HITACHI INVERTER

SJ700-2 LARGE CAPACITY SERIES

INSTRUCTION MANUAL

Read through this Instruction Manual, and keep it handy for future reference.

NT2032X

HITACHI

Introduction

Thank you for purchasing the Hitachi SJ700-2 Large Capacity Series Inverter.

This Instruction Manual describes how to handle and maintain the Hitachi SJ700 Series Inverter. Read this Instruction Manual carefully before using the inverter, and then keep it handy for those who operate, maintain, and inspect the inverter.

Before and during the installation, operation, inspection, and maintenance of the inverter, always refer to this Instruction Manual to obtain the necessary related knowledge, and ensure you understand and follow all safety information, precautions, and operating and handling instructions for the correct use of the inverter.

Always use the inverter strictly within the range of the specifications described in this Instruction Manual and correctly implement maintenance and inspections to prevent faults occurring.

When using the inverter together with optional products, also read the manuals for those products. Note that this Instruction Manual and the manual for each optional product to be used should be delivered to the end user of the inverter.

Handling of this Instruction Manual

- The contents of this Instruction Manual are subject to change without prior notice.
- Even if you lose this Instruction Manual, it will not be resupplied, so please keep it carefully.
- No part of this Instruction Manual may be reproduced in any form without the publisher's permission.
- If you find any incorrect description, missing description or have a question concerning the contents of this Instruction Manual, please contact the publisher.

Revision History

No.	Revision content	Date of issue	Manual code
1	First edition	Oct. 2007	NT2032X

- The current edition of this Instruction Manual also includes some corrections of simple misprints, missing letters, misdescriptions and certain added explanations other than those listed in the above Revision History table.

Safety Instructions

Be sure to read this Instruction Manual and appended documents thoroughly before installing, operating, maintaining, or inspecting the inverter.
In this Instruction Manual, safety instructions are classified into two levels, namely WARNING and CAUTION.

WARNING : Indicates that incorrect handling may cause hazardous situations, which may result in serious personal injury or death.

CAUTION : Indicates that incorrect handling may cause hazardous situations, which may result in moderate or slight personal injury or physical damage alone.

Note that even a CAUTION level situation may lead to a serious consequence according to circumstances. Be sure to follow every safety instruction, which contains important safety information. Also focus on and observe the items and instructions described under "Notes" in the text.

! CAUTION

Many of the drawings in this Instruction Manual show the inverter with covers and/or parts blocking your view being removed.
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 Instruction Manual when operating the inverter.

1. Installation

! CAUTION

- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its top cover. Otherwise, you run the risk of injury by dropping the inverter.
- Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter. Otherwise, you run the risk of fire.
- Install the inverter on a structure able to bear the weight specified in this Instruction Manual. Otherwise, you run the risk of injury due to the inverter falling.
- Install the inverter on a vertical wall that is free of vibrations. Otherwise, you run the risk of injury due to the inverter falling.
- Do not install and operate the inverter if it is damaged or its parts are missing. Otherwise, you run the risk of injury.
- 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, or salt water. Otherwise, you run the risk of fire.
- The inverter is precision equipment. Do not allow it to fall or be subject to high impacts, step on it, or place a heavy load on it. Doing so may cause the inverter to fail.

2. Wiring

! WARNING

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- Do not remove rubber bushings from the wiring section. Otherwise, the edges of the wiring cover may damage the wire, resulting in a short circuit or ground fault.

! CAUTION

- Make sure that the voltage of AC power supply matches the rated voltage of your inverter. Otherwise, you run the risk of injury or fire.
- Do not input single-phase power into the inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U, V, and W). Otherwise, you run the risk of injury or fire.
- Do not connect a resistor directly to any of the DC terminals (PD, P, and N). Otherwise, you run the risk of fire.
- Connect an earth-leakage breaker to the power input circuit. Otherwise, you run the risk of fire.
- Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings). Otherwise, you run the risk of fire.
- Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
- Tighten each screw to the specified torque. No screws must be left loose. Otherwise, you run the risk of fire.
- Before operating, slide switch SW1 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Since the inverter supports two modes of cooling-fan operation, the inverter power is not always off, even when the cooling fan is stopped. Therefore, be sure to confirm that the power supply is off before wiring. Otherwise, you run the risk of electric shock and injury.
- Don’t use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

3. Operation

! WARNING

- While power is supplied to the inverter, do not touch any terminal or internal part of the inverter, check signals, or connect or disconnect any wire or connector. Otherwise, you run the risk of electric shock or fire.
- 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. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. 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.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation 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 control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- The [STOP] key is effective only when its function is enabled by setting. Prepare an emergency stop switch separately. Otherwise, you run the risk of injury.
- If an operation command has been input to the inverter before the inverter enters alarm status, the inverter will restart suddenly when the alarm status is reset. Before resetting the alarm status, make sure that no operation command has been input.
- While power is supplied to the inverter, do not touch any internal part of the inverter or insert a bar in it. Otherwise, you run the risk of electric shock or fire.

! CAUTION

- Do not touch the heat sink, which heats up during the inverter operation. Otherwise, you run the risk of burn injury.
- The inverter allows you to easily control the speed of motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. Otherwise, you run the risk of injury.
- Install an external brake system if needed. Otherwise, you run the risk of injury.
- When using the inverter to operate a standard motor at a frequency of over 60 Hz, 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. Otherwise, you run the risk of damage to the motor and machine.
- During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations. Otherwise, you run the risk of damage to the machine driven by the motor.

4. Maintenance, inspection, and parts replacement

! WARNING

- Before inspecting the inverter, be sure to turn off the power supply and wait for 10 minutes or more. Otherwise, you run the risk of electric shock.
  (Before inspection, confirm that the Charge lamp on the inverter is off and the DC voltage between terminals P and N is 45 V or less.)
- Commit only a designated person to maintenance, inspection, and the replacement of parts.
  (Be sure to remove wristwatches and metal accessories, e.g., bracelets, before maintenance and inspection work and to use insulated tools for the work.)
  Otherwise, you run the risk of electric shock and injury.

5. Others

! WARNING

- Never modify the inverter. Otherwise, you run the risk of electric shock and injury.

! CAUTION

- Do not discard the inverter with household waste. Contact an industrial waste management company in your area who can treat industrial waste without polluting the environment.

Precautions Concerning Electromagnetic Compatibility (EMC)

The SJ700 series inverter conforms to the requirements of Electromagnetic Compatibility (EMC) Directive (2004/108/EC). However, when using the inverter in Europe, you must comply with the following specifications and requirements to meet the EMC Directive and other standards in Europe:

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

1. Power supply requirements
   a. Voltage fluctuation must be -15% to +10% or less.
   b. Voltage imbalance must be ±3% or less.
   c. Frequency variation must be ±4% or less.
   d. Total harmonic distortion (THD) of voltage must be ±10% or less.
2. Installation requirement
   a. A special filter and a ferrite core intended for the SJ700 large capacity series inverter must be installed, showen in the table (Table 1) below.
   b. A provided direct reactor with the SJ700 large capacity series inverter must be installed.

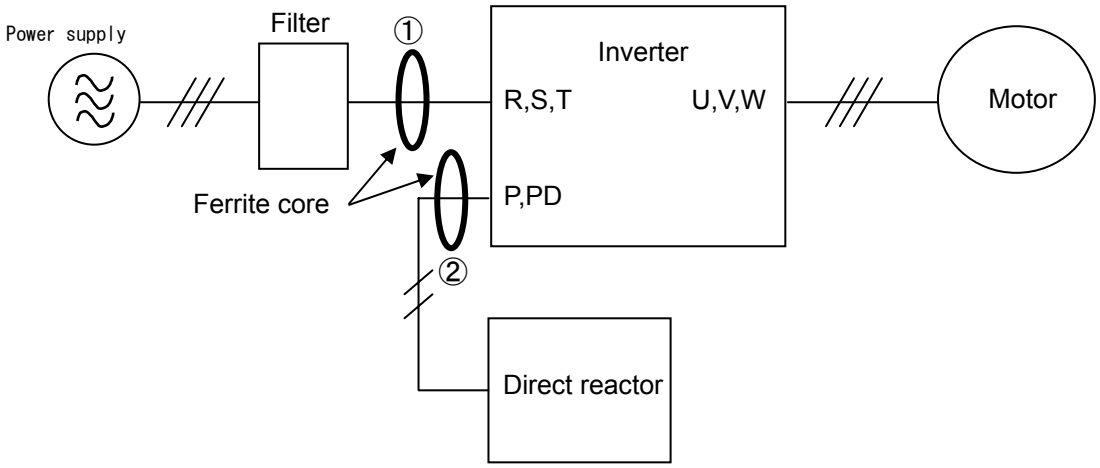

Table1

Model	Category:C2			Category:C3		
	Filter	Ferrite core ①	Ferrite core ②	Filter	Ferrite core ①	Ferrite core ②
SJ700-1850HF2/HFE2/HFU2	✓	✓	×	×	×	×
SJ700-3150HF2/HFE2/HFU2	✓	×	×	×	×	×
SJ700-4000HF2/HFE2/HFU2	✓	✓	×	×	×	×

✓ : Installation
× : No Installation

3. Wiring requirements
   a. Shielded wire (screened cable) is required for motor wiring but is not required for the direct reactor wiring. And the length of the cable must be according to the following table (Table 2).
   b. The carrier frequency setting must be less than 3 kHz (derating is required) to meet an EMC requirement.
   c. The main circuit wiring must be separated from the control circuit wiring.
4. Environmental requirements (to be met when a filter is used)
   a. Ambient temperature must be within the range -10°C to +40°C.
   b. Relative humidity must be within the range 20% to 90% (non-condensing).
   c. Vibrations must be 1.96 m/sec^2 (0.2 G) 10 – 55Hz.
   d. The inverter must be installed indoors (not exposed to corrosive gases and dust) at an altitude of 1,000 m or less.

Table2

model	Motor cable length(m)	Direct reactor cable length(m)
SJ700-1850HF2/HFE2/HFU2	5	5
SJ700-3150HF2/HFE2/HFU2	10	5
SJ700-4000HF2/HFE2/HFU2	10	5

Precautions Concerning Compliance with UL and CUL Standards

Model No.	UL Standards	CUL Standards
SJ700-1850HF2/HFE2/HFU2	UL508C	-
SJ700-3150HF2/HFE2/HFU2	UL508C	CSA C22.2 No. 14-05
SJ700-4000HF2/HFE2/HFU2	UL508C	CSA C22.2 No. 14-05

Warning Markings
GENERAL:

These devices are open type AC Inverters with three phase input and three phase output. They are intended to be used in an enclosure. They are used to provide both an adjustable voltage and adjustable frequency to the ac motor. The inverter automatically maintains the required volts-Hz ration allowing the capability through the motor speed range.

1. Only 75C CU or equivalent wires must be used for wiring.
2. Inverter models with the suffix "H" (400 V class models) are suited to circuits that transmit current not exceeding 100k rms symmetrical amperes and with voltage of no more than 480 V.
3. The inverter must be installed in an environment that is rated for at least Pollution Degree 2 or equivalent.
4. The surrounding air temperature must not exceed 50°C.
5. The capacitor discharge time is 10 minutes or more. (Caution: Care must be taken to avoid the risk of electric shock.)
6. Each model of the inverter has a solid-state overload protection circuit or an equivalent feature for the motor.
7. Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.
8. The table below lists the tightening torque and wire range specifications for the field wiring of inverter terminals.

Model No.	Required torque (N-m)	Wire range (kcmil) [mm^2]	
		Input / Output lines R(L1),S(L2),T(L3) / U(T1),V(T2),W(T3)	DC bus lines PD(+1),P(+),N(-)
SJ700-1850HF2/HFE2/HFU2	75	250 [127] (parallel)	300 [152] (parallel)
SJ700-3150HF2/HFE2/HFU2	44	400 [203] (parallel)	500 [253] (parallel)
SJ700-4000HF2/HFE2/HFU2	52	600 [304] (parallel)	800 [405] (parallel)

9. This Instruction Manual indicates the sizes of the distribution fuse and circuit breaker that must be connected to this inverter. The following table lists the inverse time and current ratings of the circuit breakers (with rated voltage of 600 V) to be connected to the individual inverter models:

Model No.	Fuse/circuit breaker (A)	
	Type	Rating
SJ700-1850HF2/HFE2/HFU2	Inverse time	400 A
SJ700-3150HF2/HFE2/HFU2	Inverse time	700 A
SJ700-4000HF2/HFE2/HFU2	Inverse time	1000 A

10. Field wiring of the inverter must incorporate UL-listed, CSA-certified closed-loop terminal connectors that match the wire gauge in terms of size. The crimping tool specified by the connector manufacturer must be used to secure each connector.

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Chapter 1 Overview

This chapter describes the inspection of the purchased product, the product warranty, and the names of parts.

Chapter 1 Overview

(Memo)

1.1 Inspection of the Purchased Product

1.1.1 Inspecting the product

After unpacking, inspect the product as described below.
If you find the product to be abnormal or defective, contact your supplier or local Hitachi Distributor.

(1) Check the product for damage (including falling of parts and dents in the inverter body) caused during transportation.
(2) Check that the product package contains an inverter set, a DCL set and this Instruction Manual.
(3) Check the specification label to confirm that the product is the one you ordered.

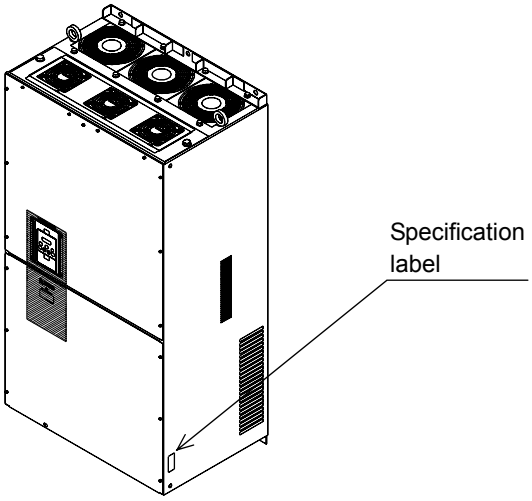


Figure 1-1-a Location of the specifications label on Inverter

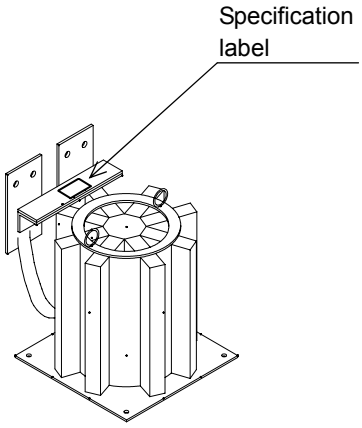


Figure 1-1-b Location of the specifications label on DCL

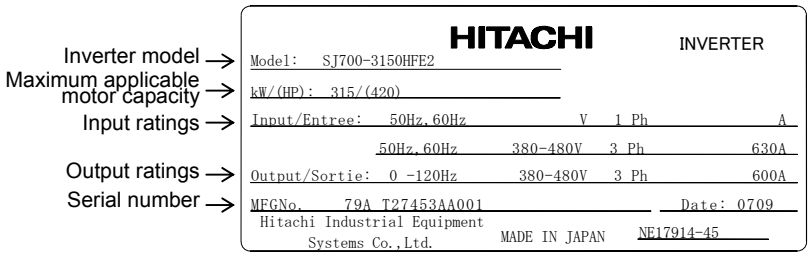


Figure 1-2-a Contents of the specifications label on Inverter

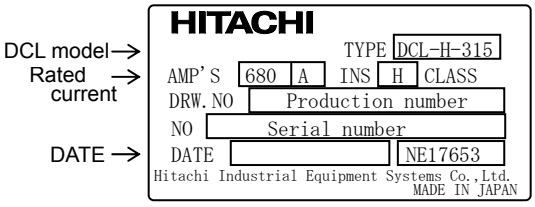


Figure 1-2-b Contents of the specifications label on DCL

1.1.2 Instruction manual (this manual)

This Instruction Manual describes how to operate the Hitachi SJ700-2 Large Capacity Series Inverter. Read this Instruction Manual thoroughly before using the inverter, and then keep it handy for future reference.
When using the inverter, together with optional products for the inverter, also refer to the manuals supplied with the optional products.
Note that this Instruction Manual and the manual for each optional product to be used should be delivered to the end user of the inverter.

1.2 Method of Inquiry and Product Warranty

1.2.1 Method of inquiry

For an inquiry about product damage or faults or a question about the product, notify your supplier of the following information:

(1) Model of your inverter
(2) Serial number (MFG No.)
(3) Date of purchase
(4) Content of inquiry
- Location and condition of damage
- Content of your question

1.2.2 Product warranty

The product will be warranted for one year after the date of purchase.
Even within the warranty period, repair of a product fault will not be covered by the warranty (but the repair will be at your own cost) in the following cases.

(1) the fault has resulted from incorrect usage not conforming to the instructions given in this Instruction Manual or the repair or modification of the product carried out by an unqualified person,
(2) the fault has resulted from a cause not attributable to the delivered product,
(3) the fault has resulted from use beyond the limits of the product specifications, or
(4) the fault has resulted from disaster or other unavoidable events.

The warranty will only apply to the delivered inverter and excludes all damage to other equipment and facilities induced by any fault of the inverter.
The warranty is effective only in Japan.

Repair at the user's charge
Following the one-year warranty period, any examination and repair of the product will be accepted at your charge. Even during the warranty period, examination and repairs of faults, subject to the above scope of the warranty disclaimer, will be available at charge.
To request a repair at your charge, contact your supplier or local Hitachi Distributor.
The Hitachi Distributors are listed on the back cover of this Instruction Manual.

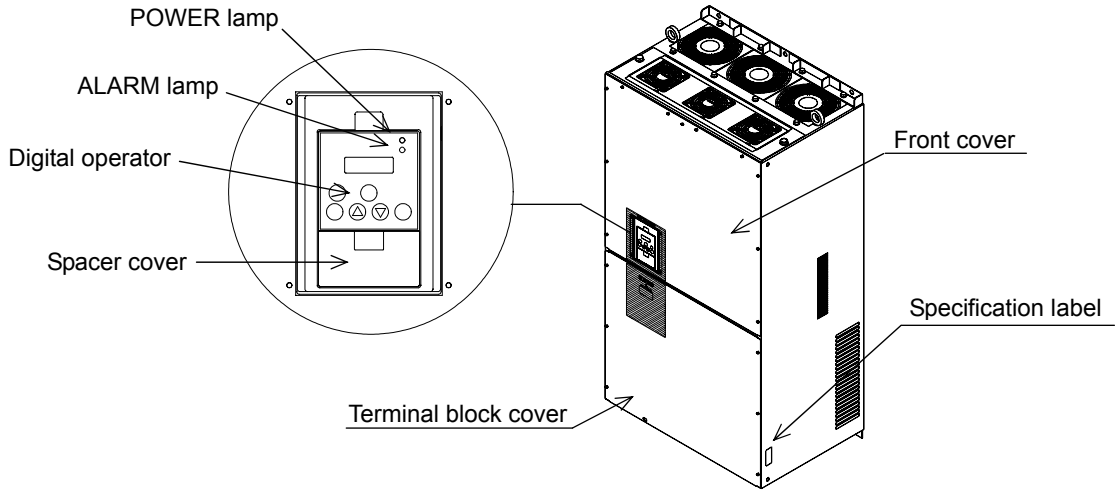
1.2.3 Warranty Terms

The warranty period under normal installation and handling conditions shall be two (2) years from the date of manufacture (“DATE” on product nameplate), or one (1) year from the date of installation, whichever occurs first. The warranty shall cover the repair or replacement, at Hitachi’s sole discretion, of ONLY the inverter that was installed.

(1) Service in the following cases, even within the warranty period, shall be charged to the purchaser:
   a. Malfunction or damage caused by mis-operation or modification or improper repair
   b. Malfunction or damage caused by a drop after purchase and transportation
   c. Malfunction or damage caused by fire, earthquake, flood, lightening, abnormal input voltage, contamination, or other natural disasters
(2) When service is required for the product at your work site, all expenses associated with field repair shall be charged to the purchaser.
(3) Always keep this manual handy; please do not loose it. Please contact your Hitachi distributor to purchase replacement or additional manuals.

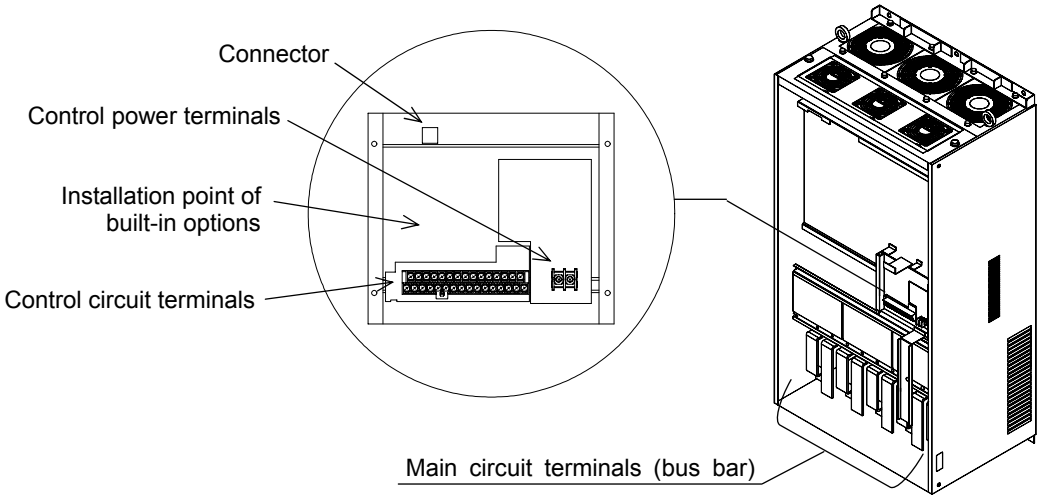
1.3 Exterior Views and Names of Parts

The figure below shows an exterior view of the inverter (model SJ700-3150HFE2).



Exterior view of shipped inverter

For the wiring of the main circuit and control circuit terminals, open the terminal block cover.
For mounting optional circuit boards, open the front cover.



Exterior view of inverter with front and terminal block covers removed

(Memo)

Chapter 2 Installation and Wiring

This chapter describes how to install the inverter and the wiring of main circuit and control signal terminals with typical examples of wiring.

Chapter 2 Installation and Wiring

(Memo)

2.1 Installation

! CAUTION

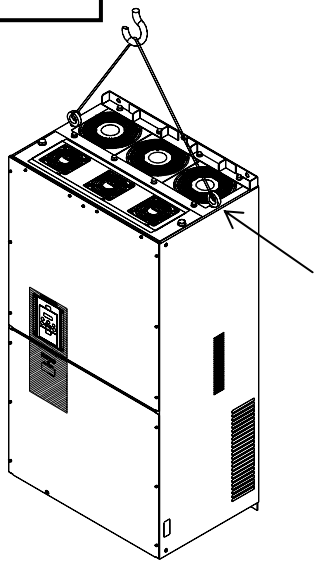
- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its top cover. Otherwise, you run the risk of injury by dropping the inverter.
- Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter. Otherwise, you run the risk of fire.
- Install the inverter on a structure able to bear the weight specified in this Instruction Manual. Otherwise, you run the risk of injury due to the inverter falling.
- Install the inverter on a vertical wall that is free of vibrations. Otherwise, you run the risk of injury due to the inverter falling.
- Do not install and operate the inverter if it is damaged or its parts are missing. Otherwise, you run the risk of injury.
- 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, or salt water. Otherwise, you run the risk of fire.
- The inverter is precision equipment. Do not allow it to fall or be subject to high impacts, step on it, or place a heavy load on it. Doing so may cause the inverter to fail.

2.1.1 Precautions for installation

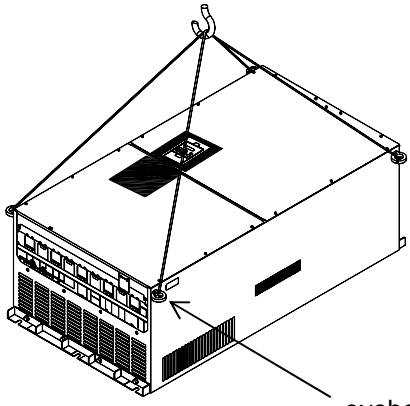
(1) Transportation

The SJ700-2 large capacity series inverter is very heavy (e.g., 315kW inverter weighs about 210kg). Therefore, treat it with enough care when it is transported. When it is lifted, use the provided eyebolts. There are two lifting methods as described below. Use either one depending on the purpose.

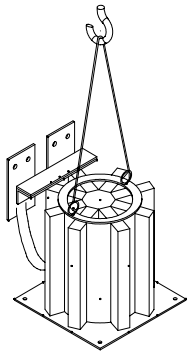
! WARNING



In case of attaching the eyebolts at the top of the inverter



In case of attaching the eyebolts at the right and left sides of the inverter

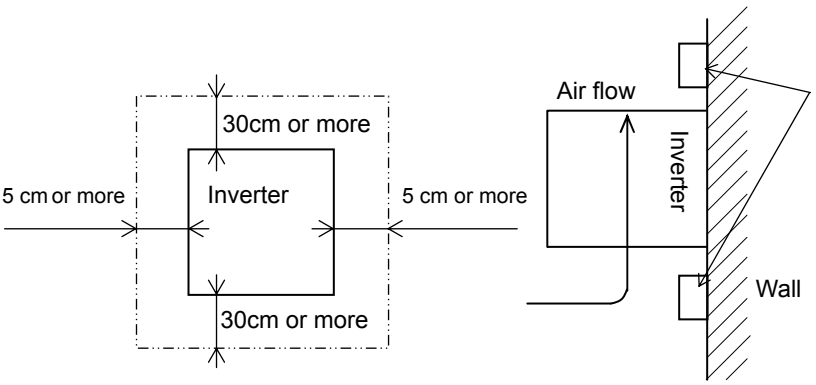


In case of lifting the DCL

(2) 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. In particular, keep sufficient distance between the inverter and other heat sources (e.g., braking resistors and reactors) if they are installed in the vicinity.



(3) Ambient temperature

Avoid installing the inverter in a place where the ambient temperature goes above or below the allowable range (-10°C to +50°C), as defined by the standard inverter specification.

Measure the temperature in a position about 5 cm distant 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).

(4) 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.

Avoid a place where the inverter is subject to condensation.

Condensation inside the inverter will result in short circuits and malfunctioning of electronic parts. Also avoid places where the inverter is exposed to direct sunlight.

(5) Ambient air

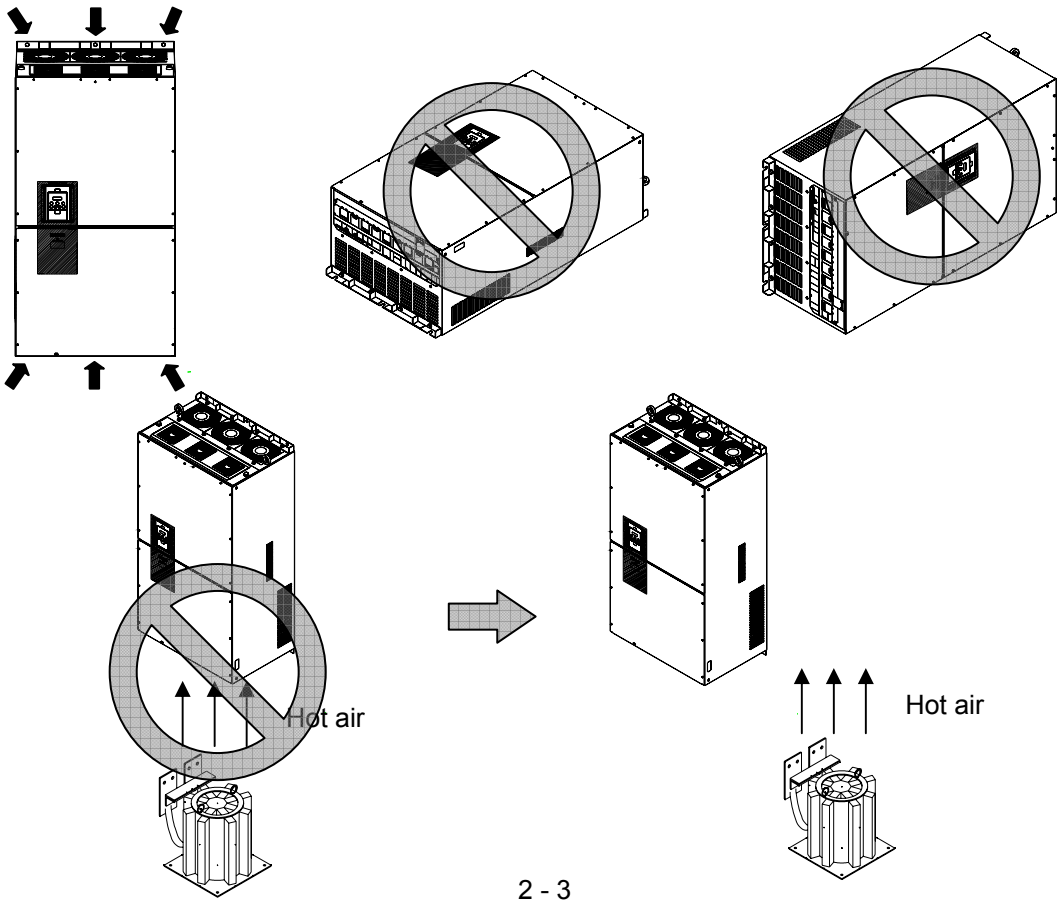
Avoid installing the inverter in a place where the inverter is subject to dust, corrosive gases, combustible gases, flammable gases, grinding fluid mist, or salt water.

Foreign particles or dust entering the inverter will cause it to fail. If you use the inverter in a considerably dusty environment, install the inverter inside a totally enclosed panel.

(6) Installation method and position

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

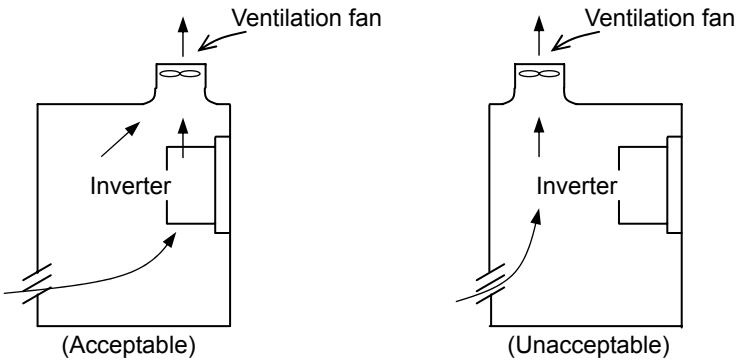
If the inverter is not installed vertically, its cooling performance may be degraded and tripping or inverter damage may result.



(7) 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. Plan the layout so that the inverter ambient temperature will remain within the allowable range.



Position of ventilation fan

(8) Reduction of enclosure size

If you mount the inverter inside an enclosure such that the heat sink of the inverter is positioned outside the enclosure, the amount of heat produced inside the enclosure can be reduced and likewise the size of the enclosure.

Mounting the inverter in an enclosure with the heat sink positioned outside requires an optional dedicated special metal fitting.

To mount the inverter in an enclosure with the heat sink positioned outside, cut out the enclosure panel according to the specified cutting dimensions.

The cooling section (including the heat sink) positioned outside the enclosure has a cooling fan. Therefore, do not place the enclosure in any environment where it is exposed to waterdrops, oil mist, or dust.

(9) Approximate loss by inverter capacity

Inverter capacity (kW)	185	315	400
Loss with 70% load (W)	4.7	8.0	10.5
Loss with 100% load (W)	6.7	11.5	15.0
Efficiency at rated output (%)	96.5	96.2	96.3

(10) Approximate loss by DCL capacity

DCL capacity (kW)	185	315	400
Loss with 70% load (W)	0.1	0.1	0.1
Loss with 100% load (W)	0.2	0.2	0.2
Efficiency at rated output (%)	99.9	99.9	99.9

2.2 Wiring

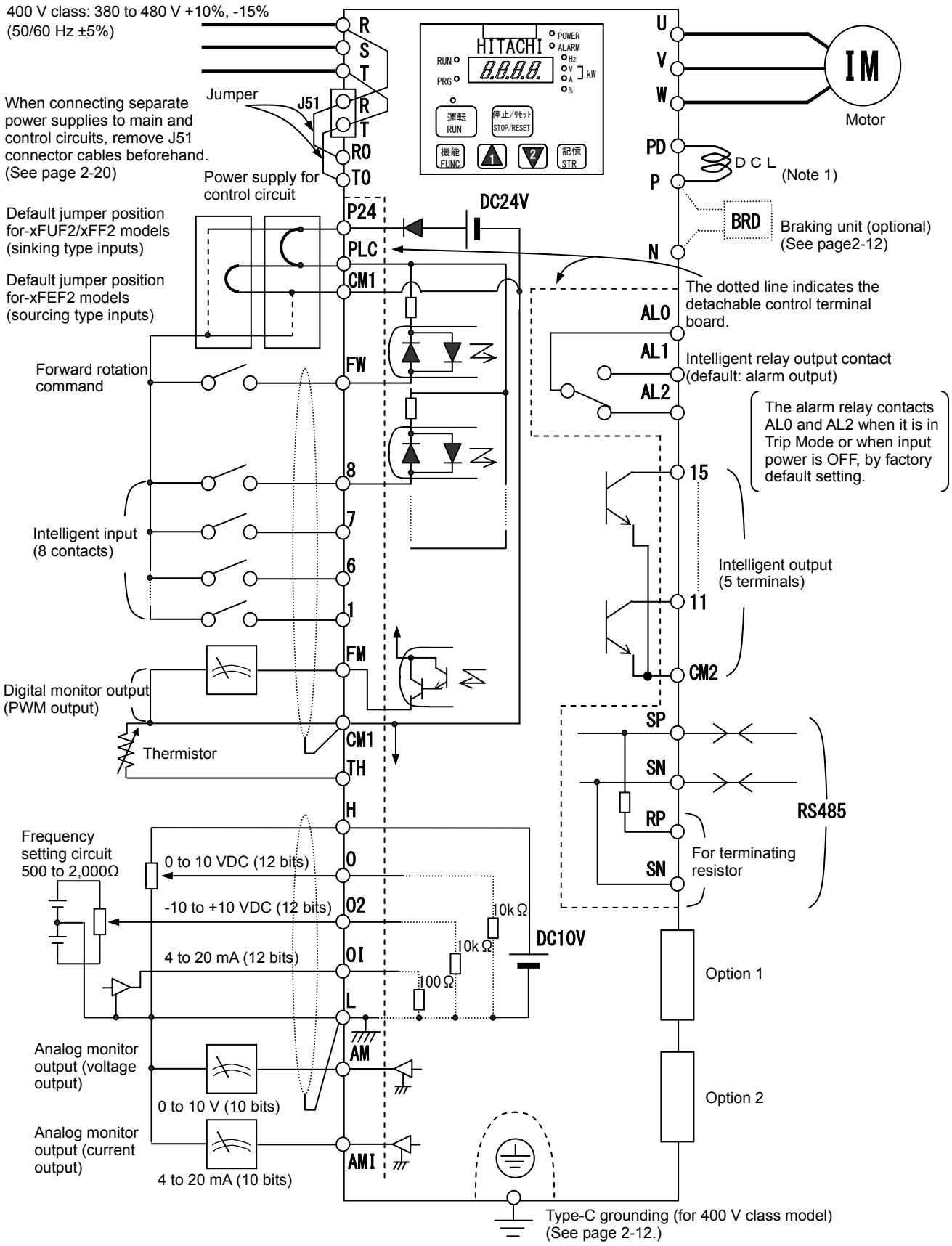
WARNING

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- Do not remove rubber bushings from the wiring section. Otherwise, the edges of the wiring cover may damage the wire, resulting in a short circuit or ground fault.

CAUTION

- Make sure that the voltage of AC power supply matches the rated voltage of your inverter. Otherwise, you run the risk of injury or fire.
- Do not input single-phase power into the inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U, V, and W). Otherwise, you run the risk of injury or fire.
- Do not connect a resistor directly to any of the DC terminals (PD, P, and N). Otherwise, you run the risk of fire.
- Connect an earth-leakage breaker to the power input(R,S,T) circuit. Otherwise, you run the risk of fire.
- Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings). Otherwise, you run the risk of fire.
- Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
- Tighten each screw to the specified torque. No screws must be left loose. Otherwise, you run the risk of fire.
- Before operating, slide switch SW1 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Since the inverter supports two modes of cooling-fan operation, the inverter power is not always off, even when the cooling fan is stopped. Therefore, be sure to confirm that the power supply is off before wiring. Otherwise, you run the risk of electric shock and injury.
- Don’t use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

2.2.1 Terminal connection diagram and explanation of terminals and switch settings



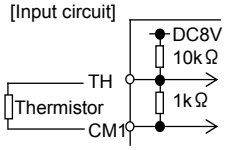
Note 1) Be sure to connect accessory DCL.

(1) Explanation of main circuit terminals

Symbol	Terminal name	Description
R, S, T (L1, L2, L3)	Main power input	Connect to the AC power supply. Leave these terminals unconnected when using a regenerative converter (HS900 series).
U, V, W (T1, T2, T3)	Inverter output	Connect a 3-phase motor.
PD, P (+1, +)	DC reactor connection	Remove the jumper from terminals PD and P, and connect the optional power factor reactor (DCL).
P, N (+, -)	Regenerative braking unit connection	Connect the optional regenerative braking unit (BRD).
⏚G	Inverter ground	Connect to ground for grounding the inverter chassis by type-C grounding (for 400 V class models).

(2) Explanation of control circuit terminals

			Symbol	Terminal name	Description	Electric property
Analog	Power supply		L	Analog power supply (common)	This common terminal supplies power to frequency command terminals (O, O2, and OI) and analog output terminals (AM and AMI). Do not ground this terminal.	
			H	Frequency setting power supply	This terminal supplies 10 VDC power to the O, O2, OI terminals.	Allowable load current: 20 mA or less
	Frequency setting input		O	Frequency command (voltage)	Input a voltage (0 to 10 VDC) as a frequency command. 10 V specifies the maximum frequency. To specify the maximum frequency with a voltage of 10 V or less, set the voltage using function "A014".	Input impedance: 10kΩ Allowable input voltages: -0.3 to +12 VDC
			O2	Auxiliary frequency command (voltage)	Input a voltage (0 to ±10 VDC) as a signal to be added to the frequency command input from the O or OI terminal. You can input an independent frequency command from this terminal (O2 terminal) alone by changing the setting.	Input impedance: 10kΩ Allowable input voltages: 0 to ±12 VDC
			OI	Frequency command (current)	Input a current (4 to 20 mA DC) as a frequency command. 20 mA specifies the maximum frequency. The OI signal is valid only when the AT signal is on. Assign the AT function to an intelligent input terminal.	Input impedance: 10kΩ Maximum allowable current: 24 mA
	Monitor output		AM	Analog monitor (voltage)	This terminal outputs one of the selected "0 to 10 VDC voltage output" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (signed or unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, and general output.	Maximum allowable current: 2 mA
			AMI	Analog monitor (current)	This terminal outputs one of the selected "4 to 20 mA DC current output" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, and general output.	Allowable load impedance: 250Ω or less
Digital (contact)	Monitor output		FM	Digital monitor (voltage)	This terminal outputs one of the selected "0 to 10 VDC voltage output (PWM output mode)" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, general output, digital output frequency, and digital current monitor. For the items "digital output frequency" and "digital current monitor," this terminal outputs a digital pulse signal at 0/10 VDC with a duty ratio of 50%.	Maximum allowable current: 1.2 mA Maximum frequency: 3.6 kHz
	Power supply		P24	Interface power supply	This terminal supplies 24 VDC power for contact input signals. If the source logic is selected, this terminal is used as a common contact input terminal.	Maximum allowable output current: 100 mA
			CM1	Interface power supply (common)	This common terminal supplies power to the interface power supply (P24), thermistor input (TH), and digital monitor (FM) terminals. If the sink logic is selected, this terminal is used as a common contact input terminal. Do not ground this terminal.	
	Contact input	Operation command	FW	Forward rotation command	Turn on this FW signal to start the forward rotation of the motor; turn it off to stop forward rotation after deceleration.	[Conditions for turning contact input on] Voltage across input and PLC: 18 VDC or more Input impedance between input and PLC: 4.7kΩ Maximum allowable voltage across input and PLC: 27 VDC Load current with 27 VDC power: about 5.6 mA
		Function selection and logic switching	1 2 3 4 5 6 7 8	Intelligent input	Select eight of a total 60 functions, and assign these eight functions to terminals 1 to 8. Note: If the emergency stop function is used, terminals 1 and 3 are used exclusively for the function. For details, see Item (3), "Emergency stop function" (on page 2-8).	

			Symbol	Terminal name	Description	Electric property
Digital (contact)	Contact input	Function selection and logic switching	PLC	Intelligent input (common)	To switch the control logic between sink logic and source logic, change the jumper connection of this (PLC) terminal to another terminal on the control circuit terminal block. Jumper terminals P24 and PLC for the sink logic; jumper terminals CM1 and PLC for the sink logic. To use an external power supply to drive the contact inputs, remove the jumper, and connect the PLC terminal to the external interface circuit.	
	Open collector output	Status and factor	11 12 13 14 15	Intelligent output	Select five of a total 51 functions, and assign these five functions to terminals 11 to 15. If you have selected an alarm code using the function "C062", terminals 11 to 13 or 11 to 14 are used exclusively for the output of cause code for alarm (e.g., inverter trip). The control logic between each of these terminals and the CM2 terminal always follows the sink or source logic.	Voltage drop between each terminal and CM2 when output signal is on: 4 V or less Maximum allowable voltage: 27 VDC Maximum allowable current: 50 mA
			CM2	Intelligent output (common)	This terminal serves as the common terminal for intelligent output terminals [11] to [15].	
	Relay contact output	Status and alarm	AL0 AL1 AL2	Intelligent relay output	Select functions from the 43 available, and assign the selected functions to these terminals, which serve as C contact output terminals. In the initial setting, these terminals output an alarm indicating that the inverter protection function has operated to stop inverter output.	(Maximum contact capacity) AL1-AL0: 250 VAC, 2 A (resistance) or 0.2 A (inductive load) AL2-AL0: 250 VAC, 1 A (resistance) or 0.2 A (inductive load) (Minimum contact capacity) 100 VAC, 10 mA 5 VDC, 100 mA
Analog	Analog input	Sensor	TH	External thermistor input	Connect to an external thermistor to make the inverter trip if an abnormal temperature is detected. The CM1 terminal serves as the common terminal for this terminal. [Recommended thermistor properties] Allowable rated power: 100 mW or more Impedance at temperature error: 3kΩ The impedance to detect temperature errors can be adjusted within the range 0Ω to 9,999Ω.	Allowable range of input voltages 0 to 8 VDC [Input circuit] 

(3) Explanation of switch settings

The internal slide switch (SW1) is used to enable or disable the emergency stop function (the function is disabled by factory setting).

* For the location of the slide switch, see page 2-10.

About the emergency stop function (disabled by the factory setting)

- The emergency stop function shuts off the inverter output (i.e. stops the switching operation of the main circuit elements) in response to a command from a hardware circuit via an intelligent input terminal without the operation by internal CPU software.

Note: The emergency stop function does not electrically shut off the inverter but merely stops the switching operation of the main circuit elements. Therefore, do not touch any terminals of the inverter or any power lines, e.g., motor cables. Otherwise, electric shock, injury, or ground fault may result.

- When the emergency stop function is enabled, intelligent input terminals 1 and 3 are used exclusively for this function, and no other functions can be assigned to these terminals. Even if other functions have been assigned to these terminals, these are automatically disabled and these terminals are used exclusively for the emergency stop function.

  Terminal [1] function:

  This terminal always serves as the a (NO) contact for the reset (RS) signal.

  This signal resets the inverter and releases the inverter from the trip due to emergency stop (E37.*).

  Terminal [3] function:

  This terminal always serves as the b (NC) contact for the emergency stop (EMR) signal.

  This signal shuts off the inverter output without the operation by internal CPU software.

  This signal makes the inverter trip due to emergency stop (E37.*).

Note: If intelligent input terminal 3 is left unconnected, the cable connected to the terminal is disconnected, or the signal logic is improper, the inverter trips due to emergency stop (E37.*). If this occurs, check and correct the wiring and signal logic, and then input the reset (RS) signal.

Only the reset (RS) signal input from intelligent input terminal [1] can release the inverter from tripping due to emergency stop (E37.*). (The inverter cannot be released from the E37.* status by any operation from the digital operator.)

- To enable the emergency stop function, set the slide lever of slide switch SW1 to ON. (With the factory setting, slide switch SW1 is set to OFF to disable the function.)

Note: Before operating slide switch SW1, make sure that the input power supply is off.

Setting of slide switch setting and function selection for intelligent input terminals [1] and [3]								
Setting of slide switch SW1	Intelligent input terminal [1]				Intelligent input terminal [3]			
	Terminal [1] function [C001]		a/b (NO/NC) selection [C011] (*1)		Terminal [3] function [C003]		a/b (NO/NC) selection [C013] (*1) (*2)	
SW1 is OFF. Emergency stop disabled (factory setting)	Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)	
	Factory setting	18 (RS)	Factory setting	00 (NO)	Factory setting	06 (JG)	Factory setting	00 (NO)
SW1 is ON. Emergency stop enabled (*5)	Automatic assignment of functions to intelligent input terminals [1] and [3] and the terminal to which function "18 (RS)" has been assigned (*3)							
	Fixed function (cannot be changed)	18 (RS)	Fixed function (cannot be changed)	00 (NO)	Fixed function (cannot be changed)	64 (EMR)	Fixed function (cannot be changed)	01 (NC)
SW1 is ON (after setting to OFF once). Emergency stop disabled (*3) (*5)	Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)	
	Setting made when SW1 is set ON retained	18 (RS)	Setting made when SW1 is set ON retained	00 (NO)	Released from emergency stop function	no (No function assigned)	Setting made when SW1 is set ON retained	01 (NC)

*1 When function "18 (RS)" is assigned to the input terminal, "a/b (NO/NC)" selection is always "00 (NO)".

*2 When terminal setting "C003" is "64 (EMR)", terminal setting "C013" is always "01 (NC)".

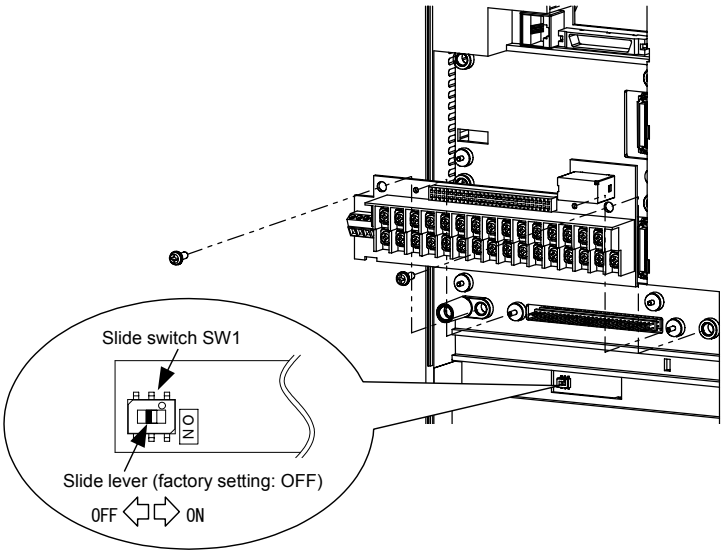
*3 If function "18 (RS)" has been assigned to an intelligent input terminal other than intelligent input terminals [1] and [3] before slide switch SW1 is set to ON, the input terminal setting for said terminal is automatically changed to "no (no function assigned)" when slide switch SW1 is set to ON to prevent any duplication of terminal functions. Even if slide switch SW1 is subsequently returned to OFF, the original function setting for said terminal will not be restored. If necessary, the original function will have to be re-assigned to said terminal.

Example: If slide switch SW1 is set to ON when function "18 (RS)" has been assigned to input terminal 2 (by terminal setting "C002"), terminal setting "C002" is changed to "no (no function assigned)," and function "18 (RS)" is assigned to input terminal 1 (by terminal setting "C001").

Even if slide switch SW1 is subsequently returned to OFF, terminal [2] function "C002" and terminal [1] function "C001" will remain as "no (no function assigned)" and "18 (RS)," respectively.

*4 Function "64 (EMR)" cannot be assigned to input terminal 3 by an operation from the digital operator. The function is automatically assigned to the terminal when slide switch SW1 is set to ON.

*5 After slide switch SW1 has been set to ON once, function assignments to intelligent input terminals [1] and [3] are not returned to their original assignments. If necessary, re-assign original functions to the intelligent input terminals.



Note: If the data of an optional operator (SRW or SRW-EX) is copied:
If operator data is copied to your SJ700 series inverter whose slide switch SW1 is ON from another SJ700 series inverter whose slide switch SW1 is OFF or an SJ300 series inverter, the digital operator on your SJ700 series inverter may display [R-ERROR COPY ROM] for a moment. This event may occur because the data on intelligent input terminals [1] and [3] cannot be copied since, on your inverter, exclusive functions have already been assigned to intelligent input terminals [1] and [3] due to the slide switch SW1 setting to ON. Note that other data is copied. If this event occurs, check the settings on both copy-source and copy-destination inverters.

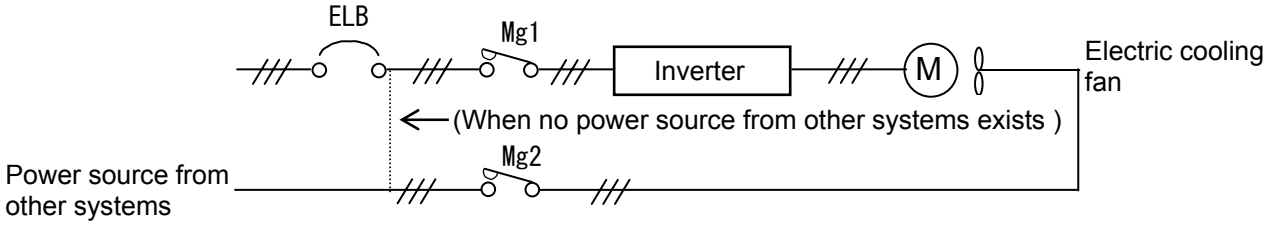
2.2.2 Wiring of the main circuit

(1) Wiring instructions

- Before wiring, be sure to confirm that the Charge lamp on the inverter is off.
  When the inverter power has been turned on once, a dangerous high voltage remains in the internal capacitors for some time after power-off, regardless of whether the inverter has been operated.
  When rewiring after power-off, always wait 10 minutes or more after power-off, and check with a multimeter that the residual voltage across terminals P and N is zero to ensure safety during rewiring work.
- Turn the shaft of screw into inverter's cover when wiring the bus bars of main circuit in 4000HF model.
  Otherwise, there is danger of contact with the cover.

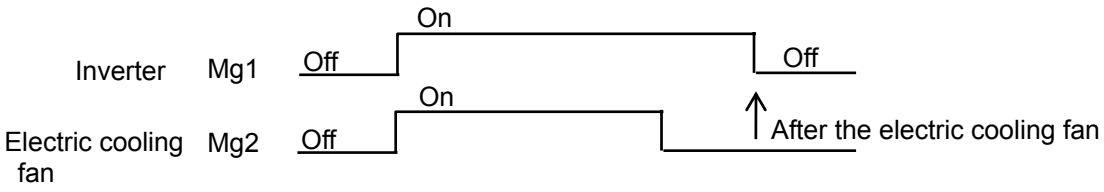
1) Main power input terminals (R, S, and T)

- Connect an earth-leakage breaker for circuit (wiring) protection between the power supply and main power input terminals (R, S, and T).
- Use an earth-leakage breaker with a high rating of a high-frequency sensitive current to prevent the breaker from malfunctioning under the influence of high frequency.
- When the protective function of the inverter operates, a fault or accident may occur in your system. Therefore, you are recommended to connect a magnetic contactor that interrupts the power supply to the inverter.
- Do not use the magnetic contactor connected to the power input terminal (primary side) or power output terminal (secondary side) of the inverter to start or stop the inverter.
  To start and stop inverter operation by external signals, use only the operation commands (FW and RV signals) that are input via control circuit terminals.
- This inverter does not support a single-phase power supply but supports only a three-phase power supply.
  If you need to use a single-phase power input, contact your supplier or local Hitachi Distributor.
- Do not operate the inverter with an phase loss power input, or it may be damaged.
  Since the factory setting of the inverter disables the phase loss input protection, the inverter will revert to the following status if a phase of power supply input is interrupted:
  R or T phase interrupted: The inverter does not operate.
  S phase interrupted: The inverter reverts to single-phase operation, and may trip because of insufficient voltage or overcurrent or be damaged.
  Internal capacitors remain charged, even when the power input is under an phase loss condition. Therefore, touching an internal part may result in electric shock and injury.
  When rewiring the main circuit, follow the instructions given in Item (1), "Wiring instructions."
- Carefully note that the internal converter module of the inverter may be damaged if:
- the imbalance of power voltage is 3% or more,
- the power supply capacity is at least 10 times as high as the inverter capacity and 500 kVA or more, or
- the power voltage changes rapidly.
  Example: The above conditions may occur when multiple inverters are connected to each other by a short bus line or your system includes a phase-advanced capacitor that is turned on and off during operation.
- Do not turn the inverter power on and off more often than once every 3 minutes.
  Otherwise, the inverter may be damaged.
- The electric cooling fan for the motor shall be powered from other systems. The motor directly connected to the power source shall also be powered from other systems. If they are powered from the same system as the inverter, an insufficient voltage protection (E09) or instantaneous power failure protection (E16) error may occur when the inverter is turned off.



When the power cannot be supplied from other systems, shut off the electromagnetic contactor MC2

for operating the electric cooling fan, and after the fan stops, shut off the electromagnetic contactor MC1 for operating the Inverter.



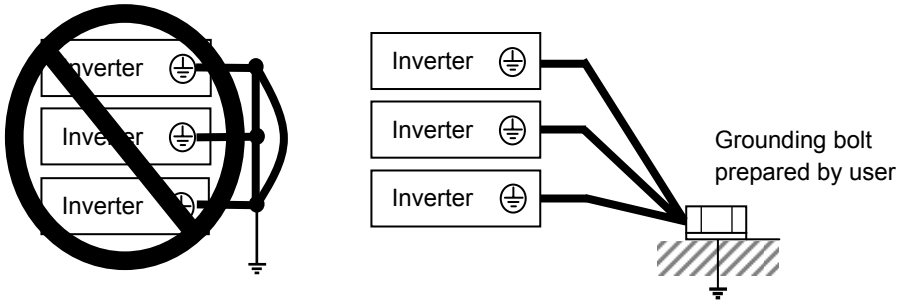
2) Inverter output terminals (U, V, and W)
- Use a cable thicker than the specified applicable cable for the wiring of output terminals to prevent the output voltage between the inverter and motor dropping. Especially at low frequency output, a voltage drop due to cable will cause the motor torque to decrease.
- Do not connect a phase-advanced capacitor or surge absorber on the output side of the inverter. If connected, the inverter may trip or the phase-advanced capacitor or surge absorber may be damaged.
- If the cable length between the inverter and motor exceeds 20 m (especially in the case of 400 V class models), the stray capacitance and inductance of the cable may cause a surge voltage at motor terminals, resulting in a motor burnout.
  A special filter to suppress the surge voltage is available. If you need this filter, contact your supplier or local Hitachi Distributor.
- When connecting multiple motors to the inverter, connect a thermal relay to the inverter output circuit for each motor.
- The RC rating of the thermal relay must be 1.1 times as high as the rated current of the motor. The thermal relay may go off too early, depending on the cable length. If this occurs, connect an AC reactor to the output of the inverter.
- Don't use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

3) DC reactor connection terminals (PD and P)
- Use these terminals to connect the DC power factor reactor (DCL).
- The cable length between the inverter and DCL must be 5 m or less.

If the DCL is not connected, power is not supplied to the main circuit of the inverter, and the inverter cannot operate.

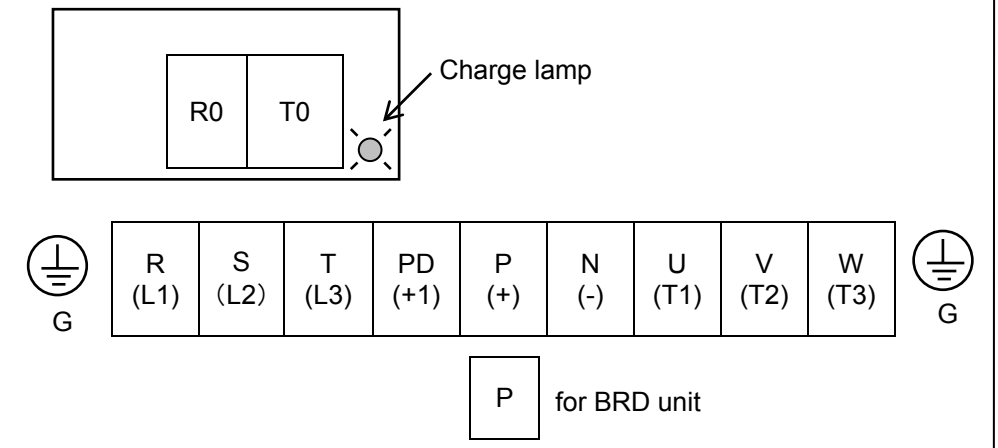
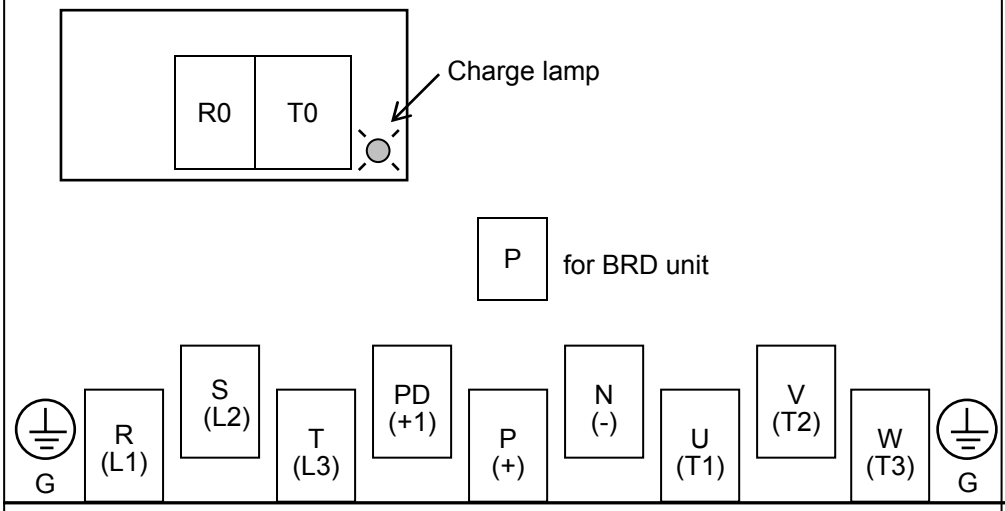
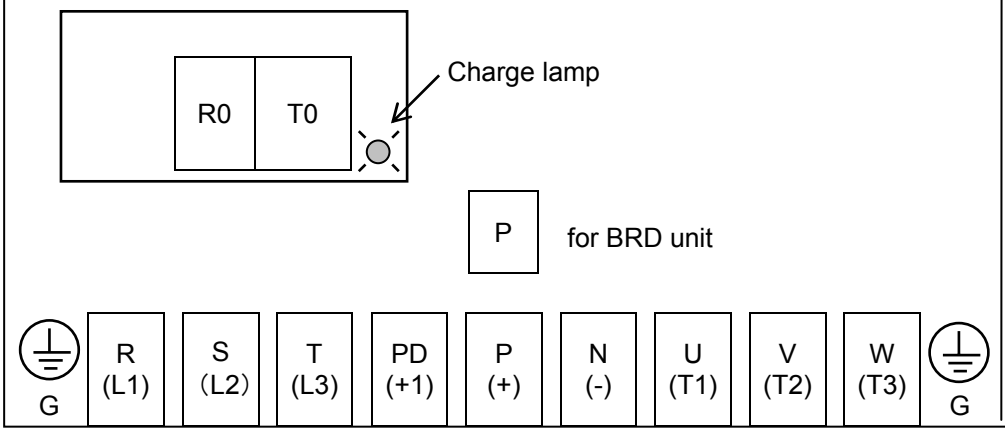
4) Regenerative braking unit connection terminals (P and N)
- Increasing the braking performance requires an optional regenerative braking unit and an external braking resistor. Connect the P and N terminals of the optional regenerative braking unit to the P and N terminals of the inverters.
- The cable length between the inverter and optional regenerative braking unit must be 5 m or less, and the two cables must be twisted for wiring.
- Do not use these terminals for connecting any devices other than the optional external braking resistor and regenerative braking unit.

5) Inverter ground terminal (G ⏚)
- Be sure to ground the inverter and motor to prevent electric shock.
- According to the Electric Apparatus Engineering Regulations, connect 400 V class models to grounding electrodes constructed in compliance with type-C grounding (conventional special type-III grounding with ground resistance of 10Ω or less).
- Use a grounding cable thicker than the specified applicable cable, and make the ground wiring as short as possible.
- When grounding multiple inverters, avoid a multi-drop connection of the grounding route and formation of a ground loop, otherwise the inverter may malfunction.

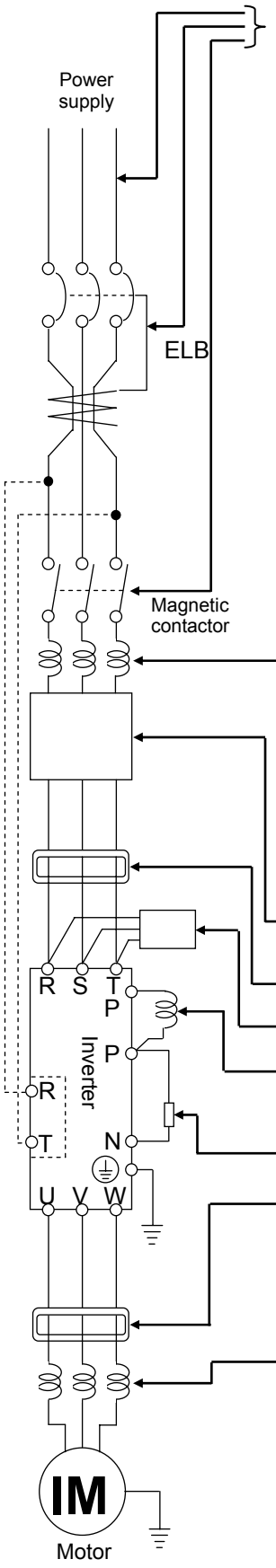


(2) Layout of main circuit terminals

The figures below show the terminal layout on the main circuit terminal block of the inverter.

Terminal layout	Inverter model
	SJ700-1850HF R0, T0 :M4 Earth terminal:M12 Other :M16 for BRD unit P:M8
	SJ700-3000, 3150HF R0, T0 :M4 Earth terminal:M12 Other :M16 for BRD unit P:M10
	SJ700-4000HF R0, T0 :M4 Earth terminal:M12 Other :M12 for BRD unit P:M10

(3) Applicable peripheral equipment



See Item (4), "Recommended cable gauges, wiring accessories, and crimp terminals."

Note 1: The peripheral equipment described here is applicable when the inverter connects a standard Hitachi 3-phase, 4-pole squirrel-cage motor.
Note 2: Select breakers that have proper capacity. (Use breakers that comply with inverters.)
Note 3: Use earth-leakage breakers (ELB) to ensure safety.
Note 4: Use copper electric wire (HIV cable) of which the maximum allowable temperature of the insulation is 75°C.
Note 5: If the power line exceeds 20 m, cable that is thicker than the specified applicable cable must be used for the power line.
Note 6: Use a 0.75 mm^2 cable to connect the alarm output contact.
Note 7: Tighten each terminal screw with the specified tightening torque. Loose terminal screws may cause short circuits and fire. Tightening a terminal screw with excessive torque may cause damage to the terminal block or inverter body.
Note 8: Select an earth-leakage breaker (ELB) of which the rated sensitivity current matches the total length of cables connected between the inverter and power supply and between the inverter and motor. Do not use a high-speed type ELB but use a delayed-type ELB because the high-speed type may malfunction.
Note 9: When a CV cable is used for wiring through a metal conduit, the average current leakage is 30 mA/km.
Note 10: When an IV cable, which has a high relative dielectric constant, is used, the leakage current is about eight times as high as the standard cable. Therefore, when using an IV cable, use the ELB of which the rated sensitivity current is eight times as high as that given in the table below. If the total cable length exceeds 100 m, use a CV cable.

Total cable length	Sensitivity current (mA)
100 m or less	50
300 m or less	100

Name	Description
Reactor on input side (for harmonic control, power supply coordination, and power factor improvement) (ALI-XXX)	Use this reactor to control harmonic waves or when the imbalance of power supply voltage is 3% or more, when the power supply capacity is 500 kVA or more, or when the power voltage may change rapidly. This reactor also improves the power factor.
Noise filter for inverter (NF-XXX)	This noise filter reduces the conductive noise that is generated by the inverter and transmitted in cables. Connect this noise filter to the primary side (input side) of the inverter.
Radio noise filter (Zero-phase reactor) (ZCL-X)	The inverter may generate radio noise through power supply wiring during operation. Use this noise filter to reduce the radio noise (radiant noise).
Radio noise filter on input side (Capacitor filter) (CFI-X)	Use this noise filter to reduce the radiant noise radiated from input cables.
DC reactor (DCL-X-XX)	Use this reactor to control the harmonic waves generated by the inverter.
Regenerative braking unit	Use these devices to increase the braking torque of the inverter for operation in which the inverter turns the connected load on and off very frequently or decelerates the load running with a high moment of inertia.
Radio noise filter (Zero-phase reactor) (ZCL-XXX)	Use this noise filter to reduce the noise generated on the output side of the inverter. (This noise filter can be used on both the input and output sides.)
AC reactor for the output side For reducing vibrations and preventing thermal relay malfunction (ACL-X-XX)	Using the inverter to drive a general-purpose motor may cause larger vibrations of the motor when compared with driving it directly with the commercial power supply. Connect this AC reactor between the inverter and motor to lessen the pulsation of motor. Also, connect this AC reactor between the inverter and motor, when the cable length between them is long (10 m or more), to prevent thermal relay malfunction due to the harmonic waves that are generated by the switching operation on the inverter. Note that the thermal relay can be replaced with a current sensor to avoid the malfunction.

(4) Recommended cable gauges, wiring accessories, and crimp terminals

Note: For compliance with CE and UL standards, see the safety precautions concerning EMC and the compliance with UL and CUL standards under Safety Instructions.

The table below lists the specifications of cables, crimp terminals, and terminal screw tightening torques for reference.

	Motor output (kW)	Applicable inverter model	Power connecter terminals (R, S, T, U, V, W, P, PD, and N)	Wire size (kcmil) [mm^2]	Size of terminal screw	Crimp terminal	Tightening torque (N-m)	Applicable device	
								Earth-leakage breaker (ELB)	Magnetic contactor (MC)
400 V class	185	SJ700-1850HF	Poewr lines R, S, T, U, V, W	250 × 2 [127 × 2]	M16	R150-16	75.0	RX400B	H400C
			Poewr lines P, PD	300 × 2 [152 × 2]	M16	R150-16			
			Braking unit lines P, N	AWG1 [42]	M8	R38-8	8.1		
			Earth lines	250 [127]	M12	R150-12	39.2		
	315	SJ700-3150HF	Poewr lines R, S, T, U, V, W	400 × 2 [203 × 2]	M16	200-16	44.0	RX800B (700A)	H800C
			Poewr lines P, PD	500 × 2 [253 × 2]	M16	325-16			
			Braking unit lines P, N	250 [127]	M10	150-11	20		
			Earth lines	400 [203]	M12	200-12	39.2		
	400	SJ700-4000HF	Poewr lines R, S, T, U, V, W	600 × 2 [304 × 2]	M12	325-12	52.0	RF-1000CBN (1000A)	H800C
			Poewr lines P, PD	800 × 2 [405 × 2]	M12	Note1			
			Braking unit lines P, N	250 × 2 [127 × 2]	M10	150-11	20		
			Earth lines	600 [304]	M12	325-12	39.2		

Note1: Please use the solderless terminals for 405mm^2 or more.

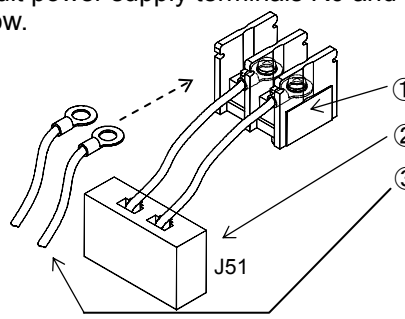
Note2: Cable gauges indicate those of HIV cables (maximum heat resistance: 75°C).

*) Use wires with the prepackaged ring lug terminals when wiring with the main circuit terminals in 1850HF model.

(5) Connecting the control circuit to a power supply separately from the main circuit

If the protective circuit of the inverter operates to open the magnetic contactor in the input power supply circuit, the inverter control circuit power is lost, and the alarm signal cannot be retained. To retain the alarm signal, connect control circuit terminals R0 and T0 to a power supply. In details, connect the control circuit power supply terminals R0 and T0 to the primary side of the magnetic contactor as shown below.

(Connection method)
Power-receiving specifications
400 V class model:
380 to 480 V (+10%, -15%)
(50/60 Hz ±5%),(537 to 678 VDC)



① Remove the connected cables.
② Remove the J51 connector.
③ Connect the control circuit power supply cables to the control circuit power supply terminal block.

Note the following when connecting separate power supplies to control circuit power supply terminals (R0 and T0) and main circuit power supply terminals (R, S, and T):

- Use a cable thicker than 1.25 mm^2 to connect the terminals R0 and T0 (terminal screw size: M4).
- Connect a 3 A fuse in the control circuit power supply line.
- If the control circuit power supply (connected to R0 and T0) is turned on earlier than the main circuit power supply (connected to R, S, and T), ground fault is not checked at power-on.
- When supplying DC power to the control circuit power supply terminals (R0 and T0), specify "00" as the "a/b (NO/NC)" selection (function code C031 to C036) for intelligent output terminals ([11] to [15]) and intelligent relay terminals (AL0, AL1, and AL2). If "01" is specified as the "a/b (NO/NC)" selection, output signals may chatter when the DC power supply is shut off.

2.2.3 Wiring of the control circuit

(1) Wiring instructions

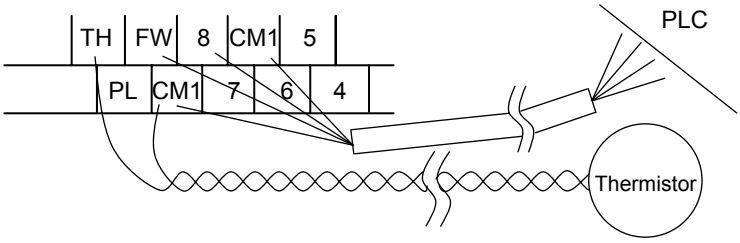
1) Terminals L and CM1 are common to I/O signals and isolated from each other.
Do not connect these common terminals to each other or ground them.
Do not ground these terminals via any external devices. (Check that the external devices connected to these terminals are not grounded.)

2) Use a shielded, twisted-pair cable (recommended gauge: 0.75 mm^2) for connection to control circuit terminals, and connect the cable insulation to the corresponding common terminal.

