

HITACHI INVERTER

NE-S1 SERIES

Quick Reference Guide

Read through this Quick Reference Guide, and keep it handy for future reference.

NT3411X

HITACHI

Introduction

Introduction

Thank you for purchasing the Hitachi NE-S1 Series Inverter.

This Quick Reference Guide describes how to handle and maintain the Hitachi NE-S1 Series Inverter.

Read this Quick Reference Guide 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 Quick Reference Guide 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 Quick Reference Guide 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 Quick Reference Guide and the manual for each optional product to be used should be delivered to the end user of the inverter.

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Revision History

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

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Chapter 1 Safety Instructions

This chapter describes the Safety instructions.

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Chapter 1 Safety Instructions

1.1 Safety Instructions

Be sure to read this Quick Reference Guide and appended documents thoroughly before installing, operating, maintaining, or inspecting the inverter.

In this Quick Reference Guide, 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  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 Quick Reference Guide 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 Quick Reference Guide 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 the 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.

Chapter 1 Safety Instructions

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.
- The inverter must be powered OFF before you change any of the slide switch settings. Otherwise, you run the risk of electric shock or injury.

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 3-phase 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.
- NE-S1 series inverter do not have terminals for braking resistor. Do not connect the resistor. Otherwise there is a 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 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Please make sure that earth screw was tighten completely in advance.
- First, check the tightening the screws of output terminal (U, V and W), and then tighten the screws of input terminal (R,S and T)

Chapter 1 Safety Instructions**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 top cover before turning on the inverter power. Do not open the top 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.
- Prepare the additional emergency stop switch in addition to the stop key of the integrated operator and/or the optional operator. Otherwise, there is a danger 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.
- Run/Stop/Reset is integrated in one button, before you press the button, please make sure that the machine(facility)
Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.

! 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.
- Regardless Run command setting(A002/A202) if the key is pressed, inverter starts running.
Therefore, if you selected Run command such as operator or terminal, please handle the key after you made sure that the machine/facility is operated safely.

Chapter 1 Safety Instructions

4. Maintenance and inspection

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.)
In case the power indication of the operator does not turn ON after power-up, inverter may be damaged. In that case, the inspection must be done after waiting two hours or more of the power OFF. Otherwise there is a danger of electric shock and/or injury.
- 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.

Chapter 1 Safety Instructions

1.2 Precautions Concerning Electromagnetic Compatibility (EMC)

CE-EMC Installation Guidelines

You are required to satisfy the EMC directive (2004/108/EC) when using a NE-S1 inverter in an EU country.

To satisfy the EMC directive and to comply with standard, you need to use a dedicated EMC filter suitable for each model, and follow the guidelines in this section. Following table shows the compliance condition for reference.

Table 1. Condition for the compliance

| Model | Cat. | Carrier f | Motor cable |
|------------------|------|-----------|----------------|
| 1-ph. 200V class | C2 | 2kHz | 20m (Shielded) |
| 3-ph. 200V class | C3 | 2kHz | 20m (Shielded) |

Table 2. Applicable EMC filter

| Input class | Inverter model | Filter model (Schaffner) |
|------------------|----------------|--------------------------|
| 1-ph. 200V class | NE1-002SB | FS24828-8-07 |
| | NE1-004SB | |
| | NE1-007SB | FS24828-27-07 |
| | NE1-015SB | |
| | NE1-022SB | |
| 3-ph. 200V class | NE1-002LB | FS24829-8-07 |
| | NE1-004LB | |
| | NE1-007LB | |
| | NE1-015LB | FS24829-16-07 |
| | NE1-022LB | |

Chapter 1 Safety Instructions

Important notes

1. Input choke or other equipment is required if necessary to comply with EMC directive from the harmonic distortion point of view (IEC 61000-3-2 and 4).
2. If the motor cable length exceeds 20m, use output choke to avoid unexpected problem due to the leakage current from the motor cable (such as malfunction of the thermal relay, vibration of the motor, etc..).
3. As user you must ensure that the HF (high frequency) impedance between adjustable frequency inverter, filter, and ground is as small as possible.
 - Ensure that the connections are metallic and have the largest possible contact areas (zinc-plated mounting plates).
4. Avoid conductor loops that act like antennas, especially loops that encompass large areas.
 - Avoid unnecessary conductor loops.
 - Avoid parallel arrangement of low-level signal wiring and power-carrying or noise-prone conductors.
5. Use shielded wiring for the motor cable and all analog and digital control lines.
 - Allow the effective shield area of these lines to remain as large as possible; i.e., do not strip away the shield (screen) further away from the cable end than absolutely necessary.
 - With integrated systems (for example, when the adjustable frequency inverter is communicating with some type of supervisory controller or host computer in the same control cabinet and they are connected at the same ground + PE-potential), connect the shields of the control lines to ground + PE (protective earth) at both ends. With distributed systems (for example the communicating supervisory controller or host computer is not in the same control cabinet and there is a distance between the systems), we recommend connecting the shield of the control lines only at the end connecting to the adjustable frequency inverter. If possible, route the other end of the control lines directly to the cable entry section of the supervisory controller or host computer. The shield conductor of the motor cables always must connected to ground + PE at both ends.
 - To achieve a large area contact between shield and ground + PE-potential, use a PG screw with a metallic shell, or use a metallic mounting clip.
 - Use only cable with braided, tinned copper mesh shield (type "CY") with 85% coverage.
 - The shielding continuity should not be broken at any point in the cable. If the use of reactors, contactors, terminals, or safety switches in the motor output is necessary, the unshielded section should be kept as short as possible.
 - Some motors have a rubber gasket between terminal box and motor housing. Very often, the terminal boxes, and particularly the threads for the metal PG screw connections, are painted. Make sure there is always a good metallic connection between the shielding of the motor cable, the metal PG screw connection, the terminal box, and the motor housing. If necessary, carefully remove paint between conducting surfaces.
6. Take measures to minimize interference that is frequently coupled in through installation cables.
 - Separate interfering cables with 0.25m minimum from cables susceptible to interference. A particularly critical point is laying parallel cables over longer distances. If two cables intersect (one crosses over the other), the interference is smallest if they intersect at an angle of 90°. Cables susceptible to interference should therefore only intersect motor cables, intermediate circuit cables, or the wiring of a rheostat at right angles and never be laid parallel to them over longer distances.

Chapter 1 Safety Instructions

7. Minimize the distance between an interference source and an interference sink (interference-threatened device), thereby decreasing the effect of the emitted interference on the interference sink.
 - You should use only interference-free devices and maintain a minimum distance of 0.25 m from the adjustable frequency inverter.
8. Follow safety measures in the filter installation.
 - If using external EMC filter, ensure that the ground terminal (PE) of the filter is properly connected to the ground terminal of the adjustable frequency inverter. An HF ground connection via metal contact between the housings of the filter and the adjustable frequency inverter, or solely via cable shield, is not permitted as a protective conductor connection. The filter must be solidly and permanently connected with the ground potential so as to preclude the danger of electric shock upon touching the filter if a fault occurs.

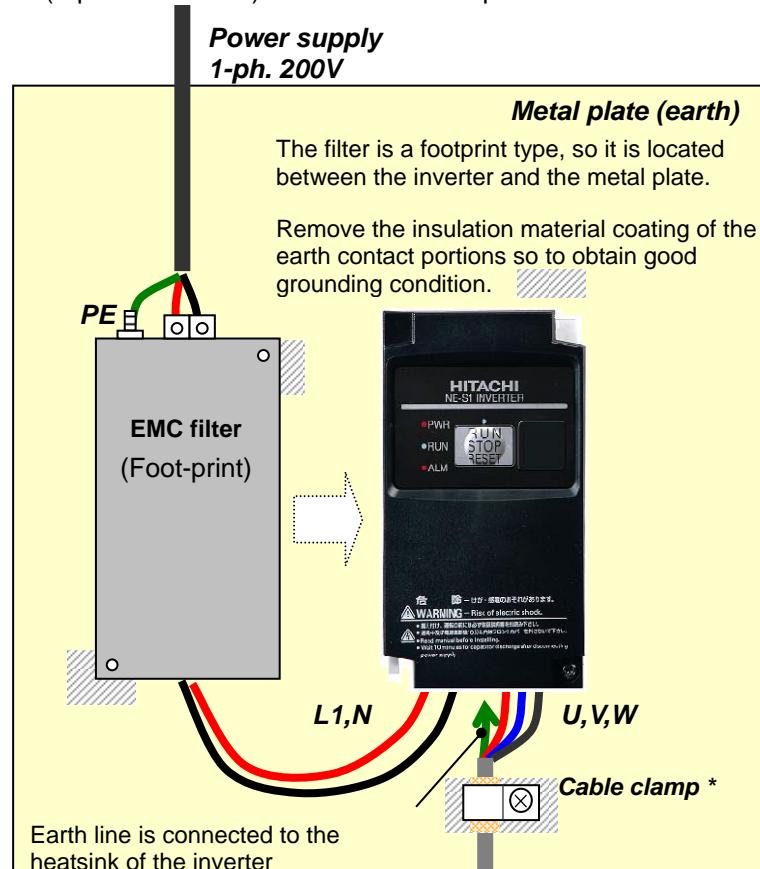
To achieve a protective ground connection for the filter:

- Ground the filter with a conductor of at least 10 mm² cross-sectional area.
- Connect a second grounding conductor, using a separate grounding terminal parallel to the protective conductor. (The cross section of each single protective conductor terminal must be sized for the required nominal load.)

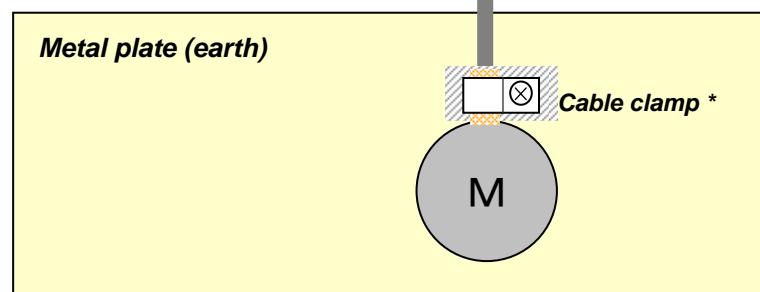
Chapter 1 Safety Instructions

Installation for NE-S1 series (example of SB models)

Model LB (3-ph. 200V class) is the same concept for the installation.



Shielded cable



*) Both earth portions of the shielded cable must be connected to the earth point by cable clamps.

Input choke or equipment to reduce harmonic current is necessary for CE marking (IEC 61000-3-2 and IEC61000-3-4) from the harmonic current point of view, even conducted emission and radiated emission passed without the input choke.

Chapter 1 Safety Instructions**Hitachi EMC Recommendations****WARNING**

- This equipment should be installed, adjusted, and serviced by qualified personal familiar with construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.

Use the following checklist to ensure the inverter is within proper operating ranges and conditions.

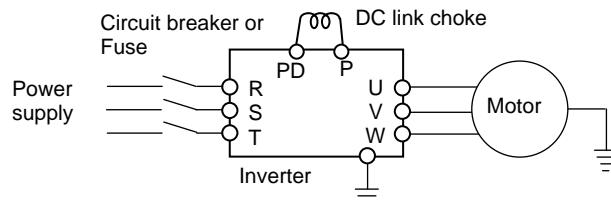
1. The power supply to NE-S1 inverters must meet these specifications:
 - Voltage fluctuation $\pm 10\%$ or less
 - Voltage imbalance $\pm 3\%$ or less
 - Frequency variation $\pm 4\%$ or less
 - Voltage distortion THD = 10% or less
2. Installation measure:
 - Use a filter designed for NE-S1 inverter. Refer to the instruction of the applicable external EMC filter.
3. Wiring:
 - Shielded wire (screened cable) is required for motor wiring, and the length must be 20 meter or less.
 - If the motor cable length exceeds the value shown above, use output choke to avoid unexpected problem due to the leakage current from the motor cable.
 - The carrier frequency setting must be 2 kHz to satisfy EMC requirements.
 - Separate the power input and motor wiring from the signal/process circuit wiring.
4. Environmental conditions—when using a filter, follow these guidelines:
 - Ambient temperature: -10 to 50 °C
(Derating is required when the ambient temperature exceeds 40 °C)
 - Humidity: 20 to 90% RH (non-condensing)
 - Vibration: 5.9 m/sec² (0.6 G) 10 ~ 55Hz
 - Location: 1000 meters or less altitude, indoors (no corrosive gas or dust)

Chapter 1 Safety Instructions

1.3 Precautions Concerning Compliance with UL and cUL Standards

(Standard to comply with : UL508C,CSA C22.2 No.14-05)

Wiring diagram of inverter



- a) Maximum surrounding air temperature rating of 50°C..
- b) Solid State motor overload protection reacts with max. 150 % of FLA.
- c) Suitable for use on a circuit capable of delivering not more than 100,000 rms Symmetrical Amperes, 240 Volts Maximum.
- d) Drive has no provision for motor over temperature protection. Motor over temperature protection is required at end application.
- e) When Protected by J, CC, G or T Class Fuses." or "When Protected By A Circuit Breaker Having An Interrupting Rating Not Less Than 100,000 rms Symmetrical Amperes, 240 Volts Maximum.
- f) Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- g) Drive has no provision for motor over temperature protection. Motor over temperature protection is required at end application.
- h) Use 60/75°C CU wire only.
- i) Tightening torque and wire range as shown in the table below.

| Model No. | Required Torque (N.m) | Wire Range (AWG) |
|-----------|-----------------------|------------------|
| NES1-002S | 0.8~1.0 | 16~14 |
| NES1-004S | 0.8~1.0 | 16~14 |
| NES1-007S | 1.8 | 14~12 |
| NES1-015S | 1.8 | 12~10 |
| NES1-022S | 1.8 | 10 |
| NES1-002L | 0.8~1.0 | 16~14 |
| NES1-004L | 0.8~1.0 | 16~14 |
| NES1-007L | 0.8~1.0 | 16~14 |
| NES1-015L | 1.8 | 14 |
| NES1-022L | 1.8 | 12 |

- j) Distribution fuse and circuit breaker size marking is included in the manual to indicate that the unit shall be connected with a Listed Cartridge Nonrenewable fuse or Inverse time circuit breaker, rated 600 Vac with the current ratings as shown in the table below:

| Model No. | Fuse | | Circuit Breaker | |
|------------|---------------------|----------------|-----------------|----------------|
| | Type | Maximum Rating | Type | Maximum Rating |
| NES1-002S | Class J, CC, G or T | 10 A | Inverse Time | 15 A |
| NES1-004S | | 20 A | | 30 A |
| NES1-007S | | 30 A | | |
| NES1-015S | Class J, CC, G or T | 10 A | Inverse Time | 15 A |
| NES1-022S | | 15 A | | 20 A |
| NES1-002L* | | 20 A | | |
| NES1-004L* | | 30 A | | |
| NES1-007L* | | 40 A | | |
| NES1-015L | | | | |
| NES1-022L | | | | |

* In case of using Circuit Breaker, an additional 5 A external protector is needed.

Chapter 2 Inspection of the Purchased Product

This chapter describes the inspection of the purchased product, the product warranty.

| | | |
|-----|--|-------|
| 2.1 | Inspection of the Purchased Product | 2 - 1 |
| 2.2 | Method of Inquiry and Product Warranty | 2 - 2 |

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Chapter 2 Inspection of the Purchased Product

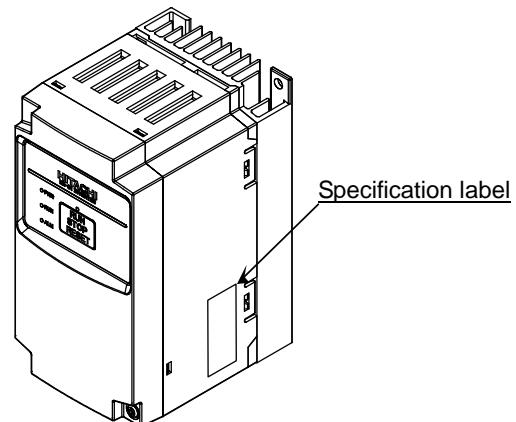
2.1 Inspection of the Purchased Product

(A) Inspecting the product

Please check the followings after unpacking.

Please contact your supplier or local Hitachi Distributor if there are any problems like below on the product.

- (1) Any damage during transportation?
- (2) Basic manual (English and Japanese) are packed together with the product?
- (3) The product is the one you ordered.
(check with the specification label)



| | | | |
|------------------------------------|--|--|--|
| Model name (NES1-002SB example) | HITACHI INVERTER | | |
| Input | Model: NES1-002SB Input : 50Hz, 60Hz 200-240 V 1Ph 3.1 A 50Hz, 60Hz V 3Ph A | | |
| Output | Output : 0, 5-400Hz 200-240 V 3Ph 1.4 A MFG No. 2616200716000001 Date : 1206 Hitachi Industrial Equipment Systems Co., Ltd. W NE18158-001 | | |
| Manufacturing number | | | |

Example of the specification label

Chapter 2 Inspection of the Purchased Product

2.2 Method of Inquiry and Product Warranty

(A) Method of inquiry

In case of contacting to the store you bought the product or Hitachi, please inform the following information.

- (1) Model name of the inverter
- (2) Manufacturing number (MFG No.)
- (3) When you bought the product
- (4) Contents of your inquiry
 - Damaged portion and condition, and else.

(B) 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) if:

- (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.

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.

(C) 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 QRG handy; please do not loose it. Please contact your Hitachi distributor to purchase replacement or additional QRG.

Chapter 3 Exterior Views

This chapter describes the exterior views and the names of parts.

| | | |
|-----|--|-------|
| 3.1 | Exterior Views and Names of Parts | 3 - 1 |
| 3.2 | Name of each portion (removing the front cover) | 3 - 2 |

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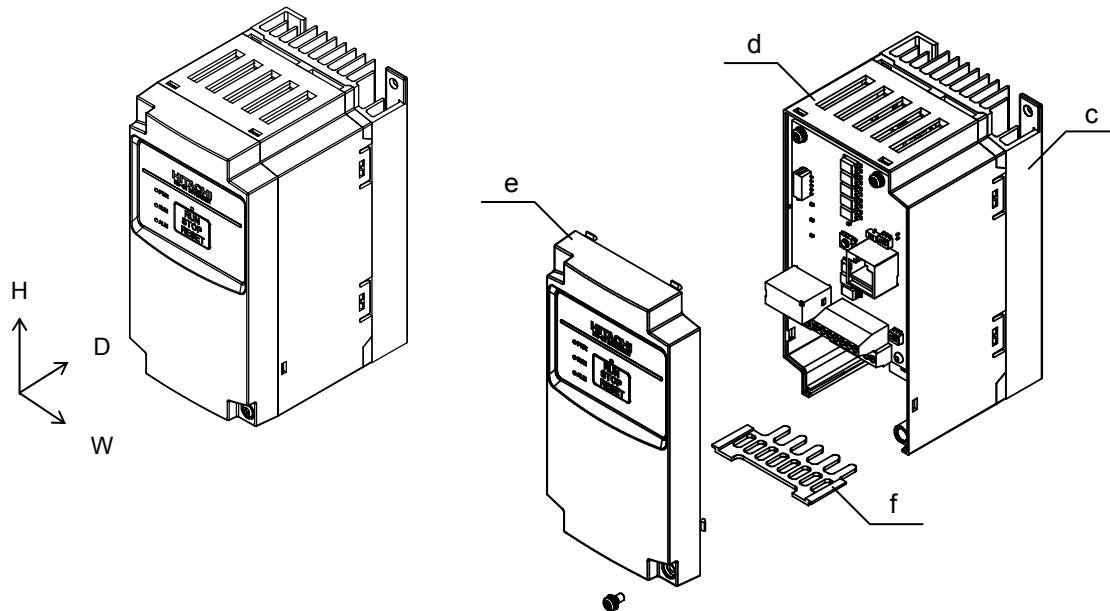
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Chapter 3 Exterior Views

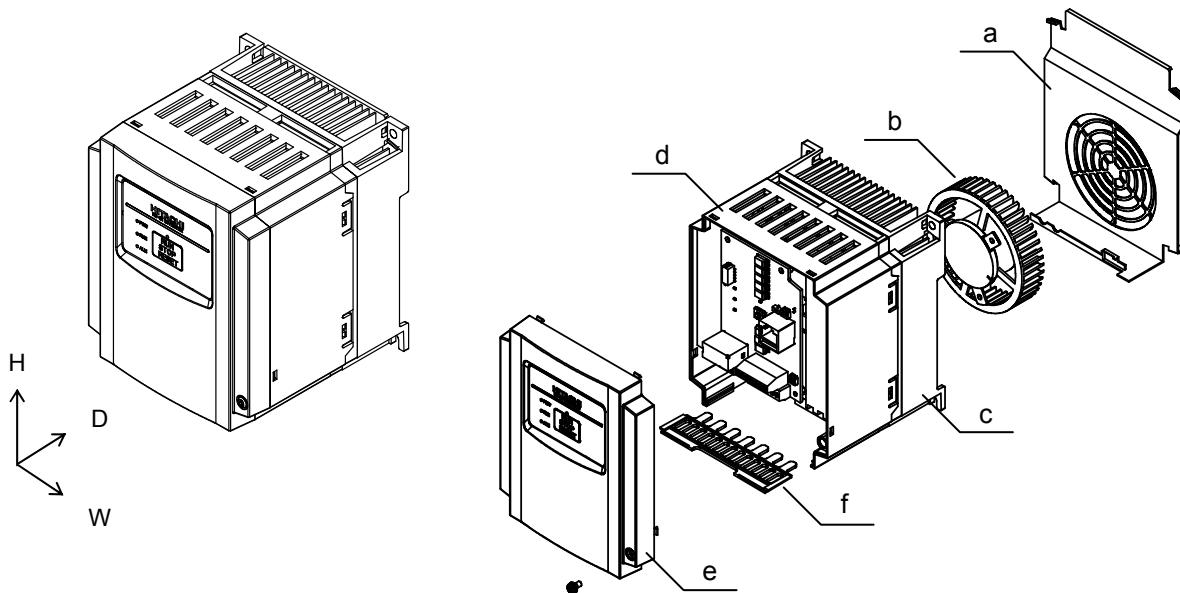
3.1 Exterior Views and Names of Parts

The figure below shows an exterior view of the inverter

- model : NES1 – 002*,004*SB/LB , 007*LB



- model : NES1 – 007*SB , 015,022SB/LB

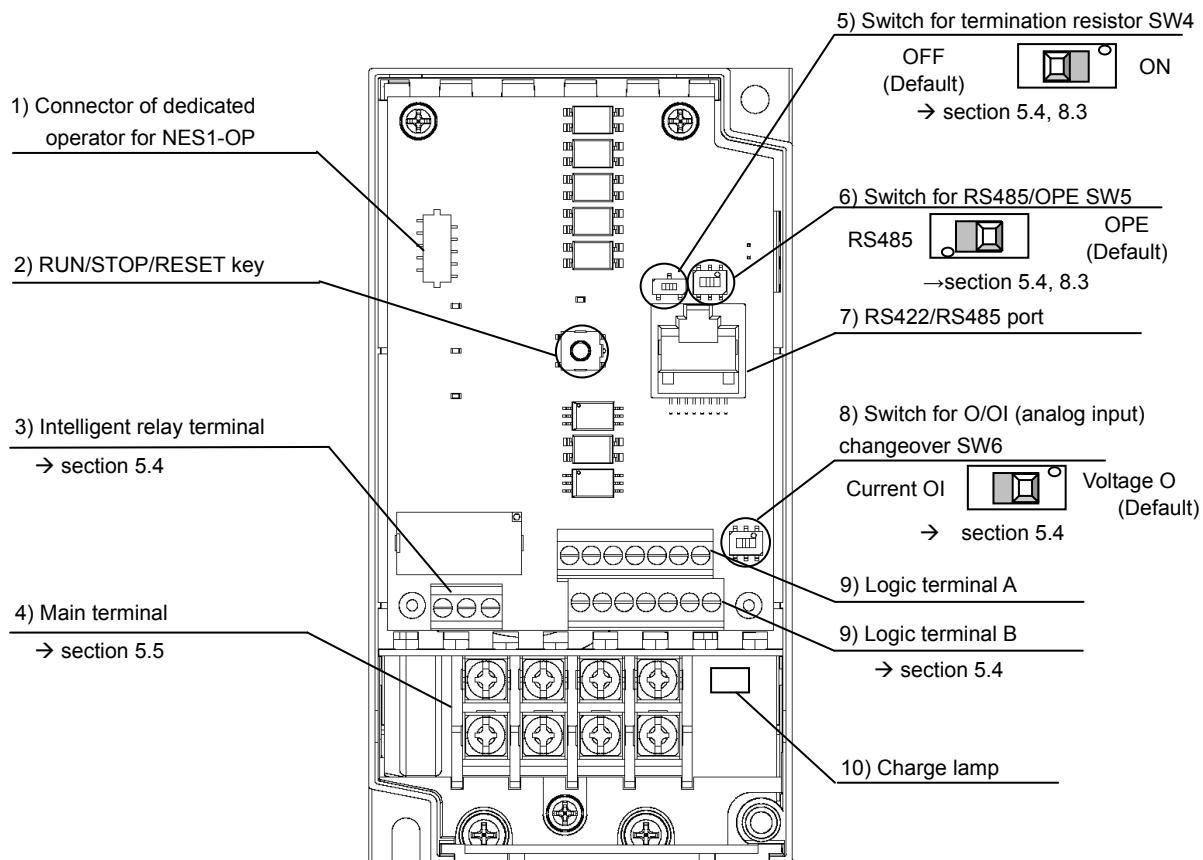


*)002-007SB/LB : without Cooling Fan

| | |
|----------------------|------------------|
| a) Cooling Fan Cover | d) Case |
| b) Cooling Fan | e) Front Cover |
| c) Heat sink | f) Backing plate |

Chapter 3 Exterior Views

3.2 Name of each portion (removing the front cover)



| Name | Description |
|--|---|
| 1) Connector of dedicated operator for NES1-OP | Dedicated operator for NE-S1 (NES1-OP) can be connected. |
| 2) RUN/STOP/RESET key | Push key for run, stop and reset operation. |
| 3) Intelligent relay terminal | Output terminal for intelligent relay (1c contact). |
| 4) Main terminal | For connecting power supply, motor output and DC reactor. |
| 5) Switch for termination resistor | Changeover for integrated resistor (100Ω) for RS485. Integrated resistor of 100Ω is connected when turning ON. |
| 6) Switch for RS485/OPE | Changeover switch for RS422/RS485. |
| 7) RS422/RS485 port | Connector for RS485 or external operator and PC software (RJ45 jack) |
| 8) Switch for O/OI (analog input) changeover | Voltage input (O) or current input (OI) can be selected. |
| 9) Logic terminal A,B | Terminal for connecting input/output signals (digital/analog) for the inverter control. |
| 10) Charge lamp | Turns ON when the internal DC bus voltage is 45V or more. In case of wiring, maintenance or else, be sure to check that this lamp is turned OFF after waiting 10 minutes of power OFF. |

Note 1) Refer to section 6.5 for the description of the display and key operation.

Note 2) Position of "10) charge lamp" depends on the model. Refer to page 2-11 for the details.

Note 3) Pay attention when operating by PC via "7)RS422/RS485 port", because the operation can also be done from the panel of the inverter.

Note 4) Be sure to turn power OFF when connecting or disconnecting the operator such as OPE-SRmini,OPE-S,WOP to the "7) RS422/RS485 port".

Note 5) When communication becomes unstable, Please do not use the termination resistor of the inverter. Please use a termination resistor suitable for your environment.

Chapter 4 Installation

This chapter describes how to install the inverter.

4.1 Precautions for installation 4 - 1

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Chapter 4 Installation**4.1 Precautions for 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 the 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.
- When you touch the inverter, you must take care at static electricity. Doing so may cause the inverter to fail.

Chapter 4 Installation

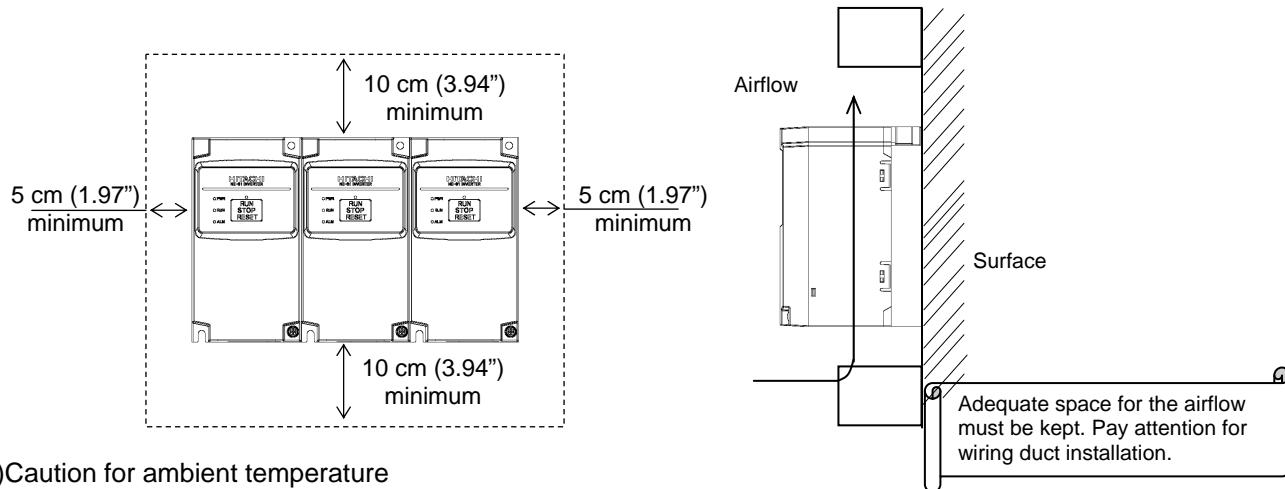
(1) Caution during transportation

Please pay attention when carrying the product because it is covered by plastic case.

Especially, do not put pressure onto the front cover and terminal cover. Otherwise there is a risk of falling down the product. Please do not use products having damage, and/or lacking components.

(2) Ensure Adequate Ventilation

To summarize the caution messages – you will need to find a solid, non-flammable, vertical surface that is in a relatively clean and dry environment. In order to ensure enough room for air circulation around the inverter to aid in cooling, it is recommended to maintain the specified clearance and the inverter specified in the below diagram.



(3) Caution for ambient temperature

Set ambient temperature at installation site within the standard specification range (-10~50°C).

Measure ambient temperature at the place apart by 5cm from the bottom center of inverter main body and confirm that it is within the allowable temperature range.

Using the inverter at higher temperature than allowable temperature may result in shortening of lifetime of inverter (especially of electrolytic capacitor). Derating curve is shown on section 12.3.

(4) Do not install the inverter in such places as high temperature, high humidity, or easy to condensate.

Use the inverter within the allowable humidity range (20~90%RH) described in standard specifications.

Especially, please use it in place where no dew condensation occurs. If dew condensation occurs and beading is generated inside the inverter, electronic parts are short-circuited each other to cause a failure. Also, please avoid installing it in a location which receives direct sunlight.

(5) Caution for installation environment

Please avoid installing the inverter in such places where dust, corrosive gas, explosive gas, flammable gas, mist of grinding fluid, or salt pollution, etc. exists.

Invasion of dust, dirt etc. into the inverter may cause a failure. So, when you use it in dusty place by necessity, please devise a countermeasure such as putting it into a closed type chassis.

CAUTION

- Reduction of the carrier frequency or using bigger kW model is required if depends on the load or ambient.

WARNING

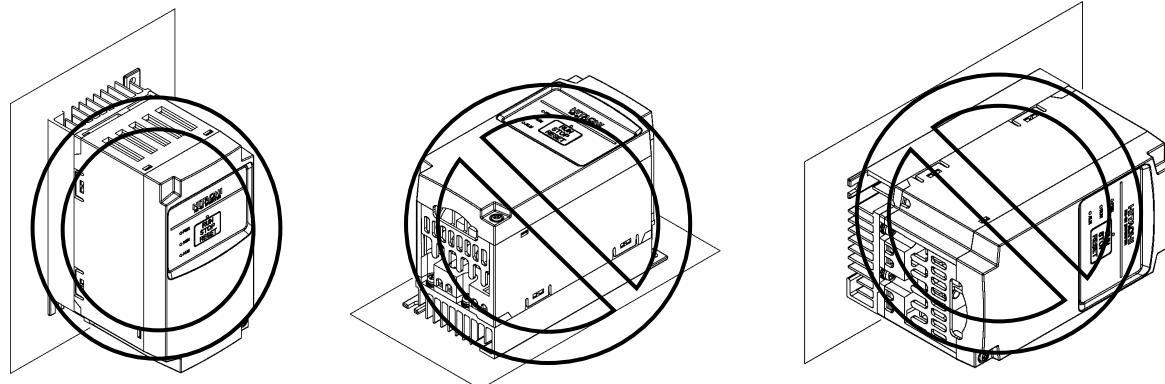
- Do not open the front cover during operation.

Chapter 4 Installation**(6) Cautions for installation direction**

Surface of the installation must be no vibration, and should be capable of holding the weight of the product. And the product must be fixed to the surface with a proper screws with vertical direction. Be sure to screw using all the screw holes for the installation.

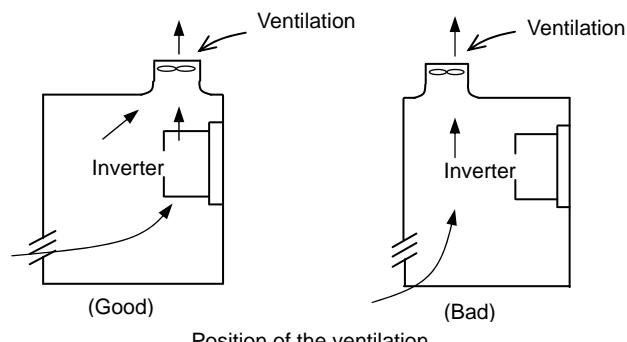
(002L/SB,004L/SB,007LB : 2 positions, 007SB,015L/SB,022L/SB : 4 positions)

There is a risk of performance failure, and/or breakdown when the product is not installed vertical direction.

**(7) Cautions for installation into the cabinet**

Please pay attention to the location of the ventilation holes of the inverter and the cabinet, in case of side-by-side installation and using ventilation fan.

cooling performance of the inverter highly depends on the location of the holes. Please pay high attention to the ambient temperature of the inverter to be less than the specified value.

Position of the ventilation**(8) Watt Loss****1-ph./3-ph. 200V class**

| Model name | 002S/L | 004S/L | 007S/L | 015S/L | 022S/L |
|-----------------------------|--------|--------|--------|--------|--------|
| Watt Loss (100% load)(W) | 22 | 30 | 48 | 79 | 104 |
| Efficiency at rated load(%) | 90 | 93 | 94 | 95 | 95.5 |

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Chapter 5 Wiring

This chapter describes the wiring of main circuit and control signal terminals.

| | | |
|-----|--|--------|
| 5.1 | Precautions for Wiring | 5 - 1 |
| 5.2 | How to attach and remove the front cover | 5 - 2 |
| 5.3 | How to attach the Exclusive operator (NES1-OP) | 5 - 3 |
| 5.4 | Wiring and terminal description..... | 5 - 4 |
| 5.5 | Mains wiring | 5 - 7 |
| 5.6 | Wiring of the control circuit..... | 5 - 12 |
| 5.7 | Connection with the programmable controller (PLC) | 5 - 14 |
| 5.8 | Notes on using multiple inverters | 5 - 15 |

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Chapter 5 Wiring**5.1 Precautions for Wiring****! WARNING**

- In order to prevent damage caused by static electricity, Please remove the static electricity of the body touch the nearby metal before touching this product.
- 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.
- The inverter must be powered OFF before you change any of the slide switch settings. Otherwise, you run the risk of electric shock or injury.

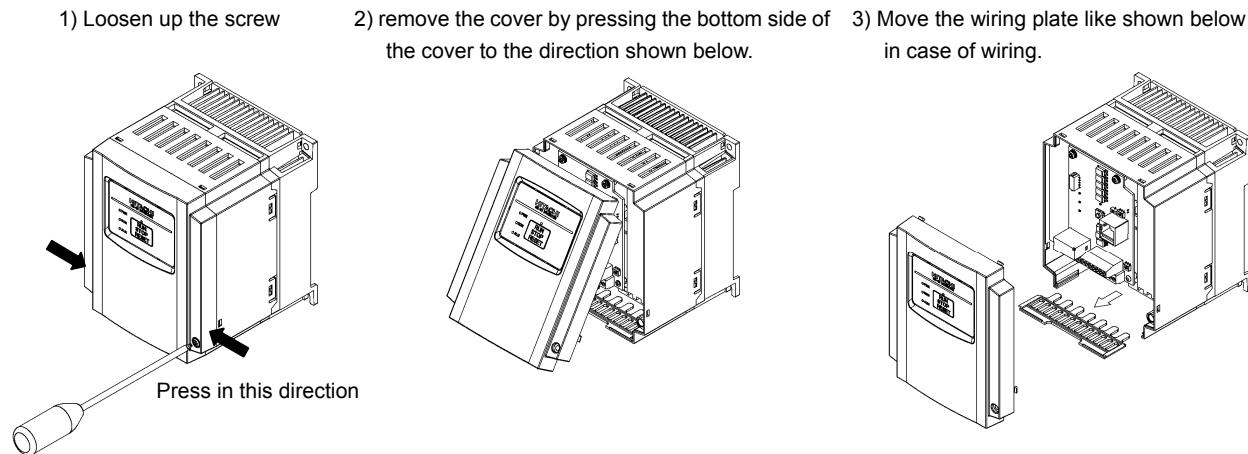
! CAUTION

- 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 3-phase 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.
- NE-S1 series inverter do not have terminals for braking resistor. Do not connect the resistor. Otherwise there is a 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 in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Please make sure that earth screw was tighten completely in advance.
- First, check the tightening the screws of output terminal (U, V and W), and then tighten the screws of input terminal (R,S and T).
- Factory default of C036 is "b contact(NC)". In the event that the initialization, C036 will be the "b contact(NC)". If you wish to use as a replacement for the conventional model of this inverter, such as in the case of built-in system use, please first check the configuration of C036. And, you must conform to the peripheral circuit logic. There is a risk of system down by logical inconsistency contact.

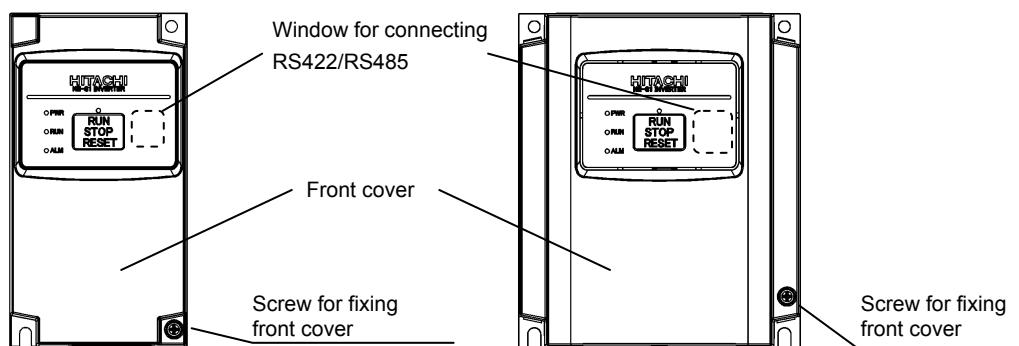
Chapter 5 Wiring

5.2 How to attach and remove the front cover

(1) How to remove



Screw for fixing the front cover is located at right-bottom side



(2) It is necessary to make window on the front cover when using remote operator

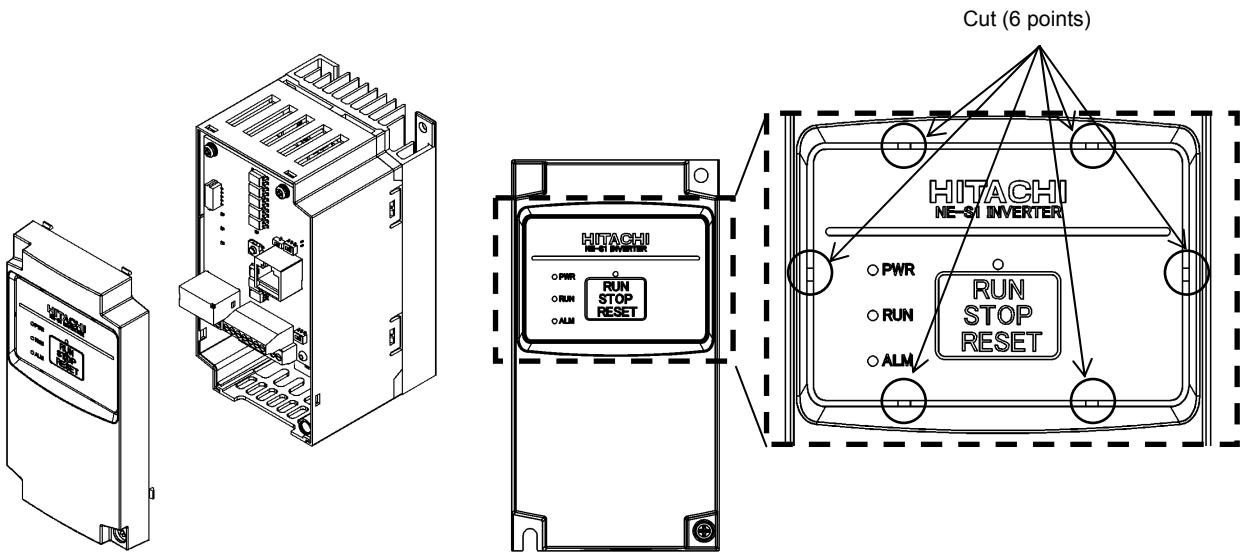
(OPE-S/SR/SBK/SRmini, WOP), Modbus-RTU, or PC software (ProDriveNext). See above for the position of the window.

- Be sure to make window after removing the front cover.
- There are cutouts at the window, so it can be removed easily by pressing up side and bottom side of the window alternatively.
- The window cannot be restored if it is once opened. Please use commercially supplied RJ45 connector cap or the like if necessary.

(3) How to attach

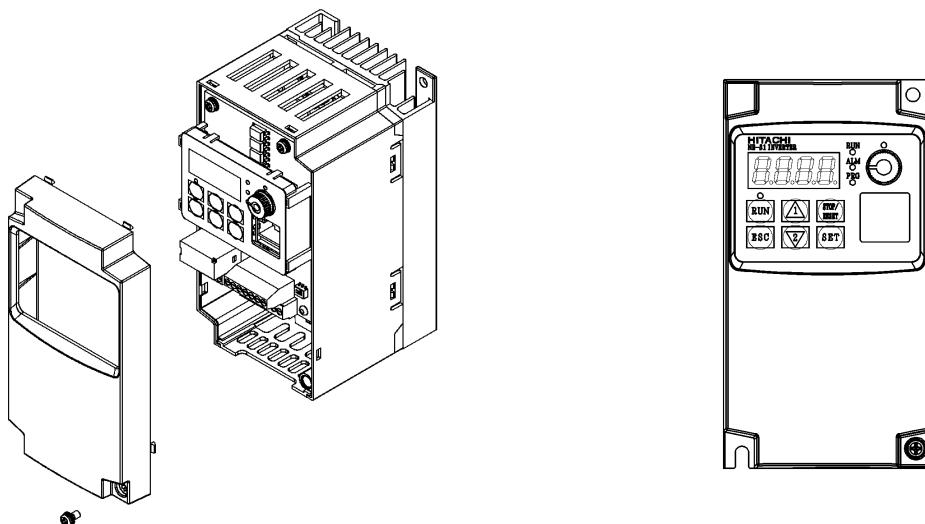
- Press the front cover to the main body until there is a click sound.
- Do not tighten the screw too much.

Chapter 5 Wiring

5.3 How to attach the Exclusive operator (NES1-OP)

1) Remove the front cover from main body

2) Cut the standard operator panel by in thin-blade-nipper and take it off.



3) The connector of the exclusive operator (NES1-OP) connect to the connector on the circuit board. And attach it to put the circuit board.

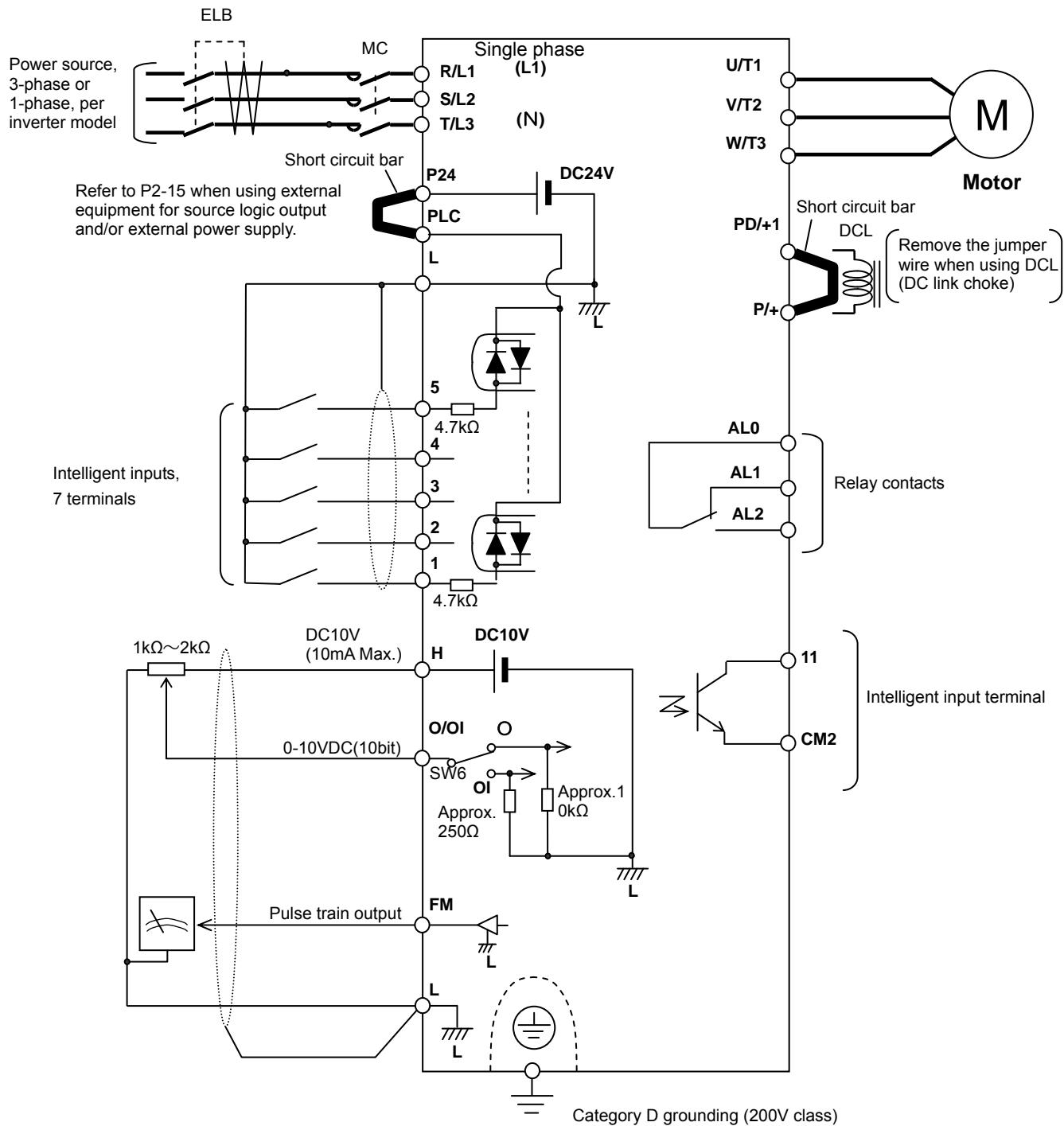
4) Attach the front cover.

5) Figure of installation (NES1-OP)

Note) Please set SW4, SW5 on the board, before installation of exclusive operator (NES1-OP).

Chapter 5 Wiring

5.4 Wiring and terminal description



Note 1) Above shows an example of voltage (O) input. Changeover of SW6 must be done in case of current (OI) input.

Chapter 5 Wiring

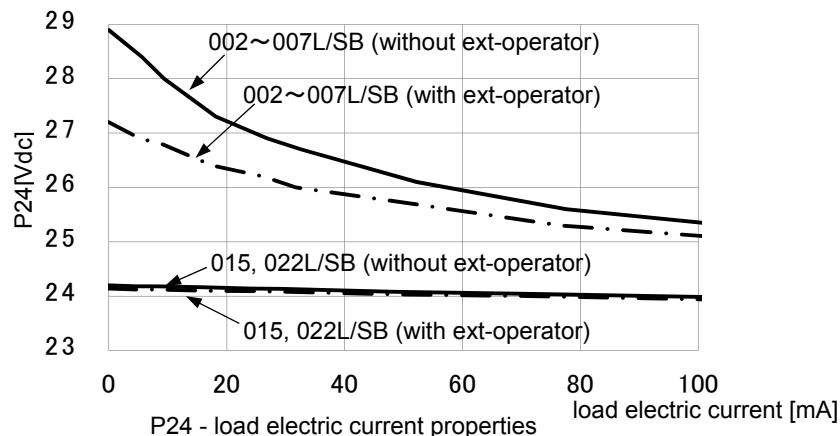
(1) Mains terminal description

| Symbol | Name | Description |
|--|-----------------------------------|--|
| R/L1(L1) | Power input terminals | Connect power supply - Use [L1] and [N] terminal in case of 1-ph. 200V power supply |
| S/L2 | | |
| T/L3(N) | | |
| U/T1 | Power output terminals | Connect 3-ph. motor |
| V/T2 | | |
| W/T3 | | |
| PD/+1 | DC link choke connection terminal | First, remove the short circuit bar between PD/+1 and P/+ terminal. Then connect optional DC link choke for improving the input harmonics. |
| P/+ | | |
| G() | Earth terminal | To make grounding. Be sure to make this grounding to avoid electric shock, and for improving the EMC performance. The terminal is located on the heatsink. |

(2) Control terminal description

| Category | Symbol | Name | Description | Electrical characteristics |
|----------|--------------|------|---|---|
| Analog | Power supply | L | Common for input signals | Common for internal control power supply, digital inputs/outputs, analog inputs/outputs |
| | | H | Power supply for freq.set | DC10V power supply. Used with variable resistor for O input. Max.10mA withdraw |
| | Freq. set | O/OI | Analog voltage (Use SW6 for changeover) | Frequency set via DC0~10V input Input impedance=apprx.10kΩ Allowable range; -0.3~+12VDC |
| | | | Analog current (Use SW6 for changeover) | Frequency set via 0~20mA Parameter adjustment should be done in case of 4~20mA Input impedance=apprx.250Ω Allowable range; 0~20mA |
| Digital | Power supply | L | Common for dig. Inputs | Common for internal control power supply, digital inputs, analog inputs/outputs |
| | | P24 | Power supply for dig. inputs | DC24V power supply for dry contact input. (Common terminal in case of source logic) note Max.100mA output |
| | | PLC | Power supply terminal for input terminals | Sink logic : connected to P24 Source logic : connected to L Remove the jumper wire when using external power supply for controlling the dry contact inputs. |

note)The voltage of P24 changes like the chart below by a load electric current. In the case of use, please be careful about external equipment. (ext-operator:OPE-S/SR/SBK/SRmini)



Chapter 5 Wiring

| Category | | Symbol | Name | Description | Electrical characteristics |
|----------|-----------------------|-----------------------|---|---|---|
| Digital | Input | 5 4 3 2 1 | Intelligent input terminals | 5 functions from 35 functions can be assigned to terminal 1 to 5. Sink or source logic can be selected. | Voltage between each input and PLC - V(ON) = min.18V - V(OFF) = MAX.3V - Max. allowable voltage = 27VDC - Load current 5mA (24V) |
| | | 11 | Intelligent output terminals | One function from 28 functions can be assigned. | Open collector output Between 11 and CM2 - Voltage drop during ON=4V or less - Max. allowable voltage = 27V - Max allowable current = 50mA |
| | Open-collector Output | CM2 | Common for intelligent output terminals | Common for the terminal 11. | Max. allowable current = 100mA |
| | | AL0 AL1 AL2 | Intelligent relay outputs | One function from 28 functions can be assigned. (1-c contact) | Max. contact capacity AL1-AL0 : AC250V, 2A(resistive),0.2A(inductive) AL2-AL0 : AC250V, 1A(resistive),0.2A(inductive) Min. contact capacity AC100V, 10mA DC5V, 100mA |
| | Pulse train | FM | Digital pulse train output | Pulse frequency MAX.3.6kHz | Pulse voltage : DC0/10V output Max. allowable current : 2mA |

(3) Changeover switch description

Refer to section 3.2 for the location of the switches.

CAUTION

- Adjustment of the switch must be done during power off. Otherwise there is a risk of electric shock.
- Power ON must be done after closing the front cover. Do not open the front cover during power up, or when there is a remaining voltage. There is a risk of electric shock.

| Symbol | Name | Description | | |
|--------|--|--|---|-------------------|
| SW4 | Termination resistor changeover switch | Select able/disable of the termination resistor of RS485 port (RJ45) | | |
| | | OFF (left side) | Termination resistor (100Ω) | Disable (Default) |
| | | ON (right side) | Termination resistor (100Ω) | Able |
| SW5 | RS485/OPE(RS422) changeover switch | Select depending on the options and communication method, connected to RS422/RS485 port. | | |
| | | OFF (right side) | For operator (OPE-S/SR/SBK/SRmini),ProDriveNext (Default) | |
| | | ON (left side) | For RS485 communication (Modbus-RTU) | |
| SW6 | Analog input (O/OI) changeover switch | OFF (left side) | Current input (0~20mA) OI | |
| | | ON (right side) | Voltage input (0~10Vdc) O (Default) | |

5.5 Mains wiring

(1) Cautions on wiring

Be sure to confirm that the charge lamp is turned OFF before the wiring work.

Once it is powered up, there will be a remaining voltage at the DC bus capacitor for a certain period regardless the motor operation.

Wiring work must be done 10 minutes after the power off, after confirming the safety.

In case the power indication of the operator does not turn ON after power-up, inverter may be damaged.

In that case, the inspection must be done after waiting 2 hours or more of the power OFF. Otherwise there is a danger of electric shock and/or injury.

1) Mains input terminals (R/L1,S,T/N)

- Use earth leakage breaker (ELB) for protection between power supply and input terminals (R/L1,S,T/N).
- The ELB is recommended to have bigger capability for the high frequency sensitivity, so to avoid malfunction.

| Distance between inverter and motor | Cutoff current of ELB |
|-------------------------------------|-----------------------|
| 100m or less | 30mA |
| 300m or less | 100mA |
| 800m or less | 200mA |

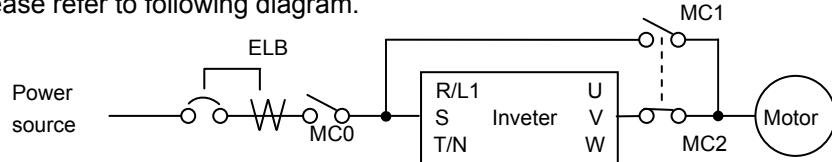
[Rough indication of earth leakage current] 30mA/km : use CV cable with metallic tube. Leakage current will be approximately 8 times more when using H-IV cable.

Therefore, it is recommended to use one class bigger capability of the ELB. Previously mentioned "leakage current" is based on the RMS value of fundamental wave, excluding harmonic current.

- There is a possibility that the malfunction or failure of the customer's system when the protection circuit of the inverter is activated. Please use magnet contactor to shutoff the inverter power supply.
- Do not turn power ON and OFF by the magnet contactor at the primary side or secondary side of the inverter to start and stop the motor. Use operation command (FW, RV) from the control input terminal in case of using external signal.
- Do not use the 3-ph input type with single phase input (phase loss). Otherwise there is a risk of inverter failure. Single phase input to the 3 phase type inverter will result in a undervoltage, overcurrent, or will result in a damage of the inverter. [DC bus capacitor will be charged even under phase loss and it is dangerous. Refer to "(1) Cautions for wiring" for the wiring.]
- There is a risk of breakdown of the internal converter module, and/or shortening drastically the lifetime of DC bus capacitors due to an increase of the ripple current. Especially, if high reliability is required on the system, use AC reactor between power supply and inverter. And if a thunder is expected, use appropriate lightening protection equipment.
 - Unbalance at the input voltage (3% or more)
 - Impedance of the power supply is 10 times or more, and 500kVA or more
 - Rapid change in voltage is expected
- (Example)- 2 or more inverters are connected at the same net with short cable.
 - Inverter is connected in parallel with the thyristor equipment with short cable.
 - Phase advancing capacitor is switching on a same net
- Frequency of the power ON/OFF must be once/3 minutes or longer interval. There is a danger of inverter failure.
- An inverter run by a private power generator may overheat the generator or suffer from a deformed output voltage waveform of the generator. Generally, the generator capacity should be five times that of the inverter (kVA) in a PWM control system or six times greater in a PAM control system.
- In the case of important equipment, to shorten the non-operational time of inverter failure, please provide a backup circuit by commercial power supply or spare inverter.

Chapter 5 Wiring

- In case of commercial power source switching functions, mechanical interlock the MC1 & MC2 contacts with each others is required. Otherwise you may damage the inverter and the danger of injury and/or fire. Please refer to following diagram.



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.

3) DC reactor connection terminals (PD and P)

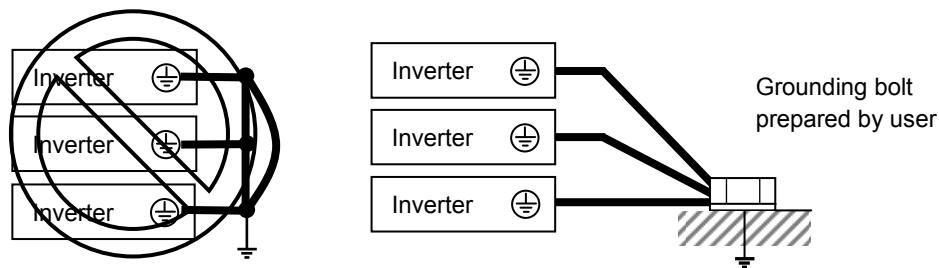
- Use these terminals to connect the optional DC power factor reactor (DCL). As the factory setting, terminals P and PD are connected by a jumper. Remove this to connect the DCL.
- The cable length between the inverter and DCL must be 5 m or less.

Remove the jumper only when connecting the DCL.

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

4) Inverter ground terminal (G)

- Be sure to ground the inverter and motor to prevent electric shock.
- According to the Electric Apparatus Engineering Regulations, connect 200 V class models to grounding electrodes constructed in compliance with type-D grounding (conventional type-III grounding with ground resistance of 100Ω or less) or the 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.



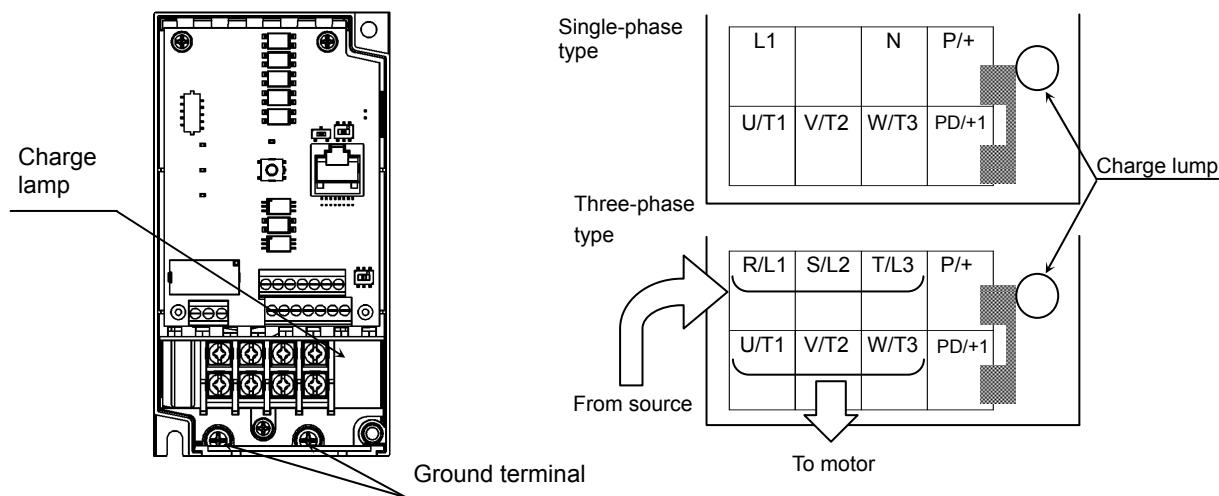
Chapter 5 Wiring

(2) Layout of main circuit terminals

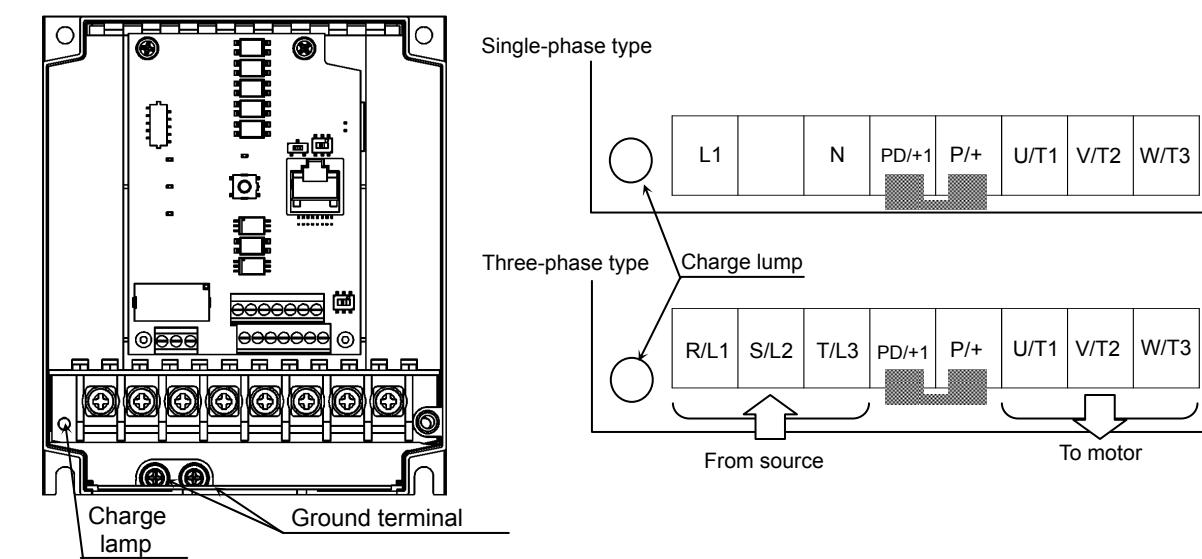
The figures below show the terminal layout on the main circuit terminal block of the inverter.

The main circuit terminal block opens a faceplate and wires it.

Single-phase 200V 0.2 to 0.4kW
Three-phase 200V 0.2 to 0.75kW

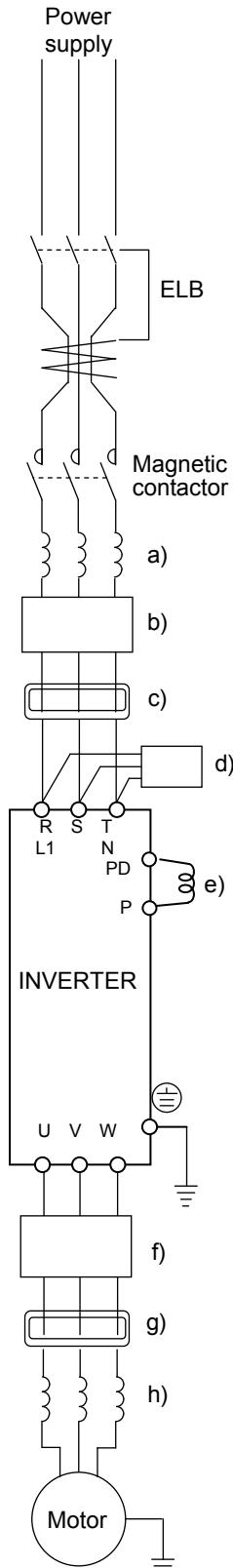


Single-phase 200V 0.75 to 2.2kW
Three-phase 200V 1.5 , 2.2kW



Chapter 5 Wiring

(3) Applicable peripheral equipment



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 mm² 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 | 30 |
| 300 m or less | 100 |
| 800 m or less | 200 |

| Name | Description |
|--|---|
| a) 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. |
| b) 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. |
| c) 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). |
| d) Radio noise filter on input side (Capacitor filter) (CFI-X) | Use this noise filter to reduce the radiant noise radiated from input cables. |
| e) DC reactor (DCL-X-XX) | Use this reactor to control the harmonic waves generated by the inverter. |
| f) Noise filter on the output side (ACF-CX) | Connect this noise filter between the inverter and motor to reduce the radiant noise radiated from cables for the purpose of reducing the electromagnetic interference with radio and television reception and preventing malfunctions of measuring equipment and sensors. |
| g) 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.) |
| h) 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. |
| h) LCR filter | This filter converts the inverter output into a sinusoidal waveform. |

Chapter 5 Wiring

(4)Wiring and Accessories

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

| Input Voltage | Motor Output (kW) | Applicable inverter model NES1- | Wiring | | | Accessories | | Note1) |
|---------------|-------------------|------------------------------------|--|---|-------------------------|---|-----------------------------------|--------|
| | | | Gauge of power line cable (mm ²) Note3) Note4) | Size of terminal screw Terminal width (mm) | Tightening Torque (N·m) | Earth-leakage breaker (ELB) Note2) Note5) | Magnetic contactor (MC) Note2) | |
| 1-phase 200V | 0.2 | 002SB | AWG14 (2.0) | M3.5 (7.6) | 1.0 | EX30 (5A) | H10C | 10A |
| | 0.4 | 004SB | AWG14 (2.0) | M3.5 (7.6) | 1.0 | EX30 (10A) | H10C | 10A |
| | 0.75 | 007SB | AWG14 (2.0) | M4 (10) | 1.4 | EX30 (15A) | H10C | 15A |
| | 1.5 | 015SB | AWG10 (5.5) | M4 (10) | 1.4 | EX30 (20A) | H20 | 20A |
| | 2.2 | 022SB | AWG10 (5.5) | M4 (10) | 1.4 | EX30 (20A) | H20 | 30A |
| 3-phase 200V | 0.2 | 002LB | AWG16 (1.25) | M3.5 (7.6) | 1.0 | EX30 (5A) | H10C | 10A |
| | 0.4 | 004LB | AWG16 (1.25) | M3.5 (7.6) | 1.0 | EX30 (10A) | H10C | 10A |
| | 0.75 | 007LB | AWG16 (1.25) | M3.5 (7.6) | 1.0 | EX30 (10A) | H10C | 15A |
| | 1.5 | 015LB | AWG14 (2.0) | M4 (10) | 1.4 | EX30 (15A) | H10C | 15A |
| | 2.2 | 022LB | AWG14 (2.0) | M4 (10) | 1.4 | EX30 (20A) | H20 | 20A |

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.) Select above proper ELB capacity following above table for the 1pc inverter. 1pc inverter must be supplied by the above proper 1pc ELB.

Note 3) If the power line exceeds 20m, cable that is thicker than the specified applicable cable must be used for the power line.

Note 4) Use copper electric wire (HIV cable) of which the maximum allowable temperature of the insulation is 75°C.

Note 5) Use earth-leakage breakers (ELB) to ensure safety.

Note 6) To comply UL, use either ELB/or FUSE which is specified by UL for the Power supply for the inverter.

Note 7) The earthed line, please use things more than electric wire diameter to show to the power line.

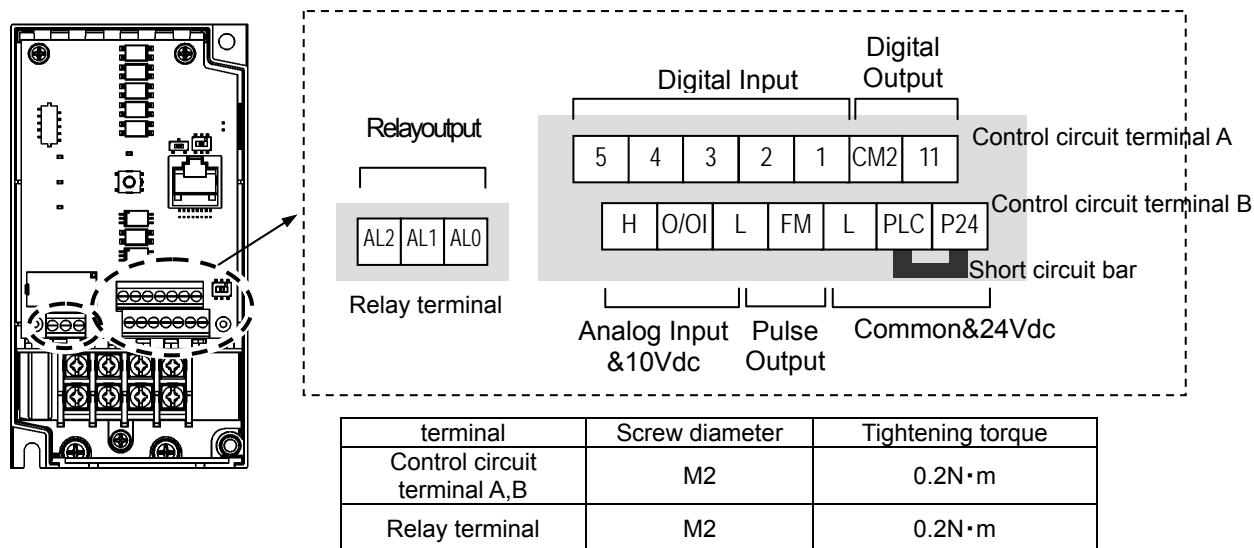
Chapter 5 Wiring

5.6 Wiring of the control circuit

(1) Wiring instructions

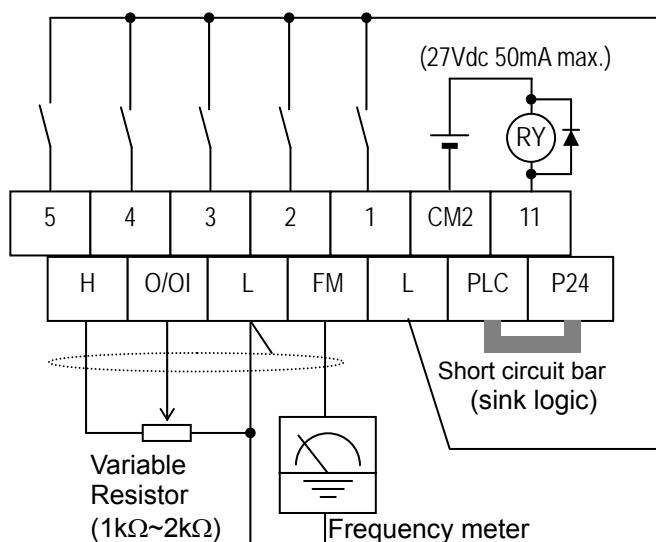
- 1) Terminals L and CM2 are common to I/O signals and isolated from each other.
Do not connect these common terminals to each other or ground them.
Do not ground these terminals via any external devices. (Check that the external devices connected to these terminals are not grounded.)
- 2) Use a shielded, twisted-pair cable (recommended gauge: 0.14-0.75 mm²) 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 20m or less.
- 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) 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.
- 6) When connecting a relay to an intelligent output terminal, also connect a surge-absorbing diode in parallel with the relay.
- 7) Do not connect analog power supply terminals H and L or interface power supply terminals P24 and L to each other. Otherwise, the inverter may fail.
- 8) Control circuit terminal block has two columns up and down. Lower terminal may wire difficult to upper terminal wire to the first. Therefore, please first wiring to lower terminal.
- 9) After wiring, gently pull the wire, please make lead wire have securely connected.
- 10) Make sure the wires are not shorted each other.

