
Ud-51	Trigger 1 activation selection at trace data trigger	00: Action at rising above the trigger level 01: Action at falling below the trigger level	00	○	47AFh	0 to 1		12-3-3
Ud-52	Trigger 1 level setting at trace data trigger	0 to 100 (%)	0	○	47B0h	0 to 100		12-3-3
Ud-53	Trigger 1 activation selection at trace signal trigger	00: Action by signal ON 01: Action by signal OFF	00	○	47B1h	0 to 1		12-3-3
Ud-54	Trace trigger 2 selection	00: Trip 01: Trace data 0 02: Trace data 1 03: Trace data 2 04: Trace data 3 05: Trace data 4 06: Trace data 5 07: Trace data 6 08: Trace data 7 09: Trace signal 0 10: Trace signal 1 11: Trace signal 2 12: Trace signal 3 13: Trace signal 4 14: Trace signal 5 15: Trace signal 6 16: Trace signal 7	00	○	47B2h	0 to 16		12-3-3
Ud-55	Trigger 2 activation selection at trace data trigger	00: Action at rising above the trigger level 01: Action at falling below the trigger level	00	○	47B3h	0 to 1	–	12-3-3
Ud-56	Trigger 2 level setting at trace data trigger	0 to 100 (%)	0	○	47B4h	0 to 100	%	12-3-3
Ud-57	Trigger 2 activation selection at trace signal trigger	00: Action by signal ON 01: Action by signal OFF	00	○	47B5h	0 to 1	–	12-3-3
Ud-58	Trigger condition selection	00: At trace trigger 1 activation 01: At trace trigger 2 activation 02: Trigger-1 OR Trigger-2 activation 03: Trigger-1 AND Trigger-2 activation	00	○	47B6h	0 to 3	–	12-3-3
Ud-59	Trigger point setting	0 to 100 (%)	0	○	47B7h	0 to 100		12-3-3
Ud-60	Sampling time setting	02: 0.5ms 03: 1ms 04: 2ms 05: 5ms 06: 10ms 07: 50ms 08: 100ms 09: 500ms 10: 1000ms	03	○	47B8h	2 to 10		12-3-3
UE Parameter								
UE-01	EzSQ Execution cycle	00: 1ms 01: 2ms	01	×	47E1h	0 to 1	1	12-2-2
UE-02	EzSQ Function enable selection	00: Disable 01: [PRG] terminal 02: Always enable 03: Debug	00	○	47E2h	0 to 3	1	12-2-2 12-2-6
UE-03	EzSQ Program continue selection	00: Program restart on trip 01: Continue program on trip	00	○	47E3h	0 to 1	1	12-2-4
UE-10	EzSQ User parameter U(00)	0 to 65535	0	○	47EAh	0 to 65535	1	12-2-2

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
UE-11	EzSQ User parameter U(01)	0 to 65535	0	○	47EBh	0 to 65535	1	12-2-2
UE-12	EzSQ User parameter U(02)	0 to 65535	0	○	47ECh	0 to 65535	1	12-2-2
UE-13	EzSQ User parameter U(03)	0 to 65535	0	○	47EDh	0 to 65535	1	12-2-2
UE-14	EzSQ User parameter U(04)	0 to 65535	0	○	47EEh	0 to 65535	1	12-2-2
UE-15	EzSQ User parameter U(05)	0 to 65535	0	○	47EFh	0 to 65535	1	12-2-2
UE-16	EzSQ User parameter U(06)	0 to 65535	0	○	47F0h	0 to 65535	1	12-2-2
UE-17	EzSQ User parameter U(07)	0 to 65535	0	○	47F1h	0 to 65535	1	12-2-2
UE-18	EzSQ User parameter U(08)	0 to 65535	0	○	47F2h	0 to 65535	1	12-2-2
UE-19	EzSQ User parameter U(09)	0 to 65535	0	○	47F3h	0 to 65535	1	12-2-2
UE-20	EzSQ User parameter U(10)	0 to 65535	0	○	47F4h	0 to 65535	1	12-2-2
UE-21	EzSQ User parameter U(11)	0 to 65535	0	○	47F5h	0 to 65535	1	12-2-2
UE-22	EzSQ User parameter U(12)	0 to 65535	0	○	47F6h	0 to 65535	1	12-2-2
UE-23	EzSQ User parameter U(13)	0 to 65535	0	○	47F7h	0 to 65535	1	12-2-2
UE-24	EzSQ User parameter U(14)	0 to 65535	0	○	47F8h	0 to 65535	1	12-2-2
UE-25	EzSQ User parameter U(15)	0 to 65535	0	○	47F9h	0 to 65535	1	12-2-2
UE-26	EzSQ User parameter U(16)	0 to 65535	0	○	47FAh	0 to 65535	1	12-2-2
UE-27	EzSQ User parameter U(17)	0 to 65535	0	○	47FBh	0 to 65535	1	12-2-2
UE-28	EzSQ User parameter U(18)	0 to 65535	0	○	47FCh	0 to 65535	1	12-2-2
UE-29	EzSQ User parameter U(19)	0 to 65535	0	○	47FDh	0 to 65535	1	12-2-2
UE-30	EzSQ User parameter U(20)	0 to 65535	0	○	47FEh	0 to 65535	1	12-2-2
UE-31	EzSQ User parameter U(21)	0 to 65535	0	○	47FFh	0 to 65535	1	12-2-2
UE-32	EzSQ User parameter U(22)	0 to 65535	0	○	4800h	0 to 65535	1	12-2-2
UE-33	EzSQ User parameter U(23)	0 to 65535	0	○	4801h	0 to 65535	1	12-2-2
UE-34	EzSQ User parameter U(24)	0 to 65535	0	○	4802h	0 to 65535	1	12-2-2
UE-35	EzSQ User parameter U(25)	0 to 65535	0	○	4803h	0 to 65535	1	12-2-2
UE-36	EzSQ User parameter U(26)	0 to 65535	0	○	4804h	0 to 65535	1	12-2-2
UE-37	EzSQ User parameter U(27)	0 to 65535	0	○	4805h	0 to 65535	1	12-2-2
UE-38	EzSQ User parameter U(28)	0 to 65535	0	○	4806h	0 to 65535	1	12-2-2
UE-39	EzSQ User parameter U(29)	0 to 65535	0	○	4807h	0 to 65535	1	12-2-2
UE-40	EzSQ User parameter U(30)	0 to 65535	0	○	4808h	0 to 65535	1	12-2-2
UE-41	EzSQ User parameter U(31)	0 to 65535	0	○	4809h	0 to 65535	1	12-2-2

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
UE-42	EzSQ User parameter U(32)	0 to 65535	0	○	480Ah	0 to 65535	1	12-2-2
UE-43	EzSQ User parameter U(33)	0 to 65535	0	○	480Bh	0 to 65535	1	12-2-2
UE-44	EzSQ User parameter U(34)	0 to 65535	0	○	480Ch	0 to 65535	1	12-2-2
UE-45	EzSQ User parameter U(35)	0 to 65535	0	○	480Dh	0 to 65535	1	12-2-2
UE-46	EzSQ User parameter U(36)	0 to 65535	0	○	480Eh	0 to 65535	1	12-2-2
UE-47	EzSQ User parameter U(37)	0 to 65535	0	○	480Fh	0 to 65535	1	12-2-2
UE-48	EzSQ User parameter U(38)	0 to 65535	0	○	4810h	0 to 65535	1	12-2-2
UE-49	EzSQ User parameter U(39)	0 to 65535	0	○	4811h	0 to 65535	1	12-2-2
UE-50	EzSQ User parameter U(40)	0 to 65535	0	○	4812h	0 to 65535	1	12-2-2
UE-51	EzSQ User parameter U(41)	0 to 65535	0	○	4813h	0 to 65535	1	12-2-2
UE-52	EzSQ User parameter U(42)	0 to 65535	0	○	4814h	0 to 65535	1	12-2-2
UE-53	EzSQ User parameter U(43)	0 to 65535	0	○	4815h	0 to 65535	1	12-2-2
UE-54	EzSQ User parameter U(44)	0 to 65535	0	○	4816h	0 to 65535	1	12-2-2
UE-55	EzSQ User parameter U(45)	0 to 65535	0	○	4817h	0 to 65535	1	12-2-2
UE-56	EzSQ User parameter U(46)	0 to 65535	0	○	4818h	0 to 65535	1	12-2-2
UE-57	EzSQ User parameter U(47)	0 to 65535	0	○	4819h	0 to 65535	1	12-2-2
UE-58	EzSQ User parameter U(48)	0 to 65535	0	○	481Ah	0 to 65535	1	12-2-2
UE-59	EzSQ User parameter U(49)	0 to 65535	0	○	481Bh	0 to 65535	1	12-2-2
UE-60	EzSQ User parameter U(50)	0 to 65535	0	○	481Ch	0 to 65535	1	12-2-2
UE-61	EzSQ User parameter U(51)	0 to 65535	0	○	481Dh	0 to 65535	1	12-2-2
UE-62	EzSQ User parameter U(52)	0 to 65535	0	○	481Eh	0 to 65535	1	12-2-2
UE-63	EzSQ User parameter U(53)	0 to 65535	0	○	481Fh	0 to 65535	1	12-2-2
UE-64	EzSQ User parameter U(54)	0 to 65535	0	○	4820h	0 to 65535	1	12-2-2
UE-65	EzSQ User parameter U(55)	0 to 65535	0	○	4821h	0 to 65535	1	12-2-2
UE-66	EzSQ User parameter U(56)	0 to 65535	0	○	4822h	0 to 65535	1	12-2-2
UE-67	EzSQ User parameter U(57)	0 to 65535	0	○	4823h	0 to 65535	1	12-2-2
UE-68	EzSQ User parameter U(58)	0 to 65535	0	○	4824h	0 to 65535	1	12-2-2
UE-69	EzSQ User parameter U(59)	0 to 65535	0	○	4825h	0 to 65535	1	12-2-2
UE-70	EzSQ User parameter U(60)	0 to 65535	0	○	4826h	0 to 65535	1	12-2-2
UE-71	EzSQ User parameter U(61)	0 to 65535	0	○	4827h	0 to 65535	1	12-2-2

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
UE-72	EzSQ User parameter U(62)	0 to 65535	0	○	4828h	0 to 65535	1	12-2-2
UE-73	EzSQ User parameter U(63)	0 to 65535	0	○	4829h	0 to 65535	1	12-2-2
UF-02	EzSQ User parameter UL(00)	-2147483648 to 2147483647	0	○	4846h 4847h	-2147483648 to 2147483647	1	12-2-2
UF-04	EzSQ User parameter UL(01)	-2147483648 to 2147483647	0	○	4848h 4849h		1	12-2-2
UF-06	EzSQ User parameter UL(02)	-2147483648 to 2147483647	0	○	484Ah 484Bh		1	12-2-2
UF-08	EzSQ User parameter UL(03)	-2147483648 to 2147483647	0	○	484Ch 484Dh		1	12-2-2
UF-10	EzSQ User parameter UL(04)	-2147483648 to 2147483647	0	○	484Eh 484Fh		1	12-2-2
UF-12	EzSQ User parameter UL(05)	-2147483648 to 2147483647	0	○	4850h 4851h		1	12-2-2
UF-14	EzSQ User parameter UL(06)	-2147483648 to 2147483647	0	○	4852h 4853h		1	12-2-2
UF-16	EzSQ User parameter UL(07)	-2147483648 to 2147483647	0	○	4854h 4855h		1	12-2-2
UF-18	EzSQ User parameter UL(08)	-2147483648 to 2147483647	0	○	4856h 4857h		1	12-2-2
UF-20	EzSQ User parameter UL(09)	-2147483648 to 2147483647	0	○	4858h 4859h		1	12-2-2
UF-22	EzSQ User parameter UL(10)	-2147483648 to 2147483647	0	○	485Ah 485Bh		1	12-2-2
UF-24	EzSQ User parameter UL(11)	-2147483648 to 2147483647	0	○	485Ch 485Dh		1	12-2-2
UF-26	EzSQ User parameter UL(12)	-2147483648 to 2147483647	0	○	485Eh 485Fh		1	12-2-2
UF-28	EzSQ User parameter UL(13)	-2147483648 to 2147483647	0	○	4860h 4861h		1	12-2-2
UF-30	EzSQ User parameter UL(14)	-2147483648 to 2147483647	0	○	4862h 4863h		1	12-2-2
UF-32	EzSQ User parameter UL(15)	-2147483648 to 2147483647	0	○	4864h 4865h	-2147483648 to 2147483647	1	12-2-2
UF-34	EzSQ User parameter UL(16)	-2147483648 to 2147483647	0	○	4866h 4867h		1	12-2-2
UF-36	EzSQ User parameter UL(17)	-2147483648 to 2147483647	0	○	4868h 4869h		1	12-2-2
UF-38	EzSQ User parameter UL(18)	-2147483648 to 2147483647	0	○	486Ah 486Bh		1	12-2-2
UF-40	EzSQ User parameter UL(19)	-2147483648 to 2147483647	0	○	486Ch 486Dh		1	12-2-2
UF-42	EzSQ User parameter UL(20)	-2147483648 to 2147483647	0	○	486Eh 486Fh		1	12-2-2
UF-44	EzSQ User parameter UL(21)	-2147483648 to 2147483647	0	○	4870h 4871h		1	12-2-2
UF-46	EzSQ User parameter UL(22)	-2147483648 to 2147483647	0	○	4872h 4873h		1	12-2-2
UF-48	EzSQ User parameter UL(23)	-2147483648 to 2147483647	0	○	4874h 4875h		1	12-2-2
UF-50	EzSQ User parameter UL(24)	-2147483648 to 2147483647	0	○	4876h 4877h		1	12-2-2
UF-52	EzSQ User parameter UL(25)	-2147483648 to 2147483647	0	○	4878h 4879h		1	12-2-2
UF-54	EzSQ User parameter UL(26)	-2147483648 to 2147483647	0	○	487Ah 487Bh		1	12-2-2
UF-56	EzSQ User parameter UL(27)	-2147483648 to 2147483647	0	○	487Ch 487Dh		1	12-2-2
UF-58	EzSQ User parameter UL(28)	-2147483648 to 2147483647	0	○	487Eh 487Fh		1	12-2-2

Code	Name	Data Range	Initial value	Change during running	Modbus communication			Page
					Register No.	Data range	Resolution	
UF-60	EzSQ User parameter UL(29)	-2147483648 to 2147483647	0	○	4880h 4881h		1	12-2-2
UF-62	EzSQ User parameter UL(30)	-2147483648 to 2147483647	0	○	4882h 4883h		1	12-2-2
UF-64	EzSQ User parameter UL(31)	-2147483648 to 2147483647	0	○	4884h 4885h		1	12-2-2
UG Parameter								
UG-01	EzSQ Debug start selection	00: [PRG] terminal 01: Always enable	00	○	48A9h	0 to 1	1	12-2-6
UG-02	EzSQ Program execute	00: Stop 01: Start	00	○	48AAh	0 to 1	1	12-2-6
UG-03	EzSQ Execute STEP action	00: Disable 01: Execute STEP action	00	○	48ABh	0 to 1	1	12-2-6
UG-10	EzSQ break task selection 1	0 to 5	0	○	48B2h	0 to 5	1	12-2-6
UG-11	EzSQ break line 1	0 to 1024	0	○	48B3h	0 to 1024	1	12-2-6
UG-12	EzSQ break task selection 2	0 to 5	0	○	48B4h	0 to 5	1	12-2-6
UG-13	EzSQ break line 2	0 to 1024	0	○	48B5h	0 to 1024	1	12-2-6
UG-14	EzSQ break task selection 3	0 to 5	0	○	48B6h	0 to 5	1	12-2-6
UG-15	EzSQ break line 3	0 to 1024	0	○	48B7h	0 to 1024	1	12-2-6
UG-16	EzSQ break task selection 4	0 to 5	0	○	48B8h	0 to 5	1	12-2-6
UG-17	EzSQ break line 4	0 to 1024	0	○	48B9h	0 to 1024	1	12-2-6
UG-18	EzSQ break task selection 5	0 to 5	0	○	48BAh	0 to 5	1	12-2-6
UG-19	EzSQ break line 5	0 to 1024	0	○	48BBh	0 to 1024	1	12-2-6

A

Appendix

This chapter describes comparison of WJ200 and WJ-C1, explanations of terms and revision history.

