# HITACHI INVERTER

# NE-S1 SERIES

## Quick Reference Guide

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

NT3411EX

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.

**Handling of this Quick Reference Guide**

- The contents of this Quick Reference Guide are subject to change without prior notice.
- Even if you lose this Quick Reference Guide, it will not be resupplied, so please keep it carefully.
- No part of this Quick Reference Guide may be reproduced in any form without the publisher's permission.
- If you find any incorrect description, missing description or have a question concerning the contents of this Quick Reference Guide, please contact the publisher.
- Read Quick Reference Guide carefully before starting the maintenance and service. (Quick Reference Guide can be downloaded from our website (Hitachi Industrial Equipment Systems Co., Ltd.) or please contact Hitachi distributor.)

**Revision History**

| No. | Revision content | Date of issue | Manual code |
|---|---|---|---|
| 1 | First edition | July,2012 | NT3411X |
| 2 | Addition 400VClass. | May,2013 | NT3411AX |
| 3 | Addition FFM option. | May,2013 | NT3411BX |
| 4 | Addition China ver. And Europe Ver. | Aug.2013 | NT3411CX |
| 5 | Addition 040H | Sep.2013 | NT3411DX |
| 6 | Addition PM control mode | Mar.2021 | NT3411EX |
| | | | |

- 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.**

(Memo)

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

**⚠ CAUTION**

Many of the drawings in this 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 front cover. Otherwise, you run the risk of injury and damage 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 Quick Reference Guide. 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. These may cause the inverter to fail.
- When touching the inverter, be aware of the electrostatic charge. It may cause the inverter to fail.

2. Wiring

**⚠ WARNING**

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- 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 AC power supply into the three phases input type inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U(T1), V(T2), and W(T3)) and the ground terminal. Otherwise, you run the risk of injury or fire.
- NE-S1 series inverter does 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.
- Please make sure that earth or ground screw is tighten properly and completely.
- First, check the screws of output terminal (U(T1), V(T2), and W(T3)) are properly tighten, and then tighten the screws of input terminal (R(L1),S(L2) and T(L3)).
- The factory default value of the intelligent relay output terminals [AL1, AL2-AL0] setting (C036) is the b-contact (NC) setting between AL1 and AL0. Also, even if it is initialized, it returns to the b-contact (NC) setting. When using this inverter as a substitute for an old model or when using it as a built-in system, check the intelligent relay output terminals [AL1, AL2-AL0] setting (C036), and use it according to the peripheral circuit logic.
  There is a risk of system down due to contact logic mismatch.

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 front cover before turning on the inverter power. Do not open the front cover while power is being supplied to the inverter or voltage remains inside. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. Stay away from the machine controlled by the inverter when the inverter is under such circumstances. (Design the machine so that human safety can be ensured, even when the inverter restarts suddenly.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation command has been input to the inverter before a short-term power failure, the inverter may restart operation after the power recovery. If such a restart may put persons in danger, design a control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- Prepare the additional emergency stop switch in addition to the stop key of the dedicated operator and the remote 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 are integrated in one key on the standard panel. Therefore, before you press the key, please make sure of the operating status of the inverter.
  Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.

**CAUTION**

- Do not touch the heatsink, 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 source (A002/A202) if the RUN/STOP/RESET key is pressed, the inverter starts running. Therefore, if you have selected Run command such as operator or terminal, please handle the RUN/STOP/RESET key after you made sure that the machine/facility can be operated safety.

4. Maintenance, inspection, and parts replacement

**WARNING**

- Before inspecting the inverter, be sure to turn off the power supply and wait for 10 minutes or more. Otherwise, you run the risk of electric shock.
  (Before inspection, confirm that the charge lamp on the inverter is off.)
  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.

# 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 frequency | Motor cable |
|---|---|---|---|
| Single phase 200 V class | C2 | 2 kHz | 20 m (Shielded) |
| Three phases 200 V class | C3 | 2 kHz | 20 m (Shielded) |
| Three phases 400 V class | C3 | 2 kHz | 20 m (Shielded) |

Table 2. Applicable EMC filter

| Input class | Inverter model | Filter model (Schaffner) |
|---|---|---|
| Single phase 200 V class | NES1-002SB | FS24828-8-07 |
| | NES1-004SB | |
| | NES1-007SB | FS24828-27-07 |
| | NES1-015SB | |
| | NES1-022SB | |
| Three phases 200 V class | NES1-002LB | FS24829-8-07 |
| | NES1-004LB | |
| | NES1-007LB | |
| | NES1-015LB | FS24829-16-07 |
| | NES1-022LB | |
| Three phases 400 V class | NES1-004HB | FS24830-6-07 |
| | NES1-007HB | |
| | NES1-015HB | FS24830-12-07 |
| | NES1-022HB | |
| | NES1-040HB | |

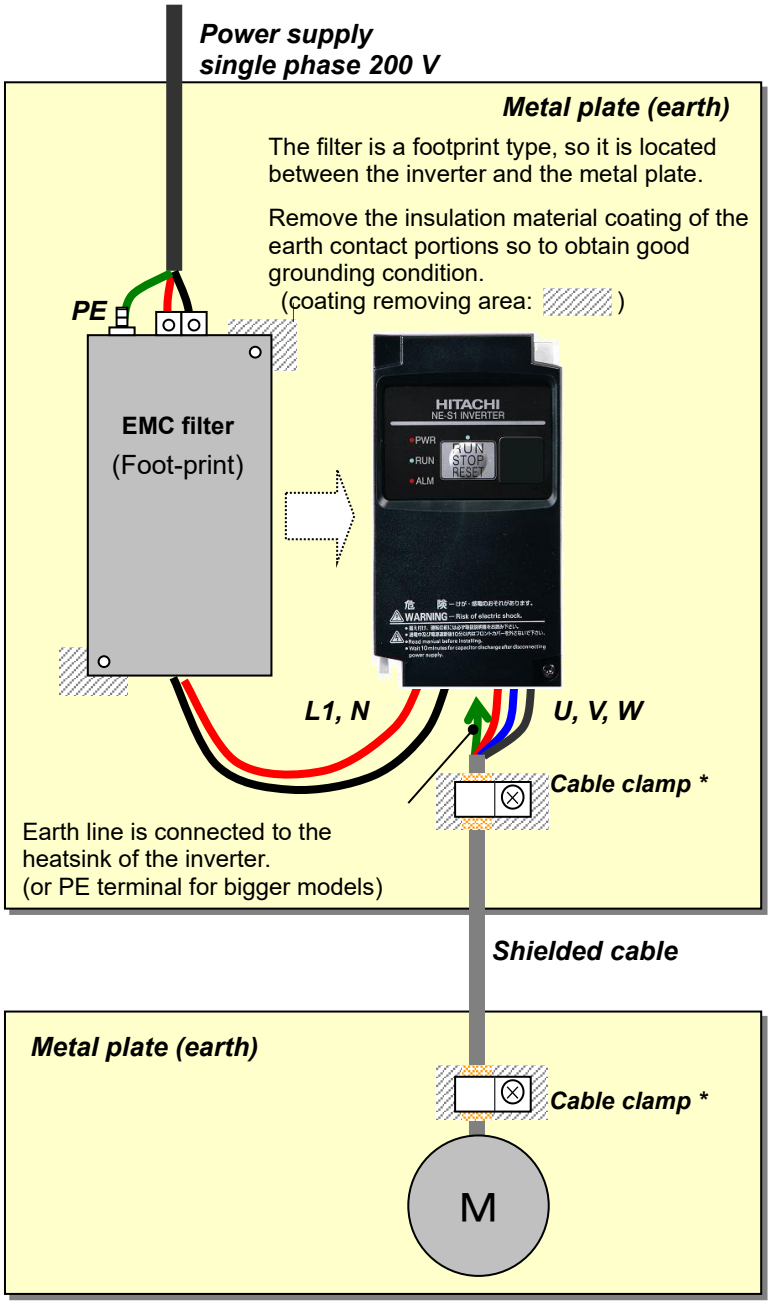
**Important notes**

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 20 m, 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. It must be ensured 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 be connected to ground + PE at both ends.
   - To achieve a large area contacts between shield and ground + PE-potential, use a PG screw with a metallic shell, or use a metallic mounting clamp.
   - Use only cable with braided, tinned copper mesh shield (type “CY”) with 85 % coverage.
   - The shielding continuity should not be broken at any point in the cable. If the use of reactors, contactors, terminals, or safety switches in the motor output is necessary, the unshielded section should be kept as short as possible.
   - Some motors have a rubber gasket between terminal box and motor housing. Very often, the terminal boxes, and particularly the threads for the metal PG screw connections, are painted. Make sure there is always a good metallic connection between the shielding of the motor cable, the metal PG screw connection, the terminal box, and the motor housing. If necessary, carefully remove paint between conducting surfaces.
6. Take measures to minimize interference that is frequently coupled in through installation cables.
   - Separate interfering cables with 0.25 m minimum from cables susceptible to interference. A particularly critical point is laying parallel cables over longer distances. If two cables intersect (one crosses over the other), the interference is smallest if they intersect at an angle of 90°. Cables susceptible to interference should therefore only intersect motor cables, intermediate circuit cables, or the wiring of a rheostat at right angles and never be laid parallel to them over longer distances.
7. Minimize the distance between an interference source and an interference sink (interference-threatened device), thereby decreasing the effect of the emitted interference on the interference sink.
   - You should use only interference-free devices and maintain a minimum distance of 0.25 m from the adjustable frequency inverter.
8. Follow safety measures in the filter installation.
   - Be sure to ground the EMC filter and inverter to the ground terminal (PE) respectively. Do not ground the metal connection between the filter housing and the inverter or the connection of the shielded wire alone. In the event of a failure, the filter should always be grounded to avoid the risk of touching the filter and getting an electric shock.

   To achieve a protective ground connection for the filter:
   - Ground the filter with a conductor of at least 10 $mm^2$ cross-sectional area.
   - Connect a second grounding conductor, using a separate grounding terminal parallel to the protective conductor. (The cross section of each single protective conductor terminal must be sized for the required nominal load.)

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

Model LB (three phases 200 V class) and HB (three phases 400 V class) are the same concept for the installation.




*) Both earth portions of the shielded cable must be connected to the earth point by cable clamps.
Input choke or equipment to reduce harmonic current is necessary for CE marking (IEC 61000-3-2 and IEC61000-3-4) from the harmonic current point of view, even conducted emission and radiated emission passed without the input choke.

## 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.

Confirm the following items 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 ±10 % or less
- Voltage imbalance ±3 % or less
- Frequency variation ±4 % or less
- Voltage distortion THD ±10 % or less

**2.** Installation measure:
- Use a filter designed for NE-S1 inverter. Refer to the instruction of the applicable external EMC filter.

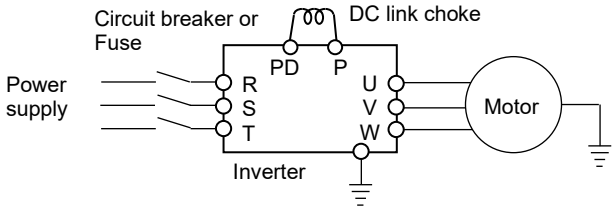
**3.** Wiring:
- Shielded wire (screened cable) is required for motor wiring, and the length must be 20 meter or less.
- If the motor cable length exceeds the value shown above, use output choke to avoid unexpected problem due to the leakage current from the motor cable.
- The carrier frequency setting 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 $m/s^2$ (0.6 G) 10 to 55 Hz
- Location: 1000 meters or less altitude, indoors (no corrosive gas or dust)

## 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 ºC.
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. For models 200 V class.
   Suitable for use on a circuit capable of delivering not more than 100,000 rms Symmetrical Amperes, 480 Volts Maximum. For models 400 V class.
d) Drive has no provision for motor over temperature protection.
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. For models 200V class.
   When Protected by J, CC, G or T Class Fuses. For models 400 V class.
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) Install device in pollution degree 2 environment
h) Branch circuit short circuit protection can use fuse or circuit breaker only. For models 200 V class.
   Branch circuit short circuit protection can use fuse only. For models 400 V class.
i) Use 60/75 ºC CU wire only.
j) Tightening torque and wire range as shown in the table below.

| Model No. | Required Torque (N·m) | Wire Range(AWG) |
|---|---|---|
| NES1-002S, 004S | 0.8 to 1.0 | 16 to 14 |
| NES1-007S | 1.8 | 14 to 12 |
| NES1-015S | 1.8 | 12 to 10 |
| NES1-022S | 1.8 | 10 |
| NES1-002L, 004L, 007L | 0.8 to 1.0 | 16 to 14 |
| NES1-015L | 1.8 | 14 |
| NES1-022L | 1.8 | 12 |
| NES1-004H, 007H, 015H | 1.8 | 16 |
| NES1-022H, 040H | 1.8 | 14 |

k) 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, 004S | Class J, CC, G or T | 10 A | Inverse Time | 15 A |
| NES1-007S | | 20 A | | |
| NES1-015S, 022S | | 30 A | | 30 A |
| NES1-002L*, 004L* | Class J, CC, G or T | 10 A | Inverse Time | 15 A |
| NES1-007L*, 015L | | 15 A | | |
| NES1-022L | | 20 A | | 20 A |
| NES1-004H, 007H, 015H, 022H, 040H | Class J, CC, G or T | 15 A | - | - |

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

# Chapter 2 Inspection of the Purchased Product

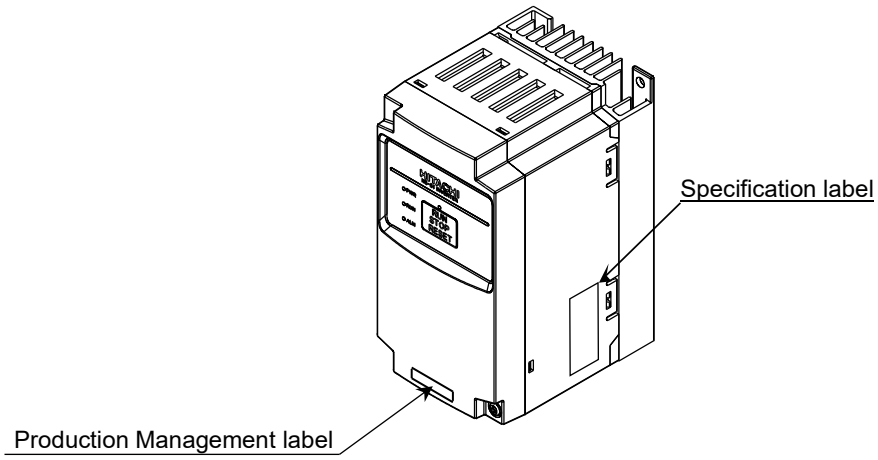
**This chapter describes the inspection of the purchased product, the product warranty.**

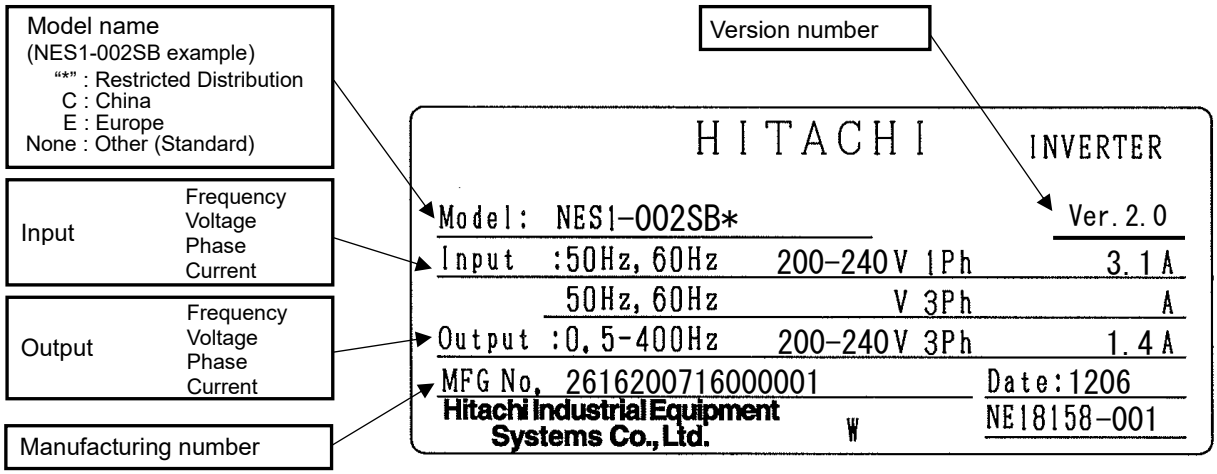
(Memo)

## 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) Check the product for damage caused during transportation.
(2) Please refer to the included manual and check that
there are no shortages in the included items.
(3) The product is the one you ordered.
(check with the specification label)




Example of the specification label

## 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 (included version number)
(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 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.
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 Quick Reference Guide 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.

(C) Warranty Terms
The warranty period under normal installation and handling conditions shall be two (2) years from the date of manufacture (“DATE” on specification label), 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 Quick Reference Guide handy; please do not lose it. Please contact your Hitachi distributor to purchase replacement or additional Quick Reference Guide.

# Chapter 3 Exterior Views

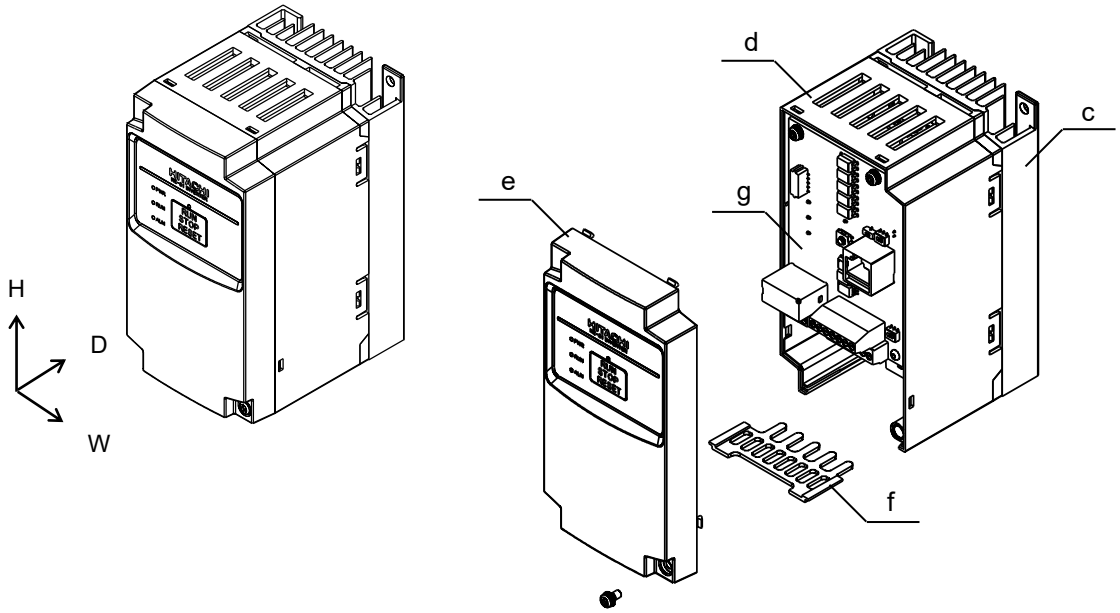
**This chapter describes the exterior views and the names of parts.**

(Memo)

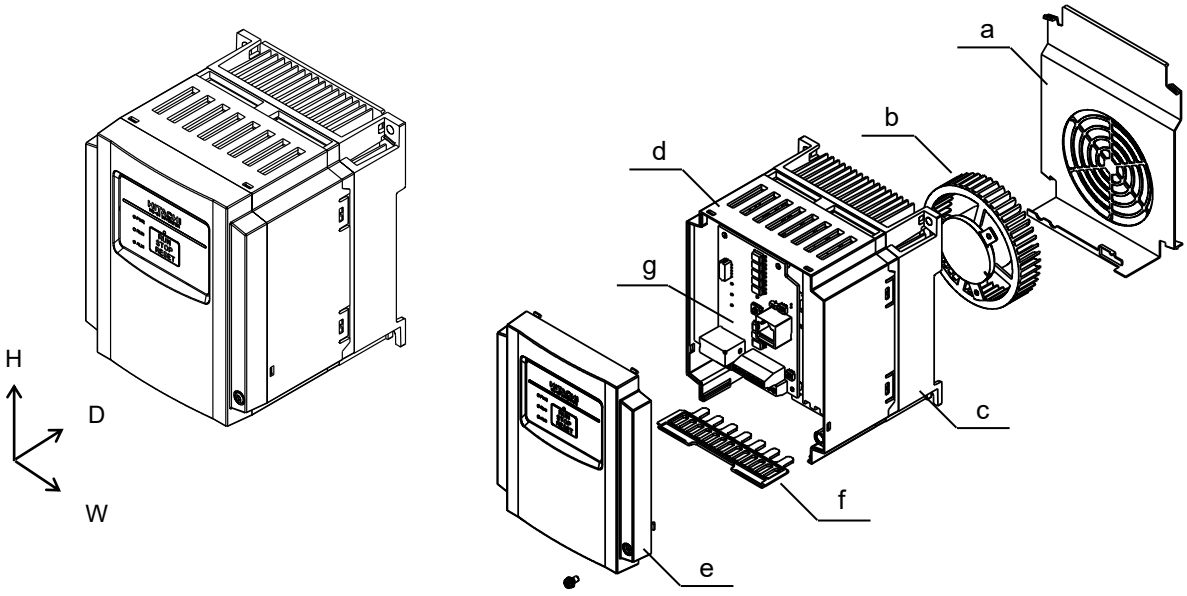
## 3.1 Exterior Views and Names of Parts

The figure below shows an exterior view of the inverter.

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



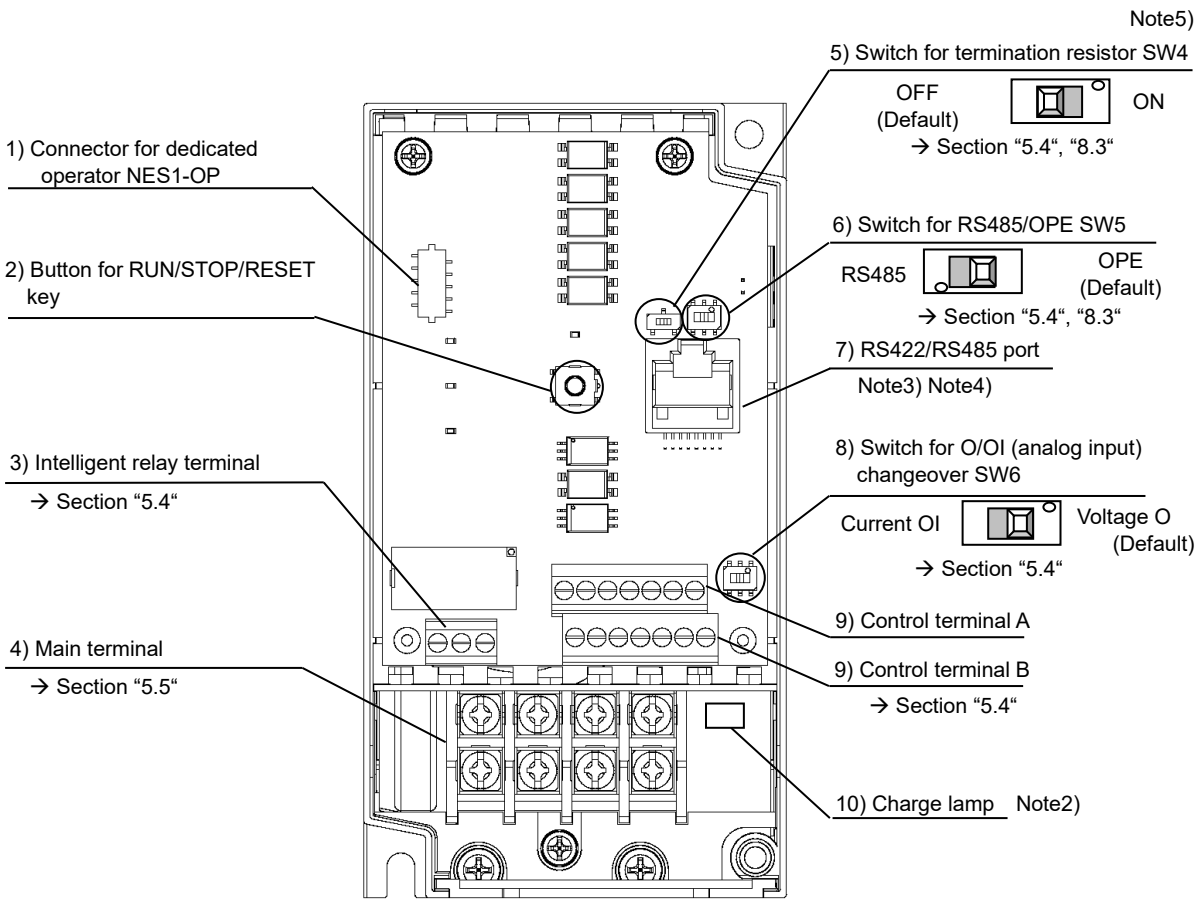

- model : NES1-007*SB, 015,022SB/LB, 004*,007,015,022,040HB




*) 002 to 007SB/LB and 004HB: without Cooling Fan

a) Cooling Fan Cover
b) Cooling Fan
c) Heatsink
d) Case
e) Front Cover
f) Backing plate
g) Control board

## 3.2 Name of each portion (removing the front cover) Note1)




| Name | Description |
|---|---|
| 1) Connector for dedicated operator NES1-OP | Dedicated operator for NE-S1 (NES1-OP) can be connected. |
| 2) Button for RUN/STOP/RESET key | Button for RUN/STOP/RESET key on the standard panel. |
| 3) Intelligent relay terminal | Output terminal for intelligent relay (1c-contact). |
| 4) Main terminal | For connecting power supply, inverter output and DC link choke. |
| 5) Switch for termination resistor SW4 | Switch for integrated termination resistor (120 Ω) for RS485. Integrated resistor of 120 Ω is connected when turning ON. |
| 6) Switch for RS485/OPE SW5 | Changeover switch for RS422/RS485 port. |
| 7) RS422/RS485 port | Connector for RS485 communication line, external operator, or communication line for PC software (RJ45 jack) |
| 8) Switch for O/OI (analog input) changeover SW6 | Voltage input (O) or current input (OI) can be selected. |
| 9) Control 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 45 V or more.<br>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 How To Operate the Inverter".
Note 2) Position of "10) charge lamp" depends on the model. Refer to section "5.5 Mains wiring" 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 standard panel of the inverter.
Note 4) Be sure to turn power OFF when connecting or disconnecting the operator such as OPE-SRmini, OPE-S/SR/SBK, SOP, SOP-VR, WOP to the "7) RS422/RS485 port".
Note 5) When RS485 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.**

(Memo)

## 4.1 Precautions for installation

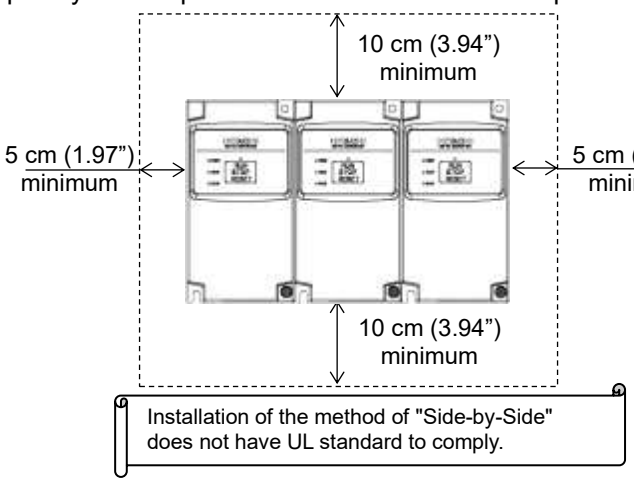
**CAUTION**

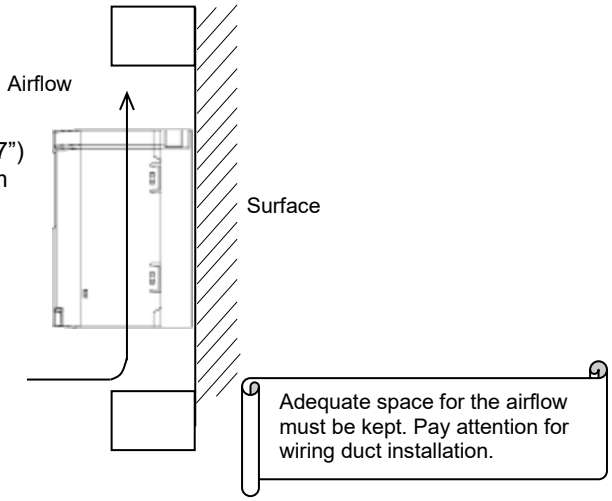
- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its front cover. Otherwise, you run the risk of injury and damage 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 Quick Reference Guide. 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. These may cause the inverter to fail.
- Be careful of static electricity when touching the inverter. Static electricity may cause an inverter failure.

# 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. Otherwise, there is a risk of falling down the product.
Please do not use products having damage, and/or lacking components.

(2) Install the inverter on the mounting surface of the iron plate.
The inverter has heat (up to about 150 °C) when the inverter is driving the motor. Since there is a risk of fire, install the inverter on the vertical wall surface of the iron plate. As shown in the figure below, secure a space of 10 cm in the vertical direction and 5 cm in the horizontal direction so as not to block the ventilation of cooling. In particular, if a heating element (reactor, etc.) is nearby, keep it far enough away.
It is possible to install multiple NE-S1 inverters side by side in the cabinet (* side-by-side installation), at this time, the ambient temperature of the installation location is 40 °C or less, and derating of carrier frequency and output current for the inverter is required.




(3) Caution for ambient temperature
Set ambient temperature at installation site within the standard specification range (-10 to 50 °C).
Measure ambient temperature at the place apart by 5 cm 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 Derating Curves".

(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 to 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 cabinet.

**WARNING**

- For safety, do not open the surface cover while the power is on.

**CAUTION**

- Depending on the ambient temperature, it is necessary to reduce the carrier frequency or raise the inverter capacity.

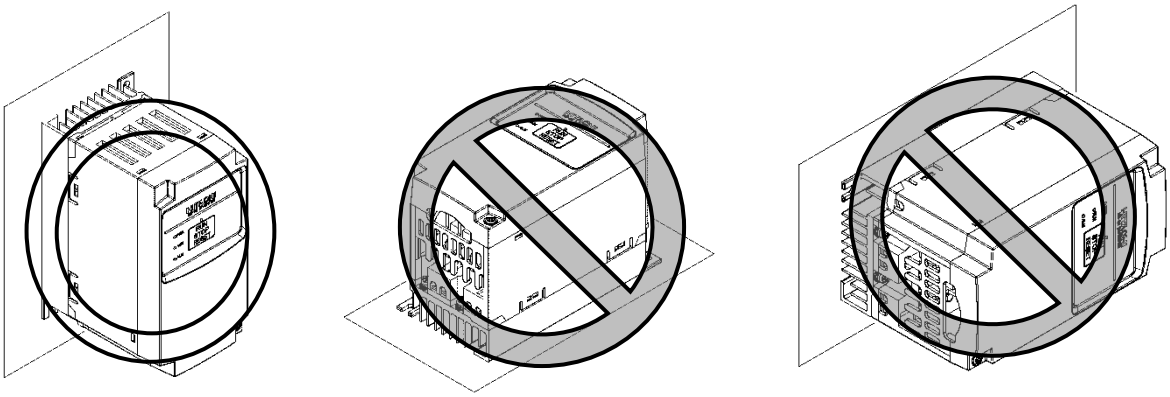
(6) Cautions for installation direction

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 proper screws with vertical direction.

Be sure to screw using all the screw holes for the installation.

(002L/S,004L/S,007L: 2 positions, 004H,007S/H,015L/S/H,022L/S/H,040H: 4 positions)

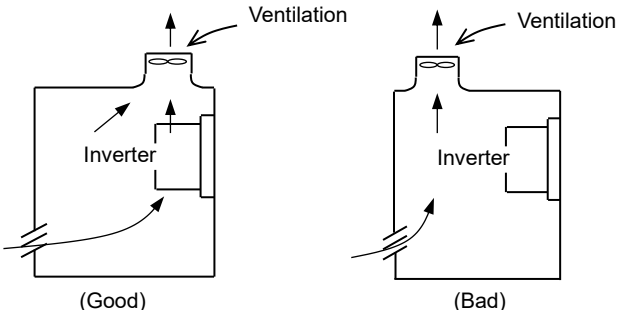
There is a risk of performance failure, and/or breakdown when the product is not installed vertical direction.



(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

Single phase / Three phases 200 V 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 |

Three phases 400 V class

| Model name | 004H | 007H | 015H | 022H | 040H |
|---|---|---|---|---|---|
| Watt Loss (100 % load)(W) | 35 | 56 | 96 | 116 | 167 |
| Efficiency at rated load (%) | 92 | 93 | 94 | 95 | 96 |

# Chapter 5 Wiring

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

(Memo)

## 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.

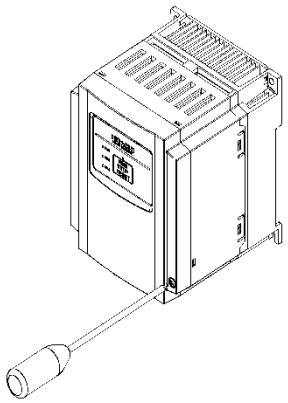
**CAUTION**

- 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 AC power supply into the three phases input type inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U(T1), V(T2), and W(T3)) and the ground terminal. Otherwise, you run the risk of injury or fire.
- NE-S1 series inverter does 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 or ground screw is tighten properly and completely.
- First, check the screws of output terminal (U(T1), V(T2), and W(T3)) are properly tighten, and then tighten the screws of input terminal (R(L1),S(L2) and T(L3)).
- The factory default value of the intelligent relay output terminals [AL1, AL2-AL0] setting (C036) is the b-contact (NC) setting between AL1 and AL0. Also, even if it is initialized, it returns to the b-contact (NC) setting. When using this inverter as a substitute for a conventional model or when using it as a built-in system, check the intelligent relay output terminals [AL1, AL2-AL0] setting (C036), and use it according to the peripheral circuit logic.
  There is a risk of system down due to contact logic mismatch.

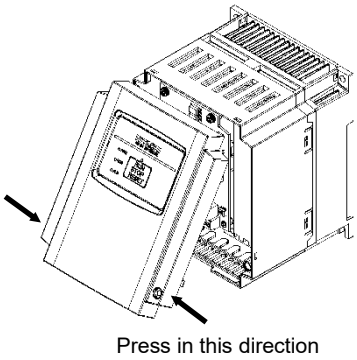
## 5.2 How to attach and remove the front cover

(1) How to remove

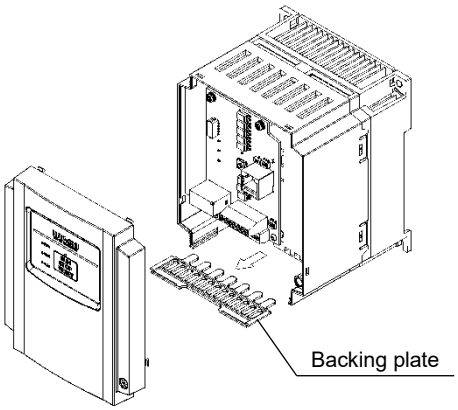
1) Loosen up the screw.



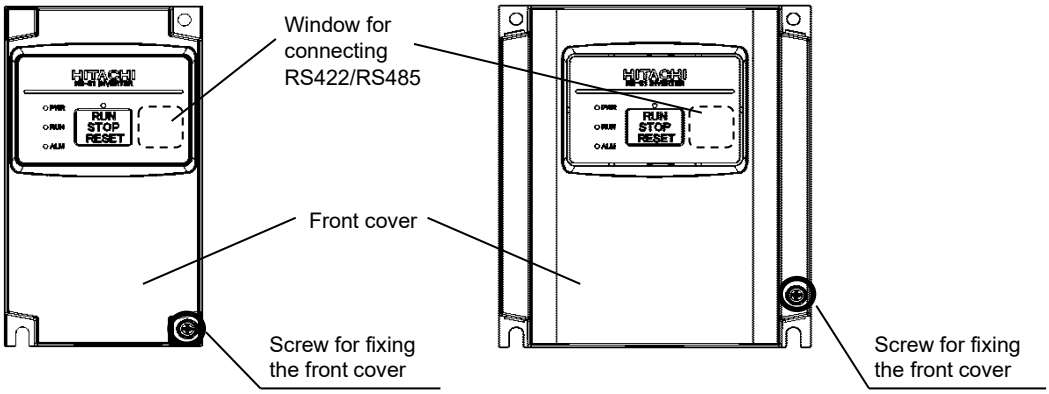
2) Remove the front cover by pressing the bottom side of the cover to the direction shown below.




3) Remove the backing plate like shown below in case of wiring.




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



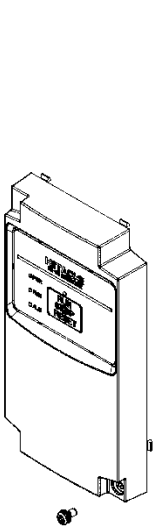

(2) It is necessary to make window on the front cover when using RS485 communication, remote operator (OPE-S/SR/SBK/SRmini, SOP, SOP-VR, WOP), or PC software (ProDriveNext). See above for the position of the window.

- 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 alternately.
- 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

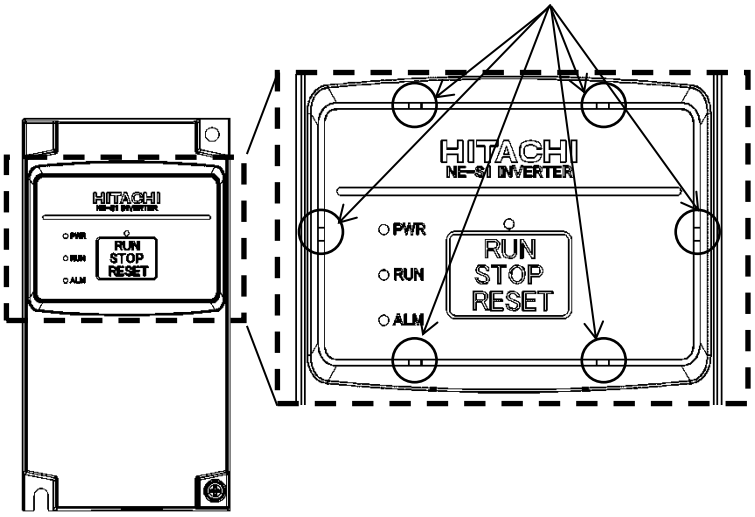
- Press the front cover to the case until there is a click sound.
- Do not tighten the screw too much.

## 5.3 How to attach the Dedicated operator (NES1-OP)

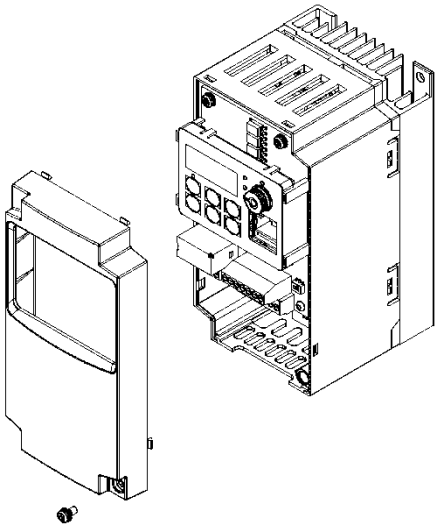


1) Remove the front cover from case.

Cut (6 points)

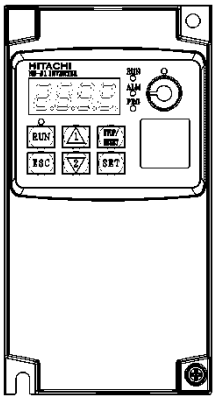



2) Cut the standard panel by thin–blade-nipper and take it off.



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

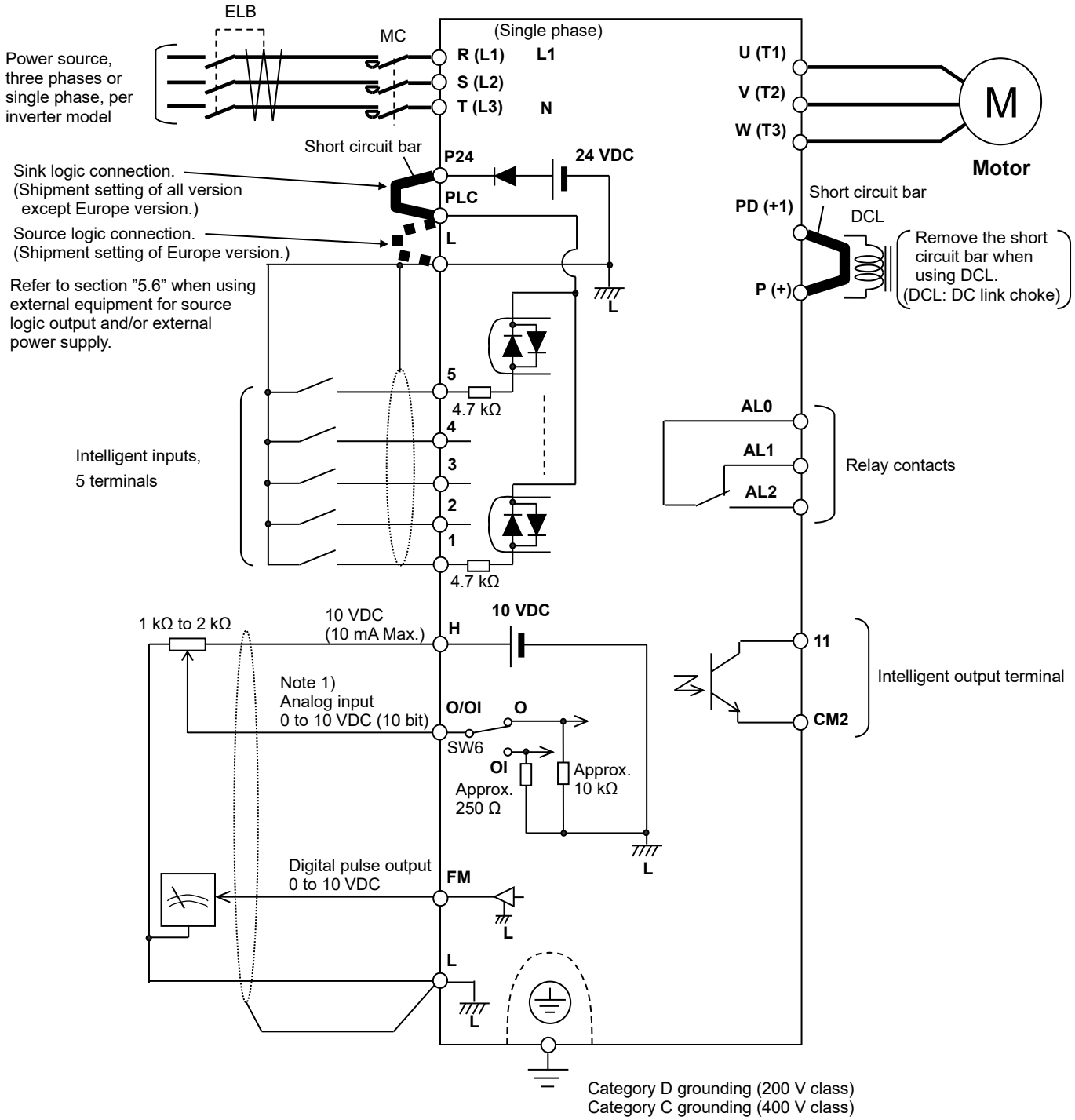
4) Attach the front cover.



5) Figure of installation (NES1-OP)

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

## 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. (Refer to "(3) Changeover switch description" below.)

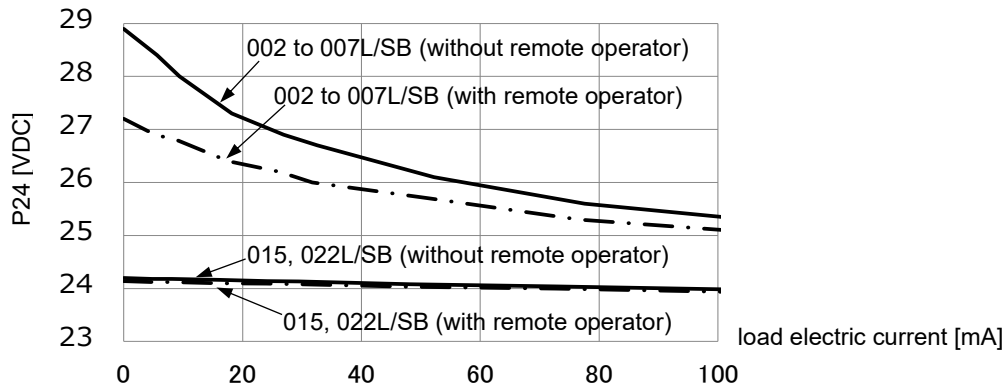
(1) Main terminal description

| Symbol | Name | Description |
|---|---|---|
| R (L1) / L1<br>S (L2)<br>T (L3) / N | Power input terminals | Connect power supply.<br>- Use L1 and N terminal in case of single phase 200 V model power supply. |
| U (T1)<br>V (T2)<br>W (T3) | Inverter output terminals | Connect three phases motor. |
| PD (+1)<br>P (+) | DC link choke connection terminals | First, remove the short circuit bar between PD (+1) and P (+) terminals.<br>Then connect optional DC link choke for improving the input harmonics. |
| G ( ⏚ ) | Ground 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 and pulse output | Common for internal control power supply, digital inputs, analog input, and digital pulse output. | |
| | | H | Power supply for external potentiometer | 10 VDC power supply. Used with variable resistor for O input. | Max.10 mA output |
| | Frequency set | O/OI | Analog voltage<br>(Use SW6 for changeover) | Frequency set via 0 to 10 VDC input. | Input impedance:<br>apprx.10 kΩ<br>Allowable range;<br>-0.3 to +12 VDC |
| | | | Analog current<br>(Use SW6 for changeover) | Frequency set via 0 to 20 mA.<br>Parameter adjustment should be done in case of 4 to 20 mA. | Input impedance:<br>apprx.250 Ω<br>Allowable range;<br>0 to 24 mA |
| Digital | Power supply | L | Common for input signals and pulse output | Common for internal control power supply, digital inputs (in case of sink logic), analog input, and digital pulse output. | |
| | | P24 | Power supply for digital inputs | 24 VDC power supply for input contact. (Common terminal in case of source logic) note) | Max.100 mA output |
| | | PLC | Power supply terminal for input terminals | Sink logic: connected to P24<br>Source logic: connected to L<br>Remove the short circuit bar 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. (remote operator: OPE-S/SR/SBK/SRmini, SOP, SOP-VR, WOP)
As for this chart application, it is just by December 2012 production.
Thereafter, all models become the curve to show in 015,022L/SB.




P24 - load electric current properties

| Category | | | Symbol | Name | Description | Electrical characteristics |
|---|---|---|---|---|---|---|
| Digital | Input | Contact | 5<br>4<br>3<br>2<br>1 | Intelligent input terminals | 5 functions from 35 functions can be assigned to terminal 1 to 5.<br>Sink or source logic can be selected. | Voltage between each input and PLC<br>- V(ON): Min.18 VDC<br>- V(OFF): MAX.3 VDC<br>- Max. allowable voltage: 27 VDC<br>- Load current: 5 mA (24 VDC) |
| | Output | Open-collector | 11 | Intelligent output terminal | One function from 28 functions can be assigned. | Open collector output<br>Between 11 and CM2<br>- Voltage drop during ON: 4 VDC or less<br>- Max. allowable voltage: 27 VDC<br>- Max. allowable current: 50 mA |
| | | | CM2 | Common for intelligent output terminal | Common for the intelligent output terminal 11. | Max. allowable current: 50 mA |
| | | Relay | AL0<br>AL1<br>AL2 | Intelligent relay outputs | One function from 28 functions can be assigned. (1c-contact) | Max. contact capacity<br>AL1-AL0: 250 VAC, 30 VDC<br>AC: 2 A (resistive), 0.2 A (inductive)<br>DC: 3 A (resistive), 0.6 A (inductive)<br>AL2-AL0: 250 VAC, 30 VDC<br>AC: 1 A (resistive), 0.2 A (inductive)<br>DC: 1 A (resistive), 0.2 A (inductive)<br>Min. contact capacity<br>100 VAC, 10 mA<br>5 VDC, 100 mA |
| | | Pulse output | FM | Digital pulse output | Output pulse frequency Max. 3.6 kHz | Pulse voltage: 0/10 VDC output<br>Max. allowable current: 1 mA |

(3) Changeover switch description

Refer to section “3.2 Name of each portion (removing the front cover)” 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 | Switch for termination resistor | Select able/disable of the termination resistor of RS485 port (RJ45). | |
| | | OFF (left side) | Termination resistor (120 Ω) Disable (Default) |
| | | ON (right side) | Termination resistor (120 Ω) Able |
| SW5 | Switch for RS485/OPE | Select depending on the options and communication method, connected to RS422/RS485 port. | |
| | | OFF (right side) | For remote operator (OPE-S/SR/SBK/SRmini, SOP, SOP-VR, WOP), ProDriveNext (Default) |
| | | ON (left side) | For RS485 communication (Modbus-RTU) |
| SW6 | Switch for O/OI (analog input) changeover | Select analog input method either voltage input (O) or current input (OI). | |
| | | OFF (left side) | Current input (0 to 20 mA) OI |
| | | ON (right side) | Voltage input (0 to 10 VDC) 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, and after confirming the safety of personnel.
In case the power indication of the operator does not turn ON after power-up, inverter may be damaged. In that case, the wiring 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) Power 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.

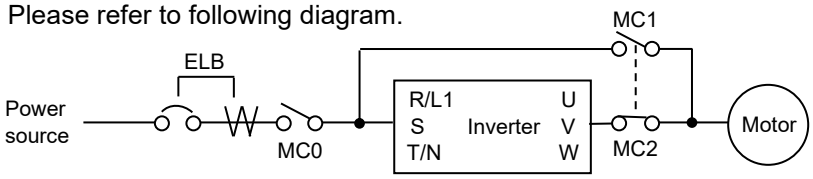
| Distance between inverter and motor | Cutoff current of ELB |
|---|---|
| 100 m or less | 30 mA |
| 300 m or less | 100 mA |
| 800 m or less | 200 mA |

[Rough indication of earth leakage current] 30 mA/km : use CV cable with metallic tube. Leakage current will be approximately 8 times more when using HIV cable.
Therefore, it is recommended to use the ELB of which the rated sensitivity current is 8 times as high as that given in the left table.
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 function of the inverter is activated. Please use magnetic 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 three phases input type inverter with single phase input (phase loss). Otherwise, there is a risk of inverter failure. Single phase input to the three phases type inverter will result in an 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 on wiring” for the wiring.
- In the following cases, 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)
  - The capacity of power supply is 10 times the inverter capacity or more, and 500 kVA or more.
  - Sudden voltage change occurred.

  (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. Otherwise, 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 greater than that of the inverter (kVA) in a PWM control system, or six times greater than that of the inverter (kVA) 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.

- In case of commercial power source switching functionality, the contacts of MC1 and MC2 must be mechanically interlocked with each other. Otherwise you may damage the inverter and the danger of injury and/or fire. Please refer to following diagram.




2) Inverter output terminals (U (T1), V (T2), and W (T3))

- Use larger gauge cable than the specified applicable cable (refer to following “(4) Wiring and Accessories”) for the wiring of output terminals to prevent the output voltage drop between the inverter and motor. Especially at low frequency output, a voltage drop due to cable resistance will cause the motor torque to decrease.
- Do not connect a phase advancing capacitor or surge absorber on the output side of the inverter. If connected, the inverter may trip or the phase advancing 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.

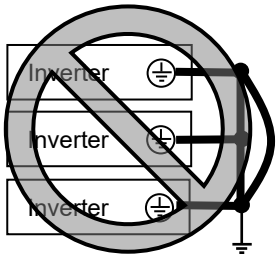
3) DC link choke connection terminals (PD (+1) and P (+))

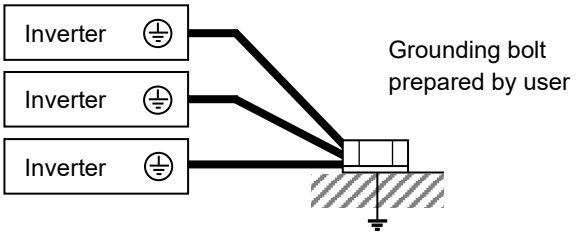
- Use these terminals to connect the optional DC link choke (DCL).
  As the factory setting, terminals P (+) and PD (+1) are connected by a short circuit bar.
  Remove this to connect the DCL.
- The cable length between the inverter and DCL must be 5 m or less.

> Remove the short circuit bar only when connecting the DCL.
> If the short circuit bar 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.
- When grounding the inverter, refer to the relevant regulations such as IEC60364.
- Use a grounding cable thicker than the specified applicable cable (refer to following “(4) Wiring and Accessories”), and make the ground wiring as short as possible.
- When grounding multiple inverters, avoid a multi-drop connection of the grounding route and formation of a ground loop, otherwise the inverter may malfunction.

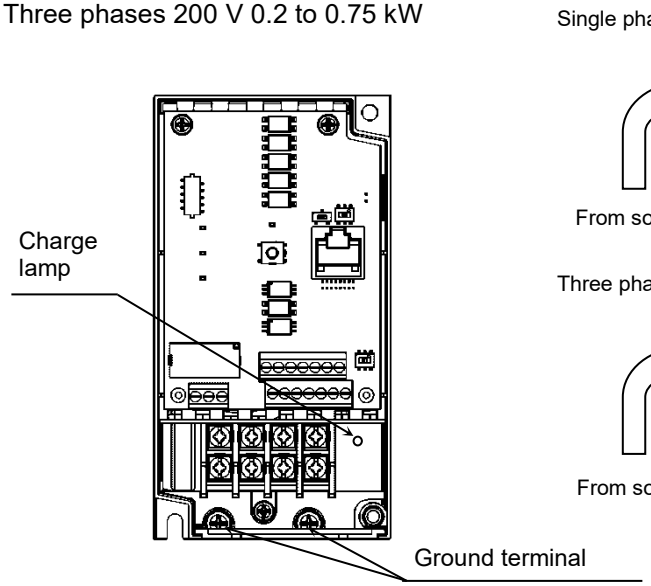


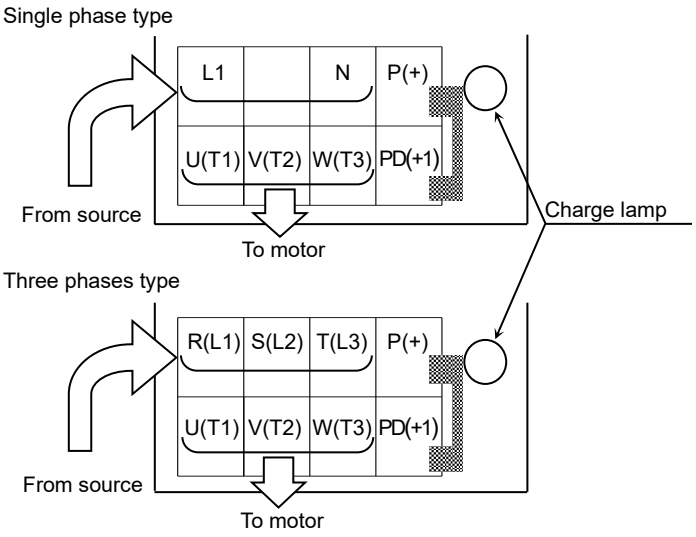



(2) Layout of main terminal

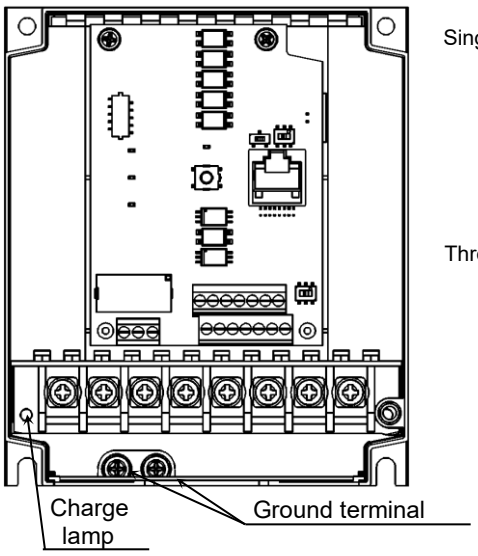
The figures below show the terminal layout on the main terminal block of the inverter.
Before wiring the main terminal block, open the front cover and remove the backing plate.

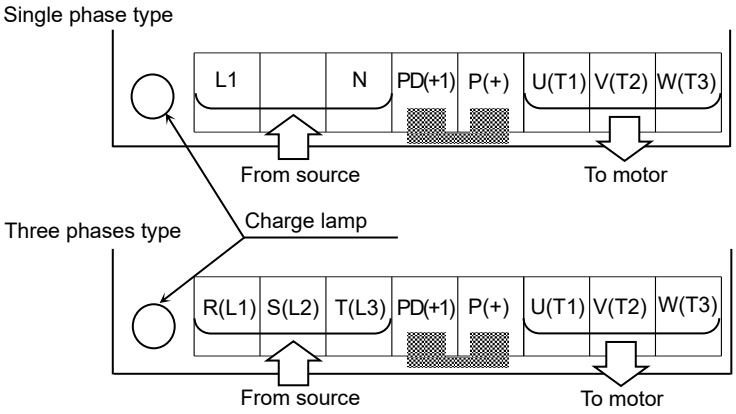
Single phase 200 V 0.2 to 0.4 kW
Three phases 200 V 0.2 to 0.75 kW



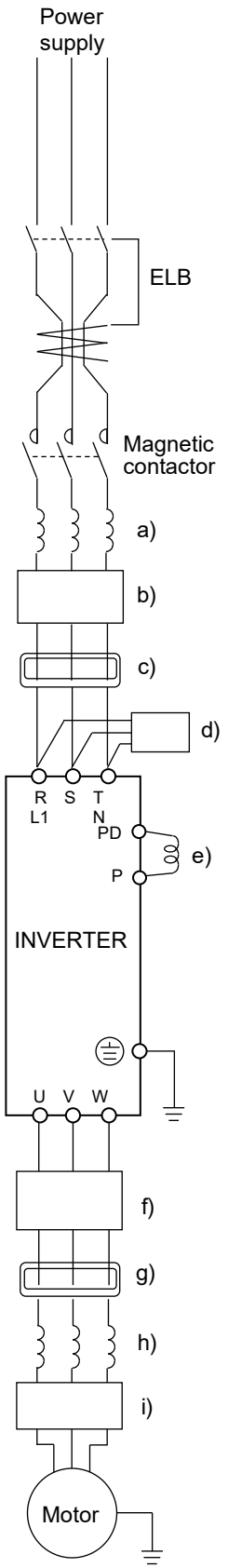




Single phase 200 V 0.75 to 2.2 kW
Three phase 200 V 1.5, 2.2 kW
Three phase 400 V 0.4 to 4.0 kW



(3) Applicable peripheral equipment




Note 1: The peripheral equipment described here is applicable when the inverter connects a standard Hitachi three phases, 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: 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 7: Select an earth-leakage breaker (ELB) of which the cutoff 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 8: When a CV cable is used for wiring through a metal conduit, the average current leakage is 30 mA/km.

Note 9: 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 cutoff current is eight times as high as that given in the right table. If the total cable length exceeds 100 m, use a CV cable.

| Total cable length | Cutoff current of ELB (mA) |
|---|---|
| 100 m or less | 30 |
| 300 m or less | 100 |
| 800 m or less | 200 |

| Name | Description |
|---|---|
| a) AC reactor on input side (for harmonic control, power supply coordination, and power factor improvement) (ALI-XXX) Note10 | 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) Note10 | 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 link choke (DCL-X-XX) | Use this DC link choke 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-X) | 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-X2-XX) | Using the inverter to drive a 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. |
| i) LCR filter | This filter converts the inverter output voltage into a sinusoidal waveform. |

Note10: If there are any thyristor equipment belonging to the same net, and a possibility that the surge voltage is given to the net, change the connecting order of above a) and b). (Connecting order: Net→ELB→Contactor→Noise filter b)→AC reactor on input side a)→Inverter).
Otherwise, there is a danger of damaging inverter and/or fire.

(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-xxxx** Note8) | Wiring | | | Accessories Note1) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Gauge of power line cable ($mm^2$) Note3),4),6) | Size of terminal screw (Terminal width (mm)) | Tightening torque (N·m) Note6) | Earth-leakage breaker (ELB) Note2),5),6) | Magnetic contactor (MC) Note2) | Fuse (UL-rated, class J,600 V) Note6) |
| Single phase 200 V | 0.2 | 002S | AWG14 (2.0) | M3.5 (7.6) | 1.0 | EB-30E (5 A) | HS10 | 10 A |
| | 0.4 | 004S | AWG14 (2.0) | M3.5 (7.6) | 1.0 | EB-30E (10 A) | HS10 | 10 A |
| | 0.75 | 007S | AWG14 (2.0) | M4 (10) | 1.4 | EB-30E (15 A) | HS10 | 15 A |
| | 1.5 | 015S | AWG10 (5.5) | M4 (10) | 1.4 | EB-30E (20 A) | HS20 | 20 A |
| | 2.2 | 022S | AWG10 (5.5) | M4 (10) | 1.4 | EB-30E (20 A) | HS20 | 30 A |
| Three phases 200 V | 0.2 | 002L | AWG16 (1.25) | M3.5 (7.6) | 1.0 | EB-30E (5 A) | HS10 | 10 A |
| | 0.4 | 004L | AWG16 (1.25) | M3.5 (7.6) | 1.0 | EB-30E (10 A) | HS10 | 10 A |
| | 0.75 | 007L | AWG16 (1.25) | M3.5 (7.6) | 1.0 | EB-30E (10 A) | HS10 | 15 A |
| | 1.5 | 015L | AWG14 (2.0) | M4 (10) | 1.4 | EB-30E (15 A) | HS10 | 15 A |
| | 2.2 | 022L | AWG14 (2.0) | M4 (10) | 1.4 | EB-30E (20 A) | HS20 | 20 A |
| Three phases 400 V | 0.4 | 004H | AWG16 (1.25) | M4 (10) | 1.4 | RXK60-S (5 A) | HS10 | 10 A |
| | 0.75 | 007H | AWG16 (1.25) | M4 (10) | 1.4 | RXK60-S (10 A) | HS10 | 10 A |
| | 1.5 | 015H | AWG16 (1.25) | M4 (10) | 1.4 | RXK60-S (10 A) | HS10 | 10 A |
| | 2.2 | 022H | AWG14 (2.0) | M4 (10) | 1.4 | RXK60-S (15 A) | HS10 | 15 A |
| | 4.0 | 040H | AWG14 (2.0) | M4 (10) | 1.4 | RXK60-S (15 A) | HS10 | 15 A |

Note 1) The peripheral equipment described here are applicable when the inverter connects a standard Hitachi three phases, 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 1 pc inverter. 1 pc inverter must be supplied by the above proper 1 pc ELB.

Note 3) If the power line exceeds 20 m, 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, please refer to section “1.3 Precautions Concerning Compliance with UL and cUL Standards”.

Note 7) The ground or earthed line should be a larger gauge than electric supply wire diameter used in the power line.

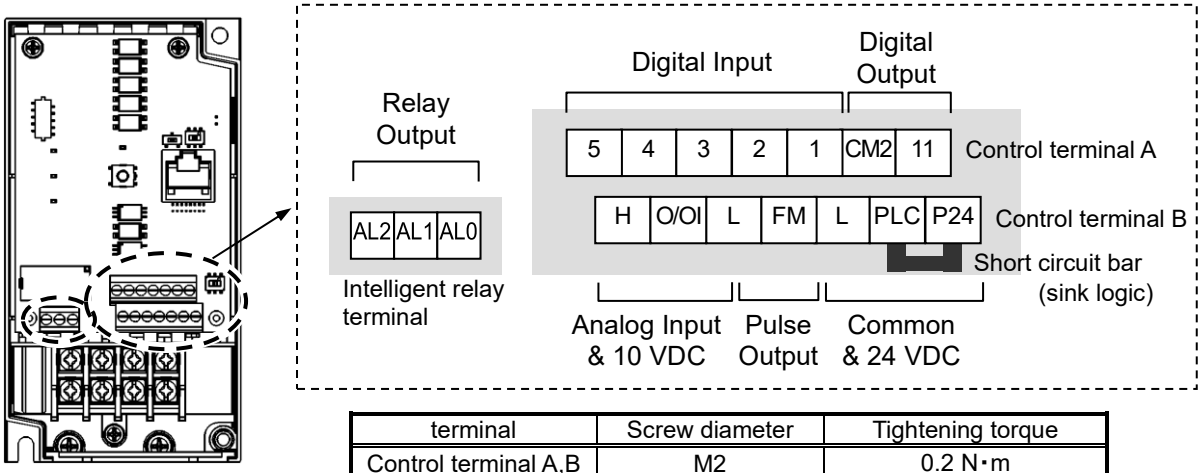
Note 8) The "**" part depends on the option equipment and destination.

## 5.6 Wiring of the control circuit

(1) Wiring instructions

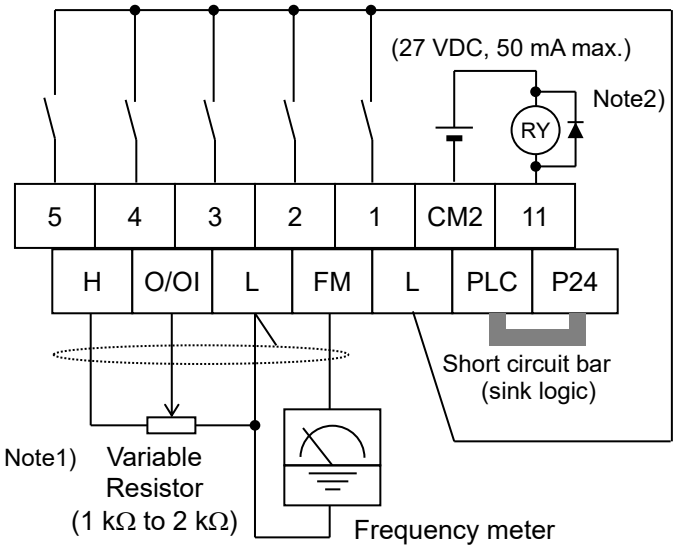
1) Terminals L and CM2 are common to I/O signals and isolated from each other.
   Do not connect these common terminals to each other or ground them.
   Do not ground these terminals via any external devices. (Check that the external devices connected to these terminals are not grounded.)
2) Use a shielded, twisted-pair cable (recommended gauge: 0.14 to 0.75 $mm^2$) for connection to control terminals, and connect the cable insulation to the corresponding common terminal.
3) The length of cables connected to control terminals must be 20 m or less.
4) Separate the control circuit wiring from the main circuit wiring (power line) and relay control circuit wiring. If it is unavoidable to cross, cross each line at a right angle. Otherwise, the inverter may malfunction.
5) When connecting a contact to a control 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 an input coil of relay to an intelligent output terminal, also connect a surge-absorbing diode in parallel with the relay (refer to next page).
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) There are two rows of control terminal blocks, one above the other, but if the upper terminal is wired first, it will be difficult to wire the lower terminal, so wire the lower terminal first.
9) After wiring, gently pull the wire, please make lead wire have securely connected.
10) Make sure that the wires are not shorted each other.

(2) Layout of control terminal




| terminal | Screw diameter | Tightening torque |
|---|---|---|
| Control terminal A,B | M2 | 0.2 N･m |
| Intelligent relay terminal | M2 | 0.2 N･m |

[example] (sink logic)



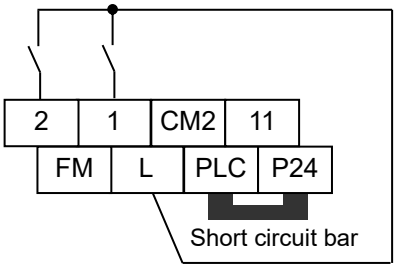

Note1) The above is a method to perform analog input (O/OI) by voltage input. It is necessary for SW6 on the board to be set for voltage input (default). (Refer to section "5.4 Wiring and terminal description (3) Changeover switch description".)
In addition, the remote operator or NES1-OP is required to make adjust.

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.

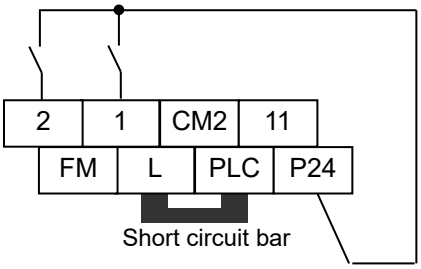
(3) Switching the input control logic

- Sink logic and source logic can be selected.
  To switch the input control logic to the source logic, remove the short circuit bar connecting terminals P24 and PLC on the control terminal B, and then connect terminals PLC and L with the short circuit bar.

1) Sink logic

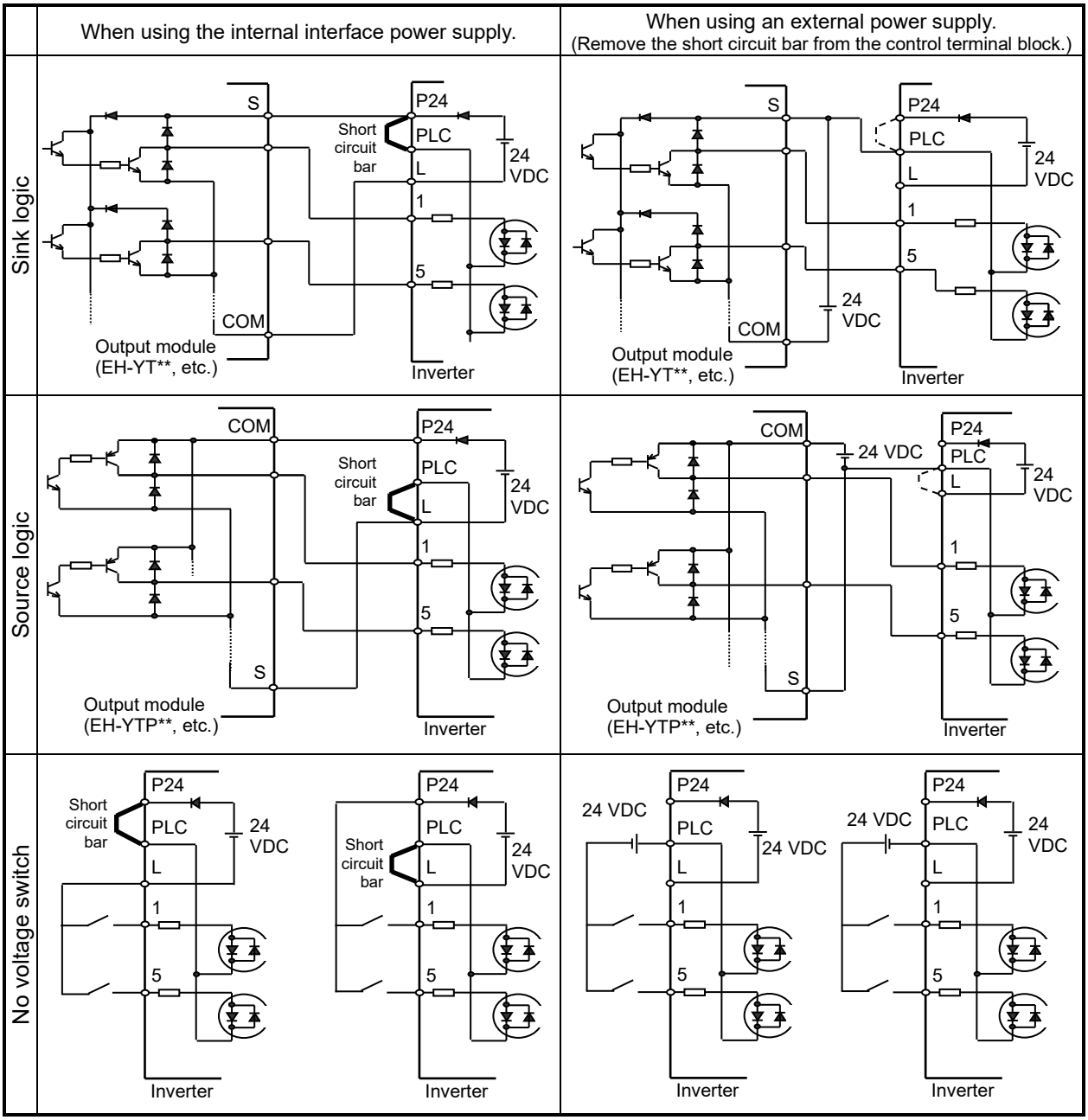



2) Source logic

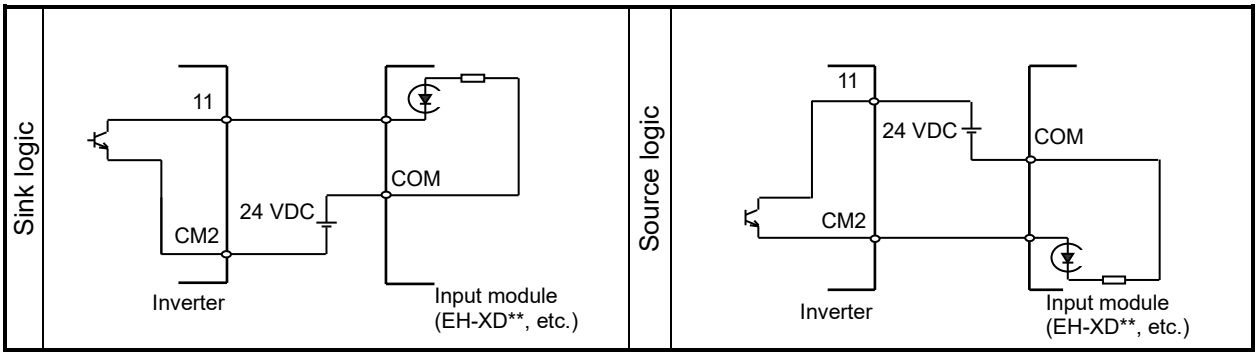


## 5.7 Connection with the programmable controller (PLC)

(1) Connecting a programmable controller to intelligent input terminals



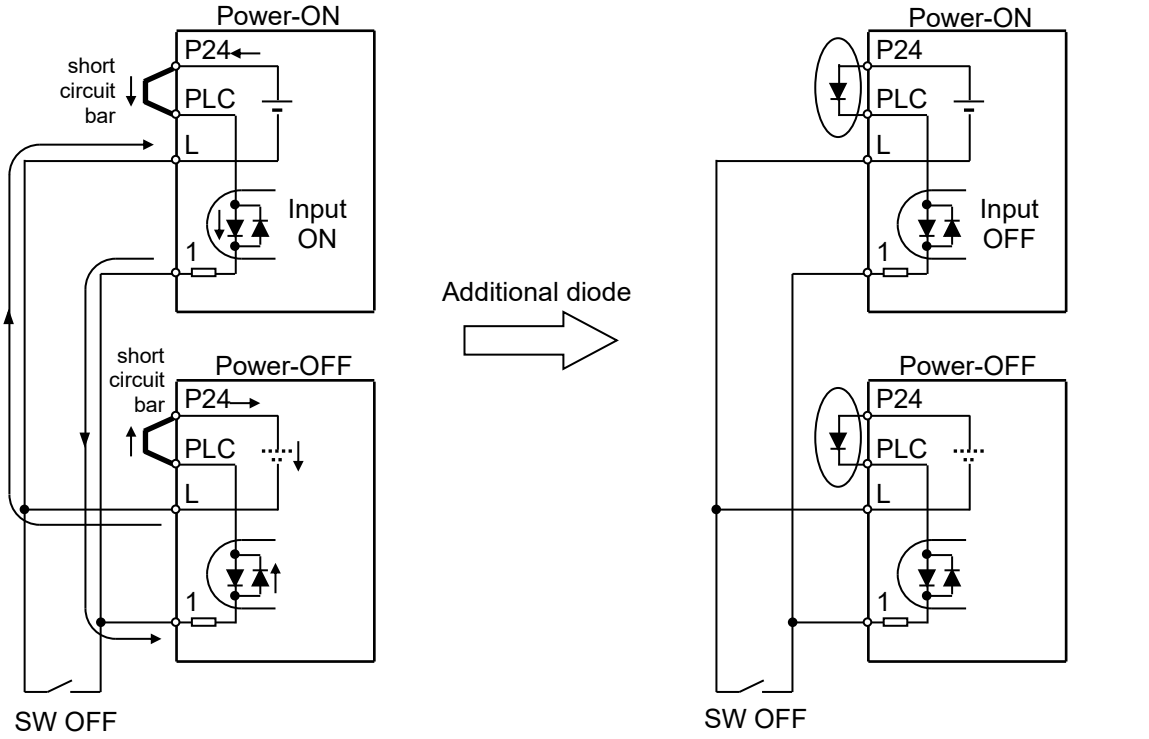

(2) Connecting a programmable controller to intelligent output terminal



## 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 despite OFF. In this case, please put a diode (rated 50 V / 0.1 A) as shown in the figure to prevent unintended ON.