3) The length of cables connected to control circuit terminals must be 20 m or less. If the cable length exceeds 20 m unavoidably, use a VX-compatible controller (RCD-A) (remote operation panel) or insulated signal converter (CVD-E).

4) Separate the control circuit wiring from the main circuit wiring (power line) and relay control circuit wiring.
If these wirings intersect with each other unavoidably, square them with each other. Otherwise, the inverter may malfunction.

5) Twist the cables connected from a thermistor to the thermistor input terminal (TH) and terminal CM1, and separate the twisted cables from other cables connected to other common terminals.
Since very low current flows through the cables connected to the thermistor, separate the cables from those (power line cables) connected to the main circuit. The length of the cables connected to the thermistor must be 20 m or less.



6) When connecting a contact to a control circuit terminal (e.g., an intelligent input terminal), use a relay contact (e.g., crossbar twin contact) in which even a very low current or voltage will not trigger any contact fault.

7) When connecting a relay to an intelligent output terminal, also connect a surge-absorbing diode in parallel with the relay.

8) Do not connect analog power supply terminals H and L or interface power supply terminals P24 and CM1 to each other.
Otherwise, the inverter may fail.

(2) Layout of control circuit terminals

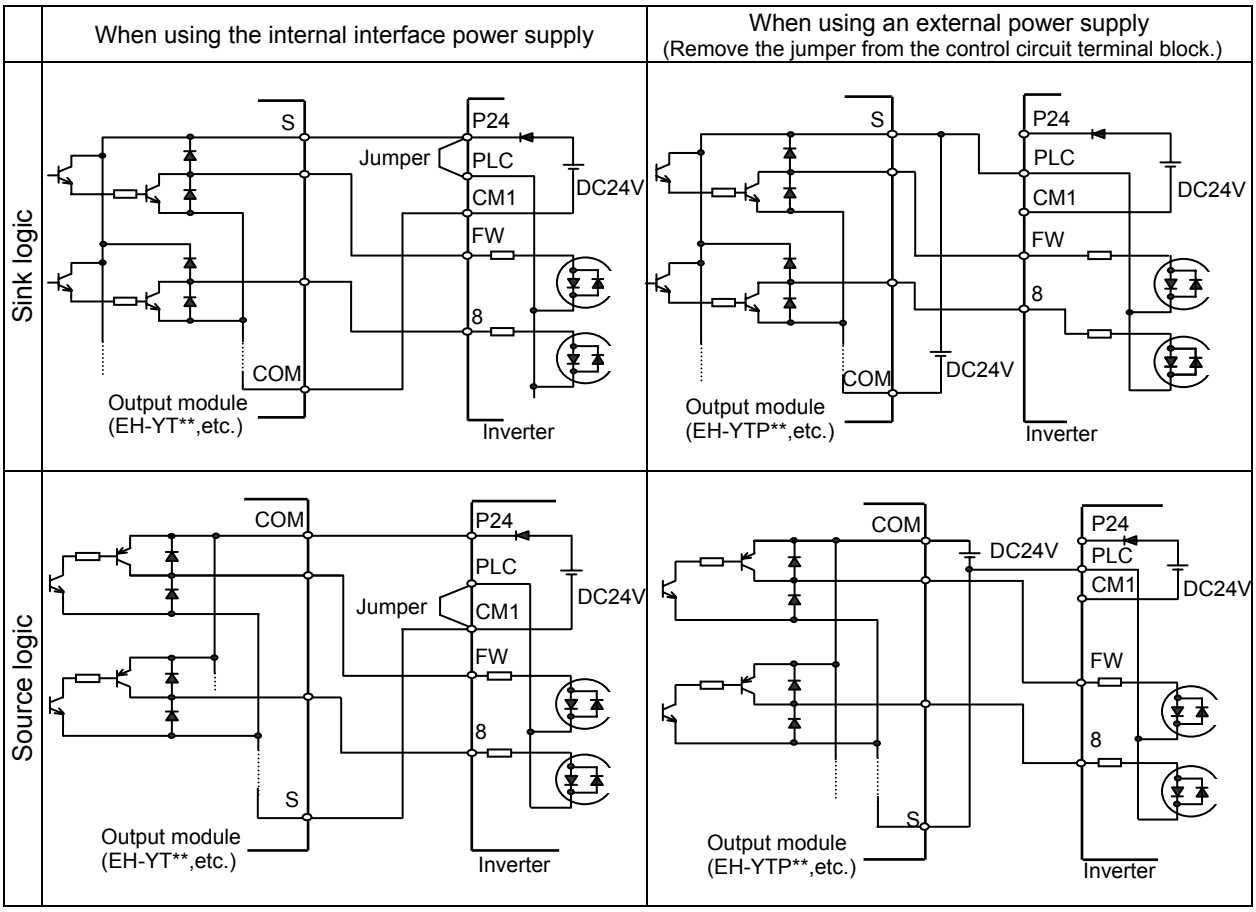
H	O2	AM	FM	TH	FW	8	CM1	5	3	1	14	13	11	AL1
L	O	OI	AMI	P24	PLC	CM1	7	6	4	2	15	CM2	12	AL0	AL2

Terminal screw size: M3

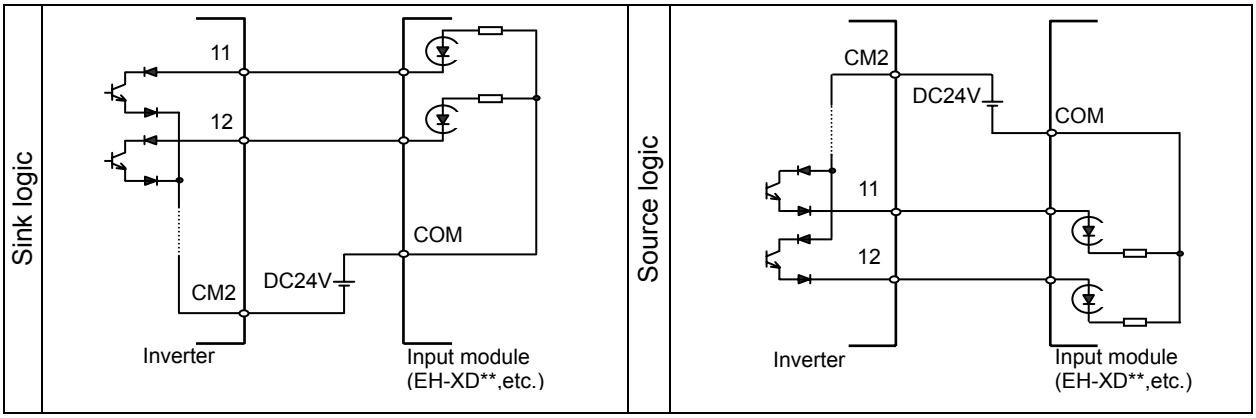
(3) Switching the input control logic

- In the factory setting, the input control logic for terminal FW and intelligent input terminals is the sink logic.
To switch the input control logic to the source logic, remove the jumper connecting terminals P24 and PLC on the control circuit block, and then connect terminals PLC and CM1 with the jumper.

(4) Connecting a programmable controller to intelligent input terminals



(5) Connecting a programmable controller to intelligent output terminals



2.2.4 Wiring of the digital operator

- You can operate the inverter with not only the digital operator mounted in the inverter as standard equipment but also an optional digital operator (OPE-S, OPE-SR, SRW-OJ, or SRW-OEX).
- When you intend to remove the standard digital operator from the inverter and use it as remote equipment, request your local Hitachi Distributor to supply a connection cable, ICS-1 (1-meter cable) or ICS-3 (3-meter cable).
  If you prepare the cable by yourself, the following product is recommended:
  HUTP5 PC 4P -X-X: Straight cable equipped with connector at both ends (made by Hitachi Cable, Ltd.)
- The length of the connection cable must be 3 m or less. If a cable over 3 m is used, the inverter may malfunction.

(Memo)

Chapter 3 Operation

This chapter describes typical methods of operating the inverter, how to operate the digital operator, and how to make a test run of the inverter.

Chapter 3 Operation

(Memo)

3.1 Operating Methods

! WARNING

- While power is supplied to the inverter, do not touch any terminal or internal part of the inverter, check signals, or connect or disconnect any wire or connector. Otherwise, you run the risk of electric shock or fire.
- 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. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. 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.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation 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 control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- The [STOP] key is effective only when its function is enabled by setting. Prepare an emergency stop switch separately. Otherwise, you run the risk of injury.
- If an operation command has been input to the inverter before the inverter enters alarm status, the inverter will restart suddenly when the alarm status is reset. Before resetting the alarm status, make sure that no operation command has been input.
- While power is supplied to the inverter, do not touch any internal part of the inverter or insert a bar in it. Otherwise, you run the risk of electric shock or fire.

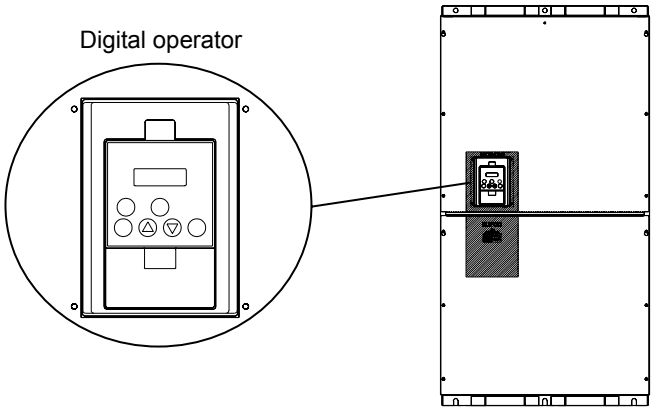
! CAUTION

- Do not touch the heat sink, which heats up during the inverter operation. Otherwise, you run the risk of burn injury.
- The inverter allows you to easily control the speed of motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. Otherwise, you run the risk of injury and damage to machine.
- Install an external brake system if needed. Otherwise, you run the risk of injury.
- When using the inverter to operate a standard motor at a frequency of over 60 Hz, 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. Otherwise, you run the risk of damage to the motor and machine and injury
- During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations. Otherwise, you run the risk of damage to the machine driven by the motor.

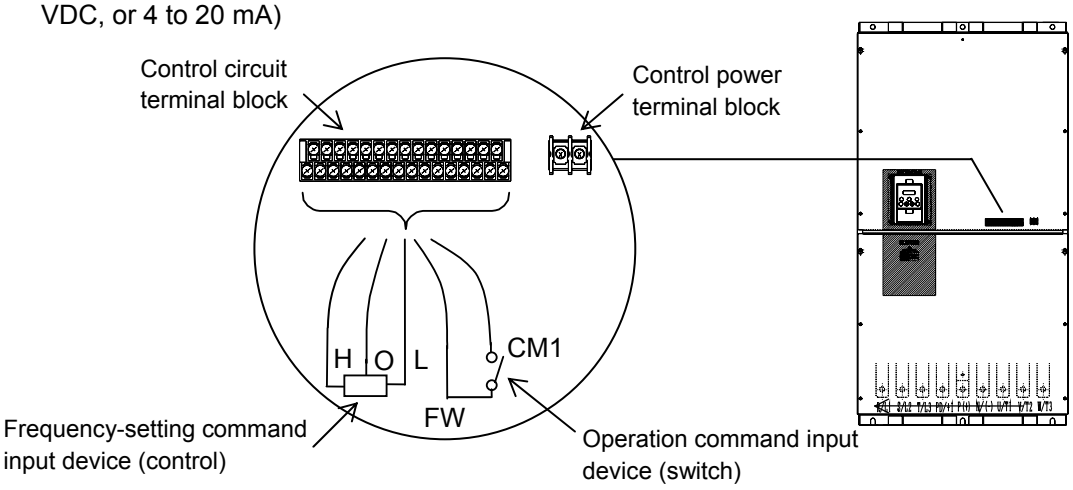
Chapter 3 Operation

You can operate the inverter in different ways, depending on how to input the operation and frequency-setting commands as described below.
This section describes the features of operating methods and the items required for operation.

(1) Entering operation and frequency-setting commands from the digital operator
This operating method allows you to operate the inverter through key operations on the standard digital operator mounted in the inverter or an optional digital operator.
When operating the inverter with a digital operator alone, you need not wire the control circuit terminals.
(Items required for operation)
1) Optional digital operator (not required when you use the standard digital operator)



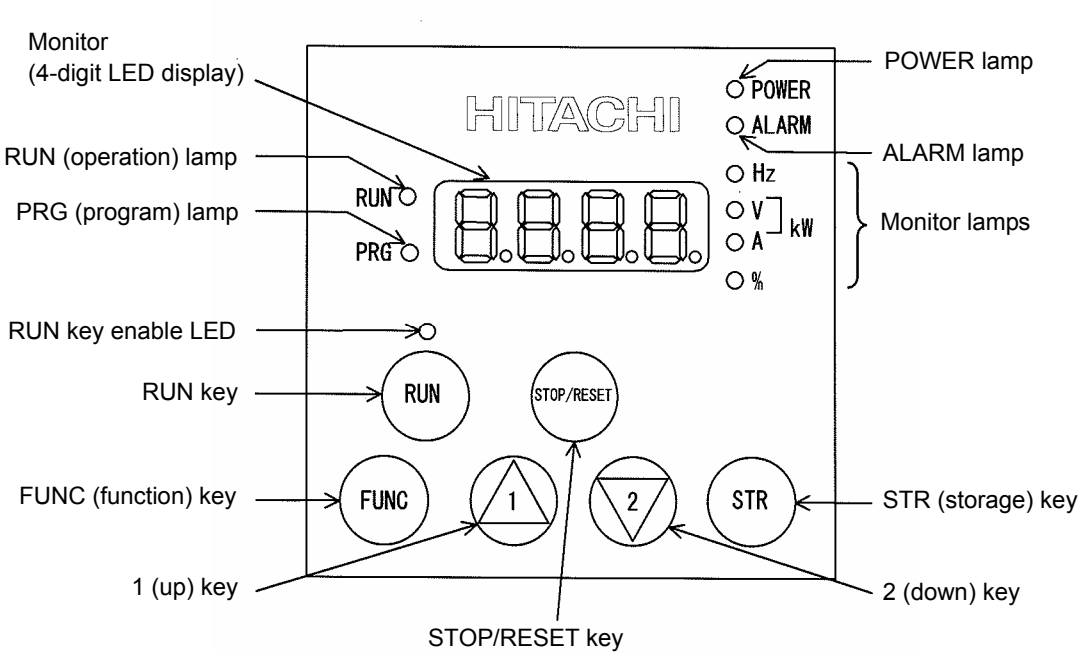
(2) Entering operation and frequency-setting commands via control circuit terminals
This operating method allows you to operate the inverter via the input of operation signals from external devices (e.g., frequency-setting circuit and start switch) to control circuit terminals.
The inverter starts operation when the input power supply is turned on and then an operation command signal (FW or RV) is turned on.
You can select the frequency-setting method (setting by voltage specification or current specification) through the input to a control circuit terminal according to your system. For details, see Item (2), "Explanation of control circuit terminals," in Section 2.2.1 (on pages 2-7 and 2-8).
(Items required for operation)
1) Operation command input device: External switch or relay
2) Frequency-setting command input device: External device to input signals (0 to 10 VDC, -10 to +10 VDC, or 4 to 20 mA)



(3) Entering operation and frequency-setting commands; both from a digital operator and via control circuit terminals
This operating method allows you to arbitrarily select the digital operator or control circuit terminals as the means to input operation commands and frequency-setting commands.
(Items required for operation)
1) See the items required for the above two operating methods.

3.2 How To Operate the Digital Operator (OPE-S)

3.2.1 Names and functions of components



Name	Function
POWER lamp	Lights when the control circuit power is on.
ALARM lamp	Lights to indicate that the inverter has tripped.
RUN (operation) lamp	Lights to indicate that the inverter is operating.
PRG (program) lamp	Lights when the monitor shows a value set for a function. This lamp starts blinking to indicate a warning (when the set value is invalid).
Monitor	Displays a frequency, output current, or set value.
Monitor lamps	Indicates the type of value and units displayed on the monitor. "Hz" (frequency), "V" (voltage), "A" (current), "kW" (electric power), and "%" (percentage)
RUN key enable LED	Lights up when the inverter is ready to respond to the RUN key. (When this lamp is on, you can start the inverter with the RUN key on the digital operator.)
RUN key	Starts the inverter to run the motor. This key is effective only when the operating device is the digital operator. (To use this key, confirm that the operating device indicator lamp is on.)
STOP/RESET key	Decelerates and stops the motor or resets the inverter from alarm status.
FUNC (function) key	Makes the inverter enter the monitor, function, or extended function mode.
STR (storage) key	Stores each set value. (Always press this key after changing a set value.)
1 (up) or 2 (down) key	Switches the inverter operation mode (among monitor, function, and extended function modes) or increases or decreases the value set on the monitor for a function.

3.2.2 Code display system and key operations

This section describes typical examples of digital operator operation (in basic and full display modes) and an example of special digital operator operation in extended function mode U.

The initial display on the monitor screen after power-on depends on the setting of function "b038". For details, see Section 4.2.81, "Initial-screen selection," (on page 4-76).
When the setting of function "b038" is "01" (factory setting), the monitor initially shows 0.00 as the setting of function "d001" (output frequency monitoring). Pressing the FUNC key in this status changes the display to d001 .

Note: The display contents on the monitor depend on the settings of functions "b037" (function code display restriction), "b038" (initial-screen selection), and "b039" (automatic setting of user parameters). For details, see Sections 4.2.80, "Function code display restriction," (on page 4-74), 4.2.81, "Initial-screen selection," (on page 4-76), and 4.2.82, "Automatic user-parameter setting," (on page 4-77).

Item	Function code	Data	Description
Function code display restriction	b037	00	Full display
		01	Function-specific display
		02	User setting
		03	Data comparison display
		04	Basic display (factory setting)
Initial-screen selection (Initial display at power-on)	b038 (*1)	00	Screen displayed when the [STR] key was pressed last (same as the operation on the SJ300 series)
		01	d001 (output frequency monitoring)
		02	d002 (output current monitoring)
		03	d003 (rotation direction minitoring)
		04	d007 (Scaled output frequency monitoring)
		05	F001 (output frequency setting)
Selection of automatic user-parameter settings	b039 (*1)	00	Disable
		01	Enable

*1 Not displayed with the factory setting

* The following procedure enables you to turn the monitor display back to d001 or 0.00 (*1) regardless of the current display mode:
  - Hold down the FUNC key for 3 seconds or more. The monitor shows d001 and 0.00 (*1) alternately.
    During this status, press the FUNC key. The monitor will show only d001 or 0.00 (*1), which is shown when the FUNC is pressed.

*1 The monitor shows 0.00 only when the motor driven by the inverter is stopped. While the motor is running, the monitor shows an output frequency.

(1) Example of operation in basic display mode ("b037" = "04" [factory setting])
- Only basic parameters can be displayed in basic display mode. (All parameters in monitor mode, four parameters in function mode, or 20 parameters in extended function mode)
- Other parameters are not displayed. To display all parameters, select the full display mode ("b037" = "00").

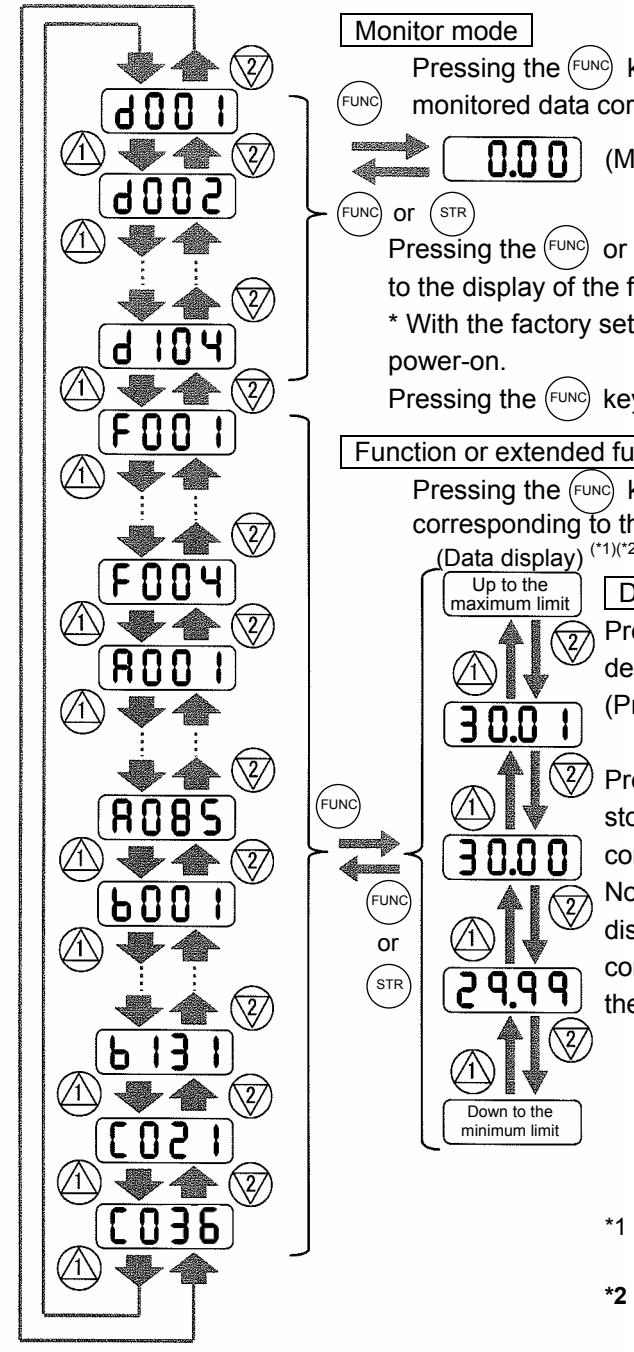
<Displayable parameters and sequence of display>

No.	Display code	Item
1	d001 to d104	Monitor display
2	F001	Output frequency setting
3	F002	Acceleration (1) time setting
4	F003	Deceleration (1) time setting
5	F004	Operation direction setting
6	A001	Frequency source setting
7	A002	Run command source setting
8	A003	Base frequency setting
9	A004	Maximum frequency setting
10	A005	[AT] selection
11	A020	Multispeed frequency setting
12	A021	Multispeed 1 setting
13	A022	Multispeed 2 setting
14	A023	Multispeed 3 setting
15	A044	1st control method
16	A045	V/f gain setting
17	A085	Operation mode selection
18	b001	Selection of restart mode
19	b002	Allowable under-voltage power failure time
20	b008	Retry-after-trip selection
21	b011	Retry wait time after trip
22	b037	Function code display restriction
23	b083	Carrier frequency setting
24	b084	Initialization mode selection
25	b130	Selection of overvoltage suppression function
26	b131	Setting of overvoltage suppression level
27	C021	Setting of intelligent output terminal 11
28	C022	Setting of intelligent output terminal 12
29	C036	Alarm relay active state

Note:
If a desired parameter is not displayed, check the setting of function "b037" (function code display restriction). To display all parameters, specify "00" for "b037".

Key operation and transition of the codes on display	Key operation and transition of the monitored data on display

Pressing the ▲1 or ▼2 key respectively scrolls up or down the code displayed in code display mode or increases or decreases the numerical data displayed in data display mode.
Press the ▲1 or ▼2 key until the desired code or numerical data is shown. To scroll codes or increase/decrease numerical data faster, press and hold the key.



Monitor mode

Pressing the FUNC key with a function code displayed shows the monitored data corresponding to the function code.

FUNC ⇄ 0.00 (Monitor display) (*1)

FUNC or STR

Pressing the FUNC or STR key with the monitored data displayed reverts to the display of the function code corresponding to the monitored data.
* With the factory setting, the monitor shows 0.00 initially after power-on.
Pressing the FUNC key in this status changes the display to d001 .

Function or extended function mode

Pressing the FUNC key with a function code displayed shows the data corresponding to the function code.

(Data display) (*1)(*2)

Up to the maximum limit

30.01

30.00

29.99

Down to the minimum limit

FUNC ⇄ FUNC or STR

Data setting

Pressing the ▲1 or ▼2 key respectively increases or decreases the displayed numerical data.
(Press the key until the desired data is shown.)

Pressing the STR key with numerical data displayed stores the data and then returns to the display of the corresponding function code.
Note that pressing the FUNC key with numerical data displayed returns to the display of the function code corresponding to the numerical data without updating the data, even if it has been changed on display.

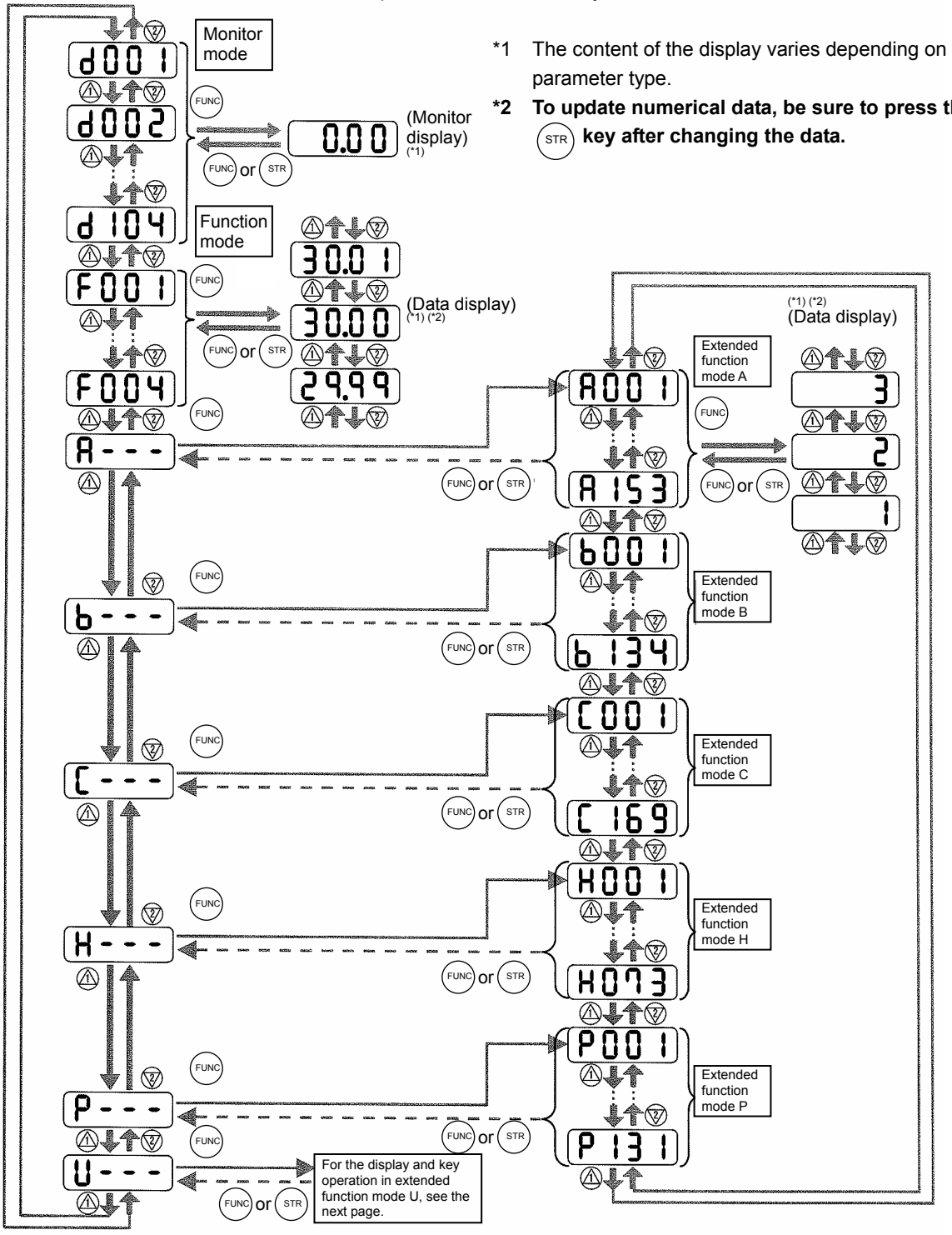
*1 The content of the display varies depending on the parameter type.

***2 To update numerical data, be sure to press the STR key after changing the data.**

(2) Example of operation in full display mode ("b037" = "00")
All parameters can be displayed in full display mode. The display sequence of parameters matches their sequence shown in Chapter 8, "List of Data Settings."

Key operation and transition of codes on display (in monitor or function mode)	Key operation and transition of monitored data on display (in monitor or function mode)	Key operation and transition of codes on display (in extended function mode)	Key operation and transition of monitored data on display (in extended function mode)

Pressing the ▲1 or ▼2 key respectively scrolls up or down the code displayed in code display mode or increases or decreases the numerical data displayed in data display mode.
Press the ▲1 or ▼2 key until the desired code or numerical data is shown. To scroll codes or increase/decrease numerical data fast, press and hold the key.



*1 The content of the display varies depending on the parameter type.

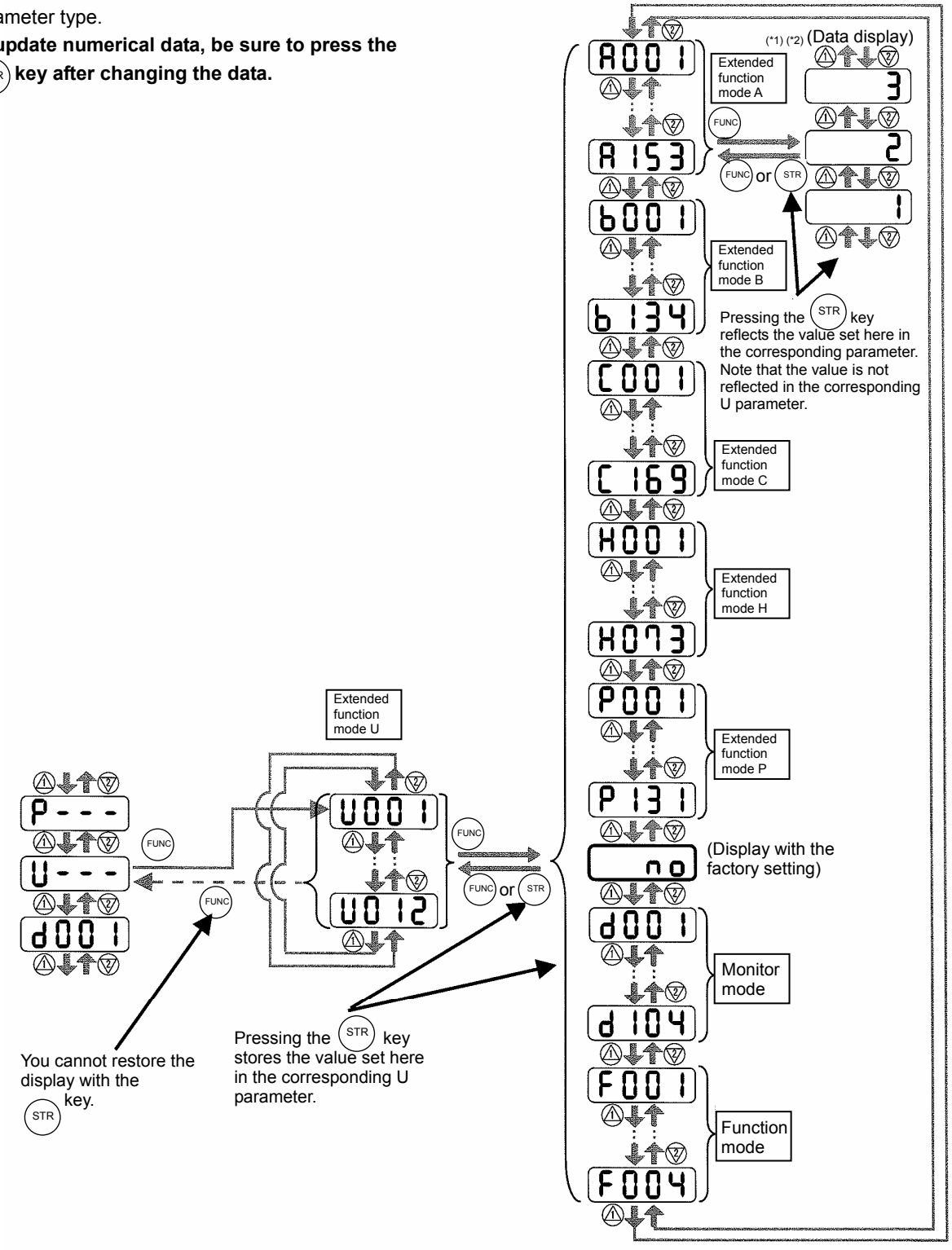
***2 To update numerical data, be sure to press the STR key after changing the data.**

(3) Code/data display and key operation in extended function mode U
The extended function mode U differs in operation from other extended function modes because the extended function mode U is used to register (or automatically record) other extended-function codes as user-specified U parameters.

Key operation and transition of codes on display (in monitor or function mode)	Key operation and transition of codes on display (in extended function mode U)	Key operation and transition of codes on display (when displaying extended-function mode parameters from the extended function mode U)	Key operation and transition of codes on display (in monitor, function, or extended

*1 The content of the display varies depending on the parameter type.

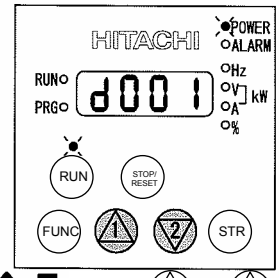
***2 To update numerical data, be sure to press the (STR) key after changing the data.**



(4) Procedure for directly specifying or selecting a code

- You can specify or select a code or data by entering each digit of the code or data instead of scrolling codes or data in the monitor, function, or extended function mode.
- The following shows an example of the procedure for changing the monitor mode code "d001" displayed to extended function code "A029":

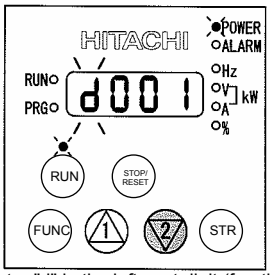
1) Display the monitor mode code.
("d001" is displayed.)



(*2)
(*3)

FUNC Press the 1 and 2 keys together. (*1)

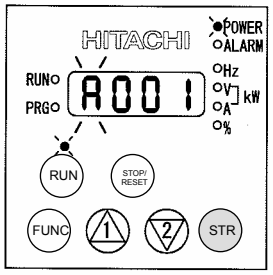
2) Change to the extended function mode.



- Character "d" in the leftmost digit (fourth digit from the right) starts blinking.

Press the 2 key twice.

("A001" is displayed.)

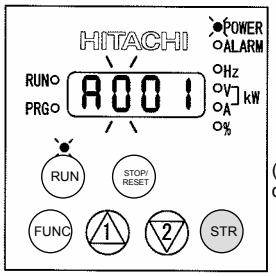


(*3)

- Character "A" is blinking.
- Pressing the [STR] key determines the blinking character.

(*2)
FUNC Press the STR key (to determine character "A").

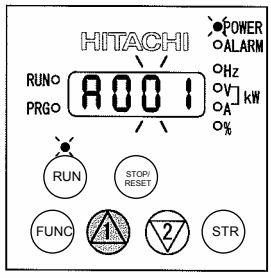
3) Change the third digit of the code.



Press the STR key.
(Character "0" is determined.)
FUNC (*2)

- Character "0" in the third digit is blinking.
- Since the third digit need not be changed, press the [STR] key to determine the character "0".

4) Change the second digit of the code.

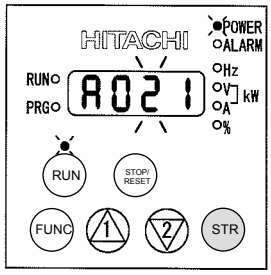


- Character "0" in the second digit is blinking.

Press the 1 key twice.

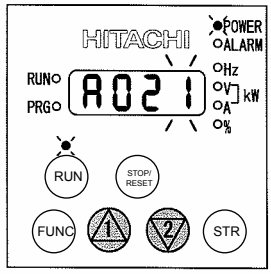
- Character "2" in the second digit is blinking.

(*2)
FUNC Press the STR key.
("A021" is displayed.)



(*2)

5) Change the first digit of the code.

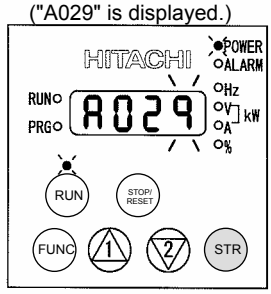


- Character "1" in the first digit is blinking.

Press the 1 key eight times or the 2 key twice.

- Character "9" in the first digit is blinking.

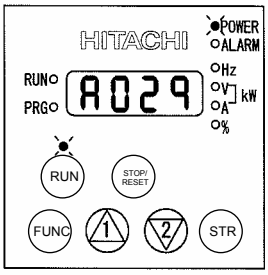
("A029" is displayed.)



(*2)

6) End the change of the extended function code.

Press the STR key.
(Character "9" is determined.)



- Selection of code "A029" is completed.

* If a code that is not defined in the code list or not intended for display is entered, the leftmost digit (fourth digit) (character "A" in this example) will start blinking again.

In such a case, confirm the code to be entered and enter it correctly. For further information, refer to Section 4.2.80. " Function code display restriction," (on page 4-74), Section 4.2.81, "Initial-screen selection," (on page 4-76), Section 4.2.82, "Automatic user-parameter setting," (on page 4-77), and Chapter 8, "List of Data Settings."

7) Press the FUNC key to display the data corresponding to the function code, change the data with the 1 and/or 2 key, and then press the STR key to store the changed data. (*4)

Note that you can also use the procedure (steps 1) to 6)) described here to change the data. (*3)(*4)

*1 This procedure can also be used on screens displaying a code other than "d001".

*2 If the FUNC key is pressed while a digit is blinking, the display will revert to the preceding status for entering the digit to the right of the blinking digit.

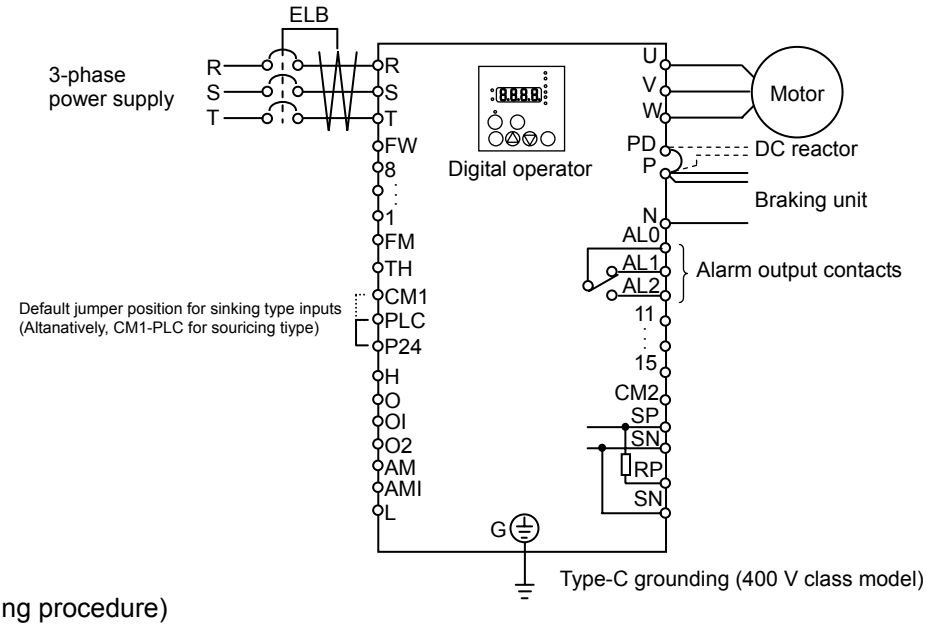
*3 If the FUNC key is pressed while the leftmost (fourth) digit is blinking, the characters having been entered to change the code will be cancelled and the display will revert to the original code shown before the 1 and 2 keys were pressed in step 1).

*4 When changing data, be sure to press the FUNC key first.

3.3 How To Make a Test Run

This section describes how to make a test run of the inverter that is wired and connected to external devices in a general way as shown below.
For the detailed method of using the digital operator, see Section 3.2, "How To Operate the Digital Operator."

(1) When entering operation and frequency-setting commands from the digital operator:
(The operating procedure below is common to the standard and optional digital operators.)



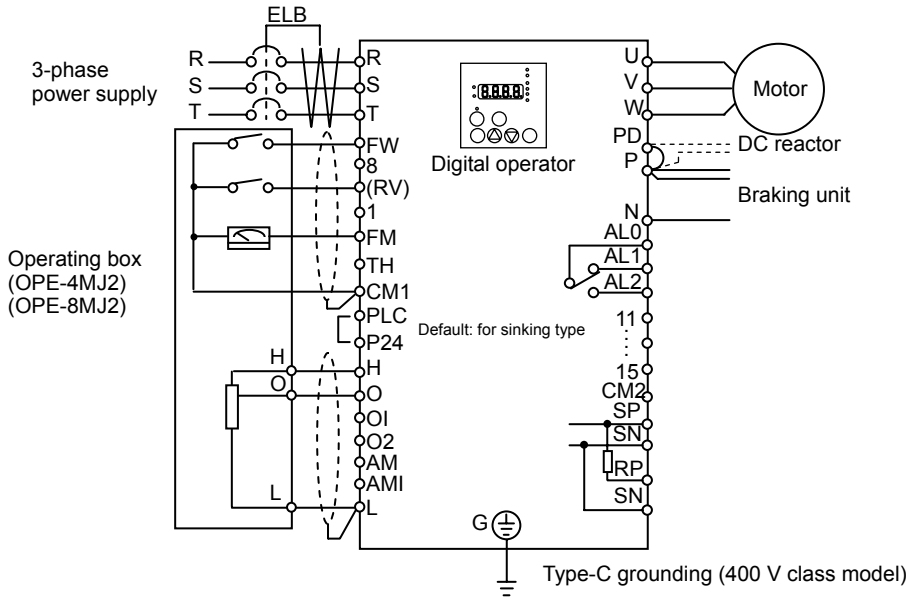
(Operating procedure)

1) Confirm that all wirings are correct.
2) Turn on the earth-leakage breaker (ELB) to supply power to the inverter.
(The POWER lamp [red LED] of the digital operator goes on.)
* When using an inverter with the factory setting, proceed to step 5).
3) Select the digital operator as the operating device via the frequency source setting function.
- Display the function code "A001" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a 2-digit numeric value.)
- Use the (1) and/or (2) key to change the displayed numeric value to [02], and then press the (STR) key once to specify the digital operator as the operating device to input frequency-setting commands.
(The display reverts to [A001].)
4) Select the digital operator as the operating device by the run command source setting function.
- Display the function code "A002" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a 2-digit numeric value.)
- Use the (1) and/or (2) key to change the displayed numeric value to "02", and then press the (STR) key once to specify the digital operator as the operating device to input operation commands.
(The display reverts to [A002]. The operating device indicator lamp above the [RUN] key goes on.)
5) Set the output frequency.
- Display the function code "F001" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a preset output frequency. With the factory setting, 0.00 [0 Hz] is shown.)
- Use the (1) and/or (2) key to change the displayed numeric value to the desired output frequency, and then press the (STR) key once to determine the frequency.
(The display reverts to [F001].)
6) Set the operation direction of the motor.
- Display the function code "F004" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows "00" or "01".)

- Use the (1) and/or (2) key to change the displayed value to "00" for forward operation or "01" for reverse operation, and then press the (STR) key once to determine the operation direction.
  (The display reverts to [F004].)

7) Set the monitor mode.
   - To monitor the output frequency, display the function code "d001", and then press the (FUNC) key once.
     (The monitor shows the output frequency.)
     To monitor the operation direction, display the function code "d003", and then press the (FUNC) key once.
     (The monitor shows  for forward operation,  for reverse operation, or  for stopping.)
   - Make sure that It is the square root of 2 times input voltage from d102 monitor.
8) Press the (RUN) key to start the motor.
   (The RUN lamp [green LED] goes on.)
9) Press the (STOP/RESET) key to decelerate or stop the motor.
   (When the motor stops, the RUN lamp [green LED] goes off.)

- During the test run, confirm that the inverter does not trip while accelerating or decelerating the motor and that the motor speed and frequencies are correct.
- If a trip due to overcurrent or overvoltage has occurred during the test run, increase the acceleration and deceleration time.
- Make sure that there is enough margin to trip level by monitoring the output current (d002) and DC voltage (d102).



(Operating procedure)

1) Confirm that all wirings are correct.
2) Turn on the earth-leakage breaker (ELB) to supply power to the inverter.
   (The POWER lamp [red LED] of the digital operator goes on.)
3) Select the control circuit terminal block as the device to input frequency-setting commands by the frequency source setting function.
   - Display the function code "A001" on the monitor screen, and then press the FUNC key once.
     (The monitor shows a 2-digit numeric value.)
   - Use the 1 and/or 2 key to change the displayed numeric value to [01], and then press the STR key once to specify the control circuit terminal block as the device to input frequency-setting commands.
     (The display reverts to [A001].)
4) Select the control circuit terminal block as the device to input operation commands by the run command source setting function.
   - Display the function code "A002" on the monitor screen, and then press the FUNC key once.
     (The monitor shows a 2-digit numeric value.)
   - Use the 1 and/or 2 key to change the displayed numeric value to "01", and then press the STR key once to specify the digital operator as the device to input operation commands.
     (The display reverts to [A002].)
5) Set the monitor mode.
   - To monitor the output frequency, display the function code "d001", and then press the FUNC key once.
     (The monitor shows the output frequency.)
     To monitor the operation direction, display the function code "d003", and then press the FUNC key once.
     (The monitor shows F for forward operation, r for reverse operation, or 0 for stopping.)
   - Make sure that It is the square root of 2 times input voltage from d102 monitor.
6) Start the motor operation.
   - Set the FW signal (at the FW terminal on the control terminal block) to the ON level to start the motor.
     (The RUN lamp [green LED] goes on.)
   - Apply a voltage across the terminals O and L on the control circuit block to output the frequency corresponding to the applied voltage from the inverter.
7) Stop the motor.
   - Set the FW signal (at the FW terminal on the control terminal block) to the OFF level to decelerate and stop the motor.
     (When the motor stops, the RUN lamp [green LED] goes off.)

Chapter 4 Explanation of Functions

This chapter describes the functions of the inverter.

Chapter 4 Explanation of Functions

(Memo)

4.1 Monitor Mode

4.1.1 Output frequency monitoring

Related code
d001: Output frequency monitoring

When the output frequency monitoring function (d001) is selected, the inverter displays the output frequency. The inverter displays "0.00" when the frequency output is stopped.
The Hz monitor lamp lights up while the inverter is displaying the output frequency.

(Display)
0.00 to 99.99 in steps of 0.01 Hz
100.0 to 400.0 in steps of 0.1 Hz

Note: When you have selected the digital operator as the device to input frequency-setting commands (A001=02), you can change the output frequency setting by using the △and/or ▽ key (only while the inverter is operating the motor).
- The change in output frequency made in this mode can be reflected in the frequency setting (function "F001"). Press the STR key to write the new frequency over the currently selected frequency setting.
- You cannot change the output frequency while the PID function is enabled or the inverter is not operating the motor.

4.1.2 Output current monitoring

Related code
d002: Output current monitoring

When the output current monitoring function (d002) is selected, the inverter displays the output current. The inverter displays "0.0" when the current output is stopped.
The A monitor lamp lights up while the inverter is displaying the output current.

(Display)
0.0 to 999.9 in steps of 0.1 A / 1000 to 9999 in steps of 1A
Note:The current monitor may be less accurate at less than 2.1kHz carrier frequency.

4.1.3 Rotation direction monitoring

Related code
d003: Rotation direction monitoring

When the rotation direction monitoring function (d003) is selected, the inverter displays the motor operation direction.
The RUN lamp lights up while the inverter is operating the motor (in forward or reverse direction).

(Display)
F: Forward operation
o: Motor stopped
r: Reverse operation

4.1.4 Process variable (PV), PID feedback monitoring

Related code
d004: Process variable (PV), PID feedback monitoring
A071: PID Function Enable
A075: PV scale conversion

When "01" (enabling PID operation) or "02" (enabling inverted-data output) has been specified for function "A071" (PID Function Enable) and the process variable (PV), PID feedback monitoring function (d004) is selected, the inverter displays the PID feedback data.
You can also convert the PID feedback to gain data by setting a PV scale conversion (with function "A075").

Value displayed by function "d004" = "feedback quantity" (%) x " PV scale conversion (A075)"
The PV scale conversion can be set (by function "A075") within the range 0.01 to 99.99 in steps of 0.01.

(Display)
0.00 to 99.99 in steps of 0.01
100.0 to 999.9 in steps of 0.1
1000. to 9999. in steps of 1
1000 to 9999 in steps of 10
⌈100 to ⌈999 in units of 100

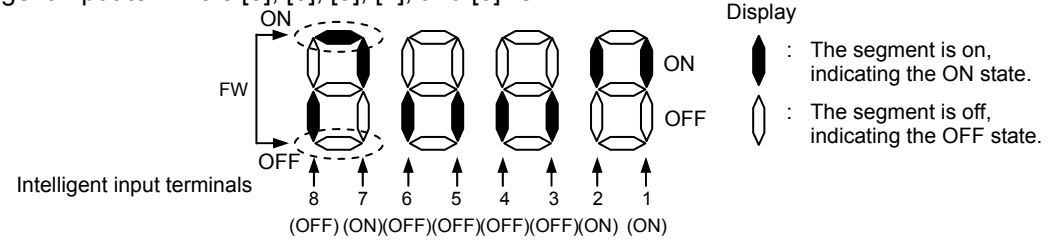
4.1.5 Intelligent input terminal status

Related code
d005: Intelligent input terminal status

When the intelligent input terminal status function (d005) is selected, the inverter displays the states of the inputs to the intelligent input terminals.
The internal CPU of the inverter checks each intelligent input for significance, and the inverter displays active inputs as those in the ON state. (*1)
Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

FW terminal and intelligent input terminals [7], [2], and [1]: ON
Intelligent input terminals [8], [6], [5], [4], and [3]: OFF



(*1)When input terminal response time is set, terminal recognition is delayed. (refer 4.2.79)

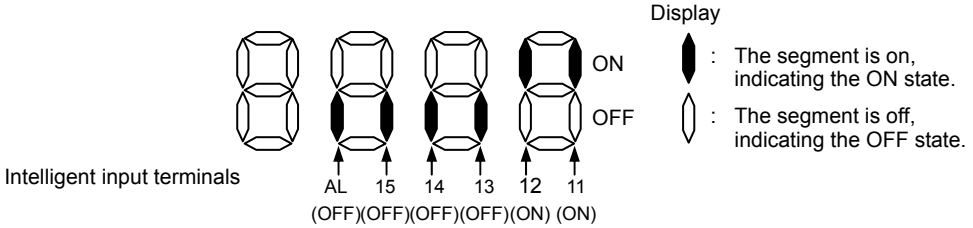
4.1.6 Intelligent output terminal status

Related code
d006: Intelligent output terminal status

When the intelligent output terminal status function (d006) is selected, the inverter displays the states of the outputs from the intelligent output terminals.
This function does not monitor the states of the control circuit terminals but monitors those of the outputs from the internal CPU.
Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

Intelligent output terminals [12] and [11]: ON
Alarm relay terminal AL and intelligent output terminals [15] to [13]: OFF



4.1.7 Scaled output frequency monitoring

Related code
d007: Scaled output frequency monitoring
b086: Frequency scaling conversion factor

When the scaled output frequency monitoring (d007) is selected, the inverter displays the gain data converted from the output frequency with the frequency scaling conversion factor (b086).
Use this function, for example, to change the unit of a value (e.g., motor speed) on display.
Value displayed by function "d007" = "output frequency monitor(d001)" x "frequency scaling conversion factor (b086)"
The frequency scaling conversion factor (b086) can be set within the range 0.1 to 99.9 in steps of 0.1.

(Example) Displaying the speed of a 4-pole motor

Speed N (min^{-1}) = (120 x f [Hz])/pole = f (Hz) x 30
As the result of the above calculation with the factor (b086) set to 30.0, the inverter displays "1800" (60 x 30.0) when the output frequency is 60 Hz.

(Display)

0.00 to 99.99 in steps of 0.01
100.0 to 999.9 in steps of 0.1
1000. to 9999. in steps of 1
1000 to 3996 in units of 10

Note: When you have selected the digital operator as the device to input frequency-setting commands, you can change the output frequency setting by using the △ and/or ▽ key (only while the inverter is operating the motor).

- The change in output frequency made in this mode can be reflected in the frequency setting (function "F001"). Press the STR key to write the new frequency over the currently selected frequency setting. (The precision of the storable frequency data depends on the frequency setting.)
- You cannot change the output frequency while the PID function is enabled or the inverter is not operating the motor.

4.1.8 Actual-frequency monitoring

Related code
d008: Actual-frequency monitoring
P011: Encoder pulse-per-revolution (PPR) setting
H004: Motor poles setting, 1st motor
H204: Motor poles setting, 2nd motor

The actual-frequency monitoring function is effective only when a motor equipped with an encoder is connected to the inverter and the feedback option board (SJ-FB) is mounted in the inverter. When the actual-frequency monitoring function (d008) is selected, the inverter displays the actual operating frequency of the motor (regardless of the motor control method (A044 or A244)).

(Display)
Forward operation:
0.00 to 99.99 in steps of 0.01 Hz
100.0 to 400.0 in steps of 0.1 Hz
Reverse operation:
- 0.0 to -99.9 in steps of 0.1 Hz
- 100 to -400 in steps of 1 Hz

Note: To use this monitoring function, set the encoder pulse-per-revolution (PPR) setting (P011) and the number of motor poles (H004 or H204) correctly.

4.1.9 Torque command monitoring

Related code
d009: Torque command monitoring
P033: Torque command input selection
P034: Torque command setting
A044: V/f characteristic curve selectcion
C001 to C008: Terminal [1] to [8]

The torque command monitoring function is effective when you have selected control by torque for the vector control with sensor. When the torque command monitoring function (d009) is selected, the inverter displays the value of the currently input torque command.
The % monitor lamp lights up while the inverter is displaying the torque command value.
Assign 52 (ATR) on intelligent input terminal and turn on to activate torque control.

(Display)
0. to 200. in steps of 1 %

4.1.10 Torque bias monitoring

Related code
d010: Torque bias monitoring
A044: V/f characteristic curve selectcion
P036: Torque bias mode
P037: Torque bias value
P038: Torque bias polarity

The torque bias monitoring function is effective when you have selected the vector control with sensor. When the torque bias monitoring function (d010) is selected, the inverter displays the value of the currently set value of torque bias.
The % monitor lamp lights up while the inverter is displaying the torque bias value.

(Display)
-200. to +200. in steps of 1 %

4.1.11 Torque monitoring

Related code
d012: Torque monitoring
A044: V/f characteristic curve selectcion

When the torque monitoring function (d012) is selected, the inverter displays the estimated value of the torque output from the inverter.
The % monitor lamp lights up while the inverter is displaying the estimated output torque.

(Display)
-200. to +200. in steps of 1 %

Indicator accuracy : about ±20%
The indicator accuracy may exceed ±20% at more than 100% of torque.

Note: This monitoring function is effective only when you have selected the sensorless vector control, 0Hz-range sensorless vector control, or vector control with sensor as the control mode.
Displayed value is not accurate when the other control method is selected.

4.1.12 Output voltage monitoring

Related code
d013: Output voltage monitoring

When the output voltage monitoring function (d013) is selected, the inverter displays the voltage output from the inverter.
The V monitor lamp lights up while the inverter is displaying the output voltage.

(Display)
0.0 to 600.0 in steps of 0.1 V
(remark) Displayed value may not be accurate when the output voltage is differ from input voltage.

4.1.13 Power monitoring

Related code
d014: Power monitoring

When the power monitoring function (d014) is selected, the inverter displays the electric power (momentary value) input to the inverter.
The kW monitor lamps (V and A lamps) light up while the inverter is displaying the input power.

(Display)
0.0 to 999.9 in steps of 0.1 kW

4.1.14 Cumulative power monitoring

Related code
d015: Cumulative power monitoring
b078: Cumulative power clearance
b079: Cumulative input power display gain setting

When the cumulative power monitoring function is selected, the inverter displays the cumulative value of electric power input to the inverter.
You can also convert the value to be displayed to gain data by setting the cumulative input power display gain setting (b079).

Value displayed by function "d015" = "calculated value of input power (kW/h)"/"cumulative input power display gain setting (b079)"
The cumulative power input gain can be set within the range 1 to 1000 in steps of 1.

You can clear the cumulative power data by specifying "01" for the cumulative power clearance function (b078) and pressing the STR key.
You can also clear the cumulative power data at an intelligent input terminal by assigning function "53" (KHC: cumulative power clearance) to the intelligent input terminal.
When the cumulative input power display gain setting (b079) is set to "1000", the cumulative power data up to 999000 (kW/h) can be displayed.

(Display)
0.0 to 999.9 in steps of 1 kW/h, or the unit set for function "b079"
1000 to 9999 in units of 10 kW/h, or the unit set for function "b079"
⌈100 to ⌈999 in units of 1000 kW/h, or the unit set for function "b079"

4.1.15 Cumulative operation RUN time monitoring

Related code
d016: Cumulative operation RUN time monitoring

When the cumulative operation RUN time monitoring function (d016) is selected, the inverter displays the cumulative time of the inverter operation.

(Display)
0. to 9999. in units of 1 hour
1000 to 9999 in units of 10 hours
⌈100 to ⌈999 in units of 1,000 hours

4.1.16 Cumulative power-on time monitoring

Related code
d017: Cumulative power-on time monitoring

When the cumulative power-on time monitoring function(d017) is selected, the inverter displays the cumulative time throughout which the inverter power has been on.

(Display)
0. to 9999. in units of 1 hour
1000 to 9999 in units of 10 hours
⌈100 to ⌈999 in units of 1,000 hours

4.1.17 Heat sink temperature monitoring

Related code
d018: Heat sink temperature monitoring

When the heat sink temperature monitoring function (d018) is selected, the inverter displays the temperature of the internal heat sink of the inverter.

(Display)
-020. to 200.0 in steps of 0.1 °C

4.1.18 Motor temperature monitoring

Related code
d019: Motor temperature monitoring
b098: Thermistor for thermal protection control

When the motor temperature monitoring function is selected, the inverter displays the temperature of the thermistor connected between control circuit terminals TH and CM1.
Use the thermistor model PB-41E made by Shibaura Electronics Corporation.
Specify "02" (enabling NTC) for the thermistor for thermal protection control (function "b098").

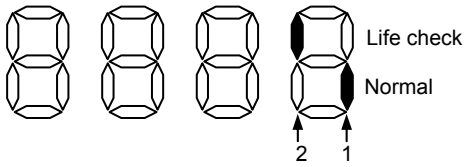
(Display)
-020. to 200.0 in steps of 0.1 °C.

Note: If "01" (enabling PTC) is specified for the thermistor for thermal protection control (function "b098"), motor temperature monitoring is disabled.

4.1.19 Life-check monitoring

Related code
d022: Life-check monitoring

When the life-check monitoring function (d002) is selected, the inverter displays the operating life status of two inverter parts output from corresponding intelligent output terminals by using LED segments of the monitor.
The two targets of life-check monitoring are:
1: Life of the capacitor on the main circuit board
(SJ700-2 large capacity inverter is not supported for this function.)
2: Degradation of cooling fan speed



Note 1: The inverter estimates the capacitor life every 10 minutes. If you turn the inverter power on and off repeatedly at intervals of less than 10 minutes, the capacitor life cannot be checked correctly.
Note 2: If you have specified "01" for the selection of cooling fan operation (function "b0092"), the inverter determines the cooling fan speed to be normal while the cooling fan is stopped.

4.1.20 Program counter display (easy sequence function)

Related code
d023: Program counter

While the easy sequence function is operating, the inverter displays the program line number that is being executed.
For details, refer to the “Programming Software EzSQ” manual.

4.1.21 Program number monitoring (easy sequence function)

Related code
d024: Program number monitoring

When the program number monitoring function (d024) is selected, the inverter displays the program number of the downloaded easy sequence program.
Note that you must describe a program number in the program you create. For details, refer to the “Programming Software EzSQ” manual.

Related code
d025: user monitor 0
d026: user monitor 1
d027: user monitor 2

4.1.22 User Monitors 0 to 2 (easy sequence function)

The user monitor function allows you to monitor the results of operations in an easy sequence program.
For details, refer to the Programming Software EzSQ Instruction Manual.

Related code
d028: Pulse counter monitor

4.1.23 Pulse counter monitor

Pulse counter monitor allows you to monitor the accumulated pulse of intelligent input terminals pulse counter 74 (PCNT).

4.1.24 Position command monitor (in absolute position control mode)

Related code
d029: Pulse counter monitor

The user monitor function allows you to monitor the results of operations in an easy sequence program.
For details, refer to the Programming Software EzSQ Instruction Manual.

4.1.25 Current position monitor (in absolute position control mode)

Related code
d030: Position feedback monitor

The current position monitor function allows you to monitor the current position in absolute position control mode.
For details, see Section 4.3.12.

4.1.26 Trip Counter

Related code
d080: Trip Counter

When the trip counter function (d080) is selected, the inverter displays the number of times the inverter has tripped.

(Display)
0. to 9999. in units of 1 trip
1000 to 6553 in units of 10 trips

4.1.27 Trip monitoring 1 to 6

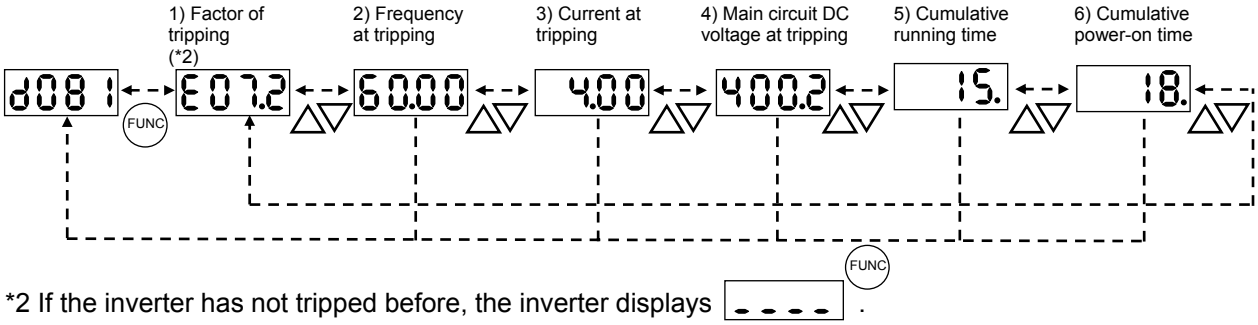
Related code
d081: Trip monitoring 1
d082: Trip monitoring 2
d083: Trip monitoring 3
d084: Trip monitoring 4
d085: Trip monitoring 5
d086: Trip monitoring 6

When the trip monitoring function (d081 to d086) is selected, the inverter displays the trip history data. The last six protective trips the inverter made can be displayed.
Select the trip monitoring 1 (d081) to display the data on the most recent trip.

(Display contents)
1) Factor of tripping (one of E01 to E79) (*1)
2) Output frequency at tripping (Hz)
3) Output current at tripping (A) (*2)
4) Main circuit DC voltage at tripping (V) (*3)
5) Cumulative inverter-running time until tripping (h)
6) Cumulative inverter power-on time until tripping (h)

*1 See Section 5.1.1, "Protective functions."
*2 When the inverter status is in stop mode as a trip history, monitored value can be zero.
*3 When grounding fault is detected at power on, monitored value can be zero.

(Display by trip monitoring)



*2 If the inverter has not tripped before, the inverter displays ____ .

4.1.28 Programming error monitoring

Related code
d090: Programming error monitoring

If an attempt is made to set the data conflicting with other data on the inverter, the inverter displays a warning.
The PRG (program) lamp lights up while the warning is displayed (until the data is rewritten forcibly or corrected).
For details on the programming error monitoring function, see Section 5.2. Warning Codes

4.1.29 DC voltage monitoring

Related code
d102: DC voltage monitoring

When the DC voltage monitoring is selected, the inverter displays the DC voltage (across terminals P and N) of the inverter.
While the inverter is operating, the monitored value changes as the actual DC voltage of the inverter changes.

(Display)
0.0 to 999.9 in steps of 0.1 V

4.1.30 BRD load factor monitoring

Related code
d103: BRD load factor monitoring
b090: Dynamic braking usage ratio

When the BRD load factor monitoring function (d103) is selected, the inverter displays the BRD load factor. If the BRD load factor exceeds the value set as the dynamic braking usage ratio (b090), the inverter will trip because of the braking resistor overload protection (error code "E06").

(Display)
0.0 to 100.0 in steps of 0.1%

4.1.31 Electronic thermal overload monitoring

Related code
d104: Electronic thermal overload monitoring

When the electronic thermal overload monitoring function (d104) is selected, the inverter displays the electronic thermal overload. If the electronic thermal overload exceeds 100%, the inverter will trip because of the overload protection (error code "E05").

(Display)
0.0 to 100.0 in steps of 0.1%

4.2 Function Mode

4.2.1 Output frequency setting

Related code
F001: Output frequency setting
A001: Frequency source setting
A020/A220/A320:
Multispeed frequency setting, 1st/2nd/3rd motors
C001 to C008:
Terminal [1] to [8] functions

The output frequency setting function allows you to set the inverter output frequency.
You can set the inverter output frequency with this function (F001) only when you have specified "02" for the frequency source setting (A001). For other methods of frequency setting, see Section 4.2.4, "frequency source setting (A001)."
(If the setting of function "A001" is other than "02", function "F001" operates as the frequency command monitoring function.)
The frequency set with function "F001" is automatically set as the Multispeed frequency setting (A020). To set the second and third multispeed s, use the multispeed frequency setting, 2nd motor, function (A220) and multispeed frequency setting, 3rd motor, function (A320), or use function "F001" for the setting after turning on the SET and SET3 signals. For the setting using the SET and SET3 signals, assign the SET function (08) and SET3 function (17) to intelligent input terminals.
If the set output frequency is used as the target data for the PID function, PID feedback data will be displayed in percent (%). ("100%" indicates the maximum frequency.)

Item	Function code	Range of data	Description
Output frequency setting	F001	0.0, start frequency to maximum frequency, 1st/2nd/3rd motors (Hz) 0.0 to 100.0 (Enabling the PID operation)	The frequency set with F001 is equal to the setting of A020. The second control frequency set with F001 is equal to the setting of A220. The third control frequency set with F001 is equal to the setting of A320.
Multispeed 0	A020/A220/A320		

4.2.2 Keypad Run key routing

Related code
F004: Keypad Run key routing

When you enter operation commands via the digital operator, the Keypad Run key routing function allows you to select the direction of motor operation.
This function is ineffective when you use the control terminal block or remote operator to input operation commands.

Item	Function code	Data	Description
Keypad Run key routing	F004	00	Forward operation
		01	Reverse operation

4.2.3 Rotational direction restriction

Related code
b035: Rotational direction restriction

The rotational direction restriction function allows you to restrict the direction of motor operation.
This function is effective regardless of the specification of operation command input device (e.g., control circuit block or digital operator).
If an operation command to drive the motor in a restricted direction is input, the inverter (digital operator) will display  .

Item	Function code	Data	Description
Rotational direction restriction	b035	00	Both forward and reverse operations are enabled.
		01	Only forward operation is enabled.
		02	Only reverse operation is enabled.

4.2.4 Frequency source setting

Related code
A001: Frequency source setting

The frequency source setting function allows you to select the method to input the frequency-setting command.

Motor rotation direction is inverted when -10 to 0V is given as frequency command to 02-L terminals.

Item	Function code	Data	Description
Frequency source setting	A001	(00)	(Valid only when the OPE-SR is used) Use the control provided on the digital operator to set the frequency.
		01	Input the frequency-setting command via a control circuit terminal (0-L, OI-L, or O2-L).
		02	Use the digital operator (function "F001") or remote operator to set the frequency.
		03	Input the frequency-setting command via an RS485 communication terminal.
		04	Input the frequency-setting command from the board connected to optional port 1.
		05	Input the frequency-setting command from the board connected to optional port 2.
		06	Use the SJ-FB to input the frequency-setting command as a pulse train (see 4.2.21)
		07	Use the SET-Freq command of the easy sequence function as the frequency-setting command.
		10	Use the operation result of the set frequency operation function as the frequency-setting command. (see 4.2.12)

4.2.5 Run command source setting

Related code
A002: Run command source setting
C001 to C008: Terminal [1] to [8] functions
C019: Terminal [FW] active state
F004: Keypad Run key routing

The run command source setting function allows you to select the method to input operation commands (to start and stop the motor).
As the operation commands via control circuit terminals, turn the FW signal (for forward operation) or RV signal (for reverse operation) on and off to start and stop the motor, respectively.
(Note that the factory setting assigns the FW signal to intelligent input terminal [8].)
To switch each intelligent input terminal between a and b contacts, specify each terminal with function "C011" to "C019", and then perform input a/b (NO/NC) selection for each terminal.
When using the digital operation for the inverter operation, specify the desired motor operation direction with function "F004", and use the RUN and STOP/RESET keys to start and stop the motor, respectively.
If the start commands for both forward and reverse operations are input at the same time, the inverter will assume the input of a stop command.

Item	Function code	Data	Description
Run command source setting	A002	01	Input the start and stop commands via control circuit terminals (FW and RV).
		02	Input the start and stop commands from the digital or remote operator.
		03	Input the start and stop commands via RS485 communication terminals.
		04	Input the start and stop commands from option board 1.
		05	Input the start and stop commands from option board 2.
Terminal [FW] active state	C019 C011 to C018	00	a (NO) contact
		01	b (NC) contact

Note 1: If function "31" (forcible operation) or "51" (forcible-operation terminal) is assigned to an intelligent input terminal, the settings made with functions "A001" and "A002" will be invalidated when the said intelligent input terminal is turned on and those methods to input frequency-setting and operation commands which are specified for the said terminal will be enabled.
Note 2: On the remote operator (SRW) being used to operate the inverter, pressing the REMT (remote) key enables you to input both frequency-setting and operation commands from the remote operator.
Note 3: When the DeviceNet option board (SJ-DN) is used, A002 is not needed to be changed from default because the run command source is automatically set via DeviceNet. (In case it is changed, it is to be set as 01, 02 or 03.)

4.2.6 Stop mode selection

Related code
b091: Stop mode selection
F003/F203/F303:
Deceleration (1) time setting,
1st/2nd/3rd motors
b003: Retry wait time before motor restart
b007: Restart frequency threshold
b008: Restart mode after FRS

The stop mode selection function allows you to select one of two methods of stopping the motor when a stop command is input from the digital operator or via the control circuit terminal block. One is to decelerate the motor according to the specified deceleration time and then stop it; the other is to let the motor run freely until it stops.
If a start command is input while the motor is in free-running status, the inverter will restart the motor according to the setting of the restart mode after FRS (b088). (See Section 4.2.47.)

Item	Function code	Data	Description
Stop mode selection	b091	00	Normal stopping (stopping after deceleration)
		01	Free-running until stopping
Restart mode after FRS	b088	00	Starting with 0 Hz
		01	Starting with matching frequency
Restart frequency threshold	b007	0.00 to 400.0(Hz)	Starting with 0 Hz if the frequency-matching result is less than the set lower limit
Retry wait time before motor restart	b003	0.3 to 100.(s)	Time to wait until the restart of the motor after free-running ends

4.2.7 STOP key enable

Related code
b087: STOP key enable

When the control circuit terminal block is selected as the device to input operation commands, the STOP key enable function allows you to enable or disable the motor-stopping and trip reset functions of the STOP key of the digital operator.
This function is effective only when the digital operator (02) is not specified for the run command source setting (A002) (see Section 4.2.5).
If the digital operator (02) is specified for "A002", the motor-stopping and trip reset functions of the STOP key are enabled regardless of this setting (STOP key enable).