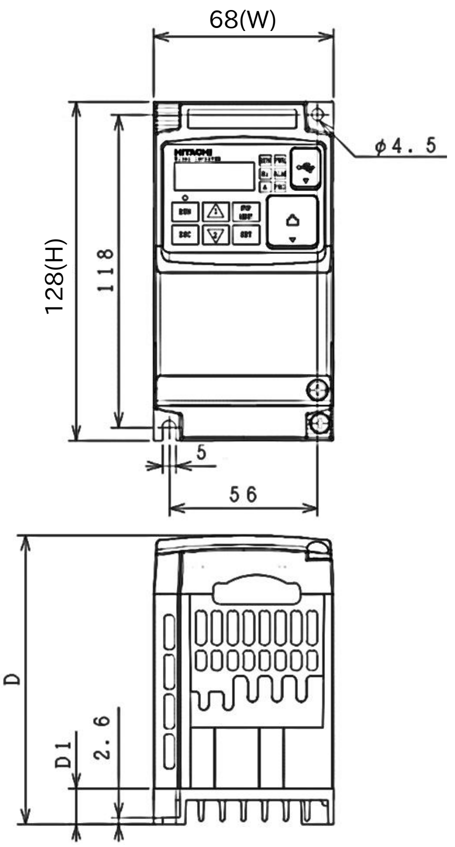
A.1 Replacement from WJ200

A.1.1 Comparison of External Dimensions and Mounting Dimensions

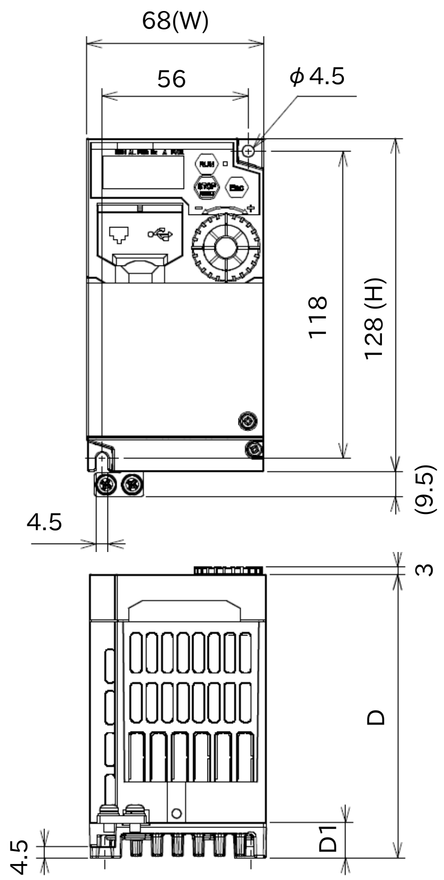
A

- The external dimensions and mounting dimensions of WJ200 Series and WJ-C1 are identical. Refer to the figure below for differences in other dimensions. (The depth of C1-110L/C1-110H/C1-150H is 10 mm shorter than WJ200-110L/WJ200-110H/WJ200-150H.)

WJ200	WJ-C1
Single-phase 200 V, 001S/002S/004S Three-phase 200 V, 001L/002L/004L/007L	Single-phase 200 V, 001S/002S/004S Three-phase 200 V, 001L/002L/004L/007L

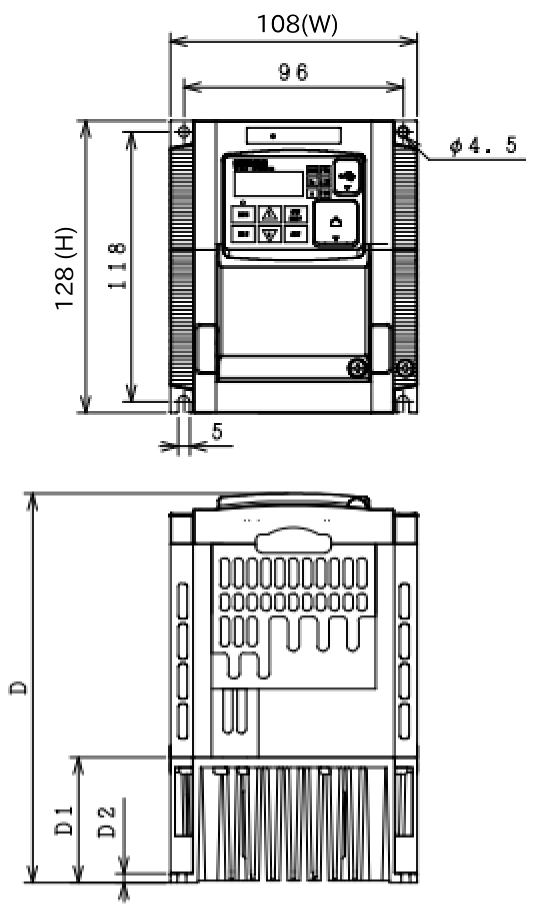


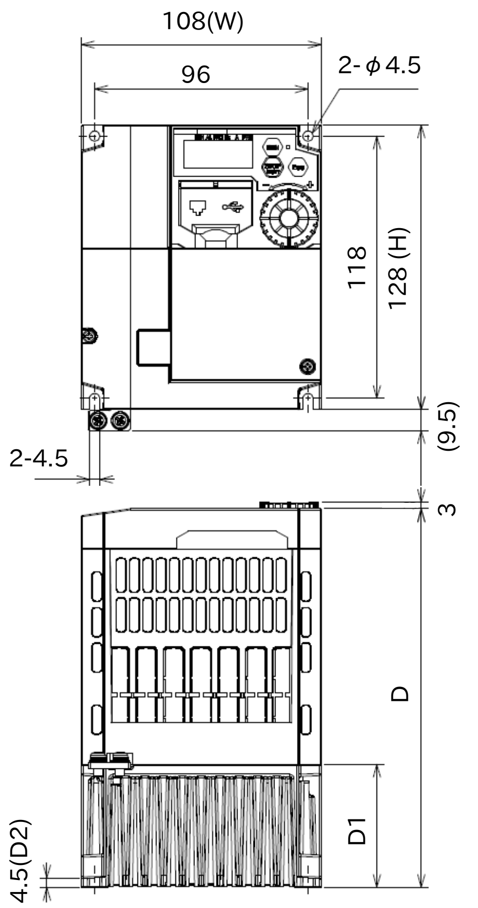
Model	W (mm)	H (mm)	D (mm)	D1 (mm)
WJ200-001S	68	128	109	13.5
WJ200-002S				
WJ200-004S			122.5	27
WJ200-001L			109	13.5
WJ200-002L				
WJ200-004L			122.5	27
WJ200-007L			145.5	50



Model	W (mm)	H (mm)	D (mm)	D1 (mm)
C1-001S	68	128	109	13.5
C1-002S				
C1-004S			122.5	27
C1-001L			109	13.5
C1-002L				
C1-004L			122.5	27
C1-007L			145.5	50

WJ200	WJ-C1
Single-phase 200 V, 007S/015S/022S Three-phase 200 V, 015L/022L Three-phase 400 V, 004H/007H/015H/022H/030H	Single-phase 200 V, 007S/015S/022S Three-phase 200 V, 015L/022L Three-phase 400 V, 004H/007H/015H/022H/030H

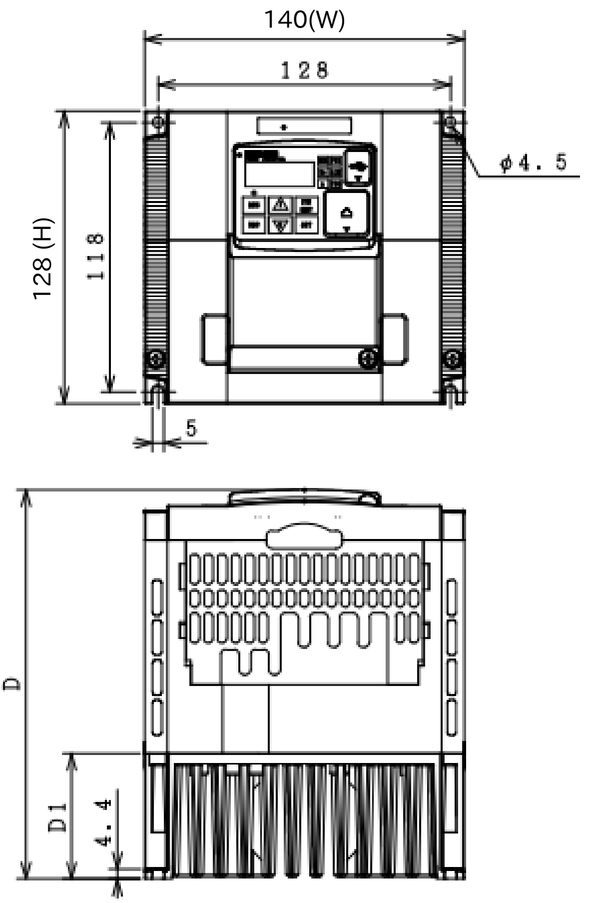


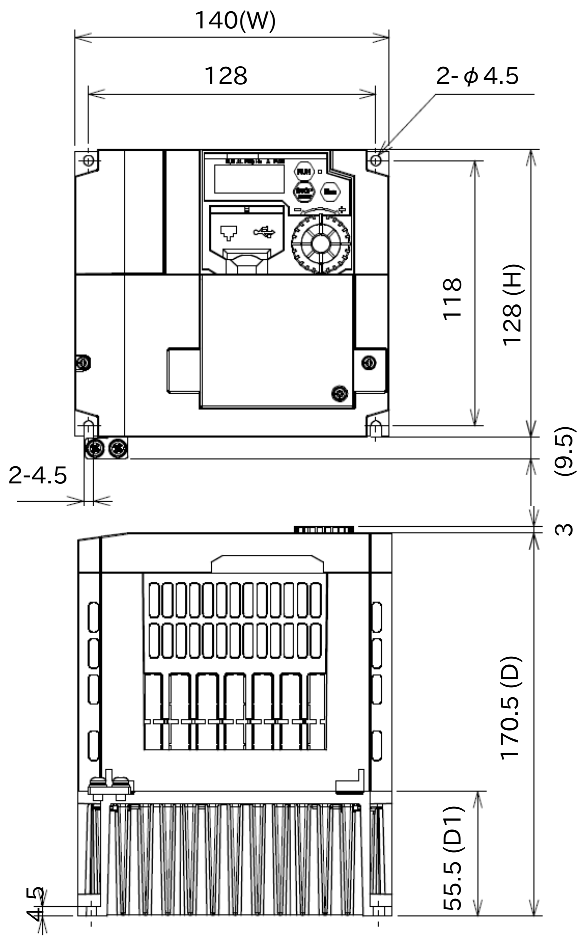


Model	W (mm)	H (mm)	D (mm)	D1 (mm)	D2 (mm)
WJ200-007S					
WJ200-015S					
WJ200-022S			170.5	55	4.4
WJ200-015L					
WJ200-022L					
WJ200-004H	108	128	143.5	28	4.3
WJ200-007H					
WJ200-015H			170.5	55	4.4
WJ200-022H					
WJ200-030H					

型式	W (mm)	H (mm)	D (mm)	D1 (mm)	D2 (mm)
C1-007S					
C1-015S					
C1-022S			170.5	55.5	
C1-015L					
C1-022L					
C1-004H	108	128	143.5	28.5	4.5
C1-007H					
C1-015H			170.5	55.5	
C1-022H					
C1-030H					

WJ200	WJ-C1
Three-phase 200 V, 037L Three-phase 400 V, 040H	Three-phase 200 V, 037L Three-phase 400 V, 040H

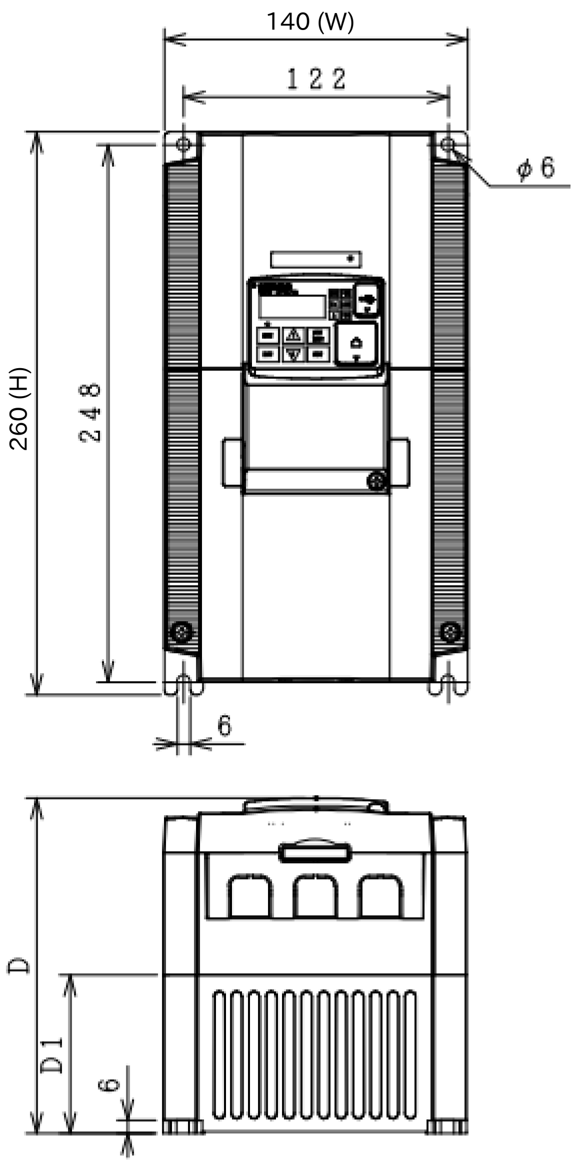




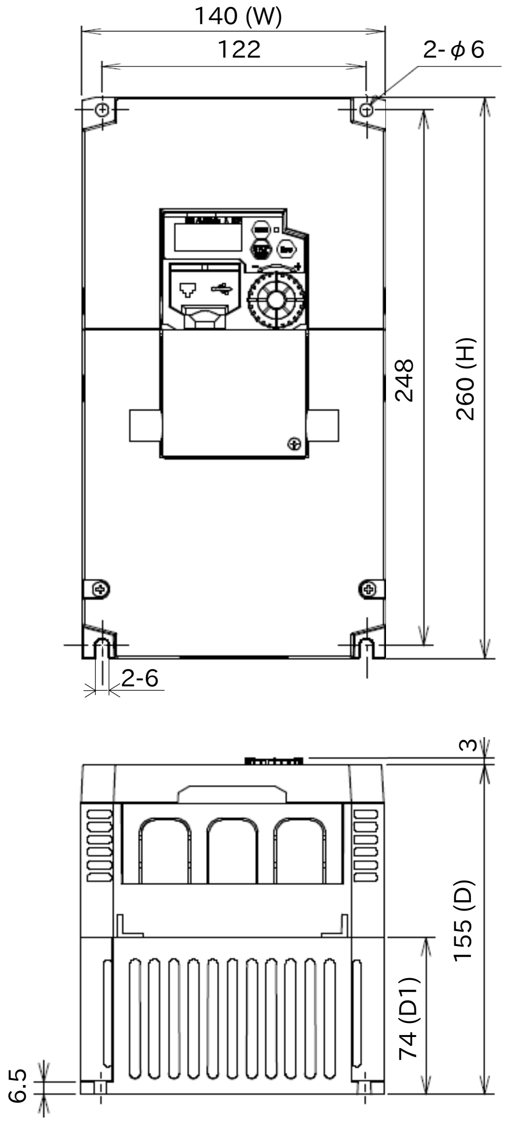
Model	W (mm)	H (mm)	D (mm)	D1 (mm)
WJ200-037L WJ200-040H	140	128	170.5	55

Model	W (mm)	H (mm)	D (mm)	D1 (mm)
C1-037L C1-040H	140	128	170.5	55.5

WJ200	WJ-C1
Three-phase 200 V, 055L/075L Three-phase 400 V, 055H/075H	Three-phase 200 V, 055L/075L Three-phase 400 V, 055H/075H