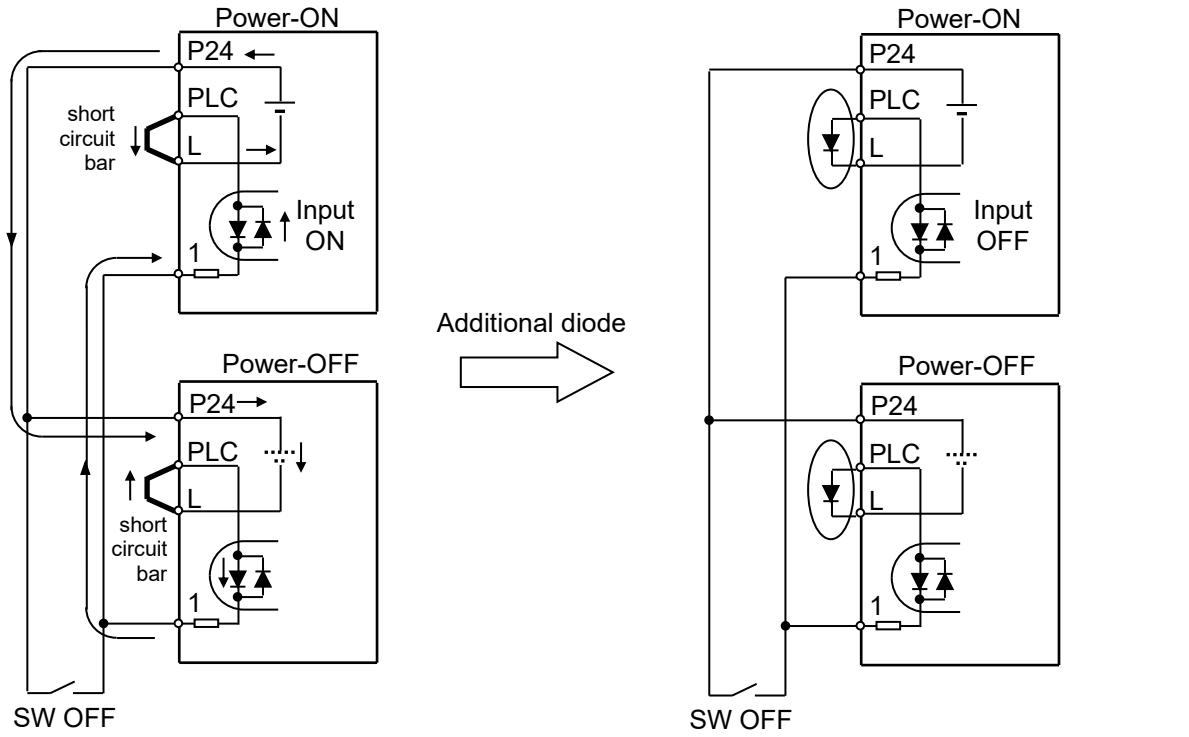
(1) Sink logic




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

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

(2) Source logic




The input is recognized as ON despite OFF without diode.

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

# Chapter 6 Operation

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

(Memo)

## 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 front cover before turning on the inverter power. Do not open the front cover while power is being supplied to the inverter or voltage remains inside. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. Stay away from the machine controlled by the inverter when the inverter is under such circumstances. (Design the machine so that human safety can be ensured, even when the inverter restarts suddenly.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation command has been input to the inverter before a short-term power failure, the inverter may restart operation after the power recovery. If such a restart may put persons in danger, design a control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- 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 are integrated in one key on the standard panel. Therefore, before you press the key, please make sure that the machine (facility) can be operated. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.

**CAUTION**

- Do not touch the heatsink, 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 source (A002/A202) if the RUN/STOP/RESET key is pressed, the inverter starts running. Therefore, if you have selected Run command such as operator or terminal, please handle the RUN/STOP/RESET key after you made sure that the machine/facility can be operated safety.

## 6.2 Confirmation before power up the inverter

Please confirm the followings before operation.

(1) Connection of the power input (R(L1)/L1, S(L2), T(L3)/N) and inverter output (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 must be no terminals connecting to ground other than the ground terminal is grounded. Otherwise, there is a risk of inverter malfunction.
(5) There must be no short circuit by the wire clip 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 open the window for connecting RS422/RS485 of the standard panel. 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 dedicated 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, SOP, SOP-VR)
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 SW5 to the operator side (OFF side) in that case (refer to “3.2 Name of each portion (removing the front cover)”). 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) are 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 SW5 to the operator side (OFF side) in that case (refer to “3.2 Name of each portion (removing the front cover)”). Refer to the WOP manual for the detailed information.

(4) Inverter setting software (ProDriveNext)
ProDriveNext Version “Hitachi Inverter Tool 1.2.33.010” and later are applied to the NE-S1 series inverter. ProDriveNext Version “Hitachi Inverter Tool 2.2.6.2” and later are applied to the NE-S1 Ver.2.0 series inverter.
PC can be used with USB/RS422 conversion cable and connected to the RS422/RS485 port (RJ45) in the inverter. Turn the changeover switch SW5 to the operator side (OFF side) in that case (refer to “3.2 Name of each portion (removing the front cover)”). Refer to the manual for ProDriveNext for the detailed information.

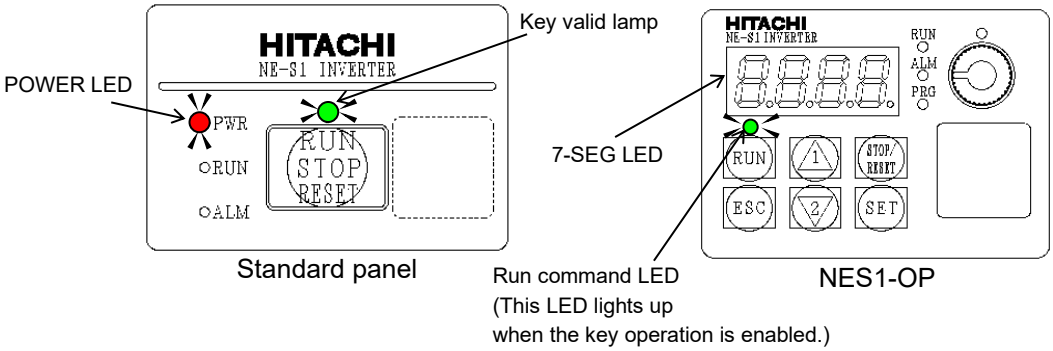
It is necessary to turn power off to store the changed data.

## 6.4 Power up the inverter

(1) Power up the inverter after confirming the items shown in above section “6.2 Confirmation before power up the inverter”.

(2) Confirm the LED is emitting like shown below.
- Standard panel : Confirm that both POWER LED 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 monitoring: d001)” will be displayed under default condition.

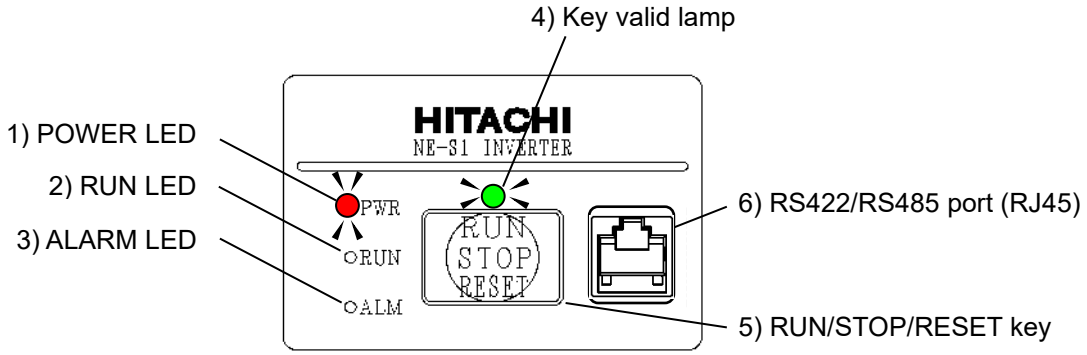
(3) Refer to section “6.5 How To Operate the Inverter” and set required parameters. And then refer to section “6.6 Motor operation”.




Note) It will take around 1.5 seconds for the inverter to be ready (each LED emits). This time is required for immediate operation after the inverter is turned on.

## 6.5 How To Operate the Inverter

(A) Names and functions of standard panel

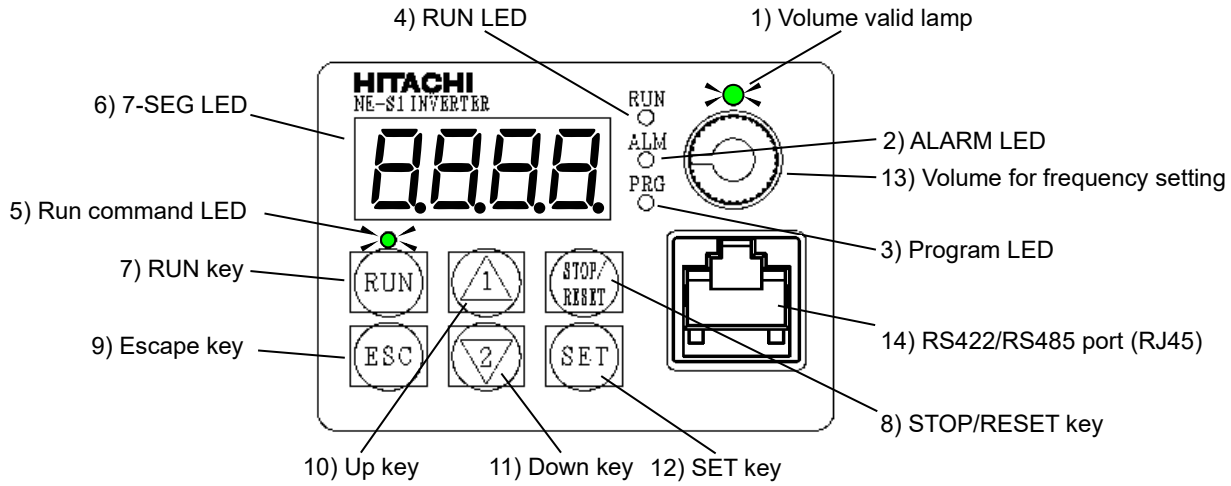



| Name | Description |
|---|---|
| 1) POWER LED | - Turns ON (red) during the inverter is powered up. |
| 2) RUN LED | - Turns ON (green) during inverter operation.<br>This turns ON either RUN command is given, or the inverter is giving out power. Therefore, it keeps turning ON during 0 Hz driving, or 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.<br>- Refer to section “6.8 When tripping occurs”, how to reset the trip status. |
| 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 valid in default settings and it can be made invalid by the button sensitivity selection (C151) to “no”.<br>- Makes inverter restore from the trip state if the inverter is in trip state.<br>- If the Modbus communication mode is selected, it can be temporary changed to a remote operator mode if the inverter is powered up with pressing the RUN/STOP/RESET key and keep it pressing 5 seconds, and take off from the key. Changeover switch must be changed later. Note 1) |
| 6) RS422/RS485 port (RJ45)<br>Note2) | - This is a port for remote operator, Modbus communication, or ProDriveNext (RS485/ operator changeover switch SW5 must be operated before power ON). In case of Modbus communication, it is necessary to set the changeover switch and parameter (C070).<br>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. |

Note 1) It is necessary to set changeover switch SW5 and the parameter “C070” for releasing the Modbus communication. If the parameter “C070” is set to “01(Modbus)”, remote operator via the RS422/RS485 port (RJ45) cannot be used.

Note 2) Connecting to the RS422/485 port (RJ45) must be done during the inverter power off.

(B) Names and functions of dedicated operator (NES1-OP)
(*same applies to digital operator (OPE-S/SR/SBK, OPE-SRmini, SOP, SOP-VR).)

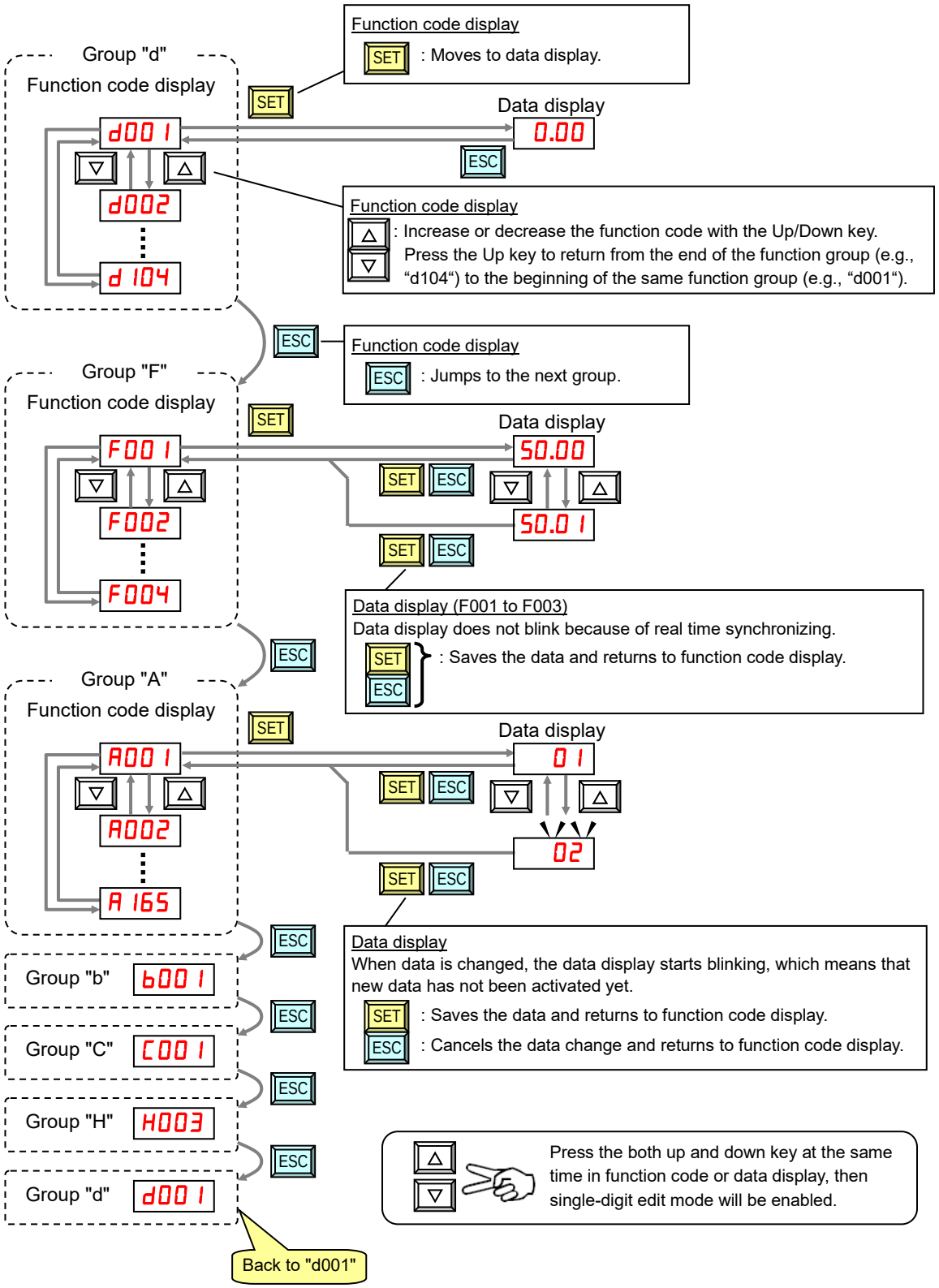



| Name | Description |
|---|---|
| 1) Volume valid lamp | - Turns ON (Green) when the frequency source (A001/A201) is set to “00 (VR)”. (The frequency setting volume of the operator is active). |
| 2) ALARM LED | - Turns ON (Red) when the inverter is in trip status.<br>- Refer to section “6.8 When tripping occurs”, how to reset the trip status. |
| 3) Program LED | - Turns ON (Green) when the display shows changeable parameter.<br>- Blinks when there is a mismatch in setting. Refer to section “9.3 Warning Codes for Digital operator”. |
| 4) RUN LED | - Turns ON (Green) when the inverter is driving the motor.<br>(RUN LED is lit even when the set frequency is put in operation command 0 Hz or during deceleration after the operation command OFF.) |
| 5) RUN command LED | - Turns ON (Green) when a run command source (A002/A202) is set to “02 (Operator)”. (Run key is effective.) |
| 6) 7-SEG LED | - Shows each parameter, monitors etc. LED color is red. |
| 7) RUN key | - Makes inverter run. (Run command source (A002/A202) is need to set “02 (Operator)”.)<br>- Set the operation direction in RUN key routing (F004). |
| 8) STOP/RESET key | - Makes inverter decelerates to a stop. (Even if run command source (A002/A202) is not set to “02 (Operator)”, STOP/RESET key is valid at the factory setting. STOP/RESET key can be disabled in the STOP/RESET key enable (b087) setting.)<br>- Resets the inverter when it is in trip status. |
| 9) Escape key | - Goes to the top of next function group when a function mode is shown.<br>- Cancels the setting and returns to the function code when a data is shown.<br>- Moves the cursor to a digit left when inverter is in single-digit edit mode.<br>- Pressing this key for 1 second leads to display data of d001, regardless of current display. |
| 10) Up key<br>11) Down key | - Increase or decrease the data. Scroll speed is accelerated by holding down a key.<br>- Pressing the both keys at the same time gives you the single-digit edit mode. |
| 12) SET key | - Goes to the data display mode when a function code is shown.<br>- Sets the data and goes back to show the function code when data is shown.<br>- Moves the cursor to a digit right when inverter is in single-digit edit mode. |
| 13) Volume for frequency setting | - This is a volume for frequency setting. This volume is valid when the frequency source (A001/A201) is set to “00 (VR)”. |
| 14) RS422/RS485 port (RJ45)<br>Note1) | - This is a port for remote operator, Modbus connection, or ProDriveNext (RS485 / operator changeover switch SW5 must be operated before power ON). In case of Modbus communication, it is necessary to set the changeover switch SW5 and parameter (C070). Display of NES1-OP will be according to the parameter setting of “b150“ continuously, if the remote operator is connected while the dedicated operator (NES1-OP) is integrated. |

Note 1) Connecting to the RS422/485 port (RJ45) must be done during the inverter power off.

(C) Key operations

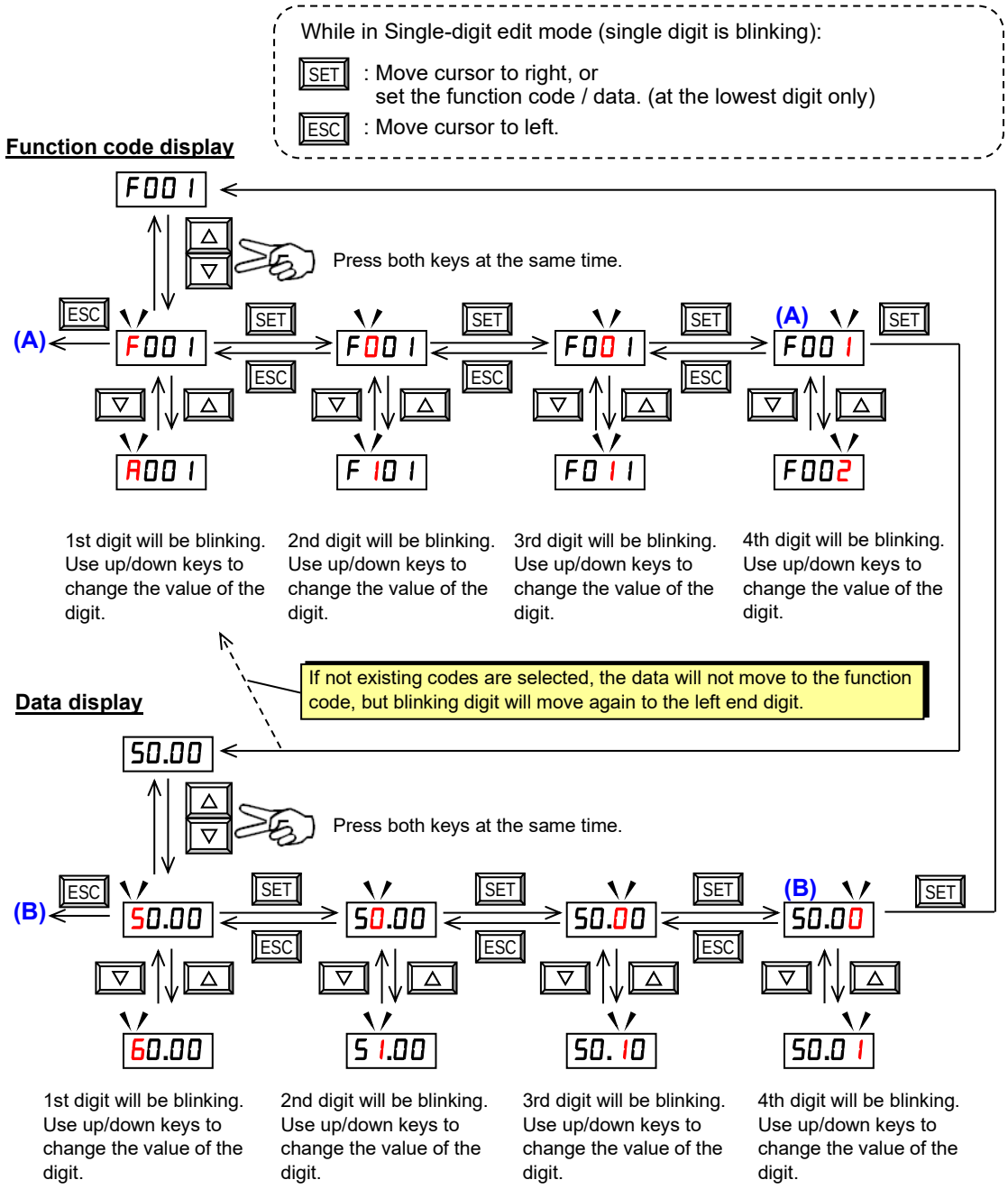
This section shows the key operations of the digital operator and dedicated operator (NES1-OP).




Note) Pressing the Escape key will make the display go to the top of next function group, regardless the display contents (e.g., A02 1 → [ESC] → b00 1).

[Single-Digit Edit Mode]

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

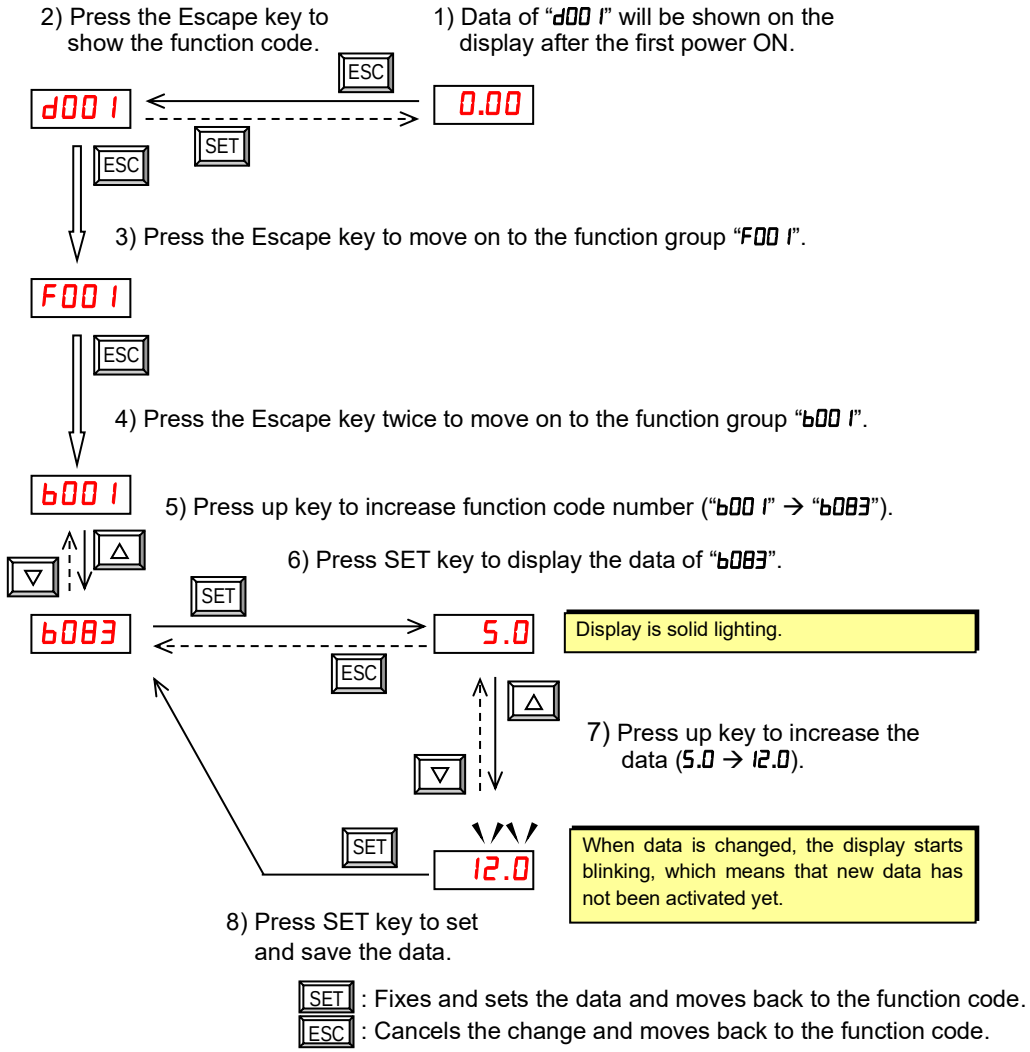



Note1) When pressing Escape key with cursor on the highest digit, the cursor will jump to the lowest digit. ((A) and (B) in above figure.)

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.

[Setting example]

After power ON, changing from "0.00" display to the "b083" (carrier frequency) data.




Note1) Function codes "**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 the Escape key for more than 1 second leads to "d001" display, regardless the display situation. But note that the display will circulates while keep pressing the Escape key because of the original function of the key.
(e.g., "F001"→ "A001" → "b001" → "C001" → …→ displays "0.00" (data of "d001") after 1 second.)

NES1-OP
Key position

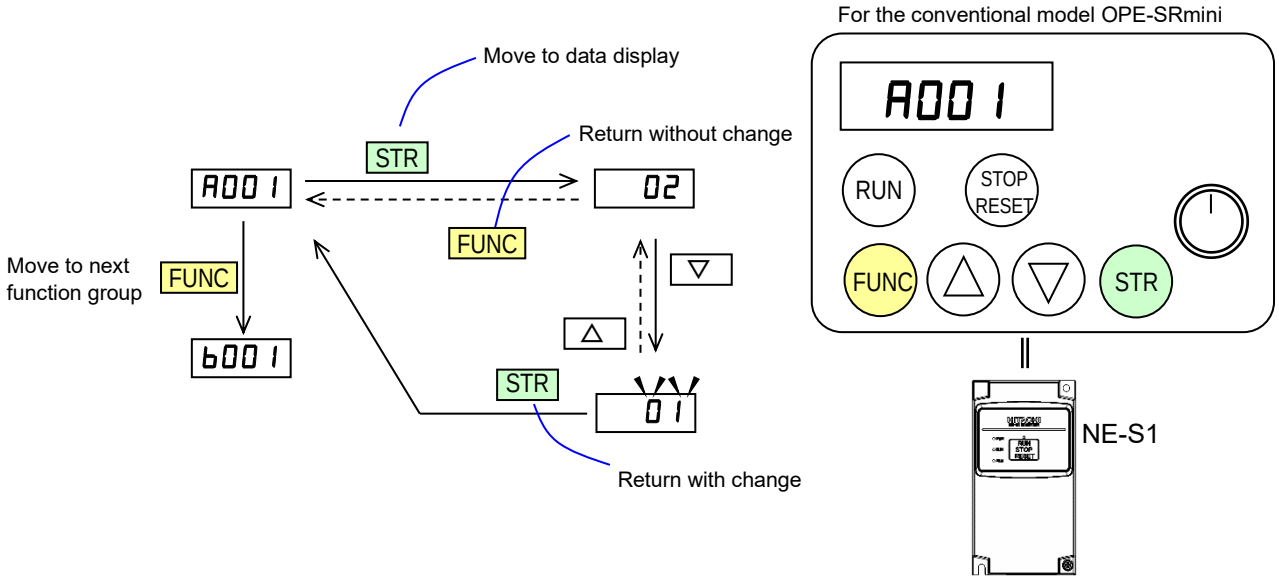
| | | |
|---|---|---|
| RUN | △ | STOP |
| ESC | ▽ | SET |

| | When a function code is shown… | When a data is shown… |
|---|---|---|
| **ESC key** | Moves on to the next function group. | Cancels the change and moves back to the function code. |
| **SET key** | Moves on to the data display. | Fixes and sets the data and moves back to the function code. |
| **△ key** | Increases function code. | Increases data value. |
| **▽ key** | Decreases function code. | Decreases data value. |
| **▽ + △ keys** | Goes into the single-digit edit mode. | Goes into the single-digit edit mode. |

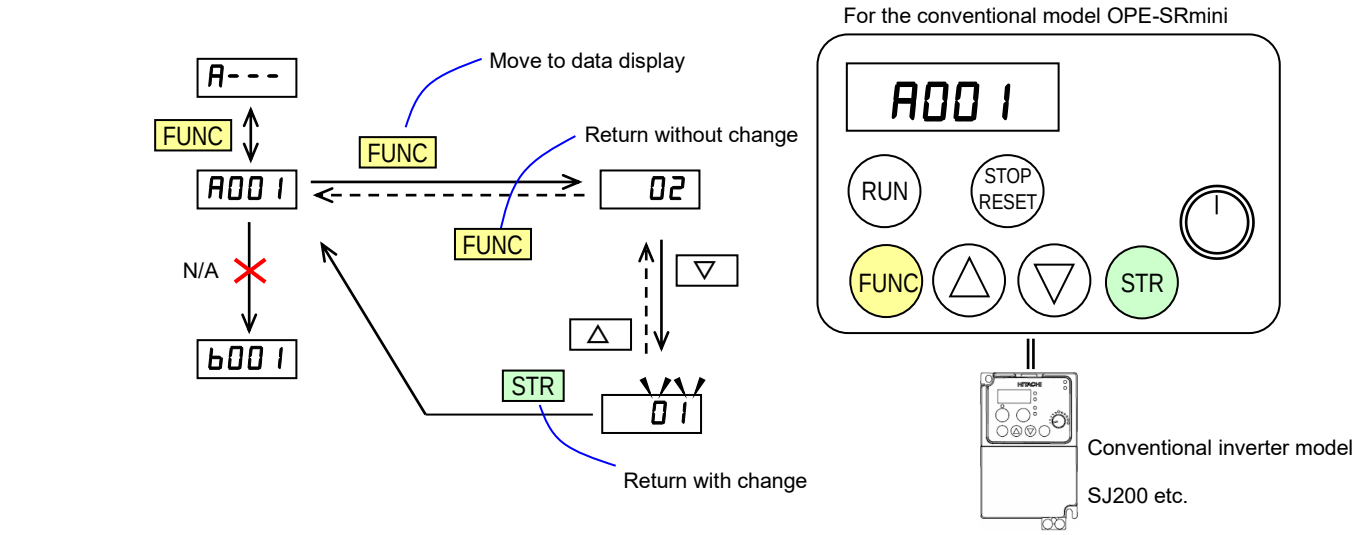
[Connection of the operator for another model]

NE-S1 series inverter can be operated by using the remote operator (OPE-S/SR/SBK, OPE-SRmini, SOP, SOP-VR, WOP). Transition from the function code display to the data display is activated by the STR key, not the FUNC key. Notice that pressing the FUNC key is moved to the next function group, when remote operator is showing the function code display. Remote operator displays the “d001” when it holds down a FUNC key for over a second even any state.

(Example) NE-S1 series inverter and OPE-SRmini combination




(Reference) Conventional inverter model and OPE-SRmini combination



## 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 the run command is given but the frequency command is 0 Hz. Additionally, the motor will not run if 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.
(These are examples of sink logic and uses internal control power supply.)

**(A) Driving with the standard panel**

RUN/STOP/RESET key on the standard panel is effective regardless of the setting of the run command source (A002/A202). Thus, following driving method (1) to (3) are possible without an option if an inverter is factory default setting.

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

This is the operation method when run command is given by "RUN/STOP/RESET key", frequency command is given by fixed value such as 20/40/60 Hz and acceleration & deceleration times are 10 seconds. (If you do not need to change such as acceleration & deceleration times, an optional operator is not required.)
To set the frequency command, use the multi-speed frequency setting (speed 1=60.00 Hz, speed 2=40.00 Hz, speed 3=20.00 Hz).

■ Setup

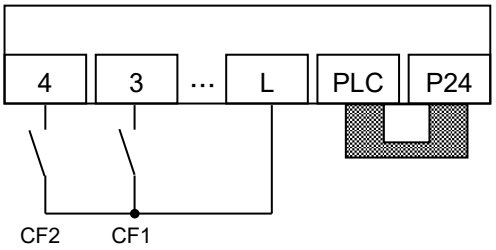
| Function Name | Code | Data | Note |
|---|---|---|---|
| Intelligent input [3] function | C003 | 02 (CF1) | Default |
| Intelligent input [4] function | C004 | 03 (CF2) | |

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

| Function Name | Code | Setting Range | Note |
|---|---|---|---|
| Acceleration time (1) | F002 | 0.00 to 3600.00 sec. | Default: 10.00 sec. |
| Deceleration time (1) | F003 | 0.00 to 3600.00 sec. | Default: 10.00 sec. |

* One of the following is required when changing parameters on NE-S1 series inverters.
a) Dedicated operator (NES1-OP), b) Digital operator, c) WOP,
d) Modbus communication, e) Inverter setting software (ProDriveNext)

■ Control circuit terminals wiring (Sink logic)




■ Example of multi-speed (default)

| Intelligent input terminal [4] | Intelligent input terminal [3] | Code | Restricted Distribution Other (Standard) | Restricted Distribution China / Europe |
|---|---|---|---|---|
| OFF | ON | A021 (multi-speed frequency 1) | 60.00 Hz command | 50.00 Hz command |
| ON | OFF | A022 (multi-speed frequency 2) | 40.00 Hz command | 35.00 Hz command |
| ON | ON | A023 (multi-speed frequency 3) | 20.00 Hz command | 20.00 Hz command |

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

This is the operation method when run command is given by "RUN/STOP/RESET key", frequency command is given by analog input such as O-L voltage and acceleration & deceleration times are 10 seconds. (If you do not need to change such as acceleration & deceleration times, an optional operator is not required.)
Below diagram is to set the external frequency setting by connecting H-O-L volume to supply O-L voltage.

■ Setup

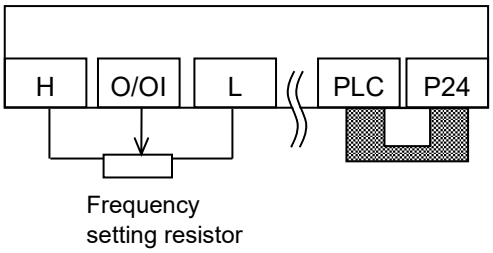
| Function Name | Code | Data | Note |
|---|---|---|---|
| Frequency source | A001 | 01 (Control terminal) | Default |

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

| Function Name | Code | Setting Range | Note |
|---|---|---|---|
| Acceleration time (1) | F002 | 0.00 to 3600.00 sec. | Default: 10.00 sec. |
| Deceleration time (1) | F003 | 0.00 to 3600.00 sec. | Default: 10.00 sec. |

* One of the following is required when changing parameters on NE-S1 series inverters.
a) Dedicated operator (NES1-OP), b) Digital operator, c) WOP,
d) Modbus communication, e) Inverter setting software (ProDriveNext)

■ Control circuit terminals wiring (Sink logic)




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). (Refer to 5 - 8 page.)

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

This is the operation method when run command is given by intelligent input terminal such as FW (RV) function and frequency command is given by analog input such as O-L voltage and acceleration & deceleration times are 10 seconds. (If you do not need to change such as acceleration & deceleration times, an optional operator is not required.)
Below diagram is to set the external frequency setting by connecting H-O-L volume to supply O-L voltage.

■ Setup

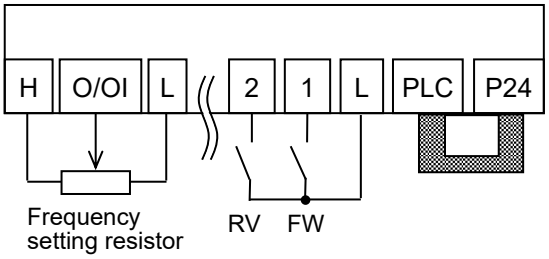
| Function Name | Code | Data | Note |
|---|---|---|---|
| Frequency source | A001 | 01 (Control terminal) | Default |
| Run command source | A002 | 01 (Control terminal) | Default |
| Intelligent input [1] function | C001 | 00 (FW) | Default |
| Intelligent input [2] function | C002 | 01 (RV) | |

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

| Function Name | Code | Setting Range | Note |
|---|---|---|---|
| Acceleration time (1) | F002 | 0.00 to 3600.00 sec. | Default: 10.00 sec. |
| Deceleration time (1) | F003 | 0.00 to 3600.00 sec. | Default: 10.00 sec. |

* One of the following is required when changing parameters on NE-S1 series inverters.
a) Dedicated operator (NES1-OP), b) Digital operator, c) WOP,
d) Modbus communication, e) Inverter setting software (ProDriveNext)

■ Control circuit terminals wiring (Sink logic)




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). (Refer to 5 - 8 page)

**(B) Driving with the dedicated operator (NES1-OP)**
(*same applies to digital operator (OPE-S/SR/SBK, OPE-SRmini, SOP, SOP-VR).)

(1) Method to perform driving and frequency setting in the operator (*Must be set by the operator)

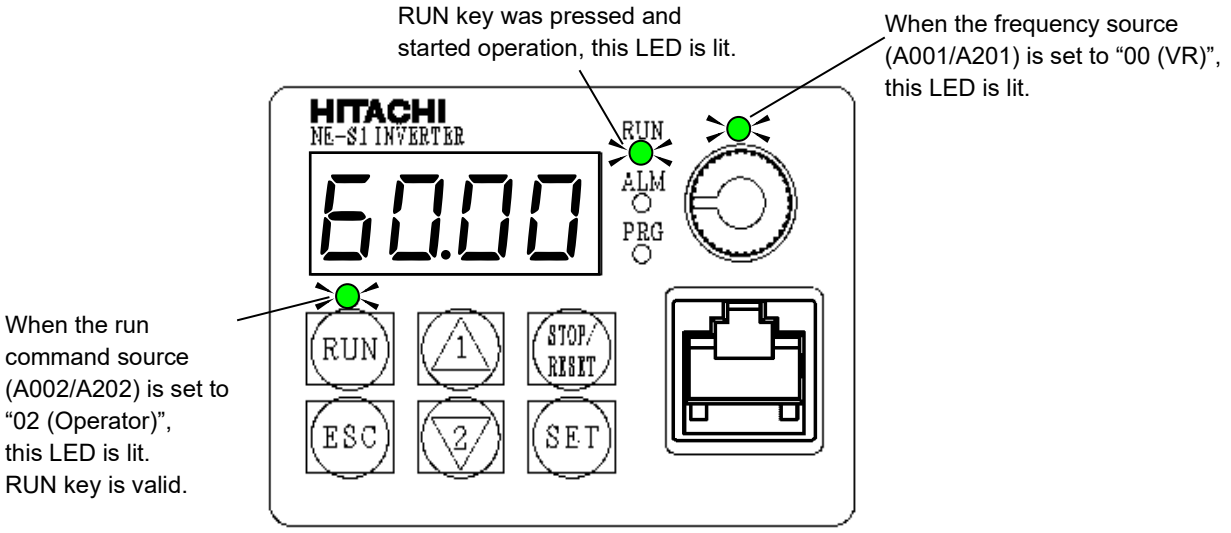
How to drive by key operation of the dedicated operator (NES1-OP).

■ Setup

| Function Name | Code | Data | Note |
|---|---|---|---|
| Frequency source | A001 | 02 (Operator) | |
| Run command source | A002 | 02 (Operator) | Run command LED lights up. |
| Output frequency setting | F001 | 0.00 to “A004“ Hz<br>(“A004“: Maximum frequency) | Default: 0.00 Hz |
| RUN key routing | F004 | 00(Forward) / 01(Reverse) | Can not be changed during operation. |

The initial value of 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. sec. | Default: 10.00 sec. |
| Deceleration time (1) | F003 | 0.00 to 3600. sec. | Default: 10.00 sec. |




■ Control circuit terminals wiring
No connect

■ Operation
Please operate in accordance with section “6.7 Test Run with the motor”.

(2) Method to perform driving in 3-wire input and perform frequency setting in analog current (4 to 20mA)
(*Must be set by the operator)

■ Setup

| Function Name | Code | Data | Note |
|---|---|---|---|
| Frequency source | A001 | 01 (Ccontrol terminal) | Default |
| Run command source | A002 | 01 (Ccontrol terminal) | Default |
| Intelligent input [1] function | C001 | 20 (STA: Starting the motor) *1 | |
| Intelligent input [2] function | C002 | 21 (STP: Stopping the motor) *1 | |
| Intelligent input [3] function | C003 | 22 (F/R: Switching the motor operation direction) *1 | |

*1 : Refer to section “7.5.3 3-wire input function (STA, STP, and F/R)” for details of 3-wire input mode.

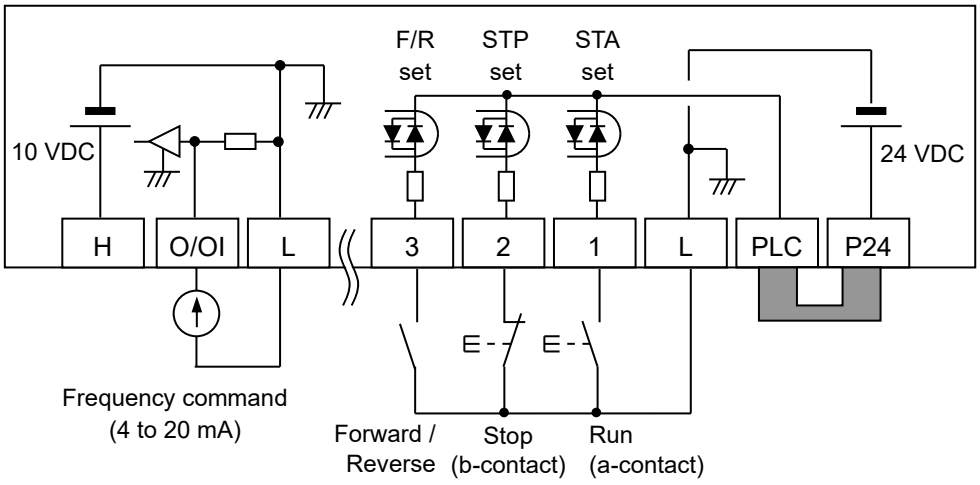
The initial value of acceleration and deceleration time is 10 seconds.
Please change the following parameters, as necessary.

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

It is necessary for SW6 on the board to be set for current input. (Refer to 5 - 8 page.)
When used with 4 to 20 mA, you need to change the following parameter.

| Function Name | Code | Data | Note |
|---|---|---|---|
| [O/OI] input active range start ratio | A013 | 20. % | Default: 0. % |

■ Control circuit terminals wiring (Sink logic)

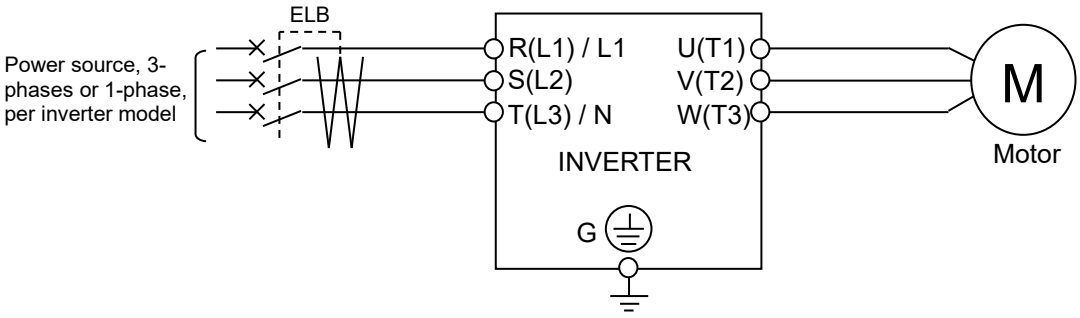



* This wiring diagram is an example of using the built-in power of the inverter.
Refer to Section “5.6 Wiring of the control circuit” when you use an external power supply.

■ Operation
Please operate in accordance with section “6.7 Test Run with the motor”.

## 6.7 Test Run with the motor

The following figure shows an example of basic connection. Please refer to section “6.6 Motor Operation” for how to wire for operation command and frequency command from the control terminal block. Please refer to section “6.5 How To Operate the Inverter” for how to operate the parameter settings. To set the parameter, an operator is required.




| No. | Procedure |
|---|---|
| 1 | Please check whether there is any problem with the wiring. |
| 2 | Turn on the power to the inverter. The POWER LED (red) turns ON. |
| | In case of input operation command and frequency command without operator (Initial state at shipment). *1) |
| 3 | Turn on both intelligent input terminal 3,4 (CF1,CF2). (Multi-speed frequency 3: The initial value is set 20 Hz.) |
| 4 | Push the RUN/STOP/RESET key. The RUN LED turns ON. |
| 5 | Please check that there is no abnormality in the inverter, motor rotation direction and motor rotation speed. If the rotation direction of the motor is different, please turn off the inverter and check the charge lamp is OFF. Please replace the two phases of the three-phase wiring of the output. |
| 6 | If there are no problems, turn on intelligent input terminal 3 (CF1) only. (Multi-speed frequency 1 : The initial value is set 60 Hz.) |
| 7 | After checking the operation, push the RUN/STOP/RESET key. Motor starts to slow down. The RUN LED turns OFF when the motor is stopped. |
| | In case of input operation command and frequency command from control terminal block. |
| 3 | Please check that the O/OI input value (the frequency command) is zero. Then, turn ON either the intelligent input terminal 1 (FW) or intelligent input terminal 2 (RV). The RUN LED turns ON. |
| 4 | Increase the analog voltage / current (frequency command) gradually. |
| 5 | Please check that there is no abnormality in the inverter, motor rotation direction and motor rotation speed. If the rotation direction of the motor is different, please turn off the inverter and check the charge lamp is OFF. Please replace the two phases of the three-phase wiring of the output. |
| 6 | If there are no problems, increase the analog voltage / current gradually. |
| 7 | After checking the operation, turn OFF the intelligent input terminal that is turned ON at No.3 above. The RUN LED turns OFF when the motor is stopped. |

| | |
|---|---|
| | In case of input operation command and frequency command from operator. *1) |
| 3 | Set the frequency source (A001) to "02 (Operator)". |
| 4 | Set the run command source (A002) to "02 (Operator)". |
| 5 | Set the output frequency setting (F001). It is recommended to set slow (about 10 Hz) for the safety. |
| 6 | Set the RUN key routing (F004). |
| 7 | Set the output frequency monitoring (d001) to the monitor display on the operator, then press the SET key. Checking the "0.00 (Hz)". |
| 8 | Press the RUN key, then motor starts to rotate. And the RUN LED turns ON. |
| 9 | Please check that there is no abnormality in the inverter, motor rotation direction and motor rotation speed. For the rotation direction of the motor, refer to rotation direction monitoring (d003) display. |
| 10 | If there are no problems, increase the output frequency setting (F001) gradually. |
| 11 | After checking the operation, push the STOP key. Motor starts to slow down. The RUN LED turns OFF when the motor is stopped. |
| | In case of input operation command from operator and frequency command from operator's volume. |
| 3 | Set the frequency source (A001) to "00 (VR)". The volume valid lamp turns ON. |
| 4 | Set the run command source (A002) to "02 (Operator)". |
| 5 | To avoid sudden motor operation by pressing the RUN key, turn the operator's volume to the left full. |
| 6 | Set the RUN key routing (F004). |
| 7 | Press the RUN key, then the RUN LED turns ON. |
| 8 | Turn the operator's volume to the right gradually. The motor starts to rotate. |
| 9 | Please check that there is no abnormality in the inverter, motor rotation direction and motor rotation speed. For the rotation direction of the motor, refer to rotation direction monitoring (d003) display. |
| 10 | If there are no problems, turn the operator's volume to the right gradually. Then, the output frequency will be increase gradually. |
| 11 | After checking the operation, push the STOP key. Motor starts to slow down. The RUN LED turns OFF when the motor is stopped. Even if the operator's volume is turned to the left full, the motor will stop. But the operation command is kept in running and the RUN LED will not turn OFF. |
| 12 | To avoid sudden motor operation by pressing the RUN key on the next running, turn the operator's volume to the left full. |

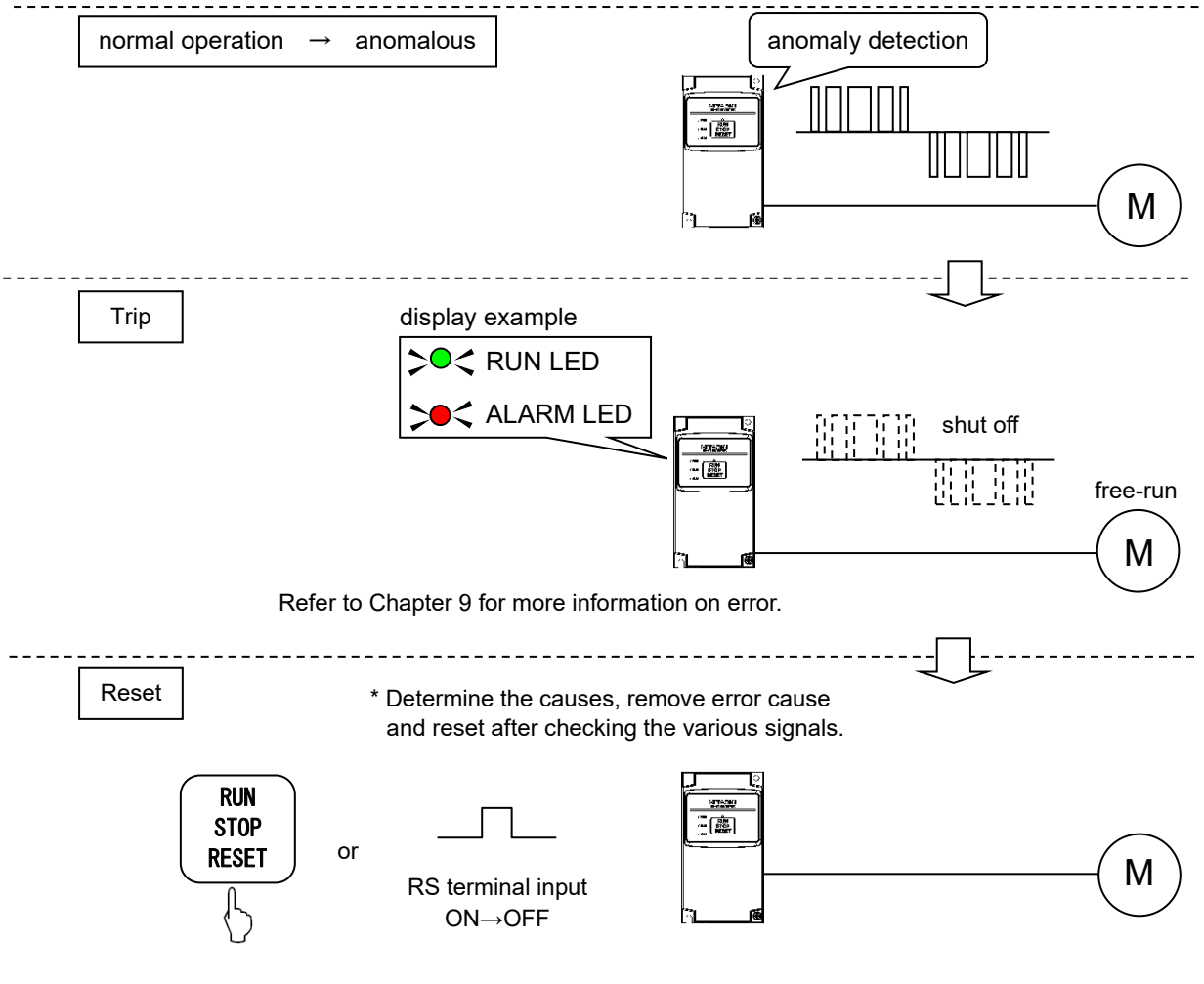
*1) "Operator" refers to dedicated operator (NES1-OP), digital operator (OPE-S/SR/SBK, OPE-SRmini, SOP, SOP-VR), WOP.

■ Point to be checked

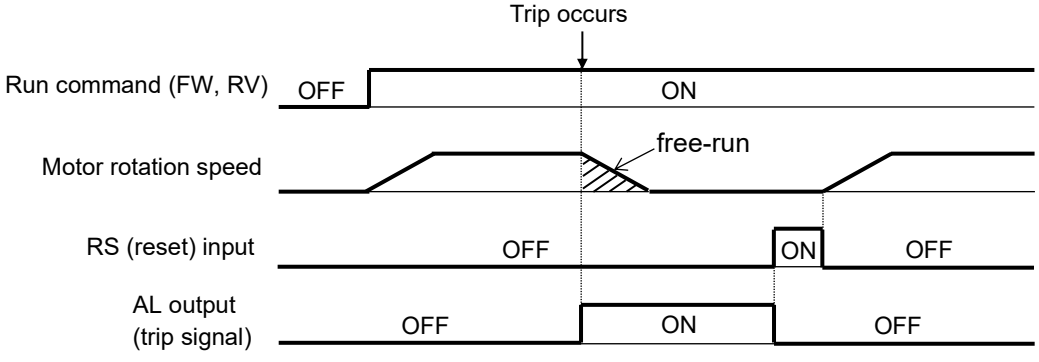
- Check whether there is any trip in the middle of acceleration and deceleration. Check the frequency meter and the number of revolutions is correct.
- When an overcurrent trip or overvoltage trip occurs during the test run, please make sure of the input / output state of the inverter and the load condition, or please increase the length of the acceleration time (1) (F002) and deceleration time (1) (F003). To change the acceleration and deceleration time, an operator is required.
- Check the output current monitoring (d002), DC bus voltage monitoring (d102). Ensure that there is a margin to the value of the current and voltage trip. To check the monitor, an operator is required.

## 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. At the same time, the ALARM LED lights up and blinks (please check the section "9.1 Indication of the error"). Then, the inverter displays an error code. This chain of operations is called the trip. Motor is in free-run mode due to trip. Please investigate the cause of the error from the error code and remove the cause of the error. During the trip, a run command is not 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.




Overview of the operation at occuring trip.



# Chapter 7 Explanation of Functions

**This chapter describes the functions of the inverter.**
**An operator (NES1-OP, OPE-SRmini, OPE-S/SR/SBK, SOP, SOP-VR or WOP) is needed to change a parameter setting or monitoring the parameters. Parameter settings can be changed using the ProDriveNext.**
**In this chapter, the digital operator (NES1-OP, OPE-SRmini, OPE-S/SR/SBK, SOP, SOP-VR) is premised to be connected to the inverter.**

(Memo)

## 7.1 Monitoring the data

### 7.1.1 Output frequency monitoring (d001)

When the output frequency monitoring (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 (except NES1-OP).

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

Note1: When the up/down memory mode is set to clear last frequency command (C101=00), the frequency command changed by the UP/DWN function is not stored.
Note2: Do not operate (A020), (A220), (A021) to (A027), (F001), (d001), (d007) by the △/▽ key on the operator after power off. Also, do not perform the intelligent input UP/DWN terminal operation and the △/▽ key operation at the same time after power off. The frequency command may not be stored correctly because all of the parameter settings are saved after power off.

**Monitoring and setting mode of the output frequency**

If the frequency set in monitoring is set to enabled (b163=01) and the output frequency monitoring (d001) is displaying, the output frequency can be changed by the △/▽ key only during the inverter is operating the motor.

1) This mode is only valid when the frequency source is set to operator (A001=02).
2) The changed frequency data will be reflected in the output frequency setting (F001).
3) Press the STR key (NES1-OP: SET key) to write the new frequency data to the currently selected frequency setting.
4) This mode will be invalid while the PID function is enabled or the inverter is not operating the motor.
5) If the △/▽ key is operated in this mode, d001 display changes to F001 display. So, there may be a time difference between the key operation and the changed frequency data display.
6) The single-digit edit mode (refer to page 6 - 9) is invalid in this mode.

### 7.1.2 Output current monitoring (d002)

When the output current monitoring (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 (d003)

When the rotation direction monitoring (d003) is selected, the inverter displays the motor operation direction.
The RUN LED 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 PV (Process variable) monitoring (d004,A071,A075)

When "01" (PID enabled) or "02" (PID enabled with reverse output) has been specified for function "A071" (PID enable) and the PV monitoring (d004) is selected, the inverter displays the PV.
You can also convert the PV to gain data by setting a PV scale conversion (A075).

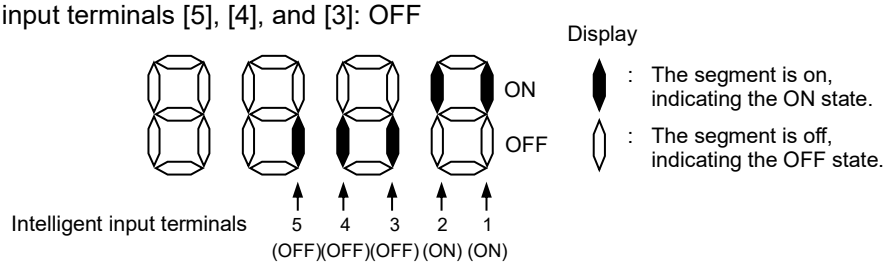
Value displayed by function "d004" = "PV quantity (%)" x "PV scale conversion (A075)".
The PV scale conversion can be set by function "A075" within the range 0.01 to 99.99 in steps of 0.01.

(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 1,000

### 7.1.5 Intelligent input terminal status (d005)

When the intelligent input terminal status (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 state, 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

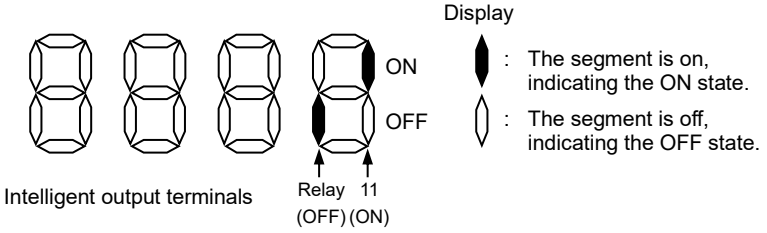



(*1) When input terminal response time is set, terminal recognition is delayed. Please refer to subsection "7.3.3 Intelligent input terminal response time".

### 7.1.6 Intelligent output terminal status (d006)

When the intelligent output terminal status (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 terminals but monitors those of the outputs from the internal CPU.
Intelligent output terminal status is independent of the a/b-contact selection for the intelligent output terminals.

(Example)
Intelligent output terminal [11]: ON
Intelligent relay outputs: OFF



### 7.1.7 Scaled output frequency monitoring (d007,b086)

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 monitoring (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 × f (Hz)) / pole = f (Hz) × 30
As the result of the above calculation with the factor (b086) set to 30.00, the inverter displays "1800." (60 x 30.00) 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 3999 in units of 10

Note1: When the up/down memory mode is set to clear last frequency command (C101=00), the frequency command changed by the UP/DWN function is not stored.
Note2: Do not operate (A020), (A220), (A021) to (A027), (F001), (d001), (d007) by the △/▽ key on the operator after power off. Also, do not perform the intelligent input UP/DWN terminal operation and the △/▽ key operation at the same time after power off. The frequency command may not be stored correctly because the settings are saved after power off.

**Monitoring and setting mode of the output frequency**

If the frequency set in monitoring is set to enabled (b163=01) and the scaled output frequency monitoring (d007) is displaying, the output frequency can be changed by the △/▽ key only during the inverter is operating the motor.

1) This mode is only valid when the frequency source is set to operator (A001=02).
2) The changed frequency data will be reflected in the output frequency setting (F001).
3) Press the STR key (NES1-OP: SET key) to write the new frequency data to the currently selected frequency setting.
4) This mode will be invalid while the PID function is enabled or the inverter is not operating the motor.
5) If the △/▽ key is operated in this mode, d007 display changes to F001 display. So, there may be a time difference between the key operation and the changed frequency data display.
6) The single-digit edit mode (refer to page 6 - 9) is invalid in this mode.

### 7.1.8 Output voltage monitoring (d013)

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

(Display)
0.0 to 600.0 in steps of 0.1 V

### 7.1.9 Input power monitoring (d014)

When the input power monitoring (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 (d015,b078,b079)

When the cumulative power monitoring (d015) 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 power display gain (b079).

Value displayed by function "d015" = "calculated value of input power (kWh)" / "cumulative power display gain (b079)".
The cumulative power display gain (b079) 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 (b078) and pressing the STR key (NES1-OP: SET key).
You can also clear the cumulative power data by turning ON the intelligent input terminal that is assigned "53" (KHC: Clear watt-hour data).
When the cumulative power display gain (b079) is set to "1000.", the cumulative power data up to 999,000,000 (kWh) can be displayed.

(Display)
- 0.0 to 999.9 in steps of 0.1 kWh, or the unit set for function "b079"
- 1000. to 9999. in steps of 1 kWh, or the unit set for function "b079"
- 1000 to 9999 in units of 10 kWh, or the unit set for function "b079"
- ⌈100 to ⌈999 in units of 1,000 kWh, or the unit set for function "b079"

### 7.1.11 Cumulative operation RUN time monitoring (d016)

When the cumulative operation RUN time monitoring (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 (d017)

When the cumulative power-on time monitoring (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 Heatsink temperature monitoring (d018)

When the heatsink temperature monitoring (d018) is selected, the inverter displays the temperature of the internal heatsink of the inverter.

(Display)
- -20.0 to 120.0 in steps of 0.1 °C

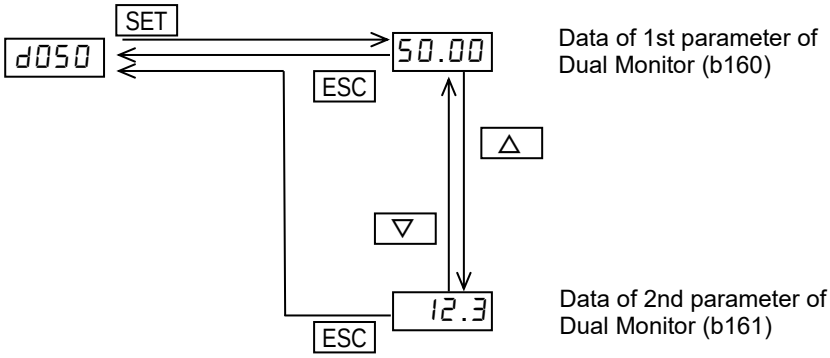
### 7.1.14 Current time monitoring (d031)

When the current time monitoring (d031) is selected, the inverter displays the current time. This function is only displayed when WOP is connected. Please refer to WOP manual (NT214X).

### 7.1.15 Dual monitoring (d050,b160,b161)

When the dual monitoring (d050) is selected, the inverter displays two different data configured in "b160" and "b161".

| Item | Func. code | Range of data | Description |
|---|---|---|---|
| Dual monitoring | d050 | – | Two monitor data that is setting in b160 and b161. |
| 1st parameter of Dual Monitor | b160 | 001 to 018 | d001 to d018 (*1) |
| 2nd parameter of Dual Monitor | b161 | 001 to 018 | d001 to d018 (*1) |




(*1) If the frequency set in monitoring is set to enabled (b163=01), the output frequency can be changed at "d001" or "d007" by the △/▽ key in driving. But you can not change the output frequency setting at "d050", even if "b160" or "b161" is set to "d001" or "d007".

### 7.1.16 Inverter mode monitoring (d060)

When the Inverter mode monitoring (d060) is selected, the inverter displays the current inverter mode. (This function is added from NE-S1 Ver.2.0.)

(Display)
I : Induction Motor
P: Permanent Magnet Motor

### 7.1.17 Trip Counter (d080)

When the trip counter (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

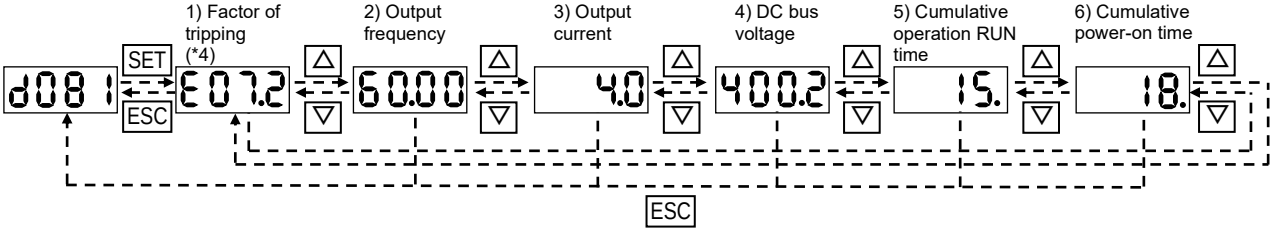
### 7.1.18 Trip monitoring 1 to 6 (d081 to d086)

When the trip monitoring 1 to 6 (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) DC bus voltage at tripping (VDC) (*3)
5) Cumulative operation RUN time until tripping (hr)
6) Cumulative power-on time until tripping (hr)

(*1) Please refer to "Chapter 9 Error Codes".
(*2) When the inverter status is in stop mode as a trip history ("E**.1"), monitored value can be zero.
(*3) When ground fault protection is detected at power on, monitored value can be zero.

Display by trip monitoring




(*4) If the inverter has not tripped before, the inverter displays - - - - .

### 7.1.19 Warning monitoring (d090)

If an attempt is made to set the data conflicting with other data on the inverter, the inverter displays a warning in the operator. Please refer to section "9.3 Warning Codes for Digital operator".
The Program LED flashes while the warning is displayed (until the data is rewritten forcibly or corrected).

### 7.1.20 DC bus voltage monitoring (d102)

When the DC bus voltage monitoring (d102) is selected, the inverter displays the DC bus voltage of the inverter. While the inverter is operating, the monitored value changes as the actual DC bus voltage of the inverter changes.

(Display)
0.0 to 1000. in steps of 0.1 VDC

### 7.1.21 Electronic thermal overload monitoring (d104)

When the electronic thermal overload monitoring (d104) is selected, the inverter displays the current electronic thermal overload rate. If the electronic thermal overload monitoring (d104) 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 induction motor nameplate data into appropriate parameters to ensure proper operation and protection of the induction motor. Refer to the appropriate pages in this guide.
*b012/b212 are the induction motor overload protection level.
*A082/A282 are the induction motor AVR voltage selection.
*H003/H203 are the induction motor capacity.
*H004/H204 are the number of induction motor poles.

## 7.2 Using the basic functions

### 7.2.1 Frequency source setting and Output frequency setting (F001,A001/A201,A020/A220,A021 to A027,C001 to C005)

(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 | A001<br>A201 | 00 | (Valid only when the NES1-OP, OPE-SR/SRmini is used)<br>Use the VR control provided on the valid operator to set the frequency. |
| | | 01 | Input the frequency setting command via the control terminal (O/OI-L). |
| | | 02 | Use the operator (function "F001") to set the frequency. |
| | | 03 | Input the frequency setting command via the Modbus communication. |
| | | 10 | Use the operation result of the frequency calculation function as the frequency setting command. Please refer to subsection "7.5.14 Frequency calculation function". |

(2) Output frequency setting

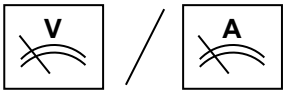
The output frequency setting function allows you to set the inverter output frequency.
You can set the inverter output frequency with "F001" only when you have specified "02" for the frequency source (A001/A201). If the setting of function "A001/A201" is other than "02", "F001" operates as the frequency command monitoring function.
The frequency set with "F001" is automatically set as the multi-speed frequency 0 (A020). To set the 2nd motor output frequency, use the multi-speed frequency 0, 2nd motor (A220) or use "F001" for the setting after turning on the "SET" signal. About "SET" signal, refer to subsection "7.5.21 2nd motor control function (SET)".
If the PID function is valid, the output frequency setting (F001) will be displayed in percent (%).
(Setting range: 0.0 to 100.0 (%).)

| 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".<br>The 2nd motor control frequency set with "F001" is equal to the setting of "A220". |
| Multi-speed frequency 0 | A020/A220 | | |

■Case1: Setting the output frequency by the operator

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Frequency source | A001/A201 | 02 | Operator |

■Case2: Setting the output frequency by analog input

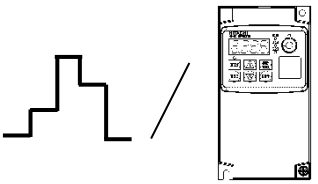



| Item | Function code | Range of data | Description |
|---|---|---|---|
| Frequency source | A001/A201 | 01 | Control terminal |

Note) It is able to select analog input method either voltage input (O) or current input (OI) by the switch for O/OI (analog input) changeover (SW6). Please refer to section "3.2 Name of each portion (removing the front cover)".

■Case3: Setting the output frequency by multi-speed function

If one or more of the intelligent input terminals are assigned to "CF1" to "CF3" or "SF1" to "SF3" and turn ON, the multi-speed function is valid regardless the setting of frequency source (A001/A201).
The frequency command is set from one of the multi-speed frequencies 1 to 7 (A021 to A027) by the multi-speed function. But, if all of the intelligent input terminals assigned to "CF1" to "CF3" or "SF1" to "SF3" turn OFF (define to "speed 0"), the frequency command is set according to frequency source (A001/A201).
Please refer to subsection "7.5.11 Multi-speed select setting (CF1 to CF3 and SF1 to SF3)" for more information of multi-speed function.

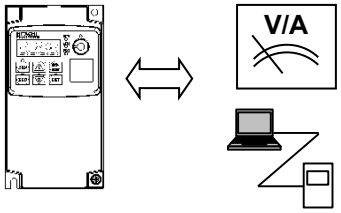


| Item | Function code | Range of data | Description |
|---|---|---|---|
| Frequency source | A001/A201 | ** | This setting is valid at "speed 0". |
| Intelligent input [1] to [5] function | C001 to C005 | 02-04<br>32-34 | CF1 to CF3: binary operation<br>SF1 to SF3: bit operation<br>Binary or bit operation can be selected by (A019). |
| Multi-speed frequency 0 | A020/A220 | Note) | Multi-speed frequency setting |
| Multi-speed frequency 1 to 7 | A021 to A027 | Note) | Multi-speed frequency setting |

Note) Range of data: 0.00, start frequency (b082) to maximum frequency (A004/A204)(Hz).

■Case4: Setting the output frequency by switching between the operator and the other source

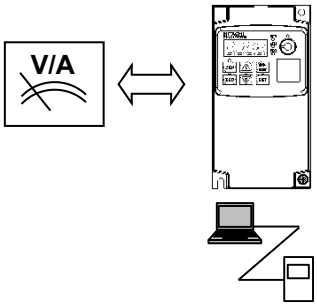
If one of the intelligent input terminals is assigned to "OPE" and turns ON, the frequency source will be forced to the operator regardless the setting of frequency source (A001/A201).
Notice: If "OPE" terminal turns on, the run command source will be forced to the operator, too.




| Item | Function code | Range of data | Description |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 31 | OPE: operator control<br>ON: operator<br>OFF: according to (A001/A201) setting |

■Case5: Setting the output frequency by switching between analog input and the other source

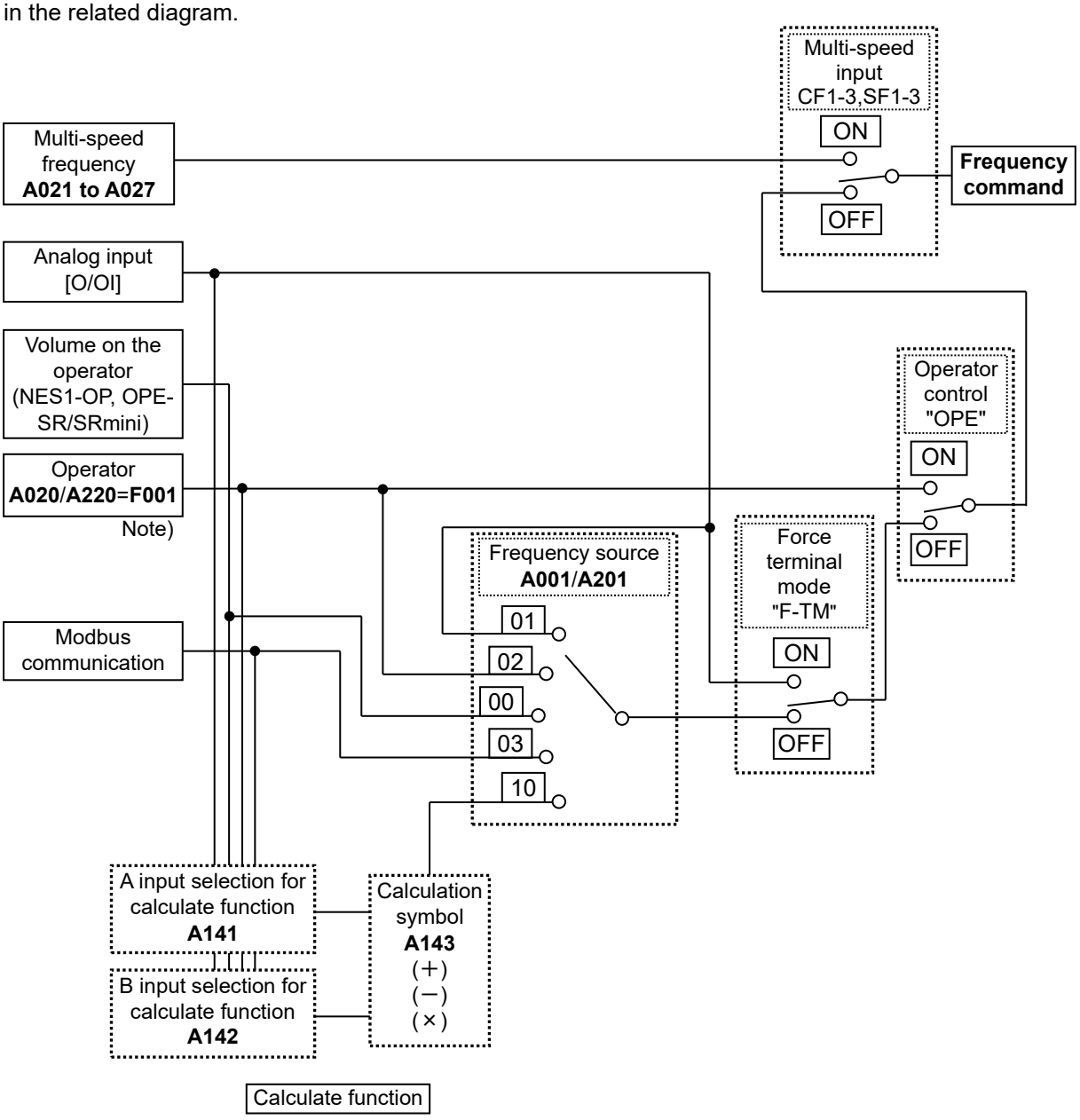
If one of the intelligent input terminals is assigned to "F-TM" and turns ON, the frequency source will be forced to the control terminal (analog input) regardless the setting of frequency source (A001/A201).
Notice: If "F-TM" terminal turns on, the run command source will be forced to the control terminal, too.




| Item | Function code | Range of data | Description |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 51 | F-TM: force terminal mode<br>ON: control terminal<br>OFF: according to (A001/A201) setting |

Note) If both of "OPE" and "F-TM" terminals are ON, the frequency source and the run command source are forced to the operator.