Function code	Data	Stop command with STOP key	Trip reset command with STOP key
b087	00	Enabled	Enabled
	01	Disabled	Disabled
	02	Disabled	Enabled

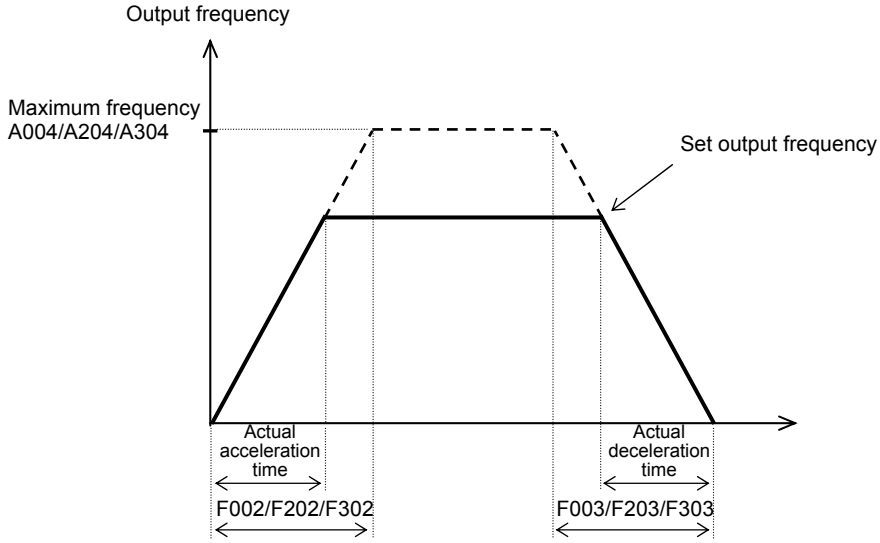
4.2.8 Acceleration/deceleration time setting

Related code

F002/F202/F302: Acceleration (1) time setting, 1st/2nd/3rd motors
F003/F203/F303: Deceleration (1) time setting, 1st/2nd/3rd motors
A004/A204/A304: Maximum frequency setting, 1st/2nd/3rd motors
P031: Accel/decel time input selection
C001 to C008: Terminal [1] to [8] functions

- Specify a longer time for slower acceleration or deceleration; specify a shorter time for quicker acceleration or deceleration.
- The time set with this function is the time to accelerate (or decelerate) the motor from 0 Hz to the maximum frequency (or vice versa).
- If you assign the LAD cancellation (LAC) function to an intelligent input terminal and turns on the terminal, the set acceleration/deceleration time will be ignored, and the output frequency will immediately follow the frequency-setting command.
- To switch the acceleration and deceleration time among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals (see Section 4.2.38). Use the SET and SET3 signals for switching.
- As the Accel/decel time input selection by P031, select one of the (1) input from the digital operation, (2) input from option board 1, (3) input from option board 2, and (4) input from the easy sequence program.

Item	Function code	Range of data	Description
Acceleration (1) time setting	F002/F202/ F302	0.01 to 3600.(s)	Set the length of time to accelerate the motor from 0 Hz to the maximum frequency.
Deceleration (1) time setting	F003/F203/ F303	0.01 to 3600.(s)	Set the length of time to decelerate the motor from the maximum frequency to 0 Hz.
Accel/decel time input selection	P031	00	Input from the digital operator (OPE)
		01	Input from option board 1 (OP1)
		02	Input from option board 1 (OP2)
		03	Input from the easy sequence program (PRG)
Terminal function	C001 to C008	46	LAD cancellation



The actual time to accelerate/decelerate the motor will be no less than the minimum acceleration/deceleration time that depends on the inertial effect (J) due to the mechanical system and motor torque. If you set a time shorter than the minimum acceleration/deceleration time, the inverter may trip because of overcurrent or overvoltage.

Acceleration time (ts)

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

Deceleration time (t_B)

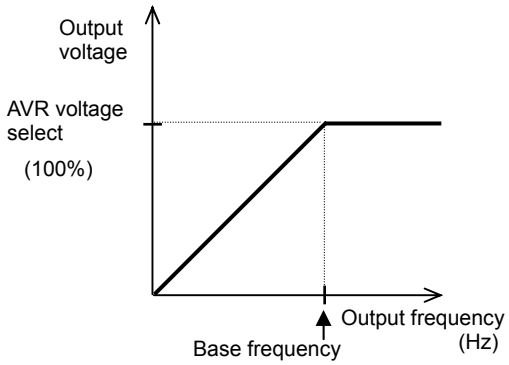
$$t_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$$

J_L: Inertia effect (J) of the load converted to that of the motor shaft (kg-m^2)
J_M: Inertia effect (J) of the motor (kg-m^2)
N_M: Motor speed (rpm)
Ts: Maximum acceleration torque driven by the inverter (N-m)
T_B: Maximum deceleration torque driven by the inverter (N-m)
T_L: Required running torque (N-m)

4.2.9 Base frequency setting

Related code
A003/A203/A303: Base frequency setting, 1st/2nd/3rd motors
A081: AVR function select
A082: AVR voltage select

(1) Base frequency and motor voltage
- With the base frequency setting and AVR voltage select functions, adjust the inverter outputs (frequency and voltage) to the motor ratings.
- The base frequency is the nominal frequency of the motor. Set a base frequency that meets the motor specification. Carefully note that setting the base frequency to less than 50 Hz may result in motor burnout.
- A special motor requires a base frequency of 60 Hz or more. Your inverter model may not be suitable for such a special motor, and one with a larger capacity may be required.
- Select the motor voltage that meets the motor specification. Selecting a motor voltage exceeding the motor specification may result in motor burnout.



- To switch the base frequency among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals (see Section 4.2.38). Use the SET and SET3 signals for switching.

Item	Function code	Range of data	Description
Base frequency setting	A003/A203/ A303	30. to maximum frequency, 1st/2nd/3rd motors (Hz)	
AVR voltage select	A082	380/400/415/440/460/480	

(2) AVR function
The AVR function maintains the correct voltage output to the motor, even when the voltage input to the inverter fluctuates. The output voltage maintained by this function is based on the voltage specified by the AVR voltage select.
Use the AVR function select (A081) to enable or disable the AVR function.

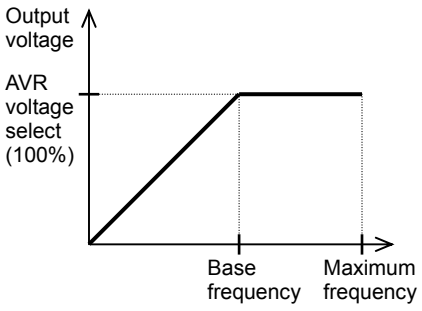
Item	Function code	Data	Description
AVR function select	A081	00	The AVR function is always enabled.
		01	The AVR function is always disabled.
		02	The AVR function is disabled at deceleration. (*1)

*1 Disabling the AVR function at motor deceleration increases the energy loss on the decelerated motor and decreases the energy regenerated on the inverter, which results in a shorter deceleration time.

4.2.10 Maximum frequency setting

Related code
A004/A204/A304: Maximum frequency setting, 1st/2nd/3rd motors

The maximum frequency setting function allows you to set the maximum frequency of the motor driven by the inverter.
The maximum frequency set here corresponds to the maximum level of each external analog input (See Section 4.2.12) (for example, 10 V of the input of 0 to 10 V).
To switch the maximum frequency among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.
The inverter output voltage with the frequency ranging from the base frequency to the maximum frequency is that selected by the AVR voltage select function (A082).



Item	Function code	Range of data	Description
Maximum frequency setting	A004/A204/ A304	30. to 400. (Hz) (185 to 315kW) 30. to 120. (Hz) (400kW)	The maximum output frequency is set.

4.2.11 External analog input setting (O, OI, and O2)

Related code
A005: [AT] selection
A006: [O2] selection
C001 to C008: Terminal [1] to [8] functions

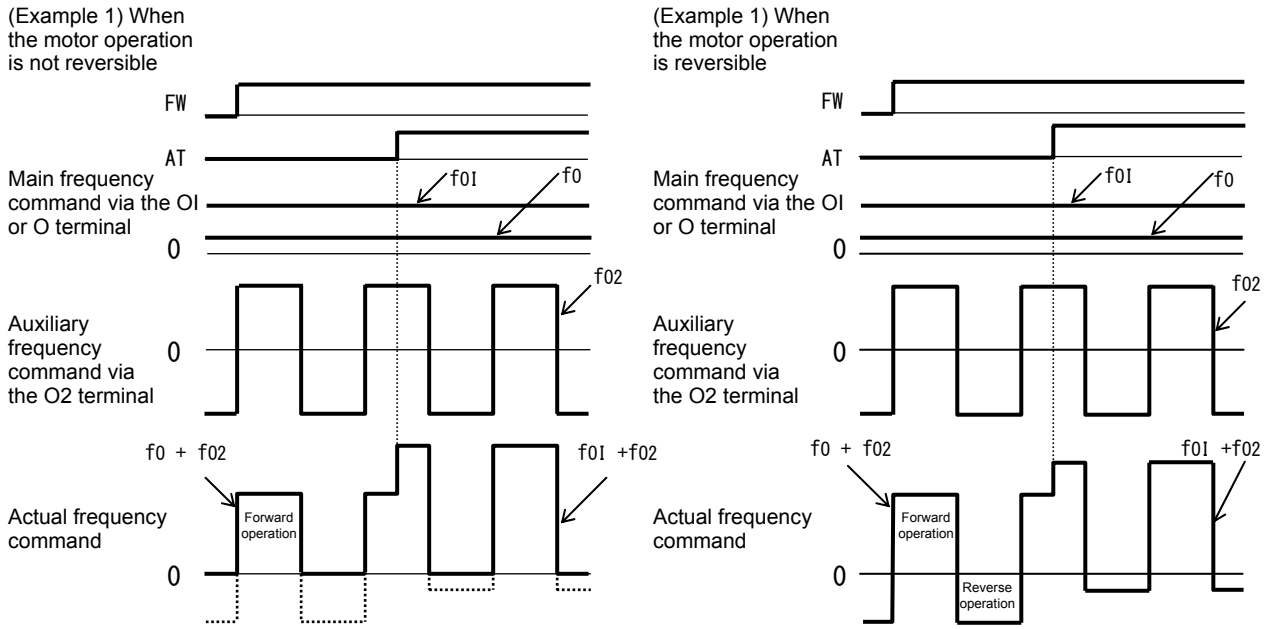
The inverter has the following three types of external analog input terminals:
O-L terminal: 0 to 10 V
OI-L terminal: 4 to 20 mA
O2-L terminal: -10 to 10 V

The table below lists the settings of the external analog input terminals.

Item	Function code	Data	Description
[AT] selection	A005	00	Switching between the O and OI terminals with the AT terminal Turning on the AT terminal enables the OI-L terminal. Turning on the AT terminal enables the O-L terminal.
		01	Switching between the O and O2 terminals with the AT terminal Turning on the AT terminal enables the O2-L terminal. Turning on the AT terminal enables the O-L terminal.
		(02)	(Valid only when the OPE-SR is used) Switching between the O terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the O-L terminal.
		(03)	(Valid only when the OPE-SR is used) Switching between the OI terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the OI-L terminal.
		(04)	(Valid only when the OPE-SR is used) Switching between the O2 terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the O2-L terminal.
[O2] selection	A006	00	Using the O2 terminal independently
		01	Using the O2 terminal for auxiliary frequency command (nonreversible) in addition to the O and OI terminals
		02	Using the O2 terminal for auxiliary frequency command (reversible) in addition to the O and OI terminals
		03	Disabling the O2 terminal

Note that whether frequency commands are input to the O2-L terminal and whether the motor operation is reversible depend on the combination of settings of functions "A005" and "A006" and whether function "16" (AT) is assigned to an intelligent input terminal as shown in the table below.
When the motor operation is reversible, the inverter operates the motor in a reverse direction if the sum of the frequencies specified by the main frequency and auxiliary frequency commands is less than 0 (even when the forward operation [FW] terminal is on). Even when no wire is connected to the 02 terminal, reverse operation of the motor may occur and prolong the acceleration time if the output voltage fluctuates near 0 V.

	A006	A005	AT terminal	Main frequency command	Whether to input an auxiliary frequency command (via the O2-L terminal)	Reversible/ nonreversible
When the AT function is assigned to an intelligent input terminal	00,03	00	OFF	O-L terminal	No input	Nonreversible
			ON	OI-L terminal	No input	
		01	OFF	O-L terminal	No input	
			ON	O2-L terminal	No input	Reversible
	01	00 (Example 1)	OFF	O-L terminal	Input	Nonreversible
			ON	OI-L terminal	Input	
		01	OFF	O-L terminal	Input	
			ON	O2-L terminal	No input	Reversible
	02	00 (Example 2)	OFF	O-L terminal	Input	Reversible
			ON	OI-L terminal	Input	
		01	OFF	O-L terminal	Input	
			ON	O2-L terminal	No input	
When the AT function is not assigned to any intelligent input terminal	00	—	—	O2-L terminal	No input	Reversible
	01	—	—	Addition of signals on O-L and OI-L terminals	Input	Nonreversible
	02	—	—	Addition of signals on O-L and OI-L terminals	Input	Reversible
	03	—	—	Addition of signals on O-L and OI-L terminals	No input	Nonreversible



4.2.12 Frequency operation function

Related code
A141: Operation-target frequency selection 1
A142: Operation-target frequency selection 2
A143: Operator selection
A001: Frequency source setting
A076: PV source setting

The frequency operation function allows you to use the result of an arithmetic operation on two frequency commands as the actual frequency command or PID feedback data.
To use the operation result as the actual frequency command, specify "10" for the frequency source setting (A001).
To use the operation result as the PID feedback data, specify "10" for the PV source setting (A076).

Item	Function code	Data	Description
Operation-target frequency selection 1 and 2	A141/A142	00	Digital operator (A020/A220/A320)
		(01)	Control on the digital operator (Valid only when the OPE-SR is connected)
		02	Input via the O terminal
		03	Input via the OI terminal
		04	Input via the RS485 terminal
		05	Input from option board 1
		06	Input from option board 2
		07	Input of pulse train
Operator selection for frequency operation	A143	00	Addition: (A141) + (A142)
		01	Subtraction: (A141) - (A142)
		02	Multiplication: (A141) x (A142)
Frequency source setting	A001	10	Output of operation result
PV source setting	A076	10	Output of operation result

Note 1: The [1] (up) and [2] (down) keys of the digital operator are ineffective when the frequency operation function is enabled. Also, the frequency displayed by the output frequency monitoring (d001), Scaled output frequency monitoring (d007), or output frequency setting (F001) cannot be changed with key operations.
Note 2: The settings of "A141" and "A142" can be the same.

4.2.13 Frequency addition function

Related code
A145: Frequency to be added
A146: Sign of the frequency to be added
C001 to C008: Terminal [1] to [8]functions

The frequency addition function allows you to add or subtract the value specified as the frequency to be added (A145) to or from the frequency value of a selected frequency command.
To use this function, assign function "50" (ADD) to an intelligent input terminal.
When the ADD terminal is turned on, the inverter performs the addition or subtraction of the value specified as "A145".

Item	Function code	Data or range of data	Description
Frequency to be added	A145	0.00 to 400.00(Hz) (185 to315kW) 0.00 to 120.00 (Hz) (400kW)	Setting of the frequency to be added
Selection of the sign of the frequency to be added	A146	00	(Frequency command) + (A145)
		01	(Frequency command) - (A145)
Terminal function	C001 to C008	50	ADD selection of the trigger for adding the frequency (A145)

Note 1: If the sign of the frequency value in the frequency command changes from minus (-) to plus (+), or vice versa, as the result of frequency addition, the motor operation direction will be inverted.
Note 2: When the PID function is used, the frequency addition function can apply to PID target data. (In such cases, the data display by function "A145" is in percentage [in steps of 0.01%]).

4.2.14 Start/end frequency setting for external analog input

Related code
A011: [O]-[L] input active range start frequency
A012: [O]-[L] input active range end frequency
A013: [O]-[L] input active range start voltage
A014: [O]-[L] input active range end voltage
A015: [O]-[L] input start frequency enable
A101: [OI]-[L] input active range start frequency
A102: [OI]-[L] input active range end frequency
A103: [OI]-[L] input active range start current
A104: [OI]-[L] input active range end current
A105: [OI]-[L] input start frequency enable
A111: [O2]-[L] input active range start frequency
A112: [O2]-[L] input active range end frequency
A113: [O2]-[L] input active range start voltage
A114: [O2]-[L] input active range end voltage

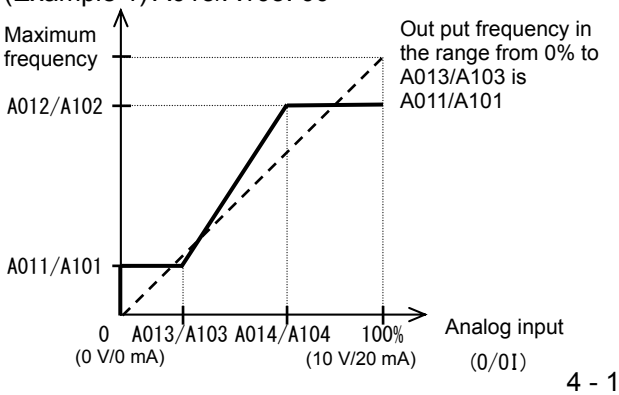
The start/end frequency setting function allows you to set the inverter output frequency in relation to the external analog inputs (frequency commands) via the following terminals:
O-L terminal: 0 to 10 V
OI-L terminal: 4 to 20 mA
O2-L terminal: -10 to +10 V

(1) Start/end frequency settings for the O-L and OI-L terminals

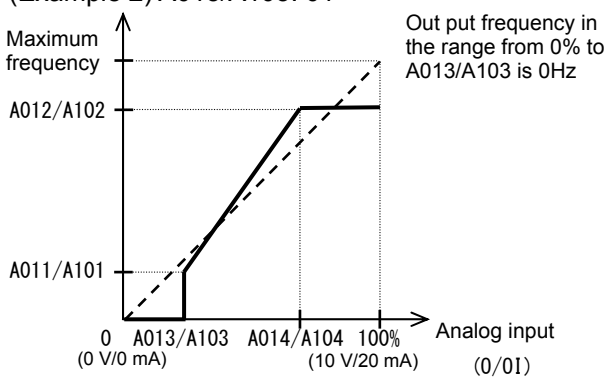
Item	Function code	Range of data	Description
[O]/[OI]-[L] input active range start frequency	A011/A101	0.00 to 400.0(Hz) (185 to315kW) 0.00 to 120.0 (Hz) (400kW)	Setting of the start frequency
[O]/[OI]-[L] input active range end frequency	A012/A102	0.0 to 400.0(Hz) (185 to315kW) 0.00 to 120.0 (Hz) (400kW)	Setting of the end frequency
[O]/[OI]-[L] input active range start voltage	A013/A103	0. to 100.(%)	Setting of the rate of the start frequency to the external frequency command (0 to 10 V/0 to 20 mA)
[O]/[OI]-[L] input active range end voltage	A014/A104	0. to 100.(%)	Setting of the rate of the end frequency to the external frequency command (0 to 10 V/0 to 20 mA)
[O]/[OI]-[L] input start frequency enable	A015/A105	00	Externally input start frequency The frequency set as "A011" or "A101" is output as the output frequency while the start-frequency rate is 0% to the value set as "A013" or "A103".
		01	0 Hz 0 Hz is output as the output frequency while the start-frequency rate is 0% to the value set as "A013" or "A103".

If the voltage of the signal to be input to the O-L terminal is 0 to 5 V, specify 50% for "A014".

(Example 1) A015/A105: 00



(Example 2) A015/A105: 01

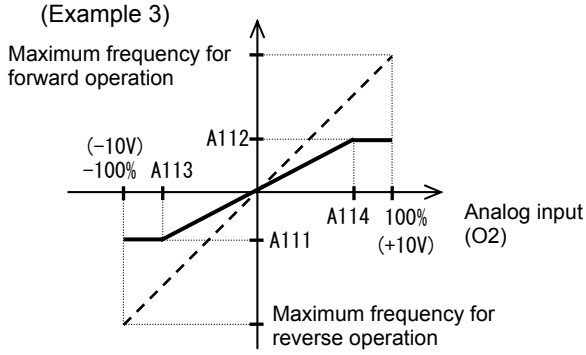


(2) Start/end frequency settings for the O2-L terminal

Item	Function code	Range of data	Description	Remarks
02 start frequency	A111	-400. to 400.(Hz) (185 to315kW) -120. to 120. (Hz) (400kW)	Setting of the start frequency	(Example 3)
02 end frequency	A112	-400. to 400.(Hz) (185 to315kW) -120. to 120. (Hz) (400kW)	Setting of the end frequency	
02 start-frequency rate	A113	-100. to 100.(%)	Setting of the rate of the start frequency to the external frequency command (-10 to +10 V) (*1)	
02 end-frequency rate	A114	-100. to 100.(%)	Setting of the rate of the end frequency to the external frequency command (-10 to +10 V) (*1)	

*1 The frequency rates correspond to the voltages (-10 to +10 V) of the external frequency command as follows:
-10 to 0 V: -100% to 0%
0 to +10 V: 0% to 100%
For example, if the voltage of the signal to be input to the O2-L terminal is -5 to +5 V, specify 50% for "A114".

(Example 3)



4.2.15 External analog input (O/OI/O2) filter setting

Related code
A016: External frequency filter time const.

The external analog input filter setting function allows you to set the input-voltage/input-current sampling time to be applied when frequency commands are input as external analog signals.
You can use this filter function effectively for removing noise from the frequency-setting circuit signal.
If the noise disables the stable operation of the inverter, increase the setting. Setting a larger value makes the inverter response slower. The filtering constant is "set value (1 to 30) x 2 ms."
When the setting is "31" (factory setting), a hysteresis of ±0.1 Hz is added to the filtering constant (500 ms).

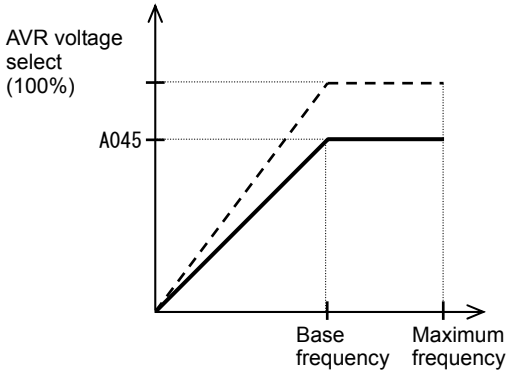
Item	Function code	Range of data	Description
External frequency filter time const.	A016	1. to 30. or 31.	Setting of 1. to 30.: "Set value x 2" ms filter Setting of 31.: 500 ms filter (fixed) with hysteresis of ±0.1 Hz

4.2.16 V/f gain setting

Related code
A045: V/f gain setting
A082: AVR voltage select

The V/f gain setting function allows you to change the inverter output voltage by specifying the rate of the output voltage to the voltage (100%) selected with the AVR voltage select function (A082).
If the motor operation is cranky, try to increase the gain setting.

Item	Function code	Range of data	Description
V/f gain setting	A045	20. to 100. (%)	Setting of the rate of reducing the output voltage



4.2.17 V/F characteristic curve selection

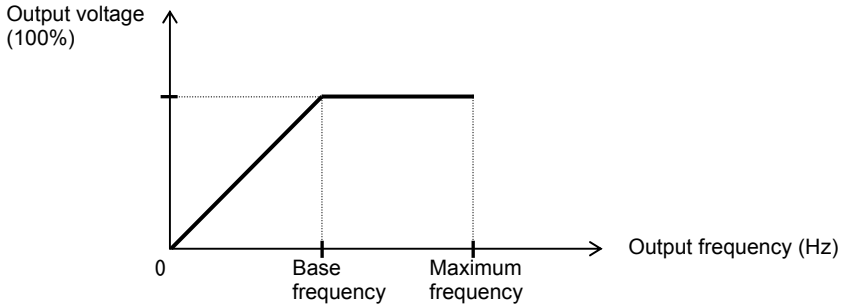
Related code

A044/A244/A344: V/F characteristic curve selection, 1st/2nd/3rd motors
b100/b102/b104/b106/b108/b110/b112: Free-setting V/f frequency (1) (2) (3) (4) (5) (6) (7)
b101/b103/b105/b107/b109/b111/b113: Free-setting V/f voltage (1) (2) (3) (4) (5) (6) (7)

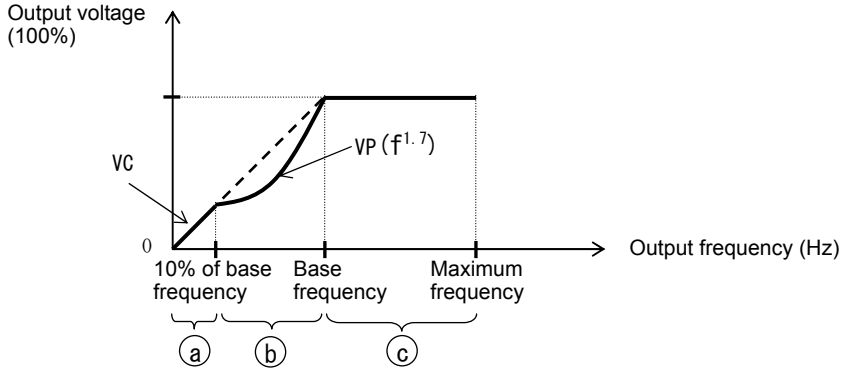
The V/F characteristic curve selection function allows you to set the output voltage/output frequency (V/f) characteristic.
To switch the V/F characteristic curve selection among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.

Function code	Data	V/f characteristic	Remarks
A044/A244/ A344	00	Constant torque characteristic (VC)	
	01	Reduced-torque characteristic (1.7th power of VP)	
	02	Free V/f characteristic	Available only for A044 and A244
	03	Sensorless vector control (SLV)	Available only for A044 and A244 (See Section 4.2.96.)
	04	0 Hz-range sensorless vector control	Available only for A044 and A244 (See Section 4.2.97.)
	05	Vector control with sensor (V2)	Available only for A044

(1) Constant torque characteristic (VC)
With this control system set, the output voltage is in proportion to the output frequency within the range from 0 Hz to the base frequency. Within the output frequency range over the base frequency up to the maximum frequency, the output voltage is constant, regardless of the change in the output frequency.



(2) Reduced-torque characteristic (1.7th power of VP)
This control system is suited when the inverter is used with equipment (e.g., fan or pump) that does not require a large torque at a low speed.
Since this control system reduces the output voltage at low frequencies, you can use it to increase the efficiency of equipment operation and reduce the noise and vibrations generated from the equipment.
The V/f characteristic curve for this control system is shown below.



Period ⓐ : While the output frequency increases from 0 Hz to the 10% of the base frequency, the output voltage follows the constant torque characteristic.
(Example) If the base frequency is 60 Hz, the constant torque characteristic is maintained within the output frequency range of 0 to 60 Hz.

Period ⓑ : While the output frequency increases from the 10% of base frequency to the base frequency, the output voltage follows the reduced-torque characteristic. In other words, the output voltage increases according to the 1.7th power of the output frequency.

Period ⓒ : While the output frequency increases from the base frequency to the maximum frequency, the output voltage is constant.

(3) Free V/f characteristic setting

The free V/f characteristic setting function allows you to set an arbitrary V/f characteristic by specifying the voltages and frequencies (b100 to b113) for the seven points on the V/f characteristic curve.

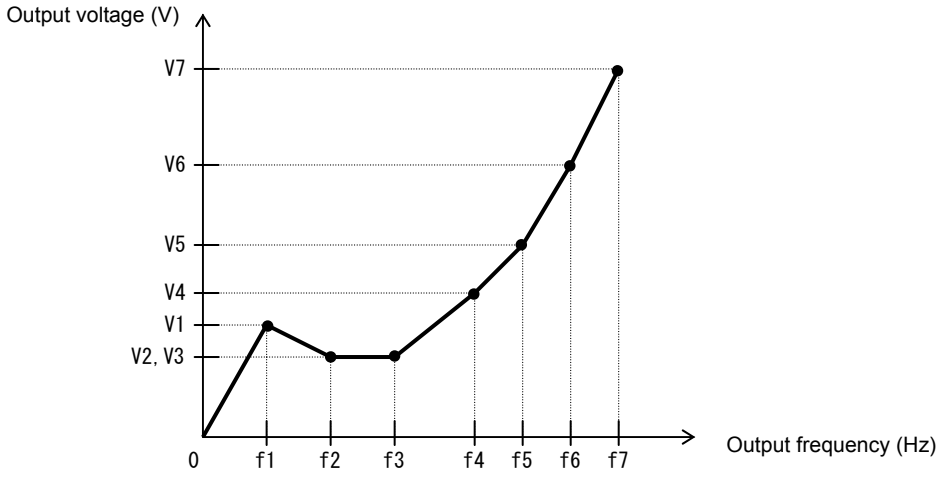
The free V/f frequencies (1 to 7) set by this function must always be in the collating sequence of "1 ≤ 2 ≤ 3 ≤ 4 ≤ 5 ≤ 6 ≤ 7".

Since all free V/f frequencies are set to 0 Hz as default (factory setting), specify their arbitrary values (begin setting with free-setting V/f frequency (7)). (The inverter cannot operate with the free V/f characteristic in the factory setting.)

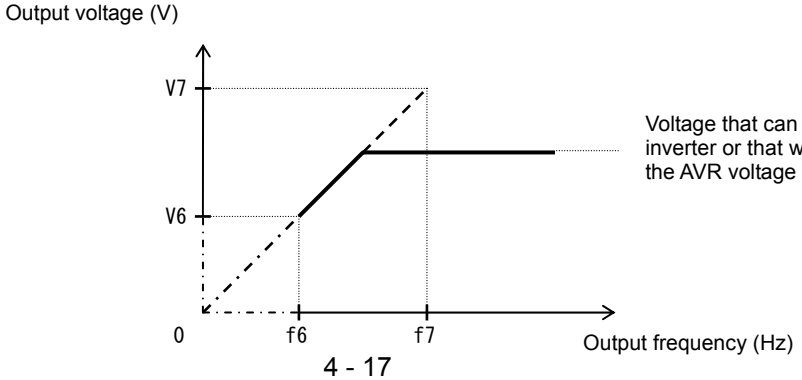
Enabling the free V/f characteristic setting function disables the torque boost selection (A041/A241), base frequency setting (A003/A203/A303), and maximum frequency setting (A004/A204/A304). (The inverter assumes the value of free-setting V/f frequency (7) as the maximum frequency.)

Item	Function code	Data	Description
Free-setting V/f frequency (7)	b112	0.to 400.(Hz) (185 to315kW) 0. to 120. (Hz) (400kW)	Setting of the output frequency at each breakpoint of the V/f characteristic curve
Free-setting V/f frequency (6)	b110	0. to free-setting V/f frequency (7) (Hz)	
Free-setting V/f frequency (5)	b108	0. to free-setting V/f frequency (6) (Hz)	
Free-setting V/f frequency (4)	b106	0. to free-setting V/f frequency (5) (Hz)	
Free-setting V/f frequency (3)	b104	0. to free-setting V/f frequency (4) (Hz)	
Free-setting V/f frequency (2)	b102	0. to free-setting V/f frequency (3) (Hz)	
Free-setting V/f frequency (1)	b100	0. to free-setting V/f frequency (2) (Hz)	
Free-setting V/f voltage (7)	b113	0.0 to 800.0(V)	Setting of the output voltage at each breakpoint of the V/f characteristic curve (*1)
Free-setting V/f voltage (6)	b111		
Free-setting V/f voltage (5)	b109		
Free-setting V/f voltage (4)	b107		
Free-setting V/f voltage (3)	b105		
Free-setting V/f voltage (2)	b103		
Free-setting V/f voltage (1)	b101		

(Example)



*1 Even if 800 V is set as a free-setting V/f voltage (1 to 7), the inverter output voltage cannot exceed the inverter input voltage or that specified by the AVR voltage select.
Carefully note that selecting an inappropriate control system (V/f characteristic) may result in overcurrent during motor acceleration or deceleration or vibration of the motor or other machine driven by the inverter.



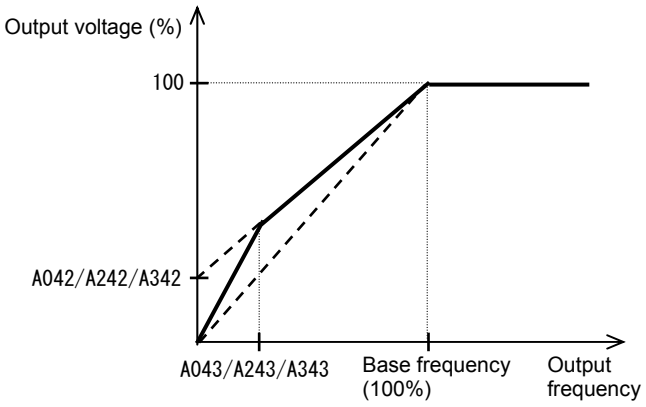
4.2.18 Torque boost setting

Related code
A041/A241: Torque boost selection, 1st/2nd motors
A042/A242/A342: Manual torque boost value, 1st/2nd3rd motors
A043/A243/A343: Manual torque boost frequency adjustment, 1st/2nd/3rd motors
H003/H203: Motor capacity, 1st/2nd motors
H004/H204: Motor poles setting, 1st/2nd motors

The torque boost setting function allows you to compensate for the voltage drop due to wiring and the primary resistance of the motor so as to improve the motor torque at low speeds.
When you select automatic torque boost by the torque boost selection (A041/A241), adjust the settings of the motor capacity selection (H003/H203) and motor pole selection (H004/H204) based on the motor to be driven.

Item	Function code	Data or range of data	Description
Torque boost selection	A041/A241	00	Manual torque boost
		01	Automatic torque boost
Manual torque boost value	A042/A242/A342	0.0 to 20.0(%)	Setting of the rate of the boost to the output voltage (100%)
Manual torque boost frequency adjustment	A043/A243/A343	0.0 to 50.0(%)	Setting of the rate of the frequency at breakpoint to the base frequency
Motor capacity	H003/H203	11.0 to 400.0(kW)	Selection of the motor capacity
Motor poles setting	H004/H204	2, 4, 6, 8, or 10 (poles)	Selection of the number of poles of the motor
Voltage compensation gain setting for automatic torque boost	A046/A246	0. to 255.	See Item (2), "Automatic torque boost."
Slippage compensation gain setting for automatic torque boost	A047/A247	0. to 255.	See Item (2), "Automatic torque boost."

(1) Automatic torque boost
The inverter outputs the voltage according to the settings of the manual torque boost (A042/A242/A342) and manual torque boost frequency adjustment (A043/A243/A343).
Use the manual torque boost value (A042/A242/A342) to specify the rate of the boost to the voltage (100%) set by the AVR voltage select.
The set rate of voltage corresponds to the boost voltage that is output when the output frequency is 0 Hz.
When increasing the value of the manual torque boost value, be careful to prevent motor over-excitation. Over-excitation may result in motor burnout.
Use the manual torque boost frequency adjustment (A043/A243/A343) to specify the rate of the frequency at each breakpoint to the base frequency (100%).
To switch the settings among the 1st, 2nd, and 3rd settings ("A041 to A043", "A241 to A243", and "A342 and A343"), assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.



(2) Automatic torque boost
When automatic torque boost (data "01") is selected by the torque boost selection (A041/A241), the inverter automatically adjusts the output frequency and voltage according to the load on the motor. (During actual operation, the automatic torque boost is usually combined with the manual torque boost.)
When you select the automatic torque boost, adjust the settings of the motor capacity selection (H003/H203) and motor pole selection (H004/H204) according to the motor to be driven.
If the inverter trips due to overcurrent during motor deceleration, set the AVR function select (A081) to always enable the AVR function (data "00").
If you cannot obtain the desired operation characteristic by using the automatic torque boost, make the following adjustments:

Symptom	Adjustment method	Adjustment item
Motor torque is insufficient at low speed. (The motor does not rotate at low speed.)	(1) Increase the voltage setting for manual torque boost step by step.	A042/A242
	(2) Increase the slippage compensation gain for automatic torque boost step by step.	A047/A247
	(3) Increase the voltage compensation gain for automatic torque boost step by step.	A046/A246
	(4) Reduce the carrier frequency setting.	b083
The motor speed falls when a load is applied to the motor.	Increase the slippage compensation gain for the automatic torque boost step by step.	A047/A247
The motor speed increases when a load is applied to the motor.	Reduce the slippage compensation gain for the automatic torque boost step by step.	A047/A247
The inverter trips due to overcurrent when a load is applied to the motor.	(1) Reduce the voltage compensation gain for the automatic torque boost step by step.	A046/A246
	(2) Reduce the slippage compensation gain for the automatic torque boost step by step.	A047/A247
	(3) Reduce the voltage setting for the manual torque boost step by step.	A042/A242

This function cannot be selection for 3rd moter setting.
Manual torque boost valid.

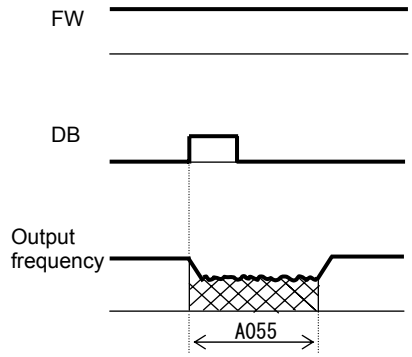
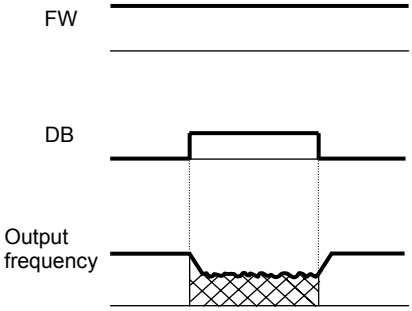
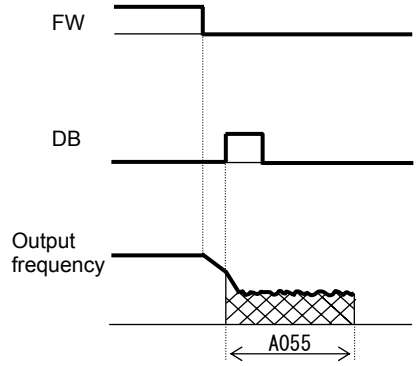
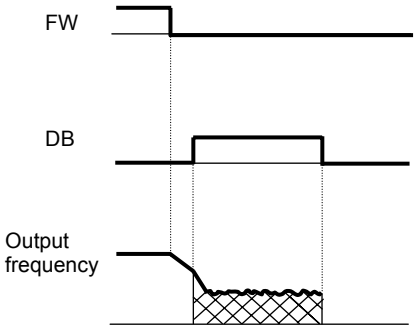
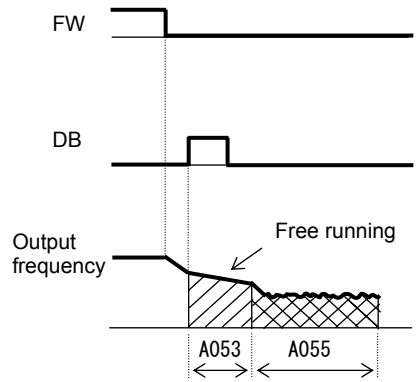
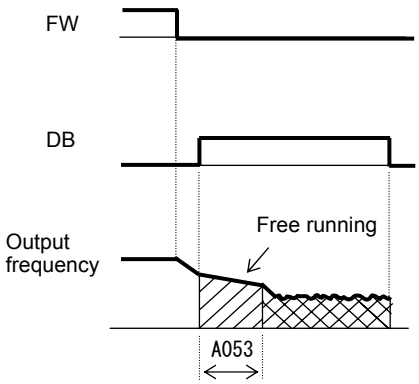
4.2.19 DC braking (DB) setting

The DC braking function allows you to apply DC braking to the motor according to the load on the motor.
You can control DC braking in two ways: the external control through signal input to intelligent input terminals and the internal control to be performed automatically when the motor is started and stopped.
Note that the motor cannot be stopped by DC braking if the load on the motor produces a large moment of inertia.

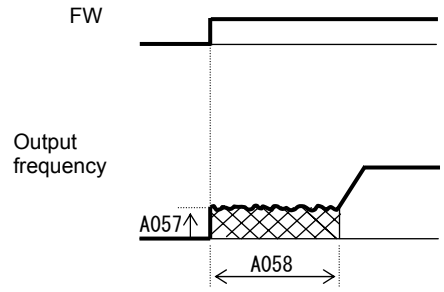
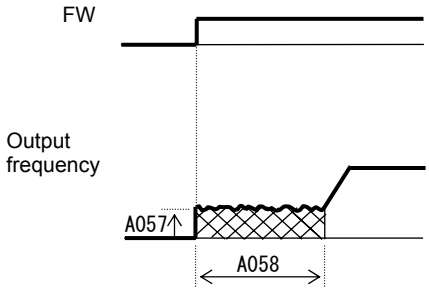
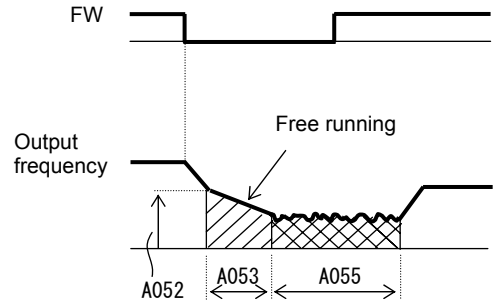
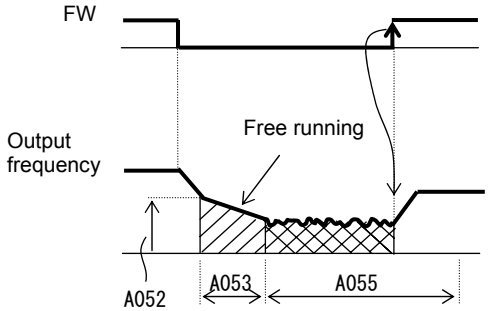
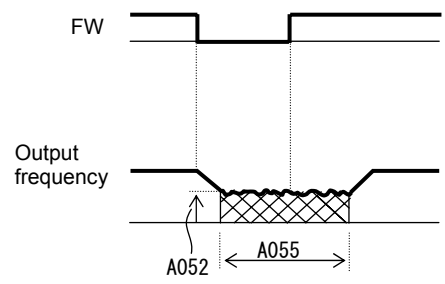
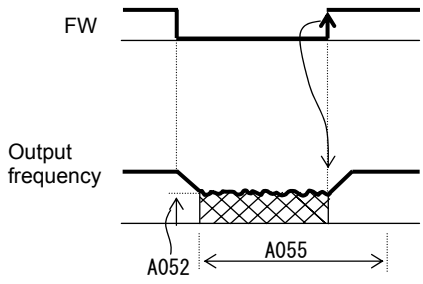
Related code
A051: DC braking enable
A052: DC braking frequency setting
A053: DC braking wait time
A054: DC braking force during deceleration
A055: DC braking time for deceleration
A056: DC braking/edge or level detection for [DB] input
A057: DC braking force for starting
A058: DC braking time for starting
A059: DC braking carrier frequency setting
C001 to C008: Terminal [1] to [8] functions

Item	Function code	Data or range of data	Description
DC braking enable	A051	00	Internal DC braking is disabled.
		01	Internal DC braking is enabled.
		02	Internal DC braking is enabled. (The braking operates only with the set braking frequency.)
DC braking frequency setting	A052	0.00 to 400.0 (Hz) (185 to315kW) 0.00 to 120. 0(Hz) (400kW)	With internal DC braking enabled, DC braking is started when the output frequency reaches the set braking frequency.
DC braking wait time	A053	0.0 to 5.0 (s)	The DC braking wait time specifies the delay in starting DC braking after the set braking time has elapsed or the DB terminal has been turned on.
DC braking force during deceleration/ DC braking force for starting	A054/A057	0. to 35. (%)	"0" specifies the smallest force (zero current); "35" specifies the largest force (35% current).
DC braking time for deceleration	A055	0.0 to 60.0 (s)	This setting is valid for the external DC braking in edge mode or for the internal DC braking.
DC braking/edge or level detection for [DB] input	A056	00	Edge mode (See examples 1-a to 6-a.)
		01	Level mode (See examples 1-b to 6-b.)
DC braking time for starting	A058	0.0 to 60.0 (s)	This setting is valid for the internal DC braking. DC braking is started when the motor-start command is input.
DC braking carrier frequency setting	A059	0.5 to 3.0 (kHz)	Unit: kHz

(1) External DC braking
Assign function "07" (DB) to terminal function (C001 to C008).
Turn the DB terminal on and off to control the direct braking, regardless of the setting of DC braking enable (A051).
Adjust the braking force by adjusting the DC braking force setting (A054).
When you set the DC braking wait time (A053), the inverter output will be shut off for the set period of delay, and the motor will run freely during the period. DC braking will be restarted after the delay.
When setting the DC braking time with function "A055" or for the DC braking operation via the DB terminal, determine the length of time in consideration of the heat generation on the motor.
Select the braking mode by the DC braking/edge or level detection for [DB] input (A056), and then make any other necessary settings suitable for your system.

(a) Edge mode (A056: 00)	(b) Level mode (A056: 01)
(Example 1-a) 	(Example 1-b) 
(Example 2-a) 	(Example 2-b) 
(Example 3-a) 	(Example 3-b) 

(2) Internal DC braking (A051: 01)
You can apply DC braking to the motor even without entering braking signals via the DB terminal when the inverter starts and stops. To use the internal DC braking function, specify "01" for the DC braking enable (A051).
Use function "A057" to set the DC braking force for starting, and use function "A058" to specify the DC braking time for starting, regardless of the braking mode selection (edge or level mode). (See examples 4-a and 4-b.)
Set the braking force for periods other than starting by using the DC braking force setting (A054).
Set the output frequency at which to start DC braking by using the DC braking frequency setting (A052).
When you set the DC braking wait time (A053), the inverter output will be shut off when the output frequency reaches the setting of "A052" after the operation command (FW signal) is turned off, and the motor will run freely for the delay time set by "A053". DC braking will be started after the delay (A053).
The internal DC braking operation to be performed when the operation command is switched from the stop command to the start command varies depending on the braking mode (edge or level mode).
Edge mode: The DC braking time setting (A055) is given priority over operation commands, and the inverter performs DC braking according to the setting of "A055". When the output frequency reaches the setting of "A052" the inverter performs DC braking for the time set for "A055". Even if the stop command is input during DC braking, DC braking continues until the time set for "A055" elapses. (See examples 5-a and 6-a.)
Level mode: Operation commands are given priority over the DC braking time setting. The inverter follows operation commands, regardless of the DC braking time setting (A055). If the start command is input during DC braking, the inverter starts the normal motor operation, regardless of the DC braking time setting (A055). (See examples 5-b and 6-b.)

<table>
<tr><th>(a) Edge mode</th><th>(b) Level mode</th></tr>
<tr><td>i) (Example 4-a) when the start command is input:
 
</td><td>i) (Example 4-b) when the start command is input:
 
</td></tr>
<tr><td>ii) (Example 5-a) when the stop command is input:
 
</td><td>ii) (Example 5-b) when the stop command is input:
 
</td></tr>
<tr><td>ii) (Example 6-a) when the stop command is input:
 
</td><td>ii) (Example 6-b) when the stop command is input:
 
</td></tr>
</table>

HITACHI INVERTER

SJ700-2 LARGE CAPACITY SERIES

INSTRUCTION MANUAL

Read through this Instruction Manual, and keep it handy for future reference.

NT2032X

HITACHI

Introduction

Thank you for purchasing the Hitachi SJ700-2 Large Capacity Series Inverter.

This Instruction Manual describes how to handle and maintain the Hitachi SJ700 Series Inverter. Read this Instruction Manual carefully before using the inverter, and then keep it handy for those who operate, maintain, and inspect the inverter.

Before and during the installation, operation, inspection, and maintenance of the inverter, always refer to this Instruction Manual to obtain the necessary related knowledge, and ensure you understand and follow all safety information, precautions, and operating and handling instructions for the correct use of the inverter.

Always use the inverter strictly within the range of the specifications described in this Instruction Manual and correctly implement maintenance and inspections to prevent faults occurring.

When using the inverter together with optional products, also read the manuals for those products. Note that this Instruction Manual and the manual for each optional product to be used should be delivered to the end user of the inverter.

Handling of this Instruction Manual

- The contents of this Instruction Manual are subject to change without prior notice.
- Even if you lose this Instruction Manual, it will not be resupplied, so please keep it carefully.
- No part of this Instruction Manual may be reproduced in any form without the publisher's permission.
- If you find any incorrect description, missing description or have a question concerning the contents of this Instruction Manual, please contact the publisher.

Revision History

No.	Revision content	Date of issue	Manual code
1	First edition	Oct. 2007	NT2032X

- The current edition of this Instruction Manual also includes some corrections of simple misprints, missing letters, misdescriptions and certain added explanations other than those listed in the above Revision History table.

Safety Instructions

Be sure to read this Instruction Manual and appended documents thoroughly before installing, operating, maintaining, or inspecting the inverter.
In this Instruction Manual, safety instructions are classified into two levels, namely WARNING and CAUTION.

WARNING : Indicates that incorrect handling may cause hazardous situations, which may result in serious personal injury or death.

CAUTION : Indicates that incorrect handling may cause hazardous situations, which may result in moderate or slight personal injury or physical damage alone.

Note that even a CAUTION level situation may lead to a serious consequence according to circumstances. Be sure to follow every safety instruction, which contains important safety information. Also focus on and observe the items and instructions described under "Notes" in the text.

! CAUTION

Many of the drawings in this Instruction Manual show the inverter with covers and/or parts blocking your view being removed.
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 Instruction Manual when operating the inverter.

1. Installation

! CAUTION

- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its top cover. Otherwise, you run the risk of injury by dropping the inverter.
- Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter. Otherwise, you run the risk of fire.
- Install the inverter on a structure able to bear the weight specified in this Instruction Manual. Otherwise, you run the risk of injury due to the inverter falling.
- Install the inverter on a vertical wall that is free of vibrations. Otherwise, you run the risk of injury due to the inverter falling.
- Do not install and operate the inverter if it is damaged or its parts are missing. Otherwise, you run the risk of injury.
- 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, or salt water. Otherwise, you run the risk of fire.
- The inverter is precision equipment. Do not allow it to fall or be subject to high impacts, step on it, or place a heavy load on it. Doing so may cause the inverter to fail.

2. Wiring

! WARNING

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- Do not remove rubber bushings from the wiring section. Otherwise, the edges of the wiring cover may damage the wire, resulting in a short circuit or ground fault.

! CAUTION

- Make sure that the voltage of AC power supply matches the rated voltage of your inverter. Otherwise, you run the risk of injury or fire.
- Do not input single-phase power into the inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U, V, and W). Otherwise, you run the risk of injury or fire.
- Do not connect a resistor directly to any of the DC terminals (PD, P, and N). Otherwise, you run the risk of fire.
- Connect an earth-leakage breaker to the power input circuit. Otherwise, you run the risk of fire.
- Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings). Otherwise, you run the risk of fire.
- Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
- Tighten each screw to the specified torque. No screws must be left loose. Otherwise, you run the risk of fire.
- Before operating, slide switch SW1 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Since the inverter supports two modes of cooling-fan operation, the inverter power is not always off, even when the cooling fan is stopped. Therefore, be sure to confirm that the power supply is off before wiring. Otherwise, you run the risk of electric shock and injury.
- Don’t use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

3. Operation

! WARNING

- While power is supplied to the inverter, do not touch any terminal or internal part of the inverter, check signals, or connect or disconnect any wire or connector. Otherwise, you run the risk of electric shock or fire.
- 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. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. 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.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation 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 control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- The [STOP] key is effective only when its function is enabled by setting. Prepare an emergency stop switch separately. Otherwise, you run the risk of injury.
- If an operation command has been input to the inverter before the inverter enters alarm status, the inverter will restart suddenly when the alarm status is reset. Before resetting the alarm status, make sure that no operation command has been input.
- While power is supplied to the inverter, do not touch any internal part of the inverter or insert a bar in it. Otherwise, you run the risk of electric shock or fire.

! CAUTION

- Do not touch the heat sink, which heats up during the inverter operation. Otherwise, you run the risk of burn injury.
- The inverter allows you to easily control the speed of motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. Otherwise, you run the risk of injury.
- Install an external brake system if needed. Otherwise, you run the risk of injury.
- When using the inverter to operate a standard motor at a frequency of over 60 Hz, 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. Otherwise, you run the risk of damage to the motor and machine.
- During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations. Otherwise, you run the risk of damage to the machine driven by the motor.

4. Maintenance, inspection, and parts replacement

! WARNING

- Before inspecting the inverter, be sure to turn off the power supply and wait for 10 minutes or more. Otherwise, you run the risk of electric shock.
  (Before inspection, confirm that the Charge lamp on the inverter is off and the DC voltage between terminals P and N is 45 V or less.)
- Commit only a designated person to maintenance, inspection, and the replacement of parts.
  (Be sure to remove wristwatches and metal accessories, e.g., bracelets, before maintenance and inspection work and to use insulated tools for the work.)
  Otherwise, you run the risk of electric shock and injury.

5. Others

! WARNING

- Never modify the inverter. Otherwise, you run the risk of electric shock and injury.

! CAUTION

- Do not discard the inverter with household waste. Contact an industrial waste management company in your area who can treat industrial waste without polluting the environment.

Precautions Concerning Electromagnetic Compatibility (EMC)

The SJ700 series inverter conforms to the requirements of Electromagnetic Compatibility (EMC) Directive (2004/108/EC). However, when using the inverter in Europe, you must comply with the following specifications and requirements to meet the EMC Directive and other standards in Europe:

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

1. Power supply requirements
   a. Voltage fluctuation must be -15% to +10% or less.
   b. Voltage imbalance must be ±3% or less.
   c. Frequency variation must be ±4% or less.
   d. Total harmonic distortion (THD) of voltage must be ±10% or less.
2. Installation requirement
   a. A special filter and a ferrite core intended for the SJ700 large capacity series inverter must be installed, showen in the table (Table 1) below.
   b. A provided direct reactor with the SJ700 large capacity series inverter must be installed.

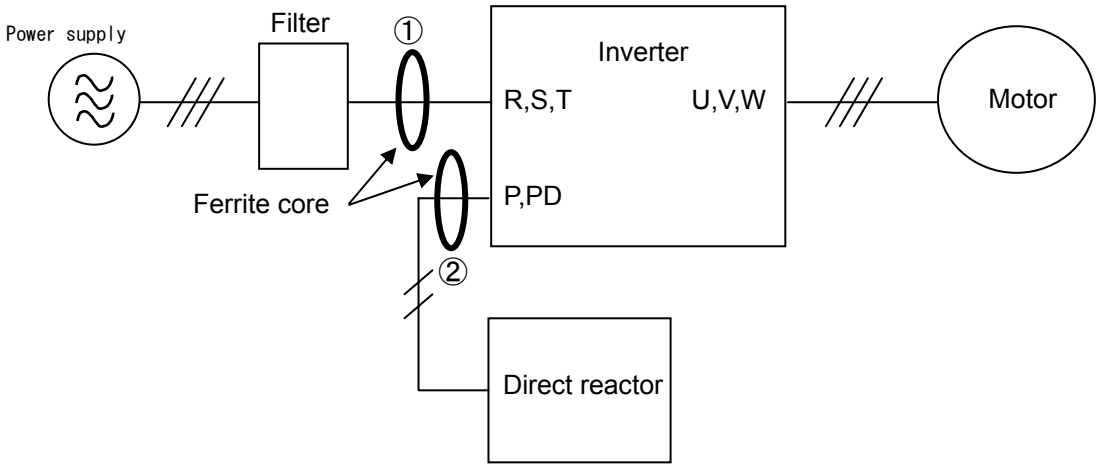


Table1

Model	Category:C2			Category:C3		
	Filter	Ferrite core ①	Ferrite core ②	Filter	Ferrite core ①	Ferrite core ②
SJ700-1850HF2/HFE2/HFU2	✓	✓	×	×	×	×
SJ700-3150HF2/HFE2/HFU2	✓	×	×	×	×	×
SJ700-4000HF2/HFE2/HFU2	✓	✓	×	×	×	×

✓ : Installation
× : No Installation

3. Wiring requirements
   a. Shielded wire (screened cable) is required for motor wiring but is not required for the direct reactor wiring. And the length of the cable must be according to the following table (Table 2).
   b. The carrier frequency setting must be less than 3 kHz (derating is required) to meet an EMC requirement.
   c. The main circuit wiring must be separated from the control circuit wiring.
4. Environmental requirements (to be met when a filter is used)
   a. Ambient temperature must be within the range -10°C to +40°C.
   b. Relative humidity must be within the range 20% to 90% (non-condensing).
   c. Vibrations must be 1.96 m/sec^2 (0.2 G) 10 – 55Hz.
   d. The inverter must be installed indoors (not exposed to corrosive gases and dust) at an altitude of 1,000 m or less.

Table2

model	Motor cable length(m)	Direct reactor cable length(m)
SJ700-1850HF2/HFE2/HFU2	5	5
SJ700-3150HF2/HFE2/HFU2	10	5
SJ700-4000HF2/HFE2/HFU2	10	5

Precautions Concerning Compliance with UL and CUL Standards

Model No.	UL Standards	CUL Standards
SJ700-1850HF2/HFE2/HFU2	UL508C	-
SJ700-3150HF2/HFE2/HFU2	UL508C	CSA C22.2 No. 14-05
SJ700-4000HF2/HFE2/HFU2	UL508C	CSA C22.2 No. 14-05

Warning Markings
GENERAL:

These devices are open type AC Inverters with three phase input and three phase output. They are intended to be used in an enclosure. They are used to provide both an adjustable voltage and adjustable frequency to the ac motor. The inverter automatically maintains the required volts-Hz ration allowing the capability through the motor speed range.

1. Only 75C CU or equivalent wires must be used for wiring.
2. Inverter models with the suffix "H" (400 V class models) are suited to circuits that transmit current not exceeding 100k rms symmetrical amperes and with voltage of no more than 480 V.
3. The inverter must be installed in an environment that is rated for at least Pollution Degree 2 or equivalent.
4. The surrounding air temperature must not exceed 50°C.
5. The capacitor discharge time is 10 minutes or more. (Caution: Care must be taken to avoid the risk of electric shock.)
6. Each model of the inverter has a solid-state overload protection circuit or an equivalent feature for the motor.
7. Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.
8. The table below lists the tightening torque and wire range specifications for the field wiring of inverter terminals.

Model No.	Required torque (N-m)	Wire range (kcmil) [mm^2]	
		Input / Output lines R(L1),S(L2),T(L3) / U(T1),V(T2),W(T3)	DC bus lines PD(+1),P(+),N(-)
SJ700-1850HF2/HFE2/HFU2	75	250 [127] (parallel)	300 [152] (parallel)
SJ700-3150HF2/HFE2/HFU2	44	400 [203] (parallel)	500 [253] (parallel)
SJ700-4000HF2/HFE2/HFU2	52	600 [304] (parallel)	800 [405] (parallel)

9. This Instruction Manual indicates the sizes of the distribution fuse and circuit breaker that must be connected to this inverter. The following table lists the inverse time and current ratings of the circuit breakers (with rated voltage of 600 V) to be connected to the individual inverter models:

Model No.	Fuse/circuit breaker (A)	
	Type	Rating
SJ700-1850HF2/HFE2/HFU2	Inverse time	400 A
SJ700-3150HF2/HFE2/HFU2	Inverse time	700 A
SJ700-4000HF2/HFE2/HFU2	Inverse time	1000 A

10. Field wiring of the inverter must incorporate UL-listed, CSA-certified closed-loop terminal connectors that match the wire gauge in terms of size. The crimping tool specified by the connector manufacturer must be used to secure each connector.

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Chapter 2 Installation and Wiring

Chapter 3 Operation

Chapter 4 Explanation of Functions

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Appendix

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Chapter 1 Overview

This chapter describes the inspection of the purchased product, the product warranty, and the names of parts.

Chapter 1 Overview

(Memo)

1.1 Inspection of the Purchased Product

1.1.1 Inspecting the product

After unpacking, inspect the product as described below.
If you find the product to be abnormal or defective, contact your supplier or local Hitachi Distributor.

(1) Check the product for damage (including falling of parts and dents in the inverter body) caused during transportation.
(2) Check that the product package contains an inverter set, a DCL set and this Instruction Manual.
(3) Check the specification label to confirm that the product is the one you ordered.

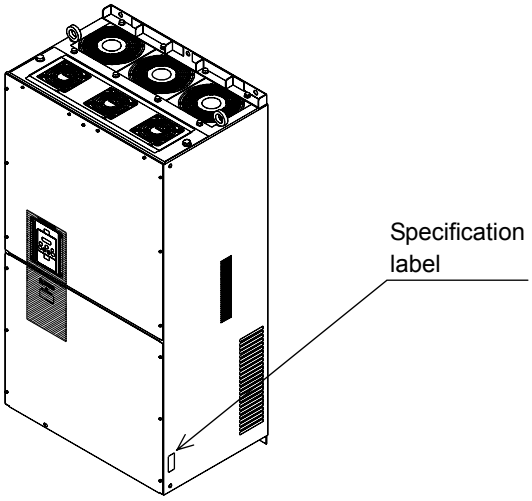


Figure 1-1-a Location of the specifications label on Inverter

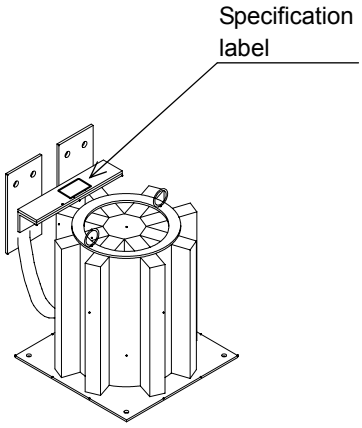


Figure 1-1-b Location of the specifications label on DCL

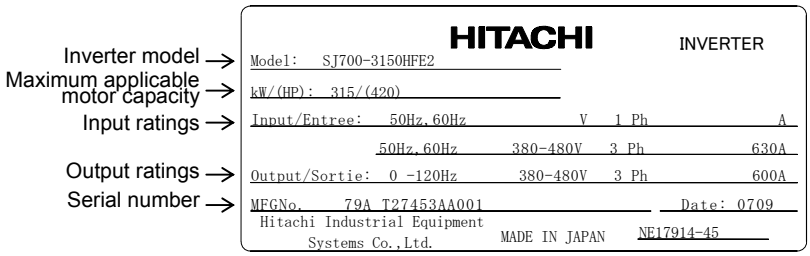


Figure 1-2-a Contents of the specifications label on Inverter

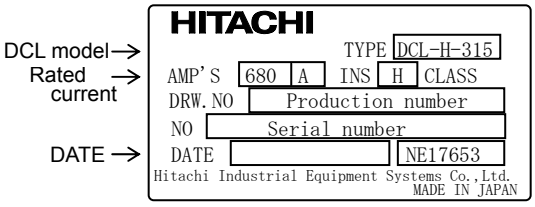


Figure 1-2-b Contents of the specifications label on DCL

1.1.2 Instruction manual (this manual)

This Instruction Manual describes how to operate the Hitachi SJ700-2 Large Capacity Series Inverter. Read this Instruction Manual thoroughly before using the inverter, and then keep it handy for future reference.
When using the inverter, together with optional products for the inverter, also refer to the manuals supplied with the optional products.
Note that this Instruction Manual and the manual for each optional product to be used should be delivered to the end user of the inverter.

1.2 Method of Inquiry and Product Warranty

1.2.1 Method of inquiry

For an inquiry about product damage or faults or a question about the product, notify your supplier of the following information:

(1) Model of your inverter
(2) Serial number (MFG No.)
(3) Date of purchase
(4) Content of inquiry
- Location and condition of damage
- Content of your question

1.2.2 Product warranty

The product will be warranted for one year after the date of purchase.
Even within the warranty period, repair of a product fault will not be covered by the warranty (but the repair will be at your own cost) in the following cases.

(1) the fault has resulted from incorrect usage not conforming to the instructions given in this Instruction Manual or the repair or modification of the product carried out by an unqualified person,
(2) the fault has resulted from a cause not attributable to the delivered product,
(3) the fault has resulted from use beyond the limits of the product specifications, or
(4) the fault has resulted from disaster or other unavoidable events.

The warranty will only apply to the delivered inverter and excludes all damage to other equipment and facilities induced by any fault of the inverter.
The warranty is effective only in Japan.

Repair at the user's charge
Following the one-year warranty period, any examination and repair of the product will be accepted at your charge. Even during the warranty period, examination and repairs of faults, subject to the above scope of the warranty disclaimer, will be available at charge.
To request a repair at your charge, contact your supplier or local Hitachi Distributor.
The Hitachi Distributors are listed on the back cover of this Instruction Manual.

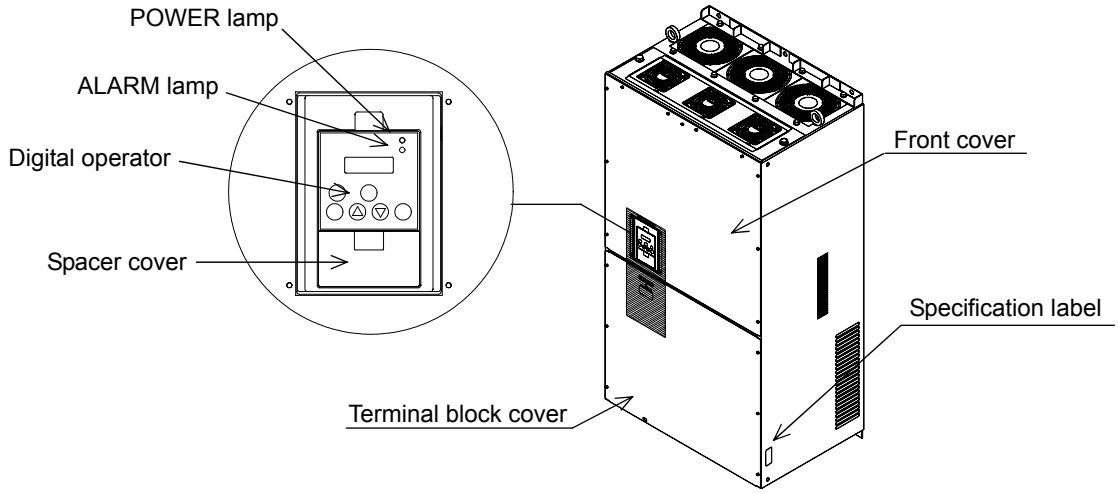
1.2.3 Warranty Terms

The warranty period under normal installation and handling conditions shall be two (2) years from the date of manufacture (“DATE” on product nameplate), or one (1) year from the date of installation, whichever occurs first. The warranty shall cover the repair or replacement, at Hitachi’s sole discretion, of ONLY the inverter that was installed.

(1) Service in the following cases, even within the warranty period, shall be charged to the purchaser:
   a. Malfunction or damage caused by mis-operation or modification or improper repair
   b. Malfunction or damage caused by a drop after purchase and transportation
   c. Malfunction or damage caused by fire, earthquake, flood, lightening, abnormal input voltage, contamination, or other natural disasters
(2) When service is required for the product at your work site, all expenses associated with field repair shall be charged to the purchaser.
(3) Always keep this manual handy; please do not loose it. Please contact your Hitachi distributor to purchase replacement or additional manuals.

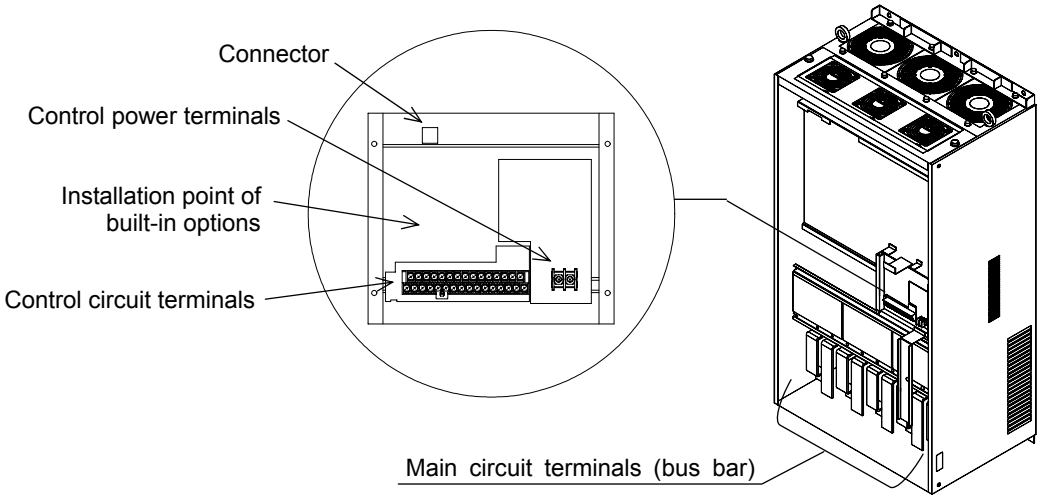
1.3 Exterior Views and Names of Parts

The figure below shows an exterior view of the inverter (model SJ700-3150HFE2).



Exterior view of shipped inverter

For the wiring of the main circuit and control circuit terminals, open the terminal block cover.
For mounting optional circuit boards, open the front cover.



Exterior view of inverter with front and terminal block covers removed

(Memo)

Chapter 2 Installation and Wiring

This chapter describes how to install the inverter and the wiring of main circuit and control signal terminals with typical examples of wiring.

Chapter 2 Installation and Wiring

(Memo)

2.1 Installation

! CAUTION

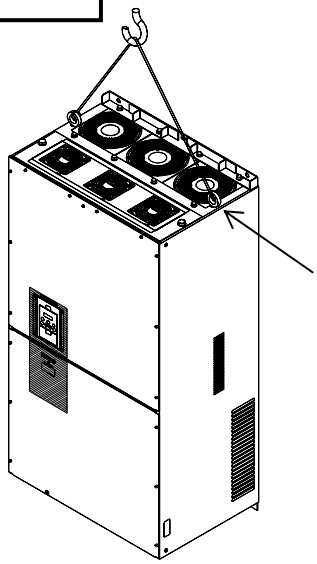
- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its top cover. Otherwise, you run the risk of injury by dropping the inverter.
- Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter. Otherwise, you run the risk of fire.
- Install the inverter on a structure able to bear the weight specified in this Instruction Manual. Otherwise, you run the risk of injury due to the inverter falling.
- Install the inverter on a vertical wall that is free of vibrations. Otherwise, you run the risk of injury due to the inverter falling.
- Do not install and operate the inverter if it is damaged or its parts are missing. Otherwise, you run the risk of injury.
- 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, or salt water. Otherwise, you run the risk of fire.
- The inverter is precision equipment. Do not allow it to fall or be subject to high impacts, step on it, or place a heavy load on it. Doing so may cause the inverter to fail.

2.1.1 Precautions for installation

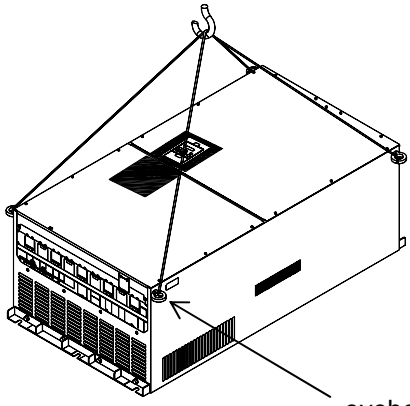
(1) Transportation

The SJ700-2 large capacity series inverter is very heavy (e.g., 315kW inverter weighs about 210kg). Therefore, treat it with enough care when it is transported. When it is lifted, use the provided eyebolts. There are two lifting methods as described below. Use either one depending on the purpose.