(2) Layout of control circuit terminals



Chapter 5 Wiring

[example] (sink logic)



Note1) The above is a method to perform analog input(O/OI) by voltage input. It is necessary for SW6 on the board to be set for voltage input(default).

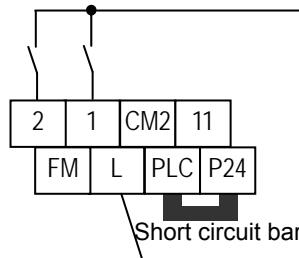
Note2) If you want to connect a relay to an intelligent output terminal, please connect a surge absorbing diode in parallel with the relay. The output circuit may malfunction by voltage surge.

(3) Switching the input control logic

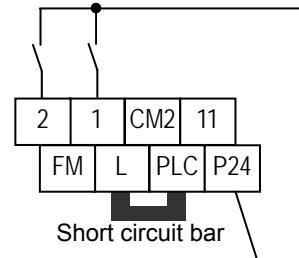
- In the factory setting, and intelligent input terminals is the sink logic.

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 L with the jumper.

1)Sink logic



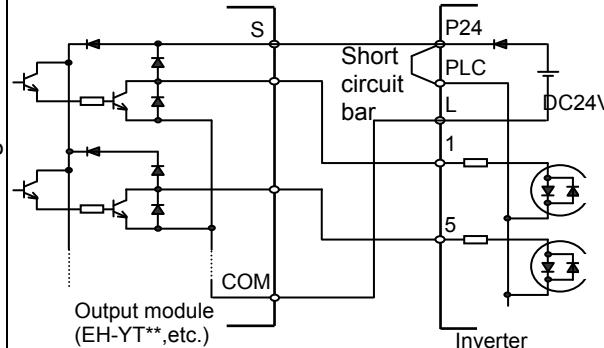
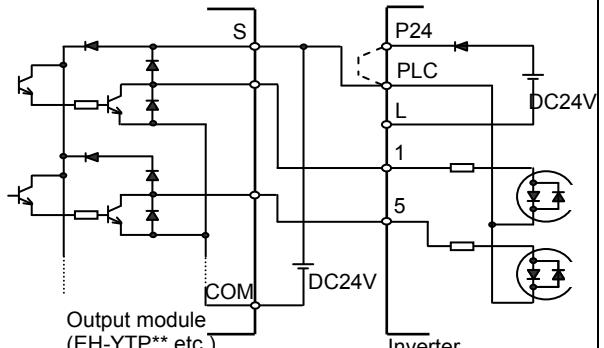
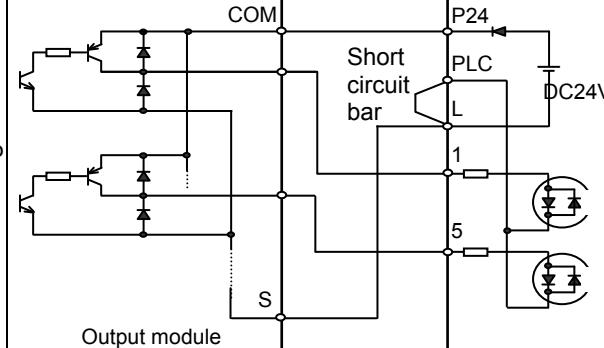
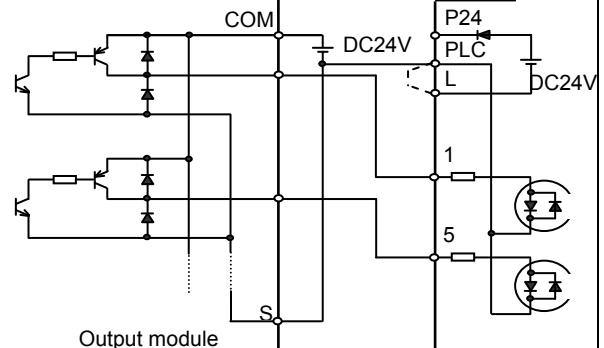
2)Source logic



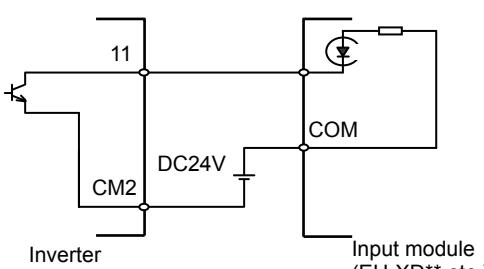
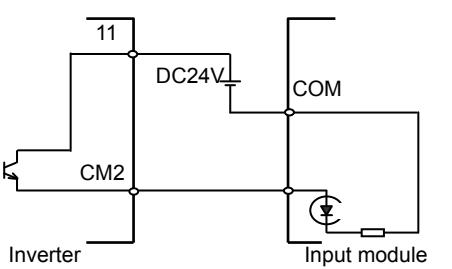
Chapter 5 Wiring

5.7 Connection with the programmable controller (PLC)

(1) Connecting a programmable controller to intelligent input terminals

| | When using the internal interface power supply (Remove the short circuit bar from the control circuit terminal block.) | When using an external power supply |
|--------------|--|--|
| Sink logic |  <p>Output module (EH-YT**,etc.)</p> <p>Inverter</p> |  <p>Output module (EH-YTP**,etc.)</p> <p>Inverter</p> |
| Source logic |  <p>Output module (EH-YT**,etc.)</p> <p>Inverter</p> |  <p>Output module (EH-YTP**,etc.)</p> <p>Inverter</p> |

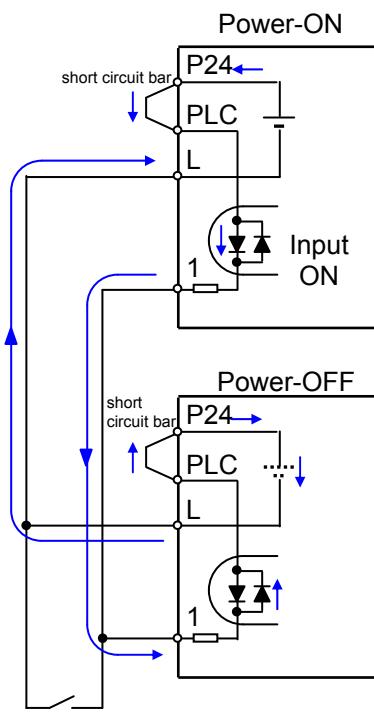
(2) Connecting a programmable controller to intelligent output terminals

| | | | |
|------------|--|--------------|---|
| Sink logic |  <p>Input module (EH-XD**,etc.)</p> <p>Inverter</p> | Source logic |  <p>Input module (EH-XD**,etc.)</p> <p>Inverter</p> |
|------------|--|--------------|---|

5.8 Notes on using multiple inverters

A plurality of inverter uses the common input and when inverter is timing of different power-on, as shown in the figure below the current flowing around. The input may be recognized as ON in spite of OFF. In this case, please put a diode(rated 50V/0.1A) as shown in the figure to prevent.

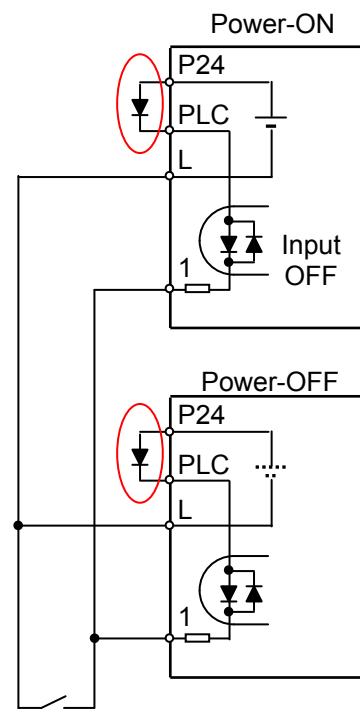
(1) Sink logic



SW OFF

The input is recognized
as ON in spite of OFF without Diode.

Additional diode

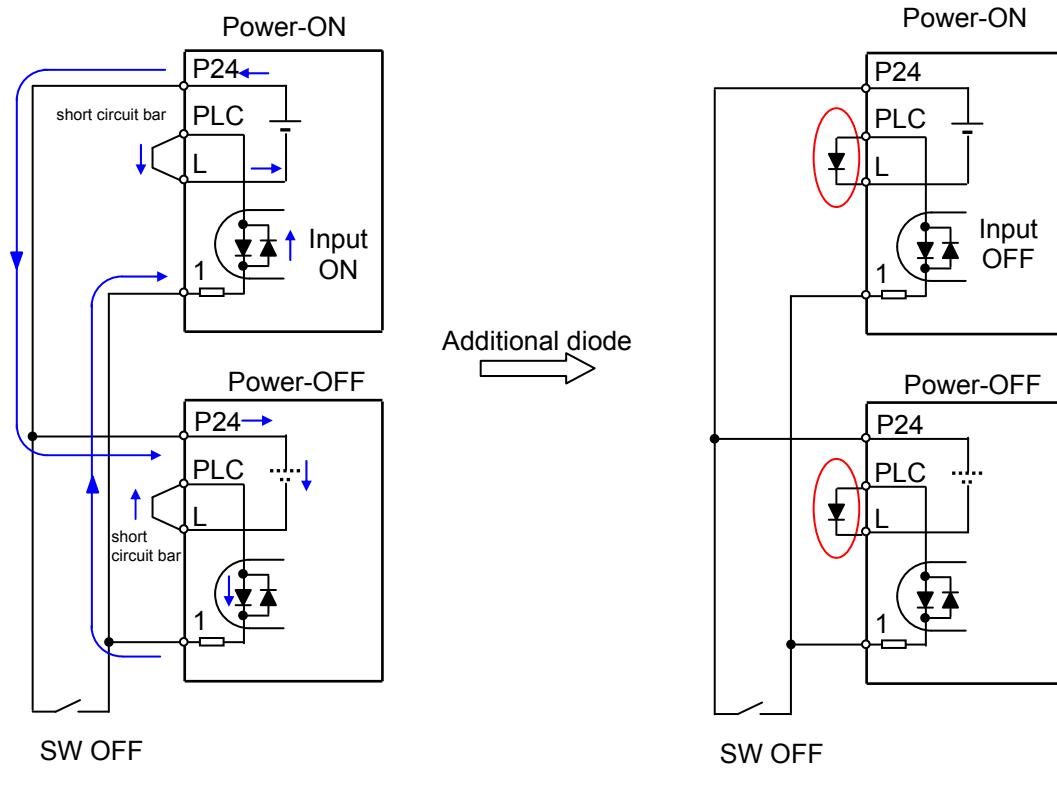


SW OFF

Providing a diode instead of the short circuit bar, so that the current flowing is prevented.

Chapter 5 Wiring

(2) Source logic



The input is recognized
as ON in spite of OFF without Diode.

Providing a diode instead of the short circuit
bar, so that the current flowing is prevented.

Chapter 6 Operation

This chapter describes typical methods of operating the inverter, how to operate the digital operator.

| | | |
|-----|---|--------|
| 6.1 | Precautions of Operation | 6 - 1 |
| 6.2 | Confirmation before power up the inverter | 6 - 2 |
| 6.3 | Changing parameters..... | 6 - 2 |
| 6.4 | Power up the inverter..... | 6 - 3 |
| 6.5 | How To Operate the Digital Operator..... | 6 - 4 |
| 6.6 | Motor Operation..... | 6 - 11 |
| 6.7 | Conduct a test run of the motor | 6 - 17 |
| 6.8 | When tripping occurs | 6 - 19 |

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Chapter 6 Operation

6.1 Precautions of Operation

! **WARNING**

- Please do not rotate suddenly. Check the direction of rotation at low frequencies. Otherwise, there is a danger of injury.
- 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 top cover before turning on the inverter power. Do not open the top 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.
- Prepare the additional emergency stop switch in addition to the stop key of the integrated operator and/or the optional operator. Otherwise, there is a danger 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. Otherwise, there is a danger of injury.
- 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.
- Run/Stop/Reset is integrated in one button, before you press the button, please make sure that the machine(facility) Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.

! **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 or damage to the machine controlled by the inverter.
- 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 injury or 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 injury or damage to the machine driven by the motor.
- Regardless Run command setting(A002/A202) if the key is pressed, inverter starts running. Therefore, if you selected Run command such as operator or terminal, please handle the key after you made sure that the machine/facility is operated safely.

Chapter 6 Operation

6.2 Confirmation before power up the inverter

Please confirm the followings before operation.

- (1) Connection of the power input (R,S,T, L1,N) and motor (U/T1, V/T2, W/T3) is correctly connected. Otherwise there is a risk of inverter failure.
- (2) There must be no mis-connection of the control wiring. Otherwise there is a risk of inverter failure.
- (3) Earth grounding is properly connected. Otherwise there is a risk of electric shock.
- (4) There is no ground fault other than earth grounding terminal. Otherwise there is a risk of inverter malfunction.
- (5) There must be no short circuit by the wire chip etc., There must be no tools left inside the inverter. Otherwise there is a risk of inverter failure.
- (6) There must be no short circuit or ground fault at the output side. Otherwise there is a risk of inverter failure.
- (7) Front cover must be closed. When using the RS422/RS485 port, please use to open the window of the front cover. Otherwise there is a risk of electric shock.

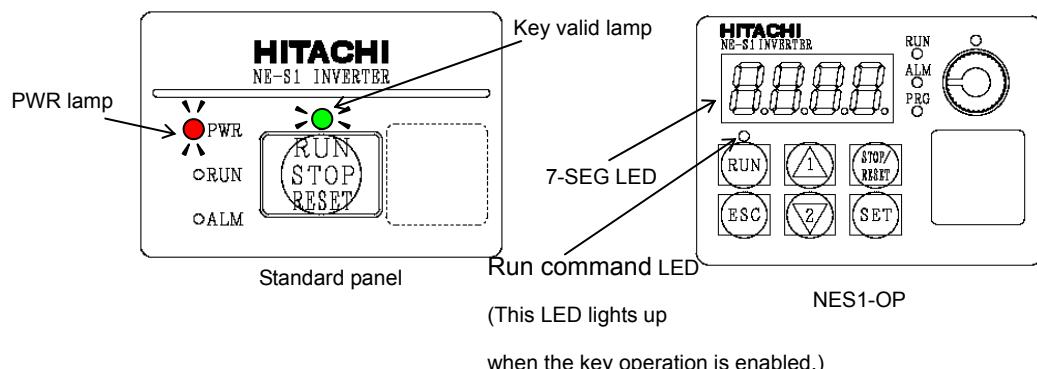
6.3 Changing parameters

One of the following is required when changing parameters on NE-S1 series inverters.

- (1) Dedicated operator (NES1-OP)
The operator (NES1-OP) is used with integration onto the inverter. It is not possible to use the operator external with cable.
- (2) Digital operator (OPE-SRmini,OPE-S/SR/SBK)
Digital operator can be used with connector cable (ICS-1,3) and connected to the RS422/RS485 port (RJ45) in the inverter. Turn the changeover switch to the operator side (OFF side) in that case. Refer to the manual for each operator for the detailed information.
- (3) 5-line LCD operator (WOP)
WOP having serial number of “16918938000081” or later (2011/07 production) is applied to NE-S1 series inverter. (English only)
WOP can be used with connector cable (ICS-1,3) and connected to the RS422/RS485 port (RJ45) in the inverter. Turn the changeover switch to the operator side (OFF side) in that case. Refer to the manual for WOP for the detailed information.
- (4) PC programming tool (ProDriveNext)
ProDriveNext Version “1.2.33.010” and later is applied to the NE-S1 series inverter.
PC can be used with connector cable and connected to the RS422/RS485 port (RJ45) in the inverter. Turn the changeover switch to the operator side (OFF side) in that case. Refer to the manual for ProDriveNext for the detailed information.
It is necessary to turn power off to store the changed data.

6.4 Power up the inverter

- (1) Power up the inverter after confirming the items shown in above section 6.2.
- (2) Confirm the LED is emitting like shown below.
 - Standard panel : Confirm that both PWR lamp and Key valid lamp are emitting
 - Dedicated operator (NES1-OP) : Confirm that the 7-SEG LED is emitting. Display will be the one set by b038 (Initial display selection). "0.00(output frequency monitor)" will be displayed under default condition.
- (3) Refer to section "6.5" and set required parameters. And then refer to section "6.6 Motor operation".



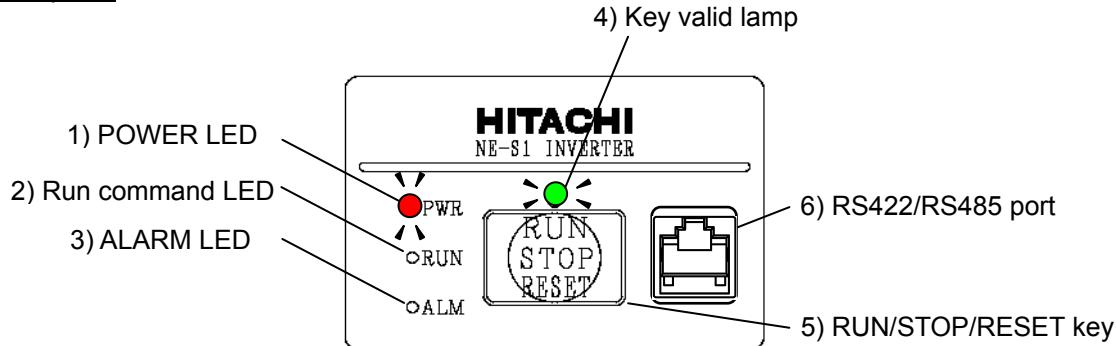
Note 1) It will take around 1.5 seconds for the inverter to be ready(each LED emits). Please take into account this delay in case of an application , which this delay will be important.

Chapter 6 Operation

6.5 How To Operate the Inverter

(A) Names and functions of components

Standard panel



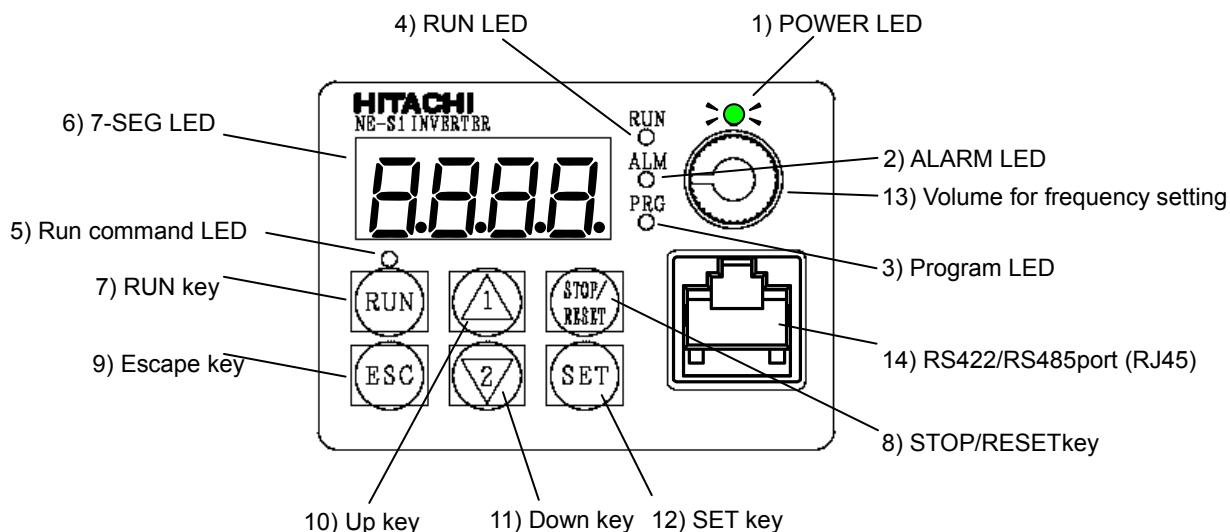
| Name | Description |
|----------------------------|--|
| 1) POWER LED | - Turns on (red) during inverter is powered up |
| 2) Run command LED | - Turns on (green) during inverter operation. (This turns ON either Run command is given, or the inverter is giving out power. Therefore it keeps turning on during 0 Hz driving, or keeps turning on during deceleration period even after the run command is OFF.) |
| 3) ALARM LED | - Turns on (red) when the inverter is in trip status. - See section 6.8 for details on clearing alarms. |
| 4) Key valid lamp | - Turns on (green) when the RUN/STOP/RESET is ready. It turns off when there is a RUN command. If the run command is being given from the RUN/STOP/RESET key, the lamp is being on during deceleration period even after the run command is OFF. While Run command is given such as FW(RV) terminal, if "RUN/STOP/RESET key" was pressed, even Run command is OFF, the "Key valid lamp" is OFF until inverter is Stopped. |
| 5)RUN/STOP/RESET key | - Makes inverter run, stop and reset. RUN/STOP/RESET key is set default and it can be made invalid by the key sensitivity selection (C151) to "no". - It restores from the trip state if the inverter is in trip state. - If the ModBus communication is selected, it can be temporary changed to a external operator mode if the inverter is powered up with pressing the RUN/STOP/RESET key and keep it pressing 5seconds, and take off from the key.. Changeover switch must be changed later on. Note 1) |
| 6) RS422/RS485 port (RJ45) | - This is a port for external operator, Modbus connection, or ProDrioveNext (RS485/operator changeover switch must be operated) before Power ON. In case of Modbus communication, it is necessary to set the changeover switch and parameter (C070). Display of NES1-OP will be according to the parameter set of b150 continuously, if the external operator is connected while the dedicated operator (NES1-OP) is integrated. Note2) |

Note 1) It is necessary to set changeover switch and the parameter C070 for releasing the Modbus communication. If the parameter C070 is set to Modbus, external operator via the RJ45 jack cannot be used.

Note 2) Connecting work on RJ45 jack must be done during the inverter power off.

Chapter 6 Operation

(B) Dedicated operator (NES1-OP) *same applies to external Operator



| Name | Description |
|----------------------------------|--|
| 1) POWER LED | - Turns ON (Green) while the inverter is powered up. |
| 2) ALARM LED | - Turns ON (Red) when the inverter trips. - See Chapter 6.8 for details on clearing alarms. |
| 3) Program LED | - Turns ON (Green) when the display shows changeable parameter. - Blinks when there is a mismatch in setting. Refer to "9.3". |
| 4) RUN LED | - Turns ON (Green) when the inverter is driving the motor. (RUN LED is lit even when the set frequency is put in operation command 0Hz or during deceleration after the operation command OFF.) |
| 5) RUN command LED | - Turns ON (Green) when a Run command is set to the operator. (Run key is effective.) |
| 6) 7-SEG LED | - Shows each parameter, monitors etc. |
| 7) RUN key | - Makes inverter run. But operation command destination must be the operator. - Set the operation direction in F004. |
| 8) STOP/RESETkey | - Makes inverter decelerates to a stop. (Even if operation command is non-operator, Stop key is valid. Stop key can be disabled in the settings[b087].) - Reset the inverter when it is in trip situation |
| 9) Escape key | - Go to the top of next function group, when a function mode is shown - Cancel the setting and return to the function code, when a data is shown - Moves the cursor to a digit left, when it is in digit-to-digit setting mode - Pressing for 1 second leads to display data of d00 I , regardless of current display. |
| 10) Up key 11) Down key | - Increase or decrease the data. It accelerates hold down a key. - Pressing the both keys at the same time gives you the digit-to-digit edit. |
| 12) SET key | - Go to the data display mode when a function code is shown - Sets the data and go back to show the function code, when data is shown. - Moves the cursor to a digit right, when it is in digit-to-digit display mode |
| 13) Volume for frequency setting | - This is a Volume for frequency setting. (A001=00(VR)) |

Chapter 6 Operation

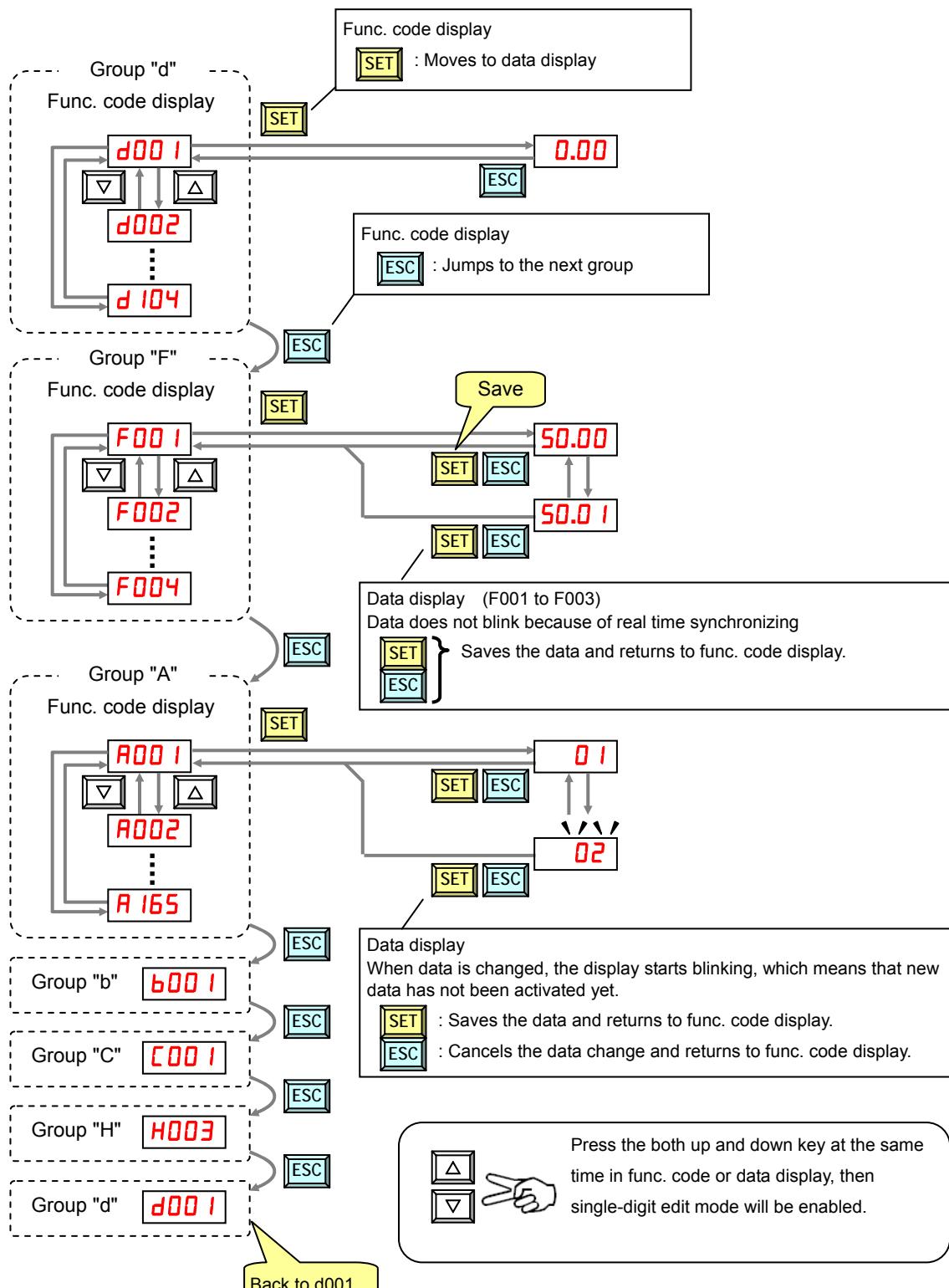
14) RS422/RS485port
(RJ45)

- This is a port for external operator, Modbus connection, or ProDrioveNext (RS485/operator changeover switch must be operated) before Power ON. In case of Modbus communication, it is necessary to set the changeover switch and parameter (C070). Display of NES1-OP will be according to the parameter set of b150 continuously, if the external operator is connected while the dedicated operator (NES1-OP) is integrated. Note1)

Note 1) Connecting work on RJ45 jack must be done during the inverter power off.

Chapter 6 Operation

(C) Key operations : This section shows the key operations of the digital operator and Dedicated operator (NES1-OP).

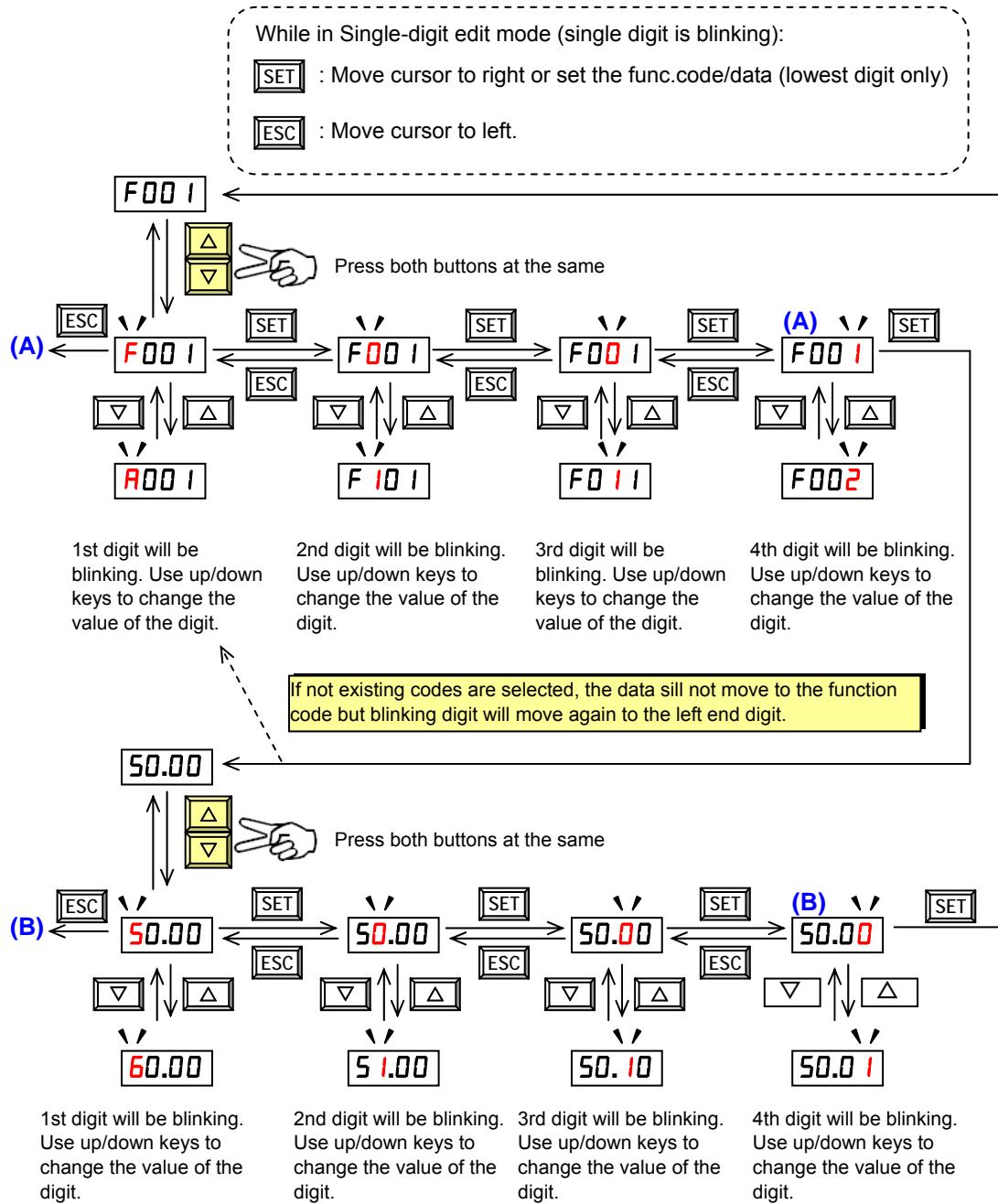


Note) Pressing the [ESC] key will make the display go to the top of next function group, regardless the display contents.
(e.g. A002 → [ESC] → b001)

Chapter 6 Operation

[Single-Digit Edit Mode]

If a target function code or data is far from current data, using the single-digit edit mode makes it quicker. Pressing the up key and down key at the same time leads you to go into the digit-to-digit changing mode.



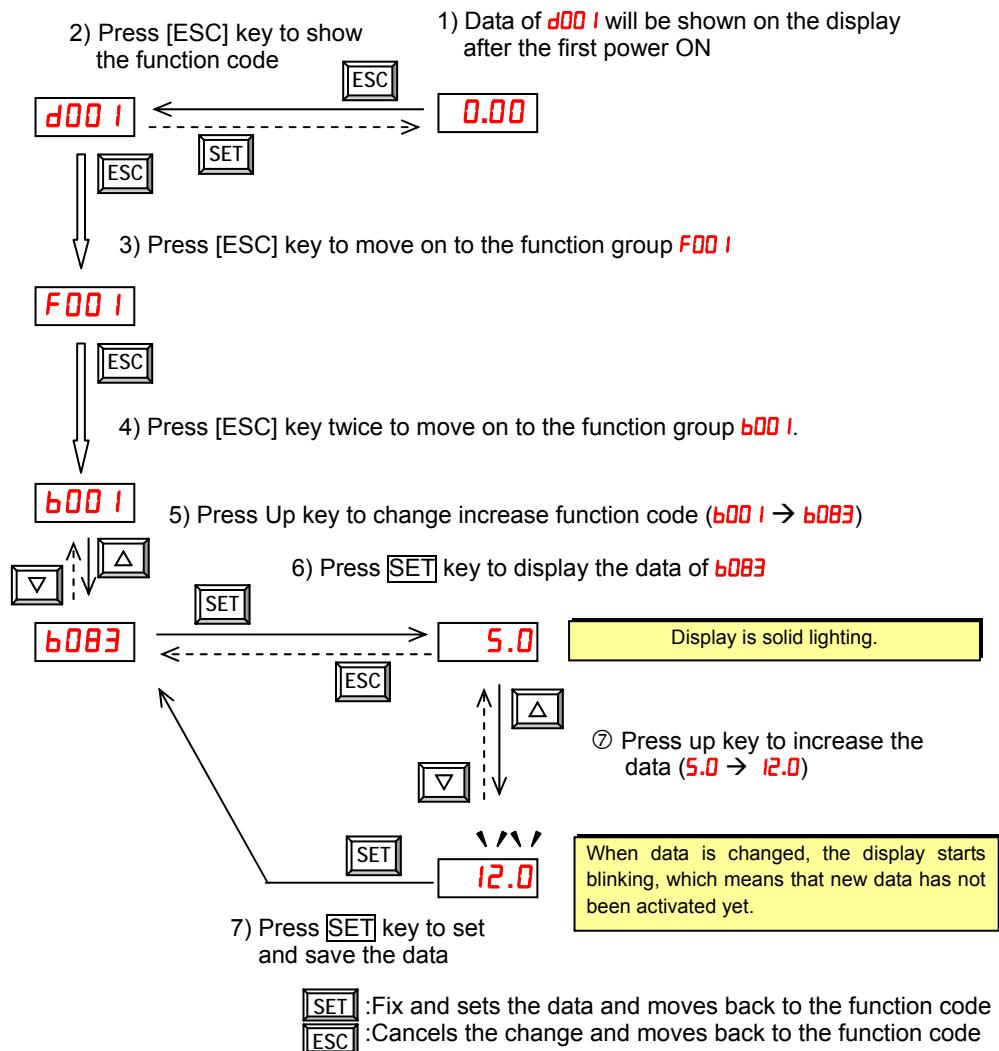
Note1) When pressing [ESC] with cursor on the highest digit, the cursor will jump to the lowest digit. ((A) and (B) in above figure.)

Note2) When pressing up key and down key at the same time in single-digit edit mode, the single-digit edit mode is disabled and goes back to normal mode.

Chapter 6 Operation

[Setting example]

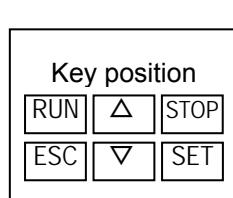
After power ON, changing from **0.00** display to change the **b003** (carrier frequency) data.



Note1) Function code **dxxx** are for monitor and not possible to change.

Function codes **Fxxx** other than **F004** are reflected on the performance just after changing the data (before pressing **SET** key), and there will be no blinking.

Note2) Keep pressing for more than 1 second leads to **d001** display, regardless the display situation. But note that the display will circulates while keep pressing the [ESC] key because of the original function of the key.
 (e.g. **F001** → **R001** → **b001** → **C001** → ... → displays **50.00** after 1 second)



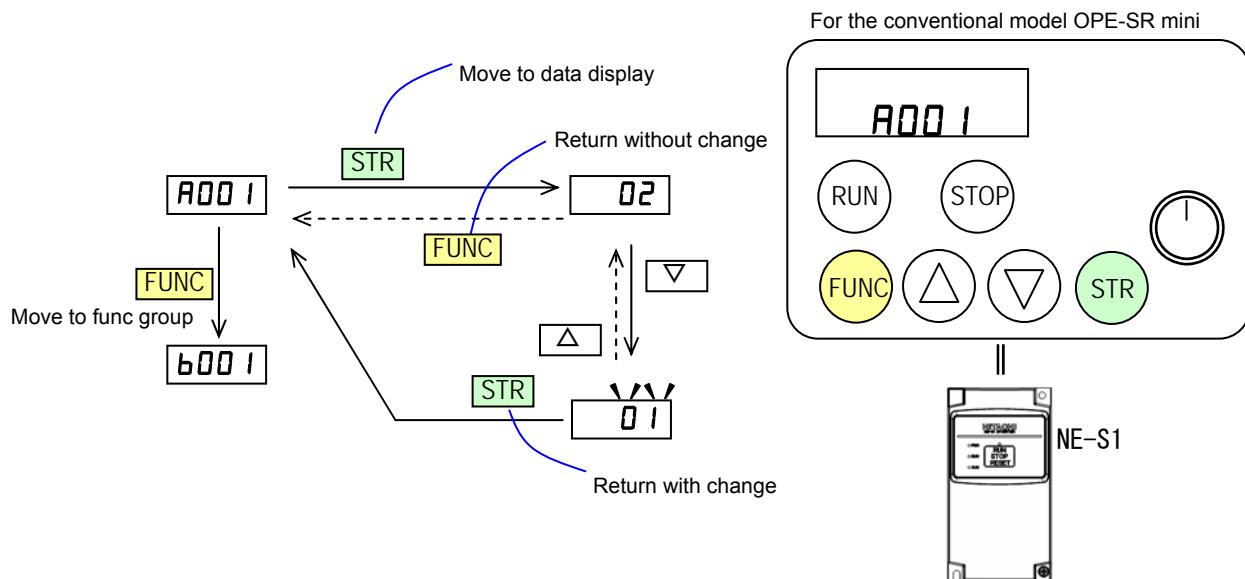
| | When a function code is shown... | When a data is shown... |
|----------------|------------------------------------|---|
| ESC key | Move on to the next function group | Cancels the change and moves back to the function code |
| SET key | Move on to the data display | Fix and sets the data and moves back to the function code |
| △ key | Increase function code | Increase data value |
| ▽ key | Decrease function code | Decrease data value |

Chapter 6 Operation

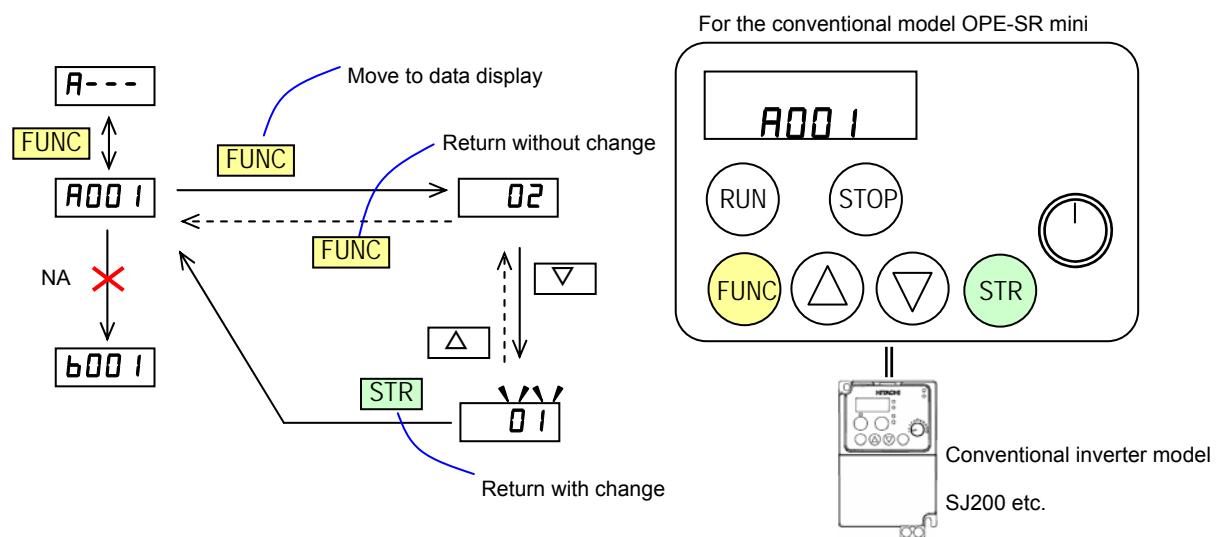
[Connection of the operator for another model]

NES1 can operate even (OPE-S/SR/SBK, OPE-SR mini). STR key and FUNC key are different from the behavior of conventional key operation system. In order to transition from the func code display to the data display is the STR key, not the FUNC key. NES1 is a function group transfer by pressing the FUNC key, when operator shows the func code display. Operator displays the d001 when it hold down a FUNC key for over a second even any state.

NES1 and OPE-SR mini combination



[Reference] Conventional inverter model and OPE-SR mini combination



Chapter 6 Operation**6.6 Motor Operation**

Both "Run command" and "frequency command" is necessary to run the motor. Motor does not run if one of each is missing. For example, motor will not run when a run command is given, but a frequency command is 0Hz. Additionally, the motor will not run if a FRS (free run stop) signal (and the like) is being given.

NE-S1 series inverter has following way to set the run command and frequency command. (This is an example of sink logic and uses internal control power supply.)

(A) Driving with the standard panel

RUN/STOP/RESET key on the standard operation panel is effective regardless of the setting of the driving order method(A002). Thus, following driving method (1) to (3) is possible without an option if it is factory default setting.

(1)Method to perform driving in RUN/STOP/RESET key and perform frequency setting in Multispeed select

This is the operation method using Run command is given by "RUN/STOP/RESET key" & Frequency setting is given by Fixed value such as 20/40/60Hz, Accel&Decel time is 10 seconds. If you don't need to change such as Accel&Decel time, optional Operator is not required.) To set the Freq. setting, use the Multi-speed frequency setting (1=60Hz),(2=40Hz),(3=20Hz).

■Setup

| Function Name | Code | Data | Note |
|--------------------|------|---------|---------|
| Input [3] function | C003 | 02(CF1) | |
| Input [4] function | C004 | 03(CF2) | Default |

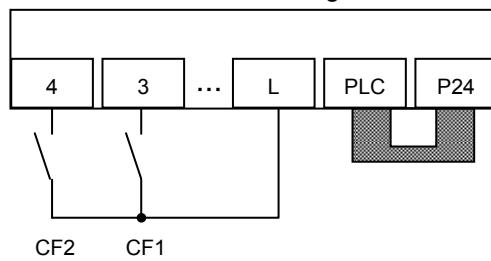
The initial value of Acceleration/ Deceleration time is 10sec.

Please change the following parameters as needed.

| Function Name | Code | Setting Range | Note |
|-------------------|------|------------------|-------------------|
| Acceleration time | F002 | 0.00 to 3600sec. | Default : 10 sec. |
| Deceleration time | F003 | 0.00 to 3600sec. | Default : 10 sec. |

* One of the following is required when changing parameters on NE-S1 series inverters.

- a) Dedicated operator (NES1-OP)
- b) Digital operator
- c) 5-line LCD operator
- d) Modbus
- e) PC programming tool (ProDriveNext)

■Control circuit terminals wiring**■Example of use (default)**

| | Intelligent input terminal [3] | Intelligent input terminal [4] |
|------------|--------------------------------|--------------------------------|
| 60Hz order | OFF | ON |
| 40Hz order | ON | OFF |
| 20Hz order | ON | ON |

Chapter 6 Operation

(2) Method to perform driving in RUN/STOP/RESET key and perform frequency setting in volume resistor

This is the operation method using Run command is given by "RUN/STOP/RESET key" & Frequency setting is given by analog input such as O-L voltage, Accel&Decel time is 10 seconds. (If you don't need to change such as Accel&Decel time, optional Operator is not required.) Below diagram is to set the external Freq. setting connecting H-O-L volume to supply O-L voltage.

■ Setup

| Function Name | Code | Data | Note |
|------------------|------|--------------------------------|---------|
| Frequency source | A001 | 01 (Control circuit terminals) | Default |

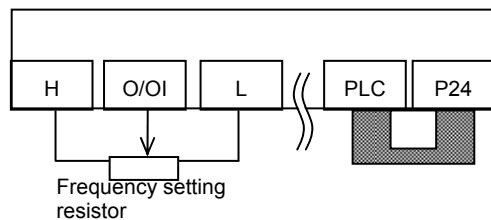
The initial value of Acceleration/ Deceleration time is 10sec.
Please change the following parameters as needed.

| Function Name | Code | Setting Range | Note |
|-------------------|------|-------------------|-------------------|
| Acceleration time | F002 | 0.00 to 3600 sec. | default : 10 sec. |
| Deceleration time | F003 | 0.00 to 3600 sec. | default : 10 sec. |

* One of the following is required when changing parameters on NE-S1 series inverters.

- a) Dedicated operator (NES1-OP)
- b) Digital operator
- c) 5-line LCD operator
- d) Modbus
- e) PC programming tool (ProDriveNext)

■ Control circuit terminals wiring



Note)
The above is a method to perform analog input(O/OI) by voltage input. It is necessary for SW6 on the board to be set for voltage input(default). →

Chapter 6 Operation

(3) Method to perform driving in FW/RV terminal and perform frequency setting in volume resistor

This is the operation method using Run command is given by intelligent input terminal such as FW(RV) function & Frequency setting is given by analog input such as O-L voltage. If you don't need to change such as Accel&Decel time, optional Operator is not required.) Below diagram is to set the external Freq. setting connecting H-O-L volume to supply O-L voltage.

■Setup

| Function Name | Code | Data | Note |
|--------------------|------|--------------------------------|---------|
| Frequency source | A001 | 01 (Control circuit terminals) | Default |
| Run command source | A002 | 01 (Control circuit terminals) | Default |
| Input [1] function | C001 | 00 (FW) | Default |
| Input [2] function | C002 | 01 (RV) | |

The initial value of Acceleration/ Deceleration time is 10sec.

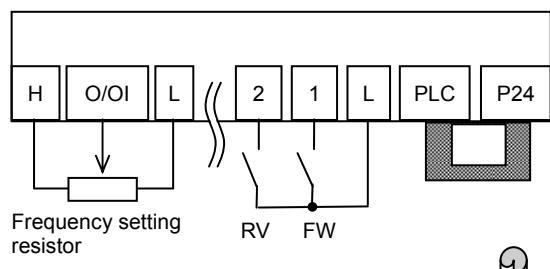
Please change the following parameters as needed.

| Function Name | Code | Setting Range | Note |
|-------------------|------|-------------------|-------------------|
| Acceleration time | F002 | 0.00 to 3600 sec. | Default : 10 sec. |
| Deceleration time | F003 | 0.00 to 3600 sec. | Default : 10 sec. |

* One of the following is required when changing parameters on NE-S1 series inverters.

- a) Dedicated operator (NES1-OP)
- b) Digital operator
- c) 5-line LCD operator
- d) Modbus
- e) PC programming tool (ProDriveNext)

■Control circuit terminals wiring



Note)

The above is a method to perform analog input(O/OI) by voltage input. It is necessary for SW6 on the board to be set for voltage input(default). →

Chapter 6 Operation

(B) Method to perform driving with the dedicated operator (NES1-OP)

*same applies to external Operator (OPE-S/SR/SBK,OPE-SR mini)

(1) Setting the operation command and Frequency command by operator (*Must be set by the operator.)

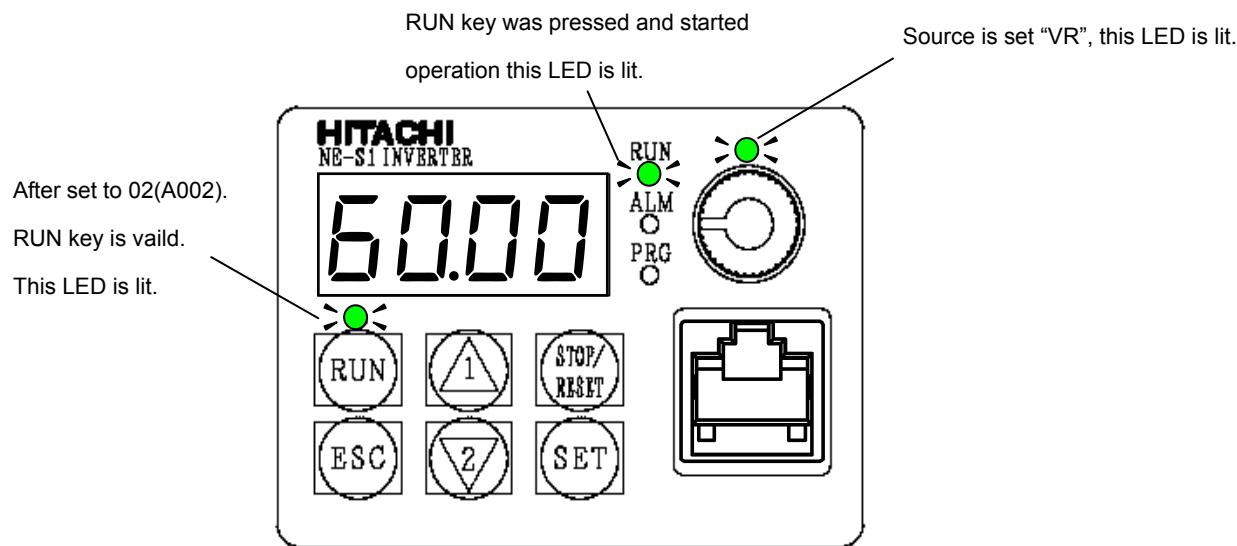
How to drive by key operation of the Dedicated operator.

■ Setup

| Function Name | Code | Data | Note |
|--------------------------|------|--|-------------------------------------|
| Frequency source | A001 | 02(Operator) | |
| Run command source | A002 | 02(Operator) | Run command LED light up |
| Output frequency setting | F001 | 0.0 to A004(Max frequency) (default is 0.00Hz.) | |
| Keypad RUN key routing | F004 | 00(Forward) / 01(Reverse) | Can not be changed during operation |

The initial value of the acceleration and deceleration time is 10 seconds. Please change the following parameters as necessary.

| Function Name | Code | Setting Range | Note |
|-----------------------|------|----------------------|-------------------------------|
| Acceleration time (1) | F002 | 0.00 to 3600 seconds | Initial value : 10.00 seconds |
| Deceleration time (1) | F003 | 0.00 to 3600 seconds | Initial value : 10.00 seconds |



■ The control circuit terminal block wiring : No connect

■ Operation

Please be operated in accordance with section 6.7.

Chapter 6 Operation

(2) Carried out in 3-wire input to operation / stop. Carried out in the frequency setting analog current signal(0 to 20mA).

(Setting must be changed by the operator.)

■ Setup

| Function Name | Code | Data | Note |
|--------------------|------|--|---------------|
| Frequency source | A001 | 01(The control circuit terminal) | Initial value |
| Run command source | A002 | 01(The control circuit terminal) | Initial value |
| Input [1] function | C001 | 20(Starting the motor) *1 | |
| Input [2] function | C002 | 21(Stopping the motor) *1 | |
| Input [3] function | C003 | 22(Switching the motor operation direction) *1 | |

*1 : Details 3-wire input mode refer to 7.5.3.

The initial value of the acceleration and deceleration time is 10 seconds. Please change the following parameters as necessary.

| Function Name | Code | Setting Range | Note |
|-----------------------|------|----------------------|-------------------------------|
| Acceleration time (1) | F002 | 0.00 to 3600 seconds | Initial value : 10.00 seconds |
| Deceleration time (1) | F003 | 0.00 to 3600 seconds | Initial value : 10.00 seconds |

SW6 must be set to the current. (Refer to 5.4)

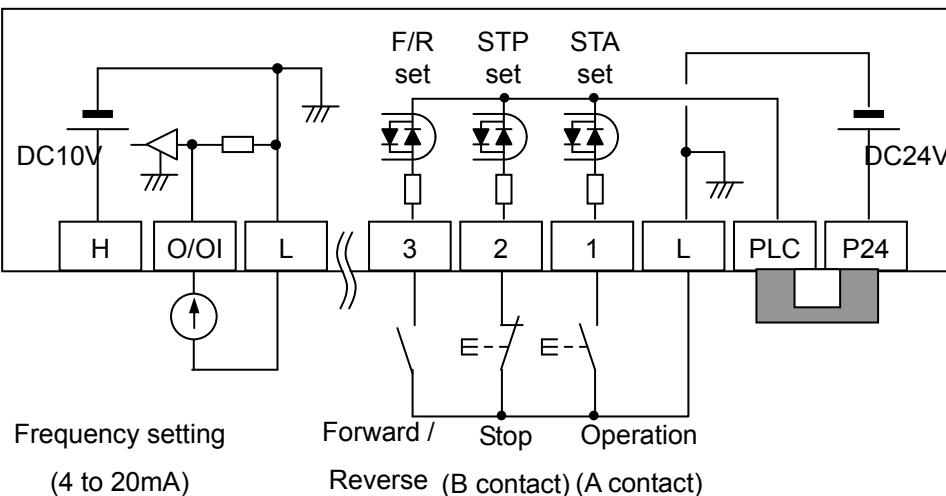
When used with 4 to 20mA, you need to change the following parameters.

| Function Name | Code | Data | Note |
|---|------|------|--------------------|
| [O/OI] input active range start voltage | A013 | 20% | Initial value : 0% |

* One of the following is required when changing parameters on NE-S1 series inverters.

- a) Dedicated operator (NES1-OP)
- b) Digital operator
- c) 5-line LCD operator
- d) Modbus
- e) PC programming tool (ProDriveNext)

■ The control circuit terminal block wiring



Chapter 6 Operation

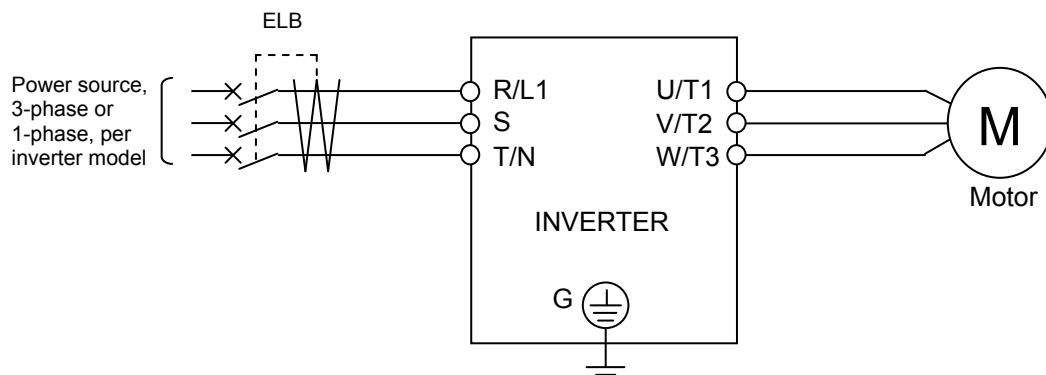
* This wiring diagram is an example of using the built-in power inverter. Refer to Section 5.6, when you use an external power supply.

■Operation

Please be operated in accordance with section 6.7.

6.7 Test Run with the motor

The following figure shows an example of basic connection is basic. Please refer to section 6.6 wiring for operation command and frequency command from the control circuit terminal block. On how to operate the parameter settings, please refer to section 6.5. To set the parameter, the operator is required.



| No. | Procedure |
|-----|--|
| 1 | Please check whether there is any problem with the wiring. |
| 2 | Turn on the power to the inverter.(POWER lamp(red) lights.) |
| | In case of input operation command and frequency command without operator.(State initial shipment) *1) |
| 3 | Turns on both intelligent input terminal 3,4(CF1,CF2). (Multi-speed freq. 3 : The initial value is set 20Hz.) |
| 4 | Push RUN/STOP/RESET key. RUN lamp(while driving) is lit. |
| | Please check and that there is no abnormality in the inverter and motor rotation direction motor rotation speed. |
| 5 | If the direction of rotation of the motor is different, please turn off the inverter and check Power lamp is OFF. Please replace the two phases of the three-phase wiring of the output. |
| 6 | If there are no problems, only to turn on intelligent input terminal 3 (CF1). (Multi-speed freq. 3 : The initial value is set 60Hz.) |
| 7 | After checking the operation, push RUN/STOP/RESET key. Motor starts to slow down. The RUN lamp(while driving) turns off when the motor is stopped. |
| | In case of input operation command and frequency command from control circuit terminal block. |
| 3 | Check that the the input value is (zero) to O / OI of the frequency command. |
| | The only one on the an intelligent input terminal 1(FW) or intelligent input terminal 2(RV). RUN lamp(while driving) is lit. |
| 4 | Gradually increasing the analog voltage / current frequency command to O/OI. |
| | Please check and that there is no abnormality in the inverter and motor rotation direction motor rotation speed. |
| 5 | If the direction of rotation of the motor is different, please turn off the inverter and check Power lamp is OFF. Please replace the two phases of the three-phase wiring of the output. |
| 6 | If there are no problems, gradually increasing the analog voltage / current to O/OI. |
| 7 | After checking the operation, the only one off the an intelligent input terminal 1(FW) or intelligent input terminal 2(RV). The RUN lamp(while driving) turns off when the motor is stopped. |
| | In case of input operation command and frequency command from operator. *1) |
| 3 | Set to "operator" frequency source setting. (A001=02) |

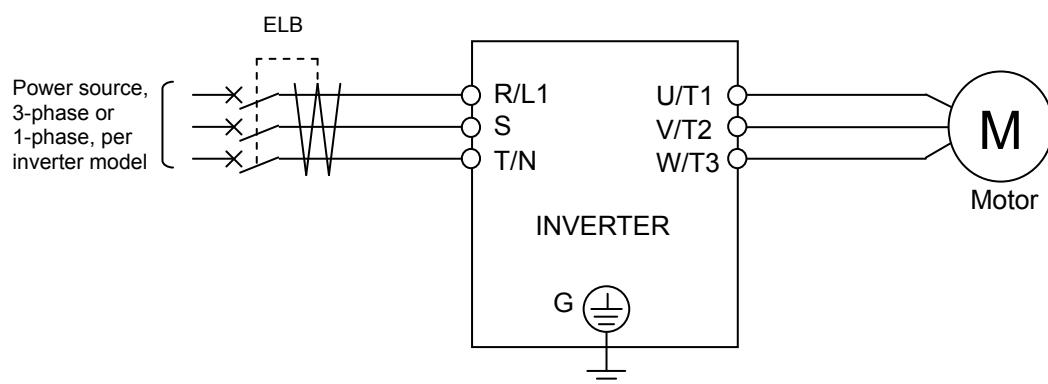
Chapter 6 Operation

| | |
|----|---|
| 4 | Set to "operator" run command source setting. (A002=02) |
| 5 | Set the output frequency. (F001) It is recommended to first slow and for the safety of about 10Hz. |
| 6 | Set the operation direction. (F004) |
| 7 | Set "Frequency output" to the monitor display on the operator. Displays the (d001). Then press the SET key. Checking the "0.00"(Hz). |
| 8 | Press the RUN key. Motor starts to rotate. Then, the operator's RUN(while driving) lamp is lit. |
| 9 | Please check and that there is no abnormality in the inverter and motor rotation direction motor rotation speed. The direction of rotation of the motor, refer to [d003] display. |
| 10 | If there are no problems, gradually increase the output frequency in F001. |
| 11 | After checking the operation, push STOP key. Motor starts to slow down. The RUN lamp(while driving) turns off when the motor is stopped. |

*1)"Operator" refers to Dedicated operator(NES1-OP), external digital operator(OPE-S/SR/SBK, OPE-SR mini), 5 line LCD operator(WOP).

■point to be checked

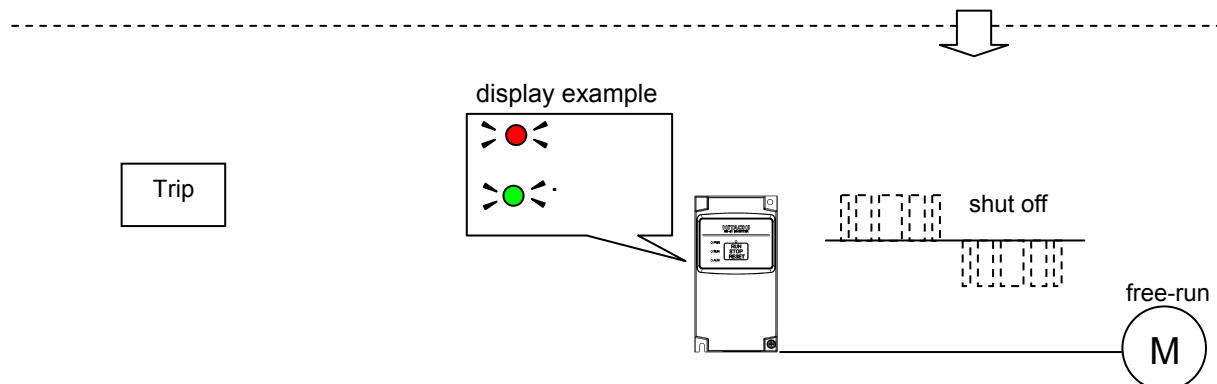
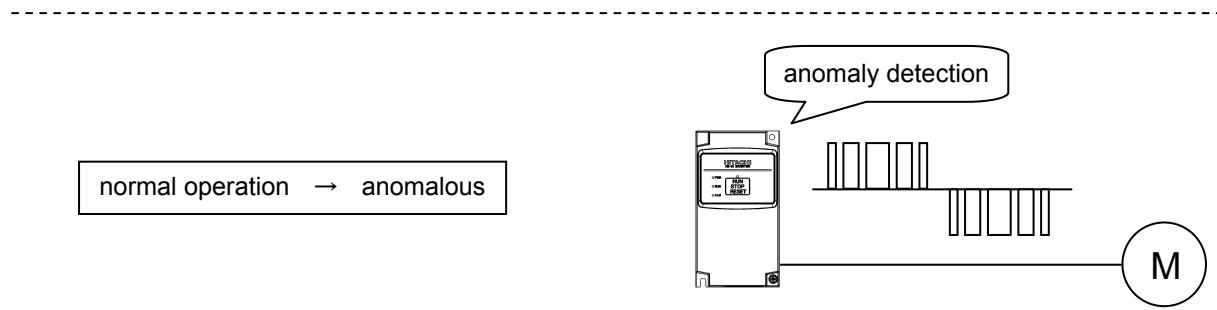
- Whether there is any trip in the middle of acceleration and deceleration. Frequency meter and check whether the correct number of revolutions.
- When an overcurrent trip or overvoltage trip occurs during the test run, please make sure the input and the output of the inverter state, the load condition.
- When an overcurrent trip or overvoltage trip occurs during the test run, please increase the length of the acceleration (F002)and deceleration time (F003). The operator is required to change the acceleration and deceleration time.
- Check the Output Current Monitor (d002), DC voltage monitor(d102). Ensure that there is a margin to the value of the current and voltage trip value. To check the monitor, operator is required.



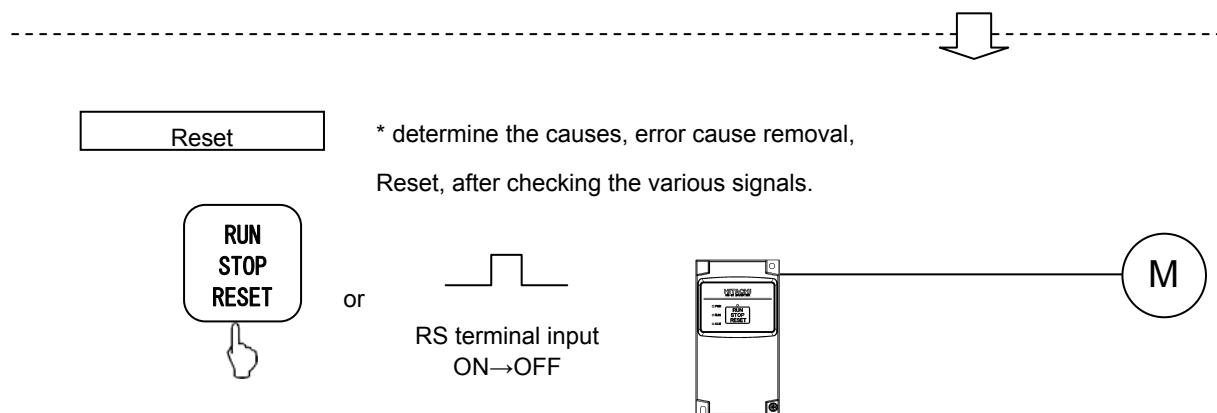
Chapter 6 Operation

6.8 When tripping occurs

During operation, If any abnormalities (overcurrent, overload, etc.) is detected, and in order to protect the motor and inverter, the inverter output is shut off to the motor. ALARM lamp is lit at the same time. Then, it displays an error code. This chain of operations is called the trip. Motor is in free-run mode due to trip. To investigate the cause of the error from the error code that is displayed. And remove the cause of the error. During the trip, a run command isn't accepted. Press the [RUN/STOP/RESET]key to cancel the trip. If reset is assigned to an intelligent input terminal, please reset input "ON to OFF". However, depending on the cause of trip may not be able to cancel the trip by reset. In this case, the power is turned off and turned on again. Before reset execution please review the various input signals such as operation command. Please note that If operation command signal remains ON, restart immediately after the reset operation

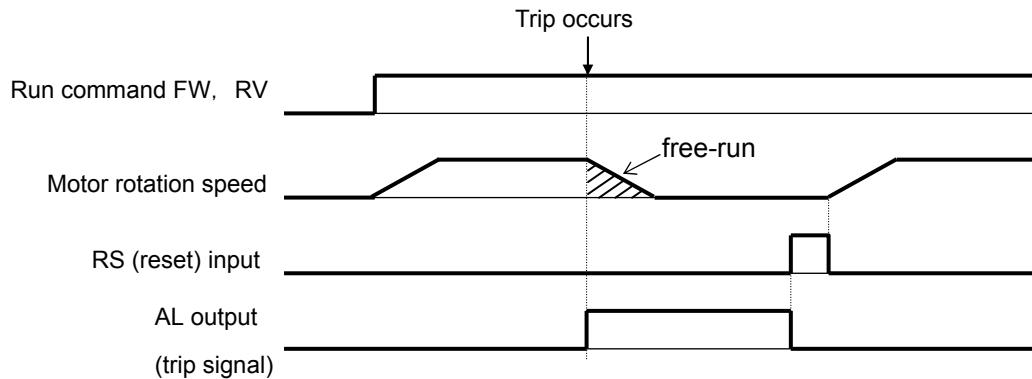


Refer to Chapter 9 for more information on error



Chapter 6 Operation

Overview of the operation at the time of trip



Chapter 7 Explanation of Functions

This chapter describes the functions of the inverter.

To change a parameter setting or monitoring the parameters, you must have operator(NES1-OP,OPE-SRmini,OPE-S/SR/SBK,WOP). Parameter settings can be changed using the ProDriveNext.

| | | |
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| 7.3 | Setting the intelligent I/O terminal function | 7-12 |
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Chapter 7 Explanation of Functions

7.1 Monitoring the data

7.1.1 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) and Data change mode selection (b163=01), you can change the output frequency setting by using the Δ 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.
- When use UP/DWN function, please do not use it.

7.1.2 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.

(Display)

0.0 to 655.3 in steps of 0.1 A

7.1.3 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

7.1.4 Process variable (PV), PID feedback monitoring

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 1000

Chapter 7 Explanation of Functions

7.1.5 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.

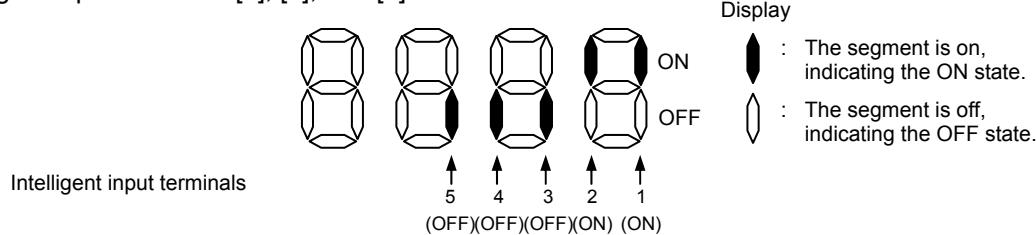
The internal CPU of the inverter checks each intelligent input for significance, and the inverter displays active inputs as those in the ON state. (*1)

Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

Intelligent input terminals [2], and [1]: ON

Intelligent input terminals [5], [4], and [3]: OFF



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

7.1.6 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.

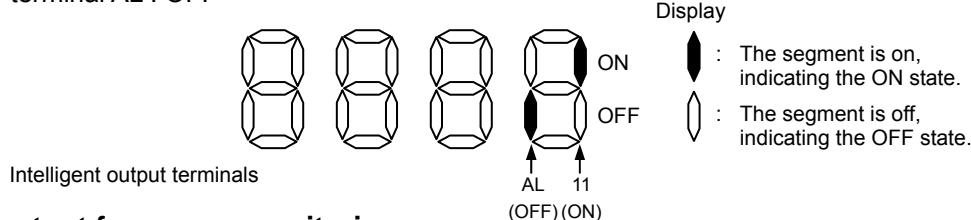
This function does not monitor the states of the control circuit terminals but monitors those of the outputs from the internal CPU.

Intelligent input terminal status is independent of the a/b contact selection for the intelligent input terminals.

(Example)

Intelligent output terminals [11]: ON

Alarm relay terminal AL : OFF



7.1.7 Scaled output frequency monitoring

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 0.01 to 99.99 in steps of 0.01.

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

Speed N (min^{-1}) = $(120 \times f [\text{Hz}])/\text{pole} = f (\text{Hz}) \times 30$

As the result of the above calculation with the factor (b086) set to 30.00, 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 and Data change mode selection (b163=01), you can change the output frequency setting by using the Δ 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.
- When use UP/DWN function, please do not use it.

Chapter 7 Explanation of Functions

7.1.8 Output voltage monitoring

When the output voltage monitoring function (d013) is selected, the inverter displays the voltage output from the inverter.

(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.

7.1.9 Input power monitoring

When the power monitoring function (d014) is selected, the inverter displays the electric power (momentary value) input to the inverter.

(Display)

0.0 to 999.9 in steps of 0.1 kW

7.1.10 Cumulative power monitoring

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"

7.1.11 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

7.1.12 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

7.1.13 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)

-20.0 to 150.0 in steps of 0.1 °C

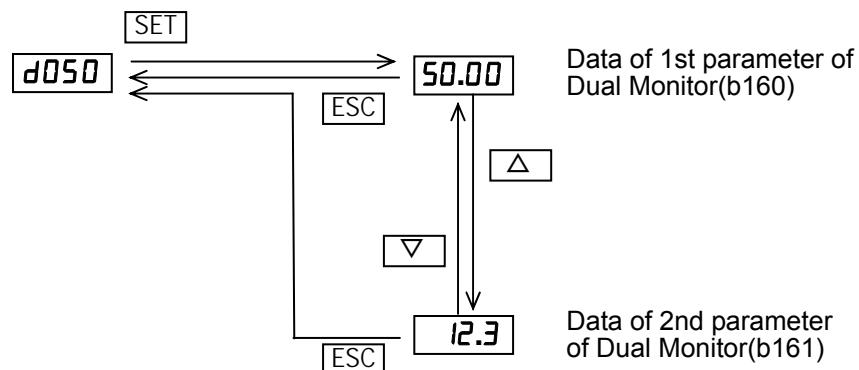
Chapter 7 Explanation of Functions

7.1.14 Dual monitoring

Displays two different data configured in **b160** and **b161**.

| Item | Func. code | Range of data | Description |
|-------------------------------|------------|---------------|---|
| Dual monitor | d050 | — | Setting data of b160 and b161 . |
| 1st parameter of Dual Monitor | b160 | 001~018 | d001~d018 (*1) |
| 2nd parameter of Dual Monitor | b161 | 001~018 | d001~d018 (*1) |

(*1) Excluding a Trip monitor 1 to 6(d081 to d086).