The related diagram of the frequency command selection is shown below.
The inverter output is performed according to the "frequency command" obtained from several conditions in the related diagram.




Note) If the frequency source is set to operator (A001/A201=02), it is able to set the frequency command by "F001". If the frequency source is set to other than operator (A001/A201≠02), it is not able to set but to monitor the frequency command by "F001".
If the frequency set in monitoring is set to enabled (b163=01) and "d001" or "d007" is displaying, the frequency command can be changed by the △/▽ key only during the inverter is operating the motor.

### 7.2.2 Run command source setting (A002/A202,C001 to C005,C011 to C015,F004)

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 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] and the "RV" signal to intelligent input terminal [2].)
To switch each intelligent input terminal active state between a-contact and b-contact, specify each terminal with function "C011" to "C015", and then perform input NO/NC selection for each terminal.
When using the digital operator 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 | A002 A202 | 01 | Input the start and stop commands via control terminals. |
| | | 02 | Input the start and stop commands via the standard panel or the operator. |
| | | 03 | Input the start and stop commands via Modbus communication. |
| Intelligent input [1] to [5] function | C001 to C005 | 00 | FW: Forward Run/Stop |
| | | 01 | RV: Reverse Run/Stop |
| Intelligent input [1] to [5] active state | C011 to C015 | 00 | a-contact (NO) |
| | | 01 | b-contact (NC) |

Note 1: If "OPE" (Operator Control) or "F-TM" (Force Terminal Mode) is assigned to an intelligent input terminal, the settings made with functions "A001/A201" and "A002/A202" 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 intelligent input terminal will be enabled.
Note 2: On the WOP being used to operate the inverter, pressing the REMOTE key enables you to input both frequency setting and operation commands from the WOP.
Note 3: RUN/STOP/RESET key on the standard panel is valid regardless of the "A002/A202". However, when setting 3-wire function is disabled. Refer to subsection "7.5.3 3-wire input function (STA, STP, and F/R)" for more information of the 3-wire function.

### 7.2.3 Run key routing (F004)

When you enter operation commands via the standard panel or the digital operator, the run key routing function allows you to select the direction of motor operation.
This function is ineffective when you use the other methods (including via WOP) to input operation commands.

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

### 7.2.4 Rotational direction restriction (b035)

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 terminal 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 |
|---|---|---|---|
| Rotation direction restriction | b035 | 00 | Both forward and reverse operations are enabled. |
| | | 01 | Only forward operation is enabled. |
| | | 02 | Only reverse operation is enabled. |

## 7.2.5 Stop mode selection (b091)

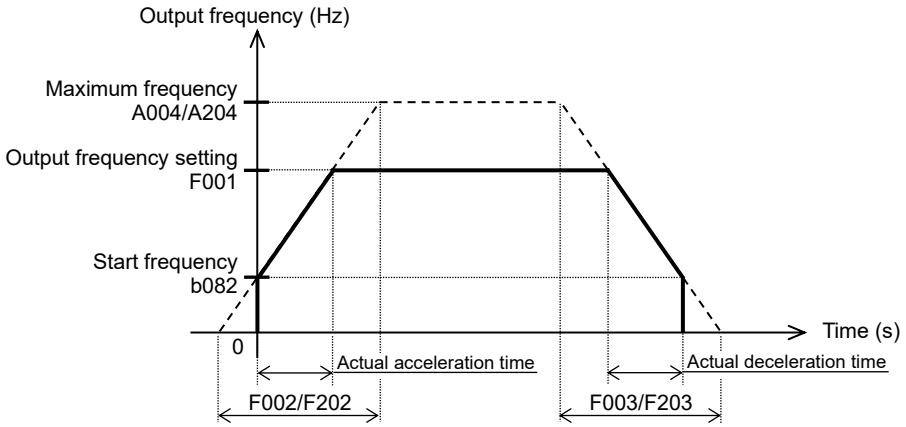
The stop mode selection function allows you to select one of two methods of stopping the motor when a stop command is input. One is to decelerate the motor according to the specified deceleration time and then stop it; the other is to let the motor be free-running until it stops.
If a start command is 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 (F002/F202,F003/F203)

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).
It is able to divide the acceleration and deceleration into two phases. Please refer to subsection "7.5.12 Two-stage acceleration/deceleration function (2CH)" for detail.

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Acceleration time (1) | F002/F202 | 0.00 to 3600.(s) | Set the length of time to accelerate the motor from 0 Hz to the maximum frequency. |
| Deceleration time (1) | 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 moment (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 (E01 to E04) or overvoltage (E07).

Minimum acceleration time: $t_S$ (s)

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

Minimum deceleration time: $t_B$ (s)

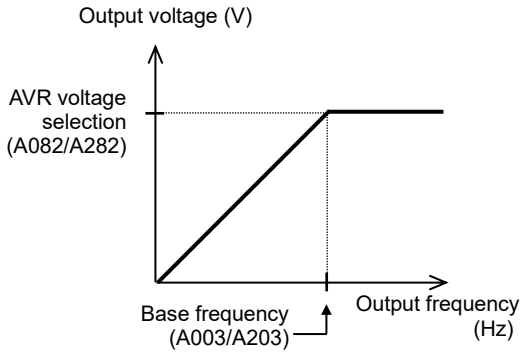
$$t_B = \frac{(J_L+J_M)\times N_M}{9.55\times(T_B+T_L)}$$

$J_L$: Inertia moment (J) of the load converted to that of the motor shaft ($kgm^2$)
$J_M$: Inertia moment (J) of the motor ($kgm^2$)
$N_M$: Motor speed ($min^{-1}$)
$T_S$: Maximum acceleration torque driven by the inverter (N·m)
$T_B$: Maximum deceleration torque driven by the inverter (N·m)
$T_L$: Required running torque (N·m)

## 7.2.7 Base frequency setting (A003/A203,A082/A282)

(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 motor controls, refer to subsection "7.5.21 2nd motor control function (SET)".

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Base frequency | A003/A203 | 30.0 to maximum frequency (A004/A204) (Hz) | |
| AVR voltage selection | A082/A282 | 200 / 215 / 220 / 230 / 240 (V) | Selectable on 200 V class inverter models. |
| | | 380 / 400 / 415 / 440 / 460 / 480 (V) | Selectable on 400 V class inverter models. |

## 7.2.8 Using the AVR Functions (A081/A281, A082/A282, A083, A084)

(1) What's the AVR function?

The AVR function maintains the correct voltage output to the motor, even when the input voltage to the inverter fluctuates. The output voltage maintained by this function is based on the voltage specified by the AVR voltage selection (A082/A282). But it cannot exceed the input voltage to the inverter.
Use the AVR function selection (A081/A281) to enable or disable the AVR function.

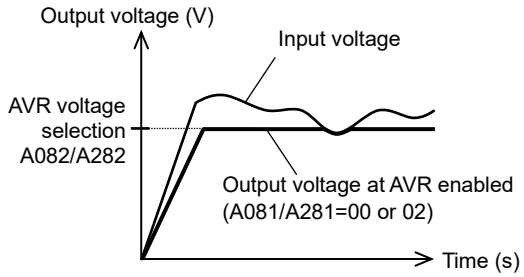
(2) AVR filter time constant and AVR deceleration gain

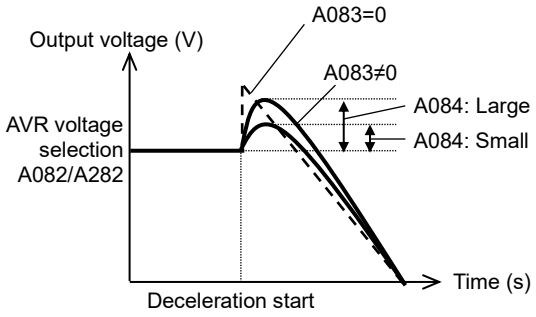
Motor acts as a generator during deceleration. Therefore, energy is regenerated to the inverter. As a result, the DC bus voltage of the inverter is increased. If DC bus voltage exceeds overvoltage level, the inverter is generated the overvoltage trip (E07).
The higher the output voltage of the inverter, 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 the AVR function selection (A081/A281) = "02" (AVR enabled except during deceleration).
2. Please tune voltage characteristics using the AVR filter time constant (A083) and the AVR deceleration gain (A084).

| Item | Function code | Data | Description |
|---|---|---|---|
| AVR function selection | 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 selection | A082/A282 | 200 / 215 / 220 / 230 / 240 (V) | Selectable on 200 V class inverter models. |
| | | 380 / 400 / 415 / 440 / 460 / 480 (V) | Selectable on 400 V class inverter models. |
| AVR filter time constant | A083 | 0.000 to 1.000 (s) | See diagram below. (*2) |
| AVR deceleration gain | A084 | 50. to 200. (%) | See diagram below. (*2)(*3) |

(*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" at deceleration.
(*3) After NE-S1 Ver.2.0, when the AVR function selection (A081/A281) is other than "00" (always enabled), the AVR deceleration gain (A084) will be effective at constant speed.

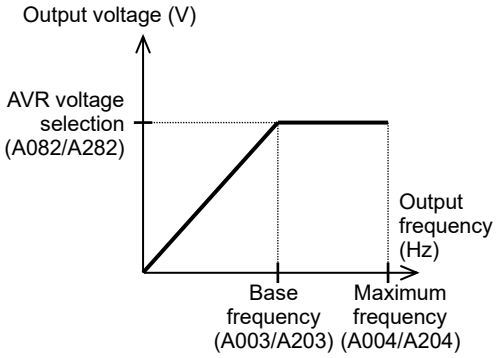



Example) If set to A081/A281=02

### 7.2.9 Maximum frequency setting (A004/A204)

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 VDC of the input of 0 to 10 VDC).
To switch the maximum frequency among the 1st and 2nd motor controls, refer to subsection "7.5.21 2nd motor control function (SET)".
The inverter output voltage with the frequency ranging from the base frequency to the maximum frequency is that selected by the AVR voltage selection (A082/A282).




| Item | Function code | Range of data | Description |
|---|---|---|---|
| Maximum frequency | A004/A204 | Base frequency (A003/A203) to 400.0 (Hz) | The maximum output frequency is set. |

### 7.2.10 Carrier frequency setting (b083)

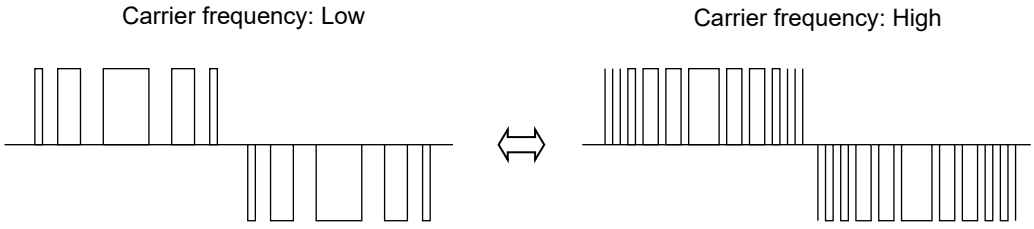
The carrier frequency setting function allows you to change the carrier frequency of the PWM waveform output from the inverter.
Increasing the carrier frequency can lower the metallic noise from the motor, but may increase the inverter noise (radiation noise, electrical noise, etc.) and current leakage.
You can use this function effectively to avoid resonance of the mechanical system and motor.

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

Note: When increasing the carrier frequency, derate the output current as shown in the section "12.3. Derating Curves".

■Carrier frequency and affecting range

| Carrier frequency | Low ⟷ High | |
|---|---|---|
| Metallic noise from the motor | × (High) | ○ (Low) |
| Inverter noise and current leakage | ○ (Low) | × (High) |
| Inverter heating | ○ (Low) | × (High) |




<Example> Output voltage waveform of the inverter (PWM output)

## 7.3 Setting the intelligent I/O terminal function

### 7.3.1 Intelligent input terminal setting (C001 to C005)

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 and 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/Stop | Operation command | 7 - 12 |
| | 01 | RV: Reverse Run/Stop | | |
| | 02 | CF1: Multi-speed selection, Bit 1 | Multi-speed operation function (binary) | 7 - 33 |
| | 03 | CF2: Multi-speed selection, Bit 2 | | |
| | 04 | CF3: Multi-speed selection, Bit 3 | | |
| | 06 | JG: Jogging | Jogging operation function | 7 - 30 |
| | 07 | DB: External DC braking | DC braking (external DC braking) function | 7 - 46 |
| | 08 | SET: Set (select) 2nd Motor Data | 2nd motor control function | 7 - 45 |
| | 09 | 2CH: Two-stage Acceleration and Deceleration | 2-stage acceleration/deceleration function | 7 - 35 |
| | 11 | FRS: Free-run Stop | Free-run stop function | 7 - 62 |
| | 12 | EXT: External Trip | External trip function | 7 - 72 |
| | 13 | USP: Unattended Start Protection | Unattended start protection function | 7 - 63 |
| | 15 | SFT: Software Lock | Software lock function | 7 - 50 |
| | 18 | RS: Reset Inverter | Reset function | 7 - 60 |
| | 20 | STA: Start (3-wire interface) | 3-wire input function | 7 - 28 |
| | 21 | STP: Stop (3-wire interface) | | |
| | 22 | F/R: FW, RV (3-wire interface) | | |
| | 23 | PID: PID Disable | PID function | 7 - 40 |
| | 24 | PIDC: PID Reset | | |
| | 27 | UP: Remote Control UP Function | Remote control (UP/DWN) function | 7 - 38 |
| | 28 | DWN: Remote Control DOWN Function | | |
| | 29 | UDC: Remote Control Data Clearing | | |
| | 31 | OPE: Operator Control | Forcible-operation from the operator function | 7 - 51 |
| | 32 | SF1: Multi-speed selection, Bit operation Bit 1 | Multi-speed operation function (Bit) | 7 - 34 |
| | 33 | SF2: Multi-speed selection, Bit operation Bit 2 | | |
| | 34 | SF3: Multi-speed selection, Bit operation Bit 3 | | |
| | 39 | OLR: Overload Restriction Source Changeover | Overload restriction function | 7 - 69 |
| | 50 | ADD: ADD frequency enable | Frequency addition function | 7 - 38 |
| | 51 | F-TM: Force Terminal Mode | Forcible-operation from terminal function | 7 - 51 |
| | 53 | KHC: Clear watt-hour data | Cumulative power monitoring function | 7 - 6 |
| | 65 | AHD: Analog command hold | Analog command holding function | 7 - 22 |
| | 83 | HLD: Retain output frequency | Retain output frequency function | 7 - 32 |
| | 84 | ROK: Permission of Run command | Permission of Run command function | 7 - 32 |
| | 86 | DISP: Display limitation | Display limitation function | 7 - 52 |
| | no | NO: No function | - | - |

### 7.3.2 Intelligent input terminal a/b (NO/NC) selection (C011 to C015)

The intelligent 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].
The a-contact turns on the input signal when closed and turns it off when opened.
The b-contact turns on the input signal when opened and turns it off when closed.
The intelligent input terminal to which the "RS" (reset) is assigned functions only as an a-contact.

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent input [1] to [5] active state | C011 to C015 | 00 | a-contact (NO: normally open) |
| | | 01 | b-contact (NC: normally closed) |

### 7.3.3 Intelligent input terminal response time (C160 to C164)

The intelligent input terminal response time function allows you to specify a response time for each of intelligent input terminals [1] to [5]. You can use this function effectively to remove noise (e.g., chattering). If the noise 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 0 to 400 ms (corresponding to settings of 0 to 200).

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Intelligent input [1] to [5] response time | C160 to C164 | 0. to 200. | Variable in step of 1 (×2 ms) |

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

### 7.3.4 Intelligent output terminal setting (C021,C026)

You can assign the functions described below to the intelligent output terminal [11] (C021) and the intelligent relay terminal (C026).
The intelligent output terminal [11] is used for open-collector output, and the intelligent relay terminal is used for relay output.

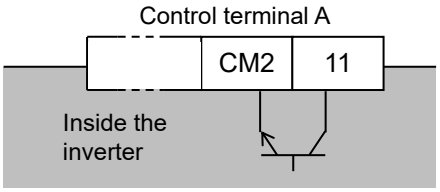
| Function code | Data | Description | Reference item | Page |
|---|---|---|---|---|
| C021, C026 | 00 | RUN: Run Signal | Running signal | 7 - 74 |
| | 01 | FA1: Frequency Arrival Type 1-Constant Speed | Frequency arrival signals | 7 - 74 |
| | 02 | FA2: Frequency Arrival Type 2-Over frequency | | |
| | 03 | OL: Overload Advance Notice Signal | Overload restriction / overload notice advance signal | 7 - 70 |
| | 04 | OD: Output Deviation for PID Control | PID function | 7 - 43 |
| | 05 | AL: Alarm Signal | Protective functions | 7 - 66 |
| | 06 | FA3: Frequency Arrival Type 3-Set frequency | Frequency arrival signals | 7 - 74 |
| | 09 | UV: Undervoltage | undervoltage | 7 - 55 |
| | 11 | RNT: Run Time Expired | Operation time over signal | 7 - 76 |
| | 12 | ONT: Power ON time Expired | Power-on time over signal | 7 - 76 |
| | 13 | THM: Thermal Warning | Electronic thermal protection | 7 - 68 |
| | 21 | ZS: Zero Hz Speed Detection Signal | 0 Hz detection signal | 7 - 76 |
| | 27 | Dc: Analog Input Disconnect Detection | Window comparators function | 7 - 81 |
| | 31 | FBV: PID Second Stage Output | PID function | 7 - 43 |
| | 32 | NDc: Network Disconnect Detection | RS485 communication | 7 - 78 |
| | 33 | LOG: Logic Output Function | Logical operation function | 7 - 77 |
| | 41 | FR: Starting Contact Signal | Starting contact signal | 7 - 78 |
| | 42 | OHF: Heatsink Overheat Warning | Heatsink overheat warning | 7 - 78 |
| | 43 | LOC: Low current detection | Low-current indication signal | 7 - 79 |
| | 50 | IRDY: Inverter Ready Signal | Inverter ready signal | 7 - 79 |
| | 51 | FWR: Forward Rotation | Forward rotation signal | 7 - 79 |
| | 52 | RVR: Reverse Rotation | Reverse rotation signal | 7 - 80 |
| | 53 | MJA: Major Failure Signal | Major failure signal | 7 - 80 |
| | 54 | WC: Window Comparator for Analog Input | Window comparators function | 7 - 81 |
| | 58 | FREF: Frequency Command Source Signal | Frequency Command Source signal | 7 - 82 |
| | 59 | REF: Run Command Source Signal | Run Command Source signal | 7 - 82 |
| | 60 | SETM: 2nd Motor Selection | 2nd Motor Selection signal | 7 - 82 |
| | no | NO: No function | - | - |

## 7.3.5 Intelligent output terminal a/b (NO/NC) selection (C031,C036)

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 intelligent relay terminal.
The a-contact turns on the output signal when closed and turns it off when opened.
The b-contact turns on the output signal when opened and turns it off when closed.

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent output [11] active state | C031 | 00 | a-contact (NO: normally open) |
| | | 01 | b-contact (NC: normally closed) |
| Intelligent relay active state | C036 | 00 | a-contact (NO: normally open) |
| | | 01 | b-contact (NC: normally closed) |

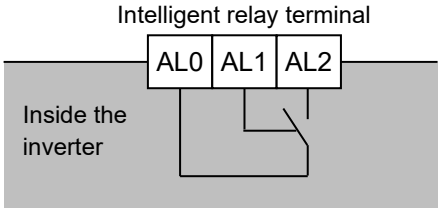
(1) Specifications of intelligent output terminal [11]




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

| Setting of "C031" | Power supply | Inverter status | Output signal |
|---|---|---|---|
| 00 (a-contact) | ON | Normal | OFF |
| | | Active (Error) | ON |
| | OFF | – | – |
| 01 (b-contact) | ON | Normal | ON |
| | | Active (Error) | OFF |
| | OFF | – | – |

(2) Specifications of intelligent relay terminal




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

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 |

### 7.3.6 Output signal delay/hold function (C130,C131,C140,C141)

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 terminal [11] and the intelligent relay terminal).

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

## 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).

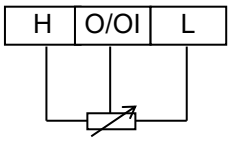
Voltage input : 0 to 10 VDC (Variable resistor is a voltage input.)
Current input : 0 to 20 mA (Please set "A013=20 %" at the case of "4 to 20 mA".)

The analog input signal can be assigned the following functions.

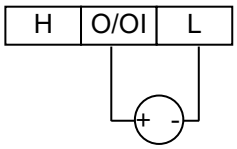
| Item | Function code | Data | Description |
|---|---|---|---|
| Frequency source | A001/A201 | 01 (Control terminal (O/OI input)) | |
| PID enable | A071 | 01 (PID Enabled),<br>02 (PID Enabled with reverse output) | In case of the PID function is enabled, analog input can be used for PV source. |
| PV source | A076 | 01 ([O/OI] terminal) | |

Example of wiring

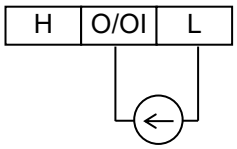
Variable resistor
(1 kΩ to 2 kΩ)




Voltage input
(0 to 10 VDC)




Current input
(0/4 to 20 mA)




Please refer to section "3.2 Name of each portion (removing the front cover)" about SW6 setting.

### 7.4.2 Analog input (O/OI) filter setting (A016)

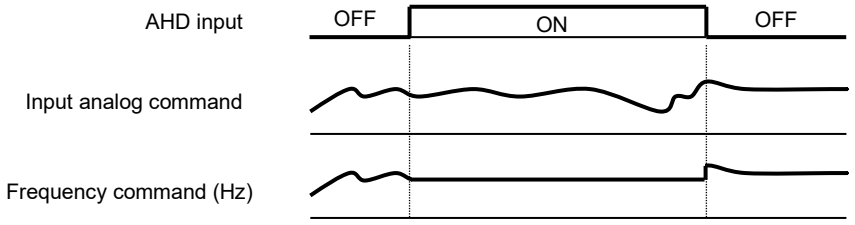
The analog input filter setting function allows you to set the input voltage/current filtering time to be applied when frequency commands are input as analog signals.
You can use this filter function effectively for removing noise from the frequency setting circuit signal.
If the noise disables the stable operation of the inverter, increase the setting value of "A016". Setting a larger value to "A016" makes the inverter response slower. The filtering constant is value of "A016" (1 to 30) x 2 ms.
When the "A016" setting is "31", a hysteresis of ± 0.1 Hz is added to the filtering constant (500 ms).

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Analog input filter | A016 | 1. to 30. or 31. | Setting of 1. to 30. : "Set value x 2" ms filter.<br>Setting of 31. : 500 ms filter (fixed) with hysteresis of ± 0.1 Hz. |

### 7.4.3 Analog command holding function (AHD) (C001 to C005,C101)

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 the 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 |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 65 | AHD: Analog command hold |

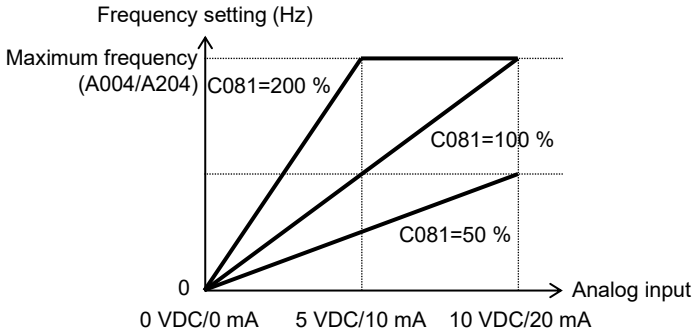



Note)
Frequency command remains when inverter is switched with "SET" terminal during "AHD" terminal is on. Turn "AHD" terminal off to re-hold the frequency command.

### 7.4.4 Analog Input Adjustment (C081)

This function can change the gain of the analog input. Please use the fine adjustment of the analog input signal. Please refer to subsection "7.4.5 Start/end frequency setting for external analog input" for the scale transformation.

| Item | Function code | Range of data | Description |
|---|---|---|---|
| O/OI input gain calibration | C081 | 0.0 to 200.0 (%) | This function will fine-tune the gain for the analog input. |



## 7.4.5 Start/end frequency setting for external analog input (A011 to A015,A161 to A165)

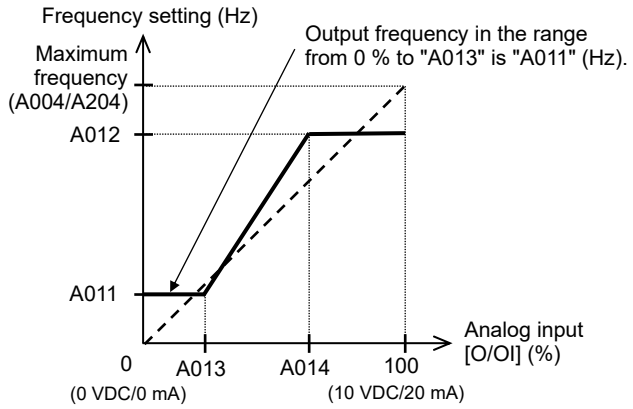
The start/end frequency setting function allows you to set the inverter output frequency in relation to the external analog inputs (frequency commands) via the following terminals:

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

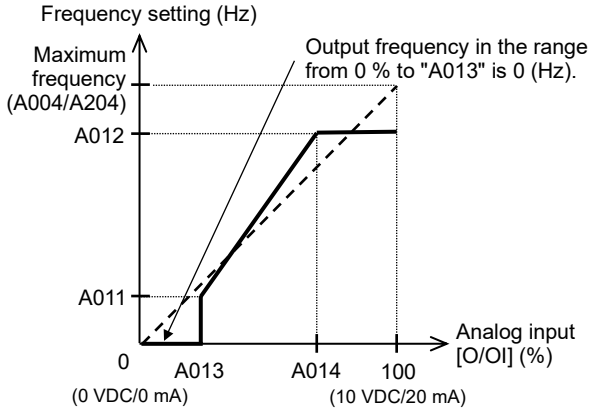
| Item | Function code | Range of data | Description |
|---|---|---|---|
| [O/OI] / [VR] input active range start frequency | A011/A161 | 0.00 to 400.0 (Hz) | Setting of the start frequency. |
| [O/OI] / [VR] input active range end frequency | A012/A162 | 0.00 to 400.0 (Hz) | Setting of the end frequency. |
| [O/OI] / [VR] input active range start ratio | A013/A163 | 0. to A014/A164 (%) | Setting of the rate of the start frequency to the external frequency command (0 to 10 VDC / 0 to 20 mA). |
| [O/OI] / [VR] input active range end ratio | A014/A164 | A013/A163 to 100. (%) | Setting of the rate of the end frequency to the external frequency command (0 to 10 VDC / 0 to 20 mA). |
| [O/OI] / [VR] input start frequency enables | A015/A165 | 00 | Externally input start frequency<br>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". |
| | | 01 | 0 Hz<br>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 VDC, specify 50 % for "A014".

(Example 1) "A015": 00




(Example 2) "A015": 01



## 7.4.6 FM terminal (C027,C030,C105)

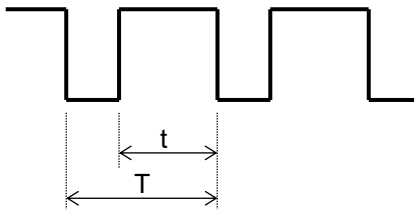
You can monitor the inverter output frequency and output current via the FM terminal on the control terminal B. The FM terminal is a pulse output terminal.

(1) FM signal selection

Select the signal to be output from the FM terminal among those shown in the table below.
If you select "03" (output frequency (pulse train)) or "08" (output current (pulse train)), connect a digital frequency counter to the FM terminal. To monitor other output signals, use an analog meter.

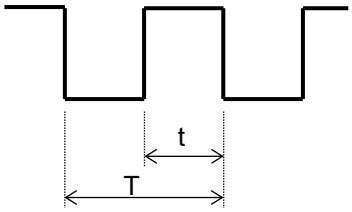
| Item | Data | Description | Waveform | Scale range |
|---|---|---|---|---|
| C027 | 00 | Output frequency | PWM | 0 to maximum frequency (A004/A204) (Hz). |
| | 01 | Output current | PWM | 0 to 200 %. |
| | 03 | Output frequency (*1) | Pulse train | 0 to maximum frequency (A004/A204) (Hz). |
| | 04 | Output voltage | PWM | 0 to 133 %. (The 100 % output voltage is equivalent to duty 75 % (i.e., 7.5 VDC) of full scale.) |
| | 05 | Input power | PWM | 0 to 200 %. |
| | 06 | Electronic thermal load ratio | PWM | 0 to 100 %. |
| | 07 | LAD frequency (*2) | PWM | 0 to maximum frequency (A004/A204) (Hz). |
| | 08 | Output current | Pulse train | Refer to (3) below. |
| | 10 | Heatsink temperature | PWM | 0 ºC to 200 ºC (0 ºC is output when the heatsink temperature is 0 ºC or less.). |

(Example 1) Waveform: PWM




Cycle (T): Fixed (6.4 ms)
Duty (t/T): Varied

(Example 2) Waveform: Pulse train




Cycle (T): Varied
Duty (t/T): Fixed (1/2)

(*1) When "b086" (frequency scaling conversion factor) is set, the value converted by gain is output.
(*2) LAD frequency: the linear acceleration / deceleration frequency

(2) FM terminal analog meter adjustment

Adjust the pulse voltage output gain for the external analog meter connected to the FM terminal.

| Item | Function code | Range of data | Description |
|---|---|---|---|
| FM gain 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 | (0.20 to 2.00) × Inverter rated current (A) | Setting of the current for 1,440 Hz output. |

## 7.5 To drive the motor

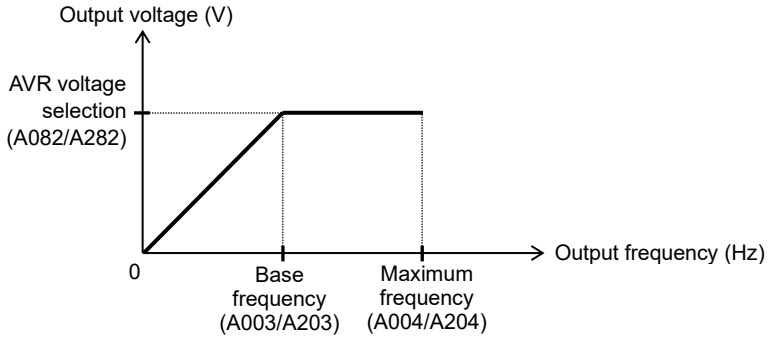
### 7.5.1 V/f characteristic curve selection (A044/A244,b100 to b113)

The V/f characteristic curve selection function allows you to set the output voltage/frequency (V/f) characteristic. To switch the V/f characteristic curve selection among the 1st and 2nd motor controls, refer to subsection "7.5.21 2nd motor control function (SET)".

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

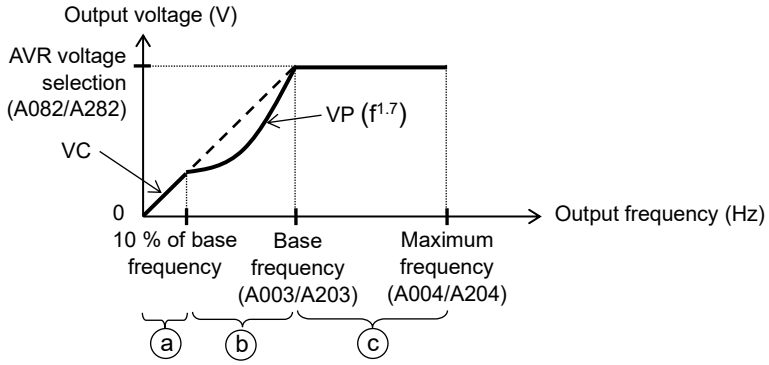
(1) Constant torque characteristic (VC)

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

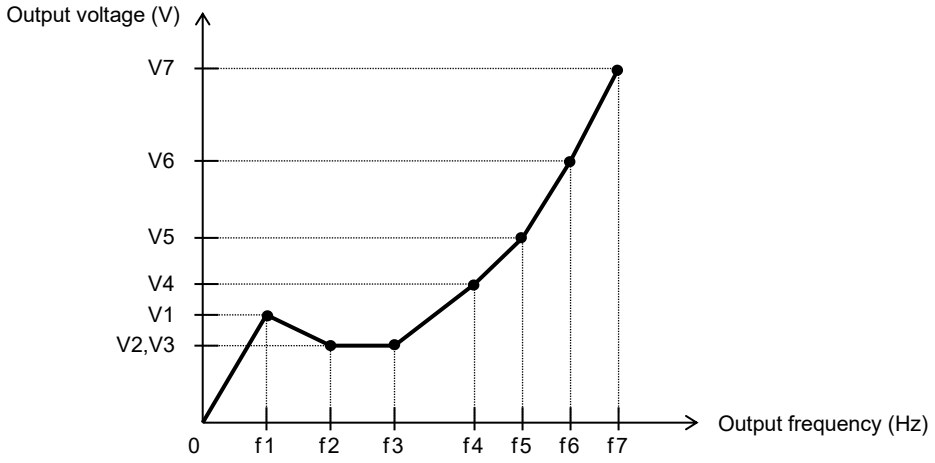
Period ⓒ : While the output frequency increases from the base frequency to the maximum frequency, the output voltage is constant.

(3) Free V/f characteristic setting

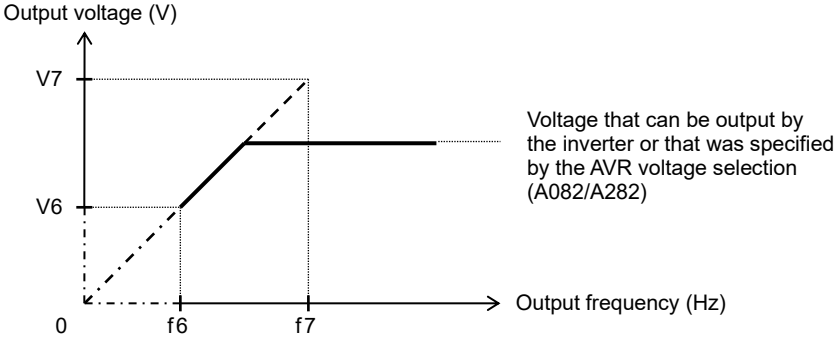
The free V/f characteristic setting function allows you to set an arbitrary V/f characteristic by specifying the voltages and frequencies (b100 to b113) for the seven points on the V/f characteristic curve.
The free V/f frequencies (f1 to f7) set by this function must always be in the collating sequence of "f1 ≤ f2 ≤ f3 ≤ f4 ≤ f5 ≤ f6 ≤ f7".
Since all free V/f frequencies are set to 0 Hz as default (factory setting), specify their arbitrary values (begin setting with free V/f setting, frequency 7 (b112)). (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 (A003/A203), and maximum frequency (A004/A204). (The inverter assumes the value of free V/f setting, frequency 7 (b112) as the maximum frequency.)

| Item | Function code | Data | Description |
|---|---|---|---|
| Free V/f setting, frequency 7 | b112 | b110 to 400. (Hz) | Setting of the output frequency at each breakpoint of the V/f characteristic curve. |
| Free V/f setting, frequency 6 | b110 | b108 to b112 (Hz) | |
| Free V/f setting, frequency 5 | b108 | b106 to b110 (Hz) | |
| Free V/f setting, frequency 4 | b106 | b104 to b108 (Hz) | |
| Free V/f setting, frequency 3 | b104 | b102 to b106 (Hz) | |
| Free V/f setting, frequency 2 | b102 | b100 to b104 (Hz) | |
| Free V/f setting, frequency 1 | b100 | 0. to b102 (Hz) | |
| Free V/f setting, voltage 7 | b113 | 0.0 to 300.0 (V): Selectable on 200 V class inverter models<br>0.0 to 600.0 (V): Selectable on 400 V class inverter models | Setting of the output voltage at each breakpoint of the V/f characteristic curve (*1). |
| Free V/f setting, voltage 6 | b111 | | |
| Free V/f setting, voltage 5 | b109 | | |
| Free V/f setting, voltage 4 | b107 | | |
| Free V/f setting, voltage 3 | b105 | | |
| Free V/f setting, voltage 2 | b103 | | |
| Free V/f setting, voltage 1 | b101 | | |

(Example)




(*1) Even if the free V/f setting, voltage 1 to 7 can be set within 0 to 300 VDC (600 VDC), the inverter output voltage cannot exceed the inverter input voltage or the AVR voltage selection (A082/A282).
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.



## 7.5.2 Torque boost setting

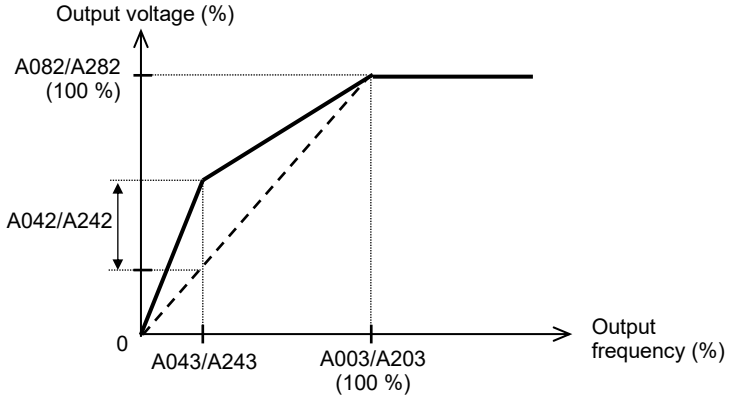
### (A041/A241,A042/A242,A043/A243,A046/A246,A047/A247,H003/H203,H004/H204)

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 (H003/H203) and motor poles setting (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 selection (A082/A282). |
| Manual torque boost frequency | 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 | 0.10 to 5.50 (kW) | Selection of the motor capacity. |
| Motor poles setting | H004/H204 | 2 / 4 / 6 / 8 (poles) | Selection of the number of the motor poles. |
| Voltage compensation gain for automatic torque boost | A046/A246 | 0. to 255. (%) | See Item "(2) Automatic torque boost" below. |
| Slip compensation gain for automatic torque boost | A047/A247 | 0. to 255. (%) | See Item "(2) Automatic torque boost" below. |

(1) Manual torque boost

The inverter outputs the voltage according to the settings of the manual torque boost value (A042/A242) and manual torque boost frequency (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 selection (A082/A282).
When increasing the value of the manual torque boost value (A042/A242), be careful to prevent motor over-excitation. Over-excitation may result in motor burnout.
Use the manual torque boost frequency (A043/A243) to specify the rate of the frequency at each breakpoint to the base frequency (A003/A203) (100 %).
To switch the settings among the 1st and 2nd motor controls ("A041 to A043" and "A241 to A243"), refer to subsection "7.5.21 2nd motor control function (SET)".



(2) Automatic torque boost

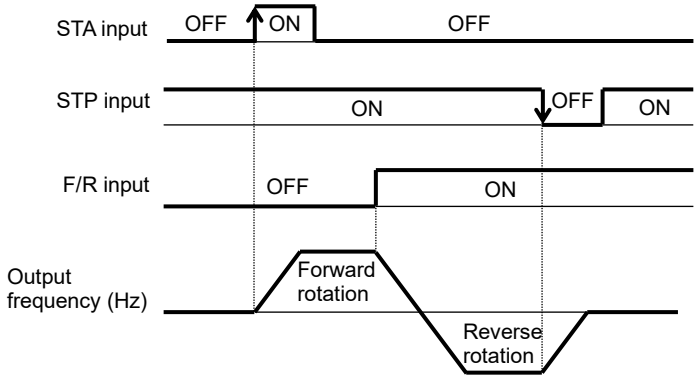
When automatic torque boost is selected by the torque boost selection (A041/A241=01), the inverter automatically adjusts the output frequency and voltage according to the load on the motor.
(During actual operation, the automatic torque boost is usually combined with the manual torque boost.)
When you select the automatic torque boost, adjust the settings of the motor capacity (H003/H203) and motor poles setting (H004/H204) according to the motor to be driven.
If the inverter trips due to overcurrent during motor deceleration, set the AVR function selection to always enable the AVR function (A081/A281=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.<br>(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 slip 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 slip compensation gain for automatic torque boost step by step. | A047/A247 |
| The motor speed increases when a load is applied to the motor. | Reduce the slip compensation gain for 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 automatic torque boost step by step. | A046/A246 |
| | (2) Reduce the slip compensation gain for automatic torque boost step by step. | A047/A247 |
| | (3) Reduce the voltage setting for the manual torque boost value step by step. | A042/A242 |

## 7.5.3 3-wire input function (STA, STP, and F/R) (C001 to C005)

The 3-wire input function allows you to use automatic-reset contacts (e.g., push-button switches) to start and stop the inverter.
Specify "01" (control terminal) for the run command source (A002/A202).
Assign function "20" (STA), "21" (STP), and "22" (F/R) to three of the intelligent input 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" signal is OFF, the "STA" signal is invalid.

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

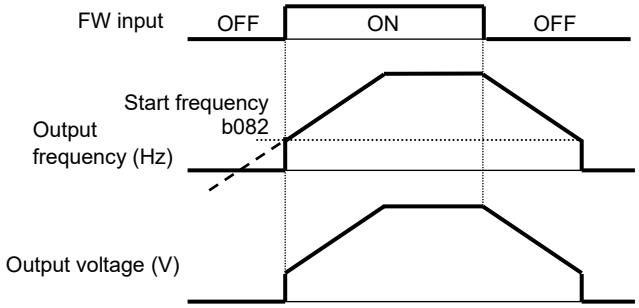



Note : In 3-wire input function, "STP" input is used at the b-contact, even if the setting of "STP" is the a-contact.

### 7.5.4 Start frequency setting (b082)

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 to easily trip because of overcurrent.

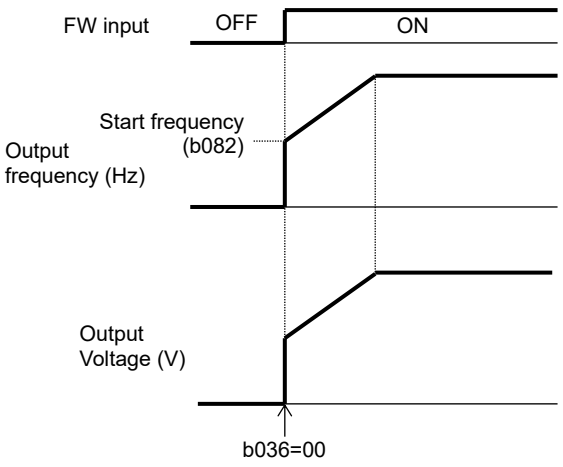
| Item | Function code | Range of data | Description |
|---|---|---|---|
| Start frequency | b082 | 0.01 to 9.99 (Hz) | Setting of the start frequency. |



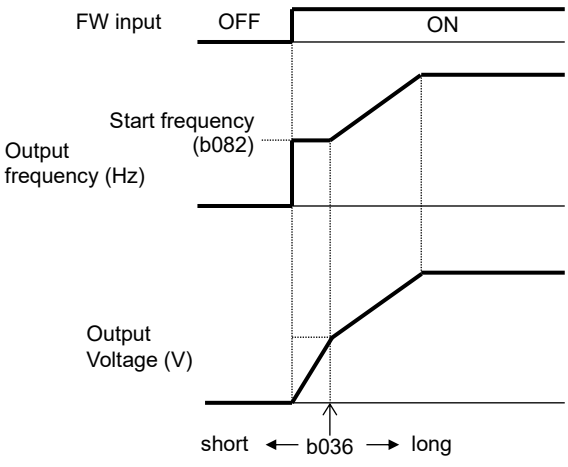

### 7.5.5 Reduced voltage start function (b036,b082)

The reduced voltage start function allows 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 | 0 | Disabling this function. |
| | | 1 to 250 | 1: Short (about 4 ms)<br>↕<br>250: Long (about 1000 ms) |




Reduced voltage start function: disabled

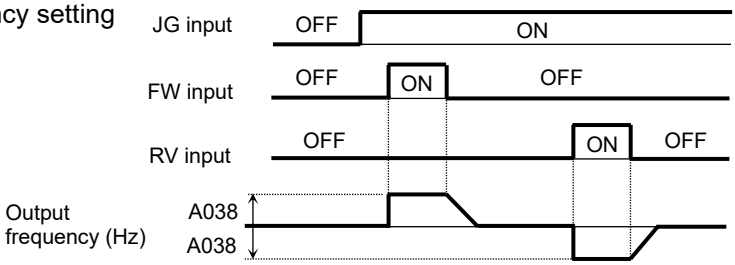



Reduced voltage start function: enabled

## 7.5.6 Jogging (JG) command setting (A038,A039,C001 to C005)

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 one of the intelligent input [1] to [5] functions (C001 to C005).

(1) Jog frequency setting




Since the jogging function does not use an acceleration ramp, the inverter can easily trip during the jogging operation. Adjust the jog frequency (A038) properly so that the inverter will not trip.

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Jog frequency | A038 | Start frequency (b082) to 9.99 (Hz) | Setting of the frequency to output during jogging operation. |

(2) Jog stop mode

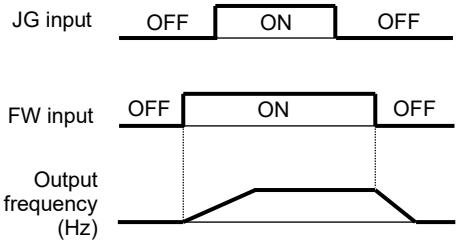
| Item | Function code | Data | Description |
|---|---|---|---|
| Jog stop mode | A039 | 00 | Disabling jogging while the motor is operating, and enabling free-running when the motor is stopped. |
| | | 01 | Disabling jogging while the motor is operating, and enabling stopping after deceleration when the motor is stopped. |
| | | 02 (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 (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 settings (refer to subsection "7.5.22 DC braking (DB) function") if you specify "02" or "05" for the jog stop mode (A039).

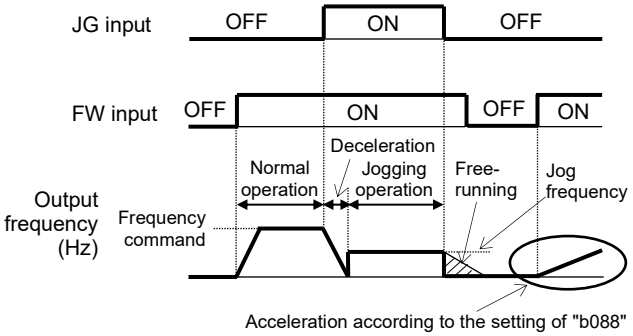
Note 3: Jogging frequency can be changed in the output frequency setting (F001) during jogging operation. The changed frequency setting is saved in "A038".

(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)



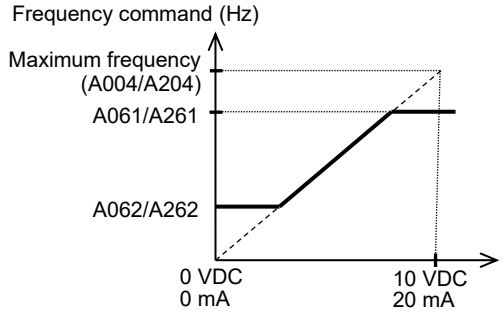

When "03", "04", or "05" is specified for the jog stop mode (A039), the jogging operation will be performed, even if the "FW" signal is turned on earlier than the "JG" signal. However, the motor will stop after free-running if the "JG" signal is turned off earlier than the "FW" signal.

## 7.5.7 Frequency limit setting (A061/A261,A062/A262)

The frequency limit setting function allows you to place upper and lower limits on the inverter frequency command. This function restricts the input of frequency commands that specify any frequencies outside the upper and lower limits. When the PID function is enable, this 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). Make sure that upper/lower limit does not exceed the maximum frequency (A004/A204). Be sure to set the output frequency setting (F001) and the multi-speed frequency 1 to 7 (A021 to A027) between upper and lower limits.
If 0 Hz is set for the frequency upper/lower limits, they will not operate.

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Frequency upper limit | A061/A261 | 0.00, the frequency lower limit (A062/A262) to the maximum frequency (A004/A204) (Hz) | Setting of the upper limit of the frequency command. |
| Frequency lower limit | A062/A262 | 0.00, the start frequency (b082) to the frequency upper limit (A061/A261) (Hz) | Setting of the lower limit of the frequency command. |

(Example) When the O/OI-L terminal is used for frequency command:



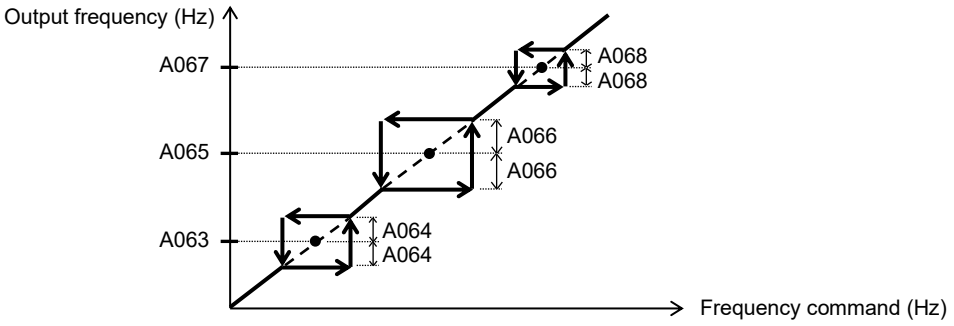

If 0 VDC or 0 mA is input as the frequency command, the inverter will output the frequency specified in "A062/A262".

## 7.5.8 Jump frequency function (A063 to A068)

The jump frequency function allows you to operate the inverter so that it avoids the resonant frequency of the machine driven by the inverter.
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 frequency (center) 1 to 3 | A063 / A065 / A067 | 0.00 to 400.0 (Hz) (*1) | Setting of the center frequency of the frequency range to be jumped. |
| Jump frequency width (hysteresis) 1 to 3 | A064 / A066 / A068 | 0.00 to 10.00 (Hz) | Setting of the half bandwidth of the frequency range to be jumped. |

(*1) Setting of 0.00 Hz disables the jump frequency function.



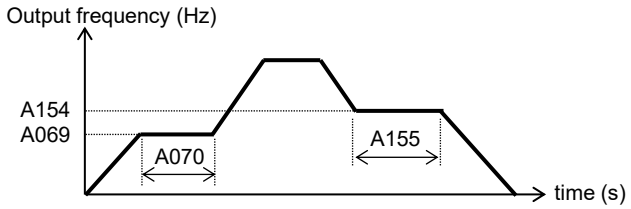
## 7.5.9 Acceleration/Deceleration hold frequency setting (A069,A070,A154,A155)

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.

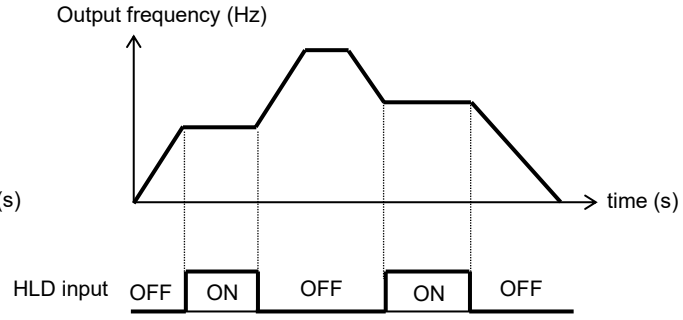
1) by the setting parameter (A069, A070, A154, A155)
2) by the terminal function (HLD)

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Acceleration hold frequency | A069 | 0.00 to 400.0 (Hz) | Setting of the frequency at which to stop acceleration. |
| Acceleration hold time | A070 | 0.0 to 60.0 (s) | Setting of the length of time to stop acceleration. |
| Deceleration hold frequency | A154 | 0.00 to 400.0 (Hz) | Setting of the frequency at which to stop deceleration. |
| Deceleration hold time | A155 | 0.0 to 60.0 (s) | Setting of the length of time to stop deceleration. |
| Intelligent input [1] to [5] function | C001 to C005 | 83 | HLD : Retain output frequency |

(Example 1) By the setting parameter (A069, A070, A154, A155)



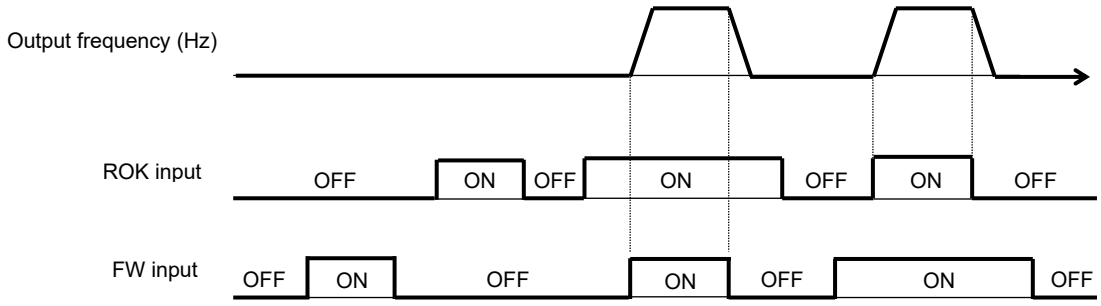

(Example 2) By the terminal function (HLD)




## 7.5.10 Permission of Run command function (ROK) (C001 to C005)

The Permission of Run command function allows you to make the run command to be valid or invalid.
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 |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 84 | ROK: Permission of Run command |



## 7.5.11 Multi-speed select setting (CF1 to CF3 and SF1 to SF3) (A019,A020/A220,A021 to A027,C001 to C005,C169)

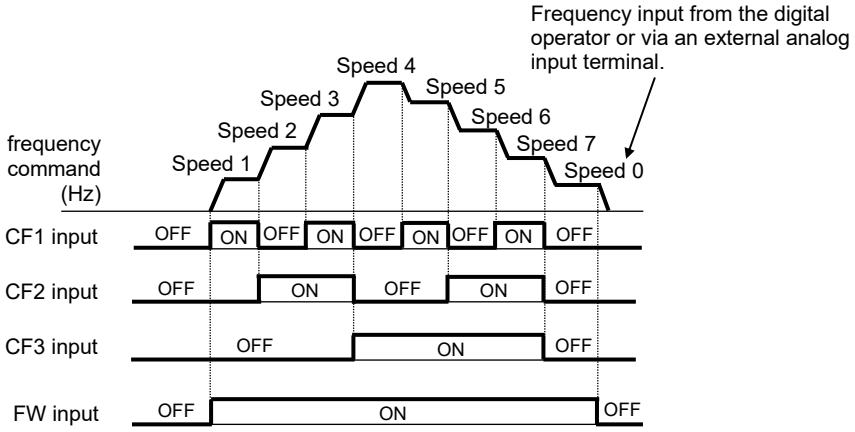
The multi-speed select setting function allows you to set multiple motor speeds and switch among them by way of signal input via specified intelligent input terminals.
Multi-speed operation can be performed in two modes: binary operation mode (with up to 8 speeds) using three input terminals and bit operation mode (with up to 4 speeds) using three input terminals.

| Item | Function code | Data | Description |
|---|---|---|---|
| Multi-speed operation selection | A019 | 00 | Binary operation mode with up to 8 speeds. |
| | | 01 | Bit operation mode with up to 4 speeds. |
| Multi-speed frequency 0 to 7 | A020/A220 A021 to A027 | 0.00, start frequency (b082) to maximum frequency (A004/A204) (Hz) | Setting of the frequency as each speed. |

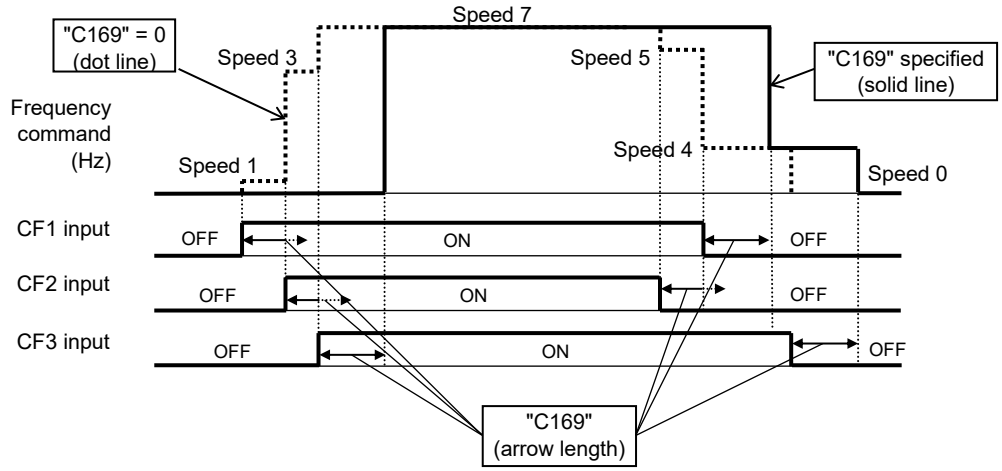
(1) Binary operation mode

Assign functions "02" (CF1) to "04" (CF3) individually to the intelligent input [1] to [5] functions (C001 to C005) to make multi-speed 0 to 7 available for selection.
Specify the desired frequencies for speeds 1 to 7 by setting multi-speed frequency 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 terminal for the frequency source setting.

| Multispeed | CF3 | CF2 | CF1 |
|---|---|---|---|
| Speed 0 | OFF | OFF | OFF |
| Speed 1 | OFF | OFF | ON |
| Speed 2 | OFF | ON | 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 |



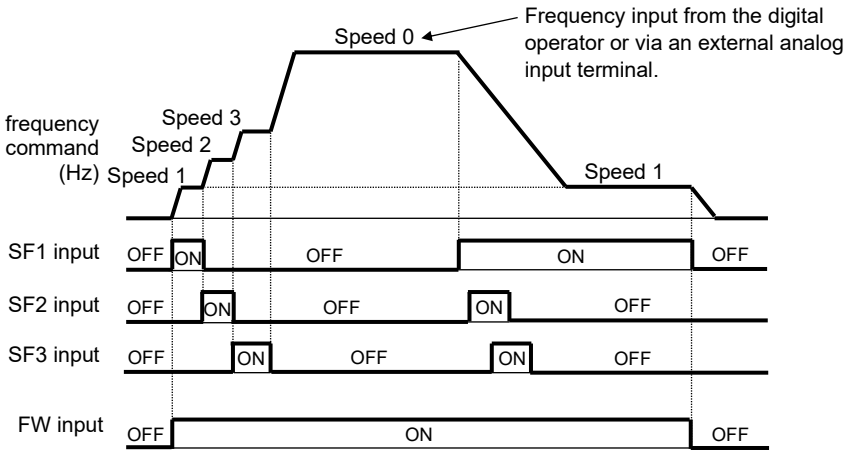

With multi-speed binary operation mode, you can use the multi-speed determination time (C169) to specify a delay to be set until the relevant terminal input is determined. (delay time = "C169" × 10 ms)
Use this specification to prevent the application of fluctuating terminal input before it is determined.
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 intelligent input [1] to [5] functions (C001 to C005) to make multi-speed 0 to 3 available for selection.
Specify the desired frequencies for speeds 1 to 3 (SF1 to SF3) by setting multi-speed frequency 1 to 3 (A021 to A023).

| Multispeed | SF3 | SF2 | SF1 |
|---|---|---|---|
| Speed 0 | OFF | OFF | OFF |
| Speed 1 | × | × | ON |
| Speed 2 | × | 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 function number among them has priority over others. The "×" mark in the above table indicates that the speed can be selected regardless of whether or not the corresponding terminal is turned on.

## 7.5.12 Two-stage acceleration/deceleration function (2CH) (A092/A292 to A096/A296)

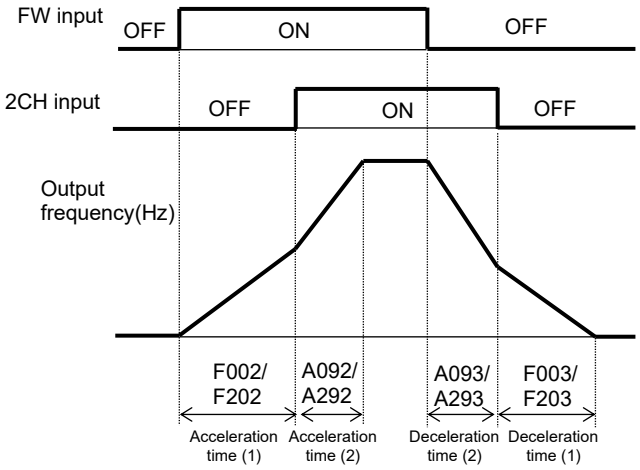
The two-stage acceleration/deceleration function allows you to change the acceleration or deceleration time while the inverter is accelerating or decelerating the motor.
Select one of the following three methods of changing the acceleration or deceleration time:

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

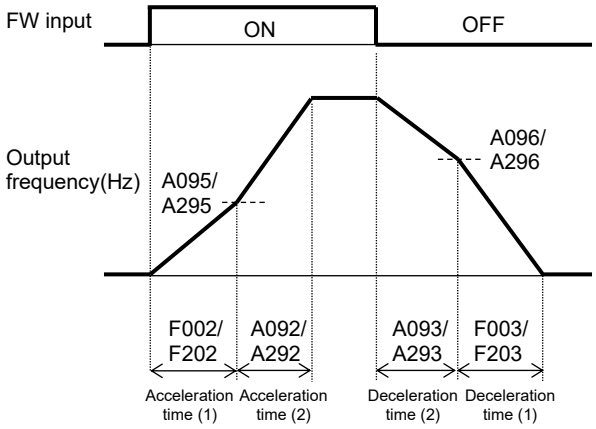
To change the acceleration/deceleration time by the signal input to an intelligent input terminal, assign function "09" (2CH) to one of the intelligent input [1] to [5] functions (C001 to C005).

| Item | Function code | Data | Description |
|---|---|---|---|
| Acceleration time (2) | A092/A292 | 0.00 to 3600. (s) | (See examples 1 to 3.) |
| Deceleration time (2) | A093/A293 | 0.00 to 3600. (s) | (See examples 1 to 3.) |
| Selection 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 selection 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 selection method to switch to Acc2/Dec2 profile (A094/A294). (See example 2.) |

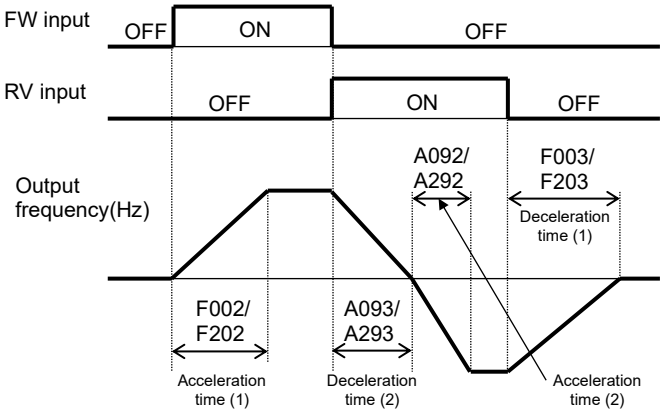
(Example 1) When "00" is specified for "A094/A294".




(Example 2) When "01" is specified for "A094/A294".




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



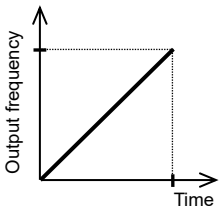
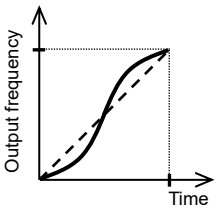
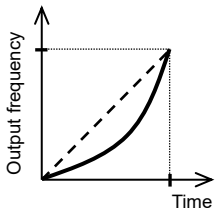
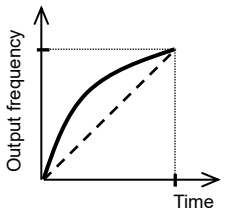
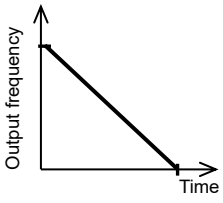
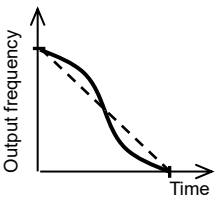
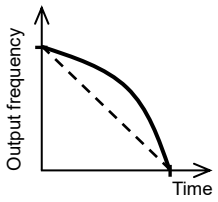
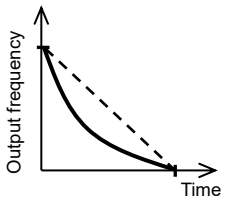
## 7.5.13 Acceleration/deceleration curve selection (A097,A098,A131,A132)

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 and a deceleration pattern.
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 | Inverse U-curve acceleration/deceleration |
| Acceleration/deceleration curve constant | A131/A132 | 01 to 10 | 01 (small degree of swelling)<br>⇕<br>10 (large degree of swelling) |

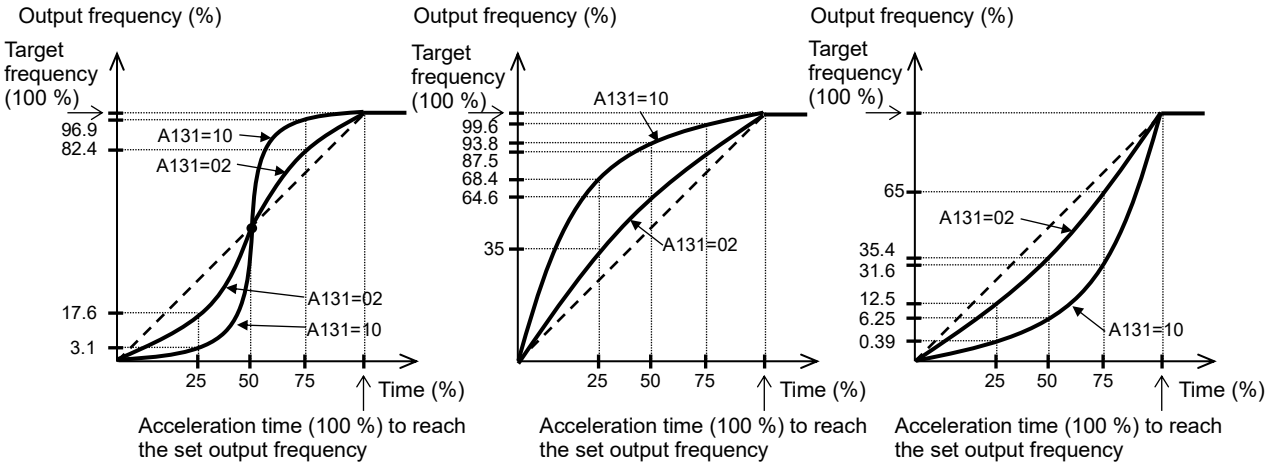
(1) Acceleration/deceleration pattern selection

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

| Setting | 00 | 01 | 02 | 03 |
|---|---|---|---|---|
| Curve | Linear | S-curve | U-curve | Inverse 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). | |

(2) Curve constant (swelling degree)

Specify the swelling degree of the curve with reference to the following graphs (in case of acceleration):




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

## 7.5.14 Frequency calculation function (A141 to A143,A001/A201,A076)

The frequency calculation function allows you to use the result of an arithmetic calculation on two frequency commands as the actual frequency command or PV (Process Variable) data.
To use the calculation result as the actual frequency command, specify "10" for the frequency source (A001/A201).
To use the calculation result as the PV data, specify "10" for the PV source (A076).

| Item | Function code | Data | Description |
|---|---|---|---|
| A/B input selection for calculate function | A141/A142 | 00 | Operator (A020/A220) |
| | | 01 | Volume VR on the operator (Valid only when NES1-OP, OPE-SR/SRmini is connected) |
| | | 02 | Input via the O/OI terminal |
| | | 04 | Input via the Modbus communication |
| Calculation symbol | A143 | 00 | Addition: (A141) + (A142) |
| | | 01 | Subtraction: (A141) - (A142) |
| | | 02 | Multiplication: (A141) × (A142) |
| Frequency source | A001/A201 | 10 | Output of calculation result |
| PV source | A076 | 10 | Output of calculation result |

Note 1: Remote control function (refer to subsection "7.5.16 Remote control function (UP and DWN)") is ineffective when the frequency calculation 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 △ or ▽ key operations (refer to subsection "7.1.1 Output frequency monitoring").

Note 2: The settings of "A141" and "A142" can be the same.

## 7.5.15 Frequency addition function (A145,A146,C001 to C005)

The frequency addition function allows you to add or subtract the value specified as the ADD frequency (A145) to or from the frequency value of a selected frequency command.
To use this function, assign function "50" (ADD) to one of the intelligent input [1] to [5] functions (C001 to C005). 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 |
|---|---|---|---|
| ADD frequency | A145 | 0.00 to 400.0 (Hz) | Setting of the frequency to be added. |
| ADD direction selection | A146 | 00 | (Frequency command) + (A145) |
| | | 01 | (Frequency command) - (A145) |
| Intelligent input [1] to [5] function | C001 to C005 | 50 | The trigger for adding the frequency "A145". |

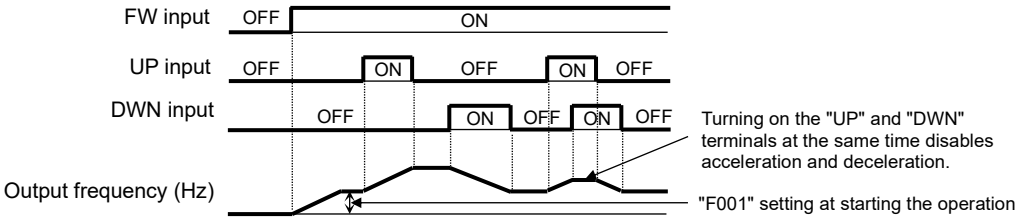
Note 1: If the sign of the frequency value in the frequency command changes from minus (-) to plus (+), or vice versa, as the result of frequency addition, the motor operation direction will be inverted.
Note 2: When the PID function is used, the frequency addition function can apply to PID target data. (In such cases, the "A145" display is in percentage which the PID target data as 100.00 % [in steps of 0.01 %].)

## 7.5.16 Remote control function (UP and DWN) (C101,C104,C001 to C005)

The remote control function allows you to change the inverter output frequency by operating the UP and DWN intelligent input terminals. To use this function, assign functions "27" (UP) and "28" (DWN) to two of the intelligent input [1] to [5] functions (C001 to C005).
This function is only effective when "01" (control terminal) or "02" (operator) has been specified for the frequency source (A001/A201) or the multi-speed function is valid. If "01" (control terminal) has been specified, this function is only effective when the analog command holding function (AHD) is enabled.
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 motor controls, refer to subsection "7.5.21 2nd motor control function (SET)".
You can store the frequency settings adjusted using this function.
Set "01" (enable) on "C101" to store the frequency settings.
In case of the "C101=00", the frequency command returns to a value at the time of the power supply injection when inverter is the undervoltage state.
You can also clear the stored frequency settings. Assign function "29" (UDC) to one of the intelligent input [1] to [5] functions (C001 to C005), and turn on the "UDC" terminal to clear the frequency settings adjusted with the "UP" and "DWN" signals. In this case, the value obeys setting of "C104".

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 27 | UP: Remote control UP function |
| | | 28 | DWN: Remote control DOWN function |
| | | 29 | UDC: 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/DWN clear mode | C104 | 00 | 0 Hz |
| | | 01 | Memory data when power supply is turned on. |

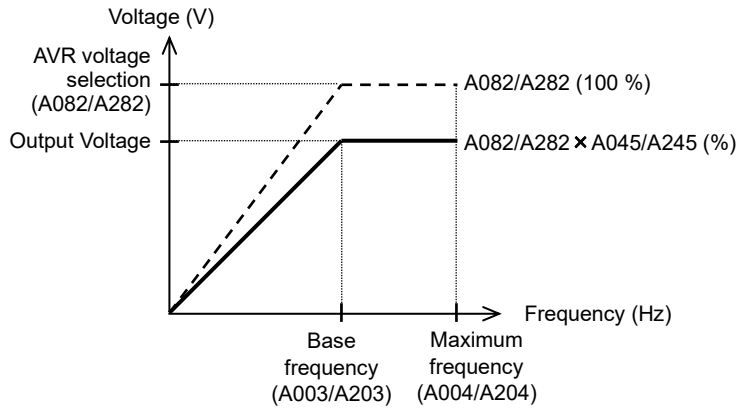
(*1) Do not operate the "UP" / "DWN" terminal or the operator's △/▽ key after the inverter power is shut off. Also, do not perform the "UP" / "DWN" terminal operation and the operator's △/▽ key operation at the same time after the inverter power is shut off. Otherwise, the frequency settings may not be stored correctly.



## 7.5.17 V/f gain setting (A045/A245,A082/A282)

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 selection (A082/A282).
If the motor operation is cranky, try to decrease the gain setting.

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



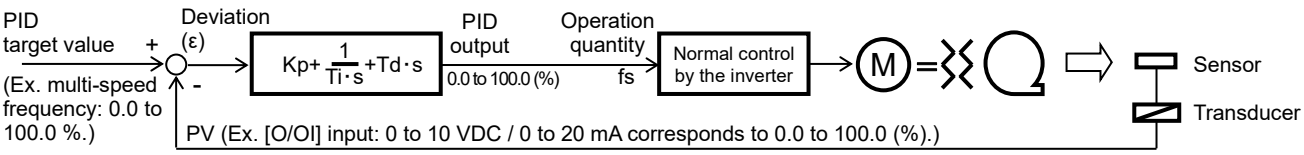
## 7.5.18 PID function (A071 to A078,A156 to A158,C044,C052,C053)

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" or "02" for PID enable (A071).
You can disable the PID function with an external signal during the PID operation. For this purpose, assign function "23" (PID: PID disabled) to one of the intelligent input [1] to [5] functions (C001 to C005). 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 (refer to subsection "7.2.9 Maximum frequency setting"), frequency limiter (refer to subsection "7.5.7 Frequency limit setting"), PID variation range (A078).)