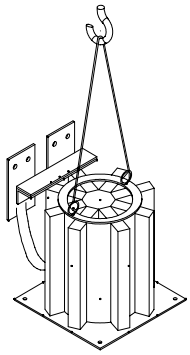
! WARNING



In case of attaching the eyebolts at the top of the inverter



In case of attaching the eyebolts at the right and left sides of the inverter

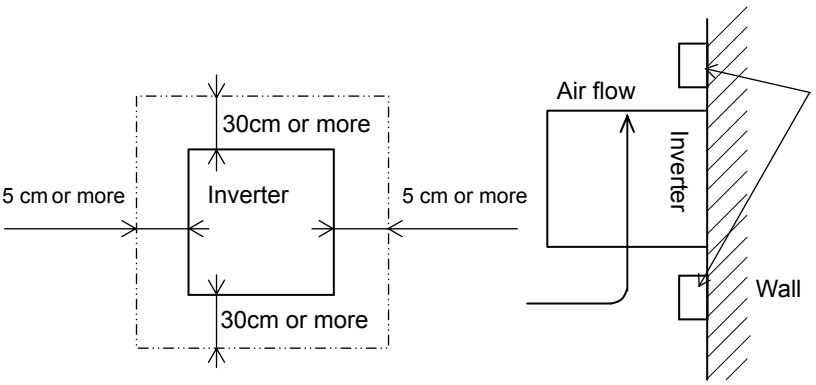


In case of lifting the DCL

(2) 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. In particular, keep sufficient distance between the inverter and other heat sources (e.g., braking resistors and reactors) if they are installed in the vicinity.



(3) Ambient temperature

Avoid installing the inverter in a place where the ambient temperature goes above or below the allowable range (-10°C to +50°C), as defined by the standard inverter specification.

Measure the temperature in a position about 5 cm distant 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).

(4) 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.

Avoid a place where the inverter is subject to condensation.

Condensation inside the inverter will result in short circuits and malfunctioning of electronic parts. Also avoid places where the inverter is exposed to direct sunlight.

(5) Ambient air

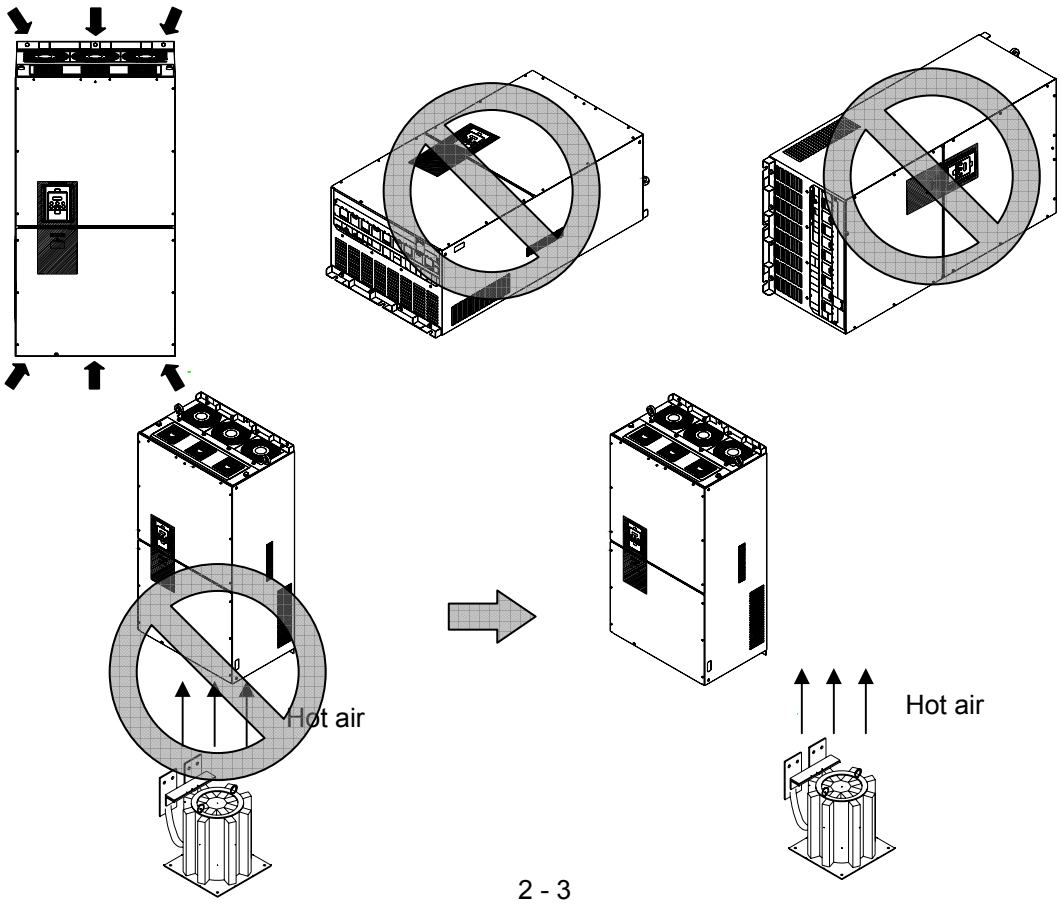
Avoid installing the inverter in a place where the inverter is subject to dust, corrosive gases, combustible gases, flammable gases, grinding fluid mist, or salt water.

Foreign particles or dust entering the inverter will cause it to fail. If you use the inverter in a considerably dusty environment, install the inverter inside a totally enclosed panel.

(6) Installation method and position

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

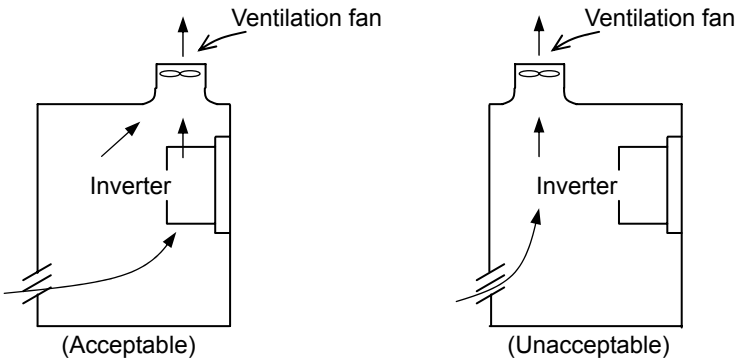
If the inverter is not installed vertically, its cooling performance may be degraded and tripping or inverter damage may result.



(7) 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. Plan the layout so that the inverter ambient temperature will remain within the allowable range.



Position of ventilation fan

(8) Reduction of enclosure size

If you mount the inverter inside an enclosure such that the heat sink of the inverter is positioned outside the enclosure, the amount of heat produced inside the enclosure can be reduced and likewise the size of the enclosure.

Mounting the inverter in an enclosure with the heat sink positioned outside requires an optional dedicated special metal fitting.

To mount the inverter in an enclosure with the heat sink positioned outside, cut out the enclosure panel according to the specified cutting dimensions.

The cooling section (including the heat sink) positioned outside the enclosure has a cooling fan. Therefore, do not place the enclosure in any environment where it is exposed to waterdrops, oil mist, or dust.

(9) Approximate loss by inverter capacity

Inverter capacity (kW)	185	315	400
Loss with 70% load (W)	4.7	8.0	10.5
Loss with 100% load (W)	6.7	11.5	15.0
Efficiency at rated output (%)	96.5	96.2	96.3

(10) Approximate loss by DCL capacity

DCL capacity (kW)	185	315	400
Loss with 70% load (W)	0.1	0.1	0.1
Loss with 100% load (W)	0.2	0.2	0.2
Efficiency at rated output (%)	99.9	99.9	99.9

2.2 Wiring

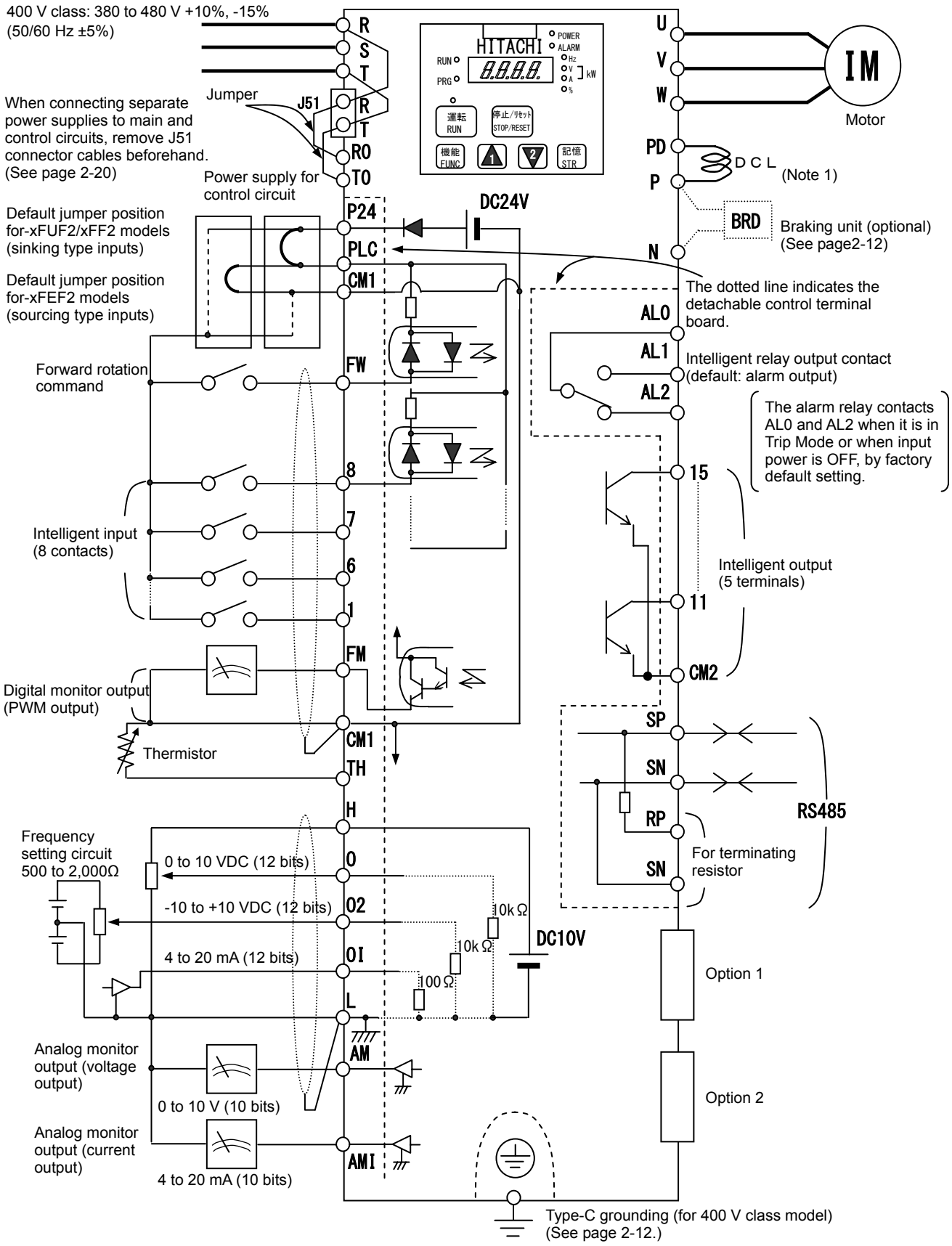
WARNING

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- Do not remove rubber bushings from the wiring section. Otherwise, the edges of the wiring cover may damage the wire, resulting in a short circuit or ground fault.

CAUTION

- Make sure that the voltage of AC power supply matches the rated voltage of your inverter. Otherwise, you run the risk of injury or fire.
- Do not input single-phase power into the inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U, V, and W). Otherwise, you run the risk of injury or fire.
- Do not connect a resistor directly to any of the DC terminals (PD, P, and N). Otherwise, you run the risk of fire.
- Connect an earth-leakage breaker to the power input(R,S,T) circuit. Otherwise, you run the risk of fire.
- Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings). Otherwise, you run the risk of fire.
- Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
- Tighten each screw to the specified torque. No screws must be left loose. Otherwise, you run the risk of fire.
- Before operating, slide switch SW1 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Since the inverter supports two modes of cooling-fan operation, the inverter power is not always off, even when the cooling fan is stopped. Therefore, be sure to confirm that the power supply is off before wiring. Otherwise, you run the risk of electric shock and injury.
- Don’t use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

2.2.1 Terminal connection diagram and explanation of terminals and switch settings



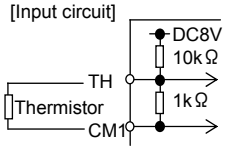
Note 1) Be sure to connect accessory DCL.

(1) Explanation of main circuit terminals

Symbol	Terminal name	Description
R, S, T (L1, L2, L3)	Main power input	Connect to the AC power supply. Leave these terminals unconnected when using a regenerative converter (HS900 series).
U, V, W (T1, T2, T3)	Inverter output	Connect a 3-phase motor.
PD, P (+1, +)	DC reactor connection	Remove the jumper from terminals PD and P, and connect the optional power factor reactor (DCL).
P, N (+, -)	Regenerative braking unit connection	Connect the optional regenerative braking unit (BRD).
⏚G	Inverter ground	Connect to ground for grounding the inverter chassis by type-C grounding (for 400 V class models).

(2) Explanation of control circuit terminals

			Symbol	Terminal name	Description	Electric property
Analog	Power supply		L	Analog power supply (common)	This common terminal supplies power to frequency command terminals (O, O2, and OI) and analog output terminals (AM and AMI). Do not ground this terminal.	
			H	Frequency setting power supply	This terminal supplies 10 VDC power to the O, O2, OI terminals.	Allowable load current: 20 mA or less
	Frequency setting input		O	Frequency command (voltage)	Input a voltage (0 to 10 VDC) as a frequency command. 10 V specifies the maximum frequency. To specify the maximum frequency with a voltage of 10 V or less, set the voltage using function "A014".	Input impedance: 10kΩ Allowable input voltages: -0.3 to +12 VDC
			O2	Auxiliary frequency command (voltage)	Input a voltage (0 to ±10 VDC) as a signal to be added to the frequency command input from the O or OI terminal. You can input an independent frequency command from this terminal (O2 terminal) alone by changing the setting.	Input impedance: 10kΩ Allowable input voltages: 0 to ±12 VDC
			OI	Frequency command (current)	Input a current (4 to 20 mA DC) as a frequency command. 20 mA specifies the maximum frequency. The OI signal is valid only when the AT signal is on. Assign the AT function to an intelligent input terminal.	Input impedance: 10kΩ Maximum allowable current: 24 mA
	Monitor output		AM	Analog monitor (voltage)	This terminal outputs one of the selected "0 to 10 VDC voltage output" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (signed or unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, and general output.	Maximum allowable current: 2 mA
			AMI	Analog monitor (current)	This terminal outputs one of the selected "4 to 20 mA DC current output" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, and general output.	Allowable load impedance: 250Ω or less
Digital (contact)	Monitor output		FM	Digital monitor (voltage)	This terminal outputs one of the selected "0 to 10 VDC voltage output (PWM output mode)" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, general output, digital output frequency, and digital current monitor. For the items "digital output frequency" and "digital current monitor," this terminal outputs a digital pulse signal at 0/10 VDC with a duty ratio of 50%.	Maximum allowable current: 1.2 mA Maximum frequency: 3.6 kHz
	Power supply		P24	Interface power supply	This terminal supplies 24 VDC power for contact input signals. If the source logic is selected, this terminal is used as a common contact input terminal.	Maximum allowable output current: 100 mA
			CM1	Interface power supply (common)	This common terminal supplies power to the interface power supply (P24), thermistor input (TH), and digital monitor (FM) terminals. If the sink logic is selected, this terminal is used as a common contact input terminal. Do not ground this terminal.	
	Contact input	Operation command	FW	Forward rotation command	Turn on this FW signal to start the forward rotation of the motor; turn it off to stop forward rotation after deceleration.	[Conditions for turning contact input on] Voltage across input and PLC: 18 VDC or more Input impedance between input and PLC: 4.7kΩ Maximum allowable voltage across input and PLC: 27 VDC Load current with 27 VDC power: about 5.6 mA
		Function selection and logic switching	1 2 3 4 5 6 7 8	Intelligent input	Select eight of a total 60 functions, and assign these eight functions to terminals 1 to 8. Note: If the emergency stop function is used, terminals 1 and 3 are used exclusively for the function. For details, see Item (3), "Emergency stop function" (on page 2-8).	

			Symbol	Terminal name	Description	Electric property
Digital (contact)	Contact input	Function selection and logic switching	PLC	Intelligent input (common)	To switch the control logic between sink logic and source logic, change the jumper connection of this (PLC) terminal to another terminal on the control circuit terminal block. Jumper terminals P24 and PLC for the sink logic; jumper terminals CM1 and PLC for the sink logic. To use an external power supply to drive the contact inputs, remove the jumper, and connect the PLC terminal to the external interface circuit.	
	Open collector output	Status and factor	11 12 13 14 15	Intelligent output	Select five of a total 51 functions, and assign these five functions to terminals 11 to 15. If you have selected an alarm code using the function "C062", terminals 11 to 13 or 11 to 14 are used exclusively for the output of cause code for alarm (e.g., inverter trip). The control logic between each of these terminals and the CM2 terminal always follows the sink or source logic.	Voltage drop between each terminal and CM2 when output signal is on: 4 V or less Maximum allowable voltage: 27 VDC Maximum allowable current: 50 mA
			CM2	Intelligent output (common)	This terminal serves as the common terminal for intelligent output terminals [11] to [15].	
	Relay contact output	Status and alarm	AL0 AL1 AL2	Intelligent relay output	Select functions from the 43 available, and assign the selected functions to these terminals, which serve as C contact output terminals. In the initial setting, these terminals output an alarm indicating that the inverter protection function has operated to stop inverter output.	(Maximum contact capacity) AL1-AL0: 250 VAC, 2 A (resistance) or 0.2 A (inductive load) AL2-AL0: 250 VAC, 1 A (resistance) or 0.2 A (inductive load) (Minimum contact capacity) 100 VAC, 10 mA 5 VDC, 100 mA
Analog	Analog input	Sensor	TH	External thermistor input	Connect to an external thermistor to make the inverter trip if an abnormal temperature is detected. The CM1 terminal serves as the common terminal for this terminal. [Recommended thermistor properties] Allowable rated power: 100 mW or more Impedance at temperature error: 3kΩ The impedance to detect temperature errors can be adjusted within the range 0Ω to 9,999Ω.	Allowable range of input voltages 0 to 8 VDC [Input circuit] 

(3) Explanation of switch settings

The internal slide switch (SW1) is used to enable or disable the emergency stop function (the function is disabled by factory setting).

* For the location of the slide switch, see page 2-10.

About the emergency stop function (disabled by the factory setting)

- The emergency stop function shuts off the inverter output (i.e. stops the switching operation of the main circuit elements) in response to a command from a hardware circuit via an intelligent input terminal without the operation by internal CPU software.

Note: The emergency stop function does not electrically shut off the inverter but merely stops the switching operation of the main circuit elements. Therefore, do not touch any terminals of the inverter or any power lines, e.g., motor cables. Otherwise, electric shock, injury, or ground fault may result.

- When the emergency stop function is enabled, intelligent input terminals 1 and 3 are used exclusively for this function, and no other functions can be assigned to these terminals. Even if other functions have been assigned to these terminals, these are automatically disabled and these terminals are used exclusively for the emergency stop function.

  Terminal [1] function:

  This terminal always serves as the a (NO) contact for the reset (RS) signal.

  This signal resets the inverter and releases the inverter from the trip due to emergency stop (E37.*).

  Terminal [3] function:

  This terminal always serves as the b (NC) contact for the emergency stop (EMR) signal.

  This signal shuts off the inverter output without the operation by internal CPU software.

  This signal makes the inverter trip due to emergency stop (E37.*).

Note: If intelligent input terminal 3 is left unconnected, the cable connected to the terminal is disconnected, or the signal logic is improper, the inverter trips due to emergency stop (E37.*). If this occurs, check and correct the wiring and signal logic, and then input the reset (RS) signal.

Only the reset (RS) signal input from intelligent input terminal [1] can release the inverter from tripping due to emergency stop (E37.*). (The inverter cannot be released from the E37.* status by any operation from the digital operator.)

- To enable the emergency stop function, set the slide lever of slide switch SW1 to ON. (With the factory setting, slide switch SW1 is set to OFF to disable the function.)

Note: Before operating slide switch SW1, make sure that the input power supply is off.

Setting of slide switch setting and function selection for intelligent input terminals [1] and [3]								
Setting of slide switch SW1	Intelligent input terminal [1]				Intelligent input terminal [3]			
	Terminal [1] function [C001]		a/b (NO/NC) selection [C011] (*1)		Terminal [3] function [C003]		a/b (NO/NC) selection [C013] (*1) (*2)	
SW1 is OFF. Emergency stop disabled (factory setting)	Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)	
	Factory setting	18 (RS)	Factory setting	00 (NO)	Factory setting	06 (JG)	Factory setting	00 (NO)
SW1 is ON. Emergency stop enabled (*5)	Automatic assignment of functions to intelligent input terminals [1] and [3] and the terminal to which function "18 (RS)" has been assigned (*3)							
	Fixed function (cannot be changed)	18 (RS)	Fixed function (cannot be changed)	00 (NO)	Fixed function (cannot be changed)	64 (EMR)	Fixed function (cannot be changed)	01 (NC)
SW1 is ON (after setting to OFF once). Emergency stop disabled (*3) (*5)	Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)	
	Setting made when SW1 is set ON retained	18 (RS)	Setting made when SW1 is set ON retained	00 (NO)	Released from emergency stop function	no (No function assigned)	Setting made when SW1 is set ON retained	01 (NC)

*1 When function "18 (RS)" is assigned to the input terminal, "a/b (NO/NC)" selection is always "00 (NO)".

*2 When terminal setting "C003" is "64 (EMR)", terminal setting "C013" is always "01 (NC)".

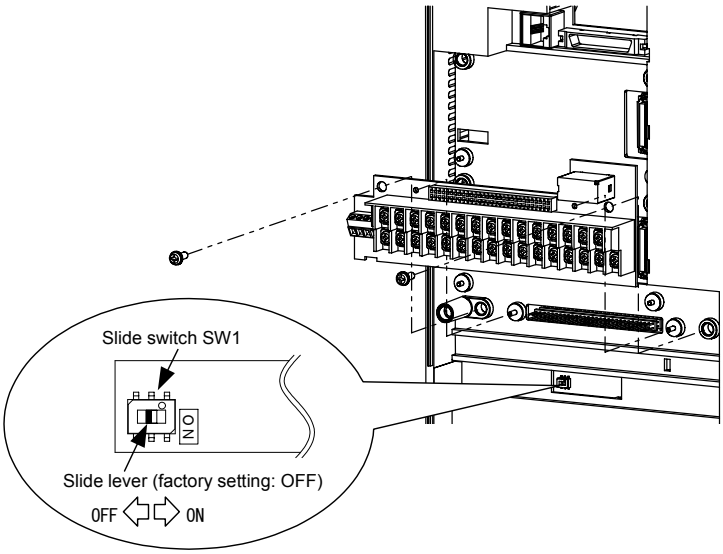
*3 If function "18 (RS)" has been assigned to an intelligent input terminal other than intelligent input terminals [1] and [3] before slide switch SW1 is set to ON, the input terminal setting for said terminal is automatically changed to "no (no function assigned)" when slide switch SW1 is set to ON to prevent any duplication of terminal functions. Even if slide switch SW1 is subsequently returned to OFF, the original function setting for said terminal will not be restored. If necessary, the original function will have to be re-assigned to said terminal.

Example: If slide switch SW1 is set to ON when function "18 (RS)" has been assigned to input terminal 2 (by terminal setting "C002"), terminal setting "C002" is changed to "no (no function assigned)," and function "18 (RS)" is assigned to input terminal 1 (by terminal setting "C001").

Even if slide switch SW1 is subsequently returned to OFF, terminal [2] function "C002" and terminal [1] function "C001" will remain as "no (no function assigned)" and "18 (RS)," respectively.

*4 Function "64 (EMR)" cannot be assigned to input terminal 3 by an operation from the digital operator. The function is automatically assigned to the terminal when slide switch SW1 is set to ON.

*5 After slide switch SW1 has been set to ON once, function assignments to intelligent input terminals [1] and [3] are not returned to their original assignments. If necessary, re-assign original functions to the intelligent input terminals.



Note: If the data of an optional operator (SRW or SRW-EX) is copied:
If operator data is copied to your SJ700 series inverter whose slide switch SW1 is ON from another SJ700 series inverter whose slide switch SW1 is OFF or an SJ300 series inverter, the digital operator on your SJ700 series inverter may display [R-ERROR COPY ROM] for a moment. This event may occur because the data on intelligent input terminals [1] and [3] cannot be copied since, on your inverter, exclusive functions have already been assigned to intelligent input terminals [1] and [3] due to the slide switch SW1 setting to ON. Note that other data is copied. If this event occurs, check the settings on both copy-source and copy-destination inverters.

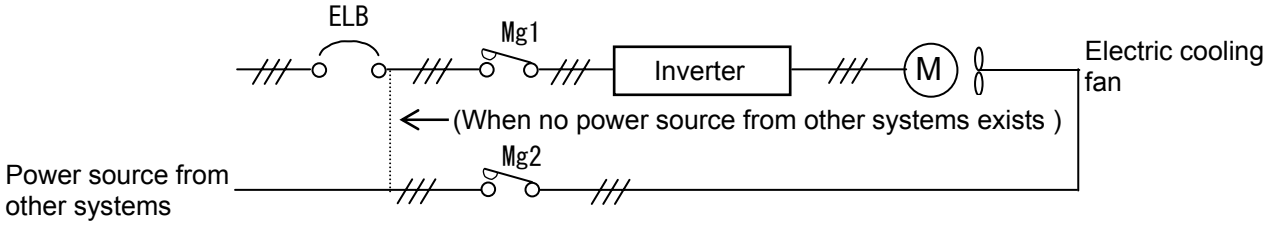
2.2.2 Wiring of the main circuit

(1) Wiring instructions

- Before wiring, be sure to confirm that the Charge lamp on the inverter is off.
  When the inverter power has been turned on once, a dangerous high voltage remains in the internal capacitors for some time after power-off, regardless of whether the inverter has been operated.
  When rewiring after power-off, always wait 10 minutes or more after power-off, and check with a multimeter that the residual voltage across terminals P and N is zero to ensure safety during rewiring work.
- Turn the shaft of screw into inverter's cover when wiring the bus bars of main circuit in 4000HF model.
  Otherwise, there is danger of contact with the cover.

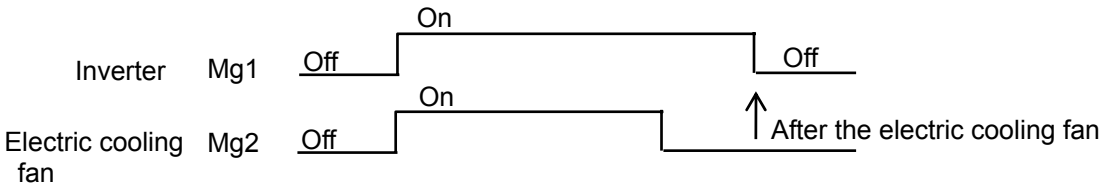
1) Main power input terminals (R, S, and T)

- Connect an earth-leakage breaker for circuit (wiring) protection between the power supply and main power input terminals (R, S, and T).
- Use an earth-leakage breaker with a high rating of a high-frequency sensitive current to prevent the breaker from malfunctioning under the influence of high frequency.
- When the protective function of the inverter operates, a fault or accident may occur in your system. Therefore, you are recommended to connect a magnetic contactor that interrupts the power supply to the inverter.
- Do not use the magnetic contactor connected to the power input terminal (primary side) or power output terminal (secondary side) of the inverter to start or stop the inverter.
  To start and stop inverter operation by external signals, use only the operation commands (FW and RV signals) that are input via control circuit terminals.
- This inverter does not support a single-phase power supply but supports only a three-phase power supply.
  If you need to use a single-phase power input, contact your supplier or local Hitachi Distributor.
- Do not operate the inverter with an phase loss power input, or it may be damaged.
  Since the factory setting of the inverter disables the phase loss input protection, the inverter will revert to the following status if a phase of power supply input is interrupted:
  R or T phase interrupted: The inverter does not operate.
  S phase interrupted: The inverter reverts to single-phase operation, and may trip because of insufficient voltage or overcurrent or be damaged.
  Internal capacitors remain charged, even when the power input is under an phase loss condition. Therefore, touching an internal part may result in electric shock and injury.
  When rewiring the main circuit, follow the instructions given in Item (1), "Wiring instructions."
- Carefully note that the internal converter module of the inverter may be damaged if:
- the imbalance of power voltage is 3% or more,
- the power supply capacity is at least 10 times as high as the inverter capacity and 500 kVA or more, or
- the power voltage changes rapidly.
  Example: The above conditions may occur when multiple inverters are connected to each other by a short bus line or your system includes a phase-advanced capacitor that is turned on and off during operation.
- Do not turn the inverter power on and off more often than once every 3 minutes.
  Otherwise, the inverter may be damaged.
- The electric cooling fan for the motor shall be powered from other systems. The motor directly connected to the power source shall also be powered from other systems. If they are powered from the same system as the inverter, an insufficient voltage protection (E09) or instantaneous power failure protection (E16) error may occur when the inverter is turned off.



When the power cannot be supplied from other systems, shut off the electromagnetic contactor MC2

for operating the electric cooling fan, and after the fan stops, shut off the electromagnetic contactor MC1 for operating the Inverter.



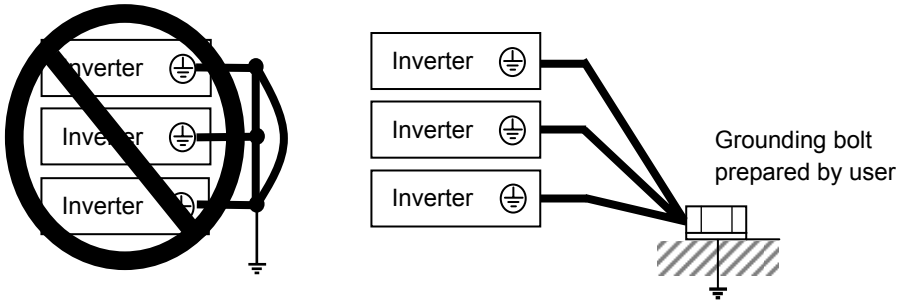
2) Inverter output terminals (U, V, and W)
- Use a cable thicker than the specified applicable cable for the wiring of output terminals to prevent the output voltage between the inverter and motor dropping. Especially at low frequency output, a voltage drop due to cable will cause the motor torque to decrease.
- Do not connect a phase-advanced capacitor or surge absorber on the output side of the inverter. If connected, the inverter may trip or the phase-advanced capacitor or surge absorber may be damaged.
- If the cable length between the inverter and motor exceeds 20 m (especially in the case of 400 V class models), the stray capacitance and inductance of the cable may cause a surge voltage at motor terminals, resulting in a motor burnout.
  A special filter to suppress the surge voltage is available. If you need this filter, contact your supplier or local Hitachi Distributor.
- When connecting multiple motors to the inverter, connect a thermal relay to the inverter output circuit for each motor.
- The RC rating of the thermal relay must be 1.1 times as high as the rated current of the motor. The thermal relay may go off too early, depending on the cable length. If this occurs, connect an AC reactor to the output of the inverter.
- Don't use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

3) DC reactor connection terminals (PD and P)
- Use these terminals to connect the DC power factor reactor (DCL).
- The cable length between the inverter and DCL must be 5 m or less.

If the DCL is not connected, power is not supplied to the main circuit of the inverter, and the inverter cannot operate.

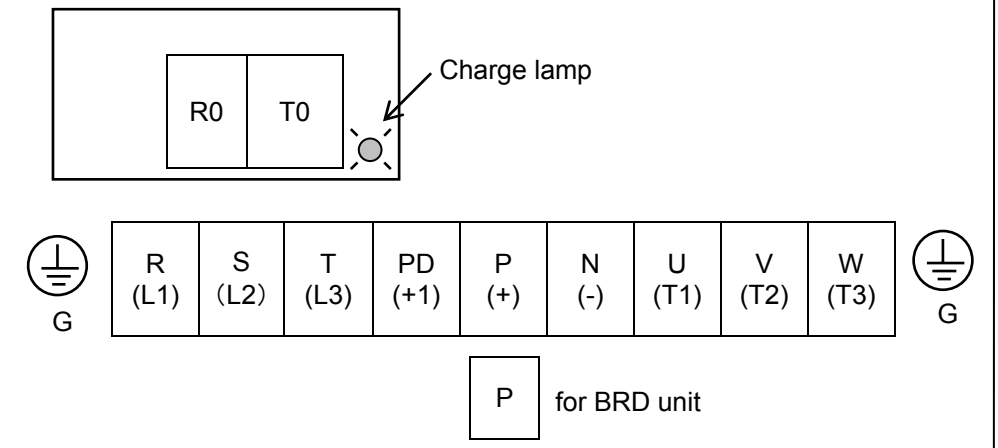
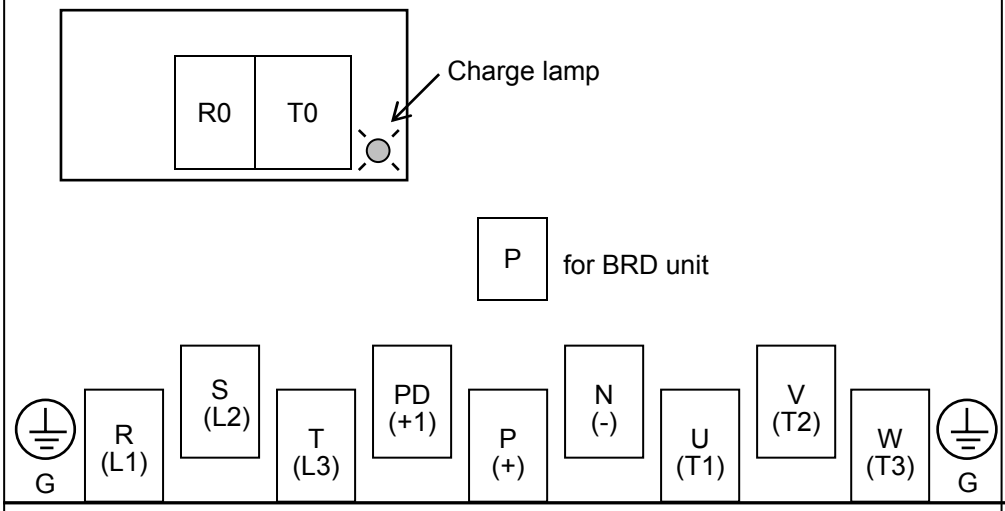
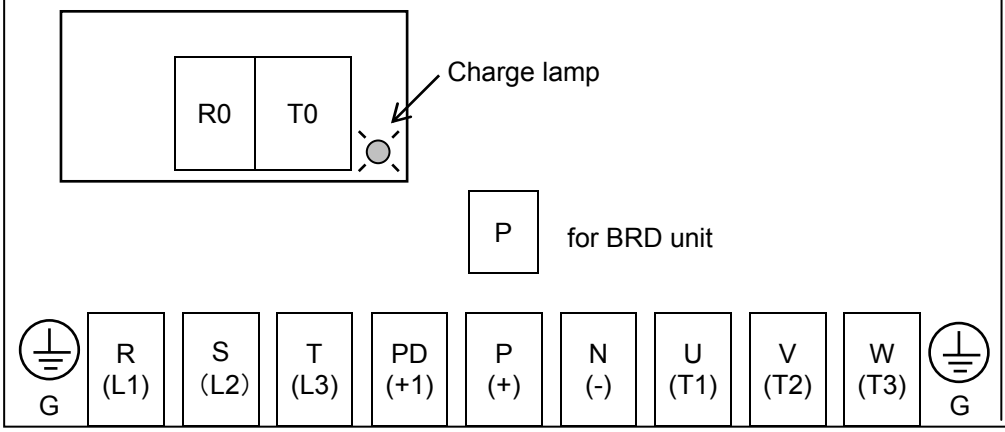
4) Regenerative braking unit connection terminals (P and N)
- Increasing the braking performance requires an optional regenerative braking unit and an external braking resistor. Connect the P and N terminals of the optional regenerative braking unit to the P and N terminals of the inverters.
- The cable length between the inverter and optional regenerative braking unit must be 5 m or less, and the two cables must be twisted for wiring.
- Do not use these terminals for connecting any devices other than the optional external braking resistor and regenerative braking unit.

5) Inverter ground terminal (G ⏚)
- Be sure to ground the inverter and motor to prevent electric shock.
- According to the Electric Apparatus Engineering Regulations, connect 400 V class models to grounding electrodes constructed in compliance with type-C grounding (conventional special type-III grounding with ground resistance of 10Ω or less).
- Use a grounding cable thicker than the specified applicable cable, and make the ground wiring as short as possible.
- When grounding multiple inverters, avoid a multi-drop connection of the grounding route and formation of a ground loop, otherwise the inverter may malfunction.

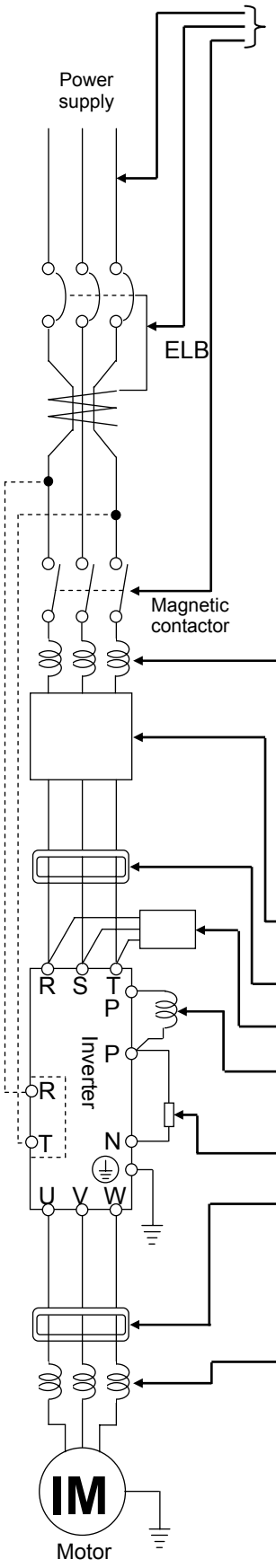


(2) Layout of main circuit terminals

The figures below show the terminal layout on the main circuit terminal block of the inverter.

Terminal layout	Inverter model
	SJ700-1850HF R0, T0 :M4 Earth terminal:M12 Other :M16 for BRD unit P:M8
	SJ700-3000, 3150HF R0, T0 :M4 Earth terminal:M12 Other :M16 for BRD unit P:M10
	SJ700-4000HF R0, T0 :M4 Earth terminal:M12 Other :M12 for BRD unit P:M10

(3) Applicable peripheral equipment



See Item (4), "Recommended cable gauges, wiring accessories, and crimp terminals."

Note 1: The peripheral equipment described here is applicable when the inverter connects a standard Hitachi 3-phase, 4-pole squirrel-cage motor.
Note 2: Select breakers that have proper capacity. (Use breakers that comply with inverters.)
Note 3: Use earth-leakage breakers (ELB) to ensure safety.
Note 4: Use copper electric wire (HIV cable) of which the maximum allowable temperature of the insulation is 75°C.
Note 5: If the power line exceeds 20 m, cable that is thicker than the specified applicable cable must be used for the power line.
Note 6: Use a 0.75 mm^2 cable to connect the alarm output contact.
Note 7: Tighten each terminal screw with the specified tightening torque. Loose terminal screws may cause short circuits and fire. Tightening a terminal screw with excessive torque may cause damage to the terminal block or inverter body.
Note 8: Select an earth-leakage breaker (ELB) of which the rated sensitivity current matches the total length of cables connected between the inverter and power supply and between the inverter and motor. Do not use a high-speed type ELB but use a delayed-type ELB because the high-speed type may malfunction.
Note 9: When a CV cable is used for wiring through a metal conduit, the average current leakage is 30 mA/km.
Note 10: When an IV cable, which has a high relative dielectric constant, is used, the leakage current is about eight times as high as the standard cable. Therefore, when using an IV cable, use the ELB of which the rated sensitivity current is eight times as high as that given in the table below. If the total cable length exceeds 100 m, use a CV cable.

Total cable length	Sensitivity current (mA)
100 m or less	50
300 m or less	100

Name	Description
Reactor on input side (for harmonic control, power supply coordination, and power factor improvement) (ALI-XXX)	Use this reactor to control harmonic waves or when the imbalance of power supply voltage is 3% or more, when the power supply capacity is 500 kVA or more, or when the power voltage may change rapidly. This reactor also improves the power factor.
Noise filter for inverter (NF-XXX)	This noise filter reduces the conductive noise that is generated by the inverter and transmitted in cables. Connect this noise filter to the primary side (input side) of the inverter.
Radio noise filter (Zero-phase reactor) (ZCL-X)	The inverter may generate radio noise through power supply wiring during operation. Use this noise filter to reduce the radio noise (radiant noise).
Radio noise filter on input side (Capacitor filter) (CFI-X)	Use this noise filter to reduce the radiant noise radiated from input cables.
DC reactor (DCL-X-XX)	Use this reactor to control the harmonic waves generated by the inverter.
Regenerative braking unit	Use these devices to increase the braking torque of the inverter for operation in which the inverter turns the connected load on and off very frequently or decelerates the load running with a high moment of inertia.
Radio noise filter (Zero-phase reactor) (ZCL-XXX)	Use this noise filter to reduce the noise generated on the output side of the inverter. (This noise filter can be used on both the input and output sides.)
AC reactor for the output side For reducing vibrations and preventing thermal relay malfunction (ACL-X-XX)	Using the inverter to drive a general-purpose motor may cause larger vibrations of the motor when compared with driving it directly with the commercial power supply. Connect this AC reactor between the inverter and motor to lessen the pulsation of motor. Also, connect this AC reactor between the inverter and motor, when the cable length between them is long (10 m or more), to prevent thermal relay malfunction due to the harmonic waves that are generated by the switching operation on the inverter. Note that the thermal relay can be replaced with a current sensor to avoid the malfunction.

(4) Recommended cable gauges, wiring accessories, and crimp terminals

Note: For compliance with CE and UL standards, see the safety precautions concerning EMC and the compliance with UL and CUL standards under Safety Instructions.

The table below lists the specifications of cables, crimp terminals, and terminal screw tightening torques for reference.

	Motor output (kW)	Applicable inverter model	Power connecter terminals (R, S, T, U, V, W, P, PD, and N)	Wire size (kcmil) [mm^2]	Size of terminal screw	Crimp terminal	Tightening torque (N-m)	Applicable device	
								Earth-leakage breaker (ELB)	Magnetic contactor (MC)
400 V class	185	SJ700-1850HF	Poewr lines R, S, T, U, V, W	250 × 2 [127 × 2]	M16	R150-16	75.0	RX400B	H400C
			Poewr lines P, PD	300 × 2 [152 × 2]	M16	R150-16			
			Braking unit lines P, N	AWG1 [42]	M8	R38-8	8.1		
			Earth lines	250 [127]	M12	R150-12	39.2		
	315	SJ700-3150HF	Poewr lines R, S, T, U, V, W	400 × 2 [203 × 2]	M16	200-16	44.0	RX800B (700A)	H800C
			Poewr lines P, PD	500 × 2 [253 × 2]	M16	325-16			
			Braking unit lines P, N	250 [127]	M10	150-11	20		
			Earth lines	400 [203]	M12	200-12	39.2		
	400	SJ700-4000HF	Poewr lines R, S, T, U, V, W	600 × 2 [304 × 2]	M12	325-12	52.0	RF-1000CBN (1000A)	H800C
			Poewr lines P, PD	800 × 2 [405 × 2]	M12	Note1			
			Braking unit lines P, N	250 × 2 [127 × 2]	M10	150-11	20		
			Earth lines	600 [304]	M12	325-12	39.2		

Note1: Please use the solderless terminals for 405mm^2 or more.

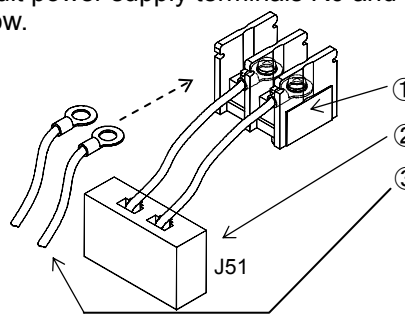
Note2: Cable gauges indicate those of HIV cables (maximum heat resistance: 75°C).

*) Use wires with the prepackaged ring lug terminals when wiring with the main circuit terminals in 1850HF model.

(5) Connecting the control circuit to a power supply separately from the main circuit

If the protective circuit of the inverter operates to open the magnetic contactor in the input power supply circuit, the inverter control circuit power is lost, and the alarm signal cannot be retained. To retain the alarm signal, connect control circuit terminals R0 and T0 to a power supply. In details, connect the control circuit power supply terminals R0 and T0 to the primary side of the magnetic contactor as shown below.

(Connection method)
Power-receiving specifications
400 V class model:
380 to 480 V (+10%, -15%)
(50/60 Hz ±5%),(537 to 678 VDC)



① Remove the connected cables.
② Remove the J51 connector.
③ Connect the control circuit power supply cables to the control circuit power supply terminal block.

Note the following when connecting separate power supplies to control circuit power supply terminals (R0 and T0) and main circuit power supply terminals (R, S, and T):

- Use a cable thicker than 1.25 mm^2 to connect the terminals R0 and T0 (terminal screw size: M4).
- Connect a 3 A fuse in the control circuit power supply line.
- If the control circuit power supply (connected to R0 and T0) is turned on earlier than the main circuit power supply (connected to R, S, and T), ground fault is not checked at power-on.
- When supplying DC power to the control circuit power supply terminals (R0 and T0), specify "00" as the "a/b (NO/NC)" selection (function code C031 to C036) for intelligent output terminals ([11] to [15]) and intelligent relay terminals (AL0, AL1, and AL2). If "01" is specified as the "a/b (NO/NC)" selection, output signals may chatter when the DC power supply is shut off.

2.2.3 Wiring of the control circuit

(1) Wiring instructions

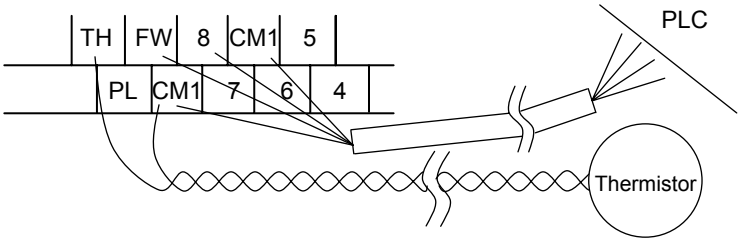
1) Terminals L and CM1 are common to I/O signals and isolated from each other.
Do not connect these common terminals to each other or ground them.
Do not ground these terminals via any external devices. (Check that the external devices connected to these terminals are not grounded.)

2) Use a shielded, twisted-pair cable (recommended gauge: 0.75 mm^2) for connection to control circuit terminals, and connect the cable insulation to the corresponding common terminal.

3) The length of cables connected to control circuit terminals must be 20 m or less. If the cable length exceeds 20 m unavoidably, use a VX-compatible controller (RCD-A) (remote operation panel) or insulated signal converter (CVD-E).

4) Separate the control circuit wiring from the main circuit wiring (power line) and relay control circuit wiring.
If these wirings intersect with each other unavoidably, square them with each other. Otherwise, the inverter may malfunction.

5) Twist the cables connected from a thermistor to the thermistor input terminal (TH) and terminal CM1, and separate the twisted cables from other cables connected to other common terminals.
Since very low current flows through the cables connected to the thermistor, separate the cables from those (power line cables) connected to the main circuit. The length of the cables connected to the thermistor must be 20 m or less.



6) When connecting a contact to a control circuit terminal (e.g., an intelligent input terminal), use a relay contact (e.g., crossbar twin contact) in which even a very low current or voltage will not trigger any contact fault.

7) When connecting a relay to an intelligent output terminal, also connect a surge-absorbing diode in parallel with the relay.

8) Do not connect analog power supply terminals H and L or interface power supply terminals P24 and CM1 to each other.
Otherwise, the inverter may fail.

(2) Layout of control circuit terminals

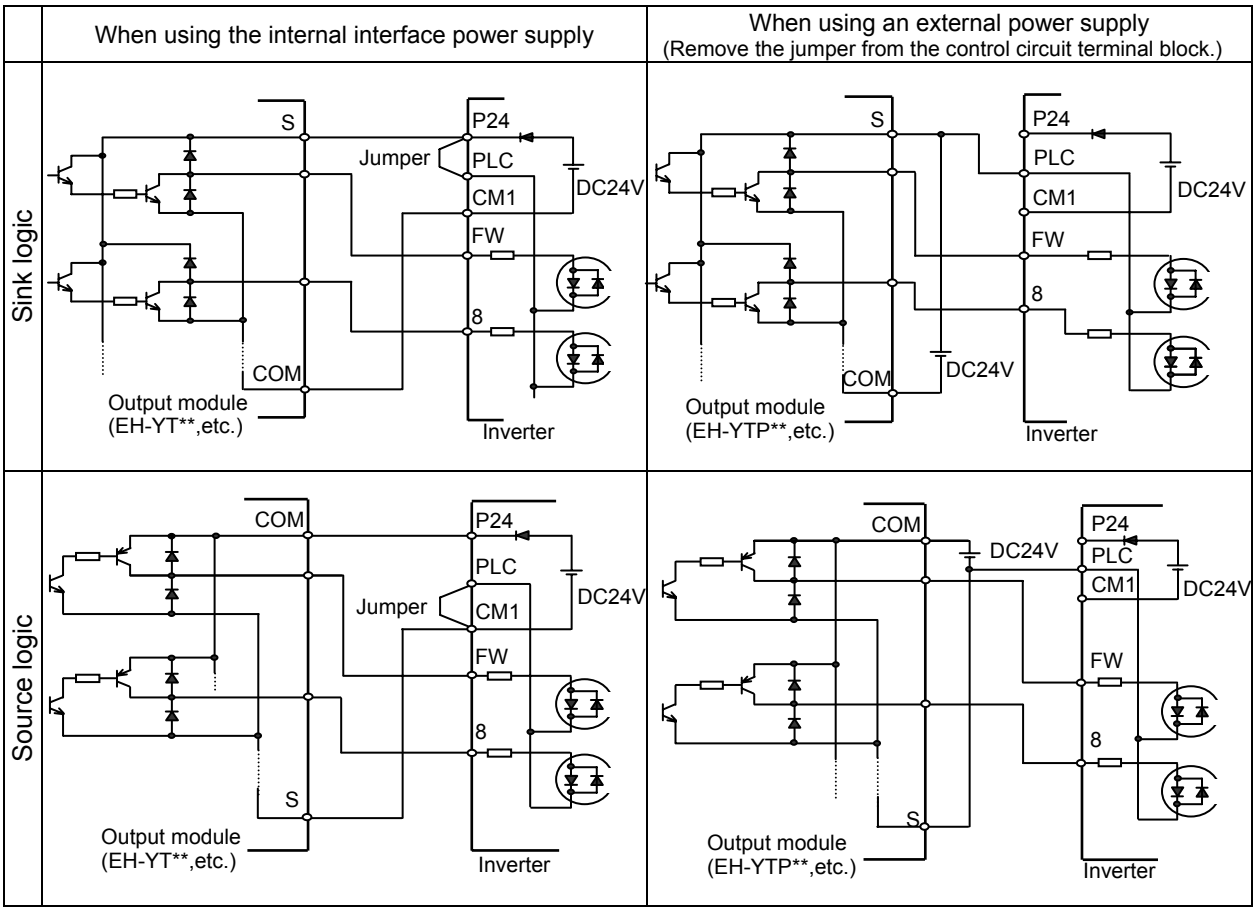
H	O2	AM	FM	TH	FW	8	CM1	5	3	1	14	13	11	AL1
L	O	OI	AMI	P24	PLC	CM1	7	6	4	2	15	CM2	12	AL0	AL2

Terminal screw size: M3

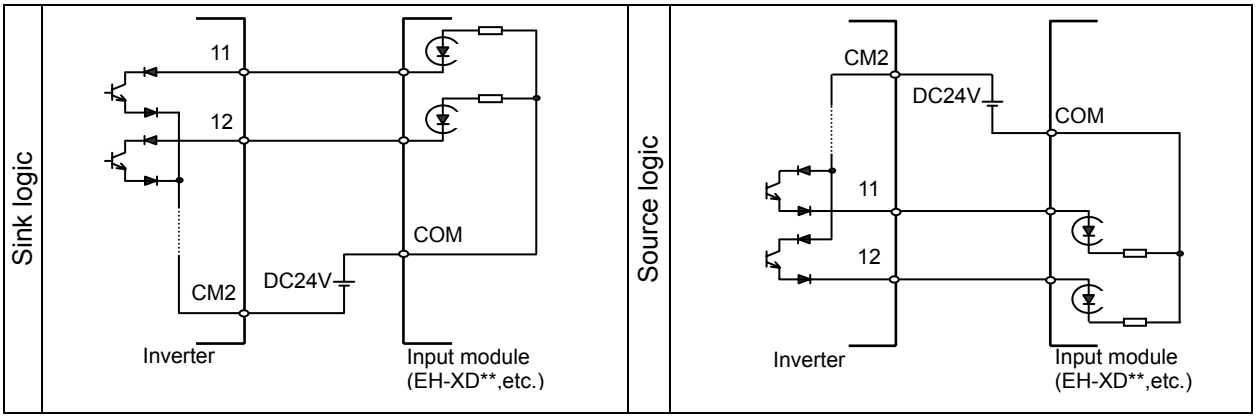
(3) Switching the input control logic

- In the factory setting, the input control logic for terminal FW and intelligent input terminals is the sink logic.
To switch the input control logic to the source logic, remove the jumper connecting terminals P24 and PLC on the control circuit block, and then connect terminals PLC and CM1 with the jumper.

(4) Connecting a programmable controller to intelligent input terminals



(5) Connecting a programmable controller to intelligent output terminals



2.2.4 Wiring of the digital operator

- You can operate the inverter with not only the digital operator mounted in the inverter as standard equipment but also an optional digital operator (OPE-S, OPE-SR, SRW-OJ, or SRW-OEX).
- When you intend to remove the standard digital operator from the inverter and use it as remote equipment, request your local Hitachi Distributor to supply a connection cable, ICS-1 (1-meter cable) or ICS-3 (3-meter cable).
  If you prepare the cable by yourself, the following product is recommended:
  HUTP5 PC 4P -X-X: Straight cable equipped with connector at both ends (made by Hitachi Cable, Ltd.)
- The length of the connection cable must be 3 m or less. If a cable over 3 m is used, the inverter may malfunction.

(Memo)

Chapter 3 Operation

This chapter describes typical methods of operating the inverter, how to operate the digital operator, and how to make a test run of the inverter.

Chapter 3 Operation

(Memo)

3.1 Operating Methods

! WARNING

- While power is supplied to the inverter, do not touch any terminal or internal part of the inverter, check signals, or connect or disconnect any wire or connector. Otherwise, you run the risk of electric shock or fire.
- 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. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. 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.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation 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 control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- The [STOP] key is effective only when its function is enabled by setting. Prepare an emergency stop switch separately. Otherwise, you run the risk of injury.
- If an operation command has been input to the inverter before the inverter enters alarm status, the inverter will restart suddenly when the alarm status is reset. Before resetting the alarm status, make sure that no operation command has been input.
- While power is supplied to the inverter, do not touch any internal part of the inverter or insert a bar in it. Otherwise, you run the risk of electric shock or fire.

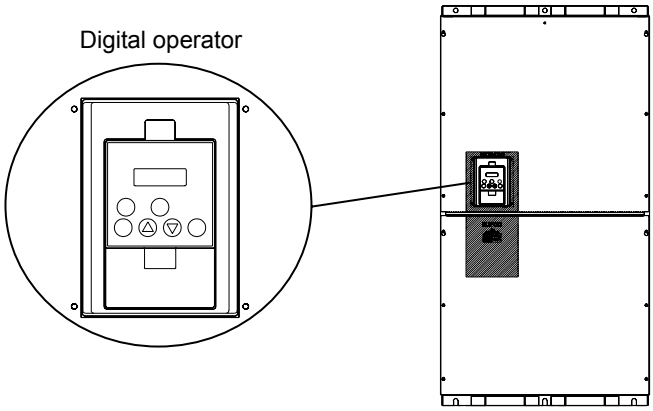
! CAUTION

- Do not touch the heat sink, which heats up during the inverter operation. Otherwise, you run the risk of burn injury.
- The inverter allows you to easily control the speed of motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. Otherwise, you run the risk of injury and damage to machine.
- Install an external brake system if needed. Otherwise, you run the risk of injury.
- When using the inverter to operate a standard motor at a frequency of over 60 Hz, 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. Otherwise, you run the risk of damage to the motor and machine and injury
- During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations. Otherwise, you run the risk of damage to the machine driven by the motor.

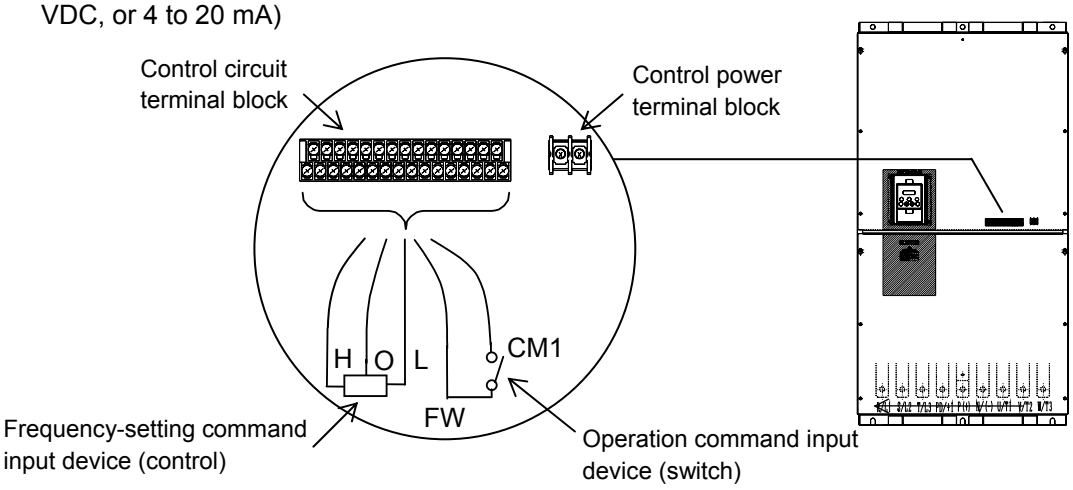
Chapter 3 Operation

You can operate the inverter in different ways, depending on how to input the operation and frequency-setting commands as described below.
This section describes the features of operating methods and the items required for operation.

(1) Entering operation and frequency-setting commands from the digital operator
This operating method allows you to operate the inverter through key operations on the standard digital operator mounted in the inverter or an optional digital operator.
When operating the inverter with a digital operator alone, you need not wire the control circuit terminals.
(Items required for operation)
1) Optional digital operator (not required when you use the standard digital operator)



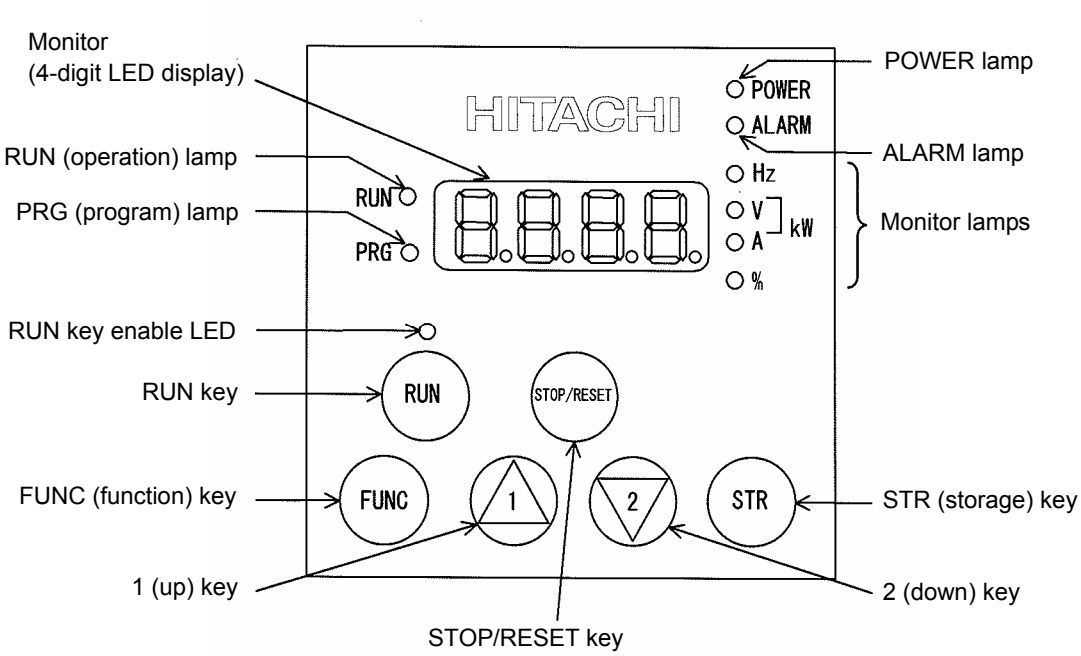
(2) Entering operation and frequency-setting commands via control circuit terminals
This operating method allows you to operate the inverter via the input of operation signals from external devices (e.g., frequency-setting circuit and start switch) to control circuit terminals.
The inverter starts operation when the input power supply is turned on and then an operation command signal (FW or RV) is turned on.
You can select the frequency-setting method (setting by voltage specification or current specification) through the input to a control circuit terminal according to your system. For details, see Item (2), "Explanation of control circuit terminals," in Section 2.2.1 (on pages 2-7 and 2-8).
(Items required for operation)
1) Operation command input device: External switch or relay
2) Frequency-setting command input device: External device to input signals (0 to 10 VDC, -10 to +10 VDC, or 4 to 20 mA)



(3) Entering operation and frequency-setting commands; both from a digital operator and via control circuit terminals
This operating method allows you to arbitrarily select the digital operator or control circuit terminals as the means to input operation commands and frequency-setting commands.
(Items required for operation)
1) See the items required for the above two operating methods.

3.2 How To Operate the Digital Operator (OPE-S)

3.2.1 Names and functions of components



Name	Function
POWER lamp	Lights when the control circuit power is on.
ALARM lamp	Lights to indicate that the inverter has tripped.
RUN (operation) lamp	Lights to indicate that the inverter is operating.
PRG (program) lamp	Lights when the monitor shows a value set for a function. This lamp starts blinking to indicate a warning (when the set value is invalid).
Monitor	Displays a frequency, output current, or set value.
Monitor lamps	Indicates the type of value and units displayed on the monitor. "Hz" (frequency), "V" (voltage), "A" (current), "kW" (electric power), and "%" (percentage)
RUN key enable LED	Lights up when the inverter is ready to respond to the RUN key. (When this lamp is on, you can start the inverter with the RUN key on the digital operator.)
RUN key	Starts the inverter to run the motor. This key is effective only when the operating device is the digital operator. (To use this key, confirm that the operating device indicator lamp is on.)
STOP/RESET key	Decelerates and stops the motor or resets the inverter from alarm status.
FUNC (function) key	Makes the inverter enter the monitor, function, or extended function mode.
STR (storage) key	Stores each set value. (Always press this key after changing a set value.)
1 (up) or 2 (down) key	Switches the inverter operation mode (among monitor, function, and extended function modes) or increases or decreases the value set on the monitor for a function.

3.2.2 Code display system and key operations

This section describes typical examples of digital operator operation (in basic and full display modes) and an example of special digital operator operation in extended function mode U.

The initial display on the monitor screen after power-on depends on the setting of function "b038". For details, see Section 4.2.81, "Initial-screen selection," (on page 4-76).
When the setting of function "b038" is "01" (factory setting), the monitor initially shows 0.00 as the setting of function "d001" (output frequency monitoring). Pressing the FUNC key in this status changes the display to d001 .

Note: The display contents on the monitor depend on the settings of functions "b037" (function code display restriction), "b038" (initial-screen selection), and "b039" (automatic setting of user parameters). For details, see Sections 4.2.80, "Function code display restriction," (on page 4-74), 4.2.81, "Initial-screen selection," (on page 4-76), and 4.2.82, "Automatic user-parameter setting," (on page 4-77).

Item	Function code	Data	Description
Function code display restriction	b037	00	Full display
		01	Function-specific display
		02	User setting
		03	Data comparison display
		04	Basic display (factory setting)
Initial-screen selection (Initial display at power-on)	b038 (*1)	00	Screen displayed when the [STR] key was pressed last (same as the operation on the SJ300 series)
		01	d001 (output frequency monitoring)
		02	d002 (output current monitoring)
		03	d003 (rotation direction minitoring)
		04	d007 (Scaled output frequency monitoring)
		05	F001 (output frequency setting)
Selection of automatic user-parameter settings	b039 (*1)	00	Disable
		01	Enable

*1 Not displayed with the factory setting

* The following procedure enables you to turn the monitor display back to d001 or 0.00 (*1) regardless of the current display mode:
  - Hold down the FUNC key for 3 seconds or more. The monitor shows d001 and 0.00 (*1) alternately.
    During this status, press the FUNC key. The monitor will show only d001 or 0.00 (*1), which is shown when the FUNC is pressed.

*1 The monitor shows 0.00 only when the motor driven by the inverter is stopped. While the motor is running, the monitor shows an output frequency.

(1) Example of operation in basic display mode ("b037" = "04" [factory setting])
- Only basic parameters can be displayed in basic display mode. (All parameters in monitor mode, four parameters in function mode, or 20 parameters in extended function mode)
- Other parameters are not displayed. To display all parameters, select the full display mode ("b037" = "00").

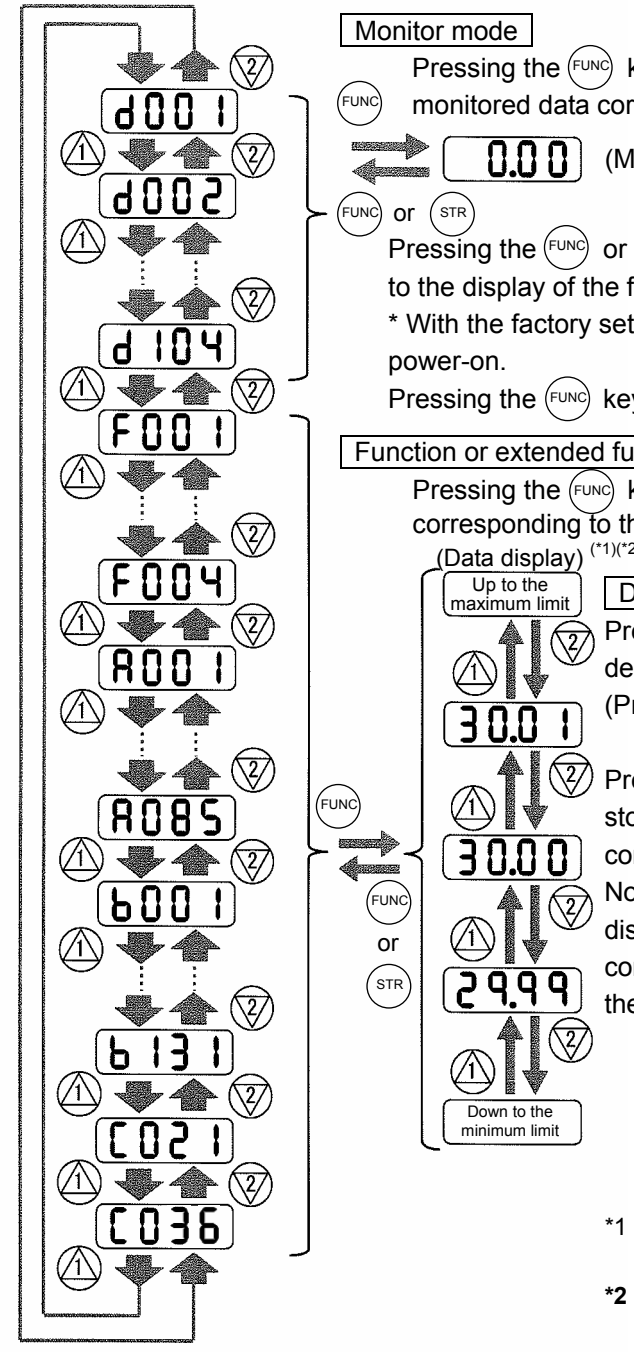
<Displayable parameters and sequence of display>

No.	Display code	Item
1	d001 to d104	Monitor display
2	F001	Output frequency setting
3	F002	Acceleration (1) time setting
4	F003	Deceleration (1) time setting
5	F004	Operation direction setting
6	A001	Frequency source setting
7	A002	Run command source setting
8	A003	Base frequency setting
9	A004	Maximum frequency setting
10	A005	[AT] selection
11	A020	Multispeed frequency setting
12	A021	Multispeed 1 setting
13	A022	Multispeed 2 setting
14	A023	Multispeed 3 setting
15	A044	1st control method
16	A045	V/f gain setting
17	A085	Operation mode selection
18	b001	Selection of restart mode
19	b002	Allowable under-voltage power failure time
20	b008	Retry-after-trip selection
21	b011	Retry wait time after trip
22	b037	Function code display restriction
23	b083	Carrier frequency setting
24	b084	Initialization mode selection
25	b130	Selection of overvoltage suppression function
26	b131	Setting of overvoltage suppression level
27	C021	Setting of intelligent output terminal 11
28	C022	Setting of intelligent output terminal 12
29	C036	Alarm relay active state

Note:
If a desired parameter is not displayed, check the setting of function "b037" (function code display restriction). To display all parameters, specify "00" for "b037".

Key operation and transition of the codes on display	Key operation and transition of the monitored data on display

Pressing the ▲1 or ▼2 key respectively scrolls up or down the code displayed in code display mode or increases or decreases the numerical data displayed in data display mode.
Press the ▲1 or ▼2 key until the desired code or numerical data is shown. To scroll codes or increase/decrease numerical data faster, press and hold the key.



Monitor mode

Pressing the FUNC key with a function code displayed shows the monitored data corresponding to the function code.

FUNC ⇄ 0.00 (Monitor display) (*1)

FUNC or STR

Pressing the FUNC or STR key with the monitored data displayed reverts to the display of the function code corresponding to the monitored data.
* With the factory setting, the monitor shows 0.00 initially after power-on.
Pressing the FUNC key in this status changes the display to d001 .

Function or extended function mode

Pressing the FUNC key with a function code displayed shows the data corresponding to the function code.

(Data display) (*1)(*2)

Up to the maximum limit

30.01

30.00

29.99

Down to the minimum limit

FUNC ⇄ FUNC or STR

Data setting

Pressing the ▲1 or ▼2 key respectively increases or decreases the displayed numerical data.
(Press the key until the desired data is shown.)

Pressing the STR key with numerical data displayed stores the data and then returns to the display of the corresponding function code.
Note that pressing the FUNC key with numerical data displayed returns to the display of the function code corresponding to the numerical data without updating the data, even if it has been changed on display.