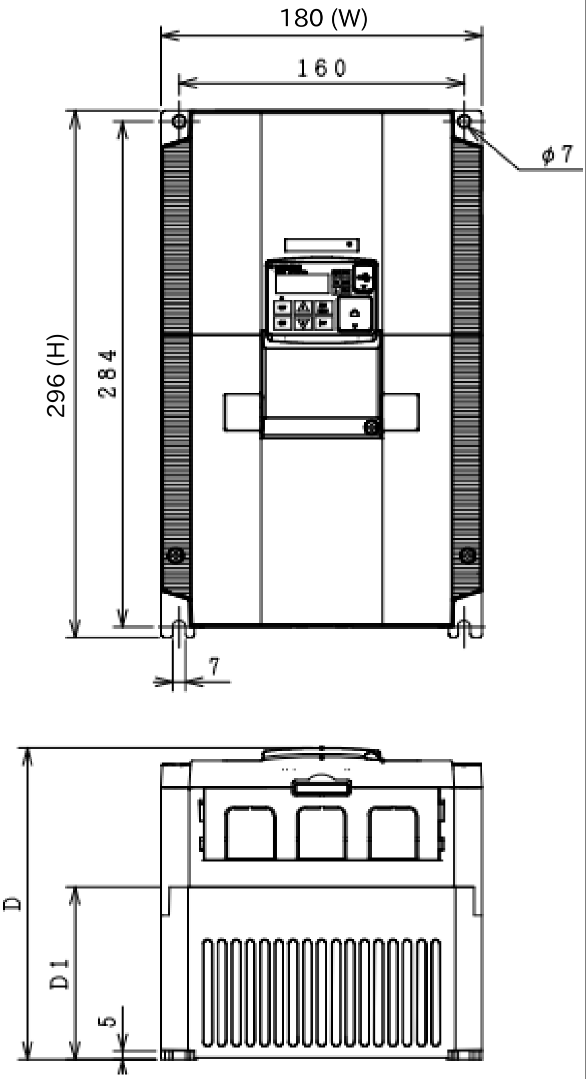


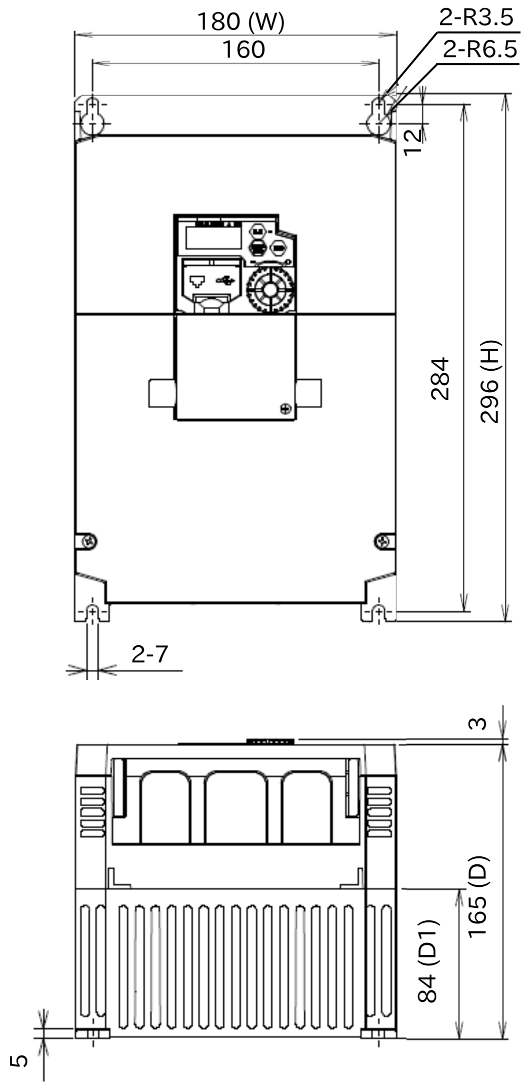
Model	W (mm)	H (mm)	D (mm)	D1 (mm)
WJ200-055L	140	260	155	73.3
WJ200-075L				
WJ200-055H				
WJ200-075H				



Model	W (mm)	H (mm)	D (mm)	D1 (mm)
C1-055L	140	260	155	74
C1-075L				
C1-055H				
C1-075H				

WJ200	WJ-C1
Three-phase 200 V, 110L Three-phase 400 V, 110H/150H	Three-phase 200 V, 110L Three-phase 400 V, 110H/150H



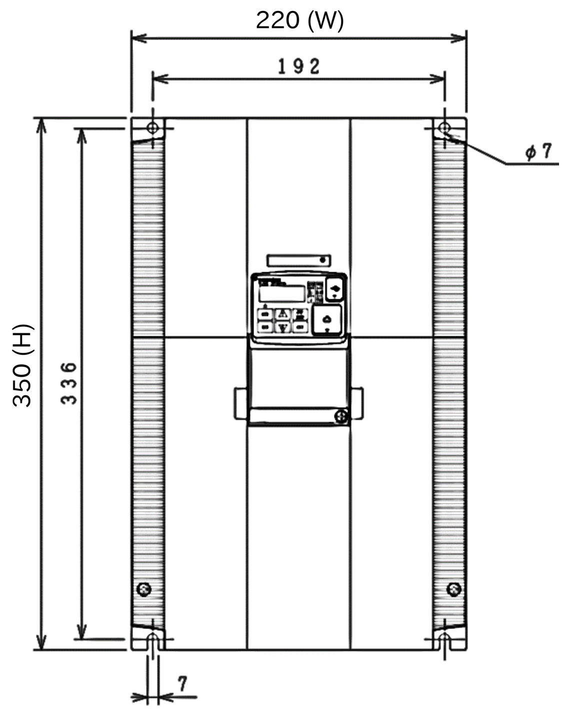


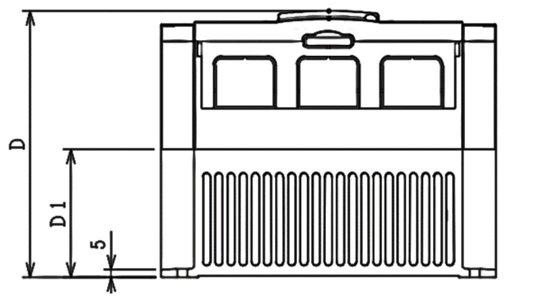
Model	W (mm)	H (mm)	D (mm)	D1 (mm)
WJ200-110L	180	296	175	97
WJ200-110H				
WJ200-150H				

Model	W (mm)	H (mm)	D (mm)	D1 (mm)
C1-110L	180	296	165	84
C1-110H				
C1-150H				

WJ200

Three-phase 200 V, 150L

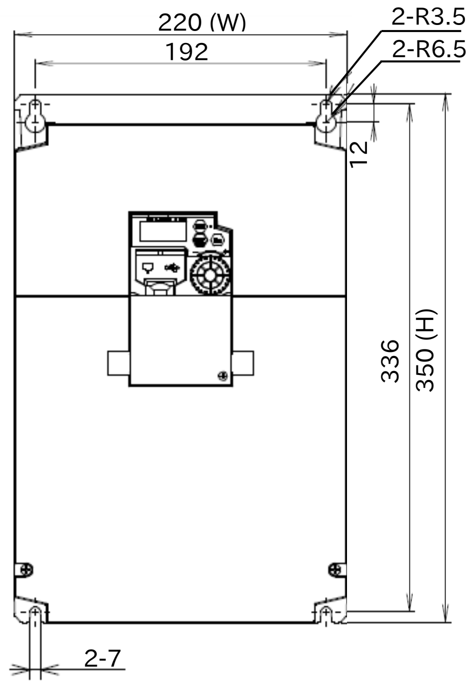


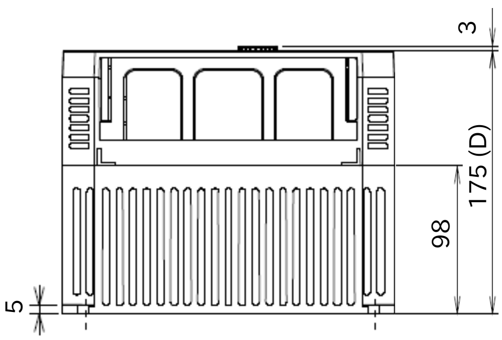


Model	W (mm)	H (mm)	D (mm)	D1 (mm)
WJ200-150L	220	350	175	84

WJ-C1

Three-phase 200 V, 150L





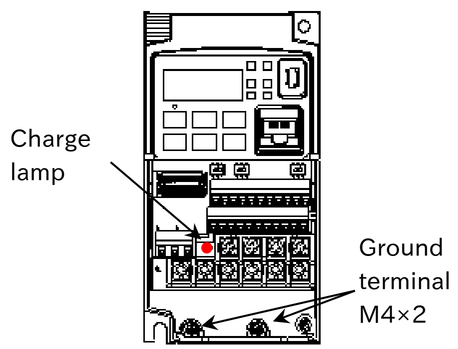
Model	W (mm)	H (mm)	D (mm)	D1 (mm)
C1-150L	220	350	175	98

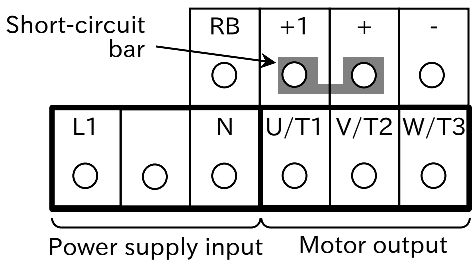
A.1.2 Comparison of Main Circuit Terminal

- The main circuit terminal arrangement of WJ200 and WJ-C1 differs greatly. Be careful not to make incorrect wiring during replacement, etc.
- In WJ-C1 single-phase, 200 V all models/three-phase 200 V, 0.1 to 3.7 kW/three-phase 400 V, 0.4 to 4.0 kW, the ground terminal is the ground bar (M4×2) on the left side of the bottom of the inverter.

Single-phase 200 V, 0.1 kW to 0.4 kW

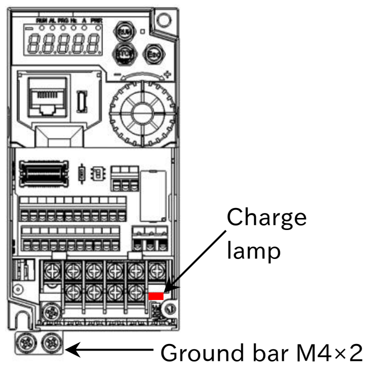
WJ200-001S/002S/004S

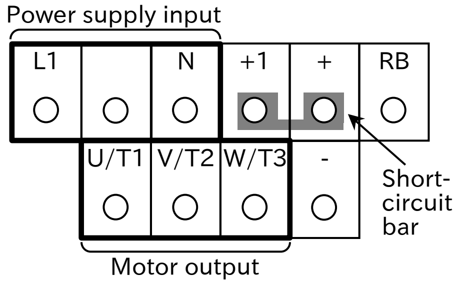




Screw size	M3.5
Terminal width	7.6 mm

C1-001S/002S/004S

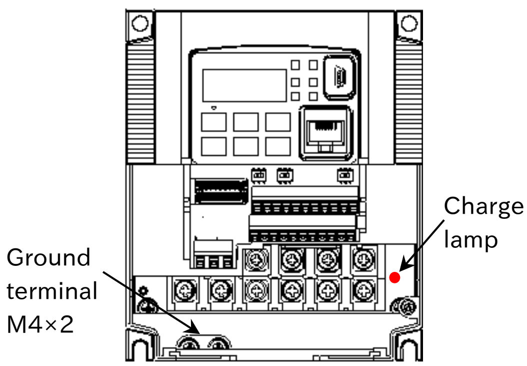


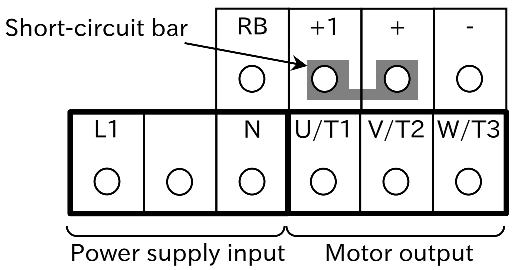


Screw size	M3.5
Terminal width	7.3 mm

Single-phase 200 V, 0.75 kW to 2.2 kW

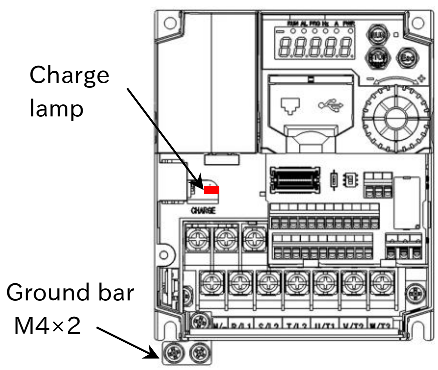
WJ200-007S/015S/022S

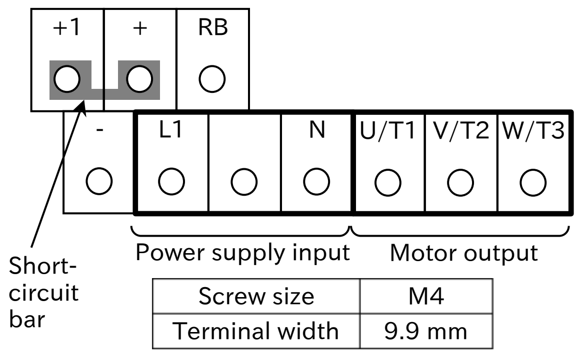




Screw size	M4
Terminal width	10 mm

C1-007S/015S/022S

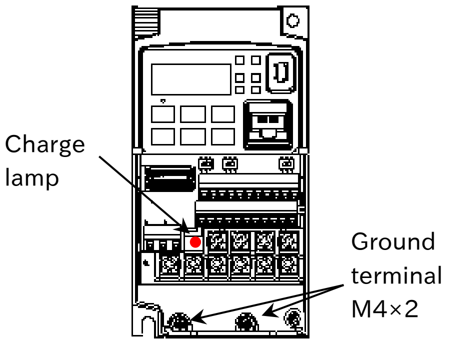


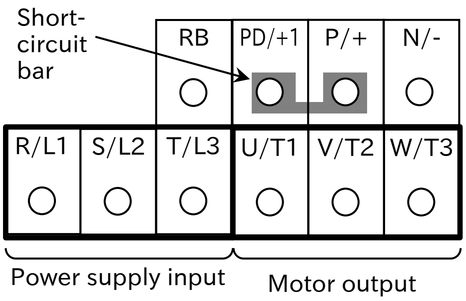


Screw size	M4
Terminal width	9.9 mm

Three-phase 200 V, 0.1 kW to 0.75 kW

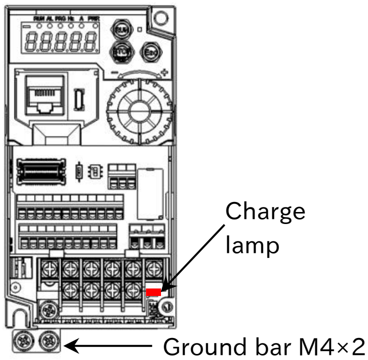
WJ200-001L/002L/004L/007L

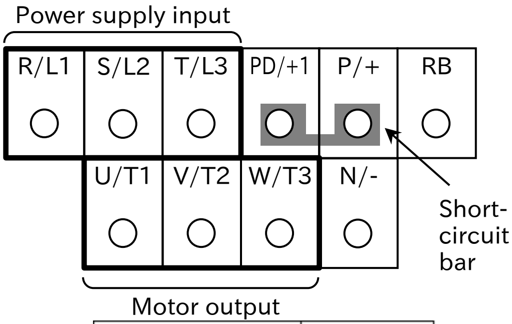




Screw size	M3.5
Terminal width	7.6 mm

C1-001L/002L/004L/007L

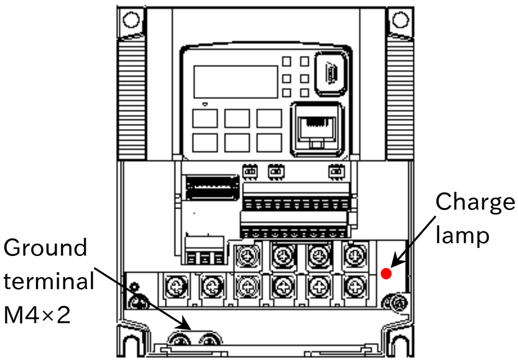


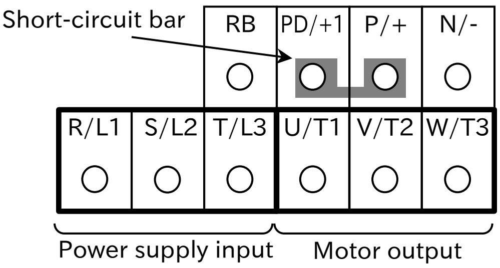


Screw size	M3.5
Terminal width	7.3 mm

Three-phase 200 V, 1.5 kW to 2.2 kW / Three-phase 400 V, 0.4 kW to 3.0 kW

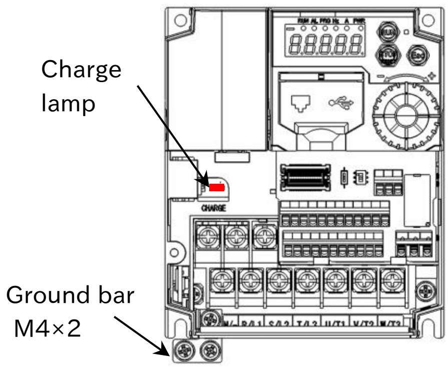
WJ200-015L/022L 004H/007H/015H/022H/030H