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| PID enable | A071 | 00 | Disabling the PID operation |
| | | 01 | Enabling the PID operation |
| | | 02 | Enabling the PID operation with reverse output |
| PID proportional gain | A072 | 0.00 to 25.00 | Proportional gain |
| PID integral time constant | A073 | 0.0 to 3600. (s) | Integrated gain |
| PID derivative time constant | A074 | 0.00 to 100.0 (s) | Derivative gain |
| PV scale conversion | A075 | 0.01 to 99.99 | Scale for unit conversion of PV data |
| PV source | A076 | 01 | O/OI-L: [0 to 10 VDC] / [4 to 20 mA] |
| | | 02 | Modbus communication |
| | | 10 | Calculation result (*1) |
| Reverse PID action | A077 | 00 | PID input = SP-PV (SP: PID target value) |
| | | 01 | PID input = -(SP-PV) (SP: PID target value) |
| 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 | 0.00 to 400.0 (Hz) | When PID output drops below the operating level, to stop the output. |
| PID sleep function action delay time | A157 | 0.0 to 25.5 (s) | Delay time for the PID sleep function to start. |
| PID sleep function return threshold | A158 | 0.00 to 400.0 (Hz) | Returning level for PID sleep function |
| PID deviation level | C044 | 0.0 to 100.0 (%) | Level to determine the "OD" signal output |
| PV comparison signal output high limit | C052 | 0.0 to 100.0 (%) | Level to determine the "FBV" signal output turning off. |
| PV comparison signal output low limit | C053 | 0.0 to 100.0 (%) | Level to determine the "FBV" signal output turning on. |
| Intelligent input [1] to [5] function | C001 to C005 | 23 | PID: PID Disable |
| | | 24 | PIDC: PID Reset |
| Intelligent output [11] function | C021 | 04 | OD: Output Deviation for PID Control |
| Intelligent relay function | C026 | 31 | FBV: PID Second Stage Output |

(*1) Refer to subsection "7.5.14 Frequency calculation function".
(Note) Do not set the analog input filter (A016) to 31 (500 ms fixed filter) when using PID function. There is a risk of unstable PID operation.

(1) Basic configuration of PID control



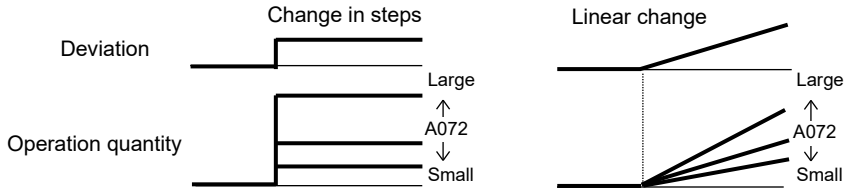

PID target value, PV, PID output: 0.0 to 100.0 (%)
Operation quantity (fs) is converted from PID output, and it is used in normal control by the inverter.
(The Operation quantity (fs) range "0 to maximum frequency (A004/A204) (Hz)" is corresponded to the PID output range "0.0 to 100.0 (%)".)

Kp: Proportional gain (A072), Ti: Integral time (A073), Td: Derivative time (A074),
s: Operator, $\varepsilon$ : Deviation, PV: Process Variable (PID feedback)

(2) PID operation

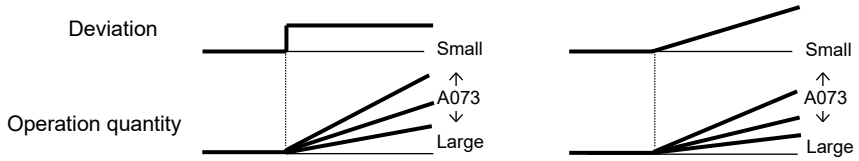
1) P operation

This is an operation that the operation quantity is proportional to the deviation between SP and PV.



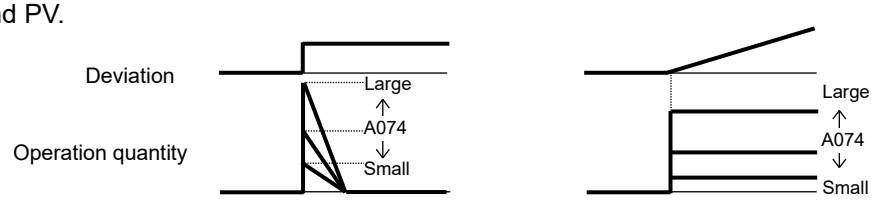

2) I operation

This is an operation that the operation quantity is proportional to the time integral value of the deviation between SP and PV.




3) D operation

This is an operation that the operation quantity is proportional to the change of the deviation between SP and PV.




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 PID operation is a combination of the P operation 1), I operation 2), and D operation 3).

(3) PID scale

The display of the function codes in the below table is scaled by the following equation:

(The converted value) = (Value before conversion) × (A075)

| | | | | | | |
|---|---|---|---|---|---|---|
| d004 | F001 | A011 | A012 | A020 | A220 | A021 |
| A022 | A023 | A024 | A025 | A026 | A027 | A145 |

(4) PV source setting

Select the PV source to be used for the PID feedback signal with the PV source (A076).
Specify the PID target value in the range 0.0 to 100.0 (%) according to the frequency source (A001/A201) other than the PV source (A076). When the digital operator is used, the parameter related to the frequency command such as "F001" is to be the PID target value (setting range: 0.0 to 100.0 (%)).
When you specify the "02" (Modbus communication) for the PV source (A076), transfer data as described below.
Write the setting data (on the assumption that "10000" indicates 100.00 %) 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 (*1) | 0 to 10000 | 0.01 (%) |

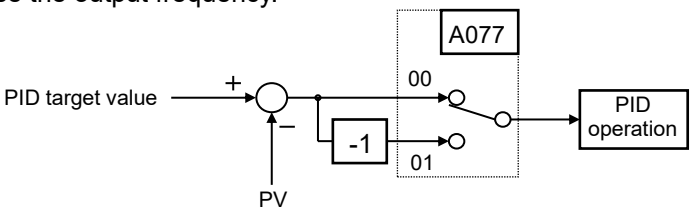
(*1) This register is readable and writable. However, this register can be read only when Modbus communication has been specified for PV source (A076=02). It cannot be read with other settings.

(5) Output of inverted PID deviation

Some sensor characteristics may cause the polarity of the deviation of PV from the target value to be inconsistent with the inverter frequency command. If the inconsistency occurs, specify "01" for the reverse PID action (A077) to invert the polarity of the deviation.

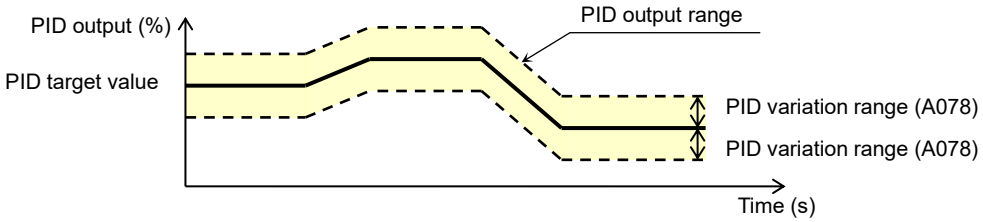
(Example) When controlling the compressor for a refrigerator
Assume that the temperature and voltage specifications of the temperature sensor are - 20°C to + 100°C and 0 to 10 VDC and the target value is 0°C.
If the current temperature is 10°C and the inverter is under the normal type of PID control, the inverter will reduce the output frequency because the PV is larger than the target value.

→ In such a case, specify "01" for the reverse PID action (A077) to invert the PV 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 PID 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 100.0 %.)
The variation of PID output is limited within ± "A078" % from the PID target value.
Setting "0.0" for the PID variation range (A078) disables the PID variation limit function.




(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 PID operation with reverse output) is set for the PID 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 function 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:

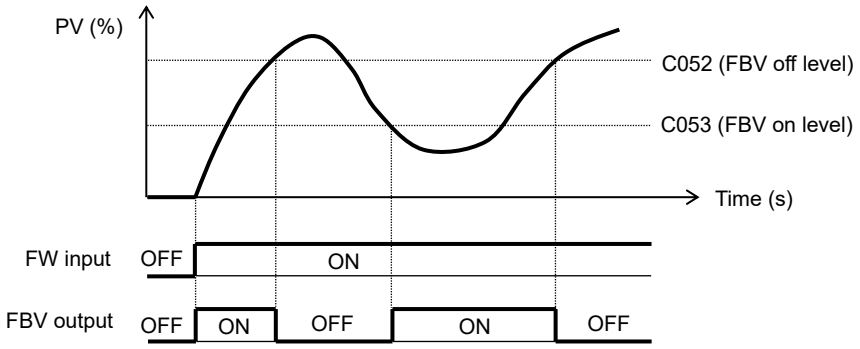
- If the PV does not quickly follow the change in the target value.
  → Increase the PID proportional gain (A072).
- If the PV is unstable although it quickly follows the change in the target value.
  → Reduce the PID proportional gain (A072).
- If considerable time is required until the PV matches the target value.
  → Reduce the PID integral time constant (A073).
- If the PV fluctuates unsteadily.
  → Increase the PID integral time constant (A073).
- If the inverter response is slow even after the P gain is increased.
  → Increase the PID derivative time constant (A074).
- If the PV becomes fluctuant and unsteady when the P gain is increased.
  → Reduce the PID derivative time constant (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 "C044", the "OD" signal can be output to an intelligent output terminal.
A value from 0.0 % to 100.0 % can be set as the level "C044".
To use this output function, assign function "04" (OD) to the intelligent output [11] function (C021) or the intelligent relay function (C026).

(10) PV comparison signal

PV comparison signal can be output to an intelligent output terminal when the PV exceeds the specified range.
To use this signal output function, assign function "31" (FBV) to the intelligent output [11] function (C021) or the intelligent relay function (C026).




(11) Process variable (PV) monitoring (d004)

You can monitor the PV data on the inverter.
When you set a PV scale conversion (A075), the value to be displayed at "d004" can be the product of the PV and the scale.

"d004" = "PV (%)" × "PV scale conversion (A075)"

(12) Reset of PID integration (PIDC)

The PID integration reset function clears the integral result of PID operation.
To use this function, assign function "24" (PIDC) to one of the intelligent input [1] to [5] 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.

(13) PID sleep function

If the operation quantity (fs) is below the PID sleep function action threshold (A156), it stops the output after the PID sleep function action delay time (A157). If the operation quantity (fs) is above the "A156", it start the output after the "A157". If the operation quantity (fs) returns within "A157", PID sleep function doesn't work.
PID sleep function return threshold (A158) should set higher than "A156".
Even if the PID function is disabled, when the frequency command value is below the "A156", it stops 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 "FRS" input terminal function and set the stop mode selection is deceleration stop (b091=00).

### 7.5.19 Energy-saving operation (A085,A086)

The energy-saving 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 operate a fan, pump, or other load that has a reduced torque characteristic.
To use this function, specify "01" for the energy-saving operation mode (A085).
Use the energy-saving mode tuning (A086) to adjust the response and accuracy of the energy-saving operation.
The energy-saving 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.
When the frequency source is control terminal (A001/A201=01), this function may not operate the inverter sufficiently. In this case, please set the analog input filter to 500 ms fixed filter with ± 0.1 Hz hysteresis (A016=31).

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

| Item | Function code | Data | Response | Accuracy |
|---|---|---|---|---|
| Energy-saving mode tuning | A086 | 0.0 (%)<br>↕<br>100.0 (%) | Slow<br>↕<br>Quick | High<br>↕<br>Low |

### 7.5.20 Stabilization constant setting (H006/H206,A045/A245,b083)

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 (H003/H203) and motor poles setting (H004/H204) to determine whether the settings match the motor specifications. If they do not match, readjust the settings.
As an adjustment guide, if the inverter is driving a motor of which the capacity is lower than the inverter rating, 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 (A045/A245)

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

## 7.5.21 2nd motor control function (SET) (C001 to C005)

The 2nd 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 one of the intelligent input [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 |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 08 | SET: Set 2nd motor data |

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

F002/F202: Acceleration time (1)
F003/F203: Deceleration time (1)
A001/A201: Frequency source
A002/A202: Run command source
A003/A203: Base frequency
A004/A204: Maximum frequency
A020/A220: Multi-speed frequency 0
A041/A241: Torque boost selection
A042/A242: Manual torque boost value
A043/A243: Manual torque boost frequency
A044/A244: V/f characteristic curve
A045/A245: V/f gain
A046/A246: Voltage compensation gain for automatic torque boost
A047/A247: Slip compensation gain for automatic torque boost
A061/A261: Frequency upper limit
A062/A262: Frequency lower limit
A081/A281: AVR function selection
A082/A282: AVR voltage selection
A092/A292: Acceleration time (2)
A093/A293: Deceleration time (2)
A094/A294: Selection method to switch to Acc2/Dec2 profile
A095/A295: Acc1 to Acc2 frequency transition point
A096/A296: Dec2 to Dec1 frequency transition point
b012/b212: Level of electronic thermal (calculated within the inverter from current output)
b013/b213: Electronic thermal characteristic
b021/b221: Overload restriction operation mode
b022/b222: Overload restriction level
b023/b223: Deceleration rate at overload restriction
C041/C241: Overload warning level
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 motor controls, confirm 1st or 2nd motor control settings with the ON/OFF states of the "SET" terminal.
Please perform the change during the inverter and the motor is stopped.
This function is effective during an inverter stop.

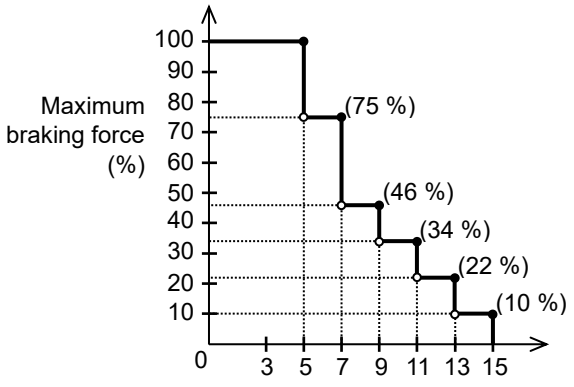
## 7.5.22 DC braking (DB) function (A051 to A059,C001 to C005)

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. (when the inverter starts and stops.) |
| | | 02 | Internal DC braking is enabled. (when the frequency command is equal or less than "A052".) |
| DC braking frequency | A052 | 0.00 to 60.00 (Hz) | With internal DC braking enabled, DC braking is performed when the frequency command is less than this setting 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 frequency has reached or the "DB" terminal has been turned on. |
| DC braking force for deceleration / DC braking force at start | 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 detection (See examples 1-a to 6-a). |
| | | 01 | Level detection (See examples 1-b to 6-b). |
| DC braking time at start | A058 | 0.0 to 10.0 (s) | This setting is valid for the internal DC braking. DC braking is started when the run command is input. |
| Carrier frequency during DC braking | A059 | 2.0 to 15.0 (kHz) | Carrier frequency at the DC braking |
| Intelligent input [1] to [5] function | C001 to C005 | 07 | DB: External DC braking |

(1) Carrier frequency during DC braking

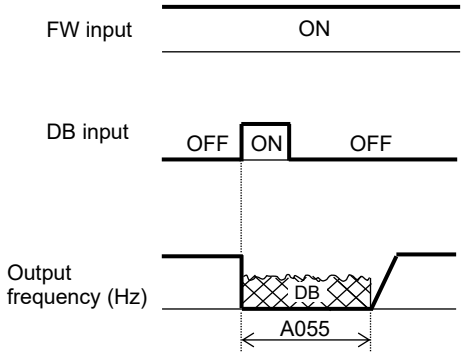
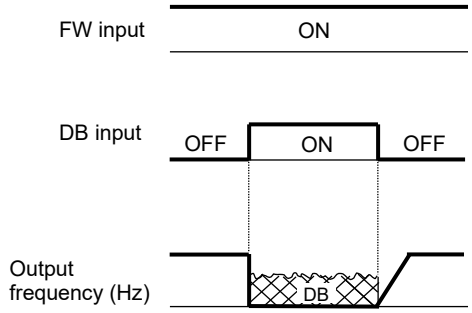
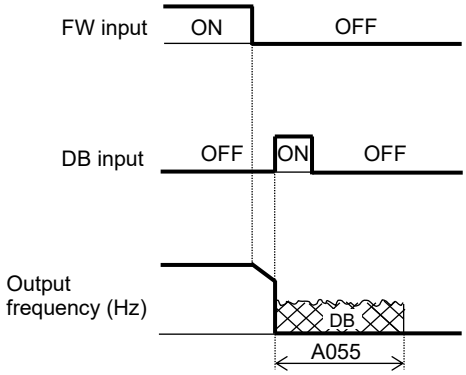
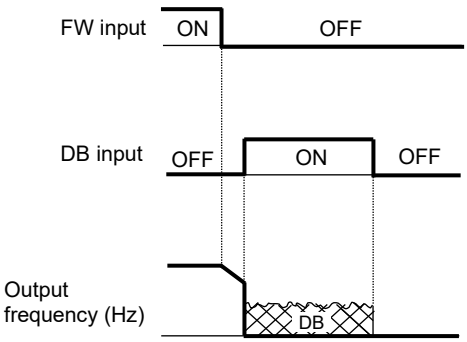
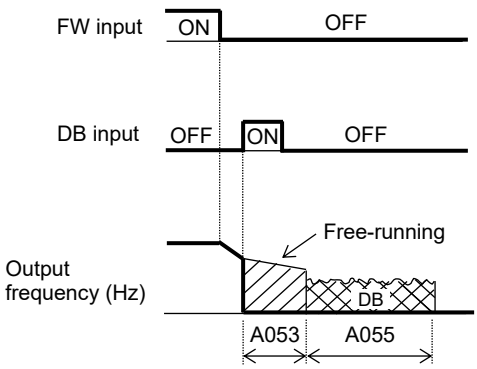
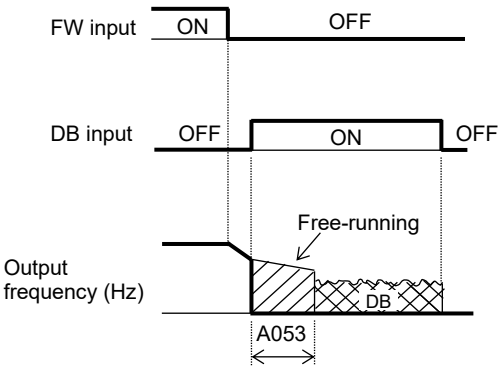
Use the carrier frequency during DC braking (A059) to specify the carrier frequency for DC braking. But the braking force is reduced automatically when "A059" is set to 5.0 kHz or more. For detailed decreasing ratio, refer to the diagram "DC braking force limiter" below.




DC braking force limiter

(2) External DC braking

Assign function "07" (DB) to one of the intelligent input [1] to [5] functions (C001 to C005).
DC braking is controlled by ON/OFF of "DB" terminal when the setting of DC braking enable (A051) is "00" (Disabled) and "01" (Enabled during stop).
Adjust the braking force by adjusting the DC braking force for deceleration (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 be free-running 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.

<table>
<tr><th>(a) Edge mode (A056=00)</th><th>(b) Level mode (A056=01)</th></tr>
<tr><td>(Example 1-a) When the inverter is running:<br> 
</td><td>(Example 1-b) When the inverter is running:<br> 
</td></tr>
<tr><td>(Example 2-a)<br>When the inverter is decelerating and "A053=0.0":<br> 
</td><td>(Example 2-b)<br>When the inverter is decelerating and "A053=0.0":<br> 
</td></tr>
<tr><td>(Example 3-a)<br>When the inverter is decelerating and "A053≠0.0":<br> 
</td><td>(Example 3-b)<br>When the inverter is decelerating and "A053≠0.0":<br> 
</td></tr>
</table>

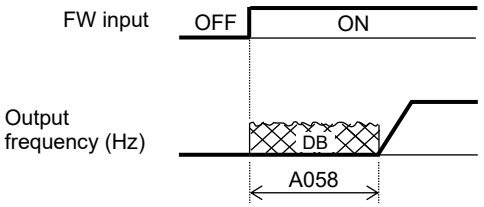
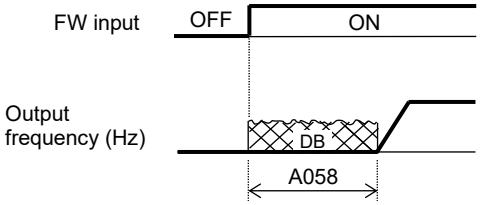
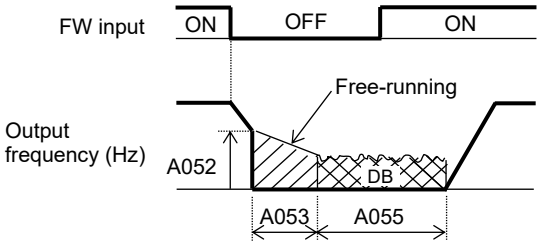
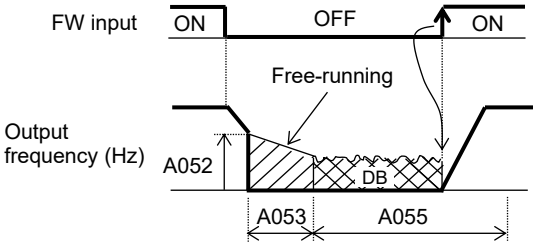
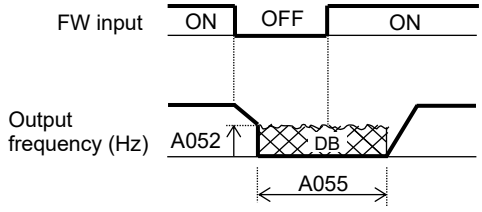
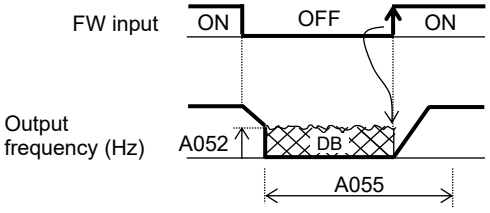
Note) The output frequency is 0 Hz when the inverter state is free-running or DB operating.

(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 for deceleration (A054).
Set the output frequency at which to start DC braking by using the DC braking frequency (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 is turned off, and the motor will be free-running 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 for deceleration (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 for deceleration (A055). If the start command is input during DC braking, the inverter starts the normal motor operation, regardless of the DC braking time for deceleration (A055). (See examples 5-b and 6-b.)

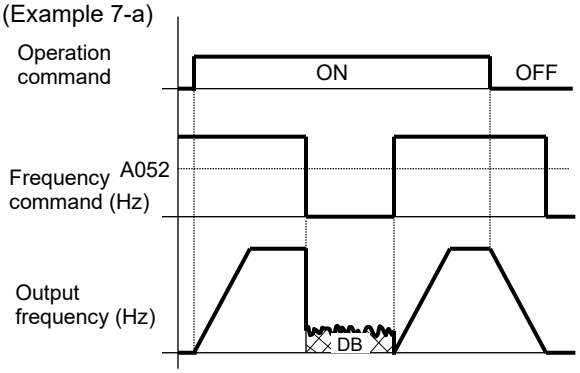
<table>
<tr><th>(a) Edge mode (A056=00)</th><th>(b) Level mode (A056=01)</th></tr>
<tr><td>(Example 4-a) When the start command is input:<br> 
</td><td>(Example 4-b) When the start command is input:<br> 
</td></tr>
<tr><td>(Example 5-a)<br>When the stop command is input and "A053≠0.0":<br> 
</td><td>(Example 5-b)<br>When the stop command is input and "A053≠0.0":<br> 
</td></tr>
<tr><td>(Example 6-a)<br>When the stop command is input and "A053=0.0":<br> 
</td><td>(Example 6-b)<br>When the stop command is input and "A053=0.0":<br> 
</td></tr>
</table>

Note) The output frequency is 0 Hz when the inverter state is free-running or DB operating.

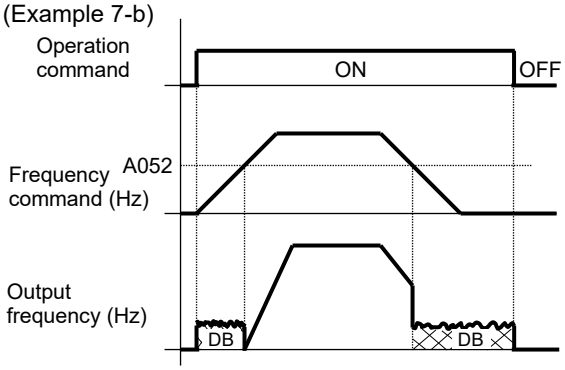
(4) Internal DC braking (A051=02)

You can also operate the internal DC braking function so that DC braking is applied to the motor when the inverter frequency command falls to the DC braking frequency (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., "FW" 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 (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)

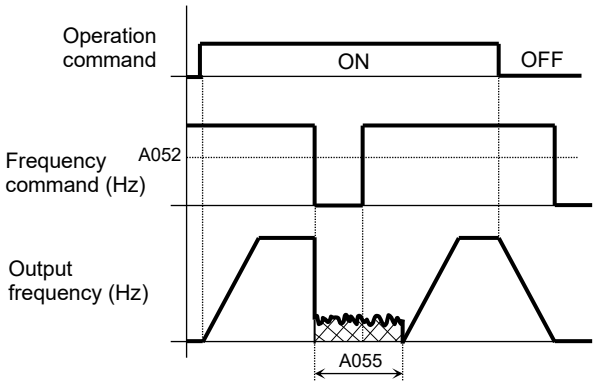



(Example 7-b)

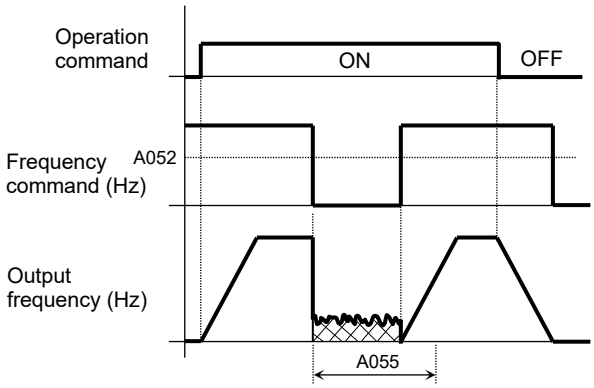



How the inverter returns to the normal output varies depending on the setting of the DC braking / edge or level detection for [DB] input (A056).

(a) Edge mode (A056=00)




(b) Level mode (A056=01)




## 7.5.23 Motor capacity and poles setting (H003/H203,H004/H204)

When operating multiple motors with one inverter, select the motor capacity (H003/H203) close to sum of these motor capacities. If the poles of these motors are different, set the smallest motor poles to the motor poles setting (H004/H204).
When the automatic torque boost function is valid, if these settings are wrong, it may cause the torque reduction, or the motor operation is unstable.

| Item | Function code | Data | Description |
|---|---|---|---|
| Motor capacity | H003/H203 | 0.10 to 5.50 (kW) | |
| Motor poles setting | H004/H204 | 2 / 4 / 6 / 8 (poles) | |

## 7.6 Functions related to the operator display

### 7.6.1 STOP/RESET key enable (b087,A002/A202)

The STOP/RESET key enable function allows you to enable or disable the motor-stopping and trip reset functions by the STOP/RESET key of the standard panel or the digital operator.
This function is effective only when the operator (02) is not specified for the run command source (A002/A202).
If the operator (02) is specified for the run command source (A002/A202), the motor-stopping and trip reset functions by the STOP/RESET key are enabled regardless of this setting (STOP/RESET key enable).

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

### 7.6.2 Software lock (SFT) function (b031,b166,C001 to C005)

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 intelligent input [1] to [5] functions (C001 to C005).
It is the mode for allowing changes during operation when "b031" is set "10", high level access mode.

| Function code | Data | "SFT" terminal | Description |
|---|---|---|---|
| b031 | 00 | ON / OFF | All parameters except "b031" are locked when "SFT" terminal is ON. |
| | 01 | ON / OFF | All parameters except "b031","F001","A020","A220","A021" to "A027", and "A038" are locked when "SFT" terminal is ON. |
| | 02 | — | All parameters except "b031" are locked. |
| | 03 | — | All parameters except "b031","F001","A020","A220","A021" to "A027", and "A038" are locked. |
| | 10 | — | High level access including "b031" is available.<br>See the "Run Mode Edit - B" column described in each tables of the section "13.1 Operator" for the accessible parameters in this high level access mode. |

The following function can prohibit Read/Write by WOP.

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

### 7.6.3 Forcible-operation from the operator (OPE) function (C001 to C005)

The forcible-operation from the operator (OPE) function allows you to forcibly enable the inverter operation from the operator when the 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 operator control function (OPE) is assigned is OFF, frequency and operation commands are input from the devices selected by functions "A001/A201" and "A002/A202". When the terminal is ON, the device to input frequency and operation commands is forcibly switched to the operator internally.
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, "OPE" function is given priority.

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 31 | OPE: Operator control |

### 7.6.4 Forcible-operation from terminal (F-TM) function (C001 to C005)

The forcible-operation from terminal (F-TM) function allows you to forcibly enable the inverter operation via control terminal when the control terminal 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 (F-TM) is assigned is OFF, frequency and operation commands are input from the devices selected by functions "A001/A201" and "A002/A202". When the terminal is ON, the device to input frequency and operation commands is forcibly switched to the control terminal internally.
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 |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 51 | F-TM: Force terminal mode |

### 7.6.5 Action selection in case of external operator disconnection (b165)

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

| Item | Function code | Data | Description |
|---|---|---|---|
| Operation at external operator connection loss | b165 | 00 | Trip (E40.x) |
| | | 01 | Trip after deceleration stop (E40.x) |
| | | 02 | Ignore |
| | | 03 | Free-run stop |
| | | 04 | Deceleration stop |

### 7.6.6 Initial display selection (selection of the initial display after power-on) (b038)

The initial display selection function allows you to specify the display that is displayed on the operator immediately after the inverter power is turned on. The table below lists the displays (items) selectable. (The factory setting is "001" (d001).)

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

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

### 7.6.7 Select automatic return to the initial display (b164,b038)

If you do not manipulate the operator for 10 minutes, the operator display automatically changes to the display that you set in the "b038".
To use this function, specify "01" for the automatic return to the initial display (b164).

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

### 7.6.8 NES1-OP display selection (b150)

All keys on the NES1-OP do not work when you connect a remote operator.
This function sets the monitor code to be displayed in NES1-OP.

| Item | Function code | Data | Description |
|---|---|---|---|
| Display external operator connected | b150 | 001 to 060 | "d001" to "d060" corresponding to the monitor item. |

### 7.6.9 Data Read/Write selection (b166)

This function is to choose whether to allow read/write of data for the WOP. Refer to subsection "7.6.2 Software lock (SFT) function".

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

### 7.6.10 Display limitation function (DISP) (C001 to C005,b038)

To use this function, assign function "86" (DISP) to one of the intelligent input [1] to [5] functions (C001 to C005).
While the "DISP" terminal is turned ON, the operator displays a parameter chosen by initial display selection (b038). And cannot select other parameter.

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

## 7.6.11 Function code display restriction (b037)

The function code display restriction function allows you to arbitrarily switch the display mode or the display content on the 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 display (d***) only |

(1) Function-specific display mode (b037=01)

If a specific function has not been selected, the operator 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, A244, A245, A261, A262, A281, A282, A292 to A296, b212, b213, b221 to b223, C241, H203, H204 and H206 |
| 2 | (A044 = 02) or/<br>(One of C001 to C005 = 08 and A244 = 02) | b100 to b113 |
| 3 | (b013 = 02) or/<br>(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<br>(A244 = 00 or 01) | A241 to A243, A246, A247 |
| 6 | (A051 = 01 or 02) or/<br>(One of C001 to C005 = 07) | A052 to A059 |
| 7 | One of C001 to C005 = 06 | A054, A055, A059 |
| 8 | A071 = 01 or 02 | d004, A072 to A078, A156 to A158, C044, C052, C053 |
| 9 | (A097 = 01 to 03) or/ (A098 = 01 to 03) | A131, A132 |
| 10 | b050 = 01 to 03 | b051 to b054, b133, b134 |
| 11 | b130 = 01 to 03 | b131 to b134 |
| 12 | C070 = 01 | C071 to C078 |

(2) Data comparison display mode (b037=03)

The operator displays only the parameters that have been changed from the factory settings, except all monitoring indications (d***), code "F001" and code "b037".

(3) Basic display mode (b037=04)

The operator 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 time (1) |
| 4 | F003 | Deceleration time (1) |
| 5 | F004 | RUN key routing |
| 6 | A001 | Frequency source |
| 7 | A002 | Run command source |
| 8 | A003 | Base frequency |
| 9 | A004 | Maximum frequency |
| 10 | A020 | Multi-speed frequency 0 |
| 11 | A021 | Multi-speed frequency 1 |
| 12 | A022 | Multi-speed frequency 2 |
| 13 | A023 | Multi-speed frequency 3 |
| 14 | A044 | V/f characteristic curve |
| 15 | A045 | V/f gain |
| 16 | A085 | Energy-saving operation mode |
| 17 | b001 | Restart mode on undervoltage trip |
| 18 | b002 | Allowable undervoltage time |
| 19 | b008 | Restart mode on overvoltage / overcurrent trip |
| 20 | b011 | Retry wait time on overvoltage / overcurrent trip |
| 21 | b031 | Software lock mode selection |
| 22 | b037 | Function code display restriction |
| 23 | b083 | Carrier frequency |
| 24 | b084 | Initialization mode (parameters or trip history) |
| 25 | b130 | Deceleration overvoltage suppression enable |
| 26 | b131 | Deceleration overvoltage suppression level |
| 27 | b180 | Initialization trigger |
| 28 | C001 | Intelligent Input [1] function |
| 29 | C002 | Intelligent Input [2] function |
| 30 | C003 | Intelligent Input [3] function |
| 31 | C004 | Intelligent Input [4] function |
| 32 | C005 | Intelligent Input [5] function |
| 33 | C021 | Intelligent output [11] function |
| 34 | C036 | Intelligent relay active state |

(4) Monitor display (d***) only (b037=05)

The operator displays only the parameters of all monitoring indications (d***) and "b037".

## 7.6.12 Button sensitivity selection (C151)

This function sets RUN/STOP/RESET key sensitivity of the standard panel. If set to "no", the key is disabled.

| Item | Function code | Data | Description |
|---|---|---|---|
| Button sensitivity selection | C151 | 0 to 250 | Data times 2 ms |
| | | no | Disabled the RUN/STOP/RESET key |

## 7.6.13 Scroll sensitivity selection (C152)

On 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 Scroll sensitivity selection (C152).
This function only works when an operator except WOP is connected.

| Item | Function code | Data | Description |
|---|---|---|---|
| Scroll sensitivity selection | C152 | 1 to 20 | 1: (Faster) ←——→ 20: (Slower) |

## 7.7 Functions about restarting

### 7.7.1 Retry (UnderVoltage, OverCurrent, OverVoltage) (b001 to b005,b007,b008,b010,b011,b028 to b030)

(1) Retry (restart) after undervoltage

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 restart mode on undervoltage trip (b001), the inverter will retry the motor operation for the number of times set as "b005" after an undervoltage, and then trip if all retries fail. (The inverter will not trip if you specify an unlimited number of retries (b005=01).)
With function "b004" you can select whether to make the inverter trip when an 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 |
|---|---|---|---|
| Restart mode on undervoltage trip (*3)(*4) | b001 | 00 | Tripping |
| | | 01 | Restarting the motor with 0 Hz |
| | | 02 | Restarting the motor with active frequency matching. (See example 1.) (*2)(*5) |
| | | 03 | Restarting the motor with active frequency matching. The inverter trips after decelerating and stopping the motor. (*1)(*2)(*5) |
| Allowable undervoltage 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 | b003 | 0.3 to 100.0 (s) | Time to wait until restarting the motor. |
| Instantaneous undervoltage trip alarm enable (*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 undervoltage trip | 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 motor frequency becomes less than the frequency set here during motor free-running. (See examples 3 and 4.) |
| Current level of active frequency matching | b028 | (0.20 to 2.00) × inverter rated current (A) | Current limit for restarting with active frequency matching. |
| Deceleration rate of active frequency matching | b029 | 0.1 to 3000. (s) | Duration of frequency lowering when restarting with active frequency matching. |
| Start frequency of active frequency matching | b030 | 00 | Frequency set when the inverter output has been shut off. |
| | | 01 | Maximum frequency |
| | | 02 | Newly frequency command |
| Intelligent output [11] function | C021 | 05 | AL: Alarm Signal |
| Intelligent relay function | C026 | 09 | UV: Undervoltage |

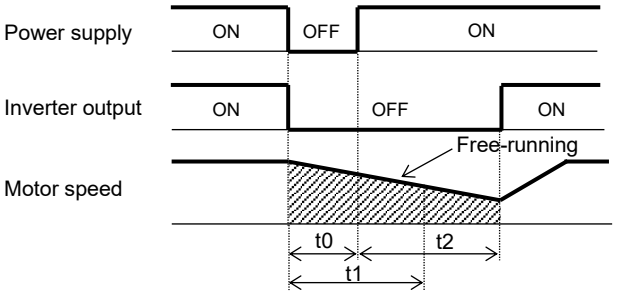
About (*1) to (*5), see the next page.

(*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 of the base frequency.
2) The voltage induced on the motor is attenuated quickly.
(*3) Even when a retry operation ("01" to "03") is specified for the restart mode on undervoltage trip (b001) and a disabling undervoltage trip ("00" or "02") is specified for the instantaneous undervoltage trip alarm enable (b004), the inverter will trip if the undervoltage failure continues over the allowable undervoltage time (b002). (See example 2.)
When retry mode is trip (b001=00) and the instantaneous undervoltage time is within allowable undervoltage time (b002) setting, the undervoltage trip will occur.
(*4) Even when a retry operation is specified for "b001", the inverter will trip if the undervoltage status continues for 40 seconds or more.
(*5) When starting the motor with active frequency matching is selected, the inverter may restart suddenly by alarm resetting, resetting and retry-start.

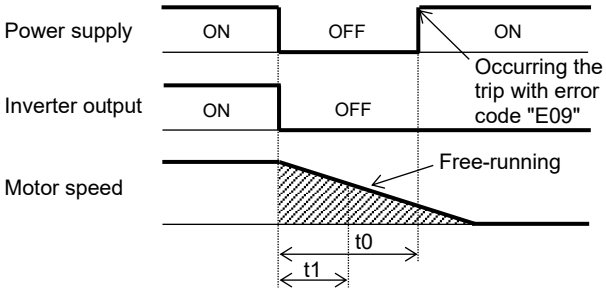
The figures below show the timing charts for starting with active frequency matching (when "02" is specified for the restart mode on undervoltage trip (b001)).

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

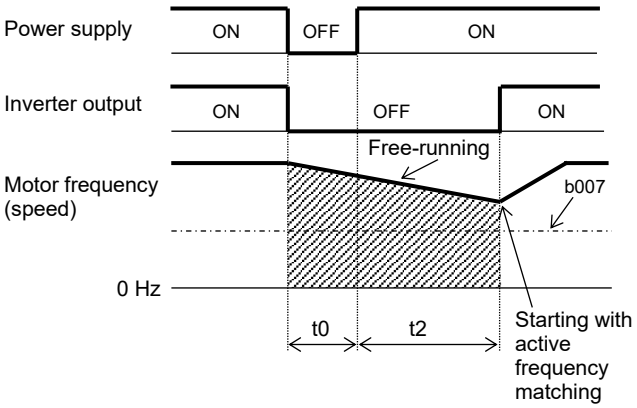
(Example 1) When "t0" is equal or less than "t1".



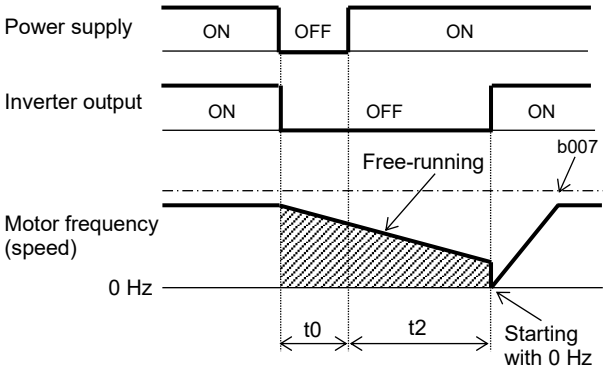

(Example 2) When "t0" is more than "t1".




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




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



(2) Retry (restart) after overcurrent, overvoltage

You can select tripping or retrying (restarting) the motor operation as the inverter operation to be performed at the occurrence of overcurrent or overvoltage.
If you specify a retry operation for the restart mode on overvoltage / overcurrent trip (b008), the inverter will retry the motor operation for the number of times set as "b010" after an overcurrent or overvoltage, and then trip if all retries fail.
When selecting a retry operation, also set the retry conditions listed below according to the system to be driven by the inverter.

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Restart frequency threshold | b007 | 0.00 to 400.0 (Hz) | Restarting the motor with 0 Hz if the motor frequency becomes less than the frequency set here during motor free-running. (See above examples 3 and 4.) |
| Restart mode on overvoltage / overcurrent trip | b008 | 00 | Tripping |
| | | 01 | Restarting the motor with 0 Hz |
| | | 02 | Restarting the motor with active frequency matching. (*2) |
| | | 03 | Restarting the motor with active frequency matching. The inverter trips after decelerating and stopping the motor. (*2) |
| Number of retry on overvoltage / overcurrent trip | b010 | 1 to 3 (times) | Number of retries to be made after the occurrence of overvoltage or overcurrent. (*1) |
| Retry wait time on overvoltage / overcurrent trip | b011 | 0.3 to 100.0 (s) | Time to wait until restarting the motor. |
| Current level of active frequency matching | b028 | (0.20 to 2.00) × inverter rated current (A) | Current limit for restarting with active frequency matching. |
| Deceleration rate of active frequency matching | b029 | 0.1 to 3000. (s) | Duration of frequency lowering when restarting with active frequency matching. |
| Start frequency of active frequency matching | b030 | 00 | Frequency set when the inverter output has been shut off. |
| | | 01 | Maximum frequency |
| | | 02 | Newly frequency command |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 05 | AL: Alarm Signal |

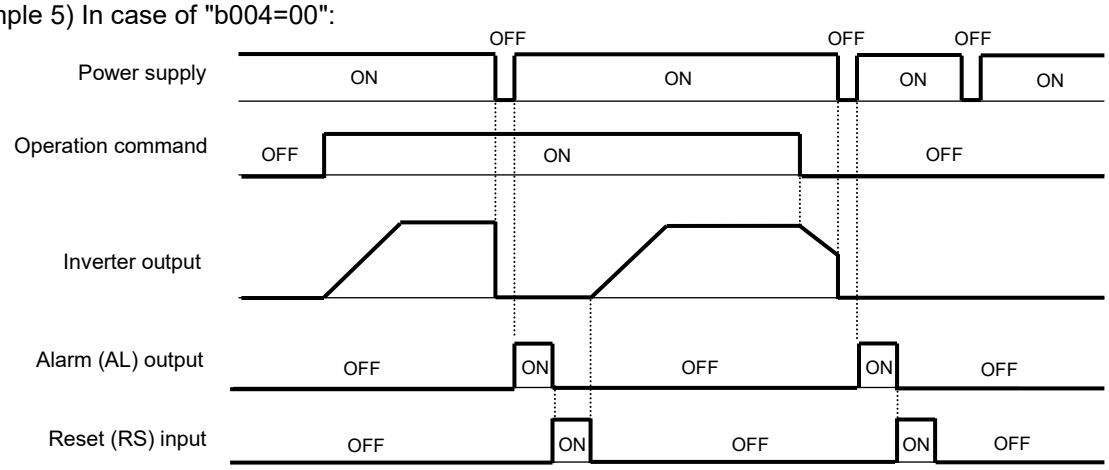
(*1) Even when a retry operation is specified for "b008", the inverter will trip if the cause of trip is not removed by the end of the retry wait time on overvoltage / overcurrent trip (b011). If this occurs, prolong the retry wait time.
(*2) When starting the motor with active frequency matching is selected, inverter may restart suddenly by alarm resetting, resetting and retry-start.

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

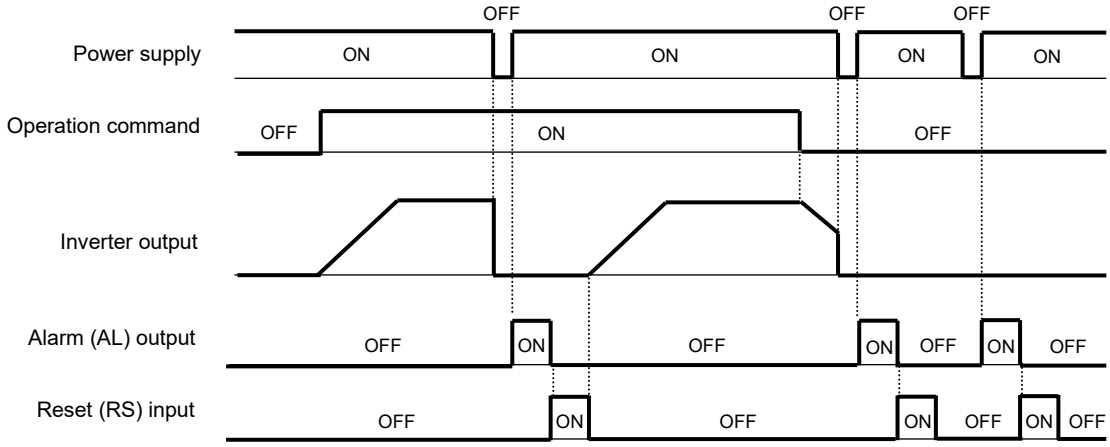
Use function "b004" to specify whether to output an alarm when undervoltage is occurred in the stopped state. The inverter outputs the alarm providing the control power remains in the inverter.

Output of the alarms for undervoltage in the stopped state:
Examples 5 to 7 show the alarm output operations with standard settings.

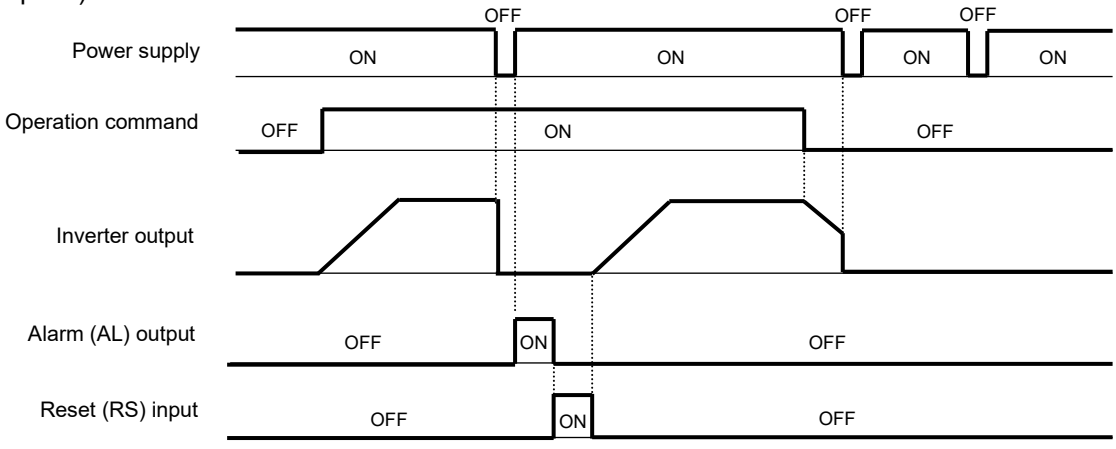
(Example 5) In case of "b004=00":




(Example 6) In case of "b004=01":




(Example 7) In case of "b004=02":

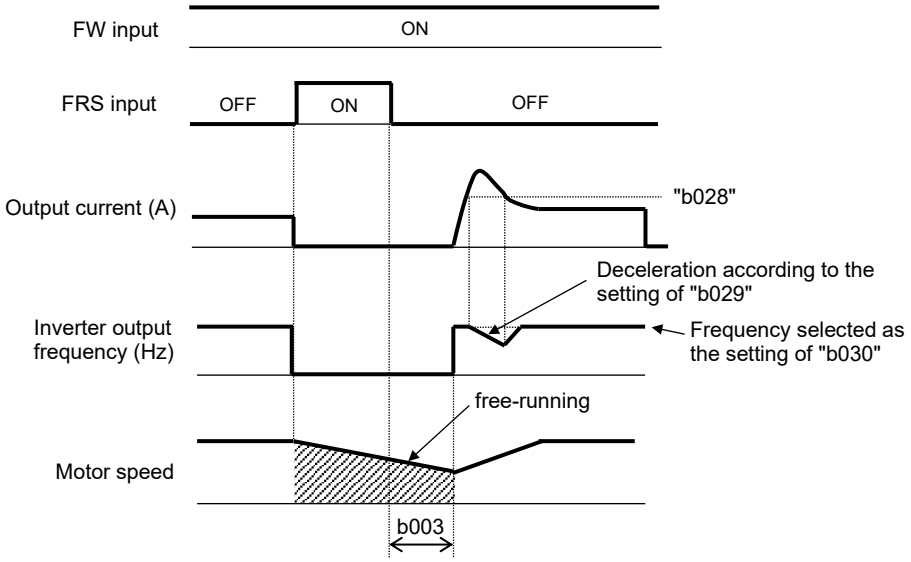


(4) Restarting methods

- Restart with active frequency matching
  The inverter starts the output with the frequency specified for the start frequency of active frequency matching (b030), but if there is a difference between the motor rotation frequency and the specified frequency, the output current increases. If the output current exceeds the current level of active frequency matching (b028), the output frequency is reduced in accordance with the deceleration rate of active frequency matching (b029) to reduce the output current, and restart the output frequency to follow the motor rotation frequency.

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 0000 until the inverter restarts the motor operation.

(Example) In case of after free-run stop:

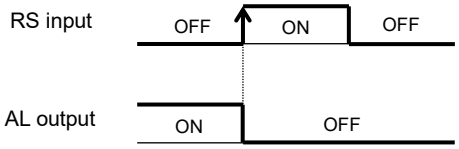


### 7.7.2 Reset (RS) function (b003,b007,C102,C103,C001 to C005)

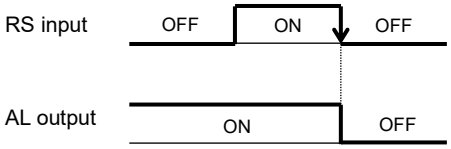
The reset function allows you to recover the inverter from a tripped state.
To perform resetting, press the STOP/RESET key of the standard panel or the operator, or turn the "RS" terminal ON.
To use the control terminal for resetting, assign function "18" (RS) to one of the intelligent input [1] to [5] functions (C001 to C005).
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 active frequency matching, increase the retry wait time before motor restart (b003).
You can select the alarm reset timing with the reset 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 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. Therefore, 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 100.0 (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 motor frequency becomes less than the frequency set here during motor free-running. |
| Reset selection | C102 | 00 | Resetting the trip when the "RS" signal is turned on. (See example 1.)<br>(When operation is normal)<br>Shutting off the inverter output. (See example 3.)<br>(When an error has occurred)<br>Resetting the trip. |
| | | 01 | Resetting the trip when the "RS" signal is turned off. (See example 2.)<br>(When operation is normal)<br>Shutting off the inverter output. (See example 3.)<br>(When an error has occurred)<br>Resetting the trip. |
| | | 02 | Resetting the trip when the "RS" signal is turned on. (See example 1.)<br>(When operation is normal)<br>Disabling the "RS" input. (See example 4.)<br>(When an error has occurred)<br>Resetting the trip. |
| Restart mode after reset | C103 | 00 | Start with 0 Hz. |
| | | 01 | Start with active frequency matching. (See example 5.) |

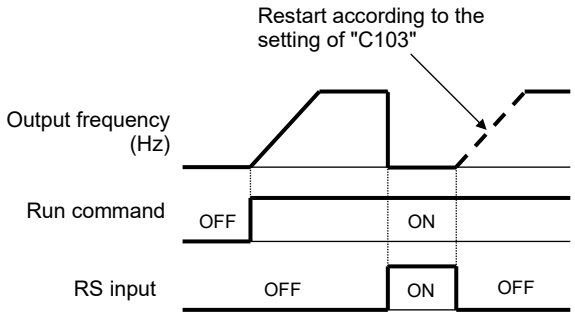
(Example 1) In case of "C102=00 or 02"



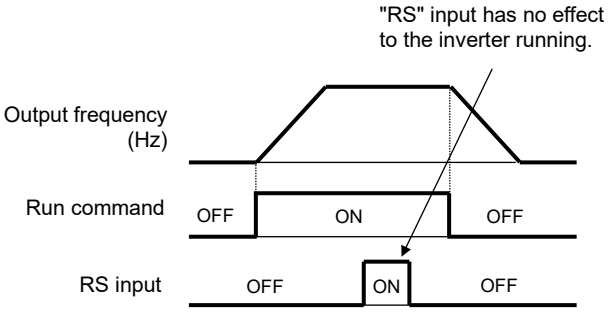

(Example 2) In case of "C102=01"



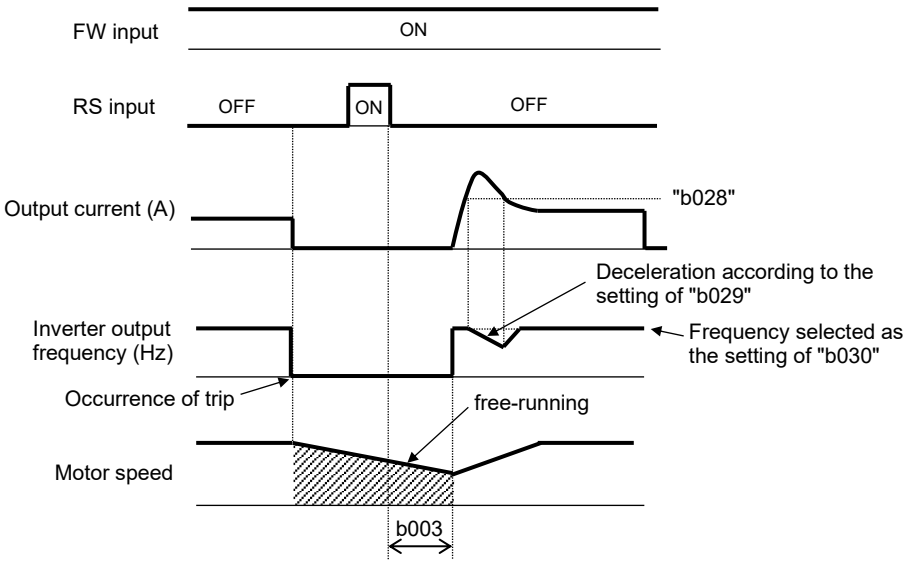

(Example 3) In case of "C102=00 or 01"




(Example 4) In case of "C102=02"




(Example 5) Restarting with active frequency matching




After the retry wait time before motor restart (b003), the inverter restarts the motor with the frequency set as "b030". If the output current exceeds the current level of active frequency matching (b028), the output frequency is reduced in accordance with the deceleration rate of active frequency matching (b029) to reduce the output current, and restart the output frequency to follow the motor rotation frequency.

When the output frequency matches the motor speed, 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".

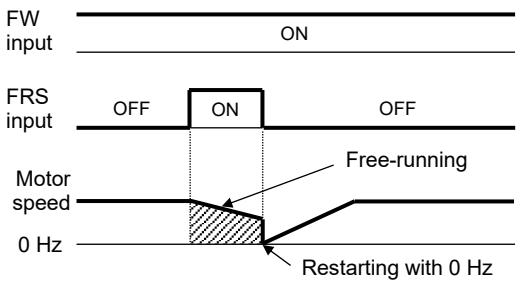
(note) Inverter starts from 0 Hz when reset signal is given during retry waiting because the frequency stored in inverter is cleared.

## 7.7.3 Free-run stop (FRS) function (b003,b007,b028 to b030,b088,C001 to C005)

The free-run stop (FRS) function allows you to shut off the inverter output and 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 intelligent input [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 before motor restart (b003).
However, the inverter does not restart the motor if the operator has been specified for the run command source (A002/A202=02). To restart the motor in such status, enter a new operation command.
You can select the inverter restarting mode with the restart mode after FRS (b088). (See examples 1,2.)
Even when restarting with active frequency matching 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 from the free-run status.

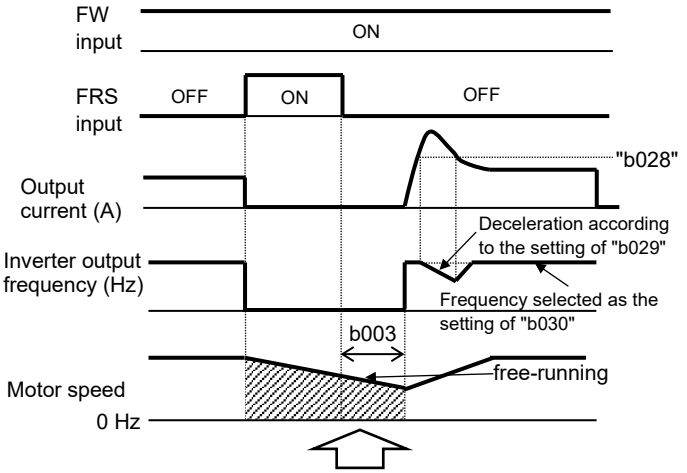
| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Restart mode after FRS | b088 | 00 | Restart with 0 Hz (See example 1.) |
| | | 01 | Restart with active frequency matching (See example 2.) |
| Retry wait time before motor restart | b003 | 0.3 to 100.0 (s) | Time to wait until restarting the motor. |
| Restart frequency threshold | b007 | 0.00 to 400.0 (Hz) | Restart from 0 Hz if the motor frequency at restart is less than this setting. |
| Current level of active frequency matching | b028 | (0.20 to 2.00) × inverter rated current (A) | Current limit for restarting with active frequency matching. |
| Deceleration rate of active frequency matching | b029 | 0.1 to 3000. (s) | Duration of frequency lowering when restarting with active frequency matching. |
| Start frequency of active frequency matching | b030 | 00 | Frequency set when the inverter output has been shut off. |
| | | 01 | Maximum frequency |
| | | 02 | Newly frequency command |
| Intelligent input [1] to [5] function | C001 to C005 | 11 | FRS: Free-run Stop |

(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 frequency matching



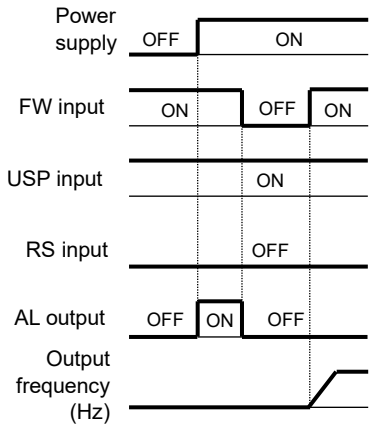

After the "b003", the inverter restarts the motor with the frequency set as "b030". If the output current exceeds the "b028", the output frequency is reduced in accordance with "b029" to reduce the output current, and restart the output frequency to follow the motor rotation frequency.
When the output frequency matches the motor speed, 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".

## 7.7.4 Unattended start protection (USP) function (C001 to C005)

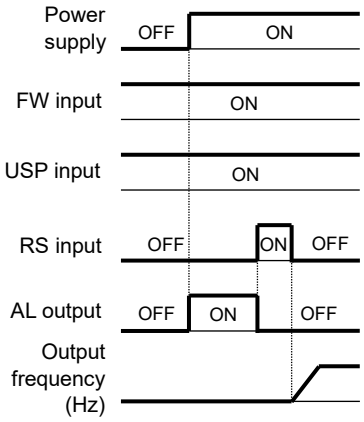
The unattended start protection function allows you to make the inverter trip with error code "E13" displayed if the inverter power is turned on when an operation command has been turned on.
You can recover the inverter from tripping by performing the reset operation or turning the operation command off. (See example 1.)
If the reset operation is performed when 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 intelligent input [1] to [5] functions (C001 to C005).
This function is invalid with the standard panel (RUN/STOP/RESET key).
When a run command is input from the operator or Modbus within two seconds after the power supply injection, the inverter trips with error code "E13".

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

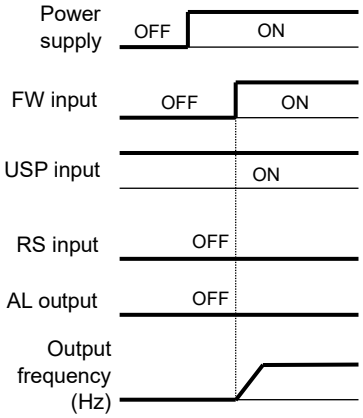
(Example 1) Power on during "FW" on: (Recovery by "FW" off)




(Example 2) Power on during "FW" on: (Recovery by "RS" on)




(Example 3) "FW" on after Power on: (Normal operation)




| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent input [1] to [5] function | C001 to C005 | 13 | USP: Unattended Start Protection |

### 7.7.5 Deceleration and stopping at power failure (nonstop deceleration at instantaneous power failure) (b050 to b054,b133,b134)

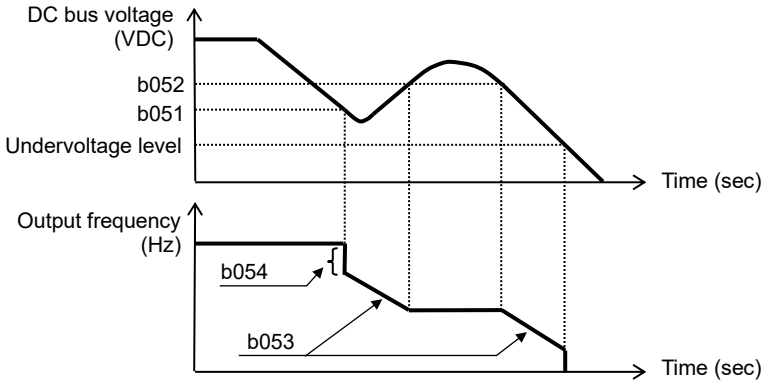
The nonstop deceleration at instantaneous power failure is the function making the inverter decelerate and stop the motor while maintaining the voltage below the overvoltage level when an instantaneous power failure occurs during the inverter operation.
You can select three modes with controlled deceleration on power loss selection (b050).

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Controlled deceleration on power loss selection | b050 | 00 | Disabling the nonstop deceleration function. |
| | | 01 | Enabling the nonstop deceleration function. (DEC & STOP) |
| | | 02 | Enabling the nonstop deceleration function. (*5) (DC bus voltage constant control, no restoration.) |
| | | 03 | Enabling the nonstop deceleration function. (*5) (DC bus voltage constant control, Restoration to be done.) |
| DC bus voltage trigger level of controlled deceleration (*4) | b051 | 0.0 to 400.0 (VDC) | Selectable on 200 V class inverter models. |
| | | 0.0 to 800.0 (VDC) | Selectable on 400 V class inverter models. |
| Overvoltage threshold of controlled deceleration (*1)(*4) | b052 | 0.0 to 400.0 (VDC) | Selectable on 200 V class inverter models. |
| | | 0.0 to 800.0 (VDC) | Selectable on 400 V class inverter models. |
| Deceleration time of controlled deceleration (*3) | b053 | 0.01 to 300.0 (s) | |
| Initial frequency drop of controlled deceleration (*4) | b054 | 0.00 to 10.00 (Hz) | |
| Deceleration overvoltage suppression proportional gain | b133 | 0.00 to 5.00 | Proportional gain setting for DC bus voltage constant control (valid when "b050=02 or 03") |
| Deceleration overvoltage suppression integral time | b134 | 0.0 to 150.0 (s) | Integral time setting for DC bus voltage constant control (valid when "b050=02 or 03") |

(*1) In case of "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.
(*2) 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.
(*3) Setting higher initial frequency drop of controlled deceleration (b054) may result in overcurrent trip due to sudden deceleration.
Setting lower "b054", or longer deceleration time of controlled deceleration (b053) may result in undervoltage trip due to less regeneration power.
(*4) Each of the values of "b051" and "b052" must be undervoltage level (175 V (200 V class), 350 V (400 V class)) or more. This function does not operate when undervoltage occurs. The value of "b051" must be less than that of "b052".
(*5) When "02" or "03" is specified for "b050", PI control is performed so that the DC bus voltage is maintained at a constant level. PI-gain (P-gain, I-gain) can adjust by "b133" and "b134".

<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 "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 "b051" or less, at first the inverter reduces the output frequency by "b054", and then decelerates the motor by "b053".
If the voltage increases to an overvoltage level (exceeding the overvoltage threshold of controlled deceleration (b052)) because of regeneration, the inverter enters the LAD stop state until the voltage falls below "b052".




<2> DC voltage constant control during nonstop operation at instantaneous power failure

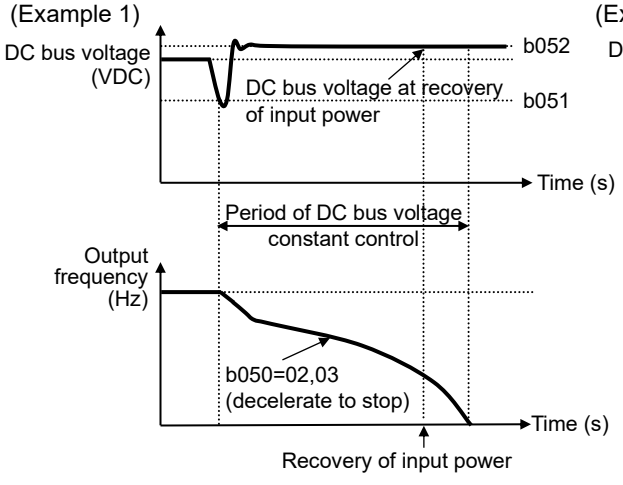
If instantaneous power failure occurs or the DC bus voltage drops during inverter operation, the inverter decelerates the motor while maintaining the DC bus voltage at the level specified as the overvoltage threshold of controlled deceleration (b052).
This function starts operating when all the following conditions are met:

- "02" or "03" has been specified for "b050".
- The inverter is running. (This function does not operate if the inverter is in trip status or stop status or undervoltage status.)
- The input power fails momentarily, or the DC bus voltage drops to "b051" or less.

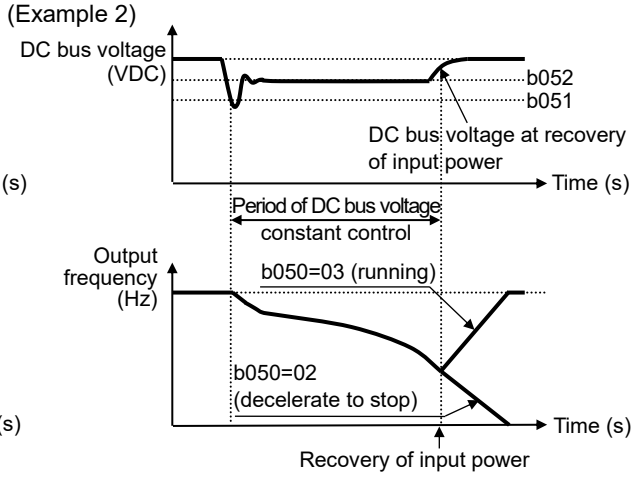
If instantaneous power failure only lasts a short time, the inverter can continue operation without stopping its output. Conversely, if instantaneous power failure causes undervoltage, the inverter stops its output immediately and ends the operation of this function. When power is subsequently restored, the inverter operates according to the restart mode on undervoltage trip (b001).
When "03" is specified for "b050", the inverter can be restored to normal operation if the input power is recovered from instantaneous power failure before the inverter stops its output. The inverter, however, may decelerate and stop the motor if the DC bus voltage is below "b052" when the input power is recovered. The table below lists the differences in operation according to the setting of "b052".
When this function operates and the inverter decelerates and stops the motor, the motor is forcibly stopped even if the run command is ON. To restart the motor, turn on the run command again after confirming the recovery of inverter input power.

| b050 | b052 | Operation |
|---|---|---|
| 02 (No restoration) | "b052" ≥ DC bus voltage at input power recovery | Decelerating and stopping the motor. (DC bus voltage constant control) (Example 1) |
| | "b052" < DC bus voltage at input power recovery | Decelerating and stopping the motor. (Example 2) |
| 03 (Restoration to be done) | "b052" ≥ DC bus voltage at input power recovery | Decelerating and stopping the motor. (DC bus voltage constant control) (Example 1) |
| | "b052" < DC bus voltage at input power recovery | Restarting the motor. (Example 2) |

(Example 1)




(Example 2)




Note) Depending on the proportional gain (b133) and the integral time (b134), the DC bus voltage may be lower than "b052" during the DC bus voltage constant control.

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

### 7.8.1 Alarm signal (AL)

When the inverter detects an anomaly, the inverter output is shut off, the inverter outputs an alarm signal "AL". This is called a trip. If you perform reset operation, the inverter deactivates the trip state. Alarm signal is turned OFF at the same time.

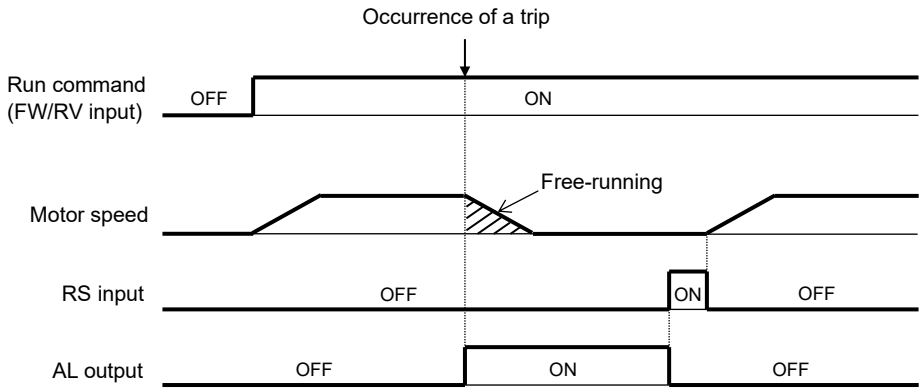
How to perform reset operation.

1) Pressing the STOP/RESET key.
2) To use the reset input terminal (18: RS).

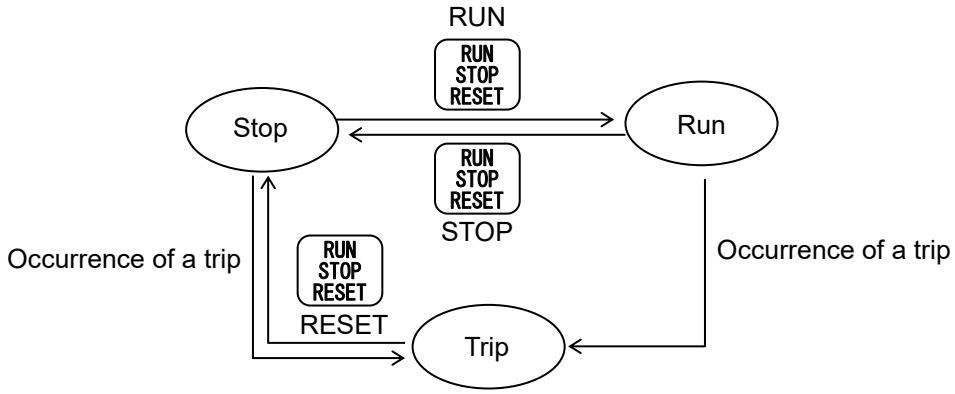
(Part of the cause of trip can not be released by reset operation. In this case, it is required a power cycle.)

Alarm signal (05: AL) can be assigned to the intelligent output [11] function (C021) or intelligent relay function (C026). (The factory setting: "C026=05 (AL)")
Relay contacts are 1c. (Refer to subsection "7.3.5 Intelligent output terminal a/b (NO/NC) selection")

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 05 | AL : Alarm Signal |
| Intelligent input [1] to [5] function | C001 to C005 | 18 | RS: Reset Inverter |




Run/Stop/Trip state transition using the RUN/STOP/RESET key of the standard panel is shown in the following.

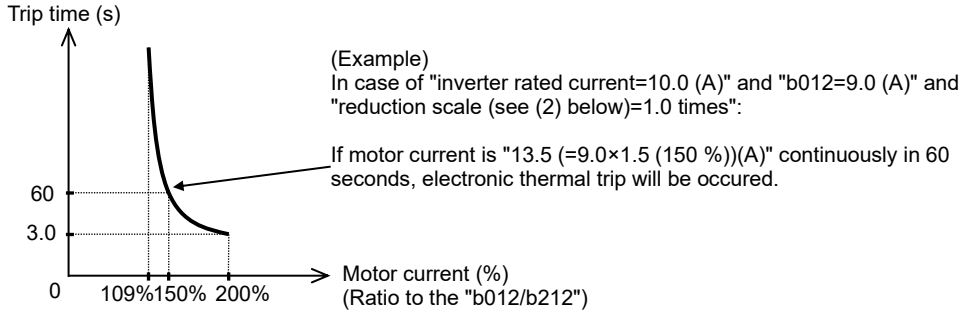


## 7.8.2 Electronic thermal protection (b012/b212,b013/b213,b015 to b020,C061)

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 |
|---|---|---|---|
| Level of electronic thermal (calculated within the inverter from output current) | b012/b212 | (0.20 to 1.00) × inverter rated current (A) | See the example below. |



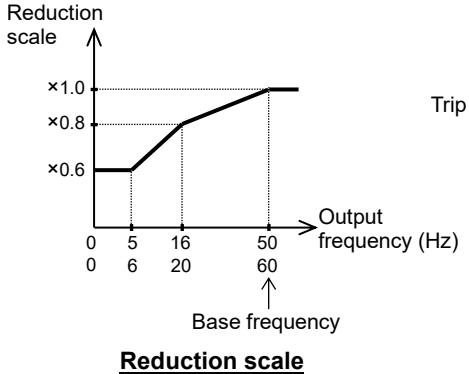

(2) Electronic thermal characteristic

The frequency characteristic set as the electronic thermal characteristic is integrated with the value of "b012" or "b212".
The cooling fan performance of a standard motor lowers when the motor speed is low. So, it is necessary to decrease load (current) at the low speed.
The reduced torque characteristic is designed to match the heat generation by Hitachi's standard 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

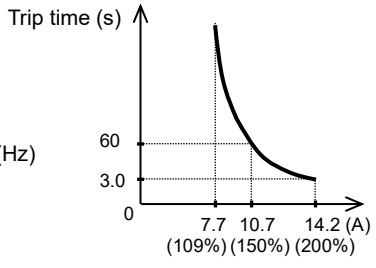
The time-limit characteristic determined by the below graph is integrated with each frequency multiplied by reduction scales.



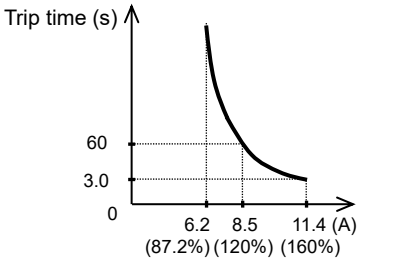

**Reduction scale**

(Example) NES1-015LB* (rated current: 7.1 (A)), Base frequency 60 Hz, "b012=7.1 (A) (1.00×rated current)".