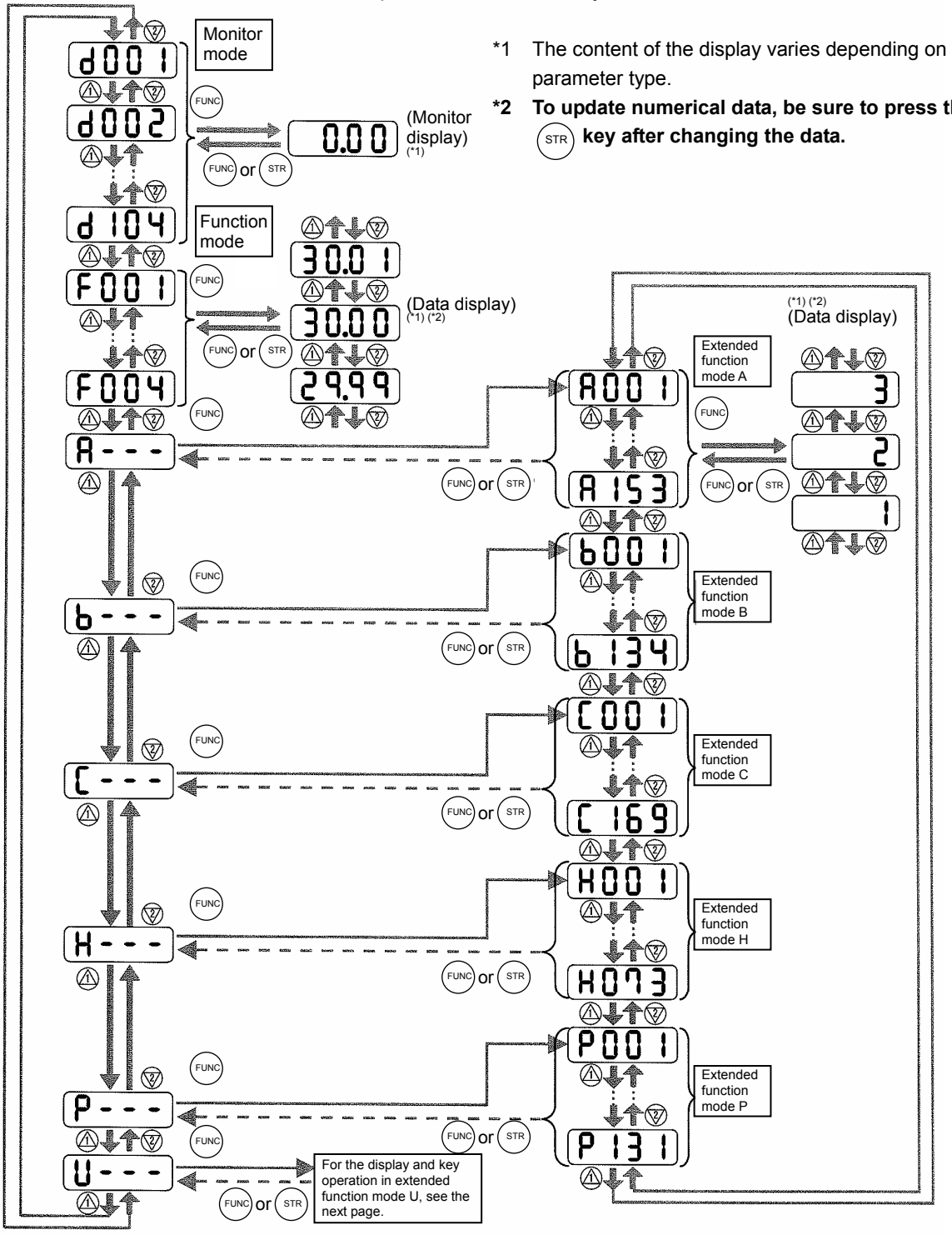
*1 The content of the display varies depending on the parameter type.

***2 To update numerical data, be sure to press the STR key after changing the data.**

(2) Example of operation in full display mode ("b037" = "00")
All parameters can be displayed in full display mode. The display sequence of parameters matches their sequence shown in Chapter 8, "List of Data Settings."

Key operation and transition of codes on display (in monitor or function mode)	Key operation and transition of monitored data on display (in monitor or function mode)	Key operation and transition of codes on display (in extended function mode)	Key operation and transition of monitored data on display (in extended function mode)

Pressing the ▲1 or ▼2 key respectively scrolls up or down the code displayed in code display mode or increases or decreases the numerical data displayed in data display mode.
Press the ▲1 or ▼2 key until the desired code or numerical data is shown. To scroll codes or increase/decrease numerical data fast, press and hold the key.



*1 The content of the display varies depending on the parameter type.

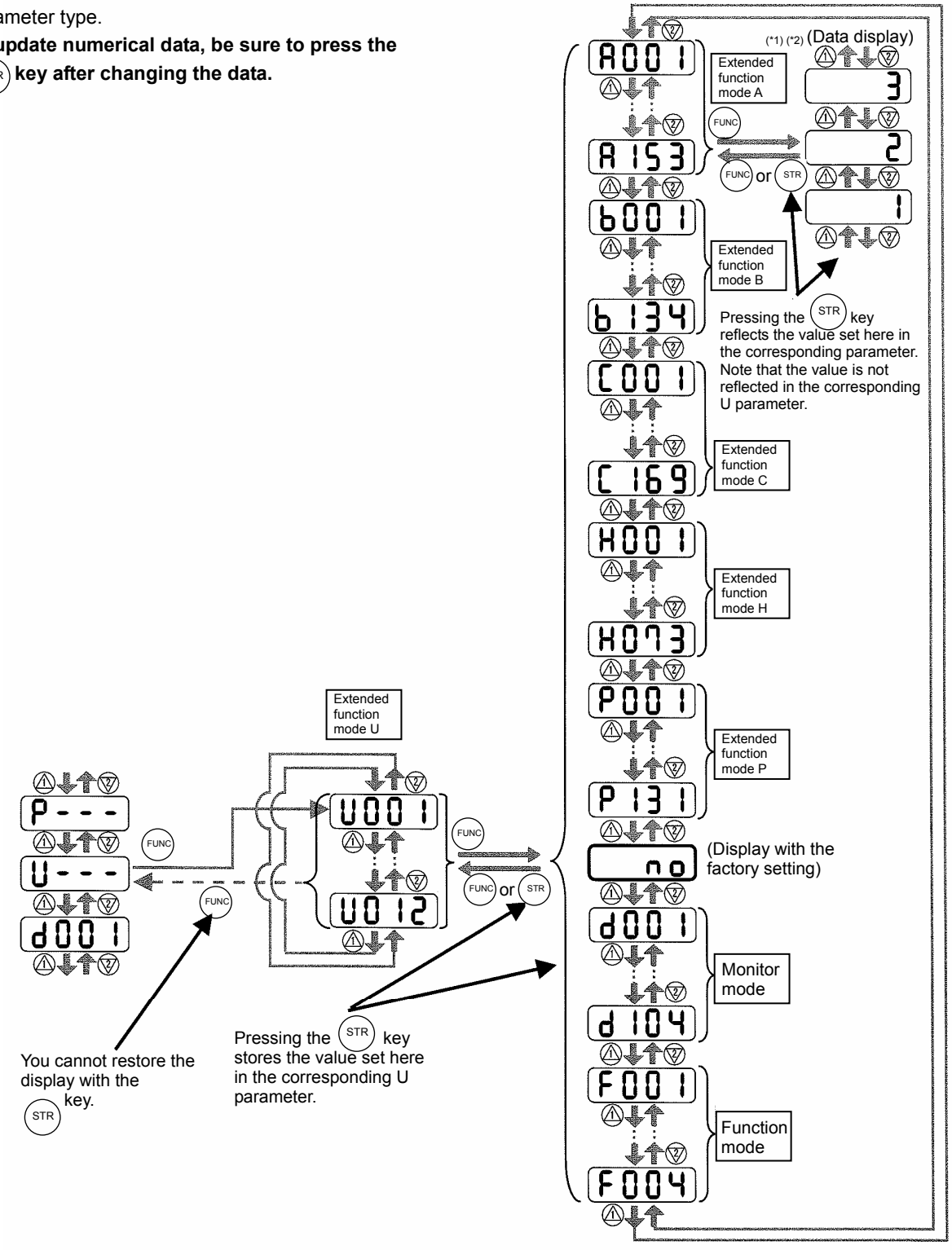
***2 To update numerical data, be sure to press the STR key after changing the data.**

(3) Code/data display and key operation in extended function mode U
The extended function mode U differs in operation from other extended function modes because the extended function mode U is used to register (or automatically record) other extended-function codes as user-specified U parameters.

Key operation and transition of codes on display (in monitor or function mode)	Key operation and transition of codes on display (in extended function mode U)	Key operation and transition of codes on display (when displaying extended-function mode parameters from the extended function mode U)	Key operation and transition of codes on display (in monitor, function, or extended

*1 The content of the display varies depending on the parameter type.

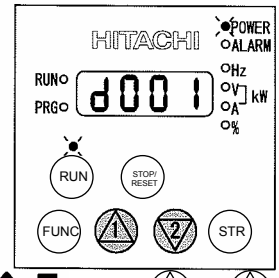
***2 To update numerical data, be sure to press the (STR) key after changing the data.**



(4) Procedure for directly specifying or selecting a code

- You can specify or select a code or data by entering each digit of the code or data instead of scrolling codes or data in the monitor, function, or extended function mode.
- The following shows an example of the procedure for changing the monitor mode code "d001" displayed to extended function code "A029":

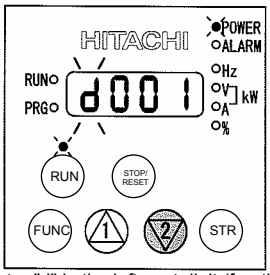
1) Display the monitor mode code.
("d001" is displayed.)



(*2)
(*3)

FUNC Press the 1 and 2 keys together. (*1)

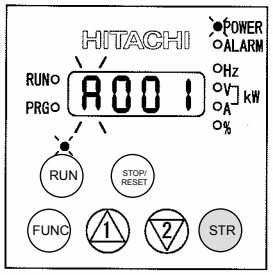
2) Change to the extended function mode.



- Character "d" in the leftmost digit (fourth digit from the right) starts blinking.

Press the 2 key twice.

("A001" is displayed.)

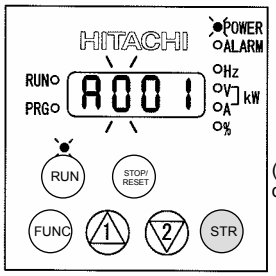


(*3)

- Character "A" is blinking.
- Pressing the [STR] key determines the blinking character.

(*2)
FUNC Press the STR key (to determine character "A").

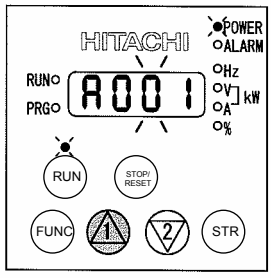
3) Change the third digit of the code.



Press the STR key.
(Character "0" is determined.)
FUNC (*2)

- Character "0" in the third digit is blinking.
- Since the third digit need not be changed, press the [STR] key to determine the character "0".

4) Change the second digit of the code.

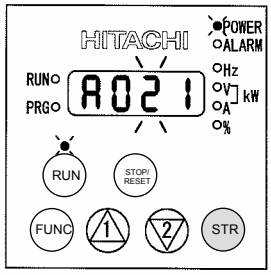


- Character "0" in the second digit is blinking.

Press the 1 key twice.

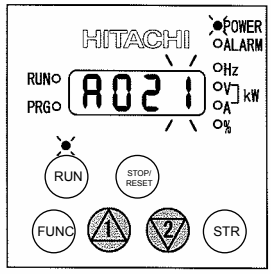
- Character "2" in the second digit is blinking.

(*2)
FUNC Press the STR key.
("A021" is displayed.)



(*2)

5) Change the first digit of the code.

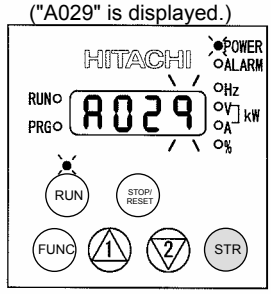


- Character "1" in the first digit is blinking.

Press the 1 key eight times or the 2 key twice.

- Character "9" in the first digit is blinking.

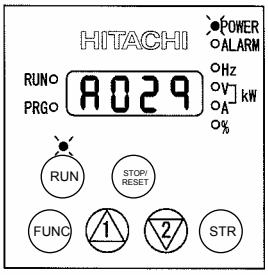
("A029" is displayed.)



(*2)

6) End the change of the extended function code.

Press the STR key.
(Character "9" is determined.)



- Selection of code "A029" is completed.

* If a code that is not defined in the code list or not intended for display is entered, the leftmost digit (fourth digit) (character "A" in this example) will start blinking again.

In such a case, confirm the code to be entered and enter it correctly. For further information, refer to Section 4.2.80. " Function code display restriction," (on page 4-74), Section 4.2.81, "Initial-screen selection," (on page 4-76), Section 4.2.82, "Automatic user-parameter setting," (on page 4-77), and Chapter 8, "List of Data Settings."

7) Press the FUNC key to display the data corresponding to the function code, change the data with the 1 and/or 2 key, and then press the STR key to store the changed data. (*4)

Note that you can also use the procedure (steps 1) to 6)) described here to change the data. (*3)(*4)

*1 This procedure can also be used on screens displaying a code other than "d001".

*2 If the FUNC key is pressed while a digit is blinking, the display will revert to the preceding status for entering the digit to the right of the blinking digit.

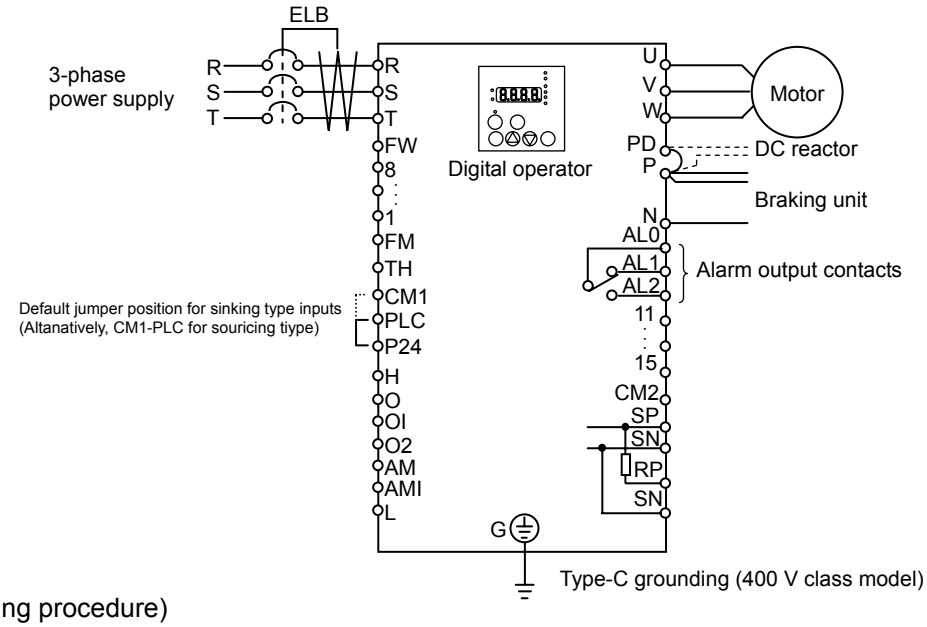
*3 If the FUNC key is pressed while the leftmost (fourth) digit is blinking, the characters having been entered to change the code will be cancelled and the display will revert to the original code shown before the 1 and 2 keys were pressed in step 1).

*4 When changing data, be sure to press the FUNC key first.

3.3 How To Make a Test Run

This section describes how to make a test run of the inverter that is wired and connected to external devices in a general way as shown below.
For the detailed method of using the digital operator, see Section 3.2, "How To Operate the Digital Operator."

(1) When entering operation and frequency-setting commands from the digital operator:
(The operating procedure below is common to the standard and optional digital operators.)



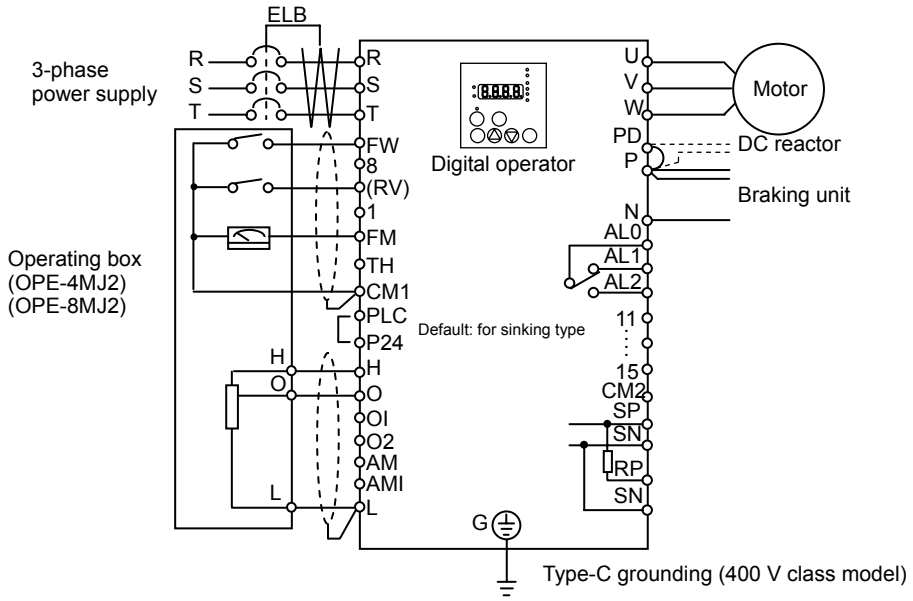
(Operating procedure)

1) Confirm that all wirings are correct.
2) Turn on the earth-leakage breaker (ELB) to supply power to the inverter.
(The POWER lamp [red LED] of the digital operator goes on.)
* When using an inverter with the factory setting, proceed to step 5).
3) Select the digital operator as the operating device via the frequency source setting function.
- Display the function code "A001" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a 2-digit numeric value.)
- Use the (1) and/or (2) key to change the displayed numeric value to [02], and then press the (STR) key once to specify the digital operator as the operating device to input frequency-setting commands.
(The display reverts to [A001].)
4) Select the digital operator as the operating device by the run command source setting function.
- Display the function code "A002" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a 2-digit numeric value.)
- Use the (1) and/or (2) key to change the displayed numeric value to "02", and then press the (STR) key once to specify the digital operator as the operating device to input operation commands.
(The display reverts to [A002]. The operating device indicator lamp above the [RUN] key goes on.)
5) Set the output frequency.
- Display the function code "F001" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a preset output frequency. With the factory setting, 0.00 [0 Hz] is shown.)
- Use the (1) and/or (2) key to change the displayed numeric value to the desired output frequency, and then press the (STR) key once to determine the frequency.
(The display reverts to [F001].)
6) Set the operation direction of the motor.
- Display the function code "F004" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows "00" or "01".)

- Use the (1) and/or (2) key to change the displayed value to "00" for forward operation or "01" for reverse operation, and then press the (STR) key once to determine the operation direction.
  (The display reverts to [F004].)

7) Set the monitor mode.
   - To monitor the output frequency, display the function code "d001", and then press the (FUNC) key once.
     (The monitor shows the output frequency.)
     To monitor the operation direction, display the function code "d003", and then press the (FUNC) key once.
     (The monitor shows  for forward operation,  for reverse operation, or  for stopping.)
   - Make sure that It is the square root of 2 times input voltage from d102 monitor.
8) Press the (RUN) key to start the motor.
   (The RUN lamp [green LED] goes on.)
9) Press the (STOP/RESET) key to decelerate or stop the motor.
   (When the motor stops, the RUN lamp [green LED] goes off.)

- During the test run, confirm that the inverter does not trip while accelerating or decelerating the motor and that the motor speed and frequencies are correct.
- If a trip due to overcurrent or overvoltage has occurred during the test run, increase the acceleration and deceleration time.
- Make sure that there is enough margin to trip level by monitoring the output current (d002) and DC voltage (d102).



(Operating procedure)

1) Confirm that all wirings are correct.
2) Turn on the earth-leakage breaker (ELB) to supply power to the inverter.
   (The POWER lamp [red LED] of the digital operator goes on.)
3) Select the control circuit terminal block as the device to input frequency-setting commands by the frequency source setting function.
   - Display the function code "A001" on the monitor screen, and then press the FUNC key once.
     (The monitor shows a 2-digit numeric value.)
   - Use the 1 and/or 2 key to change the displayed numeric value to [01], and then press the STR key once to specify the control circuit terminal block as the device to input frequency-setting commands.
     (The display reverts to [A001].)
4) Select the control circuit terminal block as the device to input operation commands by the run command source setting function.
   - Display the function code "A002" on the monitor screen, and then press the FUNC key once.
     (The monitor shows a 2-digit numeric value.)
   - Use the 1 and/or 2 key to change the displayed numeric value to "01", and then press the STR key once to specify the digital operator as the device to input operation commands.
     (The display reverts to [A002].)
5) Set the monitor mode.
   - To monitor the output frequency, display the function code "d001", and then press the FUNC key once.
     (The monitor shows the output frequency.)
     To monitor the operation direction, display the function code "d003", and then press the FUNC key once.
     (The monitor shows F for forward operation, r for reverse operation, or 0 for stopping.)
   - Make sure that It is the square root of 2 times input voltage from d102 monitor.
6) Start the motor operation.
   - Set the FW signal (at the FW terminal on the control terminal block) to the ON level to start the motor.
     (The RUN lamp [green LED] goes on.)
   - Apply a voltage across the terminals O and L on the control circuit block to output the frequency corresponding to the applied voltage from the inverter.
7) Stop the motor.
   - Set the FW signal (at the FW terminal on the control terminal block) to the OFF level to decelerate and stop the motor.
     (When the motor stops, the RUN lamp [green LED] goes off.)

Chapter 4 Explanation of Functions

This chapter describes the functions of the inverter.

Chapter 4 Explanation of Functions

(Memo)

4.1 Monitor Mode

4.1.1 Output frequency monitoring

Related code
d001: Output frequency monitoring

When the output frequency monitoring function (d001) is selected, the inverter displays the output frequency. The inverter displays "0.00" when the frequency output is stopped.
The Hz monitor lamp lights up while the inverter is displaying the output frequency.

(Display)
0.00 to 99.99 in steps of 0.01 Hz
100.0 to 400.0 in steps of 0.1 Hz

Note: When you have selected the digital operator as the device to input frequency-setting commands (A001=02), you can change the output frequency setting by using the △and/or ▽ key (only while the inverter is operating the motor).
- The change in output frequency made in this mode can be reflected in the frequency setting (function "F001"). Press the STR key to write the new frequency over the currently selected frequency setting.
- You cannot change the output frequency while the PID function is enabled or the inverter is not operating the motor.

4.1.2 Output current monitoring

Related code
d002: Output current monitoring

When the output current monitoring function (d002) is selected, the inverter displays the output current. The inverter displays "0.0" when the current output is stopped.
The A monitor lamp lights up while the inverter is displaying the output current.

(Display)
0.0 to 999.9 in steps of 0.1 A / 1000 to 9999 in steps of 1A
Note:The current monitor may be less accurate at less than 2.1kHz carrier frequency.

4.1.3 Rotation direction monitoring

Related code
d003: Rotation direction monitoring

When the rotation direction monitoring function (d003) is selected, the inverter displays the motor operation direction.
The RUN lamp lights up while the inverter is operating the motor (in forward or reverse direction).

(Display)
F: Forward operation
o: Motor stopped
r: Reverse operation

4.1.4 Process variable (PV), PID feedback monitoring

Related code
d004: Process variable (PV), PID feedback monitoring
A071: PID Function Enable
A075: PV scale conversion

When "01" (enabling PID operation) or "02" (enabling inverted-data output) has been specified for function "A071" (PID Function Enable) and the process variable (PV), PID feedback monitoring function (d004) is selected, the inverter displays the PID feedback data.
You can also convert the PID feedback to gain data by setting a PV scale conversion (with function "A075").

Value displayed by function "d004" = "feedback quantity" (%) x " PV scale conversion (A075)"
The PV scale conversion can be set (by function "A075") within the range 0.01 to 99.99 in steps of 0.01.

(Display)
0.00 to 99.99 in steps of 0.01
100.0 to 999.9 in steps of 0.1
1000. to 9999. in steps of 1
1000 to 9999 in steps of 10
⌈100 to ⌈999 in units of 100

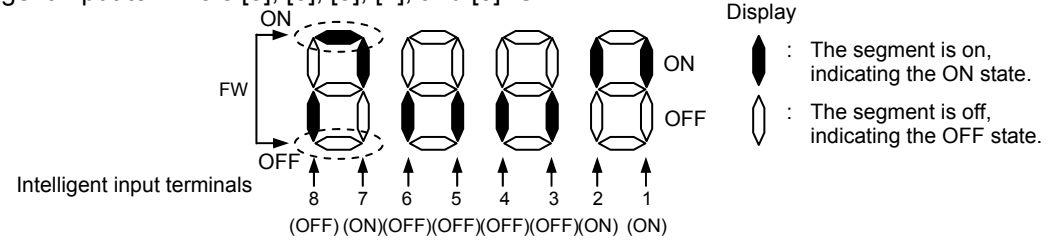
4.1.5 Intelligent input terminal status

Related code
d005: Intelligent input terminal status

When the intelligent input terminal status function (d005) is selected, the inverter displays the states of the inputs to the intelligent input terminals.
The internal CPU of the inverter checks each intelligent input for significance, and the inverter displays active inputs as those in the ON state. (*1)
Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

FW terminal and intelligent input terminals [7], [2], and [1]: ON
Intelligent input terminals [8], [6], [5], [4], and [3]: OFF



(*1)When input terminal response time is set, terminal recognition is delayed. (refer 4.2.79)

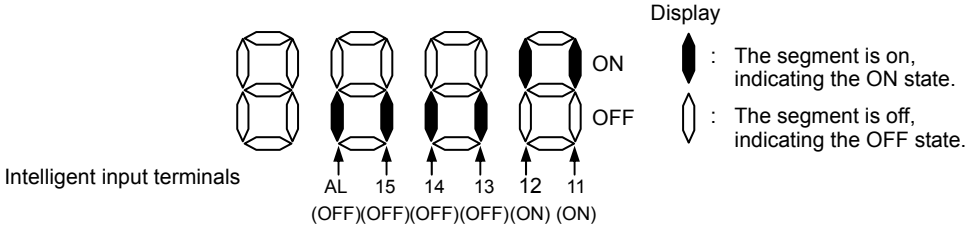
4.1.6 Intelligent output terminal status

Related code
d006: Intelligent output terminal status

When the intelligent output terminal status function (d006) is selected, the inverter displays the states of the outputs from the intelligent output terminals.
This function does not monitor the states of the control circuit terminals but monitors those of the outputs from the internal CPU.
Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

Intelligent output terminals [12] and [11]: ON
Alarm relay terminal AL and intelligent output terminals [15] to [13]: OFF



4.1.7 Scaled output frequency monitoring

Related code
d007: Scaled output frequency monitoring
b086: Frequency scaling conversion factor

When the scaled output frequency monitoring (d007) is selected, the inverter displays the gain data converted from the output frequency with the frequency scaling conversion factor (b086).
Use this function, for example, to change the unit of a value (e.g., motor speed) on display.
Value displayed by function "d007" = "output frequency monitor(d001)" x "frequency scaling conversion factor (b086)"
The frequency scaling conversion factor (b086) can be set within the range 0.1 to 99.9 in steps of 0.1.

(Example) Displaying the speed of a 4-pole motor

Speed N (min^{-1}) = (120 x f [Hz])/pole = f (Hz) x 30
As the result of the above calculation with the factor (b086) set to 30.0, the inverter displays "1800" (60 x 30.0) when the output frequency is 60 Hz.

(Display)

0.00 to 99.99 in steps of 0.01
100.0 to 999.9 in steps of 0.1
1000. to 9999. in steps of 1
1000 to 3996 in units of 10

Note: When you have selected the digital operator as the device to input frequency-setting commands, you can change the output frequency setting by using the △ and/or ▽ key (only while the inverter is operating the motor).

- The change in output frequency made in this mode can be reflected in the frequency setting (function "F001"). Press the STR key to write the new frequency over the currently selected frequency setting. (The precision of the storable frequency data depends on the frequency setting.)
- You cannot change the output frequency while the PID function is enabled or the inverter is not operating the motor.

4.1.8 Actual-frequency monitoring

Related code
d008: Actual-frequency monitoring
P011: Encoder pulse-per-revolution (PPR) setting
H004: Motor poles setting, 1st motor
H204: Motor poles setting, 2nd motor

The actual-frequency monitoring function is effective only when a motor equipped with an encoder is connected to the inverter and the feedback option board (SJ-FB) is mounted in the inverter. When the actual-frequency monitoring function (d008) is selected, the inverter displays the actual operating frequency of the motor (regardless of the motor control method (A044 or A244)).

(Display)
Forward operation:
0.00 to 99.99 in steps of 0.01 Hz
100.0 to 400.0 in steps of 0.1 Hz
Reverse operation:
- 0.0 to -99.9 in steps of 0.1 Hz
- 100 to -400 in steps of 1 Hz

Note: To use this monitoring function, set the encoder pulse-per-revolution (PPR) setting (P011) and the number of motor poles (H004 or H204) correctly.

4.1.9 Torque command monitoring

Related code
d009: Torque command monitoring
P033: Torque command input selection
P034: Torque command setting
A044: V/f characteristic curve selectcion
C001 to C008: Terminal [1] to [8]

The torque command monitoring function is effective when you have selected control by torque for the vector control with sensor. When the torque command monitoring function (d009) is selected, the inverter displays the value of the currently input torque command.
The % monitor lamp lights up while the inverter is displaying the torque command value.
Assign 52 (ATR) on intelligent input terminal and turn on to activate torque control.

(Display)
0. to 200. in steps of 1 %

4.1.10 Torque bias monitoring

Related code
d010: Torque bias monitoring
A044: V/f characteristic curve selectcion
P036: Torque bias mode
P037: Torque bias value
P038: Torque bias polarity

The torque bias monitoring function is effective when you have selected the vector control with sensor. When the torque bias monitoring function (d010) is selected, the inverter displays the value of the currently set value of torque bias.
The % monitor lamp lights up while the inverter is displaying the torque bias value.

(Display)
-200. to +200. in steps of 1 %

4.1.11 Torque monitoring

Related code
d012: Torque monitoring
A044: V/f characteristic curve selectcion

When the torque monitoring function (d012) is selected, the inverter displays the estimated value of the torque output from the inverter.
The % monitor lamp lights up while the inverter is displaying the estimated output torque.

(Display)
-200. to +200. in steps of 1 %

Indicator accuracy : about ±20%
The indicator accuracy may exceed ±20% at more than 100% of torque.

Note: This monitoring function is effective only when you have selected the sensorless vector control, 0Hz-range sensorless vector control, or vector control with sensor as the control mode.
Displayed value is not accurate when the other control method is selected.

4.1.12 Output voltage monitoring

Related code
d013: Output voltage monitoring

When the output voltage monitoring function (d013) is selected, the inverter displays the voltage output from the inverter.
The V monitor lamp lights up while the inverter is displaying the output voltage.

(Display)
0.0 to 600.0 in steps of 0.1 V
(remark) Displayed value may not be accurate when the output voltage is differ from input voltage.

4.1.13 Power monitoring

Related code
d014: Power monitoring

When the power monitoring function (d014) is selected, the inverter displays the electric power (momentary value) input to the inverter.
The kW monitor lamps (V and A lamps) light up while the inverter is displaying the input power.

(Display)
0.0 to 999.9 in steps of 0.1 kW

4.1.14 Cumulative power monitoring

Related code
d015: Cumulative power monitoring
b078: Cumulative power clearance
b079: Cumulative input power display gain setting

When the cumulative power monitoring function is selected, the inverter displays the cumulative value of electric power input to the inverter.
You can also convert the value to be displayed to gain data by setting the cumulative input power display gain setting (b079).

Value displayed by function "d015" = "calculated value of input power (kW/h)"/"cumulative input power display gain setting (b079)"
The cumulative power input gain can be set within the range 1 to 1000 in steps of 1.

You can clear the cumulative power data by specifying "01" for the cumulative power clearance function (b078) and pressing the STR key.
You can also clear the cumulative power data at an intelligent input terminal by assigning function "53" (KHC: cumulative power clearance) to the intelligent input terminal.
When the cumulative input power display gain setting (b079) is set to "1000", the cumulative power data up to 999000 (kW/h) can be displayed.

(Display)
0.0 to 999.9 in steps of 1 kW/h, or the unit set for function "b079"
1000 to 9999 in units of 10 kW/h, or the unit set for function "b079"
⌈100 to ⌈999 in units of 1000 kW/h, or the unit set for function "b079"

4.1.15 Cumulative operation RUN time monitoring

Related code
d016: Cumulative operation RUN time monitoring

When the cumulative operation RUN time monitoring function (d016) is selected, the inverter displays the cumulative time of the inverter operation.

(Display)
0. to 9999. in units of 1 hour
1000 to 9999 in units of 10 hours
⌈100 to ⌈999 in units of 1,000 hours

4.1.16 Cumulative power-on time monitoring

Related code
d017: Cumulative power-on time monitoring

When the cumulative power-on time monitoring function(d017) is selected, the inverter displays the cumulative time throughout which the inverter power has been on.

(Display)
0. to 9999. in units of 1 hour
1000 to 9999 in units of 10 hours
⌈100 to ⌈999 in units of 1,000 hours

4.1.17 Heat sink temperature monitoring

Related code
d018: Heat sink temperature monitoring

When the heat sink temperature monitoring function (d018) is selected, the inverter displays the temperature of the internal heat sink of the inverter.

(Display)
-020. to 200.0 in steps of 0.1 °C

4.1.18 Motor temperature monitoring

Related code
d019: Motor temperature monitoring
b098: Thermistor for thermal protection control

When the motor temperature monitoring function is selected, the inverter displays the temperature of the thermistor connected between control circuit terminals TH and CM1.
Use the thermistor model PB-41E made by Shibaura Electronics Corporation.
Specify "02" (enabling NTC) for the thermistor for thermal protection control (function "b098").

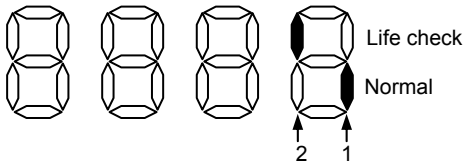
(Display)
-020. to 200.0 in steps of 0.1 °C.

Note: If "01" (enabling PTC) is specified for the thermistor for thermal protection control (function "b098"), motor temperature monitoring is disabled.

4.1.19 Life-check monitoring

Related code
d022: Life-check monitoring

When the life-check monitoring function (d002) is selected, the inverter displays the operating life status of two inverter parts output from corresponding intelligent output terminals by using LED segments of the monitor.
The two targets of life-check monitoring are:
1: Life of the capacitor on the main circuit board
(SJ700-2 large capacity inverter is not supported for this function.)
2: Degradation of cooling fan speed



Note 1: The inverter estimates the capacitor life every 10 minutes. If you turn the inverter power on and off repeatedly at intervals of less than 10 minutes, the capacitor life cannot be checked correctly.
Note 2: If you have specified "01" for the selection of cooling fan operation (function "b0092"), the inverter determines the cooling fan speed to be normal while the cooling fan is stopped.

4.1.20 Program counter display (easy sequence function)

Related code
d023: Program counter

While the easy sequence function is operating, the inverter displays the program line number that is being executed.
For details, refer to the “Programming Software EzSQ” manual.

4.1.21 Program number monitoring (easy sequence function)

Related code
d024: Program number monitoring

When the program number monitoring function (d024) is selected, the inverter displays the program number of the downloaded easy sequence program.
Note that you must describe a program number in the program you create. For details, refer to the “Programming Software EzSQ” manual.

Related code
d025: user monitor 0
d026: user monitor 1
d027: user monitor 2

4.1.22 User Monitors 0 to 2 (easy sequence function)

The user monitor function allows you to monitor the results of operations in an easy sequence program.
For details, refer to the Programming Software EzSQ Instruction Manual.

Related code
d028: Pulse counter monitor

4.1.23 Pulse counter monitor

Pulse counter monitor allows you to monitor the accumulated pulse of intelligent input terminals pulse counter 74 (PCNT).

4.1.24 Position command monitor (in absolute position control mode)

Related code
d029: Pulse counter monitor

The user monitor function allows you to monitor the results of operations in an easy sequence program.
For details, refer to the Programming Software EzSQ Instruction Manual.

4.1.25 Current position monitor (in absolute position control mode)

Related code
d030: Position feedback monitor

The current position monitor function allows you to monitor the current position in absolute position control mode.
For details, see Section 4.3.12.

4.1.26 Trip Counter

Related code
d080: Trip Counter

When the trip counter function (d080) is selected, the inverter displays the number of times the inverter has tripped.

(Display)
0. to 9999. in units of 1 trip
1000 to 6553 in units of 10 trips

4.1.27 Trip monitoring 1 to 6

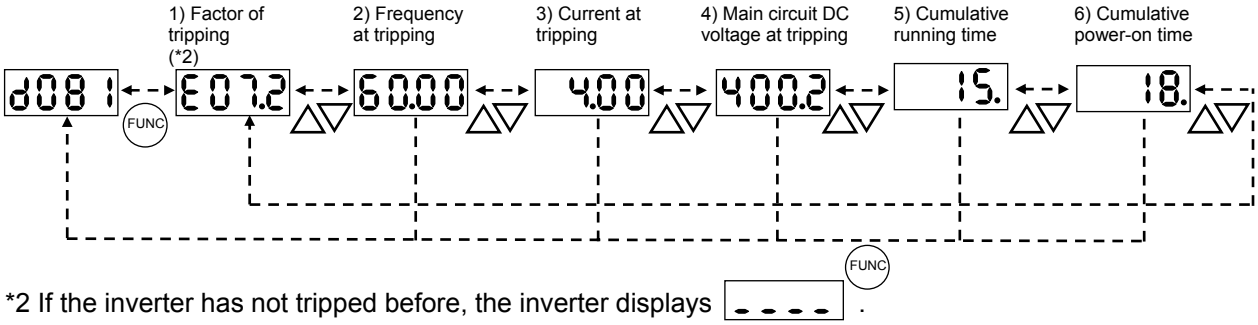
Related code
d081: Trip monitoring 1
d082: Trip monitoring 2
d083: Trip monitoring 3
d084: Trip monitoring 4
d085: Trip monitoring 5
d086: Trip monitoring 6

When the trip monitoring function (d081 to d086) is selected, the inverter displays the trip history data. The last six protective trips the inverter made can be displayed.
Select the trip monitoring 1 (d081) to display the data on the most recent trip.

(Display contents)
1) Factor of tripping (one of E01 to E79) (*1)
2) Output frequency at tripping (Hz)
3) Output current at tripping (A) (*2)
4) Main circuit DC voltage at tripping (V) (*3)
5) Cumulative inverter-running time until tripping (h)
6) Cumulative inverter power-on time until tripping (h)

*1 See Section 5.1.1, "Protective functions."
*2 When the inverter status is in stop mode as a trip history, monitored value can be zero.
*3 When grounding fault is detected at power on, monitored value can be zero.

(Display by trip monitoring)



*2 If the inverter has not tripped before, the inverter displays ____ .

4.1.28 Programming error monitoring

Related code
d090: Programming error monitoring

If an attempt is made to set the data conflicting with other data on the inverter, the inverter displays a warning.
The PRG (program) lamp lights up while the warning is displayed (until the data is rewritten forcibly or corrected).
For details on the programming error monitoring function, see Section 5.2. Warning Codes

4.1.29 DC voltage monitoring

Related code
d102: DC voltage monitoring

When the DC voltage monitoring is selected, the inverter displays the DC voltage (across terminals P and N) of the inverter.
While the inverter is operating, the monitored value changes as the actual DC voltage of the inverter changes.

(Display)
0.0 to 999.9 in steps of 0.1 V

4.1.30 BRD load factor monitoring

Related code
d103: BRD load factor monitoring
b090: Dynamic braking usage ratio

When the BRD load factor monitoring function (d103) is selected, the inverter displays the BRD load factor. If the BRD load factor exceeds the value set as the dynamic braking usage ratio (b090), the inverter will trip because of the braking resistor overload protection (error code "E06").

(Display)
0.0 to 100.0 in steps of 0.1%

4.1.31 Electronic thermal overload monitoring

Related code
d104: Electronic thermal overload monitoring

When the electronic thermal overload monitoring function (d104) is selected, the inverter displays the electronic thermal overload. If the electronic thermal overload exceeds 100%, the inverter will trip because of the overload protection (error code "E05").

(Display)
0.0 to 100.0 in steps of 0.1%

4.2 Function Mode

4.2.1 Output frequency setting

Related code
F001: Output frequency setting
A001: Frequency source setting
A020/A220/A320:
Multispeed frequency setting, 1st/2nd/3rd motors
C001 to C008:
Terminal [1] to [8] functions

The output frequency setting function allows you to set the inverter output frequency.
You can set the inverter output frequency with this function (F001) only when you have specified "02" for the frequency source setting (A001). For other methods of frequency setting, see Section 4.2.4, "frequency source setting (A001)."
(If the setting of function "A001" is other than "02", function "F001" operates as the frequency command monitoring function.)
The frequency set with function "F001" is automatically set as the Multispeed frequency setting (A020). To set the second and third multispeed s, use the multispeed frequency setting, 2nd motor, function (A220) and multispeed frequency setting, 3rd motor, function (A320), or use function "F001" for the setting after turning on the SET and SET3 signals. For the setting using the SET and SET3 signals, assign the SET function (08) and SET3 function (17) to intelligent input terminals.
If the set output frequency is used as the target data for the PID function, PID feedback data will be displayed in percent (%). ("100%" indicates the maximum frequency.)

Item	Function code	Range of data	Description
Output frequency setting	F001	0.0, start frequency to maximum frequency, 1st/2nd/3rd motors (Hz) 0.0 to 100.0 (Enabling the PID operation)	The frequency set with F001 is equal to the setting of A020. The second control frequency set with F001 is equal to the setting of A220. The third control frequency set with F001 is equal to the setting of A320.
Multispeed 0	A020/A220/A320		

4.2.2 Keypad Run key routing

Related code
F004: Keypad Run key routing

When you enter operation commands via the digital operator, the Keypad Run key routing function allows you to select the direction of motor operation.
This function is ineffective when you use the control terminal block or remote operator to input operation commands.

Item	Function code	Data	Description
Keypad Run key routing	F004	00	Forward operation
		01	Reverse operation

4.2.3 Rotational direction restriction

Related code
b035: Rotational direction restriction

The rotational direction restriction function allows you to restrict the direction of motor operation.
This function is effective regardless of the specification of operation command input device (e.g., control circuit block or digital operator).
If an operation command to drive the motor in a restricted direction is input, the inverter (digital operator) will display  .

Item	Function code	Data	Description
Rotational direction restriction	b035	00	Both forward and reverse operations are enabled.
		01	Only forward operation is enabled.
		02	Only reverse operation is enabled.

4.2.4 Frequency source setting

Related code
A001: Frequency source setting

The frequency source setting function allows you to select the method to input the frequency-setting command.

Motor rotation direction is inverted when -10 to 0V is given as frequency command to 02-L terminals.

Item	Function code	Data	Description
Frequency source setting	A001	(00)	(Valid only when the OPE-SR is used) Use the control provided on the digital operator to set the frequency.
		01	Input the frequency-setting command via a control circuit terminal (0-L, OI-L, or O2-L).
		02	Use the digital operator (function "F001") or remote operator to set the frequency.
		03	Input the frequency-setting command via an RS485 communication terminal.
		04	Input the frequency-setting command from the board connected to optional port 1.
		05	Input the frequency-setting command from the board connected to optional port 2.
		06	Use the SJ-FB to input the frequency-setting command as a pulse train (see 4.2.21)
		07	Use the SET-Freq command of the easy sequence function as the frequency-setting command.
		10	Use the operation result of the set frequency operation function as the frequency-setting command. (see 4.2.12)

4.2.5 Run command source setting

Related code
A002: Run command source setting
C001 to C008: Terminal [1] to [8] functions
C019: Terminal [FW] active state
F004: Keypad Run key routing

The run command source setting function allows you to select the method to input operation commands (to start and stop the motor).
As the operation commands via control circuit terminals, turn the FW signal (for forward operation) or RV signal (for reverse operation) on and off to start and stop the motor, respectively.
(Note that the factory setting assigns the FW signal to intelligent input terminal [8].)
To switch each intelligent input terminal between a and b contacts, specify each terminal with function "C011" to "C019", and then perform input a/b (NO/NC) selection for each terminal.
When using the digital operation for the inverter operation, specify the desired motor operation direction with function "F004", and use the RUN and STOP/RESET keys to start and stop the motor, respectively.
If the start commands for both forward and reverse operations are input at the same time, the inverter will assume the input of a stop command.

Item	Function code	Data	Description
Run command source setting	A002	01	Input the start and stop commands via control circuit terminals (FW and RV).
		02	Input the start and stop commands from the digital or remote operator.
		03	Input the start and stop commands via RS485 communication terminals.
		04	Input the start and stop commands from option board 1.
		05	Input the start and stop commands from option board 2.
Terminal [FW] active state	C019 C011 to C018	00	a (NO) contact
		01	b (NC) contact

Note 1: If function "31" (forcible operation) or "51" (forcible-operation terminal) is assigned to an intelligent input terminal, the settings made with functions "A001" and "A002" will be invalidated when the said intelligent input terminal is turned on and those methods to input frequency-setting and operation commands which are specified for the said terminal will be enabled.
Note 2: On the remote operator (SRW) being used to operate the inverter, pressing the REMT (remote) key enables you to input both frequency-setting and operation commands from the remote operator.
Note 3: When the DeviceNet option board (SJ-DN) is used, A002 is not needed to be changed from default because the run command source is automatically set via DeviceNet. (In case it is changed, it is to be set as 01, 02 or 03.)

4.2.6 Stop mode selection

Related code
b091: Stop mode selection
F003/F203/F303:
Deceleration (1) time setting,
1st/2nd/3rd motors
b003: Retry wait time before motor restart
b007: Restart frequency threshold
b008: Restart mode after FRS

The stop mode selection function allows you to select one of two methods of stopping the motor when a stop command is input from the digital operator or via the control circuit terminal block. One is to decelerate the motor according to the specified deceleration time and then stop it; the other is to let the motor run freely until it stops.
If a start command is input while the motor is in free-running status, the inverter will restart the motor according to the setting of the restart mode after FRS (b088). (See Section 4.2.47.)

Item	Function code	Data	Description
Stop mode selection	b091	00	Normal stopping (stopping after deceleration)
		01	Free-running until stopping
Restart mode after FRS	b088	00	Starting with 0 Hz
		01	Starting with matching frequency
Restart frequency threshold	b007	0.00 to 400.0(Hz)	Starting with 0 Hz if the frequency-matching result is less than the set lower limit
Retry wait time before motor restart	b003	0.3 to 100.(s)	Time to wait until the restart of the motor after free-running ends

4.2.7 STOP key enable

Related code
b087: STOP key enable

When the control circuit terminal block is selected as the device to input operation commands, the STOP key enable function allows you to enable or disable the motor-stopping and trip reset functions of the STOP key of the digital operator.
This function is effective only when the digital operator (02) is not specified for the run command source setting (A002) (see Section 4.2.5).
If the digital operator (02) is specified for "A002", the motor-stopping and trip reset functions of the STOP key are enabled regardless of this setting (STOP key enable).

Function code	Data	Stop command with STOP key	Trip reset command with STOP key
b087	00	Enabled	Enabled
	01	Disabled	Disabled
	02	Disabled	Enabled

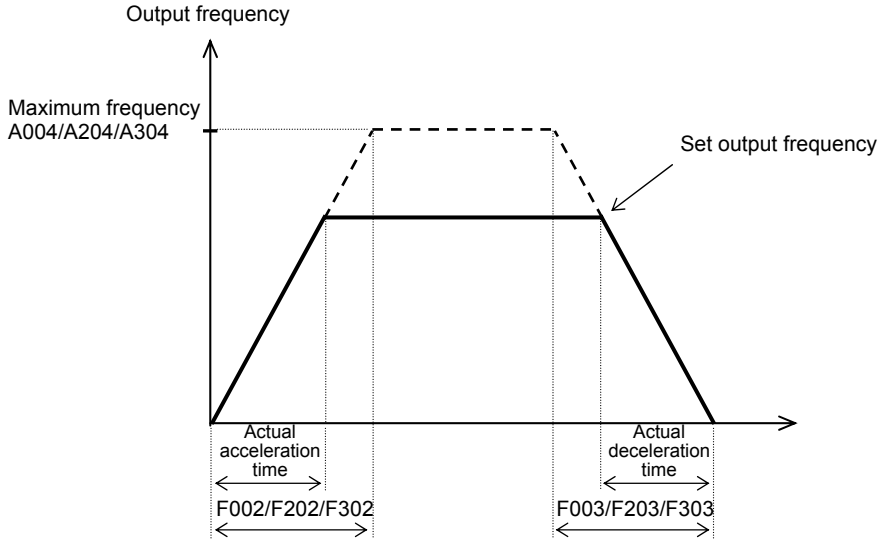
4.2.8 Acceleration/deceleration time setting

Related code

F002/F202/F302: Acceleration (1) time setting, 1st/2nd/3rd motors
F003/F203/F303: Deceleration (1) time setting, 1st/2nd/3rd motors
A004/A204/A304: Maximum frequency setting, 1st/2nd/3rd motors
P031: Accel/decel time input selection
C001 to C008: Terminal [1] to [8] functions

- Specify a longer time for slower acceleration or deceleration; specify a shorter time for quicker acceleration or deceleration.
- The time set with this function is the time to accelerate (or decelerate) the motor from 0 Hz to the maximum frequency (or vice versa).
- If you assign the LAD cancellation (LAC) function to an intelligent input terminal and turns on the terminal, the set acceleration/deceleration time will be ignored, and the output frequency will immediately follow the frequency-setting command.
- To switch the acceleration and deceleration time among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals (see Section 4.2.38). Use the SET and SET3 signals for switching.
- As the Accel/decel time input selection by P031, select one of the (1) input from the digital operation, (2) input from option board 1, (3) input from option board 2, and (4) input from the easy sequence program.

Item	Function code	Range of data	Description
Acceleration (1) time setting	F002/F202/ F302	0.01 to 3600.(s)	Set the length of time to accelerate the motor from 0 Hz to the maximum frequency.
Deceleration (1) time setting	F003/F203/ F303	0.01 to 3600.(s)	Set the length of time to decelerate the motor from the maximum frequency to 0 Hz.
Accel/decel time input selection	P031	00	Input from the digital operator (OPE)
		01	Input from option board 1 (OP1)
		02	Input from option board 1 (OP2)
		03	Input from the easy sequence program (PRG)
Terminal function	C001 to C008	46	LAD cancellation



The actual time to accelerate/decelerate the motor will be no less than the minimum acceleration/deceleration time that depends on the inertial effect (J) due to the mechanical system and motor torque. If you set a time shorter than the minimum acceleration/deceleration time, the inverter may trip because of overcurrent or overvoltage.

Acceleration time (ts)

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

Deceleration time (t_B)

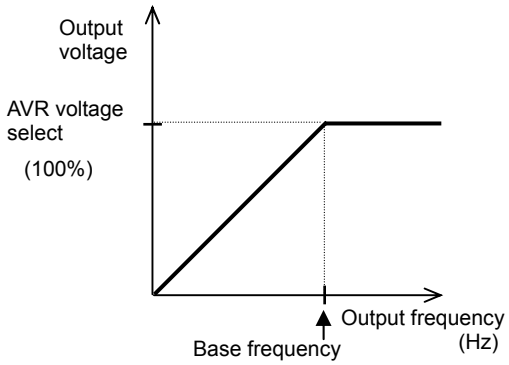
$$t_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$$

J_L: Inertia effect (J) of the load converted to that of the motor shaft (kg-m^2)
J_M: Inertia effect (J) of the motor (kg-m^2)
N_M: Motor speed (rpm)
Ts: Maximum acceleration torque driven by the inverter (N-m)
T_B: Maximum deceleration torque driven by the inverter (N-m)
T_L: Required running torque (N-m)

4.2.9 Base frequency setting

Related code
A003/A203/A303: Base frequency setting, 1st/2nd/3rd motors
A081: AVR function select
A082: AVR voltage select

(1) Base frequency and motor voltage
- With the base frequency setting and AVR voltage select functions, adjust the inverter outputs (frequency and voltage) to the motor ratings.
- The base frequency is the nominal frequency of the motor. Set a base frequency that meets the motor specification. Carefully note that setting the base frequency to less than 50 Hz may result in motor burnout.
- A special motor requires a base frequency of 60 Hz or more. Your inverter model may not be suitable for such a special motor, and one with a larger capacity may be required.
- Select the motor voltage that meets the motor specification. Selecting a motor voltage exceeding the motor specification may result in motor burnout.



- To switch the base frequency among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals (see Section 4.2.38). Use the SET and SET3 signals for switching.

Item	Function code	Range of data	Description
Base frequency setting	A003/A203/ A303	30. to maximum frequency, 1st/2nd/3rd motors (Hz)	
AVR voltage select	A082	380/400/415/440/460/480	

(2) AVR function
The AVR function maintains the correct voltage output to the motor, even when the voltage input to the inverter fluctuates. The output voltage maintained by this function is based on the voltage specified by the AVR voltage select.
Use the AVR function select (A081) to enable or disable the AVR function.

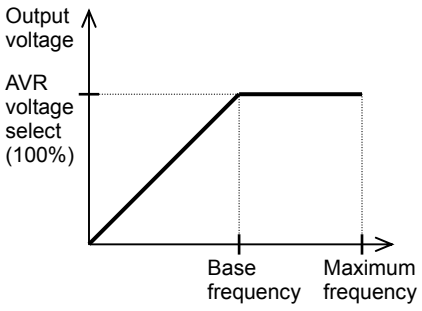
Item	Function code	Data	Description
AVR function select	A081	00	The AVR function is always enabled.
		01	The AVR function is always disabled.
		02	The AVR function is disabled at deceleration. (*1)

*1 Disabling the AVR function at motor deceleration increases the energy loss on the decelerated motor and decreases the energy regenerated on the inverter, which results in a shorter deceleration time.

4.2.10 Maximum frequency setting

Related code
A004/A204/A304: Maximum frequency setting, 1st/2nd/3rd motors

The maximum frequency setting function allows you to set the maximum frequency of the motor driven by the inverter.
The maximum frequency set here corresponds to the maximum level of each external analog input (See Section 4.2.12) (for example, 10 V of the input of 0 to 10 V).
To switch the maximum frequency among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.
The inverter output voltage with the frequency ranging from the base frequency to the maximum frequency is that selected by the AVR voltage select function (A082).



Item	Function code	Range of data	Description
Maximum frequency setting	A004/A204/ A304	30. to 400. (Hz) (185 to 315kW) 30. to 120. (Hz) (400kW)	The maximum output frequency is set.

4.2.11 External analog input setting (O, OI, and O2)

Related code
A005: [AT] selection
A006: [O2] selection
C001 to C008: Terminal [1] to [8] functions

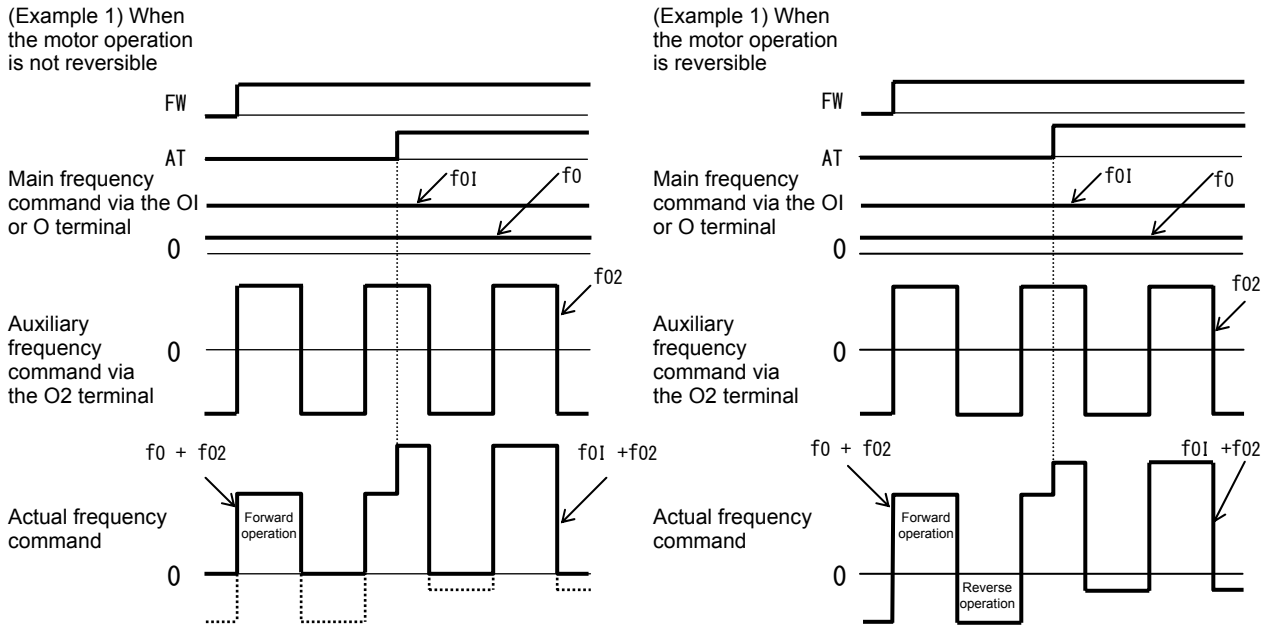
The inverter has the following three types of external analog input terminals:
O-L terminal: 0 to 10 V
OI-L terminal: 4 to 20 mA
O2-L terminal: -10 to 10 V

The table below lists the settings of the external analog input terminals.

Item	Function code	Data	Description
[AT] selection	A005	00	Switching between the O and OI terminals with the AT terminal Turning on the AT terminal enables the OI-L terminal. Turning on the AT terminal enables the O-L terminal.
		01	Switching between the O and O2 terminals with the AT terminal Turning on the AT terminal enables the O2-L terminal. Turning on the AT terminal enables the O-L terminal.
		(02)	(Valid only when the OPE-SR is used) Switching between the O terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the O-L terminal.
		(03)	(Valid only when the OPE-SR is used) Switching between the OI terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the OI-L terminal.
		(04)	(Valid only when the OPE-SR is used) Switching between the O2 terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the O2-L terminal.
[O2] selection	A006	00	Using the O2 terminal independently
		01	Using the O2 terminal for auxiliary frequency command (nonreversible) in addition to the O and OI terminals
		02	Using the O2 terminal for auxiliary frequency command (reversible) in addition to the O and OI terminals
		03	Disabling the O2 terminal

Note that whether frequency commands are input to the O2-L terminal and whether the motor operation is reversible depend on the combination of settings of functions "A005" and "A006" and whether function "16" (AT) is assigned to an intelligent input terminal as shown in the table below.
When the motor operation is reversible, the inverter operates the motor in a reverse direction if the sum of the frequencies specified by the main frequency and auxiliary frequency commands is less than 0 (even when the forward operation [FW] terminal is on). Even when no wire is connected to the 02 terminal, reverse operation of the motor may occur and prolong the acceleration time if the output voltage fluctuates near 0 V.

	A006	A005	AT terminal	Main frequency command	Whether to input an auxiliary frequency command (via the O2-L terminal)	Reversible/ nonreversible
When the AT function is assigned to an intelligent input terminal	00,03	00	OFF	O-L terminal	No input	Nonreversible
			ON	OI-L terminal	No input	
		01	OFF	O-L terminal	No input	
			ON	O2-L terminal	No input	Reversible
	01	00 (Example 1)	OFF	O-L terminal	Input	Nonreversible
			ON	OI-L terminal	Input	
		01	OFF	O-L terminal	Input	
			ON	O2-L terminal	No input	Reversible
	02	00 (Example 2)	OFF	O-L terminal	Input	Reversible
			ON	OI-L terminal	Input	
		01	OFF	O-L terminal	Input	
			ON	O2-L terminal	No input	
When the AT function is not assigned to any intelligent input terminal	00	—	—	O2-L terminal	No input	Reversible
	01	—	—	Addition of signals on O-L and OI-L terminals	Input	Nonreversible
	02	—	—	Addition of signals on O-L and OI-L terminals	Input	Reversible
	03	—	—	Addition of signals on O-L and OI-L terminals	No input	Nonreversible



4.2.12 Frequency operation function

Related code
A141: Operation-target frequency selection 1
A142: Operation-target frequency selection 2
A143: Operator selection
A001: Frequency source setting
A076: PV source setting

The frequency operation function allows you to use the result of an arithmetic operation on two frequency commands as the actual frequency command or PID feedback data.
To use the operation result as the actual frequency command, specify "10" for the frequency source setting (A001).
To use the operation result as the PID feedback data, specify "10" for the PV source setting (A076).

Item	Function code	Data	Description
Operation-target frequency selection 1 and 2	A141/A142	00	Digital operator (A020/A220/A320)
		(01)	Control on the digital operator (Valid only when the OPE-SR is connected)
		02	Input via the O terminal
		03	Input via the OI terminal
		04	Input via the RS485 terminal
		05	Input from option board 1
		06	Input from option board 2
		07	Input of pulse train
Operator selection for frequency operation	A143	00	Addition: (A141) + (A142)
		01	Subtraction: (A141) - (A142)
		02	Multiplication: (A141) x (A142)
Frequency source setting	A001	10	Output of operation result
PV source setting	A076	10	Output of operation result

Note 1: The [1] (up) and [2] (down) keys of the digital operator are ineffective when the frequency operation function is enabled. Also, the frequency displayed by the output frequency monitoring (d001), Scaled output frequency monitoring (d007), or output frequency setting (F001) cannot be changed with key operations.
Note 2: The settings of "A141" and "A142" can be the same.

4.2.13 Frequency addition function

Related code
A145: Frequency to be added
A146: Sign of the frequency to be added
C001 to C008: Terminal [1] to [8]functions

The frequency addition function allows you to add or subtract the value specified as the frequency to be added (A145) to or from the frequency value of a selected frequency command.
To use this function, assign function "50" (ADD) to an intelligent input terminal.
When the ADD terminal is turned on, the inverter performs the addition or subtraction of the value specified as "A145".

Item	Function code	Data or range of data	Description
Frequency to be added	A145	0.00 to 400.00(Hz) (185 to315kW) 0.00 to 120.00 (Hz) (400kW)	Setting of the frequency to be added
Selection of the sign of the frequency to be added	A146	00	(Frequency command) + (A145)
		01	(Frequency command) - (A145)
Terminal function	C001 to C008	50	ADD selection of the trigger for adding the frequency (A145)

Note 1: If the sign of the frequency value in the frequency command changes from minus (-) to plus (+), or vice versa, as the result of frequency addition, the motor operation direction will be inverted.
Note 2: When the PID function is used, the frequency addition function can apply to PID target data. (In such cases, the data display by function "A145" is in percentage [in steps of 0.01%]).

4.2.14 Start/end frequency setting for external analog input

Related code
A011: [O]-[L] input active range start frequency
A012: [O]-[L] input active range end frequency
A013: [O]-[L] input active range start voltage
A014: [O]-[L] input active range end voltage
A015: [O]-[L] input start frequency enable
A101: [OI]-[L] input active range start frequency
A102: [OI]-[L] input active range end frequency
A103: [OI]-[L] input active range start current
A104: [OI]-[L] input active range end current
A105: [OI]-[L] input start frequency enable
A111: [O2]-[L] input active range start frequency
A112: [O2]-[L] input active range end frequency
A113: [O2]-[L] input active range start voltage
A114: [O2]-[L] input active range end voltage

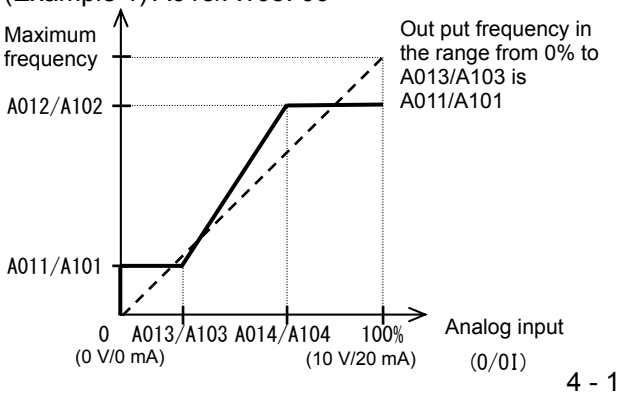
The start/end frequency setting function allows you to set the inverter output frequency in relation to the external analog inputs (frequency commands) via the following terminals:
O-L terminal: 0 to 10 V
OI-L terminal: 4 to 20 mA
O2-L terminal: -10 to +10 V

(1) Start/end frequency settings for the O-L and OI-L terminals

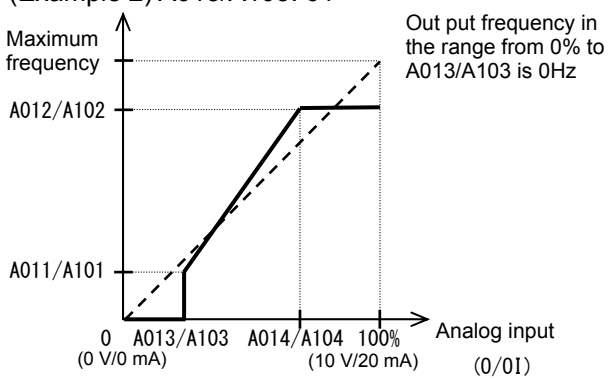
Item	Function code	Range of data	Description
[O]/[OI]-[L] input active range start frequency	A011/A101	0.00 to 400.0(Hz) (185 to315kW) 0.00 to 120.0 (Hz) (400kW)	Setting of the start frequency
[O]/[OI]-[L] input active range end frequency	A012/A102	0.0 to 400.0(Hz) (185 to315kW) 0.00 to 120.0 (Hz) (400kW)	Setting of the end frequency
[O]/[OI]-[L] input active range start voltage	A013/A103	0. to 100.(%)	Setting of the rate of the start frequency to the external frequency command (0 to 10 V/0 to 20 mA)
[O]/[OI]-[L] input active range end voltage	A014/A104	0. to 100.(%)	Setting of the rate of the end frequency to the external frequency command (0 to 10 V/0 to 20 mA)
[O]/[OI]-[L] input start frequency enable	A015/A105	00	Externally input start frequency The frequency set as "A011" or "A101" is output as the output frequency while the start-frequency rate is 0% to the value set as "A013" or "A103".
		01	0 Hz 0 Hz is output as the output frequency while the start-frequency rate is 0% to the value set as "A013" or "A103".

If the voltage of the signal to be input to the O-L terminal is 0 to 5 V, specify 50% for "A014".

(Example 1) A015/A105: 00



(Example 2) A015/A105: 01

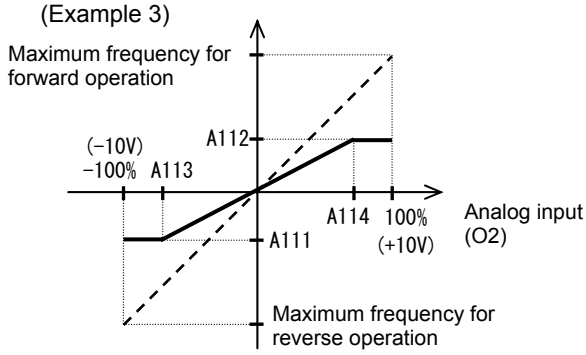


(2) Start/end frequency settings for the O2-L terminal

Item	Function code	Range of data	Description	Remarks
02 start frequency	A111	-400. to 400.(Hz) (185 to315kW) -120. to 120. (Hz) (400kW)	Setting of the start frequency	(Example 3)
02 end frequency	A112	-400. to 400.(Hz) (185 to315kW) -120. to 120. (Hz) (400kW)	Setting of the end frequency	
02 start-frequency rate	A113	-100. to 100.(%)	Setting of the rate of the start frequency to the external frequency command (-10 to +10 V) (*1)	
02 end-frequency rate	A114	-100. to 100.(%)	Setting of the rate of the end frequency to the external frequency command (-10 to +10 V) (*1)	

*1 The frequency rates correspond to the voltages (-10 to +10 V) of the external frequency command as follows:
-10 to 0 V: -100% to 0%
0 to +10 V: 0% to 100%
For example, if the voltage of the signal to be input to the O2-L terminal is -5 to +5 V, specify 50% for "A114".

(Example 3)



4.2.15 External analog input (O/OI/O2) filter setting

Related code
A016: External frequency filter time const.

The external analog input filter setting function allows you to set the input-voltage/input-current sampling time to be applied when frequency commands are input as external analog signals.
You can use this filter function effectively for removing noise from the frequency-setting circuit signal.
If the noise disables the stable operation of the inverter, increase the setting. Setting a larger value makes the inverter response slower. The filtering constant is "set value (1 to 30) x 2 ms."
When the setting is "31" (factory setting), a hysteresis of ±0.1 Hz is added to the filtering constant (500 ms).

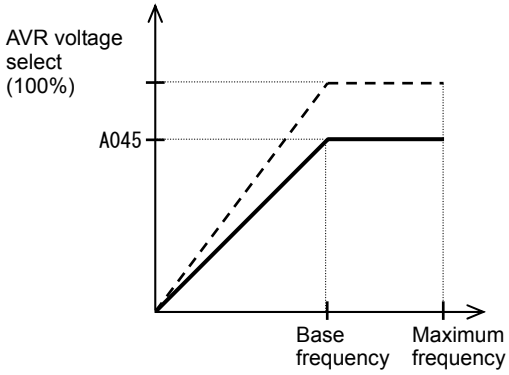
Item	Function code	Range of data	Description
External frequency filter time const.	A016	1. to 30. or 31.	Setting of 1. to 30.: "Set value x 2" ms filter Setting of 31.: 500 ms filter (fixed) with hysteresis of ±0.1 Hz

4.2.16 V/f gain setting

Related code
A045: V/f gain setting
A082: AVR voltage select

The V/f gain setting function allows you to change the inverter output voltage by specifying the rate of the output voltage to the voltage (100%) selected with the AVR voltage select function (A082).
If the motor operation is cranky, try to increase the gain setting.