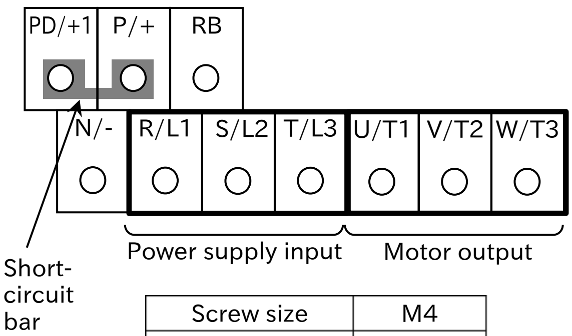




Screw size	M4
Terminal width	10 mm

C1-015L/022L 004H/007H/015H/022H/030H

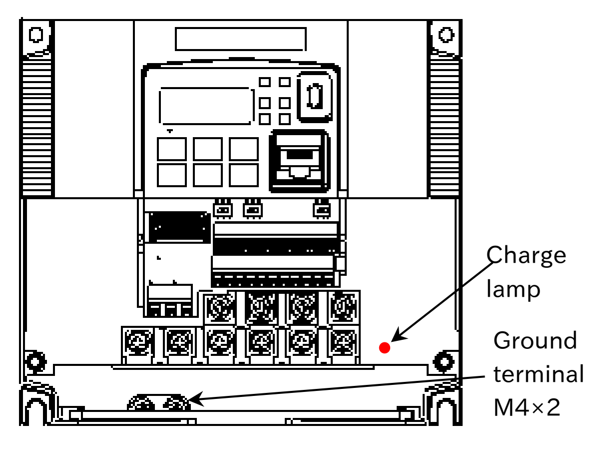


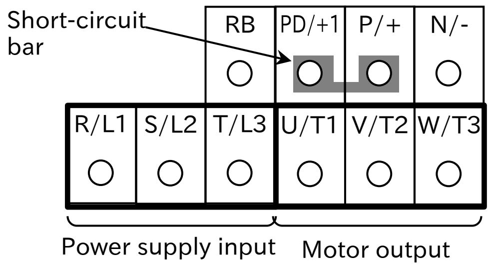


Screw size	M4
Terminal width	9.9 mm

Three-phase 200 V, 3.7 kW / Three-phase 400 V, 4.0 kW

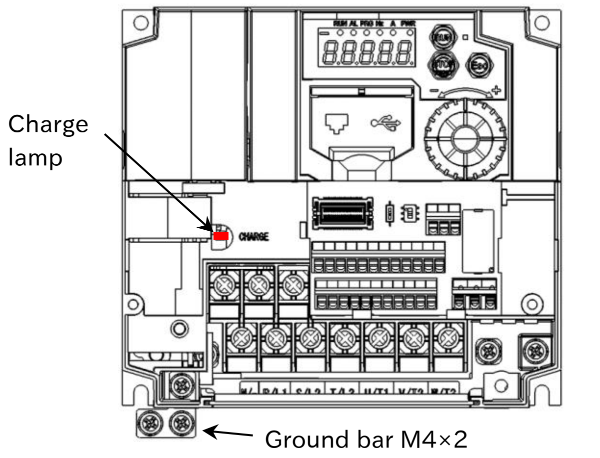
WJ200-037L/040H

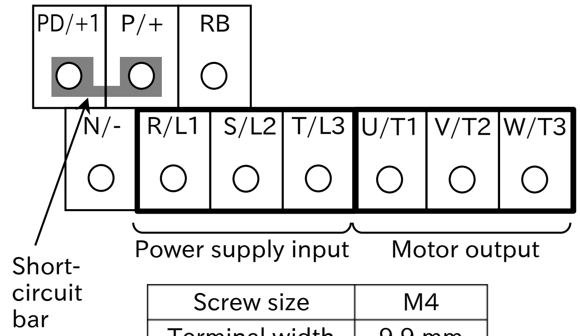




Screw size	M4
Terminal width	10 mm

C1-037L/040H

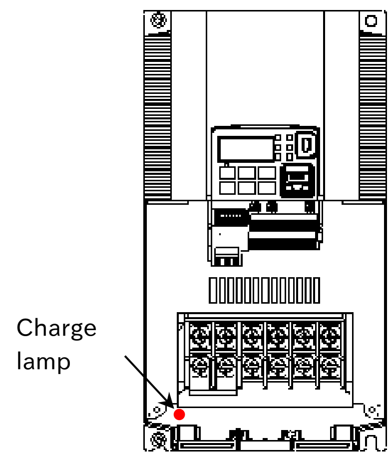


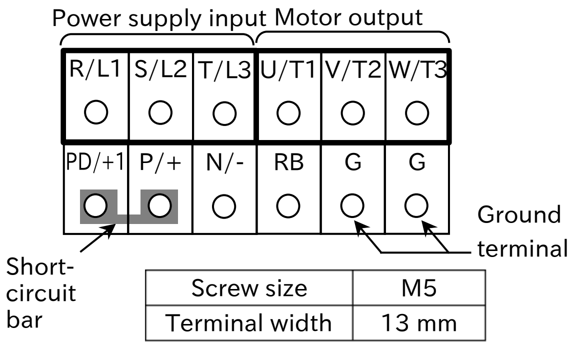


Screw size	M4
Terminal width	9.9 mm

Three-phase 200 V, 5.5 kW to 7.5 kW / Three-phase 400 V, 5.5 kW to 7.5 kW

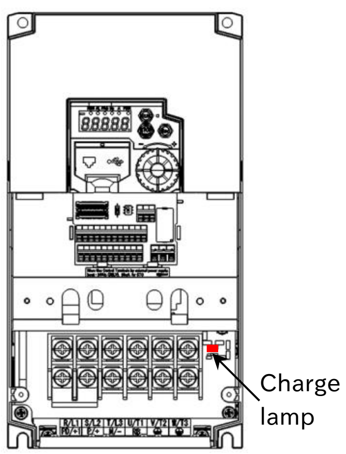
WJ200-055L/075L/055H/075H

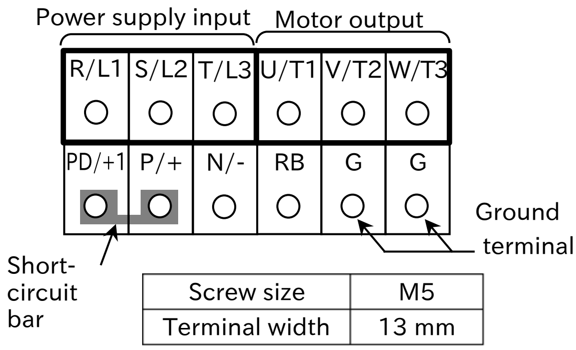




Screw size	M5
Terminal width	13 mm

C1-055L/075L/055H/075H

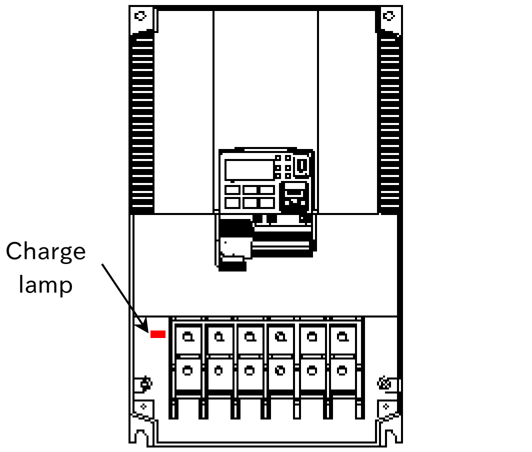


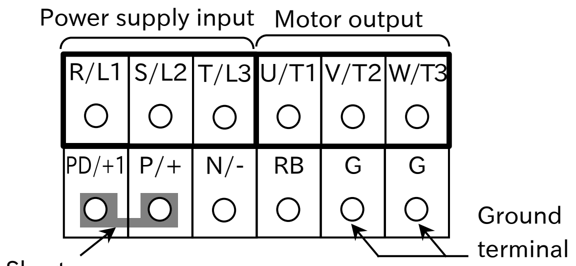


Screw size	M5
Terminal width	13 mm

Three-phase 200 V, 11 kW / Three-phase 400 V, 11 kW to 15 kW

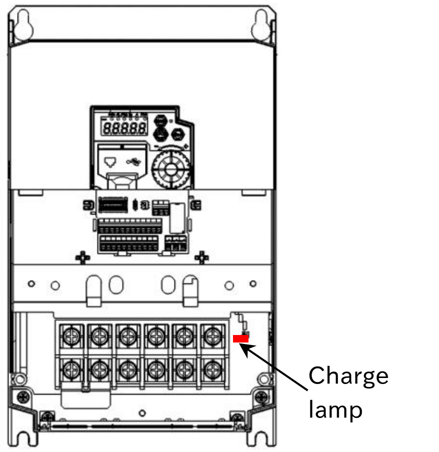
WJ200-110L/110H/150H

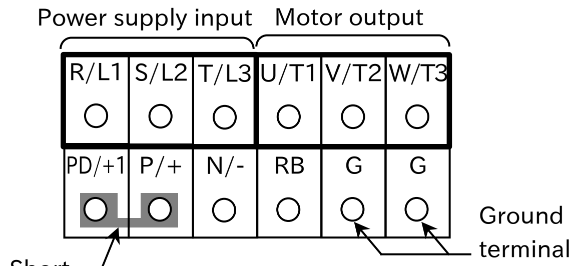




Screw size	M6
Terminal width	17.5 mm

C1-110L/110H/150H

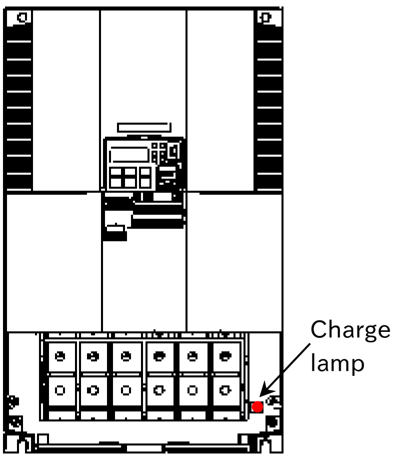


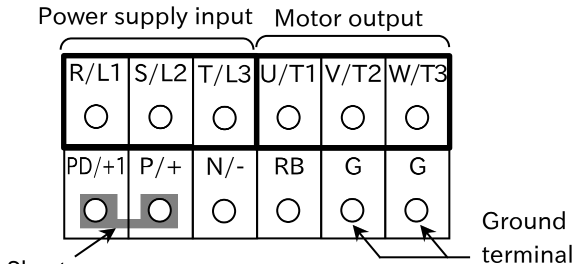


Screw size	M6
Terminal width	16.5 mm

Three-phase 200 V, 15 kW

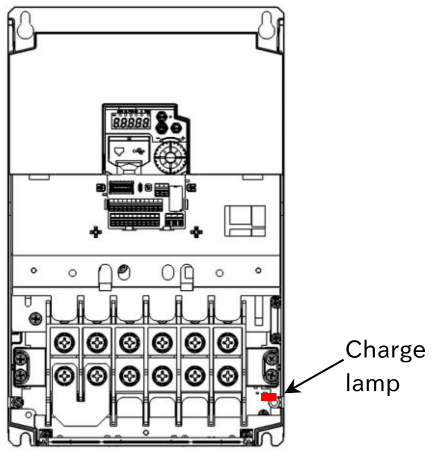
WJ200-150L

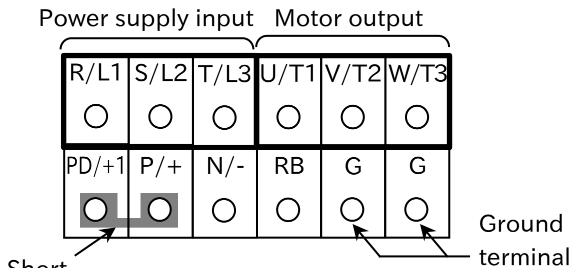




Screw size	M8
Terminal width	23 mm

C1-150L





Screw size	M8
Terminal width	23 mm

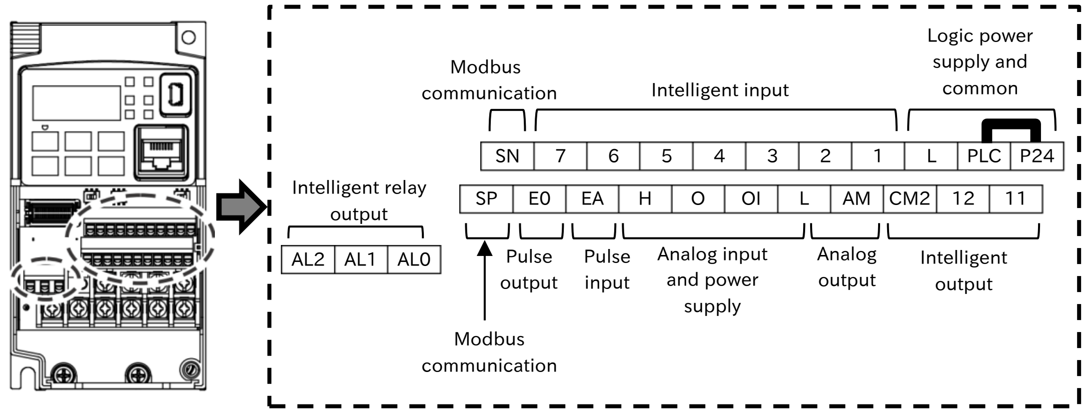
A.1.3 Comparison of Control Circuit Terminal

A

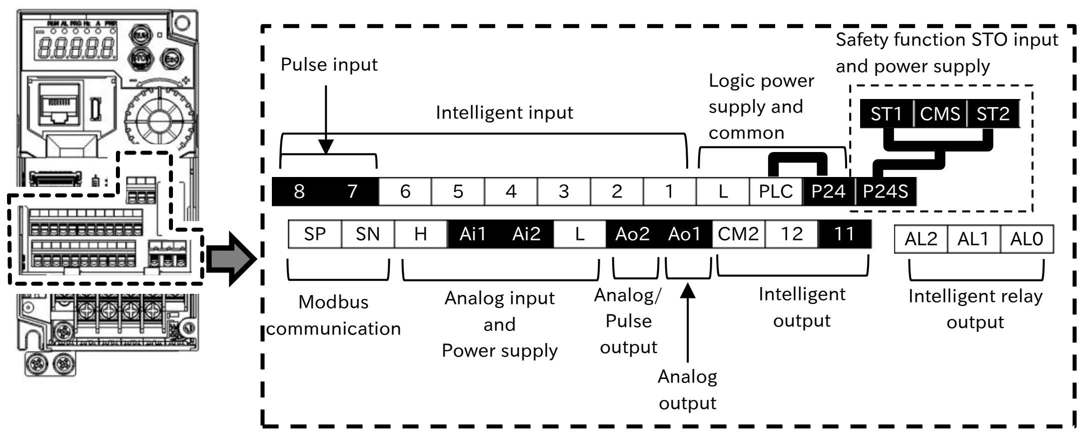
- Spring clamp type terminal block is used for control circuit terminal of both WJ200 and WJ-C1, and the recommended wire diameter and terminal are the same. For details, refer to "5.4.2 Recommended Wire Diameter and Wiring Method for Control Circuit Terminals".

■ Comparison of control circuit terminal arrangement

WJ200



WJ-C1



*) Terminals that have been added/changed electrical characteristics or changed functions compared to WJ200 are outlined in white. For those whose terminal symbols only have been changed, refer to the following comparison table.

■ Major changes of control circuit terminal function

Item	WJ200		WJ-C1	
	Symbol	Description	Symbol	Description
Safety input	GS1 GS2	By turning ON the safety function selector switch on the control board, input terminals [3] and [4] are switched to the safety function STO input terminals [GS1] and [GS2].	ST1 ST2 P24S CMS	Safety function STO input terminals [ST1] and [ST2] have been added as dedicated terminals. In addition, [P24S] and [CMS] have been added as dedicated power supply for functional safety. For details, refer to "14.1 Using the Safety Function STO (Safe Torque Off)".
A phase pulse input	EA	Max. input frequency is 1.8 kHz.	8	Max. input frequency is 32 kHz. (Other electrical characteristics are not changed.)
Logic power supply	P24	Internal 24 VDC power supply terminal for contact input.	P24	In addition to the content shown on the left, by inputting an external 24 VDC power supply to this terminal and the [L] terminal, only the control board can be started.

Details of comparison of control circuit terminal block

Item		WJ200 Symbol	WJ200 Name	WJ-C1 Symbol	WJ-C1 Name	Note (Functionality/Electrical characteristics, etc.)
Analog iput/output						
	Power supply	L	Common for input signal	L	Common for input signal	Equivalent
		H	Power supply for frequency setting	H	Power supply for frequency setting	
	Frequency setting (Analog input)	O	Analog input (Voltage input)	Ai1	Analog input 1 (Voltage/Current)	In WJ-C1, both [Ai1]/[Ai2] terminals can be switched between voltage input and current input by parameter setting.
		OI	Analog input (Current input)	Ai2	Analog input 2 (Voltage/Current)	
	Thermistor input	5 (PTC)	External thermistor input	5 (PTC)	External thermistor input	Equivalent
	Monitor output	AM	Analog output	Ao1	Analog output (Voltage/Current)	In WJ-C1, voltage output and current output can be switched by parameter setting.
Digital input						
	Power supply	L	Common for input signal	L	Common for input signal	Equivalent
		P24	Power supply terminal for input signal	P24	Power supply terminal for input signal	The electrical characteristics of internal 24 VDC power supply are equivalent. In WJ-C1, an external 24 VDC power supply to this terminal allows only the control power to operate, reading/writing parameters, communication, etc.
		PLC	Power supply terminal for input terminal	PLC	Sink/Source logic switching terminal for input signal	Equivalent
	Digital input	1 2 3 4 5 6 7	Intelligent input	1 2 3 4 5 6 7 8	Intelligent input	In WJ-C1, the input terminal function can be assigned to the input terminal [8]. However, voltage input is required to operate the assigned function.
	Pulse input	7 [EB]	Pulse input B	7	Pulse input B or Intelligent input	The maximum input pulse frequency is changed. WJ200 : 1.8 kHz WJ-C1 : 32 kHz
		EA	Pulse input A	8	Pulse input A or Intelligent input	In WJ-C1,This terminal can be used as an intelligent input terminal as well as a terminal for pulse input.
Digital output						
	Open collector output	11 12	Intelligent output	11 12	Intelligent output	Equivalent
		CM2	Common for intelligent output	CM2	Common for intelligent output	
	Relay output	AL0 AL1 AL2	Intelligent relay output	AL0 AL1 AL2	Intelligent relay output	
	Pulse output	E0	Pulse output	Ao2	Pulse output or Analog voltage output	In WJ-C1, voltage output/pulse output can be switched by parameters setting.
Serial communication		SP SN	Modbus communication	SP SN	Modbus communication	The resistance of termination resistor is changed. WJ200: 200 Ω WJ-C1: 120 Ω

Item	WJ200		WJ-C1		Note (Functionality/Electrical characteristics, etc.)
	Symbol	Name	Symbol	Name	
Functional safety	GS1 GS2	Safety input	–	–	To use the safety function, use the dedicated [ST1]/[ST2] terminals. WJ-C1 does not have a safety function selector switch.
	–	–	ST1 ST2	STO input 1/2	Functional safety STO input. To treat the WJ-C1 as a functional safety certified product, refer to the other guide "WJ Series C1 Safety Function Guide for Extended Mode (NT3632*X)". - Electrical Characteristics Voltage between [ST1]/[ST2] and [CMS]: ON voltage: min. 15 VDC OFF voltage: max. 5 VDC Maximum allowable voltage: 27 VDC Load current: 5.8 mA (27 VDC) Internal resistance: 4.7 kΩ
	–	–	P24S	24 VDC power supply	Dedicated 24 VDC power supply for [ST1]/[ST2] terminals. Maximum output current: 100 mA
	–	–	CMS	Common for 24 VDC power supply	Common terminal for [P24S].
	11 (EDM)	STO confirmation output	11 (EDM)	STO confirmation output	Equivalent *) In WJ-C1, it can comply with functional safety standards even if the [EDM] output terminal is not used.