Note) If it enable the Frequency set in monitoring(**b163=01**), (**d001**) and (**d007**) can change the output frequency as per $\Delta\triangledown$ key in driving. But (**d050**) can not chang (**d001**) and (**d007**).

7.1.15 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

7.1.16 Trip monitoring 1 to 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)

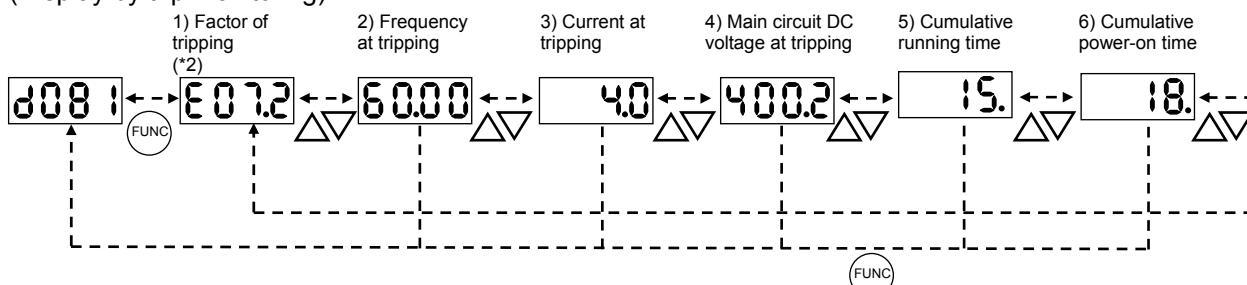
- 1) Factor of tripping (one of E01 to E41) (*1)
- 2) Output frequency at tripping (Hz)
- 3) Output current at tripping (A) (*2)
- 4) Main circuit DC voltage at tripping (V) (*3)
- 5) Cumulative inverter-running time until tripping (h)
- 6) Cumulative inverter power-on time until tripping (h)

*1 See Chapter 9.

*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 **-----**.

Chapter 7 Explanation of Functions

7.1.17 Warning monitoring

If an attempt is made to set the data conflicting with other data on the inverter, the inverter displays a warning in the operator.

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 Chapter 9.3 Warning Codes

7.1.18 DC voltage monitoring

When the DC voltage monitoring is selected, the inverter displays the DC voltage 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

7.1.19 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%

IMPORTANT! Please be sure to set the motor nameplate data into appropriate parameters to ensure proper operation and protection of the motor.

*B012 is the motor overload protection value

*A082 is the motor voltage selection

*H003 is the motor kW capacity

*H004 is the number of motor poles

Please refer to the appropriate pages in this guide and the QRG for further details.

Chapter 7 Explanation of Functions

7.2 Using the basic functions

7.2.1 Frequency source setting and Output frequency setting

(1) Frequency source setting

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

| Item | Function code | Data | Description |
|--------------------------|---------------|------|--|
| Frequency source setting | A001 A201 | 00 | (Valid only when the NES1-OP, OPE-SR/SRmini 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 (O/OI-L). |
| | | 02 | Use the digital operator (function "F001") or remote operator to set the frequency. |
| | | 03 | Input the frequency-setting command via a Modbus communication. |
| | | 10 | Use the operation result of the set frequency operation function as the frequency-setting command. |

(2) Output frequency setting

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).

(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, or use function "F001" for the setting after turning on the SET signal. For the setting using the SET signal, assign the SET function (08) 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 motors (Hz) | The frequency set with F001 is equal to the setting of A020. |
| Multispeed 0 | A020/A220 | | The second control frequency set with F001 is equal to the setting of A220. |

Chapter 7 Explanation of Functions

7.2.2 Run command source setting

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 [1].)

To switch each intelligent input terminal between a and b contacts, specify each terminal with function "C011" to "C015", 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 A202 | 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 Modbus communication. |
| Terminal active state | C011 to C015 | 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 (WOP) 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: RUN/STOP/RESET key of standard panel is valid regardless of the A002. However, when setting 3Wire functions is disabled.

7.2.3 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 |

7.2.4 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. |

Chapter 7 Explanation of Functions

7.2.5 Stop mode selection

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.

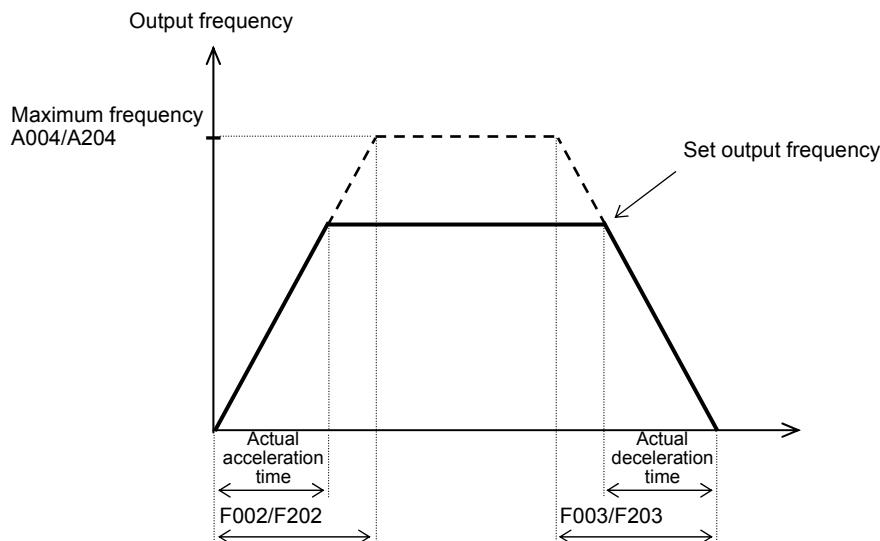
If a start command is input while the motor is in free-running status, the inverter will restart the motor according to the setting of the restart mode after FRS (b088).

| Item | Function code | Data | Description |
|---------------------|---------------|------|---|
| Stop mode selection | b091 | 00 | Normal stopping (stopping after deceleration) |
| | | 01 | Free-running until stopping |

7.2.6 Acceleration/deceleration time setting

- 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).
- To switch the acceleration and deceleration time among the 1st and 2nd settings, assign function "08" (SET) to intelligent input terminals . Use the SET signal for switching.

| Item | Function code | Range of data | Description |
|-------------------------------|---------------|------------------|--|
| Acceleration (1) time setting | F002/F202 | 0.00 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 | 0.00 to 3600.(s) | Set the length of time to decelerate the motor from the maximum frequency to 0 Hz. |



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 (t_s)

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

J_L : Inertia effect (J) of the load converted to that of the motor shaft ($\text{kg}\cdot\text{m}^2$)

J_M : Inertia effect (J) of the motor ($\text{kg}\cdot\text{m}^2$)

N_M : Motor speed (rpm)

T_s : Maximum acceleration torque driven by the inverter (N-m)

T_L : Required running torque (N-m)

Deceleration time (t_B)

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

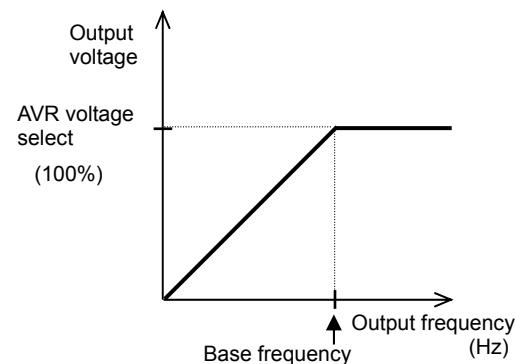
T_B : Maximum deceleration torque driven by the inverter (N-m)

Chapter 7 Explanation of Functions

7.2.7 Base frequency setting

(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 and 2nd settings, assign function "08" (SET) to intelligent input terminals. Use the SET signal for switching.



| Item | Function code | Range of data | Description |
|------------------------|---------------|---|---|
| Base frequency setting | A003/A203 | 30. to maximum frequency, 1st/2nd motors (Hz) | |
| AVR voltage select | A082/A282 | 200/215/220/230/240 | Selectable on 200 V class inverter models |
| | | 380/400/415/440/460/480 | Selectable on 400 V class inverter models |

7.2.8 Using the AVR Functions

(1) What's the 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 motor voltage select(A082/A282). But it can not exceed the receiving voltage.

Use the AVR function select (A081/A281) to enable or disable the AVR function.

(2) AVR filter time constant and AVR deceleration gain

Motor acts as a generator during deceleration. Therefore, energy is regenerated to the inverter. As a result, the DC voltage of the inverter is increased. If DC voltage exceeds overvoltage level, the inverter is generated the overvoltage trip.

The higher the output voltage of the inverter, energy is consumed by the increasing loss of the motor.

Therefore, it is possible to shorten the deceleration time. (However, the burden of the motor is increased.)

In order to shorten the deceleration time without tripping the overvoltage,

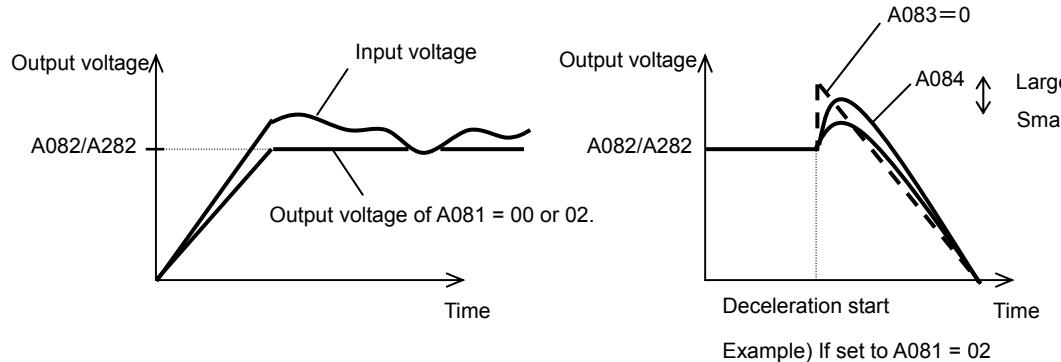
1. Set A081 = 02.
2. Please tune voltage characteristics using the A084 and A083.

Chapter 7 Explanation of Functions

| Item | Function code | Data | Description |
|--------------------------|---------------|------------------------|--|
| AVR function select | A081/A281 | 00 | The AVR function is always enabled. |
| | | 01 | The AVR function is always disabled. |
| | | 02 | The AVR function is disabled at deceleration. (*1) |
| AVR voltage select | A082/A282 | 200/215/220/230/240(V) | |
| AVR filter time constant | A083 | 0.000~1.000 (s) | See diagram below. (*2) |
| AVR deceleration gain | A084 | 50.~200. (%) | See diagram below. (*2) |

*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.

*2 Operate regardless of the A081/A281.



Chapter 7 Explanation of Functions

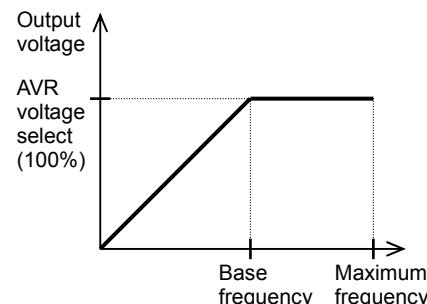
7.2.9 Maximum frequency setting

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 (for example, 10 V of the input of 0 to 10 V).

To switch the maximum frequency among the 1st and 2nd settings, assign function "08" (SET) to intelligent input terminals. Use the SET signal 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/A282).



| Item | Function code | Range of data | Description |
|---------------------------|---------------|--|--------------------------------------|
| Maximum frequency setting | A004/A204 | base frequency 1st/2nd motors to 400. (Hz) | The maximum output frequency is set. |

7.2.10 Carrier frequency setting

The carrier frequency setting function (b083) allows you to change the carrier frequency of the PWM waveform output from the inverter.

Increasing the carrier frequency can lower the metallic noise from the motor, but may increase the inverter noise and current leakage.

You can use this function effectively to avoid resonance of the mechanical system and motor.

| Item | Function code | Range of data | Description |
|---------------------------|---------------|-------------------|-------------|
| Carrier frequency setting | b083 | 2.0 to 15.0 (kHz) | |

Note: When increasing the carrier frequency (fc), derate the output current as shown in the section 12.3.

Chapter 7 Explanation of Functions

7.3 Setting the intelligent I/O terminal function

7.3.1 Intelligent input terminal setting

You can assign the functions described below to intelligent input terminals [1] to [5]. To assign the desired functions to the terminals, specify the desired data listed in the table below for terminal settings "C001" to "C005". For example, "C001" corresponds to intelligent input terminal [1].

You can select the a-contact or b-contact input for individual intelligent input terminals.

You can assign one function only to an intelligent input terminal. If you have attempted to assign a function to two or more intelligent input terminals, the function is assigned to only the terminal to which you have last attempted assignment. Function data "NO" (no assign) is assigned to other terminals, and those terminals are ineffective in terms of functions.

After assigning the desired functions to intelligent input terminals [1] to [5], confirm that the assigned functions have been stored on the inverter.

| Function code | Data | Description | Reference item | Page |
|---------------|------|---|--|------|
| C001 to C005 | 00 | FW: Forward RUN command | Operation command | — |
| | 01 | RV: Reverse RUN command | Operation command | — |
| | 02 | CF1: Multispeed 1 setting (binary operation) | Multispeed operation function (Binary) | 7-28 |
| | 03 | CF2: Multispeed 2 setting (binary operation) | | |
| | 04 | CF3: Multispeed 3 setting (binary operation) | | |
| | 06 | JG: Jogging | Jogging operation function | 7-25 |
| | 07 | DB: External DC braking | DC braking (external DC braking) function | 7-41 |
| | 08 | SET: Set 2nd motor data | 2nd motor control function | 7-40 |
| | 09 | 2CH: 2-stage acceleration/deceleration | 2-stage acceleration/deceleration function | 7-29 |
| | 11 | FRS: Free-run stop | Free-run stop function | 7-56 |
| | 12 | EXT: External trip | External trip function | 7-66 |
| | 13 | USP: Unattended start protection | Unattended start protection function | 7-57 |
| | 15 | SFT: Software lock (control circuit terminal block) | Software lock function | 7-45 |
| | 18 | RS: Reset | Reset | 7-55 |
| | 20 | STA: Starting by 3-wire input | 3-wire input function | 7-23 |
| | 21 | STP: Stopping by 3-wire input | | |
| | 22 | F/R: Forward/reverse switching by 3-wire input | | |
| | 23 | PID: PID disable | PID function | 7-34 |
| | 24 | PIDC: PID reset | Remote control (UP/DWN) function (bit) | 7-32 |
| | 27 | UP: Remote control UP function | | |
| | 28 | DWN: Remote control DOWN function | | |
| | 29 | CLR: Remote control data clearing | Forcible-operation function | 7-45 |
| | 31 | OPE: Forcible operation | | |
| | 32 | SF1: Multispeed 1 setting (bit operation) | Multispeed operation function | 7-28 |
| | 33 | SF2: Multispeed 2 setting (bit operation) | | |
| | 34 | SF3: Multispeed 3 setting (bit operation) | | |
| | 39 | OLR: Overload restriction selection | Overload restriction function | 7-63 |
| | 50 | ADD: Trigger for frequency addition (A145) | Frequency addition function | 7-32 |
| | 51 | F-TM: Forcible-terminal operation | Forcible-terminal operation function | 7-46 |
| | 53 | KHC: Cumulative power clearance | Cumulative power monitoring function | 7-3 |
| | 65 | AHD: Analog command holding | Analog command holding function | 7-17 |
| | 83 | HLD: Retain output frequency | Retain output frequency function | 7-27 |
| | 84 | ROK: Permission of Run command | Permission of Run command function | 7-27 |
| | 86 | DISP: Display limitation | Display limitation function | 7-47 |
| | no | NO: Allocation none | - | - |

7.3.2 Input terminal a/b (NO/NC) selection

The input terminal a/b (NO/NC) selection function allows you to specify a-contact or b-contact input for each of the intelligent input terminals [1] to [5].

An a-contact turns on the input signal when closed and turns it off when opened.

An b-contact turns on the input signal when opened and turns it off when closed.

The terminal to which the reset (RS) function is assigned functions only as an a-contact.

| Item | Function code | Data | Description |
|-----------------------|---------------|------|----------------|
| Terminal active state | C011 to C015 | 00 | a-contact (NO) |
| | | 01 | b-contact (NC) |

Chapter 7 Explanation of Functions

7.3.3 Input terminal response time

- The input terminal response time function allows you to specify a sampling time for each of intelligent input terminals 1 to 5. You can use this function effectively to remove noise (e.g., chattering).
- If chattering hinders constant input from an input terminal, increase the response time setting for the input terminal. Note that an increase in response time deteriorates the response. The response time can be set in a range of about 2 to 400 ms (corresponding to settings of 0 to 200).

| Item | Function code | Range of data | Description |
|---|---------------|---------------|-----------------------|
| Response time of intelligent input terminals 1 to 5 | C160-C164 | 0. to 200. | Variable in step of 1 |

Note: When the power supply is OFF-> ON or reset , this function is invalid.

7.3.4 Intelligent output terminal setting

You can assign the functions described below to the intelligent output terminals [11] (C021) and the alarm relay terminal (C026).

The intelligent output terminals [11] is used for open-collector output, and the alarm relay terminal is used for relay output.

You can select the a-contact or b-contact output for individual output terminals by using functions "C031" and "C036".

| Data | Description | Reference item | Page |
|------|---|---|------|
| 00 | RUN: Running signal | Running signal (RUN) | 7-68 |
| 01 | FA1: Constant-speed reached | Frequency-arrival signals | 7-68 |
| 02 | FA2: Set frequency overreached | | |
| 03 | OL: Overload notice advance signal | Overload restriction/overload notice advance signal | 7-63 |
| 04 | OD: Output deviation for PID control | PID function | 7-37 |
| 05 | AL: Alarm signal | Protective functions | — |
| 06 | FA3: Set frequency reached | Frequency-arrival signals | 7-68 |
| 09 | UV: Undervoltage | undervoltage | 7-53 |
| 11 | RNT: Operation time over | Operation time over signal | 7-70 |
| 12 | ONT: Plug-in time over | Plug-in time over signal | 7-70 |
| 13 | THM: Thermal alarm signal | Electronic thermal protection | 7-62 |
| 21 | ZS: 0 Hz detection signal | 0 Hz detection signal | 7-70 |
| 27 | Dc: Analog O/OI disconnection detection | Window comparators function | 7-75 |
| 31 | FBV: PID feedback comparison | PID function | 7-34 |
| 32 | NDC: Communication line disconnection | RS485 | 7-72 |
| 33 | LOG1: Logical operation result 1 | Logical operation function | 7-71 |
| 41 | FR: Starting contact signal | Starting contact signal | 7-72 |
| 42 | OHF: Heat sink overheat warning | Heat sink overheat warning | 7-72 |
| 43 | LOC: Low-current indication signal | Low-current indication signal | 7-73 |
| 50 | IRDY: Inverter ready | Inverter ready signal | 7-73 |
| 51 | FWR: Forward rotation | Forward rotation signal | 7-73 |
| 52 | RVR: Reverse rotation | Reverse rotation signal | 7-74 |
| 53 | MJA: Major failure | Major failure signal | 7-74 |
| 54 | WC:Window Comparator for Analog Voltage Input | Window comparators function | 7-75 |
| 58 | FREF:Frequency Command Source | Frequency Command Source signal | 7-76 |
| 59 | REF:Run Command Source | Run Command Source signal | 7-76 |
| 60 | SETM:2nd Motor Selection | 2nd Motor Selection signal | 7-76 |
| no | NO: Allocation none | | - |

Chapter 7 Explanation of Functions

7.3.5 Intelligent output terminal a/b (NO/NC) selection

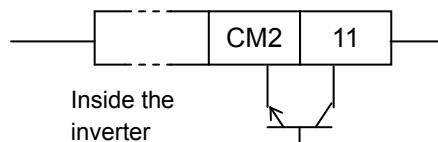
The intelligent output terminal a/b (NO/NC) selection function allows you to specify a-contact or b-contact output for each of the intelligent output terminal [11] and the alarm relay terminal.

The intelligent output terminal [11] are used for open-collector output, and the alarm relay terminal is used for relay output.

| Item | Function code | Data | Description |
|--------------------------|---------------|------|----------------|
| Terminal active state | C031 | 00 | a-contact (NO) |
| | | 01 | b-contact (NC) |
| Alarm relay active state | C036 | 00 | a-contact (NO) |
| | | 01 | b-contact (NC) |

- An a-contact turns on the output signal when closed and turns it off when opened.
- A b-contact turns on the output signal when opened and turns it off when closed.

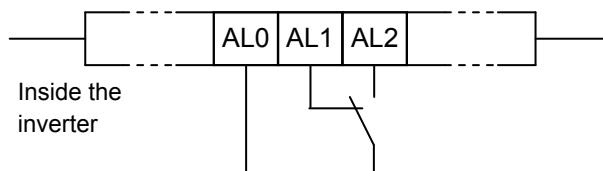
(1) Specifications of intelligent output terminal [11]



| Setting of C031 | Power supply | Output signal |
|-------------------|--------------|---------------|
| 00 (a-contact) | ON | OFF ON |
| | OFF | — |
| 01 (b-contact) | ON | ON OFF |
| | OFF | — |

| Electric characteristics (Between terminal[11] and CM2) | |
|--|--|
| Voltage drop when turned on: 4 V or less | |
| Allowable maximum voltage: 27 VDC | |
| Allowable maximum current: 50 mA | |

(2) Specifications of alarm relay terminal



Example of operation as an alarm output terminal

| Setting of C036 | Power supply | Inverter status | Output terminal state | |
|-----------------|--------------|-----------------|-----------------------|---------|
| | | | AL1-AL0 | AL2-AL0 |
| 00 | ON | Error | Closed | Open |
| | | Normal | Open | Closed |
| | OFF | — | Open | Closed |
| 01 (default) | ON | Error | Open | Closed |
| | | Normal | Closed | Open |
| | OFF | — | Open | Closed |

| | | Resistance load | Inductive load |
|---------|--------------------------|----------------------------------|---------------------------------|
| AL1-AL0 | Maximum contact capacity | 250 VAC, 2 A 30 VDC, 3 A | 250 VAC, 0.2 A 30 VDC, 0.6 A |
| | Minimum contact capacity | 100 V AC, 10 mA 5 VDC, 100 mA | |
| AL2-AL0 | Maximum contact capacity | 250 VAC, 1A 30 VDC, 1A | 250 VAC, 0.2 A 30 VDC, 0.2 A |
| | Minimum contact capacity | 100 VAC, 10 mA 5 VDC, 100 mA | |

Chapter 7 Explanation of Functions**7.3.6 Output signal delay/hold function**

The output signal delay/hold function allows you to set on-delay and off-delay times for each output terminal.

Since every output signal is turned on or off immediately when the relevant condition is satisfied, signal chattering may occur if signal outputs conflict with each other. Use this function to avoid such a problem by holding or delaying specific signal outputs.

To use this function, set on-delay and off-delay times for individual output terminals (a total of two terminals, such as intelligent output terminals [11] and the alarm relay terminal).

| Item | Function code | Range of data | Description |
|--------------------------|---------------|------------------|-----------------------------------|
| Output 11 on-delay time | C130 | 0.0 to 100.0 (s) | Setting of on for terminal [11] |
| Output 11 off-delay time | C131 | 0.0 to 100.0 (s) | Setting of off for terminal [11] |
| Output RY on-delay time | C140 | 0.0 to 100.0 (s) | Setting of on for relay terminal |
| Output RY off-delay time | C141 | 0.0 to 100.0 (s) | Setting of off for relay terminal |

Chapter 7 Explanation of Functions

7.4 Using the analog terminal

7.4.1 Analog input (O/OI)

This inverter has an external analog input terminal.

If you want to switch the voltage and current inputs, use the switch on the board(SW6).

Voltage input : 0 to 10V (Variable resistor is a voltage input.)

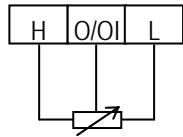
Current input : 0 to 20mA (Please set the case of "4 to 20mA" to "A013=20%")

The analog input signal can be assigned the following functions.

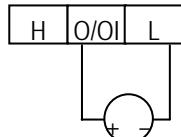
| Item | Function code | Data | Description |
|-------------------|---------------|--|-----------------|
| Frequency command | A001 | 01 | 01 : O/OI input |
| PID enable | A071 | 01(PID Enable) 02(PID Enable with reverse output) | |
| PV source | A076 | 01(O/OI) | |

Example of wiring

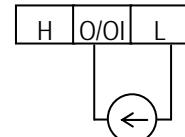
Variable resistor
(1kΩ to 2kΩ)



Voltage input
(0 to 10V)



Current input
(0/4 to 20mA)



Please refer to section 3.2 about SW6 setting.

7.4.2 External analog input (O/OI) filter setting

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).

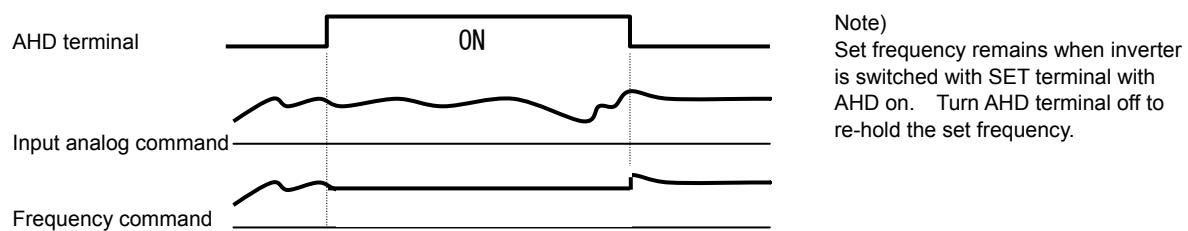
| Item | Function code | Range of data | Description |
|---------------------------------------|---------------|------------------|--|
| External frequency filter time const. | A016 | 1. to 30. or 31. | Setting of 1. to 30.: "Set value x 2" ms filter Setting of 31.: 500 ms filter (fixed) with hysteresis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

Chapter 7 Explanation of Functions

7.4.3 Analog command holding function (AHD)

- The analog command holding function allows you to make the inverter hold the analog command input via the external analog input terminal when the AHD terminal is on.
- While the AHD terminal is on, the up/down function can be used based on the analog signal held by this function as reference data.
- When "01" is specified for Up/Down memory mode selection (C101), the result of up/down processing can be stored in memory.
- If the inverter power is turned on or the RS terminal turned off with the AHD terminal left turned on, the data held immediately before power-on or turning off the RS terminal will be used.

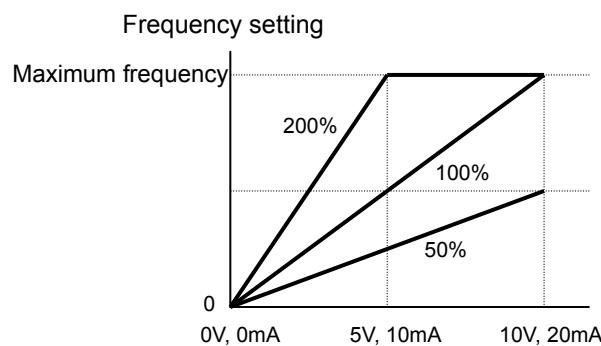
| Item | Function code | Data | Description |
|-------------------------------|---------------|------|-----------------------------|
| Terminal [1] to [5] functions | C001 to C005 | 65 | AHD: Analog command holding |



7.4.4 Analog Input Adjustment

This function can change the gain of the analog input. Please use the fine adjustment of the analog input signal. Please refer to "7.4.5" for the scale transformation.

| Item | Function code | Range of data | Description |
|-----------------------------|---------------|----------------|--|
| O/OI input span calibration | C081 | 0. to 200.0(%) | This function will fine-tune the gain for the input voltage. |



Chapter 7 Explanation of Functions

7.4.5 Start/end frequency setting for external analog input

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/OI-L terminal: 0 to 10 V or 0 to 20mA
- VR : volume of NES1-OP, OPE-SR/SRmini

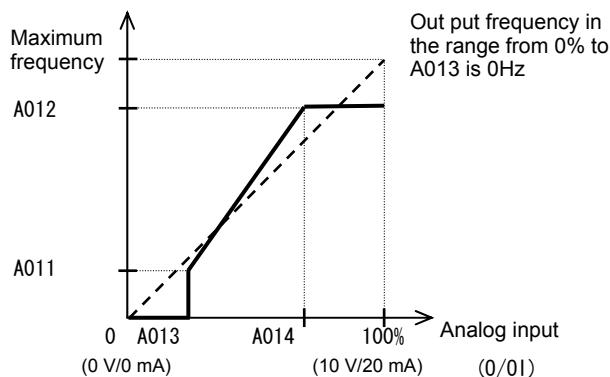
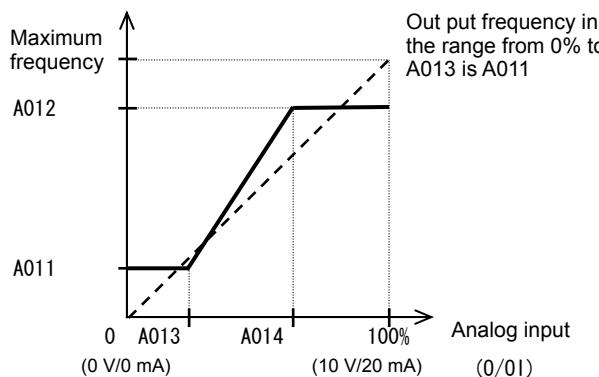
(1) Start/end frequency settings for the O/OI-L terminals

| Item | Function code | Range of data | Description |
|---|---------------|-------------------|--|
| [O/OI]-[L] input /VR active range start frequency | A011/A161 | 0.00 to 400.0(Hz) | Setting of the start frequency |
| [O/OI]-[L] input /VR active range end frequency | A012/A162 | 0.00 to 400.0(Hz) | Setting of the end frequency |
| [O/OI]-[L] input /VR active range start voltage | A013/A163 | 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 /VR active range end voltage | A014/A164 | 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/A165 | 00 01 | Externally input start frequency The frequency set as "A011/A161" is output as the output frequency while the start-frequency rate is 0% to the value set as "A013/A163". 0 Hz 0 Hz is output as the output frequency while the start-frequency rate is 0% to the value set as "A013/A163". |

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: 00

(Example 2) A015: 01



Chapter 7 Explanation of Functions

7.4.6 FM terminal

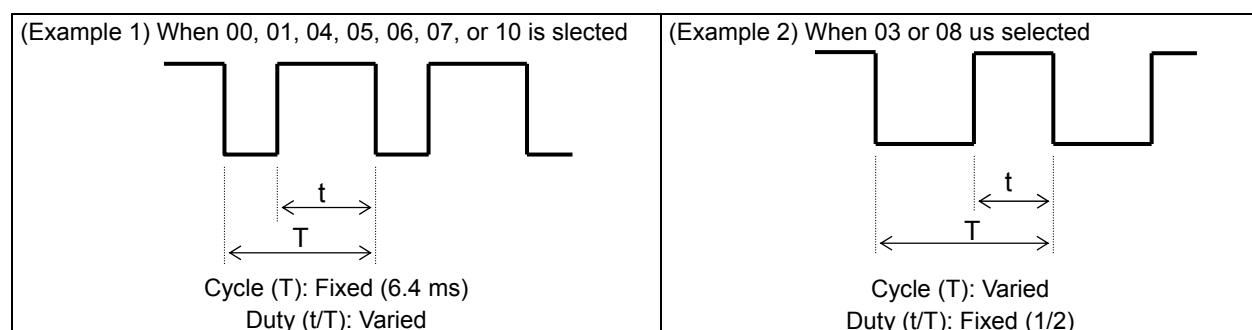
You can monitor the inverter output frequency and output current via the FM terminal on the control circuit terminal block. The FM terminal is a pulse output terminal.

(1) FM signal selection

Select the signal to be output from the FM terminal among those shown below.

If you select "03" (digital output frequency) or "08"(Digital current monitoring), connect a digital frequency counter to the FM terminal. To monitor other output signals, use an analog meter.

| Item | Data | Description | Full-scale value |
|------|------|--|---|
| C027 | 00 | Output frequency (See example 1.) | 0 to maximum frequency (Hz) |
| | 01 | Output current (See example 1.) | 0 to 200% |
| | 03 | Digital output frequency (See example 2.) *1) | 0 to maximum frequency (Hz) |
| | 04 | Output voltage (See example 1.) | 0 to 133% (75% of full scale is equivalent to 100%) |
| | 05 | Input power (See example 1.) | 0 to 200% |
| | 06 | Electronic thermal overload (See example 1.) | 0 to 100% |
| | 07 | LAD frequency (See example 1.) | 0 to maximum frequency (Hz) |
| | 08 | Digital current monitoring (See example 2.) | Refer to (3) |
| | 10 | Heat sink temperature (See example 1.) | 0°C to 200°C (0°C is output when the motor temperature is 0°C or less.) |



*1) In case of C027=03, when b086 (frequency scaling conversion factor) is set, the value converted by gain is displayed.

(2) FM terminal analog meter adjustment

Adjust the inverter output gain for the external meter connected to the FM terminal.

| Item | Function code | Range of data | Description |
|--|---------------|-----------------|---------------------------------------|
| [FM] terminal analog meter adjustment for "C027 = 00,01,04,05,06,07,10" | C105 | 50. to 200. (%) | Setting of the gain for FM monitoring |

(3) Digital current monitoring

If the output current matches the digital current monitor reference value (C030), the FM terminal will output a signal indicating 1,440 Hz.

| Item | Function code | Range of data | Description |
|---|---------------|--|--|
| Digital current monitor reference value | C030 | "0.2 x rated current" to "2.0 x rated current" (A) | Setting of the current for 1,440 Hz output |

Chapter 7 Explanation of Functions

7.5 To drive the motor

7.5.1 V/f characteristic curve selection

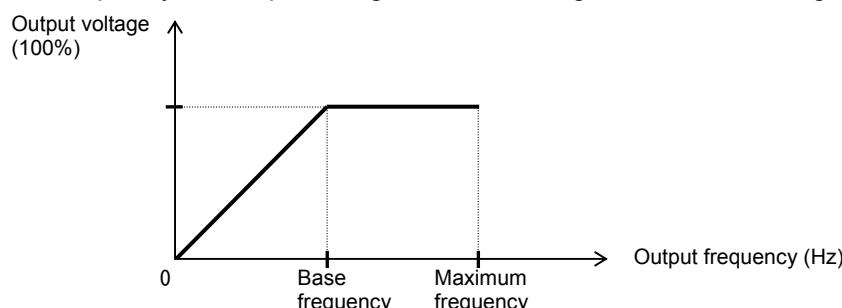
The V/F characteristic curve selection function allows you to set the output voltage/output frequency (V/f) characteristic.

To switch the V/F characteristic curve selection among the 1st and 2nd settings, assign function "08" (SET) to intelligent input terminals. Use the SET signal for switching.

| Function code | Data | V/f characteristic | Remarks |
|---------------|------|---|---------|
| A044/A244 | 00 | Constant torque characteristic (VC) | |
| | 01 | Reduced-torque characteristic (1.7th power of VP) | |
| | 02 | Free V/f characteristic | |

(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.

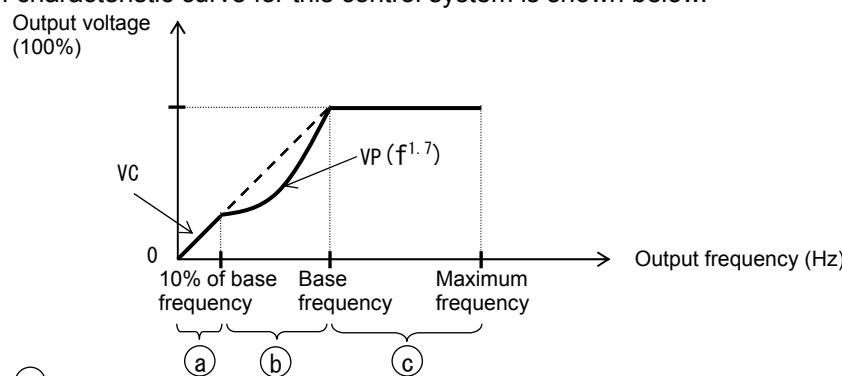


(2) Reduced-torque characteristic (1.7th power of VP)

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 (a) : 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 6 Hz.
- Period (b) : 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 (c) : While the output frequency increases from the base frequency to the maximum frequency, the output voltage is constant.

Chapter 7 Explanation of Functions

(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.

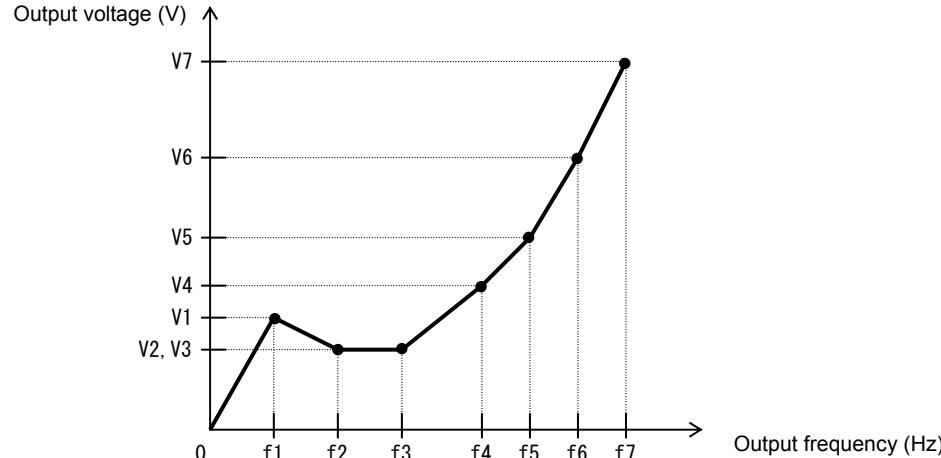
The free V/f frequencies (1 to 7) set by this function must always be in the collating sequence of "1 ≤ 2 ≤ 3 ≤ 4 ≤ 5 ≤ 6 ≤ 7".

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), and maximum frequency setting (A004/A204). (The inverter assumes the value of free-setting V/f frequency (7) as the maximum frequency.)

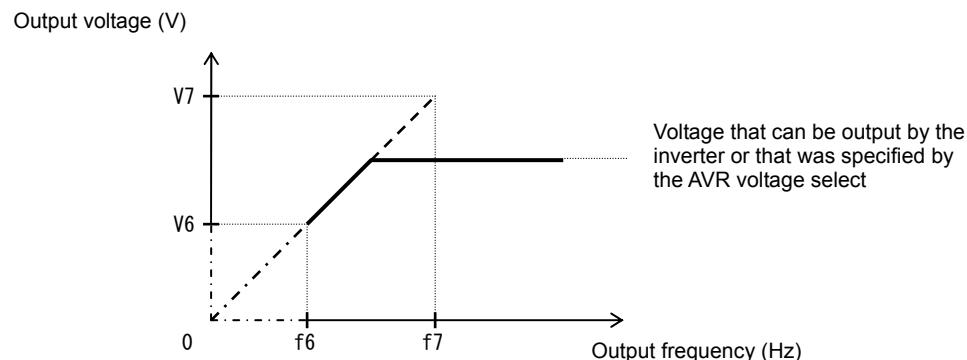
| Item | Function code | Data | Description |
|--------------------------------|---------------|---|---|
| Free-setting V/f frequency (7) | b112 | 0. to 400.(Hz) | Setting of the output frequency at each breakpoint of the V/f characteristic curve |
| Free-setting V/f frequency (6) | b110 | 0. to free-setting 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 300.0(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 300 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.



Chapter 7 Explanation of Functions

7.5.2 Torque boost setting

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 | 0.0 to 20.0(%) | Setting of the rate of the boost to the AVR voltage (A082/A282) |
| Manual torque boost frequency adjustment | A043/A243 | 0.0 to 50.0(%) | Setting of the rate of the frequency at breakpoint to the base frequency (A003/A203) |
| Motor capacity | H003/H203 | 0.1 to 5.5(kW) | Selection of the motor capacity |
| Motor poles setting | H004/H204 | 2, 4, 6, 8 (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) Manual torque boost

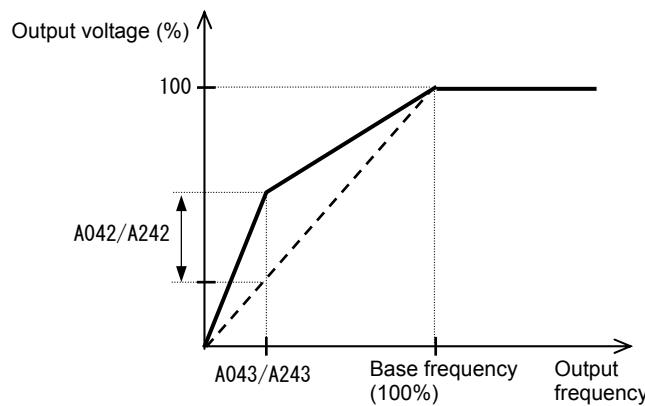
The inverter outputs the voltage according to the settings of the manual torque boost (A042/A242) and manual torque boost frequency adjustment (A043/A243).

Use the manual torque boost value (A042/A242) to specify the rate of the boost to the voltage (100%) set by the AVR voltage select.

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) to specify the rate of the frequency at each breakpoint to the base frequency (100%).

To switch the settings among the 1st and 2nd settings ("A041 to A043" and "A241 to A243"), assign function "08" (SET) to intelligent input terminals. Use the SET signal for switching.



Chapter 7 Explanation of Functions

(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 |

7.5.3 3-wire interface operation function (STA, STP, and F/R)

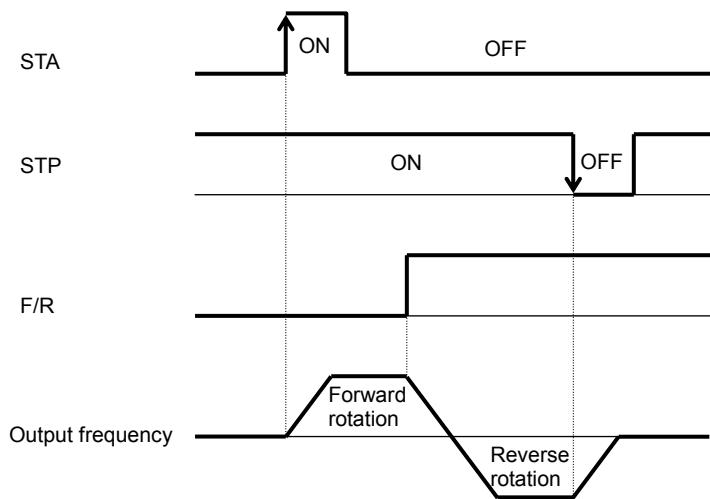
The 3-wire interface operation function allows you to use automatic- reset contacts (e.g., pushbutton switches) to start and stop the inverter.

Specify "01" (control circuit terminal block) for the run command source setting (A002).

Assign function "20" (STA), "21" (STP), and "22" (F/R) to three of the terminal [1] to [5] functions (C001 to C005) to enable the control operations described below. Assigning the STP function to an intelligent input terminal disables the functions of the FW and RV terminals.

While the (STP) is OFF , the (STA) is invalid.

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|--|
| Terminal [1] to [5] functions | C001 to C005 | 20 | STA: Starting the motor |
| | | 21 | STP: Stopping the motor |
| | | 22 | F/R: Switching the motor operation direction |



Note : In 3 wire input , STP input is used at the b point of contact. But the setting of STP is the a point of contact..

Chapter 7 Explanation of Functions

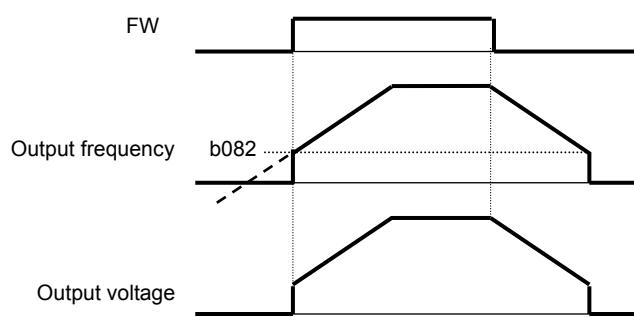
7.5.4 Start frequency setting

The start frequency setting function allows you to specify the inverter output frequency that the inverter initially outputs when an operation command is input.

Use this function mainly to adjust the start torque.

If the start frequency (b082) is set too high, the inverter will start the motor with a full voltage, which will increase the start current. Such status may trigger the overload restriction operation or make the inverter prone to easily tripping because of the overcurrent protection.

| Item | Function code | Range of data | Description |
|----------------------------|---------------|-------------------|--------------------------------|
| Start frequency adjustment | b082 | 0.01 to 9.99 (Hz) | Setting of the start frequency |

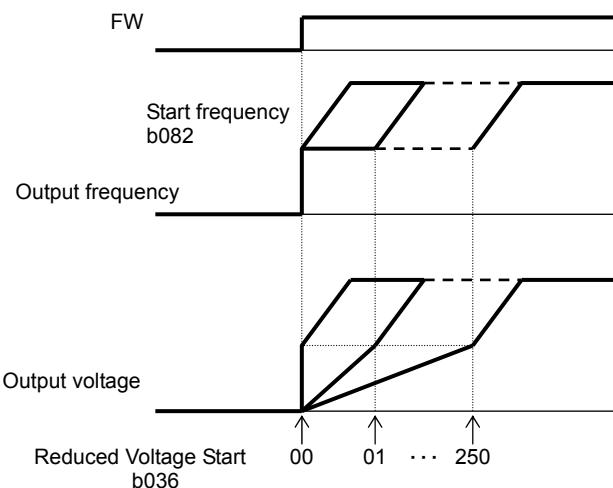


7.5.5 Reduced voltage start function

The reduced voltage start function enables you to make the inverter increase the output voltage gradually when starting the motor.

Set a small value for the reduced voltage start selection (b036) if you intend to increase the start torque. On the other hand, setting a small value will cause the inverter to perform full-voltage starting and to easily trip because of overcurrent.

| Item | Function code | Range of data | Description |
|---------------------------------|---------------|---------------|--|
| Reduced voltage start selection | b036 | 00 | Disabling the reduced voltage starting |
| | | 01 to 250 | 01: Short (about 4 ms) 250: Long (about 1000ms) |

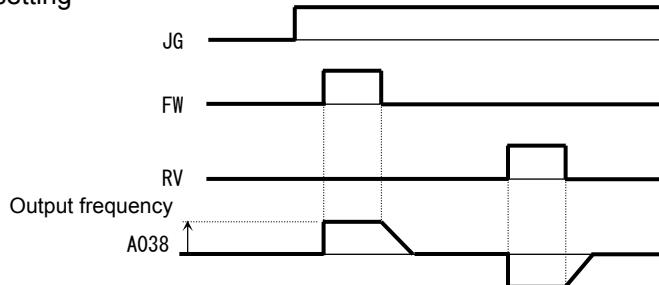


Chapter 7 Explanation of Functions

7.5.6 Jogging (JG) command setting

The jogging command setting function allows you to set and finely tune the motor-stopping position. To use this function, assign function "06" (JG) to an intelligent input terminal.

(1) Jog frequency setting



Since the inverter operates the motor with a full voltage for the jogging operation, the inverter can easily trip during the latter. Adjust the jog frequency setting (A038) properly so that the inverter will not trip.

| Item | Function code | Range of data | Description |
|-----------------------|---------------|--------------------------------|---|
| Jog frequency setting | A038 | "start frequency" to 9.99 (Hz) | Setting of the frequency to output during jogging operation |

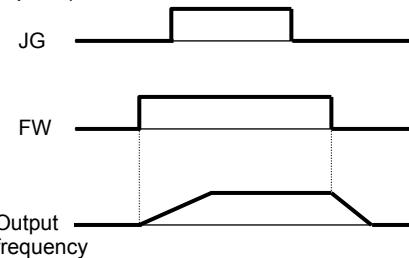
(2) Jog stop mode

| Item | Function code | Data | Description |
|---------------|---------------|------------------|---|
| Jog stop mode | A039 | 00 | Disabling jogging while the motor is operating and enabling free-running when the motor is stopped |
| | | 01 | Disabling jogging while the motor is operating and enabling stopping after deceleration when the motor is stopped |
| | | 02 (See Note 2.) | Disabling jogging while the motor is operating and enabling DC braking when the motor is stopped |
| | | 03 | Enabling jogging while the motor is operating and enabling free-running when the motor is stopped |
| | | 04 | Enabling jogging while the motor is operating and enabling stopping after deceleration when the motor is stopped |
| | | 05 (See Note 2.) | Enabling jogging while the motor is operating and enabling DC braking when the motor is stopped |

Note 1: To perform the jogging operation, always turn on the JG terminal before turning on the FW or RV terminals. (Follow this sequence of command inputs also when using the digital operator to enter operation commands.)

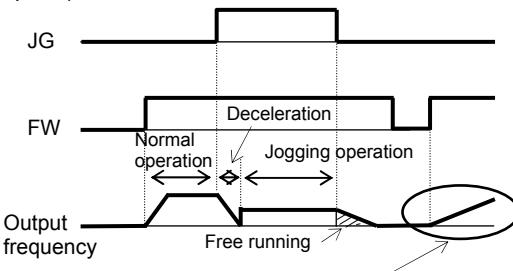
Note 2: You must set DC braking data if you specify "02" or "05" for the jog stop mode (A039).

(Example 1)



When "00", "01", or "02" is specified for the jog stop mode (A039), the jogging operation will not be performed if the FW signal is turned on earlier than the JG signal.

(Example 2)



When "03", "04", or "05" is specified for the jog stop mode (A039), the jogging operation will be performed, even if the FW signal is turned on earlier than the JG signal. However, the motor will stop after free-running if the JG signal is turned off earlier than the FW signal.

Chapter 7 Explanation of Functions

7.5.7 Frequency upper limit setting

The frequency upper limit setting function allows you to place upper and lower limits on the inverter set frequency.

This function restricts the input of frequency commands that specify any frequencies outside the upper and lower limits.

When use PID function, limits the PID-output.

Always set the upper limit before setting the lower limit. Also, be sure to keep the frequency upper limit (A061/A261) larger than the frequency lower limit (A062/A262).

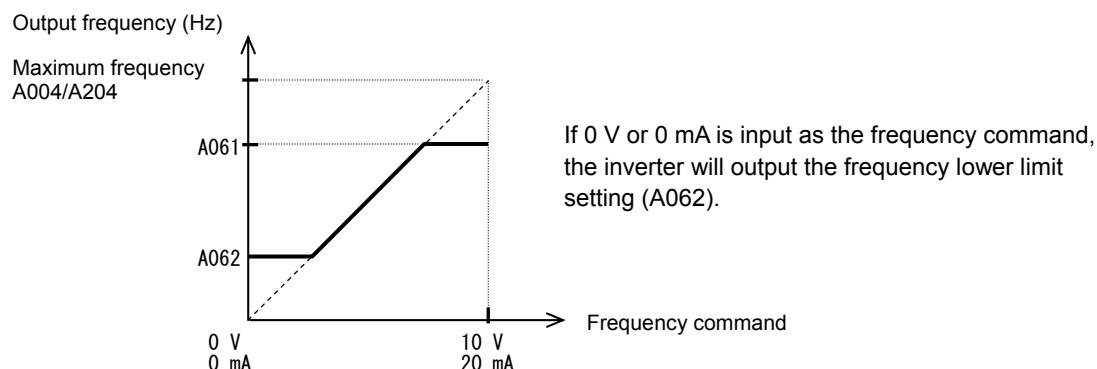
Be sure that upper limit/lower limit does not exceed Maximum frequency (A004/A204).

Be sure to set output frequency (F001) and multiple speed 1 to 7(A021 to A027) in between uppelimit and lower limit.

If 0 Hz is set for the frequency upper and lower limits, they will not operate.

| Item | Function code | Range of data | Description |
|-------------------------------|---------------|---|---|
| Frequency upper limit setting | A061/A261 | 0.00 or a frequency more than the frequency lower limit setting up to the maximum frequency (Hz) | Setting of the upper limit of the set frequency |
| Frequency lower limit setting | A062/A262 | 0.00 or a frequency not less than the starting frequency up to the frequency upper limit setting (Hz) | Setting of the lower limit of the set frequency |

When the O/OI-L terminal is used:



7.5.8 Jump frequency function

The jump frequency function allows you to operate the inverter so that it avoids the resonant frequency of the machine driven by the same.

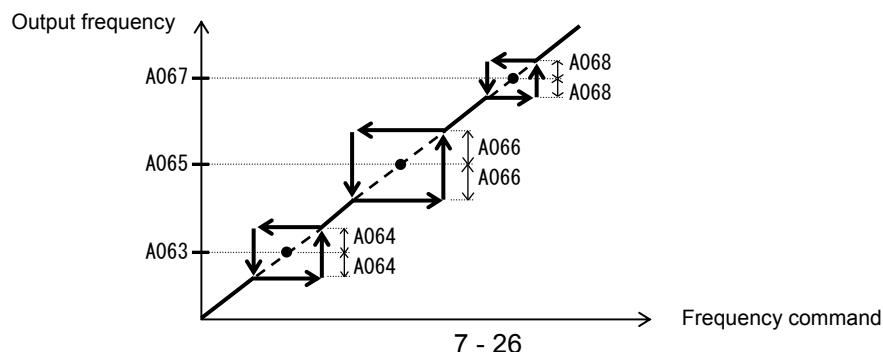
Since the inverter avoids the motor operation with a constant output frequency within the specified range of the frequencies to jump when the jump frequency function is enabled, you cannot set any inverter output frequency within the specified range of the frequencies to jump.

Note that, while the inverter is accelerating or decelerating the motor, the inverter output frequency changes continuously according to the set acceleration/deceleration time.

You can set up to three frequencies to jump.

| Item | Function code | Range of data | Description |
|--|----------------|-------------------------|---|
| Jump (center) frequency settings, 1st/2nd/3rd settings | A063/A065/A067 | 0.00 to 400.0 (Hz) (*1) | Setting of the center frequency of the frequency range to be jumped |
| Jump (hysteresis) frequency width settings, 1st/2nd/3rd settings | A064/A066/A068 | 0.00 to 10.00(Hz) | Setting of the half bandwidth of the frequency range to be jumped |

*1 Setting of 0 Hz disables the jump frequency function.



Chapter 7 Explanation of Functions

7.5.9 Acceleration/Deceleration hold frequency setting

The acceleration/deceleration hold frequency setting function allows you to make the inverter wait, upon starting the motor, until the slipping of the motor becomes less when the load on the motor causes a large moment of inertia.

Use this function if the inverter has tripped because of overcurrent when starting the motor.

This function can operate with every acceleration/deceleration pattern, regardless of the setting of the acceleration/deceleration curve selection (A097/A098).

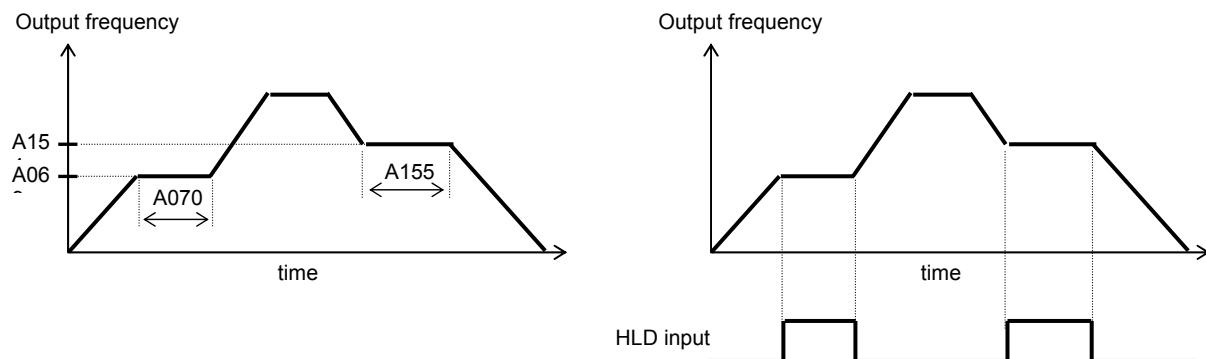
The method of this function has following two ways and can use both together.

- by the setting parameter (A069,A070,A154,A155)
- by terminal function (HLD)

| Item | Function code | Range of data | Description |
|-------------------------------------|---------------|-------------------|--|
| Acceleration hold frequency setting | A069 | 0.00 to 400.0(Hz) | Setting of the frequency at which to stop acceleration |
| Acceleration hold time setting | A070 | 0.0 to 60.0(s) | Setting of the length of time to stop acceleration |
| Deceleration hold frequency setting | A154 | 0.00 to 400.0(Hz) | Setting of the frequency at which to stop deceleration |
| Deceleration hold time setting | A155 | 0.0 to 60.0(s) | Setting of the length of time to stop deceleration |
| Terminal function | C001 to C005 | 83 | HLD : Retatin output frequency function |

1) by the setting parameter (A069,A070,A154,A155)

2) by terminal function (HLD)

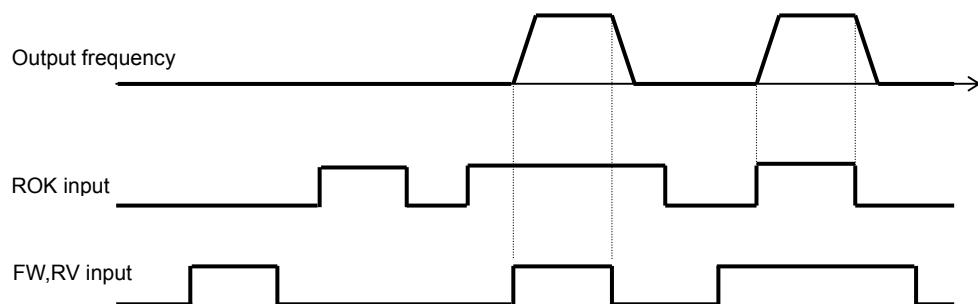


7.5.10 Permission of Run command function (ROK)

While the (ROK) input is ON, the run command is valid.

To use this function, assign function "84" (ROK) to one of the terminal [1] to [5] functions (C001 to C005).

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|---|
| Terminal [1] to [5] functions | C001 to C005 | 84 | ROK: Permission of Run command function |



Chapter 7 Explanation of Functions

7.5.11 Multispeed select setting (CF1 to CF3 and SF1 to SF3)

The multispeed select setting function allows you to set multiple motor speeds and switch among them by way of signal input via specified terminals.

Multispeed operation can be performed in two modes: binary operation mode (with up to 8 speeds) using three input terminals and bit operation mode (with up to 4 speeds) using three input terminals.

| Item | Function code | Data | Description |
|--------------------------------|---------------------------|---|---|
| Multispeed operation selection | A019 | 00 | Binary operation mode with up to 8 speeds |
| | | 01 | Bit operation mode with up to 4 speeds |
| Multispeed 0 to 7 settings | A020/A220 A021 to A027 | 0.00 or "start frequency" to "maximum frequency" (Hz) | Setting of the frequency as each speed |

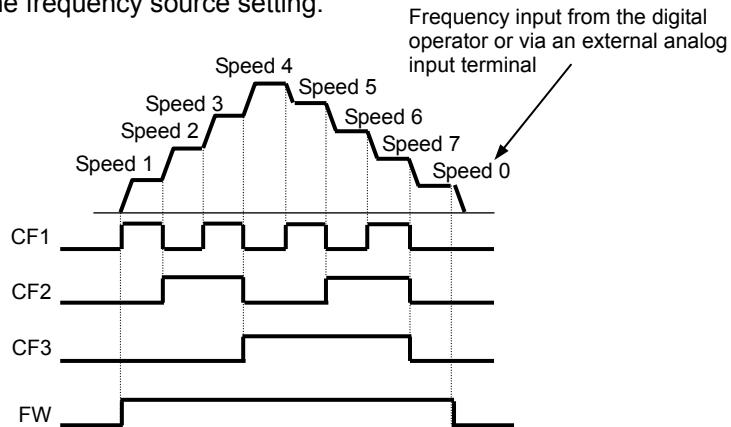
(1) Binary operation mode

Assign functions "02" (CF1) to "04" (CF3) individually to the terminal [1] to [5] functions (C001 to C005) to make multispeeds 0 to 7 available for selection.

Specify the desired frequencies for speeds 1 to 7 by setting multispeeds 1 to 7 (A021 to A027).

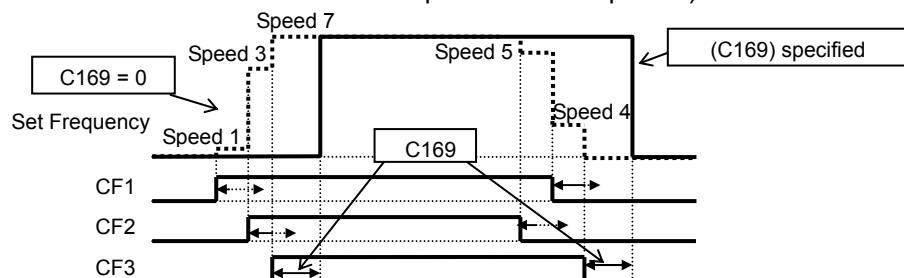
You can set speed 0 by using function "A020", "A220" or "F001" when you have specified the digital operator for the frequency source setting. You can set speed 0 by using the O/OI terminal when you have specified the control circuit board for the frequency source setting.

| Multispeed | CF3 | CF2 | CF1 |
|------------|-----|-----|-----|
| Speed 0 | OFF | OFF | OFF |
| Speed 1 | OFF | ON | ON |
| Speed 2 | ON | OFF | OFF |
| Speed 3 | OFF | ON | ON |
| Speed 4 | ON | OFF | OFF |
| Speed 5 | ON | OFF | ON |
| Speed 6 | ON | ON | OFF |
| Speed 7 | ON | ON | ON |



- With multispeed binary operation mode, you can use the multistage speed determination time setting (C169) to specify a delay to be set until the relevant terminal input is determined. (time = C169*10ms)
Use this specification to prevent the application of fluctuating terminal input before it is determined.

- The input data is finally determined when terminal input becomes stable after the delay set as C169.
(Note that a long determination time deteriorates the input terminal response.)



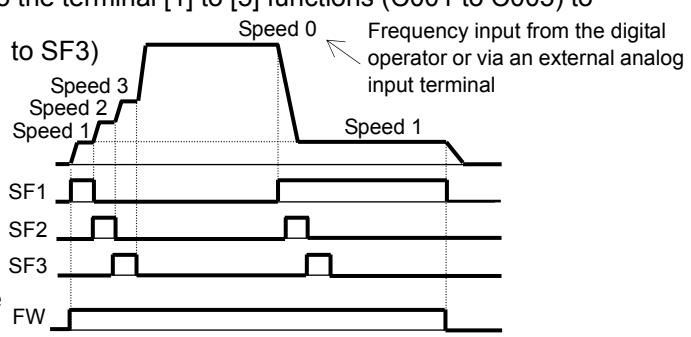
(2) Bit operation mode

- Assign functions "32" (SF1) to "34" (SF3) individually to the terminal [1] to [5] functions (C001 to C005) to make multispeeds 0 to 3 available for selection.

- Specify the desired frequencies for speeds 1 to 3 (SF1 to SF3) by setting multispeeds 1 to 3 (A021 to A023).

| Multispeed | SF3 | SF2 | SF1 |
|------------|-----|-----|-----|
| Speed 0 | OFF | OFF | OFF |
| Speed 1 | x | x | ON |
| Speed 2 | x | ON | OFF |
| Speed 3 | ON | OFF | OFF |

If two or more input terminals are turned on at the same time, the terminal given the smallest terminal number among them has priority over others. The "X" mark in the above table indicates that the speed can be selected, regardless of whether or not the corresponding terminal is turned on.



Chapter 7 Explanation of Functions

7.5.12 Two-stage acceleration/deceleration function (2CH)

The two-stage acceleration/deceleration function allows you to change the acceleration or deceleration time while the inverter is accelerating or decelerating the motor.

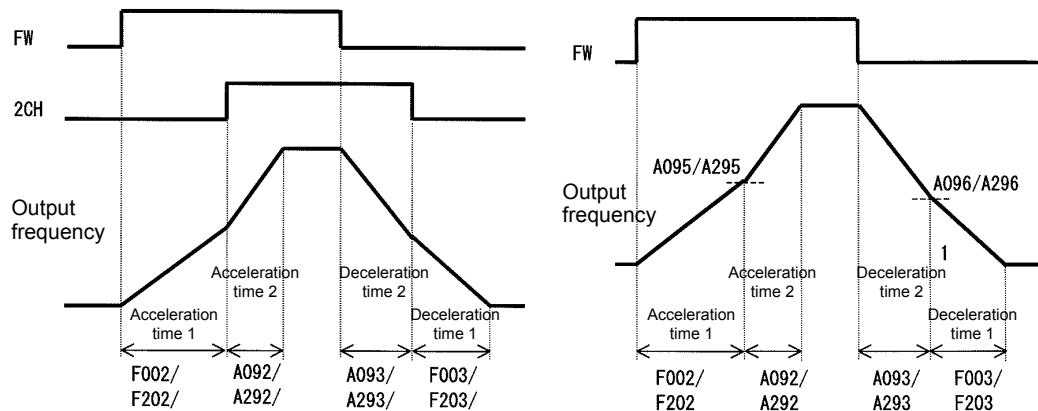
Select one of the following three methods of changing the acceleration or deceleration time:

- 1) Changing the time by the signal input to an intelligent input terminal
- 2) Automatically changing the time when the output frequency reaches a specified frequency
- 3) Automatically changing the time only when switching the motor operation from forward rotation to reverse rotation, or vice versa

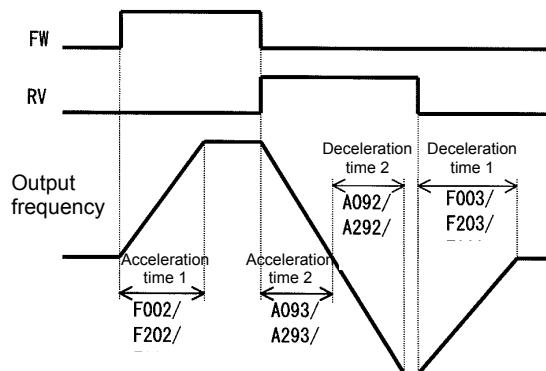
To change the acceleration/deceleration time by the signal input to an intelligent input terminal, assign function "09" (2CH) to one of the terminal functions C001 to C005.

| Item | Function code | Data | Description |
|--|---------------|--------------------|--|
| Acceleration (2) time setting | A092/A292 | 0.00 to 3600. (s) | (See examples 1 and 2.) |
| Deceleration (2) time setting | A093/A293 | 0.00 to 3600. (s) | (See examples 1 and 2.) |
| Select method to switch to Acc2/Dec2 profile | A094/A294 | 00 | Changing the time by the signal input to the 2CH terminal (See example 1.) |
| | | 01 | Changing the time at the two-stage acceleration/deceleration frequency (See example 2.) |
| | | 02 | Valid only while the inverter is switching the motor between forward and reverse operations (See example 3.) |
| Acc1 to Acc2 frequency transition point | A095/A295 | 0.00 to 400.0 (Hz) | Valid when "01" is specified for the select method to switch to Acc2/Dec2 profile (A094/A294) (See example 2.) |
| Dec2 to Dec1 frequency transition point | A096/A296 | 0.00 to 400.0 (Hz) | Valid when "01" is specified for the Select method to switch to Acc2/Dec2 profile (A094/A294) (See example 2.) |

(Example 1) When "00" is specified for "A094" or "A294" (Example 2) When "01" is specified for "A094" or "A294"



(Example 3) When "02" is specified for "A094" or "A294"



Chapter 7 Explanation of Functions

7.5.13 Acceleration/deceleration curve selection

You can set different patterns of motor acceleration and deceleration according to the type of system to be driven by the inverter.

Use functions "A097" and "A098" to select acceleration and deceleration patterns, respectively.

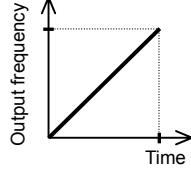
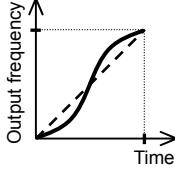
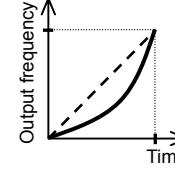
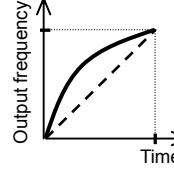
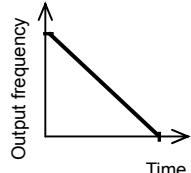
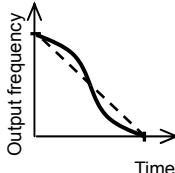
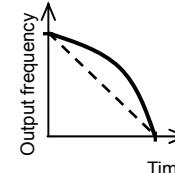
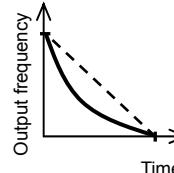
You can individually set an acceleration pattern for acceleration and a deceleration pattern for deceleration.

When the acceleration/deceleration pattern is set other than 00 (linear) using analog input as frequency source is to be avoided because it prolongs the acceleration or deceleration time.

| Item | Function code | Data or range of data | Description |
|---|---------------|-----------------------|---|
| Acceleration/deceleration curve selection | A097/A098 | 00 | Linear acceleration/deceleration |
| | | 01 | S-curve acceleration/deceleration |
| | | 02 | U-curve acceleration/deceleration |
| | | 03 | Inverted-U-curve acceleration/deceleration |
| Acceleration/deceleration curve constants setting | A131/ A132 | 01 to 10 | 01 (small degree of swelling) ◊ 10 (large degree of swelling) |

(1) Acceleration/deceleration pattern selection

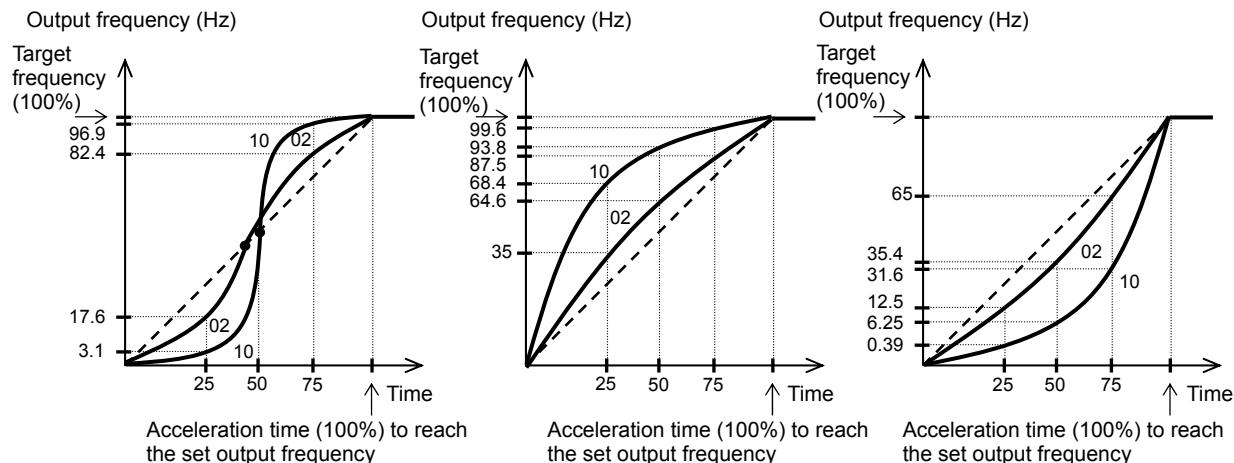
Select acceleration and deceleration patterns with reference to the following table:

| Setting | 00 | 01 | 02 | 03 |
|-----------------------------|---|--|---|--|
| Curve | Linear | S curve | U curve | Inverted-U curve |
| A097 (acceleration pattern) |  |  |  |  |
| A098 (deceleration pattern) |  |  |  |  |
| Description | With this pattern, the motor is accelerated or decelerated linearly until its speed reaches the set output frequency. | This pattern is effective for preventing the collapse of cargo carried by a lift or conveyor driven by the inverter. | This pattern is effective for the tension control on a winding machine driven by the inverter (to prevent cutting of the object to be wound). | |

Chapter 7 Explanation of Functions

(2) Curve constant (swelling degree)

Specify the swelling degree of the acceleration curve with reference to the following graphs:



The acceleration or deceleration time may be shortened midway through the acceleration or deceleration according to the curve pattern.