Item	Function code	Range of data	Description
V/f gain setting	A045	20. to 100. (%)	Setting of the rate of reducing the output voltage



4.2.17 V/F characteristic curve selection

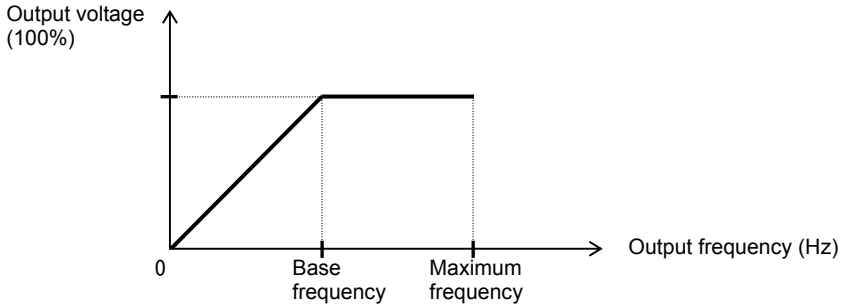
Related code

A044/A244/A344: V/F characteristic curve selection, 1st/2nd/3rd motors
b100/b102/b104/b106/b108/b110/b112: Free-setting V/f frequency (1) (2) (3) (4) (5) (6) (7)
b101/b103/b105/b107/b109/b111/b113: Free-setting V/f voltage (1) (2) (3) (4) (5) (6) (7)

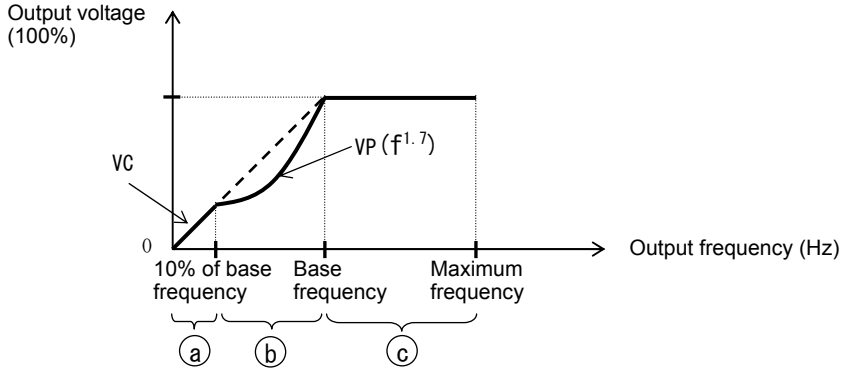
The V/F characteristic curve selection function allows you to set the output voltage/output frequency (V/f) characteristic.
To switch the V/F characteristic curve selection among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.

Function code	Data	V/f characteristic	Remarks
A044/A244/ A344	00	Constant torque characteristic (VC)	
	01	Reduced-torque characteristic (1.7th power of VP)	
	02	Free V/f characteristic	Available only for A044 and A244
	03	Sensorless vector control (SLV)	Available only for A044 and A244 (See Section 4.2.96.)
	04	0 Hz-range sensorless vector control	Available only for A044 and A244 (See Section 4.2.97.)
	05	Vector control with sensor (V2)	Available only for A044

(1) Constant torque characteristic (VC)
With this control system set, the output voltage is in proportion to the output frequency within the range from 0 Hz to the base frequency. Within the output frequency range over the base frequency up to the maximum frequency, the output voltage is constant, regardless of the change in the output frequency.



(2) Reduced-torque characteristic (1.7th power of VP)
This control system is suited when the inverter is used with equipment (e.g., fan or pump) that does not require a large torque at a low speed.
Since this control system reduces the output voltage at low frequencies, you can use it to increase the efficiency of equipment operation and reduce the noise and vibrations generated from the equipment.
The V/f characteristic curve for this control system is shown below.



Period ⓐ : While the output frequency increases from 0 Hz to the 10% of the base frequency, the output voltage follows the constant torque characteristic.
(Example) If the base frequency is 60 Hz, the constant torque characteristic is maintained within the output frequency range of 0 to 60 Hz.

Period ⓑ : While the output frequency increases from the 10% of base frequency to the base frequency, the output voltage follows the reduced-torque characteristic. In other words, the output voltage increases according to the 1.7th power of the output frequency.

Period ⓒ : While the output frequency increases from the base frequency to the maximum frequency, the output voltage is constant.

(3) Free V/f characteristic setting

The free V/f characteristic setting function allows you to set an arbitrary V/f characteristic by specifying the voltages and frequencies (b100 to b113) for the seven points on the V/f characteristic curve.

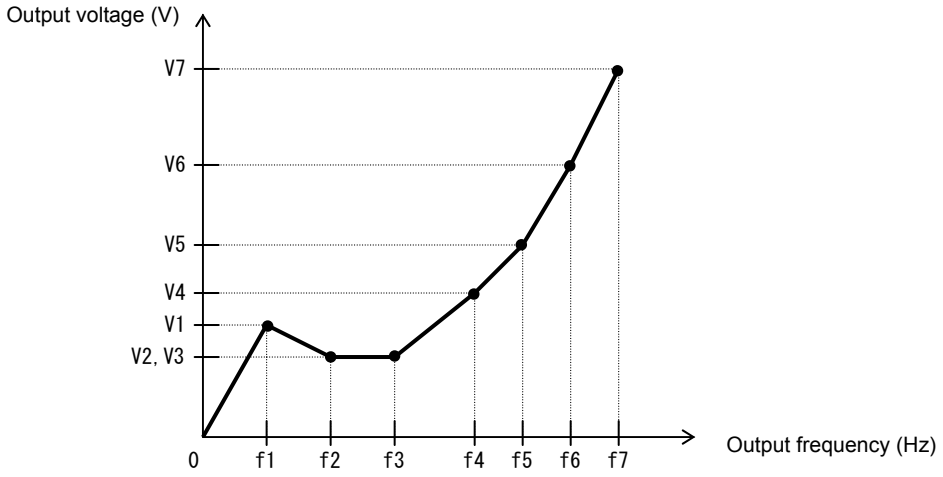
The free V/f frequencies (1 to 7) set by this function must always be in the collating sequence of "1 ≤ 2 ≤ 3 ≤ 4 ≤ 5 ≤ 6 ≤ 7".

Since all free V/f frequencies are set to 0 Hz as default (factory setting), specify their arbitrary values (begin setting with free-setting V/f frequency (7)). (The inverter cannot operate with the free V/f characteristic in the factory setting.)

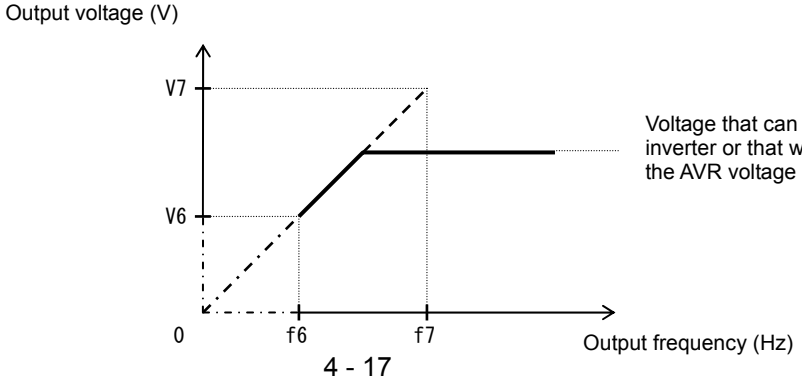
Enabling the free V/f characteristic setting function disables the torque boost selection (A041/A241), base frequency setting (A003/A203/A303), and maximum frequency setting (A004/A204/A304). (The inverter assumes the value of free-setting V/f frequency (7) as the maximum frequency.)

Item	Function code	Data	Description
Free-setting V/f frequency (7)	b112	0.to 400.(Hz) (185 to315kW) 0. to 120. (Hz) (400kW)	Setting of the output frequency at each breakpoint of the V/f characteristic curve
Free-setting V/f frequency (6)	b110	0. to free-setting V/f frequency (7) (Hz)	
Free-setting V/f frequency (5)	b108	0. to free-setting V/f frequency (6) (Hz)	
Free-setting V/f frequency (4)	b106	0. to free-setting V/f frequency (5) (Hz)	
Free-setting V/f frequency (3)	b104	0. to free-setting V/f frequency (4) (Hz)	
Free-setting V/f frequency (2)	b102	0. to free-setting V/f frequency (3) (Hz)	
Free-setting V/f frequency (1)	b100	0. to free-setting V/f frequency (2) (Hz)	
Free-setting V/f voltage (7)	b113	0.0 to 800.0(V)	Setting of the output voltage at each breakpoint of the V/f characteristic curve (*1)
Free-setting V/f voltage (6)	b111		
Free-setting V/f voltage (5)	b109		
Free-setting V/f voltage (4)	b107		
Free-setting V/f voltage (3)	b105		
Free-setting V/f voltage (2)	b103		
Free-setting V/f voltage (1)	b101		

(Example)



*1 Even if 800 V is set as a free-setting V/f voltage (1 to 7), the inverter output voltage cannot exceed the inverter input voltage or that specified by the AVR voltage select.
Carefully note that selecting an inappropriate control system (V/f characteristic) may result in overcurrent during motor acceleration or deceleration or vibration of the motor or other machine driven by the inverter.



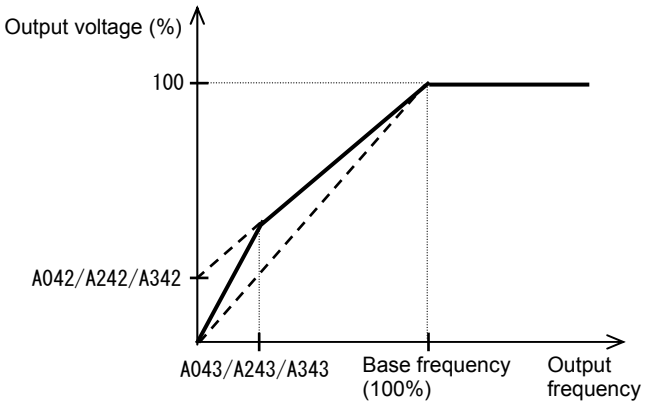
4.2.18 Torque boost setting

Related code
A041/A241: Torque boost selection, 1st/2nd motors
A042/A242/A342: Manual torque boost value, 1st/2nd3rd motors
A043/A243/A343: Manual torque boost frequency adjustment, 1st/2nd/3rd motors
H003/H203: Motor capacity, 1st/2nd motors
H004/H204: Motor poles setting, 1st/2nd motors

The torque boost setting function allows you to compensate for the voltage drop due to wiring and the primary resistance of the motor so as to improve the motor torque at low speeds.
When you select automatic torque boost by the torque boost selection (A041/A241), adjust the settings of the motor capacity selection (H003/H203) and motor pole selection (H004/H204) based on the motor to be driven.

Item	Function code	Data or range of data	Description
Torque boost selection	A041/A241	00	Manual torque boost
		01	Automatic torque boost
Manual torque boost value	A042/A242/A342	0.0 to 20.0(%)	Setting of the rate of the boost to the output voltage (100%)
Manual torque boost frequency adjustment	A043/A243/A343	0.0 to 50.0(%)	Setting of the rate of the frequency at breakpoint to the base frequency
Motor capacity	H003/H203	11.0 to 400.0(kW)	Selection of the motor capacity
Motor poles setting	H004/H204	2, 4, 6, 8, or 10 (poles)	Selection of the number of poles of the motor
Voltage compensation gain setting for automatic torque boost	A046/A246	0. to 255.	See Item (2), "Automatic torque boost."
Slippage compensation gain setting for automatic torque boost	A047/A247	0. to 255.	See Item (2), "Automatic torque boost."

(1) Automatic torque boost
The inverter outputs the voltage according to the settings of the manual torque boost (A042/A242/A342) and manual torque boost frequency adjustment (A043/A243/A343).
Use the manual torque boost value (A042/A242/A342) to specify the rate of the boost to the voltage (100%) set by the AVR voltage select.
The set rate of voltage corresponds to the boost voltage that is output when the output frequency is 0 Hz.
When increasing the value of the manual torque boost value, be careful to prevent motor over-excitation. Over-excitation may result in motor burnout.
Use the manual torque boost frequency adjustment (A043/A243/A343) to specify the rate of the frequency at each breakpoint to the base frequency (100%).
To switch the settings among the 1st, 2nd, and 3rd settings ("A041 to A043", "A241 to A243", and "A342 and A343"), assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.



(2) Automatic torque boost
When automatic torque boost (data "01") is selected by the torque boost selection (A041/A241), the inverter automatically adjusts the output frequency and voltage according to the load on the motor. (During actual operation, the automatic torque boost is usually combined with the manual torque boost.)
When you select the automatic torque boost, adjust the settings of the motor capacity selection (H003/H203) and motor pole selection (H004/H204) according to the motor to be driven.
If the inverter trips due to overcurrent during motor deceleration, set the AVR function select (A081) to always enable the AVR function (data "00").
If you cannot obtain the desired operation characteristic by using the automatic torque boost, make the following adjustments:

Symptom	Adjustment method	Adjustment item
Motor torque is insufficient at low speed. (The motor does not rotate at low speed.)	(1) Increase the voltage setting for manual torque boost step by step.	A042/A242
	(2) Increase the slippage compensation gain for automatic torque boost step by step.	A047/A247
	(3) Increase the voltage compensation gain for automatic torque boost step by step.	A046/A246
	(4) Reduce the carrier frequency setting.	b083
The motor speed falls when a load is applied to the motor.	Increase the slippage compensation gain for the automatic torque boost step by step.	A047/A247
The motor speed increases when a load is applied to the motor.	Reduce the slippage compensation gain for the automatic torque boost step by step.	A047/A247
The inverter trips due to overcurrent when a load is applied to the motor.	(1) Reduce the voltage compensation gain for the automatic torque boost step by step.	A046/A246
	(2) Reduce the slippage compensation gain for the automatic torque boost step by step.	A047/A247
	(3) Reduce the voltage setting for the manual torque boost step by step.	A042/A242

This function cannot be selection for 3rd moter setting.
Manual torque boost valid.

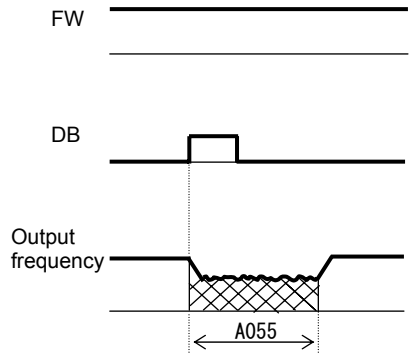
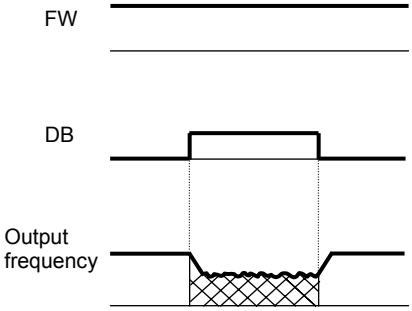
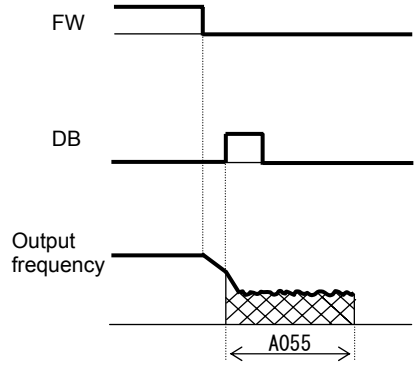
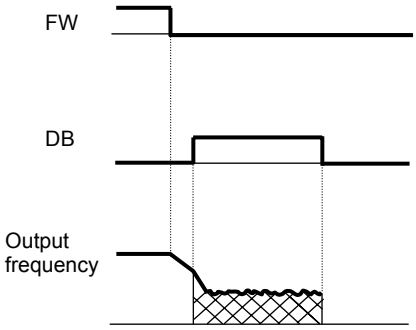
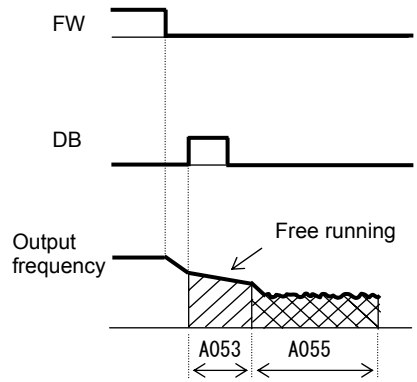
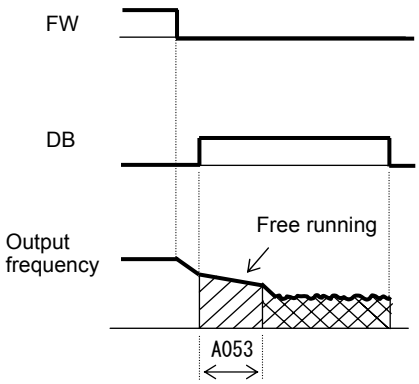
4.2.19 DC braking (DB) setting

The DC braking function allows you to apply DC braking to the motor according to the load on the motor.
You can control DC braking in two ways: the external control through signal input to intelligent input terminals and the internal control to be performed automatically when the motor is started and stopped.
Note that the motor cannot be stopped by DC braking if the load on the motor produces a large moment of inertia.

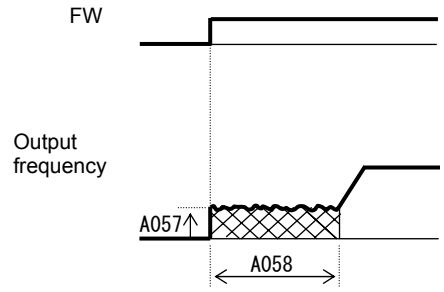
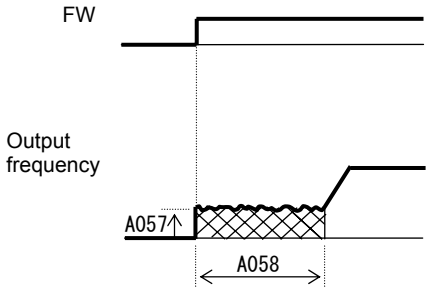
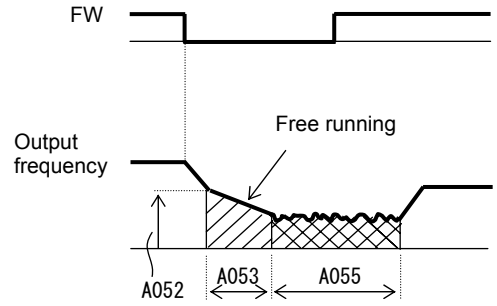
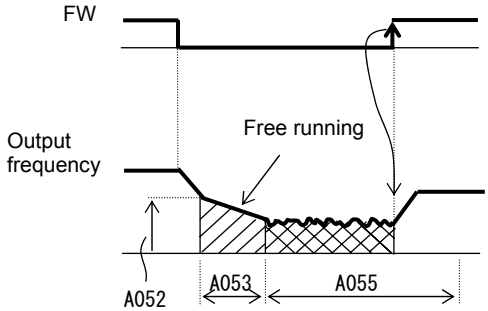
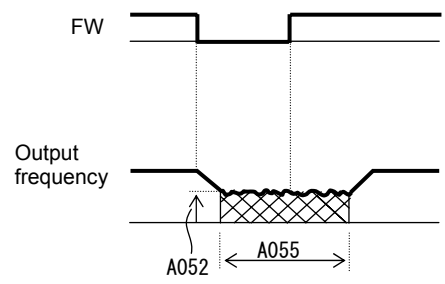
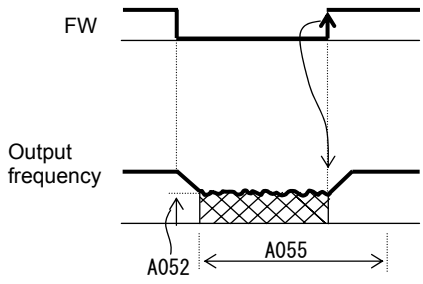
Related code
A051: DC braking enable
A052: DC braking frequency setting
A053: DC braking wait time
A054: DC braking force during deceleration
A055: DC braking time for deceleration
A056: DC braking/edge or level detection for [DB] input
A057: DC braking force for starting
A058: DC braking time for starting
A059: DC braking carrier frequency setting
C001 to C008: Terminal [1] to [8] functions

Item	Function code	Data or range of data	Description
DC braking enable	A051	00	Internal DC braking is disabled.
		01	Internal DC braking is enabled.
		02	Internal DC braking is enabled. (The braking operates only with the set braking frequency.)
DC braking frequency setting	A052	0.00 to 400.0 (Hz) (185 to315kW) 0.00 to 120. 0(Hz) (400kW)	With internal DC braking enabled, DC braking is started when the output frequency reaches the set braking frequency.
DC braking wait time	A053	0.0 to 5.0 (s)	The DC braking wait time specifies the delay in starting DC braking after the set braking time has elapsed or the DB terminal has been turned on.
DC braking force during deceleration/ DC braking force for starting	A054/A057	0. to 35. (%)	"0" specifies the smallest force (zero current); "35" specifies the largest force (35% current).
DC braking time for deceleration	A055	0.0 to 60.0 (s)	This setting is valid for the external DC braking in edge mode or for the internal DC braking.
DC braking/edge or level detection for [DB] input	A056	00	Edge mode (See examples 1-a to 6-a.)
		01	Level mode (See examples 1-b to 6-b.)
DC braking time for starting	A058	0.0 to 60.0 (s)	This setting is valid for the internal DC braking. DC braking is started when the motor-start command is input.
DC braking carrier frequency setting	A059	0.5 to 3.0 (kHz)	Unit: kHz

(1) External DC braking
Assign function "07" (DB) to terminal function (C001 to C008).
Turn the DB terminal on and off to control the direct braking, regardless of the setting of DC braking enable (A051).
Adjust the braking force by adjusting the DC braking force setting (A054).
When you set the DC braking wait time (A053), the inverter output will be shut off for the set period of delay, and the motor will run freely during the period. DC braking will be restarted after the delay.
When setting the DC braking time with function "A055" or for the DC braking operation via the DB terminal, determine the length of time in consideration of the heat generation on the motor.
Select the braking mode by the DC braking/edge or level detection for [DB] input (A056), and then make any other necessary settings suitable for your system.

(a) Edge mode (A056: 00)	(b) Level mode (A056: 01)
(Example 1-a) 	(Example 1-b) 
(Example 2-a) 	(Example 2-b) 
(Example 3-a) 	(Example 3-b) 

(2) Internal DC braking (A051: 01)
You can apply DC braking to the motor even without entering braking signals via the DB terminal when the inverter starts and stops. To use the internal DC braking function, specify "01" for the DC braking enable (A051).
Use function "A057" to set the DC braking force for starting, and use function "A058" to specify the DC braking time for starting, regardless of the braking mode selection (edge or level mode). (See examples 4-a and 4-b.)
Set the braking force for periods other than starting by using the DC braking force setting (A054).
Set the output frequency at which to start DC braking by using the DC braking frequency setting (A052).
When you set the DC braking wait time (A053), the inverter output will be shut off when the output frequency reaches the setting of "A052" after the operation command (FW signal) is turned off, and the motor will run freely for the delay time set by "A053". DC braking will be started after the delay (A053).
The internal DC braking operation to be performed when the operation command is switched from the stop command to the start command varies depending on the braking mode (edge or level mode).
Edge mode: The DC braking time setting (A055) is given priority over operation commands, and the inverter performs DC braking according to the setting of "A055". When the output frequency reaches the setting of "A052" the inverter performs DC braking for the time set for "A055". Even if the stop command is input during DC braking, DC braking continues until the time set for "A055" elapses. (See examples 5-a and 6-a.)
Level mode: Operation commands are given priority over the DC braking time setting. The inverter follows operation commands, regardless of the DC braking time setting (A055). If the start command is input during DC braking, the inverter starts the normal motor operation, regardless of the DC braking time setting (A055). (See examples 5-b and 6-b.)

<table>
<tr><th>(a) Edge mode</th><th>(b) Level mode</th></tr>
<tr><td>i) (Example 4-a) when the start command is input:
 
</td><td>i) (Example 4-b) when the start command is input:
 
</td></tr>
<tr><td>ii) (Example 5-a) when the stop command is input:
 
</td><td>ii) (Example 5-b) when the stop command is input:
 
</td></tr>
<tr><td>ii) (Example 6-a) when the stop command is input:
 
</td><td>ii) (Example 6-b) when the stop command is input:
 
</td></tr>
</table>

HITACHI INVERTER

SJ700-2 LARGE CAPACITY SERIES

INSTRUCTION MANUAL

Read through this Instruction Manual, and keep it handy for future reference.

NT2032X

HITACHI

Introduction

Thank you for purchasing the Hitachi SJ700-2 Large Capacity Series Inverter.

This Instruction Manual describes how to handle and maintain the Hitachi SJ700 Series Inverter. Read this Instruction Manual carefully before using the inverter, and then keep it handy for those who operate, maintain, and inspect the inverter.

Before and during the installation, operation, inspection, and maintenance of the inverter, always refer to this Instruction Manual to obtain the necessary related knowledge, and ensure you understand and follow all safety information, precautions, and operating and handling instructions for the correct use of the inverter.

Always use the inverter strictly within the range of the specifications described in this Instruction Manual and correctly implement maintenance and inspections to prevent faults occurring.

When using the inverter together with optional products, also read the manuals for those products. Note that this Instruction Manual and the manual for each optional product to be used should be delivered to the end user of the inverter.

Handling of this Instruction Manual

- The contents of this Instruction Manual are subject to change without prior notice.
- Even if you lose this Instruction Manual, it will not be resupplied, so please keep it carefully.
- No part of this Instruction Manual may be reproduced in any form without the publisher's permission.
- If you find any incorrect description, missing description or have a question concerning the contents of this Instruction Manual, please contact the publisher.

Revision History

No.	Revision content	Date of issue	Manual code
1	First edition	Oct. 2007	NT2032X

- The current edition of this Instruction Manual also includes some corrections of simple misprints, missing letters, misdescriptions and certain added explanations other than those listed in the above Revision History table.

Safety Instructions

Be sure to read this Instruction Manual and appended documents thoroughly before installing, operating, maintaining, or inspecting the inverter.
In this Instruction Manual, safety instructions are classified into two levels, namely WARNING and CAUTION.

WARNING : Indicates that incorrect handling may cause hazardous situations, which may result in serious personal injury or death.

CAUTION : Indicates that incorrect handling may cause hazardous situations, which may result in moderate or slight personal injury or physical damage alone.

Note that even a CAUTION level situation may lead to a serious consequence according to circumstances. Be sure to follow every safety instruction, which contains important safety information. Also focus on and observe the items and instructions described under "Notes" in the text.

! CAUTION

Many of the drawings in this Instruction Manual show the inverter with covers and/or parts blocking your view being removed.
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 Instruction Manual when operating the inverter.

1. Installation

! CAUTION

- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its top cover. Otherwise, you run the risk of injury by dropping the inverter.
- Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter. Otherwise, you run the risk of fire.
- Install the inverter on a structure able to bear the weight specified in this Instruction Manual. Otherwise, you run the risk of injury due to the inverter falling.
- Install the inverter on a vertical wall that is free of vibrations. Otherwise, you run the risk of injury due to the inverter falling.
- Do not install and operate the inverter if it is damaged or its parts are missing. Otherwise, you run the risk of injury.
- 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, or salt water. Otherwise, you run the risk of fire.
- The inverter is precision equipment. Do not allow it to fall or be subject to high impacts, step on it, or place a heavy load on it. Doing so may cause the inverter to fail.

2. Wiring

! WARNING

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- Do not remove rubber bushings from the wiring section. Otherwise, the edges of the wiring cover may damage the wire, resulting in a short circuit or ground fault.

! CAUTION

- Make sure that the voltage of AC power supply matches the rated voltage of your inverter. Otherwise, you run the risk of injury or fire.
- Do not input single-phase power into the inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U, V, and W). Otherwise, you run the risk of injury or fire.
- Do not connect a resistor directly to any of the DC terminals (PD, P, and N). Otherwise, you run the risk of fire.
- Connect an earth-leakage breaker to the power input circuit. Otherwise, you run the risk of fire.
- Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings). Otherwise, you run the risk of fire.
- Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
- Tighten each screw to the specified torque. No screws must be left loose. Otherwise, you run the risk of fire.
- Before operating, slide switch SW1 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Since the inverter supports two modes of cooling-fan operation, the inverter power is not always off, even when the cooling fan is stopped. Therefore, be sure to confirm that the power supply is off before wiring. Otherwise, you run the risk of electric shock and injury.
- Don’t use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

3. Operation

! WARNING

- While power is supplied to the inverter, do not touch any terminal or internal part of the inverter, check signals, or connect or disconnect any wire or connector. Otherwise, you run the risk of electric shock or fire.
- 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. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. 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.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation 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 control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- The [STOP] key is effective only when its function is enabled by setting. Prepare an emergency stop switch separately. Otherwise, you run the risk of injury.
- If an operation command has been input to the inverter before the inverter enters alarm status, the inverter will restart suddenly when the alarm status is reset. Before resetting the alarm status, make sure that no operation command has been input.
- While power is supplied to the inverter, do not touch any internal part of the inverter or insert a bar in it. Otherwise, you run the risk of electric shock or fire.

! CAUTION

- Do not touch the heat sink, which heats up during the inverter operation. Otherwise, you run the risk of burn injury.
- The inverter allows you to easily control the speed of motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. Otherwise, you run the risk of injury.
- Install an external brake system if needed. Otherwise, you run the risk of injury.
- When using the inverter to operate a standard motor at a frequency of over 60 Hz, 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. Otherwise, you run the risk of damage to the motor and machine.
- During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations. Otherwise, you run the risk of damage to the machine driven by the motor.

4. Maintenance, inspection, and parts replacement

! WARNING

- Before inspecting the inverter, be sure to turn off the power supply and wait for 10 minutes or more. Otherwise, you run the risk of electric shock.
  (Before inspection, confirm that the Charge lamp on the inverter is off and the DC voltage between terminals P and N is 45 V or less.)
- Commit only a designated person to maintenance, inspection, and the replacement of parts.
  (Be sure to remove wristwatches and metal accessories, e.g., bracelets, before maintenance and inspection work and to use insulated tools for the work.)
  Otherwise, you run the risk of electric shock and injury.

5. Others

! WARNING

- Never modify the inverter. Otherwise, you run the risk of electric shock and injury.

! CAUTION

- Do not discard the inverter with household waste. Contact an industrial waste management company in your area who can treat industrial waste without polluting the environment.

Precautions Concerning Electromagnetic Compatibility (EMC)

The SJ700 series inverter conforms to the requirements of Electromagnetic Compatibility (EMC) Directive (2004/108/EC). However, when using the inverter in Europe, you must comply with the following specifications and requirements to meet the EMC Directive and other standards in Europe:

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

1. Power supply requirements
   a. Voltage fluctuation must be -15% to +10% or less.
   b. Voltage imbalance must be ±3% or less.
   c. Frequency variation must be ±4% or less.
   d. Total harmonic distortion (THD) of voltage must be ±10% or less.
2. Installation requirement
   a. A special filter and a ferrite core intended for the SJ700 large capacity series inverter must be installed, showen in the table (Table 1) below.
   b. A provided direct reactor with the SJ700 large capacity series inverter must be installed.

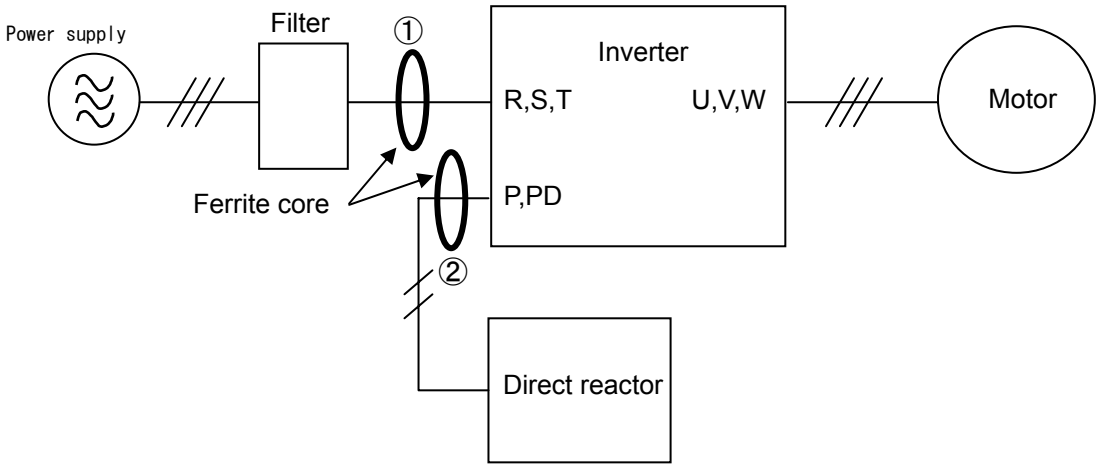


Table1

Model	Category:C2			Category:C3		
	Filter	Ferrite core ①	Ferrite core ②	Filter	Ferrite core ①	Ferrite core ②
SJ700-1850HF2/HFE2/HFU2	✓	✓	×	×	×	×
SJ700-3150HF2/HFE2/HFU2	✓	×	×	×	×	×
SJ700-4000HF2/HFE2/HFU2	✓	✓	×	×	×	×

✓ : Installation
× : No Installation

3. Wiring requirements
   a. Shielded wire (screened cable) is required for motor wiring but is not required for the direct reactor wiring. And the length of the cable must be according to the following table (Table 2).
   b. The carrier frequency setting must be less than 3 kHz (derating is required) to meet an EMC requirement.
   c. The main circuit wiring must be separated from the control circuit wiring.
4. Environmental requirements (to be met when a filter is used)
   a. Ambient temperature must be within the range -10°C to +40°C.
   b. Relative humidity must be within the range 20% to 90% (non-condensing).
   c. Vibrations must be 1.96 m/sec^2 (0.2 G) 10 – 55Hz.
   d. The inverter must be installed indoors (not exposed to corrosive gases and dust) at an altitude of 1,000 m or less.

Table2

model	Motor cable length(m)	Direct reactor cable length(m)
SJ700-1850HF2/HFE2/HFU2	5	5
SJ700-3150HF2/HFE2/HFU2	10	5
SJ700-4000HF2/HFE2/HFU2	10	5

Precautions Concerning Compliance with UL and CUL Standards

Model No.	UL Standards	CUL Standards
SJ700-1850HF2/HFE2/HFU2	UL508C	-
SJ700-3150HF2/HFE2/HFU2	UL508C	CSA C22.2 No. 14-05
SJ700-4000HF2/HFE2/HFU2	UL508C	CSA C22.2 No. 14-05

Warning Markings
GENERAL:

These devices are open type AC Inverters with three phase input and three phase output. They are intended to be used in an enclosure. They are used to provide both an adjustable voltage and adjustable frequency to the ac motor. The inverter automatically maintains the required volts-Hz ration allowing the capability through the motor speed range.

1. Only 75C CU or equivalent wires must be used for wiring.
2. Inverter models with the suffix "H" (400 V class models) are suited to circuits that transmit current not exceeding 100k rms symmetrical amperes and with voltage of no more than 480 V.
3. The inverter must be installed in an environment that is rated for at least Pollution Degree 2 or equivalent.
4. The surrounding air temperature must not exceed 50°C.
5. The capacitor discharge time is 10 minutes or more. (Caution: Care must be taken to avoid the risk of electric shock.)
6. Each model of the inverter has a solid-state overload protection circuit or an equivalent feature for the motor.
7. Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.
8. The table below lists the tightening torque and wire range specifications for the field wiring of inverter terminals.

Model No.	Required torque (N-m)	Wire range (kcmil) [mm^2]	
		Input / Output lines R(L1),S(L2),T(L3) / U(T1),V(T2),W(T3)	DC bus lines PD(+1),P(+),N(-)
SJ700-1850HF2/HFE2/HFU2	75	250 [127] (parallel)	300 [152] (parallel)
SJ700-3150HF2/HFE2/HFU2	44	400 [203] (parallel)	500 [253] (parallel)
SJ700-4000HF2/HFE2/HFU2	52	600 [304] (parallel)	800 [405] (parallel)

9. This Instruction Manual indicates the sizes of the distribution fuse and circuit breaker that must be connected to this inverter. The following table lists the inverse time and current ratings of the circuit breakers (with rated voltage of 600 V) to be connected to the individual inverter models:

Model No.	Fuse/circuit breaker (A)	
	Type	Rating
SJ700-1850HF2/HFE2/HFU2	Inverse time	400 A
SJ700-3150HF2/HFE2/HFU2	Inverse time	700 A
SJ700-4000HF2/HFE2/HFU2	Inverse time	1000 A

10. Field wiring of the inverter must incorporate UL-listed, CSA-certified closed-loop terminal connectors that match the wire gauge in terms of size. The crimping tool specified by the connector manufacturer must be used to secure each connector.

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Chapter 2 Installation and Wiring

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Chapter 4 Explanation of Functions

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Appendix

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Chapter 1 Overview

This chapter describes the inspection of the purchased product, the product warranty, and the names of parts.

Chapter 1 Overview

(Memo)

1.1 Inspection of the Purchased Product

1.1.1 Inspecting the product

After unpacking, inspect the product as described below.
If you find the product to be abnormal or defective, contact your supplier or local Hitachi Distributor.

(1) Check the product for damage (including falling of parts and dents in the inverter body) caused during transportation.
(2) Check that the product package contains an inverter set, a DCL set and this Instruction Manual.
(3) Check the specification label to confirm that the product is the one you ordered.

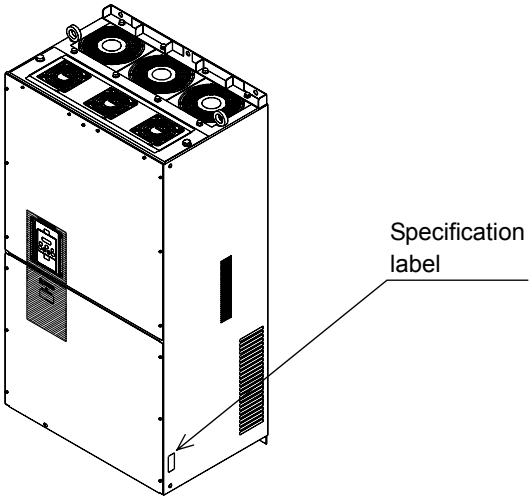


Figure 1-1-a Location of the specifications label on Inverter

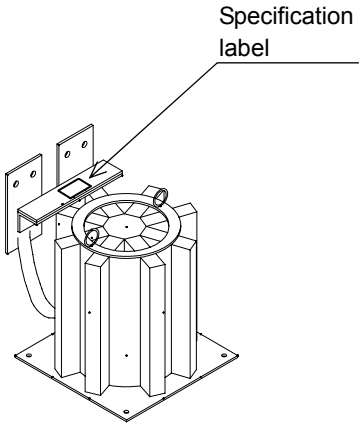


Figure 1-1-b Location of the specifications label on DCL

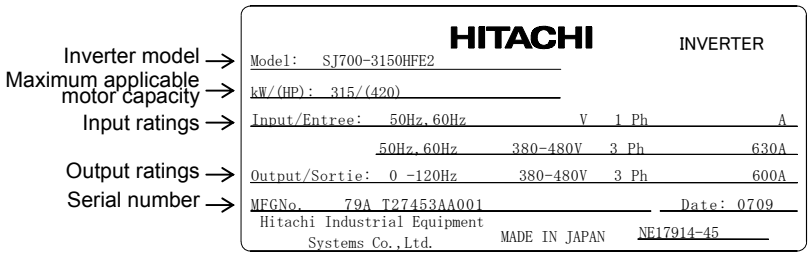


Figure 1-2-a Contents of the specifications label on Inverter

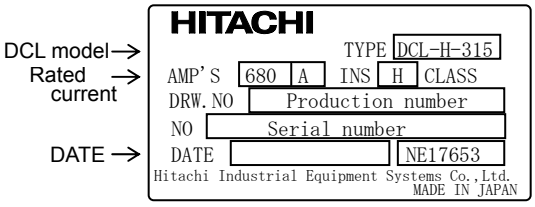


Figure 1-2-b Contents of the specifications label on DCL

1.1.2 Instruction manual (this manual)

This Instruction Manual describes how to operate the Hitachi SJ700-2 Large Capacity Series Inverter. Read this Instruction Manual thoroughly before using the inverter, and then keep it handy for future reference.
When using the inverter, together with optional products for the inverter, also refer to the manuals supplied with the optional products.
Note that this Instruction Manual and the manual for each optional product to be used should be delivered to the end user of the inverter.

1.2 Method of Inquiry and Product Warranty

1.2.1 Method of inquiry

For an inquiry about product damage or faults or a question about the product, notify your supplier of the following information:

(1) Model of your inverter
(2) Serial number (MFG No.)
(3) Date of purchase
(4) Content of inquiry
- Location and condition of damage
- Content of your question

1.2.2 Product warranty

The product will be warranted for one year after the date of purchase.
Even within the warranty period, repair of a product fault will not be covered by the warranty (but the repair will be at your own cost) in the following cases.

(1) the fault has resulted from incorrect usage not conforming to the instructions given in this Instruction Manual or the repair or modification of the product carried out by an unqualified person,
(2) the fault has resulted from a cause not attributable to the delivered product,
(3) the fault has resulted from use beyond the limits of the product specifications, or
(4) the fault has resulted from disaster or other unavoidable events.

The warranty will only apply to the delivered inverter and excludes all damage to other equipment and facilities induced by any fault of the inverter.
The warranty is effective only in Japan.

Repair at the user's charge
Following the one-year warranty period, any examination and repair of the product will be accepted at your charge. Even during the warranty period, examination and repairs of faults, subject to the above scope of the warranty disclaimer, will be available at charge.
To request a repair at your charge, contact your supplier or local Hitachi Distributor.
The Hitachi Distributors are listed on the back cover of this Instruction Manual.

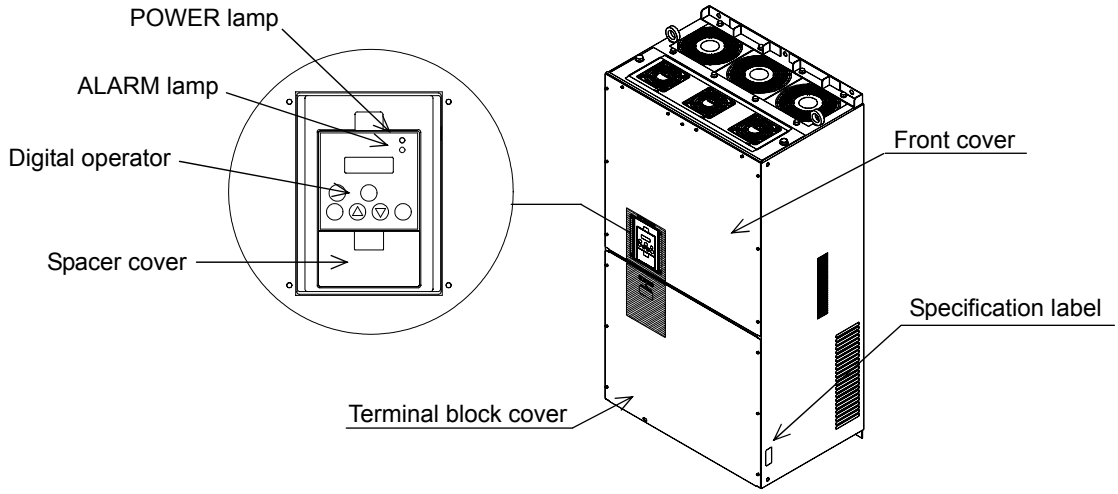
1.2.3 Warranty Terms

The warranty period under normal installation and handling conditions shall be two (2) years from the date of manufacture (“DATE” on product nameplate), or one (1) year from the date of installation, whichever occurs first. The warranty shall cover the repair or replacement, at Hitachi’s sole discretion, of ONLY the inverter that was installed.

(1) Service in the following cases, even within the warranty period, shall be charged to the purchaser:
   a. Malfunction or damage caused by mis-operation or modification or improper repair
   b. Malfunction or damage caused by a drop after purchase and transportation
   c. Malfunction or damage caused by fire, earthquake, flood, lightening, abnormal input voltage, contamination, or other natural disasters
(2) When service is required for the product at your work site, all expenses associated with field repair shall be charged to the purchaser.
(3) Always keep this manual handy; please do not loose it. Please contact your Hitachi distributor to purchase replacement or additional manuals.

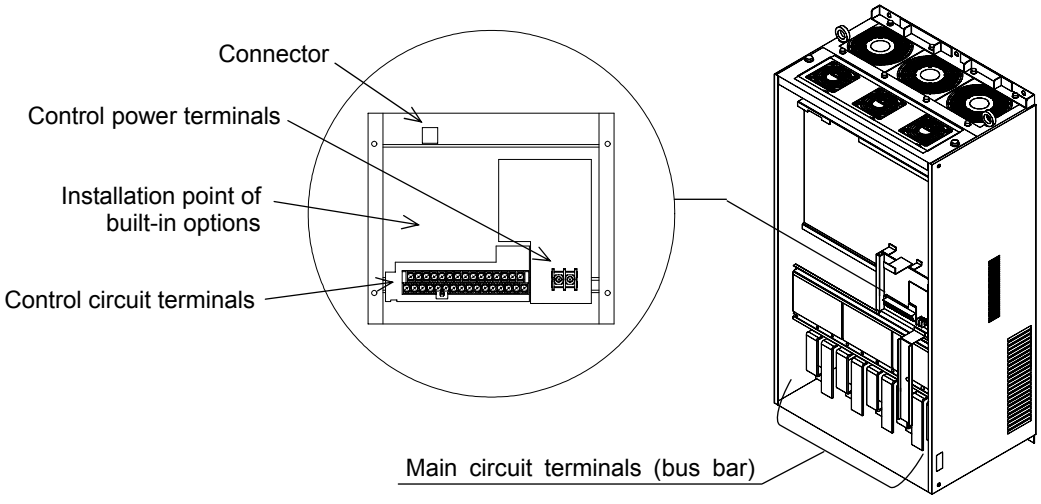
1.3 Exterior Views and Names of Parts

The figure below shows an exterior view of the inverter (model SJ700-3150HFE2).



Exterior view of shipped inverter

For the wiring of the main circuit and control circuit terminals, open the terminal block cover.
For mounting optional circuit boards, open the front cover.



Exterior view of inverter with front and terminal block covers removed

(Memo)

Chapter 2 Installation and Wiring

This chapter describes how to install the inverter and the wiring of main circuit and control signal terminals with typical examples of wiring.

Chapter 2 Installation and Wiring

(Memo)

2.1 Installation

! CAUTION

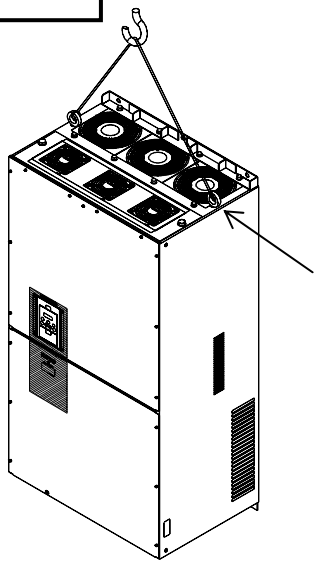
- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its top cover. Otherwise, you run the risk of injury by dropping the inverter.
- Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter. Otherwise, you run the risk of fire.
- Install the inverter on a structure able to bear the weight specified in this Instruction Manual. Otherwise, you run the risk of injury due to the inverter falling.
- Install the inverter on a vertical wall that is free of vibrations. Otherwise, you run the risk of injury due to the inverter falling.
- Do not install and operate the inverter if it is damaged or its parts are missing. Otherwise, you run the risk of injury.
- 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, or salt water. Otherwise, you run the risk of fire.
- The inverter is precision equipment. Do not allow it to fall or be subject to high impacts, step on it, or place a heavy load on it. Doing so may cause the inverter to fail.

2.1.1 Precautions for installation

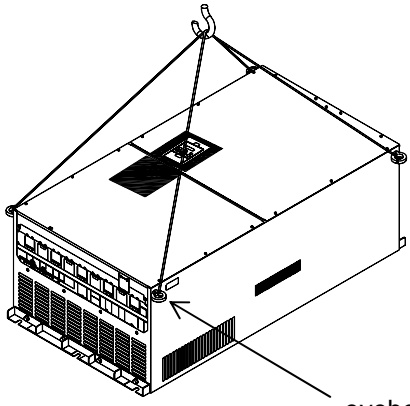
(1) Transportation

The SJ700-2 large capacity series inverter is very heavy (e.g., 315kW inverter weighs about 210kg). Therefore, treat it with enough care when it is transported. When it is lifted, use the provided eyebolts. There are two lifting methods as described below. Use either one depending on the purpose.

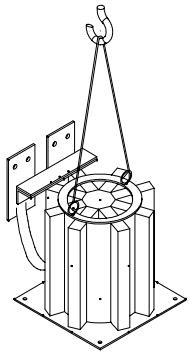
! WARNING



In case of attaching the eyebolts at the top of the inverter



In case of attaching the eyebolts at the right and left sides of the inverter

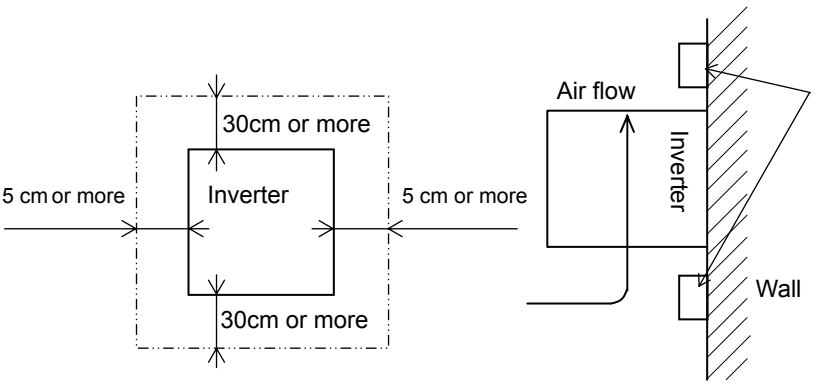


In case of lifting the DCL

(2) 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. In particular, keep sufficient distance between the inverter and other heat sources (e.g., braking resistors and reactors) if they are installed in the vicinity.



(3) Ambient temperature

Avoid installing the inverter in a place where the ambient temperature goes above or below the allowable range (-10°C to +50°C), as defined by the standard inverter specification.

Measure the temperature in a position about 5 cm distant 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).

(4) 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.

Avoid a place where the inverter is subject to condensation.

Condensation inside the inverter will result in short circuits and malfunctioning of electronic parts. Also avoid places where the inverter is exposed to direct sunlight.

(5) Ambient air

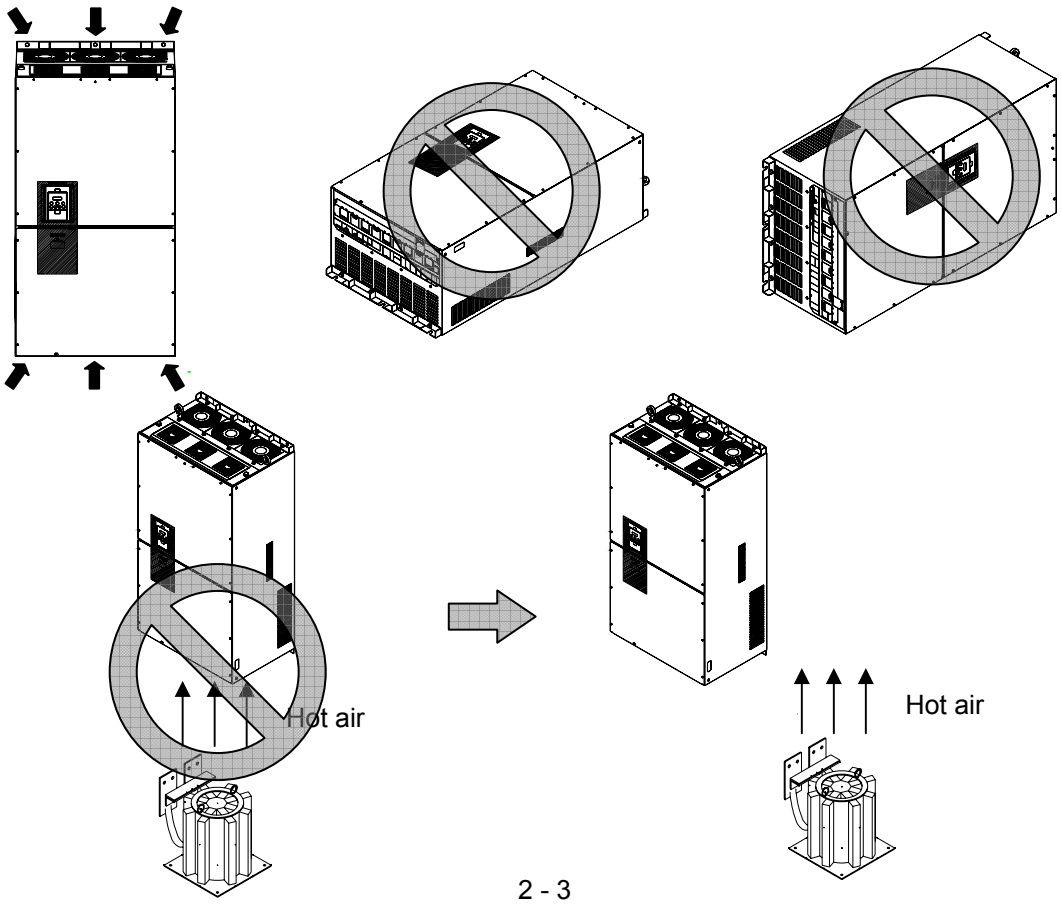
Avoid installing the inverter in a place where the inverter is subject to dust, corrosive gases, combustible gases, flammable gases, grinding fluid mist, or salt water.

Foreign particles or dust entering the inverter will cause it to fail. If you use the inverter in a considerably dusty environment, install the inverter inside a totally enclosed panel.

(6) Installation method and position

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

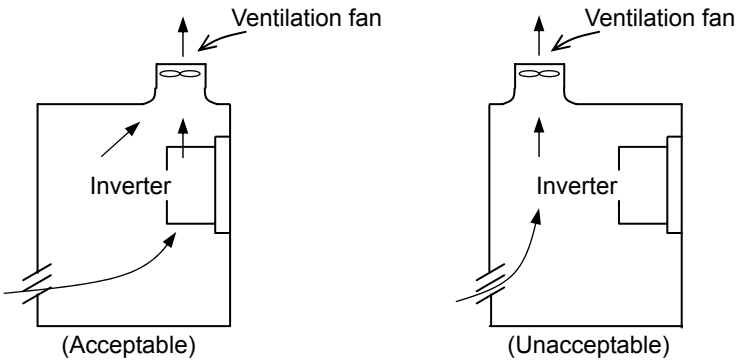
If the inverter is not installed vertically, its cooling performance may be degraded and tripping or inverter damage may result.



(7) 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. Plan the layout so that the inverter ambient temperature will remain within the allowable range.



Position of ventilation fan

(8) Reduction of enclosure size

If you mount the inverter inside an enclosure such that the heat sink of the inverter is positioned outside the enclosure, the amount of heat produced inside the enclosure can be reduced and likewise the size of the enclosure.

Mounting the inverter in an enclosure with the heat sink positioned outside requires an optional dedicated special metal fitting.

To mount the inverter in an enclosure with the heat sink positioned outside, cut out the enclosure panel according to the specified cutting dimensions.

The cooling section (including the heat sink) positioned outside the enclosure has a cooling fan. Therefore, do not place the enclosure in any environment where it is exposed to waterdrops, oil mist, or dust.

(9) Approximate loss by inverter capacity

Inverter capacity (kW)	185	315	400
Loss with 70% load (W)	4.7	8.0	10.5
Loss with 100% load (W)	6.7	11.5	15.0
Efficiency at rated output (%)	96.5	96.2	96.3

(10) Approximate loss by DCL capacity

DCL capacity (kW)	185	315	400
Loss with 70% load (W)	0.1	0.1	0.1
Loss with 100% load (W)	0.2	0.2	0.2
Efficiency at rated output (%)	99.9	99.9	99.9

2.2 Wiring

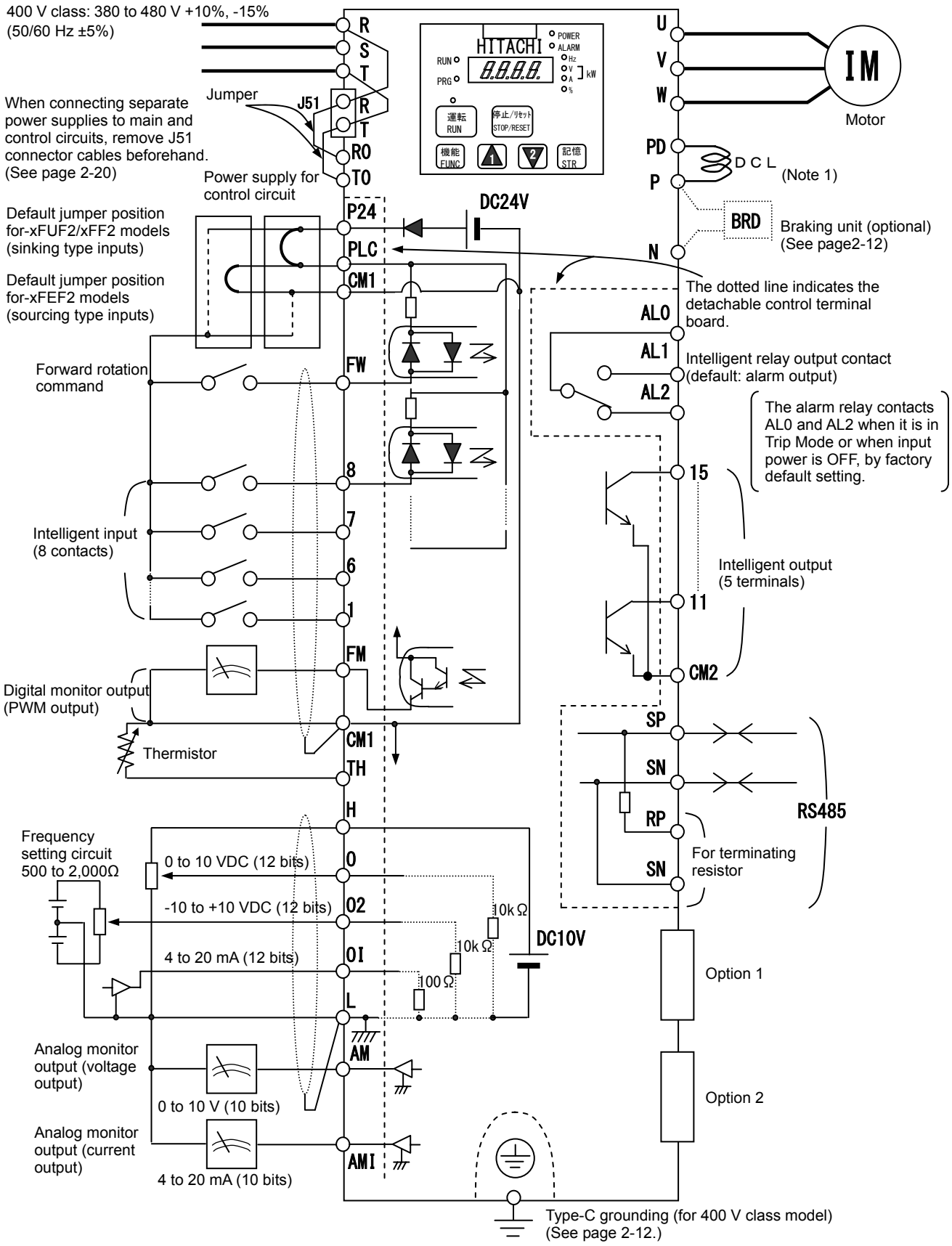
WARNING

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- Do not remove rubber bushings from the wiring section. Otherwise, the edges of the wiring cover may damage the wire, resulting in a short circuit or ground fault.

CAUTION

- Make sure that the voltage of AC power supply matches the rated voltage of your inverter. Otherwise, you run the risk of injury or fire.
- Do not input single-phase power into the inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U, V, and W). Otherwise, you run the risk of injury or fire.
- Do not connect a resistor directly to any of the DC terminals (PD, P, and N). Otherwise, you run the risk of fire.
- Connect an earth-leakage breaker to the power input(R,S,T) circuit. Otherwise, you run the risk of fire.
- Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings). Otherwise, you run the risk of fire.
- Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
- Tighten each screw to the specified torque. No screws must be left loose. Otherwise, you run the risk of fire.
- Before operating, slide switch SW1 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Since the inverter supports two modes of cooling-fan operation, the inverter power is not always off, even when the cooling fan is stopped. Therefore, be sure to confirm that the power supply is off before wiring. Otherwise, you run the risk of electric shock and injury.
- Don’t use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

2.2.1 Terminal connection diagram and explanation of terminals and switch settings



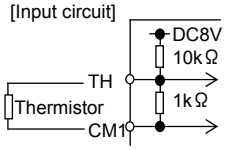
Note 1) Be sure to connect accessory DCL.

(1) Explanation of main circuit terminals

Symbol	Terminal name	Description
R, S, T (L1, L2, L3)	Main power input	Connect to the AC power supply. Leave these terminals unconnected when using a regenerative converter (HS900 series).
U, V, W (T1, T2, T3)	Inverter output	Connect a 3-phase motor.
PD, P (+1, +)	DC reactor connection	Remove the jumper from terminals PD and P, and connect the optional power factor reactor (DCL).
P, N (+, -)	Regenerative braking unit connection	Connect the optional regenerative braking unit (BRD).
⏚G	Inverter ground	Connect to ground for grounding the inverter chassis by type-C grounding (for 400 V class models).

(2) Explanation of control circuit terminals

			Symbol	Terminal name	Description	Electric property
Analog	Power supply		L	Analog power supply (common)	This common terminal supplies power to frequency command terminals (O, O2, and OI) and analog output terminals (AM and AMI). Do not ground this terminal.	
			H	Frequency setting power supply	This terminal supplies 10 VDC power to the O, O2, OI terminals.	Allowable load current: 20 mA or less
	Frequency setting input		O	Frequency command (voltage)	Input a voltage (0 to 10 VDC) as a frequency command. 10 V specifies the maximum frequency. To specify the maximum frequency with a voltage of 10 V or less, set the voltage using function "A014".	Input impedance: 10kΩ Allowable input voltages: -0.3 to +12 VDC
			O2	Auxiliary frequency command (voltage)	Input a voltage (0 to ±10 VDC) as a signal to be added to the frequency command input from the O or OI terminal. You can input an independent frequency command from this terminal (O2 terminal) alone by changing the setting.	Input impedance: 10kΩ Allowable input voltages: 0 to ±12 VDC
			OI	Frequency command (current)	Input a current (4 to 20 mA DC) as a frequency command. 20 mA specifies the maximum frequency. The OI signal is valid only when the AT signal is on. Assign the AT function to an intelligent input terminal.	Input impedance: 10kΩ Maximum allowable current: 24 mA
	Monitor output		AM	Analog monitor (voltage)	This terminal outputs one of the selected "0 to 10 VDC voltage output" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (signed or unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, and general output.	Maximum allowable current: 2 mA
			AMI	Analog monitor (current)	This terminal outputs one of the selected "4 to 20 mA DC current output" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, and general output.	Allowable load impedance: 250Ω or less
Digital (contact)	Monitor output		FM	Digital monitor (voltage)	This terminal outputs one of the selected "0 to 10 VDC voltage output (PWM output mode)" monitoring items. The monitoring items available for selection include output frequency, output current, output torque (unsigned), output voltage, input power, electronic thermal overload, LAD frequency, motor temperature, heat sink temperature, general output, digital output frequency, and digital current monitor. For the items "digital output frequency" and "digital current monitor," this terminal outputs a digital pulse signal at 0/10 VDC with a duty ratio of 50%.	Maximum allowable current: 1.2 mA Maximum frequency: 3.6 kHz
	Power supply		P24	Interface power supply	This terminal supplies 24 VDC power for contact input signals. If the source logic is selected, this terminal is used as a common contact input terminal.	Maximum allowable output current: 100 mA
			CM1	Interface power supply (common)	This common terminal supplies power to the interface power supply (P24), thermistor input (TH), and digital monitor (FM) terminals. If the sink logic is selected, this terminal is used as a common contact input terminal. Do not ground this terminal.	
	Contact input	Operation command	FW	Forward rotation command	Turn on this FW signal to start the forward rotation of the motor; turn it off to stop forward rotation after deceleration.	[Conditions for turning contact input on] Voltage across input and PLC: 18 VDC or more Input impedance between input and PLC: 4.7kΩ Maximum allowable voltage across input and PLC: 27 VDC Load current with 27 VDC power: about 5.6 mA
		Function selection and logic switching	1 2 3 4 5 6 7 8	Intelligent input	Select eight of a total 60 functions, and assign these eight functions to terminals 1 to 8. Note: If the emergency stop function is used, terminals 1 and 3 are used exclusively for the function. For details, see Item (3), "Emergency stop function" (on page 2-8).	

			Symbol	Terminal name	Description	Electric property
Digital (contact)	Contact input	Function selection and logic switching	PLC	Intelligent input (common)	To switch the control logic between sink logic and source logic, change the jumper connection of this (PLC) terminal to another terminal on the control circuit terminal block. Jumper terminals P24 and PLC for the sink logic; jumper terminals CM1 and PLC for the sink logic. To use an external power supply to drive the contact inputs, remove the jumper, and connect the PLC terminal to the external interface circuit.	
	Open collector output	Status and factor	11 12 13 14 15	Intelligent output	Select five of a total 51 functions, and assign these five functions to terminals 11 to 15. If you have selected an alarm code using the function "C062", terminals 11 to 13 or 11 to 14 are used exclusively for the output of cause code for alarm (e.g., inverter trip). The control logic between each of these terminals and the CM2 terminal always follows the sink or source logic.	Voltage drop between each terminal and CM2 when output signal is on: 4 V or less Maximum allowable voltage: 27 VDC Maximum allowable current: 50 mA
			CM2	Intelligent output (common)	This terminal serves as the common terminal for intelligent output terminals [11] to [15].	
	Relay contact output	Status and alarm	AL0 AL1 AL2	Intelligent relay output	Select functions from the 43 available, and assign the selected functions to these terminals, which serve as C contact output terminals. In the initial setting, these terminals output an alarm indicating that the inverter protection function has operated to stop inverter output.	(Maximum contact capacity) AL1-AL0: 250 VAC, 2 A (resistance) or 0.2 A (inductive load) AL2-AL0: 250 VAC, 1 A (resistance) or 0.2 A (inductive load) (Minimum contact capacity) 100 VAC, 10 mA 5 VDC, 100 mA
Analog	Analog input	Sensor	TH	External thermistor input	Connect to an external thermistor to make the inverter trip if an abnormal temperature is detected. The CM1 terminal serves as the common terminal for this terminal. [Recommended thermistor properties] Allowable rated power: 100 mW or more Impedance at temperature error: 3kΩ The impedance to detect temperature errors can be adjusted within the range 0Ω to 9,999Ω.	Allowable range of input voltages 0 to 8 VDC [Input circuit] 

(3) Explanation of switch settings

The internal slide switch (SW1) is used to enable or disable the emergency stop function (the function is disabled by factory setting).

* For the location of the slide switch, see page 2-10.

About the emergency stop function (disabled by the factory setting)

- The emergency stop function shuts off the inverter output (i.e. stops the switching operation of the main circuit elements) in response to a command from a hardware circuit via an intelligent input terminal without the operation by internal CPU software.

Note: The emergency stop function does not electrically shut off the inverter but merely stops the switching operation of the main circuit elements. Therefore, do not touch any terminals of the inverter or any power lines, e.g., motor cables. Otherwise, electric shock, injury, or ground fault may result.

- When the emergency stop function is enabled, intelligent input terminals 1 and 3 are used exclusively for this function, and no other functions can be assigned to these terminals. Even if other functions have been assigned to these terminals, these are automatically disabled and these terminals are used exclusively for the emergency stop function.

  Terminal [1] function:

  This terminal always serves as the a (NO) contact for the reset (RS) signal.

  This signal resets the inverter and releases the inverter from the trip due to emergency stop (E37.*).

  Terminal [3] function:

  This terminal always serves as the b (NC) contact for the emergency stop (EMR) signal.

  This signal shuts off the inverter output without the operation by internal CPU software.

  This signal makes the inverter trip due to emergency stop (E37.*).

Note: If intelligent input terminal 3 is left unconnected, the cable connected to the terminal is disconnected, or the signal logic is improper, the inverter trips due to emergency stop (E37.*). If this occurs, check and correct the wiring and signal logic, and then input the reset (RS) signal.

Only the reset (RS) signal input from intelligent input terminal [1] can release the inverter from tripping due to emergency stop (E37.*). (The inverter cannot be released from the E37.* status by any operation from the digital operator.)

- To enable the emergency stop function, set the slide lever of slide switch SW1 to ON. (With the factory setting, slide switch SW1 is set to OFF to disable the function.)

Note: Before operating slide switch SW1, make sure that the input power supply is off.

Setting of slide switch setting and function selection for intelligent input terminals [1] and [3]								
Setting of slide switch SW1	Intelligent input terminal [1]				Intelligent input terminal [3]			
	Terminal [1] function [C001]		a/b (NO/NC) selection [C011] (*1)		Terminal [3] function [C003]		a/b (NO/NC) selection [C013] (*1) (*2)	
SW1 is OFF. Emergency stop disabled (factory setting)	Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)	
	Factory setting	18 (RS)	Factory setting	00 (NO)	Factory setting	06 (JG)	Factory setting	00 (NO)
SW1 is ON. Emergency stop enabled (*5)	Automatic assignment of functions to intelligent input terminals [1] and [3] and the terminal to which function "18 (RS)" has been assigned (*3)							
	Fixed function (cannot be changed)	18 (RS)	Fixed function (cannot be changed)	00 (NO)	Fixed function (cannot be changed)	64 (EMR)	Fixed function (cannot be changed)	01 (NC)
SW1 is ON (after setting to OFF once). Emergency stop disabled (*3) (*5)	Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)		Selectable arbitrarily (*4)	
	Setting made when SW1 is set ON retained	18 (RS)	Setting made when SW1 is set ON retained	00 (NO)	Released from emergency stop function	no (No function assigned)	Setting made when SW1 is set ON retained	01 (NC)

*1 When function "18 (RS)" is assigned to the input terminal, "a/b (NO/NC)" selection is always "00 (NO)".

*2 When terminal setting "C003" is "64 (EMR)", terminal setting "C013" is always "01 (NC)".

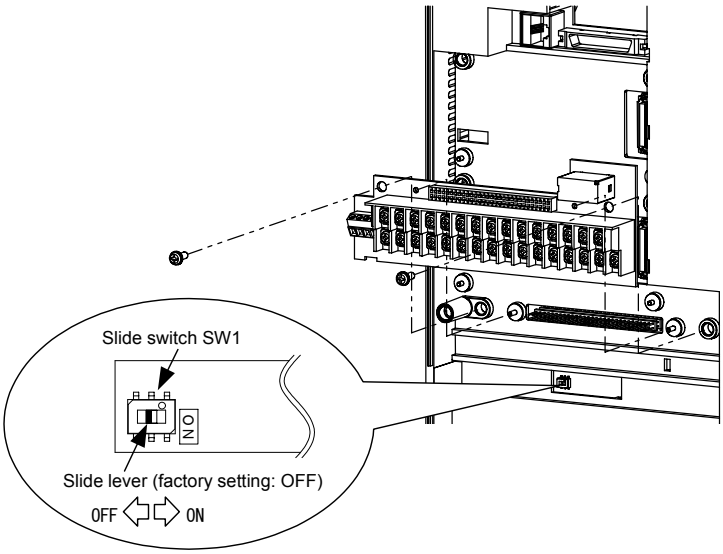
*3 If function "18 (RS)" has been assigned to an intelligent input terminal other than intelligent input terminals [1] and [3] before slide switch SW1 is set to ON, the input terminal setting for said terminal is automatically changed to "no (no function assigned)" when slide switch SW1 is set to ON to prevent any duplication of terminal functions. Even if slide switch SW1 is subsequently returned to OFF, the original function setting for said terminal will not be restored. If necessary, the original function will have to be re-assigned to said terminal.