A.1.4 Parameter Comparison Table

A

- The parameter differs between WJ200 and WJ-C1 extended mode. When updating from WJ200 to WJ-C1, please refer to the table below to check the parameters. Also, for each parameter of WJ-C1, refer to "18.2 List of Parameters/Register Numbers" and check the details in the corresponding section of this guide.

■ WJ200 d parameter group

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
d001	Output frequency monitor	dA-01	Output frequency monitor	
d002	Output current monitor	dA-02	Output current monitor	
d003	Rotation direction monitor	dA-03	Rotation direction monitor	
d004	Process variable (PV), PID feedback monitor	db-30	PID1 feedback value 1 monitor	
d005	Intelligent input terminal status	dA-51	Input terminal monitor	
d006	Intelligent output terminal status	dA-54	Output terminal monitor	
d007	Scaled output frequency monitor	dA-06	Output frequency scale conversion monitor	
d008	Actual frequency monitor	dA-08	Detect speed monitor	
d009	Torque command monitor	FA-15	Torque reference setting (monitor)	Torque control related parameters are enabled when [AA121]/[AA221] is set to "Sensorless vector control (IM) (08)".
d010	Torque bias monitor	FA-16	Torque bias setting (monitor)	
d012	Output torque monitor	dA-17	Output torque monitor	
d013	Output voltage monitor	dA-18	Output voltage monitor (RMS)	
d014	Input power monitor	dA-30	Input power monitor	
d015	Watt-hour monitor	dA-32	Accumulated input power monitor	
d016	Elapsed RUN time monitor	dC-22	Accumulated RUN time monitor	
d017	Elapsed power-on time monitor	dC-24	Accumulated power-on time monitor	
d018	Heat sink temperature monitor	dC-15	Cooling fin temperature monitor	
d022	Life check monitor	dC-16	Life assessment monitor	
d023	Program counter monitor	db-03	Program counter (Task-1)	
d024	Program number monitor	db-02	Program No. monitor	
d025	User monitor 0	db-08	User monitor-0	
d026	User monitor 1	db-10	User monitor-1	
d027	User monitor 2	db-12	User monitor-2	
d029	Positioning command monitor	FA-20	Position reference setting (monitor)	
d030	Current position monitor	dA-20	Current position monitor	
d050	Dual monitor	dC-30	Dual monitor	
d060	Inverter mode monitor	dC-01 dC-45	Inverter load type status IM/SM monitor	Parameters for load type selection and IM/SM(PMM) setting are separated.
d062	Frequency source monitor	dC-07 dC-08	Main speed input source monitor Sub speed input source monitor	
d063	Run source monitor	dC-10	RUN command input source monitor	
d080	Trip counter	dE-01	Trip counter	
d081	Trip monitor 1	dE-11	Trip monitor 1	
d082	Trip monitor 2	dE-12	Trip monitor 2	
d083	Trip monitor 3	dE-13	Trip monitor 3	
d084	Trip monitor 4	dE-14	Trip monitor 4	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
d085	Trip monitor 5	dE-15	Trip monitor 5	
d086	Trip monitor 6	dE-16	Trip monitor 6	
d090	Warning monitor	dE-50	Warning monitor	
d102	DC bus voltage monitor	dA-40	DC bus voltage monitor	
d103	BRD load ratio monitor	dA-41	BRD load factor monitor	
d104	Electronic thermal monitor	dA-42	Electronic thermal load factor monitor (Motor)	
d130	Analog input O monitor	dA-61	Analog input [Ai1] monitor	
d131	Analog input OI monitor	dA-62	Analog input [Ai2] monitor	
d133	Pulse train input monitor	dA-70	Pulse input monitor	
d153	PID deviation monitor	db-51	PID1 deviation monitor	
d155	PID output monitor	db-50	PID1 output monitor	

■ WJ200 F parameter group

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
F001	Output frequency setting	FA-01	Main speed reference setting (monitor)	
F002	Acceleration time (1)	AC120	Acceleration time 1, 1st-motor	
F202	Acceleration time (1), 2nd motor	AC220	Acceleration time 1, 2nd-motor	
F003	Deceleration time (1)	AC122	Deceleration time 1, 1st-motor	
F203	Deceleration time (1), 2nd motor	AC222	Deceleration time 1, 2nd-motor	
F004	Keypad RUN key routing	AA-12	RUN-key command rotation direction	

■ WJ200 A parameter group

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
A001	Frequency source	AA101	Main speed input source selection, 1st-motor	
A201	Frequency source, 2nd motor	AA201	Main speed input source selection, 2nd-motor	
A002	Run command source	AA111	RUN command input source selection, 1st-motor	
A202	Run command source, 2nd motor	AA211	RUN command input source selection, 2nd-motor	
A003	Base frequency	Hb104 Hd104*1	Async. Motor base frequency setting, 1st-motor Sync. Motor base frequency setting, 1st-motor	
A203	Base frequency, 2nd motor	Hb204 Hd204*1	Async. Motor base frequency setting, 2nd-motor Sync. Motor base frequency setting, 2nd-motor	
A004	Maximum frequency	Hb105 Hd105*1	Async. Motor maximum frequency setting, 1st-motor Sync. Motor maximum frequency setting, 1st-motor	

*1. These parameters are SM/PMM related functions. For details, contact your supplier or local Hitachi sales office.

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
A204	Maximum frequency, 2nd motor	Hb205 Hd205*1	Async. Motor maximum frequency setting, 2nd-motor Sync. Motor maximum frequency setting, 2nd-motor	
A005	[AT] selection	Cb-08 Cb-18	[Ai1] Input selection [Ai2] Input selection	In WJ-C1, analog voltage and current input is switched by parameter setting. For details of analog input, "9.15.3 Adjusting Analog Input".
A011	[O] input active range start frequency	Cb-03	[Ai1] Start value	
A012	[O] input active range end frequency	Cb-04	[Ai1] End value	
A013	[O] input active range start voltage	Cb-05	[Ai1] Start rate	
A014	[O] input active range end voltage	Cb-06	[Ai1] End rate	
A015	[O] input start frequency enable	Cb-07	[Ai1] Start value selection	
A016	Analog input filter	Cb-01 Cb-11	[Ai1] Filter time constant [Ai2] Filter time constant	Analog input filter for [Ai1]/[Ai2] terminals can be set individually.
A017	EzSQ function select	UE-02	EzSQ Function enable selection	
A019	Multi-speed operation selection	Ab-03	Multi-speed operation selection	
A020	Multi-speed freq. 0	Ab110	Multi-speed 0 setting, 1st-motor	
A220	Multi-speed freq. 0, 2nd motor	Ab210	Multi-speed 0 setting, 2nd-motor	
A021 to A035	Multi-speed freq. 1 to 15 (for both motors)	Ab-11 to Ab-25	Multi-speed 1 setting to Multi-speed 15 setting	
A038	Jog frequency	AG-20	Jogging frequency	
A039	Jog stop mode	AG-21	Jogging stop mode selection	
A041	Torque boost select	AA121	Control mode selection, 1st-motor	When [A041] of WJ200 is "Automatic torque boost (01)", set [AA121] of SJ-P1 to "V/f control (Automatic torque boost) (03)" for same behavior.
A241	Torque boost select, 2nd motor	AA221	Control mode selection, 2nd-motor	When [A241] of WJ200 is "Automatic torque boost (01)", set [AA221] of SJ-P1 to "V/f control (Automatic torque boost) (03)" for same behavior.
A042	Manual torque boost value	Hb141	Manual torque boost value, 1st-motor	
A242	Manual torque boost value, 2nd motor	Hb241	Manual torque boost value, 2nd-motor	
A043	Manual torque boost frequency	Hb142	Manual torque boost peak speed, 1st-motor	
A243	Manual torque boost frequency, 2nd motor	Hb242	Manual torque boost peak speed, 2nd-motor	
A044	V/f characteristic curve	AA121	Control mode selection, 1st-motor	
A244	V/f characteristic curve, 2nd motor	AA221	Control mode selection, 2nd-motor	
A045	V/f gain	Hb180	Output voltage gain, 1st-motor	
A245	V/f gain, 2nd motor	Hb280	Output voltage gain, 2nd-motor	
A046	Voltage compensation gain for automatic torque boost	HC101	Automatic torque boost voltage compensation gain, 1st-motor	
A246	Voltage compensation gain for automatic torque boost, 2nd motor	HC201	Automatic torque boost voltage compensation gain, 2nd-motor	
A047	Slip compensation gain for automatic torque boost	HC102	Automatic torque boost slip compensation gain, 1st-motor	
A247	Slip compensation gain for automatic torque boost, 2nd motor	HC202	Automatic torque boost slip compensation gain, 2nd-motor	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
A051	DC braking enable	AF101	DC braking selection, 1st-motor	2nd-motor parameter: [AF201]
A052	DC braking frequency	AF103	DC braking frequency, 1st-motor	2nd-motor parameter: [AF203]
A053	DC braking wait time	AF104	DC braking delay time, 1st-motor	2nd-motor parameter: [AF204]
A054	DC braking force for deceleration	AF105	DC braking force setting, 1st-motor	2nd-motor parameter: [AF205]
A055	DC braking time for deceleration	AF106	DC braking active time at stop, 1st-motor	2nd-motor parameter: [AF206]
A056	DC braking / edge or level detection for [DB] input	AF107	DC braking operation method selection, 1st-motor	2nd-motor parameter: [AF207]
A057	DC braking force at start	AF108	DC braking force at start, 1st-motor	2nd-motor parameter: [AF208]
A058	DC braking time at start	AF109	DC braking active time at start, 1st-motor	2nd-motor parameter: [AF209]
A059	Carrier frequency during DC braking	—	—	Aggregate to [bb101] and [bb201]
A061	Frequency upper limit	bA102	Upper frequency limit, 1st-motor	
A261	Frequency upper limit, 2nd motor	bA202	Upper frequency limit, 2nd-motor	
A062	Frequency lower limit	bA103	Lower frequency limit, 1st-motor	
A262	Frequency lower limit, 2nd motor	bA203	Lower frequency limit, 2nd-motor	
A063	Jump freq. (center) 1	AG101	Jump frequency 1, 1st-motor	2nd-motor parameter: [AG201]
A064	Jump freq. width (hysteresis) 1	AG102	Jump frequency width 1, 1st-motor	2nd-motor parameter: [AG202]
A065	Jump freq. (center) 2	AG103	Jump frequency 2, 1st-motor	2nd-motor parameter: [AG203]
A066	Jump freq. width (hysteresis) 2	AG104	Jump frequency width 2, 1st-motor	2nd-motor parameter: [AG204]
A067	Jump freq. (center) 3	AG105	Jump frequency 3, 1st-motor	2nd-motor parameter: [AG205]
A068	Jump freq. width (hysteresis) 3	AG106	Jump frequency width 3, 1st-motor	2nd-motor parameter: [AG206]
A069	Acceleration hold frequency	AG110	Acceleration stop frequency setting, 1st-motor	2nd-motor parameter: [AG210]
A070	Acceleration hold time	AG111	Acceleration stop time setting, 1st-motor	2nd-motor parameter: [AG211]
A071	PID enable	AH-01	PID1 enable	
A072	PID proportional gain	AH-61	PID1 proportional gain 1	
A073	PID integral time constant	AH-62	PID1 integral time constant 1	
A074	PID derivative time constant	AH-63	PID1 derivative gain 1	
A075	PV scale conversion	AH-04 AH-05 AH-06	PID1 scale adjustment (0%) PID1 scale adjustment (100%) PID1 scale adjustment (decimal point position)	Set by [AH-04] to [AH-06]
A076	PV source	AH-51	PID1 feedback 1 input source selection	
A077	Reverse PID action	AH-02	PID1 deviation inversion	
A078	PID output limit	AH-71	PID1 output range	
A079	PID feed forward selection	AH-70	PID1 feed-forward input source selection	
A081	AVR function select	bA146	Over-magnetization function selection, 1st-motor	This function is for V/f control mode only. [A081], [A281] and [bA146], [bA246] are compatible as follows.
A281	AVR function select, 2nd motor	bA246	Over-magnetization function selection, 2nd-motor	

[A081]	[bA146]
Enabled (00)	Disable (00)
Disabled (01)	Always Enable (01)
Enabled except during deceleration (02)	At deceleration only (02)

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
A082	AVR voltage select	Hb106 Hd106*1	Async. Motor rated voltage, 1st-motor Sync. Motor rated voltage, 1st-motor	
A282	AVR voltage select, 2nd motor	Hb206 Hd206*1	Async. Motor rated voltage, 2nd-motor Sync. Motor rated voltage, 2nd-motor	
A083	AVR filter time constant	bA147	Over-magnetization function output filter time constant, 1st-motor	2nd-motor parameter: [bA247]
A084	AVR deceleration gain	bA148	Over-magnetization function voltage gain, 1st-motor	2nd-motor parameter: [bA248]
A085	Energy-saving operation mode	Hb145	Eco drive enable, 1st-motor	2nd-motor parameter: [Hb245]
A086	Energy-saving mode tuning	Hb146	Eco drive response adjustment, 1st-motor	2nd-motor parameter: [Hb246]
A092	Acceleration time (2)	AC124	Acceleration time 2, 1st-motor	
A292	Acceleration time (2), 2nd motor	AC224	Acceleration time 2, 2nd-motor	
A093	Deceleration time (2)	AC126	Deceleration time 2, 1st-motor	
A293	Deceleration time (2), 2nd motor	AC226	Deceleration time 2, 2nd-motor	
A094	Select method to switch to Acc2/Dec2 profile	AC115	Accel/Decel change trigger, 1st-motor	
A294	Select method to switch to Acc2/Dec2 profile, 2nd motor	AC215	Accel/Decel change trigger, 2nd-motor	
A095	Acc1 to Acc2 frequency transition point	AC116	Accel1 to Accel2 frequency transition point, 1st-motor	
A295	Acc1 to Acc2 frequency transition point, 2nd motor	AC216	Accel1 to Accel2 frequency transition point, 2nd-motor	
A096	Dec1 to Dec2 frequency transition point	AC117	Decel1 to Decel2 frequency transition point, 1st-motor	
A296	Dec1 to Dec2 frequency transition point, 2nd motor	AC217	Decel1 to Decel2 frequency transition point, 2nd-motor	
A097	Acceleration curve selection	AC-03	Acceleration curve selection	
A098	Deceleration curve selection	AC-04	Deceleration curve selection	
A101	[OI] input active range start frequency	Cb-13	[Ai2] Start value	
A102	[OI] input active range end frequency	Cb-14	[Ai2] End value	
A103	[OI] input active range start current	Cb-15	[Ai2] Start rate	
A104	[OI] input active range end current	Cb-16	[Ai2] End rate	
A105	[OI] input start frequency select	Cb-17	[Ai2] Start value selection	
A131	Acceleration curve constant	AC-05	Acceleration curve constant setting	
A132	Deceleration curve constant	AC-06	Deceleration curve constant setting	
A141	A input select for calculate function	AA101	Main speed input source selection, 1st-motor	Aggregate to main and sub speed input function.
A142	B input select for calculate function	AA102	Sub speed input source selection, 1st-motor	
A143	Calculation symbol	AA105	Speed reference calculation symbol selection, 1st-motor	2nd-motor parameter: [AA205]
A145	ADD frequency	AA106	Add frequency setting, 1st-motor	2nd-motor parameter: [AA206]
A146	ADD direction select	—	—	This parameter is deleted because [AA106] can set negative value.