7.5.14 Frequency operation function

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) |
| | | 01 | Volume on the digital operator (Valid only when NES1-OP, OPE-SR/SRmini is connected) |
| | | 02 | Input via the O/OI terminal |
| | | 04 | Input via the Modbus communication |
| 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.

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7.5.15 Frequency addition function

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) | Setting of the frequency to be added |
| ADD direction select | A146 | 00 | (Frequency command) + (A145) |
| | | 01 | (Frequency command) - (A145) |
| Terminal function | C001 to C005 | 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%]).

7.5.16 Remote control function (UP and DWN)

The remote control function allows you to change the inverter output frequency by operating the UP and DWN terminals (intelligent input terminals).

To use this function, assign functions "27" (UP) and "28" (DWN) to two of the terminal [1] to [5] functions (C001 to C005).

- This function is only effective for multispeed operation when "01 (terminal)" or "02 (operator)" has been specified for the frequency source setting (A001). If "01" (control circuit terminal block) has been specified, this function is only effective when the analog command holding function (AHD) is enabled.

This function is ineffective when the external analog input has been specified for the frequency source setting (A001). This function cannot be used to set frequencies for jogging operation.

When the UP or DWN terminal is on, the 1st and 2nd acceleration/deceleration time follows the settings of "F002/F202"/"F003/F203". To switch between the 1st and 2nd controls, assign function "08" (SET) to intelligent input terminals, and turn on and off the SET terminal for switching.

You can store the frequency settings adjusted using the remote control function (UP and DWN signals).

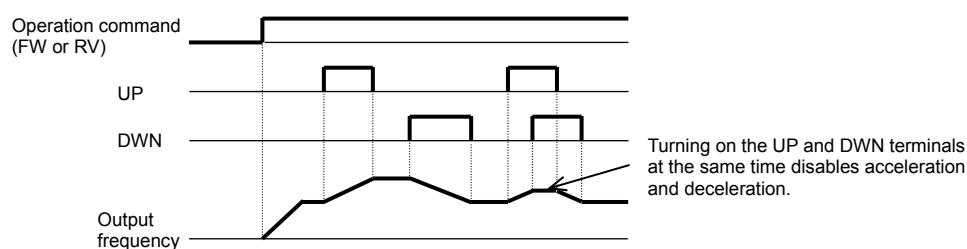
Set 01 (enable) on C101 to store the frequency settings.

In case of the C101=00, the set frequency returns to a value at the time of the power supply injection when inverter is the under voltage state.

You can also clear the stored frequency settings. Assign function "29" (UDC) to an intelligent input terminal, and turn on or off the UDC terminal to clear or store, respectively, the frequency settings adjusted with the UP and DWN signals. In this case, the value obeys setting of C104.

| Item | Function code | Data | Description |
|---|---------------|------|---|
| Terminal function | C001 to C005 | 27 | UP: Remote control UP function |
| | | 28 | DWN: Remote control DOWN function |
| | | 29 | DWN: Remote control data clearing |
| Up/Down memory mode selection | C101 | 00 | Disabling the storage of frequency settings |
| | | 01 | Enabling the storage of frequency settings (*1) |
| Up/Down clear terminal input mode selection | C104 | 00 | 0Hz |
| | | 01 | Flash data when power supply is turn on |

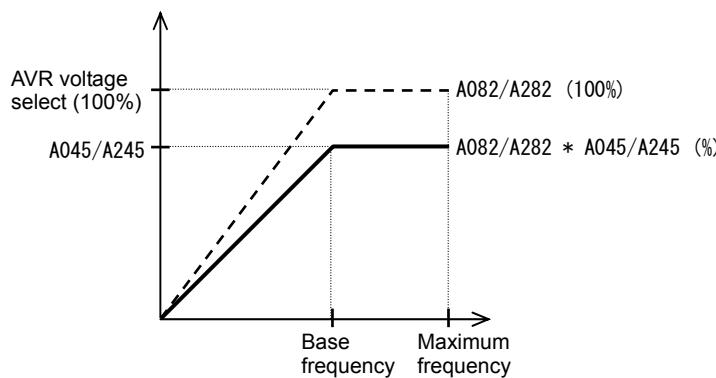
*1 Do not operate the UP or DWN terminal after the inverter power is shut off. Otherwise, the frequency settings may not be stored correctly.



Chapter 7 Explanation of Functions**7.5.17 V/f gain setting**

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 decrease the gain setting.

| Item | Function code | Range of data | Description |
|------------------|---------------|-----------------|--|
| V/f gain setting | A045/A245 | 20. to 100. (%) | Setting of the rate of reducing the output voltage |



Chapter 7 Explanation of Functions

7.5.18 PID function

The PID function allows you to use the inverter for the process control on fluid flow, airflow, and pressure. To enable this function, specify "01 enabled" or "02 inverted data output enabled" for function "A071".

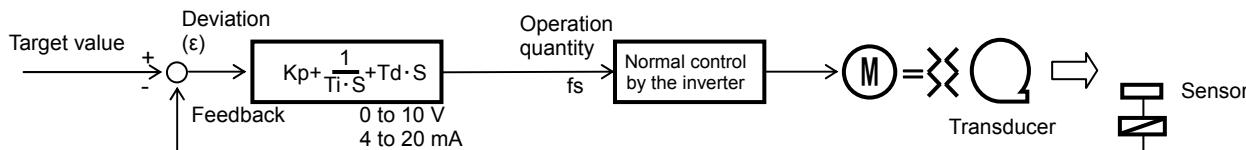
You can disable the PID function with an external signal during the PID operation. For this purpose, assign function "23" (PID terminal: disabling PID operation) to an intelligent input terminal. Turning the PID terminal on disables the PID function and makes the inverter perform the normal output.

With the PID function, you can limit the PID output according to various conditions.

maximum frequency, frequency limiter, PID variation range (A078).

| Item | Function code | Data or range of data | Description |
|---|---------------|-----------------------|--|
| PID Function Enable | A071 | 00 | Disabling the PID operation |
| | | 01 | Enabling the PID operation |
| | | 02 | Enabling inverted-data output |
| PID proportional gain | A072 | 0.2 to 25.0 | Proportional gain |
| PID integral time constant | A073 | 0.0 to 3600.(s) | Integrated gain |
| PID derivative gain | A074 | 0.00 to 100.0(s) | Derivative gain |
| PV scale conversion | A075 | 0.01 to 99.99 | Scale for unit conversion of PID feedback data |
| PV source setting | A076 | 01 | O/OI-L: [0 to 10 V]/[4-20mA] |
| | | 02 | Modbus communication |
| | | 10 | Operation result (*1) |
| Reverse PID action | A077 | 00 | Disabling the inverted output |
| | | 01 | Enabling the inverted output (deviation polarity inverted) |
| PID variation range | A078 | 0.0 to 100.0(%) | Range of PID data variation with reference to the target value |
| PID sleep function action threshold | A156 | 0.0 to 400.0(Hz) | When PID output drops below the operating level, to stop the behavior. |
| PID sleep function action delay time | A157 | 0.0 to 25.5(s) | Delay to the start of the operation of sleep |
| PID sleep function return threshold | A158 | A156 to 400.00Hz | Level of return sleep behavior |
| PID deviation level setting | C044 | 0.0 to 100.0(%) | Level to determine the OD signal output |
| Off level of feedback comparison signal | C052 | 0.0 to 100.0(%) | Level to determine the FBV signal output |
| Onlevel of feedback comparison signal | C053 | 0.0 to 100.0(%) | Level to determine the FBV signal output |

(1) Basic configuration of PID control



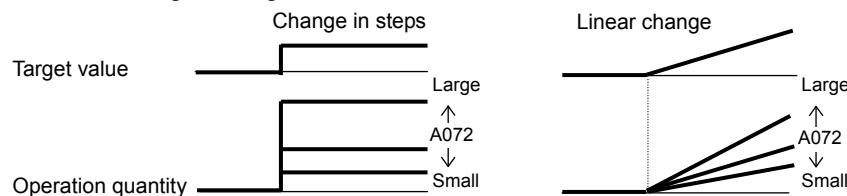
Kp: Proportional gain Ti: Integral time Td: Derivative time s: Operator ε : Deviation

Chapter 7 Explanation of Functions

(2) PID operation

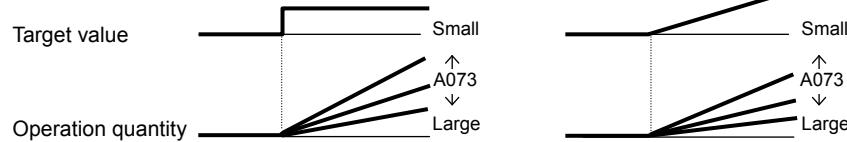
1) P operation

The proportional (P) operation stands for the operation in which the change in operation quantity is in proportion to the change in target value.



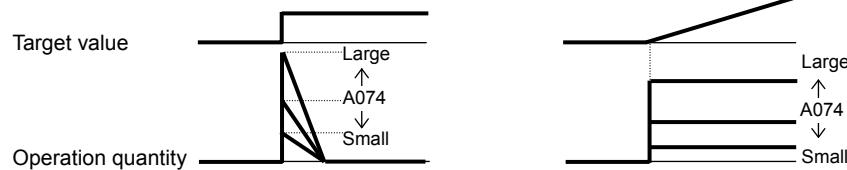
2) I operation

The integral (I) operation stands for the operation in which the operation quantity increases linearly over time.



3) D operation

The derivative (D) operation stands for the operation in which the operation quantity changes in proportion to the rate of change in the target value.



The PI operation is a combination of the P operation 1) and I operation 2). The PD operation is a combination of the P operation 1) and D operation 3). The PDI operation is a combination of the P operation 1), I operation 2), and D operation 3).

(3) PID scale

About (A075) is as the following equation.

$$(\text{The converted value}) = (\text{Value before conversion}) \times (\text{A075})$$

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| d004 | F001 | A011 | A012 | A020 | A220 | A021 | A022 |
| A023 | A024 | A025 | A026 | A027 | | | |

(4) PV source setting

Select the PV source to be used for the feedback signal with the PV source setting function (A076).

The targeted value is set by A001.

When you specify the 02 (Modbus communication) for the PV source setting (A076), transfer data as described below.

Write the setting data (on the assumption that "10000" indicates 100%) to register address 0006h.

| Register No. | Function name | Function code | Readable/writable (R/W) | Monitored data or setting | Data resolution |
|--------------|---------------|---------------|-------------------------|---------------------------|-----------------|
| 0006h | PID feedback | — | R/W | 0 to 10000 | 0.01 [%] |

Note: This register is readable and writable. However, this register can be read only when Modbus RTU has been specified as the communication mode for PID feedback. It cannot be read with other settings.

Chapter 7 Explanation of Functions

(5) Output of inverted PID deviation

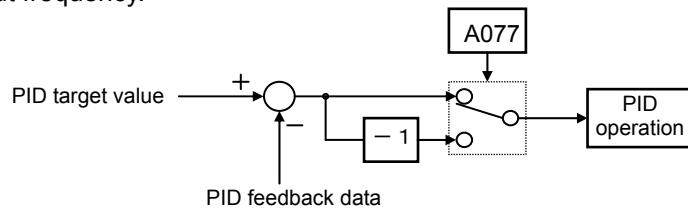
(3) Output of inverted deviation
Some sensor characteristics may cause the polarity of the deviation of feedback data from the target value to be inconsistent with the inverter operation command. If the inconsistency occurs, specify "01" for function "A077" to invert the polarity of the deviation.

Example: When controlling the compressor for a refrigerator

Assume that the temperature and voltage specifications of the temperature sensor are -20°C to +100°C and 0 to 10 V and the target value is 0°C.

If the current temperature is 10°C and the inverter is under the normal type of PID control, the inverter will reduce the output frequency because the feedback data is larger than the target value.

→ In such a case, specify "01" for function "A077" to invert the feedback deviation. Then, the inverter will increase the output frequency.



(6) Limitation on PID variation range

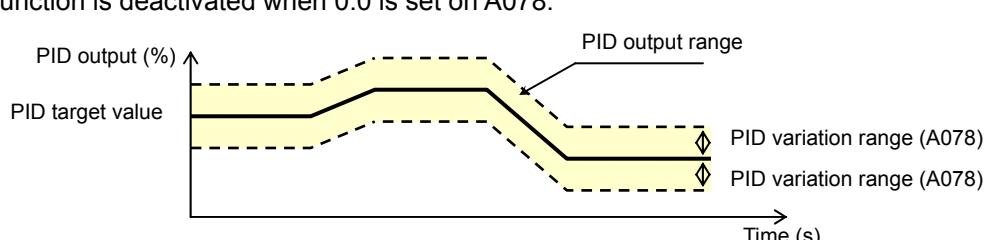
You can limit the PID output to within a specific range with reference to the target value.

To use the PID variation limit function, set the PID variation range (A078).

(Set a value on the assumption that the maximum frequency corresponds to 100%.)

The variation of PID output is limited within \pm "value of A078" from the target value.

The variation of PID output is limited within $\pm 1\%$ value of the setpoint (Setting "0.0" for the PID variation range [A078] disables this function).



Chapter 7 Explanation of Functions

(7) Output of inverted PID deviation

If the inverter is under the normal PID control and the PID operation result is a negative value, the frequency command to the inverter will be limited to 0 Hz. However, when "02" (enabling the inverted output) is set for the PID Function Enable (A071), the PID operation result to be output to the inverter is inverted if the result is a negative value.

Setting "02" for function "A071" disables the PID variation limit (A078) described above.

(8) PID gain adjustment

If the inverter response is unsteady when the PID control function is used, try to adjust gain settings as follows:

- If the feedback data does not quickly follow the change in the target value → Increase the P gain (A072).
- If the feedback data is unstable although it quickly follows the change in the target value → Reduce the P gain (A072).
- If considerable time is required until the feedback data matches the target value → Reduce the I gain (A073).
- If the feedback data fluctuates unsteadily → Increase the I gain (A073).
- If the inverter response is slow even after the P gain is increased → Increase the D gain (A074).
- If the feedback data becomes fluctuant and unsteady when the P gain is increased → Reduce the D gain (A074).

(9) Maximum PID deviation output (OD)

You can set the PID deviation level (C044) for PID control. When the PID deviation (ϵ) exceeds the level set as the level "C044", the signal is output to an intelligent output terminal.

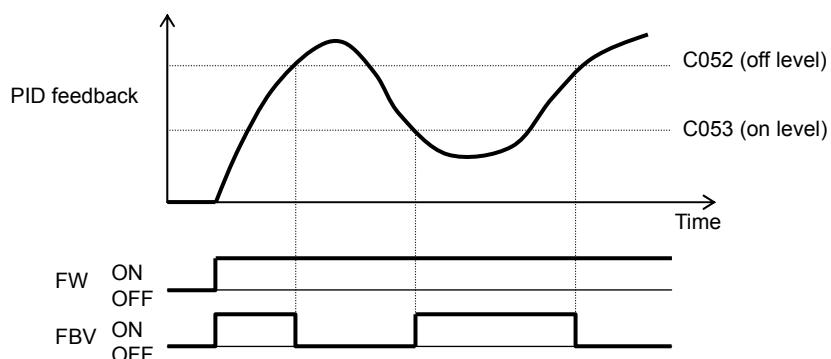
A value from 0 to 100 can be set as the level "C044". The range of values corresponds to the range of target values from 0 to the maximum.

To use this output function, assign function "04" (OD) to one of the terminal functions C021 or the alarm relay terminal function C026.

(10) Feedback comparison signal

A feedback comparison signal can be output to an intelligent output terminal when the PID feedback data exceeds the specified range.

To use this signal output function, assign function "31" (FBV) to one of the terminal functions C021 or the alarm relay terminal function C026.



(11) Process variable (PV), PID feedback monitoring (d004)

You can monitor the PID feedback data on the inverter.

When you set a PV scale conversion with function "A075", the value to be displayed as the monitored data can be the product of the feedback data and the scale.

"Monitored value" = "feedback data (%)" x "PV scale conversion (A075)"

(12) Reset of PID integration (PIDC)

This reset function clears the integral result of PID operation.

To use this function, assign function "24" (PIDC) to one of the terminal functions C001 to C005.

The integral result is cleared each time the PIDC terminal is turned on.

Never turn on the PIDC terminal during the PID operation. Otherwise, the inverter may trip because of overcurrent. Be sure to disable the PID function before turning on the PIDC terminal.

Chapter 7 Explanation of Functions

(13)PID sleep function

If PID command is below the (A156), it stop the output after the (A157). If PID command is above the (A156), it start the output after the (A157). If it returns within (A157), PID sleep function doesn't work. (A158) should set higher than (A156).

Even if the PID function is disabled, when the frequency command value is below the (A156), it stop the output after (A157). When the frequency command value is above (A158), it start the output after (A157). When using this function, please do not use the terminal free-run(FRS).

Chapter 7 Explanation of Functions

7.5.19 Energy-saver operation

The energy-saver operation function allows you to automatically minimize the inverter output power while the inverter is driving the motor at constant speed. This function is suited to operating a fan, pump, or other load that has a reduced-torque characteristic.

To use this function, specify "01" for the operation mode selection (A085).

Use the energy saving mode tuning function (A086) to adjust the response and accuracy of the energy-saver operation.

The energy-saver operation function controls the inverter operation comparatively slowly. Therefore, if a sudden change in the load occurs (e.g., impact load is applied), the motor may stall, and, consequently, the inverter may trip because of overcurrent.

| Item | Function code | Data | Description | |
|--------------------------|---------------|------|-------------------------|--|
| Operation mode selection | A085 | 00 | Normal operation | |
| | | 01 | Energy-saving operation | |

| Item | Function code | Data | Response | Accuracy |
|---------------------------|---------------|---------------|--------------------|------------------|
| Energy saving mode tuning | A086 | 0 ↓ 100 | Slow ↓ Quick | High ↓ Low |

7.5.20 Stabilization constant setting

The stabilization constant setting function allows you to adjust the inverter to stabilize the motor operation when the motor operation is unstable.

If the motor operation is unstable, check the motor capacity setting (H003/H203) and motor pole setting (H004/H204) to determine whether the settings match the motor specifications. If they do not match, readjust the settings. If the primary resistance of the motor is less than the standard motor specification, try to increase the setting of "H006/H206" step by step. Try to reduce the setting of "H006/H206" if the inverter is driving a motor of which the capacity is higher than the inverter rating.

You can also use the following methods to stabilize the motor operation:

- 1) Reducing the carrier frequency (b083)
- 2) Reducing the V/f gain setting (A045)

| Item | Function code | Data | Description |
|---------------------------|---------------|-------------------|--|
| Stabilization constant | H006/H206 | 0. to 255. | Increase or reduce the setting to stabilize the motor. |
| V/f gain setting | A045/A245 | 20. to 100. (%) | Reduce the setting to stabilize the motor. |
| Carrier frequency setting | b083 | 2.0 to 15.0 (kHz) | Reduce the setting to stabilize the motor. |

Chapter 7 Explanation of Functions

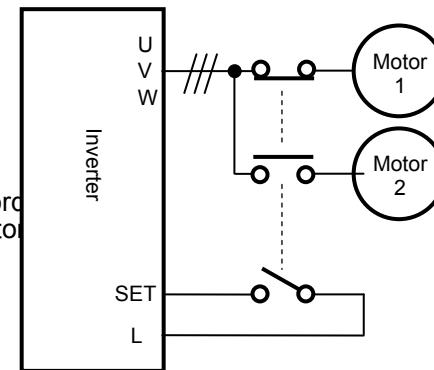
7.5.21 2nd motor control function (SET)

This motor control function allows you to switch the inverter settings to control two different types of motors. To use this function, assign function "08" (SET) to the terminal [1] to [5] functions (C001 to C005). Turn the SET terminal on and off for switching. (OFF:1st motor, ON:2nd motor)

| Item | Function code | Data | Description |
|-------------------|---------------|------|-------------------------|
| Terminal function | C001 to C005 | 08 | SET: Set 2nd motor data |

You can switch the following functional settings with the SET terminal:

- F002/F202: Acceleration (1) time setting
- F003/F203: Deceleration (1) time setting
- A001/A201: Frequency source selection
- A002/A202: Run command source selection
- A003/A203: Base frequency setting
- A004/A204: Maximum frequency setting
- A020/A220: Multispeed frequency setting
- A041/A241: Torque boost method selection
- A042/A242: Manual torque boost value
- A043/A243: Manual torque boost frequency adjustment
- A044/A244: V/F characteristic curve selection
- A045/A245: V/f gain setting
- A046/A246: Voltage compensation gain setting for automatic torque
- A047/A247: Slippage compensation gain setting for automatic torque
- A061/A261: Frequency upper limit setting
- A062/A262: Frequency lower limit setting
- A081/A281: AVR function selection
- A082/A282: AVR voltage selection
- A092/A292: Acceleration (2) time setting
- A093/A293: Deceleration (2) time setting
- A094/A294: Select method to switch to Acc2/Dec2 profile
- A095/A295: Acc1 to Acc2 frequency transition point
- A096/A296: Dec1 to Dec2 frequency transition point
- b012/b212: Electronic thermal setting (calculated within the inverter from current output)
- b013/b213: Electronic thermal characteristic
- b021/b221: Overload restriction operation mode selection
- b022/b222: Overload restriction level setting
- b023/b223: Deceleration rate at overload restriction
- C041/C241: Overload warning level setting
- H003/H203: Motor capacity
- H004/H204: Motor poles setting
- H006/H206: Motor stabilization constant



Since the inverter indicates no distinction among the 1st and 2nd controls, confirm the kind of control settings with the on/off states of the SET terminal.

Please perform the change during an inverter & motor stop.

This function is effective during an inverter stop.

Chapter 7 Explanation of Functions

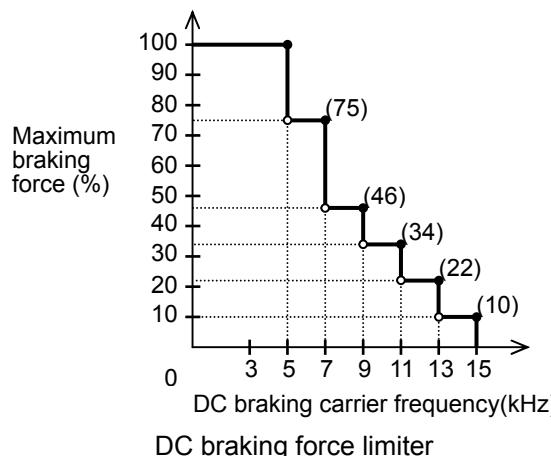
7.5.22 DC braking (DB) setting

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.

| 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 60.00 (Hz) | 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 100. (%) | "0" specifies the smallest force (zero current); "100" specifies the largest force (rated current). |
| DC braking time for deceleration | A055 | 0.0 to 10.0 (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 10.0 (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 | 2 to 15(kHz) | |

(1) Carrier frequency for DC braking

Use the DC braking carrier frequency setting (A059) to specify the carrier frequency for DC braking. But the braking power reduced is reduced when 5kHz are set as shown below. For detailed decreasing ratio, "DC braking force limiter" is to be referred.



Chapter 7 Explanation of Functions

(2) External DC braking

Assign function "07" (DB) to terminal function (C001 to C005).

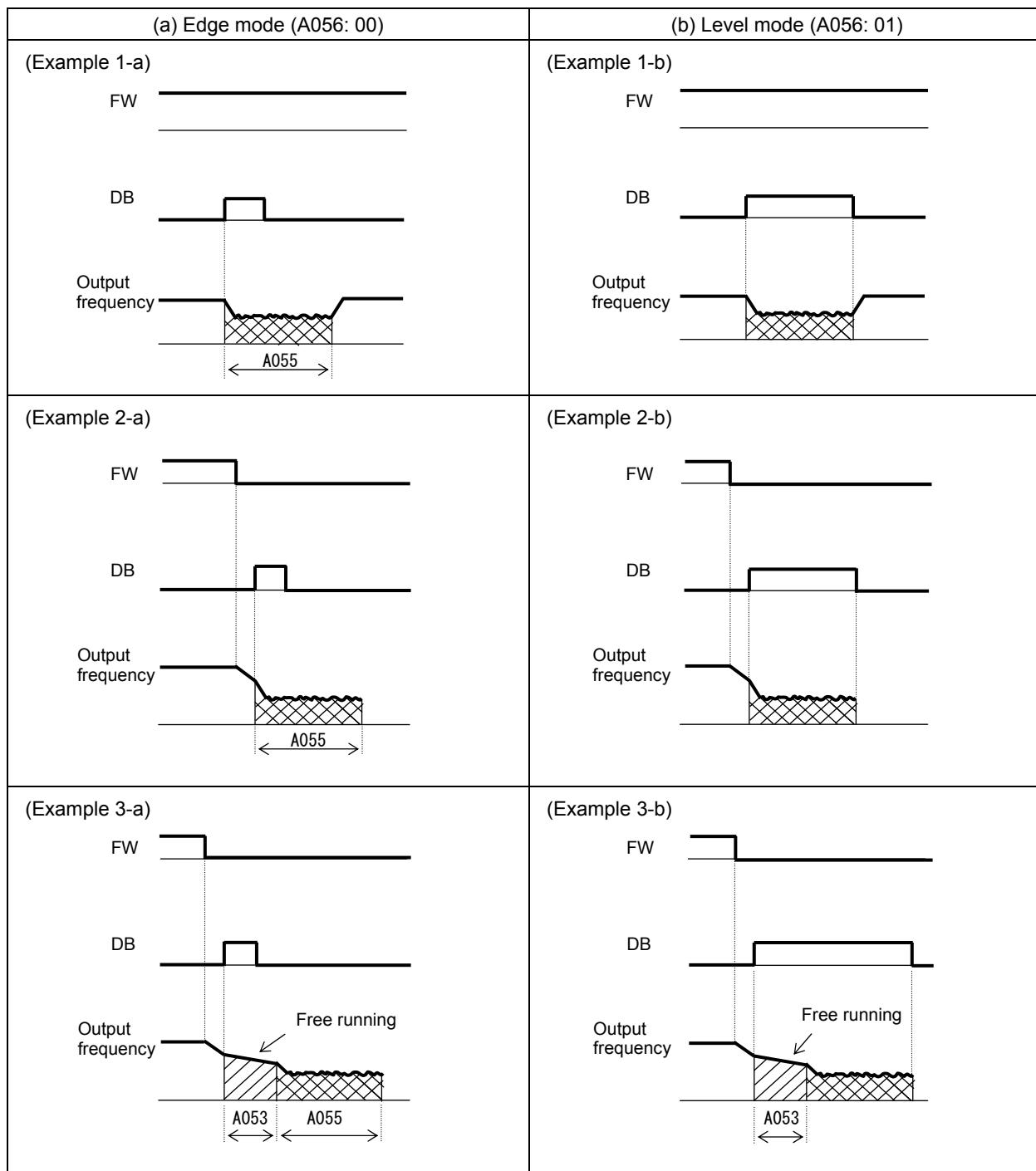
Direct braking control by ON/OFF of DB terminal when the setting of DC braking enable (A051) is 00(Invalid) and 01(Valid).

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.



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(3) 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).

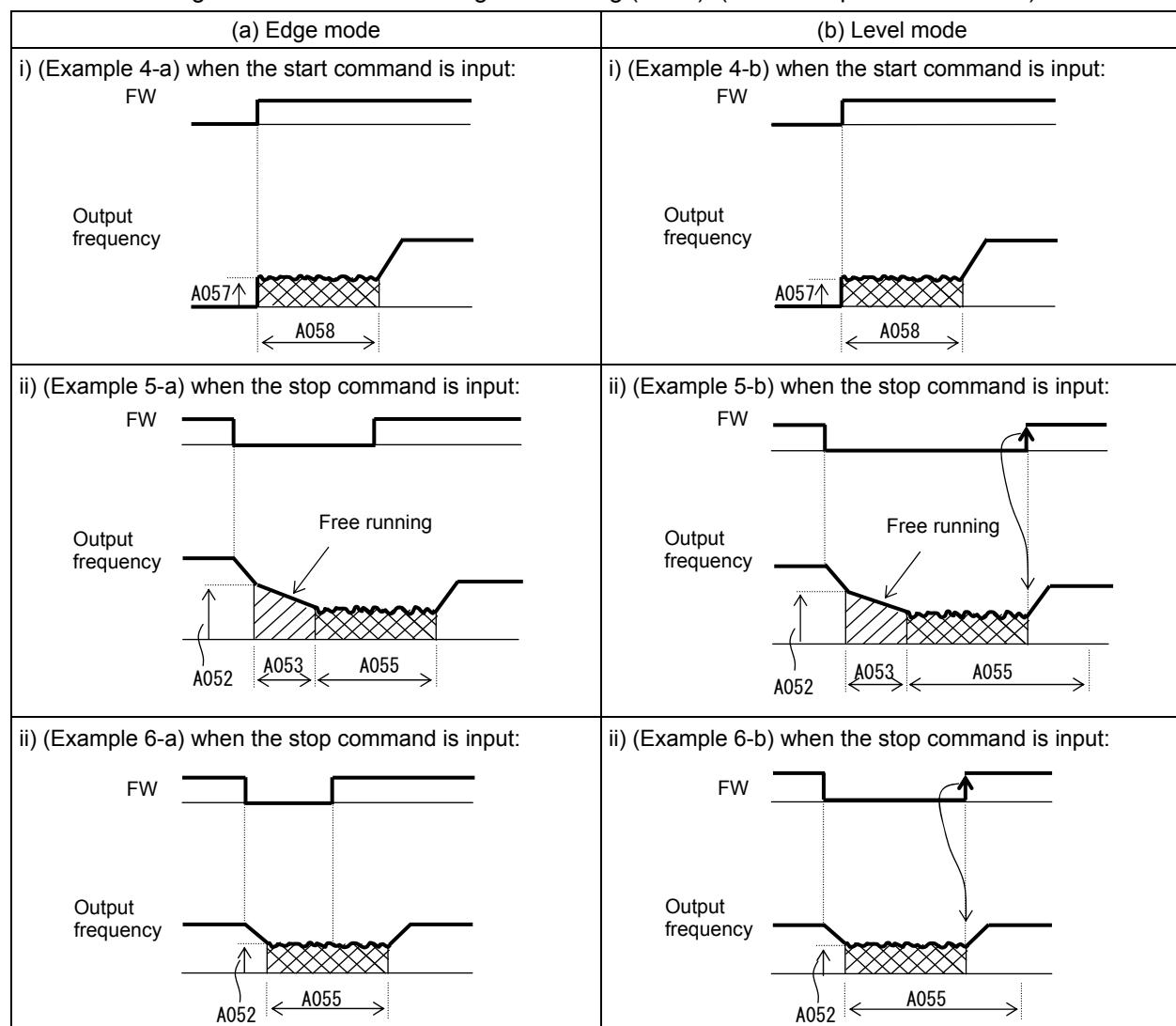
Set the output frequency at which to start DC braking by using the DC braking frequency setting (A052).

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.)



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(4) Internal DC braking (triggered only when the output frequency reaches a set frequency) (A051: 02)
 You can also operate the internal DC braking function so that DC braking is applied to the motor when the inverter output frequency falls to the DC braking frequency setting (A052) or below.

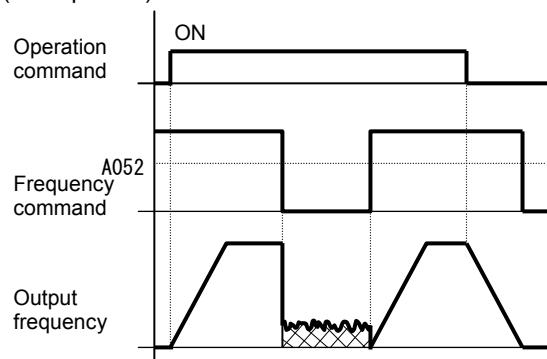
Please do not use external DC braking by ON/OFF of DB terminal when you select this function.
 In this mode, DC braking operates only when the operation command signal is on (i.e., the start command is input).

The inverter starts DC braking when both the frequency set by the frequency command and the current output frequency fall to the DC braking frequency setting (A052) or below. (See example 7-a.)
 When the frequency set by the frequency command increases to the "setting of 'A052' + 2 Hz" or more, the inverter stops DC braking and restores its normal output. (See example 7-a.)

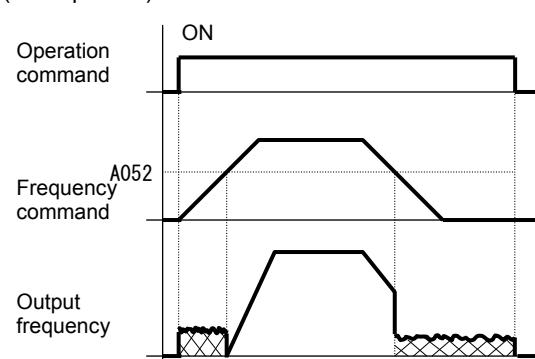
If the frequency set by the frequency command is 0 Hz when the start command is input via an analog input terminal, the inverter will start operation with DC braking because both the frequency set by the frequency command and current output frequency are 0 Hz. (See example 7-b.)

If the operation command signal (start command) is turned on when the frequency command specifies a frequency larger than the DC braking frequency (A052), the inverter will start operation with the normal output.

(Example 7-a)

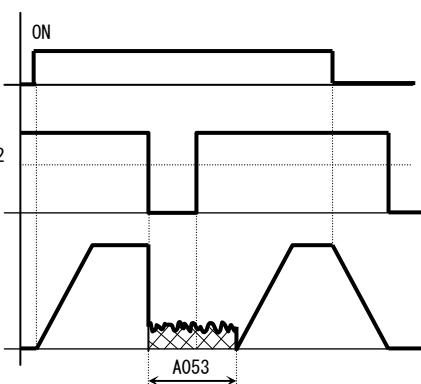


(Example 7-b)

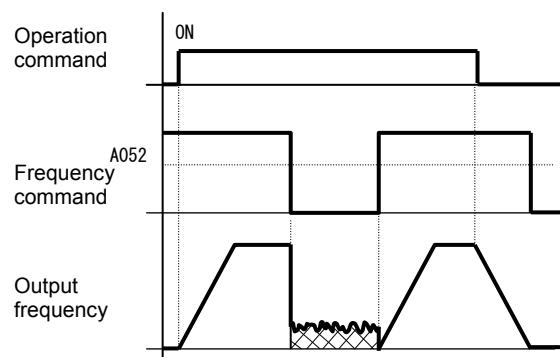


How the inverter returns to the normal output varies depending on the setting of the DC braking/edge or level detection for [DB] input (A054).

(a) Edge mode



(b) Level mode



Chapter 7 Explanation of Functions

7.6 Functions related to the operator display

7.6.1 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).

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 |

7.6.2 Software lock (SFT) function

The software lock function allows you to specify whether to disable rewriting of the data set for functional items. Use this function to protect the data against accidental rewriting.

You can select the functional items to be locked and the method of locking as described below.

When using an intelligent input terminal for this function, assign function "15" (SFT) to one of the terminal [1] to [5] functions (C001 to C005).

It is the mode for allowing changes during operation when b031 is set "10", high level access.

| Function code | Data | SFT terminal | Description |
|---------------|------|--------------|---|
| b031 | 00 | ON/OFF | Disabling rewriting of items other than "b031" (when SFT is on) or enabling rewriting (when SFT is off) |
| | 01 | ON/OFF | Disabling the rewriting of items other than "b031", "F001", "A020", "A220", "A021" to "A027", and "A038" (when SFT is on) or enabling rewriting (when SFT is off) |
| | 02 | — | Disabling the rewriting of items other than "b031" |
| | 03 | — | Disabling the rewriting of items other than "b031", "F001", "A020", "A220", "A021" to "A027", and "A038" |
| | 10 | — | The mode allowing changes during operation.((Run Mode Edit) (See Chapter 13)) |

The following function can prohibit Read/Copy by WOP.

| function | code | Data | Description |
|------------------------|------|------|----------------------|
| Data Read/Write select | b166 | 00 | Read/Write OK |
| | | 01 | Read/Write Protected |

7.6.3 Forcible-operation from digital operator (OPE) function

The forcible-operation function allows you to forcibly enable the inverter operation from the digital operator when the digital operator is not selected as the device to input frequency and operation commands. An intelligent input terminal is used to turn this function on and off.

When the intelligent input terminal to which the forcible-operation function is assigned is off, frequency and operation commands are input from the devices selected by functions "A001" and "A002". When the terminal is on, the device to input frequency and operation commands is forcibly switched to the digital operator.

If the input device is switched while the inverter is operating, the current operation command is canceled and the inverter stops the output. When restarting the inverter operation, turn off the operation command that was to be entered from each input device for safety's sake, and then enter a new operation command. When use it together with (F-TM) function, this function(OPE) is given priority.

| Item | Function code | Data | Description |
|-------------------|---------------|------|-------------------------|
| Terminal function | C001 to C005 | 31 | OPE: Forcible operation |

Chapter 7 Explanation of Functions

7.6.4 Forcible-operation from terminal (F-TM) function

The forcible-operation function allows you to forcibly enable the inverter operation via control circuit terminals when the control circuit terminal block is not selected as the device to input frequency and operation commands. An intelligent input terminal is used to turn this function on and off.

When the intelligent input terminal to which the forcible-terminal operation function is assigned is off, frequency and operation commands are input from the devices selected by functions "A001" and "A002".

When the terminal is on, the device to input frequency and operation commands is forcibly switched to the control circuit terminal block.

If the input device is switched while the inverter is operating, the current operation command is canceled and the inverter stops the output. When restarting the inverter operation, turn off the operation command that was to be entered from each input device for safety's sake, and then enter a new operation command.

When use it together with (OPE) function, (OPE) function is given priority.

| Item | Function code | Data | Description |
|-------------------|---------------|------|-----------------------------------|
| Terminal function | C001 to C005 | 51 | F-TM: Forcible-terminal operation |

7.6.5 Action selection in case of external operator disconnection

When the inverter detects a disconnection with the operator(Operator communication is cut off for five seconds or more.), inverter operation is subject to (b165).

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|--------------------------------------|
| Ex. operator com. loss action | b165 | 00 | Trip (E40.x) |
| | | 01 | Trip after Deceleration stop (E40.x) |
| | | 02 | Disregard |
| | | 03 | Free-run stop |
| | | 04 | Deceleration stop |

7.6.6 Initial-screen selection (selection of the initial screen to be displayed after power-on)

The initial-screen selection function allows you to specify the screen that is displayed on the digital operator immediately after the inverter power is turned on. The table below lists the screens (items) selectable. (The factory setting is "01" [d001].)

| Item | Function code | Data | Description |
|--------------------------|---------------|------------|--|
| Initial-screen selection | b038 | 000 | Func. code that SET key pressed last displayed. (*1) |
| | | 001 to 060 | d001 to d060 (set value(***) is the monitor No. (d***)) |
| | | 201 | F001 (output frequency setting) |
| | | 202 | B display of LCD operator (In case of Digital operator, same (000) setting) |

(*1):(Example) If the inverter power is turned off immediately after the setting of "b038" has been changed, the monitor will display "b038" as the initial screen after the next power-on.

Chapter 7 Explanation of Functions

7.6.7 Select automatic return to the initial display

If you do not manipulate the operator for 10 minutes, the operator screen automatically changes to the screen that you set in the (b038).

This function is enabled by setting the b164 = 01.

| Item | Function code | Data | Description |
|---|---------------|------|-------------|
| Automatic return to the initial display | b164 | 00 | Disable |
| | | 01 | Enable |

7.6.8 NES1-OP display selection

NES1-OP key does not work when you connect an digital operator or remote operator.

This function sets the monitor code to be displayed in NES1-OP.

| Item | Function code | Data | Description |
|---------------------------|---------------|------------|--|
| NES1-OP display selection | b150 | 001 to 050 | d001 to d050 corresponding to the monitor item |

7.6.9 Data Read/Write selection

This function is to choose whether to allow read / write of data in the WOP.

| Item | Function code | Data | Description |
|---------------------------|---------------|------|-------------|
| Data Read/Write selection | b166 | 00 | Enable |
| | | 01 | Disable |

See section 7.6.2

7.6.10 Display limitation function (DISP)

To use this function, assign function "86" (DISP) to one of the terminal [1] to [5] functions (C001 to C005). While the (DISP) input is ON , the operator displays a parameter chosen by initial-screen selection. And cannot select other parameter.

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|-----------------------------------|
| Terminal [1] to [5] functions | C001 to C005 | 86 | DISP: Display limitation function |

Chapter 7 Explanation of Functions

7.6.11 Function code display restriction

The function code display restriction function allows you to arbitrarily switch the display mode or the display content on the digital operator.

| Item | Function code | Data | Description |
|-----------------------------------|---------------|------|---------------------------|
| Function code display restriction | b037 | 00 | Full display |
| | | 01 | Function-specific display |
| | | 03 | Data comparison display |
| | | 04 | Basic display |
| | | 05 | Monitor mode (d***) only |

(1) Function-specific display mode

If a specific function has not been selected, the monitor does not display the parameters concerning the specific function.

The following table lists the details of display conditions:

| No. | Display condition | Parameter displayed when the display condition is met |
|-----|--|---|
| 1 | One of C001 to C005 = 08 | F202, F203, A201 to A204, A220, A241 to A247, A261, A262, A281, A282, A292 to A296, b212, b213, b221 to b223, C241, H203, H204 and H206 |
| 2 | A044 = 02 or/ One of C001 to C005 = 08 and A244 = 02 | b100 to b113 |
| 3 | b013 = 02 or/ One of C001 to C005 = 08 and b213 = 02 | b015 to b020 |
| 4 | A044 = 00 or 01 | A041 to A043, A046, A047 |
| 5 | One of C001 to C008 = 08 and A244 = 00, 01 | A241 to A243, A246, A247 |
| 6 | A051 = 01, 02 or/ One of C001 to C005 = 06, 07 | A052 to A059 |
| 7 | A071 = 01, 02 | d004, A072 to A079, A156 to A158, C044, C052, C053 |
| 8 | A097, A098 = 01 to 03 | A131, A132 |
| 9 | b050 = 01 to 03 | b051 to b054, b134, b135 |
| 10 | b130 = 01 to 03 | b131 to b134 |
| 11 | C070 = 01 | C071 to C078 |

(2) Data comparison display mode

The monitor displays only the parameters that have been changed from the factory settings, except all monitoring indications (d***) and code "F001".

Chapter 7 Explanation of Functions

(3) Basic display mode

The monitor displays basic parameters.

The following table lists the parameters that can be displayed in basic display mode:

| No. | Code displayed | Item |
|-----|----------------|--|
| 1 | d001 to d104 | Monitoring indication |
| 2 | F001 | Output frequency setting |
| 3 | F002 | Acceleration (1) time setting |
| 4 | F003 | Deceleration (1) time setting |
| 5 | F004 | Keypad Run key routing |
| 6 | A001 | Frequency source setting |
| 7 | A002 | Run command source setting |
| 8 | A003 | Base frequency setting |
| 9 | A004 | Maximum frequency setting |
| 10 | A020 | Multispeed frequency setting |
| 11 | A021 | Multispeed 1 setting |
| 12 | A022 | Multispeed 2 setting |
| 13 | A023 | Multispeed 3 setting |
| 14 | A044 | V/F characteristic curve selection, 1st motor |
| 15 | A045 | V/f gain setting |
| 16 | A085 | Operation mode selection |
| 17 | b001 | Selection of restart mode |
| 18 | b002 | Allowable under-voltage power failure time |
| 19 | b008 | Selection of retry after trip |
| 20 | b011 | Retry wait time after trip |
| 21 | b031 | Softlock mode selection |
| 22 | b037 | Function code display restriction |
| 23 | b083 | Carrier frequency setting |
| 24 | b084 | Initialization mode (parameters or trip history) |
| 25 | b130 | Overvoltage suppression enable |
| 26 | b131 | Overvoltage suppression level |
| 27 | b180 | Initialization trigger |
| 28 | C001 | Input terminal [1] function |
| 29 | C002 | Input terminal [2] function |
| 30 | C003 | Input terminal [3] function |
| 31 | C004 | Input terminal [4] function |
| 32 | C005 | Input terminal [5] function |
| 33 | C021 | Output terminal [11] function |
| 34 | C036 | Alarm relay active state |

(4) Monitor mode (d***) Only.

The monitor displays only the parameters of the monitor mode(d***) and b037.

7.6.12 Button sensitivity selection

This function sets Button sensitivity. If set to No, the operation button is disabled.

| Item | Function code | Data | Description |
|------------------------------|---------------|----------|----------------|
| Button sensitivity selection | C151 | 0 to 250 | Data times 2ms |
| | | no | Disable button |

Chapter 7 Explanation of Functions

7.6.13 Scroll sensitivity selection

When the display data of the operator, press and hold the UP or DOWN key.

Then, the data update rate is faster. Update rate can be adjusted by (C152).

| Item | Function code | Data | Description |
|------------------------|---------------|---------|-----------------------------|
| Operating speed scroll | C152 | 1 to 20 | 1: (Faster) 20: (Slower) |

This function only works when connected to an operator.

Chapter 7 Explanation of Functions

7.7 Functions about restarting

7.7.1 Retry (Under Voltage , Over Current / Over Voltage)

(1) Retry (restart) after under voltage / Over Current / Over Voltage

You can select tripping or retrying (restarting) the motor operation as the inverter operation to be performed at the occurrence of undervoltage.

If you specify a retry operation for the selection of restart mode (b001), the inverter will retry the motor operation for the number of times set as "b005" after a under Voltage, and then trip if all retries fail. (The inverter will not trip if you specify an unlimited number of retries.)

With function "b004" you can select whether to make the inverter trip when a undervoltage occur while the inverter is in a stopped state.

When selecting a retry operation, also set the retry conditions listed below according to the system to be driven by the inverter.

Even during a retry operation, the inverter will trip with error code "E09" (undervoltage) displayed if the undervoltage status continues for 40 seconds.

| Item | Function code | Data or range of data | Description |
|--|---------------|--|--|
| Selection of restart mode for under voltage trip (*3) (*5) | b001 | 00 | Tripping |
| | | 01 | Restarting the motor with 0 Hz at retry |
| | | 02 | Starting the motor with an active matching frequency at retry. (See example 1.) (*2) |
| | | 03 | Starting the motor with an active matching frequency at retry. The inverter trips after decelerating and stopping the motor. (*1) (*2) |
| Allowable under-voltage power failure time | b002 | 0.3 to 25.0 (s) | Restarting the motor when the power failure duration does not exceed the specified time (See example 1.) Tripping when the power failure duration exceeds the specified time (See example 2.) |
| Retry wait time before motor restart for under voltage trip | b003 | 0.3 to 100. (s) | Time to wait until restarting the motor |
| the selection of a trip after undervoltage in the stopped state (*3) | b004 | 00 | Disabling the inverter from tripping |
| | | 01 | Enabling the inverter to trip |
| | | 02 | Disabling the inverter from tripping when the inverter is stopped or while the motor is being decelerated or stopped after the operation command has been turned off |
| Number of restarts on under-voltage trip events | b005 | 00 | Retrying the motor operation up to 16 times after instantaneous power failure |
| | | 01 | Retrying the motor operation an unlimited number of times after instantaneous power failure |
| Restart frequency threshold | b007 | 0.00 to 400.0 (Hz) | Restarting the motor with 0 Hz if the frequency becomes less than the frequency set here during motor free-running (See examples 3 and 4.) |
| Trip/retry selection for over voltage / over current | b008 | 00 | Tripping |
| | | 01 | Restarting the motor with 0 Hz at retry |
| | | 02 | Starting the motor with an active matching frequency at retry. |
| | | 03 | Starting the motor with an active matching frequency at retry. The inverter trips after decelerating and stopping the motor. |
| Selection of retry count after overvoltage or overcurrent | b010 | 1 to 3 (times) | Number of retries to be made after the occurrence of overvoltage or overcurrent (*4) |
| Retry wait time after overvoltage or overcurrent | b011 | 0.3 to 100. (s) | Time to wait until restarting the motor |
| Active frequency matching, scan start frequency | b028 | "0.20 x rated current" to "2.00 x rated current" | Current limit for restarting with active matching frequency |
| Active frequency matching, scan-time constant | b029 | 0.1 to 3000.0 (s) | Duration of frequency lowering when restarting with active matching frequency |
| Active frequency matching, restart frequency select | b030 | 00 | Frequency set when the inverter output has been shut off |
| | | 01 | Maximum frequency |
| | | 02 | Newly set frequency |

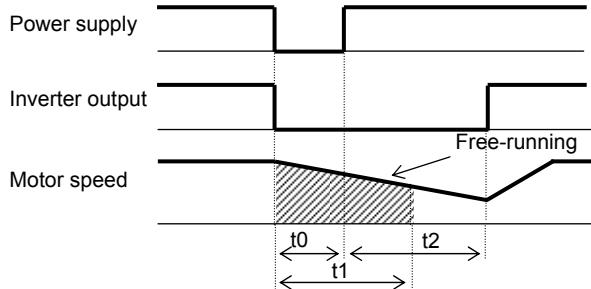
Chapter 7 Explanation of Functions

- *1 If the inverter trips because of overvoltage or overcurrent while decelerating the motor, the inverter will display error code "E09" (undervoltage), and the motor will start free-running. If this error occurs, prolong the deceleration time.
- *2 The inverter may start the motor with 0 Hz if:
 - 1) the output frequency is not more than half the base frequency or
 - 2) the voltage induced on the motor is attenuated quickly.
- *3 Even when a retry operation (01 to 03) is specified for the selection of restart mode (b001) and "disabling tripping" (00 or 02) is specified for the selection of a trip after undervoltage in the stopped state (b004), the inverter will trip if the undervoltage failure continues over the allowable under-voltage power failure time (b002). (See example 2.)
When restart mode (b001)=Trip (00), the inverter will not trip if the undervoltage failure continues over the allowable under-voltage power failure time (b002).
- *4 Even when a retry operation is specified for the trip selection, the inverter will trip if the cause of trip is not removed by the end of the retry wait time before motor restart (b003). If this occurs, prolong the retry wait time.
- *5 Even when a retry operation is specified for the retry selection, the inverter will trip if the undervoltage status continues for 40 seconds or more.
- *6 when starting the motor with active matching frequency is selected, inverter may restart suddenly by alarm resetting, resetting and retry-start.

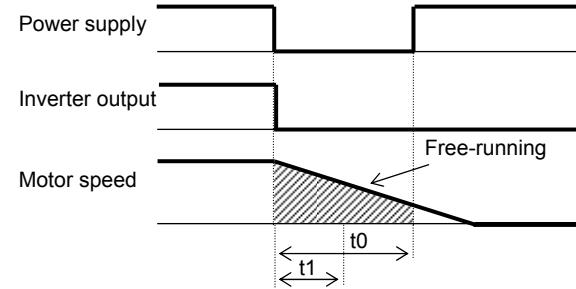
The figures below show the timing charts for starting with a matching frequency (when "02" is specified for the selection of restart mode [b001]).

t0: Duration of instantaneous power failure
t1: Allowable under-voltage power failure time (b002)
t2: Retry wait time before motor restart (b003)

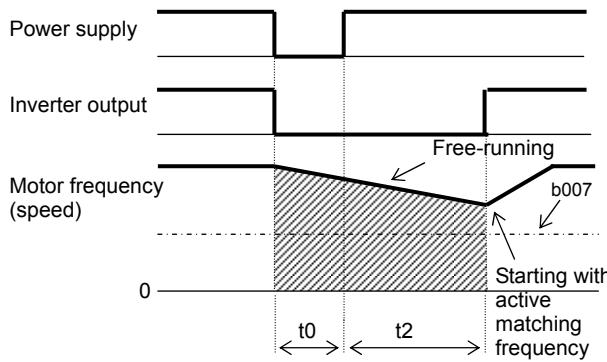
(Example 1)



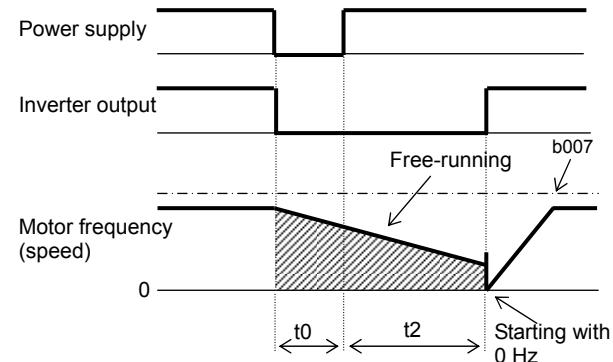
(Example 2)



(Example 3) When the motor frequency (speed) is more than the setting of "b007" (b030=00):



(Example 4) When the motor frequency (speed) is less than the setting of "b007" (b030=00):



Chapter 7 Explanation of Functions

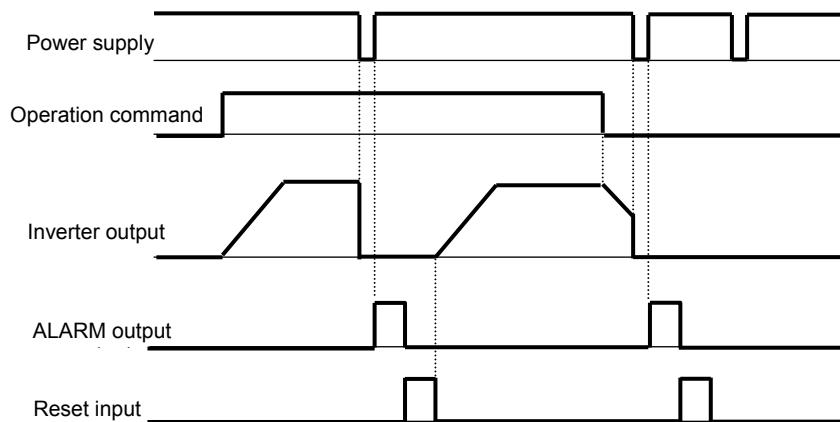
(2) Output of the alarms for undervoltage in the stopped state

Use function "b004" to specify whether to output an alarm when undervoltage occurs. The inverter outputs the alarm providing the control power remains in the inverter.

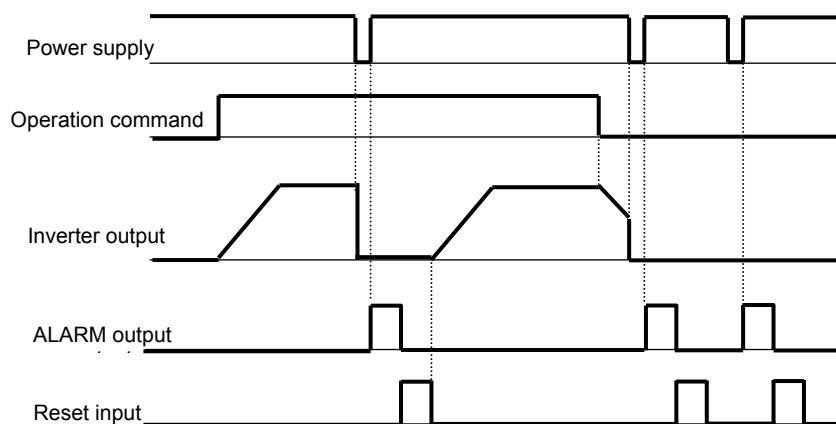
Output of the alarms for undervoltage in the stopped state:

Examples 5 to 7 show the alarm output operations with standard settings.

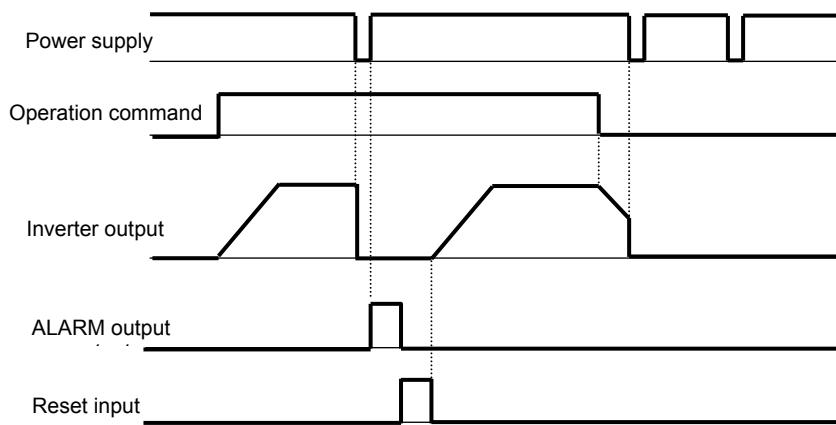
Example 5 b004=00



Example 6 b004=01



Example 7 b004=02



Chapter 7 Explanation of Functions

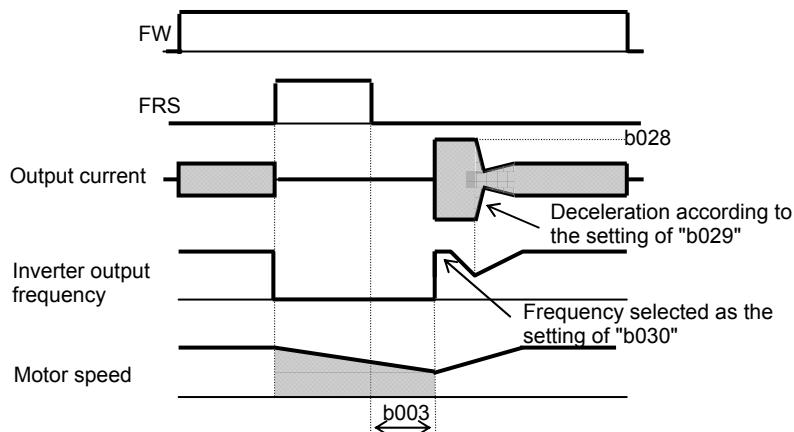
(3) Restarting methods

- Restart with an active matching frequency

The inverter starts the output with the frequency specified for the start frequency selection (b030), searches for the point where the frequency and voltage are balanced while keeping the current at the restart current level (b028), and then restarts the motor.

If the inverter trips when it restarts the motor in this way, reduce the setting of "b028".

- After the inverter output has been shut off, the digital operator continues to display  until the inverter restarts the motor operation.



Chapter 7 Explanation of Functions

7.7.2 Reset (RS) function

The reset function allows you to recover the inverter from a tripped state.

To perform resetting, press the STOP/RESET key of the digital operator or turn the RS terminal ON.

To use the control circuit terminal for resetting, assign function "18" (RS) to an intelligent input terminal.

You can select the restart mode to apply after resetting with the restart mode after reset (C103). When C102 =02, starting with 0 Hz is selected regardless to C103 setting.

If the inverter trips because of overcurrent when it starts the motor with matching frequency, increase the retry wait time before motor restart (b003).

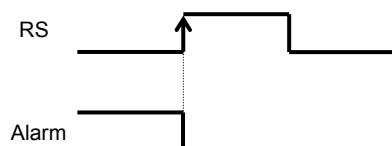
You can select the alarm reset timing with the reset mode selection (C102). You can also enable the reset signal to be output only when resetting an error alarm.

The RS terminal can be configured only as an a-contact (NO).

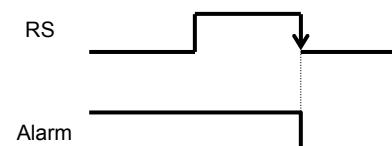
Do not use the RS terminal for the purpose of shutting off the inverter output. The reset operation clears the electronic thermal data in the inverter, and, without this data, the inverter may be damaged during operation.

| Item | Function code | Data or range of data | Description |
|--------------------------------------|---------------|-----------------------|--|
| Retry wait time before motor restart | b003 | 0.3 to 100. (s) | Time to wait after reset until restarting the motor |
| Restart frequency threshold | b007 | 0.00 to 400.0 (Hz) | Restarting the motor with 0 Hz if the frequency becomes less than the frequency set here during motor free-running. |
| Reset mode selection | C102 | 00 | Resetting the trip when the RS signal is turned on (See example 1.) (When operation is normal) Shutting off the inverter output (When an error has occurred) Resetting the trip |
| | | 01 | Resetting the trip when the RS signal is turned off (See example 2.) (When operation is normal) Shutting off the inverter output (When an error has occurred) Resetting the trip |
| | | 02 | Resetting the trip when the RS signal is turned on (See example 1.) (When operation is normal) Disabling the inverter output (When an error has occurred) Resetting the trip |
| Restart mode after reset | C103 | 00 | Start with 0 Hz |
| | | 01 | Start with active matching frequency (See example 3.) |

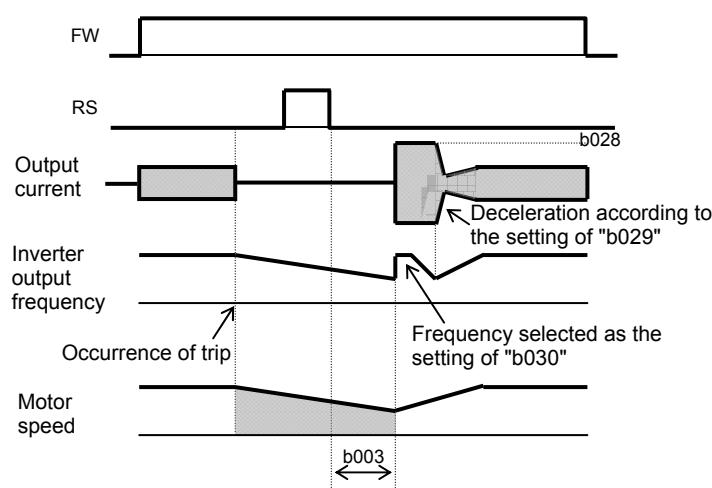
(Example 1)



(Example 2)



(Example 3) Restarting with active matching frequency



After the retry wait time (b003), the inverter restarts the motor with the frequency set as "b030". The inverter subsequently decelerates the motor according to the setting of "b029" while maintaining the output current at the level specified for "b029".

When the output voltage matches the frequency, the inverter re-accelerates the motor up to the frequency that was set when the inverter shut off the output to the motor before the restart.

If the inverter trips because of overcurrent when it restarts the motor with input frequency, reduce the setting of "b028".

(note) Inverter starts from 0Hz when reset signal is given during retry waiting because the frequency stored in inverter is cleared.

Chapter 7 Explanation of Functions

7.7.3 Free-run stop (FRS) function

The free-run stop (FRS) function allows you to shut off the inverter output to let the motor start free-running.

You can effectively use this function when stopping the motor with a mechanical brake (e.g., electromagnetic brake). If an attempt is made to forcibly stop the motor with a mechanical brake while the inverter keeps its output, the inverter may trip because of overcurrent.

To use this function, assign function "11" (FRS) to one of the terminal [1] to [5] functions (C001 to C005). The free-run stop (FRS) function operates as long as the FRS terminal is on. When the FRS terminal is turned off, the inverter restarts the motor after the retry wait time (b003). However, the inverter does not restart the motor if the digital operator (02) has been specified for the run command source setting (A002). To restart the motor in such status, enter a new operation command.

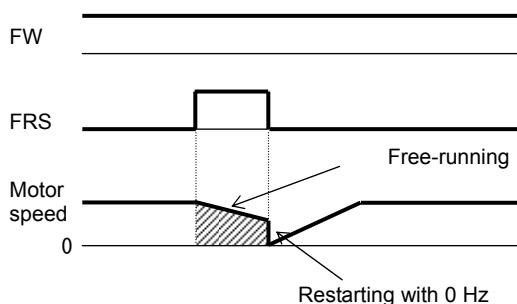
You can select the inverter output mode for restarting with the restart mode after FRS (b088) from starting the motor with 0 Hz and restarting with active matching frequency. (See examples 1, 2.)

Even when restarting with active matching frequency has been selected, the inverter restarts the motor with 0 Hz if it detects a frequency lower than the restart frequency threshold (b007).

The settings, including that of the FRS terminal, which you make for this function will affect the inverter operation at recovery of the motor from the free-running status.

| Item | Function code | Data or range of data | Description |
|---|---------------|--|---|
| Restart mode after FRS | b088 | 00 | Start with 0 Hz (See example 1.) |
| | | 01 | Restart with active matching frequency (See example 2.) |
| Retry wait time before motor restart | b003 | 0.3 to 100. (s) | Time to wait until restarting the motor |
| Restart frequency threshold | b007 | 0.00 to 400.0 (Hz) | Setting of the minimum level for frequency adjustment |
| Active frequency matching, scan start frequency | b028 | "0.20 x rated current" to "2.00 x rated current" | Current limit for restarting with active matching frequency |
| Active frequency matching, scan-time constant | b029 | 0.10 to 3000.0 (s) | Duration of frequency lowering when restarting with active matching frequency |
| Active frequency matching, restart frequency select | b030 | 00 | Frequency set when the inverter output has been shut off |
| | | 01 | Maximum frequency |
| | | 02 | Newly set frequency |

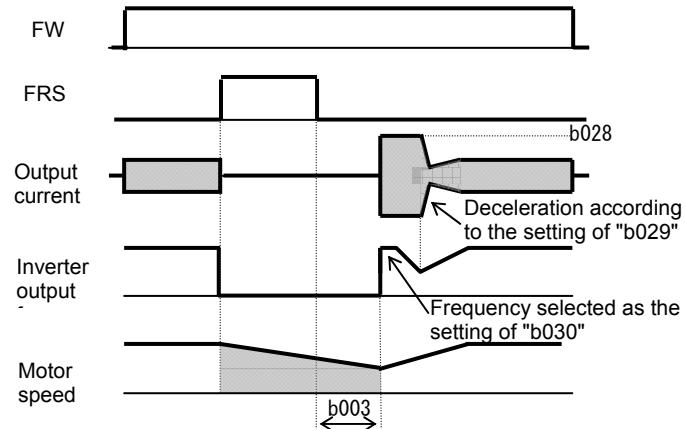
(Example 1) Restarting with 0 Hz



The inverter restarts the motor with 0 Hz regardless of the motor speed. The setting of retry wait time is ignored.

If the inverter restarts the motor with 0 Hz when the motor speed is high, the inverter may trip because of overcurrent.

(Example 2) Restarting with active matching frequency



After the retry wait time (b003), the inverter restarts the motor with the frequency set as "b030". The inverter subsequently decelerates the motor according to the setting of "b029" while maintaining the output current at the level specified for "b028". When the output voltage matches the frequency, the inverter re-accelerates the motor up to the frequency that was set when the inverter shut off the output to the motor before the restart.

If the inverter trips because of overcurrent when it restarts the motor with input frequency, reduce the setting of "b028".

Chapter 7 Explanation of Functions

7.7.4 Unattended start protection (USP) function

The unattended start protection function allows you to make the inverter trip with error code "E13" displayed if the inverter power is turned on when an operation command has been turned on.

You can recover the inverter from tripping by performing the reset operation or turning the operation command off. (See example 1.)

If the inverter is recovered from tripping with the operation command left turned on, the inverter will start operation immediately after recovery. (See example 2.)

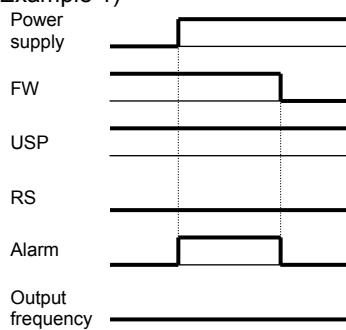
The inverter can operate normally when an operation command is turned on after the inverter power is turned on. (See example 3.)

To use this function, assign function "13" (USP) to one of the terminal [1] to [5] functions (C001 to C005). This function is invalid with the standard operation panel (RUN/STOP/RESET key).

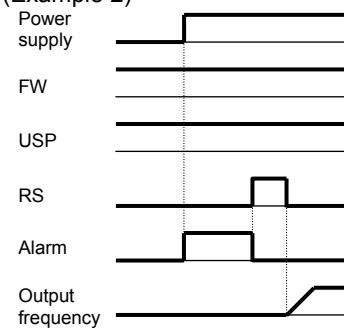
When it is input a run command from the operator or Modbus within two seconds after the power supply injection, the inverter trip(E13).

The following charts show examples of the timing of the unattended start protection operation:

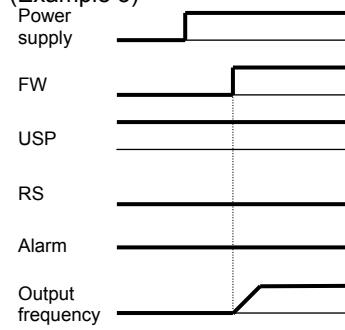
(Example 1)



(Example 2)



(Example 3)



| Item | Function code | Data | Description |
|-------------------------------|---------------|------|----------------------------------|
| Terminal [1] to [5] functions | C001 to C005 | 13 | USP: Unattended start protection |

Chapter 7 Explanation of Functions

7.7.5 Deceleration and stopping at power failure (nonstop deceleration at instantaneous power failure)

The nonstop deceleration at instantaneous power failure is the function making the inverter decelerate and stop the motor while maintaining the voltage below the overvoltage level when an instantaneous power failure occurs during the inverter operation.

You can select three modes with controller deceleration and stop on power loss (b050).

| Item | Function code | Data or range of data | Description |
|---|---------------|-----------------------|--|
| Controller deceleration and stop on power loss | b050 | 00 | Disabling the nonstop deceleration function |
| | | 01 | Enabling the nonstop deceleration function (DEC & STOP) |
| | | 02 | Enabling the nonstop deceleration function (DC voltage constant control, no restoration) |
| | | 03 | Enabling the nonstop deceleration function (DC voltage constant control, Restoration to be done) |
| DC bus voltage trigger level during power loss | b051 | 0.0 to 400.0 (V) | |
| Over-voltage threshold during power loss (*1) | b052 | 0.0 to 400.0 (V) | |
| Deceleration time setting during power loss | b053 | 0.01 to 300.0 (s) | |
| Initial output frequency decrease during power loss | b054 | 0.00 to 10.00 (Hz) | |

<1> nonstop deceleration at instantaneous power failure (b050=01)

- The nonstop deceleration at instantaneous power failure is the function making the inverter decelerate and stop the motor while maintaining the voltage below the overvoltage level (over-voltage threshold during power loss [b052]) when an instantaneous power failure occurs during the inverter operation.
- If an instantaneous power failure has occurred while the inverter is operating the motor and the output voltage falls to the DC bus voltage trigger level during power loss (b051) or less, the inverter reduces the output frequency by the initial output frequency decrease during power loss (b054) once, and then decelerates the motor for the deceleration time setting during power loss (b053).
- If the voltage increases to an overvoltage level (exceeding the over-voltage threshold during power loss [b052]) because of regeneration, the inverter enters the LAD stop state until the voltage falls below the overvoltage level.

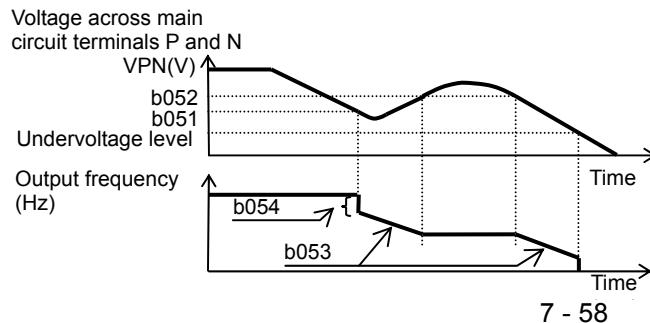
Note1:If the over-voltage threshold during power loss (b052) is less than the DC bus voltage trigger level during power loss (b051), the over-voltage threshold during power loss will be increased to the DC bus voltage trigger level during power loss when the stop level is applied. (However, the stored setting will not be changed.)