Example: If slide switch SW1 is set to ON when function "18 (RS)" has been assigned to input terminal 2 (by terminal setting "C002"), terminal setting "C002" is changed to "no (no function assigned)," and function "18 (RS)" is assigned to input terminal 1 (by terminal setting "C001").

Even if slide switch SW1 is subsequently returned to OFF, terminal [2] function "C002" and terminal [1] function "C001" will remain as "no (no function assigned)" and "18 (RS)," respectively.

*4 Function "64 (EMR)" cannot be assigned to input terminal 3 by an operation from the digital operator. The function is automatically assigned to the terminal when slide switch SW1 is set to ON.

*5 After slide switch SW1 has been set to ON once, function assignments to intelligent input terminals [1] and [3] are not returned to their original assignments. If necessary, re-assign original functions to the intelligent input terminals.



Note: If the data of an optional operator (SRW or SRW-EX) is copied:
If operator data is copied to your SJ700 series inverter whose slide switch SW1 is ON from another SJ700 series inverter whose slide switch SW1 is OFF or an SJ300 series inverter, the digital operator on your SJ700 series inverter may display [R-ERROR COPY ROM] for a moment. This event may occur because the data on intelligent input terminals [1] and [3] cannot be copied since, on your inverter, exclusive functions have already been assigned to intelligent input terminals [1] and [3] due to the slide switch SW1 setting to ON. Note that other data is copied. If this event occurs, check the settings on both copy-source and copy-destination inverters.

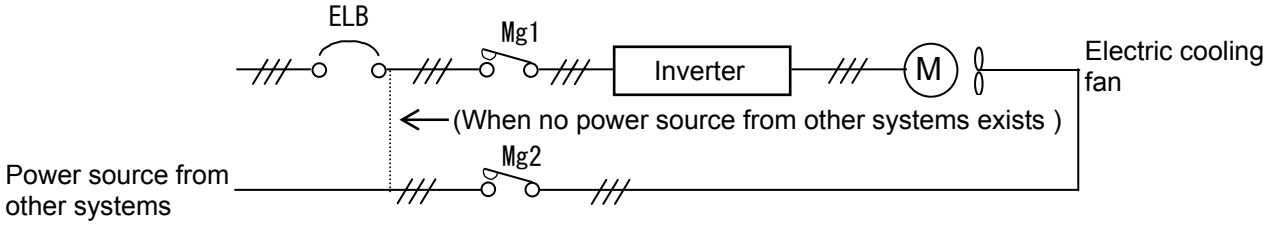
2.2.2 Wiring of the main circuit

(1) Wiring instructions

- Before wiring, be sure to confirm that the Charge lamp on the inverter is off.
  When the inverter power has been turned on once, a dangerous high voltage remains in the internal capacitors for some time after power-off, regardless of whether the inverter has been operated.
  When rewiring after power-off, always wait 10 minutes or more after power-off, and check with a multimeter that the residual voltage across terminals P and N is zero to ensure safety during rewiring work.
- Turn the shaft of screw into inverter's cover when wiring the bus bars of main circuit in 4000HF model.
  Otherwise, there is danger of contact with the cover.

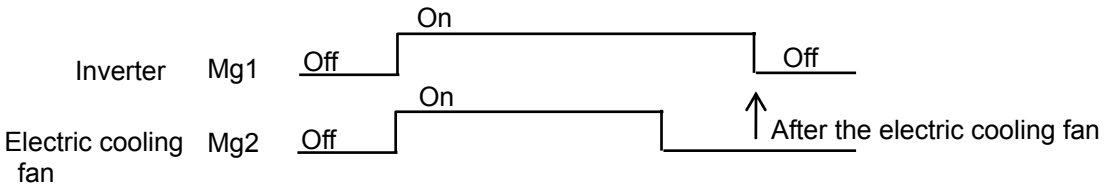
1) Main power input terminals (R, S, and T)

- Connect an earth-leakage breaker for circuit (wiring) protection between the power supply and main power input terminals (R, S, and T).
- Use an earth-leakage breaker with a high rating of a high-frequency sensitive current to prevent the breaker from malfunctioning under the influence of high frequency.
- When the protective function of the inverter operates, a fault or accident may occur in your system. Therefore, you are recommended to connect a magnetic contactor that interrupts the power supply to the inverter.
- Do not use the magnetic contactor connected to the power input terminal (primary side) or power output terminal (secondary side) of the inverter to start or stop the inverter.
  To start and stop inverter operation by external signals, use only the operation commands (FW and RV signals) that are input via control circuit terminals.
- This inverter does not support a single-phase power supply but supports only a three-phase power supply.
  If you need to use a single-phase power input, contact your supplier or local Hitachi Distributor.
- Do not operate the inverter with an phase loss power input, or it may be damaged.
  Since the factory setting of the inverter disables the phase loss input protection, the inverter will revert to the following status if a phase of power supply input is interrupted:
  R or T phase interrupted: The inverter does not operate.
  S phase interrupted: The inverter reverts to single-phase operation, and may trip because of insufficient voltage or overcurrent or be damaged.
  Internal capacitors remain charged, even when the power input is under an phase loss condition. Therefore, touching an internal part may result in electric shock and injury.
  When rewiring the main circuit, follow the instructions given in Item (1), "Wiring instructions."
- Carefully note that the internal converter module of the inverter may be damaged if:
- the imbalance of power voltage is 3% or more,
- the power supply capacity is at least 10 times as high as the inverter capacity and 500 kVA or more, or
- the power voltage changes rapidly.
  Example: The above conditions may occur when multiple inverters are connected to each other by a short bus line or your system includes a phase-advanced capacitor that is turned on and off during operation.
- Do not turn the inverter power on and off more often than once every 3 minutes.
  Otherwise, the inverter may be damaged.
- The electric cooling fan for the motor shall be powered from other systems. The motor directly connected to the power source shall also be powered from other systems. If they are powered from the same system as the inverter, an insufficient voltage protection (E09) or instantaneous power failure protection (E16) error may occur when the inverter is turned off.



When the power cannot be supplied from other systems, shut off the electromagnetic contactor MC2

for operating the electric cooling fan, and after the fan stops, shut off the electromagnetic contactor MC1 for operating the Inverter.



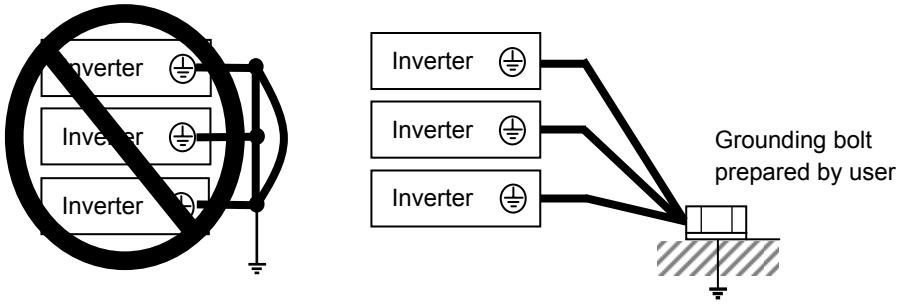
2) Inverter output terminals (U, V, and W)
- Use a cable thicker than the specified applicable cable for the wiring of output terminals to prevent the output voltage between the inverter and motor dropping. Especially at low frequency output, a voltage drop due to cable will cause the motor torque to decrease.
- Do not connect a phase-advanced capacitor or surge absorber on the output side of the inverter. If connected, the inverter may trip or the phase-advanced capacitor or surge absorber may be damaged.
- If the cable length between the inverter and motor exceeds 20 m (especially in the case of 400 V class models), the stray capacitance and inductance of the cable may cause a surge voltage at motor terminals, resulting in a motor burnout.
  A special filter to suppress the surge voltage is available. If you need this filter, contact your supplier or local Hitachi Distributor.
- When connecting multiple motors to the inverter, connect a thermal relay to the inverter output circuit for each motor.
- The RC rating of the thermal relay must be 1.1 times as high as the rated current of the motor. The thermal relay may go off too early, depending on the cable length. If this occurs, connect an AC reactor to the output of the inverter.
- Don't use this inverter under one phase condition of inverter output. It has the possibility that inverter is damaged and motor burnout is caused.

3) DC reactor connection terminals (PD and P)
- Use these terminals to connect the DC power factor reactor (DCL).
- The cable length between the inverter and DCL must be 5 m or less.

If the DCL is not connected, power is not supplied to the main circuit of the inverter, and the inverter cannot operate.

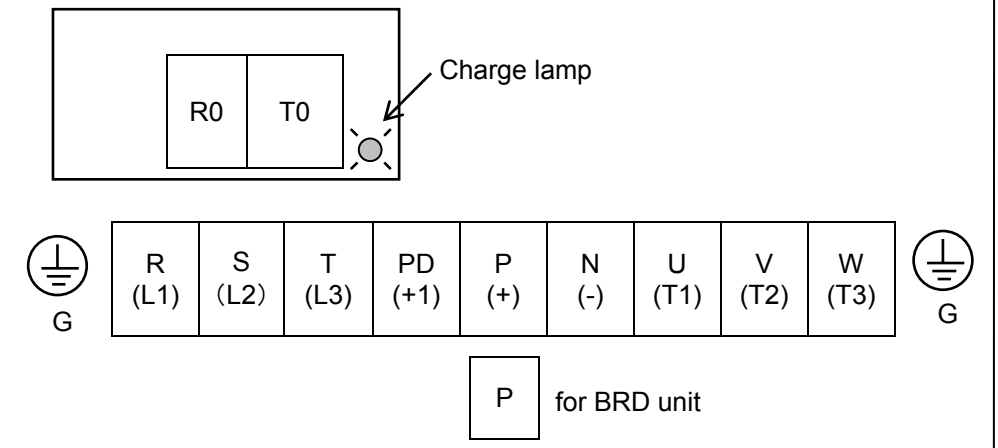
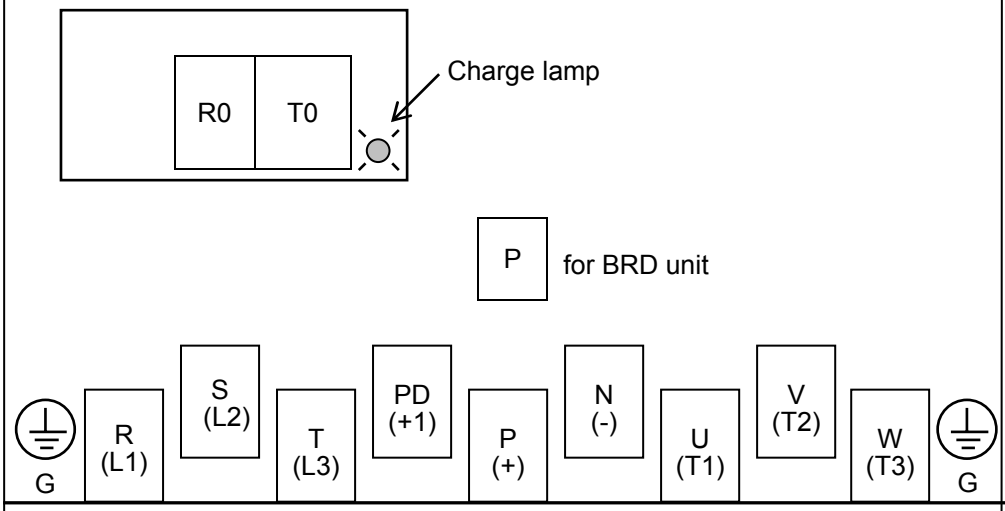
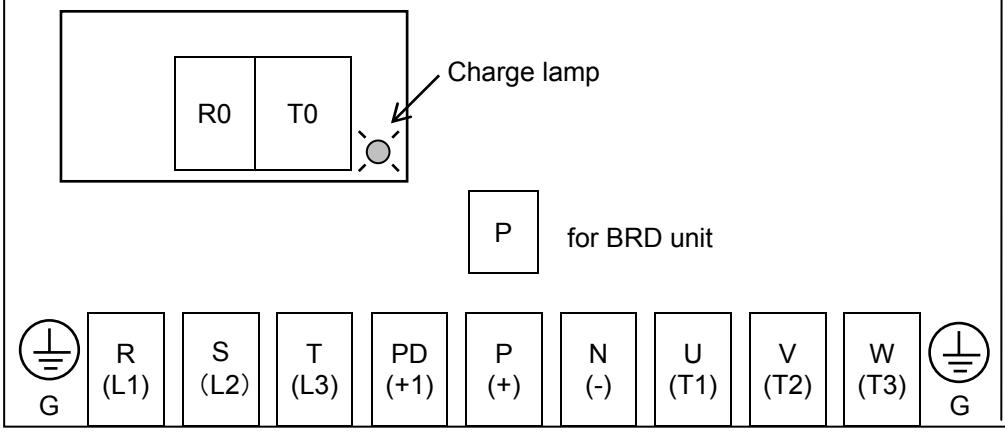
4) Regenerative braking unit connection terminals (P and N)
- Increasing the braking performance requires an optional regenerative braking unit and an external braking resistor. Connect the P and N terminals of the optional regenerative braking unit to the P and N terminals of the inverters.
- The cable length between the inverter and optional regenerative braking unit must be 5 m or less, and the two cables must be twisted for wiring.
- Do not use these terminals for connecting any devices other than the optional external braking resistor and regenerative braking unit.

5) Inverter ground terminal (G ⏚)
- Be sure to ground the inverter and motor to prevent electric shock.
- According to the Electric Apparatus Engineering Regulations, connect 400 V class models to grounding electrodes constructed in compliance with type-C grounding (conventional special type-III grounding with ground resistance of 10Ω or less).
- Use a grounding cable thicker than the specified applicable cable, and make the ground wiring as short as possible.
- When grounding multiple inverters, avoid a multi-drop connection of the grounding route and formation of a ground loop, otherwise the inverter may malfunction.

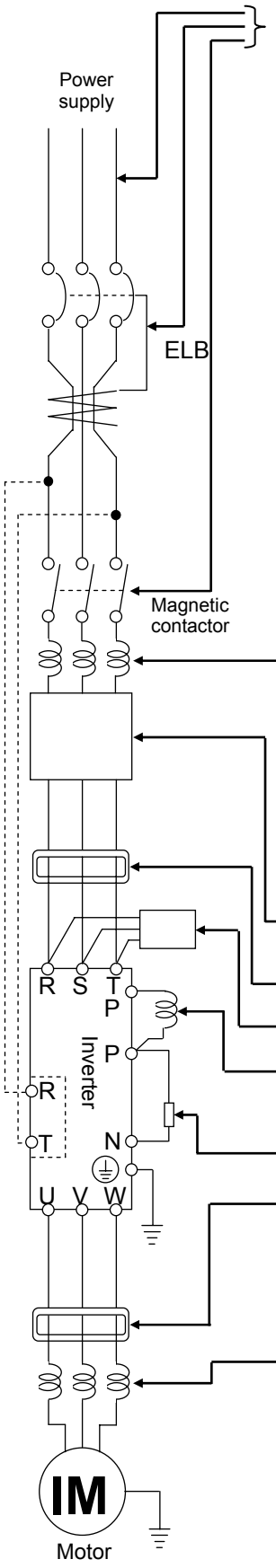


(2) Layout of main circuit terminals

The figures below show the terminal layout on the main circuit terminal block of the inverter.

Terminal layout	Inverter model
	SJ700-1850HF R0, T0 :M4 Earth terminal:M12 Other :M16 for BRD unit P:M8
	SJ700-3000, 3150HF R0, T0 :M4 Earth terminal:M12 Other :M16 for BRD unit P:M10
	SJ700-4000HF R0, T0 :M4 Earth terminal:M12 Other :M12 for BRD unit P:M10

(3) Applicable peripheral equipment



See Item (4), "Recommended cable gauges, wiring accessories, and crimp terminals."

Note 1: The peripheral equipment described here is applicable when the inverter connects a standard Hitachi 3-phase, 4-pole squirrel-cage motor.
Note 2: Select breakers that have proper capacity. (Use breakers that comply with inverters.)
Note 3: Use earth-leakage breakers (ELB) to ensure safety.
Note 4: Use copper electric wire (HIV cable) of which the maximum allowable temperature of the insulation is 75°C.
Note 5: If the power line exceeds 20 m, cable that is thicker than the specified applicable cable must be used for the power line.
Note 6: Use a 0.75 mm^2 cable to connect the alarm output contact.
Note 7: Tighten each terminal screw with the specified tightening torque. Loose terminal screws may cause short circuits and fire. Tightening a terminal screw with excessive torque may cause damage to the terminal block or inverter body.
Note 8: Select an earth-leakage breaker (ELB) of which the rated sensitivity current matches the total length of cables connected between the inverter and power supply and between the inverter and motor. Do not use a high-speed type ELB but use a delayed-type ELB because the high-speed type may malfunction.
Note 9: When a CV cable is used for wiring through a metal conduit, the average current leakage is 30 mA/km.
Note 10: When an IV cable, which has a high relative dielectric constant, is used, the leakage current is about eight times as high as the standard cable. Therefore, when using an IV cable, use the ELB of which the rated sensitivity current is eight times as high as that given in the table below. If the total cable length exceeds 100 m, use a CV cable.

Total cable length	Sensitivity current (mA)
100 m or less	50
300 m or less	100

Name	Description
Reactor on input side (for harmonic control, power supply coordination, and power factor improvement) (ALI-XXX)	Use this reactor to control harmonic waves or when the imbalance of power supply voltage is 3% or more, when the power supply capacity is 500 kVA or more, or when the power voltage may change rapidly. This reactor also improves the power factor.
Noise filter for inverter (NF-XXX)	This noise filter reduces the conductive noise that is generated by the inverter and transmitted in cables. Connect this noise filter to the primary side (input side) of the inverter.
Radio noise filter (Zero-phase reactor) (ZCL-X)	The inverter may generate radio noise through power supply wiring during operation. Use this noise filter to reduce the radio noise (radiant noise).
Radio noise filter on input side (Capacitor filter) (CFI-X)	Use this noise filter to reduce the radiant noise radiated from input cables.
DC reactor (DCL-X-XX)	Use this reactor to control the harmonic waves generated by the inverter.
Regenerative braking unit	Use these devices to increase the braking torque of the inverter for operation in which the inverter turns the connected load on and off very frequently or decelerates the load running with a high moment of inertia.
Radio noise filter (Zero-phase reactor) (ZCL-XXX)	Use this noise filter to reduce the noise generated on the output side of the inverter. (This noise filter can be used on both the input and output sides.)
AC reactor for the output side For reducing vibrations and preventing thermal relay malfunction (ACL-X-XX)	Using the inverter to drive a general-purpose motor may cause larger vibrations of the motor when compared with driving it directly with the commercial power supply. Connect this AC reactor between the inverter and motor to lessen the pulsation of motor. Also, connect this AC reactor between the inverter and motor, when the cable length between them is long (10 m or more), to prevent thermal relay malfunction due to the harmonic waves that are generated by the switching operation on the inverter. Note that the thermal relay can be replaced with a current sensor to avoid the malfunction.

(4) Recommended cable gauges, wiring accessories, and crimp terminals

Note: For compliance with CE and UL standards, see the safety precautions concerning EMC and the compliance with UL and CUL standards under Safety Instructions.

The table below lists the specifications of cables, crimp terminals, and terminal screw tightening torques for reference.

	Motor output (kW)	Applicable inverter model	Power connecter terminals (R, S, T, U, V, W, P, PD, and N)	Wire size (kcmil) [mm^2]	Size of terminal screw	Crimp terminal	Tightening torque (N-m)	Applicable device	
								Earth-leakage breaker (ELB)	Magnetic contactor (MC)
400 V class	185	SJ700-1850HF	Poewr lines R, S, T, U, V, W	250 × 2 [127 × 2]	M16	R150-16	75.0	RX400B	H400C
			Poewr lines P, PD	300 × 2 [152 × 2]	M16	R150-16			
			Braking unit lines P, N	AWG1 [42]	M8	R38-8	8.1		
			Earth lines	250 [127]	M12	R150-12	39.2		
	315	SJ700-3150HF	Poewr lines R, S, T, U, V, W	400 × 2 [203 × 2]	M16	200-16	44.0	RX800B (700A)	H800C
			Poewr lines P, PD	500 × 2 [253 × 2]	M16	325-16			
			Braking unit lines P, N	250 [127]	M10	150-11	20		
			Earth lines	400 [203]	M12	200-12	39.2		
	400	SJ700-4000HF	Poewr lines R, S, T, U, V, W	600 × 2 [304 × 2]	M12	325-12	52.0	RF-1000CBN (1000A)	H800C
			Poewr lines P, PD	800 × 2 [405 × 2]	M12	Note1			
			Braking unit lines P, N	250 × 2 [127 × 2]	M10	150-11	20		
			Earth lines	600 [304]	M12	325-12	39.2		

Note1: Please use the solderless terminals for 405mm^2 or more.

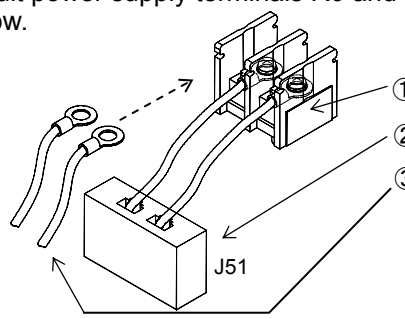
Note2: Cable gauges indicate those of HIV cables (maximum heat resistance: 75°C).

*) Use wires with the prepackaged ring lug terminals when wiring with the main circuit terminals in 1850HF model.

(5) Connecting the control circuit to a power supply separately from the main circuit

If the protective circuit of the inverter operates to open the magnetic contactor in the input power supply circuit, the inverter control circuit power is lost, and the alarm signal cannot be retained. To retain the alarm signal, connect control circuit terminals R0 and T0 to a power supply. In details, connect the control circuit power supply terminals R0 and T0 to the primary side of the magnetic contactor as shown below.

(Connection method)
Power-receiving specifications
400 V class model:
380 to 480 V (+10%, -15%)
(50/60 Hz ±5%),(537 to 678 VDC)



① Remove the connected cables.
② Remove the J51 connector.
③ Connect the control circuit power supply cables to the control circuit power supply terminal block.

Note the following when connecting separate power supplies to control circuit power supply terminals (R0 and T0) and main circuit power supply terminals (R, S, and T):

- Use a cable thicker than 1.25 mm^2 to connect the terminals R0 and T0 (terminal screw size: M4).
- Connect a 3 A fuse in the control circuit power supply line.
- If the control circuit power supply (connected to R0 and T0) is turned on earlier than the main circuit power supply (connected to R, S, and T), ground fault is not checked at power-on.
- When supplying DC power to the control circuit power supply terminals (R0 and T0), specify "00" as the "a/b (NO/NC)" selection (function code C031 to C036) for intelligent output terminals ([11] to [15]) and intelligent relay terminals (AL0, AL1, and AL2). If "01" is specified as the "a/b (NO/NC)" selection, output signals may chatter when the DC power supply is shut off.

2.2.3 Wiring of the control circuit

(1) Wiring instructions

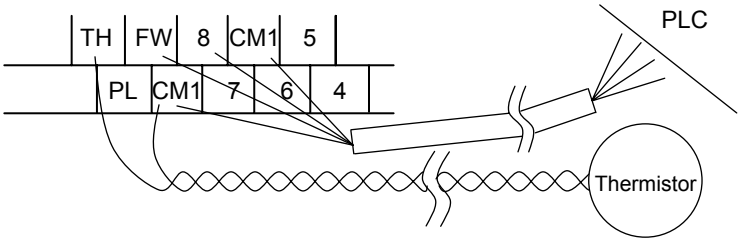
1) Terminals L and CM1 are common to I/O signals and isolated from each other.
Do not connect these common terminals to each other or ground them.
Do not ground these terminals via any external devices. (Check that the external devices connected to these terminals are not grounded.)

2) Use a shielded, twisted-pair cable (recommended gauge: 0.75 mm^2) for connection to control circuit terminals, and connect the cable insulation to the corresponding common terminal.

3) The length of cables connected to control circuit terminals must be 20 m or less. If the cable length exceeds 20 m unavoidably, use a VX-compatible controller (RCD-A) (remote operation panel) or insulated signal converter (CVD-E).

4) Separate the control circuit wiring from the main circuit wiring (power line) and relay control circuit wiring.
If these wirings intersect with each other unavoidably, square them with each other. Otherwise, the inverter may malfunction.

5) Twist the cables connected from a thermistor to the thermistor input terminal (TH) and terminal CM1, and separate the twisted cables from other cables connected to other common terminals.
Since very low current flows through the cables connected to the thermistor, separate the cables from those (power line cables) connected to the main circuit. The length of the cables connected to the thermistor must be 20 m or less.



6) When connecting a contact to a control circuit terminal (e.g., an intelligent input terminal), use a relay contact (e.g., crossbar twin contact) in which even a very low current or voltage will not trigger any contact fault.

7) When connecting a relay to an intelligent output terminal, also connect a surge-absorbing diode in parallel with the relay.

8) Do not connect analog power supply terminals H and L or interface power supply terminals P24 and CM1 to each other.
Otherwise, the inverter may fail.

(2) Layout of control circuit terminals

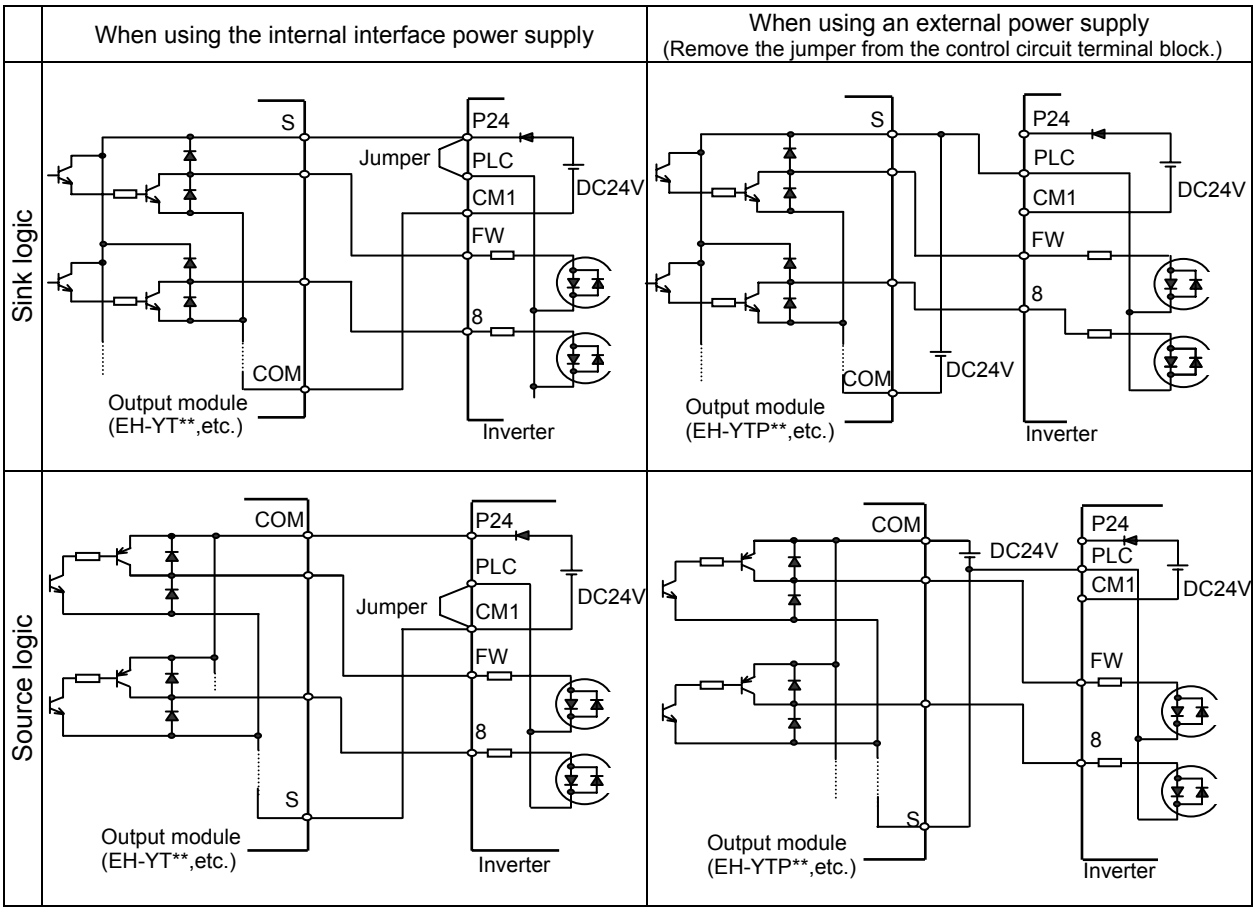
H	O2	AM	FM	TH	FW	8	CM1	5	3	1	14	13	11	AL1
L	O	OI	AMI	P24	PLC	CM1	7	6	4	2	15	CM2	12	AL0	AL2

Terminal screw size: M3

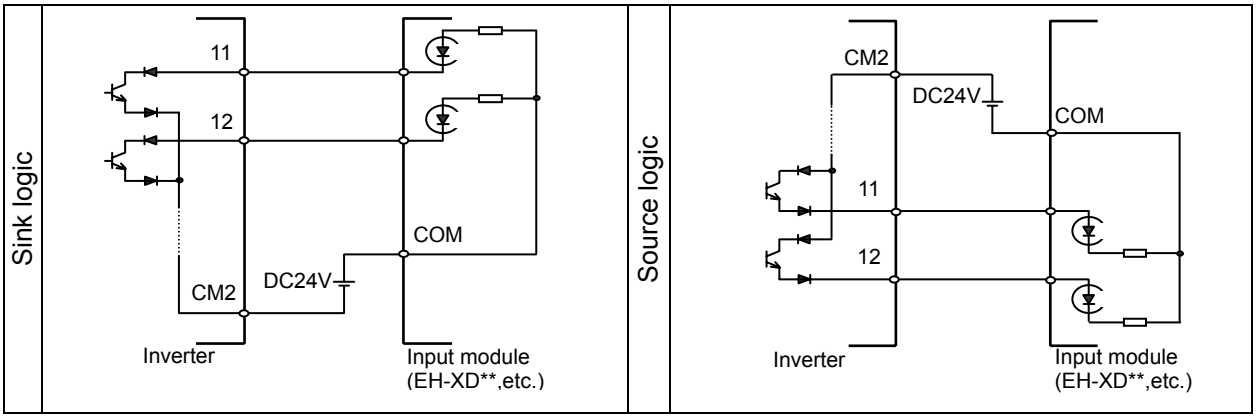
(3) Switching the input control logic

- In the factory setting, the input control logic for terminal FW and intelligent input terminals is the sink logic.
To switch the input control logic to the source logic, remove the jumper connecting terminals P24 and PLC on the control circuit block, and then connect terminals PLC and CM1 with the jumper.

(4) Connecting a programmable controller to intelligent input terminals



(5) Connecting a programmable controller to intelligent output terminals



2.2.4 Wiring of the digital operator

- You can operate the inverter with not only the digital operator mounted in the inverter as standard equipment but also an optional digital operator (OPE-S, OPE-SR, SRW-OJ, or SRW-OEX).
- When you intend to remove the standard digital operator from the inverter and use it as remote equipment, request your local Hitachi Distributor to supply a connection cable, ICS-1 (1-meter cable) or ICS-3 (3-meter cable).
  If you prepare the cable by yourself, the following product is recommended:
  HUTP5 PC 4P -X-X: Straight cable equipped with connector at both ends (made by Hitachi Cable, Ltd.)
- The length of the connection cable must be 3 m or less. If a cable over 3 m is used, the inverter may malfunction.

(Memo)

Chapter 3 Operation

This chapter describes typical methods of operating the inverter, how to operate the digital operator, and how to make a test run of the inverter.

Chapter 3 Operation

(Memo)

3.1 Operating Methods

! WARNING

- While power is supplied to the inverter, do not touch any terminal or internal part of the inverter, check signals, or connect or disconnect any wire or connector. Otherwise, you run the risk of electric shock or fire.
- 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. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. 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.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation 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 control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- The [STOP] key is effective only when its function is enabled by setting. Prepare an emergency stop switch separately. Otherwise, you run the risk of injury.
- If an operation command has been input to the inverter before the inverter enters alarm status, the inverter will restart suddenly when the alarm status is reset. Before resetting the alarm status, make sure that no operation command has been input.
- While power is supplied to the inverter, do not touch any internal part of the inverter or insert a bar in it. Otherwise, you run the risk of electric shock or fire.

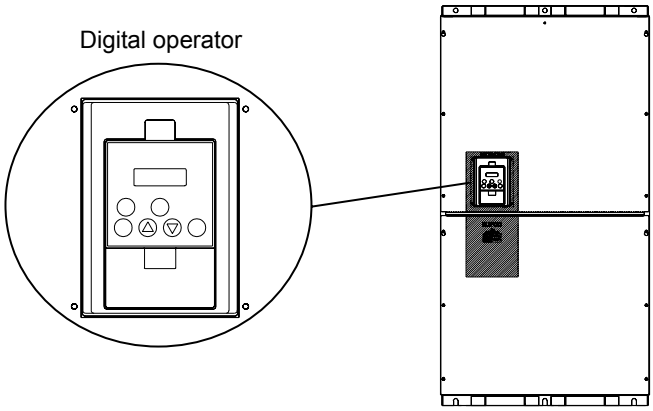
! CAUTION

- Do not touch the heat sink, which heats up during the inverter operation. Otherwise, you run the risk of burn injury.
- The inverter allows you to easily control the speed of motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. Otherwise, you run the risk of injury and damage to machine.
- Install an external brake system if needed. Otherwise, you run the risk of injury.
- When using the inverter to operate a standard motor at a frequency of over 60 Hz, 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. Otherwise, you run the risk of damage to the motor and machine and injury
- During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations. Otherwise, you run the risk of damage to the machine driven by the motor.

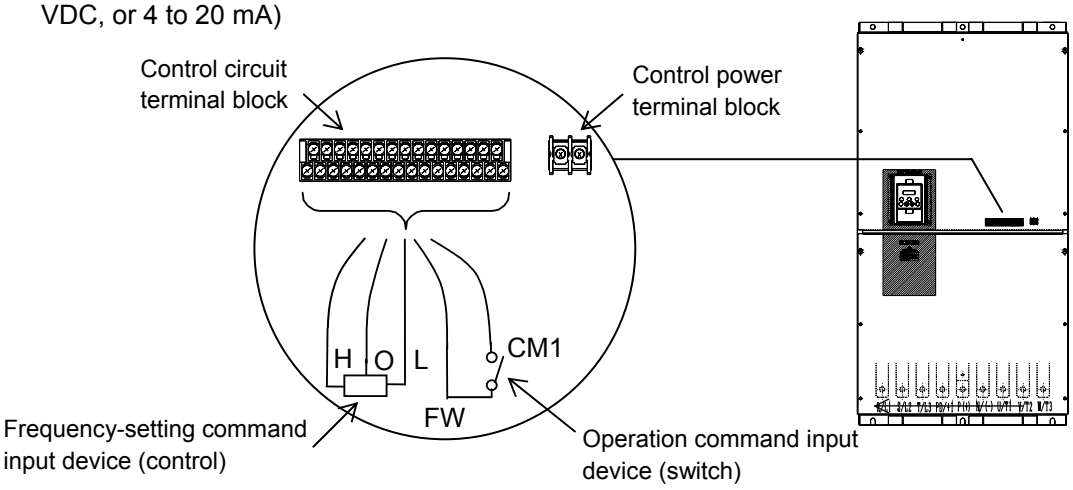
Chapter 3 Operation

You can operate the inverter in different ways, depending on how to input the operation and frequency-setting commands as described below.
This section describes the features of operating methods and the items required for operation.

(1) Entering operation and frequency-setting commands from the digital operator
This operating method allows you to operate the inverter through key operations on the standard digital operator mounted in the inverter or an optional digital operator.
When operating the inverter with a digital operator alone, you need not wire the control circuit terminals.
(Items required for operation)
1) Optional digital operator (not required when you use the standard digital operator)



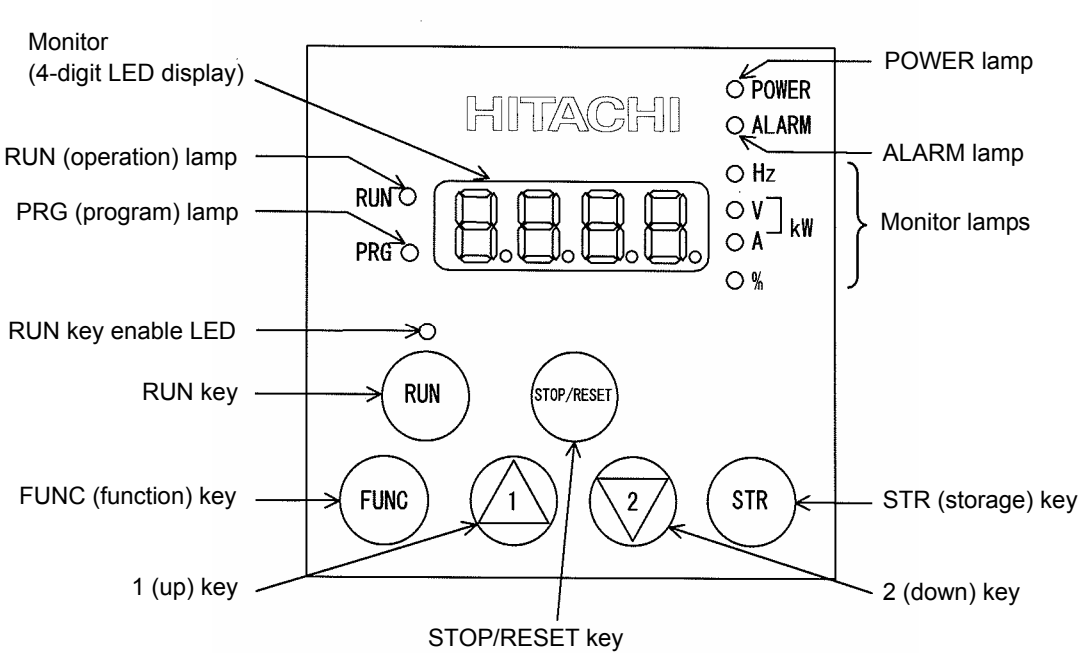
(2) Entering operation and frequency-setting commands via control circuit terminals
This operating method allows you to operate the inverter via the input of operation signals from external devices (e.g., frequency-setting circuit and start switch) to control circuit terminals.
The inverter starts operation when the input power supply is turned on and then an operation command signal (FW or RV) is turned on.
You can select the frequency-setting method (setting by voltage specification or current specification) through the input to a control circuit terminal according to your system. For details, see Item (2), "Explanation of control circuit terminals," in Section 2.2.1 (on pages 2-7 and 2-8).
(Items required for operation)
1) Operation command input device: External switch or relay
2) Frequency-setting command input device: External device to input signals (0 to 10 VDC, -10 to +10 VDC, or 4 to 20 mA)



(3) Entering operation and frequency-setting commands; both from a digital operator and via control circuit terminals
This operating method allows you to arbitrarily select the digital operator or control circuit terminals as the means to input operation commands and frequency-setting commands.
(Items required for operation)
1) See the items required for the above two operating methods.

3.2 How To Operate the Digital Operator (OPE-S)

3.2.1 Names and functions of components



Name	Function
POWER lamp	Lights when the control circuit power is on.
ALARM lamp	Lights to indicate that the inverter has tripped.
RUN (operation) lamp	Lights to indicate that the inverter is operating.
PRG (program) lamp	Lights when the monitor shows a value set for a function. This lamp starts blinking to indicate a warning (when the set value is invalid).
Monitor	Displays a frequency, output current, or set value.
Monitor lamps	Indicates the type of value and units displayed on the monitor. "Hz" (frequency), "V" (voltage), "A" (current), "kW" (electric power), and "%" (percentage)
RUN key enable LED	Lights up when the inverter is ready to respond to the RUN key. (When this lamp is on, you can start the inverter with the RUN key on the digital operator.)
RUN key	Starts the inverter to run the motor. This key is effective only when the operating device is the digital operator. (To use this key, confirm that the operating device indicator lamp is on.)
STOP/RESET key	Decelerates and stops the motor or resets the inverter from alarm status.
FUNC (function) key	Makes the inverter enter the monitor, function, or extended function mode.
STR (storage) key	Stores each set value. (Always press this key after changing a set value.)
1 (up) or 2 (down) key	Switches the inverter operation mode (among monitor, function, and extended function modes) or increases or decreases the value set on the monitor for a function.

3.2.2 Code display system and key operations

This section describes typical examples of digital operator operation (in basic and full display modes) and an example of special digital operator operation in extended function mode U.

The initial display on the monitor screen after power-on depends on the setting of function "b038". For details, see Section 4.2.81, "Initial-screen selection," (on page 4-76).
When the setting of function "b038" is "01" (factory setting), the monitor initially shows 0.00 as the setting of function "d001" (output frequency monitoring). Pressing the FUNC key in this status changes the display to d001 .

Note: The display contents on the monitor depend on the settings of functions "b037" (function code display restriction), "b038" (initial-screen selection), and "b039" (automatic setting of user parameters). For details, see Sections 4.2.80, "Function code display restriction," (on page 4-74), 4.2.81, "Initial-screen selection," (on page 4-76), and 4.2.82, "Automatic user-parameter setting," (on page 4-77).

Item	Function code	Data	Description
Function code display restriction	b037	00	Full display
		01	Function-specific display
		02	User setting
		03	Data comparison display
		04	Basic display (factory setting)
Initial-screen selection (Initial display at power-on)	b038 (*1)	00	Screen displayed when the [STR] key was pressed last (same as the operation on the SJ300 series)
		01	d001 (output frequency monitoring)
		02	d002 (output current monitoring)
		03	d003 (rotation direction minitoring)
		04	d007 (Scaled output frequency monitoring)
		05	F001 (output frequency setting)
Selection of automatic user-parameter settings	b039 (*1)	00	Disable
		01	Enable

*1 Not displayed with the factory setting

* The following procedure enables you to turn the monitor display back to d001 or 0.00 (*1) regardless of the current display mode:
  - Hold down the FUNC key for 3 seconds or more. The monitor shows d001 and 0.00 (*1) alternately.
    During this status, press the FUNC key. The monitor will show only d001 or 0.00 (*1), which is shown when the FUNC is pressed.

*1 The monitor shows 0.00 only when the motor driven by the inverter is stopped. While the motor is running, the monitor shows an output frequency.

(1) Example of operation in basic display mode ("b037" = "04" [factory setting])
- Only basic parameters can be displayed in basic display mode. (All parameters in monitor mode, four parameters in function mode, or 20 parameters in extended function mode)
- Other parameters are not displayed. To display all parameters, select the full display mode ("b037" = "00").

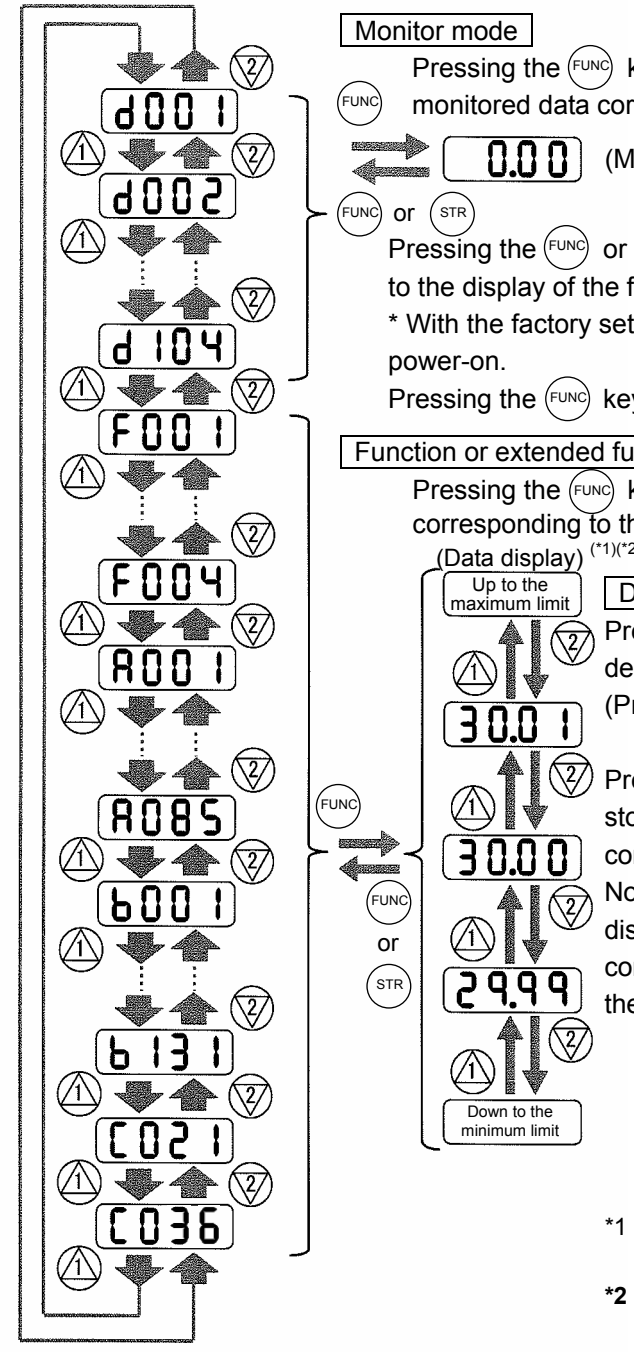
<Displayable parameters and sequence of display>

No.	Display code	Item
1	d001 to d104	Monitor display
2	F001	Output frequency setting
3	F002	Acceleration (1) time setting
4	F003	Deceleration (1) time setting
5	F004	Operation direction setting
6	A001	Frequency source setting
7	A002	Run command source setting
8	A003	Base frequency setting
9	A004	Maximum frequency setting
10	A005	[AT] selection
11	A020	Multispeed frequency setting
12	A021	Multispeed 1 setting
13	A022	Multispeed 2 setting
14	A023	Multispeed 3 setting
15	A044	1st control method
16	A045	V/f gain setting
17	A085	Operation mode selection
18	b001	Selection of restart mode
19	b002	Allowable under-voltage power failure time
20	b008	Retry-after-trip selection
21	b011	Retry wait time after trip
22	b037	Function code display restriction
23	b083	Carrier frequency setting
24	b084	Initialization mode selection
25	b130	Selection of overvoltage suppression function
26	b131	Setting of overvoltage suppression level
27	C021	Setting of intelligent output terminal 11
28	C022	Setting of intelligent output terminal 12
29	C036	Alarm relay active state

Note:
If a desired parameter is not displayed, check the setting of function "b037" (function code display restriction). To display all parameters, specify "00" for "b037".

Key operation and transition of the codes on display	Key operation and transition of the monitored data on display

Pressing the ▲1 or ▼2 key respectively scrolls up or down the code displayed in code display mode or increases or decreases the numerical data displayed in data display mode.
Press the ▲1 or ▼2 key until the desired code or numerical data is shown. To scroll codes or increase/decrease numerical data faster, press and hold the key.



Monitor mode

Pressing the FUNC key with a function code displayed shows the monitored data corresponding to the function code.

FUNC ⇄ 0.00 (Monitor display) (*1)

FUNC or STR

Pressing the FUNC or STR key with the monitored data displayed reverts to the display of the function code corresponding to the monitored data.
* With the factory setting, the monitor shows 0.00 initially after power-on.
Pressing the FUNC key in this status changes the display to d001 .

Function or extended function mode

Pressing the FUNC key with a function code displayed shows the data corresponding to the function code.

(Data display) (*1)(*2)

Up to the maximum limit

30.01

30.00

29.99

Down to the minimum limit

FUNC ⇄ FUNC or STR

Data setting

Pressing the ▲1 or ▼2 key respectively increases or decreases the displayed numerical data.
(Press the key until the desired data is shown.)

Pressing the STR key with numerical data displayed stores the data and then returns to the display of the corresponding function code.
Note that pressing the FUNC key with numerical data displayed returns to the display of the function code corresponding to the numerical data without updating the data, even if it has been changed on display.

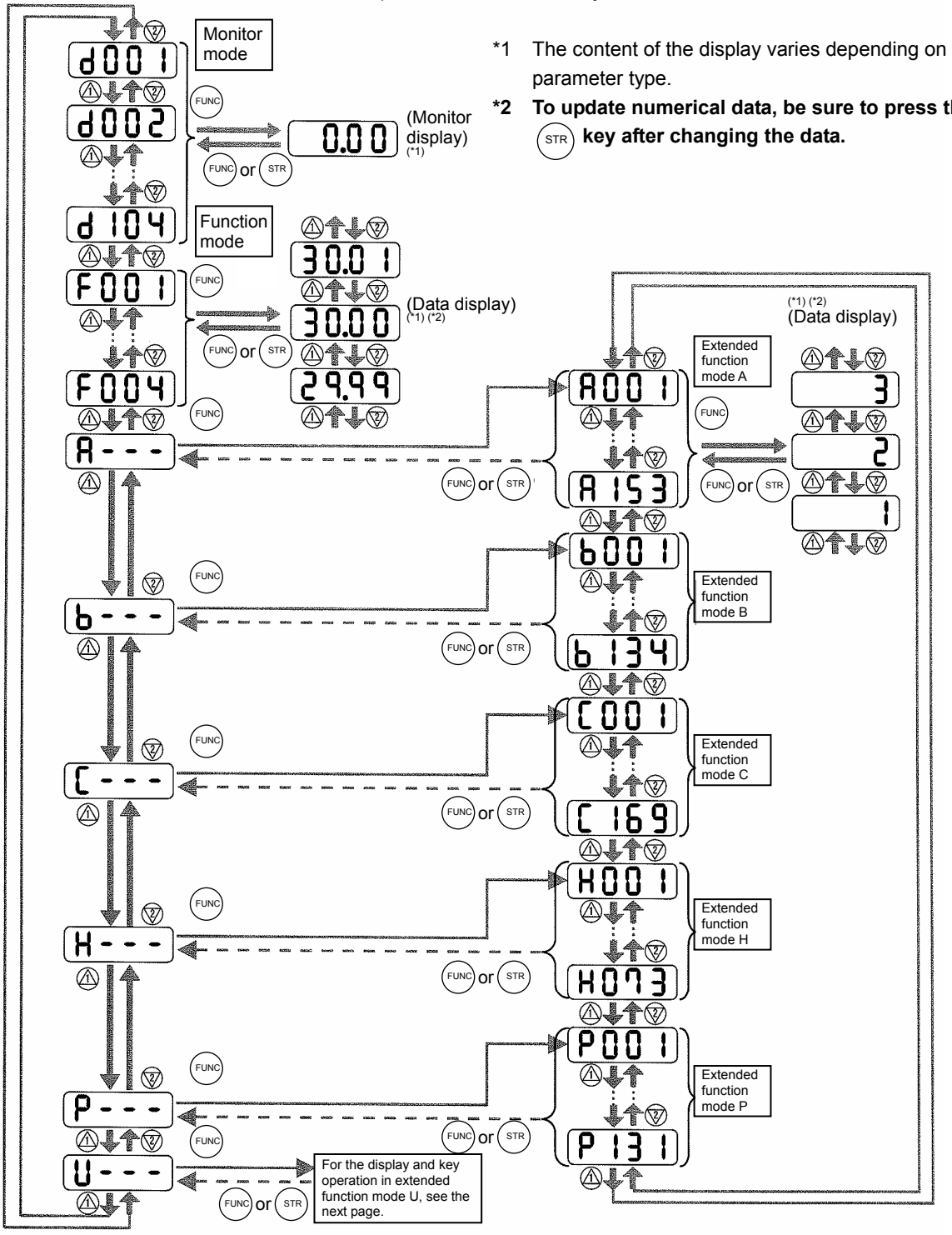
*1 The content of the display varies depending on the parameter type.

***2 To update numerical data, be sure to press the STR key after changing the data.**

(2) Example of operation in full display mode ("b037" = "00")
All parameters can be displayed in full display mode. The display sequence of parameters matches their sequence shown in Chapter 8, "List of Data Settings."

Key operation and transition of codes on display (in monitor or function mode)	Key operation and transition of monitored data on display (in monitor or function mode)	Key operation and transition of codes on display (in extended function mode)	Key operation and transition of monitored data on display (in extended function mode)

Pressing the ▲1 or ▼2 key respectively scrolls up or down the code displayed in code display mode or increases or decreases the numerical data displayed in data display mode.
Press the ▲1 or ▼2 key until the desired code or numerical data is shown. To scroll codes or increase/decrease numerical data fast, press and hold the key.



*1 The content of the display varies depending on the parameter type.

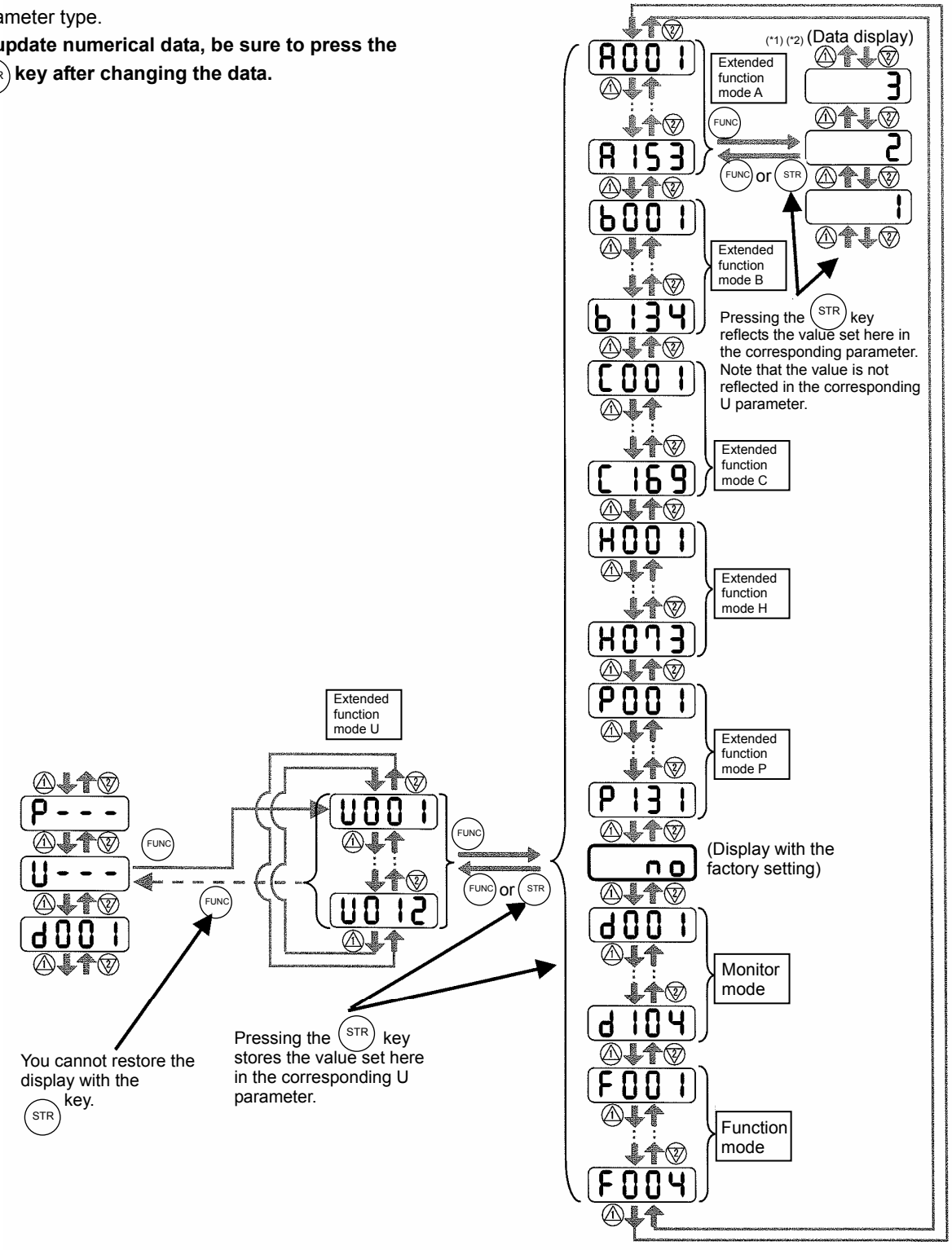
***2 To update numerical data, be sure to press the STR key after changing the data.**

(3) Code/data display and key operation in extended function mode U
The extended function mode U differs in operation from other extended function modes because the extended function mode U is used to register (or automatically record) other extended-function codes as user-specified U parameters.

Key operation and transition of codes on display (in monitor or function mode)	Key operation and transition of codes on display (in extended function mode U)	Key operation and transition of codes on display (when displaying extended-function mode parameters from the extended function mode U)	Key operation and transition of codes on display (in monitor, function, or extended

*1 The content of the display varies depending on the parameter type.

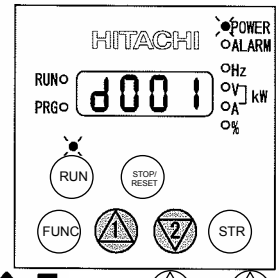
***2 To update numerical data, be sure to press the (STR) key after changing the data.**



(4) Procedure for directly specifying or selecting a code

- You can specify or select a code or data by entering each digit of the code or data instead of scrolling codes or data in the monitor, function, or extended function mode.
- The following shows an example of the procedure for changing the monitor mode code "d001" displayed to extended function code "A029":

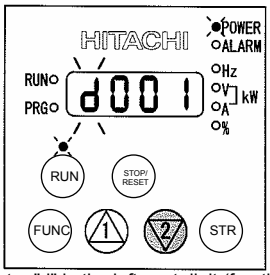
1) Display the monitor mode code.
("d001" is displayed.)



(*2)
(*3)

FUNC Press the 1 and 2 keys together. (*1)

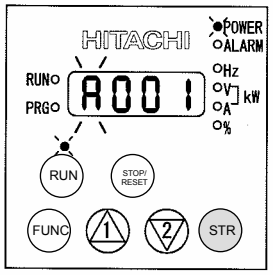
2) Change to the extended function mode.



- Character "d" in the leftmost digit (fourth digit from the right) starts blinking.

Press the 2 key twice.

("A001" is displayed.)

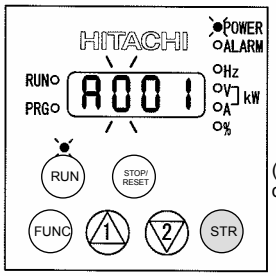


(*3)

- Character "A" is blinking.
- Pressing the [STR] key determines the blinking character.

(*2)
FUNC Press the STR key (to determine character "A").

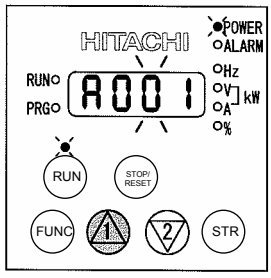
3) Change the third digit of the code.



Press the STR key.
(Character "0" is determined.)
FUNC (*2)

- Character "0" in the third digit is blinking.
- Since the third digit need not be changed, press the [STR] key to determine the character "0".

4) Change the second digit of the code.

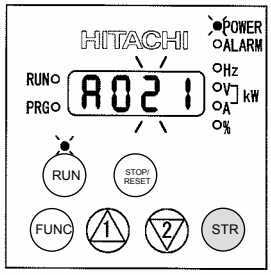


- Character "0" in the second digit is blinking.

Press the 1 key twice.

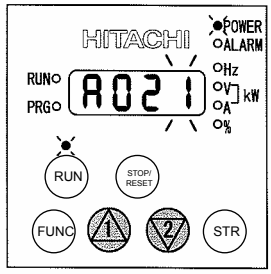
- Character "2" in the second digit is blinking.

(*2)
FUNC Press the STR key.
("A021" is displayed.)



(*2)

5) Change the first digit of the code.

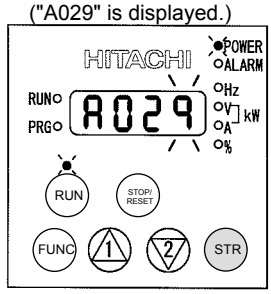


- Character "1" in the first digit is blinking.

Press the 1 key eight times or the 2 key twice.

- Character "9" in the first digit is blinking.

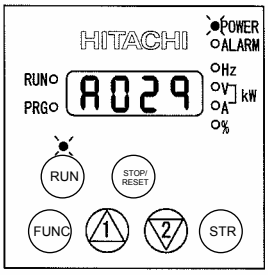
("A029" is displayed.)



(*2)

6) End the change of the extended function code.

Press the STR key.
(Character "9" is determined.)



- Selection of code "A029" is completed.

* If a code that is not defined in the code list or not intended for display is entered, the leftmost digit (fourth digit) (character "A" in this example) will start blinking again.

In such a case, confirm the code to be entered and enter it correctly. For further information, refer to Section 4.2.80. " Function code display restriction," (on page 4-74), Section 4.2.81, "Initial-screen selection," (on page 4-76), Section 4.2.82, "Automatic user-parameter setting," (on page 4-77), and Chapter 8, "List of Data Settings."

7) Press the FUNC key to display the data corresponding to the function code, change the data with the 1 and/or 2 key, and then press the STR key to store the changed data. (*4)

Note that you can also use the procedure (steps 1) to 6)) described here to change the data. (*3)(*4)

*1 This procedure can also be used on screens displaying a code other than "d001".

*2 If the FUNC key is pressed while a digit is blinking, the display will revert to the preceding status for entering the digit to the right of the blinking digit.

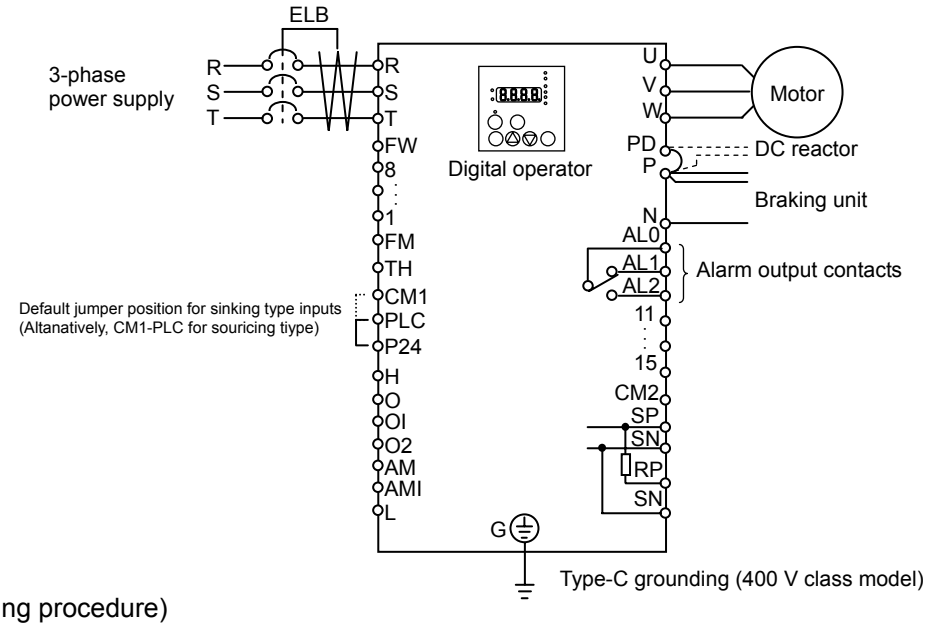
*3 If the FUNC key is pressed while the leftmost (fourth) digit is blinking, the characters having been entered to change the code will be cancelled and the display will revert to the original code shown before the 1 and 2 keys were pressed in step 1).

*4 When changing data, be sure to press the FUNC key first.

3.3 How To Make a Test Run

This section describes how to make a test run of the inverter that is wired and connected to external devices in a general way as shown below.
For the detailed method of using the digital operator, see Section 3.2, "How To Operate the Digital Operator."

(1) When entering operation and frequency-setting commands from the digital operator:
(The operating procedure below is common to the standard and optional digital operators.)



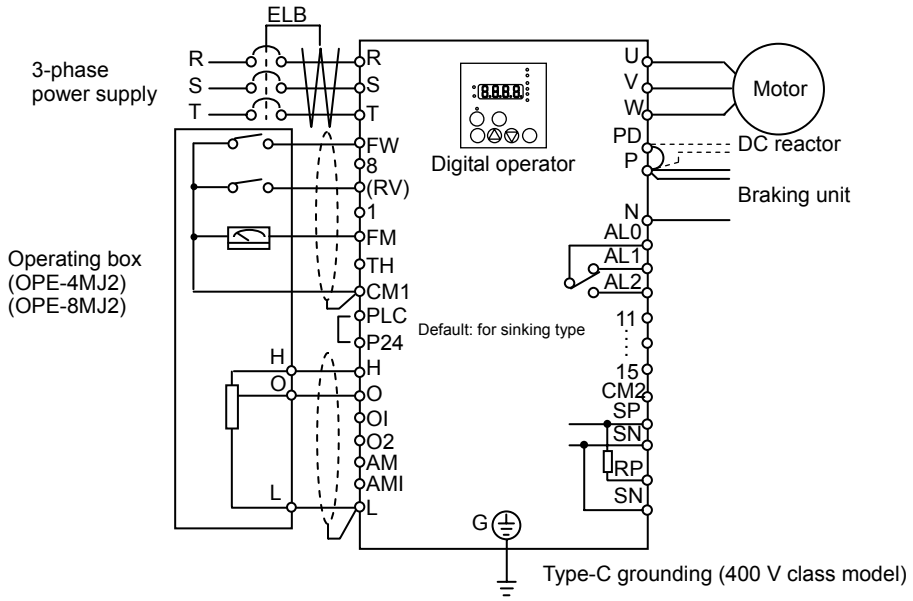
(Operating procedure)

1) Confirm that all wirings are correct.
2) Turn on the earth-leakage breaker (ELB) to supply power to the inverter.
(The POWER lamp [red LED] of the digital operator goes on.)
* When using an inverter with the factory setting, proceed to step 5).
3) Select the digital operator as the operating device via the frequency source setting function.
- Display the function code "A001" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a 2-digit numeric value.)
- Use the (1) and/or (2) key to change the displayed numeric value to [02], and then press the (STR) key once to specify the digital operator as the operating device to input frequency-setting commands.
(The display reverts to [A001].)
4) Select the digital operator as the operating device by the run command source setting function.
- Display the function code "A002" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a 2-digit numeric value.)
- Use the (1) and/or (2) key to change the displayed numeric value to "02", and then press the (STR) key once to specify the digital operator as the operating device to input operation commands.
(The display reverts to [A002]. The operating device indicator lamp above the [RUN] key goes on.)
5) Set the output frequency.
- Display the function code "F001" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows a preset output frequency. With the factory setting, 0.00 [0 Hz] is shown.)
- Use the (1) and/or (2) key to change the displayed numeric value to the desired output frequency, and then press the (STR) key once to determine the frequency.
(The display reverts to [F001].)
6) Set the operation direction of the motor.
- Display the function code "F004" on the monitor screen, and then press the (FUNC) key once.
(The monitor shows "00" or "01".)

- Use the (1) and/or (2) key to change the displayed value to "00" for forward operation or "01" for reverse operation, and then press the (STR) key once to determine the operation direction.
  (The display reverts to [F004].)

7) Set the monitor mode.
   - To monitor the output frequency, display the function code "d001", and then press the (FUNC) key once.
     (The monitor shows the output frequency.)
     To monitor the operation direction, display the function code "d003", and then press the (FUNC) key once.
     (The monitor shows  for forward operation,  for reverse operation, or  for stopping.)
   - Make sure that It is the square root of 2 times input voltage from d102 monitor.
8) Press the (RUN) key to start the motor.
   (The RUN lamp [green LED] goes on.)
9) Press the (STOP/RESET) key to decelerate or stop the motor.
   (When the motor stops, the RUN lamp [green LED] goes off.)

- During the test run, confirm that the inverter does not trip while accelerating or decelerating the motor and that the motor speed and frequencies are correct.
- If a trip due to overcurrent or overvoltage has occurred during the test run, increase the acceleration and deceleration time.
- Make sure that there is enough margin to trip level by monitoring the output current (d002) and DC voltage (d102).



(Operating procedure)

1) Confirm that all wirings are correct.
2) Turn on the earth-leakage breaker (ELB) to supply power to the inverter.
   (The POWER lamp [red LED] of the digital operator goes on.)
3) Select the control circuit terminal block as the device to input frequency-setting commands by the frequency source setting function.
   - Display the function code "A001" on the monitor screen, and then press the FUNC key once.
     (The monitor shows a 2-digit numeric value.)
   - Use the 1 and/or 2 key to change the displayed numeric value to [01], and then press the STR key once to specify the control circuit terminal block as the device to input frequency-setting commands.
     (The display reverts to [A001].)
4) Select the control circuit terminal block as the device to input operation commands by the run command source setting function.
   - Display the function code "A002" on the monitor screen, and then press the FUNC key once.
     (The monitor shows a 2-digit numeric value.)
   - Use the 1 and/or 2 key to change the displayed numeric value to "01", and then press the STR key once to specify the digital operator as the device to input operation commands.
     (The display reverts to [A002].)
5) Set the monitor mode.
   - To monitor the output frequency, display the function code "d001", and then press the FUNC key once.
     (The monitor shows the output frequency.)
     To monitor the operation direction, display the function code "d003", and then press the FUNC key once.
     (The monitor shows F for forward operation, r for reverse operation, or 0 for stopping.)
   - Make sure that It is the square root of 2 times input voltage from d102 monitor.
6) Start the motor operation.
   - Set the FW signal (at the FW terminal on the control terminal block) to the ON level to start the motor.
     (The RUN lamp [green LED] goes on.)
   - Apply a voltage across the terminals O and L on the control circuit block to output the frequency corresponding to the applied voltage from the inverter.
7) Stop the motor.
   - Set the FW signal (at the FW terminal on the control terminal block) to the OFF level to decelerate and stop the motor.
     (When the motor stops, the RUN lamp [green LED] goes off.)

Chapter 4 Explanation of Functions

This chapter describes the functions of the inverter.

Chapter 4 Explanation of Functions

(Memo)

4.1 Monitor Mode

4.1.1 Output frequency monitoring

Related code
d001: Output frequency monitoring

When the output frequency monitoring function (d001) is selected, the inverter displays the output frequency. The inverter displays "0.00" when the frequency output is stopped.
The Hz monitor lamp lights up while the inverter is displaying the output frequency.

(Display)
0.00 to 99.99 in steps of 0.01 Hz
100.0 to 400.0 in steps of 0.1 Hz

Note: When you have selected the digital operator as the device to input frequency-setting commands (A001=02), you can change the output frequency setting by using the △and/or ▽ key (only while the inverter is operating the motor).
- The change in output frequency made in this mode can be reflected in the frequency setting (function "F001"). Press the STR key to write the new frequency over the currently selected frequency setting.
- You cannot change the output frequency while the PID function is enabled or the inverter is not operating the motor.

4.1.2 Output current monitoring

Related code
d002: Output current monitoring

When the output current monitoring function (d002) is selected, the inverter displays the output current. The inverter displays "0.0" when the current output is stopped.
The A monitor lamp lights up while the inverter is displaying the output current.

(Display)
0.0 to 999.9 in steps of 0.1 A / 1000 to 9999 in steps of 1A
Note:The current monitor may be less accurate at less than 2.1kHz carrier frequency.

4.1.3 Rotation direction monitoring

Related code
d003: Rotation direction monitoring

When the rotation direction monitoring function (d003) is selected, the inverter displays the motor operation direction.
The RUN lamp lights up while the inverter is operating the motor (in forward or reverse direction).