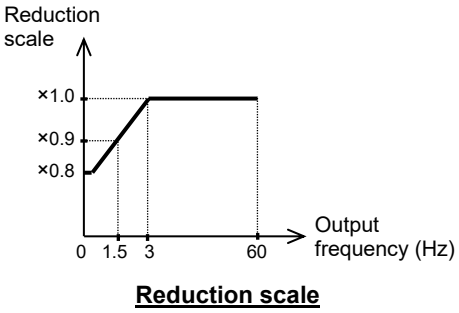
Output frequency: 60 Hz
(Reduction scale: ×1.0)




Output frequency: 20 Hz
(Reduction scale: ×0.8)

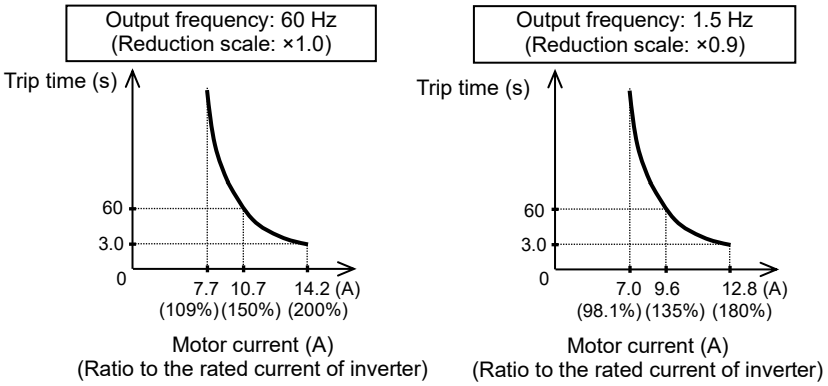


(b) Constant torque characteristic
Make this setting when driving a constant torque motor with the inverter.



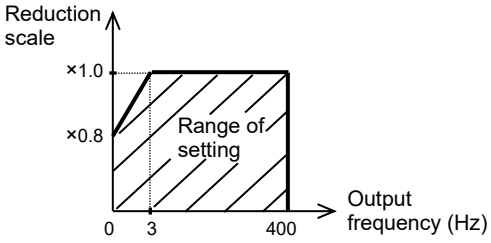

**Reduction scale**

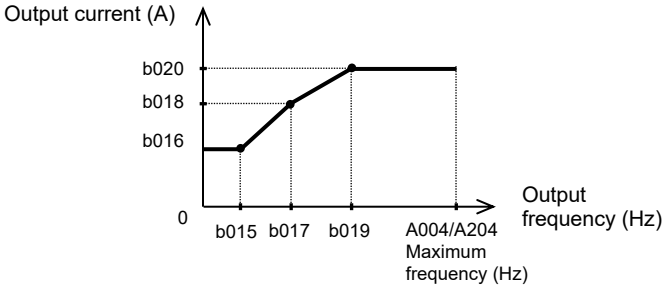
(Example) NES1-015LB* (rated current: 7.1 (A)), Base frequency 60 Hz, "b012=7.1 (A) (1.00×rated current)"




(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<br>Setting condition: b015 ≤ b017 ≤ b019 |
| Free setting, electronic thermal current 1 / 2 / 3 | b016/b018/b020 | (0.00 to 1.00) × inverter rated current (A) | Setting of the current at each breakpoint |




(3) Thermal warning

You can configure this function so that the inverter outputs a warning signal "THM" before the electronic thermal protection operates against motor overheat. You can also set the threshold level to output a warning signal with the electronic thermal warning level (C061).
To output the warning signal, assign function "13" (THM) to the intelligent output [11] function (C021) or the intelligent relay function (C026).
And electronic thermal overload monitoring is displayed on "d104".

| Item | Function code | Data | Description |
|---|---|---|---|
| Electronic thermal warning level | C061 | 0. | Disabling the thermal 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").

## 7.8.3 Overload restriction/overload notice (b021 to b026,b221 to b223,C040,C041/C241)

(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/b023 (b221/b222/b223)" and functional items "b024/b025/b026" separately.

To switch the overload restriction operation between the two settings (setting with "b021/b022/b023 (b221/b222/b223)" and setting with "b024/b025/b026"), assign function "39" (OLR) to one of the intelligent input functions [1] to [5] (C001 to C005). Turn the "OLR" signal ON and OFF to switch between the two settings. (ON: "b024/b025/b026" is valid, OFF: "b021/b022/b023 (b221/b222/b223)" is valid)

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.

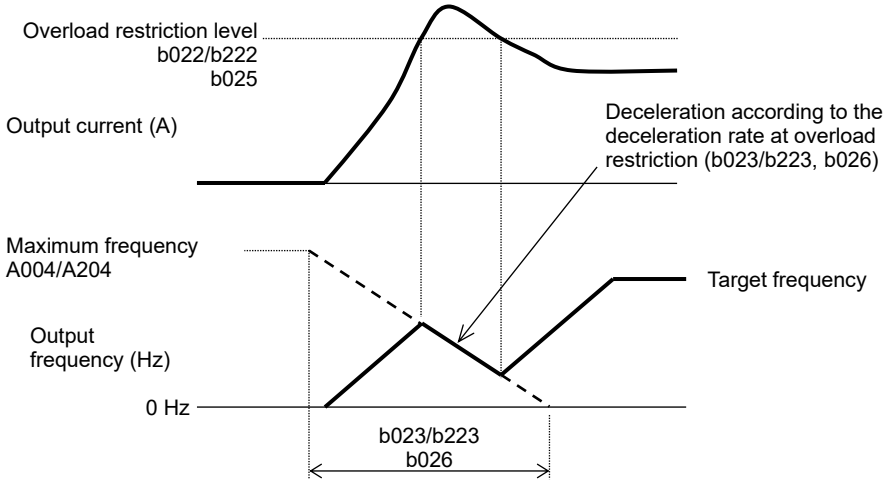
When this function operates during acceleration, the acceleration time is prolonged over the set time.

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. (refer to subsection "7.2.6 Acceleration/deceleration time setting")
- Increase the overload restriction level (b022/b222/b025).

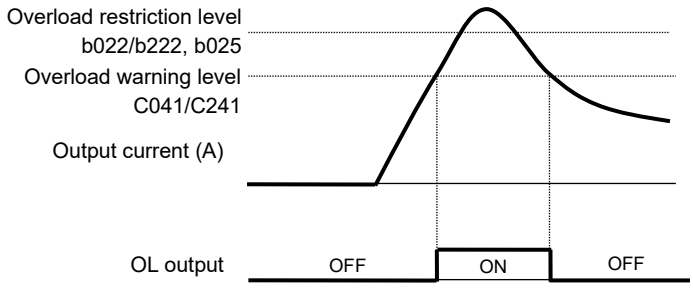
| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Overload restriction operation mode | b021/b221 b024 | 00 | Disabling the overload restriction. |
| | | 01 | Enabling the overload restriction during acceleration and constant speed operation. |
| | | 02 | Enabling the overload restriction during constant speed operation. |
| Overload restriction level | b022/b222 b025 | (0.20 to 2.00) × inverter rated current (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 |
| Intelligent input function [1] to [5] | C001 to C005 | 39 | OLR: Terminal to switch the overload restriction setting |



(2) Overload notice function

The overload notice function allows you to make the inverter output an overload notice signal "OL" 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 machine from being stopped by the overload protection of the inverter.
To use this function, assign function "03" (OL) to the intelligent output [11] function (C021) or the intelligent relay function (C026).

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Output mode of overload warning | C040 | 00 | Enabling the warning output during acceleration, deceleration, and constant speed. |
| | | 01 | Enabling the warning output during constant speed only. |
| Overload warning level | C041/ C241 | (0.00 to 2.00) × inverter rated current (A) | Specifying the current at which to output the "OL" signal (overload advance notice signal). |
| Intelligent output [11] function Intelligent relay function | C021 C026 | 03 | OL: Overload Advance Notice Signal |

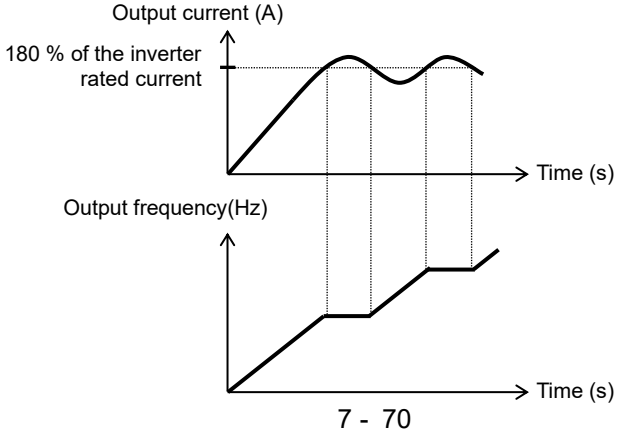



## 7.8.4 Overcurrent restraint (b027)

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 OC suppression selection (b027).

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

Note1: 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.
Note2: When an acceleration time is extremely short for the load, overcurrent trip may occur. In this case, please adjust an acceleration time.
Note3: In the case of enabling the overcurrent restraint, it may occur an inverter trip at the time of overcurrent restraint function operation depending on a motor.



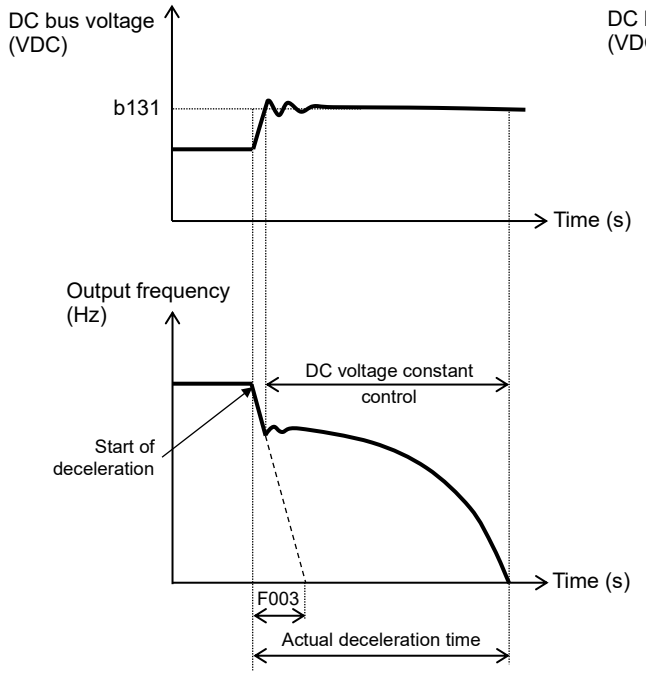
## 7.8.5 Overvoltage suppression during deceleration (b130 to b134)

The overvoltage 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 deceleration overvoltage suppression enable (b130).
When "01" (enabled (controlled deceleration)) is specified for the deceleration overvoltage suppression enable (b130), the inverter will decelerate by keeping the DC bus voltage at deceleration overvoltage suppression level (b131).
When "02" (enabled at the deceleration (with acceleration)) or "03" (enabled at the constant and deceleration (with acceleration)) is specified for the deceleration overvoltage suppression enable (b130), the inverter will start acceleration (the limit: maximum frequency (A004)) according to the deceleration overvoltage suppression const. (b132) if the DC bus voltage exceeds the deceleration overvoltage suppression level (b131). Subsequently, the inverter will restart deceleration when the DC bus voltage falls below "b131".

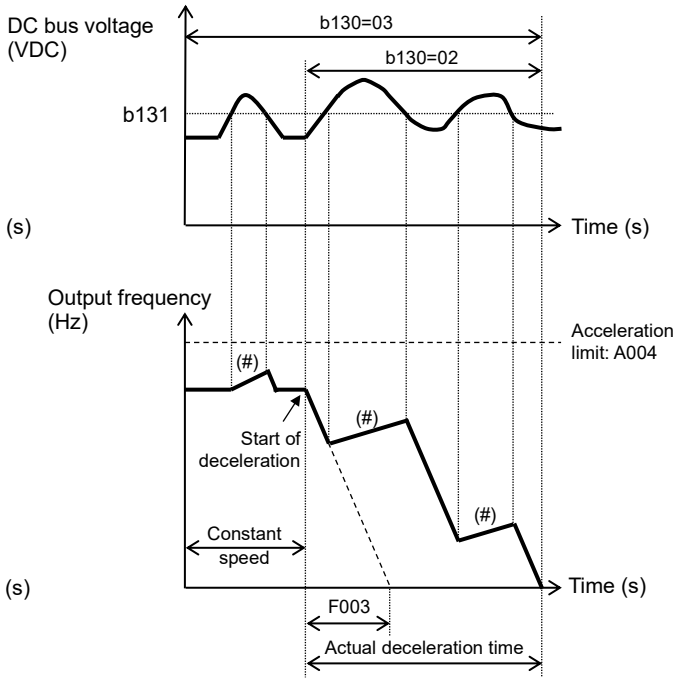
| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Deceleration overvoltage suppression enable | b130 | 00 | Disabled |
| | | 01 | Enabled (with controlled deceleration) (See example 1.) (*5) |
| | | 02 | Enabled at the deceleration (with acceleration) (See example 2.) |
| | | 03 | Enabled at the constant and deceleration (with acceleration) |
| Deceleration overvoltage suppression level (*4) | b131 | 330. to 390. (VDC) | Level setting for 200 V class models |
| | | 660. to 780. (VDC) | Level setting for 400 V class models |
| Deceleration overvoltage suppression const. | b132 | 0.10 to 30.00 (s) | Specifying the acceleration rate from 0 Hz to maximum frequency (A004) when the function is enabled. (valid when b130=02,03) |
| Deceleration overvoltage suppression proportional gain | b133 | 0.00 to 5.00 | Overvoltage suppression proportional gain setting (valid when b130=01) |
| Deceleration overvoltage suppression integral time | b134 | 0.0 to 150.0 (s) | Overvoltage suppression integral time setting (valid when b130=01) |

See next page for the detail of (*1) to (*6).

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




(Example 2) When "b130" is "02" or "03":




(#): Acceleration according to the setting of "b132"

(*1) When this function is enabled, the actual deceleration 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 deceleration overvoltage suppression enable (b130).
(*2) This function does not maintain the DC bus voltage at a constant level. Therefore, the inverter trips due to overvoltage may be caused by the setting of the deceleration rate or by a specific load condition.
(*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.
(*4) If a voltage lower than the input voltage is specified for "b131", the motor cannot be stopped. In this case, it is able to shut off the inverter output by power off the inverter or by operating the free-run stop (FRS) function (refer to subsection "7.7.3 Free-run stop (FRS) function").
(*5) When "01" is specified for "b130", PI control is performed so that internal DC bus 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.
- If the situation that the motor is not able to decelerate during overvoltage suppression continues about 10 seconds, it will be forced to decelerate by setting of "F003". (This function is added from NE-S1 Ver 2.0.)

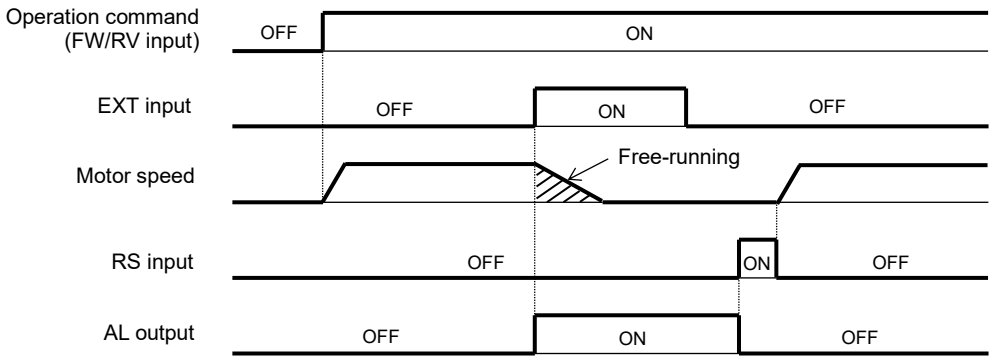
(*6) When "02" or "03" is specified for "b130", the motor may not be stopped if the stop command with short deceleration time is given during operating this function. In this case, it is able to shut off the inverter output by power off the inverter or by operating the free-run stop (FRS) function (refer to subsection "7.7.3 Free-run stop (FRS) function").

### 7.8.6 External trip (EXT) function (C001 to C005)

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 intelligent input [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 |
|---|---|---|---|
| Intelligent input [1] to [5] function | 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.



## 7.8.7 Automatic carrier frequency reduction (b083,b089)

The automatic carrier frequency reduction function automatically reduces the carrier frequency according to the increase in output current.
To enable this function, specify "01" or "02" for automatic carrier frequency reduction (b089).

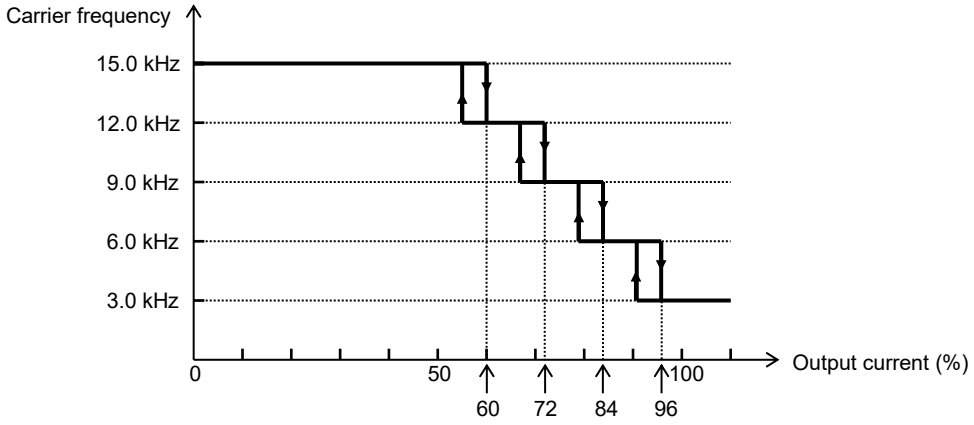
| Item | Function code | Range of data | Description |
|---|---|---|---|
| Automatic carrier frequency reduction | b089 | 00 | Disabled |
| | | 01 | Enabled, depending on the output current |
| | | 02 | Enabled, depending on the heatsink temperature |

Example) "b089=01"

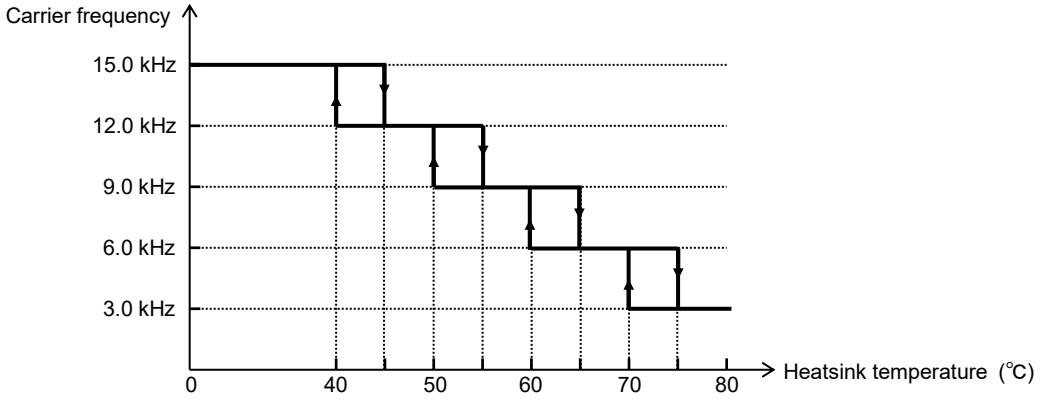
When the output current increases to 60 %, 72 %, 84 %, or 96 % of the inverter rated current, this function reduces the carrier frequency to 12, 9, 6, or 3 kHz, respectively. This function restores the original carrier frequency when the output current decreases to 5 % lower than each reduction start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

| Carrier frequency reduction start level (Restoration level) | | Carrier frequency after reduction (kHz) |
|---|---|---|
| Current dependence [b089=01] | Heatsink 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":

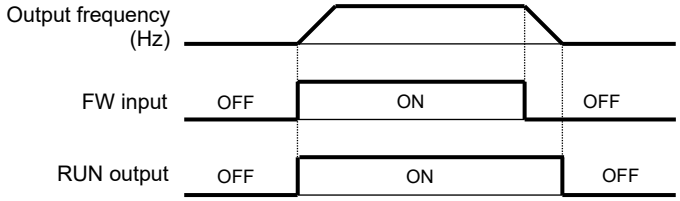



The rate of carrier frequency reduction is 2 kHz per second.
The maximum limit of carrier frequency change by this function is the value specified for the carrier frequency (b083); the minimum limit is 3 kHz. If 3 kHz or less frequency has been specified for "b083", this function is disabled regardless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

### 7.8.8 Running signal (RUN) (C021,C026)

While the inverter is operating, it outputs the running signal "RUN" via the intelligent output terminal [11] or the intelligent relay terminal.
To use this signal function, assign function "00" (RUN) to the intelligent output [11] function (C021) or the intelligent relay function (C026).
The inverter outputs the "RUN" signal even while operating the DC braking. The following figure shows a timing chart for the signal output.

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 00 | RUN: Run Signal |




### 7.8.9 Frequency arrival signals (FA1, FA2, FA3) (C021,C026,C042,C043)

The inverter outputs a frequency arrival signal "FA1", "FA2" or "FA3" when the inverter output frequency reaches a set frequency.
Assign the following functions to the intelligent output [11] function (C021) or the intelligent relay function (C026): "01" (FA1), "02" (FA2), "06" (FA3).

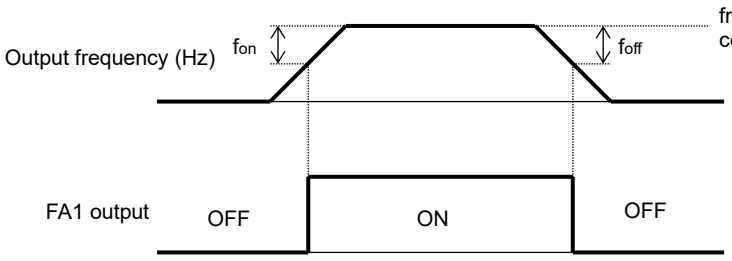
The signal hysteresis of the function "01" (FA1) or "02" (FA2) is as follows:
When the signal is on: ("set frequency" - "1 % of maximum frequency") (Hz)
When the signal is off: ("set frequency" - "2 % of maximum frequency") (Hz)

The signal hysteresis at acceleration with function "06" (FA3) 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) 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 acceleration | C042 | 0.00 (Hz) | Disabling the output of frequency arrival signal. |
| | | 0.01 to 400.0 (Hz) | Enabling the output of frequency arrival signal. |
| Frequency arrival setting for deceleration | C043 | 0.00 (Hz) | Disabling the output of frequency arrival signal. |
| | | 0.01 to 400.0 (Hz) | Enabling the output of frequency arrival signal. |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 01 | FA1: Frequency Arrival Type 1 - Constant Speed |
| | | 02 | FA2: Frequency Arrival Type 2 - Over frequency |
| | | 06 | FA3: Frequency Arrival Type 3 - Set frequency |

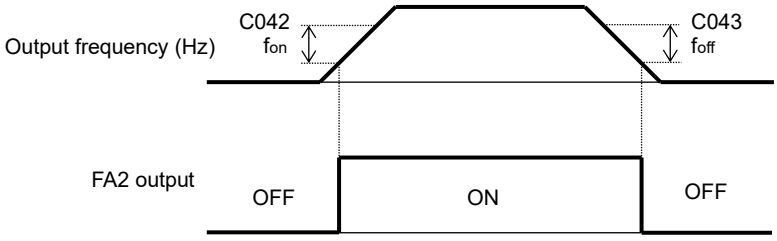
(1) Signal output when the constant-speed frequency is reached (01: FA1)
The inverter outputs the signal "FA1" when the output frequency reaches the frequency command specified by a frequency setting (F001, A020, A220) or multi-speed frequency setting (A021 to A027).




fon: 1 % of maximum frequency
foff: 2 % of maximum frequency

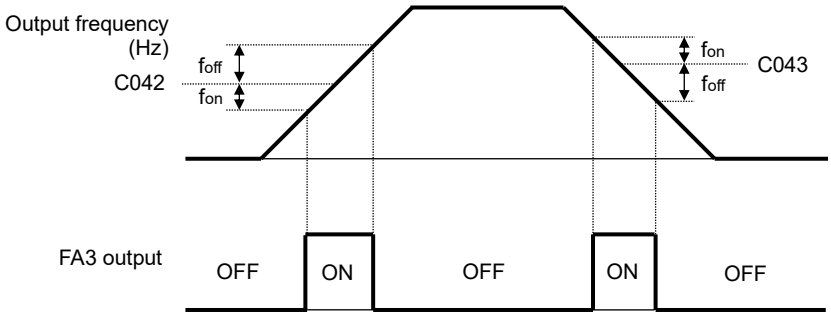
(Example)
Maximum frequency (fmax) = 120 Hz
Frequency command (fset) = 60 Hz
$f_{on}$ = 120×0.01 = 1.2 (Hz)
$f_{off}$ = 120×0.02 = 2.4 (Hz)
At acceleration, the signal turns on when the output frequency reaches 58.8 Hz (60 - 1.2 = 58.8).
At deceleration, the signal turns off when the output frequency reaches 57.6 Hz (60 - 2.4 = 57.6).

(2) Signal output when the set frequency is exceeded (02: FA2)
The inverter outputs the signal "FA2" when the output frequency exceeds the acceleration or deceleration frequency specified by a frequency setting (C042 or C043).




fon: 1 % of maximum frequency
foff: 2 % of maximum frequency

(3) Signal output only when the set frequency is reached (06: FA3)
The inverter outputs the signal "FA3" only when the output frequency reaches the frequency specified by a frequency setting (C042 or C043).




fon: 1 % of maximum frequency
foff: 2 % of maximum frequency

### 7.8.10 Running time over and power-on time over signals (RNT,ONT) (b034,C021,C026)

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

| 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.<br>(range: 10 to 99,990 hours) |
| | | 1000 to 6553 | Setting in units of 100 hours.<br>(range: 100,000 to 655,350 hours) |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 11 | RNT: Run Time Expired |
| | | 12 | ONT: Power ON time Expired |

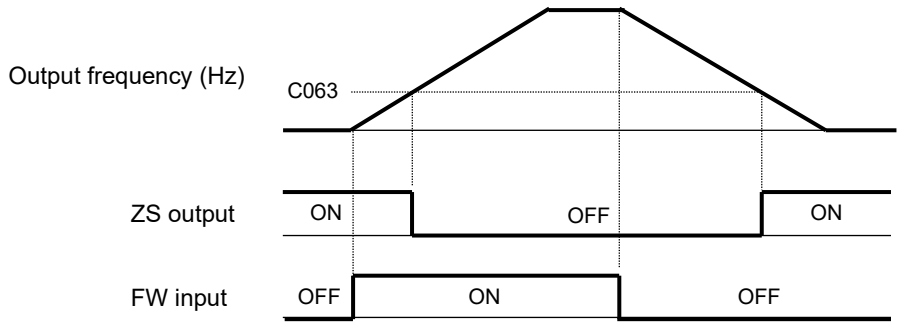
(1) Running time over signal (RNT)
To use this signal function, assign function "11" (RNT) to the intelligent output [11] function (C021) or the intelligent relay function (C026).
Specify the run/power ON warning time (b034).

(2) Power-on time over signal (ONT)
To use this signal function, assign function "12" (ONT) to the intelligent output [11] function (C021) or the intelligent relay function (C026).
Specify the run/power on warning time (b034).

### 7.8.11 0Hz speed detection signal (ZS) (C063,C021,C026)

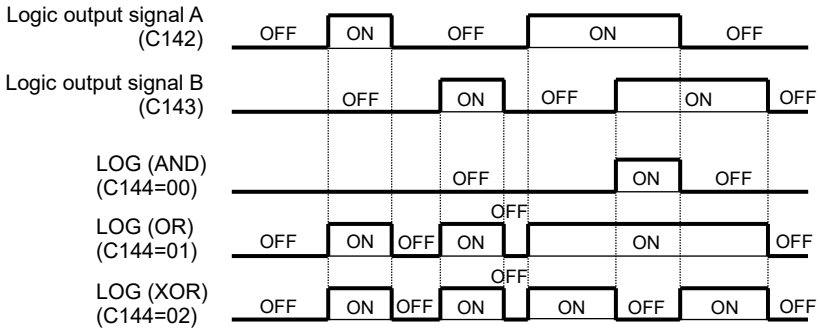
The inverter outputs the 0 Hz speed detection signal "ZS" when the inverter output frequency falls below the threshold frequency specified as the zero speed detection level (C063).
To use this function, assign function "21" (ZS) to the intelligent output [11] function (C021) or the intelligent relay function (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. |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 21 | ZS: Zero Hz Speed Detection Signal |



## 7.8.12 Logic output signal operation function (LOG) (C142,C143,C144,C021,C026)

The logic 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 logic output function (LOG) and No function (NO).
Three types of operators (AND, OR, and XOR) are selectable.



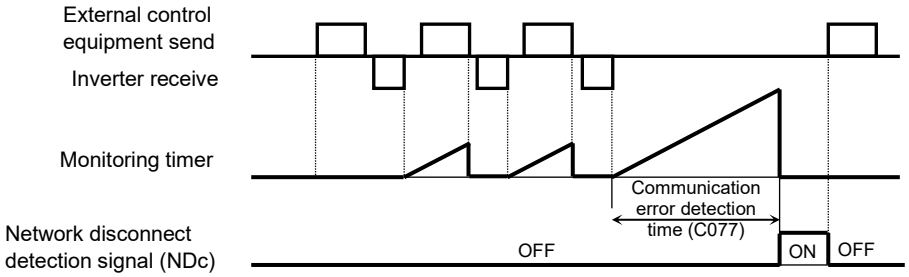

| Selected signal | Logic output operand A | Logic output operand B | Logic output operator |
|---|---|---|---|
| 33: Logic Output Function (LOG) | C142 | C143 | C144 |

(Example) To output the AND of the run signal (00: RUN) and set the frequency arrival type 2-over frequency (02: FA2) as the logic output signal (LOG) to the intelligent output terminal [11]:
- Intelligent output [11] function (C021): 33 (LOG)
- Logic output operand A (C142): 00 (RUN)
- Logic output operand B (C143): 02 (FA2)
- Logic output operator (C144): 00 (AND)

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Logic output operand A | C142 | Selection of "00" to "60" from the intelligent output functions (except LOG, NO). | Selection of operation-target A |
| Logic output operand B | C143 | Selection of "00" to "60" from the intelligent output functions (except LOG, NO). | Selection of operation-target B |
| Logic output operator | C144 | 00 | AND |
| | | 01 | OR |
| | | 02 | XOR |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 33 | LOG: Logic Output Function |

### 7.8.13 Network Disconnect Detection signal (NDc) (C077,C021,C026)

This signal function is enabled when Modbus-RTU has been selected for communication.
If a reception timeout occurs, the inverter continues to output the network disconnect detection signal "NDc" until it receives the next data.
Specify the limit time for reception timeout by setting the communication error detection time (C077).

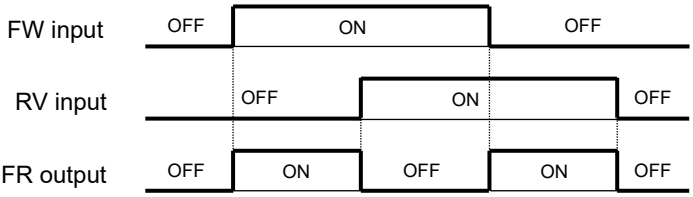



| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Communication error detection time | C077 | 0.00 to 99.99 (s) | Setting of the limit time for reception timeout. |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 32 | NDc: Network Disconnect Detection |

### 7.8.14 Starting contact signal (FR) (C021,C026)

The inverter outputs the starting contact signal "FR" while it is receiving an operation command.
The "FR" signal is output, regardless of the setting of the run command source (A002/A202).
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 |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 41 | FR: Starting Contact Signal |




### 7.8.15 Heatsink overheat warning signal (OHF) (C064,C021,C026)

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

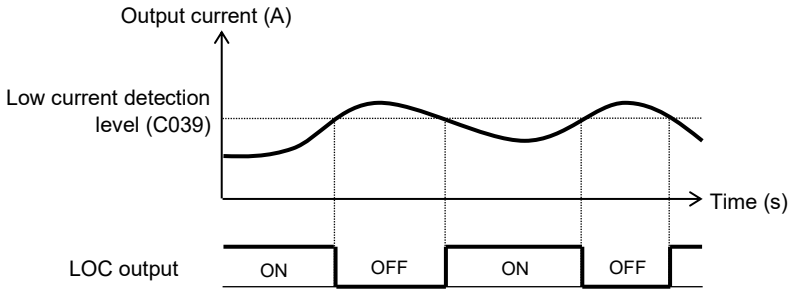
| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Heatsink overheat warning | C064 | 0. to 110. (℃) | Setting of the threshold temperature at which to output the heatsink overheat warning signal. |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 42 | OHF: Heatsink Overheat Warning |

## 7.8.16 Low current detection (LOC) signal (C038,C039,C021,C026)

The inverter outputs the low current detection signal "LOC" when the inverter output current falls to the low current detection level (C039) or less.
You can select one of the two signal output modes with the output mode of low current detection (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 |
|---|---|---|---|
| Output mode of low current detection | C038 | 00 | Enabling the signal output during operation. |
| | | 01 | Enabling the signal output only during constant-speed operation. (*1) |
| Low current detection level | C039 | (0.00 to 2.00) × Inverter rated current (A) | Setting of the threshold current level at which to output the low current detection signal. |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 43 | LOC: Low current detection signal |

(*1) When "01" (control terminal) is selected as frequency source (A001/A201), 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 analog input filter (A016).




## 7.8.17 Inverter ready signal (IRDY) (C021,C026)

The inverter outputs the inverter ready signal "IRDY" 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 at three phases model, or the L1, N terminals at single phase model) is within the range of specification.

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 50 | IRDY: Inverter Ready Signal |

## 7.8.18 Forward rotation signal (FWR) (C021,C026)

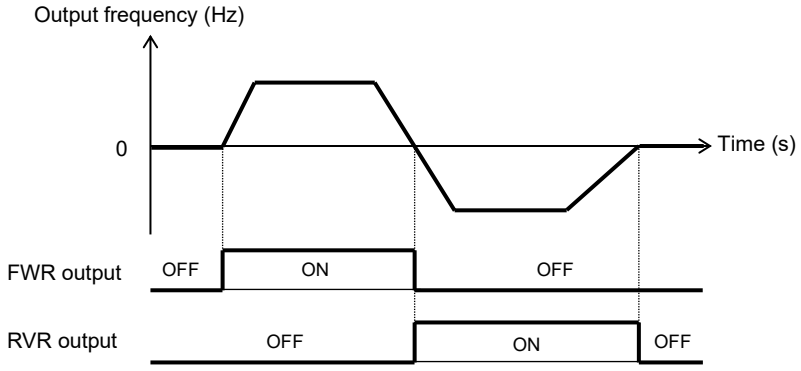
The inverter continues to output the forward rotation signal "FWR" while it is driving the motor for forward operation. The "FWR" signal is turned off while the inverter is driving the motor for reverse operation or stopping the motor.

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 51 | FWR: Forward Rotation |

### 7.8.19 Reverse rotation signal (RVR) (C021,C026)

The inverter continues to output the reverse 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 |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 52 | RVR: Reverse Rotation |




### 7.8.20 Major failure signal (MJA) (C021,C026)

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

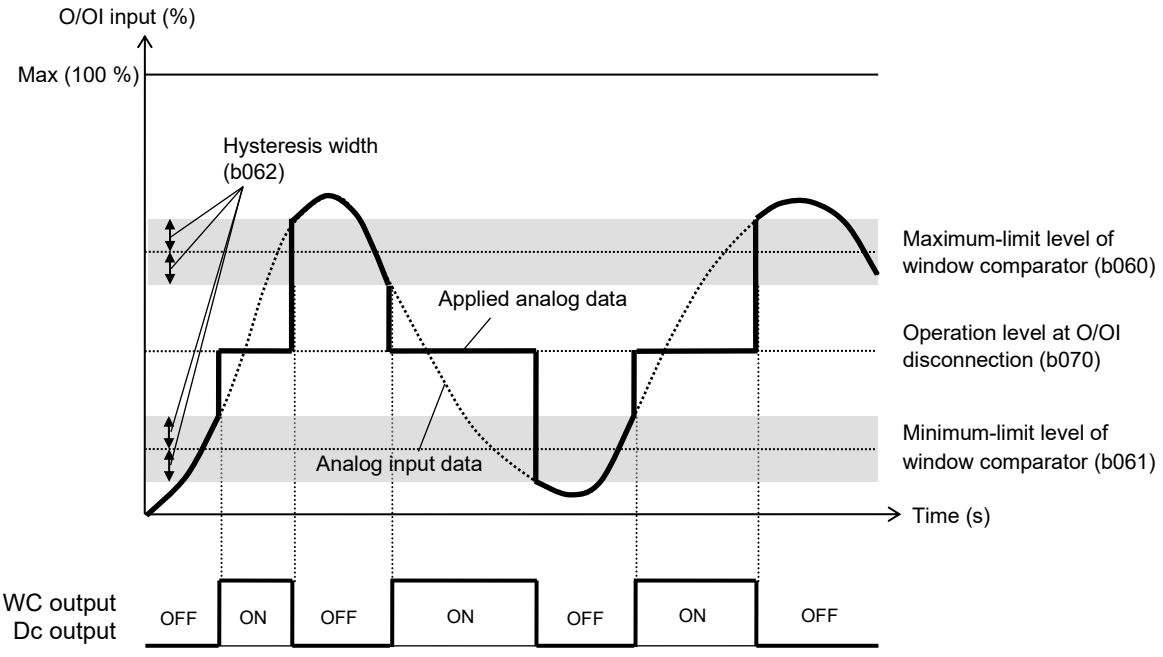
| No. | Error code | Description |
|---|---|---|
| 1 | E08.* | Memory error |
| 2 | E10.* | Current detection error |
| 3 | E11.* | CPU error |
| 4 | E14.* | Ground fault protection |
| 5 | E19.* | Thermal detection error |

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 53 | MJA: Major Failure Signal |

## 7.8.21 Window comparator (WC) (detection of terminal disconnection: Dc) (b060 to b062,b070,C021,C026)

The window comparator function outputs signal "WC" 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 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 signal of "Dc" is the same as that of "WC".

| Item | Function code | Range of data | Description |
|---|---|---|---|
| Maximum-limit level of window comparator (O/OI) | b060 | "b061 + b062 × 2 (minimum of 0)" to 100. (%) | Setting of maximum-limit level |
| Minimum-limit level of window comparator (O/OI) | b061 | 0 to "b060 - b062 × 2 (maximum of 100)" (%) | Setting of minimum-limit level |
| Hysteresis width of window comparator (O/OI) | b062 | 0 to "(b060 - b061) / 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. |
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 27 | Dc: Analog Input Disconnect Detection |
| | | 54 | WC: Window Comparator for Analog Input |




(Note) To use as disconnection detection, set the disconnection detection level to the maximum-limit level of window comparator (O/OI) (b060).
(The normal O/OI input uses an area exceeding the "b060", and the disconnection is detected below the "b060".)

### 7.8.22 Frequency command source signal (FREF)

This function outputs a "FREF" signal when the "A001=02". However, this function does not output the signal when the second control mode or the "A001≠02".

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 58 | FREF: Frequency Command Source Signal |

### 7.8.23 RUN command source signal (REF)

This function outputs a "REF" signal when the "A002=02". However, this function does not output the signal when the second control mode or the "A002≠02".

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 59 | REF: Run Command Source Signal |

### 7.8.24 2nd Motor in operation (SETM)

When the inverter is in 2nd motor control, inverter outputs a "SETM" signal.

| Item | Function code | Data | Description |
|---|---|---|---|
| Intelligent output [11] function<br>Intelligent relay function | C021<br>C026 | 60 | SETM: 2nd Motor Selection Signal |

### 7.8.25 Ground fault detection (C155)

When the inverter power is turned on, then select whether to perform ground fault detection.
Ground fault might be detected when the inverter power is turned on while the motor is rotating.

| Item | Function code | Data | Description |
|---|---|---|---|
| Ground fault detection | C155 | 00 | 00: Disabled |
| | | 01 | 01: Enabled |

### 7.8.26 Out phase loss detection (C157)

This function is to choose whether to perform output phase loss detection.
This function works when the output frequency is not less than 5 Hz but not more than 100 Hz.
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 |
|---|---|---|---|
| Output phase loss detection | C157 | 00 | 00: Disabled |
| | | 01 | 01: Enabled |

## 7.9 Initializing

### 7.9.1 Initialization setting (b084,b085,b094,b180)

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) Note3) | b084 | 00 | Disabling |
| | | 01 | Clearing the trip history |
| | | 02 | Initializing all parameters |
| | | 03 | Clearing the trip history and Initializing all parameters |
| Initialization target data setting Note4) | b094 | 00 | All parameters |
| | | 01 | All parameters except input/output terminal settings and communication data settings Note2) |
| Initial data selection Note1) Note4) | b085 | 00 | Mode 0 (Restricted Distribution Code: Other (Standard)) |
| | | 01 | Mode 1 (Restricted Distribution Code: Europe) |
| | | 03 | Mode 3 (Restricted Distribution Code: China) |
| Initialization trigger Note3) | b180 | 00 | No action |
| | | 01 | Initialize |

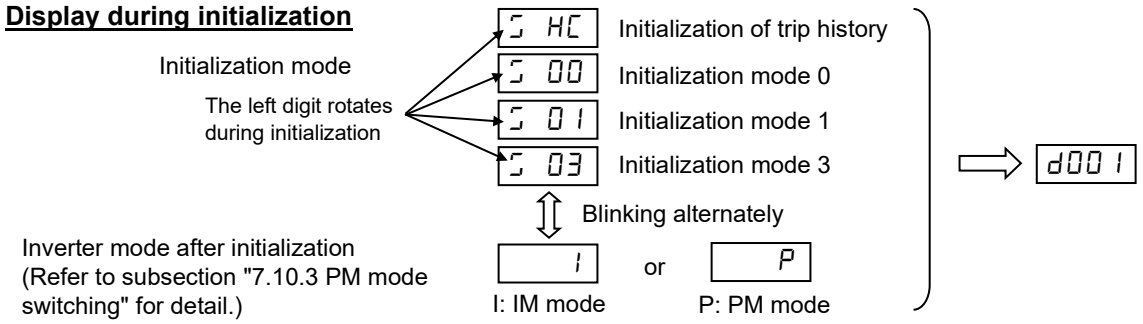
Note1) Refer to the parameter list of Chapter 13 for the difference between Mode 0 (00), Mode 1 (01), and Mode 3 (03) in initial data selection (b085).
Note2) The parameters to be related to are as follows.

| Data of "b094" | Function code | Description |
|---|---|---|
| Parameters for input/output terminal settings | C001 to C005 | Intelligent input [1] to [5] function |
| | C011 to C015 | Intelligent input [1] to [5] active state |
| | C021 | Intelligent output [11] function |
| | C026 | Intelligent relay function |
| | C031 | Intelligent output [11] active state |
| | C036 | Intelligent relay active state |
| Parameters for communication data settings | C070 | Selection of OPE/Modbus |
| | C071 | Communication speed |
| | C072 | Modbus address |
| | C074 | Communication parity |
| | C075 | Communication stop bit |
| | C076 | Communication error selection |
| | C077 | Communication error detection time |
| | C078 | Communication wait time |

Note3) Data of "b084", "b180" are not saved in the memory to avoid unintentional initializing.
Note4) "b085", "b094", "C081" (O/OI input gain calibration) are not initialized.

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" and restricted distribution code in "b085".
(3) Set "01" in "b180".
(4) The following display appears for a few seconds, and initialization is completed with "d001" displayed.

**Display during initialization**



## 7.10 PM Motor Drive

### 7.10.1 Limitation

This chapter shows the PM motor drive function that is added from NE-S1 Ver 2.0. There is a limitation in the PM motor drive. Please note below.

(1) About the specification

1. Please use for the application of reduced torque with the starting torque less than 50 %. In case of use other than above, performance of motor control cannot be guaranteed to be sufficient.
2. It is not suitable for at the usage the constant torque, the rapid acceleration/deceleration and low speed driving. Please never use it for the transportation machine, especially the gravity load usage such as elevators.
3. PM motor cannot be driven by the commercial power source directly.
4. The motor can be driven if the load of the moment of inertia is 50 times or less than the motor moment of inertia (H110). When over 50 times the motor moment of inertia, you may not be able to obtain adequate motor characteristics.
5. Two or more motors cannot be driven with one inverter.
6. When the DC braking function is used and the inverter trips by overvoltage, refer to subsection "7.5.22 DC braking (DB) setting" and adjust related parameters.
7. Please drive the motor after the brake is released if there is a maintenance brake. The motor may generate out-of-step if timing is not suitable.
8. When starting, the motor may reverse. Please use the initial magnet position estimation function when the motor reverse rotation may cause trouble the system.
9. When you use the inverter to drive a motor of which the rated current of the motor exceeds the rated current of the inverter, or the capacity is two classes lower than the maximum applicable capacity of the inverter, you may not be able to obtain adequate motor characteristics.
10. Please adjust the motor constant settings to the motor to be driven by the inverter. The motor constant data is corresponding to the data of one phase of Y connection.
11. When the motor cable is the long distance (more than 20 m as a guide), you may not be able to obtain adequate motor characteristics.
12. Please do not drive the motor that the maximum current of the motor (demagnetization level) falls below about 300 % of the rated current of the inverter. The motor may be demagnetization.
    (Note): Please note the effective value and the peak value. The rated current of the inverter in this guide is the effective value.
13. Please set the carrier frequency (b083) properly for protection from rising temperature of the motor.
14. Please set the PM rated current (H105) to the level of electronic thermal (b012).

(2) About the function

1. When the motor is rotating at the speed of 50 % or less of the base frequency (A003), the motor may restart from 0 Hz at retry if the method of retry is frequency matching.
2. When the method of retry is frequency matching, the motor may generate overcurrent trip if the motor direction of the rotation changes in free-running.
3. When the motor restarts with frequency matching at 120 Hz or more, the motor may generate overcurrent trip.
   When the motor cable is the long distance (more than 20 m as a guide) if the method of retry is frequency matching, the motor may generate overcurrent trip.
   Please restart after stopping the motor with the DC braking function or the external brake, etc.
4. A part of function cannot be used. Please refer to subsection "7.10.2 Invalid functions" for details.

## 7.10.2 Invalid functions

The following functions are invalid at the PM motor drive.

| Function | Related code | Limitation method |
|---|---|---|
| 2nd motor control | Item of *2** | Example: A201 |
| | C001 to C005 | 08 (SET) |
| | C021, C026 | 60 (SETM) |
| Jogging | A038, A039 | |
| | C001 to C005 | 06 (JG) |
| IM control | A041 to A044, A046, A047, b100 to b113, H003, H004, H006 | |
| V/f gain | A045 | |
| AVR | A081 to A084 | |
| Energy-saving operation | A085, A086 | |
| Restarting with active frequency matching | b001, b008 Note) | 02 (Resume operation after active frequency matching)<br>03 (After active frequency matching, deceleration stop and alarm output after trip) |
| | b088, C103 Note) | 01 (Restart from active frequency matching) |
| | b028 to b030 | |
| Over current suppression | b027 | |
| Reduced voltage start | b036 | |

Note) The PM motor cannot perform active frequency matching by its specification. Instead of active frequency matching, PM mode prepares the frequency matching as the restart method, and if the limitation method in the right column is selected to this related code, it will automatically switch to frequency matching.

(Remarks) Restart with frequency matching
This is a restart method to detect the motor rotation frequency by the motor residual voltage during rotation and restart from the detected frequency. About active frequency matching, refer to subsection "7.7.1 (4) Restarting methods".

### 7.10.3 PM mode switching (b171,b180)

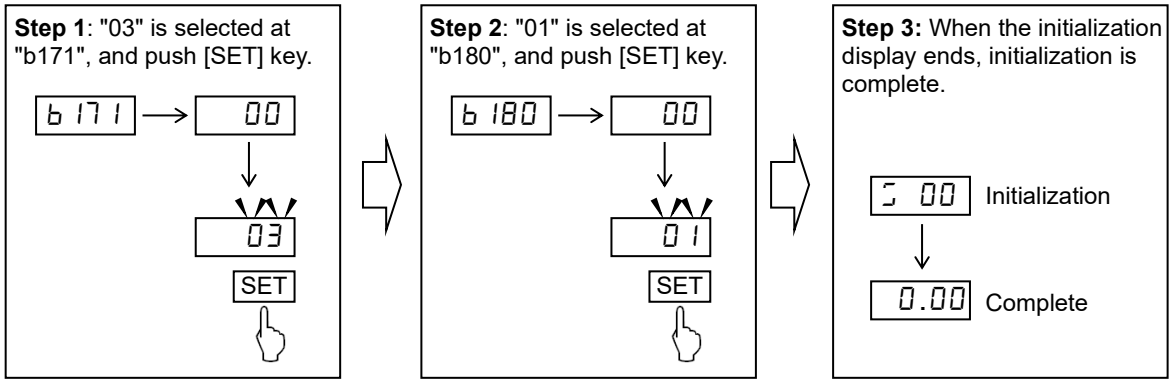
It changes to the PM mode by setting the initialization trigger (b180) to "01" after setting the inverter mode selection (b171) to "03", and initialization is executed.

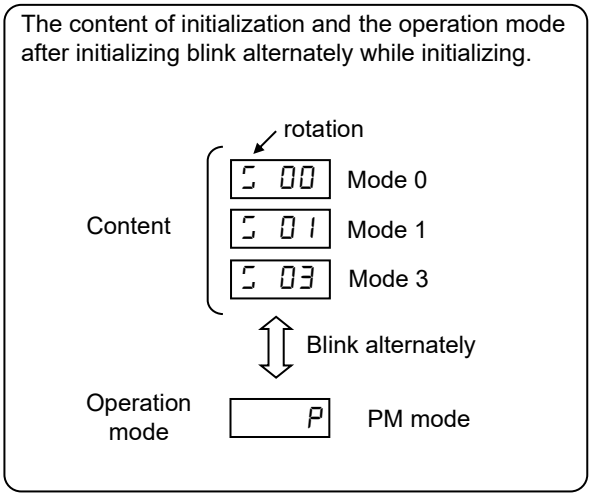
■ When using this mode, observe the following precautions.

1. When "01" is set on the initialization trigger (b180), and "SET" or "STR" key is pressed, initialization starts immediately and there is not any way to restore the previous parameter settings.
   All data will be initialized regardless the setting of the initialization target data setting (b094).
2. When display is restricted by the function code display restriction (b037) or software is locked by the software lock mode selection (b031), you cannot initialize because the function codes of initialization are no-display.

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Inverter mode selection | b171 | 00 | Disable |
| | | 01 | IM mode |
| | | 03 | PM mode |
| Initialization trigger | b180 | 00 | No action |
| | | 01 | Perform initialization |

■ Way to PM mode switching (using the NES1-OP)




Note 1: For prevent from initializing by mistake, "b171" and "b180" are restored to "00" after initializing or re-power supply. Please set it every time if you initialize.

Note 2: Even if the initialization is performed, the initial data selection (b085) and the O/OI input gain calibration (C081) are not initialized.

Note 3: There is no way to restore the previous parameter setting after initialization.

## 7.10.4 Motor constants selection (H101 to H114)

When PM motor will be driven by the inverter, the motor constant settings need to be adjusted for the motor characteristics.
The motor constants can be selected from the following three types:
(1) Motor constants of Hitachi standard PM motor.
⇒ When "00" is set on PM motor code setting (H102), motor constants use "H106" to "H110". Initial values of "H106" to "H110" are set on motor constants of Hitachi standard PM motor.
(2) Motor constants tuned by auto-tuning function.
⇒ When "01" is set on PM motor code setting (H102) after the auto-tuning allows, motor constants use automatically measure values "H111" to "H114" and Hitachi standard motor value "H110".
(3) Arbitrarily motor constants are set.
⇒ In above-mentioned both (1) and (2) cases, motor constants can be changed to the given value. Please change the value of "H106" to "H110" (at "H102=00"), or "H110" to "H114" (at "H102=01").

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| PM motor rated voltage | H101 | 200 V class: 100.0 to 240.0 (V)<br>400 V class: 200.0 to 480.0 (V) | The rated voltage of PM motor. |
| PM motor code setting | H102 | 00 (Hitachi standard) | Use "H106" to "H110" at PM motor constants |
| | | 01 (Auto-Tuning) | Use "H110" to "H114" at PM motor constants |
| PM motor capacity (*1) | H103 | 0.10 to 7.50 (kW) | The rated capacity of PM motor. |
| PM motor pole setting | H104 | 2 to 48 (poles) | The number of motor poles of PM motor. |
| PM rated current | H105 | (0.20 to 1.00) × inverter rated current (A) | The rated current of PM motor. |
| PM motor constants of Hitachi standard motor | | | Motor constant settings when auto-tuning data does not use. The initial values are motor constants of Hitachi standard motor. |
| PM const R (Resistance) | H106 | 0.001 to 65.535 (Ω) | |
| PM const Ld (d-axis inductance) | H107 | 0.01 to 655.35 (mH) | |
| PM const Lq (q-axis inductance) | H108 | 0.01 to 655.35 (mH) | |
| PM const Ke (Induction voltage constant) (*2) | H109 | 0.1 to 6553.5 (mV/(rad/s)) | |
| PM const J (Moment of inertia) (*3) | H110 | 0.001 to 9999.000 ($kgm^2$) | |
| PM motor constants tuned by auto-tuning | | | Automatically measured motor constants when the auto-tuning is executed, and they are set. After auto-tuning, you can be changed to the given value. |
| PM const R (Resistance, Auto) | H111 | 0.001 to 65.535 (Ω) | |
| PM const Ld (d-axis inductance, Auto) | H112 | 0.01 to 655.35 (mH) | |
| PM const Lq (q-axis inductance, Auto) | H113 | 0.01 to 655.35 (mH) | |
| PM const Ke (Induction voltage constant, Auto) (*2)(*4) | H114 | 0.1 to 6553.5 (mV/(rad/s)) | |

(*1) Please pay attention that settings of "H104" to "H110", "A003" and "A004" will be changed automatically, when PM motor capacity (H103) is changed.
(*2) PM induction voltage constant Ke is the peak voltage of one phase of per electrical angle speed (rad/s).
(*3) Set the PM motor constant J (H110: moment of inertia) to a value ($kgm^2$) that is added the moment of inertia of the load machine that is converted to the motor shaft data and the moment of inertia of the motor.
(*4) PM induction voltage constant Ke (auto-tuning) is measured only "H001=02 (rotation)".

## 7.10.5 PM auto-tuning function (A003,A004,A051,H001,H101 to H114)

PM auto-tuning automatically measures motor constants necessary for sensorless vector control at special driving pattern different from usually besides driving, and accuracy of vector control is improved. PM induction voltage constant Ke can be measured only "H001=02 (rotation)". PM moment of inertia J cannot be measured. Please set the PM moment of inertia J is value ($kgm^2$) that is added the moment of inertia of the load machine that is converted to the motor shaft data and the moment of inertia of the motor, by manual.

■ When using this mode, observe the following precautions.

1. When the inverter drives unknown PM motor with vector control, please measure motor constants by auto-tuning.
2. The measured motor constants are the data of one phase of Y connection.
3. Please use auto-tuning with the motor has stopped. If the motor rotates, correct constant data may not be obtained. (In such cases, the auto-tuning operation may not be completed. If the auto-tuning operation is not completed, press the STOP/RESET key. The operation will end with an error code displayed.)
4. Adjust the settings of base frequency (A003), maximum frequency (A004), PM motor rated voltage (H101), PM motor capacity (H103), PM motor pole setting (H104) and PM rated current (H105) to the motor specifications before performing auto-tuning. If these parameters are not appropriate, correct constant data may not be obtained. (In such cases, the auto-tuning operation may not be completed. If the auto-tuning operation is not completed, press the STOP/RESET key. The operation will end with an error code displayed.)
5. As a measurement guide, this function can be applied to the motors in the maximum applicable capacity class of the inverter or one class lower than the capacity class of the inverter. If this function is used for motors with other capacities or special specs, correct constant data may not be obtained. (In such cases, the auto-tuning operation may not be completed. If the auto-tuning operation is not completed, press the STOP/RESET key. The operation will end with an error code displayed.)
6. Specify "00" (disabling) for the DC braking enable (A051). (The factory setting is "00".)
   If "00" isn't specified for "A051", motor constants cannot be measured by auto-tuning.
7. When the motor cable is the long distance (more than 20 m as a guide), correct constant data may not be obtained.
8. The motor may rotate slightly during auto-tuning with no rotation, but this is not abnormal behavior.
9. The allophone and the vibration may generate during auto-tuning, but this is not abnormal behavior.
10. Do not perform auto-tuning with the shaft of the motor fixed with external brake etc. Otherwise, correct motor constants may not be obtained.
11. Please perform auto-tuning with the load machine attached to the motor. Otherwise, correct motor constants may not be obtained.
12. When "02" (rotation) is set on Auto-tuning selection (H001), the motor will rotate in performing auto-tuning. Please confirm that motor rotation (rotation speed: about 40 % of the base frequency) may not cause trouble to the system.

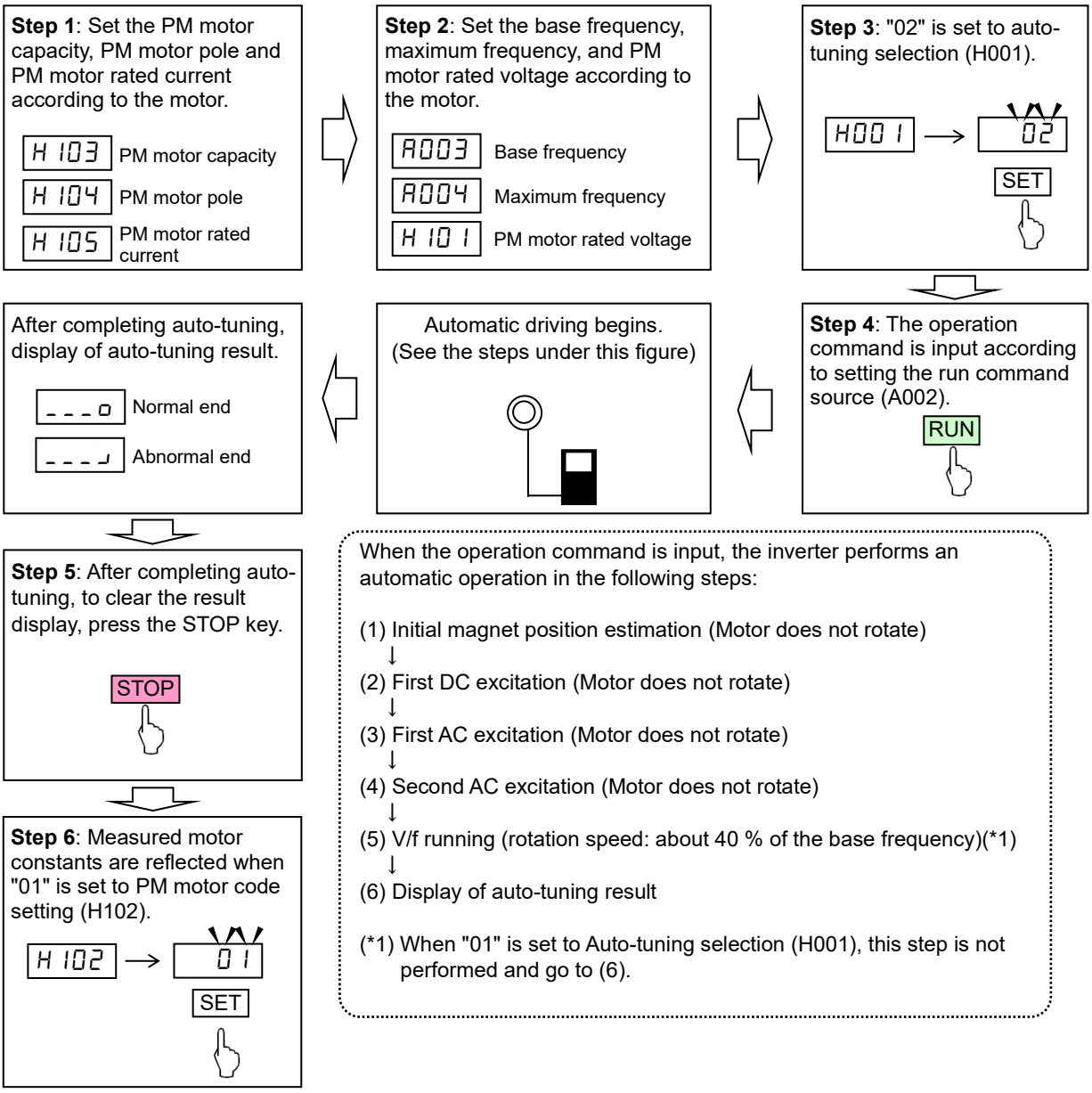
| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Base frequency (*1) | A003 | 30.0 to "A004" (Hz) | The base frequency of PM motor. |
| Maximum frequency (*1) | A004 | "A003" to 400.0 (Hz) | The maximum frequency of PM motor. |
| DC braking enable | A051 | 00 (Disabled) | |
| | | 01 (Enabled during stop) | |
| | | 02 (Frequency detection) | |
| Auto-tuning selection | H001 | 00 (Disabled) | |
| | | 01 (Not rotation) | |
| | | 02 (Rotation) | |
| PM motor rated voltage | H101 | 200 V class: 100.0 to 240.0 (V)<br>400 V class: 200.0 to 480.0 (V) | The rated voltage of PM motor. |
| PM motor code setting | H102 | 00 (Hitachi standard) | Use "H106" to "H110" at PM motor constants |
| | | 01 (Auto-Tuning) | Use "H110" to "H114" at PM motor constants |
| PM motor capacity (*2) | H103 | 0.10 to 7.50 (kW) | The rated capacity of PM motor. |
| PM motor pole setting | H104 | 2 to 48 (poles) | The number of motor poles of PM motor. |
| PM rated current | H105 | (0.20 to 1.00) × inverter rated current (A) | The rated current of PM motor. |
| PM motor constants of Hitachi standard motor | | | Motor constant settings when auto-tuning data does not use.<br>The initial values are motor constants of Hitachi standard motor. |
| PM const R (Resistance) | H106 | 0.001 to 65.535 (Ω) | |
| PM const Ld (d-axis inductance) | H107 | 0.01 to 655.35 (mH) | |
| PM const Lq (q-axis inductance) | H108 | 0.01 to 655.35 (mH) | |
| PM const Ke (Induction voltage constant) (*3) | H109 | 0.1 to 6553.5 (mV/(rad/s)) | |
| PM const J (Moment of inertia) (*4) | H110 | 0.001 to 9999.000 ($kgm^2$) | |
| PM motor constants tuned by auto-tuning | | | Automatically measured motor constants when the auto-tuning is executed, and they are set.<br>After auto-tuning, you can be changed to the given value. |
| PM const R (Resistance, Auto) | H111 | 0.001 to 65.535 (Ω) | |
| PM const Ld (d-axis inductance, Auto) | H112 | 0.01 to 655.35 (mH) | |
| PM const Lq (q-axis inductance, Auto) | H113 | 0.01 to 655.35 (mH) | |
| PM const Ke (Induction voltage constant, Auto) (*3) | H114 | 0.1 to 6553.5 (mV/(rad/s)) | |

(*1) The base frequency (the maximum frequency) calculates to the following by the rated rotation (the maximum rotation) of the motor and the motor pole.

$$\text{Base frequency (Maximum frequency) [Hz]} = \frac{\text{Rated rotation (Maximum rotation) [min}^{-1}\text{]} \times \text{pole}}{120}$$

(*2) Please pay attention that settings of "H104" to "H110", "A003" and "A004" will be changed automatically, when PM motor capacity (H103) is changed.
(*3) PM induction voltage constant Ke is the peak voltage of one phase of per electrical angle speed (rad/s).
(*4) PM moment of inertia J is value ($kgm^2$) that is added the moment of inertia of the load machine that is converted to the motor shaft data and the moment of inertia of the motor.
(*5) Even if the auto-tuning has ended normally, you cannot operate the inverter with the tuning data immediately. If you intend to operate the inverter with the tuning data, be sure to switch the setting of PM motor code setting (H102) to "01" (Auto-Tuning).
(*6) If the auto-tuning has ended abnormally, you confirm the motor cable and the parameter setting, and retry it.
(*7) If the stop command is activated during auto-tuning (by pressing the STOP/RESET key or turning off the operation command), the constants set for auto-tuning may remain in the inverter. Before retrying the auto-tuning, initialize the inverter, and then readjust the settings for the auto-tuning.
(Perform the same procedure also when you proceed to the normal inverter operation.)

■Operating procedure (using the NES1-OP)




When the operation command is input, the inverter performs an automatic operation in the following steps:

(1) Initial magnet position estimation (Motor does not rotate)
↓
(2) First DC excitation (Motor does not rotate)
↓
(3) First AC excitation (Motor does not rotate)
↓
(4) Second AC excitation (Motor does not rotate)
↓
(5) V/f running (rotation speed: about 40 % of the base frequency)(*1)
↓
(6) Display of auto-tuning result

(*1) When "01" is set to Auto-tuning selection (H001), this step is not performed and go to (6).

## 7.10.6 PM motor drive (b012,b083,H116 to H119,H121 to H123,H133 to H136,H141,H142)

This function estimates magnet position of PM motor by output voltage and current of inverter and setting motor constants, and drives PM motor.
Before using this function, be sure to make optimum constant settings for the motor with reference to subsection "7.10.4 Motor constants selection".

| Item | Function code | Data or range of data | Description |
|---|---|---|---|
| Level of electronic thermal (*1) | b012 | (0.20 to 1.00) × inverter rated current (A) | |
| Carrier frequency (*2) | b083 | 2.0 to 15.0 (kHz) | |
| PM speed response | H116 | 1. to 1000. (%) | |
| PM starting current | H117 | 20. to 100. (%) | Current value for starting (100 %=H105) (*3)(*4) |
| PM starting time | H118 | 0.01 to 60.00 (s) | Time of DC current passing for starting |
| PM stabilization constant | H119 | 0. to 120. (%) | (*5) |
| PM minimum frequency ratio | H121 | 0. to 50. (%) | Frequency of control mode switching (100 %=A003) (*6) |
| PM no-load current | H122 | 0. to 100. (%) | Current value for no-load (100 %=H105) |
| PM starting method selection | H123 | 00 (Normal) | |
| | | 01 (Initial magnet position estimation) | (*7)(*8) |
| PM initial magnet position estimation detect time | H133 | 0.03 to 2.50 (s) | The performing time of initial magnet position estimation. |
| PM initial magnet position estimation voltage gain | H134 | 0 to 120 (%) | The output voltage gain of initial magnet position estimation. |
| PM step-out protection selection | H135 | 00 (Disable) | |
| | | 01 (Error) | |
| | | 02 (Restart at 0 Hz) | |
| PM step-out protection level | H136 | 1 to 100 (%) | |
| PM overcurrent detection level | H141 | (1.00 to 2.50) × inverter rated current (A) | |
| PM starting overcurrent detection level | H142 | (1.00 to 2.50) × inverter rated current (A) | This level is applied at restarting the motor. |

(*1) Please set the PM rated current (H105) to the level of electronic thermal (b012).
(*2) Please set the carrier frequency (b083) 8.0 kHz or higher.
(*3) Automatically reduces the carrier frequency at motor starting according to the PM starting current (H117).
(*4) When too great setting, motor may generate overload trip.
(*5) When too small setting, you may not be able to obtain motor torque, and motor generate impact or generate overcurrent trip near the frequency setting at "H121".
(*6) Set the frequency ratio switching between the synchronous operation mode at low speed and the sensorless vector control mode at high speed.
(*7) The allophone may generate during initial magnet position estimation, but this is not abnormal behavior.
(*8) When using initial magnet position estimation, please start with the motor has stopped. When starting with the motor has rotated, motor may rotate greatly or generate out-of-step.

When using PM motor drive function, observe the following precautions:
In combination with the motor other than Hitachi standard motor, performance of motor control cannot be guaranteed to be sufficient.
If you cannot obtain the desired characteristics from the motor driven under the sensorless vector control, readjust the motor constants according to the symptom, as described in the table below.

| Operation status | Symptom | Adjustment method | Adjustment item |
|---|---|---|---|
| Starting | Trouble is caused when reverse running. | Enable the initial magnet position estimation function.<br>- The motor may rotate slightly, but this is not abnormal behavior. | H123 |
| | Motor generates out-of-step.<br>Motor generates overcurrent trip. | Increase the PM starting current.<br>- Note the electronic thermal protection function. | H117 |
| | | Increase the PM starting time. | H118 |
| | Need for early starting. | Enable the initial magnet position estimation function, and reduce the PM starting time. | H118<br>H123 |
| Less than "H121" setting | Motor runs unsteadily. | Increase the PM starting current.<br>- Note the electronic thermal protection function. | H117 |
| | Motor generates hunting. | Reduce the PM motor constant R step by step from the set value down to 0.7 times as high as the set value. | H106<br>H111 |
| | | Increase the PM motor constant Ld step by step from the set value up to 1.3 times as high as the set value.<br>Increase the PM motor constant Lq step by step from the set value up to 1.3 times as high as the set value.<br>- Please adjust to Ld ≤ Lq. | H107<br>H112<br>H108<br>H113 |
| Near "H121" setting | Motor generates an impact.<br>Motor generates overcurrent trip. | Adjust the PM speed response. | H116 |
| | | Adjust the PM minimum frequency ratio when a load changes. | H121 |
| More than "H121" setting | Motor generates hunting. | Adjust the PM speed response. | H116 |
| | | Increase the PM no-load current. | H122 |
| | | Increase the carrier frequency if low setting. | b083 |
| Initial magnet position estimating | Need for short time of Initial magnet position estimation. | Reduce the PM initial magnet position estimation detect time.<br>- When too small setting, motor may rotate greatly or generate out-of-step. | H133 |
| | Motor rotates greatly. | Increase the PM initial magnet position estimation detect time. | H133 |
| | | Increase the PM initial magnet position estimation voltage gain step by step.<br>- When too great setting, motor may generate overcurrent trip. | H134 |
| | Motor generates overcurrent trip. | Reduce the PM initial magnet position estimation voltage gain step by step.<br>- When too small setting, motor may rotate greatly or generate out-of-step. | H134 |

# Chapter 8 Communication Functions

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

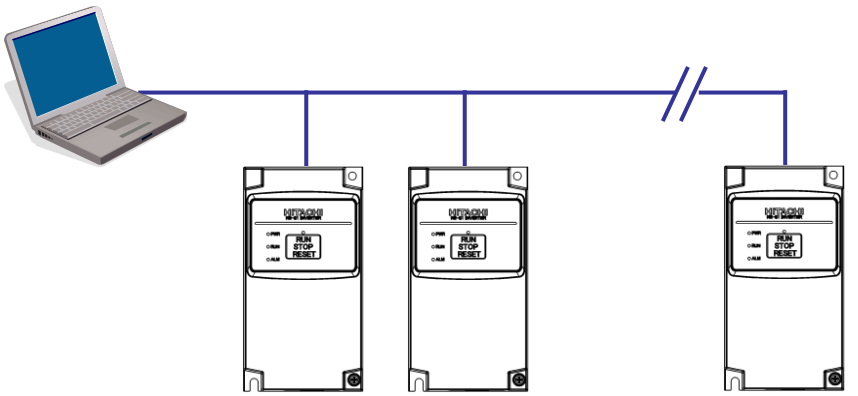
(Memo)

## 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 external control equipment | ✗ |
| Wait time for response | 0 to 1000 msec. | ✓ |
| Connections | Station address numbers from 1 to 247 | ✓ |
| Connector | RJ45 connector | – |
| Error check | Overrun, Framing block check code, CRC-16, or horizontal parity | – |
| Cable length | 500 m maximum | |

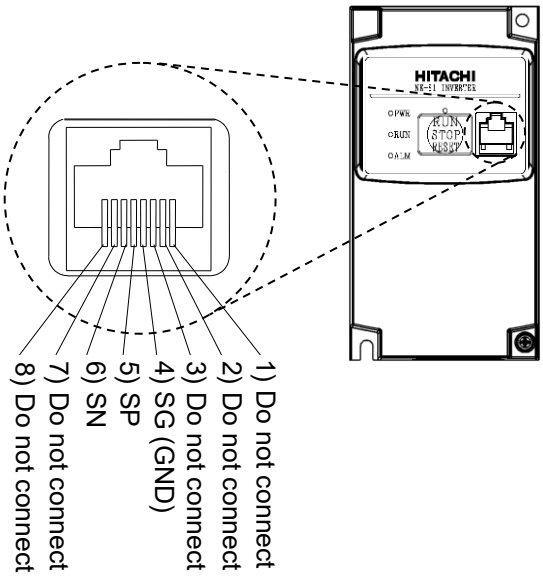
The network diagram below shows a series of inverters communicating with an external control equipment. Each inverter must have a unique address, from 1 to 247, on the network. In a typical application, an external control equipment like a host computer or controller is the master and each of the inverter(s)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



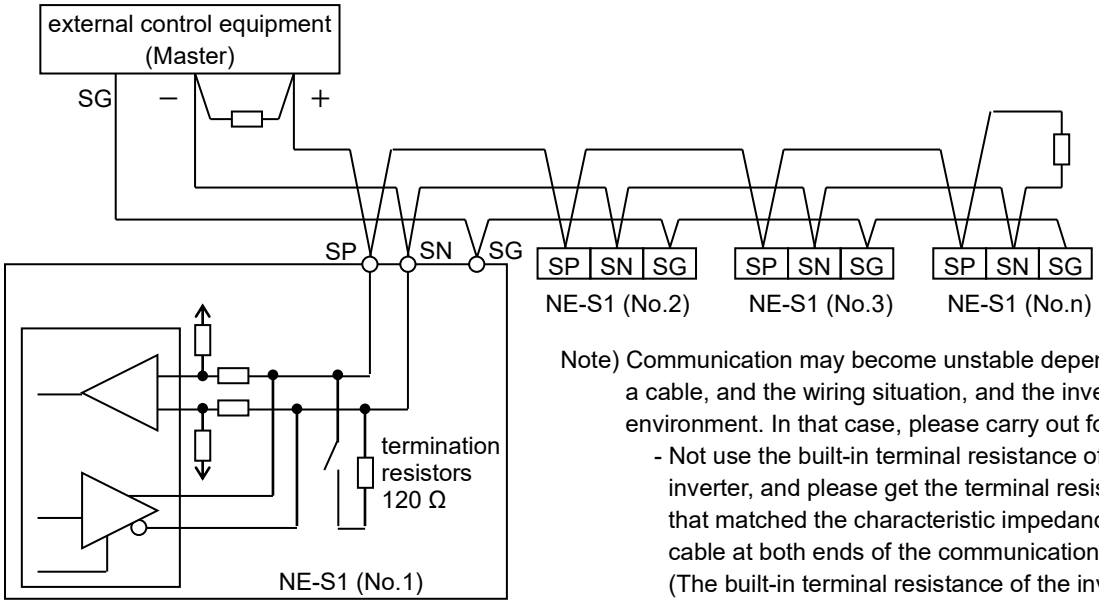
## 8.2 Connecting the Inverter to Modbus

The Modbus communication uses a pin of RJ45 as below.
The RJ45 connector is used for the external operator and Modbus communication.

| Pin No: | Signal Symbol | Description |
|---|---|---|
| 1 | DC +5 V | For Operator. Do not connect. |
| 2 | — | For Operator. Do not connect. |
| 3 | — | For Operator. Do not connect. |
| **4** | **SG (GND)** | **Signal Ground** |
| **5** | **SP** | **Send Data Positive** |
| **6** | **SN** | **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, and the inverter environment. In that case, please carry out follows.
- Not use the built-in terminal resistance of the inverter, and please get the terminal resistance that matched the characteristic impedance of the cable at both ends of the communications cable. (The built-in terminal resistance of the inverter is 120 Ω.)
- Please connect a signal ground of each inverter to external control equipment (master).
- Please lower a transmission speed.
- Please insert a repeater.