And, in case b052 is less than the supply voltage (equivalent to rectified DC voltage which is square root 2 times supply AC voltage), when power recovers while this function is activated, inverter will be in the LAD stop status and cannot decelerate. (Stop command and frequency change command are not accepted until deceleration is completed). Be sure to set b052 more than the standard supply voltage.

Note2:This nonstop deceleration function cannot be canceled until the nonstop deceleration operation is completed. To restart the inverter operation after power recovery, wait until the inverter stops, enter a stop command, and then enter an operation command.

Note3:Setting higher initial out put frequency decrease during powerloss (b054) results in over current trip due to sudden deceleration.

Setting lower b054, orlonger deceleration time during powerloss (b053) results in undervoltage trip due to less regeneration power.



Chapter 7 Explanation of Functions

<2> DC voltage constant control during nonstop operation at momentary power failure (b050 = 02: no restoration, b050 = 03: restoration to be done)

- If momentary power failure occurs or the main circuit DC voltage drops during inverter operation, the inverter decelerates the motor while maintaining the main circuit DC voltage at the level specified as the target nonstop operation voltage at momentary power failure (0V-LAD stop level) (b052).
- This function starts operating when all the following conditions are met:
 - "02" or "03" has been specified for b050.
 - The inverter is running. (This function does not operate if the inverter has been tripped, is in undervoltage status or stopped.)
 - The control power fails momentarily or the main circuit DC voltage drops to the DC bus voltage trigger level during power loss (b051) or less.
- If momentary power failure only lasts a short time, the inverter can continue operation without stopping its output. Conversely, if momentary power failure causes undervoltage, the inverter stops its output immediately and ends the operation of this function. When power is subsequently restored, the inverter operates according to the selection of restart mode (b001).
- When "03" is specified for b050, the inverter can be restored to normal operation if the input power is recovered from momentary power failure before the inverter stops its output. The inverter, however, may decelerate and stop the motor if a specific setting has been made for b051. The table below lists the differences in operation according to the setting of b051.

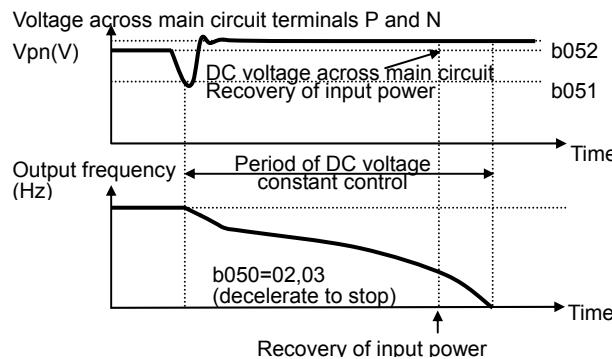
| b050 | b051 | Operation |
|-----------------------------|--|---|
| 02 (No restoration) | b052 > Main circuit DC voltage at input power recovery | Decelerating and stopping the motor (DC voltage constant control) (Example 1) |
| | b052 < Main circuit DC voltage at input power recovery | Decelerating and stopping the motor (Example 2) |
| 03 (Restoration to be done) | b052 > Main circuit DC voltage at input power recovery | Decelerating and stopping the motor (DC voltage constant control) (Example 1) |
| | b052 < Main circuit DC voltage at input power recovery | Decelerating and stopping the motor (Example 2) |

- When this function operates and the inverter decelerates and stops the motor, the motor is forcibly stopped even if the FW signal is on. To restart the motor, turn on the FW signal again after confirming the recovery of inverter input power.

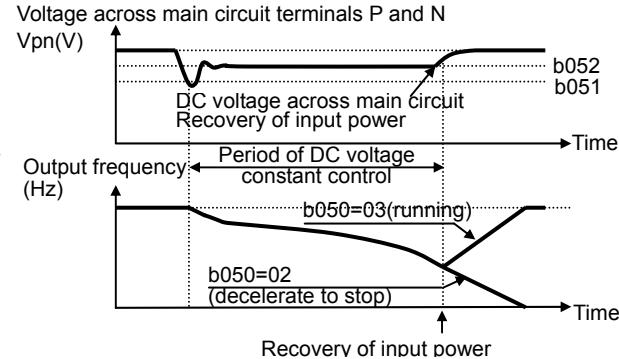
Note 4: Each of the values of b051 and b052 must be the undervoltage 173V(200V class),345V(400V class)level or more. This function does not operate when undervoltage occurs. The value of b051 must be less than that of b052.

Note 5: When "02" or "03" is specified for b050, PI control is performed so that the internal DC voltage is maintained at a constant level. PI-gain (P-Gain,I-Gain) can adjust by b133(P) and b134(I).

(Example 1)



(Example 2)



Chapter 7 Explanation of Functions

7.8 Set functions related to protection and warning, each output signal

7.8.1 Trip signal (AL)

When it detects an anomaly, the inverter output is shut off, the inverter outputs a trip signal. This is called a trip.

If you reset, the inverter deactivate trip state. Trip signal is turned OFF at the same time.

How to Reset.

1) Pressing the STOP/RESET key.

2) To use the reset terminal (18:RS).

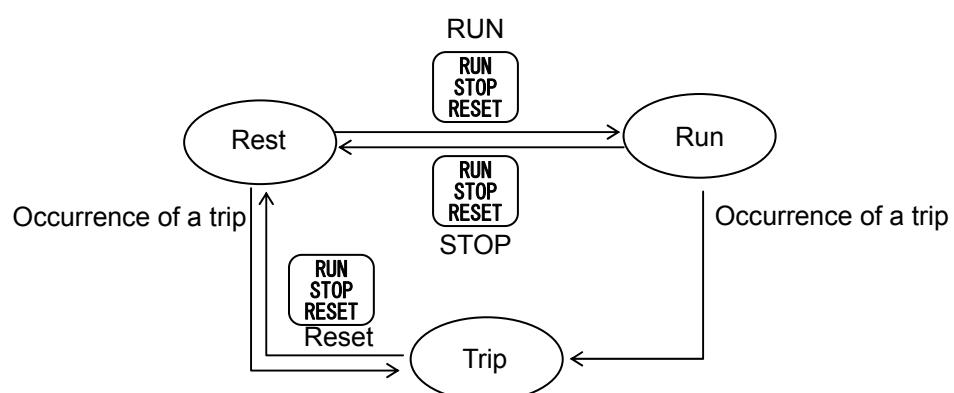
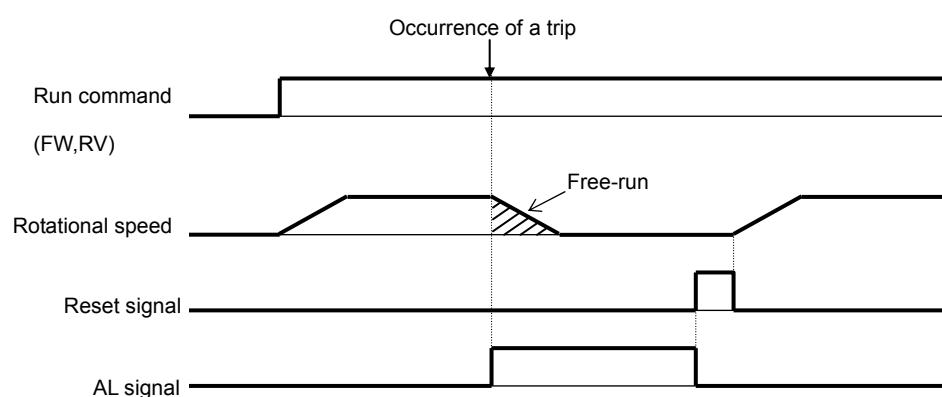
(Part of the cause of trip can not be released by a reset. In this case, it is required a power cycle.)

Trip signal(05:AL) is assigned to the output terminal 11(C021) or Alarm relay (C026).

(Initial data C026 = 05[AL])

Alarm relay contacts are 1c.(Refer to 7.3.5)

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|-------------------|
| Output [11] function | C021 | 05 | AL : Trip signal |
| Alarm relay function | C026 | | |
| Terminal [1] to [5] functions | C001 to C005 | 18 | RS : Reset signal |



Chapter 7 Explanation of Functions

7.8.2 Electronic thermal protection

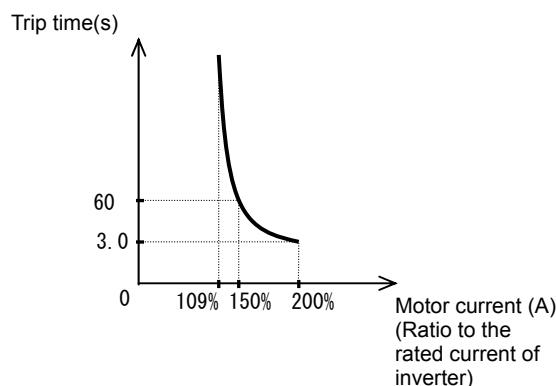
The electronic thermal protection function allows you to protect the motor against overheating. Make settings of this function based on the rated current of the motor. The inverter will trip for overheat protection according to the settings.

This function provides optimum overheat protection that is also designed with the lowering of the motor's cooling performance at low speeds in mind.

You can configure this function so that the inverter outputs a warning signal before it trips for electronic thermal protection.

(1) Electronic thermal level

| Item | Function code | Range of data | Description |
|---|---------------|--|------------------------|
| Electronic thermal setting (calculated within the inverter from current output) | b012/b212 | "0.2 x rated current" to "1.0 x rated current" | See the example below. |



(2) Electronic thermal characteristic

The frequency characteristic set as the electronic thermal characteristic is integrated with the value of "b012" or "b212".

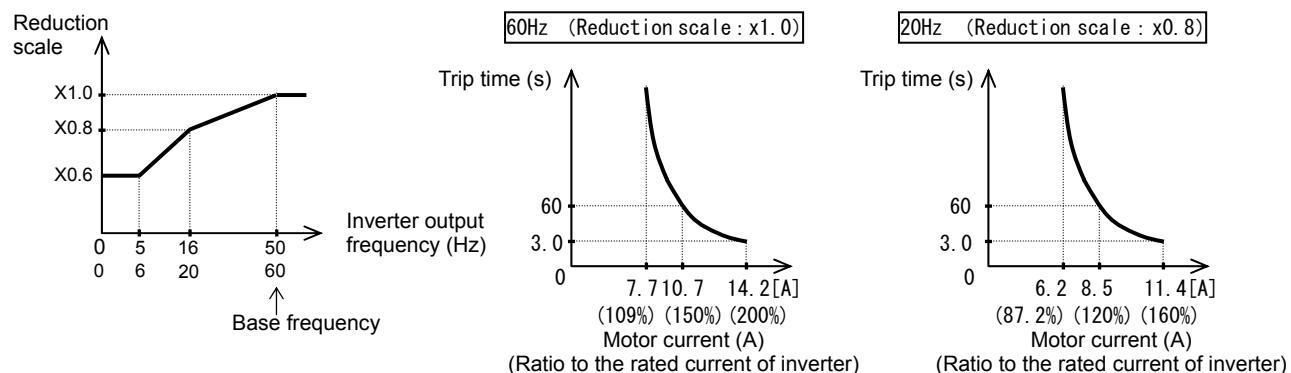
The cooling-fan performance of a general-purpose motor lowers when the motor speed is low. So load (current) is decreased.

The reduced-torque characteristic is designed to match the heat generation by Hitachi's general-purpose motors.

| Item | Function code | Data | Description |
|-----------------------------------|---------------|------|---|
| Electronic thermal characteristic | b013/b213 | 00 | Reduced-torque characteristic |
| | | 01 | Constant-torque characteristic |
| | | 02 | Free setting of electronic thermal characteristic |

(a) Reduced-torque characteristic

The time-limit characteristic determined by the value of "b012" or "b212" is integrated with each frequency multiplied by reduction scales. (Example) 015L**, Base frequency60Hz, (rated current7.1A = b012)

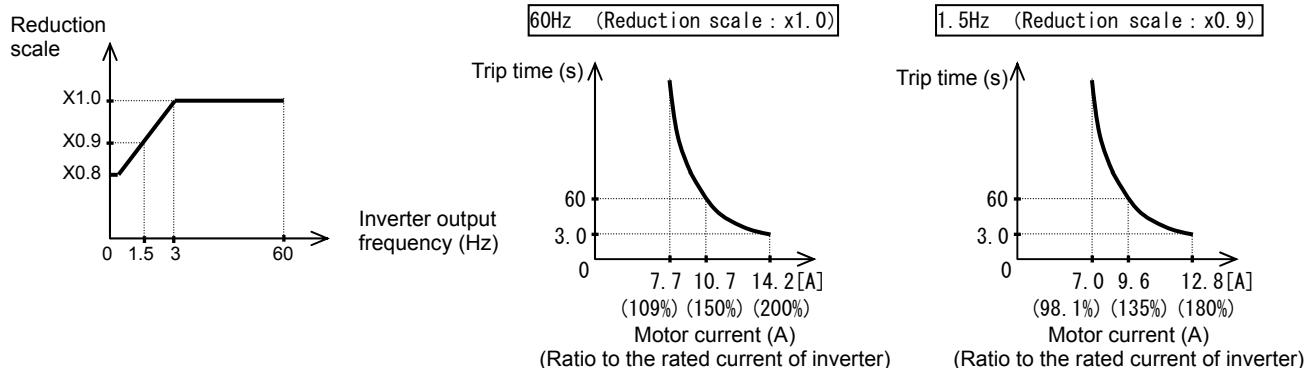


Chapter 7 Explanation of Functions

(b) Constant-torque characteristic

Make this setting when driving a constant-torque motor with the inverter.

(Example) 015L**, Base frequency60Hz, (rated current7.1A = b012)

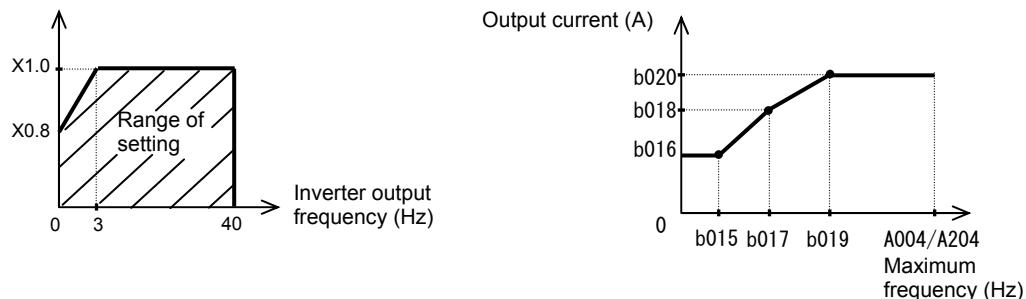


(c) Free setting of electronic thermal characteristic

To protect the motor against overheating, you can set the electronic thermal characteristic freely according to the load on the motor.

The range of setting is shown in the figures below.

| Item | Function code | Range of data | Description |
|--|----------------|--|---|
| Free setting, electronic thermal frequency (1) (2) (3) | b015/b017/b019 | 0. to 400. (Hz) | Setting of frequency at each breakpoint |
| Free setting, electronic thermal current (1) (2) (3) | b016/b018/b020 | "0.2 x rated current" to "1.0 x rated current" | Setting of the current at each breakpoint |



(3) Thermal warning

You can configure this function so that the inverter outputs a warning signal before the electronic thermal protection operates against motor overheating. You can also set the threshold level to output a warning signal with the electronic thermal warning level setting (C061).

To output the warning signal, assign function "13" (THM) to one of the intelligent output terminal [11] (C021) and the alarm relay terminal (C026).

And electronic thermal overload monitor is displayed on "d104".

| Item | Function code | Data | Description |
|--|---------------|---------------------|---|
| Electronic thermal warning level setting | C061 | 0. | Disabling the warning output |
| | | 1. to 100. (%) (*1) | Setting of the threshold level to output the thermal warning signal |

*1 Set the ratio (%) of the warning level to the integrated value of the electronic thermal characteristic. A setting of 100% corresponds to the inverter trip due to overload (error code "E05").

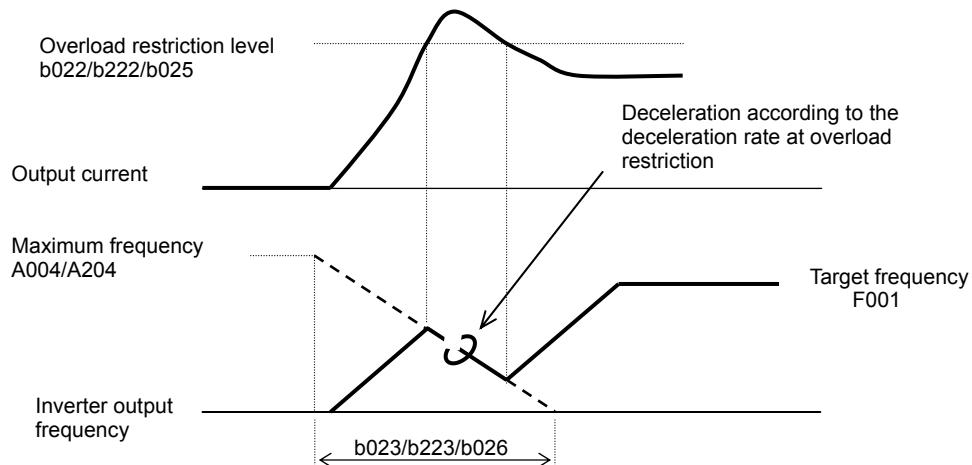
Chapter 7 Explanation of Functions

7.8.3 Overload restriction/overload notice

(1) Overload restriction function

- The overload restriction function allows you to make the inverter monitor the motor current during acceleration or constant-speed operation and automatically reduce the output frequency according to the deceleration rate at overload restriction when the motor current reaches the overload restriction level.
- This function prevents the moment of inertia from excessively increasing during motor acceleration and prevents the inverter from tripping because of overcurrent, even when the load changes suddenly during the constant-speed operation of the motor.
- You can specify two types of overload restriction operation by setting functional items "b021", "b022", and "b023" and functional items "b024", "b025", and "b026" separately.
- To switch the overload restriction operation between the two settings (setting with b021, b022, and b023 and setting with b024, b025, and b026), assign function "39" (OLR) to an intelligent input terminal. Turn the OLR signal on and off to switch between the two settings.
- The overload restriction level specifies the current at which to trigger the overload restriction function.
- The deceleration rate at overload restriction specifies the length of time to decelerate the motor from the maximum frequency to 0 Hz.
- When this function operates during deceleration, the acceleration time is prolonged over the set time. If the value set as the deceleration rate at overload restriction (b023/b223/b026) is too small, the inverter automatically decelerates the motor even during acceleration because of the overload restriction, and may trip because of the overvoltage caused by the energy regenerated by the motor.
- If this function operates during acceleration and the output frequency cannot reach the target frequency, try to make the following adjustments:
 - Increase the acceleration time.
 - Increase the overload restriction setting (b022/b222/b025).

| Item | Function code | Data or range of data | Description |
|---|-------------------|--|--|
| Overload restriction operation mode | b021/b221 b024 | 00 | Disabling the overload restriction |
| | | 01 | Enabling the overload restriction during acceleration and constant-speed operation |
| | | 02 | Enabling the overload restriction during constant-speed operation |
| Overload restriction setting | b022/b222 b025 | "Rated current x 0.2" to "rated current x 2.0" (A) | Current at which to trigger the overload restriction |
| Deceleration rate at overload restriction | b023/b223 b026 | 0.1 to 3000. (s) | Deceleration time to be applied when the overload restriction operates |
| Terminal function | C001 to C005 | 39 | Terminal to switch the overload restriction setting |



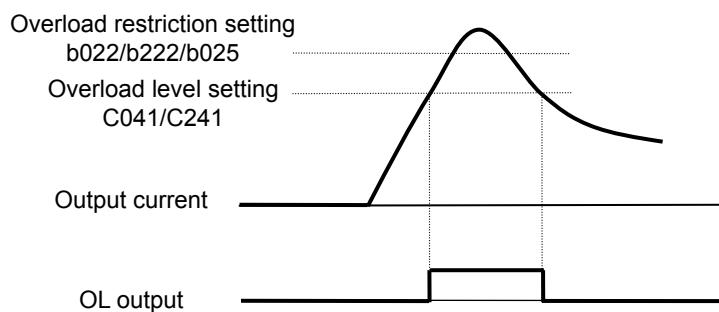
Chapter 7 Explanation of Functions

(2) Overload notice function

The overload notice function allows you to make the inverter output an overload notice signal before tripping because of overload.

You can use this function effectively to prevent the machine (e.g., a conveyor) driven by the inverter from being overloaded and prevent the conveyor from being stopped by the overload protection of the inverter. To use this function, assign function "03" (OL) to one of the intelligent output terminal [11] (C021) and the alarm relay terminal (C026).

| Item | Function code | Data or range of data | Description |
|-----------------------------|---------------|----------------------------------|---|
| Overload signal output mode | C040 | 00 | Enabling the warning output during acceleration, deceleration, and constant |
| | | 01 | Enabling the warning output during constant |
| Overload level setting | C041/C241 | 0.0 | Disabling the warning output |
| | | 0.0 to "2.0 x rated current" (A) | Specifying the current at which to output the OL signal (overload notice advance signal). |



7.8.4 Overcurrent restraint

The overcurrent restraint function allows you to restrain the overcurrent that can occur when the output current sharply increases because of rapid acceleration.

You can enable or disable the function by setting the overcurrent suppression enable (b027).

| Item | Function code | Data or range of data | Description |
|--------------------------------|---------------|-----------------------|-------------------------------------|
| Overcurrent suppression enable | b027 | 00 | Disabling the overcurrent restraint |
| | | 01 | Enabling the overcurrent restraint |

Note: When using the inverter for a lift, disable the overcurrent restraint function. If the overcurrent restraint functions during the lift operation, the lift may slide down because of insufficient torque.

Note: When an acceleration time is extremely short for the load, overcurrent trip may occur. In this case please adjust an acceleration time.

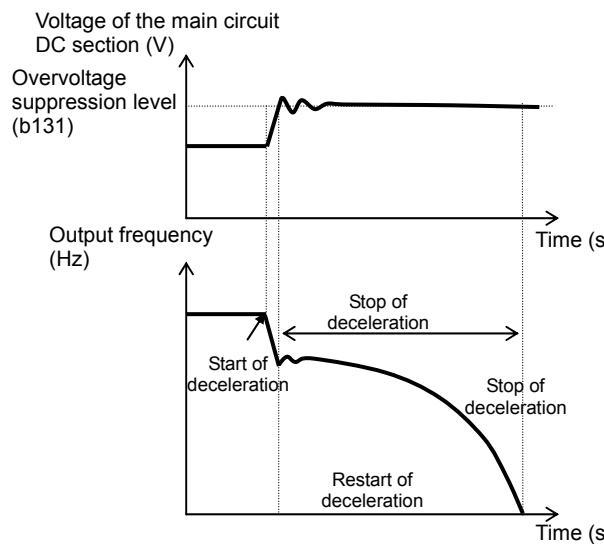
Chapter 7 Explanation of Functions

7.8.5 Over voltage suppression during deceleration

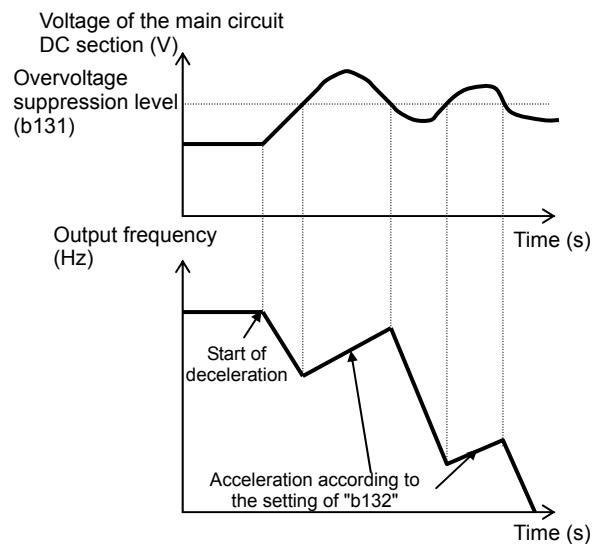
- The over voltage suppression function allows you to prevent the inverter from tripping because of the overvoltage that can be caused by the energy regenerated by the motor during deceleration.
- You can enable or disable the function by setting the overvoltage suppression enable (b130).
- When "01" (enabling the over voltage suppression [with deceleration stop]) is specified for the overvoltage suppression enable (b130), the inverter will decelerate by keeping the voltage of the main circuit DC section at over voltage suppression level (b131).
- When "02" (enabling the overvoltage suppression [with acceleration]) is specified for the overvoltage suppression enable (b130), the inverter will start acceleration according to the acceleration and deceleration rate at overvoltage suppression (b132) if the voltage of the main circuit DC section exceeds the overvoltage suppression level (b131). Subsequently, the inverter will restart deceleration when the voltage falls below the level (b131).

| Item | Function code | Data or range of data | Description |
|--|---------------|-----------------------|--|
| Overvoltage suppression enable | b130 | 00 | Disable |
| | | 01 | Enabling the overvoltage suppression (with controlled deceleration) (See example 1.) (note5) |
| | | 02 | Enabling the overvoltage suppression (with acceleration) (See example 2.) |
| | | 03 | Enabling the overvoltage suppression (It is effective at the constant/deceleration) |
| Overvoltage suppression level (See Note 4.) | b131 | 330 to 390 (V) | Level setting for 200 V class models |
| | | 660 to 780 (V) | Level setting for 400 V class models |
| Acceleration rate at overvoltage suppression | b132 | 0.10 to 30.00 (s) | Specifying the acceleration rate to be applied when the function is enabled (valid when b130=02) |
| Overvoltage suppression proportional gain | b133 | 0.00 to 5.00 | Overvoltage suppression proportional gain setting (valid when b130=01) |
| Overvoltage suppression integral time | b134 | 0.0 to 150.0 (s) | Overvoltage suppression integral time setting (valid when b130=01) |

(Example 1) When "b130" is "01":



(Example 2) When "b130" is "02":



Note 1:When this function is enabled, the actual acceleration time may be prolonged over the set time.

Note particularly that the motor may not be decelerated if the setting of "b131" is too small when "02" or "03" is specified for the overvoltage suppression enable (b130).

Note 2:This overcurrent restraint function does not maintain the DC voltage at a constant level. Therefore, inverter trips due to overvoltage may be caused by the setting of the deceleration rate or by a specific load condition.

Note 3:When this function is enabled, the inverter may require a long time to decelerate and stop the motor if the load on the motor or the moment of inertia on the motor is under a specific condition.

Note 4:If a voltage lower than the input voltage is specified for b131, the motor cannot be stopped.

Note 5:When "01" is specified for b130, PI control is performed so that internal DC voltage is maintained at a constant level.

- Setting a higher proportional gain (b133) results in a faster response. However, an excessively high proportional gain causes control to diverge and results in the inverter easily tripping.

- Setting a shorter integral time (b134) results in a faster response. However, an excessively short integral time results in the inverter easily tripping.

Chapter 7 Explanation of Functions

7.8.6 External trip (EXT) function

The external trip function allows you to make the inverter trip according to the error (trip) signal generated by an external system.

To use this function, assign function "12" (EXT) to one of the terminal [1] to [5] functions (C001 to C005). When the EXT terminal is turned on, the inverter trips with error code "E12" displayed and stops the output.

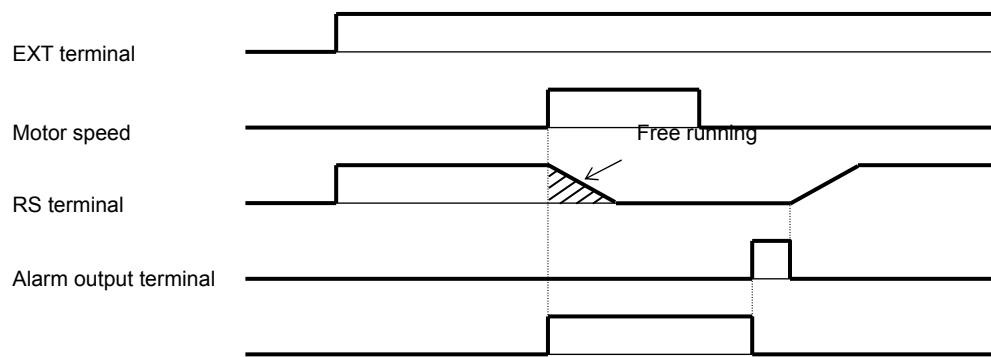
After the inverter trips with error code "E12" displayed, it will not be recovered from tripping, even when the error signal from the external system is reset (i.e., the EXT terminal is turned off).

To recover the inverter from tripping, reset the inverter or turn the inverter power off and on.

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|--------------------|
| Terminal [1] to [5] functions | C001 to C005 | 12 | EXT: External trip |

Note: Do not turn on the EXT terminal after the inverter power is shut off. Otherwise, the error history may not be stored correctly.

Operation commands
FW and RV



Chapter 7 Explanation of Functions

7.8.7 Automatic carrier frequency reduction

- The automatic carrier frequency reduction function automatically reduces the carrier frequency according to the increase in output current.
- To enable this function, specify "01" for automatic carrier frequency reduction selection (b089).

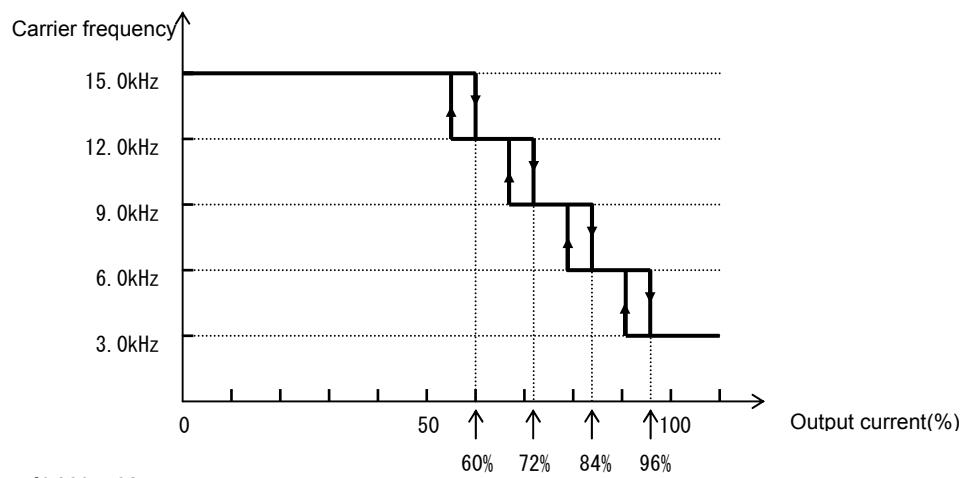
| Item | Function code | Range of data | Description |
|---------------------------------------|---------------|---------------|---|
| Automatic carrier frequency reduction | b089 | 00/01/02 | 00: Disabled, 01: Enabled, depending on the output current, 02: Enabled, depending on the heat-sink temperature |

- ex.) b089=01

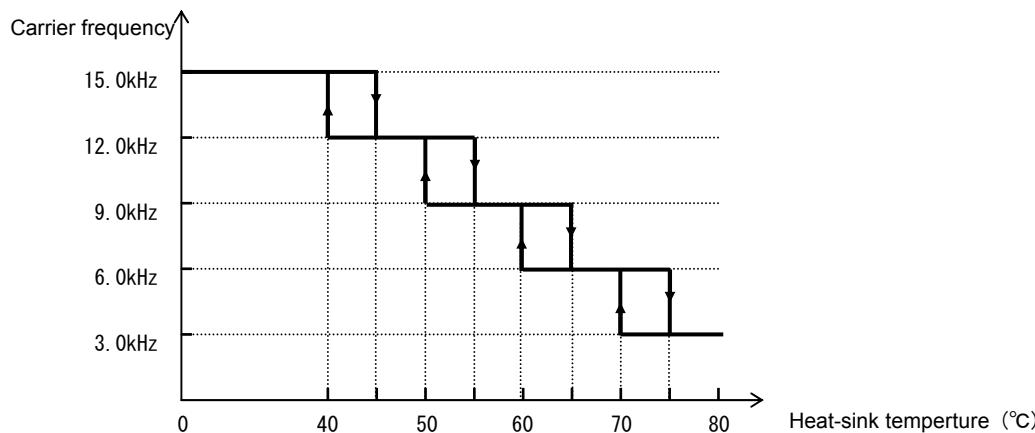
When the output current increases to 60%, 72%, 84%, or 96% of the rated current, this function reduces the carrier frequency to 12, 9, 6, or 3 kHz, respectively. This function restores the original carrier frequency when the output current decreases to 5% lower than each reduction start level.

| Carrier frequency reduction start level(Restoration level) | | Carrier frequency after reduction (kHz) |
|--|--|---|
| Current dependence [b089=01] | Heat-sink temperature dependence [b089=02] | |
| Less than 60% of rated current | Less than 45°C | 15.0 |
| 60% (55%) of rated current | 45°C(40°C) | 12.0 |
| 72% (67%) of rated current | 55°C(50°C) | 9.0 |
| 84% (79%) of rated current | 65°C(60°C) | 6.0 |
| 96% (91%) of rated current | 75°C(70°C) | 3.0 |

Action of b089 = 01



Action of b089 = 02



- The rate of carrier frequency reduction is 2 kHz per second.
- The maximum limit of carrier frequency change by this function is the value specified for the carrier frequency setting (b083); the minimum limit is 3 kHz. If 3 kHz or less frequency has been specified for b083, this function is disabled regardless of the setting of b089.

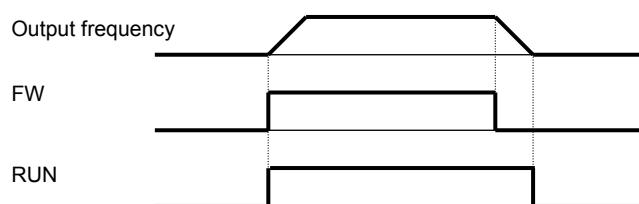
Chapter 7 Explanation of Functions

7.8.8 Running signal (RUN)

While the inverter is operating, it outputs the running (RUN) signal via an intelligent output terminal ([11]) or the alarm relay terminal.

To use this signal function, assign function "00" (RUN) to one of the intelligent output terminals [11] (C021) and the alarm relay terminal (C026).

The inverter outputs the RUN signal even while operating the DC brake. The following figure shows a timing chart for the signal output:



7.8.9 Frequency arrival signals (FA1, FA2, FA3)

The inverter outputs a frequency-arrival signal when the inverter output frequency reaches a set frequency. Assign the following functions to three of the intelligent output terminals [11] (C021) and the alarm relay terminal (C026):

"01" (FA1: constant-speed reached), "02" (FA2: set frequency overreached), "06" (FA3: set frequency reached)

The hysteresis of each frequency-arrival signal is as follows:

When the signal is on: ("set frequency" - "1% of maximum frequency") (Hz)

When the signal is off: ("set frequency" - "2% of maximum frequency") (Hz)

The signal hysteresis at acceleration with function "06" (FA3) set is as follows:

When the signal is on: ("set frequency" - "1% of maximum frequency") (Hz)

When the signal is off: ("set frequency" + "2% of maximum frequency") (Hz)

The signal hysteresis at deceleration with function "06" (FA3) set is as follows:

When the signal is on: ("set frequency" + "1% of maximum frequency") (Hz)

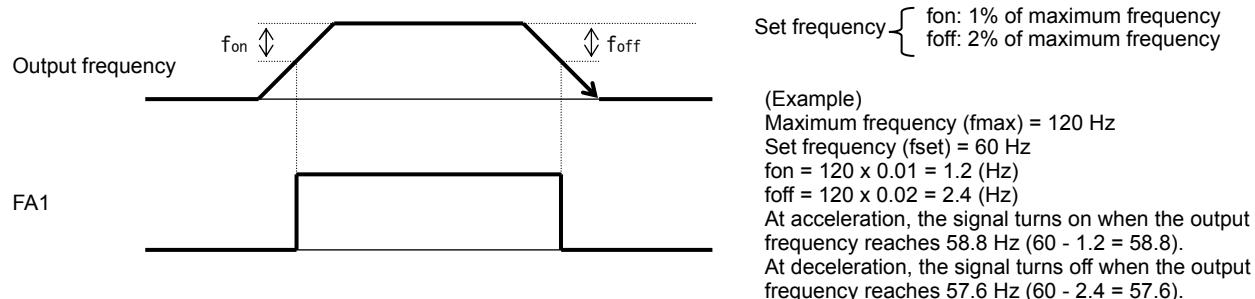
When the signal is off: ("set frequency" - "2% of maximum frequency") (Hz)

| Item | Function code | Range of data | Description |
|--------------------------------------|---------------|--------------------|-----------------------------------|
| Frequency arrival setting for accel. | C042 | 0.0 (Hz) | Disabling the output of frequency |
| | | 0.01 to 400.0 (Hz) | Enabling the output of frequency |
| Frequency arrival setting for decel. | C043 | 0.0 (Hz) | Disabling the output of frequency |
| | | 0.01 to 400.0 (Hz) | Enabling the output of frequency |

Chapter 7 Explanation of Functions

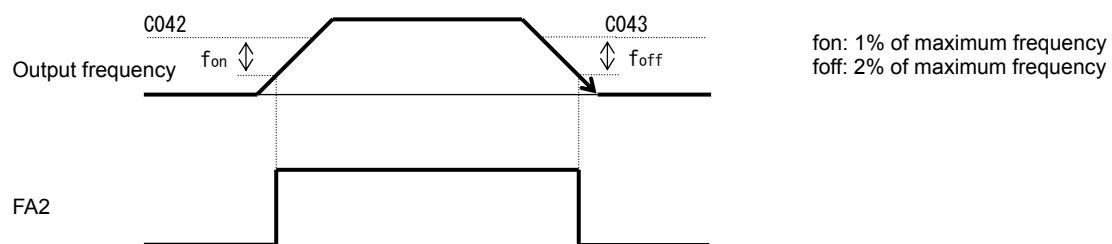
(1) Signal output when the constant-speed frequency is reached (01: FA1)

The inverter outputs the signal when the output frequency reaches the frequency specified by a frequency setting (F001, A020, A220) or multispeed setting (A021 to A027).



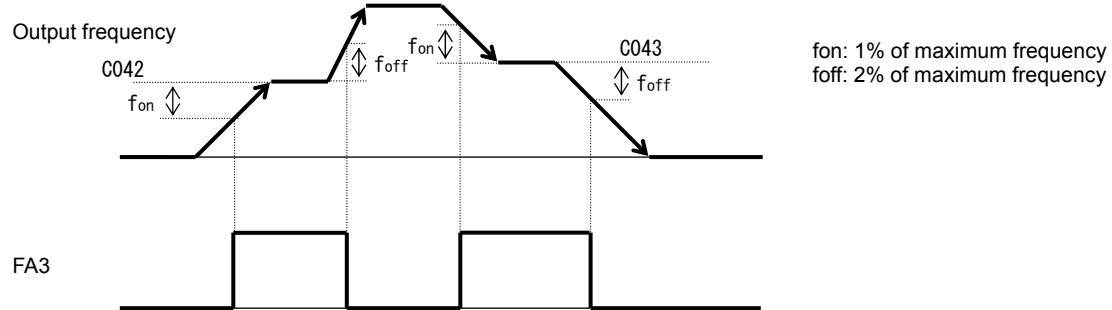
(2) Signal output when the set frequency is exceeded (02: FA2)

The inverter outputs the signal when the output frequency exceeds the acceleration or deceleration frequency specified by a frequency setting ("C042" or "C043" [FA2]).



(3) Signal output only when the set frequency is reached (06: FA3)

The inverter outputs the signal only when the output frequency reaches the frequency specified by a frequency setting ("C042" or "C043" [FA3]).



Chapter 7 Explanation of Functions

7.8.10 Running time over and power-on time over signals (RNT and ONT)

The inverter outputs the operation time over (RNT) signal or the plug-in time over (ONT) signal when the time specified as the run/power-on warning time (b034) is exceeded.

| Item | Function code | Range of data | Description |
|---------------------------|---------------|---------------|--|
| Run/power-on warning time | b034 | 0. | Disabling the signal output |
| | | 1. to 9999. | Setting in units of 10 hours (range: 10 to 99,990 hours) |
| | | 1000 to 6553 | Setting in units of 100 hours (range: 100,000 to 655,300 hours) |

(1) Operation time over (RNT) signal

To use this signal function, assign function "11" (RNT) to one of the intelligent output terminals [11] (C021) and the alarm relay terminal (C026).

Specify the run/power-on warning time (b034).

(2) Plug-in time over (ONT) signal

To use this signal function, assign function "12" (ONT) to one of the intelligent output terminals [11] (C021) and the alarm relay terminal (C026).

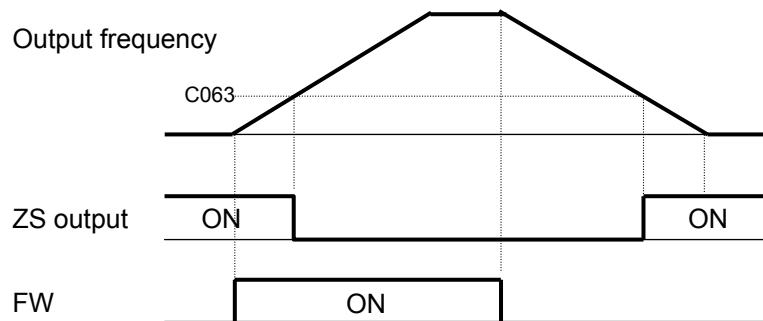
Specify the run/power-on warning time (b034).

7.8.11 0Hz speed detection signal (ZS)

The inverter outputs the 0 Hz speed detection signal when the inverter output frequency falls below the threshold frequency specified as the zero speed detection level (C063).

To use this signal function, assign function "21" (ZS) to one of the intelligent output terminals [11] (C021) and the alarm relay terminal (C026).

| Item | Function code | Data or range of data | Description |
|----------------------------|---------------|-----------------------|---|
| Zero speed detection level | C063 | 0.00 to 100.0 (Hz) | Setting of the frequency to be determined as 0 Hz |



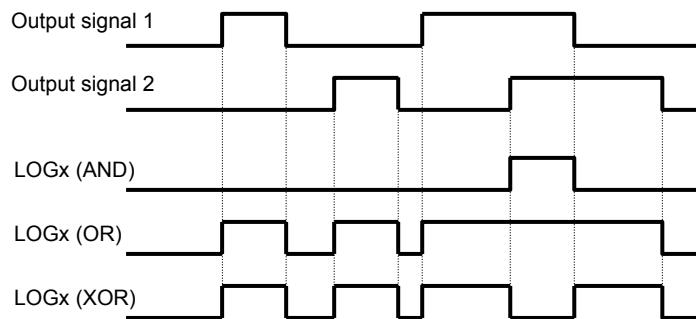
Chapter 7 Explanation of Functions

7.8.12 Logical output signal operation function (LOG1)

The logical output signal operation function allows you to make the inverter internally perform a logical operation of output signals.

This function applies to all output signals, except to logical operation results (LOG1) and allocation none (NO).

Three types of operators (AND, OR, and XOR) are selectable.



| Selected signal | Operation-target 1 selection | Operation-target 2 selection | Operator selection |
|------------------------------------|------------------------------|------------------------------|--------------------|
| 33: Logical output signal 1 (LOG1) | C142 | C143 | C144 |

(Example) To output the AND of the running signal (00: RUN) and set the frequency overreached signal (02: FA2) as the logical output signal 1 (LOG1) to the intelligent output terminal [11]:

- Intelligent output terminal [11] (C021): 33 (LOG1)
- Logical output signal 1 selection 1 (C142): 00 (RUN)
- Logical output signal 1 selection 2 (C143): 02 (FA2)
- Logical output signal 1 operator (C144): 00 (AND)

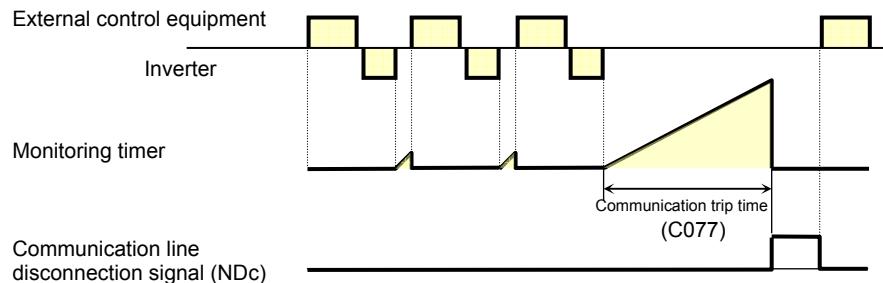
| Item | Function code | Data or range of data | Description |
|--|---------------|---|---------------------------------|
| Logical output signal selection 1 | C142 | Selection of "00" to "60" from the data (except LOG1,no) output to intelligent output terminals | Selection of operation-target 1 |
| Logical output signal selection 2 | C143 | Selection of "00" to "60" from the data (except LOG1,no) output to intelligent output terminals | Selection of operation-target 2 |
| Logical output signal operator selection | C144 | 00 01 02 | AND OR XOR |

Chapter 7 Explanation of Functions

7.8.13 Communication line disconnection signal (NDc)

This signal function is enabled when ModBus-RTU has been selected for the RS485 communication. If a reception timeout occurs, the inverter continues to output the communication line disconnection signal until it receives the next data.

Specify the limit time for reception timeout by setting the communication trip time (C077).



| Item | Function code | Data or range of data | Description |
|-------------------------------|---------------|-----------------------|---|
| Terminal function | C021 | 32 | NDc: Communication line disconnection signal |
| Alarm relay terminal function | C026 | | |
| Communication trip time | C077 | 0.00 to 99.99 (s) | Setting of the limit time for reception timeout |

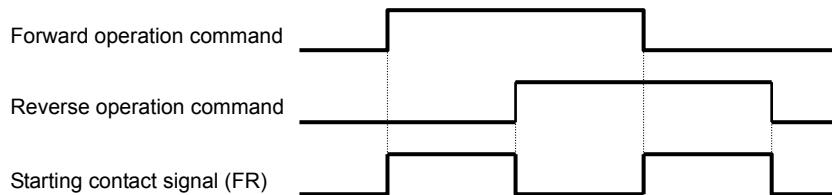
7.8.14 Starting contact signal (FR)

The inverter outputs the starting contact (FR) signal while it is receiving an operation command.

The FR signal is output, regardless of the setting of the run command source setting (A002).

If the forward operation (FW) and reverse operation (RV) commands are input at the same time, the inverter stops the motor operation.

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|-----------------------------|
| Terminal function | C021 | 41 | FR: Starting contact signal |
| Alarm relay terminal function | C026 | | |



7.8.15 Heat sink overheat warning signal (OHF)

The inverter monitors the temperature of its internal heat sink, and outputs the heat sink overheat warning (OHF) signal when the temperature exceeds the heat sink overheat warning level (C064).

| Item | Function code | Data or range of data | Description |
|----------------------------------|---------------|-----------------------|---|
| Terminal function | C021 | 42 | OHF: Heat sink overheat warning signal |
| Alarm relay terminal function | C026 | | |
| Heat sink overheat warning level | C064 | 0. to 110. (°C) | Setting of the threshold temperature at which to output the heat sink overheat warning signal |

Chapter 7 Explanation of Functions

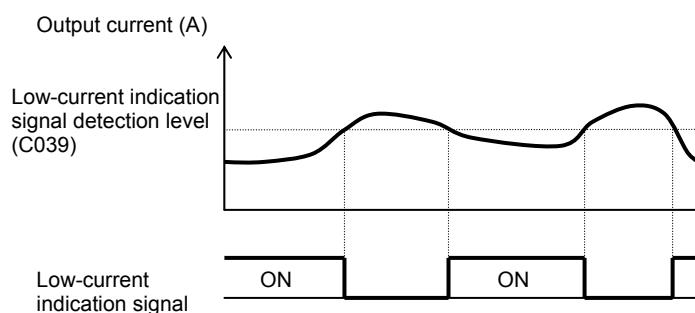
7.8.16 Low-current indication (LOC) signal

The inverter outputs the low-current indication (LOC) signal when the inverter output current falls to the low-current indication signal detection level (C039) or less.

You can select one of the two signal output modes with the low-current indication signal output mode selection (C038). In one mode, the LOC signal output is always enabled during the inverter operation. In the other mode, the LOC signal output is enabled only while the inverter is driving the motor for constant-speed operation.

| Item | Function code | Data or range of data | Description |
|---|---------------|----------------------------------|---|
| Terminal function | C021 | | |
| Alarm relay terminal function | C026 | 43 | LOC: Low-current indication signal |
| Low-current indication signal output mode selection | C038 | 00 | Enabling the signal output during operation |
| | | 01 | Enabling the signal output only during constant-speed operation (*1) |
| Low-current indication signal detection level | C039 | 0.0 to "2.0 x rated current" (A) | Setting of the threshold current level at which to output the low-current indication signal |

(*1) When 01 (control circuit terminal) is selected as frequency source setting (A001), there is a case that inverter does not recognize the speed as constant value due to sampling. In this case, adjusting is to be made by setting C038=00 (valid during operation) or increasing analogue input filter (A016).



7.8.17 Inverter ready signal (IRDY)

The inverter outputs the inverter ready (IRDY) signal when it is ready for operation (i.e., when it can receive an operation command).

- The inverter can recognize only the operation command that is input while the IRDY signal is output.
- If the IRDY signal is not output, check whether the input power supply voltage (connected to the R, S, and T terminals) is within the range of specification.

| Item | Function code | Data or range of data | Description |
|-------------------------------|---------------|-----------------------|-----------------------------|
| Terminal function | C021 | | |
| Alarm relay terminal function | C026 | 50 | IRDY: Inverter ready signal |

7.8.18 Forward rotation signal (FWR)

The inverter continues to output the forward rotation (FWR) signal while it is driving the motor for forward operation. The FWR signal is turned off while the inverter is driving the motor for reverse operation or stopping the motor.

| Item | Function code | Data or range of data | Description |
|-------------------------------|---------------|-----------------------|------------------------------|
| Terminal function | C021 | | |
| Alarm relay terminal function | C026 | 51 | FWR: Forward rotation signal |

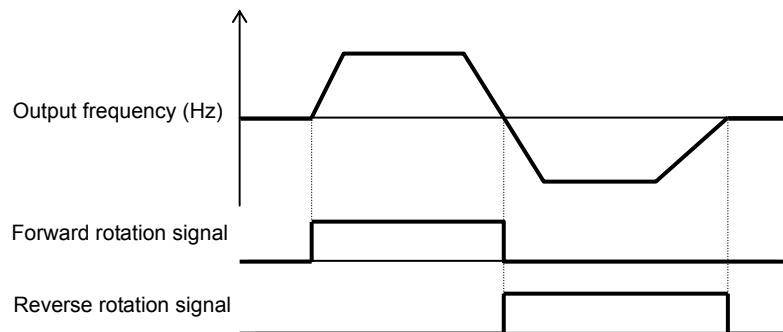
Chapter 7 Explanation of Functions

7.8.19 Reverse rotation signal (RVR)

The inverter continues to output the forward rotation (RVR) signal while it is driving the motor for reverse operation.

The RVR signal is turned off while the inverter is driving the motor for forward operation or stopping the motor.

| Item | Function code | Data or range of data | Description |
|-------------------------------|---------------|-----------------------|------------------------------|
| Terminal function | C021 | 52 | |
| Alarm relay terminal function | C026 | | RVR: Reverse rotation signal |



7.8.20 Major failure signal (MJA)

The inverter outputs the major failure (MJA) signal in addition to an alarm signal when it trips because of one of the errors listed below.

| No. | Error code | Description |
|-----|------------|---|
| 1 | E08.* | Memory error |
| 2 | E10.* | Current detection error |
| 3 | E11.* | CPU error |
| 4 | E14.* | Ground-fault protection |
| 5 | E19.* | Inverter thermal detection system error |

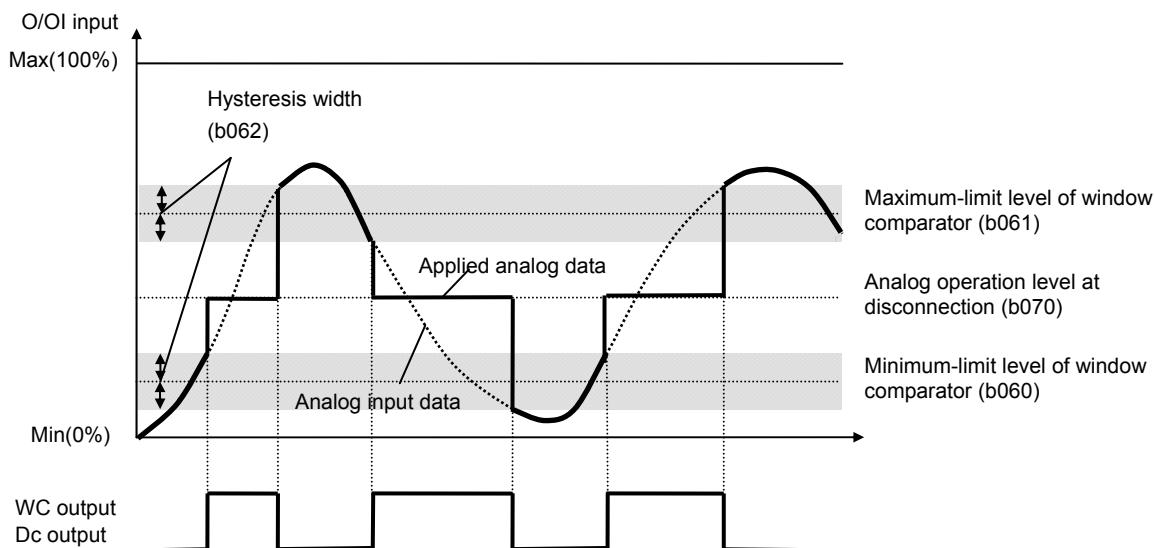
| Item | Function code | Data or range of data | Description |
|-------------------------------|---------------|-----------------------|---------------------------|
| Terminal function | C021 | 53 | |
| Alarm relay terminal function | C026 | | MJA: Major failure signal |

Chapter 7 Explanation of Functions

7.8.21 Window comparators (WC) (detection of terminal disconnection:Dc)

- The window comparator function outputs signals when the values of analog inputs O/OI is within the maximum and minimum limits specified for the window comparator. You can monitor analog inputs with reference to arbitrary levels (to find input terminal disconnection and other errors).
- You can specify a hysteresis width for the maximum-limit and minimum-limit levels of the window comparator.
- You can specify limit levels and a hysteresis width individually for analog inputs O/OI.
- You can fix the analog input data to be applied to an arbitrary value when WC is output. For this purpose, specify a desired value as the operation level at O/OI disconnection (b070). When "no" is specified, the analog input data is reflected as input.
- Output values of Dc is the same as those of WC respectively.

| Item | Function code | Range of data | Description |
|--|---------------|--|---|
| Terminal [11] functions | C021 C026 | 27 | Dc: Detection of analog input disconnection |
| Alarm relay terminal function | | 54 | WC: Window comparator |
| Maximum-limit level of window comparators O/OI | b060 | "Minimum-limit level + hysteresis width*2 (minimum of 0)" to 100. (%) | Setting of maximum-limit level |
| Minimum-limit level of window comparators O/OI | b061 | 0 to "maximum-limit level - hysteresis width*2 (maximum of 100)" (%) | Setting of minimum-limit level |
| Hysteresis width of window comparators O/OI | b062 | 0 to "(maximum-limit level - minimum-limit level)/2 (maximum of 10)" (%) | Setting of hysteresis width for maximum-limit and minimum-limit levels |
| Operation level at O/OI disconnection | b070 | 0 to 100 (%) or "no" (ignore) | Setting of the analog input value to be applied when WC (Dc) is output. |



Chapter 7 Explanation of Functions

7.8.22 Frequency command source (FREF)

This function outputs a signal when the (A001 = 02). However, this function is disabled when the second control mode.

The rest of the time (A001 = 02) the signal is turned OFF.

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|----------------------------|
| Terminal [11] functions | C021 | 58 | FREF : Frequency reference |
| Alarm relay terminal function | C026 | | |

7.8.23 RUN command source (REF)

This function outputs a signal when the (A002 = 02). However, this function is disabled when the second control mode.

The rest of the time (A002 = 02) the signal is turned OFF.

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|---------------------|
| Terminal [11] functions | C021 | 59 | REF : Run reference |
| Alarm relay terminal function | C026 | | |

7.8.24 2nd Motor in operation (SETM)

When SET terminal of intelligent input is ON, it output signal.

| Item | Function code | Data | Description |
|-------------------------------|---------------|------|---|
| Terminal [11] functions | C021 | 60 | SETM : 2 nd motor in operation |
| Alarm relay terminal function | C026 | | |

7.8.25 Ground fault detection

When the power is turned on, then select whether to ground fault detection.

Ground fault detection might be detected when the power is turned while the motor is rotating.

| Item | Function code | Data | Description |
|------------------------|---------------|-------|------------------|
| Ground fault detection | C155 | 00,01 | 00 : OFF、01 : ON |

7.8.26 Out phase loss detection

This function is to choose whether to perform output phase loss detection.

This function works when the output frequency for not less than 5Hz but not more than 100Hz.

In some cases depending on the state of the output current is low or not detected, this function doesn't work. In addition, this function may be detected when hunting.

| Item | Function code | Data | Description |
|--------------------------|---------------|-------|------------------|
| Out phase loss detection | C157 | 00,01 | 00 : OFF、01 : ON |

Chapter 7 Explanation of Functions

7.9 Initializing

7.9.1 Initialization setting

The initialization function allows you to initialize the adjusted settings on the inverter to restore the factory (default) settings. You can also clear the trip history data alone.

The Cumulative operation RUN time / Power on time are not cleared.

| Item | Function code | Data | Description |
|---|---------------|------|---|
| Initialization mode (parameters or trip history) | b084 | 00 | Disabling |
| | | 01 | Clearing the trip history |
| | | 02 | Initializing the data |
| | | 03 | Clearing the trip history and Initializing the data |
| Initialization target data setting | b094 | 00 | All parameters |
| | | 01 | All parameters except in/output terminals and communication (Note1) |
| Country code for initialization | b085 | 00 | Mode 0 |
| | | 01 | Mode 1 |
| Initialization trigger | b180 | 00 | No action |
| | | 01 | Initialize |

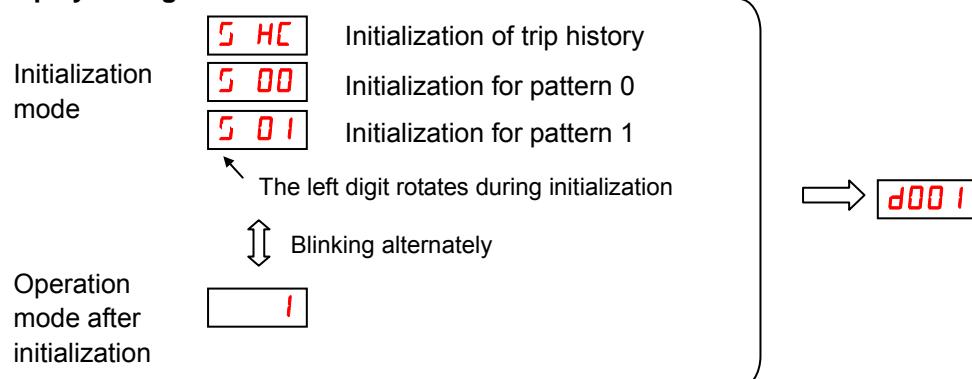
Note1: The parameters to be related to are as follows.

| Data of b094 | Function code | Description |
|------------------------------------|---------------|--|
| Parameters for in/output terminals | C001 to C005 | Input terminal [1] to [5] function |
| | C011 to C015 | Input terminal [1] to [5] active state |
| | C021 | Output terminal [11] function |
| | C026 | Reray terminal function |
| | C031 | Output terminal [11] active state |
| | C036 | Reray terminal active state |
| Parameters for communication | C070 | Selection of OPE/Modbus |
| | C071 | Communication speed selection |
| | C072 | Communication node allocation |
| | C074 | Communication parity selection |
| | C075 | Communication stop bit selection |
| | C076 | Communication error mode |
| | C077 | Communication error time |
| | C078 | Communication wait time |

To initialize the inverter, follow the steps below.

- (1) Select initialization mode in **b084**.
- (2) If **b084=02** or **03**, select initialization target data in **b094**.
- (3) If **b084=02** or **03**, select country code in **b085**.
- (4) Set **0 1** in **b180**.
- (5) The following display appears for a few seconds, and initialization is completed with **001** displayed.

Display during initialization



Note2 : Data of b084,b180 are not saved in the memory to avoid unintentional initializing.

Note3 : b085, b094, C081(O/OI input span calibration) is not initialized.

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Chapter 8 Communication Functions

This chapter describes the Communication functions. (Modbus-RTU)

| | | |
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| 8.2 | Connecting the Inverter to Modbus | 8 - 2 |
| 8.3 | Modbus setting procedure..... | 8 - 3 |
| 8.4 | Modbus Communication parameter..... | 8 - 4 |
| 8.5 | Modbus Protocol Reference | 8 - 5 |
| 8.6 | Explanation of function codes | 8 - 9 |
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| 8.8 | Modbus Data Listing | 8 - 19 |

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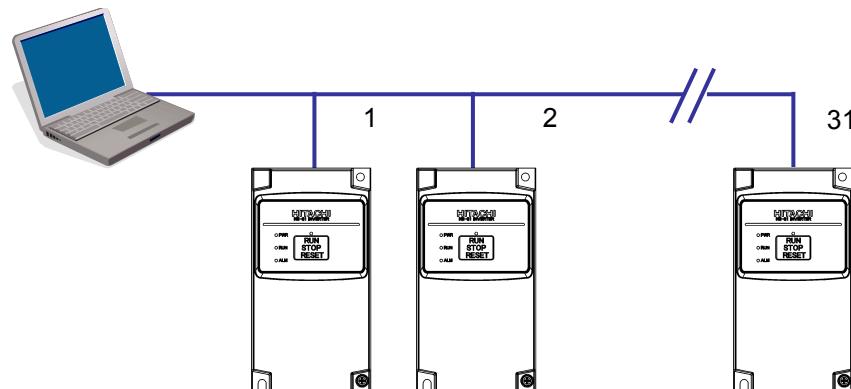
Chapter 8 Communication Functions

8.1 Communication Specification

NE-S1 Series inverters have built-in RS-485 serial communications, featuring the Modbus RTU protocol. The inverters can connect directly to existing factory networks or work with new networked applications, without any extra interface equipment. The specifications are in the following table.

| Item | Specifications | User-selectable |
|------------------------|---|-----------------|
| Transmission speed | 4800 / 9600 / 19.2k / 38.4k bps | ✓ |
| Communication mode | Asynchronous | ✗ |
| Character code | Binary | ✗ |
| LSB placement | Transmits LSB first | ✗ |
| Electrical interface | RS-485 differential transceiver | ✗ |
| Data bits | 8-bit (Modbus RTU mode) | ✗ |
| Parity | None / even / odd | ✓ |
| Stop bits | 1 or 2 bits | ✓ |
| Startup convention | One-way start from host device | ✗ |
| Wait time for response | 0 to 1000 msec. | ✓ |
| Connections | Station address numbers from 1 to 247 | ✓ |
| Connector | Terminal connector | — |
| Error check | Overrun, Framing block check code, CRC-16, or horizontal parity | — |
| Cable length | 500m maximum | |

The network diagram below shows a series of inverters communicating with a host computer. Each inverter must have a unique address, from 1 to 247, on the network. In a typical application, a host computer or controller is the master and each of the inverter(s) or other devices is a slave.



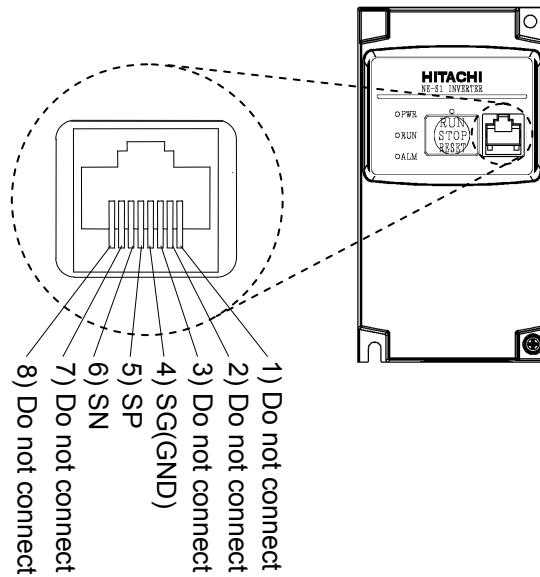
Chapter 8 Communication Functions

8.2 Connecting the Inverter to Modbus

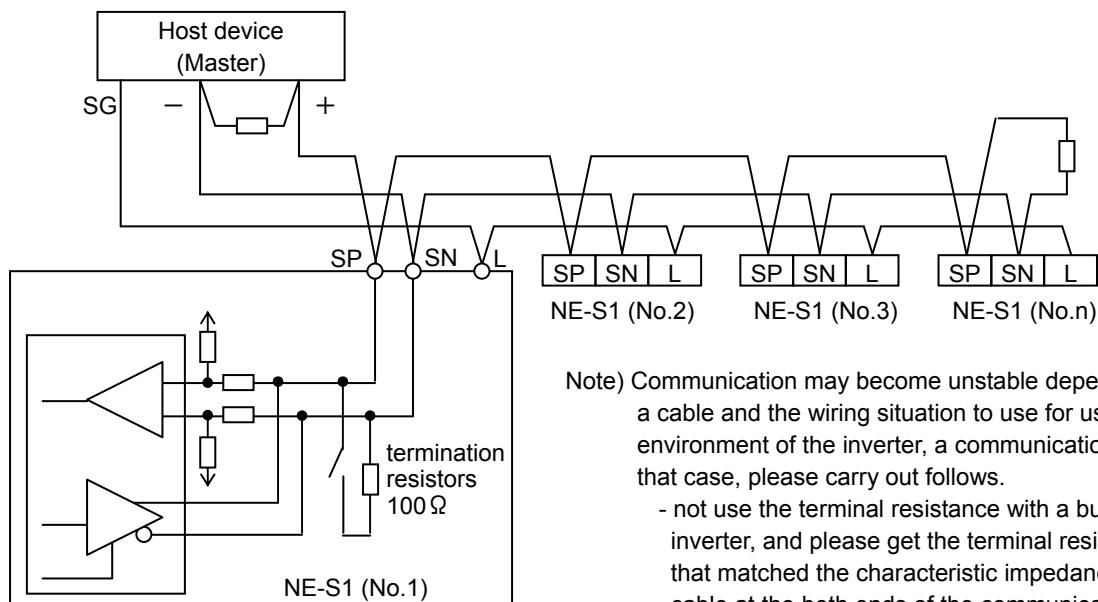
The Modbus communication uses a pin of RJ45 as below.

The the RJ45 connector is used for the external operator and Modbus communication.

| Pin No: | Signal Symbol | Description |
|---------|----------------|-------------------------------|
| 1 | DC+5V | For Operator. Do not connect. |
| 2 | — | For Operator. Do not connect. |
| 3 | — | For Operator. Do not connect. |
| 4 | SG(GND) | Signal Ground |
| 5 | S P | Send Data Positive |
| 6 | S N | Send Data Negative |
| 7 | (GND) | For Operator. Do not connect. |
| 8 | — | Not used. Do not connect. |



Please connect each inverter like the chart below in parallel.



Note) Communication may become unstable depending on a cable and the wiring situation to use for use environment of the inverter, a communication line. In that case, please carry out follows.

- not use the terminal resistance with a built-in inverter, and please get the terminal resistance that matched the characteristic impedance of the cable at the both ends of the communications cable.(the terminal resistance having built-in to inverter is 100 Ω.)
- Please connect a signal ground of each inverter to external equipment (master).
- Please lower a transfer speed.
- Please insert a repeater.

Chapter 8 Communication Functions

8.3 Modbus setting procedure

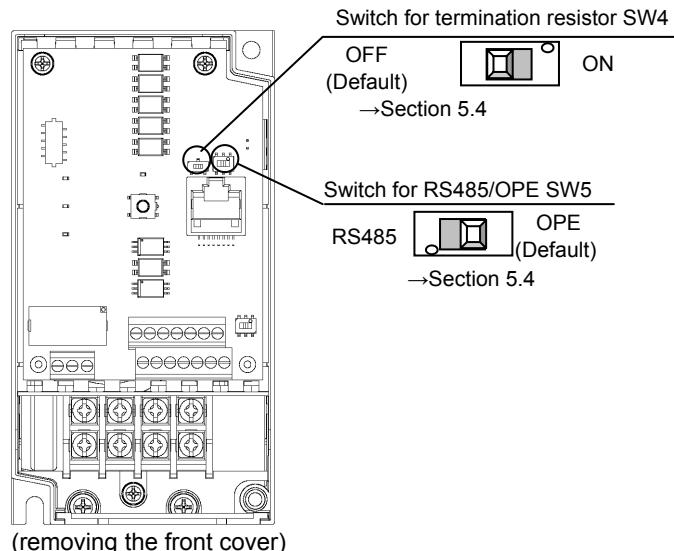
1. Changes from an operator mode to Modbus

- 1) Set a parameter (cf. 8.4) for Modbus communication by the exclusive operator (NES1-OP), remote operator (OPE-S/SR/SBK/SRmini,WOP), or ProDriveNext. (It is necessary to be set the operator side (OFF, right side) in RS485 communication / operator switch (SW5) when use the remote operator (OPE-S/SR/SBK/SRmini,WOP) or ProDriveNext. (default))
- 2) Inverter power OFF and take off the connection cable of the remote operator or ProDriveNext ,etc.
- 3) Remove the front cover.
- 4) Change RS485 communication / operator switch (SW5) to RS485 side (ON, left side).
- 5) When terminal resistance is necessary, Change terminal resistance switch (SW4) to effective (ON, right side).
- 6) Attach the front cover.
- 7) The communications cable connected to bus line of Modbus.
- 8) Inverter power ON and start Modbus communication.

2. Changes from Modbus to an operator mode

- 1) Inverter power OFF and take off a communications cable of Modbus.
- 2) Remove the front cover.
- 3) Change RS485 communication / operator switch (SW5) to operator side (OFF, right side).
- 4) Attach the front cover.
- 5) Connect the connection cable of the remote operator or ProDriveNext ,etc.
- 6) Inverter power ON while pushing the RUN/STOP/RESET key to standard operation panel. (please keep pushing key about 5 seconds).
- 7) After the operator available, change setting of communication choice (C070) to 01(Modbus) → 00(OPE) and inverter power OFF.
- 8) Inverter power ON again. The operator is available.

Note) The exclusive operator (NES1-OP) is available at the time of the Modbus communication use.