*1. These parameters are SM/PMM related functions. For details, contact your supplier or local Hitachi sales office.

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
A150	Curvature of EL-S-curve at the start of acceleration	AC-08	EL-S-curve ratio at start of acceleration	
A151	Curvature of EL-S-curve at the end of acceleration	AC-09	EL-S-curve ratio at end of acceleration	
A152	Curvature of EL-S-curve at the start of deceleration	AC-10	EL-S-curve ratio at start of deceleration	
A153	Curvature of EL-S-curve at the end of deceleration	AC-11	EL-S-curve ratio at end of deceleration	
A154	Deceleration hold frequency	AG112	Deceleration stop frequency setting, 1st-motor	2nd-motor parameter: [AG212]
A155	Deceleration hold time	AG113	Deceleration stop time setting, 1st-motor	2nd-motor parameter: [AG213]
A156	PID sleep function action threshold	AH-86	PID sleep start level	
A157	PID sleep function action delay time	AH-87	PID sleep active time	
A161	[VR] input active range start frequency	Cb-53	MOP-VR start value	
A162	[VR] input active range end frequency	Cb-54	MOP-VR end value	
A163	[VR] input active range start %	Cb-55	MOP-VR start ratio	
A164	[VR] input active range end %	Cb-56	MOP-VR end ratio	
A165	[VR] input start frequency select	Cb-57	MOP-VR start selection	

WJ200 b parameter group

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
b001	Restart mode on power failure / under-voltage trip	bb-24	Restart mode selection after instantaneous power failure/ under-voltage error	When [b001] is "Trip (00)", setting [bb-21] to zero has the same behavior.
b002	Allowable under-voltage power failure time	bb-25	Instantaneous power failure allowed time	
b003	Retry wait time before motor restart	bb-26	Retry wait time after instantaneous power failure/under-voltage error	
b004	Instantaneous power failure / under-voltage trip alarm enable	bb-27	Enable instantaneous power failure/under-voltage error while in stop status	
b005	Number of restarts on power failure / under-voltage trip events	bb-21	Number of retries after under-voltage	0: Trip, 255: Unlimited
b007	Restart frequency threshold	bb-42	Frequency matching minimum restart frequency	
b008	Restart mode on over voltage / over current trip	bb-28 bb-30	Restart mode selection after an overcurrent error Restart mode selection after an overvoltage error	When [b008] is "Trip (00)", setting [bb-22] and [bb-23] to zero has the same behavior.
b010	Number of retry on over voltage / over current trip	bb-22 bb-23	Number of retries after overcurrent Number of retries after over voltage	The behavior when overcurrent error and overvoltage error occur can be set individually.
b011	Retry wait time on over voltage / over current trip	bb-29 bb-31	Retry wait time after an overcurrent error Retry wait time after an overvoltage error	
b012	Level of electronic thermal	bC110	Electronic thermal level setting, 1st-motor	
b212	Level of electronic thermal, 2nd motor	bC210	Electronic thermal level setting, 2nd-motor	
b013	Electronic thermal characteristic	bC111	Electronic thermal characteristic selection, 1st-motor	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
b213	Electronic thermal characteristic, 2nd motor	bC211	Electronic thermal characteristic selection, 2nd-motor	
b015	Free setting electronic thermal freq.1	bC120	Free electronic thermal frequency-1, 1st-motor	2nd-motor parameter: [bC220]
b016	Free setting electronic thermal current1	bC121	Free electronic thermal current-1, 1st-motor	2nd-motor parameter: [bC221]
b017	Free setting electronic thermal freq.2	bC122	Free electronic thermal frequency-2, 1st-motor	2nd-motor parameter: [bC222]
b018	Free setting electronic thermal current2	bC123	Free electronic thermal current-2, 1st-motor	2nd-motor parameter: [bC223]
b019	Free setting electronic thermal freq.3	bC124	Free electronic thermal frequency-3, 1st-motor	2nd-motor parameter: [bC224]
b020	Free setting electronic thermal current3	bC125	Free electronic thermal current-3, 1st-motor	2nd-motor parameter: [bC225]
b021	Overload restriction operation mode	bA122	Overload restriction 1 mode selection, 1st-motor	
b221	Overload restriction operation mode, 2nd motor	bA222	Overload restriction 1 mode selection, 2nd-motor	
b022	Overload restriction level	bA123	Overload restriction 1 active level, 1st-motor	
b222	Overload restriction level, 2nd motor	bA223	Overload restriction 1 active level, 2nd-motor	
b023	Deceleration rate at overload restriction	bA124	Overload restriction 1 action time, 1st-motor	
b223	Deceleration rate at overload restriction, 2nd motor	bA224	Overload restriction 1 action time, 2nd-motor	
b024	Overload restriction operation mode 2	bA126	Overload restriction 2 mode selection, 1st-motor	2nd-motor parameter: [bA226]
b025	Overload restriction level 2	bA127	Overload restriction 2 active level, 1st-motor	2nd-motor parameter: [bA227]
b026	Deceleration rate 2 at overload restriction	bA128	Overload restriction 2 action time, 1st-motor	2nd-motor parameter: [bA228]
b027	OC suppression selection *	bA120	Overcurrent suppression enable, 1st-motor	2nd-motor parameter: [bA220]
b028	Current level of active freq. matching	bb-43	Active frequency matching restart level	
b029	Deceleration rate of active freq. matching	bb-44	Restart constant (speed) of Active frequency matching	
b030	Start freq. of active freq. matching	bb-47	Active frequency matching restart speed selection	
b031	Software lock mode selection	UA-16 UA-17	Soft-Lock selection Soft-Lock target selection	
b033	Motor cable length parameter	HA181	Cable length parameter, 1st-motor	2nd-motor parameter: [HA181]
b034	Run/power ON warning time	CE-36	Accum. RUN time (RNT) / Accum. Power-on time (ONT) setting	
b035	Rotation direction restriction	AA114	RUN direction restriction selection, 1st-motor	2nd-motor parameter: [AA214]
b036	Reduced voltage start selection	Hb131	Reduced voltage start time setting, 1st-motor	2nd-motor parameter: [Hb231]
b037	Function code display restriction	UA-10	Display restriction selection	
b038	Initial display selection	UA-91	Initial display selection	The initial display of VOP can be set with system setting of VOP itself.
b039	Automatic user parameter registration	UA-30	User-parameter auto setting function enable	
b040	Torque limit selection	bA110 bA111	Torque limit selection, 1st-motor Torque limiting parameters mode selection, 1st-motor	2nd-motor parameter: [bA210] 2nd-motor parameter: [bA211]
b041	Torque limit 1 (fwd/power)	bA112	Torque limit 1 (Forward drive), 1st-motor	2nd-motor parameter: [bA212]
b042	Torque limit 2 (fwd/power)	bA113	Torque limit 2 (Reverse regenerative), 1st-motor	2nd-motor parameter: [bA213]

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
b043	Torque limit 3 (rev/power)	bA114	Torque limit 3 (Reverse drive), 1st-motor	2nd-motor parameter: [bA214]
b044	Torque limit 4 (fwd/regen.)	bA115	Torque limit 4 (Forward regenerative), 1st-motor	2nd-motor parameter: [bA215]
b045	Torque LAD STOP selection	bA116	Torque limit LADSTOP selection, 1st-motor	2nd-motor parameter: [bA216]
b046	Reverse run protection	HC114	Direction reversal protection, 1st-motor	2nd-motor parameter: [HC214]
b049	Dual Rating Selection	Ub-03	Load type selection	
b050	Controlled deceleration on power loss	bA-30	Instantaneous power failure non-stop function, mode selection	
b051	DC bus voltage trigger level of ctrl. decel.	bA-31	Instantaneous power failure non-stop function, start voltage level	
b052	Over-voltage threshold of ctrl. decel.	bA-32	Instantaneous power failure non-stop function, target voltage level	
b053	Deceleration time of ctrl. decel.	bA-34	Instantaneous power failure non-stop function, deceleration time	
b054	Initial freq. drop of ctrl. decel.	bA-36	Instantaneous power failure non-stop function, start frequency decrement	
b060	Maximum-limit level of window comparator (O)	CE-40	[Ai1] Window comparator higher limit	
b061	Minimum-limit level of window comparator (O)	CE-41	[Ai1] Window comparator lower limit	
b062	Hysteresis width of window comparator (O)	CE-42	[Ai1] Window comparator hysteresis width	
b063	Maximum-limit level of window comparator (OI)	CE-43	[Ai2] Window comparator higher limit	
b064	Minimum-limit level of window comparator (OI)	CE-44	[Ai2] Window comparator lower limit	
b065	Hysteresis width of window comparator (OI)	CE-45	[Ai2] Window comparator hysteresis width	
b070	Operation level at O disconnection	CE-50 CE-51	[Ai1] Operation set level at disconnection or compare event [Ai1] Operation set level implement timing	
b071	Operation level at OI disconnection	CE-52 CE-53	[Ai2] Operation set level at disconnection or compare event [Ai2] Operation set level implement timing	
b075	Ambient temperature setting	bA-72	Ambient temperature	
b078	Watt-hour clearance	UA-14	Accumulated output power monitor clear	
b079	Watt-hour display gain	UA-15	Display gain for the accumulated output power monitor	
b082	Start frequency	Hb130	Minimum frequency adjustment, 1st-motor	2nd-motor parameter: [Hb230]
b083	Carrier frequency	bb101	Carrier frequency setting, 1st-motor	2nd-motor parameter: [bb201]
b084	Initialization mode (parameters or trip history)	Ub-01	Initialize mode selection	
b085	Country for initialization	Ub-02	Initialize data selection	
b086	Frequency scaling conversion factor	Ab-01	Frequency conversion gain	
b087	STOP key enable	AA-13	STOP-key enable	
b088	Restart mode after FRS	bb-40	Restart mode after FRS release	
b089	Automatic carrier frequency reduction	bb103	Automatic carrier reduction selection, 1st-motor	2nd-motor parameter: [bb203]
b090	Dynamic braking usage ratio	bA-60	Dynamic brake use ratio	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
b091	Stop mode selection	AA115	STOP mode selection, 1st-motor	2nd-motor parameter: [AA215]
b092	Cooling fan control	bA-70	Cooling fan control method selection	
b093	Clear elapsed time of cooling fan	bA-71	Clear accumulated cooling fan run time monitor	
b094	Initialization target data	Ub-01	Initialize mode selection	
b095	Dynamic braking control (BRD) selection	bA-61	Dynamic brake activation selection	
b096	BRD activation level	bA-62	Dynamic brake activation level	
b097	BRD register	bA-63	Dynamic brake resistor value	
b100	Free V/F setting, freq.1	Hb150	Free-V/f frequency 1 setting, 1st-motor	2nd-motor parameter: [Hb250]
b101	Free V/F setting, voltage.1	Hb151	Free-V/f voltage 1 setting, 1st-motor	2nd-motor parameter: [Hb251]
b102	Free V/F setting, freq.2	Hb152	Free-V/f frequency 2 setting, 1st-motor	2nd-motor parameter: [Hb252]
b103	Free V/F setting, voltage.2	Hb153	Free-V/f voltage 2 setting, 1st-motor	2nd-motor parameter: [Hb253]
b104	Free V/F setting, freq.3	Hb154	Free-V/f frequency 3 setting, 1st-motor	2nd-motor parameter: [Hb254]
b105	Free V/F setting, voltage.3	Hb155	Free-V/f voltage 3 setting, 1st-motor	2nd-motor parameter: [Hb255]
b106	Free V/F setting, freq.4	Hb156	Free-V/f frequency 4 setting, 1st-motor	2nd-motor parameter: [Hb256]
b107	Free V/F setting, voltage.4	Hb157	Free-V/f voltage 4 setting, 1st-motor	2nd-motor parameter: [Hb257]
b108	Free V/F setting, freq.5	Hb158	Free-V/f frequency 5 setting, 1st-motor	2nd-motor parameter: [Hb258]
b109	Free V/F setting, voltage.5	Hb159	Free-V/f voltage 5 setting, 1st-motor	2nd-motor parameter: [Hb259]
b110	Free V/F setting, freq.6	Hb160	Free-V/f frequency 6 setting, 1st-motor	2nd-motor parameter: [Hb260]
b111	Free V/F setting, voltage.6	Hb161	Free-V/f voltage 6 setting, 1st-motor	2nd-motor parameter: [Hb261]
b112	Free V/F setting, freq.7	Hb162	Free-V/f frequency 7 setting, 1st-motor	2nd-motor parameter: [Hb262]
b113	Free V/F setting, voltage.7	Hb163	Free-V/f voltage 7 setting, 1st-motor	2nd-motor parameter: [Hb263]
b120	Brake control enable	AE-14 AF130	DC braking control selection for simple positioning Brake control enable, 1st-motor	2nd-motor parameter: [AF230]
b121	Brake Wait Time for Release	AF131 AF138	Brake release wait time, 1st-motor (Forward) Brake release wait time, 1st-motor (Reverse)	2nd-motor parameter: [AF231] 2nd-motor parameter: [AF238]
b122	Brake Wait Time for Acceleration	AF132 AF139	Brake wait time for accel., 1st-motor (Forward) Brake wait time for accel., 1st-motor (Reverse)	2nd-motor parameter: [AF232] 2nd-motor parameter: [AF239]
b123	Brake Wait Time for Stopping	AF133 AF140	Brake wait time for stopping, 1st-motor (Forward) Brake wait time for stopping, 1st-motor (Reverse)	2nd-motor parameter: [AF233] 2nd-motor parameter: [AF240]
b124	Brake Wait Time for Confirmation	AF134 AF141	Brake confirmation signal wait time, 1st-motor (Forward) Brake confirmation signal wait time, 1st-motor (Reverse)	2nd-motor parameter: [AF234] 2nd-motor parameter: [AF241]
b125	Brake release freq.	AF135 AF142	Brake release frequency setting, 1st-motor (Forward) Brake release frequency setting, 1st-motor (Reverse)	2nd-motor parameter: [AF235] 2nd-motor parameter: [AF231]

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
b126	Brake release current	AF136 AF143	Brake release current setting, 1st-motor (Forward) Brake release current setting, 1st-motor (Reverse)	2nd-motor parameter: [AF236]
b127	Braking freq. setting	AF137 AF144	Braking frequency, 1st-motor (Forward) Braking frequency, 1st-motor (Reverse)	2nd-motor parameter: [AF237]
b130	Deceleration overvoltage suppression enable	bA140	Overvoltage suppression enable setting, 1st-motor	2nd-motor parameter: [bA240]
b131	Decel. overvolt. suppress level	bA141	Overvoltage suppression active level, 1st-motor	2nd-motor parameter: [bA241]
b132	Decel. overvolt. suppress const.	bA142	Overvoltage suppression active time, 1st-motor	2nd-motor parameter: [bA242]
b133	Decel. overvolt. suppress proportional gain	bA144	Constant DC bus voltage control P gain, 1st-motor	2nd-motor parameter: [bA244]
b134	Decel. overvolt. suppress integral time	bA145	Constant DC bus voltage control I gain, 1st-motor	2nd-motor parameter: [bA245]
b145	GS input mode select	bd-01 bd-03 bd-04 bd-05	STO input display selection Display selection during STO input change time Action selection after STO input change time STO input change time (shutoff)	
b146	Delay time of release operation	bd-02	STO input change time (release)	
b147	Special monitor display cancellation	bd-06	Warning release mode selection	
b148	Special monitor display re-display time	bd-07	Warning re-display time	
b150	Decel. overvolt. suppress level	UA-95	Display while external operator connected	
b160	1st parameter of Dual Monitor	UA-96	Dual monitor target 1 selection	
b161	2nd parameter of Dual Monitor	UA-97	Dual monitor target 2 selection	
b163	Frequency set in monitoring	UA-93	Enable frequency changes through monitor display	
b164	Automatic return to the initial display	UA-92	Enable auto-return to the initial display	
b165	Ex. operator com. loss action	UA-20	Action selection at keypad disconnection	
b166	Data Read/Write select	UA-18	Data R/W selection	
b171	Inverter mode selection	AA121 AA221	Control mode selection, 1st-motor Control mode selection, 2nd-motor	When [AA121]/[AA221] is (00) to (08), the applicable motor is IM. When [AA121]/[AA221] is (11), the applicable motor is SM(PMM).
b180	Initialization trigger	Ub-05	Enable initialization	
b190	Password Settings A	UA-01	Password for display	Aggregate to password setting and authentication.
b191	Password authentication A	UA-01		
b192	Password Settings B	UA-02	Password for softlock	Aggregate to password setting and authentication.
b193	Password authentication B	UA-02		
b910	Electronic thermal subtraction function selection	bC112 bC113	Electronic thermal decrease function enable, 1st-motor Electronic thermal decreasing time, 1st-motor	2nd-motor parameter: [bC212] 2nd-motor parameter: [bC213]
b911	Thermal subtraction time	bC113	Electronic thermal decreasing time, 1st-motor	2nd-motor parameter: [bC213] Aggregate to subtraction time and rime constant.
b912	Thermal subtraction time constant			
b913	Thermal accumulation gain	bC115	Electronic thermal accumulation gain, 1st-motor	