## 8.3 Modbus setting procedure

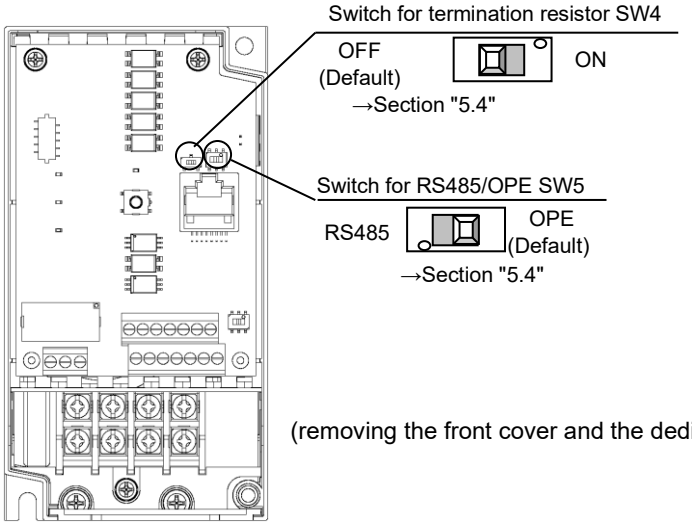
1. Changes from an operator mode to Modbus

1) Set a parameter (refer to section "8.4 Modbus Communication parameter") for Modbus communication by the dedicated operator (NES1-OP), remote operator (OPE-S/SR/SBK/SRmini, WOP, SOP, SOP-VR), or ProDriveNext. (It is necessary to be set the operator side (OFF, right side (factory setting)) in RS485/OPE (RS422) changeover switch (SW5) when use the remote operator (OPE-S/SR/SBK/SRmini, SOP, SOP-VR, WOP) or ProDriveNext.
2) Power OFF the inverter and take off the connection cable for the remote operator or ProDriveNext.
3) Remove the front cover.
4) Change RS485/OPE (RS422) changeover switch (SW5) to RS485 side (ON, left side).
5) When terminal resistance is necessary, change termination resistor changeover switch (SW4) to effective (ON, right side).
6) Attach the front cover.
7) Connect the communications cable to bus line of Modbus.
8) Power ON the Inverter and start Modbus communication.

2. Changes from Modbus to an operator mode

1) Power OFF the inverter and take off a communications cable of Modbus.
2) Remove the front cover.
3) Change RS485/OPE (RS422) changeover 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) Power ON the Inverter while pushing the RUN/STOP/RESET key on the standard panel. (Check the inverter is turned on, please keep pushing key about 5 seconds moreover.)
7) After the operator available, change setting the selection of OPE/Modbus (C070) to "00 (OPE)", and power OFF the inverter.
8) Power ON the Inverter again. The operator is available.

Note) The dedicated operator (NES1-OP) is available at the time of the Modbus communication use. In this case, do not perform 6) above, set the communication selection (C070) from "01 (Modbus)" to "00 (OPE)" on NES1-OP, and then turn on the power again.




(removing the front cover and the dedicated operator (NES1-OP))

(Note) After installing the dedicated operator (NES1-OP), the switch for termination resistor SW4 and switch for RS485/OPE SW5 cannot be changed. Therefore, switch the SW before installing the dedicated operator (NES1-OP). When changing these switches (SW4,5) after installing the dedicated operator (NES1-OP), remove the dedicated operator (NES1-OP) before setting. When reattaching the dedicated operator (NES1-OP), be careful not to damage the fixing claws (see the appendix at the end of this guide).

## 8.4 Modbus Communication parameter

**Inverter Parameter Setup**
The following parameters must be set properly to allow communications. Set the following parameters according to the communication specifications.
The data of "C070", "C071", "C074", "C075" will not be reflected unless the power is turned on again. (It is not reflected in the reset input.)

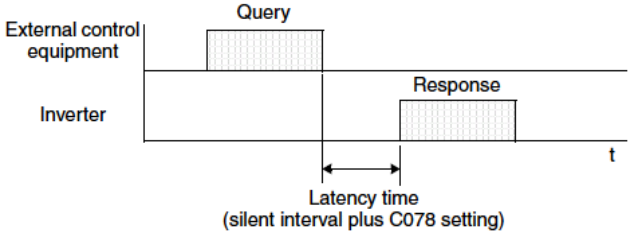
| Function Code | Name | Required | Settings |
|---|---|---|---|
| A001<br>A201 | Frequency source | ✓ | 00…VR (volume of NES1-OP, OPE-SR/SRmini)<br>01…Control terminal<br>02…Operator<br>**03…Modbus network input**<br>10…Calculate function output |
| A002<br>A202 | Run command source | ✓ | 01…Control terminal<br>02…Run key on standard panel, or remote operator<br>**03…Modbus network input** |
| C070 | Selection of OPE/Modbus | ✓ | 00… Operator<br>**01…Modbus-RTU** |
| C071 | Communication speed | ✓ | 04…4800 bps<br>05…9600 bps<br>06…19.2k bps<br>07…38.4k bps |
| C072 | Modbus Address | ✓ | Network address, range is 1 to 247. |
| C074 | Communication parity | ✓ | 00…No parity<br>01…Even parity<br>02…Odd parity |
| C075 | Communication stop bit | ✓ | 01…1 bit<br>02…2 bit |
| C076 | Communication error selection | – | 00…Trip (Error code E41)<br>01…Trip after deceleration stop<br>02…Ignore<br>03…Free-run stop<br>04…Deceleration stop |
| C077 | Communication error detection time | – | Set the communications watchdog timer period.<br>Range: 0.00 to 99.99 sec. |
| C078 | Communication wait time | ✓ | Set the inverter wait time from receiving a message to transmitting a message.<br>Range: 0. to 1000. ms |

## 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
- If "C077" is set to other than "0.00", the communication will time out if the inverter does not complete the reception of the next query within the time set in "C077" after replying to the response. Subsequent operation depends on the setting of "C076". The inverter does not return a response.




The inverter returns the response only after the inverter receives a query from the external control equipment and does not output the response positively. The silent interval is 14 bits.

Each frame is formatted (with commands) as follows:

## Message Configuration: Query

The command message sent from the master to the slave is called "Query", and the response message from the slave is called "Response". The transmission formats for queries and responses are shown below.

Query

| Frame Format |
|---|
| Header (silent interval) |
| Slave address |
| Function code |
| Query data |
| Error check (CRC-16) |
| Trailer (silent interval) |

Response

| Frame Format |
|---|
| Header (silent interval) |
| Slave address |
| Function code |
| Response data |
| Error check (CRC-16) |
| Trailer (silent interval) |

**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, master cannot read and loop back data.

**Function code:**

Specify a function external control equipment 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 Coils Status | 4 | 32 coils (in bits) |
| 0 3 h | Read Holding Registers | 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 Holding Registers | 32 | 16 registers (in bytes) |
| 1 7 h | Read/Write in Holding Registers | 32 / 32 | 16/16 registers (in bytes) |

**Data:**

- The data is related to the function code.
- The data transmission format depends on the function code.
- 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.

**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 external control equipment and transmission of a response from the inverter.

- 3.5 characters (14 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" (communication wait time).

## Message Configuration: Response

**Transmission time required:**

- A time period between reception of a query from the external control equipment and transmission of a response from the inverter is the sum of the silent interval (3.5 characters long) + "C078" (communication wait time).
- The external control equipment 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 slave address 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 setting range of the register. |
| 2 2 h | The specified functions are not available to the inverter.<br>• Function to change the content of a register that cannot be changed while the inverter is in service.<br>• Function to submit an ENTER command during running.<br>• Function to submit an ENTER command during undervoltage.<br>• Function to write in a register during tripping.<br>• Function to change the I/O terminal configuration which is not allowed.<br>• Function to change active state of RS (reset) terminal.<br>• Function to write in a register locked by softlock. |
| 2 3 h | The register (or coil) to be written in is read-only. |

**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 (6 bits) in the frame.
- When an error check code of query is incongruous. (CRC error)

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

## 8.6 Explanation of function codes

(A) Read Coils 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 | 0007h | 0008h | 0009h | 000Ah | 000Bh |
| Coil Status | ON | OFF | ON | OFF | OFF |

**Query:**

| No. | Field Name | Example (Hex) |
|---|---|---|
| 1 | Slave address *1 | 08 |
| 2 | Function code | 01 |
| 3 | Coils start address *4 (high order) | 00 |
| 4 | Coils 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 |

***1:** Broadcasting is disabled.
***2:** If the number of coils is specified as "0" or as "31" or more, the error code "03h" is returned.
***3:** Data is transferred by the specified number of data bytes (data size).
***4:** The coils are addressed starting at zero. Therefore, the 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" to "000Bh".
- Data "05h=00000101b" indicates the following assuming number "0007h" coil is the LSB.

| Item | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Coil Number | - | - | - | 000Bh | 000Ah | 0009h | 0008h | 0007h |
| Coil Status | OFF | OFF | OFF | OFF | OFF | ON | OFF | ON |

- When a read coil is outside the range of the defined coils, the coil data to be transmitted contains "0" as the status of the coil outside the range.
- When the Read Coils Status command cannot be executed normally, see "(I) Exception Response" below.

(B) Read Holding Registers [03h]

This function reads the contents of the specified number of consecutive holding registers (of specified register addresses). An example follows below.

- Reading factor, status, frequency, output current and DC bus voltage of trip monitor 1 from an inverter having a slave address "1".
- This example assumes the previous five items in the latest trip are as follows:

| Item | d081 (factor) | d081 (status) | d081 (frequency) | d081 (output current) | d081 (DC bus voltage) |
|---|---|---|---|---|---|
| Register Number | 0012h | 0013h | 0014h, 0015h | 0016h | 0017h |
| Trip factor | Overcurrent (E03) | 04h | 0.99 Hz | 3.0 A | 284 VDC |

**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 (low 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 |

***1:** Broadcasting is disabled.

***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.

***3:** The registers are addressed starting at zero. Therefore, register numbered "0012h" is addressed as "0011h". Register address value (transmitted on Modbus line) is 1 less than the register number.

The data set in the response is as follows:

| Response Buffer | 4-5 | | 6-7 | | 8-9 | |
|---|---|---|---|---|---|---|
| Register Number | 0012h (high order) | 0012h (low order) | 0013h (high order) | 0013h (low order) | 0014h (high order) | 0014h (low order) |
| Register Data | 0003h | | 0004h | | 0000h | |
| Trip data | Trip factor (E03) | | Status (acceleration) | | Frequency (0.99 Hz) | |
| **Response Buffer** | **10-11** | | **12-13** | | **14-15** | |
| Register Number | 0015h (high order) | 0015h (low order) | 0016h (high order) | 0016h (low order) | 0017h (high order) | 0017h (low order) |
| Register Data | 0063h | | 001Eh | | 011Ch | |
| Trip data | Frequency (0.99 Hz) | | Output current (3.0 A) | | DC bus voltage (284 VDC) | |

When the Read Holding Registers command cannot be executed normally, see "(I) Exception Response" below.

(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 via Modbus, set "A002/A202=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 |

***1:** No response is made for a broadcasting query.
***2:** The 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 "(I) Exception Response" below.

(D) Write in Holding Register [06h]

This function writes data in a specified holding register. An example follows:

- Write "5.00 Hz" as the multi-speed frequency 0 (A020) in an inverter having slave address "5".
- This example uses change data "500 (1F4h)" to set "5.00 Hz" as the data resolution of the register "1217h" holding the multi-speed frequency 0 (A020) is 0.01 Hz.

**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 |

***1:** No response is made for a broadcasting query.
***2:** The registers are addressed starting at zero. Therefore, register numbered "1217h" is 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 "(I) Exception Response" below.

(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 |

***1:** Broadcasting is disabled.

The test subcode is for echo (00h, 00h) only and not available to the other commands.

(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 | 0007h | 0008h | 0009h | 000Ah | 000Bh |
| Terminal status | ON | ON | ON | OFF | ON |

**Query:**

| No. | Field Name | Example (Hex) |
|---|---|---|
| 1 | Slave address *1 | 08 |
| 2 | Function code | 0F |
| 3 | Coils start address *3 (high order) | 00 |
| 4 | Coils 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 | Coils start address *3 (high order) | 00 |
| 4 | Coils 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 |

***1:** Broadcasting is disabled.
***2:** The change data is a set of high order data and low order data. So, when the data size (in bytes) to be changed is an odd number, add "1" to the data size (in bytes) to make it an even number.
***3:** The 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.
***4:** Intelligent input terminal status (d005) cannot monitor the terminal information by communication.

When writing in a selected holding coils fails, see "(I) Exception Response" below.

(G) Write in Holding Registers [10h]

This function writes data in consecutive holding registers. An example follows:

- Write "3000 seconds" as the 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 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 |

***1:** Broadcasting is disabled.
***2:** This is not the number of holding registers. Specify the number of bytes of data to be changed.
***3:** The registers are addressed starting at zero. Therefore, register numbered "1103h" is 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 "(I) Exception Response" below.

(H) Read/Write in Holding Registers [17h]

This function is to read and write data in consecutive holding registers. An example follows:

- Write "50.00 Hz" as the output frequency setting (F001) in an inverter having a slave address "1" and then to read out the output frequency monitoring (d001).

**Query:**

| No. | Field Name | Example (Hex) |
|---|---|---|
| 1 | Slave address | 01 |
| 2 | Function code | 17 |
| 3 | Start address to read *1 (high order) | 10 |
| 4 | Start address to read *1 (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 *1 (high order) | 00 |
| 8 | Start address to write *1 (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 |

***1:** Register address value (transmitted on Modbus line) is 1 less than the register number.

When writing in selected holding registers fails, see "(I) Exception Response" below.

(I) Exception Response

When sending a query (excluding a broadcasting query) to an inverter, the external control equipment 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 slave address 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 setting range of the register. |
| 2 2 h | The specified functions are not available to the inverter.<br>• Function to change the content of a register that cannot be changed while the inverter is in service.<br>• Function to submit an ENTER command during running.<br>• Function to submit an ENTER command during undervoltage.<br>• Function to write in a register during tripping.<br>• Function to change the I/O terminal configuration which is not allowed.<br>• Function to change active state of [RS] (reset) terminal.<br>• Function to write in a register locked by softlock. |
| 2 3 h | The register (or coil) to be written in is read-only. |

## 8.7 Re-calculate the internal variable

There is a necessity of the data recalculation depending on the parameter. In this case, use the ENTER command.

(A) ENTER command

To 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 | H004/H204 | Motor poles setting |
| A004/A204 | Maximum frequency | H101 | PM motor rated voltage |
| A044/A244 | V/f characteristic curve | H102 | PM motor code setting |
| A082/A282 | AVR voltage selection | H103 | PM motor capacity |
| b112 | Free V/f setting, frequency 7 | H104 | PM motor pole setting |
| H003/H203 | Motor capacity | H105 | PM rated current |

Note) The NE-S1 series inverter 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.

## 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 | (Reserved) | - | (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 (*2) |
| 0005h | (Reserved) | - | (Inaccessible) |
| 0006h | (Reserved) | - | (Inaccessible) |
| 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) | - | (Inaccessible) |
| 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) | - | (Inaccessible) |
| 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) | 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) | - | (Inaccessible) |
| 001Bh | (Reserved) | - | (Inaccessible) |
| 001Ch | UV (undervoltage) | R | 1: ON, 0: OFF |
| 001Dh | (Reserved) | - | (Inaccessible) |
| 001Eh | RNT (operation time over) | R | 1: ON, 0: OFF |
| 001Fh | ONT (power-on time over) | R | 1: ON, 0: OFF |
| 0020h | THM (thermal alarm signal) | R | 1: ON, 0: OFF |
| 0021h to 0027h | (Reserved) | - | (Inaccessible) |
| 0028h | ZS (0 Hz detection signal) | R | 1: ON, 0: OFF |
| 0029h to 002Dh | (Reserved) | - | (Inaccessible) |

| Coil No. | Item | R/W | Setting |
|---|---|---|---|
| 002Eh | Dc (analog input disconnection detection) | - | 1: ON, 0: OFF |
| 002Fh to 0031h | (Reserved) | - | (Inaccessible) |
| 0032h | FBV (PID feedback comparison) | R | 1: ON, 0: OFF |
| 0033h | (Reserved) | - | (Inaccessible) |
| 0034h | LOG (logical operation result) | R | 1: ON, 0: OFF |
| 0035h to 003Bh | (Reserved) | - | (Inaccessible) |
| 003Ch | FR (starting contact signal) | R | 1: ON, 0: OFF |
| 003Dh | OHF (heatsink overheat warning) | R | 1: ON, 0: OFF |
| 003Eh | LOC (low-current indication signal) | R | 1: ON, 0: OFF |
| 003Fh to 0044h | (Reserved) | - | (Inaccessible) |
| 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) | - | (Inaccessible) |
| 004Ah | CRC error | R | 1: Error detected, 0: No error (*3) |
| 004Bh | Overrun error | 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) | - | (Inaccessible) |
| 004Fh | (Reserved) | - | (Inaccessible) |
| 0050h | WC (window comparator) | R | 1: ON, 0: OFF |
| 0051h to 0053h | (Reserved) | - | (Inaccessible) |
| 0054h | FREF (frequency command source signal) | R | 1: Operator, 0: Others |
| 0055h | REF (RUN command source signal) | R | 1: Operator, 0: Others |
| 0056h | SETM (2nd motor selected) | R | 1: 2nd motor selected, 0: 1st motor selected |
| 0057h- | (Reserved) | - | (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 recognizes it to be ON. But ON by the communication does not display on the intelligent input terminal status (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 the reset selection (C102) to "02 (cancel trip state, no effect if in run mode)".

*3 Communication error data is retained until an error reset command* is input. (In the case of "C102 = 02", error is cleared at the time of a trip only.)
*reset command: terminal reset function, reset of coil (coil No. "0004h")

(B) Modbus Holding Registers

The following tables list the holding registers for the inverter interface to the network. The table legend is given below.

- **Register No. -** The network register address offset for the value. Some values have a high and low address.
- **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 the operator display).
- **R/W -** The read-only (R) or write-only (W) 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 7 description).
- **Data 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 external control equipment must apply the same factor when it needs to work in engineering units. However, when sending data to the inverter, the network host external control equipment 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 | (Reserved) | - | - | (Inaccessible) | |
| 0001h | Frequency source | F001 (high) | R/W | 0 to "maximum frequency (A004/A204)" (valid when A001/A201=03.) | 0.01 [Hz] |
| 0002h | | F001 (low) | R/W | | |
| 0003h | Inverter status A | - | R | 0: Initial status<br>2: Stopping<br>3: Running<br>4: Free-run stop<br>5: Jogging<br>6: DC braking<br>7: Retrying<br>8: Tripping<br>9: Undervoltage (UV) | - |
| 0004h | Inverter status B | - | R | 0: Stopping,<br>1: Running,<br>2: Tripping | - |
| 0005h | Inverter status C | - | R | 0: ---<br>1: Stopping<br>2: Decelerating<br>3: Constant-speed operation<br>4: Accelerating<br>5: Forward rotation<br>6: Reverse rotation<br>7: Switching from forward to reverse rotation<br>8: Switching from reverse to forward rotation<br>9: Starting forward<br>10: Starting reverse | - |
| 0006h | PID feedback | - | R | 0 to 10000 (R/W is valid when A076=02.) | 0.01 [%] |
| 0007h to 0010h | (Reserved) | - | - | (Inaccessible) | - |
| 0011h | Trip Counter | d080 | R | 0 to 65535 | 1 [time] |
| 0012h | Trip info. 1 (factor) | d081 | R | See the "(i) List of inverter trip factors" below. | - |
| 0013h | Trip info. 1 (inverter status) | | | See the "(i) List of inverter trip factors" below. | - |
| 0014h | Trip info. 1 (frequency) (high) | | | Output frequency at tripping. | 0.01 [Hz] |
| 0015h | Trip info. 1 (frequency) (low) | | | | |
| 0016h | Trip info. 1 (current) | | | Output current at tripping. | 0.01 [A] |
| 0017h | Trip info. 1 (voltage) | | | DC bus voltage at tripping. | 0.1 [VDC] |
| 0018h | Trip info. 1 (running time) (high) | | | Cumulative operation RUN time at tripping. | 1 [hr] |
| 0019h | Trip info. 1 (running time) (low) | | | | |
| 001Ah | Trip info. 1 (power-on time) (high) | | | Cumulative power-on time at tripping. | 1 [hr] |
| 001Bh | Trip info. 1 (power-on time) (low) | | | | |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 001Ch | Trip info. 2 (factor) | d082 | R | See the “(i) List of inverter trip factors” below. | - |
| 001Dh | Trip info. 2 (inverter status) | | | See the “(i) List of inverter trip factors” below. | - |
| 001Eh | Trip info. 2 (frequency) (high) | | | Output frequency at tripping. | 0.01 [Hz] |
| 001Fh | Trip info. 2 (frequency) (low) | | | | |
| 0020h | Trip info. 2 (current) | | | Output current at tripping. | 0.01 [A] |
| 0021h | Trip info. 2 (voltage) | | | DC bus voltage at tripping. | 0.1 [VDC] |
| 0022h | Trip info. 2 (running time) (high) | | | Cumulative operation RUN time at tripping. | 1 [hr] |
| 0023h | Trip info. 2 (running time) (low) | | | | |
| 0024h | Trip info. 2 (power-on time) (high) | | | Cumulative power-on time at tripping. | 1 [hr] |
| 0025h | Trip info. 2 (power-on time) (low) | | | | |
| 0026h | Trip info. 3 (factor) | d083 | R | See the “(i) List of inverter trip factors” below. | - |
| 0027h | Trip info. 3 (inverter status) | | | See the “(i) List of inverter trip factors” below. | - |
| 0028h | Trip info. 3 (frequency) (high) | | | Output frequency at tripping. | 0.01 [Hz] |
| 0029h | Trip info. 3 (frequency) (low) | | | | |
| 002Ah | Trip info. 3 (current) | | | Output current at tripping. | 0.01 [A] |
| 002Bh | Trip info. 3 (voltage) | | | DC bus voltage at tripping. | 0.1 [VDC] |
| 002Ch | Trip info. 3 (running time) (high) | | | Cumulative operation RUN time at tripping. | 1 [hr] |
| 002Dh | Trip info. 3 (running time) (low) | | | | |
| 002Eh | Trip info. 3 (power-on time) (high) | | | Cumulative power-on time at tripping. | 1 [hr] |
| 002Fh | Trip info. 3 (power-on time) (low) | | | | |
| 0030h | Trip info. 4 (factor) | d084 | R | See the “(i) List of inverter trip factors” below. | - |
| 0031h | Trip info. 4 (inverter status) | | | See the “(i) List of inverter trip factors” below. | - |
| 0032h | Trip info. 4 (frequency) (high) | | | Output frequency at tripping. | 0.01 [Hz] |
| 0033h | Trip info. 4 (frequency) (low) | | | | |
| 0034h | Trip info. 4 (current) | | | Output current at tripping. | 0.01 [A] |
| 0035h | Trip info. 4 (voltage) | | | DC bus voltage at tripping. | 0.1 [VDC] |
| 0036h | Trip info. 4 (running time) (high) | | | Cumulative operation RUN time at tripping. | 1 [hr] |
| 0037h | Trip info. 4 (running time) (low) | | | | |
| 0038h | Trip info. 4 (power-on time) (high) | | | Cumulative power-on time at tripping. | 1 [hr] |
| 0039h | Trip info. 4 (power-on time) (low) | | | | |
| 003Ah | Trip info. 5 (factor) | d085 | R | See the “(i) List of inverter trip factors” below. | - |
| 003Bh | Trip info. 5 (inverter status) | | | See the “(i) List of inverter trip factors” below. | - |
| 003Ch | Trip info. 5 (frequency) (high) | | | Output frequency at tripping. | 0.01 [Hz] |
| 003Dh | Trip info. 5 (frequency) (low) | | | | |
| 003Eh | Trip info. 5 (current) | | | Output current at tripping. | 0.01 [A] |
| 003Fh | Trip info. 5 (voltage) | | | DC bus voltage at tripping. | 0.1 [VDC] |
| 0040h | Trip info. 5 (running time) (high) | | | Cumulative operation RUN time at tripping. | 1 [hr] |
| 0041h | Trip info. 5 (running time) (low) | | | | |
| 0042h | Trip info. 5 (power-on time) (high) | | | Cumulative power-on time at tripping. | 1 [hr] |
| 0043h | Trip info. 5 (power-on time) (low) | | | | |
| 0044h | Trip info. 6 (factor) | d086 | R | See the “(i) List of inverter trip factors” below. | - |
| 0045h | Trip info. 6 (inverter status) | | | See the “(i) List of inverter trip factors” below. | - |
| 0046h | Trip info. 6 (frequency) (high) | | | Output frequency at tripping. | 0.01 [Hz] |
| 0047h | Trip info. 6 (frequency) (low) | | | | |
| 0048h | Trip info. 6 (current) | | | Output current at tripping. | 0.01 [A] |
| 0049h | Trip info. 6 (voltage) | | | DC bus voltage at tripping. | 0.1 [VDC] |
| 004Ah | Trip info. 6 (running time) (high) | | | Cumulative operation RUN time at tripping. | 1 [hr] |
| 004Bh | Trip info. 6 (running time) (low) | | | | |
| 004Ch | Trip info. 6 (power-on time) (high) | | | Cumulative power-on time at tripping. | 1 [hr] |
| 004Dh | Trip info. 6 (power-on time) (low) | | | | |
| 004Eh | Warning monitoring | d090 | R | See the “(ii) List of warning data” below. | - |
| 004Fh to 08FFh | (reserved) | - | - | (Inaccessible) | - |
| 0900h | ENTER command | - | W | 0: recalculate the internal value | - |
| 0901h to 1000h | (reserved) | - | - | (Inaccessible) | - |

(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 |
| Overcurrent event during constant speed | 1 | Stopping | 1 |
| Overcurrent event during deceleration | 2 | Decelerating | 2 |
| Overcurrent event during acceleration | 3 | Constant speed operation | 3 |
| Overcurrent event during other conditions | 4 | Accelerating | 4 |
| Overload protection | 5 | Operating at zero frequency | 5 |
| Overvoltage protection | 7 | Starting | 6 |
| Memory error | 8 | DC braking | 7 |
| Undervoltage | 9 | Overload restricted | 8 |
| Current detection error | 10 | | |
| CPU error | 11 | | |
| External trip | 12 | | |
| USP error | 13 | | |
| Ground fault protection | 14 | | |
| Input overvoltage protection | 15 | | |
| Thermal detection error | 19 | | |
| Temperature error | 21 | | |
| Driver error | 30 | | |
| Output phase loss protection | 34 | | |
| Low-speed overload protection | 38 | | |
| Step out error | 39 | | |
| Operator connection error | 40 | | |
| Modbus communication error | 41 | | |

(ii) List of warning data

| Modbus data | Operator display | Condition | | |
|---|---|---|---|---|
| 1 | H 001 | Frequency upper limit (A061) | > | Maximum frequency (A004) |
| 2 | H 002 | Frequency lower limit (A062) | > | Maximum frequency (A004) |
| 3 | H 005 | Output frequency setting (F001), Multi-speed frequency 0 (A020) | > | Maximum frequency (A004) |
| 10 | H 015 | Output frequency setting (F001), Multi-speed frequency 0 (A020) | > | Frequency upper limit (A061) |
| 17 | H 025 | Frequency lower limit (A062) | > | Output frequency setting (F001), Multi-speed frequency 0 (A020) |
| 23 | H 031 | Start frequency (b082) | > | Frequency upper limit (A061) |
| 25 | H 032 | Start frequency (b082) | > | Frequency lower limit (A062) |
| 27 | H 035 | Start frequency (b082) | > | Output frequency setting (F001), Multi-speed frequency 0 (A020) |
| 30 | H 037 | Start frequency (b082) | > | Jog frequency (A038) |
| 31 | H 085 | Output frequency setting (F001), Multi-speed frequency 0 (A020) | = | "Jump frequency (center) 1/2/3" ± "Jump frequency width (hysteresis) 1/2/3" (A063 ± A064, A065 ± A066, A067 ± A068) |
| 33 | H 086 | Multi-speed frequency 1 to 7 (A021 to A027) | = | |
| 34 | H 091 | Free V/f setting, frequency 7 (b112) | < | Frequency upper limit (A061) |
| 36 | H 092 | Free V/f setting, frequency 7 (b112) | < | Frequency lower limit (A062) |
| 38 | H 095 | Free V/f setting, frequency 7 (b112) | < | Output frequency setting (F001), Multi-speed frequency 0 (A020) |
| 5 | H 201 | Frequency upper limit, 2nd motor (A261) | > | Maximum frequency, 2nd motor (A204) |
| 6 | H 202 | Frequency lower limit, 2nd motor (A262) | > | Maximum frequency, 2nd motor (A204) |
| 7 | H 205 | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) | > | Maximum frequency, 2nd motor (A204) |
| 14 | H 215 | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) | > | Frequency upper limit, 2nd motor (A261) |
| 21 | H 225 | Frequency lower limit, 2nd motor (A262) | > | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) |
| 24 | H 231 | Start frequency (b082) | > | Frequency upper limit, 2nd motor (A261) |
| 26 | H 232 | Start frequency (b082) | > | Frequency lower limit, 2nd motor (A262) |
| 28 | H 235 | Start frequency (b082) | > | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) |
| 32 | H 285 | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) | = | "Jump frequency (center) 1/2/3" ± "Jump frequency width (hysteresis) 1/2/3" (A063 ± A064, A065 ± A066, A067 ± A068) |
| 35 | H 291 | Free V/f setting, frequency 7 (b112) | < | Frequency upper limit, 2nd motor (A261) |
| 37 | H 292 | Free V/f setting, frequency 7 (b112) | < | Frequency lower limit, 2nd motor (A262) |
| 39 | H 295 | Free V/f setting, frequency 7 (b112) | < | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) |

Note) The warning data of the Modbus communication do not accord with the warning code of the operator.

### (2) Registers (monitoring group d)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1001h | Output frequency monitoring | d001 (high) | R | 0 to 40000 | 0.01 [Hz] |
| 1002h | | d001 (low) | | | |
| 1003h | Output current monitoring | d002 | R | 0 to 65530 | 0.01 [A] |
| 1004h | Rotation direction monitoring | d003 | R | 0 (Stopped),<br>1 (Forward rotation),<br>2 (Reverse rotation) | - |
| 1005h | PV monitoring | d004 (high) | R | 0 to 1000000 | 0.01[%] |
| 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, $2^1$: Relay Terminal | 1 bit |
| 1009h | Scaled output frequency monitoring | d007 (high) | R | 0 to 3999600 | 0.01 |
| 100Ah | | d007 (low) | | | |
| 100Bh to 1010h | (Reserved) | - | - | (Inaccessible) | - |
| 1011h | Output voltage monitoring | d013 | R | 0 to 6000 | 0.1 [V] |
| 1012h | Input power monitoring | d014 | R | 0 to 9999 | 0.1 [kW] |
| 1013h | Cumulative power monitoring | d015 (high) | R | 0 to 9999999 | 0.1 |
| 1014h | | d015 (low) | | | |
| 1015h | Cumulative operation RUN time monitoring | d016 (high) | R | 0 to 999999 | 1 [hr] |
| 1016h | | d016 (low) | | | |
| 1017h | Cumulative power-on time monitoring | d017 (high) | R | 0 to 999999 | 1 [hr] |
| 1018h | | d017 (low) | | | |
| 1019h | Heatsink temperature monitoring | d018 | R | -200 to 1200 | 0.1 [°C] |
| 101Ah to 1025h | (Reserved) | - | - | (Inaccessible) | - |
| 1026h | DC bus voltage monitoring | d102 | R | 0 to 10000 | 0.1 [VDC] |
| 1027h | (Reserved) | - | - | (Inaccessible) | - |
| 1028h | Electronic thermal overload monitoring | d104 | R | 0 to 1000 | 0.1 [%] |
| 1029h to 1056h | (Reserved) | - | - | (Inaccessible) | - |
| 1057h *) | Inverter mode monitoring | d060 | R | 0 (Induction motor),<br>1 (PM motor) | - |
| 1058h to 1102h | (Reserved) | - | - | (Inaccessible) | - |

*) Available in NE-S1 Ver.2.0 or later.

### (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 | Run key routing | F004 | R/W | 0 (Forward),<br>1 (Reverse) | - |
| 1108h to 1200h | (Reserved) | - | - | (Inaccessible) | - |

### (4) Registers (group A)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1201h | Frequency source | A001 | R/W | 0 (VR),<br>1 (Control terminal),<br>2 (Operator),<br>3 (Modbus network input),<br>10 (Calculate function output) | - |
| 1202h | Run command source *) | A002 | R/W | 1 (Control terminal),<br>2 (Operator),<br>3 (Modbus network input) | - |
| 1203h | Base frequency | A003 | R/W | 300 to "maximum frequency (A004)" | 0.1 [Hz] |
| 1204h | Maximum frequency | A004 | R/W | "Base frequency (A003)" to 4000 | 0.1 [Hz] |
| 1205h to 120Bh | (Reserved) | - | - | (Inaccessible) | - |
| 120Ch | [O/OI] input active range start frequency | A011 | R/W | 0 to 40000 | 0.01 [Hz] |
| 120Dh | (Reserved) | - | - | (Inaccessible) | - |
| 120Eh | [O/OI] input active range end frequency | A012 | R/W | 0 to 40000 | 0.01 [Hz] |
| 120Fh | [O/OI] input active range start ratio | A013 | R/W | 0 to "[O/OI] input active range end ratio (A014)" | 1 [%] |
| 1210h | [O/OI] input active range end ratio | A014 | R/W | "[O/OI] input active range start ratio (A013)" to 100 | 1 [%] |
| 1211h | [O/OI] input start frequency enable | A015 | R/W | 0 (Use offset (A011 value)),<br>1 (Use 0 Hz) | - |
| 1212h | Analog input filter. | A016 | R/W | 1 to 30 (x 2 ms),<br>31 (500 ms fixed filter ± with 0.1 Hz hysteresis) | 1 |
| 1213,4h | (Reserved) | - | - | (Inaccessible) | - |
| 1215h | Multi-speed operation selection | A019 | R/W | 0 (Binary operation),<br>1 (Bit operation) | - |
| 1216h | (Reserved) | - | - | (Inaccessible) | - |
| 1217h | Multi-speed frequency 0 | A020 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004)" | 0.01 [Hz] |
| 1218h | (Reserved) | - | - | (Inaccessible) | - |
| 1219h | Multi-speed frequency 1 | A021 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004/A204)" | 0.01 [Hz] |
| 121Ah | (Reserved) | - | - | (Inaccessible) | - |
| 121Bh | Multi-speed frequency 2 | A022 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004/A204)" | 0.01 [Hz] |
| 121Ch | (Reserved) | - | - | (Inaccessible) | - |
| 121Dh | Multi-speed frequency 3 | A023 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004/A204)" | 0.01 [Hz] |
| 121Eh | (Reserved) | - | - | (Inaccessible) | - |
| 121Fh | Multi-speed frequency 4 | A024 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004/A204)" | 0.01 [Hz] |
| 1220h | (Reserved) | - | - | (Inaccessible) | - |
| 1221h | Multi-speed frequency 5 | A025 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004/A204)" | 0.01 [Hz] |
| 1222h | (Reserved) | - | - | (Inaccessible) | - |
| 1223h | Multi-speed frequency 6 | A026 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004/A204)" | 0.01 [Hz] |
| 1224h | (Reserved) | - | - | (Inaccessible) | - |
| 1225h | Multi-speed frequency 7 | A027 | R/W | 0 or "Start frequency (b082)" to "Maximum frequency (A004/A204)" | 0.01 [Hz] |
| 1226h to 1237h | (Reserved) | - | - | (Inaccessible) | - |

*) After changing the setting, keep the time 40 ms or longer before actually giving run command.

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1238h | Jog frequency | A038 | R/W | "Start frequency (b082)" to 999 | 0.01 [Hz] |
| 1239h | Jog stop mode | A039 | R/W | 0 (Free-run stop [invalid during run]),<br>1 (Controlled deceleration [invalid during run]),<br>2 (DC braking to stop [invalid during run]),<br>3 (Free-run stop [valid during run]),<br>4 (Controlled deceleration [valid during run]),<br>5 (DC braking to stop [valid during run]) | - |
| 123Ah | (Reserved) | - | - | (Inaccessible) | - |
| 123Bh | Torque boost selection | A041 | R/W | 0 (Manual torque boost),<br>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 | A044 | R/W | 0 (Constant torque),<br>1 (Reduced torque ($1.7^{th}$ power)),<br>2 (Free V/f) | - |
| 123Fh | V/f gain | A045 | R/W | 20 to 100 | 1 [%] |
| 1240h | Voltage compensation gain for automatic torque boost | A046 | R/W | 0 to 255 | 1 [%] |
| 1241h | Slip compensation gain for automatic torque boost | A047 | R/W | 0 to 255 | 1 [%] |
| 1242h to 1244h | (Reserved) | - | - | (Inaccessible) | - |
| 1245h | DC braking enable | A051 | R/W | 0 (Disabled),<br>1 (Enabled during stop),<br>2 (Frequency command) | - |
| 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 for 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 detection),<br>1 (Level detection) | - |
| 124Bh | DC braking force at start | A057 | R/W | 0 to 100 | 1 [%] |
| 124Ch | DC braking time at start | A058 | R/W | 0 to 100 | 0.1 [s] |
| 124Dh | Carrier frequency during DC braking | A059 | R/W | 20 to 150 | 0.1 [kHz] |
| 124E,Fh | (Reserved) | - | - | (Inaccessible) | - |
| 1250h | Frequency upper limit | A061 | R/W | 0 or "Frequency lower limit (A062)" to "Maximum frequency (A004)" | 0.01 [Hz] |
| 1251h | (Reserved) | - | - | (Inaccessible) | - |
| 1252h | Frequency lower limit | A062 | R/W | 0 or "Start frequency (b082)" to " Frequency upper limit (A061)" | 0.01 [Hz] |
| 1253h | (Reserved) | - | - | (Inaccessible) | - |
| 1254h | Jump frequency (center) 1 | A063 | R/W | 0 to 40000 | 0.01 [Hz] |
| 1255h | Jump frequency width (hysteresis) 1 | A064 | R/W | 0 to 1000 | 0.01 [Hz] |
| 1256h | (Reserved) | - | - | (Inaccessible) | - |
| 1257h | Jump frequency (center) 2 | A065 | R/W | 0 to 40000 | 0.01 [Hz] |
| 1258h | Jump frequency width (hysteresis) 2 | A066 | R/W | 0 to 1000 | 0.01 [Hz] |
| 1259h | (Reserved) | - | - | (Inaccessible) | - |
| 125Ah | Jump frequency (center) 3 | A067 | R/W | 0 to 40000 | 0.01 [Hz] |
| 125Bh | Jump frequency width (hysteresis) 3 | A068 | R/W | 0 to 1000 | 0.01 [Hz] |
| 125Ch | (Reserved) | - | - | (Inaccessible) | - |
| 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] |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 125Fh | PID enable | A071 | R/W | 0 (PID Disabled),<br>1 (PID Enabled),<br>2 (PID Enabled with reverse 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 time constant | 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 ([O/OI] terminal),<br>2 (Modbus network input),<br>10 (Calculate function output) | - |
| 1265h | Reverse PID action | A077 | R/W | 0 (PID input = SP–PV),<br>1 (PID input = – (SP–PV)) | - |
| 1266h | PID variation range | A078 | R/W | 0 to 1000 | 0.1 [%] |
| 1267,8h | (Reserved) | - | - | (Inaccessible) | - |
| 1269h | AVR function selection | A081 | R/W | 0 (AVR enabled),<br>1 (AVR disabled),<br>2 (AVR enabled except during deceleration) | - |
| 126Ah | AVR voltage selection | A082 | R/W | 200 V class: 0 (200V),<br>1 (215V),<br>2 (220V),<br>3 (230V),<br>4 (240V),<br>400 V class: 5 (380V),<br>6 (400V),<br>7 (415V),<br>8 (440V),<br>9 (460V),<br>10 (480V) | - |
| 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),<br>1 (Energy-saving operation) | - |
| 126Eh | Energy-saving mode tuning | A086 | R/W | 0 to 1000 | 0.1 [%] |
| 126Fh to 1273h | (Reserved) | - | - | (Inaccessible) | |
| 1274h | Acceleration time (2) | A092 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 1275h | | A092 (low) | | | |
| 1276h | Deceleration time (2) | A093 (high) | R/W | 0 to 360000 | 0.01 [s] |
| 1277h | | A093 (low) | | | |
| 1278h | Selection method to switch to Acc2/Dec2 profile | A094 | R/W | 0 ([2CH] input from terminal),<br>1 (Transition frequency),<br>2 (Forward and reverse) | - |
| 1279h | (Reserved) | - | - | (Inaccessible) | - |
| 127Ah | Acc1 to Acc2 frequency transition point | A095 | R/W | 0 to 40000 | 0.01 [Hz] |
| 127Bh | (Reserved) | - | - | (Inaccessible) | - |
| 127Ch | Dec2 to Dec1 frequency transition point | A096 | R/W | 0 to 40000 | 0.01 [Hz] |
| 127Dh | Acceleration curve selection | A097 | R/W | 0 (Linear),<br>1 (S-curve),<br>2 (U-curve),<br>3 (Inverse U-curve) | - |
| 127Eh | Deceleration curve selection | A098 | R/W | | |
| 127Fh to 12A4h | (Reserved) | - | - | (Inaccessible) | - |
| 12A5h | Acceleration curve constant | A131 | R/W | 1 (smallest swelling) to<br>10 (largest swelling) | - |
| 12A6h | Deceleration curve constant | A132 | R/W | 1 (smallest swelling) to<br>10 (largest swelling) | - |
| 12A7h to 12AEh | (Reserved) | - | - | (Inaccessible) | - |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 12AFh | A input selection for calculate function | A141 | R/W | 0 (Operator),<br>1 (VR),<br>2 (Terminal [O/OI] input),<br>4 (Modbus network input) | - |
| 12B0h | B input selection for calculate function | A142 | R/W | | |
| 12B1h | Calculation symbol | A143 | R/W | 0 (ADD: A141 + A142),<br>1 (SUB: A141 – A142),<br>2 (MUL: A141 x A142) | - |
| 12B2,3h | (Reserved) | - | - | (Inaccessible) | - |
| 12B4h | ADD frequency | A145 | R/W | 0 to 40000 | 0.01 [Hz] |
| 12B5h | ADD direction selection | A146 | R/W | 0 ("Frequency command" + "ADD frequency (A145)"),<br>1 ("Frequency command" – "ADD frequency (A145)") | - |
| 12B6h to 12BDh | (Reserved) | - | - | (Inaccessible) | - |
| 12BEh | Deceleration hold frequency | A154 | R/W | 0 to 40000 | 0.01 [Hz] |
| 12BFh | Deceleration hold time | A155 | R/W | 0 to 600 | 0.1 [s] |
| 12C0h | (Reserved) | - | - | (Inaccessible) | - |
| 12C1h | PID sleep function action threshold | A156 | R/W | 0 to 40000 | 0.01 [Hz] |
| 12C2h | PID sleep function action delay time | A157 | R/W | 0 to 255 | 0.1 [s] |
| 12C3h | (Reserved) | - | - | (Inaccessible) | - |
| 12C4h | PID sleep function return threshold | A158 | R/W | 0 to 40000 | 0.01[Hz] |
| 12C5,6h | (Reserved) | - | - | (Inaccessible) | - |
| 12C7h | [VR] input active range start frequency | A161 | R/W | 0 to 40000 | 0.01 [Hz] |
| 12C8h | (Reserved) | - | - | (Inaccessible) | - |
| 12C9h | [VR] input active range end frequency | A162 | R/W | 0 to 40000 | 0.01 [Hz] |
| 12CAh | [VR] input active range start ratio | A163 | R/W | 0 to "[VR] input active range end ratio (A164)" | 1 [%] |
| 12CBh | [VR] input active range end ratio | A164 | R/W | "[VR] input active range start ratio (A163)" to 100 | 1 [%] |
| 12CCh | [VR] input start frequency enable | A165 | R/W | 0 (Use offset (A161 value)),<br>1 (Use 0 Hz) | - |
| 12CDh to 1300h | (Reserved) | - | - | (Inaccessible) | - |

### (5) Registers (group B)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1301h | Restart mode on undervoltage trip | b001 | R/W | 0 (Tripping),<br>1 (Restarting with 0 Hz),<br>2 (Restarting with active frequency matching),<br>3 (Tripping after deceleration and stopping with active frequency matching) | - |
| 1302h | Allowable undervoltage 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 undervoltage trip alarm enable | b004 | R/W | 0 (Disabled),<br>1 (Enabled),<br>2 (Disabled during stop and deceleration stop) | - |
| 1305h | Number of restarts on undervoltage trip | b005 | R/W | 0 (Restart 16 times),<br>1 (Unlimited) | - |
| 1306,7h | (Reserved) | - | - | (Inaccessible) | - |
| 1308h | Restart frequency threshold | b007 | R/W | 0 to 40000 | 0.01 [Hz] |
| 1309h | Restart mode on overvoltage / overcurrent trip | b008 | R/W | 0 (Tripping),<br>1 (Restarting with 0 Hz),<br>2 (Restarting with active frequency matching),<br>3 (Tripping after deceleration and stopping with active frequency matching) | - |
| 130Ah | (Reserved) | - | - | (Inaccessible) | - |
| 130Bh | Number of retry on overvoltage / overcurrent trip | b010 | R/W | 1 to 3 | 1 [times] |
| 130Ch | Retry wait time on overvoltage / overcurrent trip | 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),<br>1 (Constant torque),<br>2 (Free setting) | - |
| 130Fh | (Reserved) | - | - | (Inaccessible) | - |
| 1310h | Free setting electronic thermal frequency 1 | b015 | R/W | 0 to "free setting electronic thermal frequency 2 (b017)" | 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 | "free setting electronic thermal frequency 1 (b015)" to "free setting electronic thermal frequency 3 (b019)" | 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 | "free setting electronic thermal frequency 2 (b017)" 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 (Disabled),<br>1 (Enabled during acceleration and constant speed operation),<br>2 (Enabled during constant speed operation only) | - |
| 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 (Disabled),<br>1 (Enabled during acceleration and constant speed operation),<br>2 (Enabled during constant speed operation only) | - |
| 131Ah | Overload restriction level 2 | b025 | R/W | 2000 to 20000 | 0.01 [%] |
| 131Bh | Deceleration rate 2 at overload restriction | b026 | R/W | 1 to 30000 | 0.1 [s] |
| 131Ch | OC suppression selection | b027 | R/W | 0 (Disabled),<br>1 (Enabled) | - |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 131Dh | Current level of active frequency matching | b028 | R/W | 2000 to 20000 | 0.01 [%] |
| 131Eh | Deceleration rate of active frequency matching | b029 | R/W | 1 to 30000 | 0.1 [s] |
| 131Fh | Start frequency of active frequency matching | b030 | R/W | 0 (Frequency at previous shutoff),<br>1 (Maximum frequency),<br>2 (Frequency command) | - |
| 1320h | Software lock mode selection | b031 | R/W | 0 (Disabling change of data other than b031 when [SFT] terminal is on),<br>1 (Disabling change of data other than b031, F001, A020, A220, A021 to A027, and A038 when [SFT] terminal is on),<br>2 (Disabling change of data other than b031),<br>3 (Disabling change of data other than b031, F001, A020, A220, A021 to A027, and A038),<br>10 (Enabling data changes during operation) | - |
| 1321,2h | (Reserved) | - | - | (Inaccessible) | - |
| 1323h | Run/power ON warning time | b034 (high) | R/W | 0 to 65535 | 10 [hr] |
| 1324h | | b034 (low) | R/W | | |
| 1325h | Rotation direction restriction | b035 | R/W | 0 (No restriction),<br>1 (Reverse rotation is restricted),<br>2 (Forward rotation is restricted) | - |
| 1326h | Reduced voltage start selection | b036 | R/W | 0 (The function disabled),<br>1 to 250 (x 4 ms) | - |
| 1327h | Function code display restriction | b037 | R/W | 0 (Full display),<br>1 (Function-specific display),<br>3 (Data comparison display),<br>4 (Basic display),<br>5 (Monitor display only) | - |
| 1328h | Initial display selection | b038 | R/W | 0, 1 to 60, 201, 202 | - |
| 1329h to 1333h | (Reserved) | - | - | (Inaccessible) | - |
| 1334h | Controlled deceleration on power loss selection | b050 | R/W | 0 (Disabled),<br>1 (Deceleration stop),<br>2 (Deceleration stop with DC bus voltage controlled),<br>3 (Deceleration stop with DC bus voltage controlled, then restart) | - |
| 1335h | DC bus voltage trigger level of controlled deceleration | b051 | R/W | 200 V class: 0 to 4000,<br>400 V class: 0 to 8000 | 0.1 [VDC] |
| 1336h | Overvoltage threshold of controlled deceleration | b052 | R/W | 200 V class: 0 to 4000,<br>400 V class: 0 to 8000 | 0.1 [VDC] |
| 1337h | (Reserved) | - | - | (Inaccessible) | - |
| 1338h | Deceleration time of controlled deceleration | b053 | R/W | 1 to 30000 | 0.01 [s] |
| 1339h | Initial frequency drop of controlled deceleration | b054 | R/W | 0 to 1000 | 0.01 [Hz] |
| 133Ah to 133Eh | (Reserved) | - | - | (Inaccessible) | - |
| 133Fh | Maximum-limit level of window comparator (O/OI) | b060 | R/W | 0 to 100<br>(Lower limit: b061 + (b062 x 2)) | 1 [%] |
| 1340h | Minimum-limit level of window comparator (O/OI) | b061 | R/W | 0 to 100<br>(Higher limit: b060 - (b062 x 2)) | 1 [%] |
| 1341h | Hysteresis width of window comparator (O/OI) | b062 | R/W | 0 to 10<br>(Higher limit : (b060 - b061) / 2) | 1 [%] |
| 1342h to 1348h | (Reserved) | - | - | (Inaccessible) | - |
| 1349h | Operation level at O/OI disconnection | b070 | R/W | 0 to 100,<br>255 (no) | 1 [%] |
| 134Ah to 1350h | (reserved) | - | - | (Inaccessible) | - |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1351h | Cumulative power clearance | b078 | R/W | 0 (OFF),<br>1 (Clearance by setting) | - |
| 1352h | Cumulative power display gain | b079 | R/W | 1 to 1000 | 1 |
| 1353,4h | (Reserved) | - | - | (Inaccessible) | - |
| 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 (Disabled),<br>1 (Clearing the trip history),<br>2 (Initializing all parameters),<br>3 (Clearing the trip history and initializing all parameters) | - |
| 1358h | Initial data selection | b085 | R/W | 0 (Mode 0),<br>1 (Mode 1),<br>3 (Mode 3) | - |
| 1359h | Frequency scaling conversion factor | b086 | R/W | 1 to 9999 | 0.01 |
| 135Ah | STOP/RESET key enable | b087 | R/W | 0 (Enabled),<br>1 (Disabled),<br>2 (Enabled only trip reset) | - |
| 135Bh | Restart mode after FRS | b088 | R/W | 0 (Restarting from 0 Hz),<br>1 (Restarting from active frequency matching) | - |
| 135Ch | Automatic carrier frequency reduction | b089 | R/W | 0 (Disabled),<br>1 (Enabled (depending on the output current)),<br>2 (Enabled (depending on the heatsink temperature)) | - |
| 135Dh | (Reserved) | - | - | (Inaccessible) | - |
| 135Eh | Stop mode selection | b091 | R/W | 0 (Deceleration stop),<br>1 (Free-run stop) | - |
| 135F,60h | (Reserved) | - | - | (Inaccessible) | - |
| 1361h | Initialization target data setting | b094 | R/W | 0 (All parameters),<br>1 (All parameters except terminal and communication data) | - |
| 1362h to 1366h | (Reserved) | - | - | (Inaccessible) | - |
| 1367h | Free V/f setting, frequency 1 | b100 | R/W | 0 to "free V/f setting, frequency 2 (b102)" | 1 [Hz] |
| 1368h | Free V/f setting, voltage 1 | b101 | R/W | 200 V class: 0 to 3000,<br>400 V class: 0 to 6000 | 0.1 [V] |
| 1369h | Free V/f setting, frequency 2 | b102 | R/W | "free V/f setting, frequency 1 (b100)" to "free V/f setting, frequency 3 (b104)" | 1 [Hz] |
| 136Ah | Free V/f setting, voltage 2 | b103 | R/W | 200 V class: 0 to 3000,<br>400 V class: 0 to 6000 | 0.1 [V] |
| 136Bh | Free V/f setting, frequency 3 | b104 | R/W | "free V/f setting, frequency 2 (b102)" to "free V/f setting, frequency 4 (b106)" | 1 [Hz] |
| 136Ch | Free V/f setting, voltage 3 | b105 | R/W | 200 V class: 0 to 3000,<br>400 V class: 0 to 6000 | 0.1 [V] |
| 136Dh | Free V/f setting, frequency 4 | b106 | R/W | "free V/f setting, frequency 3 (b104)" to "free V/f setting, frequency 5 (b108)" | 1 [Hz] |
| 136Eh | Free V/f setting, voltage 4 | b107 | R/W | 200 V class: 0 to 3000,<br>400 V class: 0 to 6000 | 0.1 [V] |
| 136Fh | Free V/f setting, frequency 5 | b108 | R/W | "free V/f setting, frequency 4 (b106)" to "free V/f setting, frequency 6 (b110)" | 1 [Hz] |
| 1370h | Free V/f setting, voltage 5 | b109 | R/W | 200 V class: 0 to 3000,<br>400 V class: 0 to 6000 | 0.1 [V] |
| 1371h | Free V/f setting, frequency 6 | b110 | R/W | "free V/f setting, frequency 5 (b108)" to "free V/f setting, frequency 7 (b112)" | 1 [Hz] |
| 1372h | Free V/f setting, voltage 6 | b111 | R/W | 200 V class: 0 to 3000,<br>400 V class: 0 to 6000 | 0.1 [V] |
| 1373h | Free V/f setting, frequency 7 | b112 | R/W | "free V/f setting, frequency 6 (b110)" to 400 | 1 [Hz] |
| 1374h | Free V/f setting, voltage 7 | b113 | R/W | 200 V class: 0 to 3000,<br>400 V class: 0 to 6000 | 0.1 [V] |
| 1375h to 1384h | (Reserved) | - | - | (Inaccessible) | - |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1385h | Deceleration overvoltage suppression enable | b130 | R/W | 0 (Disabled),<br>1 (Enabled (DC voltage constant control)),<br>2 (Enabled at the deceleration (with acceleration)),<br>3 (Enabled at the constant and deceleration (with acceleration)) | - |
| 1386h | Deceleration overvoltage suppression level | b131 | R/W | 200 V class: 330 to 390,<br>400 V class: 660 to 780 | 1 [VDC] |
| 1387h | Deceleration overvoltage suppression const. | b132 | R/W | 10 to 3000 | 0.01 [s] |
| 1388h | Deceleration overvoltage suppression proportional gain | b133 | R/W | 0 to 500 | 0.01 |
| 1389h | Deceleration overvoltage suppression integral time | b134 | R/W | 0 to 1500 | 0.1 [s] |
| 138Ah to 1398h | (Reserved) | - | - | (Inaccessible) | - |
| 1399h | Display external operator connected | b150 | R/W | 1h to 60h (BCD) (d001 to d060)<br>[Ex. 15h: d015] | - |
| 139Ah to 13A2h | (Reserved) | - | - | (Inaccessible) | - |
| 13A3h | 1st parameter of Dual Monitor | b160 | R/W | 1h to 18h (BCD) (d001 to d018)<br>[Ex. 15h: d015] | - |
| 13A4h | 2nd parameter of Dual Monitor | b161 | R/W | 1h to 18h (BCD) (d001 to d018)<br>[Ex. 15h: d015] | - |
| 13A5h | (Reserved) | - | - | (Inaccessible) | - |
| 13A6h | Frequency set in monitoring | b163 | R/W | 0 (Frequency set disabled),<br>1 (Frequency set enabled) | - |
| 13A7h | Automatic return to the initial display | b164 | R/W | 0 (Disabled),<br>1 (Enabled) | - |
| 13A8h | Operation at external operator connection loss | b165 | R/W | 0 (Tripping),<br>1 (Tripping after decelerating and stopping the motor),<br>2 (Ignoring errors),<br>3 (Stopping the motor after free-running),<br>4 (Decelerating and stopping the motor) | - |
| 13A9h | Data Read/Write selection | b166 | R/W | 0 (Read/Write OK),<br>1 (Read/Write protected) | - |
| 13AAh to 13ADh | (Reserved) | - | - | (Inaccessible) | - |
| 13AEh *) | Inverter mode selection | b171 | R/W | 0 (Disabling),<br>1 (Induction motor),<br>3 (PM motor) | - |
| 13AFh to 13B6h | (Reserved) | - | - | (Inaccessible) | - |
| 13B7h | Initialization trigger | b180 | R/W | 0 (Disabling),<br>1 (Perform initialization) | - |
| 13B8h to 1400h | (Reserved) | - | - | (Inaccessible) | - |

*) Available in NE-S1 Ver.2.0 or later.

### (6) Registers (group C)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1401h | Intelligent input [1] function | C001 | R/W | 0 (FW: Forward run/stop),<br>1 (RV: Reverse run/stop),<br>2 (CF1: Multi-speed selection, Bit 1),<br>3 (CF2: Multi-speed selection, Bit 2),<br>4 (CF3: Multi-speed selection, Bit 3),<br>6 (JG: Jogging),<br>7 (DB: External DC braking),<br>8 (SET: Set 2nd motor data),<br>9 (2CH: Two-stage acceleration and deceleration),<br>11 (FRS: Free-run stop),<br>12 (EXT: External trip),<br>13 (USP: Unattended start protection),<br>15 (SFT: Software lock),<br>18 (RS: Reset inverter),<br>20 (STA: Start (3-wire interface)),<br>21 (STP: Stop (3-wire interface)),<br>22 (F/R: FW,RV (3-wire interface)),<br>23 (PID: PID disable),<br>24 (PIDC: PID reset),<br>27 (UP: Remote control UP function),<br>28 (DWN: Remote control DOWN function),<br>29 (UDC: Remote control data clearing),<br>31 (OPE: Operator control),<br>32 (SF1: Multi-speed selection, Bit operation Bit 1),<br>33 (SF2: Multi-speed selection, Bit operation Bit 2),<br>34 (SF3: Multi-speed selection, Bit operation Bit 3),<br>39 (OLR: Overload restriction source changeover),<br>50 (ADD: ADD frequency enable),<br>51 (F-TM: Force terminal mode),<br>53 (KHC: Clear watt-hour data),<br>65 (AHD: Analog command hold),<br>83 (HLD: Retain output frequency),<br>84 (ROK: Permission of run command),<br>86 (DISP: Display limitation),<br>255 (NO: No assignment) | - |
| 1402h | Intelligent input [2] function | C002 | R/W | | - |
| 1403h | Intelligent input [3] function | C003 | R/W | | - |
| 1404h | Intelligent input [4] function | C004 | R/W | | - |
| 1405h | Intelligent input [5] function | C005 | R/W | | - |
| 1406h to 140Ah | (Reserved) | - | - | (Inaccessible) | - |
| 140Bh | Intelligent input [1] active state | C011 | R/W | 0 (Normally open (NO)),<br>1 (Normally closed (NC)) | - |
| 140Ch | Intelligent input [2] active state | C012 | R/W | 0 (Normally open (NO)),<br>1 (Normally closed (NC)) | - |
| 140Dh | Intelligent input [3] active state | C013 | R/W | 0 (Normally open (NO)),<br>1 (Normally closed (NC)) | - |
| 140Eh | Intelligent input [4] active state | C014 | R/W | 0 (Normally open (NO)),<br>1 (Normally closed (NC)) | - |
| 140Fh | Intelligent input [5] active state | C015 | R/W | 0 (Normally open (NO)),<br>1 (Normally closed (NC)) | - |
| 1410h to 1414h | (Reserved) | - | - | (Inaccessible) | - |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1415h | Intelligent output [11] function | C021 | R/W | 0 (RUN: Run signal),<br>1 (FA1: Frequency arrival type1 – constant speed),<br>2 (FA2: Frequency arrival type2 – over frequency),<br>3 (OL: Overload advance notice signal),<br>4 (OD: Output deviation for PID control),<br>5 (AL: Alarm signal),<br>6 (FA3: Frequency arrival type3 – set frequency),<br>9 (UV: Undervoltage),<br>11 (RNT: Run time expired),<br>12 (ONT: Power on time expired),<br>13 (THM: Thermal warning),<br>21 (ZS: Zero Hz speed detection signal),<br>27 (Dc: Analog input disconnect detection),<br>31 (FBV: PID second stage output),<br>32 (NDc: Network disconnect detection),<br>33 (LOG: Logic output function),<br>41 (FR: Starting contact signal),<br>42 (OHF: Heatsink overheat warning),<br>43 (LOC: Low current detection),<br>50 (IRDY: Inverter ready signal),<br>51 (FWR: Forward rotation),<br>52 (RVR: Reverse rotation),<br>53 (MJA: Major failure signal),<br>54 (WC: Window comparator for analog input),<br>58 (FREF: Frequency command source signal),<br>59 (REF: Run command source signal),<br>60 (SETM: 2nd motor selection),<br>255 (NO: No assignment) | - |
| 1416h to 1419h | (Reserved) | - | - | (Inaccessible) | - |
| 141Ah | Intelligent relay function | C026 | R/W | Same as the settings of C021. | - |
| 141Bh | [FM] terminal selection (pulse/PWM output) | C027 | R/W | 0 (Output frequency (PWM)),<br>1 (Output current (PWM)),<br>3 (Output frequency (pulse train)),<br>4 (Output voltage (PWM)),<br>5 (Input power (PWM)),<br>6 (Electronic thermal load ratio (PWM)),<br>7 (LAD frequency (PWM)),<br>8 (Output current (pulse train)),<br>10 (Heatsink temperature (PWM)) | - |
| 141C,Dh | (reserved) | - | - | (Inaccessible) | - |
| 141Eh | Digital current monitor reference value | C030 | R/W | 2000 to 20000 | 0.01 [%] |
| 141Fh | Intelligent output [11] active state | C031 | R/W | 0 (Normally open (NO)),<br>1 (Normally closed (NC)) | - |
| 1420h to 1423h | (Reserved) | - | - | (Inaccessible) | - |
| 1424h | Intelligent relay active state | C036 | R/W | 0 (Normally open (NO)),<br>1 (Normally closed (NC)) | - |
| 1425h | (Reserved) | - | - | (Inaccessible) | - |
| 1426h | Output mode of low current detection | C038 | R/W | 0 (During acceleration, deceleration, and constant speed),<br>1 (During constant speed only) | - |
| 1427h | Low current detection level | C039 | R/W | 0 to 20000 | 0.01 [%] |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1428h | Output mode of overload warning | C040 | R/W | 0 (During acceleration, deceleration, and constant speed),<br>1 (During constant speed only) | - |
| 1429h | Overload warning level | C041 | R/W | 0 to 20000 | 0.01 [%] |
| 142Ah | (Reserved) | - | - | (Inaccessible) | - |
| 142Bh | Frequency arrival setting for acceleration | C042 | R/W | 0 to 40000 | 0.01 [Hz] |
| 142Ch | (Reserved) | - | - | (Inaccessible) | - |
| 142Dh | Frequency arrival setting for deceleration | 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) | - | - | (Inaccessible) | - |
| 1438h | PV comparison signal output high limit | C052 | R/W | 0 to 1000 | 0.1 [%] |
| 1439h | PV comparison signal output low limit | C053 | R/W | 0 to 1000 | 0.1 [%] |
| 143Ah to 1440h | (Reserved) | - | - | (Inaccessible) | - |
| 1441h | Electronic thermal warning level | C061 | R/W | 0 to 100 | 1 [%] |
| 1442h | (Reserved) | - | - | (Inaccessible) | - |
| 1443h | Zero speed detection level | C063 | R/W | 0 to 10000 | 0.01 [Hz] |
| 1444h | Heatsink overheat warning | C064 | R/W | 0 to 110 | 1 [°C] |
| 1445h to 1449h | (Reserved) | - | - | (Inaccessible) | - |
| 144Ah | Selection of OPE/Modbus | C070 | R/W | 0 (OPE),<br>1 (Modbus) | - |
| 144Bh | Communication speed | C071 | R/W | 4 (4800 bps),<br>5 (9600 bps),<br>6 (19.2 kbps),<br>7 (38.4 kbps) | - |
| 144Ch | Modbus address | C072 | R/W | 1 to 247 | - |
| 144Dh | (Reserved) | - | - | (Inaccessible) | - |
| 144Eh | Communication parity | C074 | R/W | 0 (No parity),<br>1 (Even parity),<br>2 (Odd parity) | - |
| 144Fh | Communication stop bit | C075 | R/W | 1 (1 bit),<br>2 (2 bit) | - |
| 1450h | Communication error selection | C076 | R/W | 0 (Tripping),<br>1 (Tripping after decelerating and stopping the motor),<br>2 (Ignoring errors),<br>3 (Stopping the motor after free-running),<br>4 (Decelerating and stopping the motor) | - |
| 1451h | Communication error detection time | C077 | R/W | 0 to 9999 | 0.01 [s] |
| 1452h | Communication wait time | C078 | R/W | 0 to 1000 | 1 [ms] |
| 1453,4h | (Reserved) | - | - | (Inaccessible) | - |
| 1455h | O/OI input gain calibration | C081 | R/W | 0 to 2000 | 0.1 [%] |
| 1456h to 145Eh | (Reserved) | - | - | (Inaccessible) | - |
| 145Fh | (The parameter for factory use) | C091 | R | (Inaccessible) | - |
| 1460h to 1468h | (Reserved) | - | - | (Inaccessible) | - |

| 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),<br>1 (Storing the frequency data) | - |
| 146Ah | Reset selection | C102 | R/W | 0 (Resetting the trip when [RS] terminal is ON, stops inverter if in run mode),<br>1 (Resetting the trip when [RS] terminal is OFF, stops inverter if in run mode),<br>2 (Resetting the trip when [RS] terminal is ON, no effect if in run mode) | - |
| 146Bh | Restart mode after reset | C103 | R/W | 0 (Starting with 0 Hz),<br>1 (Starting with active frequency matching) | - |
| 146Ch | UP/DWN clear mode | C104 | R/W | 0 (0 Hz),<br>1 (Original setting in the memory at power on) | - |
| 146Dh | FM gain adjustment | C105 | R/W | 50 to 200 | 1 [%] |
| 146Eh to 1485h | (Reserved) | - | - | (Inaccessible) | - |
| 1486h | Intelligent output [11] on delay | C130 | R/W | 0 to 1000 | 0.1 [s] |
| 1487h | Intelligent output [11] off delay | C131 | R/W | 0 to 1000 | 0.1 [s] |
| 1488h to 148F | (Reserved) | - | - | (Inaccessible) | - |
| 1490h | Intelligent relay output on delay | C140 | R/W | 0 to 1000 | 0.1 [s] |
| 1491h | Intelligent relay output off delay | C141 | R/W | 0 to 1000 | 0.1 [s] |
| 1492h | Logic output operand A | C142 | R/W | Same as the settings of C021 and C026 (except those of LOG, NO) | - |
| 1493h | Logic output operand B | C143 | R/W | Same as the settings of C021 and C026 (except those of LOG, NO) | - |
| 1494h | Logic output operator | C144 | R/W | 0 (C142 AND C143),<br>1 (C142 OR C143),<br>2 (C142 XOR C143) | - |
| 1495h to 149Ah | (Reserved) | - | - | (Inaccessible) | - |
| 149Bh | Button sensitivity selection | C151 | R/W | 0 to 250 (x 2 ms),<br>255 (no) | - |
| 149Ch | Scroll sensitivity selection | C152 | R/W | 1 to 20 | - |
| 149D,Eh | (Reserved) | - | - | (Inaccessible) | - |
| 149Fh | Ground fault detection | C155 | R/W | 0 (Disabled),<br>1 (Enabled) | - |
| 14A0h | (Reserved) | - | - | (Inaccessible) | - |
| 14A1h | Output phase loss detection | C157 | R/W | 0 (Disabled),<br>1 (Enabled) | - |
| 14A2,3h | (Reserved) | - | - | (Inaccessible) | - |
| 14A4h | Intelligent input [1] response time | C160 | R/W | 0 to 200 (x 2 ms) | - |
| 14A5h | Intelligent input [2] response time | C161 | R/W | 0 to 200 (x 2 ms) | - |
| 14A6h | Intelligent input [3] response time | C162 | R/W | 0 to 200 (x 2 ms) | - |
| 14A7h | Intelligent input [4] response time | C163 | R/W | 0 to 200 (x 2 ms) | - |
| 14A8h | Intelligent input [5] response time | C164 | R/W | 0 to 200 (x 2 ms) | - |
| 14A9h to 14ACh | (Reserved) | - | - | (Inaccessible) | - |
| 14ADh | Multi-speed determination time | C169 | R/W | 0 to 200 (x 10 ms) | - |
| 14AEh to 1500h | (Reserved) | - | - | (Inaccessible) | - |

### (7) Registers (group H)

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 1501h | Auto-tuning selection | H001 | R/W | 0 (Disabled),<br>1 (Not rotation),<br>2 (Rotation) | - |
| 1502h | (Reserved) | - | - | (Inaccessible) | - |
| 1503h | Motor capacity | H003 | R/W | 0 (0.10 kW) to 11 (5.50 kW) | - |
| 1504h | Motor poles setting | H004 | R/W | 0 (2 poles) to 3 (8 poles) | - |
| 1505,6h | (Reserved) | - | - | (Inaccessible) | - |
| 1507h | Motor stabilization constant | H006 | R/W | 0 to 255 | 1 [%] |
| 1508h to 156Fh | (Reserved) | - | - | (Inaccessible) | - |
| 1570h *1) | PM motor rated voltage *2) | H101 | R/W | 200 V class: 1000 to 2400,<br>400 V class: 2000 to 4800 | 0.1 [V] |
| 1571h *1) | PM motor code setting *2) | H102 | R/W | 0 (Hitachi standard),<br>1 (Auto-Tuning) | - |
| 1572h *1) | PM motor capacity *2) | H103 | R/W | 0 (0.10 kW) to 12 (7.50 kW) | - |
| 1573h *1) | PM motor pole setting *2) | H104 | R/W | 0 (2 poles) to 23 (48 poles) | - |
| 1574h *1) | PM rated current *2) | H105 | R/W | 2000 to 10000 | 0.01 [%] |
| 1575h *1) | PM const R (Resistance) | H106 | R/W | 1 to 65535 | 0.001 [Ω] |
| 1576h *1) | PM const Ld<br>(d-axis inductance) | H107 | R/W | 1 to 65535 | 0.01 [mH] |
| 1577h *1) | PM const Lq<br>(q-axis inductance) | H108 | R/W | 1 to 65535 | 0.01 [mH] |
| 1578h *1) | PM const Ke<br>(Induction voltage constant) | H109 | R/W | 1 to 65535 | 0.1 [mV/<br>(rad/s)] |
| 1579h *1) | PM const J | H110 (high) | R/W | 1 to 9999000 | 0.001<br>[kgm$^2$] |
| 157Ah *1) | (Moment of inertia) | H110 (low) | R/W | | |
| 157Bh *1) | PM const R<br>(Resistance, Auto) | H111 | R/W | 1 to 65535 | 0.001 [Ω] |
| 157Ch *1) | PM const Ld<br>(d-axis inductance, Auto) | H112 | R/W | 1 to 65535 | 0.01 [mH] |
| 157Dh *1) | PM const Lq<br>(q-axis inductance, Auto) | H113 | R/W | 1 to 65535 | 0.01 [mH] |
| 157Eh *1) | PM const Ke<br>(Induction voltage constant, Auto) | H114 | R/W | 1 to 65535 | 0.1 [mV/<br>(rad/s)] |
| 157F,80h | (Reserved) | - | - | (Inaccessible) | - |
| 1581h *1) | PM speed response | H116 | R/W | 1 to 1000 | 1 [%] |
| 1582h *1) | PM starting current | H117 | R/W | 20 to 100 | 1 [%] |
| 1583h *1) | PM starting time | H118 | R/W | 1 to 6000 | 0.01 [s] |
| 1584h *1) | PM stabilization constant | H119 | R/W | 0 to 120 | 1 [%] |
| 1585h | (Reserved) | - | - | (Inaccessible) | - |
| 1586h *1) | PM minimum frequency ratio | H121 | R/W | 0 to 50 | 1 [%] |
| 1587h *1) | PM no-load current | H122 | R/W | 0 to 100 | 1 [%] |
| 1588h *1) | PM starting method selection | H123 | R/W | 0 (Not search),<br>1 (Search) | - |
| 1589h to 1591h | (Reserved) | - | - | (Inaccessible) | - |
| 1592h *1) | PM initial magnet position estimation detect time | H133 | R/W | 3 to 250 | 0.01 [s] |
| 1593h *1) | PM initial magnet position estimation voltage gain | H134 | R/W | 0 to 120 | 1 [%] |
| 1594h *1) | PM step-out protection selection | H135 | R/W | 0 (Disable),<br>1 (Error),<br>2 (Restart at 0 Hz) | - |
| 1595h *1) | PM step-out protection level | H136 | R/W | 1 to 100 | 1 [%] |
| 1596h | (Reserved) | - | - | (Inaccessible) | - |
| 1597h *1) | PM overcurrent detection level | H141 | R/W | 10000 to 25000 | 0.01 [%] |
| 1598h *1) | PM starting overcurrent detection level | H142 | R/W | 10000 to 25000 | 0.01 [%] |
| 1599h to 2102h | (Reserved) | - | - | (Inaccessible) | - |

*1) Available in NE-S1 Ver.2.0 or later.
*2) After changing the parameters, it is necessary to recalculate the internal variables. See Section "8.7 Re-calculate the internal variable".