Chapter 8 Communication Functions

8.4 Modbus Communication parameter

Inverter Parameter Setup - The inverter has several settings related to Modbus communications. The table below lists them together. The *Required* column indicates which parameters *must* be set properly to allow communications. You may need to refer to the host computer documentation in order to match some of its settings.

| Func. Code | Name | Required | Settings |
|------------|------------------------------|----------|---|
| A001 | Frequency source | ✓ | 00...Keypad potentiometer 01...Control terminal 02...Function F001 setting 03...Modbus network input 10 ...Calculate function output |
| A002 | Run command source | ✓ | 01...Control terminal 02...Run key on keypad, or digital operator 03 ... Modbus network input |
| C070 | Selection of OPE/Modbus | ✓ | 00... Operator 01....Modbus-RTU |
| C071 | Communication speed | ✓ | 04...4800 bps 05 9600 bps 06 19.2k bps 07...38.4k bps |
| C072 | Modbus Address | ✓ | Network address, range is 1 to 247 |
| C074 | Communication parity | ✓ | 00...No parity 01...Even parity 02...Odd parity |
| C075 | Communication stop bit | ✓ | Range is 1 or 2 |
| C076 | Communication error select | – | 00...Trip (Error code E60) 01...Decelerate to a stop and trip 02...Disable 03...Free run stop (coasting) 04...Decelerate to a stop |
| C077 | Communication error time-out | – | Comm. Watchdog timer period, range is 0.00 to 99.99 sec. |
| C078 | Communication wait time | ✓ | Time the inverter waits after receiving a message before it transmits. Range is 0. to 1000. ms |

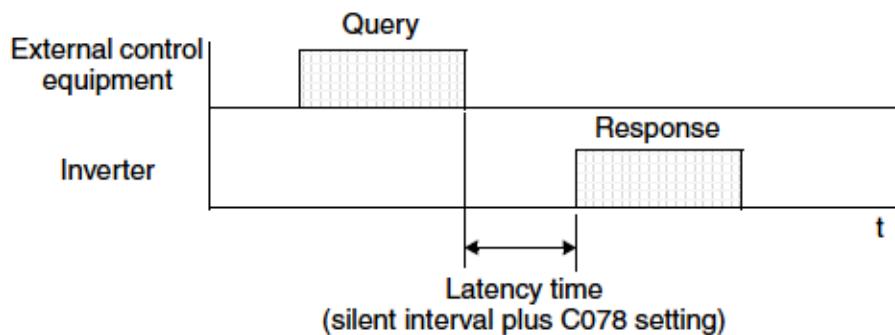
Note) When you change any of the parameters above, the inverter power must be rebooted in order to activate new parameters.

Chapter 8 Communication Functions

8.5 Modbus Protocol Reference

Transmission procedure

The transmission between the external control equipment and the inverter takes the procedure below.



- Query - A frame sent from the external control equipment to the inverter
- Response - A frame returned from inverter to the external control equipment

The inverter returns the response only after the inverter receives a query from the external control equipment and does not output the response positively. Each frame is formatted (with commands) as follows:

| Frame Format |
|---------------------------|
| Header (silent interval) |
| Slave address |
| Function code |
| Data |
| Error check |
| Trailer (silent interval) |

Chapter 8 Communication Functions

Message Configuration: Query

Slave address:

- This is a number of 1 to 247 assigned to each inverter (slave). (Only the inverter having the address given as a slave address in the query can receive the query.)
- When slave address “0” is specified, the query can be addressed to all inverters simultaneously. (Broadcasting)
- In broadcasting, you cannot call and loop back data.

Data:

- A function command is set here.
- The data format used in the NE-S1 series is corresponding to the Modbus data format below.

| Name of Data | Description |
|------------------|--|
| Coil | Binary data that can be referenced and changed (1 bit long) |
| Holding Register | 16-bit data that can be referenced and changed |

- The negative data use 2 complements.

Function code:

Specify a function you want to make the inverter execute. Function codes available to the NE-S1 series are listed below.

| Function Code | Function | Maximum data size (bytes available per message) | Maximum number of data elements available per message |
|---------------|-----------------------------|---|---|
| 0 1 h | Read Coil Status | 4 | 32 coils (in bits) |
| 0 3 h | Read Holding Resistor | 32 | 16 registers (in bytes) |
| 0 5 h | Write in Coil | 2 | 1 coil (in bits) |
| 0 6 h | Write in Holding Register | 2 | 1 register (in bytes) |
| 0 8 h | Loopback Test | – | – |
| 0 F h | Write in Coils | 4 | 32 coils (in bits) |
| 1 0 h | Write in Registers | 32 | 16 registers (in bytes) |
| 1 7h | Read/Write Holding Register | 32 | 16 registers (in bytes) |

Error check:

Modbus-RTU uses CRC (Cyclic Redundancy Check) for error checking.

- The CRC code is 16-bit data that is generated for 8-bit blocks of arbitrary length.
- The CRC code is generated by a generator polynomial CRC-16 ($X^{16} + X^{15} + X^2 + 1$).

Header and trailer (silent interval):

Latency is the time between the reception of a query from the master and transmission of a response from the inverter.

- 3.5 characters (24 bits) are always required for latency time. If the latency time shorter than 3.5 characters, the inverter returns no response.
- The actual transmission latency time is the sum of silent interval (3.5 characters long) + C078 (transmission latency time).

Chapter 8 Communication Functions

Message Configuration: Response

Transmission time required:

- A time period between reception of a query from the master and transmission of a response from the inverter is the sum of the silent interval (3.5 characters long) + C078 (transmission latency time).
- The master must provide a time period of the silent interval (3.5 characters long or longer) before sending another query to an inverter after receiving a response from the inverter.

Normal response:

- When receiving a query that contains a function code of Loopback (08h), the inverter returns a response of the same content of the query.
- When receiving a query that contains a function code of Write in Register or Coil (05h, 06h, 0Fh, or 10h), the inverter directly returns the query as a response.
- When receiving a query that contains a function code of Read Register or Coil (01h or 03h), the inverter returns, as a response, the read data together with the same slave address and function code as those of the query.

Response when an error occurs:

- When finding any error in a query (except for a transmission error), the inverter returns an exception response without executing anything.
- You can check the error by the function code in the response. The function code of the exception response is the sum of the function code of the query and 80h.
- The content of the error is known from the exception code.

| Field Configuration | |
|---------------------|--|
| Slave address | |
| Function code | |
| Exception code | |
| CRC-16 | |

| Exception Code | Description |
|----------------|---|
| 0 1 h | The specified function is not supported. |
| 0 2 h | The specified function is not found. |
| 0 3 h | The format of the specified data is not acceptable. |
| 2 1 h | The data to be written in a holding register is outside the inverter. |
| 2 2 h | The specified functions are not available to the inverter. <ul style="list-style-type: none"> • Function to change the content of a register that cannot be changed while the inverter is in service • Function to submit an ENTER command during running (UV) • Function to write in a register during tripping (UV) • Function to change the I/O terminal configuration which is not allowed. • Function to change active state of RS (reset) terminal • Function to write in a register locked by softlock |
| 2 3h | The register (or coil) to be written in is read-only |

Chapter 8 Communication Functions

No response occurs:

In the cases below, the inverter ignores a query and returns no response.

- When receiving a broadcasting query
- When detecting a transmission error in reception of a query
- When the slave address set in the query is not equal to the slave address of the inverter
- When a time interval between data elements constituting a message is shorter than 3.5 characters
- When the data length of the query is invalid
- When the reception space is more than 1.5 characters in the frame
- When an error check cord of query is incongruous (CRC error)

Note) Provide a timer in the master and make the master retransmit the same query when no response is made within a preset time period after the preceding query was sent.

Chapter 8 Communication Functions

8.6 Explanation of function codes

(A) Read Coil Status [01h]

This function reads the status (ON/OFF) of selected coils. An example follows below.

- Read intelligent input terminals [1] to [5] of an inverter having a slave address “8.”
- This example assumes the intelligent input terminals have terminal states listed below.

| Item | Data | | | | |
|----------------------------|------|-----|-----|-----|-----|
| Intelligent input terminal | [1] | [2] | [3] | [4] | [5] |
| Coil number | 7 | 8 | 9 | 10 | 11 |
| Coil Status | ON | OFF | ON | OFF | OFF |

Query:

| No. | Field Name | Example (Hex) |
|-----|------------------------------------|---------------|
| 1 | Slave address *1 | 08 |
| 2 | Function code | 01 |
| 3 | Coil start address *4 (high order) | 00 |
| 4 | Coil start address *4 (low order) | 06 |
| 5 | Number of coils (high order *2) | 00 |
| 6 | Number of coils (low order *2) | 05 |
| 7 | CRC-16 (high order) | 1C |
| 8 | CRC-16 (low order) | 91 |

Response:

| No. | Field Name | Example (Hex) |
|-----|----------------------|---------------|
| 1 | Slave address | 08 |
| 2 | Function code | 01 |
| 3 | Data size (in bytes) | 01 |
| 4 | Coil data *3 | 05 |
| 5 | CRC-16 (high order) | 92 |
| 6 | CRC-16 (low order) | 17 |

Note 1: Broadcasting is disabled.

Note 2: When 0 or more than 31 is specified as a number of coils, error code “03h” is returned.

Note 3: Data is transferred by the specified number of data bytes (data size).

Note 4: The PDU Coils are addressed starting at zero. Therefore coils numbered 1-86 are addressed as 0-85. Coil address value (transmitted on Modbus line) is 1 less than the Coil Number.

- The data set in the response shows terminal state of coils 0007h~000Dh.
- Data “05h = 00000101b” indicates the following assuming coil 7 is the LSB.

| Item | Data | | | | | | | |
|-------------|------|-----|-----|-----|-----|----|-----|----|
| Coil Number | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 |
| Coil Status | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON |

- When a read coil is outside the defined coils, the final coil data to be transmitted contains “0” as the status of the coil outside the range.
- When the Read Coil Status command cannot be executed normally, see the exception response.

Chapter 8 Communication Functions

(B) Read Holding Register [03h]

This function reads the contents of the specified number of consecutive holding registers (of specified register addresses). An example follows below.

- Reading Trip monitor 1 factor and trip frequency, current, and voltage from an inverter having a slave address “1”
- This example assumes the previous six trip factors are as follows:

| NE-S1 Command | D081 (factor) | D081 (status) | D081 (frequency) | D081 (output current) | D081 (DC-bus Voltage) |
|-----------------|--------------------|---------------|------------------|-----------------------|-----------------------|
| Register Number | 0012h | 0013h | 0014h | 0016h | 0017h |
| Trip factor | Over-Current (E03) | 04h | 9.9Hz | 3.0A | 284V |

Query:

| No. | Field Name | Example (Hex) |
|-----|--|---------------|
| 1 | Slave address *1 | 01 |
| 2 | Function code | 03 |
| 3 | Register start address *3 (high order) | 00 |
| 4 | Register start address *3 (low order) | 11 |
| 5 | Number of holding registers (high order) | 00 |
| 6 | Number of holding registers (low order) | 06 |
| 7 | CRC-16 (high order) | 95 |
| 8 | CRC-16 (low order) | CD |

Response:

| No. | Field Name | Example (Hex) |
|-----|------------------------------|---------------|
| 1 | Slave address | 01 |
| 2 | Function code | 03 |
| 3 | Data size (in bytes) *2 | 0C |
| 4 | Register data 1 (high order) | 00 |
| 5 | Register data 1 (high order) | 03 |
| 6 | Register data 2 (high order) | 00 |
| 7 | Register data 2 (low order) | 04 |
| 8 | Register data 3 (high order) | 00 |
| 9 | Register data 3 (low order) | 00 |
| 10 | Register data 4 (high order) | 00 |
| 11 | Register data 4 (low order) | 63 |
| 12 | Register data 5 (high order) | 00 |
| 13 | Register data 5 (low order) | 1E |
| 14 | Register data 6 (high order) | 01 |
| 15 | Register data 6 (low order) | 1C |
| 16 | CRC-16 (high order) | 0A |
| 17 | CRC-16 (low order) | A3 |

Note 1: Broadcasting is disabled.

Note 2: Data is transferred by the specified number of data bytes (data size). In this case, 12 bytes are used to return the content of six holding registers.

Note 3: The PDU Register Number are addressed starting at zero. Therefore register numbered “0012h” are addressed as “0011h”. Register address value (transmitted on Modbus line) is 1 less than the Register Number.

Chapter 8 Communication Functions

The data set in the response is as follows:

| Response Buffer | 4-5 | | 6-7 | | 8-9 | |
|-----------------|-------------------|------------------|-----------------------|------------------|-----------------------|------------------|
| Register Number | 12+0 (high order) | 12+0 (low order) | 12+1 (high order) | 12+1 (low order) | 12+2 (high order) | 12+2 (low order) |
| Register Data | 0003h | | 04h | | 0000h | |
| Trip data | Trip factor (E03) | | Status | | Frequency (9.9Hz) | |
| Response Buffer | 10-11 | | 12-13 | | 14-15 | |
| Register Number | 12+3 (high order) | 12+3 (low order) | 12+4 (high order) | 12+4 (low order) | 12+5 (high order) | 12+5 (low order) |
| Register Data | 0063h | | 001Eh | | 011Ch | |
| Trip data | Frequency (9.9Hz) | | Output current (3.0A) | | DC-bus voltage (284V) | |

When the Read Holding Register command cannot be executed normally, refer to the exception response.

(C) Write in Coil [05h]

This function writes data in a single coil. Coil status changes are as follows:

| Data | Coil Status | |
|--------------------------|-------------|-----------|
| | OFF to ON | ON to OFF |
| Change data (high order) | FFh | 00h |
| Change data (low order) | 00h | 00h |

An example follows (note that to command the inverter, set A002=03):

- Sending a RUN command to an inverter having slave address “8”
- This example writes in coil number “1.”

Query:

| No. | Field Name | Example (Hex) |
|-----|------------------------------------|---------------|
| 1 | Slave address *1 | 08 |
| 2 | Function code | 05 |
| 3 | Coil start address *2 (high order) | 00 |
| 4 | Coil start address *2 (low order) | 00 |
| 5 | Change data (high order) | FF |
| 6 | Change data (low order) | 00 |
| 7 | CRC-16 (high order) | 8C |
| 8 | CRC-16 (low order) | A3 |

Response:

| No. | Field Name | Example (Hex) |
|-----|------------------------------------|---------------|
| 1 | Slave address | 08 |
| 2 | Function code | 05 |
| 3 | Coil start address *2 (high order) | 00 |
| 4 | Coil start address *2 (low order) | 00 |
| 5 | Change data (high order) | FF |
| 6 | Change data (low order) | 00 |
| 7 | CRC-16 (high order) | 8C |
| 8 | CRC-16 (low order) | A3 |

Note 1: No response is made for a broadcasting query.

Note 2: The PDU Coils are addressed starting at zero. Therefore coils numbered 1-86 are addressed as 0-85. Coil address value (transmitted on Modbus line) is 1 less than the Coil Number.

When writing in a selected coil fails, see the exception response.

Chapter 8 Communication Functions

(D) Write in Holding Register [06h]

This function writes data in a specified holding register. An example follows:

- Write “50Hz” as the first Multi-speed 0 (A020) in an inverter having slave address “5.”
- This example uses change data “500(1F4h)” to set “50Hz” as the data resolution of the register “1019h” holding the first Multi-speed 0 (A020) is 0.1Hz

Query:

| No. | Field Name | Example (Hex) |
|-----|---|---------------|
| 1 | Slave address *1 | 05 |
| 2 | Function code | 06 |
| 3 | Register start address *2 (high order) | 12 |
| 4 | Register start address *2 (low order) | 16 |
| 5 | Change data (high order) | 01 |
| 6 | Change data (low order) | F4 |
| 7 | CRC-16 (high order) | 6C |
| 8 | CRC-16 (low order) | E5 |

Response:

| No. | Field Name | Example (Hex) |
|-----|---|---------------|
| 1 | Slave address | 05 |
| 2 | Function code | 06 |
| 3 | Register start address *2 (high order) | 12 |
| 4 | Register start address *2 (low order) | 16 |
| 5 | Change data (high order) | 01 |
| 6 | Change data (low order) | F4 |
| 7 | CRC-16 (high order) | 6C |
| 8 | CRC-16 (low order) | E5 |

Note 1: No response is made for a broadcasting query.

Note 2: The PDU Register Number are addressed starting at zero. Therefore register numbered “1217h” are addressed as “1216h”. Register address value (transmitted on Modbus line) is 1 less than the Register Number.

When writing in a selected holding register fails, see the exception response.

Chapter 8 Communication Functions

(E) Loopback Test [08h]

This function checks a master-slave transmission using any test data. An example follows:

- Send test data to an inverter having slave address “1” and receiving the test data from the inverter (as a loopback test).

Query:

| No. | Field Name | Example (Hex) |
|-----|---------------------------|---------------|
| 1 | Slave address *1 | 01 |
| 2 | Function code | 08 |
| 3 | Test subcode (high order) | 00 |
| 4 | Test subcode (low order) | 00 |
| 5 | Data (high order) | Any |
| 6 | Data (low order) | Any |
| 7 | CRC-16 (high order) | CRC |
| 8 | CRC-16 (low order) | CRC |

Response:

| No. | Field Name | Example (Hex) |
|-----|---------------------------|---------------|
| 1 | Slave address *1 | 01 |
| 2 | Function code | 08 |
| 3 | Test subcode (high order) | 00 |
| 4 | Test subcode (low order) | 00 |
| 5 | Data (high order) | Any |
| 6 | Data (low order) | Any |
| 7 | CRC-16 (high order) | CRC |
| 8 | CRC-16 (low order) | CRC |

Note 1: Broadcasting is disabled.

When test subcode is for echo (00h, 00h) only and not available to the other commands.

Chapter 8 Communication Functions

(F) Write in Coils [0Fh]

This function writes data in consecutive coils. An example follows:

- Change the state of intelligent input terminal [1] to [5] of an inverter having a slave address “8.”
- This example assumes the intelligent input terminals have terminal states listed below.

| Item | Data | | | | |
|----------------------------|------|-----|-----|-----|-----|
| Intelligent input terminal | [1] | [2] | [3] | [4] | [5] |
| Coil Number | 7 | 8 | 9 | 10 | 11 |
| Terminal status | ON | ON | ON | OFF | ON |

Query:

| No. | Field Name | Example (Hex) |
|-----|------------------------------------|---------------|
| 1 | Slave address *1 | 08 |
| 2 | Function code | 0F |
| 3 | Coil start address *3 (high order) | 00 |
| 4 | Coil start address *3 (low order) | 06 |
| 5 | Number of coils (high order) | 00 |
| 6 | Number of coils (low order) | 05 |
| 7 | Byte number *2 | 02 |
| 8 | Change data (high order) | 17 |
| 9 | Change data (low order) | 00 |
| 10 | CRC-16 (high order) | 83 |
| 11 | CRC-16 (low order) | EA |

Response:

| No. | Field Name | Example (Hex) |
|-----|------------------------------------|---------------|
| 1 | Slave address | 08 |
| 2 | Function code | 0F |
| 3 | Coil start address *3 (high order) | 00 |
| 4 | Coil start address *3 (low order) | 06 |
| 5 | Number of coils (high order) | 00 |
| 6 | Number of coils (low order) | 05 |
| 7 | CRC-16 (high order) | 75 |
| 8 | CRC-16 (low order) | 50 |

Note 1: Broadcasting is disabled.

Note 2: The change data is a set of high-order data and low-order data. So when the size (in bytes) of data to be changed is an odd start coil number (“7”), add “1” to the data size (in bytes) to make it an even number.

Note 3: The PDU Coils are addressed starting at zero. Therefore coils numbered 1-86 are addressed as 0-85. Coil address value (transmitted on Modbus line) is 1 less than the Coil Number.

Note 4: Intelligent input monitor (d005) cannot monitor the terminal information by communication.

Chapter 8 Communication Functions

(G) Write in Holding Registers [10h]

This function writes data in consecutive holding registers. An example follows:

- Write “3000 seconds” as the first acceleration time 1 (F002) in an inverter having a slave address “8.”
- This example uses change data “300000(493E0h)” to set “3000 seconds” as the data resolution of the registers “1103h” and “1104h” holding the first acceleration time 1 (F002) is 0.01 second.

Query:

| No. | Field Name | Example (Hex) |
|-----|---|---------------|
| 1 | Slave address *1 | 08 |
| 2 | Function code | 10 |
| 3 | Start address *3 (high order) | 11 |
| 4 | Start address *3 (low order) | 02 |
| 5 | Number of holding registers (high order) | 00 |
| 6 | Number of holding registers (low order) | 02 |
| 7 | Byte number *2 | 04 |
| 8 | Change data 1 (high order) | 00 |
| 9 | Change data 1 (low order) | 04 |
| 10 | Change data 2 (high order) | 93 |
| 11 | Change data 2 (low order) | E0 |
| 12 | CRC-16 (high order) | B0 |
| 13 | CRC-16 (low order) | 03 |

Response:

| No. | Field Name | Example (Hex) |
|-----|---|---------------|
| 1 | Slave address | 08 |
| 2 | Function code | 10 |
| 3 | Start address *3 (high order) | 11 |
| 4 | Start address *3 (low order) | 02 |
| 5 | Number of holding registers (high order) | 00 |
| 6 | Number of holding registers (low order) | 02 |
| 7 | CRC-16 (high order) | E5 |
| 8 | CRC-16 (low order) | AD |

Note 1: Broadcasting is disabled.

Note 2: This is not the number of holding registers. Specify the number of bytes of data to be changed.

Note 3: The PDU Register Number are addressed starting at zero. Therefore register numbered “1103h” are addressed as “1102h”. Register address value (transmitted on Modbus line) is 1 less than the Register Number.

When writing in selected holding registers fails, see the exception response.

Chapter 8 Communication Functions

(H) Write in Holding Registers [17h]

This function is to read and write data in consecutive holding registers. An example follows:

- Write “50.0Hz” as the set frequency (F001) in an inverter having a slave address “1” and then to read out the output frequency (d001).

Query:

| No. | Field Name | Example (Hex) |
|-----|---|---------------|
| 1 | Slave address *1 | 01 |
| 2 | Function code | 17 |
| 3 | Start address to read *3 (high order) | 10 |
| 4 | Start address to read *3 (low order) | 00 |
| 5 | Number of holding registers to read (high order) | 00 |
| 6 | Number of holding registers to read (low order) | 02 |
| 7 | Start address to write *3 (high order) | 00 |
| 8 | Start address to write *3 (low order) | 00 |
| 9 | Number of holding registers to write (high order) | 00 |
| 10 | Number of holding registers to write (low order) | 02 |
| 11 | Byte number to write*2 | 04 |
| 12 | Change data 1 (high order) | 00 |
| 13 | Change data 1 (low order) | 00 |
| 14 | Change data 2 (high order) | 13 |
| 15 | Change data 2 (low order) | 88 |
| 16 | CRC-16 (high order) | F4 |
| 17 | CRC-16 (low order) | 86 |

Response:

| No. | Field Name | Example (Hex) |
|-----|------------------------------|---------------|
| 1 | Slave address | 01 |
| 2 | Function code | 17 |
| 3 | Byte number n | 04 |
| 4 | Register Data 1 (high order) | 00 |
| 5 | Register Data 1 (low order) | 00 |
| 6 | Register Data 2 (high order) | 13 |
| 7 | Register Data 2 (low order) | 88 |
| 8 | CRC-16 (high order) | F4 |
| 9 | CRC-16 (low order) | 71 |

Note 1: Register address value (transmitted on Modbus line) is 1 less than the Register Number.

When writing in selected holding registers fails, see the exception response.

Chapter 8 Communication Functions

(I) Exception Response

When sending a query (excluding a broadcasting query) to an inverter, the master always requests a response from the inverter. Usually, the inverter returns a response according to the query. However, when finding an error in the query, the inverter returns an exception response. The exception response consists of the fields shown below.

| Field Configuration |
|---------------------|
| Slave address |
| Function code |
| Exception code |
| CRC-16 |

The content of each field is explained below. The function code of the exception response is the sum of the function code of the query and 80h. The exception code indicates the factor of the exception response.

| Function Code | |
|---------------|--------------------|
| Query | Exception Response |
| 0 1 h | 8 1 h |
| 0 3 h | 8 3 h |
| 0 5 h | 8 5 h |
| 0 6 h | 8 6 h |
| 0 F h | 8 F h |
| 1 0 h | 9 0 h |
| 1 7 h | 9 7 h |

| Exception Code | |
|----------------|---|
| Code | Description |
| 0 1 h | The specified function is not supported. |
| 0 2 h | The specified function is not found. |
| 0 3 h | The format of the specified data is not acceptable. |
| 2 1 h | The data to be written in a holding register is outside the inverter. |
| 2 2 h | <p>The specified functions are not available to the inverter.</p> <ul style="list-style-type: none"> • Function to change the content of a register that cannot be changed while the inverter is in service • Function to submit an ENTER command during running (UV) • Function to write in a register during tripping (UV) • Function to write in a read-only register (or coil) • to write in a register during softlock • to change the input/output terminal which could not be changed • to change NO->NC of Reset terminal |
| 2 3 h | To write a register/coil for READ ONLY |

Chapter 8 Communication Functions

8.7 Re-calculate the internal variable

There are necessary data of the recomputation.

In this case, use the ENTER command.

(A) ENTER Command

When recalculate the internal value, Set 0000h to the register(0900h) by the Write in Holding Register command [06h].

| Value | Description |
|-------|--------------------------------|
| 0000h | recalculate the internal value |

List of parameters needing the recalculation of the internal variable

| code | Function name | code | Function name |
|-----------|--------------------------|-----------|---------------------|
| A003/A203 | Base frequency | H003/H203 | Motor capacity |
| A004/A204 | Maximum frequency | H004/H204 | Motor poles setting |
| A044/A244 | V/f characteristic curve | | |
| A082/A282 | AVR voltage select | | |
| b112 | Free V/F setting, freq.7 | | |

Note) NE-S1 series does not have a data store command/register because the data of all parameters store at the time of power supply OFF. Therefore, it is necessary to put back data before power supply OFF when need to use the data before the change in next power supply injection.

Chapter 8 Communication Functions

8.8 Modbus Data Listing

(A) Modbus Coil List

The following tables list the primary coils for the inverter interface to the network. The table legend is given below.

- **Coil No.** - The network *register address offset* for the coil. The coil data is a single bit (binary) value.
- **Item** - The functional name of the coil
- **R/W** - The read-only (R) or read-write (R/W) access permitted to the inverter data
- **Setting** - The meaning of each of the states of the coils

| Coil No. | Item | R/W | Setting |
|----------------|---------------------------------------|-----|--|
| 0000h | unused | - | (Inaccessible) |
| 0001h | Operation command | R/W | 1: Run, 0: Stop (valid when A002/A202 = 03) |
| 0002h | Rotation direction command | R/W | 1: Reverse rotation, 0: Forward rotation (valid when A002/A202 = 03) |
| 0003h | External trip (EXT) | R/W | 1: Trip |
| 0004h | Trip reset (RS) | R/W | 1: Reset |
| 0005h | (Reserved) | - | - |
| 0006h | (Reserved) | - | - |
| 0007h | Intelligent input terminal [1] | R/W | 1: ON, 0: OFF (*1) |
| 0008h | Intelligent input terminal [2] | R/W | 1: ON, 0: OFF (*1) |
| 0009h | Intelligent input terminal [3] | R/W | 1: ON, 0: OFF (*1) |
| 000Ah | Intelligent input terminal [4] | R/W | 1: ON, 0: OFF (*1) |
| 000Bh | Intelligent input terminal [5] | R/W | 1: ON, 0: OFF (*1) |
| 000Ch to 000Eh | (Reserved) | - | - |
| 000Fh | Operation status | R | 1: Run, 0: Stop (interlocked to "d003") |
| 0010h | Rotation direction | R | 1: Reverse rotation, 0: Forward rotation (interlocked to "d003") |
| 0011h | Inverter ready (IRDY) | R | 1: Ready, 0: Not ready (Same as Coil No.0045h) |
| 0012h | (Reserved) | - | - |
| 0013h | RUN (running) | R | 1: ON, 0: OFF |
| 0014h | FA1 (constant-speed reached) | R | 1: ON, 0: OFF |
| 0015h | FA2 (set frequency overreached) | R | 1: ON, 0: OFF |
| 0016h | OL (overload advance notice (1)) | R | 1: ON, 0: OFF |
| 0017h | OD (output deviation for PID control) | R | 1: ON, 0: OFF |
| 0018h | AL (alarm signal) | R | 1: ON, 0: OFF |
| 0019h | FA3 (set frequency reached) | R | 1: ON, 0: OFF |
| 001Ah | (Reserved) | - | - |
| 001Bh | (Reserved) | - | - |
| 001Ch | UV (undervoltage) | R | 1: ON, 0: OFF |
| 001Dh | (Reserved) | - | - |
| 001Eh | RNT (operation time over) | R | 1: ON, 0: OFF |
| 001Fh | ONT (plug-in time over) | R | 1: ON, 0: OFF |
| 0020h | THM (thermal alarm signal) | R | 1: ON, 0: OFF |
| 0021h to 0027h | (Reserved) | - | - |
| 0028h | ZS (0 Hz detection signal) | R | 1: ON, 0: OFF |
| 0029h to 002Dh | (Reserved) | - | - |

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| Coil No. | Item | R/W | Setting |
|----------------|---|-----|--|
| 002Eh | Odc: Analog O disconnection detection | - | 1: ON, 0: OFF |
| 002Fh to 0031h | (Reserved) | - | - |
| 0032h | FBV (PID feedback comparison) | R | 1: ON, 0: OFF |
| 0033h | NDc (communication train disconnection) | R | 1: ON, 0: OFF |
| 0034h | LOG1 (logical operation result 1) | R | 1: ON, 0: OFF |
| 0035h to 003Bh | (Reserved) | - | - |
| 003Ch | FR (starting contact signal) | R | 1: ON, 0: OFF |
| 003Dh | OHF (heat sink overheat warning) | R | 1: ON, 0: OFF |
| 003Eh | LOC (low-current indication signal) | R | 1: ON, 0: OFF |
| 003Fh to 0044h | (Reserved) | - | - |
| 0045h | IRDY (inverter ready) | R | 1: ON, 0: OFF (Same as Coil No.0011h) |
| 0046h | FWR (forward rotation) | R | 1: ON, 0: OFF |
| 0047h | RVR (reverse rotation) | R | 1: ON, 0: OFF |
| 0048h | MJA (major failure) | R | 1: ON, 0: OFF |
| 0049h | (Reserved) | - | - |
| 004Ah | CRC error | R | 1: Error detected, 0: No error (*3) |
| 004Bh | Overrun | R | 1: Error detected, 0: No error (*3) |
| 004Ch | Framing error | R | 1: Error detected, 0: No error (*3) |
| 004Dh | Parity error | R | 1: Error detected, 0: No error (*3) |
| 004Eh | (Reserved) | - | - |
| 004Fh | (Reserved) | - | - |
| 0050h | WCO (window comparator O) | R | 1: ON, 0: OFF |
| 0051h to 0053h | (Reserved) | - | - |
| 0054h | FREF (FQ command source) | R | 1: Operator, 0: Others |
| 0055h | REF (RUN command source) | R | 1: Operator, 0: Others |
| 0056h | SETM (2nd motor selected) | R | 1: 2nd motor selected, 0: 1st motor selected |
| 0057h | (Reserved) | - | - |
| 0058h | (Reserved) | - | - |
| 0059h- | unused | R | inaccessible |

- *1 The input terminal function can do ON/OFF by Modbus communication. If either the coil of the input terminal or the signal of the control circuit is ON, the inverter recognize it to be ON. But ON by the communication does not display on the input terminal monitor (d005) , because (d005) is a monitor for the signal of the control circuit only.
- *2 The writable coil is cleared (0(OFF)) by the reset input. When you do not want to clear , please set C102(reset choice) = 02. (but cleared by the reset at the time of the trip.)
- *3 Communication error data is retained until an error reset command is input. (In the case of (C102(reset choice) = 02) , error is cleared at the time of a trip only.)
(Reset:terminal reset function , reset of coil (coil No.0004h))

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(B) Modbus Holding Registers

The following tables list the holding registers for the inverter interface to the network. The table legend is given below.

- **Function name** - The standard functional name of the parameter or function for the inverter
- **Function code** - The inverter's reference code for the parameter or function (same as inverter keypad display)
- **R/W** - The read-only(R) or read-write access(R/W) permitted to the data in the inverter
- **Monitoring and setting items** - How the parameter or setting works (same as Chapter 3 description).
- **Register No.** - The network *register address offset* for the value. Some values have a high-byte and low-byte address.
- **Resolution** - This is the quantity represented by the LSB of the network value, in engineering units. When the network data range is greater than the inverter's internal data range, this 1-bit resolution will be fractional.

Note): The network values are binary integers. Since these values cannot have an embedded decimal point, for many parameters it represents the actual value (in engineering units) multiplied by a factor of 10 or 100. Network communications must use the listed range for network data. The inverter automatically divides received values by the appropriate factor in order to establish the decimal point for internal use. Likewise, the network host computer must apply the same factor when it needs to work in engineering units. However, when sending data to the inverter, the network host computer must scale values to the integer range listed for network communications

(1) Registers (frequency, status, trip monitor)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|-------------------|---------------|-----|---|-----------------|
| 0000h | unused | - | - | Inaccessible | |
| 0001h | Frequency source | F001 (high) | R/W | 0 to 40000 (valid when A001/A201 = 03) | 0.01 [Hz] |
| | | F001 (low) | | | |
| 0003h | Inverter status A | - | R | 0: Initial status 6: DC braking 2: Stopping 7: Retrying 3: Running 8: Tripping 4: Free-run stop 9: Undervoltage (UV), 5: Jogging | - |
| 0004h | Inverter status B | - | R | 0: Stopping, 1: Running, 2: Tripping | - |
| 0005h | Inverter status C | - | R | 0: --- 6: Reverse rotation 1: Stopping 7: Switching from fwd. 2: Decelerating to rev. rotation, 3: Constant-speed 8: Switching from rev. operation to fwd. rotation, 4: Accelerating 9: Starting fwd. 5: Forward rotation 10: Starting rev. | - |
| 0006h | PID feedback | - | R/W | 0 to 10000 | 0.01 [%] |
| 0007h to 0010h | (Reserved) | - | R | - | - |

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|-------------------------------------|---------------|-----|---|-----------------|
| 0011h | Trip Counter | d080 | R | 0 to 65530 | 1 [time] |
| 0012h | Trip info. 1 (factor) | | | See the list of inverter trip factors below | - |
| 0013h | Trip info. 1 (inverter status) | | | See the list of inverter trip factors below | - |
| 0014h | Trip info. 1 (frequency) (high) | | | 0 to 40000 | 0.01[Hz] |
| 0015h | Trip info. 1 (frequency) (low) | | | Output current at tripping | 0.01[A] |
| 0016h | Trip info. 1 (current) | | | DC input voltage at tripping | 0.1[V] |
| 0017h | Trip info. 1 (voltage) | | | Cumulative running time at tripping | 1[h] |
| 0018h | Trip info. 1 (running time) (high) | | | Cumulative power-on time at tripping | 1[h] |
| 0019h | Trip info. 1 (running time) (low) | | | | |
| 001Ah | Trip info. 1 (power-on time) (high) | | | | |
| 001Bh | Trip info. 1 (power-on time) (low) | | | | |
| 001Ch | Trip info. 2 (factor) | | R | See the list of inverter trip factors below | - |
| 001Dh | Trip info. 2 (inverter status) | | | See the list of inverter trip factors below | - |
| 001Eh | Trip info. 2 (frequency) (high) | | | 0 to 40000 | 0.01[Hz] |
| 001Fh | Trip info. 2 (frequency) (low) | | | Output current at tripping | 0.01[A] |
| 0020h | Trip info. 2 (current) | | | DC input voltage at tripping | 0.1[V] |
| 0021h | Trip info. 2 (voltage) | | | Cumulative running time at tripping | 1[h] |
| 0022h | Trip info. 2 (running time) (high) | | | Cumulative power-on time at tripping | 1[h] |
| 0023h | Trip info. 2 (running time) (low) | | | | |
| 0024h | Trip info. 2 (power-on time) (high) | | | | |
| 0025h | Trip info. 2 (power-on time) (low) | | | | |
| 0026h | Trip info. 3 (factor) | | R | See the list of inverter trip factors below | - |
| 0027h | Trip info. 3 (inverter status) | | | See the list of inverter trip factors below | - |
| 0028h | Trip info. 3 (frequency) (high) | | | 0 to 40000 | 0.01[Hz] |
| 0029h | Trip info. 3 (frequency) (low) | | | Output current at tripping | 0.01[A] |
| 002Ah | Trip info. 3 (current) | | | DC input voltage at tripping | 0.1[V] |
| 002Bh | Trip info. 3 (voltage) | | | Cumulative running time at tripping | 1[h] |
| 002Ch | Trip info. 3 (running time) (high) | | | Cumulative power-on time at tripping | 1[h] |
| 002Dh | Trip info. 3 (running time) (low) | | | | |
| 002Eh | Trip info. 3 (power-on time) (high) | | | | |
| 002Fh | Trip info. 3 (power-on time) (low) | | | | |
| 0030h | Trip info. 4 (factor) | | R | See the list of inverter trip factors below | - |
| 0031h | Trip info. 4 (inverter status) | | | See the list of inverter trip factors below | - |
| 0032h | Trip info. 4 (frequency) (high) | | | 0 to 40000 | 0.01[Hz] |
| 0033h | Trip info. 4 (frequency) (low) | | | Output current at tripping | 0.01[A] |
| 0034h | Trip info. 4 (current) | | | DC input voltage at tripping | 0.1[V] |
| 0035h | Trip info. 4 (voltage) | | | Cumulative running time at tripping | 1[h] |
| 0036h | Trip info. 4 (running time) (high) | | | Cumulative power-on time at tripping | 1[h] |
| 0037h | Trip info. 4 (running time) (low) | | | | |
| 0038h | Trip info. 4 (power-on time) (high) | | | | |
| 0039h | Trip info. 4 (power-on time) (low) | | | | |
| 003Ah | Trip info. 5 (factor) | | R | See the list of inverter trip factors below | - |
| 003Bh | Trip info. 5 (inverter status) | | | See the list of inverter trip factors below | - |
| 003Ch | Trip info. 5 (frequency) (high) | | | 0 to 40000 | 0.01[Hz] |
| 003Dh | Trip info. 5 (frequency) (low) | | | Output current at tripping | 0.01[A] |
| 003Eh | Trip info. 5 (current) | | | DC input voltage at tripping | 0.1[V] |
| 003Fh | Trip info. 5 (voltage) | | | Cumulative running time at tripping | 1[h] |
| 0040h | Trip info. 5 (running time) (high) | | | Cumulative power-on time at tripping | 1[h] |
| 0041h | Trip info. 5 (running time) (low) | | | | |
| 0042h | Trip info. 5 (power-on time) (high) | | | | |
| 0043h | Trip info. 5 (power-on time) (low) | | | | |
| 0044h | Trip info. 6 (factor) | | R | See the list of inverter trip factors below | - |
| 0045h | Trip info. 6 (inverter status) | | | See the list of inverter trip factors below | - |
| 0046h | Trip info. 6 (frequency) (high) | | | 0 to 40000 | 0.01[Hz] |
| 0047h | Trip info. 6 (frequency) (low) | | | Output current at tripping | 0.01[A] |
| 0048h | Trip info. 6 (current) | | | DC input voltage at tripping | 0.1[V] |
| 0049h | Trip info. 6 (voltage) | | | Cumulative running time at tripping | 1[h] |
| 004Ah | Trip info. 6 (running time) (high) | | | Cumulative power-on time at tripping | 1[h] |
| 004Bh | Trip info. 6 (running time) (low) | | | | |
| 004Ch | Trip info. 6 (power-on time) (high) | | | | |
| 004Dh | Trip info. 6 (power-on time) (low) | | | | |
| 004Eh | Programming error monitoring | d090 | R | See the list of warning data | - |
| 004Fh to 08Efh | (reserved) | - | - | - | - |
| 0900h | recalculate the internal value | - | W | 0: recalculate | - |
| 0901h to 1000h | (reserved) | - | - | Inaccessible | - |

Chapter 8 Communication Functions

i) List of inverter trip factors

| Upper part of trip factor code (indicating the factor) | | Lower part of trip factor code (indicating the inverter status) | |
|--|------|---|------|
| Name | Code | Name | Code |
| No trip factor | 0 | Resetting | 0 |
| Over-current event while at constant speed | 1 | Stopping | 1 |
| Over-current event during deceleration | 2 | Decelerating | 2 |
| Over-current event during acceleration | 3 | Constant-speed operation | 3 |
| Over-current event during other conditions | 4 | Accelerating | 4 |
| Overload protection | 5 | Operating at zero frequency | 5 |
| Oversupply protection | 7 | Starting | 6 |
| Memory error | 8 | DC braking | 7 |
| Undervoltage protection | 9 | Overload restricted | 8 |
| Current detection error | 10 | | |
| CPU error | 11 | | |
| External trip | 12 | | |
| USP error | 13 | | |
| Ground-fault protection | 14 | | |
| Input oversupply protection | 15 | | |
| Inverter thermal trip | 21 | | |
| CPU error | 22 | | |
| Driver error | 30 | | |
| Output phase loss protection | 34 | | |
| Low-speed overload protection | 38 | | |
| Operator connection | 40 | | |
| Modbus communication error | 41 | | |

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ii) List of warning data

| Modbus data | Operator display | Condition | | |
|-------------|------------------|---|---|---|
| 1 | H 001 | Frequency upper limit setting (A061) | > | Maximum frequency setting (A004) |
| 2 | H 002 | Frequency lower limit setting (A062) | > | Maximum frequency setting (A004) |
| 3 | H 005 | Output frequency setting (F001), multispeed 0 (A020) (note 1) | > | Maximum frequency setting (A004) |
| 10 | H 015 | Output frequency setting (F001), multispeed 0 (A020) (note 1) | > | Frequency upper limit setting (A061) |
| 17 | H 025 | Frequency lower limit setting (A062) | > | Output frequency setting (F001), multispeed 0 (A020) (note 1) |
| 23 | H 031 | Start frequency adjustment (b082) | > | Frequency upper limit setting (A061) |
| 25 | H 032 | Start frequency adjustment (b082) | > | Frequency lower limit setting (A062) |
| 27 | H 035 | Start frequency adjustment (b082) | > | Output frequency setting (F001), multispeed 0 (A020) (note 1) |
| 30 | H 037 | Start frequency adjustment (b082) | > | Jog frequency setting (A038) |
| 31 | H 085 | Output frequency setting (F001), multispeed 0 (A020) (note 1) | = | Jump (center) frequency settings 1/2/3 ± " Jump (hysteresis) frequency width settings 1/2/3" |
| 33 | H 086 | Multispeed 1 to 7 settings (A021 to A027) | = | A063 ± A064, A065 ± A066, A067 ± A068 |
| 34 | H 091 | Free-setting V/f frequency (7) (b112) | < | Frequency upper limit setting (A061) |
| 36 | H 092 | Free-setting V/f frequency (7) (b112) | < | Frequency lower limit setting (A062) |
| 38 | H 095 | Free-setting V/f frequency (7) (b112) | < | Output frequency setting (F001), multispeed 0 (A020) (note 1) |
| 5 | H 201 | Frequency upper limit setting (A261) | > | Maximum frequency setting (A204) |
| 6 | H 202 | Frequency lower limit setting (A262) | > | Maximum frequency setting (A204) |
| 7 | H 205 | Output frequency setting (F001), multispeed 0 (A220) (note 1) | > | Maximum frequency setting (A204) |
| 14 | H 215 | Output frequency setting (F001), multispeed 0 (A220) (note 1) | > | Frequency upper limit setting (A261) |
| 21 | H 225 | Frequency lower limit setting (A262) | > | Output frequency setting (F001), multispeed 0 (A220) (note 1) |
| 24 | H 231 | Start frequency adjustment (b082) | > | Frequency upper limit setting (A261) |
| 26 | H 232 | Start frequency adjustment (b082) | > | Frequency lower limit setting (A262) |
| 28 | H 235 | Start frequency adjustment (b082) | > | Output frequency setting (F001), multispeed 0 (A220) (note 1) |
| 32 | H 285 | Output frequency setting (F001), multispeed 0 (A220) (note 1) | = | Jump (center) frequency settings 1/2/3 ± " Jump (hysteresis) frequency width settings 1/2/3" A063 ± A064, A065 ± A066, A067 ± A068 |
| 35 | H 291 | Free-setting V/f frequency (7) (b112) | < | Frequency upper limit setting (A261) |
| 37 | H 292 | Free-setting V/f frequency (7) (b112) | < | Frequency lower limit setting (A262) |
| 39 | H 295 | Free-setting V/f frequency (7) (b112) | < | Output frequency setting (F001), multispeed 0 (A220) (note 1) |

Note) The warning data of the Modbus communication do not accord with the warning cord of the operator.

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(2) Registers (monitoring group d)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|---|-----------------|
| 1001h | Output frequency monitor | d001 (high) | R | 0 to 40000 | 0.01 [Hz] |
| 1002h | | d001 (low) | | | |
| 1003h | Output current monitor | d002 | R | 0 to 65530 | 0.01 [A] |
| 1004h | Rotation direction minitoring | d003 | R | 0: Stopping, 1: Forward rotation, 2: Reverse rotation | 0.1 [Hz] |
| 1005h | Process variable (PV), PID feedback monitoring | d004 (high) | R | 0 to 99990 | 0.1 |
| 1006h | | d004 (low) | | | |
| 1007h | Intelligent input terminal status | d005 | R | 2^0: Terminal 1 to 2^4: Terminal 5 | 1 bit |
| 1008h | Intelligent output terminal status | d006 | R | 2^0: Terminal 11 to 2^1:Relay Terminal | 1 bit |
| 1009h | Scaled output frequency monitor | d007 (high) | R | 0 to 399960 | 0.01 |
| 100Ah | | d007 (low) | | | |
| 100Bh to 1010h | (Reserved) | - | - | Inaccessible | - |
| 1011h | Output voltage monitor | d013 | R | 0 to 6000 | 0.1 [V] |
| 1012h | Power monitor | d014 | R | 0 to 1000 | 0.1 [kW] |
| 1013h | Watt-hour monitor | d015 (high) | R | 0 to 9999000 | 0.1 |
| 1014h | | d015 (low) | | | |
| 1015h | Elapsed RUN time monitor | d016 (high) | R | 0 to 999900 | 1 [h] |
| 1016h | | d016 (low) | | | |
| 1017h | Elapsed power-on time monitor | d017 (high) | R | 0 to 999900 | 1 [h] |
| 1018h | | d017 (low) | | | |
| 1019h | Heat sink temperature monitor | d018 | R | -200 to 1500 | 0.1 [°c] |
| 101Ah to 1025h | (Reserved) | - | - | Inaccessible | - |
| 1026h | DC voltage monitoring (across P and N) | d102 | R | 0 to 10000 | 0.1 [V] |
| 1027h | (Reserved) | - | - | Inaccessible | - |
| 1028h | Electronic thermal overload monitoring | d104 | R | 0 to 1000 | 0.1 [%] |
| 1029h to 1057h | (Reserved) | - | - | Inaccessible | - |
| 1058h to 1102h | unused | - | - | Inaccessible | - |

(3) Registers (group F)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|------------------------|---------------|-----|--|-----------------|
| 1103h | Acceleration time (1) | F002 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 1104h | | F002 (low) | | | |
| 1105h | Deceleration time (1) | F003 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 1106h | | F003 (low) | | | |
| 1107h | Keypad Run key routing | F004 | R/W | 0 (forward rotation), 1 (reverse rotation) | - |
| 1108h to 1200h | Unused | - | - | Inaccessible | - |

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(3) Registers (group A)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|---|---------------|-----|--|-----------------|
| 1201h | Frequency source | A001 | R/W | 0 (keypad potentiometer), 1 (control circuit terminal block), 2 (digital operator), 3 (Modbus), 10 (operation function result) | - |
| 1202h | Run command source (*) | A002 | R/W | 1 (control circuit terminal block), 2 (digital operator), 3 (Modbus) | - |
| 1203h | Base frequency | A003 | R/W | 300 to "maximum frequency" | 0.1 [Hz] |
| 1204h | Maximum frequency | A004 | R/W | 300 to 4000 | 0.1 [Hz] |
| 1205h to 120Ah | (Reserved) | - | - | - | - |
| 120Bh | (Reserved) | - | - | - | - |
| 120Ch | [O/OI] input active range start frequency | A011 | R/W | 0 to 40000 | 0.01 [Hz] |
| 120Dh | (Reserved) | - | - | - | - |
| 120Eh | [O/OI] input active range end frequency | A012 | R/W | 0 to 40000 | 0.01 [Hz] |
| 120Fh | [O/OI] input active range start voltage/current | A013 | R/W | 0 to "[O/OI]-[L] input active range end voltage/current" | 1 [%] |
| 1210h | [O/OI] input active range end voltage/current | A014 | R/W | "[O/OI]-[L] input active range start voltage/current" to 100 | 1 [%] |
| 1211h | [O/OI] input start frequency select | A015 | R/W | 0 (external start frequency), 1 (0 Hz) | - |
| 1212h | Analog input filter. | A016 | R/W | 1 to 30 or 31 (500 ms filter ± 0.1 Hz with hysteresis) | 1 |
| 1213h | (Reserved) | - | - | - | - |
| 1214h | (Reserved) | - | - | - | - |
| 1215h | Multi speed operation selection | A019 | R/W | 0 (binary), 1 (bit) | - |
| 1216h | (Reserved) | - | - | - | - |
| 1217h | Multi-speed freq. 0 | A020 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |
| 1218h | (Reserved) | - | - | - | - |
| 1219h | Multi-speed freq. 1 | A021 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |
| 121Ah | (Reserved) | - | - | - | - |
| 121Bh | Multi-speed freq. 2 | A022 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |
| 121Ch | (Reserved) | - | - | - | - |
| 121Dh | Multi-speed freq. 3 | A023 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |
| 121Eh | (Reserved) | - | - | - | - |
| 121Fh | Multi-speed freq. 4 | A024 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |
| 1220h | (Reserved) | - | - | - | - |
| 1221h | Multi-speed freq. 5 | A025 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |
| 1222h | (Reserved) | - | - | - | - |
| 1223h | Multi-speed freq. 6 | A026 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |
| 1224h | (Reserved) | - | - | - | - |
| 1225h | Multi-speed freq. 7 | A027 | R/W | 0 or "start frequency" to "maximum frequency" | 0.01 [Hz] |

*)After changing the setting, keep the time 40ms or longer before actually give run command.

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|---|-----------------|
| 1226h to 1237h | (Reserved) | - | - | - | - |
| 1238h | Jog frequency | A038 | R/W | "Start frequency" to 999 | 0.01 [Hz] |
| 1239h | Jog stop mode | A039 | R/W | 0 (free-running after jogging stops [disabled during operation]) 1 (deceleration and stop after jogging stops [disabled during operation]) 2 (DC braking after jogging stops [disabled during operation]) 3 (free-running after jogging stops [enabled during operation]) 4 (deceleration and stop after jogging stops [enabled during operation]) 5 (DC braking after jogging stops [enabled during operation]) | - |
| 123Ah | (Reserved) | - | - | - | - |
| 123Bh | Torque boost method selection | A041 | R/W | 0 (manual torque boost), 1 (automatic torque boost) | - |
| 123Ch | Manual torque boost value | A042 | R/W | 0 to 200 | 0.1 [%] |
| 123Dh | Manual torque boost frequency | A043 | R/W | 0 to 500 | 0.1 [%] |
| 123Eh | V/F characteristic curve selection, 1st motor | A044 | R/W | 0 (VC), 1 (VP), 2 (free V/f) | - |
| 123Fh | V/f gain | A045 | R/W | 20 to 100 | 1 [%] |
| 1240h | Voltage compensation gain setting for automatic torque boost, 1st motor | A046 | R/W | 0 to 255 | 1 [%] |
| 1241h | Slippage compensation gain setting for automatic torque boost, 1st motor | A047 | R/W | 0 to 255 | 1 [%] |
| 1242h to 1244h | (Reserved) | - | - | - | - |
| 1245h | DC braking enable | A051 | R/W | 0 (disabling), 1 (enabling), 2 (output freq < [A052]) | - |
| 1246h | DC braking frequency | A052 | R/W | 0 to 6000 | 0.01 [Hz] |
| 1247h | DC braking wait time | A053 | R/W | 0 to 50 | 0.1 [s] |
| 1248h | DC braking force during deceleration | A054 | R/W | 0 to 100 | 1 [%] |
| 1249h | DC braking time for deceleration | A055 | R/W | 0 to 100 | 0.1 [s] |
| 124Ah | DC braking/edge or level detection for [DB] input | A056 | R/W | 0 (edge operation), 1 (level operation) | - |
| 124Bh | DC braking force for starting | A057 | R/W | 0 to 100 | 1 [%] |
| 124Ch | DC braking time for starting | A058 | R/W | 0 to 100 | 0.1 [s] |
| 124Dh | DC braking carrier frequency setting | A059 | R/W | 20 to 150 | 0.1 [kHz] |
| 124Eh | (Reserved) | - | - | - | - |

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|--------------|--------------------------------|---------------|-----|--|-----------------|
| 124Fh | (Reserved) | - | - | - | - |
| 1250h | Frequency upper limit | A061 | R/W | 0 or "maximum frequency limit" to "maximum frequency" | 0.01 [Hz] |
| 1251h | (Reserved) | - | - | - | - |
| 1252h | Frequency lower limit | A062 | R/W | 0 or "maximum frequency limit" to "maximum frequency" | 0.01 [Hz] |
| 1253h | (Reserved) | - | - | - | - |
| 1254h | Jump freq. (center) 1 | A063 | R/W | 0 to 40000 | 0.01 [Hz] |
| 1255h | Jump freq. width(hysteresis) 1 | A064 | R/W | 0 to 1000 | 0.01 [Hz] |
| 1256h | (Reserved) | - | - | - | - |
| 1257h | Jump freq. (center) 2 | A065 | R/W | 0 to 40000 | 0.01 [Hz] |
| 1258h | Jump freq. width(hysteresis) 2 | A066 | R/W | 0 to 1000 | 0.01 [Hz] |
| 1259h | (Reserved) | - | - | - | - |
| 125Ah | Jump freq. (center) 3 | A067 | R/W | 0 to 40000 | 0.01 [Hz] |
| 125Bh | Jump freq. width(hysteresis) 3 | A068 | R/W | 0 to 1000 | 0.01 [Hz] |
| 125Ch | (Reserved) | - | - | - | - |
| 125Dh | Acceleration hold frequency | A069 | R/W | 0 to 40000 | 0.01 [Hz] |
| 125Eh | Acceleration hold time | A070 | R/W | 0 to 600 | 0.1 [s] |
| 125Fh | PID Function Enable | A071 | R/W | 0 (disabling), 1 (enabling), 2 (enabling inverted-data output) | - |
| 1260h | PID proportional gain | A072 | R/W | 0 to 2500 | 0.01 |
| 1261h | PID integral time constant | A073 | R/W | 0 to 36000 | 0.1 [s] |
| 1262h | PID derivative gain | A074 | R/W | 0 to 10000 | 0.01 [s] |
| 1263h | PV scale conversion | A075 | R/W | 1 to 9999 | 0.01 |
| 1264h | PV source | A076 | R/W | 1 (input via O/OI), 2 (external communication), 10 (operation result output) | - |
| 1265h | Reverse PID | A077 | R/W | 00 (disabling), 01 (enabling) | - |
| 1266h | PID output limiter | A078 | R/W | 0 to 1000 | 0.1 [%] |
| 1267h | (Reserved) | - | - | - | - |
| 1268h | (Reserved) | - | - | - | - |
| 1269h | AVR function select | A081 | R/W | 0 (always on), 1 (always off), 2 (off during deceleration) | - |
| 126Ah | AVR voltage select | A082 | R/W | 200 V class: 0 (200)/1 (215)/2 (220)/3 (230)/4 (240) | - |
| 126Bh | AVR filter time constant | A083 | R/W | 0 to 1000 | 0.001[s] |
| 126Ch | AVR deceleration gain | A084 | R/W | 50 to 200 | 1[%] |
| 126Dh | Energy-saving operation mode | A085 | R/W | 0 (normal operation), 1 (energy-saving operation) | - |
| 126Eh | Energy-saving mode tuning | A086 | R/W | 0 to 1000 | 0.1 [%] |

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------------------|-----|--|-----------------|
| 126Fh to 1273h | (Reserved) | - | - | - | |
| 1274h | Acceleration time (2) | A092 (high) A092 (low) | R/W | 0 to 360000 | 0.01 [s] |
| 1275h | | | | | |
| 1276h | Deceleration time (2) | A093 (high) A093 (low) | R/W | 0 to 360000 | 0.01 [s] |
| 1277h | | | | | |
| 1278h | Select method to switch to Acc2/Dec2 profile | A094 | R/W | 0 (switching by 2CH terminal), 1 (switching by setting) 2 (Forward and reverse) | - |
| 1279h | (Reserved) | - | - | - | - |
| 127Ah | Acc1 to Acc2 frequency transition point | A095 | R/W | 0 to 40000 | 0.01 [Hz] |
| 127Bh | (Reserved) | - | - | - | - |
| 127Ch | Dec1 to Dec2 frequency transition point | A096 | R/W | 0 to 40000 | 0.01 [Hz] |
| 127Dh | Acceleration curve selection | A097 | R/W | 0 (linear), 1 (S curve), 2 (U curve), 3 (inverted-U curve) | - |
| 127Eh | Deceleration curve setting | A098 | R/W | 0 (linear), 1 (S curve), 2 (U curve), 3 (inverted-U curve) | - |
| 127Fh to 12A4h | (Reserved) | - | - | - | - |
| 12A5h | Acceleration curve constant | A131 | R/W | 1 (smallest swelling) to 10 (largest swelling) | - |
| 12A6h | Deceleration curve constant | A132 | R/W | 1 (smallest swelling) to 10 (largest swelling) | - |
| 12A7h to 12AEh | (Reserved) | - | - | - | - |
| 12AFh | Operation-target frequency selection 1 | A141 | R/W | 0 (digital operator), 1 (keypad potentiometer), 2 (input via O/OI), 4 (external communication) | - |

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|---|---------------|-----|--|-----------------|
| 12B0h | Operation-target frequency selection 2 | A142 | R/W | 0 (digital operator), 1 (keypad potentiometer), 2 (input via O/OI), 4 (external communication) | - |
| 12B1h | Operator selection | A143 | R/W | 0 (addition: A141 + A142), 1 (subtraction: A141 - A142), 2 (multiplication: A141 x A142) | - |
| 12B2h | (Reserved) | - | - | - | - |
| 12B3h | (Reserved) | - | - | - | - |
| 12B4h | Frequency to be added | A145 | R/W | 0 to 40000 | 0.01 [Hz] |
| 12B5h | Sign of the frequency to be added | A146 | R/W | 00 (frequency command + A145), 01 (frequency command - A145) | - |
| 12B6h to 12BCh | (Reserved) | - | - | - | - |
| 12BDh | (Reserved) | - | - | - | - |
| 12BEh | Deceleration hold frequency | A154 | R/W | 0~40000 | 0.01 [Hz] |
| 12BFh | Deceleration hold time | A155 | R/W | 0~600 | 0.1 [s] |
| 12C0h | (Reserved) | - | - | - | - |
| 12C1h | PID sleep function triggering level | A156 | R/W | 0~40000 | 0.01 [Hz] |
| 12C2h | PID sleep function action delay time | A157 | R/W | 0~255 | 0.1 [s] |
| 12C3h to 12C5h | (Reserved) | - | - | - | - |
| 12C6h | (Reserved) | - | - | - | - |
| 12C7h | [VR] input active range start frequency | A161 | R/W | 0~40000 | 0.01 [Hz] |
| 12C8h | (Reserved) | - | - | - | - |
| 12C9h | [VR] input active range end frequency | A162 | R/W | 0~40000 | 0.01 [Hz] |
| 12CAh | [VR] input active range start % | A163 | R/W | 0~100 | 1 [%] |
| 12CBh | [VR] input active range end % | A164 | R/W | 0~100 | 1 [%] |
| 12CCh | [VR] input start frequency select | A165 | R/W | 0(start frequency A161) / 1(0Hz) | - |
| 12CDh to 1300h | unused | - | - | Inaccessible | - |

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(4) Registers (group B)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|--------------|---|---------------|-----|--|-----------------|
| 1301h | Restart mode on power failure / under-voltage trip | b001 | R/W | 0 (tripping), 1 (starting with 0 Hz), 2 (starting with matching frequency), 3 (tripping after deceleration and stopping with matching frequency) | - |
| 1302h | Allowable under-voltage power failure time | b002 | R/W | 3 to 250 | 0.1 [s] |
| 1303h | Retry wait time before motor restart | b003 | R/W | 3 to 1000 | 0.1 [s] |
| 1304h | Instantaneous power failure/under-voltage trip alarm enable | b004 | R/W | 0 (disabling), 1 (enabling), 2 (disabling during stopping and decelerating to stop) | - |
| 1305h | Number of restarts on power failure/under-voltage trip events | b005 | R/W | 0 (16 times), 1 (unlimited) | - |
| 1306h | (Reserved) | - | - | - | - |
| 1307h | (Reserved) | - | - | - | - |
| 1308h | Restart frequency threshold | b007 | R/W | 0 to 40000 | 0.01 [Hz] |
| 1309h | Restart mode on over voltage / over current | b008 | R/W | 0 (tripping), 1 (starting with 0 Hz), 2 (starting with matching frequency), 3 (tripping after deceleration and stopping with matching frequency) | - |
| 130Ah | (Reserved) | - | - | - | - |
| 130Bh | Number of retry on over voltage / over current | b010 | R/W | 1 to 3 | 1 [times] |
| 130Ch | Retry wait time on over voltage / over current | b011 | R/W | 3 to 1000 | 0.1 [s] |
| 130Dh | Level of electronic thermal | b012 | R/W | 2000 to 10000 | 0.01 [%] |
| 130Eh | Electronic thermal characteristic | b013 | R/W | 0 (reduced-torque characteristic), 1 (constant-torque characteristic), 2 (free setting) | - |
| 130Fh | (Reserved) | - | - | Inaccessible | - |
| 1310h | Free setting, electronic thermal frequency (1) | b015 | R/W | 0 to 400 | 1 [Hz] |
| 1311h | Free setting, electronic thermal current (1) | b016 | R/W | 0 to 10000 | 0.01 [%] |
| 1312h | Free setting, electronic thermal frequency (2) | b017 | R/W | 0 to 400 | 1 [Hz] |
| 1313h | Free setting, electronic thermal current (2) | b018 | R/W | 0 to 10000 | 0.01 [%] |
| 1314h | Free setting, electronic thermal frequency (3) | b019 | R/W | 0 to 400 | 1 [Hz] |
| 1315h | Free setting, electronic thermal current (3) | b020 | R/W | 0 to 10000 | 0.01 [%] |
| 1316h | Overload restriction operation mode | b021 | R/W | 0 (disabling), 1 (enabling during acceleration and constant-speed operation), 2 (enabling during constant-speed operation) | - |
| 1317h | Overload restriction level | b022 | R/W | 2000 to 20000 | 0.01 [%] |
| 1318h | Deceleration rate at overload restriction | b023 | R/W | 1 to 30000 | 0.1 [s] |
| 1319h | Overload restriction operation mode (2) | b024 | R/W | 0 (disabling), 1 (enabling during acceleration and constant-speed operation), 2 (enabling during constant-speed operation) | - |
| 131Ah | Overload restriction level 2 | b025 | R/W | 2000 to 20000 | 0.01 [%] |
| 131Bh | Deceleration rate at overload restriction (2) | b026 | R/W | 1 to 30000 | 0.1 [s] |
| 131Ch | Over current suppression enable | b027 | R/W | 0 (disabling), 1 (enabling) | - |
| 131Dh | Current level of active freq. matching | b028 | R/W | 1000 to 20000 | 0.01 [%] |
| 131Eh | Deceleration rate of active freq. matching | b029 | R/W | 1 to 30000 | 0.1 [s] |

Chapter 8 Communication Functions

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|---|-----------------|
| 131Fh | Start freq. of active frequency matching | b030 | R/W | 0 (frequency at the last shutoff), 1 (maximum frequency), 2 (set frequency) | - |
| 1320h | Software lock mode selection | b031 | R/W | 0 (disabling change of data other than "b031" when SFT is on), 1 (disabling change of data other than "b031" and frequency settings when SFT is on), 2 (disabling change of data other than "b031"), 3 (disabling change of data other than "b031" and frequency settings), 10 (enabling data changes during operation) | - |
| 1321h | (Reserved) | - | - | - | - |
| 1322h | (Reserved) | - | - | - | - |
| 1323h | Run/power-on warning time | b034 (high) | R/W | 0 to 65535 | 1 [10h] |
| 1324h | | b034 (low) | R/W | | |
| 1325h | Rotation direction restriction | b035 | R/W | 0 (Enable for both dir)/ 1 (Enable for forward only)/ 2 (Enable for reverse only) | - |
| 1326h | Reduced voltage start selection | b036 | R/W | 0 (minimum reduced voltage start time) to 250 (maximum reduced voltage start time) | - |
| 1327h | Function code display restriction | b037 | R/W | 0 (full display), 1 (function-specific display), 3 (data comparison display), 4 (basic display), 5 (monitor display) | - |
| 1328h | Initial display selection | b038 | R/W | 000,001-060/201/202 | - |
| 1329h to 1333h | (Reserved) | - | - | - | - |
| 1334h | Controlled deceleration on power loss | b050 | R/W | 0 (disabling), 1 (enabling), 2, (nonstop operation at momentary power failure (no restoration)) 3, (nonstop operation at momentary power failure (restoration to be done)) | - |
| 1335h | DC bus voltage trigger level of ctrl. decel. | b051 | R/W | 0 to 4000 | 0.1 [V] |
| 1336h | Over-voltage threshold of ctrl. decel. | b052 | R/W | 0 to 4000 | 0.1 [V] |
| 1337h | Deceleration time of ctrl. decel. | b053 (high) | R/W | 1 to 30000 | 0.01 [s] |
| 1338h | | b053 (low) | R/W | | |
| 1339h | Initial freq. drop of ctrl. decel. | b054 | R/W | 0 to 1000 | 0.01 [Hz] |
| 133Ah to 133Eh | (Reserved) | - | - | - | - |
| 133Fh | Maximum-limit level of window comparators O | b060 | R/W | 0. to 100. (lower limit : b061 + b062 *2) (%) | 1 [%] |
| 1340h | Minimum-limit level of window comparators O | b061 | R/W | 0. to 100. (lower limit : b060 - b062*2) (%) | 1 [%] |
| 1341h | Hysteresis width of window comparators O | b062 | R/W | 0. to 10. (lower limit : b061 - b062 / 2) (%) | 1 [%] |

Chapter 8 Communication Functions

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|--|-----------------|
| 1342h to 1348h | (Reserved) | - | - | - | |
| 1349h | Operation level at O disconnection | b070 | R/W | 0. to 100. (%) or "no" (ignore) | 1 [%] |
| 134Ah to 1350h | (reserved) | - | - | - | - |
| 1351h | Cumulative input power data clearance | b078 | R/W | Clearance by setting "1" | - |
| 1352h | Watt-hour display gain | b079 | R/W | 1 to 1000 | 1 |
| 1353h to 1354h | (Reserved) | - | - | - | - |
| 1355h | Start frequency | b082 | R/W | 1 to 999 | 0.01 [Hz] |
| 1356h | Carrier frequency | b083 | R/W | 20 to 150 | 0.1 [kHz] |
| 1357h | Initialization mode (parameters or trip history) | b084 | R/W | 0(disabling),1 (clearing the trip history), 2 (initializing the data), 3 (clearing the trip history and initializing the data) | - |
| 1358h | Country code for initialization | b085 | R/W | 0 (area A), 1 (area B) | - |
| 1359h | Frequency scaling conversion factor | b086 | R/W | 1 to 9999 | 0.01 |
| 135Ah | STOP key enable | b087 | R/W | 0 (enabling), 1 (disabling), 2 (disabling only stop) | - |
| 135Bh | Restart mode after FRS | b088 | R/W | 0 (starting with 0 Hz), 1 (starting with matching frequency) | - |
| 135Ch | Automatic carrier frequency reduction | b089 | R/W | 0(disabling)/1(enabling(output current controlled)) | - |
| 135Dh | (Reserved) | - | - | - | - |
| 135Eh | Stop mode selection | b091 | R/W | 0 (deceleration until stop), 1 (free-run stop) | - |
| 135Fh | (Reserved) | - | - | - | - |
| 1360h | (Reserved) | - | - | - | - |
| 1361h | Initialization target data | b094 | R/W | 0(All parameter) /1(expect terminal and communication) | - |
| 1362h to 1366h | (Reserved) | - | - | - | - |
| 1367h | Free-setting V/f frequency (1) | b100 | R/W | 0. to "free-setting V/f frequency (2)" | 1 [Hz] |
| 1368h | Free-setting V/f voltage (1) | b101 | R/W | 0. to 3000 | 0.1 [V] |
| 1369h | Free-setting V/f frequency (2) | b102 | R/W | 0. to "free-setting V/f frequency (3)" | 1 [Hz] |
| 136Ah | Free-setting V/f voltage (2) | b103 | R/W | 0. to 3000 | 0.1 [V] |
| 136Bh | Free-setting V/f frequency (3) | b104 | R/W | 0. to "free-setting V/f frequency (4)" | 1 [Hz] |
| 136Ch | Free-setting V/f voltage (3) | b105 | R/W | 0. to 3000 | 0.1 [V] |
| 136Dh | Free-setting V/f frequency (4) | b106 | R/W | 0. to "free-setting V/f frequency (5)" | 1 [Hz] |
| 136Eh | Free-setting V/f voltage (4) | b107 | R/W | 0. to 3000 | 0.1 [V] |
| 136Fh | Free-setting V/f frequency (5) | b108 | R/W | 0. to "free-setting V/f frequency (6)" | 1 [Hz] |
| 1370h | Free-setting V/f voltage (5) | b109 | R/W | 0. to 3000 | 0.1 [V] |
| 1371h | Free-setting V/f frequency (6) | b110 | R/W | 0. to "free-setting V/f frequency (7)" | 1 [Hz] |
| 1372h | Free-setting V/f voltage (6) | b111 | R/W | 0. to 3000 | 0.1 [V] |
| 1373h | Free-setting V/f frequency (7) | b112 | R/W | 0. to 400. | 1 [Hz] |
| 1374h | Free-setting V/f voltage (7) | b113 | R/W | 0. to 3000 | 0.1 [V] |

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|---|-----------------|
| 1375h to 1384h | (Reserved) | - | - | - | - |
| 1385h | Deceleration over voltage suppression enable | b130 | R/W | 0 (disabling), 1 (enabling), 2 (enabling with acceleration), 3 (when Const/Dec) | - |
| 1386h | Decel. over volt. suppress level | b131 | R/W | 200 V class: 330 to 390 (V) 400 V class: 660 to 780 (V) | 1 [V] |
| 1387h | Decel. over volt. suppress const. | b132 | R/W | 10 to 3000 | 0.01 [s] |
| 1388h | Decel. overvolt. suppress proportional gain | b133 | R/W | 0 to 500 | 0.01 |
| 1389h | Decel. overvolt. suppress Integral time | b134 | R/W | 0 to 1500 | 0.1 [s] |
| 138Ah to 1398h | (Reserved) | - | - | - | - |
| 1399h | Display ex.operator connected | b150 | R/W | 001 to 060 | - |
| 139Ah to 13A2h | (Reserved) | - | - | - | - |
| 13A3h | 1st parameter of Dual Monitor | b160 | R/W | 001 to 018 | - |
| 13A4h | 2nd parameter of Dual Monitor | b161 | R/W | 001 to 018 | - |
| 13A5h | (Reserved) | - | - | - | - |
| 13A6h | Freq. set in monitoring | b163 | R/W | 0 (disabling), 1 (enabling) | - |
| 13A7h | Automatic return to the initial display | b164 | R/W | 0 (disabling), 1 (enabling) | - |
| 13A8h | Ex. operator com. loss action | b165 | R/W | 0 (tripping), 1 (tripping after decelerating and stopping the motor), 2 (ignoring errors), 3 (stopping the motor after free-running), 4 (decelerating and stopping the motor) | - |
| 13A9h | Data Read/Write select | b166 | R/W | 0 (Read/Write OK) / 1 (Protected) | - |
| 13AAh to 13B6h | (Reserved) | - | - | - | - |
| 13B7h | Initialization trigger | b180 | R/W | 0 (disabling), 1 (enabling) | - |
| 13B8h to 1400h | unused | - | - | Inaccessible | - |