(Display)
F: Forward operation
o: Motor stopped
r: Reverse operation

4.1.4 Process variable (PV), PID feedback monitoring

Related code
d004: Process variable (PV), PID feedback monitoring
A071: PID Function Enable
A075: PV scale conversion

When "01" (enabling PID operation) or "02" (enabling inverted-data output) has been specified for function "A071" (PID Function Enable) and the process variable (PV), PID feedback monitoring function (d004) is selected, the inverter displays the PID feedback data.
You can also convert the PID feedback to gain data by setting a PV scale conversion (with function "A075").

Value displayed by function "d004" = "feedback quantity" (%) x " PV scale conversion (A075)"
The PV scale conversion can be set (by function "A075") within the range 0.01 to 99.99 in steps of 0.01.

(Display)
0.00 to 99.99 in steps of 0.01
100.0 to 999.9 in steps of 0.1
1000. to 9999. in steps of 1
1000 to 9999 in steps of 10
⌈100 to ⌈999 in units of 100

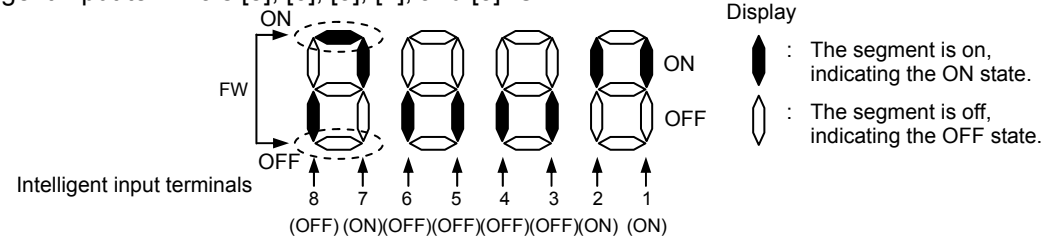
4.1.5 Intelligent input terminal status

Related code
d005: Intelligent input terminal status

When the intelligent input terminal status function (d005) is selected, the inverter displays the states of the inputs to the intelligent input terminals.
The internal CPU of the inverter checks each intelligent input for significance, and the inverter displays active inputs as those in the ON state. (*1)
Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

FW terminal and intelligent input terminals [7], [2], and [1]: ON
Intelligent input terminals [8], [6], [5], [4], and [3]: OFF



(*1)When input terminal response time is set, terminal recognition is delayed. (refer 4.2.79)

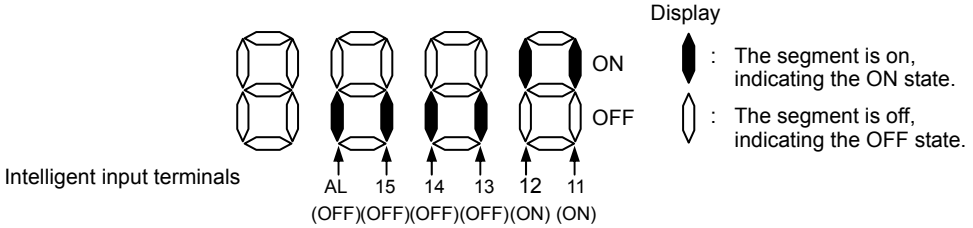
4.1.6 Intelligent output terminal status

Related code
d006: Intelligent output terminal status

When the intelligent output terminal status function (d006) is selected, the inverter displays the states of the outputs from the intelligent output terminals.
This function does not monitor the states of the control circuit terminals but monitors those of the outputs from the internal CPU.
Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

Intelligent output terminals [12] and [11]: ON
Alarm relay terminal AL and intelligent output terminals [15] to [13]: OFF



4.1.7 Scaled output frequency monitoring

Related code
d007: Scaled output frequency monitoring
b086: Frequency scaling conversion factor

When the scaled output frequency monitoring (d007) is selected, the inverter displays the gain data converted from the output frequency with the frequency scaling conversion factor (b086).
Use this function, for example, to change the unit of a value (e.g., motor speed) on display.
Value displayed by function "d007" = "output frequency monitor(d001)" x "frequency scaling conversion factor (b086)"
The frequency scaling conversion factor (b086) can be set within the range 0.1 to 99.9 in steps of 0.1.

(Example) Displaying the speed of a 4-pole motor

Speed N (min^{-1}) = (120 x f [Hz])/pole = f (Hz) x 30
As the result of the above calculation with the factor (b086) set to 30.0, the inverter displays "1800" (60 x 30.0) when the output frequency is 60 Hz.

(Display)

0.00 to 99.99 in steps of 0.01
100.0 to 999.9 in steps of 0.1
1000. to 9999. in steps of 1
1000 to 3996 in units of 10

Note: When you have selected the digital operator as the device to input frequency-setting commands, you can change the output frequency setting by using the △ and/or ▽ key (only while the inverter is operating the motor).

- The change in output frequency made in this mode can be reflected in the frequency setting (function "F001"). Press the STR key to write the new frequency over the currently selected frequency setting. (The precision of the storable frequency data depends on the frequency setting.)
- You cannot change the output frequency while the PID function is enabled or the inverter is not operating the motor.

4.1.8 Actual-frequency monitoring

Related code
d008: Actual-frequency monitoring
P011: Encoder pulse-per-revolution (PPR) setting
H004: Motor poles setting, 1st motor
H204: Motor poles setting, 2nd motor

The actual-frequency monitoring function is effective only when a motor equipped with an encoder is connected to the inverter and the feedback option board (SJ-FB) is mounted in the inverter. When the actual-frequency monitoring function (d008) is selected, the inverter displays the actual operating frequency of the motor (regardless of the motor control method (A044 or A244)).

(Display)
Forward operation:
0.00 to 99.99 in steps of 0.01 Hz
100.0 to 400.0 in steps of 0.1 Hz
Reverse operation:
- 0.0 to -99.9 in steps of 0.1 Hz
- 100 to -400 in steps of 1 Hz

Note: To use this monitoring function, set the encoder pulse-per-revolution (PPR) setting (P011) and the number of motor poles (H004 or H204) correctly.

4.1.9 Torque command monitoring

Related code
d009: Torque command monitoring
P033: Torque command input selection
P034: Torque command setting
A044: V/f characteristic curve selectcion
C001 to C008: Terminal [1] to [8]

The torque command monitoring function is effective when you have selected control by torque for the vector control with sensor. When the torque command monitoring function (d009) is selected, the inverter displays the value of the currently input torque command.
The % monitor lamp lights up while the inverter is displaying the torque command value.
Assign 52 (ATR) on intelligent input terminal and turn on to activate torque control.

(Display)
0. to 200. in steps of 1 %

4.1.10 Torque bias monitoring

Related code
d010: Torque bias monitoring
A044: V/f characteristic curve selectcion
P036: Torque bias mode
P037: Torque bias value
P038: Torque bias polarity

The torque bias monitoring function is effective when you have selected the vector control with sensor. When the torque bias monitoring function (d010) is selected, the inverter displays the value of the currently set value of torque bias.
The % monitor lamp lights up while the inverter is displaying the torque bias value.

(Display)
-200. to +200. in steps of 1 %

4.1.11 Torque monitoring

Related code
d012: Torque monitoring
A044: V/f characteristic curve selectcion

When the torque monitoring function (d012) is selected, the inverter displays the estimated value of the torque output from the inverter.
The % monitor lamp lights up while the inverter is displaying the estimated output torque.

(Display)
-200. to +200. in steps of 1 %

Indicator accuracy : about ±20%
The indicator accuracy may exceed ±20% at more than 100% of torque.

Note: This monitoring function is effective only when you have selected the sensorless vector control, 0Hz-range sensorless vector control, or vector control with sensor as the control mode.
Displayed value is not accurate when the other control method is selected.

4.1.12 Output voltage monitoring

Related code
d013: Output voltage monitoring

When the output voltage monitoring function (d013) is selected, the inverter displays the voltage output from the inverter.
The V monitor lamp lights up while the inverter is displaying the output voltage.

(Display)
0.0 to 600.0 in steps of 0.1 V
(remark) Displayed value may not be accurate when the output voltage is differ from input voltage.

4.1.13 Power monitoring

Related code
d014: Power monitoring

When the power monitoring function (d014) is selected, the inverter displays the electric power (momentary value) input to the inverter.
The kW monitor lamps (V and A lamps) light up while the inverter is displaying the input power.

(Display)
0.0 to 999.9 in steps of 0.1 kW

4.1.14 Cumulative power monitoring

Related code
d015: Cumulative power monitoring
b078: Cumulative power clearance
b079: Cumulative input power display gain setting

When the cumulative power monitoring function is selected, the inverter displays the cumulative value of electric power input to the inverter.
You can also convert the value to be displayed to gain data by setting the cumulative input power display gain setting (b079).

Value displayed by function "d015" = "calculated value of input power (kW/h)"/"cumulative input power display gain setting (b079)"
The cumulative power input gain can be set within the range 1 to 1000 in steps of 1.

You can clear the cumulative power data by specifying "01" for the cumulative power clearance function (b078) and pressing the STR key.
You can also clear the cumulative power data at an intelligent input terminal by assigning function "53" (KHC: cumulative power clearance) to the intelligent input terminal.
When the cumulative input power display gain setting (b079) is set to "1000", the cumulative power data up to 999000 (kW/h) can be displayed.

(Display)
0.0 to 999.9 in steps of 1 kW/h, or the unit set for function "b079"
1000 to 9999 in units of 10 kW/h, or the unit set for function "b079"
⌈100 to ⌈999 in units of 1000 kW/h, or the unit set for function "b079"

4.1.15 Cumulative operation RUN time monitoring

Related code
d016: Cumulative operation RUN time monitoring

When the cumulative operation RUN time monitoring function (d016) is selected, the inverter displays the cumulative time of the inverter operation.

(Display)
0. to 9999. in units of 1 hour
1000 to 9999 in units of 10 hours
⌈100 to ⌈999 in units of 1,000 hours

4.1.16 Cumulative power-on time monitoring

Related code
d017: Cumulative power-on time monitoring

When the cumulative power-on time monitoring function(d017) is selected, the inverter displays the cumulative time throughout which the inverter power has been on.

(Display)
0. to 9999. in units of 1 hour
1000 to 9999 in units of 10 hours
⌈100 to ⌈999 in units of 1,000 hours

4.1.17 Heat sink temperature monitoring

Related code
d018: Heat sink temperature monitoring

When the heat sink temperature monitoring function (d018) is selected, the inverter displays the temperature of the internal heat sink of the inverter.

(Display)
-020. to 200.0 in steps of 0.1 °C

4.1.18 Motor temperature monitoring

Related code
d019: Motor temperature monitoring
b098: Thermistor for thermal protection control

When the motor temperature monitoring function is selected, the inverter displays the temperature of the thermistor connected between control circuit terminals TH and CM1.
Use the thermistor model PB-41E made by Shibaura Electronics Corporation.
Specify "02" (enabling NTC) for the thermistor for thermal protection control (function "b098").

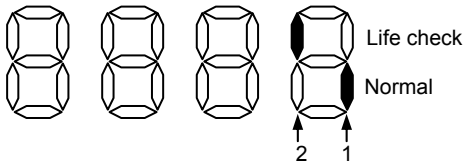
(Display)
-020. to 200.0 in steps of 0.1 °C.

Note: If "01" (enabling PTC) is specified for the thermistor for thermal protection control (function "b098"), motor temperature monitoring is disabled.

4.1.19 Life-check monitoring

Related code
d022: Life-check monitoring

When the life-check monitoring function (d002) is selected, the inverter displays the operating life status of two inverter parts output from corresponding intelligent output terminals by using LED segments of the monitor.
The two targets of life-check monitoring are:
1: Life of the capacitor on the main circuit board
(SJ700-2 large capacity inverter is not supported for this function.)
2: Degradation of cooling fan speed



Note 1: The inverter estimates the capacitor life every 10 minutes. If you turn the inverter power on and off repeatedly at intervals of less than 10 minutes, the capacitor life cannot be checked correctly.
Note 2: If you have specified "01" for the selection of cooling fan operation (function "b0092"), the inverter determines the cooling fan speed to be normal while the cooling fan is stopped.

4.1.20 Program counter display (easy sequence function)

Related code
d023: Program counter

While the easy sequence function is operating, the inverter displays the program line number that is being executed.
For details, refer to the “Programming Software EzSQ” manual.

4.1.21 Program number monitoring (easy sequence function)

Related code
d024: Program number monitoring

When the program number monitoring function (d024) is selected, the inverter displays the program number of the downloaded easy sequence program.
Note that you must describe a program number in the program you create. For details, refer to the “Programming Software EzSQ” manual.

Related code
d025: user monitor 0
d026: user monitor 1
d027: user monitor 2

4.1.22 User Monitors 0 to 2 (easy sequence function)

The user monitor function allows you to monitor the results of operations in an easy sequence program.
For details, refer to the Programming Software EzSQ Instruction Manual.

Related code
d028: Pulse counter monitor

4.1.23 Pulse counter monitor

Pulse counter monitor allows you to monitor the accumulated pulse of intelligent input terminals pulse counter 74 (PCNT).

4.1.24 Position command monitor (in absolute position control mode)

Related code
d029: Pulse counter monitor

The user monitor function allows you to monitor the results of operations in an easy sequence program.
For details, refer to the Programming Software EzSQ Instruction Manual.

4.1.25 Current position monitor (in absolute position control mode)

Related code
d030: Position feedback monitor

The current position monitor function allows you to monitor the current position in absolute position control mode.
For details, see Section 4.3.12.

4.1.26 Trip Counter

Related code
d080: Trip Counter

When the trip counter function (d080) is selected, the inverter displays the number of times the inverter has tripped.

(Display)
0. to 9999. in units of 1 trip
1000 to 6553 in units of 10 trips

4.1.27 Trip monitoring 1 to 6

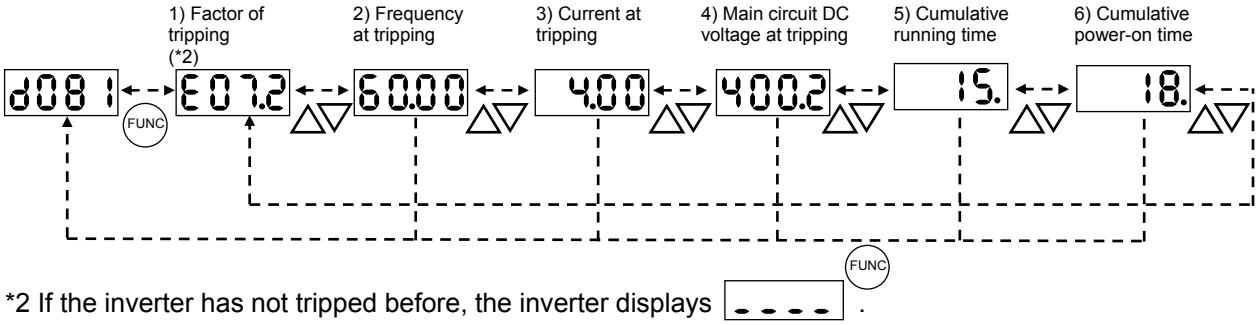
Related code
d081: Trip monitoring 1
d082: Trip monitoring 2
d083: Trip monitoring 3
d084: Trip monitoring 4
d085: Trip monitoring 5
d086: Trip monitoring 6

When the trip monitoring function (d081 to d086) is selected, the inverter displays the trip history data. The last six protective trips the inverter made can be displayed.
Select the trip monitoring 1 (d081) to display the data on the most recent trip.

(Display contents)
1) Factor of tripping (one of E01 to E79) (*1)
2) Output frequency at tripping (Hz)
3) Output current at tripping (A) (*2)
4) Main circuit DC voltage at tripping (V) (*3)
5) Cumulative inverter-running time until tripping (h)
6) Cumulative inverter power-on time until tripping (h)

*1 See Section 5.1.1, "Protective functions."
*2 When the inverter status is in stop mode as a trip history, monitored value can be zero.
*3 When grounding fault is detected at power on, monitored value can be zero.

(Display by trip monitoring)



*2 If the inverter has not tripped before, the inverter displays ____ .

4.1.28 Programming error monitoring

Related code
d090: Programming error monitoring

If an attempt is made to set the data conflicting with other data on the inverter, the inverter displays a warning.
The PRG (program) lamp lights up while the warning is displayed (until the data is rewritten forcibly or corrected).
For details on the programming error monitoring function, see Section 5.2. Warning Codes

4.1.29 DC voltage monitoring

Related code
d102: DC voltage monitoring

When the DC voltage monitoring is selected, the inverter displays the DC voltage (across terminals P and N) of the inverter.
While the inverter is operating, the monitored value changes as the actual DC voltage of the inverter changes.

(Display)
0.0 to 999.9 in steps of 0.1 V

4.1.30 BRD load factor monitoring

Related code
d103: BRD load factor monitoring
b090: Dynamic braking usage ratio

When the BRD load factor monitoring function (d103) is selected, the inverter displays the BRD load factor. If the BRD load factor exceeds the value set as the dynamic braking usage ratio (b090), the inverter will trip because of the braking resistor overload protection (error code "E06").

(Display)
0.0 to 100.0 in steps of 0.1%

4.1.31 Electronic thermal overload monitoring

Related code
d104: Electronic thermal overload monitoring

When the electronic thermal overload monitoring function (d104) is selected, the inverter displays the electronic thermal overload. If the electronic thermal overload exceeds 100%, the inverter will trip because of the overload protection (error code "E05").

(Display)
0.0 to 100.0 in steps of 0.1%

4.2 Function Mode

4.2.1 Output frequency setting

Related code
F001: Output frequency setting
A001: Frequency source setting
A020/A220/A320:
Multispeed frequency setting, 1st/2nd/3rd motors
C001 to C008:
Terminal [1] to [8] functions

The output frequency setting function allows you to set the inverter output frequency.
You can set the inverter output frequency with this function (F001) only when you have specified "02" for the frequency source setting (A001). For other methods of frequency setting, see Section 4.2.4, "frequency source setting (A001)."
(If the setting of function "A001" is other than "02", function "F001" operates as the frequency command monitoring function.)
The frequency set with function "F001" is automatically set as the Multispeed frequency setting (A020). To set the second and third multispeed s, use the multispeed frequency setting, 2nd motor, function (A220) and multispeed frequency setting, 3rd motor, function (A320), or use function "F001" for the setting after turning on the SET and SET3 signals. For the setting using the SET and SET3 signals, assign the SET function (08) and SET3 function (17) to intelligent input terminals.
If the set output frequency is used as the target data for the PID function, PID feedback data will be displayed in percent (%). ("100%" indicates the maximum frequency.)

Item	Function code	Range of data	Description
Output frequency setting	F001	0.0, start frequency to maximum frequency, 1st/2nd/3rd motors (Hz) 0.0 to 100.0 (Enabling the PID operation)	The frequency set with F001 is equal to the setting of A020. The second control frequency set with F001 is equal to the setting of A220. The third control frequency set with F001 is equal to the setting of A320.
Multispeed 0	A020/A220/A320		

4.2.2 Keypad Run key routing

Related code
F004: Keypad Run key routing

When you enter operation commands via the digital operator, the Keypad Run key routing function allows you to select the direction of motor operation.
This function is ineffective when you use the control terminal block or remote operator to input operation commands.

Item	Function code	Data	Description
Keypad Run key routing	F004	00	Forward operation
		01	Reverse operation

4.2.3 Rotational direction restriction

Related code
b035: Rotational direction restriction

The rotational direction restriction function allows you to restrict the direction of motor operation.
This function is effective regardless of the specification of operation command input device (e.g., control circuit block or digital operator).
If an operation command to drive the motor in a restricted direction is input, the inverter (digital operator) will display  .

Item	Function code	Data	Description
Rotational direction restriction	b035	00	Both forward and reverse operations are enabled.
		01	Only forward operation is enabled.
		02	Only reverse operation is enabled.

4.2.4 Frequency source setting

Related code
A001: Frequency source setting

The frequency source setting function allows you to select the method to input the frequency-setting command.

Motor rotation direction is inverted when -10 to 0V is given as frequency command to 02-L terminals.

Item	Function code	Data	Description
Frequency source setting	A001	(00)	(Valid only when the OPE-SR is used) Use the control provided on the digital operator to set the frequency.
		01	Input the frequency-setting command via a control circuit terminal (0-L, OI-L, or O2-L).
		02	Use the digital operator (function "F001") or remote operator to set the frequency.
		03	Input the frequency-setting command via an RS485 communication terminal.
		04	Input the frequency-setting command from the board connected to optional port 1.
		05	Input the frequency-setting command from the board connected to optional port 2.
		06	Use the SJ-FB to input the frequency-setting command as a pulse train (see 4.2.21)
		07	Use the SET-Freq command of the easy sequence function as the frequency-setting command.
		10	Use the operation result of the set frequency operation function as the frequency-setting command. (see 4.2.12)

4.2.5 Run command source setting

Related code
A002: Run command source setting
C001 to C008: Terminal [1] to [8] functions
C019: Terminal [FW] active state
F004: Keypad Run key routing

The run command source setting function allows you to select the method to input operation commands (to start and stop the motor).
As the operation commands via control circuit terminals, turn the FW signal (for forward operation) or RV signal (for reverse operation) on and off to start and stop the motor, respectively.
(Note that the factory setting assigns the FW signal to intelligent input terminal [8].)
To switch each intelligent input terminal between a and b contacts, specify each terminal with function "C011" to "C019", and then perform input a/b (NO/NC) selection for each terminal.
When using the digital operation for the inverter operation, specify the desired motor operation direction with function "F004", and use the RUN and STOP/RESET keys to start and stop the motor, respectively.
If the start commands for both forward and reverse operations are input at the same time, the inverter will assume the input of a stop command.

Item	Function code	Data	Description
Run command source setting	A002	01	Input the start and stop commands via control circuit terminals (FW and RV).
		02	Input the start and stop commands from the digital or remote operator.
		03	Input the start and stop commands via RS485 communication terminals.
		04	Input the start and stop commands from option board 1.
		05	Input the start and stop commands from option board 2.
Terminal [FW] active state	C019 C011 to C018	00	a (NO) contact
		01	b (NC) contact

Note 1: If function "31" (forcible operation) or "51" (forcible-operation terminal) is assigned to an intelligent input terminal, the settings made with functions "A001" and "A002" will be invalidated when the said intelligent input terminal is turned on and those methods to input frequency-setting and operation commands which are specified for the said terminal will be enabled.
Note 2: On the remote operator (SRW) being used to operate the inverter, pressing the REMT (remote) key enables you to input both frequency-setting and operation commands from the remote operator.
Note 3: When the DeviceNet option board (SJ-DN) is used, A002 is not needed to be changed from default because the run command source is automatically set via DeviceNet. (In case it is changed, it is to be set as 01, 02 or 03.)

4.2.6 Stop mode selection

Related code
b091: Stop mode selection
F003/F203/F303:
Deceleration (1) time setting,
1st/2nd/3rd motors
b003: Retry wait time before motor restart
b007: Restart frequency threshold
b008: Restart mode after FRS

The stop mode selection function allows you to select one of two methods of stopping the motor when a stop command is input from the digital operator or via the control circuit terminal block. One is to decelerate the motor according to the specified deceleration time and then stop it; the other is to let the motor run freely until it stops.
If a start command is input while the motor is in free-running status, the inverter will restart the motor according to the setting of the restart mode after FRS (b088). (See Section 4.2.47.)

Item	Function code	Data	Description
Stop mode selection	b091	00	Normal stopping (stopping after deceleration)
		01	Free-running until stopping
Restart mode after FRS	b088	00	Starting with 0 Hz
		01	Starting with matching frequency
Restart frequency threshold	b007	0.00 to 400.0(Hz)	Starting with 0 Hz if the frequency-matching result is less than the set lower limit
Retry wait time before motor restart	b003	0.3 to 100.(s)	Time to wait until the restart of the motor after free-running ends

4.2.7 STOP key enable

Related code
b087: STOP key enable

When the control circuit terminal block is selected as the device to input operation commands, the STOP key enable function allows you to enable or disable the motor-stopping and trip reset functions of the STOP key of the digital operator.
This function is effective only when the digital operator (02) is not specified for the run command source setting (A002) (see Section 4.2.5).
If the digital operator (02) is specified for "A002", the motor-stopping and trip reset functions of the STOP key are enabled regardless of this setting (STOP key enable).

Function code	Data	Stop command with STOP key	Trip reset command with STOP key
b087	00	Enabled	Enabled
	01	Disabled	Disabled
	02	Disabled	Enabled

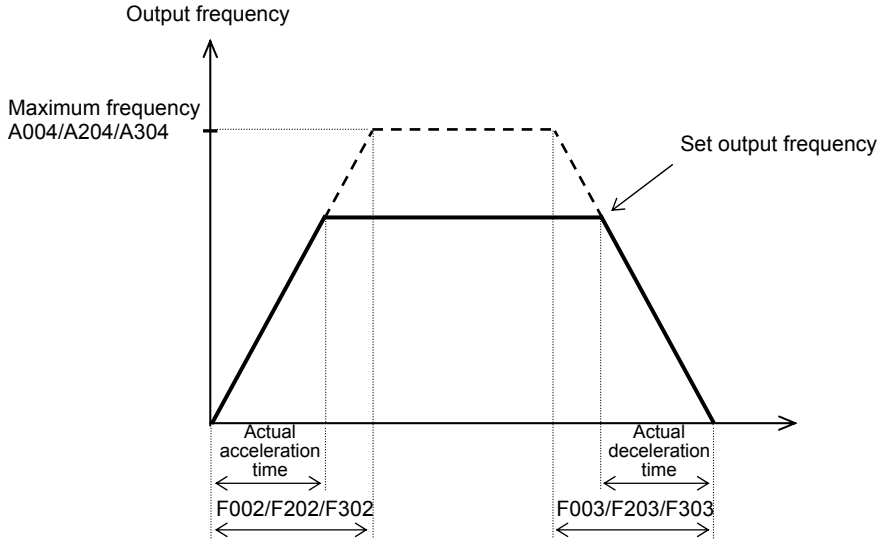
4.2.8 Acceleration/deceleration time setting

Related code

F002/F202/F302: Acceleration (1) time setting, 1st/2nd/3rd motors
F003/F203/F303: Deceleration (1) time setting, 1st/2nd/3rd motors
A004/A204/A304: Maximum frequency setting, 1st/2nd/3rd motors
P031: Accel/decel time input selection
C001 to C008: Terminal [1] to [8] functions

- Specify a longer time for slower acceleration or deceleration; specify a shorter time for quicker acceleration or deceleration.
- The time set with this function is the time to accelerate (or decelerate) the motor from 0 Hz to the maximum frequency (or vice versa).
- If you assign the LAD cancellation (LAC) function to an intelligent input terminal and turns on the terminal, the set acceleration/deceleration time will be ignored, and the output frequency will immediately follow the frequency-setting command.
- To switch the acceleration and deceleration time among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals (see Section 4.2.38). Use the SET and SET3 signals for switching.
- As the Accel/decel time input selection by P031, select one of the (1) input from the digital operation, (2) input from option board 1, (3) input from option board 2, and (4) input from the easy sequence program.

Item	Function code	Range of data	Description
Acceleration (1) time setting	F002/F202/ F302	0.01 to 3600.(s)	Set the length of time to accelerate the motor from 0 Hz to the maximum frequency.
Deceleration (1) time setting	F003/F203/ F303	0.01 to 3600.(s)	Set the length of time to decelerate the motor from the maximum frequency to 0 Hz.
Accel/decel time input selection	P031	00	Input from the digital operator (OPE)
		01	Input from option board 1 (OP1)
		02	Input from option board 1 (OP2)
		03	Input from the easy sequence program (PRG)
Terminal function	C001 to C008	46	LAD cancellation



The actual time to accelerate/decelerate the motor will be no less than the minimum acceleration/deceleration time that depends on the inertial effect (J) due to the mechanical system and motor torque. If you set a time shorter than the minimum acceleration/deceleration time, the inverter may trip because of overcurrent or overvoltage.

Acceleration time (ts)

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

Deceleration time (t_B)

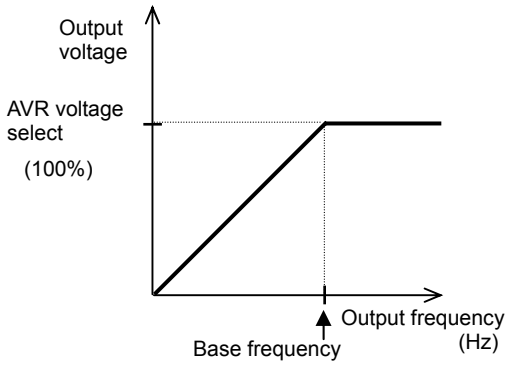
$$t_B = \frac{(J_L + J_M) \times N_M}{9.55 \times (T_B + T_L)}$$

J_L: Inertia effect (J) of the load converted to that of the motor shaft (kg-m^2)
J_M: Inertia effect (J) of the motor (kg-m^2)
N_M: Motor speed (rpm)
Ts: Maximum acceleration torque driven by the inverter (N-m)
T_B: Maximum deceleration torque driven by the inverter (N-m)
T_L: Required running torque (N-m)

4.2.9 Base frequency setting

Related code
A003/A203/A303: Base frequency setting, 1st/2nd/3rd motors
A081: AVR function select
A082: AVR voltage select

(1) Base frequency and motor voltage
- With the base frequency setting and AVR voltage select functions, adjust the inverter outputs (frequency and voltage) to the motor ratings.
- The base frequency is the nominal frequency of the motor. Set a base frequency that meets the motor specification. Carefully note that setting the base frequency to less than 50 Hz may result in motor burnout.
- A special motor requires a base frequency of 60 Hz or more. Your inverter model may not be suitable for such a special motor, and one with a larger capacity may be required.
- Select the motor voltage that meets the motor specification. Selecting a motor voltage exceeding the motor specification may result in motor burnout.



- To switch the base frequency among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals (see Section 4.2.38). Use the SET and SET3 signals for switching.

Item	Function code	Range of data	Description
Base frequency setting	A003/A203/ A303	30. to maximum frequency, 1st/2nd/3rd motors (Hz)	
AVR voltage select	A082	380/400/415/440/460/480	

(2) AVR function
The AVR function maintains the correct voltage output to the motor, even when the voltage input to the inverter fluctuates. The output voltage maintained by this function is based on the voltage specified by the AVR voltage select.
Use the AVR function select (A081) to enable or disable the AVR function.

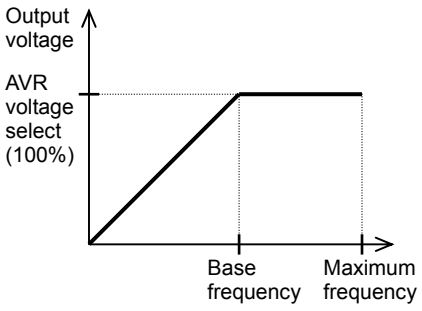
Item	Function code	Data	Description
AVR function select	A081	00	The AVR function is always enabled.
		01	The AVR function is always disabled.
		02	The AVR function is disabled at deceleration. (*1)

*1 Disabling the AVR function at motor deceleration increases the energy loss on the decelerated motor and decreases the energy regenerated on the inverter, which results in a shorter deceleration time.

4.2.10 Maximum frequency setting

Related code
A004/A204/A304: Maximum frequency setting, 1st/2nd/3rd motors

The maximum frequency setting function allows you to set the maximum frequency of the motor driven by the inverter.
The maximum frequency set here corresponds to the maximum level of each external analog input (See Section 4.2.12) (for example, 10 V of the input of 0 to 10 V).
To switch the maximum frequency among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.
The inverter output voltage with the frequency ranging from the base frequency to the maximum frequency is that selected by the AVR voltage select function (A082).



Item	Function code	Range of data	Description
Maximum frequency setting	A004/A204/ A304	30. to 400. (Hz) (185 to 315kW) 30. to 120. (Hz) (400kW)	The maximum output frequency is set.

4.2.11 External analog input setting (O, OI, and O2)

Related code
A005: [AT] selection
A006: [O2] selection
C001 to C008: Terminal [1] to [8] functions

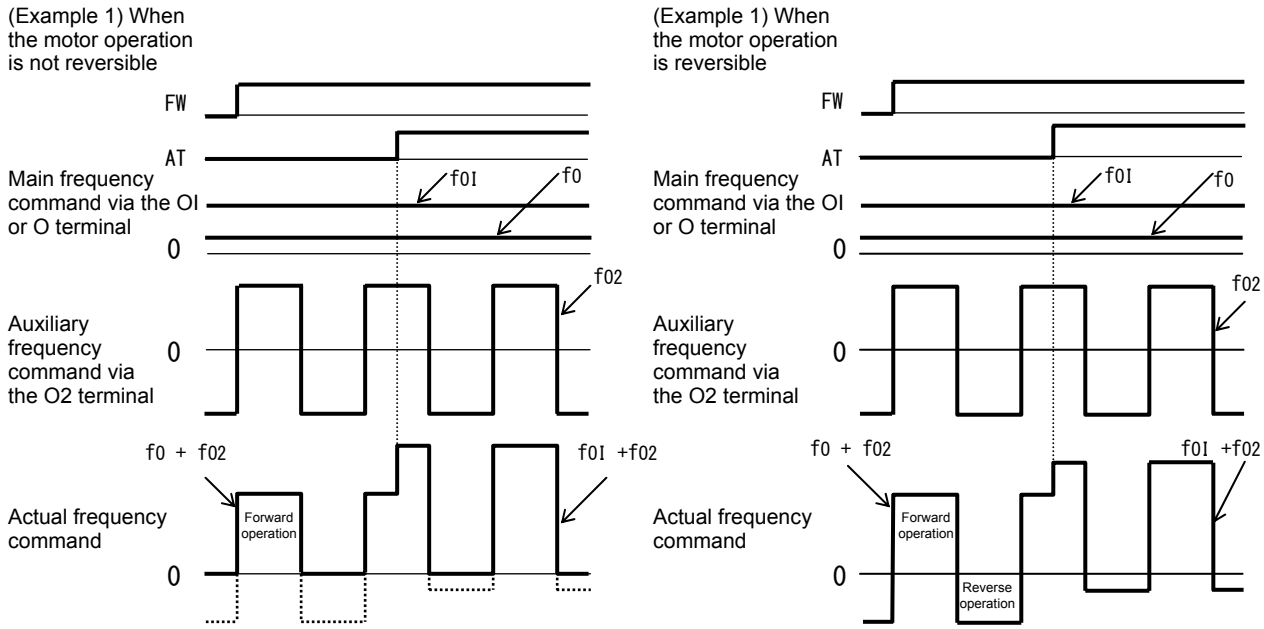
The inverter has the following three types of external analog input terminals:
O-L terminal: 0 to 10 V
OI-L terminal: 4 to 20 mA
O2-L terminal: -10 to 10 V

The table below lists the settings of the external analog input terminals.

Item	Function code	Data	Description
[AT] selection	A005	00	Switching between the O and OI terminals with the AT terminal Turning on the AT terminal enables the OI-L terminal. Turning on the AT terminal enables the O-L terminal.
		01	Switching between the O and O2 terminals with the AT terminal Turning on the AT terminal enables the O2-L terminal. Turning on the AT terminal enables the O-L terminal.
		(02)	(Valid only when the OPE-SR is used) Switching between the O terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the O-L terminal.
		(03)	(Valid only when the OPE-SR is used) Switching between the OI terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the OI-L terminal.
		(04)	(Valid only when the OPE-SR is used) Switching between the O2 terminal and the control with the AT terminal Turning on the AT terminal enables the pot on OPE-SR terminal. Turning on the AT terminal enables the O2-L terminal.
[O2] selection	A006	00	Using the O2 terminal independently
		01	Using the O2 terminal for auxiliary frequency command (nonreversible) in addition to the O and OI terminals
		02	Using the O2 terminal for auxiliary frequency command (reversible) in addition to the O and OI terminals
		03	Disabling the O2 terminal

Note that whether frequency commands are input to the O2-L terminal and whether the motor operation is reversible depend on the combination of settings of functions "A005" and "A006" and whether function "16" (AT) is assigned to an intelligent input terminal as shown in the table below.
When the motor operation is reversible, the inverter operates the motor in a reverse direction if the sum of the frequencies specified by the main frequency and auxiliary frequency commands is less than 0 (even when the forward operation [FW] terminal is on). Even when no wire is connected to the 02 terminal, reverse operation of the motor may occur and prolong the acceleration time if the output voltage fluctuates near 0 V.

	A006	A005	AT terminal	Main frequency command	Whether to input an auxiliary frequency command (via the O2-L terminal)	Reversible/ nonreversible
When the AT function is assigned to an intelligent input terminal	00,03	00	OFF	O-L terminal	No input	Nonreversible
			ON	OI-L terminal	No input	
		01	OFF	O-L terminal	No input	
			ON	O2-L terminal	No input	Reversible
	01	00 (Example 1)	OFF	O-L terminal	Input	Nonreversible
			ON	OI-L terminal	Input	
		01	OFF	O-L terminal	Input	
			ON	O2-L terminal	No input	Reversible
	02	00 (Example 2)	OFF	O-L terminal	Input	Reversible
			ON	OI-L terminal	Input	
		01	OFF	O-L terminal	Input	
			ON	O2-L terminal	No input	
When the AT function is not assigned to any intelligent input terminal	00	—	—	O2-L terminal	No input	Reversible
	01	—	—	Addition of signals on O-L and OI-L terminals	Input	Nonreversible
	02	—	—	Addition of signals on O-L and OI-L terminals	Input	Reversible
	03	—	—	Addition of signals on O-L and OI-L terminals	No input	Nonreversible



4.2.12 Frequency operation function

Related code
A141: Operation-target frequency selection 1
A142: Operation-target frequency selection 2
A143: Operator selection
A001: Frequency source setting
A076: PV source setting

The frequency operation function allows you to use the result of an arithmetic operation on two frequency commands as the actual frequency command or PID feedback data.
To use the operation result as the actual frequency command, specify "10" for the frequency source setting (A001).
To use the operation result as the PID feedback data, specify "10" for the PV source setting (A076).

Item	Function code	Data	Description
Operation-target frequency selection 1 and 2	A141/A142	00	Digital operator (A020/A220/A320)
		(01)	Control on the digital operator (Valid only when the OPE-SR is connected)
		02	Input via the O terminal
		03	Input via the OI terminal
		04	Input via the RS485 terminal
		05	Input from option board 1
		06	Input from option board 2
		07	Input of pulse train
Operator selection for frequency operation	A143	00	Addition: (A141) + (A142)
		01	Subtraction: (A141) - (A142)
		02	Multiplication: (A141) x (A142)
Frequency source setting	A001	10	Output of operation result
PV source setting	A076	10	Output of operation result

Note 1: The [1] (up) and [2] (down) keys of the digital operator are ineffective when the frequency operation function is enabled. Also, the frequency displayed by the output frequency monitoring (d001), Scaled output frequency monitoring (d007), or output frequency setting (F001) cannot be changed with key operations.
Note 2: The settings of "A141" and "A142" can be the same.

4.2.13 Frequency addition function

Related code
A145: Frequency to be added
A146: Sign of the frequency to be added
C001 to C008: Terminal [1] to [8]functions

The frequency addition function allows you to add or subtract the value specified as the frequency to be added (A145) to or from the frequency value of a selected frequency command.
To use this function, assign function "50" (ADD) to an intelligent input terminal.
When the ADD terminal is turned on, the inverter performs the addition or subtraction of the value specified as "A145".

Item	Function code	Data or range of data	Description
Frequency to be added	A145	0.00 to 400.00(Hz) (185 to315kW) 0.00 to 120.00 (Hz) (400kW)	Setting of the frequency to be added
Selection of the sign of the frequency to be added	A146	00	(Frequency command) + (A145)
		01	(Frequency command) - (A145)
Terminal function	C001 to C008	50	ADD selection of the trigger for adding the frequency (A145)

Note 1: If the sign of the frequency value in the frequency command changes from minus (-) to plus (+), or vice versa, as the result of frequency addition, the motor operation direction will be inverted.
Note 2: When the PID function is used, the frequency addition function can apply to PID target data. (In such cases, the data display by function "A145" is in percentage [in steps of 0.01%]).

4.2.14 Start/end frequency setting for external analog input

Related code
A011: [O]-[L] input active range start frequency
A012: [O]-[L] input active range end frequency
A013: [O]-[L] input active range start voltage
A014: [O]-[L] input active range end voltage
A015: [O]-[L] input start frequency enable
A101: [OI]-[L] input active range start frequency
A102: [OI]-[L] input active range end frequency
A103: [OI]-[L] input active range start current
A104: [OI]-[L] input active range end current
A105: [OI]-[L] input start frequency enable
A111: [O2]-[L] input active range start frequency
A112: [O2]-[L] input active range end frequency
A113: [O2]-[L] input active range start voltage
A114: [O2]-[L] input active range end voltage

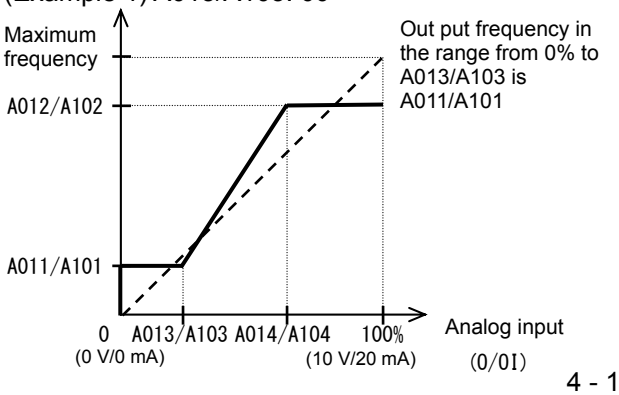
The start/end frequency setting function allows you to set the inverter output frequency in relation to the external analog inputs (frequency commands) via the following terminals:
O-L terminal: 0 to 10 V
OI-L terminal: 4 to 20 mA
O2-L terminal: -10 to +10 V

(1) Start/end frequency settings for the O-L and OI-L terminals

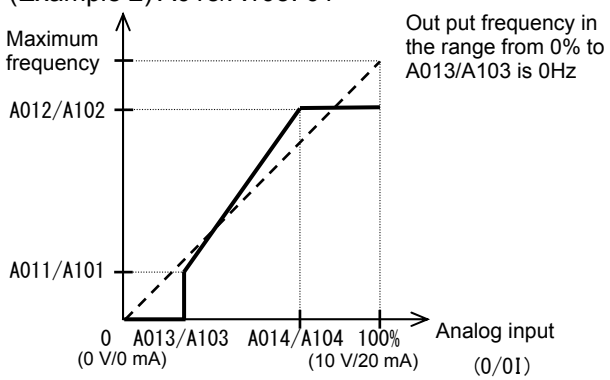
Item	Function code	Range of data	Description
[O]/[OI]-[L] input active range start frequency	A011/A101	0.00 to 400.0(Hz) (185 to315kW) 0.00 to 120.0 (Hz) (400kW)	Setting of the start frequency
[O]/[OI]-[L] input active range end frequency	A012/A102	0.0 to 400.0(Hz) (185 to315kW) 0.00 to 120.0 (Hz) (400kW)	Setting of the end frequency
[O]/[OI]-[L] input active range start voltage	A013/A103	0. to 100.(%)	Setting of the rate of the start frequency to the external frequency command (0 to 10 V/0 to 20 mA)
[O]/[OI]-[L] input active range end voltage	A014/A104	0. to 100.(%)	Setting of the rate of the end frequency to the external frequency command (0 to 10 V/0 to 20 mA)
[O]/[OI]-[L] input start frequency enable	A015/A105	00	Externally input start frequency The frequency set as "A011" or "A101" is output as the output frequency while the start-frequency rate is 0% to the value set as "A013" or "A103".
		01	0 Hz 0 Hz is output as the output frequency while the start-frequency rate is 0% to the value set as "A013" or "A103".

If the voltage of the signal to be input to the O-L terminal is 0 to 5 V, specify 50% for "A014".

(Example 1) A015/A105: 00



(Example 2) A015/A105: 01

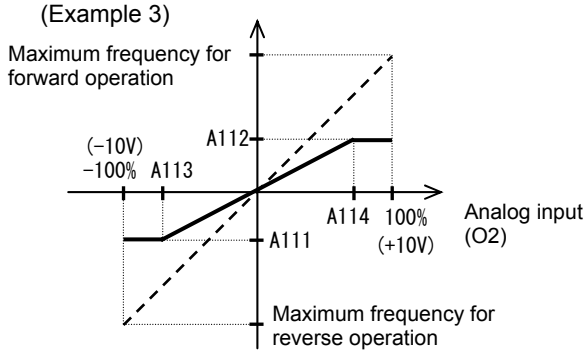


(2) Start/end frequency settings for the O2-L terminal

Item	Function code	Range of data	Description	Remarks
02 start frequency	A111	-400. to 400.(Hz) (185 to315kW) -120. to 120. (Hz) (400kW)	Setting of the start frequency	(Example 3)
02 end frequency	A112	-400. to 400.(Hz) (185 to315kW) -120. to 120. (Hz) (400kW)	Setting of the end frequency	
02 start-frequency rate	A113	-100. to 100.(%)	Setting of the rate of the start frequency to the external frequency command (-10 to +10 V) (*1)	
02 end-frequency rate	A114	-100. to 100.(%)	Setting of the rate of the end frequency to the external frequency command (-10 to +10 V) (*1)	

*1 The frequency rates correspond to the voltages (-10 to +10 V) of the external frequency command as follows:
-10 to 0 V: -100% to 0%
0 to +10 V: 0% to 100%
For example, if the voltage of the signal to be input to the O2-L terminal is -5 to +5 V, specify 50% for "A114".

(Example 3)



4.2.15 External analog input (O/OI/O2) filter setting

Related code
A016: External frequency filter time const.

The external analog input filter setting function allows you to set the input-voltage/input-current sampling time to be applied when frequency commands are input as external analog signals.
You can use this filter function effectively for removing noise from the frequency-setting circuit signal.
If the noise disables the stable operation of the inverter, increase the setting. Setting a larger value makes the inverter response slower. The filtering constant is "set value (1 to 30) x 2 ms."
When the setting is "31" (factory setting), a hysteresis of ±0.1 Hz is added to the filtering constant (500 ms).

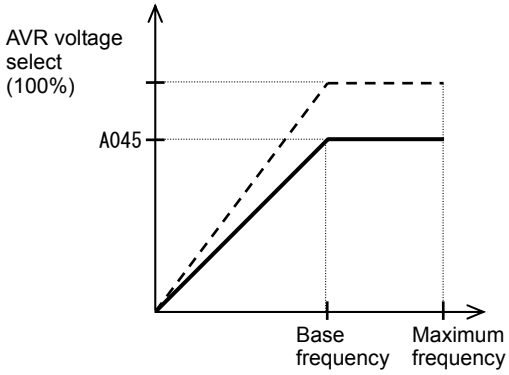
Item	Function code	Range of data	Description
External frequency filter time const.	A016	1. to 30. or 31.	Setting of 1. to 30.: "Set value x 2" ms filter Setting of 31.: 500 ms filter (fixed) with hysteresis of ±0.1 Hz

4.2.16 V/f gain setting

Related code
A045: V/f gain setting
A082: AVR voltage select

The V/f gain setting function allows you to change the inverter output voltage by specifying the rate of the output voltage to the voltage (100%) selected with the AVR voltage select function (A082).
If the motor operation is cranky, try to increase the gain setting.

Item	Function code	Range of data	Description
V/f gain setting	A045	20. to 100. (%)	Setting of the rate of reducing the output voltage



4.2.17 V/F characteristic curve selection

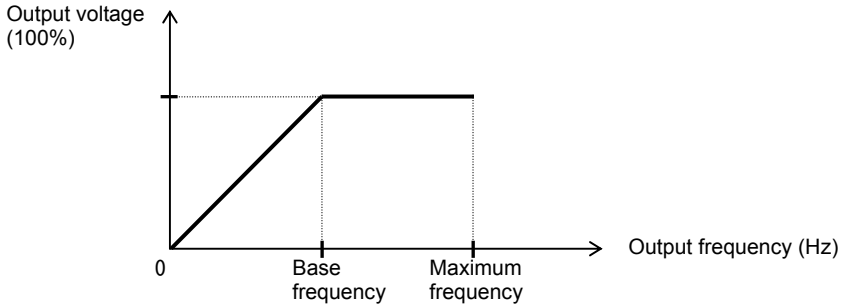
Related code

A044/A244/A344: V/F characteristic curve selection, 1st/2nd/3rd motors
b100/b102/b104/b106/b108/b110/b112: Free-setting V/f frequency (1) (2) (3) (4) (5) (6) (7)
b101/b103/b105/b107/b109/b111/b113: Free-setting V/f voltage (1) (2) (3) (4) (5) (6) (7)

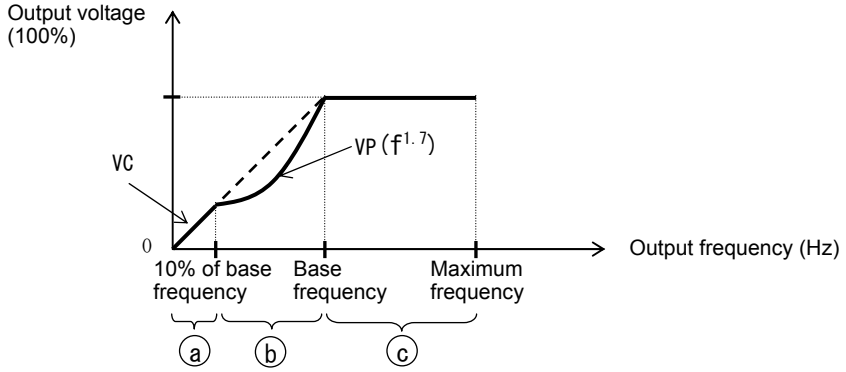
The V/F characteristic curve selection function allows you to set the output voltage/output frequency (V/f) characteristic.
To switch the V/F characteristic curve selection among the 1st, 2nd, and 3rd settings, assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.

Function code	Data	V/f characteristic	Remarks
A044/A244/ A344	00	Constant torque characteristic (VC)	
	01	Reduced-torque characteristic (1.7th power of VP)	
	02	Free V/f characteristic	Available only for A044 and A244
	03	Sensorless vector control (SLV)	Available only for A044 and A244 (See Section 4.2.96.)
	04	0 Hz-range sensorless vector control	Available only for A044 and A244 (See Section 4.2.97.)
	05	Vector control with sensor (V2)	Available only for A044

(1) Constant torque characteristic (VC)
With this control system set, the output voltage is in proportion to the output frequency within the range from 0 Hz to the base frequency. Within the output frequency range over the base frequency up to the maximum frequency, the output voltage is constant, regardless of the change in the output frequency.



(2) Reduced-torque characteristic (1.7th power of VP)
This control system is suited when the inverter is used with equipment (e.g., fan or pump) that does not require a large torque at a low speed.
Since this control system reduces the output voltage at low frequencies, you can use it to increase the efficiency of equipment operation and reduce the noise and vibrations generated from the equipment.
The V/f characteristic curve for this control system is shown below.



Period ⓐ : While the output frequency increases from 0 Hz to the 10% of the base frequency, the output voltage follows the constant torque characteristic.
(Example) If the base frequency is 60 Hz, the constant torque characteristic is maintained within the output frequency range of 0 to 60 Hz.

Period ⓑ : While the output frequency increases from the 10% of base frequency to the base frequency, the output voltage follows the reduced-torque characteristic. In other words, the output voltage increases according to the 1.7th power of the output frequency.

Period ⓒ : While the output frequency increases from the base frequency to the maximum frequency, the output voltage is constant.

(3) Free V/f characteristic setting

The free V/f characteristic setting function allows you to set an arbitrary V/f characteristic by specifying the voltages and frequencies (b100 to b113) for the seven points on the V/f characteristic curve.

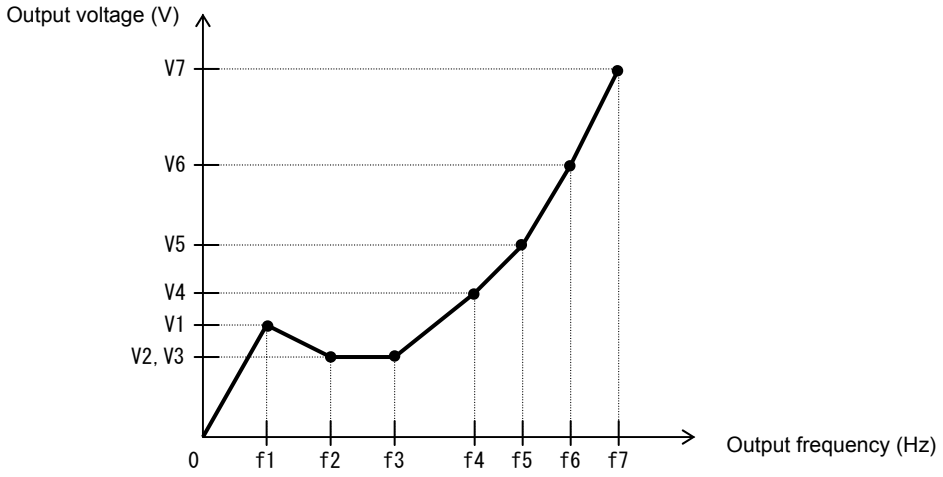
The free V/f frequencies (1 to 7) set by this function must always be in the collating sequence of "1 ≤ 2 ≤ 3 ≤ 4 ≤ 5 ≤ 6 ≤ 7".

Since all free V/f frequencies are set to 0 Hz as default (factory setting), specify their arbitrary values (begin setting with free-setting V/f frequency (7)). (The inverter cannot operate with the free V/f characteristic in the factory setting.)

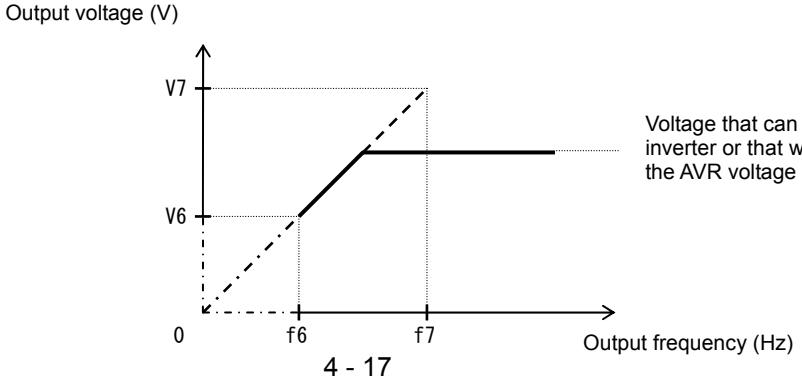
Enabling the free V/f characteristic setting function disables the torque boost selection (A041/A241), base frequency setting (A003/A203/A303), and maximum frequency setting (A004/A204/A304). (The inverter assumes the value of free-setting V/f frequency (7) as the maximum frequency.)

Item	Function code	Data	Description
Free-setting V/f frequency (7)	b112	0.to 400.(Hz) (185 to315kW) 0. to 120. (Hz) (400kW)	Setting of the output frequency at each breakpoint of the V/f characteristic curve
Free-setting V/f frequency (6)	b110	0. to free-setting V/f frequency (7) (Hz)	
Free-setting V/f frequency (5)	b108	0. to free-setting V/f frequency (6) (Hz)	
Free-setting V/f frequency (4)	b106	0. to free-setting V/f frequency (5) (Hz)	
Free-setting V/f frequency (3)	b104	0. to free-setting V/f frequency (4) (Hz)	
Free-setting V/f frequency (2)	b102	0. to free-setting V/f frequency (3) (Hz)	
Free-setting V/f frequency (1)	b100	0. to free-setting V/f frequency (2) (Hz)	
Free-setting V/f voltage (7)	b113	0.0 to 800.0(V)	Setting of the output voltage at each breakpoint of the V/f characteristic curve (*1)
Free-setting V/f voltage (6)	b111		
Free-setting V/f voltage (5)	b109		
Free-setting V/f voltage (4)	b107		
Free-setting V/f voltage (3)	b105		
Free-setting V/f voltage (2)	b103		
Free-setting V/f voltage (1)	b101		

(Example)



*1 Even if 800 V is set as a free-setting V/f voltage (1 to 7), the inverter output voltage cannot exceed the inverter input voltage or that specified by the AVR voltage select.
Carefully note that selecting an inappropriate control system (V/f characteristic) may result in overcurrent during motor acceleration or deceleration or vibration of the motor or other machine driven by the inverter.



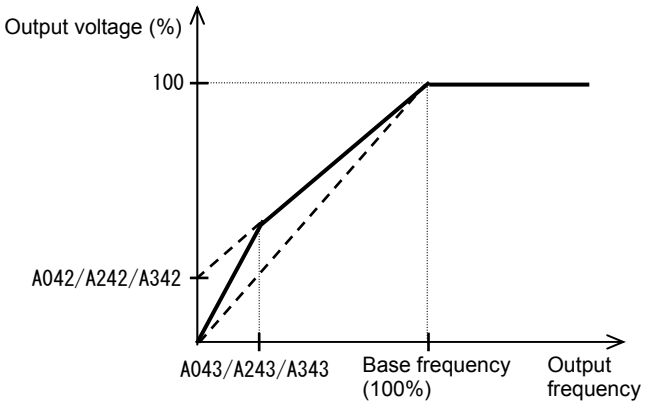
4.2.18 Torque boost setting

Related code
A041/A241: Torque boost selection, 1st/2nd motors
A042/A242/A342: Manual torque boost value, 1st/2nd3rd motors
A043/A243/A343: Manual torque boost frequency adjustment, 1st/2nd/3rd motors
H003/H203: Motor capacity, 1st/2nd motors
H004/H204: Motor poles setting, 1st/2nd motors

The torque boost setting function allows you to compensate for the voltage drop due to wiring and the primary resistance of the motor so as to improve the motor torque at low speeds.
When you select automatic torque boost by the torque boost selection (A041/A241), adjust the settings of the motor capacity selection (H003/H203) and motor pole selection (H004/H204) based on the motor to be driven.

Item	Function code	Data or range of data	Description
Torque boost selection	A041/A241	00	Manual torque boost
		01	Automatic torque boost
Manual torque boost value	A042/A242/A342	0.0 to 20.0(%)	Setting of the rate of the boost to the output voltage (100%)
Manual torque boost frequency adjustment	A043/A243/A343	0.0 to 50.0(%)	Setting of the rate of the frequency at breakpoint to the base frequency
Motor capacity	H003/H203	11.0 to 400.0(kW)	Selection of the motor capacity
Motor poles setting	H004/H204	2, 4, 6, 8, or 10 (poles)	Selection of the number of poles of the motor
Voltage compensation gain setting for automatic torque boost	A046/A246	0. to 255.	See Item (2), "Automatic torque boost."
Slippage compensation gain setting for automatic torque boost	A047/A247	0. to 255.	See Item (2), "Automatic torque boost."

(1) Automatic torque boost
The inverter outputs the voltage according to the settings of the manual torque boost (A042/A242/A342) and manual torque boost frequency adjustment (A043/A243/A343).
Use the manual torque boost value (A042/A242/A342) to specify the rate of the boost to the voltage (100%) set by the AVR voltage select.
The set rate of voltage corresponds to the boost voltage that is output when the output frequency is 0 Hz.
When increasing the value of the manual torque boost value, be careful to prevent motor over-excitation. Over-excitation may result in motor burnout.
Use the manual torque boost frequency adjustment (A043/A243/A343) to specify the rate of the frequency at each breakpoint to the base frequency (100%).
To switch the settings among the 1st, 2nd, and 3rd settings ("A041 to A043", "A241 to A243", and "A342 and A343"), assign function "08" (SET) and "17" (SET3) to intelligent input terminals. Use the SET and SET3 signals for switching.



(2) Automatic torque boost
When automatic torque boost (data "01") is selected by the torque boost selection (A041/A241), the inverter automatically adjusts the output frequency and voltage according to the load on the motor. (During actual operation, the automatic torque boost is usually combined with the manual torque boost.)
When you select the automatic torque boost, adjust the settings of the motor capacity selection (H003/H203) and motor pole selection (H004/H204) according to the motor to be driven.
If the inverter trips due to overcurrent during motor deceleration, set the AVR function select (A081) to always enable the AVR function (data "00").
If you cannot obtain the desired operation characteristic by using the automatic torque boost, make the following adjustments:

Symptom	Adjustment method	Adjustment item
Motor torque is insufficient at low speed. (The motor does not rotate at low speed.)	(1) Increase the voltage setting for manual torque boost step by step.	A042/A242
	(2) Increase the slippage compensation gain for automatic torque boost step by step.	A047/A247
	(3) Increase the voltage compensation gain for automatic torque boost step by step.	A046/A246
	(4) Reduce the carrier frequency setting.	b083
The motor speed falls when a load is applied to the motor.	Increase the slippage compensation gain for the automatic torque boost step by step.	A047/A247
The motor speed increases when a load is applied to the motor.	Reduce the slippage compensation gain for the automatic torque boost step by step.	A047/A247
The inverter trips due to overcurrent when a load is applied to the motor.	(1) Reduce the voltage compensation gain for the automatic torque boost step by step.	A046/A246
	(2) Reduce the slippage compensation gain for the automatic torque boost step by step.	A047/A247
	(3) Reduce the voltage setting for the manual torque boost step by step.	A042/A242

This function cannot be selection for 3rd moter setting.
Manual torque boost valid.

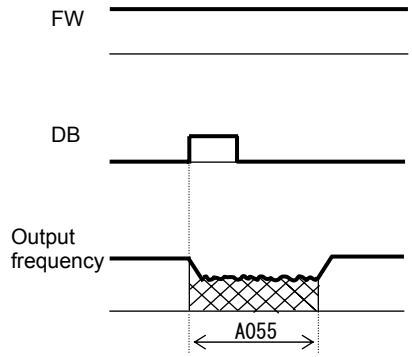
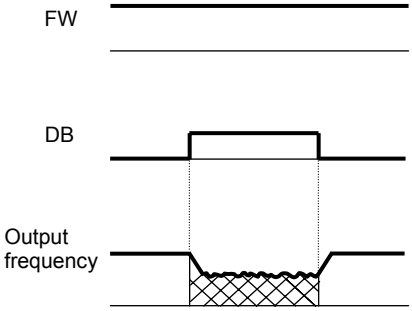
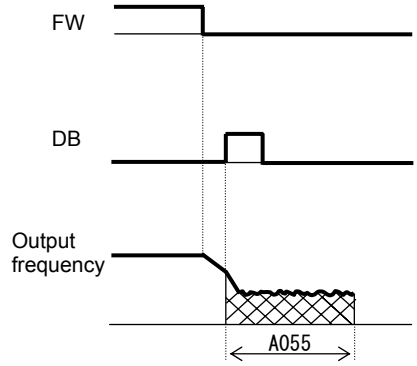
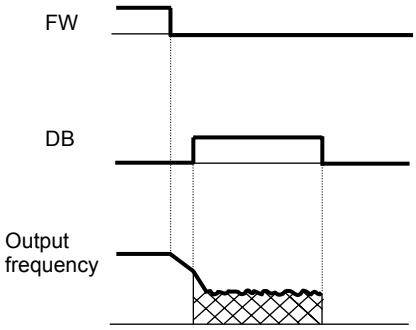
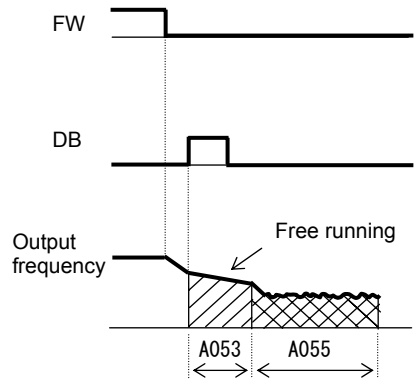
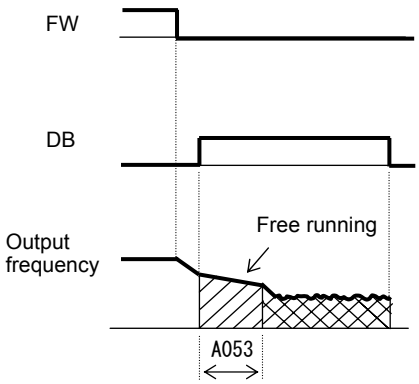
4.2.19 DC braking (DB) setting

The DC braking function allows you to apply DC braking to the motor according to the load on the motor.
You can control DC braking in two ways: the external control through signal input to intelligent input terminals and the internal control to be performed automatically when the motor is started and stopped.
Note that the motor cannot be stopped by DC braking if the load on the motor produces a large moment of inertia.

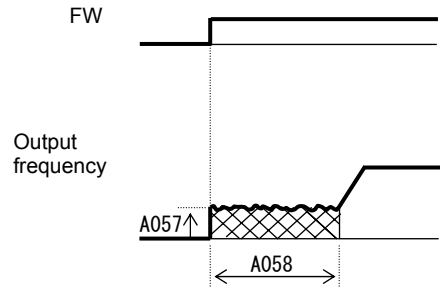
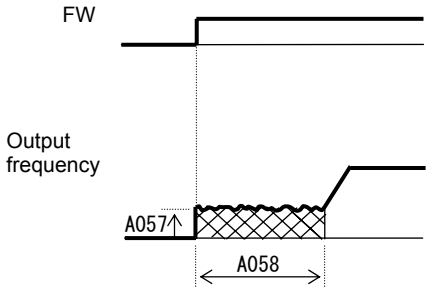
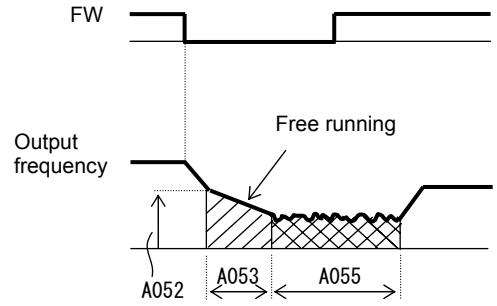
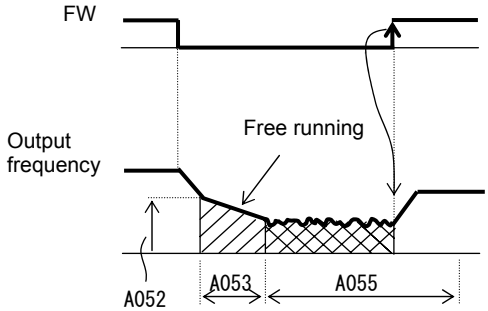
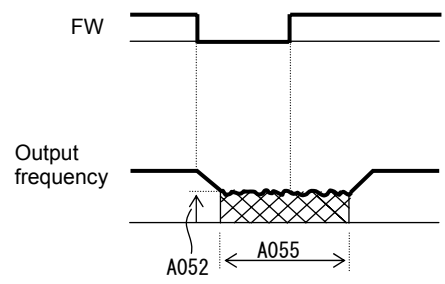
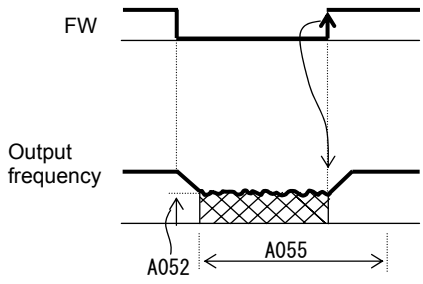
Related code
A051: DC braking enable
A052: DC braking frequency setting
A053: DC braking wait time
A054: DC braking force during deceleration
A055: DC braking time for deceleration
A056: DC braking/edge or level detection for [DB] input
A057: DC braking force for starting
A058: DC braking time for starting
A059: DC braking carrier frequency setting
C001 to C008: Terminal [1] to [8] functions

Item	Function code	Data or range of data	Description
DC braking enable	A051	00	Internal DC braking is disabled.
		01	Internal DC braking is enabled.
		02	Internal DC braking is enabled. (The braking operates only with the set braking frequency.)
DC braking frequency setting	A052	0.00 to 400.0 (Hz) (185 to315kW) 0.00 to 120. 0(Hz) (400kW)	With internal DC braking enabled, DC braking is started when the output frequency reaches the set braking frequency.
DC braking wait time	A053	0.0 to 5.0 (s)	The DC braking wait time specifies the delay in starting DC braking after the set braking time has elapsed or the DB terminal has been turned on.
DC braking force during deceleration/ DC braking force for starting	A054/A057	0. to 35. (%)	"0" specifies the smallest force (zero current); "35" specifies the largest force (35% current).
DC braking time for deceleration	A055	0.0 to 60.0 (s)	This setting is valid for the external DC braking in edge mode or for the internal DC braking.
DC braking/edge or level detection for [DB] input	A056	00	Edge mode (See examples 1-a to 6-a.)
		01	Level mode (See examples 1-b to 6-b.)
DC braking time for starting	A058	0.0 to 60.0 (s)	This setting is valid for the internal DC braking. DC braking is started when the motor-start command is input.
DC braking carrier frequency setting	A059	0.5 to 3.0 (kHz)	Unit: kHz

(1) External DC braking
Assign function "07" (DB) to terminal function (C001 to C008).
Turn the DB terminal on and off to control the direct braking, regardless of the setting of DC braking enable (A051).
Adjust the braking force by adjusting the DC braking force setting (A054).
When you set the DC braking wait time (A053), the inverter output will be shut off for the set period of delay, and the motor will run freely during the period. DC braking will be restarted after the delay.
When setting the DC braking time with function "A055" or for the DC braking operation via the DB terminal, determine the length of time in consideration of the heat generation on the motor.
Select the braking mode by the DC braking/edge or level detection for [DB] input (A056), and then make any other necessary settings suitable for your system.

(a) Edge mode (A056: 00)	(b) Level mode (A056: 01)
(Example 1-a) 	(Example 1-b) 
(Example 2-a) 	(Example 2-b) 
(Example 3-a) 	(Example 3-b) 

(2) Internal DC braking (A051: 01)
You can apply DC braking to the motor even without entering braking signals via the DB terminal when the inverter starts and stops. To use the internal DC braking function, specify "01" for the DC braking enable (A051).
Use function "A057" to set the DC braking force for starting, and use function "A058" to specify the DC braking time for starting, regardless of the braking mode selection (edge or level mode). (See examples 4-a and 4-b.)
Set the braking force for periods other than starting by using the DC braking force setting (A054).
Set the output frequency at which to start DC braking by using the DC braking frequency setting (A052).
When you set the DC braking wait time (A053), the inverter output will be shut off when the output frequency reaches the setting of "A052" after the operation command (FW signal) is turned off, and the motor will run freely for the delay time set by "A053". DC braking will be started after the delay (A053).
The internal DC braking operation to be performed when the operation command is switched from the stop command to the start command varies depending on the braking mode (edge or level mode).
Edge mode: The DC braking time setting (A055) is given priority over operation commands, and the inverter performs DC braking according to the setting of "A055". When the output frequency reaches the setting of "A052" the inverter performs DC braking for the time set for "A055". Even if the stop command is input during DC braking, DC braking continues until the time set for "A055" elapses. (See examples 5-a and 6-a.)
Level mode: Operation commands are given priority over the DC braking time setting. The inverter follows operation commands, regardless of the DC braking time setting (A055). If the start command is input during DC braking, the inverter starts the normal motor operation, regardless of the DC braking time setting (A055). (See examples 5-b and 6-b.)

<table>
<tr><th>(a) Edge mode</th><th>(b) Level mode</th></tr>
<tr><td>i) (Example 4-a) when the start command is input:
 
</td><td>i) (Example 4-b) when the start command is input:
 
</td></tr>
<tr><td>ii) (Example 5-a) when the stop command is input:
 
</td><td>ii) (Example 5-b) when the stop command is input:
 
</td></tr>
<tr><td>ii) (Example 6-a) when the stop command is input:
 
</td><td>ii) (Example 6-b) when the stop command is input:
 
</td></tr>
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