■ WJ200 C parameter group

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
C001	Input [1] function	CA-01	Input terminal [1] function	
C002	Input [2] function	CA-02	Input terminal [2] function	
C003	Input [3] function	CA-03	Input terminal [3] function	
C004	Input [4] function	CA-04	Input terminal [4] function	
C005	Input [5] function	CA-05	Input terminal [5] function	
C006	Input [6] function	CA-06	Input terminal [6] function	
C007	Input [7] function	CA-07	Input terminal [7] function	
C011	Input [1] active state	CA-21	Input terminal [1] active state	
C012	Input [2] active state	CA-22	Input terminal [2] active state	
C013	Input [3] active state	CA-23	Input terminal [3] active state	
C014	Input [4] active state	CA-24	Input terminal [4] active state	
C015	Input [5] active state	CA-25	Input terminal [5] active state	
C016	Input [6] active state	CA-26	Input terminal [6] active state	
C017	Input [7] active state	CA-27	Input terminal [7] active state	
C021	Output [11] function	CC-01	Output terminal [11] function	
C022	Output [12] function	CC-02	Output terminal [12] function	
C026	Alarm relay function	CC-07	Output terminal [AL] function	
C027	[EO] terminal selection (Pulse/PWM output)	Cd-01 Cd-03	[FM] Output wave form selection [FM] Output monitor selection	
C028	[AM] terminal selection (Analog voltage output 0...10V)	Cd-04	[Ao1] Output monitor selection	
C030	Digital current monitor reference value	Cd-02	[FM] Output base frequency (at frequency output)	
C031	Output [11] active state	CC-11	Output terminal [11] active state	
C032	Output [12] active state	CC-12	Output terminal [12] active state	
C036	Alarm relay active state	CC-17	Output terminal [AL] active state	
C038	Output mode of low current detection	CE101	Low current signal output mode selection, 1st motor	2nd-motor parameter: [CE201]
C039	Low current detection level	CE102	Low current detection level 1, 1st motor	2nd-motor parameter: [CE202]
C040	Output mode of overload warning	CE105	Overload signal output mode selection, 1st motor	2nd-motor parameter: [CE205]
C041	Overload warning level	CE106	Overload warning level 1, 1st motor	
C241	Overload warning level, 2nd motor	CE206	Overload warning level 1, 2nd motor	
C042	Frequency arrival setting for acceleration	CE-10	Arrival frequency 1 value setting during acceleration	
C043	Frequency arrival setting for deceleration	CE-11	Arrival frequency 1 value setting during deceleration	
C044	PID deviation level	AH-72	PID1 over deviation level	
C045	Frequency arrival setting 2 for acceleration	CE-12	Arrival frequency 2 value setting during acceleration	
C046	Frequency arrival setting 2 for deceleration	CE-13	Arrival frequency 2 value setting during deceleration	
C047	Pulse train input/output scale conversion	Cd-16	Pulse input/output scale conversion gain	
C052	PID FBV output high limit	AH-73	Turn-off level for the PID1 feedback compare signal	
C053	PID FBV output low limit	AH-74	Turn-on level for the PID1 feedback compare signal	
C054	Over-torque/under-torque selection	CE125	Over/Under torque selection, 1st-motor	2nd-motor parameter: [CE225]
C055	Over/under-torque level (Forward powering mode)	CE120	Over-torque level (Forward drive), 1st motor	2nd-motor parameter: [CE220]

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
C056	Over/under-torque level (Reverse regen. mode)	CE121	Over-torque level (Reverse regenerative), 1st motor	2nd-motor parameter: [CE221]
C057	Over/under-torque level (Reverse powering mode)	CE122	Over-torque level (Reverse drive), 1st motor	2nd-motor parameter: [CE222]
C058	Over/under-torque level (Forward regen. mode)	CE123	Over-torque level (Forward regenerative), 1st motor	2nd-motor parameter: [CE223]
C059	Signal output mode of Over/under-torque	CE124	Over/Under torque output signal mode, 1st-motor	2nd-motor parameter: [CE224]
C061	Electronic thermal warning level	CE-30	Electronic thermal warning level (Motor)	
C063	Zero speed detection level	CE-33	Zero speed detection level	
C064	Heat sink overheat warning	CE-34	Cooling fin overheat warning level	
C071	Communication speed	CF-01	RS485 communication baud rate selection	
C072	Modbus address	CF-02	RS485 communication node address	
C074	Communication parity	CF-03	RS485 communication parity selection	
C075	Communication stop bit	CF-04	RS485 communication stop bit selection	
C076	Communication error select	CF-05	RS485 communication error selection	
C077	Communication error time-out	CF-06	RS485 communication timeout setting	
C078	Communication wait time	CF-07	RS485 communication wait time setting	
C081	O input span calibration	Cb-31	[Ai1] Voltage/Current gain adjustment	
C082	OI input span calibration	Cb-33	[Ai2] Voltage/Current gain adjustment	
C085	Thermistor input (PTC) span calibration	Cb-41	Thermistor gain adjustment	
C091	Debug mode enable *	UC-01	Debug mode selection[1]	
C096	Communication selection	CF-08	RS485 communication mode selection	
C098	EzCOM start adr. of master	CF-20	EzCOM start node No.	
C099	EzCOM end adr. of master	CF-21	EzCOM end node No.	
C100	EzCOM starting trigger	CF-22	EzCOM start method selection	
C101	Up/Down memory mode selection	CA-61	FUP/FDN data save enable	
C102	Reset selection	CA-72	Reset mode selection	
C103	Restart mode after reset	bb-41	Restart mode after RS release	
C104	UP/DWN clear mode	CA-62	FUP/FDN UDC selection	
C105	EO gain adjustment	Cd-14	[FM] Gain adjustment	
C106	AM gain adjustment	Cd-24	[Ao1] Gain adjustment (Voltage/Current)	
C109	AM bias adjustment	Cd-23	[Ao1] Bias adjustment (Voltage/Current)	
C111	Overload warning level 2	CE107	Overload warning level 2, 1st motor	
C130	Output [11] on delay	CC-20	Output terminal [11] on-delay time	
C131	Output [11] off delay	CC-21	Output terminal [11] off-delay time	
C132	Output [12] on delay	CC-22	Output terminal [12] on-delay time	

[1]. This parameter is for factory settings. Do not change the setting from initial value.

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
C133	Output [12] off delay	CC-23	Output terminal [12] off-delay time	
C140	Relay output on delay	CC-32	Output terminal [AL] on-delay time	
C141	Relay output off delay	CC-33	Output terminal [AL] off-delay time	
C142	Logic output 1 operand A	CC-40	LOG1 operand-1 selection	
C143	Logic output 1 operand B	CC-41	LOG1 operand-2 selection	
C144	Logic output 1 operator	CC-42	LOG1 logical calculation selection	
C145	Logic output 2 operand A	CC-43	LOG2 operand-1 selection	
C146	Logic output 2 operand B	CC-44	LOG2 operand-2 selection	
C147	Logic output 2 operator	CC-45	LOG2 logical calculation selection	
C148	Logic output 3 operand A	CC-46	LOG3 operand-1 selection	
C149	Logic output 3 operand B	CC-47	LOG3 operand-2 selection	
C150	Logic output 3 operator	CC-48	LOG3 logical calculation selection	
C160	Input [1] response time	CA-41	Input terminal [1] response time	
C161	Input [2] response time	CA-42	Input terminal [2] response time	
C162	Input [3] response time	CA-43	Input terminal [3] response time	
C163	Input [4] response time	CA-44	Input terminal [4] response time	
C164	Input [5] response time	CA-45	Input terminal [5] response time	
C165	Input [6] response time	CA-46	Input terminal [6] response time	
C166	Input [7] response time	CA-47	Input terminal [7] response time	
C169	Multistage speed/position determination time	CA-55	Multistage input determination time	
C900	IRDY action selection	—		
C901	Processing cycle of overload advance notice signal select	—		
C902	Filter time constant for overload advance notice signal	CE-61	Output current related filter for terminal function	
C903	Overload advance notice signal hysteresis	—		

■ WJ200 H parameter group

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
H001	Auto-tuning selection	HA-01	Auto-tuning selection	
H002	Motor constant selection	—		
H202	Motor constant selection, 2nd motor	—		
H003	Motor capacity	Hb102	Async. Motor capacity setting, 1st-motor	
H203	Motor capacity, 2nd motor	Hb202	Async. Motor capacity setting, 2nd-motor	
H004	Motor poles setting	Hb103	Async. Motor number of poles setting, 1st-motor	
H204	Motor poles setting, 2nd motor	Hb203	Async. Motor number of poles setting, 2nd-motor	
H005	Motor speed response constant	HA115	Speed response, 1st-motor	*) Adjustment may be required.
H205	Motor speed response constant, 2nd motor	HA215	Speed response, 2nd-motor	*) Adjustment may be required.
H006	Motor stabilization constant	HA110	Stabilization constant, 1st-motor	*) Adjustment may be required.
H206	Motor stabilization constant, 2nd motor	HA210	Stabilization constant, 2nd-motor	*) Adjustment may be required.
H020	Motor constant R1 (Hitachi motor)	Hb110	Async. Motor constant R1, 1st-motor	*) Adjustment may be required.

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
H220	Motor constant R1, 2nd motor (Hitachi motor)	Hb210	Async. Motor constant R1, 2nd-motor	*) Adjustment may be required.
H021	Motor constant R2 (Hitachi motor)	Hb112	Async. Motor constant R2, 1st-motor	*) Adjustment may be required.
H221	Motor constant R2, 2nd motor (Hitachi motor)	Hb212	Async. Motor constant R2, 2nd-motor	*) Adjustment may be required.
H022	Motor constant L (Hitachi motor)	Hb114	Async. Motor constant L, 1st-motor	*) Adjustment may be required.
H222	Motor constant L, 2nd motor (Hitachi motor)	Hb214	Async. Motor constant L, 2nd-motor	*) Adjustment may be required.
H023	Motor constant I0 (Hitachi motor)	Hb116	Async. Motor constant I0, 1st-motor	*) Adjustment may be required.
H223	Motor constant I0, 2nd motor (Hitachi motor)	Hb216	Async. Motor constant I0, 2nd-motor	*) Adjustment may be required.
H024	Motor constant J (Hitachi motor)	Hb118	Async. Motor constant J, 1st-motor	*) Adjustment may be required.
H224	Motor constant J, 2nd motor (Hitachi motor)	Hb218	Async. Motor constant J, 2nd-motor	*) Adjustment may be required.
H030	Motor constant R1 (Auto tuned data)	—		In WJ-C1, Auto tuning data is save to [Hb110] to [Hb118] or [Hb210] to [Hb218].
H230	Motor constant R1, 2nd motor (Auto tuned data)	—		
H031	Motor constant R2 (Auto tuned data)	—		
H231	Motor constant R2, 2nd motor (Auto tuned data)	—		
H032	Motor constant L (Auto tuned data)	—		
H232	Motor constant L, 2nd motor (Auto tuned data)	—		
H033	Motor constant I0 (Auto tuned data)	—		
H233	Motor constant I0, 2nd motor (Auto tuned data)	—		
H034	Motor constant J (Auto tuned data)	—		
H234	Motor constant J, 2nd motor (Auto tuned data)	—		
H050	Slip compensation P gain for V/f control with FB	Hb170	Slip compensation P-gain with encoder, 1st-motor	2nd-motor parameter: [Hb270]
H051	Slip compensation I gain for V/f control with FB	Hb171	Slip compensation I-gain with encoder, 1st-motor	2nd-motor parameter: [Hb271]
H102*1	PM motor code setting	—		
H103*1	PM motor capacity (*2)	Hd102*1	Sync. Motor capacity setting, 1st-motor	2nd-motor parameter: [Hd202]*1
H104*1	PM motor pole setting	Hd103*1	Sync. Motor number of poles setting, 1st-motor	2nd-motor parameter: [Hd203]*1
H105*1	PM Rated Current	Hd108*1	Sync. Motor rated current, 1st-motor	2nd-motor parameter: [Hd208]*1
H106*1	PM const R(Resistance)	Hd110*1	Sync. Motor constant R, 1st-motor	2nd-motor parameter: [Hd210]*1
H107*1	PM const Ld (d-axis inductance)	Hd112*1	Sync. Motor constant Ld, 1st-motor	2nd-motor parameter: [Hd212]*1
H108*1	PM const Lq (q-axis inductance)	Hd114*1	Sync. Motor constant Lq, 1st-motor	2nd-motor parameter: [Hd214]*1
H109*1	PM const Ke (Induction voltage constant)	Hd116*1	Sync. Motor constant Ke, 1st-motor	2nd-motor parameter: [Hd216]*1
H110*1	PM const J (Moment of inertia)	Hd118*1	Sync. Motor constant J, 1st-motor	2nd-motor parameter: [Hd218]*1

*1. These parameters are SM/PMM related functions. For details, contact your supplier or local Hitachi sales office.

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
H111*1	PM const R (Resistance)	—		In WJ-C1, Auto tuning data is save to [Hd110] to [Hd114].
H112*1	PM const Ld (d-axis inductance)	—		
H113*1	PM const Lq (q-axis inductance)	—		
H116*1	PM Speed Response	HA115	Speed response, 1st-motor	2nd-motor parameter: [HA215]
H117*1	PM Starting Current	AF108	DC braking force at start, 1st-motor	2nd-motor parameter: [AF208]
H118*1	PM Starting Time	AF109	DC braking active time at start, 1st-motor	2nd-motor parameter: [AF209]
H119*1	PM Stabilization Constant	—		
H121*1	PM Minimum Frequency	Hd130*1	Sync. Motor minimum frequency adjustment, 1st-motor	2nd-motor parameter: [Hd230]*1
H122*1	PM No-Load Current	Hd131*1	Sync. Motor No-Load current, 1st-motor	2nd-motor parameter: [Hd231]*1
H123*1	PM Starting Method Select	Hd132*1	Sync. Motor starting method, 1st-motor	2nd-motor parameter: [Hd232]*1
H131*1	PM Initial Magnet Position Estimation 0V Wait Times	Hd133*1	Sync. Motor IMPE 0V wait number, 1st-motor	2nd-motor parameter: [Hd233]*1
H132*1	PM Initial Magnet Position Estimation Detect Wait Times	Hd134*1	Sync. Motor IMPE detect wait number, 1st-motor	2nd-motor parameter: [Hd234]*1
H133*1	PM Initial Magnet Position Estimation Detect Times	Hd135*1	Sync. Motor IMPE detect number, 1st-motor	2nd-motor parameter: [Hd235]*1
H134*1	PM Initial Magnet Position Estimation Voltage Gain	Hd136*1	Sync. Motor IMPE voltage gain, 1st-motor	2nd-motor parameter: [Hd236]*1

*1. These parameters are SM/PMM related functions. For details, contact your supplier or local Hitachi sales office.