### (8) Registers (2nd motor 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 | (Reserved) | - | - | (Inaccessible) | - |

### (9) Registers (2nd motor 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 (VR),<br>1 (Control terminal),<br>2 (Operator),<br>3 (Modbus network input),<br>10 (Calculate function output) | - |
| 2202h | Run command source, 2nd motor | A202 | R/W | 1 (Control terminal),<br>2 (Operator),<br>3 (Modbus network input) | - |
| 2203h | Base frequency, 2nd motor | A203 | R/W | 300 to "maximum frequency, 2nd motor (A204)" | 0.1 [Hz] |
| 2204h | Maximum frequency, 2nd motor | A204 | R/W | "Base frequency, 2nd motor (A203)" to 4000 | 0.1 [Hz] |
| 2205h to 2216h | (Reserved) | - | - | (Inaccessible) | - |
| 2217h | Multi-speed frequency 0, 2nd motor | A220 | R/W | 0 or "start frequency (b082)" to "maximum frequency, 2nd motor (A204)" | 0.01 [Hz] |
| 2218h to 223Ah | (Reserved) | - | - | (Inaccessible) | - |
| 223Bh | Torque boost selection, 2nd motor | A241 | R/W | 0 (Manual torque boost),<br>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, 2nd motor | A244 | R/W | 0 (Constant torque),<br>1 (Reduced torque ($1.7^{th}$ power)),<br>2 (Free V/f) | - |
| 223Fh | V/f gain, 2nd motor | A245 | R/W | 20 to 100 | 1 [%] |
| 2240h | Voltage compensation gain for automatic torque boost, 2nd motor | A246 | R/W | 0 to 255 | 1 [%] |
| 2241h | Slip compensation gain for automatic torque boost, 2nd motor | A247 | R/W | 0 to 255 | 1 [%] |
| 2242h to 224Fh | (Reserved) | - | - | (Inaccessible) | - |
| 2250h | Frequency upper limit, 2nd motor | A261 | R/W | 0 or "frequency lower limit, 2nd motor (A262)" to "maximum frequency, 2nd motor (A204)" | 0.01 [Hz] |
| 2251h | (Reserved) | - | - | (Inaccessible) | - |
| 2252h | Frequency lower limit, 2nd motor | A262 | R/W | 0 or "start frequency (b082)" to "frequency upper limit, 2nd motor (A261)" | 0.01 [Hz] |
| 2253h to 2268h | (Reserved) | - | - | (Inaccessible) | - |

| Register No. | Function name | Function code | R/W | Monitoring and setting items | Data resolution |
|---|---|---|---|---|---|
| 2269h | AVR function selection, 2nd motor | A281 | R/W | 0 (AVR enabled),<br>1 (AVR disabled),<br>2 (AVR enabled except during deceleration) | - |
| 226Ah | AVR voltage selection, 2nd motor | A282 | R/W | 200 V class: 0 (200V),<br>1 (215V),<br>2 (220V),<br>3 (230V),<br>4 (240V),<br>400 V class: 5 (380V),<br>6 (400V),<br>7 (415V),<br>8 (440V),<br>9 (460V),<br>10 (480V) | - |
| 226Bh to 226Eh | (Reserved) | - | - | (Inaccessible) | - |
| 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 | Selection method to switch to Acc2/Dec2 profile, 2nd motor | A294 | R/W | 0 ([2CH] input from terminal),<br>1 (Transition frequency),<br>2 (Forward and reverse) | - |
| 2274h | (Reserved) | - | - | (Inaccessible) | - |
| 2275h | Acc1 to Acc2 frequency transition point, 2nd motor | A295 | R/W | 0 to 40000 | 0.01 [Hz] |
| 2276h | (Reserved) | - | - | (Inaccessible) | - |
| 2277h | Dec2 to Dec1 frequency transition point, 2nd motor | A296 | R/W | 0 to 40000 | 0.01 [Hz] |
| 2278h to 230Bh | (Reserved) | - | - | (Inaccessible) | - |
| 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),<br>1 (Constant torque),<br>2 (Free setting) | - |
| 230Eh to 2315h | (Reserved) | - | - | (Inaccessible) | - |
| 2316h | Overload restriction operation mode, 2nd motor | b221 | R/W | 0 (Disabled),<br>1 (Enabled during acceleration and constant speed operation),<br>2 (Enabled during constant speed operation only) | - |
| 2317h | Overload restriction level, 2nd motor | b222 | R/W | 2000 to 20000 | 0.01 [%] |
| 2318h | Deceleration rate at overload restriction, 2nd motor | b223 | R/W | 1 to 30000 | 0.1 [s] |
| 2319h to 2428h | (Reserved) | - | - | (Inaccessible) | - |
| 2429h | Overload warning level, 2nd motor | C241 | R/W | 0 to 20000 | 0.01 [%] |
| 242Ah to 2502h | (Reserved) | - | - | (Inaccessible) | - |
| 2503h | Motor capacity, 2nd motor *) | H203 | R/W | 0 (0.10kW) to 11 (5.50kW) | - |
| 2504h | Motor poles setting, 2nd motor *) | H204 | R/W | 0 (2 poles) to 3 (8 poles) | - |
| 2505,6h | (Reserved) | - | - | (Inaccessible) | - |
| 2507h | Motor stabilization constant, 2nd motor *) | H206 | R/W | 0 to 255 | 1 [%] |
| 2508h– | (Reserved) | - | - | (Inaccessible) | - |

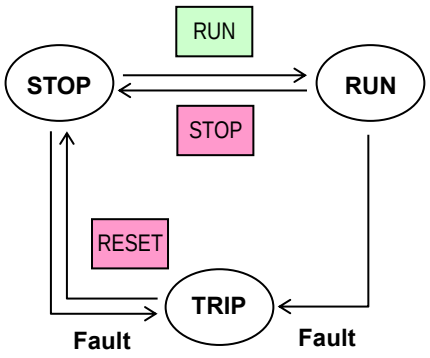
*) After changing the parameters, it is necessary to recalculate the internal variables. See Section "8.7 Re-calculate the internal variable".

# Chapter 9 Error Codes

**This chapter describes the error codes of the inverter, error indications by the functions, and troubleshooting methods.**

(Memo)

## 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 on “trips” similar to the way a circuit breaker trips due to an overcurrent 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, the fault except some ones can be cleared by pressing the RESET key or turning ON the “RS” input terminal.

* How to remove the trip condition
a) Pressing the RUN/STOP/RESET key. (STOP/RESET key in the operator.)
b) Turning ON the intelligent input terminal assigned to reset (18: RS).
c) A power cycle of the inverter.
Note) By the factor of trip, it may not be canceled by a reset a),b). In this case, please go to c).

**[Standard panel]**

The ALARM LED (red) and RUN LED (green) of the standard panel show the trip condition as below list.

| Error contents | LED Lighting, Blinking | |
|---|---|---|
| | ALARM LED | RUN LED |
| Overcurrent | Lighting | Blinking |
| Overvoltage Note2) | Blinking : Same period | Blinking : Same period |
| Undervoltage Note3) | Blinking : Alternation | Blinking : Alternation |
| Overload | Lighting | Lighting |
| Major failure Note1) | Lighting | Lights out |
| Others Note4) | Blinking | Lights out |

Note1) The Major failure: Memory error, Current detection error, CPU error, Ground fault protection, Thermal detection error.

Note2) The blinking is a period for 1 sec. The condition of the blinking is same timing at ALARM LED and RUN LED. (At the time of the lighting, both ALARM LED and RUN LED turn on. At the time of lights out, both turn off.)

Note3) The blinking is a period for 1 sec. As for the condition of the blinking, ALARM LED and RUN LED repeat a flash in turn. (At the time of ALARM LED turning on, RUN LED turns off. At the time of ALARM LED turning off, RUN LED turns on.)

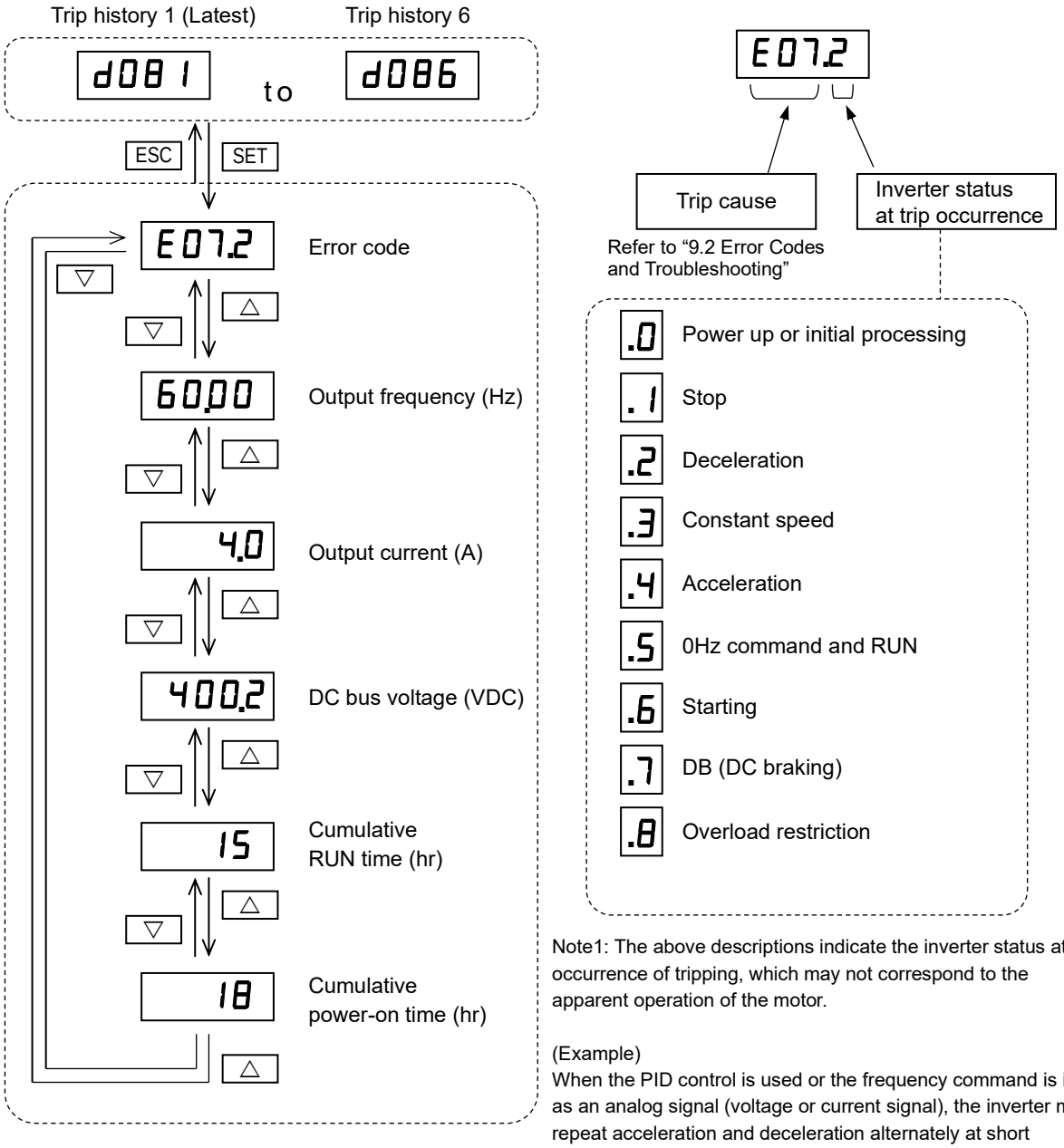
Note4) The other trips are Input overvoltage protection, Temperature error, Driver error, Output phase loss protection, Low-speed overload protection, Operator connection error (except NES1-OP), Modbus communication error and so on.

**[Dedicated operator (NES1-OP)]**

Trip History and Inverter Status

It is recommended to find the cause of the fault first 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 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 selecting the trip history: 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 (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 the occurrence of tripping may not correspond to the apparent operation of the motor.

Note2: Detailed information of the trip that is occurred during undervoltage is not stored.

## 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.<br><br>When a current as high as about 235 % (peak) of the inverter's rated output current is detected, the protective function operates and the inverter trips. (*4)(*5) | During constant speed | E01 | Check whether the load has fluctuated sharply.<br>(Eliminate the load fluctuation.)<br>Check for the short circuit of output connections.<br>(Check the output cables.)<br>Check for the ground fault.<br>(Check the output cables and motor.) | 7 - 13<br>7 - 27 |
| | | During deceleration | E02 | Check whether the inverter has decelerated the motor quickly.<br>(Increase the deceleration time.) | |
| | | During acceleration | E03 | Check whether the inverter has accelerated the motor quickly.<br>(Increase the acceleration time.)<br>Check whether the motor has been locked.<br>(Check the motor and wiring.)<br>Check whether the torque boost voltage has been set too high.<br>(Reduce the torque boost voltage.) | |
| | | Others | E04 | Check whether the DC braking force is too high.<br>(Reduce the braking force.) | 7 - 46 |
| Overload protection (*1) | This protective function monitors the inverter output current, and shuts off the inverter output when the internal electronic thermal protection circuit detects a motor overload. | | E05 | Check whether the motor load is too high.<br>(Check the motor load.)<br>Check whether the thermal level is appropriate.<br>(Adjust the level appropriately.) | 7 - 67<br>7 - 69 |
| Overvoltage protection | If the DC bus voltage rises too high, it may cause the inverter fault. To avoid this problem, the inverter will trip when the DC bus voltage exceeds a specified level *) because of an increase in the energy regenerated by the motor or the input voltage (during operation).<br>*) About 400 VDC (200 V class) or about 800 VDC (400 V class) | | E07 | Check whether the inverter has decelerated the motor quickly.<br>(Increase the deceleration time.)<br>Check for a ground fault.<br>(Check the output cables and motor.)<br>Check whether the motor has been rotated by the action of the load.<br>(Reduce the regenerative energy.) | 7 - 13 |
| Memory error (*2) (*3) | When the built-in memory is failed by external noise or an abnormal temperature rise, the inverter shuts off its output.<br>Note: A Memory error may cause a CPU error. | | E08 | Check for the noise sources located near the inverter.<br>(Remove noise sources.)<br>Check whether the cooling efficiency has deteriorated.<br>(Check the heatsink for clogging and clean it.)<br>(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 bus voltage falls below about 173 VDC (in case of the 200 V class models) or about 345 VDC (in case of the 400 V class models).<br>When the inverter input voltage is recovered, depending on the undervoltage time (t0) and b002 setting, the following operation will occur.<br>When b001 = 00: (t0 ≤ b002) -> E09 occur<br>When b001≠00: (t0 > b002) -> E09 occur<br>If t0 > 40 seconds, E09 will occur before the input voltage is recovered. | | E09 | Check whether the power supply voltage has dropped.<br>(Check the power supply.)<br>Check whether the power supply capacity is sufficient.<br>(Check the power supply.) | - |
| Current detection error | If an error occurs in the internal current detector (CT), the inverter will shut off its output. | | E10 | Check whether the inverter has failed.<br>(Repair the inverter.) | - |
| CPU error (*3) | If the internal CPU malfunctions or an error occurs in it, the inverter will shut off its output.<br>Note: Reading an abnormal data from the built-in memory may result in a CPU error. | | E11 | Check for the noise sources located near the inverter.<br>(Remove noise sources.)<br>Check whether the inverter has failed.<br>(Repair the inverter.) | - |

*1 The inverter will not accept any reset command within about 10 seconds after tripping (i.e., after the overload protective function operates).

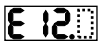
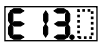
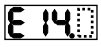
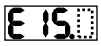
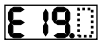
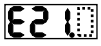
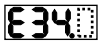
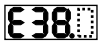
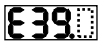
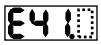
*2 The inverter will not accept any reset command after a Memory error occurs with error code "E08" displayed. Turn off the inverter power once. If error code "E08" is displayed when the inverter power is turned on subsequently, the internal memory device may have failed, or parameters may have not been stored correctly. In such cases, initialize the inverter, and then re-set the parameters (refer to section “7.9 Initializing”).

*3 The inverter will not accept reset commands input via the RS terminal or the STOP/RESET key or the Modbus communication. Therefore, turn off the inverter power.

*4 At the time of trip occurrence, as for the effective-value electric current with the measuring instrument and the current value of the trip history, a low value may be displayed by timing of the data sampling.

*5 When PM drive mode is selected, the overcurrent level can be changed by setting "H141" and "H142". The error level changes depending on the changed value.

# Chapter 9 Error Codes

| Name | Description | Display on digital operator | Troubleshooting and corrective action | Reference page |
|---|---|---|---|---|
| External trip | External trip is detected when the intelligent input terminal set for external trip (12: EXT) is turned on. |  | Check whether an error has occurred in the external equipment when the external trip function has been enabled.<br>(Recover the external equipment from the error.) | - |
| USP error | USP error is indicated when the inverter power is turned on with an input run command 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 run command signal remaining in the inverter when the USP function has been enabled.<br>(Reset the run command, and then turn on the inverter power.) | 7 - 63 |
| 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.<br>(This function does not operate when a residual voltage remains in the motor.) |  | Check for the ground fault.<br>(Check the output cables and motor.)<br>Check the inverter itself for abnormality.<br>(Remove the output cables from the inverter, and then check the inverter.) | 7 - 82<br>11 - 6 |
| Input overvoltage protection | This protective function determines an error if the input voltage is kept above a protection level for 100 seconds while the inverter is stopped. The protection level is about 390 VDC (200 V class) or about 780 VDC (400 V class). |  | Check whether the input voltage is high while the inverter is stopped.<br>(Lower the input voltage, suppress the power voltage fluctuation, or connect an AC reactor between the power supply and the inverter input.) | - |
| Thermal detection error | When the thermal sensor in the inverter module is not function. |  | Check whether the inverter has failed.<br>(Repair 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.<br>(Check the installation.)<br>Check whether the ambient temperature is high.<br>(Lower the ambient temperature.)<br>Check the heatsink for clogging.<br>(Clean the heatsink.) | - |
| 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.<br>(Check the output cables.)<br>Check for the ground fault.<br>(Check the output cables and motor.)<br>Check the heatsink for clogging.<br>(Clean the heatsink.) | 5 - 9 |
| Output phase loss protection | Output phase loss is detected when the output frequency is from 5 Hz to 100 Hz. This error may also occur if the output current is disturbed because of hunting of the motor. |  | Check for the output phase loss.<br>(Check the cables and motor.)<br>Check whether the inverter has failed.<br>(Repair the inverter.) | 7 - 82 |
| 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 its output.<br>(Note that a high frequency may be recorded as the error history data.) |  | Check whether the motor load is too high.<br>(Reduce the load factor.) | - |
| Step out error | When the PM motor mode is selected, if the motor steps out, rotation of the motor will not be detected while driving, inverter will shut off its output. |  | Check whether the motor load is too high.<br>(Adjust the motor constant.)<br>(Check the load conditions.)<br>(Adjust acceleration / deceleration time.) | |
| Operator connection error | When the connection between inverter and operator failed, inverter trips and displays the error code. |  | Check the communication between inverter and operator.<br>(Check the operator cable.)<br>If "b165" is set to "02" or more, this error will not be detected. | - |
| Modbus communication error | If timeout occurs because of line disconnection during the communication in Modbus-RTU mode, the inverter will trip according to the setting of communication error selection (C076). |  | Check whether the communication speed setting is correct.<br>(Adjust the communication speed.)<br>Check whether the wiring distance is appropriate.<br>Check whether the wiring is disconnected.<br>(Check the connections.) | 8 - 6 |

*3 The inverter will not accept reset commands input via the RS terminal or the STOP/RESET key or the Modbus communication. Therefore, turn off the inverter power.

## 9.3 Warning Codes for Digital operator

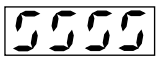
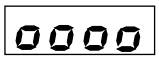
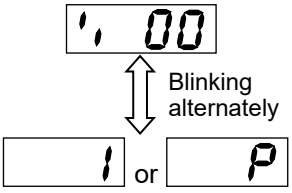
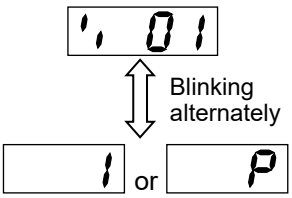
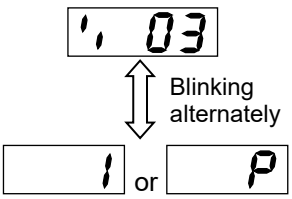
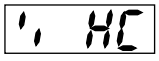
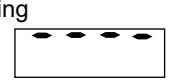
The display of warning code for digital operator is follows.
It is not displayed with the standard panel.
The inverter displays a warning code when the data set as a target function code satisfies the condition (specified in the "Condition" column of the table below) in relation to the data set as the corresponding basic function code.

| Warning code | Condition | | |
|---|---|---|---|
| H 001 | Frequency upper limit (A061) | > | Maximum frequency (A004) |
| H 002 | Frequency lower limit (A062) | > | Maximum frequency (A004) |
| H 005 | Output frequency setting (F001), Multi-speed frequency 0 (A020) Note1) | > | Maximum frequency (A004) |
| H 015 | Output frequency setting (F001), Multi-speed frequency 0 (A020) Note1) | > | Frequency upper limit (A061) |
| H 025 | Frequency lower limit (A062) | > | Output frequency setting (F001), Multi-speed frequency 0 (A020) Note1) |
| H 031 | Start frequency (b082) | > | Frequency upper limit (A061) |
| H 032 | Start frequency (b082) | > | Frequency lower limit (A062) |
| H 035 | Start frequency (b082) | > | Output frequency setting (F001), Multi-speed frequency 0 (A020) Note1) |
| H 037 | Start frequency (b082) | > | Jog frequency (A038) |
| H 085 | Output frequency setting (F001), Multi-speed frequency 0 (A020) Note1) | = | "Jump frequency (center) 1/2/3" ± "Jump frequency width (hysteresis) 1/2/3" Note2) (A063 ± A064, A065 ± A066, A067 ± A068) |
| H 086 | Multi-speed frequency 1 to 7 (A021 to A027) | = | |
| H 091 | Free V/f setting, frequency 7 (b112) | < | Frequency upper limit (A061) |
| H 092 | Free V/f setting, frequency 7 (b112) | < | Frequency lower limit (A062) |
| H 095 | Free V/f setting, frequency 7 (b112) | < | Output frequency setting (F001), Multi-speed frequency 0 (A020) Note1) |
| H 201 | Frequency upper limit, 2nd motor (A261) | > | Maximum frequency, 2nd motor (A204) |
| H 202 | Frequency lower limit, 2nd motor (A262) | > | Maximum frequency, 2nd motor (A204) |
| H 205 | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) Note1) | > | Maximum frequency, 2nd motor (A204) |
| H 215 | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) Note1) | > | Frequency upper limit, 2nd motor (A261) |
| H 225 | Frequency lower limit, 2nd motor (A262) | > | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) Note1) |
| H 231 | Start frequency (b082) | > | Frequency upper limit, 2nd motor (A261) |
| H 232 | Start frequency (b082) | > | Frequency lower limit, 2nd motor (A262) |
| H 235 | Start frequency (b082) | > | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) Note1) |
| H 285 | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) Note1) | = | "Jump frequency (center) 1/2/3" ± "Jump frequency width (hysteresis) 1/2/3" Note2) (A063 ± A064, A065 ± A066, A067 ± A068) |
| H 291 | Free V/f setting, frequency 7 (b112) | < | Frequency upper limit, 2nd motor (A261) |
| H 292 | Free V/f setting, frequency 7 (b112) | < | Frequency lower limit, 2nd motor (A262) |
| H 295 | Free V/f setting, frequency 7 (b112) | < | Output frequency setting (F001), Multi-speed frequency 0, 2nd motor (A220) Note1) |

Note1) These parameters are checked, even when the operator (02) is not specified for the frequency source (A001/A201).
Note2) The warning will be occurred when the frequency setting (i.e., F001, A020, A220, A021 to A027) is in the jump frequency range.

## 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 | When RS input is ON or when STOP/RESET key is pressed during a trip is occurring. | Rotating  |
| Waiting in undervoltage status | If the input voltage falls, the inverter will shut off its output, display the symbol shown on the right, and wait for the recovery of the input voltage.<br>The inverter will display the same symbol also during an instantaneous power failure.<br>(Remark) Inverter trips with undervoltage 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 symbol shown on the right while awaiting retry after an instantaneous power failure or tripping. |  |
| Power-off | The inverter displays the symbol 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 rotation direction restriction (b035), the inverter will display the symbol 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.<br>In case of the initial data selection (b085) = 0. (mode 0)<br>“I” is displayed for IM control mode and “P” is displayed for PM motor control mode. |  Blinking alternately |
| | Display during initialization for the parameter.<br>In case of the initial data selection (b085) = 1. (mode 1)<br>“I” is displayed for IM control mode and “P” is displayed for PM motor control mode. |  Blinking alternately |
| | Display during initialization for the parameter.<br>In case of the initial data selection (b085) = 3. (mode 3)<br>“I” is displayed for IM control mode and “P” is displayed for PM motor control mode. |  Blinking alternately |
| During Initialization for trip history | Display during initialization for the trip history. |  |
| Empty trip history | The trip history monitor displays the symbol shown on the right when there is no corresponding trip history data. |  |
| Communication error | If a problem occurs in the communication between the digital operator and inverter, the inverter will display the symbol shown on the right. | Blinking  |

# Chapter 10 Troubleshooting

**This chapter describes the troubleshooting methods.**

(Memo)

## Troubleshooting Tips

The below tables list typical symptoms and the corresponding solution(s).

1. Inverter does not power up.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Power cable is incorrectly wired. | Check input wiring. | 5 - 6 to 5 - 13 |
| Short circuit bar or DCL option between [P] terminal and [PD] terminal is disconnected. | Install short circuit bar or DCL option between [P] terminal and [PD] terminal. | |
| Power cable is breaking. | Check input wiring. | |
| A normal voltage is not applied to terminal L1 and N terminal (single phase), R, S and T terminal (three phases circuit) to supply power to. | Apply a normal voltage to terminal L1 and N terminal (single phase), or R, S and T terminal (three phases circuit) to supply power to. | |

2. Motor does not start.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Incorrect RUN command source is selected. | Check run command source (A002/A202) for correct source.<br>Ex. Control terminal (digital input): 01<br>Operator (RUN key): 02 | 7 - 12 |
| Incorrect frequency source is selected. | Check frequency source (A001/A201) for correct source.<br>Ex. Control terminal (analog input): 01<br>Operator (F001): 02 | 7 - 9 |
| Frequency setting is 0 Hz. | If frequency source is control terminal (A001/A201=01), check analog voltage or current signal at [O/OI] terminal. | 5 - 6 to 5 - 8<br>7 - 9 to 7 - 11 |
| | If frequency source is operator (A001/A201=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. | 7 - 33 |
| Run command source is not set to input terminal. | If run command source is control terminal (A002/A202=01), set "forward (00: FW)" or "reverse (01: RV)" to any intelligent 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 intelligent input terminals. | 7 - 17 |
| “Multi-speed selection input(s) (02 to 04: CF1 to CF3, 32 to 34: SF1 to SF3)” is (are) set to intelligent input terminal(s) and the input is (are) active. | Deactivate the input(s). (Since multi-speed operation is performed when the multi-speed selection input(s) is (are) ON, operation does not occur if the corresponding multi-speed frequency (A021 to A027) is 0 Hz.) | 7 - 33 |
| Both "forward (00: FW)" and "reverse (01: RV)" inputs are active. | If run command source is control terminal (A002/A202=01), activate either "forward (00: FW)" or "reverse (01: RV)" input. | 7 - 12 |
| Rotation direction restriction (b035) is enabled. | Check whether b035 for correct setting. | 7 - 12 |
| Incorrect the intelligent input terminal wiring or the short circuit bar position. | Wire the intelligent input terminal correctly and/or install the short circuit bar correctly. (ON/OFF status of the intelligent input terminals are monitored in "d005".) | 5 - 14 |
| 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. | 5 - 6 to 5 - 8<br>7 - 21 |
| Run command source is operator (A002/A202=02), but an intelligent input terminal is set to "Force terminal mode (51: F-TM)" and the input is active. | Deactivate the input. | 7 - 51 |
| RUN command source is control terminal (A002/A202=01), but an intelligent input terminal is set to "Operator control (31: OPE)" and the input is active. | Deactivate the input. | 7 - 51 |
| Inverter is in trip status.<br>(Standard panel: ALARM LED and RUN LED are blinking or/and lighting.<br>Digital operator: ALARM LED is lighting and "Exxx" indication is displaying.) | Reset inverter by STOP/RESET key or RS input or a power cycle of the inverter and check error code and cause.<br>If the inverter cannot be reset, power OFF the inverter and make countermeasure of the error cause. After making countermeasure, power ON the inverter. | 6 - 19, 7 - 66<br>9 - 3 to 9 - 6 |
| "Reset (18: RS)" or "Free-run stop (11: FRS)" is set to intelligent input terminal and the input is active. | Deactivate the input. | 7 - 60, 7 - 62 |

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| "Permission of run command (84: ROK)" is set to intelligent input terminal and the input is not active. | Activate the input. | 7 - 32 |
| Cable between inverter and motor, or internal cable of motor is breaking. | Check the wiring. | 5 - 6 to 5 - 13 |
| Excessive load is given. | Remove excessive load. | - |
| Motor is locked. | Unlock the motor. | - |

3. Motor does not accelerate to command speed.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Bad connection of analog wiring. | Check the wiring. In case of analog voltage or variable resistor input, check voltage between [O/OI] terminal and [L] terminal. In case of analog current, check current between current source and [O/OI] terminal. Check and set the SW6 once again when the inverter is power-off. | 5 - 6, 7 - 21 |
| Overload restriction or OC suppression function works. | Deactivate the functions or check the function level. | 7 - 69, 7-70 |
| Maximum frequency (A004/A204) or frequency upper limit (A061/A261) is lower than as expected. | Adjust these parameters to proper. | 7 - 16, 7 - 31 |
| Acceleration time is excessive. | Shorten the acceleration time (F002/A092/A292). | 7 - 13, 7 - 35 |
| “Multi-speed selection input(s) (02 to 04: CF1 to CF3, 32 to 34: SF1 to SF3)" is (are) set to intelligent input terminal(s) and the input is (are) active. | Deactivate the input(s). (Since multi-speed operation is performed when the multi-speed selection input(s) is (are) ON, operation does not occur if the corresponding multi-speed frequency (A021 to A027) is 0 Hz.) | 7 - 33 |
| "Jogging (06: JG)" is set to input terminal and the input is active. | Deactivate the input. | 7 - 30 |
| Excessive load is given. | 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 | Reference page |
|---|---|---|
| Incorrect frequency source is selected. | Check whether the frequency source is operator (A001/A201=02). | 7 - 9 |
| "Force terminal mode (51: F-TM)" is set to intelligent input terminal and the input is active. | Deactivate the input. | 7 - 51 |

5. A part of function codes is not displayed.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Function code display restriction (b037) is enabled. | Set "00 (full display)" to "b037". | 7 - 52, 7 - 53 |
| "Display limitation (86: DISP)" is set to intelligent input terminal and the input is active. | Deactivate the input. | |

6. Operator does not respond.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| "Display limitation (86: DISP)" is set to intelligent input terminal and the input is active. | Deactivate the input. | 7 - 52 |

7. Parameter data does not change.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Inverter is in RUN status. | Stop the inverter, make sure that the motor stops, and then try again. Some parameters can be changed even RUN status by setting the high level access mode (b031=10). | - |
| Software lock mode selection (b031) is enabled. | - Disable software lock mode selection.<br>- Turn off the input that is set to "Software lock (15: SFT)". | 7 - 50 |

8. Motor rotates opposite direction to the command.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Incorrect wiring to motor. | Exchange any two of U/T1, V/T2 or W/T3 wirings. | 5 - 6 to 5 - 13 |
| Incorrect logic of direction signal in 3-wire operation. | Check the logic of intelligent input that is set as "FW/RV at 3-wire operation (22: F/R)". | 7 - 28 |

9. Motor rotates opposite direction to the command with RUN key of the operator.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| RUN key routing (F004) is incorrectly set. | Check whether "F004" for correct setting. | 7 - 12 |

10. Overcurrent protection trip (E03) is occurred when motor is running.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Acceleration time is too short. | Extend acceleration time (F002/F202/A092/A292). | 7 - 13, 7 - 35 |
| | Enable acceleration hold function (A069, A070). | 7 - 32 |
| Excessive load is given. | Remove excessive load. | - |
| | Enable torque boost function. | 7 - 27 |
| | Set "free V/f" in V/f characteristic curve (A044/A244=02). | 7 - 25 |
| Overload restriction operation mode is disabled (b021/b221/b024=00). | Enable overload restriction (b021/b221/b024=01/02). | 7 - 69 |

In case of the inverter trips due to Overcurrent (E03), even though overload restriction is enabled (b021/b221=01/02).

| | | |
|---|---|---|
| Overload restriction level (b022/b222/b025) is too high. | Set overload restriction level (b022/b222/b025) lower. | 7 - 69 |
| Deceleration rate at overload restriction (b023/b223/b026) is too short. | Set deceleration rate at overload restriction (b023/b223/b026) longer. | |

11. STOP/RESET key does not respond.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| STOP/RESET key is set to disabled. | Check STOP/RESET key enable (b087). | 7 - 50 |
| Deceleration overvoltage suppression enable (b130) function is enabled. | Deactivate the function or adjust the activation level of the function. | 7 - 71 |
| Controlled deceleration on power loss selection (b050) function is enabled. | Deactivate the function or adjust the activation level of the function. | 7 - 64 |

12. Sound of motor or machine is noisy.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Carrier frequency is too low. | Set carrier frequency (b083) higher.<br>(This could cause electric noise and leak current higher.) | 7 - 16 |
| Machine frequency and motor frequency are resonated. | Change output frequency slightly. If resonating is occurred, use jump frequency function (A063 to A068) to avoid machine resonant frequency. | 7 - 31 |
| Over excitation is occurred. | Set base frequency (A003/A203) and AVR voltage selection (A082/A282) according to motor rating. If not improved, reduce V/f gain (A045/A245) slightly or change V/f characteristic curve as free V/f (A044/A244=02). | 7 - 14<br>7 - 39<br>7 - 25 |

13. Overload protection trip (E05) is occurred.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Electronic thermal level is improper. | Set electronic thermal level (b012/b212) proper. | 7 - 67 |

14. Overvoltage protection trip (E07) is occurred.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Deceleration time is too short. | Extend deceleration time (F003/F203/A093/A293). | 7 - 13, 7 - 35 |
| Deceleration overvoltage suppression enable (b130) is disabled (00). | Enable deceleration overvoltage suppression enable (b130=01/02). | 7 - 71 |

In case of the inverter trips due to overvoltage (E07), even though overvoltage suppression is enabled (b130=01/02).

| | | |
|---|---|---|
| Deceleration overvoltage suppression proportional gain (b133) or integral time (b134) is improper. | Set deceleration overvoltage suppression proportional gain (b133) and integral time (b134) proper. | 7 - 71 |
| Deceleration overvoltage suppression level (b131) is too high. | Set Deceleration overvoltage suppression level (b131) lower. (Lower limit of "b131" must be "(input voltage) × √2 × 1.1".) | |

15. Output frequency is unstable.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Some parameters are improper. | Set output frequency slightly smaller or bigger value than power source frequency. | 7 - 9 |
| | Change motor stabilization constant (H006/H206). | 7 - 44 |
| | Reduce carrier frequency (b083). | 7 - 16 |
| | Reduce V/f gain (A045/A245). | 7 - 39 |
| Load variation is excessive. | Change motor and inverter to one size bigger. | - |
| Power voltage variation is excessive. | Check power source. | - |

16. Output torque is not sufficient.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Some parameters are improper. [Acceleration] | Increase manual torque boost value (A042/A242) and/or manual torque boost frequency (A043/A243). | 7 - 27 |
| | Reduce carrier frequency (b083). | 7 - 16 |
| | Change torque boost selection to automatic (A041/A241=01). | 7 - 27 |
| Some parameters are improper. [Deceleration] | Extend deceleration time (F003/F203/A093/A293). | 7 - 13, 7 - 35 |
| | Disable AVR function (A081/A281=01/02). | 7 - 14 |

17. When operator cable is disconnected, inverter will trip or stop.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Operation at external operator connection loss (b165) is improper. | Set Operation at external operator connection loss to ignore (b165=02). | 7 - 51 |

18. No response over Modbus communication.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| New parameter data is not updated. | If "C070", "C071", "C074" or "C075" is changed, cycle power. | 8 - 6 |
| Run command source (A002/A202) is incorrect. | Set run command source to Modbus network input (A002/A202=03) when RUN command is sent by Modbus communication. | 7 - 12 |
| Frequency source (A001/A201) is incorrect. | Set frequency source to Modbus network input (A001/A201=03). | 7 - 9 |
| Communication speed (C071) is incorrect. | Check communication speed (C071). | 8 - 6 |
| Modbus address (C072) is incorrect or duplication of Modbus address. | Check Modbus address (C072). | |
| Communication parity (C074) is incorrect. | Check communication parity (C074). | |
| Communication stop bit (C075) is incorrect. | Check communication stop bit (C075). | |
| Wiring is incorrect. | Check communication wiring at SP,SN via RJ45 connector. | 8 - 4 |
| The setting of switch SW5 on the board is on the operator side. (OFF, right side) | Set switch SW5 to RS485 side (ON, left side). | 8 - 5 |

19. When inverter starts, ECB (Earth leakage Circuit Breaker) trips.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Leak current of inverter is excessive. | Reduce carrier frequency (b083). | 7 - 16 |
| | Increase current sensor level of ECB, or replace ECB with another one having higher current sensor level. | 5 - 12, 5 - 13 |

20. DC braking does not work.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| DC braking force for deceleration (A054) is set to "0". | Set DC braking force for deceleration (A054) proper. | 7 - 46 |
| DC braking time for deceleration (A055) is set to "0.0". | Set DC braking time for deceleration (A055) proper. | |

21. Undervoltage trip (E09) is occurred.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Input voltage is decreased 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 | Reference page |
|---|---|---|
| TV or radio catches the radiation noise generated by the inverter. | Put away those devices from the inverter as far as possible. | - |
| | Insert ZCL into the main power input line and inverter output line to the motor. | 5 - 12 |

23. Remote operator becomes a communication error.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| The cable and connectors are poor contact.<br>The cable has disconnection. | Reconnect the cable.<br>Replace the cable. | - |
| SW5 has become RS485 side (ON, left side). | Set SW5 to operator side (OFF, right side). | 3 - 4, 5 - 8 |
| Selection of OPE/Modbus has become Modbus (C070=01). | Press the RUN/STOP/RESET key on the standard panel (hold down the key for about 5 seconds after turning on the power), then set the selection of OPE/Modbus (C070) to 00 (OPE). After that, it is necessary to shut off and turn on the power once. | 8 - 5 |

24. NES1-OP display does not light up or is not normal display.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Inverter connector and NES1-OP are poor contact. | Reconnect the NES1-OP after power-off. | 5 - 5 |

25. Output phase loss protection (E34) is occurred.

| Possible Cause(s) | Corrective Action | Reference page |
|---|---|---|
| Motor cable is disconnected or not connected. | Check the wiring. | 5 - 6 to 5 - 13 |
| Motor current is too small. | Set output phase loss detection to disabled (C157=00). | 7 - 82 |

# Chapter 11 Maintenance and Inspection

**This chapter describes the precautions and procedures for the maintenance and inspection of the inverter.**

(Memo)

## 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, DC bus capacitors, and relays, and replace them if necessary.

## 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 & vibration | ✓ | | Visual and aural | Stable environment for electronic controls |
| | Power supply voltage | Voltage tolerance | ✓ | | Digital voltmeter, measure between inverter terminals [L1], [L2], [L3] | 200 V class: 50/60 Hz 200 to 240 V (-15/+10 %) 400 V class: 50/60 Hz 380 to 480 V (-15/+10 %) |
| Main circuit | Ground Insulation | Adequate resistance | | ✓ | Refer to next page | 5 MΩ or greater |
| | Ground terminal | No loose screws | | ✓ | Torque wrench | M4: 0.8 N· m |
| | Components | Overheating | | ✓ | Thermal trip events | No trip events |
| | Terminal block | Secure connections | | ✓ | Visual | No abnormalities |
| | | No loose screws | | ✓ | Torque wrench | M3.5: 1.0 N· m M4: 1.5 N· m |
| | DC bus capacitors | Leaking, swelling | | ✓ | Visual | No abnormalities |
| | Relay(s) | Chattering | | ✓ | Aural | Single click when switching ON or OFF |
| | Resistors | Cracks or discoloring | | ✓ | Visual | No abnormalities |
| Control circuit | 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 |
| | Terminal | No loose screws | | ✓ | Torque wrench | M2: 0.2 N· m |
| Cooling | 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 work |

**Note 1:** The life of DC bus capacitors is affected by the ambient temperature. Refer to section “11.6 Capacitor Life Curves”.

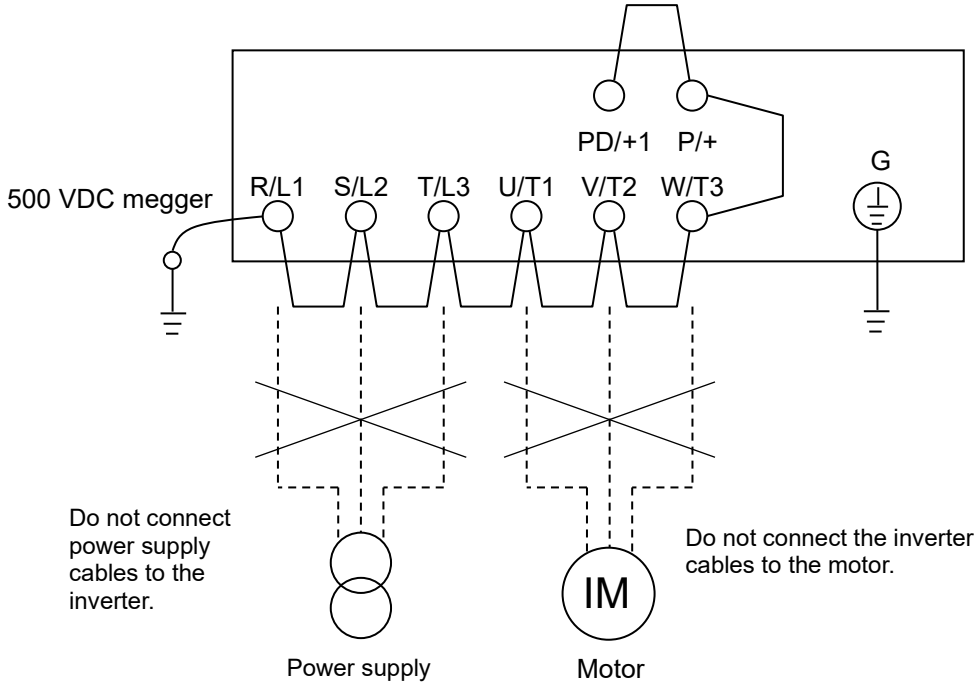
**Note 2:** Designed life of a cooling fan is 10 years. However, it is affected by the ambient temperature and other environmental conditions.

**Note 3:** The inverter must be cleaned periodically. If dust accumulates on the fan and heatsink, 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.

## 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/L1, S/L2, T/L3, U/T1, V/T2, W/T3, P/+ and PD/+1 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/L1, S/L2, T/L3, U/T1, V/T2, W/T3, P/+ and PD/+1. (Single phase input model is R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, P/+ and PD/+1)

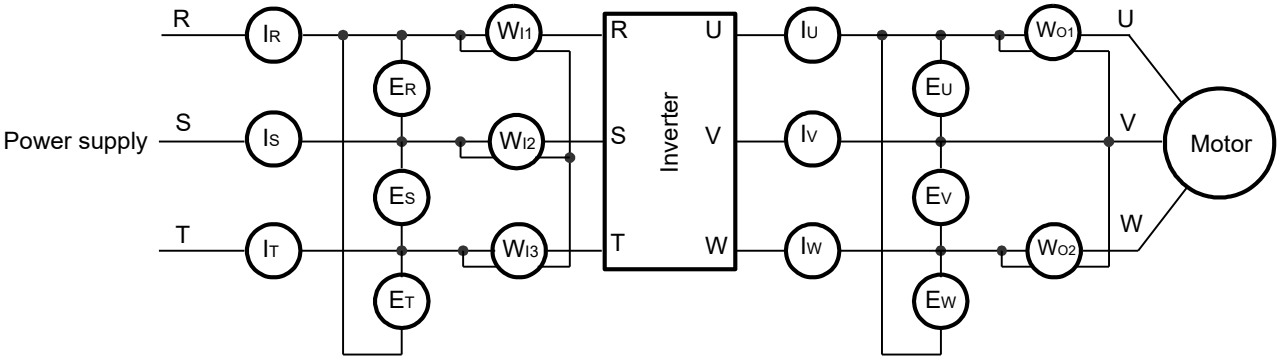



## 11.4 Withstand Voltage Test

Do not carry out a withstand voltage test for the inverter. The test may damage its internal parts or cause them to deteriorate.

## 11.5 Methods of Measuring the Input/Output Voltages, Current, and Power

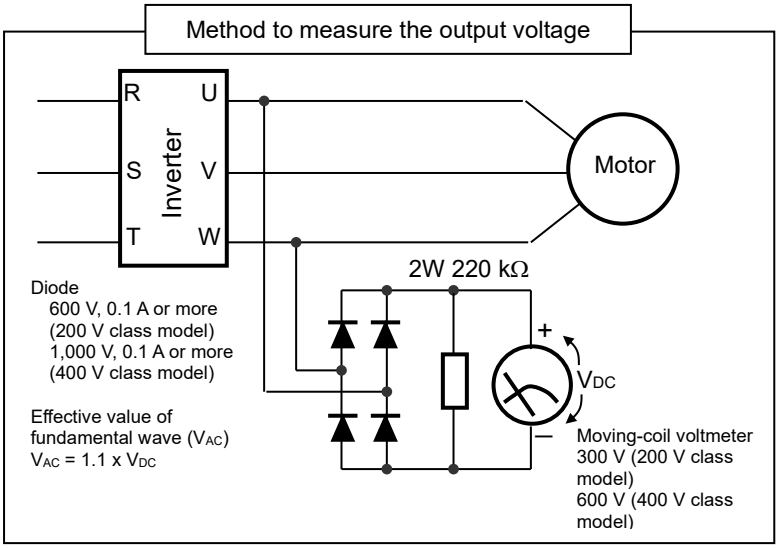
This section describes the measuring instruments generally used to measure the input and output voltages, output current, and output power of the inverter.



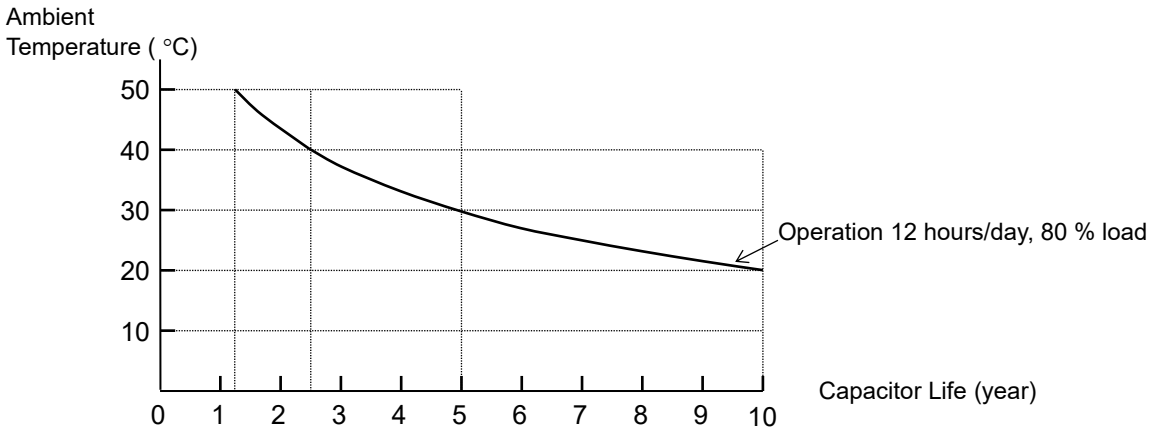

| Measurement item | Measuring point | Measuring instrument | Remarks | Reference values |
|---|---|---|---|---|
| Input voltage ($E_{IN}$) | Across R-S, S-T, and T-R ($E_R$), ($E_S$), and ($E_T$) | Moving-iron voltmeter or rectifier-type voltmeter | Effective value of full waves | 200 V class models: 200 to 240 V, 50/60 Hz<br>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<br>$I_{IN} = (I_R + I_S + I_T)/3$ |
| 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 ($W_{IN}$) $Pf_{IN} = \frac{W_{IN}}{\sqrt{3} \cdot E_{IN} \cdot I_{IN}} \times 100\ (\%)$ | | | |
| 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 input voltage ($E_{OUT}$), input current ($I_{OUT}$), and input power ($W_{OUT}$) $Pf_{OUT} = \frac{W_{OUT}}{\sqrt{3} \cdot E_{OUT} \cdot I_{OUT}} \times 100\ (\%)$ | | | |

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 multimeter may be inapplicable for the measurement because of the adverse effect of noise.



## 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 DC bus 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 DC bus 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.

# 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 Quick Reference Guide handy; please do not lose it. Please contact your Hitachi distributor to acquire replacement or additional manuals.

# Chapter 12 Specifications

**This chapter describes the specifications and external dimensions of the inverter.**

(Memo)

## 12.1 Specifications

200 V Class

| Item | | Three phases 200 V class Specifications | | | | | Single phase 200 V class Specifications | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NE-S1 inverters, 200 V models Note8) | | 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 phases: 200 V-15 % to 240 V+10 %, 50/60 Hz ± 5 % | | | | | Single phase: 200 V-15 % to 240 V+10 %, 50/60 Hz ±5 % | | | | |
| Rated output voltage Note2) | | Three phases: 200 V to 240 V (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) | | Approx. 50 % | | | Approx. 20 to 40 % | | Approx. 50 % | | | Approx. 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 |

400 V Class

| Item | | Three phases 400 V class Specifications | | | | |
|---|---|---|---|---|---|---|
| NE-S1 inverters, 400 V models Note8) | | 004H* | 007H* | 015H* | 022H* | 040H* |
| Applicable motor size Note1) | kW | 0.4 | 0.75 | 1.5 | 2.2 | 4.0 |
| | HP | 1/2 | 1 | 2 | 3 | 5 |
| Rated capacity (kVA) | 380 V | 0.9 | 1.6 | 2.6 | 3.6 | 6.0 |
| | 480 V | 1.2 | 2.0 | 3.4 | 4.5 | 7.6 |
| Rated input voltage | | Three phases: 380 V-15 % to 480 V +10 %, 50/60 Hz ±5 % | | | | |
| Rated output voltage Note2) | | Three phases: 380 V to 480 V (proportional to input voltage) | | | | |
| Rated output current (A) | | 1.5 | 2.5 | 4.1 | 5.5 | 9.2 |
| Cooling method | | Self-cooling | Force ventilation | | | |
| Braking (capacitive feedback) Note3) | | Approx. 50 % | | Approx. 20 to 40 % | | |
| Weight | (kg) | 0.9 | 0.9 | 1.0 | 1.1 | 1.2 |
| | (lb) | 2.0 | 2.0 | 2.2 | 2.4 | 2.7 |

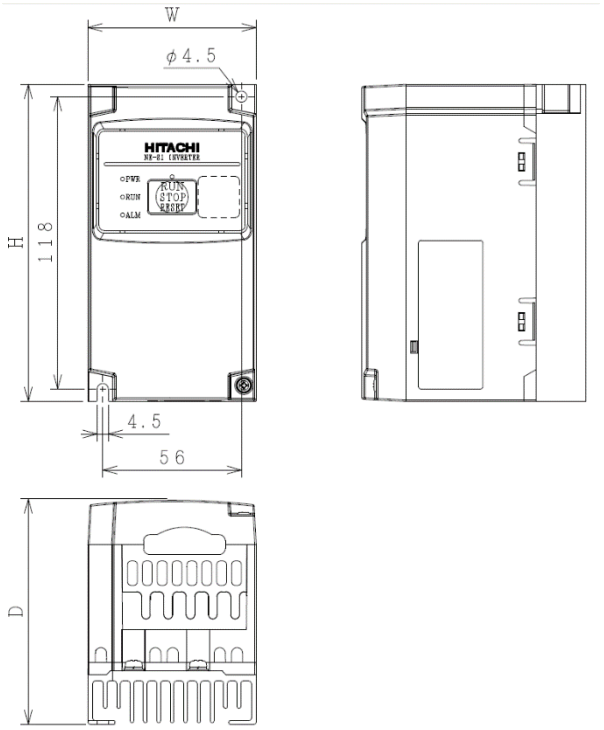
# Chapter 12 Specifications

Common specification

| Item | | Specification |
|---|---|---|
| Protective housing (JIS C 0920, IEC60529) | | IP20 / UL Open type |
| Control | Control method | Pulse Width Modulation (PWM) control |
| | Output frequency range Note4) | 0.01 to 400.00 Hz |
| | Frequency accuracy Note5) | Digital command: ±0.01 % of the maximum frequency<br>Analog command: ±0.2 % of the maximum frequency (25°C ± 10°C) |
| | Frequency setting resolution | Digital input: 0.01 Hz<br>Analog input: Maximum output frequency / 1000 |
| | Volt. / Freq. characteristic | V/f control (constant torque, reduced torque), PM sensorless vector control |
| | Overload capacity | 150 % / 60 seconds |
| | Acceleration/deceleration time | 0.00 to 3,600.00 seconds (in linear or curved pattern)、2nd motors setting is possible |
| Input signal | Frequency setting | External signal: adjustable resistor / 0 to +10 VDC / 0 to 20 mA,<br>Modbus, Option operator, Dedicated operator |
| | RUN/STOP Order | External digital input signal (3-wire input possible), Modbus communication,<br>Option Operator, Dedicated Operator |
| | Intelligent input terminal | 5 terminals |
| | Analog input | 1 terminal (O/OI terminal: Voltage input 10 bit / 0 to 10 VDC, Current input: 10 bit / 0 to 20 mA selecting it with a changeover switch) |
| Output signal | Intelligent output terminal | 1 open-collector output terminals, 1 relay (1c-contact) output terminal |
| | Pulse Output | 1 terminal |
| connection | RS-422 Note7) | RJ45 Connector (Common with RS485: selecting it with a changeover switch)<br>For Option Operator, Inverter setting software (ProDriveNext) |
| | RS-485 Note7) | RJ45 Connector (Common with RS422: selecting it with a changeover switch)<br>For Modbus-RTU |
| General specification | Temperature Note6) | Operating (ambient): -10 to 50°C / Storage: -20 to 65°C<br>The storage temperature refers to the short-term temperature during transport. |
| | Humidity | 20 to 90 % humidity (non-condensing) |
| | Vibration | 5.9 m/s$^2$ (0.6 G), 10 to 55 Hz |
| | Location | Altitude 1,000 m or less, indoors (no corrosive gasses or dust) |
| | Standards Compliance | UL, CE, c-UL, c-tick |

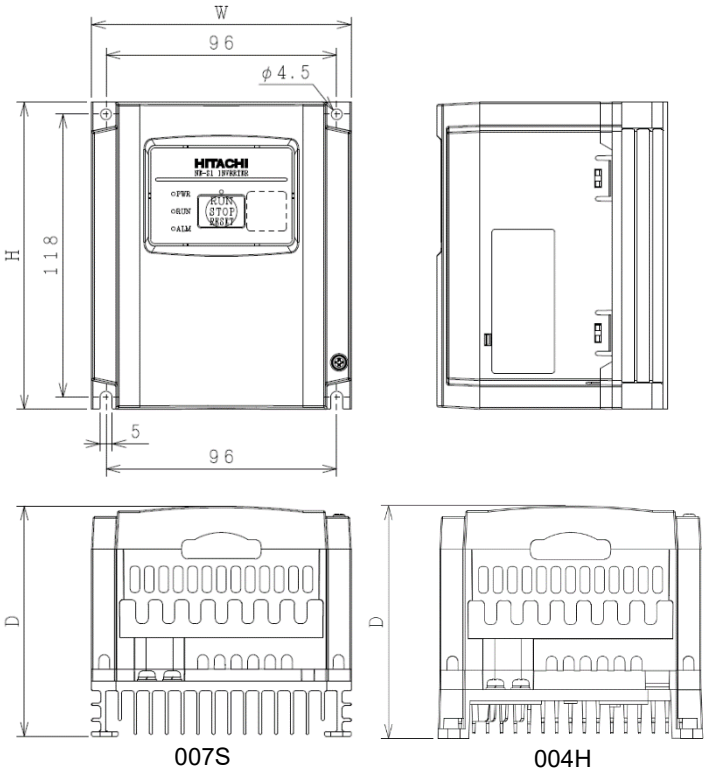
Note1) The applicable motor refers to Hitachi standard three phases motor (4-pole). When using other motors, care must be taken to prevent the rated motor current (50/60 Hz) from exceeding the rated output current of the inverter.
Note2) The output voltage decreases as the main supply voltage decreases (except when using the AVR function). In any case, the output voltage cannot exceed the input power supply voltage.
Note3) The regenerative braking torque is the average deceleration torque at the shortest deceleration (stopping from 50/60 Hz as indicated). It is not continuous regenerative braking torque. The average deceleration torque varies with motor loss. This value decreases when operating beyond 50 Hz.
Note4) To operate the motor beyond 50/60 Hz, consult the motor manufacturer for the maximum allowable rotation speed.
Note5) To get motor stabilized operation, inverter output frequency might exceed preset maximum frequency (A004/A204).
Note6) Derating curve is shown on section "12.3 Derating Curves".
Note7) Connecting work on RS422/RS485 port must be done during the inverter power off.
Note8) "*" changes by Restricted Distribution. For more detail, refer to section "2.1 Inspection of the Purchased Product".

## 12.2 Dimensions



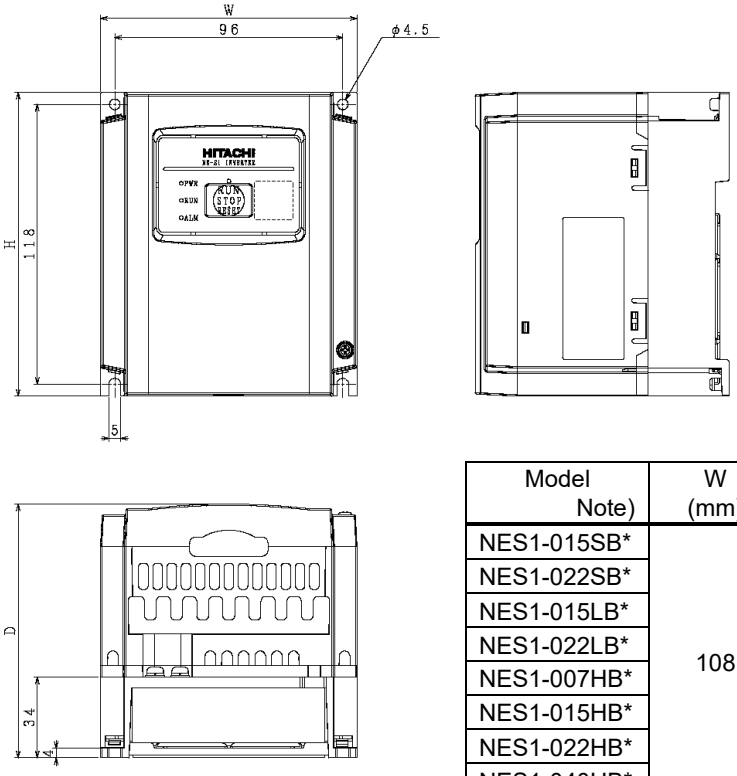

| Model<br>Note) | W<br>(mm) | H<br>(mm) | D<br>(mm) |
|---|---|---|---|
| NES1-002SB* | 68 | 128 | 76 |
| NES1-004SB* | | | 91 |
| NES1-002LB* | | | 76 |
| NES1-004LB* | | | 91 |
| NES1-007LB* | | | 115 |

Note) "*" changes by Restricted Distribution.




| Model<br>Note) | W<br>(mm) | H<br>(mm) | D<br>(mm) |
|---|---|---|---|
| NES1-007SB* | 108 | 128 | 96 |
| NES1-004HB* | | | |

Note) "*" changes by Restricted Distribution.




| Model<br>Note) | W<br>(mm) | H<br>(mm) | D<br>(mm) |
|---|---|---|---|
| NES1-015SB* | 108 | 128 | 107 |
| NES1-022SB* | | | 125 |
| NES1-015LB* | | | 107 |
| NES1-022LB* | | | 125 |
| NES1-007HB* | | | 96 |
| NES1-015HB* | | | 111 |
| NES1-022HB* | | | 125 |
| NES1-040HB* | | | 135 |

Note) "*" changes by Restricted Distribution.

## 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.

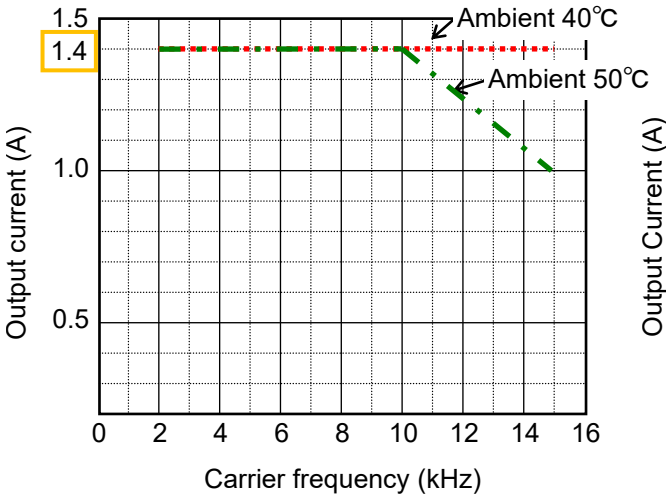
In case that the region code is the European or Chinese version, check the notice of after August 2012.

Legend for Graphs:

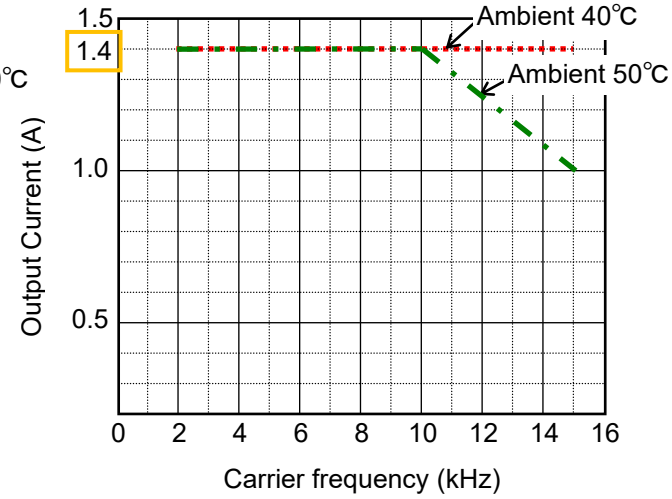
- Ambient temperature 30℃ max.
- Ambient temperature 40℃ max.
- Ambient temperature 50℃ max.
- Rated output current (A)

**Production: after August 2012**

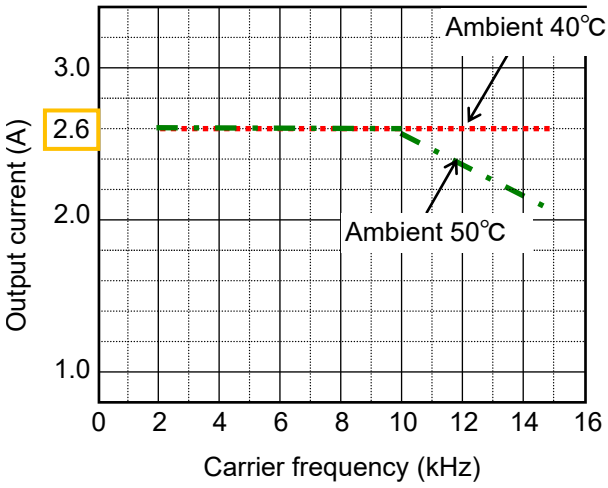
**NES1-002LB**



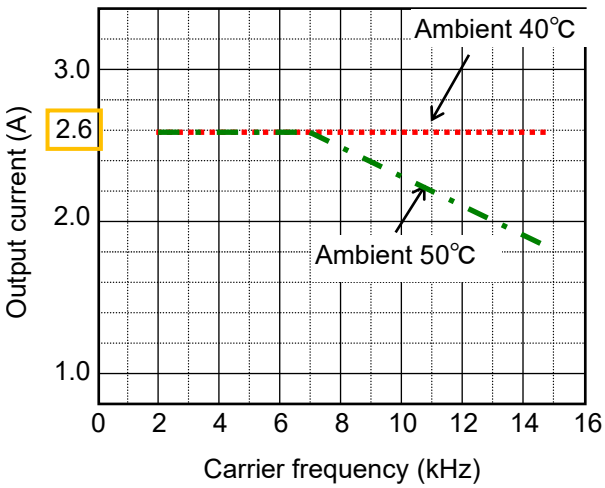

**NES1-002SB**



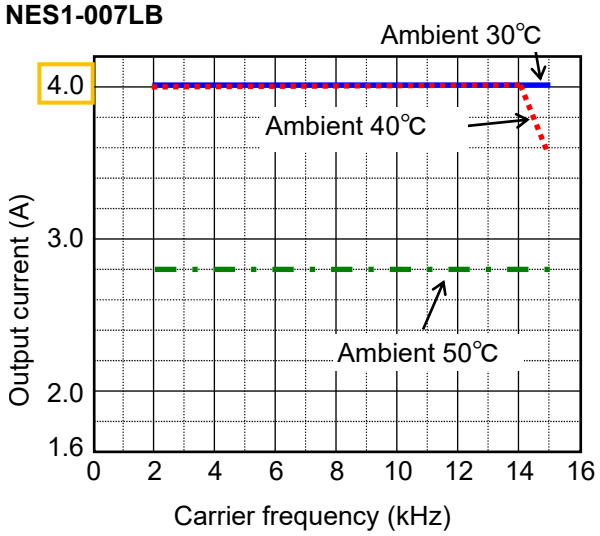

**NES1-004LB**



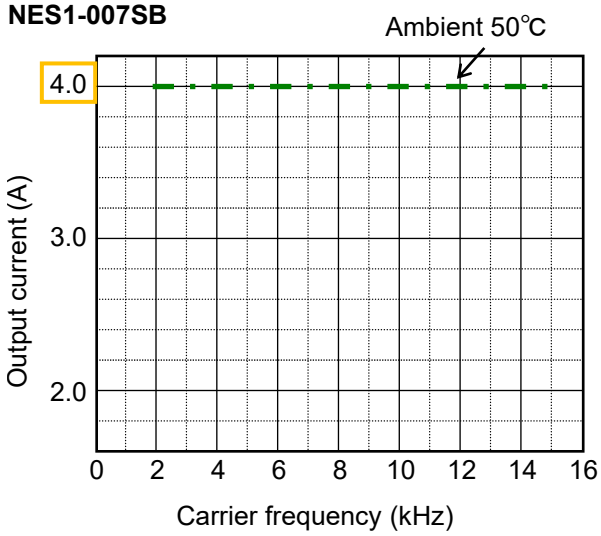

**NES1-004SB**



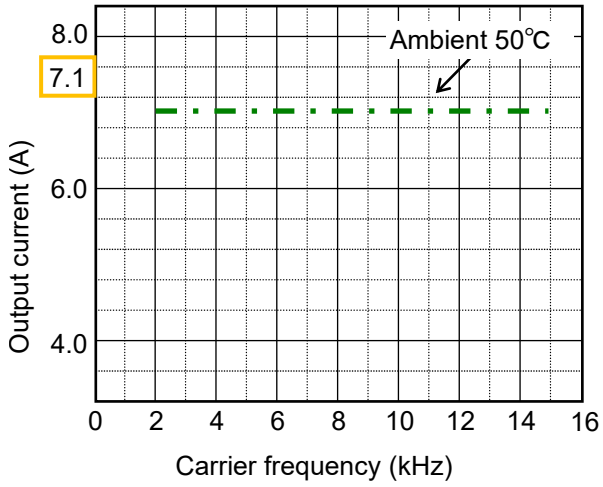
**NES1-007LB**



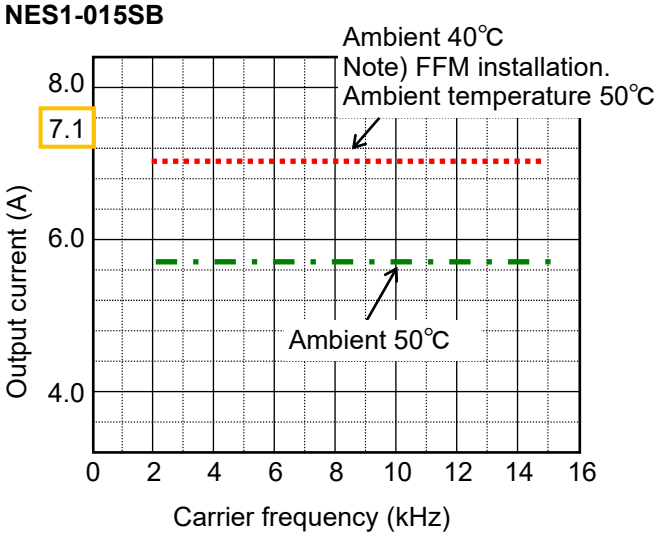

**NES1-007SB**



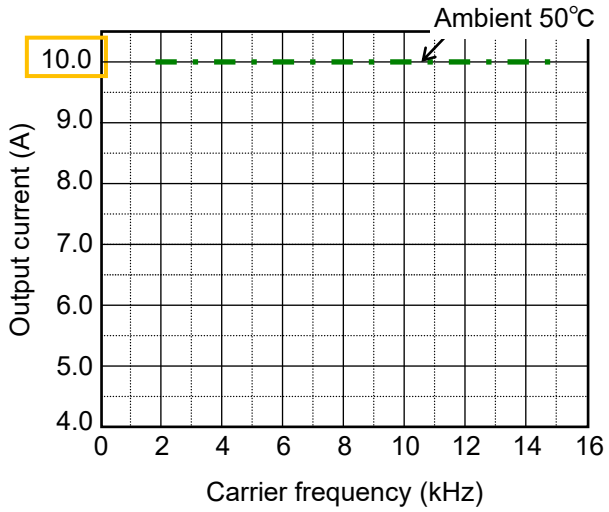

**NES1-015LB**



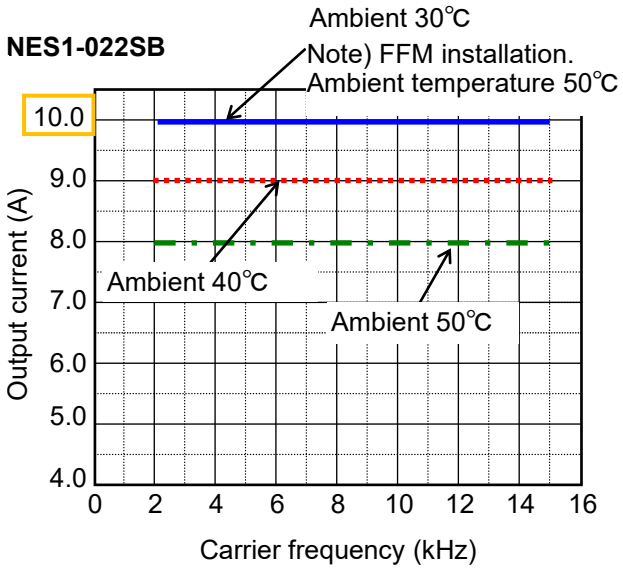

**NES1-015SB**




**NES1-022LB**

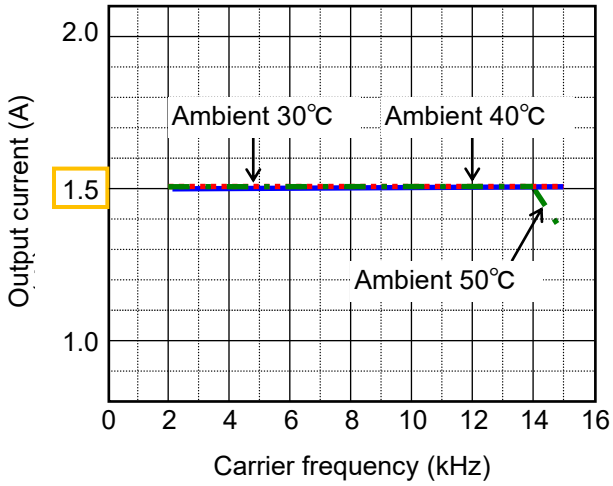



**NES1-022SB**

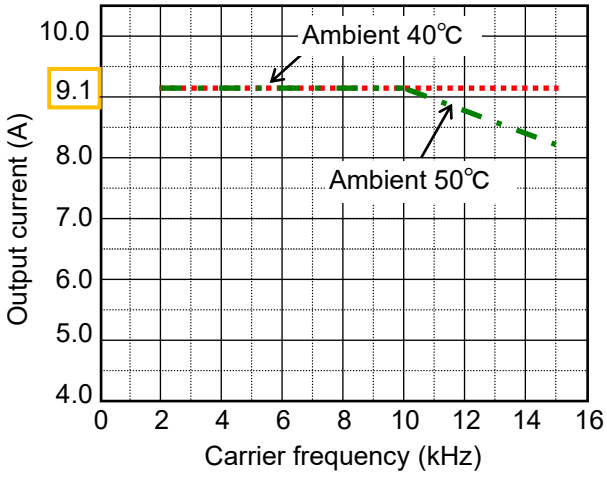



Note) “FFM installation. Ambient temperature 50℃” shows that attaching FFM becomes derating-free.

**NES1-004HB**



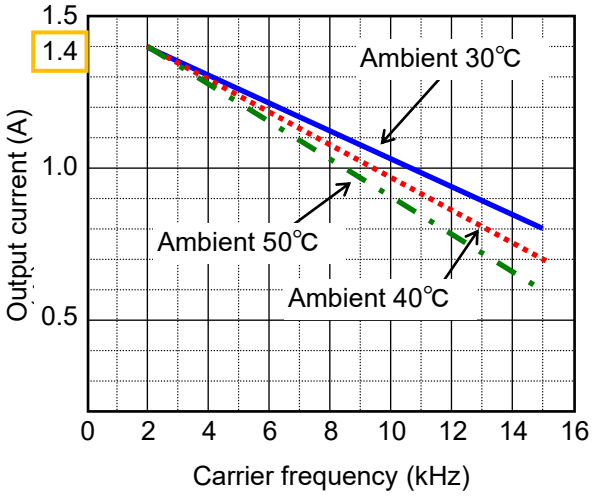

**NES1-040HB**



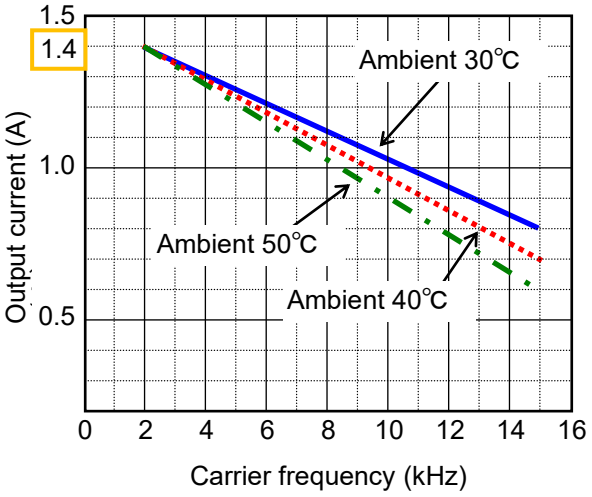

Note) NES1-007 to 022HB is not necessary for the derating.