Chapter 8 Communication Functions

(5) Registers (group C)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|------------------------|---------------|-----|--|-----------------|
| 1401h | Input [1] function | C001 | R/W | 1 (RV: Reverse RUN), 2 (CF1: Multispeed 1 setting), 3 (CF2: Multispeed 2 setting), 4 (CF3: Multispeed 3 setting), 6 (JG: Jogging), 7 (DB: external DC braking), 8 (SET: Set 2nd motor data), 9 (2CH: 2-stage acceleration/deceleration), 11 (FRS: free-run stop), 12 (EXT: external trip), 13 (USP: unattended start protection), 15 (SFT: software lock), 18 (RS: reset), 20 (STA: starting by 3-wire input), 21 (STP: stopping by 3-wire input), 22 (F/R: forward/reverse switching by 3-wire input), 23 (PID: PID disable), 24 (PIDC: PID reset), 27 (UP: remote control UP function), 28 (DWN: remote control DOWN function), 29 (UDC: remote control data clearing), 31 (OPE: forcible operation), 32 (SF1: multispeed bit 1), 33 (SF2: multispeed bit 2), 34 (SF3: multispeed bit 3), 39 (OLR: overload restriction selection), 50 (ADD: trigger for frequency addition [A145]), 51 (F-TM: forcible-terminal operation), 53 (KHC: cumulative power clearance), 65 (AHD: analog command holding), 83 (HLD: retain output frequency), 84 (ROK: permission of run command), 86 (DISP: Display limitation), 255 (no: no assignment), | - |
| 1402h | Input [2] function | C002 | R/W | | - |
| 1403h | Input [3] function | C003 | R/W | | - |
| 1404h | Input [4] function | C004 | R/W | | - |
| 1405h | Input [5] function | C005 | R/W | | - |
| 1406h to 140Ah | (Reserved) | - | - | Inaccessible | - |
| 140Bh | Input [1] active state | C011 | R/W | 0 (NO), 1 (NC) | - |
| 140Ch | Input [2] active state | C012 | R/W | 0 (NO), 1 (NC) | - |
| 140Dh | Input [3] active state | C013 | R/W | 0 (NO), 1 (NC) | - |
| 140Eh | Input [4] active state | C014 | R/W | 0 (NO), 1 (NC) | - |
| 140Fh | Input [5] active state | C015 | R/W | 0 (NO), 1 (NC) | - |
| 1410h to 1414h | (Reserved) | - | - | Inaccessible | - |

Chapter 8 Communication Functions

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|---|---------------|-----|---|-----------------|
| 1415h | Output [11] function | C021 | R/W | 0 (RUN: running), 1 (FA1: constant-speed reached), 2 (FA2: set frequency overreached), 3 (OL: overload notice advance signal (1)), 4 (OD: output deviation for PID control), 5 (AL: alarm signal), 6 (FA3: set frequency reached), 9 (UV: undervoltage), 11 (RNT: operation time over), 12 (ONT: plug-in time over), 13 (THM: thermal alarm signal), 21 (ZS: 0 Hz detection signal), 31 (FBV: PID feedback comparison), 32 (NDc: communication line disconnection), 33 (LOG1: logical operation result 1), 41 (FR: starting contact signal), 42 (OHF: heat sink overheat warning), 43 (LOC: low-current indication signal), 50 (IRDY: inverter ready), 51 (FWR: forward rotation), 52 (RVR: reverse rotation), 53 (MJA: major failur) 54 (WCO: window comparator O), 58(FREF),59(REF),60(SETM), 255 (no: no assignment) | - |
| 1416h to 1419h | (Reserved) | - | - | | - |
| 141Ah | Alarm relay function | C026 | R/W | | - |
| 141Bh | [FM] terminal selection | C027 | R/W | 0 (output frequency), 1 (output current), 3 (digital output frequency), 4 (output voltage), 5 (input power), 6 (electronic thermal overload), 7 (LAD frequency), 8 (digital current monitoring), 10 (heat sink temperature) | - |
| 141Ch | (reserved) | - | - | - | - |
| 141Dh | (reserved) | - | - | - | - |
| 141Eh | Digital current monitor reference value | C030 | R/W | 2000 to 20000 | 0.01 [%] |
| 141Fh | Output [11] active state | C031 | R/W | 0 (NO), 1 (NC) | - |
| 1420h to 1423h | (Reserved) | - | - | - | - |
| 1424h | Alarm relay active state | C036 | R/W | 0 (NO), 1 (NC) | - |
| 1425h | (Reserved) | - | - | - | - |
| 1426h | Output mode of low current detection | C038 | R/W | 0 (output during acceleration/deceleration and constant-speed operation), 1 (output only during constant-speed operation) | - |
| 1427h | Low current detection level | C039 | R/W | 0 to 20000 | 0.01 [%] |
| 1428h | Overload signal output mode | C040 | R/W | 00 (output during acceleration/deceleration and constant-speed operation), 01 (output only during constant-speed operation) | - |
| 1429h | Overload warning level | C041 | R/W | 0 to 20000 | 0.01 [%] |

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|---|-----------------|
| 142Ah | (Reserved) | - | - | - | - |
| 142Bh | Frequency arrival setting for accel. | C042 | R/W | 0 to 40000 | 0.01 [Hz] |
| 142Ch | (Reserved) | - | - | - | - |
| 142Dh | Frequency arrival setting for decel. | C043 | R/W | 0 to 40000 | 0.01 [Hz] |
| 142Eh | PID deviation level | C044 | R/W | 0 to 1000 | 0.1 [%] |
| 142Fh to 1437h | (Reserved) | - | - | - | - |
| 1438h | Maximum PID feedback data | C052 | R/W | 0 to 1000 | 0.1 [%] |
| 1439h | Minimum PID feedback data | C053 | R/W | 0 to 1000 | 0.1 [%] |
| 143Ah to 1440h | (Reserved) | - | - | - | - |
| 1441h | Electronic thermal warning level | C061 | R/W | 0 to 100 | 1 [%] |
| 1442h | (Reserved) | - | - | - | - |
| 1443h | Zero speed detection level | C063 | R/W | 0 to 10000 | 0.01 [Hz] |
| 1444h | Heat sink overheat warning level | C064 | R/W | 0 to 110 | 1 [°c] |
| 1445h to 144Ah | (Reserved) | - | - | - | - |
| 144Bh | Communication speed | C071 | R/W | 04(4800bps), 05(9600bps), 06(19.2kbps), 07(38.4kbps) | - |
| 144Ch | Modbus address | C072 | R/W | 1. to 247. | - |
| 144Dh | (Reserved) | - | - | - | - |
| 144Eh | Communication parity | C074 | R/W | 00 (no parity), 01 (even parity), 02 (odd parity) | - |
| 144Fh | Communication stop bit | C075 | R/W | 1 (1 bit), 2 (2 bits) | - |
| 1450h | Selection of the operation after communication error | C076 | R/W | 0 (tripping), 1 (tripping after decelerating and stopping the motor), 2 (ignoring errors), 3 (stopping the motor after free-running), 4 (decelerating and stopping the motor) | - |
| 1451h | Communication timeout limit | C077 | R/W | 0 to 9999 | 0.01 [s] |
| 1452h | Communication wait time | C078 | R/W | 0 to 1000 | 1 [ms] |
| 1453h to 1454h | (Reserved) | - | - | - | - |
| 1455h | [O/OI] input span calibration | C081 | R/W | 0 to 2000 | 0.1 |
| 1456h to 145Eh | (Reserved) | - | - | - | - |
| 145Fh | Debug mode enable | C091 | R | 0/1 | - |
| 1460h to 1468h | (Reserved) | - | - | - | - |

Chapter 8 Communication Functions

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|-------------------------------------|---------------|-----|--|-----------------|
| 1469h | Up/Down memory mode selection | C101 | R/W | 0 (not storing the frequency data), 1 (storing the frequency data) | - |
| 146Ah | Reset mode selection | C102 | R/W | 0 (resetting the trip when RS is on), 1 (resetting the trip when RS is off), 2 (enabling resetting only upon tripping [resetting when RS is on]) | - |
| 146Bh | Restart mode after reset | C103 | R/W | 0 (starting with 0 Hz), 1 (starting with matching frequency) | - |
| 146Ch | UP/DWN clear mode | C104 | R/W | 0 (0Hz) /1 (when power supply is turned on) | - |
| 146Dh | FM gain adjustment | C105 | R/W | 50 to 200 | 1 [%] |
| 146Eh to 1485h | (Reserved) | - | - | - | - |
| 1486h | Output [11] on-delay time | C130 | R/W | 0 to 1000 | 0.1 [s] |
| 1487h | Output [11] off-delay time | C131 | R/W | 0 to 1000 | 0.1 [s] |
| 1488h to 148F | (Reserved) | - | - | - | - |
| 1490h | Output RY on-delay time | C140 | R/W | 0 to 1000 | 0.1 [s] |
| 1491h | Output RY off-delay time | C141 | R/W | 0 to 1000 | 0.1 [s] |
| 1492h | Logic output 1 operand A | C142 | R/W | Same as the settings of C021 to C026 (except those of LOG1,no) | - |
| 1493h | Logic output 1 operand B | C143 | R/W | Same as the settings of C021 to C026 (except those of LOG1,no) | - |
| 1494h | Logical output 1 operator | C144 | R/W | 0 (AND), 1 (OR), 2 (XOR) | - |
| 1495h to 149Ah | (Reserved) | - | - | - | - |
| 149Bh | Button sensitivity selection | C151 | R/W | 0 to 250 / no(255) | - |
| 149Ch | Scroll sensitivity selection | C152 | R/W | 1 to 20 | - |
| 149Dh to 14A3h | (Reserved) | - | - | - | - |
| 14A4h | Input [1] response time | C160 | R/W | 0 to 200 | |
| 14A5h | Input [2] response time | C161 | R/W | 0 to 200 | |
| 14A6h | Input [3] response time | C162 | R/W | 0 to 200 | |
| 14A7h | Input [4] response time | C163 | R/W | 0 to 200 | |
| 14A8h | Input [5] response time | C164 | R/W | 0 to 200 | |
| 14A9h to 14ACh | (Reserved) | - | - | - | - |
| 14ADh | Multistage speed determination time | C169 | R/W | 0 to 200 | |
| 14A4h to 1500h | unused | - | - | Inaccessible | - |

(6) Registers (group H)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|---|---------------|-----|--|-----------------|
| 1501h | (Reserved) | - | - | - | |
| 1502h | (Reserved) | - | - | - | |
| 1503h | Motor capacity, 1st motor | H003 | R/W | 00(0.1kW)-11 (5.5kW) | - |
| 1504h | Motor poles setting, 1st motor | H004 | R/W | 0 (2 poles), 1 (4 poles), 2 (6 poles), 3 (8 poles) | - |
| 1505h | (Reserved) | - | - | - | - |
| 1506h | (Reserved) | - | - | - | - |
| 1507h | Motor stabilization constant, 1st motor | H006 | R/W | 0 to 255 | 1 |
| 1508h to 2102h | unused | - | - | Inaccessible | - |

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(7) Registers (2nd control settings F group)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|----------------------------------|---------------|-----|------------------------------|-----------------|
| 2103h | Acceleration time (1), 2nd motor | F202 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 2104h | | F202 (low) | R/W | | |
| 2105h | Deceleration time (1), 2nd motor | F203 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 2106h | | F203 (low) | R/W | | |
| 2107h to 2200h | unused | - | - | Inaccessible | - |

(8) Registers (2nd control settings A,B,C,H group)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|--|-----------------|
| 2201h | Frequency source, 2nd motor | A201 | R/W | 0 (keypad potentiometer), 1 (control circuit terminal block), 2 (digital operator), 3 (Modbus), 10 (operation function result) | - |
| 2202h | Frequency source, 2nd motor | A202 | R/W | 1 (control circuit terminal block), 2 (digital operator), 3 (Modbus) | - |
| 2203h | Base frequency, 2nd motor | A203 | R/W | 300 to "maximum frequency, 2nd motor" | 0.1 [Hz] |
| 2204h | Maximum frequency, 2nd motor | A204 | R/W | 300 to 4000 | 0.1 [Hz] |
| 2205h to 2215h | (Reserved) | - | - | Inaccessible | - |
| 2216h | (Reserved) | - | - | Inaccessible | - |
| 2217h | Multispeed frequency setting, 2nd motor | A220 | R/W | 0 or "start frequency" to "maximum frequency, 2nd motor" | 0.01 [Hz] |
| 2218h to 223Ah | (Reserved) | - | - | Inaccessible | - |
| 223Bh | Torque boost method selection, 2nd motor | A241 | R/W | 0 (manual torque boost), 1 (automatic torque boost) | - |
| 223Ch | Manual torque boost value, 2nd motor | A242 | R/W | 0 to 200 | 0.1 [%] |
| 223Dh | Manual torque boost frequency, 2nd motor | A243 | R/W | 0 to 500 | 0.1 [%] |
| 223Eh | V/F characteristic curve selection, 2nd motor | A244 | R/W | 0 (VC), 1 (VP), 2 (free V/f) | - |
| 223Fh | V/f gain, 2nd motor | A245 | R/W | 20 to 100 | 1 [%] |
| 2240h | Voltage compensation gain setting for automatic torque boost, 2nd motor | A246 | R/W | 0 to 255 | 1 |
| 2241h | Slippage compensation gain setting for automatic torque boost, 2nd motor | A247 | R/W | 0 to 255 | 1 |
| 2242h to 224Eh | (Reserved) | - | - | Inaccessible | - |
| 224Fh | (Reserved) | - | - | Inaccessible | - |
| 2250h | Frequency upper limit, 2nd motor | A261 | R/W | 00 or "2nd minimum frequency limit" to "maximum frequency, 2nd motor" | 0.01 [Hz] |
| 2251h | (Reserved) | - | - | Inaccessible | - |
| 2252h | Frequency lower limit, 2nd motor | A262 | R/W | 00 or "start frequency" to "maximum frequency, 2nd motor limit" | 0.01 [Hz] |
| 2253h to 2268h | (Reserved) | - | - | Inaccessible | - |
| 2269h | AVR function select, 2nd motor | A281 | R/W | 0 (always on), 1 (always off), 2 (off during deceleration) | - |
| 226Ah | AVR voltage select, 2nd motor | A282 | R/W | 200 V class: 0 (200)/1 (215)/2 (220)/3 (230)/4 (240) | |
| 226Bh to 226Eh | (Reserved) | - | - | Inaccessible | - |

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| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|----------------|--|---------------|-----|--|-----------------|
| 226Fh | Acceleration time (2), 2nd motor | A292 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 2270h | | A292 (low) | R/W | | |
| 2271h | Deceleration time (2), 2nd motor | A293 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 2272h | | A293 (low) | R/W | | |
| 2273h | Select method to switch to Acc2/Dec2, 2nd motor | A294 | R/W | 0 (switching by 2CH terminal), 1 (switching by setting), 2 (switching only when the rotation is reversed) | - |
| 2274h | (Reserved) | - | - | - | - |
| 2275h | Acc1 to Acc2 frequency transition point, 2nd motor | A295 | R/W | 0 to 40000 | 0.01 [Hz] |
| 2276h | (Reserved) | - | - | - | - |
| 2277h | Dec1 to Dec2 frequency transition point, 2nd motor | A296 | R/W | 0 to 40000 | 0.01 [Hz] |
| 2278h to 230Bh | (Reserved) | - | - | - | - |
| 230Ch | Level of electronic thermal, 2nd motor | b212 | R/W | 2000 to 10000 | 0.01 [%] |
| 230Dh | Electronic thermal characteristic, 2nd motor | b213 | R/W | 0 (reduced-torque characteristic), 1 (constant-torque characteristic), 2 (free setting) | - |
| 230Eh to 2315h | (Reserved) | - | - | - | - |
| 2316h | Overload restriction operation mode, 2nd motor | b221 | R/W | 0 (disabling), 1 (enabling during acceleration and constant-speed operation), 2 (enabling during constant-speed operation) | - |
| 2317h | Overload restriction level, 2nd motor | b222 | R/W | 1000 to 20000 | 0.01[%] |
| 2318h | Deceleration rate at overload restriction, 2nd motor | b223 | R/W | 1 to 30000 | 0.1[s] |
| 2319h to 2428h | unused | - | - | Inaccessible | - |
| 2429h | Overload warning level 2, 2nd motor | C241 | R/W | 0 to 20000 | 0.01[%] |
| 242Ah to 2502h | Unused | - | - | Inaccessible | - |
| 2503h | Motor capacity, 2nd motor | H203 | R/W | 00(0.1kW)- 11 (5.5kW) | - |
| 2504h | Motor poles setting, 2nd motor | H204 | R/W | 0 (2 poles), 1 (4 poles), 2 (6 poles), 3 (8 poles) | - |
| 2505h | (Reserved) | - | - | - | - |
| 2506h | (Reserved) | - | - | - | - |
| 2507h | Motor stabilization constant, 2nd motor | H206 | R/W | 0 to 255 | 1 |
| 2508h~ | (Reserved) | - | - | Inaccessible | - |

Chapter 9 Error Codes

This chapter describes the error codes of the inverter, error indications by the functions, and troubleshooting methods.

| | | |
|-----|--|-------|
| 9.1 | Indication of the error | 9 - 1 |
| 9.2 | Error Codes and Troubleshooting | 9 - 3 |
| 9.3 | Warning Codes for Digital operator | 9 - 5 |
| 9.4 | Other Display for Digital operator | 9 - 6 |

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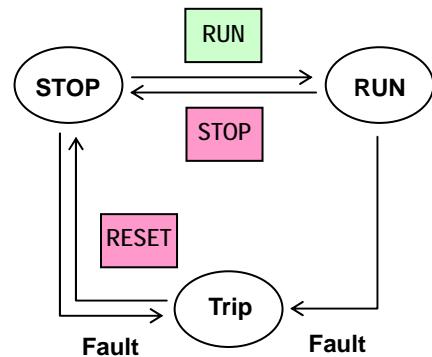
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Chapter 9 Error Codes

9.1 Indication of the error

The microprocessor in the inverter detects a variety of fault conditions and captures the event, recording it in a history table. The inverter output turns OFF, or “trips” similar to the way a circuit breaker trips due to an over-current condition. Most faults occur when the motor is running (refer to the diagram to the right). However, the inverter could have an internal fault and trip in Stop Mode.

In either case, you can clear the fault by pressing the Reset key/terminal except some errors.



* How to remove the error condition

- Pressing the [RUN/STOP/RESET] key. ([STOP/RESET] key in the operator.)
- Intelligent input terminal is assigned reset(18:RS). And to operate the terminal.
- A power cycle of the inverter.

Note) Error by a factor may not be canceled by a reset a),b). In this case, please go to c).

[Standard panel]

The ALM (red) of the main body, LED indication of RUN (yellowish green) display it like a list shown below at the time of error outbreak.

| Error contents | LED Lighting, Blinking | |
|--------------------|------------------------|------------------------|
| | ALM LED | RUN LED |
| Over-current event | Lighting | Blinking |
| Over-voltage | Blinking : Same period | Blinking : Same period |
| Under-voltage | Blinking : Alternation | Blinking : Alternation |
| Over load | Lighting | Lighting |
| Major failure | Lighting | Lights out |
| Others | Blinking | Lights out |

Note1) The Major fault : When a Memory error, Current detection error, CPU error, Ground fault, Thermal detection error

Note2) The blinking is a period for 1s.

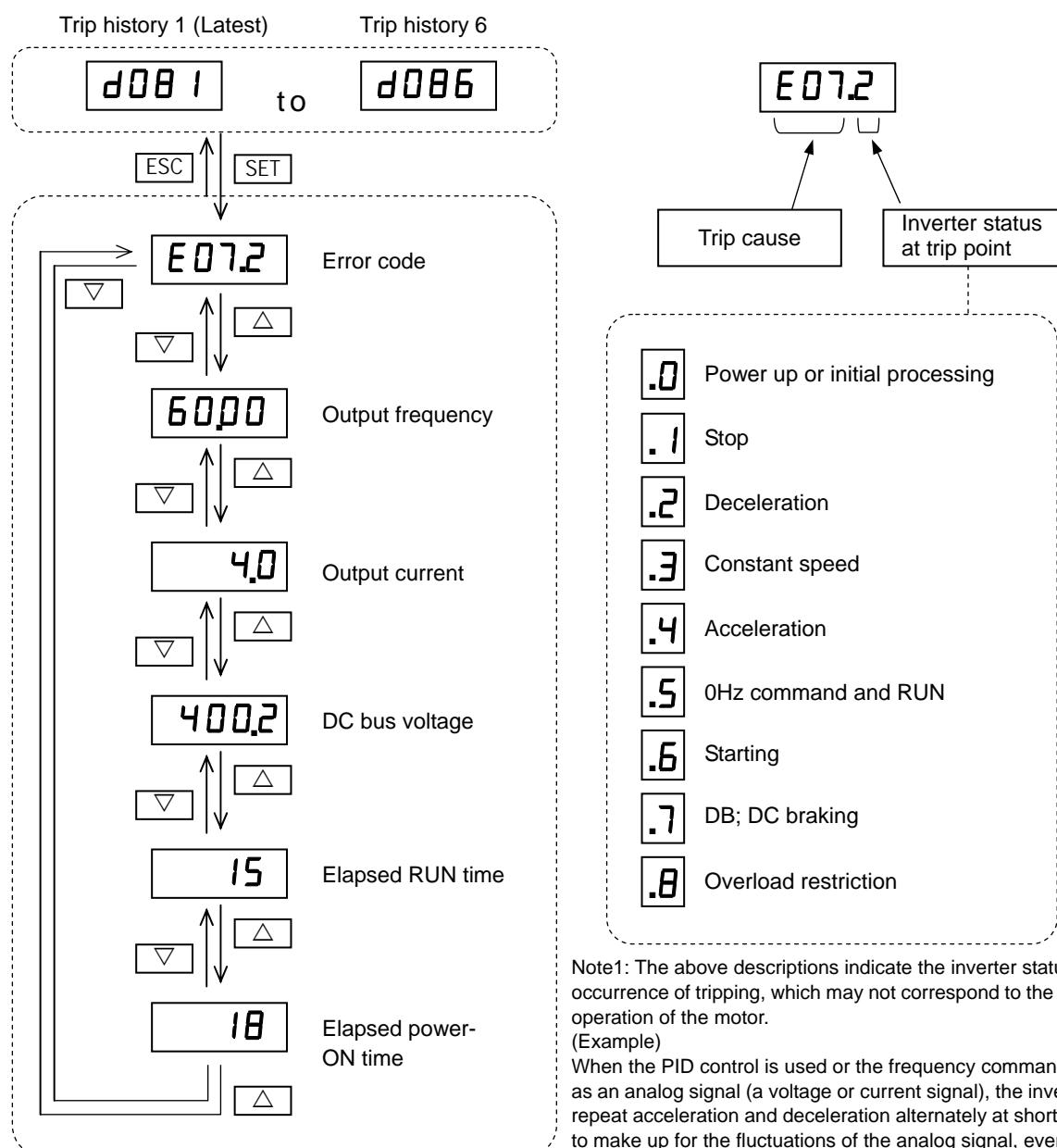
Chapter 9 Error Codes

[Digital Operator (NES1-OP, OPE-S/SR/SBK/SRmini)]

Trip History and Inverter Status

We recommend that you first find the cause of the fault before clearing it. When a fault occurs, the inverter stores important performance data at the moment of the fault. To access the data, use the monitor function (dxxx) and select **d081** I details about the present fault. The previous 5 faults are stored in **d082** to **d086**. Each error shifts **d081-d085** to **d082-d086**, and writes the new error to **d081**.

The following Monitor Menu map shows how to access the error codes. When fault(s) exist, you can review their details by first selecting the proper function: **d081** is the most recent, and **d086** is the oldest.



Note1: The above descriptions indicate the inverter status at the occurrence of tripping, which may not correspond to the apparent operation of the motor.
(Example)

When the PID control is used or the frequency command is input as an analog signal (a voltage or current signal), the inverter may repeat acceleration and deceleration alternately at short intervals to make up for the fluctuations of the analog signal, even if the motor is apparently running at constant speed.

In such cases, the inverter status at tripping may not correspond to the apparent operation of the motor.

Note2: During undervoltage, detailed information of the trip (historical trail) is not stored.

Chapter 9 Error Codes

9.2 Error Codes and Troubleshooting

It is not displayed with the standard panel.

| Name | Description | | Display on digital operator | Troubleshooting and corrective action | Reference page |
|--------------------------|---|---------------------------------|---|---|----------------|
| Overcurrent protection | If the motor is constrained or suddenly accelerated or decelerated, a high current will flow in the inverter and the inverter may fail. To avoid this problem, the inverter shuts off its output and displays the error code shown on the right when it detects a current higher than a specified level. This protective function uses a DC current detector (CT) to detect overcurrent. When a current as high as about 235%(peak) of the inverter's rated output current is detected, the protective circuit operates and the inverter trips. (*4) | During constant-speed operation |  | Check whether the load has fluctuated sharply. (Eliminate the load fluctuation.) Check for the short circuit of output connections. (Check the output cables.) Check for the ground fault. (Check the output cables and motor.) | 7-8 7-22 |
| | | During deceleration |  | Check whether the inverter has decelerated the motor quickly. (Increase the deceleration time.) | |
| | | During acceleration |  | Check whether the inverter has accelerated the motor quickly. (Increase the acceleration time.) Check whether the motor has been locked. (Check the motor and wiring.) Check whether the torque boost current has been set too high. (Reduce the boost current.) | |
| | | Others |  | Check whether the DC braking force is too high. (Reduce the braking force.) Check whether the current detector (CT) is normal. (Replace or repair the CT.) | 7-41 |
| Overload protection (*1) | This protective function monitors the inverter output current, and shuts off the inverter output and displays the error code shown on the right when the internal electronic thermal protection circuit detects a motor overload. If the error occurs, the inverter will trip according to the setting of the electronic thermal function. | |  | Check whether the motor load is too high. (Reduce the load factor.) Check whether the thermal level is appropriate. (Adjust the level appropriately.) Note: The electronic thermal protection is easily triggered when the output frequency is 5 Hz or less. If the moment of inertia of the load is large, this protective function may operate when the inverter accelerates the motor and the acceleration may be disabled. If this problem occurs, increase the torque boost current or adjust other settings as needed. | 7-61 7-63 |
| Overvoltage protection | If the DC voltage across the P and N terminals rises too high, an inverter failure may result. To avoid this problem, this protective function shuts off the inverter output and displays the error code shown on the right when the DC voltage across the P and N terminals exceeds a specified level because of an increase in the energy regenerated by the motor or the input voltage (during operation). The inverter will trip if the DC voltage across the P and N terminals exceeds about 400 VDC (in case of the 200 V class models) or about 800 VDC (in case of the 400 V class models). | |  | Check whether the inverter has decreased the motor quickly. (Increase the deceleration time.) Check for a ground fault. (Check the output cables and motor.) Check whether the motor has been rotated by the action of the load. (Reduce the regenerative energy.) | 7-8 |
| Memory error (*2) (*3) | When the built-in Memory is caused by external noise or an abnormal temperature rise, the inverter shuts off its output and displays the error code shown on the right. Note: A Memory error may cause a CPU error. | |  | Check for the noise sources located near the inverter. (Remove noise sources.) Check whether the cooling efficiency has deteriorated. (Check the heat sink for clogging, and clean it.) (Replace the cooling fan.) | - |
| Under voltage | If the inverter input voltage drops, the control circuit of the inverter cannot function normally. Therefore, the inverter shuts off its output when the input voltage falls below a specified level. The inverter will trip if the DC voltage across the P and N terminals exceeds about 175 VDC (in case of the 200 V class models) or about 345 VDC (in case of the 400 V class models). | |  | Check whether the power supply voltage has dropped. (Check the power supply.) Check whether the power supply capacity is sufficient. (Check the power supply.) | - |
| Current detection error | If an error occurs in the internal current detector (CT), the inverter will shut off its output and display the error code shown on the right. | |  | Check whether the inverter has failed. (Repair the inverter.) | - |
| CPU error (*3) | If the internal CPU malfunctions or an error occurs in it, the inverter will shut off its output and display the error code shown on the right. Note: Reading an abnormal data from the built-in memory may result in a CPU error. | |  | Check for the noise sources located near the inverter. (Remove noise sources.) Check whether the inverter has failed. (Repair the inverter.) | - |

*1 The inverter will not accept any reset command within about 10 seconds after tripping (i.e., after the protective function operates).

*2 The inverter will not accept any reset command after a Memory error occurs with error code  displayed. Turn off the inverter power once. If error code "E08" is displayed when the inverter power is turned on subsequently, the internal memory device may have failed or parameters may have not been stored correctly. In such cases, initialize the inverter, and then re-set the parameters.

*3 The inverter will not accept reset commands input via the RS terminal or entered by the STOP/RESET key. Therefore, turn off the inverter power.

*4 Rms current will be lower.

Chapter 9 Error Codes

| Name | Description | Display on digital operator | Troubleshooting and corrective action | Reference page |
|--|---|---|---|----------------|
| External trip | If an error occurs in the external equipment or device connected to the inverter, the inverter will fetch the error signal and shut off its output. (This protective function is enabled when the external trip function is enabled.) |  | Check whether an error has occurred in the external equipment (when the external trip function has been enabled). (Recover the external equipment from the error.) | - |
| USP error | A USP error is indicated when the inverter power is turned on with an input operation signal remaining in the inverter. (This protective function is enabled when the USP function is enabled.) |  | Check whether the inverter power has been turned on with an input operation signal remaining in the inverter (when the USP function has been enabled). (Reset the operation command, and then turn on the inverter power.) | 7-57 |
| Ground-fault protection (*3) | When the inverter power is turned on, this protective function detects the ground fault between the inverter output circuit and the motor to protect the inverter. (This function does not operate when a residual voltage remains in the motor.) |  | Check for the ground fault. (Check the output cables and motor.) Check the inverter itself for abnormality. (Remove the output cables from the inverter, and then check the inverter.) | 7-76 11-4 |
| Input overvoltage protection | This protective function determines an error if the input voltage is kept above the specification level for 100 seconds while the inverter is stopped. |  | Check whether the input voltage is high while the inverter is stopped. (Lower the input voltage, suppress the power voltage fluctuation, or connect an AC reactor between the power supply and the inverter input.) | - |
| Inverter thermal detection circuit error | When the thermal sensor in the inverter module is not function. |  | Check whether the inverter has failed. (Replace the inverter.) | - |
| Temperature error | If the main circuit temperature rises because of a high ambient temperature or for other reasons, the inverter will shut off its output. |  | Check whether the inverter is installed vertically. (Check the installation.) Check whether the ambient temperature is high. (Lower the ambient temperature.) | - |
| Driver error | If instantaneous overcurrent occurs, the main circuit element temperature is abnormal, or the main circuit element drive power drops, the inverter will shut off its output to protect the main circuit element. (After tripping because of this protective function, the inverter cannot retry the operation.) |  | Check the output circuit for a short circuit. (Check the output cables.) Check for the ground fault. (Check the output cables and motor.) Check the heat sink for clogging. (Clean the heat sink.) | 5-7 |
| Output phase loss protection | Output phase Loss Logic Detection.(There are undetectable terms of use) |  | Check for the output phase loss. (Check the Output Freq, carrier Freq current output cables and motor.) | 7-76 |
| Low-speed overload protection | If overload occurs during the motor operation at a very low speed, the electronic thermal protection circuit in the inverter will detect the overload and shut off the inverter output. (Note that a high frequency may be recorded as the error history data.) |  | Check whether the motor load is too high. (Reduce the load factor.) | - |
| Operator connection error | When the connection between inverter and operator keypad failed, inverter trips and displays the error code. |  | Check the operator cable. | - |
| Modbus communication error | If timeout occurs because of line disconnection during the communication in Modbus-RTU mode, the inverter will display the error code shown on the right. (The inverter will trip according to the setting of "C076".) |  | Check whether the communication speed setting is correct. Check whether the wiring distance is appropriate. (Check the connections.) | 8-4 |

*3 The inverter will not accept reset commands input via the RS terminal or entered by the STOP/RESET key. Therefore, turn off the inverter power.

Chapter 9 Error Codes

9.3 Warning Codes for Digital operator

The warning code for Digital operator is follows.

It is not displayed with the standard panel.

The inverter displays a warning code when the data set as a target function code satisfies the condition (specified in the Condition column) in relation to the data set as the corresponding basic function code.

| Warning code | Condition | | |
|--------------|---|---|--|
| H 001 | Frequency upper limit setting (A061) | > | Maximum frequency setting (A004) |
| H 002 | Frequency lower limit setting (A062) | > | Maximum frequency setting (A004) |
| H 005 | Output frequency setting (F001), multispeed 0 (A020) (note 1) | > | Maximum frequency setting (A004) |
| H 015 | Output frequency setting (F001), multispeed 0 (A020) (note 1) | > | Frequency upper limit setting (A061) |
| H 025 | Frequency lower limit setting (A062) | > | Output frequency setting (F001), multispeed 0 (A020) (note 1) |
| H 031 | Start frequency adjustment (b082) | > | Frequency upper limit setting (A061) |
| H 032 | Start frequency adjustment (b082) | > | Frequency lower limit setting (A062) |
| H 035 | Start frequency adjustment (b082) | > | Output frequency setting (F001), multispeed 0 (A020) (note 1) |
| H 037 | Start frequency adjustment (b082) | > | Jog frequency setting (A038) |
| H 085 | Output frequency setting (F001), multispeed 0 (A020) (note 1) | = | Jump (center) frequency settings 1/2/3 ± " Jump (hysteresis) frequency width settings 1/2/3" A063 ± A064, A065 ± A066, A067 ± A068 |
| H 086 | Multispeed 1 to 7 settings (A021 to A027) | = | |
| H 091 | Free-setting V/f frequency (7) (b112) | < | Frequency upper limit setting (A061) |
| H 092 | Free-setting V/f frequency (7) (b112) | < | Frequency lower limit setting (A062) |
| H 095 | Free-setting V/f frequency (7) (b112) | < | Output frequency setting (F001), multispeed 0 (A020) (note 1) |
| H 201 | Frequency upper limit setting (A261) | > | Maximum frequency setting (A204) |
| H 202 | Frequency lower limit setting (A262) | > | Maximum frequency setting (A204) |
| H 205 | Output frequency setting (F001), multispeed 0 (A220) (note 1) | > | Maximum frequency setting (A204) |
| H 215 | Output frequency setting (F001), multispeed 0 (A220) (note 1) | > | Frequency upper limit setting (A261) |
| H 225 | Frequency lower limit setting (A262) | > | Output frequency setting (F001), multispeed 0 (A220) (note 1) |
| H 231 | Start frequency adjustment (b082) | > | Frequency upper limit setting (A261) |
| H 232 | Start frequency adjustment (b082) | > | Frequency lower limit setting (A262) |
| H 235 | Start frequency adjustment (b082) | > | Output frequency setting (F001), multispeed 0 (A220) (note 1) |
| H 285 | Output frequency setting (F001), multispeed 0 (A220) (note 1) | = | Jump (center) frequency settings 1/2/3 ± " Jump (hysteresis) frequency width settings 1/2/3" A063 ± A064, A065 ± A066, A067 ± A068 |
| H 291 | Free-setting V/f frequency (7) (b112) | < | Frequency upper limit setting (A261) |
| H 292 | Free-setting V/f frequency (7) (b112) | < | Frequency lower limit setting (A262) |
| H 295 | Free-setting V/f frequency (7) (b112) | < | Output frequency setting (F001), multispeed 0 (A220) (note 1) |

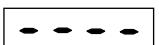
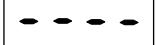
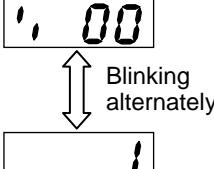
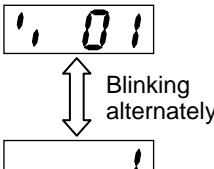
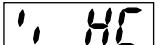
Note1)These parameters are checked, even when the digital operator (02) is not specified for the frequency source setting (A001).

Chapter 9 Error Codes

9.4 Other Display for Digital operator

The other display for Digital operator is follows.

It is not displayed with the standard panel.

| Name | Description | Display on digital operator |
|---|---|---|
| Reset | RS input is ON or STOP/RESET key is pressed. | Rotating  |
| Waiting in undervoltage status | If the input voltage falls, the inverter will shut off its output, display the code shown on the right, and wait for the recovery of the input voltage. The inverter will display the same error code also during an instantaneous power failure. (remark) Inverter trips with under voltage when this status continues for 40 seconds. |  |
| Waiting for retry | When the retry after instantaneous power failure or tripping has been enabled, the inverter displays the code shown on the right while awaiting retry after an instantaneous power failure or tripping. |  |
| Power-off | The inverter displays the code shown on the right when the inverter power is turned off. |  |
| Restricted operation command | When an operation direction has been restricted by the setting of "b035", the inverter will display the code shown on the right if the operation command specifying the restricted operation direction is input. |  |
| During Initialization for the parameter | Display during initialization for the parameter. In case of the b085=0 (pattern 0) |  Blinking alternately |
| | Display during initialization for the parameter. In case of the b085=1 (pattern 1) |  Blinking alternately |
| During Initialization for trip history | Display during initialization for the trip history. |  |
| Empty trip history | If the inverter has not tripped before, the inverter displays. |  |
| Communication error | If a problem occurs in the communication between the digital operator and inverter, the inverter will display the code shown on the right. | Blinking  |

Chapter 10 Troubleshooting

This chapter describes the troubleshooting methods.

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Chapter 10 Troubleshooting

Troubleshooting Tips

The table below lists typical symptoms and the corresponding solution(s).

1. Inverter does not power up.

| Possible Cause(s) | Corrective Action |
|--|---|
| Power cable is incorrectly wired. | Check input wiring. |
| Short bar or DCL between [P] and [PD] is disconnected. | Install short bar or DCL between [P] and [PD] terminal. |
| Power cable is breaking. | Check input wiring. |
| The case of single-phase 200V class, power is not connected to terminal L1, N. | Check input wiring. |

2. Motor does not start.

| Possible Cause(s) | Corrective Action |
|--|--|
| Incorrect RUN command source is selected. | Check RUN command source (A002) for correct source. Ex. Terminal (digital input) : 01 Operator (RUN key) : 02 |
| Incorrect frequency source is selected. | Check frequency source (A001) for correct source. Ex. Terminal (analog input) : 01 Operator (F001) : 02 |
| Frequency setting is 0Hz. | If frequency source is terminal (A001=01), check analog voltage or current signal at [O/OI] terminals. If frequency source is operator (A001=02), set frequency in F001. Depending on frequency source, input proper frequency reference. If frequency source is multi-speed operation, set frequency in A020 to A027 and A220. |
| RUN command is not set to input terminal. | If RUN command source is terminal (A002=01), set "forward" (00:FW) or "reverse" (01:RV) to any input terminals. In case of 3-wire control, set "3-wire start" (20:STA), "3-wire stop" (21:STP) and "3-wire FW/RV" (22:F/R) to any input terminals. |
| "Multi-speed input(s) (02 to 04:CF1 to CF3)" is (are) set to input terminal(s) and active. | Deactivate the input(s). |
| Both FWD and REV input are active. | If RUN command source is FWD/REV input, activate either FWD or REV input. |
| Rotation direction restriction (b035) is enabled. | Check b035. |
| Incorrect input wiring or short bar position | Wire inputs correctly and/or install short bar. (ON/OFF status of inputs are monitored in d005.) |
| Incorrect analog input or variable resistor wiring | Wire correctly. In case of analog voltage or variable resistor input, check voltage between [O/OI] and [L] terminal. In case of analog current, check current between current source and [O/OI] terminal. |
| RUN command source is operator, but input terminal is set to "Force terminal" and active. | Deactivate the input. |
| RUN command source is terminal, but input terminal is set to "Force operator" and active. | Deactivate the input. |
| Inverter is in trip status. (With ALARM LED and "Exxx" indication) | Reset inverter by STOP/RESET key and check error code or Power OFF the inverter. |
| "18:RS" or "11:FRS" is set to input terminal and the input is active. | Deactivate the input. |
| "84:ROK" is set to input terminal and the input is active. | Activate the input. |
| Cable between inverter and motor or internal cable of motor is breaking. | Check the wiring. |
| Excessive load. | Remove excessive load. |
| Motor is locked. | Unlock the motor. |

Chapter 10 Troubleshooting

3. Motor does not accelerate to command speed.

| Possible Cause(s) | Corrective Action |
|--|---|
| Bad connection of analog wiring. | Check the wiring. In case of analog voltage or variable resistor input, check voltage between [O/OI] and [L] terminal. In case of analog current, check current between current source and [O/OI] terminal. Check SW6. Once again, set the SW6 ON-OFF |
| Overload restriction or OC suppression function works. | Check the function level. |
| Max. frequency (A004) or upper limit (A061/A261) is lower than as expected. | Check the value. |
| Acceleration time is excessive. | Change acceleration time (F002/A092/A292). |
| "Multi-speed input(s) (02 to 04:CF1 to CF3)" is (are) set to input terminal(s) and active. | Deactivate the input(s). |
| "06:JG" is set to input terminal and the input is active. | Deactivate the input. |
| Excessive load. | Remove excessive load. |
| Motor is locked. | Unlock the motor. |

4. Inverter does not respond to changes in frequency setting F001 display from operator.

| Possible Cause(s) | Corrective Action |
|---|-----------------------------------|
| Incorrect frequency source is selected. | Check frequency source (A001=02). |
| "51:F-TM" is set to input terminal and the input is active. | Deactivate the input. |

5. A part of function codes is not displayed.

| Possible Cause(s) | Corrective Action |
|---|-------------------------------|
| "Function code display restriction" (b037) is enabled. | Set 00 (all display) to b037. |
| "86:DISP" is set to input terminal and the input is active. | Deactivate the input. |

6. Operator (keypad) does not respond.

| Possible Cause(s) | Corrective Action |
|---|-----------------------|
| "86:DISP" is set to input terminal and the input is active. | Deactivate the input. |

7. Parameter data does not change.

| Possible Cause(s) | Corrective Action |
|---|--|
| Inverter is in RUN status. | Stop the inverter, make sure the motor stops and try again. If "RUN mode edit" is enabled, a part of function codes can be changed in RUN status. |
| Software lock function (b031) is enabled. | Disable software lock function. |

8. Motor rotates reverse direction with forward command.

| Possible Cause(s) | Corrective Action |
|--|---|
| Incorrect power wiring. | Exchange any two of U/T1, V/T2 or W/T3. |
| Incorrect logic of direction signal in 3-wire operation. | Check the logic of input set as "22:F/R". |

9. Motor rotates reverse direction with RUN key of keypad.

| Possible Cause(s) | Corrective Action |
|---|-------------------|
| Keypad RUN key routing (F004) is incorrectly set. | Check F004. |

Chapter 10 Troubleshooting

10. .Overcurrent trip (E03)

| Possible Cause(s) | Corrective Action |
|---|---|
| Acceleration time is short. | Change acceleration time (F002/A092/A292). Enable "acceleration hold" function (A069,A070) |
| Excess load. | Remove excess load. Enable torque boost function. Set free V/f in V/F characteristic curve selection (A044/A244=02) |
| Overload restriction (b021) is disabled (00). | Enable overload restriction (b021=01/02). |
| When the inverter trips due to Overcurrent(E03), despite overload restriction is enabled(b021=01/02). | |
| Overload restriction level (b022/b025) is high. | Set overload restriction level (b022/b025) lower. |
| Deceleration rate at overload restriction (b023/b026) is too short. | Set deceleration rate at overload restriction (b023/b026) longer. |

11. STOP/RESET key does not respond.

| Possible Cause(s) | Corrective Action |
|--|--|
| STOP/RESET key disabled. | Check "STOP key enable" function. (b087) |
| Deceleration overvoltage suppression (b130) or controlled deceleration on power loss (b050) function is enabled. | Check b130 and b050. |

12. Sound noise of motor or machine.

| Possible Cause(s) | Corrective Action |
|--|--|
| Carrier frequency is low. | Set carrier frequency (b083) higher. (This could cause electric noise and leak current higher.) |
| Machine frequency and motor frequency are resonated. | Change output frequency slightly. If resonating in accel/deceleration, use jump frequency function (A063-68) to avoid machine frequency. |
| Over excitation | Set base frequency (A003/A203) and AVR voltage (A082/A282) according to motor rating. If not improved, reduce V/f gain (A045/A245) slightly or change V/f curve (A044/A244) as free V/f. |

13. Overload trip (E05).

| Possible Cause(s) | Corrective Action |
|-----------------------------------|--|
| Improper electronic thermal level | Check electronic thermal setting (b012/b013) |

14. Over voltage trip (E07).

| Possible Cause(s) | Corrective Action |
|--|---|
| Short deceleration time | Change deceleration time. (F003/F203/A093/A293) |
| Overvoltage suppression during deceleration (b130) is disabled (00). | Enable overvoltage suppression (b130=01/02). |

When the inverter trips due to over voltage, despite over voltage suppression is enabled.

| | |
|---|--|
| Improper overvoltage suppression proportional gain (b134) or integral time (135). | Check overvoltage suppression proportional gain (b134) and integral time (b135). |
| Overvoltage suppression level (b131) is high. | Set Overvoltage suppression level (b131) lower. (Lower limit of parameter b131 must be (input voltage) $\times \sqrt{2} \times 1.1$.) |

15. Unstable output frequency.

| Possible Cause(s) | Corrective Action |
|---------------------------------------|---|
| Improper parameters | Set output frequency slightly smaller or bigger value than power source frequency. Change motor stabilization constant (H006/H206). Reduce carrier frequency (b083). Reduce V-Gain (A045). |
| Load variation is excessive. | Change motor and inverter to one size bigger. |
| Power voltage variation is excessive. | Check power source. |

Chapter 10 Troubleshooting

16. Output torque is not sufficient.

| Possible Cause(s) | Corrective Action |
|------------------------------------|--|
| Improper parameters [Acceleration] | Increase torque boost (A042/A242-A043/A243) |
| | Reduce carrier frequency (b083). |
| | Change torque boost select (A041/A241) to automatic. |
| Improper parameters [Deceleration] | Increase deceleration time (F003/F203/A093/A293). |
| | Disable AVR function (A081/A281). |

17. If cable to operator is disconnected, inverter will trip or stop.

| Possible Cause(s) | Corrective Action |
|---------------------------|---|
| Improper setting of b165. | Set ex.operator com loss action (b165) to 02. |

18. No response over Modbus communication.

| Possible Cause(s) | Corrective Action |
|--|--|
| New parameter is not updated. | If C070, C071, C074 or C075 is changed, cycle power or reset inverter by turning RS terminal ON and OFF. |
| Incorrect setting of RUN command source (A002/A202). | Set RUN command source (A002/A202) to 03. |
| Incorrect setting of Frequency source (A001/A201). | Set frequency source (A001/A201) to 03. |
| Incorrect setting of com. speed. | Check communication speed (C071). |
| Incorrect setting or duplication of Modbus address. | Check Modbus address (C072). |
| Incorrect setting of com. parity. | Check communication parity (C074). |
| Incorrect setting of com. stop bit. | Check communication stop bit (C075). |
| Incorrect wiring. | Check communication wiring at SP,SN . |

19. When inverter starts, ECB (Earth leakage Circuit Breaker) trips.

| Possible Cause(s) | Corrective Action |
|--|--|
| Leak current of inverter is excessive. | Reduce carrier frequency (A083). Increase current sensor level of ECB or replace ECB with another one having higher current sensor level. |

20. DC braking doesn't work

| Possible Cause(s) | Corrective Action |
|---|---|
| DC braking force for deceleration (A054) isn't set. (Defaults (0.)) | Set DC braking force for deceleration (A054). |
| DC braking time for deceleration (A055) isn't set. (Defaults (0.0)) | Set DC braking time for deceleration (A055). |

21. Under-voltage error

| Possible Cause(s) | Corrective Action |
|--|--|
| Decrease in input voltage due to capacity shortage of electric source. | Make capacity of electric source larger. |

22. TV or radio near inverter receives noises

| Possible Cause(s) | Corrective Action |
|--|--|
| The radiation noise generated by the inverter. | Put away those devices from the inverter as far as possible. |

23. Remote operator becomes a communication error.

| Possible Cause(s) | Corrective Action |
|---|---|
| Poor contact of the cables and connectors. Disconnection of cable. | Reconnect the cable. Replace the cable. |
| SW5 has become RS485 side. | SW5 sets operator side. |
| Selection of OPE/Modbus(C070) has become "01(Modbus)". | Turn on the power while pressing the [RUN/STOP/RESET] key. Key you press and hold for about 5 seconds after power is turned on. Selection of OPE/Modbus(C070) sets "00(OPE)". Please on the power again after power-off. |

Chapter 10 Troubleshooting

24. NES1-OP does not appear. NES1-OP display is abnormal.

| Possible Cause(s) | Corrective Action |
|---|---|
| Poor contact of the inverter connector and NES1-OP. | Please reconnect the NES1-OP after power-off. |

25. Output phase loss protection(E34) is occur.

| Possible Cause(s) | Corrective Action |
|---|--|
| Motor cable is disconnected or not connected. | Check the wiring. |
| Motor current is small. | Out phase loss set(C157) sets 00(disable). |

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Chapter 11 Maintenance and Inspection

This chapter describes the precautions and procedures for the maintenance and inspection of the inverter.

| | | |
|------|--|--------|
| 11.1 | Precautions for Maintenance and Inspection | 11 - 1 |
| 11.2 | Daily and Periodic Inspections | 11 - 2 |
| 11.3 | Ground Resistance Test with a Megger | 11 - 3 |
| 11.4 | Withstand Voltage Test..... | 11 - 3 |
| 11.5 | Methods of Measuring the Input/Output Voltages, Current, and Power | 11 - 4 |
| 11.6 | Capacitor Life Curves..... | 11 - 5 |

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Chapter 11 Maintenance and Inspection

11.1 Precautions for Maintenance and Inspection

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.)
In case the power indication of the operator does not turn ON after power-up, inverter may be damaged. In that case, the inspection must be done after waiting 2 hours or more of the power OFF. Otherwise there is a danger of electric shock and/or injury.
- 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.
- Never modify the inverter. Otherwise, you run the risk of electric shock and injury.

(A) Daily inspection

Basically check your system during the inverter operation to confirm that:

- 1) the motor is operating according to the settings on the inverter,
- 2) the installation environment is normal,
- 3) the cooling system is normal,
- 4) no abnormal vibrations and noise are generated,
- 5) no equipment overheating and discoloration are found, and
- 6) there are no unusual smells.

While the inverter is operating, measure the inverter input power voltage with a multimeter to confirm that:

- 1) the power supply voltage does not fluctuate often
- 2) the voltages between the power supply wires are balanced.

(B) Cleaning

Always keep the inverter clean. When cleaning the inverter, wipe off dirt and stains on the inverter surface lightly with a soft cloth dipped in a neutral detergent solution.

Note:

Do not use solvents such as acetone, benzene, toluene, and alcohol for cleaning. These solvents cause the inverter surface to dissolve or the coating on the surface to peel off. In particular, never use a detergent or alcohol to clean the monitor of the digital operator.

(C) Periodic inspection

Check those inverter sections and parts which are accessible only while the inverter is power off and which should be inspected regularly. When you intend to carry out a periodic inspection, contact your local Hitachi Distributor.

During a periodic inspection, perform the following:

- 1) Check that the cooling system is normal. Clean the air filter as needed.
- 2) Check the screws and bolts for tightness, and retighten them. Screws and bolts may have loosened because of vibrations and temperature changes. Check them carefully.
- 3) Check to ensure conductors and insulators are not corroded or damaged.
- 4) Measure the dielectric breakdown voltage of insulators.
- 5) Check the cooling fan, smoothing capacitors, and relays, and replace them if necessary.

Chapter 11 Maintenance and Inspection

11.2 Daily and Periodic Inspections

| Item Inspected | | Check for... | Inspection Cycle | | Inspection Method | Criteria |
|-----------------|----------------------|---------------------------------|------------------|------|---|--|
| | | | Daily | Year | | |
| Overall | Ambient environment | Extreme temperatures & humidity | ✓ | | Thermometer, hygrometer | Ambient temperature between -10 to 50°C, Humidity 90% or less non-condensing |
| | Major devices | Abnormal noise & vib. | ✓ | | Visual and aural | Stable environment for electronic controls |
| | Power supply voltage | Voltage tolerance | ✓ | | Digital volt meter, measure between inverter terminals [L1], [L2], [L3] | 200V class: 50/60 Hz 200 to 240V (-15/+10%) 400V class: 50/60 Hz 380 to 460V (-15/+10%) |
| Main circuit | Ground Insulation | Adequate resistance | | ✓ | Refer to P6-16 | 5 MΩ or greater |
| | Ground terminal | No loose screws | | ✓ | Torque wrench | M4: 1.4Nm |
| | Components | Overheating | | ✓ | Thermal trip events | No trip events |
| | Terminal block | Secure connections | | ✓ | Visual | No abnormalities |
| | | No loose screws | | ✓ | Torque wrench | M3.5: 0.8Nm M4: 1.2Nm |
| | Smoothing capacitors | Leaking, swelling | | ✓ | Visual | No abnormalities |
| | Relay(s) | Chattering | | ✓ | Aural | Single click when switching ON or OFF |
| Control circuit | Resistors | Cracks or discoloring | | ✓ | Visual | Check Ohms of optional braking res. |
| | Function | Voltage balance between phases | | ✓ | Measure voltage between U,V,W | Difference must be 2% or less. |
| | | Protection circuit | | ✓ | e.g. Input Ex.trip signal and check inverter behavior and alarm signal. | Functions properly. |
| | Overall | No odor, discoloring, corrosion | | ✓ | Visual | No abnormalities |
| | Capacitor | Leaking, swelling | | ✓ | Visual | Undistorted appearance |
| Cooling | Terminal | No loose screws | | ✓ | Torque wrench | M2: 0.2Nm |
| | Cooling fan | Noise | ✓ | | Power down, manually rotate | Rotation must be smooth |
| | | Dust | | ✓ | Visual | Vacuum to clean |
| | | Mounting | | ✓ | Visual | Mounted firmly |
| | Heat sink | Dust | | ✓ | Visual | Vacuum to clean |
| Display | LEDs | Legibility | ✓ | | Visual | All LED segments work |

Note 1: The life of a capacitor is affected by the ambient temperature. See "11.6".

Note 2: Designed life of a cooling fan is 10 years. However, it is affected by the ambient temperature and other environmental conditions.

Note 3: The inverter must be cleaned periodically. If dust accumulates on the fan and heat sink, it can cause overheating of the inverter.

Note 4: Do not pull the cooling FAN's wire, otherwise cooling FAN might cut the wires and cause failure.

Chapter 11 Maintenance and Inspection

11.3 Ground Resistance Test with a Megger

When testing an external circuit with a megger, disconnect all the external circuit cables from the inverter to prevent it from being exposed to the test voltage.

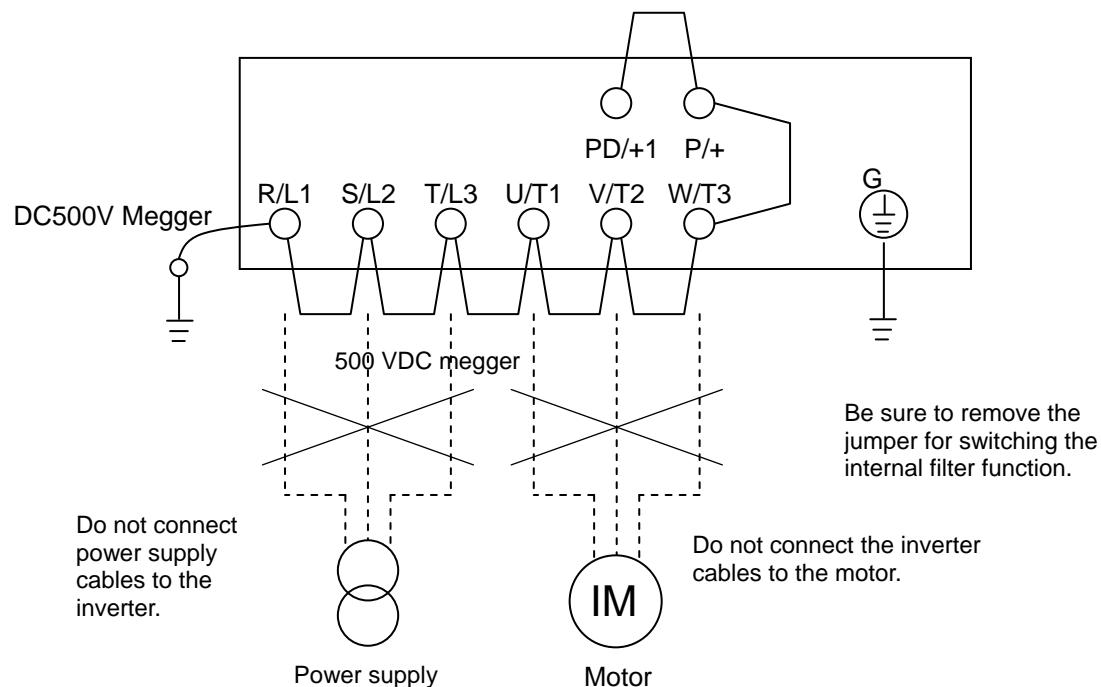
Use a tester (in high-resistance range mode) for a conduction test on the control circuit. Do not use a megger or buzzer for that purpose.

Apply the ground resistance test using a megger only to the main circuit of the inverter. Do not carry out the test using a megger for its control circuit.

Use a 500 VDC megger for the ground resistance test.

Before the main circuit test with a megger, and then connect terminals R, S, T, U, V, W, P and PD by wires as shown in the figure below. Subsequently, carry out the test.

After the test using the megger, remove the wires from terminals R, S, T, U, V, W, P and PD.



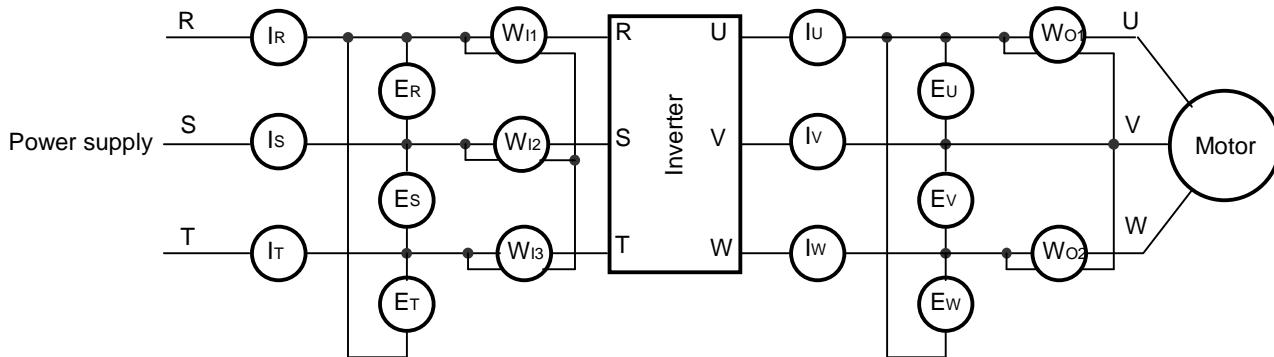
11.4 Withstand Voltage Test

Do not carry out a withstand voltage test for the inverter. The test may damage its internal parts or cause them to deteriorate.

Chapter 11 Maintenance and Inspection

11.5 Methods of Measuring the Input/Output Voltages, Current, and Power

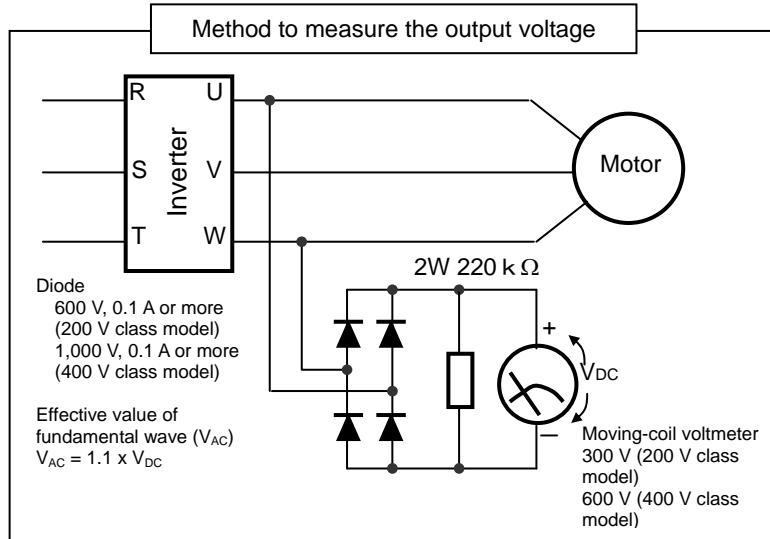
This section describes the measuring instruments generally used to measure the input and output voltages, output current, and output power of the inverter.

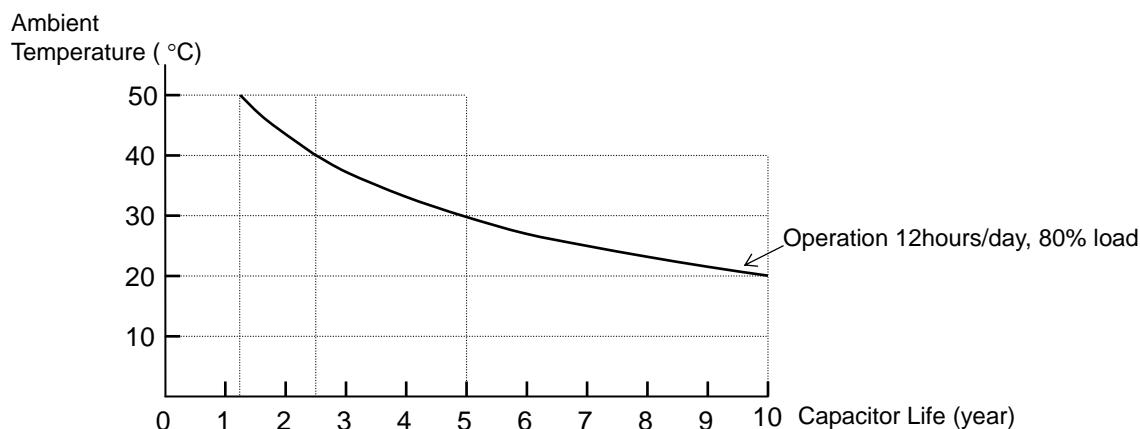


| Measurement item | Measuring point | Measuring instrument | Remarks | Reference values |
|------------------------------------|---|--|-------------------------------------|--|
| Input voltage (E_{IN}) | Across R-S, S-T, and T-R (E_R , (E_S) , and (E_T)) | ✖ Moving-iron voltmeter or ► rectifier-type voltmeter | Effective value of full waves | 200 V class models: 200 to 240 V, 50/60 Hz 400 V class 380 to 480 V, 50/60 Hz |
| Input current (I_{IN}) | Current at R, S, and T (I_R , (I_S) , and (I_T)) | ✖ Moving-iron ammeter | Effective value of full waves | When input currents are unbalanced $I_{IN} = (I_R + I_S + I_T)/3$ |
| Input power (W_{IN}) | Across R-S, S-T, and T-R (W_{11}) + (W_{12}) + (W_{13}) | ✖ Electrodynamometer-type wattmeter | Effective value of full waves | 3-wattmeter method |
| input power factor (Pf_{IN}) | Calculated from the measured input voltage (E_{IN}), input current (I_{IN}), and input power (W_{IN}) | $Pf_{IN} = \frac{W_{IN}}{\sqrt{3} \cdot E_{IN} \cdot I_{IN}} \times 100 \text{ (%)}$ | | |
| Output voltage (E_{OUT}) | Across U-V, V-W, and W-U (E_U , (E_V) , and (E_W)) | ► Method shown in the figure below or rectifier-type voltmeter | Effective value of fundamental wave | |
| Output current (I_{OUT}) | Current at U, V, and W (I_U , (I_V) , and (I_W)) | ✖ Moving-iron ammeter | Effective value of full waves | |
| Output power (W_{OUT}) | Across U-V and V-W (W_{01}) + (W_{02}) | ✖ Electrodynamometer-type wattmeter | Effective value of full waves | 2-wattmeter method (or 3-wattmeter method) |
| Output power factor (Pf_{OUT}) | Calculated from the measured output voltage (E_{OUT}), input current (I_{OUT}), and input power (W_{OUT}) | $Pf_{OUT} = \frac{W_{OUT}}{\sqrt{3} \cdot E_{OUT} \cdot I_{OUT}} \times 100 \text{ (%)}$ | | |

Notes:

1. To measure the output voltage, use an instrument that reads the effective value of the fundamental wave. To measure the current or power, use an instrument that reads the effective value of full waves.
2. Since the inverter output waveform is controlled by PWM, it has a large margin of error, especially at low frequencies. In many cases, general testers may be inapplicable for the measurement because of the adverse effect of noise.



Chapter 11 Maintenance and Inspection**11.6 Capacitor Life Curves****Capacitor Life**

Note 1: The ambient temperature indicates the temperature measured at a position about 5 cm distant from the bottom center of the inverter body. If the inverter is mounted in an enclosure, the ambient temperature is the temperature within the enclosure.

Note 2: Inverter has a limited life because chemical reactions occur inside the capacitor during operation. The capacitor Life is the above curve. (The curve is not the guaranteed lifespan but rather, the expected design lifespan.)
Note that the smoothing capacitor life will be shortened significantly if the inverter is used at a high ambient temperature or with a heavy load that requires a current beyond its rated current.

Chapter 11 Maintenance and Inspection

Warranty

Warranty Terms

The warranty period under normal installation and handling conditions shall be two (2) years from the date of manufacture, 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 QRG handy; please do not lose it. Please contact your Hitachi distributor to purchase replacement or additional manuals.

Chapter 12 Specifications

This chapter describes the specifications and external dimensions of the inverter.

| | | |
|------|-----------------------|------|
| 12.1 | Specifications | 12-1 |
| 12.2 | Dimensions..... | 12-2 |
| 12.3 | Derating Curves | 12-4 |

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Chapter 12 Specifications

12.1 Specifications

| Item | | Three-phase 200V class Specifications | | | | | Single-phase 200V class Specifications | | | | |
|---|------|--|------|------|-------------------|------|---|------|------|-------------------|------|
| NES1 inverters, 200V models | | 002L | 004L | 007L | 015L | 022L | 002S | 004S | 007S | 015S | 022S |
| Applicable motor size Note1) | kW | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| | HP | 1/4 | 1/2 | 1 | 2 | 3 | 1/4 | 1/2 | 1 | 2 | 3 |
| Rated capacity (kVA) | 200V | 0.4 | 0.9 | 1.3 | 2.4 | 3.4 | 0.4 | 0.9 | 1.3 | 2.4 | 3.4 |
| | 240V | 0.5 | 1.0 | 1.6 | 2.9 | 4.1 | 0.5 | 1.0 | 1.6 | 2.9 | 4.1 |
| Rated input voltage | | Three-phase: 200V-15% to 240V +10%, 50/60Hz ±5% | | | | | Single-phase: 200V-15% to 240V +10%, 50/60Hz ±5% | | | | |
| Rated output voltage Note2) | | 3-phase: 200 to 240V (proportional to input voltage) | | | | | | | | | |
| Rated output current (A) | | 1.4 | 2.6 | 4.0 | 7.1 | 10.0 | 1.4 | 2.6 | 4.0 | 7.1 | 10.0 |
| Cooling method | | Self-cooling | | | Force ventilation | | Self-cooling | | | Force ventilation | |
| Braking (capacitive feedback) Note3) | | Apprx.50% | | | Apprx.20 to 40% | | Apprx.50% | | | Apprx.20 to 40% | |
| Weight | (kg) | 0.7 | 0.8 | 0.9 | 1.2 | 1.3 | 0.7 | 0.8 | 1.0 | 1.2 | 1.3 |
| | (lb) | 1.6 | 1.8 | 2.0 | 2.7 | 2.9 | 1.6 | 1.8 | 2.2 | 2.7 | 2.9 |

Common specification

| Item | | Spec |
|---|--------------------------------|--|
| Protective housing (JIS C 0920,IEC60529) | | IP20 |
| Control | Control method | Sinusoidal Pulse Width Modulation (PWM) control |
| | Output frequency range Note4) | 0.1 to 400 Hz |
| | Frequency accuracy Note5) | Digital command: ±0.01% of the maximum frequency Analog command: ±0.4% of the maximum frequency (25°C ± 10°C) |
| | Frequency setting resolution | Digital input: 0.01 Hz Analog input: Maximum output frequency/1000 |
| | Volt./Freq. characteristic | V/f control (constant torque, reduced torque) |
| | Overload capacity | 150%/60 seconds |
| | Acceleration/deceleration time | 0.00 to 3,600.0 seconds (in linear or curved pattern), 2nd motors setting is possible |
| Input signal | Freq. setting | External signal : adjustable resistor / 0 to +10 VDC /0 to 20 mA, Modbus, Option operator, Dedicated operator |
| | RUN/STOP Order | External digital input signal (3-wire input possible) , Modbus Option Operator, Dedicated Operator |
| | Intelligent input terminal | 5terminals |
| | Analog input | 1terminal (O/OI terminal : Voltage input10bit/0 to 10V, Current input : 10bit/0 to 20mA selecting it with a changeover switch) |
| Output signal | Intelligent output terminal | 5 open-collector output terminals, 1 relay (1c-contact) output terminal |
| | Pulse Output | 1terminal |
| connection | RS-422 | RJ45 Connector ,(Common with RS485 : selecting it with a changeover switch) Option Operator,ProDriveNext |
| | RS-485 | RJ45 Connector ,(Common with RS422 : selecting it with a changeover switch) Modbus-RTU |
| General specification | Temperature Note6) | Operating (ambient): -10 to 50°C, / Storage: -20 to 65°C |
| | Humidity | 20 to 90% humidity (non-condensing) |
| | Vibration | 5.9m/s ² (0.6G), 10 to 55 Hz |
| | Location | Altitude 1,000m or less, indoors (no corrosive gasses or dust) |
| Standards Compliance | | UL, CE, c-UL, c-tick |

Note1) The applicable motor refers to Hitachi standard 3-phase motor (4p). When using other motors, care must be taken to prevent the rated motor current (50/60Hz) from exceeding the rated output current of the inverter.

Note2) The output voltage decreases as the main supply voltage decreases (except when using the AVR function). In any case, the output voltage cannot exceed the input power supply voltage.

Note3) The braking torque via capacitive feedback is the average deceleration torque at the shortest deceleration (stopping from 50/60Hz as indicated). It is not continuous regenerative braking torque. The average deceleration torque varies with motor loss. This value decreases when operating beyond 50Hz.

Note4) To operate the motor beyond 50/60Hz, consult the motor manufacturer for the maximum allowable rotation speed.

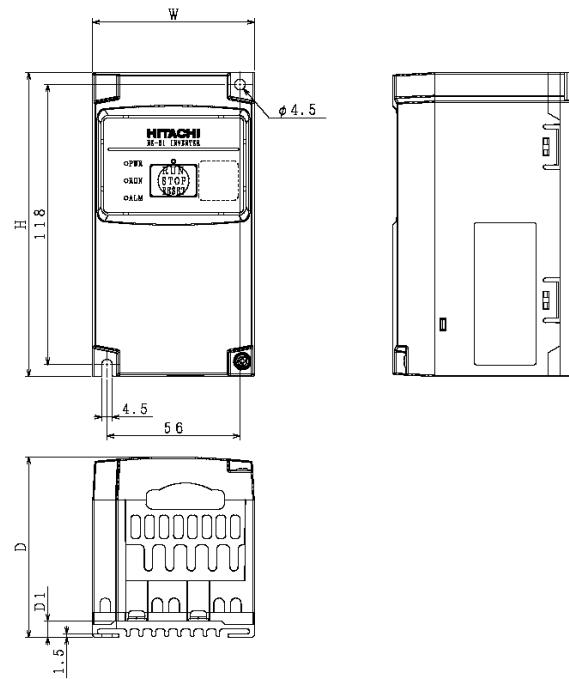
Note5) To get motor stabilized operation, inverter output Frequency might exceeds preset maximum Freq.(A004/A204) by 2Hz in maximum.