■ WJ200 P parameter group

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
P001	Reaction when option card error occurs	oA-10	Operation selection at an option error	
P003	[EA] terminal selection	AA124 CA-90	Speed compensation with encoder selection, 1st-motor Pulse input target function selection	
P004	Pulse train input mode selection for feedback	CA-91	Pulse input mode selection	
P011	Encoder pulse setting	CA-81	Encoder constant setting	
P012	Simple positioning selection	AA123	Vector control mode selection, 1st-motor	
P014	Creep Speed	AE-16	Position displacement at creep speed	
P015	Over-speed error detection level	AE-15	Creep speed setting	
P017	Speed deviation error detection level	AE-04	Positioning completed range setting	
P026	Deceleration time Input Type	bb-80	Over-speed detection level	
P027	Reaction when option card error occurs	bb-83	Speed deviation error detection level	
P031	[EA] terminal selection	AC-01	Acceleration/Deceleration time input source selection	
P033	Torque command input selection	Ad-01	Torque reference input source selection	
P034	Torque command level input	Ad-02	Torque reference value setting	
P036	Torque bias mode selection	Ad-11	Torque bias input source selection	
P037	Torque bias value setting	Ad-12	Torque bias value setting	
P038	Torque bias polar selection	Ad-13	Torque bias polarity selection	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
P039	Speed limit of Torque control (Forward rotation)	Ad-41	Speed limit at torque control (at Forward rotation)	
P040	Speed limit of Torque control (Forward rotation)	Ad-42	Speed limit at torque control (at Reverse rotation)	
P041	Speed / Torque control switching time	Ad-04	Switching time of speed control to torque control	
P044	Communication watchdog timer (for option)	oA-11	Communication Watch Dog Timer	In WJ-C1, when communication option is required, use a communication options for WJ200 in basic mode.
P045	Inverter action on communication error (for option)	oA-12	Action selection at a communication error	
P046	DeviceNet polled I/O: Output instance number	—		
P048	Inverter action on communication idle mode	—		
P049	Motor poles setting for RPM	—		Aggregate to [Hb103] and [Hd103]
P055	Pulse train input frequency scale setting	CA-92	Pulse input frequency scale	
P056	Pulse train input frequency filter time constant setting	CA-93	Pulse input frequency filter time constant	
P057	Pulse train input bias setting	CA-94	Pulse input frequency bias value	
P058	Limitation of the pulse train input setting	CA-95	Pulse input upper frequency detection level	
P059	Lower cut off level of the input pulse	CA-96	Pulse input lower frequency detection level	
P060	Multistage position 0	AE-20	Position reference 0	
P061	Multistage position 1	AE-22	Position reference 1	
P062	Multistage position 2	AE-24	Position reference 2	
P063	Multistage position 3	AE-26	Position reference 3	
P064	Multistage position 4	AE-28	Position reference 4	
P065	Multistage position 5	AE-30	Position reference 5	
P066	Multistage position 6	AE-32	Position reference 6	
P067	Multistage position 7	AE-34	Position reference 7	
P068	Homing mode selection	AE-70	Homing function selection	
P069	Homing direction	AE-71	Direction of homing function	
P070	Low speed homing freq.	AE-72	Low-speed homing speed setting	
P071	High speed homing freq.	AE-73	High-speed homing speed setting	
P072	Position range (Forward)	AE-52	Position control range setting (forward)	
P073	Position range (Reverse)	AE-54	Position control range setting (reverse)	
P075	Positioning mode selection	AE-56	Position control mode selection	
P077	Encoder disconnection timeout	CA-85	Encoder disconnection time	
P080	Positioning restart range	AE-17	Positioning restart range	
P081	Store position at power off selection	AE-61	Save current position at power off	
P082	Current position at power off	—		
P083	Preset position data	AE-62	Pre-set position data	
P100	EzSQ user parameter (00)	UE-10	EzSQ User parameter U(00)	
P101	EzSQ user parameter (01)	UE-11	EzSQ User parameter U(01)	
P102	EzSQ user parameter (02)	UE-12	EzSQ User parameter U(02)	
P103	EzSQ user parameter (03)	UE-13	EzSQ User parameter U(03)	
P104	EzSQ user parameter (04)	UE-14	EzSQ User parameter U(04)	
P105	EzSQ user parameter (05)	UE-15	EzSQ User parameter U(05)	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
P106	EzSQ user parameter U(06)	UE-16	EzSQ User parameter U(06)	
P107	EzSQ user parameter U(07)	UE-17	EzSQ User parameter U(07)	
P108	EzSQ user parameter U(08)	UE-18	EzSQ User parameter U(08)	
P109	EzSQ user parameter U(09)	UE-19	EzSQ User parameter U(09)	
P110	EzSQ user parameter U(10)	UE-20	EzSQ User parameter U(10)	
P111	EzSQ user parameter U(11)	UE-21	EzSQ User parameter U(11)	
P112	EzSQ user parameter U(12)	UE-22	EzSQ User parameter U(12)	
P113	EzSQ user parameter U(13)	UE-23	EzSQ User parameter U(13)	
P114	EzSQ user parameter U(14)	UE-24	EzSQ User parameter U(14)	
P115	EzSQ user parameter U(15)	UE-25	EzSQ User parameter U(15)	
P116	EzSQ user parameter U(16)	UE-26	EzSQ User parameter U(16)	
P117	EzSQ user parameter U(17)	UE-27	EzSQ User parameter U(17)	
P118	EzSQ user parameter U(18)	UE-28	EzSQ User parameter U(18)	
P119	EzSQ user parameter U(19)	UE-29	EzSQ User parameter U(19)	
P120	EzSQ user parameter U(20)	UE-30	EzSQ User parameter U(20)	
P121	EzSQ user parameter U(21)	UE-31	EzSQ User parameter U(21)	
P122	EzSQ user parameter U(22)	UE-32	EzSQ User parameter U(22)	
P123	EzSQ user parameter U(23)	UE-33	EzSQ User parameter U(23)	
P124	EzSQ user parameter U(24)	UE-34	EzSQ User parameter U(24)	
P125	EzSQ user parameter U(25)	UE-35	EzSQ User parameter U(25)	
P126	EzSQ user parameter U(26)	UE-36	EzSQ User parameter U(26)	
P127	EzSQ user parameter U(27)	UE-37	EzSQ User parameter U(27)	
P128	EzSQ user parameter U(28)	UE-38	EzSQ User parameter U(28)	
P129	EzSQ user parameter U(29)	UE-39	EzSQ User parameter U(29)	
P130	EzSQ user parameter U(30)	UE-40	EzSQ User parameter U(30)	
P131	EzSQ user parameter U(31)	UE-41	EzSQ User parameter U(31)	
P140	EzCOM number of data	CF-23	EzCOM data size	
P141	EzCOM destination 1 address	CF-24	EzCOM destination address 1	
P142	EzCOM destination 1 register	CF-25	EzCOM destination register 1	
P143	EzCOM source 1 register	CF-26	EzCOM source register 1	
P144	EzCOM destination 2 address	CF-27	EzCOM destination address 2	
P145	EzCOM destination 2 register	CF-28	EzCOM destination register 2	
P146	EzCOM source 2 register	CF-29	EzCOM source register 2	
P147	EzCOM destination 3 address	CF-30	EzCOM destination address 3	
P148	EzCOM destination 3 register	CF-31	EzCOM destination register 3	
P149	EzCOM source 3 register	CF-32	EzCOM source register 3	
P150	EzCOM destination 4 address	CF-33	EzCOM destination address 4	
P151	EzCOM destination 4 register	CF-34	EzCOM destination register 4	
P152	EzCOM source 4 register	CF-35	EzCOM source register 4	
P153	EzCOM destination 5 address	CF-36	EzCOM destination address 5	
P154	EzCOM destination 5 register	CF-37	EzCOM destination register 5	
P155	EzCOM source 5 register	CF-38	EzCOM source register 5	
P160	Option I/F command register to write 1	oJ-01	Writing register 1, Gr. A	
P161	Option I/F command register to write 2	oJ-02	Writing register 2, Gr. A	
P162	Option I/F command register to write 3	oJ-03	Writing register 3, Gr. A	
P163	Option I/F command register to write 4	oJ-04	Writing register 4, Gr. A	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
P164	Option I/F command register to write 5	oJ-05	Writing register 5, Gr. A	
P165	Option I/F command register to write 6	oJ-06	Writing register 6, Gr. A	
P166	Option I/F command register to write 7	oJ-07	Writing register 7, Gr. A	
P167	Option I/F command register to write 8	oJ-08	Writing register 8, Gr. A	
P168	Option I/F command register to write 9	oJ-09	Writing register 9, Gr. A	
P169	Option I/F command register to write 10	oJ-10	Writing register 10, Gr. A	
P170	Option I/F command register to read 1	oJ-11	Reading register 1 Gr. A	
P171	Option I/F command register to read 2	oJ-12	Reading register 2 Gr. A	
P172	Option I/F command register to read 3	oJ-13	Reading register 3 Gr. A	
P173	Option I/F command register to read 4	oJ-14	Reading register 4 Gr. A	
P174	Option I/F command register to read 5	oJ-15	Reading register 5 Gr. A	
P175	Option I/F command register to read 6	oJ-16	Reading register 6 Gr. A	
P176	Option I/F command register to read 7	oJ-17	Reading register 7 Gr. A	
P177	Option I/F command register to read 8	oJ-18	Reading register 8 Gr. A	
P178	Option I/F command register to read 9	oJ-19	Reading register 9 Gr. A	
P179	Option I/F command register to read 10	oJ-20	Reading register 10 Gr. A	
P180	Profibus Node address	—		In WJ-C1, when communication option is required, use a communication options for WJ200 in basic mode.
P181	Profibus Clear Node address	—		
P182	Profibus Map selection	—		
P185	CANOpen Node address	—		
P186	CANOpen speed selection	—		
P190	CompoNet Node address	—		
P192	DeviceNet MAC ID	—		
P195	ML2 frame length	—		
P196	ML2 Node address	—		
P200	Serial communication mode	CG-01	Register mapping function selection	
P201	Modbus external register 1	CG-11	External register 1	
P202	Modbus external register 2	CG-12	External register 2	
P203	Modbus external register 3	CG-13	External register 3	
P204	Modbus external register 4	CG-14	External register 4	
P205	Modbus external register 5	CG-15	External register 5	
P206	Modbus external register 6	CG-16	External register 6	
P207	Modbus external register 7	CG-17	External register 7	
P208	Modbus external register 8	CG-18	External register 8	
P209	Modbus external register 9	CG-19	External register 9	
P210	Modbus external register 10	CG-20	External register 10	
P211	Modbus register format 1	CG-31	External register 1 format	
P212	Modbus register format 2	CG-32	External register 2 format	
P213	Modbus register format 3	CG-33	External register 3 format	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
P214	Modbus register format 4	CG-34	External register 4 format	
P215	Modbus register format 5	CG-35	External register 5 format	
P216	Modbus register format 6	CG-36	External register 6 format	
P217	Modbus register format 7	CG-37	External register 7 format	
P218	Modbus register format 8	CG-38	External register 8 format	
P219	Modbus register format 9	CG-39	External register 9 format	
P220	Modbus register format 10	CG-40	External register 10 format	
P221	Modbus register scaling 1	CG-51	External register 1 scaling	
P222	Modbus register scaling 2	CG-52	External register 2 scaling	
P223	Modbus register scaling 3	CG-53	External register 3 scaling	
P224	Modbus register scaling 4	CG-54	External register 4 scaling	
P225	Modbus register scaling 5	CG-55	External register 5 scaling	
P226	Modbus register scaling 6	CG-56	External register 6 scaling	
P227	Modbus register scaling 7	CG-57	External register 7 scaling	
P228	Modbus register scaling 8	CG-58	External register 8 scaling	
P229	Modbus register scaling 9	CG-59	External register 9 scaling	
P230	Modbus register scaling 10	CG-60	External register 10 scaling	
P301	Modbus internal register 1	CG-71	Internal register 1	
P302	Modbus internal register 2	CG-72	Internal register 2	
P303	Modbus internal register 3	CG-73	Internal register 3	
P304	Modbus internal register 4	CG-74	Internal register 4	
P305	Modbus internal register 5	CG-75	Internal register 5	
P306	Modbus internal register 6	CG-76	Internal register 6	
P307	Modbus internal register 7	CG-77	Internal register 7	
P308	Modbus internal register 8	CG-78	Internal register 8	
P309	Modbus internal register 9	CG-79	Internal register 9	
P310	Modbus internal register 10	CG-80	Internal register 10	
P400	Modbus endian setting	CF-12	RS485 endianness selection	
P900	Single-phase encoder pulse input half cycle / whole cycle select	—		
P901	Filter time constant for speed detection	CA-86	Speed feedback filter	

■ WJ200 U パラメータグループ

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
U001	User selection 1	UA-31	User-parameter 1 selection	
U002	User selection 2	UA-32	User-parameter 2 selection	
U003	User selection 3	UA-33	User-parameter 3 selection	
U004	User selection 4	UA-34	User-parameter 4 selection	
U005	User selection 5	UA-35	User-parameter 5 selection	
U006	User selection 6	UA-36	User-parameter 6 selection	
U007	User selection 7	UA-37	User-parameter 7 selection	
U008	User selection 8	UA-38	User-parameter 8 selection	
U009	User selection 9	UA-39	User-parameter 9 selection	
U010	User selection 10	UA-40	User-parameter 10 selection	
U011	User selection 11	UA-41	User-parameter 11 selection	

WJ200		WJ-C1 (Extended mode)		Note
Code	Name	Code	Name	
U012	User selection 12	UA-42	User-parameter 12 selection	
U013	User selection 13	UA-43	User-parameter 13 selection	
U014	User selection 14	UA-44	User-parameter 14 selection	
U015	User selection 15	UA-45	User-parameter 15 selection	
U016	User selection 16	UA-46	User-parameter 16 selection	
U017	User selection 17	UA-47	User-parameter 17 selection	
U018	User selection 18	UA-48	User-parameter 18 selection	
U019	User selection 19	UA-49	User-parameter 19 selection	
U020	User selection 20	UA-50	User-parameter 20 selection	
U021	User selection 21	UA-51	User-parameter 21 selection	
U022	User selection 22	UA-52	User-parameter 22 selection	
U023	User selection 23	UA-53	User-parameter 23 selection	
U024	User selection 24	UA-54	User-parameter 24 selection	
U025	User selection 25	UA-55	User-parameter 25 selection	
U026	User selection 26	UA-56	User-parameter 26 selection	
U027	User selection 27	UA-57	User-parameter 27 selection	
U028	User selection 28	UA-58	User-parameter 28 selection	
U029	User selection 29	UA-59	User-parameter 29 selection	
U030	User selection 30	UA-60	User-parameter 30 selection	
U031	User selection 31	UA-61	User-parameter 31 selection	
U032	User selection 32	UA-62	User-parameter 32 selection	

A.2 Glossary

B

Name	Description
Basic Guide	Basic instruction manual showing only the information necessary for handling the inverter.

C

Name	Description
CE marking	A mark that is attached when meeting the EU standards. Required for sales in Europe.
Charge lamp	Indicates the charging status of the inverter to the main circuit DC voltage circuit. Even if the input power is shut off, the voltage remains as long as it is lit.
Control power supply	Power supply required to set parameters by the keypad, control PWM output gate circuit, etc.

D

Name	Description
Dynamic braking resistor	Resistor for power consumption connected to regenerative braking unit or built-in braking resistor operation circuit. Selection is required depending on the power consumption and operating time.

E

Name	Description
EMC	Electromagnetic compatibility A property that prevents other devices from malfunctioning due to noise, and a property that prevents malfunction due to noise.

F

Name	Description
Frequency setting device	A setting device with a built-in variable resistor. Connect to the analog input terminals.

H

Name	Description
Harmonic (noise)	Sine wave (distorted wave) current with a frequency that is an integral multiple of the commercial power supply (sine wave) generated by the input circuit of the inverter.
Harmonic suppression unit	The input current waveform is made sinusoidal to reduce and suppress the harmonics generated by the inverter. In addition, regenerative power can be returned to the power supply.
High frequency noise	Noise generated by voltage switching performed during power conversion of inverters, etc. There are conducted noise conducted through electric wires, radiation noise transmitted through the air, and induction noise induced in adjacent electric wires.

I

Name	Description
I/O	Input/Output
IGBT	Insulated gate bipolar transistor One of the switching elements of an inverter.
IM	Induction motor.
Intelligent input terminal	A multifunction contact input terminal. The function can be changed in the setting.
Intelligent output terminal	A multifunction contact output terminal. The function can be changed in the setting.
Inverter model	The model written on the specification label of the inverter.

K

Name	Description
Keypad	The operation part installed on the surface for operating the inverter.

L

Name	Description
LAD	Lead to acceleration and deceleration Accelerate and decelerate the motor.
LD rating	Light duty: One of the load ratings that indicates the rated current and overload current rating. It can drive motors with a higher rated current than the ND rating, but the overload current rating and temperature rating are relatively low. Can be used with light loads.

M

Name	Description
Main power supply	Supplies power to R,S,T terminals using the power supply required for inverter driving.
MFG No.	Manufacturing number of product
MOP MOP-VR	7-segment display remote operator that can be used in WJ-C1 extended mode. MOP-VR is also equipped with a potentiometer for frequency setting.

N

Name	Description
ND rating	Normal duty: One of the load ratings that indicates the rated current and overload current rating. Generally used when load conditions are severe.

P

Name	Description
Phase loss	The unstable state of input/output due to some power wiring being interrupted.
PLC	Programmable logic controller
PMM	Permanent Magnet synchronous Motor.
Power LED [PWR]	Indicates the input status of the control power supply. The main circuit power supply may remain due to the wiring even if the LED is not lit.
PWM	Pulse Width Modulation This is the pulse output method of the inverter.

R

Name	Description
Regeneration	When the fan is turned by wind, or when the motor is decelerated, the power generated on the motor side is returned to the inverter.
Regenerative converter	Option that allows regenerative power to be returned to the power supply. Significantly suppresses the power supply harmonic current.
Regenerative braking unit	The regenerative power can be consumed by the braking resistor. (Depending on the model, there are built-in and non-built-in braking resistor operation circuits. Select and connect an appropriate braking resistor.)
RTU	Remote terminal unit. Here, the name of Modbus protocol.

S

Name	Description
Sink logic	Difference in common for input and output terminals. With sink logic, for example, when using PLC output unit, current flows from the inverter input terminal side to the output unit side when the inverter input terminal is ON.
SM	Synchronous Motor. PMM is one of SM.
Source logic	Difference in common of input and output terminals. With the source logic, for example, when using PLC output unit, current flows from the output unit side to the inverter input terminal side when the inverter input terminal is ON.
Specification label	A label with inverter specifications attached to the side of the product.

U

Name	Description
UL standards	Standards published by UL LLC.
User's Guide	Instruction manual showing detailed information necessary for handling the inverter.

V

名称	説明
VOP	Remote operator with LCD panel available in WJ-C1 extended-mode. In addition to normal operations, VOP can also use functions such as parameter Read/Write and multi-lingual display.

Revision History

No.	Revision comments	Date
NT363X	First edition	2024/4