Note6) Derating curve is shown on section 12.3.

Note7) Connecting work on RJ45 jack must be done during the inverter power off.

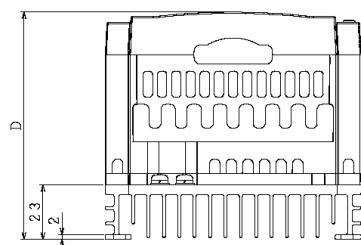
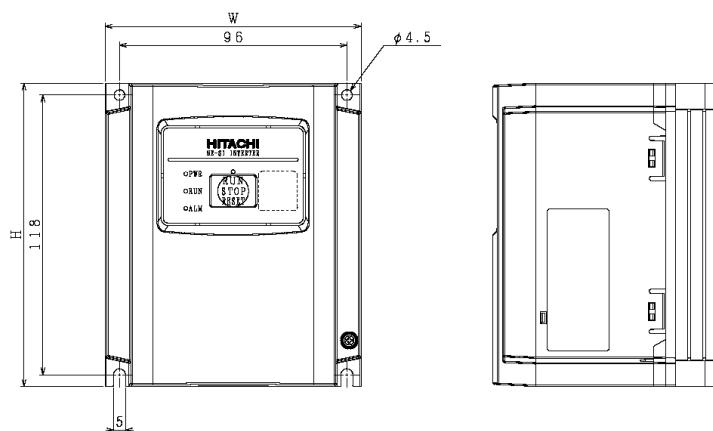
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12.2 Dimensions

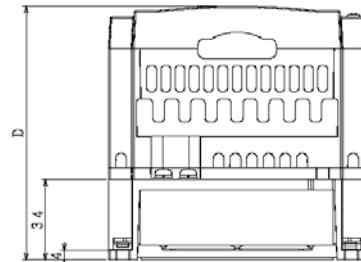
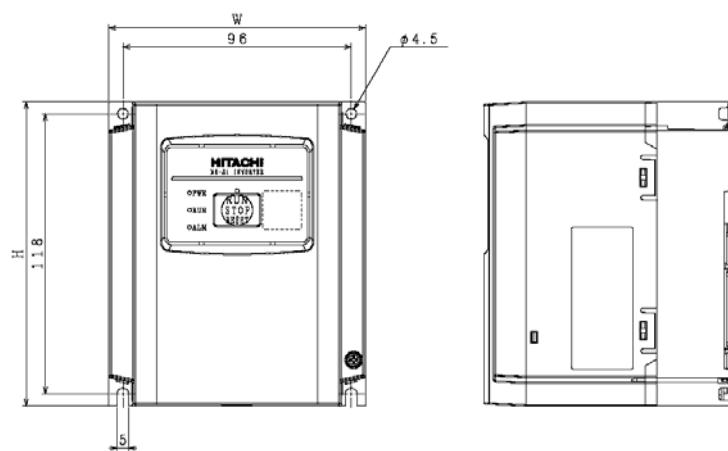


| Model | W (mm) | H (mm) | D (mm) | D1 (mm) |
|------------|-----------|-----------|-----------|------------|
| NES1-002SB | 68 | 128 | 76 | 7 |
| NES1-004SB | | | 91 | 21.5 |
| NES1-002LB | | | 76 | 7 |
| NES1-004LB | | | 91 | 21.5 |
| NES1-007LB | | | 115 | 46 |

Chapter 12 Specifications



| Model | W (mm) | H (mm) | D (mm) |
|------------|-----------|-----------|-----------|
| NES1-007SB | 108 | 128 | 96 |



| Model | W (mm) | H (mm) | D (mm) |
|------------|-----------|-----------|-----------|
| NES1-015SB | 108 | 128 | 107 |
| NES1-022SB | | | 125 |
| NES1-015LB | | | 107 |
| NES1-022LB | | | 125 |

Chapter 12 Specifications

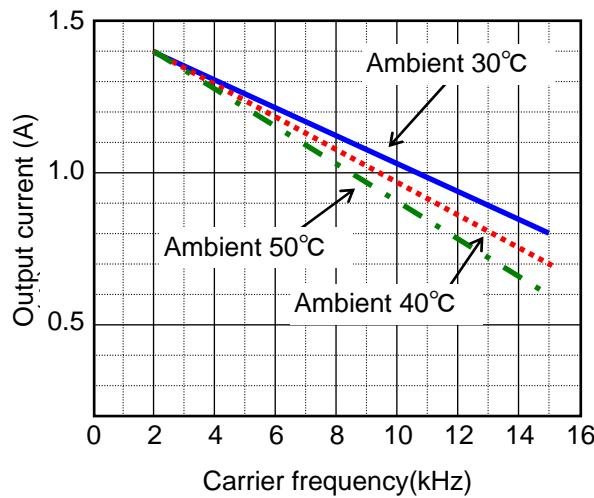
12.3 Derating Curves

Use the following derating curves to help determine the optimal carrier frequency setting for your inverter and find the output current derating. Be sure to use the proper curve for your particular NE-S1 inverter model number.

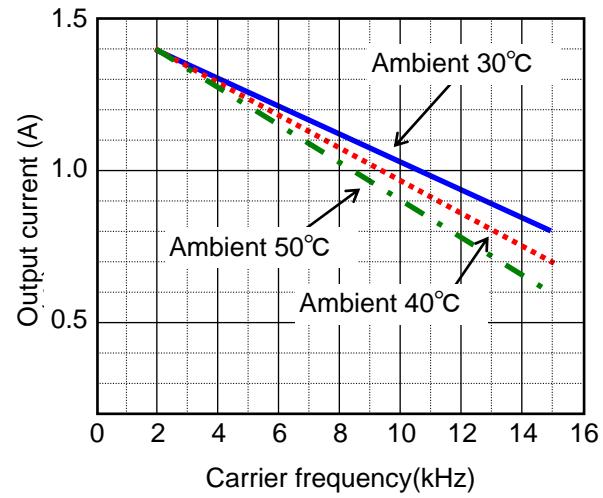
Legend for Graphs:

- Ambiente temperature 30°C max.
- Ambiente temperature 40°C max.
- - - Ambiente temperature 50°C max.

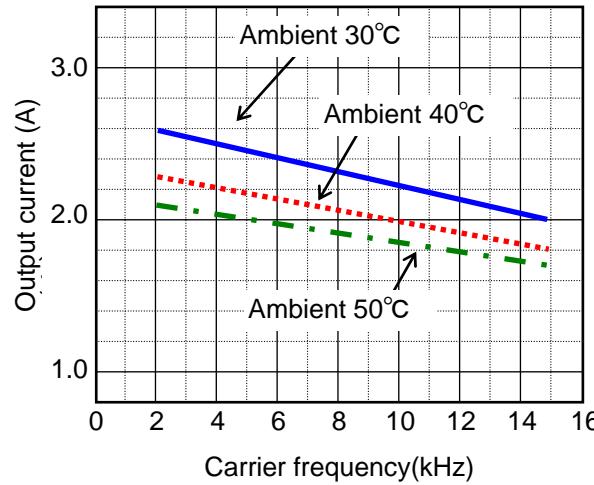
NES1-002LB



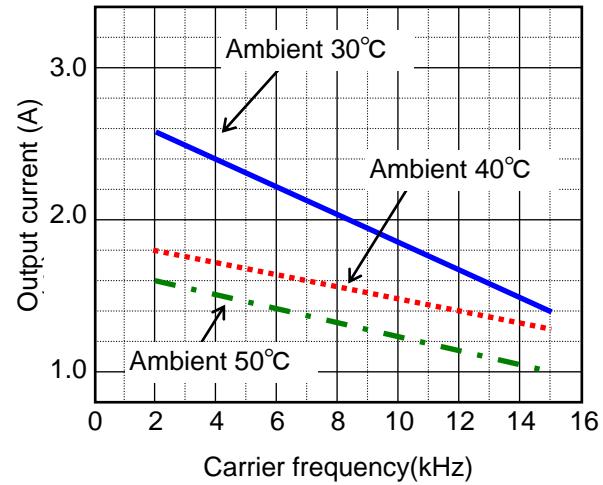
NES1-002SB



NES1-004LB

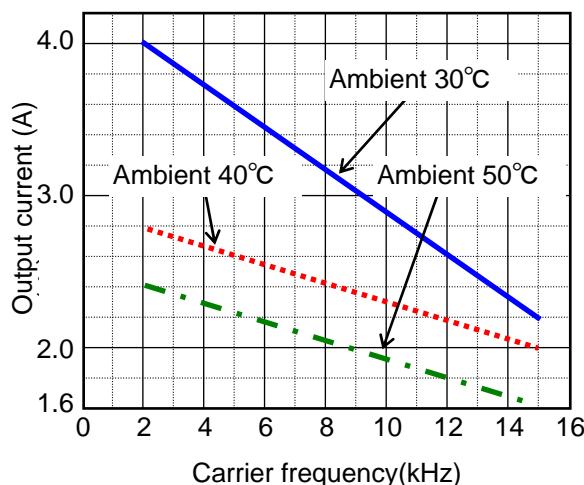


NES1-004SB

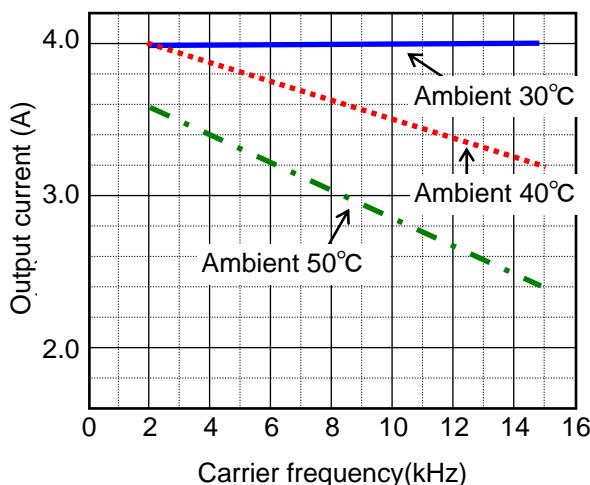


Chapter 12 Specifications

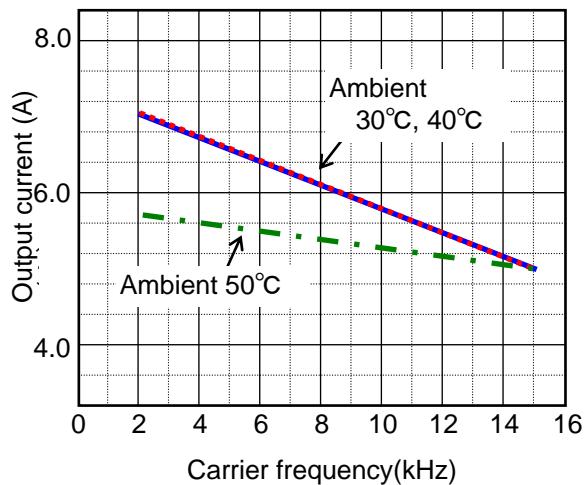
NES1-007LB



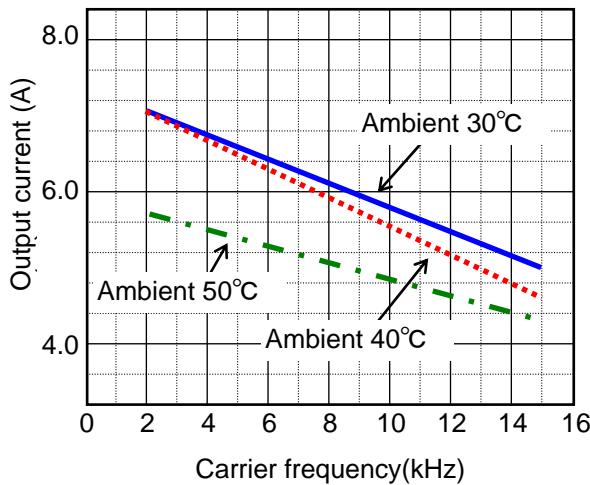
NES1-007SB



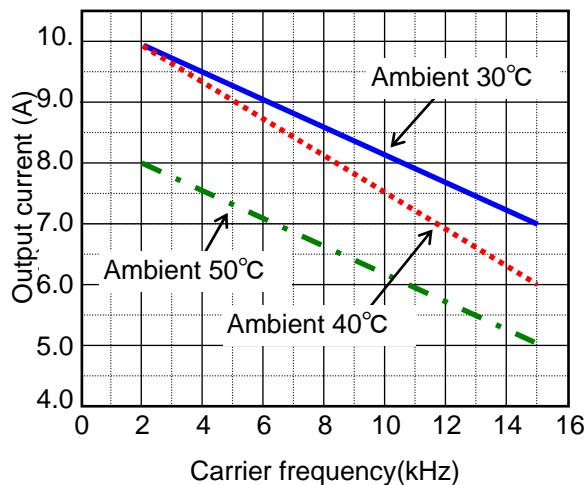
NES1-015LB



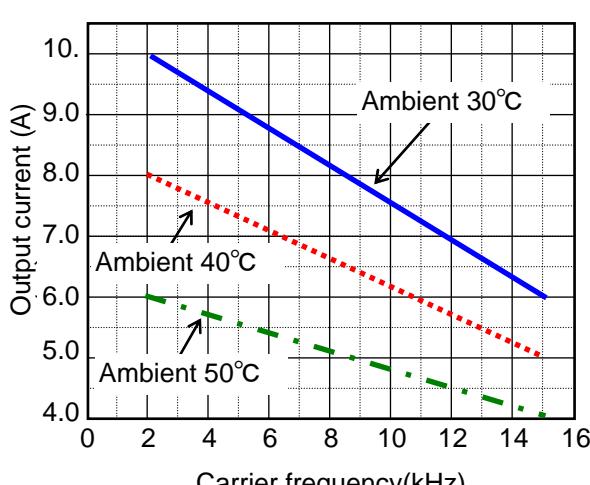
NES1-015SB



NES1-022LB



NES1-022SB



Legend for Graphs:

- Ambient temperature 30°C max.
- Ambient temperature 40°C max.
- - - Ambient temperature 50°C max.

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Chapter 13 List of Data Settings

This lists the user-programmable parameters for the NE-S1 series inverters and the default values. This list presents the parameters in a format oriented toward the keypad on the inverter.

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Chapter 13 List of Data Settings

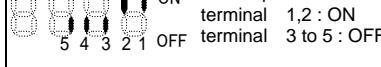
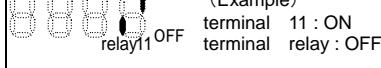
[Parameter Settings for Keypad Entry]

NE-S1 series inverters provide many functions and parameters that can be configured by the user. We recommend that you record all parameters that have been edited, in order to help in troubleshooting or recovery from a loss of parameter data.

Inverter model NES1 } This information is printed on the specification label located on the right side of the inverter

MFG. No.

[Monitoring mode]

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|--|---|---------------|--------------|-------|
| | | | | Initial data | Units |
| d001 | Output frequency monitoring | 0.00 to 99.99/100.0 to 400.0 (Hz) | ✓ | — | — |
| d002 | Output current monitoring | 0.0 to 655.3 (A) | ✗ | — | — |
| d003 | Rotation direction monitoring | F(forward rotation) / o(stopped) / r(reverse rotation) | ✗ | — | — |
| d004 | PID feedback monitoring | 0.00 to 99.99/100.0 to 999.9/1000. to 9999./1000 to 9999(10000 to 99990)/100 to 199(100000 to 999000) | ✗ | — | — |
| d005 | Intelligent input terminal status |  | ✗ | — | — |
| d006 | Intelligent input terminal status |  | ✗ | — | — |
| d007 | Scaled output frequency monitoring | 0.00 to 99.99/100.0 to 999.9/1000. to 9999./1000 to 3999 | ✓ | — | — |
| d013 | Output voltage monitoring | 0.0 to 600.0(V) | ✗ | — | — |
| d014 | Input power monitoring | 0.0 to 999.9(kW) | ✗ | — | — |
| d015 | Cumulative power monitoring | 0.0 to 999.9/1000. to 9999./1000 to 9999(10000 to 99990)/100 to 199(100000 to 999000) | ✗ | — | — |
| d016 | Cumulative operation RUN time monitoring | 0. to 9999./1000 to 9999(10000 to 99990)/100 to 199(100000 to 999000)(hr) | ✗ | — | — |
| d017 | Cumulative power-on time monitoring | 0. to 9999./1000 to 9999(10000 to 99990)/100 to 199(100000 to 999000)(hr) | ✗ | — | — |
| d018 | Heat sink temperature monitoring | -020. to 120.0(°C) | ✗ | — | — |

Chapter 13 List of Data Settings

| Func. Code | "F" Function | | Run Mode Edit | Defaults | |
|------------|--|--|---------------|--------------|-------|
| | Name | Description | | Initial data | Units |
| d050 | Dual Monitoring | display the monitoring data selected by b160, b161 | ✗ | — | — |
| d080 | Trip counter | 0. to 9999./1000 to 6553(10000 to 65530)(time) | ✗ | — | — |
| d081 | Trip monitoring 1 | Factor, frequency(Hz),current(A), voltage across P-N(V), running time(hours), power-on time(hours) | ✗ | — | — |
| d082 | Trip monitoring 2 | | ✗ | — | — |
| d083 | Trip monitoring 3 | | ✗ | — | — |
| d084 | Trip monitoring 4 | | ✗ | — | — |
| d085 | Trip monitoring 5 | | ✗ | — | — |
| d086 | Trip monitoring 6 | | ✗ | — | — |
| d090 | Warning monitoring | Warning code | ✗ | — | — |
| d102 | DC voltage monitoring | 0.0 to 999.9/1000.(V) | ✗ | — | — |
| d104 | Electronic thermal overload monitoring | 0.0 to 100.0(%) | ✗ | — | — |

Chapter 13 List of Data Settings

[Function mode (F Group)]

Note) Mark “✓” in [Run Mode Edit] shows the accessible parameters when b031 is set “10”, high level access.

| “F” Function | | | Run Mode Edit | Defaults | |
|---------------|--|---|---------------------|--------------|-------|
| Func. Code | Name | Description | | Initial data | Units |
| F001 | Output frequency setting | Standard default target frequency that determines constant motor speed, range is 0.00 / start frequency to maximum frequency (A004) | ✓ | 0.00 | Hz |
| F002 | Acceleration time (1) | Standard default acceleration, range is 0.00 to 3600 seconds. | ✓ | 10.00 | s |
| F202 | Acceleration time (1), 2 nd motor | | ✓ | 10.00 | s |
| F003 | Deceleration time (1) | Standard default deceleration, range is 0.00 to 3600 seconds. | ✓ | 10.00 | s |
| F203 | Deceleration time (1), 2 nd motor | | ✓ | 10.00 | s |
| F004 | Keypad RUN key routing | Two options; select codes: 00 ...Forward 01 ...Reverse | ✗ | 00 | — |

Chapter 13 List of Data Settings

[Function mode (A Group)]

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|--|---|---------------|--------------|-------|
| | | | | Initial data | Units |
| A001 | Frequency source | Five options; select codes: 00 ...POT on ext. operator 01 ...Control terminal 02 ...Function F001 setting 03 ...Modbus network input 10 ...Calculate function output | ✗ | 01 | – |
| A201 | Frequency source, 2 nd motor | 02 ...Function F001 setting 03 ...Modbus network input 10 ...Calculate function output | ✗ | 01 | – |
| A002 | Run command source | Three options; select codes: 01 ...Control terminal 02 ...Run key on keypad, or digital operator 03 ...Modbus network input | ✗ | 01 | – |
| A202 | Run command source, 2 nd motor | 02 ...Run key on keypad, or digital operator 03 ...Modbus network input | ✗ | 01 | – |
| A003 | Base frequency | Settable from 30.0 Hz to the maximum frequency(A004) | ✗ | 60.0 | Hz |
| A203 | Base frequency, 2 nd motor | Settable from 30.0 Hz to the 2 nd maximum frequency(A204) | ✗ | 60.0 | Hz |
| A004 | Maximum frequency | Settable from the base frequency to 400.0 | ✗ | 60.0 | Hz |
| A204 | Maximum frequency, 2 nd motor | Settable from the 2 nd base frequency to 400.0 | ✗ | 60.0 | Hz |
| A011 | [O/OI] input active range start frequency | The output frequency corresponding to the analog input range starting point, range is 0.00 to 400.00 | ✓ | 0.00 | Hz |
| A012 | [O/OI] input active range end frequency | The output frequency corresponding to the analog input range ending point, range is 0.0 to 400.00 | ✓ | 0.00 | Hz |
| A013 | [O/OI] input active range start voltage | The starting point (offset) for the active analog input range, range is 0. to 100. | ✓ | 0. | % |
| A014 | [O/OI] input active range end voltage | The ending point (offset) for the active analog input range, range is 0. to 100. | ✓ | 100. | % |
| A015 | [O/OI] input start frequency enable | Two options; select codes: 00...Use offset (A011 value) 01...Use 0Hz | ✓ | 01 | – |
| A016 | Analog input filter | Range n = 1 to 31, 1 to 31 •2ms filter | ✓ | 31. | Spl. |
| A019 | Multi-speed operation selection | Select codes: 00...Binary operation (8 speeds selectable with 3 terminals) 01...Bit operation (4 speeds selectable with 3 terminals) | ✗ | 00 | – |
| A020 | Multi-speed freq. 0 | Defines the first speed of a multi-speed profile, range is 0.00 / start frequency to 400.0 A020 = Speed 0 (1st motor) | ✓ | 0.00 | Hz |
| A220 | Multi-speed freq. 0, 2 nd motor | Defines the first speed of a multi-speed profile or a 2nd motor, range is 0.00 / start frequency to 400.0 A220 = Speed 0 (2nd motor) | ✓ | 0.00 | Hz |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|--------------|---|---|---------------|--------------|-------|
| | | | | Initial data | Units |
| A021 to A027 | Multi-speed freq. 1 to 7 (for both motors) | Defines 7 more speeds, range is 0.00 / start frequency to 400.0. <i>A021</i> =Speed 1 ~ <i>A027</i> =Speed7 | ✓ | See next row | Hz |
| | | <i>A021</i> | ✓ | 60.00 | Hz |
| | | <i>A022</i> | ✓ | 40.00 | Hz |
| | | <i>A023</i> | ✓ | 20.00 | Hz |
| | | <i>A024</i> ~ <i>A027</i> | ✓ | 0.00 | Hz |
| A038 | Jog frequency | Defines limited speed for jog, range is from start frequency to 9.99 Hz | ✓ | 6.00 | Hz |
| A039 | Jog stop mode | Define how end of jog stops the motor; six options: <i>00</i> ...Free-run stop (invalid during run) <i>01</i> ...Controlled deceleration (invalid during run) <i>02</i> ...DC braking to stop (invalid during run) <i>03</i> ...Free-run stop (valid during run) <i>04</i> ...Controlled deceleration (valid during run) <i>05</i> ...DC braking to stop (valid during run) | ✓ | 04 | — |
| A041 | Torque boost select | Two options: <i>00</i> ...Manual torque boost <i>01</i> ...Automatic torque boost | ✗ | 00 | — |
| A241 | Torque boost select, 2 nd motor | <i>00</i> ...Manual torque boost <i>01</i> ...Automatic torque boost | ✗ | 00 | — |
| A042 | Manual torque boost value | Can boost starting torque between 0 and 20% above normal V/f curve, range is 0.0 to 20.0% | ✓ | 1.0 | % |
| A242 | Manual torque boost value, 2 nd motor | <i>00</i> ...Manual torque boost value, 2 nd motor | ✓ | 1.0 | % |
| A043 | Manual torque boost frequency | Sets the frequency of the V/f breakpoint A in graph (top of previous page) for torque boost, range is 0.0 to 50.0% | ✓ | 5.0 | % |
| A243 | Manual torque boost frequency, 2 nd motor | <i>00</i> ...Manual torque boost frequency, 2 nd motor | ✓ | 5.0 | % |
| A044 | V/f characteristic curve | Three available V/f curves; <i>00</i> ...Constant torque <i>01</i> ...Reduced torque (1.7) <i>02</i> ...Free V/F | ✗ | 00 | — |
| A244 | V/f characteristic curve, 2 nd motor | <i>00</i> ...V/f characteristic curve, 2 nd motor | ✗ | 00 | — |
| A045 | V/f gain | Sets voltage gain of the inverter, range is 20. to 100.% | ✓ | 100. | % |
| A245 | V/f gain, 2 nd motor | <i>00</i> ...V/f gain, 2 nd motor | ✓ | 100. | % |
| A046 | Voltage compensation gain for automatic torque boost | Sets voltage compensation gain under automatic torque boost, range is 0. to 255. | ✓ | 100. | — |
| A246 | Voltage compensation gain for automatic torque boost, 2 nd motor | <i>00</i> ...Voltage compensation gain for automatic torque boost, 2 nd motor | ✓ | 100. | — |
| A047 | Slip compensation gain for automatic torque boost | Sets slip compensation gain under automatic torque boost, range is 0. to 255. | ✓ | 100. | — |

Chapter 13 List of Data Settings

| "A" Function | | | Run Mode Edit | Defaults | |
|--------------|--|--|---------------|--------------|-------|
| Func. Code | Name | Description | | Initial data | Units |
| A247 | Slip compensation gain for automatic torque boost, 2 nd motor | | ✓ | 100. | — |
| A051 | DC braking enable | Three options; select codes: 00...Disable 01...Enable during stop 02...Frequency detection | ✓ | 00 | — |
| A052 | DC braking frequency | The frequency at which DC braking begins, range is from the start frequency (b082) to 60.00Hz | ✓ | 0.50 | Hz |
| A053 | DC braking wait time | The delay from the end of controlled deceleration to start of DC braking (motor free runs until DC braking begins), range is 0.0 to 5.0 seconds. | ✓ | 0.0 | s |
| A054 | DC braking force for deceleration | Level of DC braking force, settable from 0 to 100% | ✓ | 50. | % |
| A055 | DC braking time for deceleration | Sets the duration for DC braking, range is from 0.0 to 10.0 seconds. | ✓ | 0.5 | s |
| A056 | DC braking / edge or level detection for [DB] input | Two options; select codes: 00...Edge detection 01...Level detection | ✓ | 01 | — |
| A057 | DC braking force at start | Level of DC braking force at start, settable from 0 to 100% | ✓ | 0. | % |
| A058 | DC braking time at start | Sets the duration for DC braking, range is from 0.0 to 10.0 seconds. | ✓ | 0.0 | s |
| A059 | Carrier frequency during DC braking | Carrier frequency of DC braking performance, range is from 2.0 to 15.0kHz | ✓ | 2.0 | kHz |
| A061 | Frequency upper limit | Sets a limit on output frequency less than the maximum frequency (A004). Range is from frequency lower limit (A062) to maximum frequency (A004). 0.00 setting is disabled >0.00 setting is enabled | ✓ | 0.00 | Hz |
| A261 | Frequency upper limit, 2nd motor | Sets a limit on output frequency less than the maximum frequency (A204). Range is from frequency lower limit (A262) to maximum frequency (A204). 0.00 setting is disabled >0.00 setting is enabled | ✓ | 0.00 | Hz |
| A062 | Frequency lower limit | Sets a limit on output frequency greater than zero. Range is start frequency (b082) to frequency upper limit (A061) 0.00 setting is disabled >0.00 setting is enabled | ✓ | 0.00 | Hz |

Chapter 13 List of Data Settings

| Func. Code | "A" Function | | Run Mode Edit | Defaults | |
|----------------------|--|--|---------------|----------------------|-------|
| | Name | Description | | Initial data | Units |
| A262 | Frequency lower limit, 2nd motor | Sets a limit on output frequency greater than zero. Range is start frequency (A082) to frequency upper limit (A261) 0.00 setting is disabled >0.00 setting is enabled | ✓ | 0.00 | Hz |
| A063 A065 A067 | Jump freq. (center) 1 to 3 | Up to 3 output frequencies can be defined for the output to jump past to avoid motor resonances (center frequency) Range is 0.00 to 400.0 Hz | ✓ | 0.00 0.00 0.00 | Hz |
| A064 A066 A068 | Jump freq. width (hysteresis) 1 to 3 | Defines the distance from the center frequency at which the jump around occurs Range is 0.00 to 10.00 Hz | ✓ | 0.50 0.50 0.50 | Hz |
| A069 | Acceleration hold frequency | Sets the frequency to hold acceleration, range is 0.00 to 400.00Hz | ✓ | 0.00 | Hz |
| A070 | Acceleration hold time | Sets the duration of acceleration hold, range is 0.0 to 60.0 seconds. | ✓ | 0.0 | s |
| A071 | PID enable | Enables PID function, three option codes: 00 ...PID Disable 01 ...PID Enable 02 ...PID Enable with reverse output | ✓ | 00 | — |
| A072 | PID proportional gain | Proportional gain has a range of 0.00 to 25.00 | ✓ | 1.00 | — |
| A073 | PID integral time constant | Integral time constant has a range of 0.0 to 3600.0 seconds. | ✓ | 1.0 | s |
| A074 | PID derivative time constant | Derivative time constant has a range of 0.00 to 100.00 seconds. | ✓ | 0.00 | s |
| A075 | PV scale conversion | Process Variable (PV), scale factor (multiplier), range of 0.01 to 99.99 | ✓ | 1.00 | — |
| A076 | PV source | Selects source of Process Variable (PV), option codes: 01 ...[O/OI] terminal 02 ...Modbus network 10 ...Calculate function output | ✓ | 01 | — |
| A077 | Reverse PID action | Two option codes: 00 ...PID input = SP-PV 01 ...PID input = -(SP-PV) | ✓ | 00 | — |
| A078 | PID variation range | Sets the limit of PID output as percent of full scale, range is 0.0 to 100.0% | ✓ | 0.0 | % |
| A081 | AVR function select | Automatic (output) voltage regulation, selects from three type of AVR functions, three option codes: 00 ...AVR enabled 01 ...AVR disabled 02 ...AVR enabled except during deceleration | ✗ | 02 | — |
| A281 | AVR function select, 2 nd motor | | ✗ | 02 | — |
| A082 | AVR voltage select | 200V class inverter settings:200/215/220/230/240 | ✗ | 200 | V |

Chapter 13 List of Data Settings

| "A" Function | | | Run Mode Edit | Defaults | |
|--------------|---|---|---------------|--------------|-------|
| Func. Code | Name | Description | | Initial data | Units |
| A282 | AVR voltage select, 2 nd motor | | ✗ | 200 | V |
| A083 | AVR filter time constant | Define the time constant of the AVR filter, range is 0.000 to 1.000 seconds. | ✓ | 0.030 | s |
| A084 | AVR deceleration gain | Gain adjustment of the braking performance, range is 50 to 200% | ✓ | 100. | % |
| A085 | Energy-saving operation mode | Two option codes: 00...Normal operation 01...Energy-saving operation | ✗ | 00 | — |
| A086 | Energy-saving mode tuning | Range is 0.0 to 100.0 %. | ✓ | 50.0 | % |
| A092 | Acceleration time (2) | Duration of 2 nd segment of acceleration, range is: 0.00 to 3600.00 seconds. | ✓ | 10.00 | s |
| A292 | Acceleration time (2), 2 nd motor | | ✓ | 10.00 | s |
| A093 | Deceleration time (2) | Duration of 2 nd segment of deceleration, range is: 0.00 to 3600.00 seconds. | ✓ | 10.00 | s |
| A293 | Deceleration time (2), 2 nd motor | | ✓ | 10.00 | s |
| A094 | Select method to switch to Acc2/Dec2 profile | Three options for switching from 1st to 2nd accel/decel: 00...2CH input from terminal 01...Transition frequency 02...Forward and reverse | ✗ | 00 | — |
| A294 | Select method to switch to Acc2/Dec2 profile, 2 nd motor | | ✗ | 00 | — |
| A095 | Acc1 to Acc2 frequency transition point | Output frequency at which Accel1 switches to Accel2, range is 0.00 to 400.00 Hz | ✗ | 0.00 | Hz |
| A295 | Acc1 to Acc2 frequency transition point, 2 nd motor | | ✗ | 0.00 | Hz |
| A096 | Dec1 to Dec2 frequency transition point | Output frequency at which Decel1 switches to Decel2, range is 0.0 to 400.0 Hz | ✗ | 0.00 | Hz |
| A296 | Dec1 to Dec2 frequency transition point, 2 nd motor | | ✗ | 0.00 | Hz |
| A097 | Acceleration curve selection | Set the characteristic curve of Acc1 and Acc2, five options: 00...linear 01...S-curve 02...U-curve 03...Inverse U-curve | ✗ | 00 | — |
| A098 | Deceleration curve selection | Set the characteristic curve of Dec1 and Dec2, options are same as above (A097) | ✗ | 00 | — |
| A131 | Acceleration curve constant | Range is 1 to 10. | ✓ | 2 | — |
| A132 | Deceleration curve constant | Range is 1 to 10. | ✓ | 2 | — |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|---|--|---------------|--------------|-------|
| | | | | Initial data | Units |
| A141 | A input select for calculate function | Seven options: 00...Operator 01...VR 02...Terminal [O/OI] input 04...RS485 | ✓ | 00 | — |
| A142 | B input select for calculate function | Seven options: 00...Operator 01...VR 02...Terminal [O/OI] input 04...RS485 | ✓ | 02 | — |
| A143 | Calculation symbol | Calculates a value based on the A input source (A141 selects) and B input source (A142 selects). Three options: 00...ADD (A input + B input) 01...SUB (A input - B input) 02...MUL (A input * B input) | ✓ | 00 | — |
| A145 | ADD frequency | An offset value that is applied to the output frequency when the [ADD] terminal is ON. Range is 0.00 to 400.00 Hz | ✓ | 0.00 | Hz |
| A146 | ADD direction select | Two options: 00...Plus (adds A145 value to the output frequency setting) 01...Minus (subtracts A145 value from the output frequency setting) | ✓ | 00 | — |
| A154 | Deceleration hold frequency | Sets the frequency to hold deceleration, range is 0.00 to 400.00Hz | ✓ | 0.00 | Hz |
| A155 | Deceleration hold time | Sets the duration of deceleration hold, range is 0.0 to 60.0 seconds. | ✓ | 0.0 | s |
| A156 | PID sleep function action threshold | Sets the threshold for the action, set range 0.00 to 400.00 Hz | ✓ | 0.00 | Hz |
| A157 | PID sleep function action delay time | Sets the delay time for the action, set range 0.0 to 25.5 seconds. | ✓ | 0.0 | s |
| A158 | PID sleep function return threshhold | A156 to 400.0(Hz) | ✓ | 0.00 | Hz |
| A161 | [VR] input active range start frequency | The output frequency corresponding to the analog input range starting point, range is 0.00 to 400.00 Hz | ✓ | 0.00 | Hz |
| A162 | [VR] input active range end frequency | The output frequency corresponding to the current input range ending point, range is 0.00 to 400.00 Hz | ✓ | 0.00 | Hz |
| A163 | [VR] input active range start % | The starting point (offset) for the current input range, range is 0. to 100.% | ✓ | 0. | % |
| A164 | [VR] input active range end % | The ending point (offset) for the current input range, range is 0. to 100.% | ✓ | 100. | % |
| A165 | [VR] input start frequency select | Two options; select codes: 00...Use offset (A161 value) 01...Use 0Hz | ✓ | 01 | — |

Chapter 13 List of Data Settings

[Function mode (b Group)]

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|---|--|---------------|------------------------|-------|
| | | | | Initial data | Units |
| b001 | Restart mode on power failure / under-voltage trip | Select inverter restart method, Four option codes: <u>00</u> ...Alarm output after trip, no automatic restart <u>01</u> ...Restart at 0Hz <u>02</u> ...Resume operation after frequency matching <u>03</u> ...Resume previous freq. after freq. matching, then decelerate to stop and display trip info | ✓ | 00 | — |
| b002 | Allowable under-voltage power failure time | The amount of time a power input under-voltage can occur without tripping the power failure alarm. Range is 0.3 to 25 sec. If under-voltage exists longer than this time, the inverter trips, even if the restart mode is selected. | ✓ | 1.0 | s |
| b003 | Retry wait time before motor restart | Time delay after under-voltage condition goes away, before the inverter runs motor again. Range is 0.3 to 100.0 seconds. | ✓ | 1.0 | s |
| b004 | Instantaneous power failure / under-voltage trip alarm enable | Three option codes: <u>00</u> ...Disable <u>01</u> ...Enable <u>02</u> ...Disable during stop and decelerates to a stop | ✓ | 00 | — |
| b005 | Number of restarts on power failure / under-voltage trip events | Two option codes: <u>00</u> ...Restart 16 times <u>01</u> ...Always restart | ✓ | 00 | — |
| b007 | Restart frequency threshold | Restart the motor from 0Hz if the frequency becomes less than this set value during the motor is coasting, range is 0.00 to 400.00Hz | ✓ | 0.50 | Hz |
| b008 | Restart mode on over voltage / over current trip | Select inverter restart method, Four option codes: <u>00</u> ...Alarm output after trip, no automatic restart <u>01</u> ...Restart at 0Hz <u>02</u> ...Resume operation after frequency matching <u>03</u> ...Resume previous freq. after active freq. matching, then decelerate to stop and display trip info | ✓ | 00 | — |
| b010 | Number of retry on over voltage / over current trip | Range is 1 to 3 times | ✓ | 3 | — |
| b011 | Retry wait time on over voltage / over current trip | Range is 0.3 to 100.0 sec. | ✓ | 1.0 | s |
| b012 | Level of electronic thermal | Set a level between 20% and 100% for the rated inverter current. | ✓ | Rated current for | A |
| b212 | Level of electronic thermal, 2 nd motor | | ✓ | each inverter model *1 | A |
| b013 | Electronic thermal characteristic | Select from three curves, option codes: | ✓ | 01 | — |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|--|---|---------------|----------------------|-------|
| | | | | Initial data | Units |
| b213 | Electronic thermal characteristic, 2 nd motor | 00...Reduced torque 01...Constant torque 02...Free setting | ✓ | 01 | — |
| b015 | Free setting electronic thermal ~freq.1 | Range is 0 to 60 17Hz | ✓ | 0 | Hz |
| b016 | Free setting electronic thermal ~current1 | Range is 0.00 to inverter rated current Amps | ✓ | 0.0 | A |
| b017 | Free setting electronic thermal ~freq.2 | Range is 60 15 to 60 19Hz | ✓ | 0 | Hz |
| b018 | Free setting electronic thermal ~current2 | Range is 0.00 to inverter rated current Amps | ✓ | 0.0 | A |
| b019 | Free setting electronic thermal ~freq.3 | Range is 60 17 to 400Hz | ✓ | 0 | Hz |
| b020 | Free setting electronic thermal ~current3 | Range is 0.00 to inverter rated current Amps | ✓ | 0.0 | A |
| b021 | Overload restriction operation mode | Select the operation mode during overload conditions, three options, option codes: 00...Disabled 01...Enabled for acceleration and constant speed 02...Enabled for constant speed only | ✓ | 01 | — |
| b221 | Overload restriction operation mode, 2 nd motor | | ✓ | 01 | — |
| b022 | Overload restriction level | Sets the level of overload restriction, between 20% and 200% of the rated current of the inverter, setting resolution is 1% of rated current | ✓ | Rated current x 1.50 | A |
| b222 | Overload restriction level, 2 nd motor | | ✓ | Rated current x 1.50 | A |
| b023 | Deceleration rate at overload restriction | Sets the deceleration rate when inverter detects overload, range is 0.1 to 3000.0, resolution 0.1 seconds. | ✓ | 1.0 | s |
| b223 | Deceleration rate at overload restriction, 2 nd motor | | ✓ | 1.0 | s |
| b024 | Overload restriction operation mode 2 | Select the operation mode during overload conditions, three options, option codes: 00...Disabled 01...Enabled for acceleration and constant speed 02...Enabled for constant speed only | ✓ | 01 | — |
| b025 | Overload restriction level 2 | Sets the level of overload restriction, between 20% and 200% of the rated current of the inverter, setting resolution is 1% of rated current | ✓ | Rated current x 1.50 | A |
| b026 | Deceleration rate 2 at overload restriction | Sets the deceleration rate when inverter detects overload, range is 0.1 to 3000.0, resolution 0.1 seconds. | ✓ | 1.0 | s |
| b027 | OC suppression selection * | Two option codes: 00...Disabled 01...Enabled | ✓ | 01 | — |
| b028 | Current level of active freq. matching | Sets the current level of active freq. matching restart, range is 0.2*inverter rated current to 2.0*inverter rated current, resolution 0.1 seconds. | ✓ | Rated current | A |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|--|--|---------------|--------------|-------|
| | | | | Initial data | Units |
| b029 | Deceleration rate of active freq. matching | Sets the deceleration rate when active freq. matching restart, range is 0.1 to 3000.0, resolution 0.1 seconds. | ✓ | 0.5 | s |
| b030 | Start freq. of active freq. matching | Three option codes: 00...freq at previous shutoff 01...start from max. Hz 02...start from set frequency | ✓ | 00 | — |
| b031 | Software lock mode selection | Prevents parameter changes, in five options, option codes: 00...all parameters except b031 are locked when [SFT] terminal is ON 01...all parameters except b031 and output frequency F001 are locked when [SFT] terminal is ON 02...all parameters except b031 are locked 03...all parameters except b031 and output frequency F001 are locked 10...High level access including b031 See appendix C for the accessible parameters in this mode. | ✓ | 01 | — |
| b034 | Run/power ON warning time | Range is, 0.:Warning disabled 1. to 9999.: 10~99,990 hrs (unit: 10) 1000 to 6553: 100,000~655,350 hrs (unit: 100) | ✓ | 0. | Hrs. |
| b035 | Rotation direction restriction | Three option codes: 00...No restriction 01...Reverse rotation is restricted 02...Forward rotation is restricted | ✗ | 00 | — |
| b036 | Reduced voltage start selection | Set range, 0 (disabling the function), 1 (approx. 4ms) to 250 (approx. 1s) | ✓ | 3 | — |
| b037 | Function code display restriction | Five option codes: 00...Full display 01...Function-specific display 03...Data comparison display 04...Basic display 05...Monitor display only | ✓ | 00 | — |
| b038 | Initial display selection | 000...Func. code that SET key pressed last displayed.(*) 001~060...d001~d060 displayed 201...F001 displayed 202...B display of LCD operator (In case of Digital operator, same 000 setting) | ✓ | 001 | — |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|--|---|---------------|--------------|-------|
| | | | | Initial data | Units |
| b050 | Controlled deceleration on power loss | Four option codes: 00...Disabled 01...Decelerates to a stop 02...Decelerates to a stop with DC bus voltage controlled 03...Decelerates to a stop with DC bus voltage controlled, then restart | ✗ | 00 | - |
| b051 | DC bus voltage trigger level of ctrl. decel. | Setting of DC bus voltage to start controlled decel. operation. Range is 0.0 to 400.0 | ✗ | 220.0 | V |
| b052 | Over-voltage threshold of ctrl. decel. | Setting the OV-LAD stop level of controlled decel. operation. Range is 0.0 to 400.0 | ✗ | 360.0 | V |
| b053 | Deceleration time of ctrl. decel. | Range is 0.10 to 300.00 seconds. | ✗ | 1.00 | s |
| b054 | Initial freq. drop of ctrl. decel. | Setting of initial freq. drop. Range is 0.00 to 10.00 Hz | ✗ | 0.00 | Hz |
| b060 | Maximum-limit level of window comparator (O/OI) | Set range, {Min.-limit level (b051) + hysteresis width (b062)x2} to 100 % | ✓ | 100. | % |
| b061 | Minimum-limit level of window comparator (O/OI) | Set range, 0 to {Max.-limit level (b060) - hysteresis width (b062)x2}maximum of 100 % | ✓ | 0. | % |
| b062 | Hysteresis width of window comparator (O/OI) | Set range, 0 to {Max.-limit level (b060) - Min.-limit level (b051)}/2 % (Maximum of 10%) | ✓ | 0. | % |
| b070 | Operation level at O/OI disconnection | Set range, 0 to 100%, or "no" (ignore) | ✓ | no | - |
| b078 | Watt-hour clearance | Two option codes: 00...OFF 01...ON (press STR then clear) | ✓ | 00 | - |
| b079 | Watt-hour display gain | Set range is, 1.to1000. | ✓ | 1. | |
| b082 | Start frequency | Sets the starting frequency for the inverter output, range is 0.01 to 9.99 Hz | ✓ | 0.50 | Hz |
| b083 | Carrier frequency | Sets the PWM carrier (internal switching frequency), range is 2.0 to 15.0 kHz | ✓ | 2.0 | kHz |
| b084 | Initialization mode (parameters or trip history) | Select initialized data, four option codes: 00...Initialization disabled 01...Clears Trip history 02...Initializes all Parameters 03...Clears Trip history and initializes all parameters | ✗ | 00 | - |
| b085 | Country for initialization | Select default parameter values for country on initialization, two option codes: 00...Mode 1 01... Mode 2 | ✗ | 00 | - |
| b086 | Frequency scaling conversion factor | Specify a constant to scale the displayed frequency for d007 monitor, range is 0.01 to 99.99 | ✓ | 1.00 | - |
| b087 | STOP key enable | Select whether the STOP key on the keypad is enabled, three option codes: 00...Enabled 01...Disabled always 02...Disabled for stop | ✓ | 00 | - |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|---|---|---------------|--------------|-------|
| | | | | Initial data | Units |
| b088 | Restart mode after FRS | Selects how the inverter resumes operation when free-run stop (FRS) is cancelled, two options: 00...Restart from 0Hz 01...Restart from frequency detected from real speed of motor (freq. matching) | ✓ | 00 | — |
| b089 | Automatic carrier frequency reduction | Three option codes: 00...Disabled 01...Enabled, depending on the output current 02...Enabled, depending on the heat-sink temperature | ✗ | 00 | — |
| b091 | Stop mode selection | 00(Dec and Stop) / 01(FRS) | ✓ | 00 | — |
| b094 | Initialization target data setting | 00(ALL parameters)/ 01(expect terminal and communication data) | ✗ | 00 | — |
| b100 | Free V/F setting, freq.1 | Set range, 0 ~ value of b 102 | ✗ | 0. | Hz |
| b101 | Free V/F setting, voltage.1 | Set range, 0.0 ~ 300.0V | ✗ | 0.0 | V |
| b102 | Free V/F setting, freq.2 | Set range, value of b 100 ~b 104 | ✗ | 0. | Hz |
| b103 | Free V/F setting, voltage.2 | Set range, 0.0 ~ 300.0V | ✗ | 0.0 | V |
| b104 | Free V/F setting, freq.3 | Set range, value of b 102 ~b 106 | ✗ | 0. | Hz |
| b105 | Free V/F setting, voltage.3 | Set range, 0.0 ~ 300.0V | ✗ | 0.0 | V |
| b106 | Free V/F setting, freq.4 | Set range, value of b 104 ~b 108 | ✗ | 0. | Hz |
| b107 | Free V/F setting, voltage.4 | Set range, 0.0 ~ 300.0V | ✗ | 0.0 | V |
| b108 | Free V/F setting, freq.5 | Set range, value of b 108 ~b 110 | ✗ | 0. | Hz |
| b109 | Free V/F setting, voltage.5 | Set range, 0.0 ~ 300.0V | ✗ | 0.0 | V |
| b110 | Free V/F setting, freq.6 | Set range, value of b 108 ~b 112 | ✗ | 0. | Hz |
| b111 | Free V/F setting, voltage.6 | Set range, 0.0 ~ 300.0V | ✗ | 0.0 | V |
| b112 | Free V/F setting, freq.7 | Set range, b 110 ~ 400 | ✗ | 0. | Hz |
| b113 | Free V/F setting, voltage.7 | Set range, 0.0 ~ 300.0V | ✗ | 0.0 | V |
| b130 | Deceleration overvoltage suppression enable | 00...Disabled 01...Enabled 02...Enabled with accel. 03...when CONST/DEC | ✓ | 00 | — |
| b131 | Decel. overvolt. suppress level | DC bus voltage of suppression. Range is: 200V class...330 to 390 | ✓ | 360 | V |
| b132 | Decel. overvolt. suppress const. | Accel. rate when b130=02. Set range: 0.10 ~ 30.00 seconds. | ✓ | 1.00 | s |
| b133 | Decel. overvolt. suppress proportional gain | Proportional gain when b130=01. Range is: 0.00 to 5.00 | ✓ | 0.20 | — |
| b134 | Decel. overvolt. suppress integral time | Integration time when b130=01. Range is: 0.0 to 150.0 seconds. | ✓ | 1.0 | s |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|---|---|---------------|--------------|-------|
| | | | | Initial data | Units |
| b150 | Display ex.operator connected | When an external operator is connected via RS-422 port, the built-in display is locked and shows only one "d" parameter configured in: 001 ~ 050 | ✓ | 001 | — |
| b160 | 1st parameter of Dual Monitor | Set any two "d" parameters in b160 and b161, then they can be monitored in d050. The two parameters are switched by up/down keys. Set range: 001 ~ 010 | ✓ | 001 | — |
| b161 | 2nd parameter of Dual Monitor | | ✓ | 002 | — |
| b163 | Frequency set in monitoring | Two option codes: 00 ...Freq. set disabled 01 ...Freq. set enabled | ✓ | 01 | — |
| b164 | Automatic return to the initial display | 10 min. after the last key operation, display returns to the initial parameter set by b038 . Two option codes: 00 ...Disable 01 ...Enable | ✓ | 00 | — |
| b165 | Ex. operator com. loss action | Five option codes: 00 ...Trip 01 ...Trip after deceleration to a stop 02 ...Ignore 03 ...Coasting (FRS) 04 ...Decelerates to a stop | ✓ | 02 | — |
| b166 | Data Read/Write select | 00 ... Read/Write OK 01 ... Protected | ✓ | 00 | — |
| b180 | Initialization trigger (*) | This is to perform initialization by parameter input with b084 , b085 and b094 . Two option codes: 00 ...Initialization disable 01 ...Perform initialization | ✗ | 00 | — |

Chapter 13 List of Data Settings

[Function mode (C Group)]

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|--|--|---------------|---------------|-------|
| | | | | Initial data | Units |
| C001 | Input [1] function | Select input terminal [1] function, 34 options (see next section) | ✓ | 00 [FW] | – |
| C002 | Input [2] function | Select input terminal [2] function, 34 options (see next section) | ✓ | 01 [RV] | – |
| C003 | Input [3] function | Select input terminal [3] function, 34 options (see next section) | ✓ | 02 [CF1] | – |
| C004 | Input [4] function | Select input terminal [4] function, 34 options (see next section) | ✓ | 03 [CF2] | – |
| C005 | Input [5] function | Select input terminal [5] function, 34 options (see next section) | ✓ | 18 [RS] | – |
| C011 | Input [1] active state | Select logic conversion, two option codes: 00...normally open [NO] 01...normally closed [NC] | ✓ | 00 | – |
| C012 | Input [2] active state | | ✓ | 00 | – |
| C013 | Input [3] active state | | ✓ | 00 | – |
| C014 | Input [4] active state | | ✓ | 00 | – |
| C015 | Input [5] active state | | ✓ | 00 | – |
| C021 | Output [11] function | 27 programmable functions available for logic (discrete) outputs (see next section) | ✓ | 01 [FA1] | – |
| C026 | Alarm relay function | 27 programmable functions available for logic (discrete) outputs (see next section) | ✓ | 05 [AL] | – |
| C027 | [FM] terminal selection (Pulse/PWM output) | 9 programmable functions: 00...Output frequency (PWM) 01...Output current (PWM) 03...Output frequency (Pulse train) 04...Output voltage (PWM) 05...Input power (PWM) 06...Electronic thermal load ratio (PWM) 07...LAD frequency (PWM) 08...Output current (Pulse train) 10...Heat sink temperature (PWM) | ✓ | 07 | – |
| C030 | Digital current monitor reference value | Current with digital current monitor output at 1,440Hz Range is 20%~200% of rated current | ✓ | Rated current | A |
| C031 | Output [11] active state | Select logic conversion, two option codes: 00...normally open [NO] 01...normally closed [NC] | ✓ | 00 | – |
| C036 | Alarm relay active state | | ✓ | 01 | – |
| C038 | Output mode of low current detection | Two option codes: 00...During acceleration, deceleration and constant speed 01...During constant speed only | ✓ | 01 | – |
| C039 | Low current detection level | Set the level of low load detection, range is 0.00 to 2.00*inverter rated current | ✓ | Rated current | A |

Chapter 13 List of Data Settings

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|---|---|---------------|----------------------|-------|
| | | | | Initial data | Units |
| C040 | Output mode of overload warning | Two option codes: 00...During accel., decel. and constant speed 01...During constant speed only | ✓ | 01 | — |
| C041 | Overload warning level | Sets the overload warning signal level between 0% and 200% (from 0 to two time the rated current of the inverter) | ✓ | Rated current x 1.15 | A |
| C241 | Overload warning level, 2 nd motor | | ✓ | Rated current x 1.15 | A |
| C042 | Frequency arrival setting for acceleration | Sets the frequency arrival setting threshold for the output frequency during acceleration, range is 0.00 to 400.00 Hz | ✓ | 0.00 | Hz |
| C043 | Frequency arrival setting for deceleration | Sets the frequency arrival setting threshold for the output frequency during deceleration, range is 0.00 to 400.00 Hz | ✓ | 0.00 | Hz |
| C044 | PID deviation level | Sets the allowable PID loop error magnitude (absolute value), SP-PV, range is 0.0 to 100% | ✓ | 3.0 | % |
| C052 | PID FBV output high limit | When the PV exceeds this value, the PID loop turns OFF the PID second stage output, range is 0.0 to 100% | ✓ | 100.0 | % |
| C053 | PID FBV output low limit | When the PV goes below this value, the PID loop turns ON the PID second stage output, range is 0.0 to 100% | ✓ | 0.0 | % |
| C061 | Electronic thermal warning level | Set range is 0 to 100% Setting 0 means disabled. | ✓ | 90 | % |
| C063 | Zero speed detection level | Set range is 0.00 to 100.00Hz | ✓ | 0.00 | Hz |
| C064 | Heat sink overheat warning | Set range is 0 to 110 °C | ✓ | 100. | °C |
| C070 | Selection of OPE/Modbus | 00 (OPE) / 01 (Modbus) | ✗ | 00 | — |
| C071 | Communication speed | Five option codes: 04...4,800 bps 05...9,600 bps 06...19,200 bps 07...38,400 bps | ✓ | 05 | bps |
| C072 | Modbus address | Set the address of the inverter on the network. Range is 1 to 247 | ✓ | 1. | — |
| C074 | Communication parity | Three option codes: 00...No parity 01...Even parity 02...Odd parity | ✓ | 00 | — |
| C075 | Communication stop bit | Two option codes: 01...1 bit 02...2 bit | ✓ | 1 | — |
| C076 | Communication error select | Selects inverter response to communications error. Five options: 00...Trip 01...Decelerate to a stop and trip 02...Disable 03...Free run stop (coasting) 04...Decelerates to a stop | ✓ | 02 | — |

Chapter 13 List of Data Settings

| "C" Function | | | Run Mode Edit | Defaults | |
|--------------|-------------------------------|---|---------------|--------------|-------|
| Func. Code | Name | Description | | Initial data | Units |
| C077 | Communication error time-out | Sets the communications watchdog timer period. Range is 0.00 to 99.99 seconds. 0.0 = disabled | ✓ | 0.00 | s |
| C078 | Communication wait time | Time the inverter waits after receiving a message before it transmits. Range is 0. to 1000. m seconds. | ✓ | 0. | ms |
| C081 | O/OI input span calibration | Scale factor between the external frequency command on terminals L-O /OI(voltage/current input) and the frequency output, range is 0.0 to 200% | ✓ | 100.0 | % |
| C091 | Debug mode enable * | Displays debug parameters. Two option codes: 00...Disable 01...Enable <Do not set> (for factory use) | ✓ | 00 | — |
| C101 | Up/Down memory mode selection | Controls speed setpoint for the inverter after power cycle. Two option codes: 00...Clear last frequency (return to default frequency F00 I) 01...Keep last frequency adjusted by UP/DWN | ✓ | 00 | — |
| C102 | Reset selection | Determines response to Reset input [RS]. Three option codes: 00...Cancel trip state at input signal ON transition, stops inverter if in Run Mode 01...Cancel trip state at signal OFF transition, stops inverter if in Run Mode 02...Cancel trip state at input ON transition, no effect if in Run Mode | ✓ | 00 | — |
| C103 | Restart mode after reset | Determines the restart mode after reset is given, two option codes: 00...Start with 0 Hz 01...Start with freq. matching | ✓ | 00 | — |
| C104 | UP/DWN clear mode | Freq. set value when UDC signal is given to the input terminal, two option codes: 00...0 Hz 01...Original setting (in the memory at power on) | ✓ | 00 | — |
| C105 | FM gain adjustment | Set range is 50 to 200% | ✓ | 100. | % |
| C130 | Output [11] on delay | Set range is 0.0 to 100.0 seconds. | ✓ | 0.0 | s |
| C131 | Output [11] off delay | | ✓ | 0.0 | s |
| C140 | Relay output on delay | Set range is 0.0 to 100.0 seconds. | ✓ | 0.0 | s |
| C141 | Relay output off delay | | ✓ | 0.0 | s |
| C142 | Logic output 1 operand A | All the programmable functions available for logic (discrete) outputs except LOG1 , no | ✓ | 00 | — |
| C143 | Logic output 1 operand B | | ✓ | 00 | — |

Chapter 13 List of Data Settings

| Func. Code | "C" Function | | Run Mode Edit | Defaults | |
|------------|-------------------------------------|--|---------------|--------------|-------|
| | Name | Description | | Initial data | Units |
| C144 | Logic output 1 operator | Applies a logic function to calculate [LOG] output state, Three options: 00...[LOG] = A AND B 01...[LOG] = A OR B 02...[LOG] = A XOR B | ✓ | 00 | — |
| C151 | Button sensitivity selection | 0 to 250 / no | ✓ | 10 | — |
| C152 | Scroll sensitivity selection | 1 to 20 | ✓ | 10 | — |
| C155 | Ground fault detection | 00(OFF) / 01(ON) | ✓ | 1 | — |
| C157 | Out phase loss detection | 00(OFF) / 01(ON) | ✓ | 0 | — |
| C160 | Input [1] response time | Sets response time of each input terminal, set range: 0 (x 2 [ms]) to 200 (x 2 [ms]) (0 to 400 [ms]) | ✓ | 1. | — |
| C161 | Input [2] response time | | ✓ | 1. | — |
| C162 | Input [3] response time | | ✓ | 1. | — |
| C163 | Input [4] response time | | ✓ | 1. | — |
| C164 | Input [5] response time | | ✓ | 1. | — |
| C169 | Multistage speed determination time | Set range is 0. to 200. (x 10ms) | ✓ | 0. | ms |

Chapter 13 List of Data Settings

Input Function Summary Table – This table shows all thirty-four intelligent input functions at a glance. Detailed description of these functions, related parameters and settings, and example wiring diagrams are in “Using Intelligent Input Terminals” on page 4-8.

| Input Function Summary Table | | | | |
|------------------------------|-----------------|---------------------------------------|-------------|---|
| Option Code | Terminal Symbol | Function Name | Description | |
| 00 | FW | FORWARD Run/Stop | ON | Inverter is in Run Mode, motor runs forward |
| | | | OFF | Inverter is in Stop Mode, motor stops |
| 01 | RV | Reverse Run/Stop | ON | Inverter is in Run Mode, motor runs reverse |
| | | | OFF | Inverter is in Stop Mode, motor stops |
| 02 | CF1 *1 | Multi-speed Select, Bit 0 (LSB) | ON | Binary encoded speed select, Bit 0, logical 1 |
| | | | OFF | Binary encoded speed select, Bit 0, logical 0 |
| 03 | CF2 | Multi-speed Select, Bit 1 | ON | Binary encoded speed select, Bit 1, logical 1 |
| | | | OFF | Binary encoded speed select, Bit 1, logical 0 |
| 04 | CF3 | Multi-speed Select, Bit 2(MSB) | ON | Binary encoded speed select, Bit 2, logical 1 |
| | | | OFF | Binary encoded speed select, Bit 2, logical 0 |
| 06 | JG | Jogging | ON | Inverter is in Run Mode, output to motor runs at jog parameter frequency |
| | | | OFF | Inverter is in Stop Mode |
| 07 | DB | External DC braking | ON | DC braking will be applied during deceleration |
| | | | OFF | DC braking will not be applied |
| 08 | SET | Set (select) 2nd Motor Data | ON | The inverter uses 2nd motor parameters for generating frequency output to motor |
| | | | OFF | The inverter uses 1st (main) motor parameters for generating frequency output to motor |
| 09 | 2CH | 2-stage Acceleration and Deceleration | ON | Frequency output uses 2nd-stage acceleration and deceleration values |
| | | | OFF | Frequency output uses standard acceleration and deceleration values |
| 11 | FRS | Free-run Stop | ON | Causes output to turn OFF, allowing motor to free run (coast) to stop |
| | | | OFF | Output operates normally, so controlled deceleration stops motor |
| 12 | EXT | External Trip | ON | When assigned input transitions OFF to ON, inverter latches trip event and displays E 12 |
| | | | OFF | No trip event for ON to OFF, any recorded trip events remain in history until reset |
| 13 | USP | Unattended Start Protection | ON | On power up, the inverter will not resume a Run command (mostly used in the US) |
| | | | OFF | On power up, the inverter will resume a Run command that was active before power loss |
| 15 | SFT | Software Lock | ON | The keypad and remote programming devices are prevented from changing parameters |
| | | | OFF | The parameters may be edited and stored |
| 18 | RS | Reset Inverter | ON | The trip condition is reset, the motor output is turned OFF, and power up reset is asserted |
| | | | OFF | Normal power-ON operation |
| 20 | STA | Start (3-wire interface) | ON | Starts the motor rotation |
| | | | OFF | No change to present motor status |
| 21 | STP | Stop (3-wire interface) | ON | Stops the motor rotation |
| | | | OFF | No change to present motor status |
| 22 | F/R | FWD, REV (3-wire interface) | ON | Selects the direction of motor rotation: ON = FWD. While the motor is rotating, a change of F/R will start a deceleration, followed by a change in direction |
| | | | OFF | Selects the direction of motor rotation: OFF = REV. While the motor is rotating, a change of F/R will start a deceleration, followed by a change in direction |
| 23 | PID | PID Disable | ON | Temporarily disables PID loop control. Inverter output turns OFF as long as PID Enable is active (R07 I=0 I) |
| | | | OFF | Has no effect on PID loop operation, which operates normally if PID Enable is active (R07 I=0 I) |

Chapter 13 List of Data Settings

| Input Function Summary Table | | | | |
|------------------------------|-----------------|---|-------------|--|
| Option Code | Terminal Symbol | Function Name | Description | |
| 24 | PIDC | PID Reset | ON | Resets the PID loop controller. The main consequence is that the integrator sum is forced to zero |
| | | | OFF | No effect on PID controller |
| 27 | UP | Remote Control UP Function (motorized speed pot.) | ON | Accelerates (increases output frequency) motor from current frequency |
| | | | OFF | Output to motor operates normally |
| 28 | DWN | Remote Control Down Function (motorized speed pot.) | ON | Decelerates (decreases output frequency) motor from current frequency |
| | | | OFF | Output to motor operates normally |
| 29 | UDC | Remote Control Data Clearing | ON | Clears the UP/DWN frequency memory by forcing it to equal the set frequency parameter F001. Setting <i>C101</i> must be set=00 to enable this function to work |
| | | | OFF | UP/DWN frequency memory is not changed |
| 31 | OPE | Operator Control | ON | Forces the source of the output frequency setting <i>R001</i> and the source of the Run command <i>R002</i> to be from the digital operator |
| | | | OFF | Source of output frequency set by <i>R001</i> and source of Run command set by <i>R002</i> is used |
| 32 | SF1 | Multi-speed Select, Bit operation Bit 1 | ON | Bit encoded speed select, Bit 1, logical 1 |
| | | | OFF | Bit encoded speed select, Bit 1, logical 0 |
| 33 | SF2 | Multi-speed Select, Bit operation Bit 2 | ON | Bit encoded speed select, Bit 2, logical 1 |
| | | | OFF | Bit encoded speed select, Bit 2, logical 0 |
| 34 | SF3 | Multi-speed Select, Bit operation Bit 3 | ON | Bit encoded speed select, Bit 3, logical 1 |
| | | | OFF | Bit encoded speed select, Bit 3, logical 0 |
| 39 | OLR | Overload Restriction Source Changeover | ON | Perform overload restriction |
| | | | OFF | Normal operation |
| 50 | ADD | ADD frequency enable | ON | Adds the <i>R145</i> (add frequency) value to the output frequency |
| | | | OFF | Does not add the <i>R145</i> value to the output frequency |
| 51 | F-TM | Force Terminal Mode | ON | Force inverter to use input terminals for output frequency and Run command sources |
| | | | OFF | Source of output frequency set by <i>R001</i> and source of Run command set by <i>R002</i> is used |
| 53 | KHC | Clear watt-hour data | ON | Clear watt-hour data |
| | | | OFF | No action |
| 65 | AHD | Analog command hold | ON | Analog command is held |
| | | | OFF | Analog command is not held |
| 83 | HLD | Retain output frequency | ON | Retain the current output frequency |
| | | | OFF | No retention |
| 84 | ROK | Permission of Run command | ON | Run command permitted |
| | | | OFF | Run command is not permitted |
| 86 | DISP | Display limitation | ON | Only a parameter configured in <i>b038</i> is shown |
| | | | OFF | All the monitors can be shown |
| no | no | No function | ON | (input ignored) |
| | | | OFF | (input ignored) |

Chapter 13 List of Data Settings

Output Function Summary Table – This table shows all functions for the logical outputs (terminals [11] and [AL]) at a glance. Detailed descriptions of these functions, related parameters and settings, and example wiring diagrams are in “Using Intelligent Output Terminals” in chapter 4.

| Output Function Summary Table | | | | |
|-------------------------------|-----------------|---|-------------|---|
| Option Code | Terminal Symbol | Function Name | Description | |
| 00 | RUN | Run Signal | ON | When the inverter is in Run Mode |
| | | | OFF | When the inverter is in Stop Mode |
| 01 | FA1 | Frequency Arrival Type 1–Constant Speed | ON | When output to motor is at the set frequency |
| | | | OFF | When output to motor is OFF, or in any acceleration or deceleration ramp |
| 02 | FA2 | Frequency Arrival Type 2–Over frequency | ON | When output to motor is at or above the set freq., even if in accel (C042) or decel (C043) ramps |
| | | | OFF | When output to motor is OFF, or at a level below the set frequency |
| 03 | OL | Overload Advance Notice Signal 1 | ON | When output current is more than the set threshold (C041) for the overload signal |
| | | | OFF | When output current is less than the set threshold for the deviation signal |
| 04 | OD | Output Deviation for PID Control | ON | When PID error is more than the set threshold for the deviation signal |
| | | | OFF | When PID error is less than the set threshold for the deviation signal |
| 05 | AL | Alarm Signal | ON | When an alarm signal has occurred and has not been cleared |
| | | | OFF | When no alarm has occurred since the last cleaning of alarm(s) |
| 06 | FA3 | Frequency Arrival Type 3–Set frequency | ON | When output to motor is at the set frequency, during accel (C042) and decel (C043). |
| | | | OFF | When output to motor is OFF, or is not at a level of the set frequency |
| 09 | UV | Undervoltage | ON | Inverter is in Undervoltage |
| | | | OFF | Inverter is not in Undervoltage |
| 11 | RNT | Run Time Expired | ON | Total running time of the inverter exceeds the specified value |
| | | | OFF | Total running time of the inverter does not exceed the specified value |
| 12 | ONT | Power ON time Expired | ON | Total power ON time of the inverter exceeds the specified value |
| | | | OFF | Total power ON time of the inverter does not exceed the specified value |
| 13 | THM | Thermal Warning | ON | Accumulated thermal count exceeds the C061 set value |
| | | | OFF | Accumulated thermal count does not exceed the C061 set value |
| 21 | ZS | Zero Hz Speed Detection Signal | ON | Output frequency falls below the threshold specified in C063 |
| | | | OFF | Output frequency is higher than the threshold specified in C063 |
| 27 | ODc | Analog Voltage Input Disconnect Detection | ON | When the [O] input value < b070 setting (signal loss detected) |
| | | | OFF | When no signal loss is detected |
| 31 | FBV | PID Second Stage Output | ON | Transitions to ON when the inverter is in RUN Mode and the PID Process Variable (PV) is less than the Feedback Low Limit (C053) |
| | | | OFF | Transitions to OFF when the PID Process Variable (PV) exceeds the PID High Limit (C052), and transitions to OFF when the inverter goes from Run Mode to Stop Mode |

Chapter 13 List of Data Settings

| Output Function Summary Table | | | | |
|-------------------------------|-----------------|--|-------------|--|
| Option Code | Terminal Symbol | Function Name | Description | |
| 32 | NDc | Network Disconnect Detection | ON | When the communications watchdog timer (period specified by C071) has time out |
| | | | OFF | When the communications watchdog timer is satisfied by regular communications activity |
| 33 | LOG | Logic Output Function 1 | ON | When the Boolean operation specified by C143 has a logical "1" result |
| | | | OFF | When the Boolean operation specified by C143 has a logical "0" result |
| 41 | FR | Starting Contact Signal | ON | Either FW or RV command is given to the inverter |
| | | | OFF | No FW or RV command is given to the inverter, or both are given to the inverter |
| 42 | OHF | Heat Sink Overheat Warning | ON | Temperature of the heat sink exceeds a specified value (C064) |
| | | | OFF | Temperature of the heat sink does not exceed a specified value (C064) |
| 43 | LOC | Low load detection | ON | Motor current is less than the specified value (C039) |
| | | | OFF | Motor current is not less than the specified value (C039) |
| 50 | IRDY | Inverter Ready Signal | ON | Inverter can receive a run command |
| | | | OFF | Inverter cannot receive a run command |
| 51 | FWR | Forward Rotation | ON | Inverter is driving the motor in forward direction |
| | | | OFF | Inverter is not driving the motor in forward direction |
| 52 | RVR | Reverse Rotation | ON | Inverter is driving the motor in reverse direction |
| | | | OFF | Inverter is not driving the motor in reverse direction |
| 53 | MJA | Major Failure Signal | ON | Inverter is tripping with major failure |
| | | | OFF | Inverter is normal, or is not tripping with major failure |
| 54 | WCO | Window Comparator for Analog Voltage Input | ON | Analog voltage input value is inside of the window comparator |
| | | | OFF | Analog voltage input value is outside of the window comparator |
| 58 | FREF | Frequency Command Source | ON | Frequency command is given from the operator |
| | | | OFF | Frequency command is not given from the operator |
| 59 | REF | Run Command Source | ON | Run command is given from the operator |
| | | | OFF | Run command is not given from the operator |
| 60 | SETM | 2 nd Motor Selection | ON | 2 nd motor is being selected |
| | | | OFF | 2 nd motor is not being selected |
| no | no | Not used | ON | - |
| | | | OFF | - |

[Function mode (H Group)]

| Func. Code | Name | Description | Run Mode Edit | Defaults | |
|------------|---|---|---------------|--|-------|
| | | | | Initial data | Units |
| H003 | Motor capacity | Twelve selections: 0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5 | ✗ | Specified by the capacity of each inverter model | kW |
| H203 | Motor capacity, 2 nd motor | | ✗ | | kW |
| H004 | Motor poles setting | Five selections: 2 / 4 / 6 / 8 | ✗ | 4 | poles |
| H204 | Motor poles setting, 2 nd motor | | ✗ | 4 | poles |
| H006 | Motor stabilization constant | Motor constant (factory set), range is 0 to 255 | ✓ | 100. | - |
| H206 | Motor stabilization constant, 2 nd motor | | ✓ | 100. | - |

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