**Production: before July 2012**

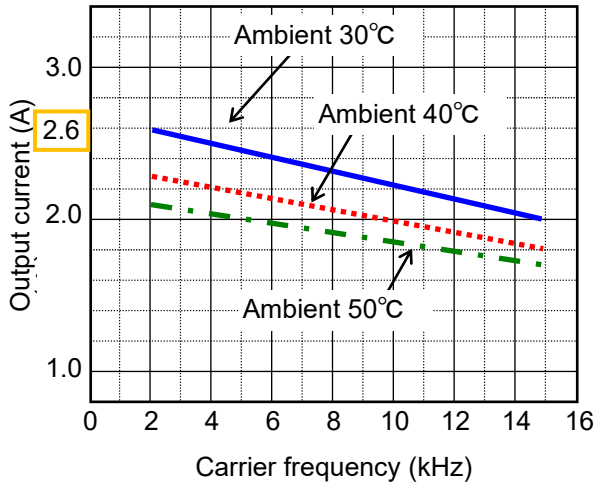
**NES1-002LB**



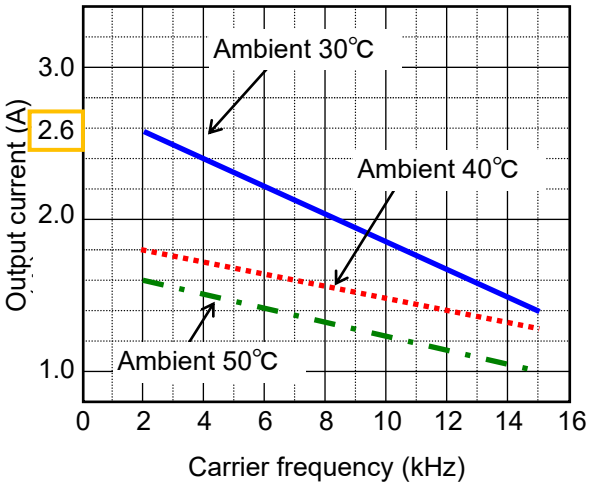

**NES1-002SB**



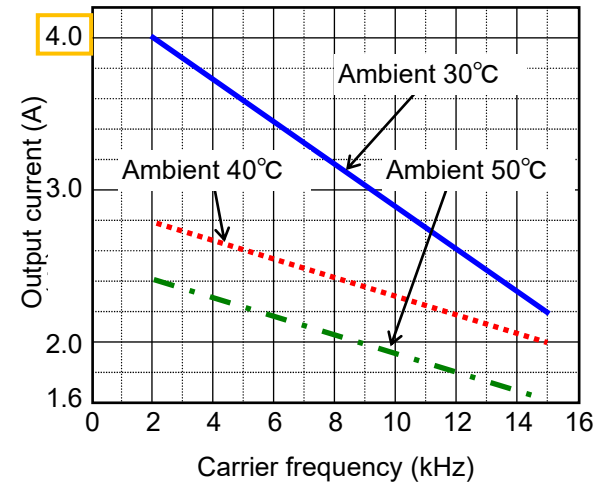

**NES1-004LB**



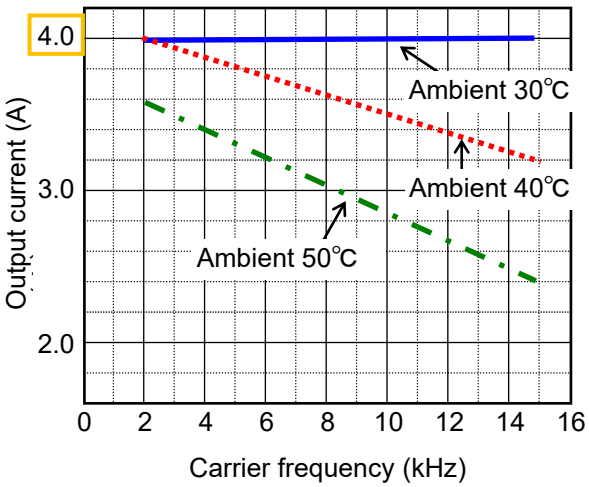

**NES1-004SB**



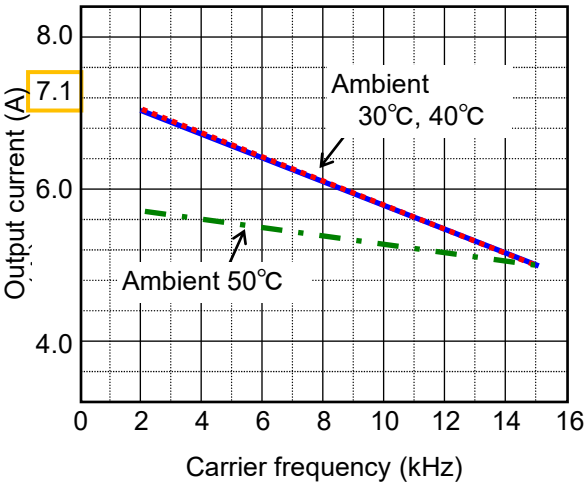
**NES1-007LB**



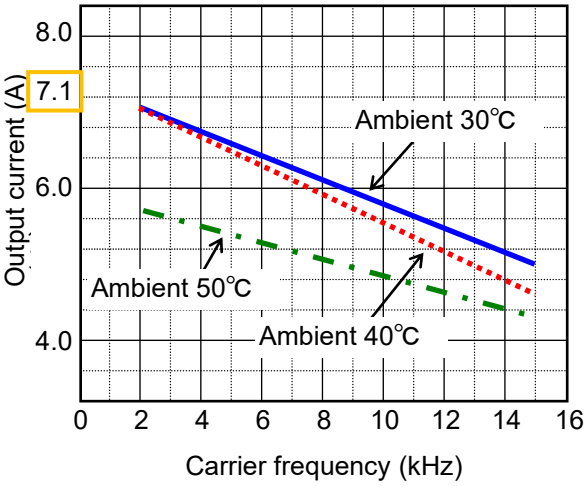

**NES1-007SB**



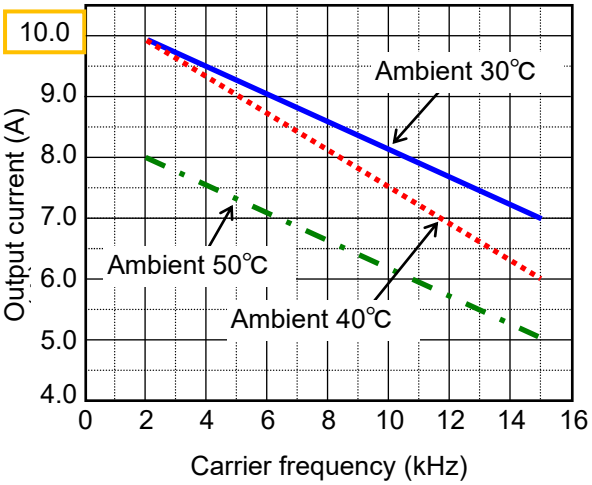

**NES1-015LB**



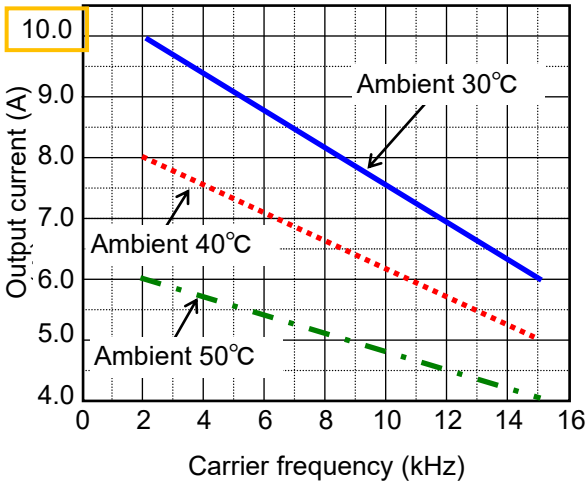

**NES1-015SB**




**NES1-022LB**




**NES1-022SB**



# Chapter 13 Option

**This chapter describes the options for NE-S1.**

(Memo)

## 13.1 Operator

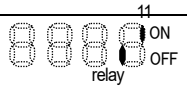
Operator can be selected from NES1-OP, OPE-S/SR/SBK/SRmini, SOP, SOP-VR and WOP. NES1-OP can be attached to the NE-S1 inverter. Other than it, be the connection with the cable.

### 13.1.1 Attention at the data setting

・When Function code display restriction (b037) is set other than "00" (Full display), some functions are not displayed.
・When Software lock mode selection (b031) is validly set, the parameter cannot be changed.
・The parameter with the symbol "✕" in the "Run Mode Edit - A" column cannot be changed while driving.
・When Software lock mode selection (b031) are set "10", the parameter with the symbol "✓" in the "Run Mode Edit - B" column can be changed while driving.

### 13.1.2 Monitoring mode (Display of NES1-OP, OPE-S/SR/SBK/SRmini, SOP, SOP-VR)

・The data of Output frequency monitoring (d001) is displayed after power on. This data displayed after power on can be changed by setting of "b038".

| "d" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| d001 | Output frequency monitoring | 0.00 to 99.99 / 100.0 to 400.0 (Hz) | ✓ | ✓ | – | – | – | 7 - 3 |
| d002 | Output current monitoring | 0.0 to 655.3 (A) | ✕ | ✕ | – | – | – | 7 - 3 |
| d003 | Rotation direction monitoring | F (forward rotation) / o (stopped) / r (reverse rotation) | ✕ | ✕ | – | – | – | 7 - 3 |
| d004 | PV monitoring | 0.00 to 99.99 / 100.0 to 999.9 / 1000. to 9999. / 1000 to 9999 (10000 to 99990) / ⌜100 to ⌜999 (100000 to 999000) | ✕ | ✕ | – | – | – | 7 - 4 |
| d005 | Intelligent input terminal status |   (Example) terminal 1,2: ON terminal 3 to 5: OFF | ✕ | ✕ | – | – | – | 7 - 4 |
| d006 | Intelligent output terminal status |   (Example) terminal 11: ON terminal relay: OFF | ✕ | ✕ | – | – | – | 7 - 4 |
| d007 | Scaled output frequency monitoring | 0.00 to 99.99 / 100.0 to 999.9 / 1000. to 9999. /1000 to 3999 (10000 to 39990) | ✓ | ✓ | – | – | – | 7 - 5 |
| d013 | Output voltage monitoring | 0.0 to 600.0 (V) | ✕ | ✕ | – | – | – | 7 - 5 |
| d014 | Input power monitoring | 0.0 to 999.9 (kW) | ✕ | ✕ | – | – | – | 7 - 5 |
| d015 | Cumulative power monitoring | 0.0 to 999.9 / 1000. to 9999. / 1000 to 9999 (10000 to 99990) / ⌜100 to ⌜999 (100000 to 999000) *1) | ✕ | ✕ | – | – | – | 7 - 6 |
| d016 | Cumulative operation RUN time monitoring | 0. to 9999. / 1000 to 9999 (10000 to 99990) / ⌜100 to ⌜999 (100000 to 999000) (hr) | ✕ | ✕ | – | – | – | 7 - 6 |
| d017 | Cumulative power-on time monitoring | 0. to 9999. / 1000 to 9999 (10000 to 99990) / ⌜100 to ⌜999 (100000 to 999000) (hr) | ✕ | ✕ | – | – | – | 7 - 6 |

*1) About units, refer to "7.1.10 Cumulative power monitoring".

| "d" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| d018 | Heatsink temperature monitoring | -20.0 to 120.0 (°C) | × | × | – | – | – | 7 - 6 |
| d050 | Dual Monitoring | Displays the monitoring data selected by b160, b161. | × | × | – | – | – | 7 - 7 |
| d060 *2) | Inverter mode Monitoring | I (Induction Motor) / P (Permanent Magnet Motor) | × | × | – | – | – | 7 - 7 |
| d080 | Trip counter | 0. to 9999. / 1000 to 6553 (10000 to 65530) (counts) | × | × | – | – | – | 7 - 7 |
| d081 | Trip monitoring 1 | Factor, frequency (Hz), current (A), DC bus voltage (VDC), running time (hr), power-on time (hr) | × | × | – | – | – | 7 - 8 |
| 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 | × | × | – | – | – | 7 - 8 |
| d102 | DC bus voltage monitoring | 0.0 to 999.9 / 1000. (VDC) | × | × | – | – | – | 7 - 8 |
| d104 | Electronic thermal overload monitoring | 0.0 to 100.0 (%) | × | × | – | – | – | 7 - 8 |

*2) It is displayed in NE-S1 Ver. 2.0 or later.

### 13.1.3 Function mode (Display of NES1-OP, OPE-S/SR/SBK/SRmini, SOP, SOP-VR)

| "F" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| F001 | Output frequency setting | Standard default target frequency that determines motor rated speed. Range: 0.00 / start frequency (b082) to maximum frequency (A004/A204) (Hz), or 0.0 to 100.0 (%) (when PID function is enabled) | ✓ | ✓ | 0.00 | ← | ← | 7 - 9 |
| F002 | Acceleration time (1) | Standard default acceleration time. Range: 0.00 to 3600 seconds. | ✓ | ✓ | 10.00 | ← | ← | 7 - 13 |
| F202 | Acceleration time (1), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | |
| F003 | Deceleration time (1) | Standard default deceleration time. Range: 0.00 to 3600 seconds. | ✓ | ✓ | 10.00 | ← | ← | |
| F203 | Deceleration time (1), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | |
| F004 | RUN key routing | 00…Forward<br>01…Reverse | ✗ | ✗ | 00 | ← | ← | 7 - 12 |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A001 | Frequency source | 00… VR (volume of NES1-OP, OPE-SR/SRmini)<br>01…Control terminal<br>02…Operator<br>03…Modbus network input<br>10…Calculate function output | ✗ | ✗ | 01 | ← | ← | 7 - 9 |
| A201 | Frequency source, 2nd motor | | ✗ | ✗ | 01 | ← | ← | |
| A002 | Run command source | 01…Control terminal<br>02…Run key on standard panel, or remote operator<br>03…Modbus network input | ✗ | ✗ | 01 | ← | ← | 7 - 12 |
| A202 | Run command source, 2nd motor | | ✗ | ✗ | 01 | ← | ← | |
| A003 | Base frequency | Range: 30.0 to the maximum frequency (A004) (Hz) | ✗ | ✗ | 60.0 *3) | 50.0 *3) | 50.0 *3) | 7 - 14 |
| A203 | Base frequency, 2nd motor | Range: 30.0 to the maximum frequency, 2nd motor (A204) (Hz) | ✗ | ✗ | 60.0 | 50.0 | 50.0 | |
| A004 | Maximum frequency | Range: the base frequency (A003) to 400.0 (Hz) | ✗ | ✗ | 60.0 *3) | 50.0 *3) | 50.0 *3) | 7 - 16 |
| A204 | Maximum frequency, 2nd motor | Range: the base frequency, 2nd motor (A203) to 400.0 (Hz) | ✗ | ✗ | 60.0 | 50.0 | 50.0 | |
| A011 | [O/OI] input active range start frequency | The output frequency corresponding to the analog input range starting point.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 23 |
| A012 | [O/OI] input active range end frequency | The output frequency corresponding to the analog input range ending point.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | |
| A013 | [O/OI] input active range start ratio | The starting point (offset) for the active analog input range.<br>Range: 0. to A014 (%) | ✗ | ✓ | 0. | ← | ← | |
| A014 | [O/OI] input active range end ratio | The ending point (offset) for the active analog input range.<br>Range: A013 to 100. (%) | ✗ | ✓ | 100. | ← | ← | |
| A015 | [O/OI] input start frequency enable | 00…Use offset (A011 value)<br>01…Use 0 Hz | ✗ | ✓ | 01 | ← | ← | |
| A016 | Analog input filter | Range: 1. to 30. : ×2 ms filter<br>31. : 500 ms fixed filter with ±0.1 Hz hys. | ✗ | ✓ | 31. | 8. | 31. | 7 - 21 |
| A019 | Multi-speed operation selection | 00...Binary operation<br>(8 speeds selectable with 3 terminals)<br>01...Bit operation<br>(4 speeds selectable with 3 terminals) | ✗ | ✗ | 00 | ← | ← | 7 - 33 |
| A020 | Multi-speed frequency 0 | Define the first speed of a multi-speed function.<br>Range: 0.00 / start frequency (b082) to maximum frequency (A004) (Hz) | ✓ | ✓ | 0.00 | ← | ← | |
| A220 | Multi-speed frequency 0, 2nd motor | Define the first speed of a multi-speed function for 2nd motor.<br>Range: 0.00 / start frequency (b082) to maximum frequency, 2nd motor (A204) (Hz) | ✓ | ✓ | 0.00 | ← | ← | |

*3) The initial data for PM mode will be different.

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A021 to A027 | Multi-speed frequency 1 to 7 (for both motors) | Define 7 more speeds of a multi-speed function.<br>Range: 0.00 / start frequency (b082) to maximum frequency (A004/A204) (Hz) | ✓ | ✓ | See next row | ← | ← | 7 - 33 |
| | | A021 | ✓ | ✓ | 60.00 | 50.00 | 50.00 | |
| | | A022 | ✓ | ✓ | 40.00 | 35.00 | 35.00 | |
| | | A023 | ✓ | ✓ | 20.00 | ← | ← | |
| | | A024 to A027 | ✓ | ✓ | 0.00 | ← | ← | |
| A038 | Jog frequency | Define limited speed for jogging operation.<br>Range: start frequency (b082) to 9.99 (Hz) | ✓ | ✓ | 6.00 | ← | ← | 7 - 30 |
| A039 | Jog stop mode | Define how to stop the motor at end of jogging operation.<br>00…Free-run stop (invalid during run)<br>01…Controlled deceleration (invalid during run)<br>02…DC braking to stop (invalid during run)<br>03…Free-run stop (valid during run)<br>04…Controlled deceleration (valid during run)<br>05…DC braking to stop (valid during run) | ✗ | ✓ | 04 | ← | ← | |
| A041 | Torque boost selection | 00…Manual torque boost<br>01…Automatic torque boost | ✗ | ✗ | 00 | ← | ← | 7 - 27 |
| A241 | Torque boost selection, 2nd motor | | ✗ | ✗ | 00 | ← | ← | |
| A042 | Manual torque boost value | Set the boost starting torque between 0 and 20 % above normal V/f curve.<br>Range: 0.0 to 20.0 (%) (Ratio to A082/282) | ✓ | ✓ | 1.0 | 3.0 | 1.0 | |
| A242 | Manual torque boost value, 2nd motor | | ✓ | ✓ | 1.0 | 3.0 | 1.0 | |
| A043 | Manual torque boost frequency | Set The frequency of the V/f breakpoint for torque boost.<br>Range: 0.0 to 50.0 (%) (Ratio to A003/203) | ✓ | ✓ | 5.0 | ← | ← | |
| A243 | Manual torque boost frequency, 2nd motor | | ✓ | ✓ | 5.0 | ← | ← | |
| A044 | V/f characteristic curve | Three available V/f curves.<br>00…Constant torque<br>01…Reduced torque (1.7th power)<br>02…Free V/f | ✗ | ✗ | 00 | ← | ← | 7 - 25 |
| A244 | V/f characteristic curve, 2nd motor | | ✗ | ✗ | 00 | ← | ← | |
| A045 | V/f gain | Set the inverter output voltage gain.<br>Range: 20. to 100. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 39 |
| A245 | V/f gain, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |
| A046 | Voltage compensation gain for automatic torque boost | Set The voltage compensation gain under automatic torque boost.<br>Range: 0. to 255. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 27 |
| A246 | Voltage compensation gain for automatic torque boost, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A047 | Slip compensation gain for automatic torque boost | Set slip compensation gain under automatic torque boost.<br>Range: 0. to 255. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 27 |
| A247 | Slip compensation gain for automatic torque boost, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |
| A051 | DC braking enable | 00…Disabled<br>01…Enabled during stop<br>02…Frequency command | ✗ | ✓ | 00 | ← | ← | 7 - 46 |
| A052 | DC braking frequency | The frequency at which DC braking begins.<br>Range: 0.00 to 60.00 (Hz) | ✗ | ✓ | 0.50 | ← | ← | |
| 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).<br>Range: 0.0 to 5.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| A054 | DC braking force for deceleration | Level of DC braking force.<br>Range: 0. to 100. (%) | ✗ | ✓ | 50. | ← | ← | |
| A055 | DC braking time for deceleration | Set the duration for DC braking.<br>Range: 0.0 to 10.0 seconds. | ✗ | ✓ | 0.5 | ← | ← | |
| A056 | DC braking / edge or level detection for [DB] input | 00…Edge detection<br>01…Level detection | ✗ | ✓ | 01 | ← | ← | |
| A057 | DC braking force at start | Level of DC braking force at start.<br>Range: 0. to 100. (%) | ✗ | ✓ | 0. | ← | ← | |
| A058 | DC braking time at start | Set the duration for DC braking at start.<br>Range: 0.0 to 10.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| A059 | Carrier frequency during DC braking | Carrier frequency of DC braking performance.<br>Range: 2.0 to 15.0 (kHz) | ✗ | ✓ | 2.0 | ← | ← | |
| A061 | Frequency upper limit | Set the upper limit on output frequency.<br>Range: frequency lower limit (A062) to maximum frequency (A004) (Hz).<br>0.00 setting disables frequency upper limit function. | ✗ | ✓ | 0.00 | ← | ← | 7 - 31 |
| A261 | Frequency upper limit, 2nd motor | Set the upper limit on output frequency for 2nd motor.<br>Range: frequency lower limit, 2nd motor (A262) to maximum frequency, 2nd motor (A204) (Hz).<br>0.00 setting disables frequency upper limit function for 2nd motor. | ✗ | ✓ | 0.00 | ← | ← | |
| A062 | Frequency lower limit | Set the lower limit on output frequency.<br>Range: start frequency (b082) to frequency upper limit (A061) (Hz)<br>0.00 setting disables frequency lower limit function. | ✗ | ✓ | 0.00 | ← | ← | |
| A262 | Frequency lower limit, 2nd motor | Set the lower limit on output frequency for 2nd motor.<br>Range: start frequency (b082) to frequency upper limit, 2nd motor (A261) (Hz)<br>0.00 setting disables frequency lower limit function for 2nd motor. | ✗ | ✓ | 0.00 | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A063<br>A065<br>A067 | Jump frequency (center) 1 to 3 | Up to 3 output frequencies can be defined for the output to jump passed to avoid motor resonances (center frequency).<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00<br>0.00<br>0.00 | ← | ← | 7 - 31 |
| A064<br>A066<br>A068 | Jump frequency width (hysteresis) 1 to 3 | Define the distance from the center frequency at which the jump occurs.<br>Range: 0.00 to 10.00 (Hz) | ✗ | ✓ | 0.50<br>0.50<br>0.50 | ← | ← | |
| A069 | Acceleration hold frequency | Set the frequency to hold acceleration.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 32 |
| A070 | Acceleration hold time | Set the duration of acceleration hold.<br>Range: 0.0 to 60.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| A071 | PID enable | 00…PID Disabled<br>01…PID Enabled<br>02…PID Enabled with reverse output | ✗ | ✓ | 00 | ← | ← | 7 - 40 |
| A072 | PID proportional gain | PID proportional gain.<br>Range: 0.00 to 25.00 | ✓ | ✓ | 1.00 | ← | ← | |
| A073 | PID integral time constant | PID integral time constant.<br>Range: 0.0 to 3600. seconds. | ✓ | ✓ | 1.0 | ← | ← | |
| A074 | PID derivative time constant | PID derivative time constant.<br>Range: 0.00 to 100.0 seconds. | ✓ | ✓ | 0.00 | ← | ← | |
| A075 | PV scale conversion | Process Variable (PV) scale factor (multiplier).<br>Range: 0.01 to 99.99 | ✗ | ✓ | 1.00 | ← | ← | |
| A076 | PV source | Select source of Process Variable (PV).<br>01…[O/OI] terminal<br>02…Modbus network input<br>10…Calculate function output | ✗ | ✓ | 01 | ← | ← | |
| A077 | Reverse PID action | 00…PID input = SP - PV<br>01…PID input = - (SP - PV)<br>(SP: PID set point) | ✗ | ✓ | 00 | ← | ← | |
| A078 | PID variation range | Set the range of PID data variation with reference to the target value.<br>Range: 0.0 to 100.0 (%) | ✗ | ✓ | 0.0 | ← | ← | |
| A081 | AVR function selection | Automatic (output) voltage regulation, select from three type of AVR functions.<br>00…AVR enabled<br>01…AVR disabled<br>02…AVR enabled except during deceleration | ✗ | ✗ | 02 | 01 | 02 | 7 - 14 |
| A281 | AVR function selection, 2nd motor | | ✗ | ✗ | 02 | 01 | 02 | |
| A082 | AVR voltage selection | 200 V class inverter settings:<br>……200 / 215 / 220 / 230 / 240 (V)<br>400 V class inverter settings:<br>……380 / 400 / 415 / 440 / 460 / 480 (V) | ✗ | ✗ | 200 / 400 | 220 / 380 | 230 / 400 | |
| A282 | AVR voltage selection, 2nd motor | | ✗ | ✗ | 200 / 400 | 220 / 380 | 230 / 400 | |
| A083 | AVR filter time constant | Define the time constant of the AVR filter.<br>Range: 0.000 to 1.000 seconds. | ✗ | ✓ | 0.030 | ← | ← | |
| A084 | AVR deceleration gain | The gain adjustment of the braking performance.<br>Range: 50. to 200. (%) | ✗ | ✓ | 100. | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A085 | Energy-saving operation mode | 00…Normal operation<br>01…Energy-saving operation | ✗ | ✗ | 00 | ← | ← | 7 - 44 |
| A086 | Energy-saving mode tuning | Range: 0.0 to 100.0 (%). | ✓ | ✓ | 50.0 | ← | ← | |
| A092 | Acceleration time (2) | Duration of 2nd segment of acceleration.<br>Range: 0.00 to 3600. seconds. | ✓ | ✓ | 10.00 | ← | ← | 7 - 35 |
| A292 | Acceleration time (2), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | |
| A093 | Deceleration time (2) | Duration of 2nd segment of deceleration.<br>Range: 0.00 to 3600. seconds. | ✓ | ✓ | 10.00 | ← | ← | |
| A293 | Deceleration time (2), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | |
| A094 | Selection method to switch to Acc2/Dec2 profile | Three options for switching from 1st to 2nd acceleration / deceleration.<br>00…[2CH] input from terminal<br>01…Transition frequency<br>02…Forward and reverse | ✗ | ✗ | 00 | ← | ← | |
| A294 | Selection method to switch to Acc2/Dec2 profile, 2nd motor | | ✗ | ✗ | 00 | ← | ← | |
| A095 | Acc1 to Acc2 frequency transition point | Output frequency at which Acc1 switches to Acc2.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✗ | 0.00 | ← | ← | |
| A295 | Acc1 to Acc2 frequency transition point, 2nd motor | | ✗ | ✗ | 0.00 | ← | ← | |
| A096 | Dec2 to Dec1 frequency transition point | Output frequency at which Dec2 switches to Dec1.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✗ | 0.00 | ← | ← | |
| A296 | Dec2 to Dec1 frequency transition point, 2nd motor | | ✗ | ✗ | 0.00 | ← | ← | |
| A097 | Acceleration curve selection | Set the characteristic curve of Acc1 and Acc2.<br>00…linear<br>01…S-curve<br>02…U-curve<br>03…Inverse U-curve | ✗ | ✗ | 00 | ← | ← | 7 - 36 |
| A098 | Deceleration curve selection | Set the characteristic curve of Dec1 and Dec2.<br>Options are same as above A097. | ✗ | ✗ | 00 | ← | ← | |
| A131 | Acceleration curve constant | Range: 01. to 10. | ✗ | ✓ | 02 | ← | ← | |
| A132 | Deceleration curve constant | Range: 01. to 10. | ✗ | ✓ | 02 | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A141 | A input selection for calculate function | 00…Operator<br>01… VR (volume of NES1-OP, OPE-SR/SRmini)<br>02…Terminal [O/OI] input<br>04…Modbus network input | ✗ | ✓ | 00 | ← | ← | 7 - 37 |
| A142 | B input selection for calculate function | 00…Operator<br>01… VR (volume of NES1-OP, OPE-SR/SRmini)<br>02…Terminal [O/OI] input<br>04…Modbus network input | ✗ | ✓ | 02 | ← | ← | 7 - 37 |
| A143 | Calculation symbol | Set the operator between A input selection (A141 selects) and B input selection (A142 selects).<br>00…ADD (A input + B input)<br>01…SUB (A input - B input)<br>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.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 38 |
| A146 | ADD direction selection | 00…Plus (adds A145 value to the output frequency setting)<br>01…Minus (subtracts A145 value from the output frequency setting) | ✗ | ✓ | 00 | ← | ← | |
| A154 | Deceleration hold frequency | Set the frequency to hold deceleration.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 32 |
| A155 | Deceleration hold time | Set the duration of deceleration hold.<br>Range: 0.0 to 60.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| A156 | PID sleep function action threshold | Set the starting threshold for the PID sleep function.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 40 |
| A157 | PID sleep function action delay time | Set the delay time for the PID sleep function to start.<br>Range: 0.0 to 25.5 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| A158 | PID sleep function return threshold | Set the ending threshold for the PID sleep function.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | |
| A161 | [VR] input active range start frequency | The output frequency corresponding to the [VR] input range starting point.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 23 |
| A162 | [VR] input active range end frequency | The output frequency corresponding to the [VR] input range ending point.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | |
| A163 | [VR] input active range start ratio | The starting point (offset) for the [VR] input range.<br>Range: 0. to A164 (%) | ✗ | ✓ | 0. | ← | ← | |
| A164 | [VR] input active range end ratio | The ending point (offset) for the [VR] input range.<br>Range: A163 to 100. (%) | ✗ | ✓ | 100. | ← | ← | |
| A165 | [VR] input start frequency enable | 00…Use offset (A161 value)<br>01…Use 0 Hz | ✗ | ✓ | 01 | ← | ← | |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b001 | Restart mode on undervoltage trip | Select inverter restart method.<br>00…Alarm output after trip, no automatic restart<br>01…Restart at 0 Hz<br>02…Resume operation after active frequency matching<br>03…After active frequency matching, deceleration stop and alarm output after trip | ✗ | ✓ | 00 | ← | ← | 7 - 55 |
| b002 | Allowable undervoltage time | Set the amount of time a power input undervoltage can occur without trip.<br>Range: 0.3 to 25.0 seconds.<br>If undervoltage occurs longer than this time, the inverter trips even if the restart mode is selected. | ✗ | ✓ | 1.0 | ← | ← | |
| b003 | Retry wait time before motor restart | Set the delay time from undervoltage condition going away to the inverter restarting.<br>Range: 0.3 to 100.0 seconds. | ✗ | ✓ | 1.0 | ← | ← | |
| b004 | Instantaneous undervoltage trip alarm enable | 00…Disabled<br>01…Enabled<br>02…Disabled during stop and deceleration stop | ✗ | ✓ | 00 | ← | ← | |
| b005 | Number of restarts on undervoltage trip | 00…Restart 16 times<br>01…Always restart | ✗ | ✓ | 00 | ← | ← | |
| b007 | Restart frequency threshold | Set the frequency the motor restarts from 0 Hz at free-running status.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.50 | ← | ← | |
| b008 | Restart mode on overvoltage / overcurrent trip | Select inverter restart method.<br>00…Alarm output after trip, no automatic restart<br>01…Restart at 0 Hz<br>02…Resume operation after active frequency matching<br>03…After active frequency matching, deceleration stop and alarm output after trip | ✗ | ✓ | 00 | ← | ← | 7 - 57 |
| b010 | Number of retry on overvoltage / overcurrent trip | Range: 1 to 3 times | ✗ | ✓ | 3 | ← | ← | |
| b011 | Retry wait time on overvoltage / overcurrent trip | Range: 0.3 to 100.0 seconds. | ✗ | ✓ | 1.00 | ← | ← | |
| b012 | Level of electronic thermal | Set a level of electronic thermal.<br>Range: (0.20 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 1.00 × inverter rated current | ← | ← | 7 - 67 |
| b212 | Level of electronic thermal, 2nd motor | | ✗ | ✓ | 1.00 × inverter rated current | ← | ← | |
| b013 | Electronic thermal characteristic | 00…Reduced torque<br>01…Constant torque<br>02…Free setting | ✗ | ✓ | 01 | ← | ← | |
| b213 | Electronic thermal characteristic, 2nd motor | | ✗ | ✓ | 01 | ← | ← | |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b015 | Free setting electronic thermal frequency 1 | Range: 0. to b017 (Hz) | ✗ | ✓ | 0. | ← | ← | 7 - 68 |
| b016 | Free setting electronic thermal current 1 | Range: (0.00 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 0.00 | ← | ← | |
| b017 | Free setting electronic thermal frequency 2 | Range: b015 to b019 (Hz) | ✗ | ✓ | 0. | ← | ← | |
| b018 | Free setting electronic thermal current 2 | Range: (0.00 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 0.00 | ← | ← | |
| b019 | Free setting electronic thermal frequency 3 | Range: b017 to 400. (Hz) | ✗ | ✓ | 0. | ← | ← | |
| b020 | Free setting electronic thermal current 3 | Range: (0.00 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 0.00 | ← | ← | |
| b021 | Overload restriction operation mode | Select the restriction operation mode during overload conditions.<br>00…Disabled<br>01…Enabled for acceleration and constant speed<br>02…Enabled for constant speed only | ✗ | ✓ | 01 | ← | ← | 7 - 69 |
| b221 | Overload restriction operation mode, 2nd motor | | ✗ | ✓ | 01 | ← | ← | |
| b022 | Overload restriction level | Set the level of overload restriction.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✗ | ✓ | 1.50 × inverter rated current | ← | ← | |
| b222 | Overload restriction level, 2nd motor | | ✗ | ✓ | 1.50 × inverter rated current | ← | ← | |
| b023 | Deceleration rate at overload restriction | Set the deceleration rate when inverter detects over b022 / b222.<br>Range: 0.1 to 3000. seconds. | ✗ | ✓ | 1.0 | ← | ← | |
| b223 | Deceleration rate at overload restriction, 2nd motor | | ✗ | ✓ | 1.0 | ← | ← | |
| b024 | Overload restriction operation mode 2 | Select the restriction operation mode during overload conditions.<br>00…Disabled<br>01…Enabled for acceleration and constant speed<br>02…Enabled for constant speed only | ✗ | ✓ | 01 | ← | ← | |
| b025 | Overload restriction level 2 | Set the level of overload restriction.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✗ | ✓ | 1.50 × inverter rated current | ← | ← | |
| b026 | Deceleration rate 2 at overload restriction | Set the deceleration rate when inverter detects over b025.<br>Range: 0.1 to 3000. seconds. | ✗ | ✓ | 1.0 | ← | ← | |
| b027 | OC suppression selection | 00…Disabled<br>01…Enabled | ✗ | ✓ | 01 | ← | ← | 7 - 70 |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b028 | Current level of active frequency matching | Set the current level of active frequency matching restart.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✗ | ✓ | 1.00 × inverter rated current | ← | ← | 7 - 55 |
| b029 | Deceleration rate of active frequency matching | Set the deceleration rate when active frequency matching restart.<br>Range: 0.1 to 3000. seconds. | ✗ | ✓ | 0.5 | ← | ← | |
| b030 | Start frequency of active frequency matching | 00…frequency at previous shutoff<br>01…start from maximum frequency<br>02…start from frequency command | ✗ | ✓ | 00 | ← | ← | |
| b031 | Software lock mode selection | Prevents parameter changes.<br>00…all parameters except b031 are locked when [SFT] terminal is ON.<br>01…all parameters except b031, F001, A020, A220, A021 to A027, and A038 are locked when [SFT] terminal is ON.<br>02…all parameters except b031 are locked.<br>03…all parameters except b031, F001, A020, A220, A021 to A027, and A038 are locked.<br>10…High level access including b031.<br>See the "Run Mode Edit - B" column in the table in this chapter for the accessible parameters in this high level access mode. | ✗ | ✓ | 01 | 10 | 01 | 7 - 50 |
| b034 | Run/power ON warning time | Range:<br>0. (Warning disabled),<br>1. to 9999. (10 to 99,990 hrs (unit: 10)),<br>1000 to 6553 (100,000 to 655,350 hrs (unit: 100)) | ✗ | ✓ | 0. | ← | ← | 7 - 76 |
| b035 | Rotation direction restriction | 00…No restriction<br>01…Reverse rotation is restricted<br>02…Forward rotation is restricted | ✗ | ✗ | 00 | ← | ← | 7 - 12 |
| b036 | Reduced voltage start selection | Range:<br>0 (the function disabled),<br>1 (approx. 4 ms) to 250 (approx. 1 sec) | ✗ | ✓ | 3 | ← | ← | 7 - 29 |
| b037 | Function code display restriction | 00…Full display<br>01…Function-specific display<br>03…Data comparison display<br>04…Basic display<br>05…Monitor display only | ✗ | ✓ | 00 | ← | ← | 7 - 53 |
| b038 | Initial display selection | 000…Function code that SET key pressed last displayed<br>001 to 060…d001 to d060 displayed<br>201…F001 displayed<br>202…B display of WOP (In case of Digital operator, same "000" setting) | ✗ | ✓ | 001 | ← | ← | 7 - 52 |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b050 | Controlled deceleration on power loss selection | 00…Disabled<br>01…Deceleration stop<br>02…Deceleration stop with DC bus voltage controlled<br>03…Deceleration stop with DC bus voltage controlled, then restart | ✗ | ✗ | 00 | ← | ← | 7 - 64 |
| b051 | DC bus voltage trigger level of controlled deceleration | Set the DC bus voltage that starts controlled deceleration operation.<br>Range: 0.0 to 400.0 (VDC).<br>(200 V class inverter settings),<br>0.0 to 800.0 (VDC).<br>(400 V class inverter settings) | ✗ | ✗ | 220.0/ 440.0 | ← | ← | |
| b052 | Overvoltage threshold of controlled deceleration | Set the OV-LAD stop level of controlled deceleration operation.<br>Range: 0.0 to 400.0 (VDC).<br>(200 V class inverter settings),<br>0.0 to 800.0 (VDC).<br>(400 V class inverter settings) | ✗ | ✗ | 360.0/ 720.0 | ← | ← | |
| b053 | Deceleration time of controlled deceleration | Range: 0.01 to 300.0 seconds. | ✗ | ✗ | 1.00 | ← | ← | |
| b054 | Initial frequency drop of controlled deceleration | Set the initial frequency drop of controlled deceleration.<br>Range: 0.00 to 10.00 (Hz) | ✗ | ✗ | 0.00 | ← | ← | |
| b060 | Maximum-limit level of window comparator (O/OI) | Range: {b061+(b062 × 2)} to 100 (%) | ✓ | ✓ | 100. | ← | ← | 7 - 81 |
| b061 | Minimum-limit level of window comparator (O/OI) | Range: 0 to {b060 - (b062 × 2)} (%) | ✓ | ✓ | 0. | ← | ← | |
| b062 | Hysteresis width of window comparator (O/OI) | Range: 0 to {(b060 - b061) / 2} (%)<br>(Maximum of 10 %) | ✓ | ✓ | 0. | ← | ← | |
| b070 | Operation level at O/OI disconnection | Range: 0 to 100 (%), or "no" (ignore) | ✗ | ✓ | no | ← | ← | |
| b078 | Cumulative power clearance | 00…OFF<br>01…ON (press STR/SET key then clear) | ✓ | ✓ | 00 | ← | ← | 7 - 6 |
| b079 | Cumulative power display gain | Range: 1. to 1000. | ✓ | ✓ | 1. | ← | ← | |
| b082 | Start frequency | Set the starting frequency for the inverter output.<br>Range: 0.01 to 9.99 (Hz) | ✗ | ✓ | 0.50 | ← | ← | 7 - 29 |
| b083 | Carrier frequency | Set the PWM carrier frequency (internal switching frequency).<br>Range: 2.0 to 15.0 (kHz)<br>(The settings may require a derating of the output current. See section 12.3.) | ✗ | ✓ | 2.0 *4) | ← | ← | 7 - 16 |

*4) The initial data for PM mode will be different.

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b084 | Initialization mode (parameters or trip history) | Select initialized data.<br>00…Initialization disabled<br>01…Clearing trip history<br>02…Initializing all parameters<br>03…Clearing trip history and initializing all parameters | ✗ | ✗ | 00 | ← | ← | 7 - 83 |
| b085 | Initial data selection | Select default parameter values on initialization.<br>00…Mode 0<br>01…Mode 1<br>03…Mode 3 | ✗ | ✗ | 00 | 03 | 01 | |
| b086 | Frequency scaling conversion factor | Specify a constant to scale the displayed frequency for d007 monitor.<br>Range: 0.01 to 99.99 | ✓ | ✓ | 1.00 | ← | ← | 7 - 5 |
| b087 | STOP/RESET key enable | Select whether the STOP/RESET key is enabled.<br>00…Enabled<br>01…Disabled always<br>02…Enabled only trip reset | ✗ | ✓ | 00 | ← | ← | 7 - 50 |
| b088 | Restart mode after FRS | Selects how the inverter resumes operation when free-run stop (FRS) is cancelled.<br>00…Restart from 0 Hz<br>01…Restart from active frequency matching | ✗ | ✓ | 00 | ← | ← | 7 - 62 |
| b089 | Automatic carrier frequency reduction | 00…Disabled<br>01…Enabled, depending on the output current<br>02…Enabled, depending on the heatsink temperature | ✗ | ✗ | 00 | ← | ← | 7 - 73 |
| b091 | Stop mode selection | 00…Deceleration stop<br>01…Free-run stop | ✗ | ✓ | 00 | ← | ← | 7 - 13 |
| b094 | Initialization target data setting | 00…ALL parameters<br>01… ALL parameters except terminal and communication data | ✗ | ✗ | 00 | ← | ← | 7 - 83 |
| b100 | Free V/f setting, frequency 1 | Range: 0. to b102 (Hz) | ✗ | ✗ | 0. | ← | ← | 7 - 26 |
| b101 | Free V/f setting, voltage 1 | Range: 0.0 to 300.0 V (200 V class), 0.0 to 600.0 V (400 V class) | ✗ | ✗ | 0.0 | ← | ← | |
| b102 | Free V/f setting, frequency 2 | Range: b100 to b104 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b103 | Free V/f setting, voltage 2 | Range: 0.0 to 300.0 V (200 V class), 0.0 to 600.0 V (400 V class) | ✗ | ✗ | 0.0 | ← | ← | |
| b104 | Free V/f setting, frequency 3 | Range: b102 to b106 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b105 | Free V/f setting, voltage 3 | Range: 0.0 to 300.0 V (200 V class), 0.0 to 600.0 V (400 V class) | ✗ | ✗ | 0.0 | ← | ← | |
| b106 | Free V/f setting, frequency 4 | Range: b104 to b108 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b107 | Free V/f setting, voltage 4 | Range: 0.0 to 300.0 V (200 V class), 0.0 to 600.0 V (400 V class) | ✗ | ✗ | 0.0 | ← | ← | |
| b108 | Free V/f setting, frequency 5 | Range: b106 to b110 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b109 | Free V/f setting, voltage 5 | Range: 0.0 to 300.0 V (200 V class), 0.0 to 600.0 V (400 V class) | ✗ | ✗ | 0.0 | ← | ← | |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b110 | Free V/f setting, frequency 6 | Range: b108 to b112 (Hz) | ✗ | ✗ | 0. | ← | ← | 7 - 26 |
| b111 | Free V/f setting, voltage 6 | Range: 0.0 to 300.0 V (200 V class), 0.0 to 600.0 V (400 V class) | ✗ | ✗ | 0.0 | ← | ← | |
| b112 | Free V/f setting, frequency 7 | Range: b110 to 400. (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b113 | Free V/f setting, voltage 7 | Range: 0.0 to 300.0 V (200 V class), 0.0 to 600.0 V (400 V class) | ✗ | ✗ | 0.0 | ← | ← | |
| b130 | Deceleration overvoltage suppression enable | 00…Disabled<br>01…Enabled (DC voltage constant control)<br>02…Enabled at the deceleration (with acceleration)<br>03…Enabled at the constant and deceleration (with acceleration) | ✗ | ✓ | 00 | ← | ← | 7 - 71 |
| b131 | Deceleration overvoltage suppression level | DC bus voltage of suppression starting.<br>Range: 330. to 390. (VDC).<br>(200 V class inverter settings),<br>660. to 780. (VDC).<br>(400 V class inverter settings) | ✗ | ✓ | 360. / 720. | ← | ← | |
| b132 | Deceleration overvoltage suppression const. | Acceleration rate when b130=02,03.<br>Range: 0.10 to 30.00 seconds. | ✗ | ✓ | 1.00 | ← | ← | |
| b133 | Deceleration overvoltage suppression proportional gain | Proportional gain when b130=01.<br>Range: 0.00 to 5.00 | ✓ | ✓ | 0.20 | ← | ← | |
| b134 | Deceleration overvoltage suppression integral time | Integral time when b130=01.<br>Range: 0.0 to 150.0 seconds. | ✓ | ✓ | 1.0 | ← | ← | |
| b150 | Display external operator connected | When an external operator is connected via RS-422 port, the NES1-OP is locked and shows only one "d" parameter.<br>Range: 001 to 060 (d001 to d060) | ✓ | ✓ | 001 | ← | ← | 7 - 52 |
| 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.<br>Range: 001 to 018 (d001 to d018) | ✓ | ✓ | 001 | ← | ← | 7 - 7 |
| b161 | 2nd parameter of Dual Monitor | | ✓ | ✓ | 002 | ← | ← | |
| b163 | Frequency set in monitoring | 00…Frequency set disabled<br>01…Frequency set enabled | ✓ | ✓ | 01 | ← | ← | 7 - 3 |
| b164 | Automatic return to the initial display | After 10 minutes from the last key operation, display returns to the initial parameter set by b038.<br>00…Disabled<br>01…Enabled | ✓ | ✓ | 00 | ← | ← | 7 - 52 |
| b165 | Operation at external operator connection loss | 00…Trip<br>01…Trip after deceleration stop<br>02…Ignore<br>03…Free-run stop<br>04…Deceleration stop | ✓ | ✓ | 02 | ← | ← | 7 - 51 |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b166 | Data Read/Write selection | 00…Read/Write OK<br>01…Read/Write protected | ✗ | ✓ | 00 | ← | ← | 7 - 52 |
| b171 *5) | Inverter mode selection | 00…Disable<br>01…Induction Motor<br>03…Permanent Magnet Motor | ✗ | ✗ | 00 | ← | ← | 7 - 86 |
| b180 | Initialization trigger | Select to perform initialization or not.<br>00…Initialization disable<br>01…Perform initialization | ✗ | ✗ | 00 | ← | ← | 7 - 83 |

*5) It is displayed in NE-S1 Ver. 2.0 or later.

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C001 | Intelligent input [1] function | Select input terminal [1] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 00 [FW] | ← | ← | 7 - 17 |
| C002 | Intelligent input [2] function | Select input terminal [2] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 01 [RV] | ← | ← | |
| C003 | Intelligent input [3] function | Select input terminal [3] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 02 [CF1] | ← | ← | |
| C004 | Intelligent input [4] function | Select input terminal [4] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 03 [CF2] | ← | ← | |
| C005 | Intelligent input [5] function | Select input terminal [5] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 18 [RS] | ← | ← | |
| C011 | Intelligent input [1] active state | Select logic conversion.<br>00…normally open [NO]<br>01…normally closed [NC] | ✗ | ✓ | 00 | ← | ← | |
| C012 | Intelligent input [2] active state | | ✗ | ✓ | 00 | ← | ← | |
| C013 | Intelligent input [3] active state | | ✗ | ✓ | 00 | ← | ← | |
| C014 | Intelligent input [4] active state | | ✗ | ✓ | 00 | ← | ← | |
| C015 | Intelligent input [5] active state | | ✗ | ✓ | 00 | ← | ← | |
| C021 | Intelligent output [11] function | Select output terminal [11] function from 27 programmable functions (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 01 [FA1] | ← | ← | 7 - 18 |
| C026 | Intelligent relay function | Select intelligent relay terminal function from 27 programmable functions (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 05 [AL] | ← | ← | |
| C027 | [FM] terminal selection (Pulse/PWM output) | 00…Output frequency (PWM)<br>01…Output current (PWM)<br>03…Output frequency (Pulse train)<br>04…Output voltage (PWM)<br>05…Input power (PWM)<br>06…Electronic thermal load ratio (PWM)<br>07…LAD frequency (PWM)<br>08…Output current (Pulse train)<br>10…Heatsink temperature (PWM) | ✗ | ✓ | 07 | ← | ← | 7 - 24 |
| C030 | Digital current monitor reference value | Set the current value output pulse frequency is 1440 Hz when C027=08.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✓ | ✓ | 1.00 × inverter rated current | ← | ← | 7 - 24 |
| C031 | Intelligent output [11] active state | Select logic conversion.<br>00…normally open [NO]<br>01…normally closed [NC] | ✗ | ✓ | 00 | ← | ← | 7 - 19 |
| C036 | Intelligent relay active state | | ✗ | ✓ | 01 | ← | ← | |

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C038 | Output mode of low current detection | 00…During acceleration, deceleration, and constant speed<br>01…During constant speed only | ✗ | ✓ | 01 | ← | ← | 7 - 79 |
| C039 | Low current detection level | Set the level of low current detection.<br>Range: (0.00 to 2.00) × inverter rated current Amps. | ✓ | ✓ | 1.00 × inverter rated current | ← | ← | |
| C040 | Output mode of overload warning | 00…During acceleration, deceleration, and constant speed<br>01…During constant speed only | ✗ | ✓ | 01 | ← | ← | 7 - 70 |
| C041 | Overload warning level | Set the overload warning signal level.<br>Range: (0.00 to 2.00) × inverter rated current Amps. | ✓ | ✓ | 1.15 × inverter rated current | ← | ← | |
| C241 | Overload warning level, 2nd motor | | ✓ | ✓ | 1.15 × inverter rated current | ← | ← | |
| C042 | Frequency arrival setting for acceleration | Set the frequency arrival setting threshold for the output frequency during acceleration.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 74 |
| C043 | Frequency arrival setting for deceleration | Set the frequency arrival setting threshold for the output frequency during deceleration.<br>Range: 0.00 to 400.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | |
| C044 | PID deviation level | Set the allowable PID deviation (absolute value).<br>Range: 0.0 to 100.0 (%) | ✗ | ✓ | 3.0 | ← | ← | 7 - 40 |
| C052 | PV comparison signal output high limit | When the PV exceeds this value, the [FBV] function signal turns OFF.<br>Range: 0.0 to 100.0 (%) | ✗ | ✓ | 100.0 | ← | ← | |
| C053 | PV comparison signal output low limit | When the PV goes below this value, the [FBV] function signal turns ON.<br>Range: 0.0 to 100.0 (%) | ✗ | ✓ | 0.0 | ← | ← | |
| C061 | Electronic thermal warning level | Range: 0. to 100. (%)<br>(Setting "0." means disabled.) | ✗ | ✓ | 90. | ← | ← | 7 - 68 |
| C063 | Zero speed detection level | Range: 0.00 to 100.0 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 76 |
| C064 | Heatsink overheat warning | Range: 0. to 110. (°C) | ✗ | ✓ | 100. | ← | ← | 7 - 78 |
| C070 | Selection of OPE/Modbus | 00…OPE<br>01…Modbus | ✗ | ✗ | 00 | ← | ← | 8 - 6 |
| C071 | Communication speed | 04…4,800 bps<br>05…9,600 bps<br>06…19,200 bps<br>07…38,400 bps | ✗ | ✓ | 05 | ← | ← | |
| C072 | Modbus address | Set the address of the inverter on the Modbus network.<br>Range: 1. to 247. | ✗ | ✓ | 1. | ← | ← | |
| C074 | Communication parity | 00…No parity<br>01…Even parity<br>02…Odd parity | ✗ | ✓ | 00 | ← | ← | |
| C075 | Communication stop bit | 01…1 bit<br>02…2 bit | ✗ | ✓ | 01 | ← | ← | |

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C076 | Communication error selection | Select inverter response to communication error.<br>00…Trip<br>01…Trip after deceleration stop<br>02…Ignore<br>03…Free-run stop<br>04…Deceleration stop | ✗ | ✓ | 02 | ← | ← | 8 - 6 |
| C077 | Communication error detection time | Set the communications watchdog timer period.<br>Range: 0.00 to 99.99 seconds.<br>(Setting "0.00" means disabled.) | ✗ | ✓ | 0.00 | ← | ← | |
| C078 | Communication wait time | Set the inverter wait time from receiving a message to transmitting a message.<br>Range: 0. to 1000. milliseconds. | ✗ | ✓ | 0. | ← | ← | |
| C081 | O/OI input gain calibration | Set the scale factor between the external frequency command on terminals L–O/OI, and the output frequency.<br>Range: 0.0 to 200.0 (%) | ✓ | ✓ | 100.0 | ← | ← | 7 - 22 |
| C091 | (The parameter for factory use) | **(Do not change)** | ✓ | ✓ | 00 | ← | ← | - |
| C101 | Up/Down memory mode selection | Select keep the last frequency command adjusted by UP/DWN key or not.<br>00…Clear last frequency command (return to default frequency F001)<br>01…Keep last frequency command adjusted by UP/DWN key | ✗ | ✓ | 00 | ← | ← | 7 - 38 |
| C102 | Reset selection | Select response method when [RS] terminal turns ON/OFF.<br>00…Cancel trip state at [RS] terminal input ON transition, stops inverter if in Run Mode<br>01…Cancel trip state at [RS] terminal input OFF transition, stops inverter if in Run Mode<br>02…Cancel trip state at [RS] terminal input ON transition, no effect if in Run Mode | ✓ | ✓ | 00 | ← | ← | 7 - 60 |
| C103 | Restart mode after reset | Select the restart mode after resetting.<br>00…Start with 0 Hz<br>01…Start with active frequency matching | ✗ | ✓ | 00 | ← | ← | |
| C104 | UP/DWN clear mode | Select the frequency set value when [UDC] terminal turns to ON.<br>00…0 Hz<br>01…Original setting (in the memory at power on) | ✗ | ✓ | 00 | ← | ← | 7 - 38 |
| C105 | FM gain adjustment | Range: 50. to 200. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 24 |
| C130 | Intelligent output [11] on delay | Range: 0.0 to 100.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | 7 - 20 |
| C131 | Intelligent output [11] off delay | | ✗ | ✓ | 0.0 | ← | ← | |
| C140 | Intelligent relay output on delay | Range: 0.0 to 100.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| C141 | Intelligent relay output off delay | | ✗ | ✓ | 0.0 | ← | ← | |

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C142 | Logic output operand A | Select from all the programmable functions available for logic outputs except LOG, NO. | ✗ | ✓ | 00 | ← | ← | 7 - 77 |
| C143 | Logic output operand B | | ✗ | ✓ | 00 | ← | ← | |
| C144 | Logic output operator | Select a logic operator to calculate [LOG] output state.<br>00…[LOG] = A AND B<br>01…[LOG] = A OR B<br>02…[LOG] = A XOR B | ✗ | ✓ | 00 | ← | ← | |
| C151 | Button sensitivity selection | Range: 0. to 250. (×2 ms) / no | ✗ | ✓ | 10. | ← | ← | 7 - 54 |
| C152 | Scroll sensitivity selection | Range: 1. to 20. | ✗ | ✓ | 10. | ← | ← | |
| C155 | Ground fault detection | 00…Disabled<br>01…Enabled | ✗ | ✓ | 01 | ← | ← | 7 - 82 |
| C157 | Output phase loss detection | 00…Disabled<br>01…Enabled | ✗ | ✓ | 00 | ← | ← | 7 - 82 |
| C160 | Intelligent input [1] response time | Set response time of each input terminal.<br>Range: 0. to 200. (×2 ms) | ✗ | ✓ | 1. | ← | ← | 7 - 18 |
| C161 | Intelligent input [2] response time | | ✗ | ✓ | 1. | ← | ← | |
| C162 | Intelligent input [3] response time | | ✗ | ✓ | 1. | ← | ← | |
| C163 | Intelligent input [4] response time | | ✗ | ✓ | 1. | ← | ← | |
| C164 | Intelligent input [5] response time | | ✗ | ✓ | 1. | ← | ← | |
| C169 | Multi-speed determination time | Range: 0. to 200. (×10 ms) | ✗ | ✓ | 0. | ← | ← | 7 - 33 |

| "H" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| H001 *6) | Auto-tuning selection | 00…Disabled<br>01…Not rotation<br>02…Rotation | ✕ | ✕ | 00 | ← | ← | 7 - 88 |
| H003 | Motor capacity | 0.10 / 0.20 / 0.40 / 0.55 / 0.75 / 1.10 / 1.50 / 2.20 / 3.00 / 3.70 / 4.00 / 5.50 (kW) | ✕ | ✕ | *7) | ← | ← | 7 - 49 |
| H203 | Motor capacity, 2nd motor | | ✕ | ✕ | | ← | ← | |
| H004 | Motor poles setting | 2 / 4 / 6 / 8 (poles) | ✕ | ✕ | 4 | ← | ← | |
| H204 | Motor poles setting, 2nd motor | | ✕ | ✕ | 4 | ← | ← | |
| H006 | Motor stabilization constant | Range: 0. to 255. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 44 |
| H206 | Motor stabilization constant, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |
| H101 *6) | PM motor rated voltage | Range: 100.0 to 240.0 (V)<br>(200 V class inverter settings)<br>200.0 to 480.0 (V)<br>(400 V class inverter settings) | ✕ | ✕ | 200.0 / 400.0 | ← | ← | 7 - 87 |
| H102 *6) | PM motor code setting | 00…Hitachi standard<br>(Use H106 to H110 at motor constants)<br>01…Auto-Tuning<br>(Use H110 to H114 at motor constants) | ✕ | ✕ | 00 | ← | ← | |
| H103 *6) | PM motor capacity | 0.10 / 0.20 / 0.40 / 0.55 / 0.75 / 1.10 / 1.50 / 2.20 / 3.00 / 3.70 / 4.00 / 5.50 / 7.50 (kW) | ✕ | ✕ | *7) | ← | ← | |
| H104 *6) | PM motor pole setting | 2 / 4 / 6 / 8 / 10 / 12 / 14 / 16 / 18 / 20 / 22 / 24 / 26 / 28 / 30 / 32 / 34 / 36 / 38 / 40 / 42 / 44 / 46 / 48 (poles) | ✕ | ✕ | 01 (4P) | ← | ← | |
| H105 *6) | PM rated current | Range: (0.20 to 1.00) × inverter rated current Amps. | ✕ | ✕ | *7) | ← | ← | |
| H106 *6) | PM const R (Resistance) | Range: 0.001 to 65.535 (Ω) | ✕ | ✕ | *7) | ← | ← | |
| H107 *6) | PM const Ld (d-axis inductance) | Range: 0.01 to 655.35 (mH) | ✕ | ✕ | *7) | ← | ← | |
| H108 *6) | PM const Lq (q-axis inductance) | Range: 0.01 to 655.35 (mH) | ✕ | ✕ | *7) | ← | ← | |
| H109 *6) | PM const Ke (Induction voltage constant) | Range: 0.1 to 6553.5 (mV/(rad/s)) | ✕ | ✕ | *7) | ← | ← | |
| H110 *6) | PM const J (Moment of inertia) | Range: 0.001 to 9999.000 ($kgm^2$) | ✕ | ✕ | *7) | ← | ← | |

*6) It is displayed in PM mode.
*7) Specified by the capacity of each inverter model.

| "H" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| H111 *6) | PM const R (Resistance, Auto) | Range: 0.001 to 65.535 (Ω) | ✗ | ✗ | *7) | ← | ← | 7 - 87 |
| H112 *6) | PM const Ld (d-axis inductance, Auto) | Range: 0.01 to 655.35 (mH) | ✗ | ✗ | *7) | ← | ← | |
| H113 *6) | PM const Lq (q-axis inductance, Auto) | Range: 0.01 to 655.35 (mH) | ✗ | ✗ | *7) | ← | ← | |
| H114 *6) | PM const Ke (Induction voltage constant, Auto) | Range: 0.1 to 6553.5 (mV/(rad/s)) | ✗ | ✗ | *7) | ← | ← | |
| H116 *6) | PM speed response | Range: 1. to 1000. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 92 |
| H117 *6) | PM starting current | Range: 20. to 100. (%) | ✗ | ✗ | 70. | ← | ← | |
| H118 *6) | PM starting time | Range: 0.01 to 60.00 seconds | ✗ | ✗ | 1.00 | ← | ← | |
| H119 *6) | PM stabilization constant | Range: 0. to 120. (%) | ✓ | ✓ | 100. | ← | ← | |
| H121 *6) | PM minimum frequency ratio | Range: 0. to 50. (%) | ✓ | ✓ | 8. | ← | ← | |
| H122 *6) | PM no-load current | Range: 0. to 100. (%) | ✓ | ✓ | 10. | ← | ← | |
| H123 *6) | PM starting method selection | 00…Normal<br>01…Initial magnet position estimation | ✗ | ✗ | 00 | ← | ← | |
| H133 *6) | PM initial magnet position estimation detect time | Range: 0.03 to 2.50 seconds | ✗ | ✗ | 0.05 | ← | ← | |
| H134 *6) | PM initial magnet position estimation voltage gain | Range: 0 to 120 (%) | ✗ | ✗ | 100 | ← | ← | |
| H135 *6) | PM step-out protection selection | 00…Disable<br>01…Error<br>02…Restart at 0 Hz | ✓ | ✓ | 00 | ← | ← | |
| H136 *6) | PM step-out protection level | Range: 1 to 100 (%) | ✓ | ✓ | 50 | ← | ← | |
| H141 *6) | PM overcurrent detection level | Range: (1.00 to 2.50) × inverter rated current Amps. | ✗ | ✓ | 2.35 × inverter rated current | ← | ← | |
| H142 *6) | PM starting overcurrent detection level | Range: (1.00 to 2.50) × inverter rated current Amps. | ✗ | ✓ | 1.80 × inverter rated current | ← | ← | |

*6) It is displayed in PM mode.
*7) Specified by the capacity of each inverter model.

### 13.1.4 Monitoring mode (Display of WOP)

・The initial state displays "d001" at power on. If you want to fix it to any display, please change setting of "b038".

| "d" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| d001 (Output FQ) | Output frequency monitoring | 0.00 to 400.00 (Hz) | ✓ | ✓ | – | – | – | 7 - 3 |
| d002 (Output current) | Output current monitoring | 0.0 to 655.3 (A) | ✗ | ✗ | – | – | – | 7 - 3 |
| d003 (Rotation) | Rotation direction monitoring | FWD (forward rotation)<br>STOP (stopped)<br>REV (reverse rotation) | ✗ | ✗ | – | – | – | 7 - 3 |
| d004 (PID-FB) | PV monitoring | 0.00 to 10000.0 | ✗ | ✗ | – | – | – | 7 - 4 |
| d005 (Input) | Intelligent input terminal status | 1 to 5 terminals<br>LLLLL/HHHHH | ✗ | ✗ | – | – | – | 7 - 4 |
| d006 (Output) | Intelligent output terminal status | 11, RY terminal<br>LL/HH | ✗ | ✗ | – | – | – | 7 - 4 |
| d007 (Scaled FQ) | Scaled output frequency monitoring | 0.00 to 39996.00 | ✓ | ✓ | – | – | – | 7 - 5 |
| d013 (Output Voltage) | Output voltage monitoring | 0.0 to 600.0 (V) | ✗ | ✗ | – | – | – | 7 - 5 |
| d014 (Input Power) | Input power monitoring | 0.0 to 999.9 (kW) | ✗ | ✗ | – | – | – | 7 - 5 |
| d015 (kW-hour) | Cumulative power monitoring | 0.0 to 999999.9 *1) | ✗ | ✗ | – | – | – | 7 - 6 |
| d016 (RUN time) | Cumulative operation RUN time monitoring | 0. to 999999. (hr) | ✗ | ✗ | – | – | – | 7 - 6 |
| d017 (ON time) | Cumulative power-on time monitoring | 0. to 999999. (hr) | ✗ | ✗ | – | – | – | 7 - 6 |
| d018 (Heatsink Tmp.) | Heatsink temperature monitoring | -20.0 to 120.0 (°C) | ✗ | ✗ | – | – | – | 7 - 6 |
| d031 (Clock) | Current time monitoring | Current time | ✗ | ✗ | – | – | – | 7 - 6 |
| d050 (Dual) | Dual Monitoring | Display the monitoring data selected by b160, b161. | ✗ | ✗ | – | – | – | 7 - 7 |
| d060 (Inverter mode) *2) | Inverter mode Monitoring | IM (Induction Motor) /<br>PM (Permanent Magnet Motor) | ✗ | ✗ | – | – | – | 7 - 7 |

*1) About units, refer to "7.1.10 Cumulative power monitoring".
*2) It is displayed in NE-S1 Ver. 2.0 or later.

| "d" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| d080 (Trip Counter) | Trip counter | 0. to 65535. (counts) | ✕ | ✕ | – | – | – | 7 - 7 |
| d081 (ERR1) | Trip monitoring 1 | Factor, frequency (Hz), current (A), DC bus voltage (VDC), running time (hr), power-on time (hr) | ✕ | ✕ | – | – | – | 7 - 8 |
| d082 (ERR2) | Trip monitoring 2 | | ✕ | ✕ | – | – | – | |
| d083 (ERR3) | Trip monitoring 3 | | ✕ | ✕ | – | – | – | |
| d084 (ERR4) | Trip monitoring 4 | | ✕ | ✕ | – | – | – | |
| d085 (ERR5) | Trip monitoring 5 | | ✕ | ✕ | – | – | – | |
| d086 (ERR6) | Trip monitoring 6 | | ✕ | ✕ | – | – | – | |
| d090 (WARN) | Warning monitoring | Warning code | ✕ | ✕ | – | – | – | 7 - 8 |
| d102 (DC Voltage) | DC bus voltage monitoring | 0.0 to 1000.0 (VDC) | ✕ | ✕ | – | – | – | 7 - 8 |
| d104 (E.Thermal) | Electronic thermal overload monitoring | 0.0 to 100.0 (%) | ✕ | ✕ | – | – | – | 7 - 8 |

### 13.1.5 Function mode (Display of WOP)

| "F" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| F001 (Set Frequency) | Output frequency setting | Standard default target frequency that determines motor rated speed. Range: 0.00 / start frequency (b082) to maximum frequency (A004/A204) (Hz), or 0.0 to 100.0 (%) (when PID function is enabled) | ✓ | ✓ | 0.00 | ← | ← | 7 - 9 |
| F002 (Accel.time1) | Acceleration time (1) | Standard default acceleration time. Range: 0.00 to 3600.00 seconds. | ✓ | ✓ | 10.00 | ← | ← | 7 - 13 |
| F202 (Accel.time1-M2) | Acceleration time (1), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | |
| F003 (Decel.time1) | Deceleration time (1) | Standard default deceleration time. Range: 0.00 to 3600.00 seconds. | ✓ | ✓ | 10.00 | ← | ← | |
| F203 (Decel.time1-M2) | Deceleration time (1), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | |
| F004 (RUN key direction) | RUN key routing | 00…FWD 01…REV | ✗ | ✗ | 00 | ← | ← | 7 - 12 |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A001 (Frequency source) | Frequency source | 00…VR<br>01…Terminal<br>02…Operator<br>03…Modbus<br>10…Math | ✕ | ✕ | 01 | ← | ← | 7 - 9 |
| A201 (Frequency source-M2) | Frequency source, 2nd motor | | ✕ | ✕ | 01 | ← | ← | |
| A002 (RUN cmd source) | Run command source | 01…Terminal<br>02…Operator<br>03…Modbus | ✕ | ✕ | 01 | ← | ← | 7 - 12 |
| A202 (RUN cmd source-M2) | Run command source, 2nd motor | | ✕ | ✕ | 01 | ← | ← | |
| A003 (Base Frequency) | Base frequency | Range: 30.0 to the maximum frequency (A004) (Hz) | ✕ | ✕ | 60.0 *3) | 50.0 *3) | 50.0 *3) | 7 - 14 |
| A203 (Base Frequency-M2) | Base frequency, 2nd motor | Range: 30.0 to the maximum frequency, 2nd motor (A204) (Hz) | ✕ | ✕ | 60.0 | 50.0 | 50.0 | |
| A004 (Max. Frequency) | Maximum frequency | Range: the base frequency (A003) to 400.0 (Hz) | ✕ | ✕ | 60.0 *3) | 50.0 *3) | 50.0 *3) | 7 - 16 |
| A204 (Max. Frequency -M2) | Maximum frequency, 2nd motor | Range: the base frequency, 2nd motor (A203) to 400.0 (Hz) | ✕ | ✕ | 60.0 | 50.0 | 50.0 | |
| A011 ([O/OI] start FQ) | [O/OI] input active range start frequency | The output frequency corresponding to the analog input range starting point. Range: 0.00 to 400.00 (Hz) | ✕ | ✓ | 0.00 | ← | ← | 7 - 23 |
| A012 ([O/OI] end FQ) | [O/OI] input active range end frequency | The output frequency corresponding to the analog input range ending point. Range: 0.00 to 400.00 (Hz) | ✕ | ✓ | 0.00 | ← | ← | |
| A013 ([O/OI] start %) | [O/OI] input active range start ratio | The starting point (offset) for the active analog input range. Range: 0. to A014 (%) | ✕ | ✓ | 0. | ← | ← | |
| A014 ([O/OI] end %) | [O/OI] input active range end ratio | The ending point (offset) for the active analog input range. Range: A013 to 100. (%) | ✕ | ✓ | 100. | ← | ← | |
| A015 ([O/OI] start FQ select) | [O/OI] input start frequency enable | 00…Start FQ<br>01…0Hz | ✕ | ✓ | 01 | ← | ← | |
| A016 (Analog-in filter) | Analog input filter | Range: 1. to 30. : × 2 ms filter<br>31. : 500 ms fixed filter with ±0.1 Hz hys. | ✕ | ✓ | 31. | 8. | 31. | 7 - 21 |
| A019 (Multispeed select) | Multi-speed operation selection | 00...Binary (8)<br>01...Bit (4) | ✕ | ✕ | 00 | ← | ← | 7 - 33 |

*3) The initial data for PM mode will be different.

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A020 (Multispeed 0) | Multi-speed frequency 0 | Define the first speed of a multi-speed function. Range: 0.00 / start frequency (b082) to maximum frequency (A004) (Hz) | ✓ | ✓ | 0.00 | ← | ← | 7 - 33 |
| A220 (Multispeed 0-M2) | Multi-speed frequency 0, 2nd motor | Define the first speed of a multi-speed function for 2nd motor. Range: 0.00 / start frequency (b082) to maximum frequency, 2nd motor (A204) (Hz) | ✓ | ✓ | 0.00 | ← | ← | |
| A021 to A027 (Multispeed 1 to Multispeed 7) | Multi-speed frequency 1 to 7 (for both motors) | Define 7 more speeds of a multi-speed function. Range: 0.00 / start frequency (b082) to maximum frequency (A004/A204) (Hz) | ✓ | ✓ | See next row | ← | ← | |
| | | A021 | ✓ | ✓ | 60.00 | 50.00 | 50.00 | |
| | | A022 | ✓ | ✓ | 40.00 | 35.00 | 35.00 | |
| | | A023 | ✓ | ✓ | 20.00 | ← | ← | |
| | | A024 to A027 | ✓ | ✓ | 0.00 | ← | ← | |
| A038 (Jog frequency) | Jog frequency | Define limited speed for jogging operation. Range: start frequency (b082) to 9.99 (Hz) | ✓ | ✓ | 6.00 | ← | ← | 7 - 30 |
| A039 (Jog stop mode) | Jog stop mode | Define how to stop the motor at end of jogging operation. 00…FRS 01…DEC 02…DB 03…FRS(RUN) 04…DEC(RUN) 05…DB(RUN) | ✗ | ✓ | 04 | ← | ← | |
| A041 (TRQ boost sel) | Torque boost selection | 00…Manual 01…Auto | ✗ | ✗ | 00 | ← | ← | 7 - 27 |
| A241 (TRQ boost sel-M2) | Torque boost selection, 2nd motor | | ✗ | ✗ | 00 | ← | ← | |
| A042 (TRQ boost V%) | Manual torque boost value | Set the boost starting torque between 0 and 20 % above normal V/f curve. Range: 0.0 to 20.0 (%) (Ratio to A082/A282) | ✓ | ✓ | 1.0 | 3.0 | 1.0 | |
| A242 (TRQ boost V%-M2) | Manual torque boost value, 2nd motor | | ✓ | ✓ | 1.0 | 3.0 | 1.0 | |
| A043 (TRQ boost FQ%) | Manual torque boost frequency | Set the frequency of the V/f breakpoint for torque boost. Range: 0.0 to 50.0 (%) (Ratio to A003/A203) | ✓ | ✓ | 5.0 | ← | ← | |
| A243 (TRQ boost FQ%-M2) | Manual torque boost frequency, 2nd motor | | ✓ | ✓ | 5.0 | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A044 (V/F select) | V/f characteristic curve | Three available V/f curves.<br>00…VC<br>01…VP<br>02…Free-V/F | ✗ | ✗ | 00 | ← | ← | 7 - 25 |
| A244 (V/F select-M2) | V/f characteristic curve, 2nd motor | | ✗ | ✗ | 00 | ← | ← | |
| A045 (V/F gain) | V/f gain | Set the inverter output voltage gain.<br>Range: 20. to 100. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 39 |
| A245 (V/F gain-M2) | V/f gain, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |
| A046 (A.TQ-BST V gain) | Voltage compensation gain for automatic torque boost | Set voltage compensation gain under automatic torque boost.<br>Range: 0. to 255. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 27 |
| A246 (A.TQ-BST V gain-M2) | Voltage compensation gain for automatic torque boost, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |
| A047 (A.TQ-BST SL gain) | Slip compensation gain for automatic torque boost | Set slip compensation gain under automatic torque boost.<br>Range: 0. to 255. (%) | ✓ | ✓ | 100. | ← | ← | |
| A247 (A.TQ-BST SL gain-M2) | Slip compensation gain for automatic torque boost, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |
| A051 (DB enable) | DC braking enable | 00…OFF<br>01…ON<br>02…ON(FQ) | ✗ | ✓ | 00 | ← | ← | 7 - 46 |
| A052 (DB Frequency) | DC braking frequency | The frequency at which DC braking begins.<br>Range: 0.00 to 60.00 (Hz) | ✗ | ✓ | 0.50 | ← | ← | |
| A053 (DB wait time) | DC braking wait time | The delay from the end of controlled deceleration to start of DC braking (motor free runs until DC braking begins).<br>Range: 0.0 to 5.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| A054 (DB force) | DC braking force for deceleration | Level of DC braking force.<br>Range: 0. to 100. (%) | ✗ | ✓ | 50. | ← | ← | |
| A055 (DB decel time) | DC braking time for deceleration | Set the duration for DC braking.<br>Range: 0.0 to 10.0 seconds. | ✗ | ✓ | 0.5 | ← | ← | |
| A056 (DB input select) | DC braking / edge or level detection for [DB] input | 00…Edge<br>01…Level | ✗ | ✓ | 01 | ← | ← | |
| A057 (DB force start) | DC braking force at start | Level of DC braking force at start.<br>Range: 0. to 100. (%) | ✗ | ✓ | 0. | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A058 (DB time start) | DC braking time at start | Set the duration for DC braking at start. Range: 0.0 to 10.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | 7 - 46 |
| A059 (DB carrier FQ) | Carrier frequency during DC braking | Carrier frequency of DC braking performance. Range: 2.0 to 15.0 (kHz) | ✗ | ✓ | 2.0 | ← | ← | |
| A061 (FQ upper limit) | Frequency upper limit | Set the upper limit on output frequency. Range: frequency lower limit (A062) to maximum frequency (A004) (Hz). 0.00 setting disables frequency limit function. | ✗ | ✓ | 0.00 | ← | ← | 7 - 31 |
| A261 (FQ upper limit-M2) | Frequency upper limit, 2nd motor | Set the upper limit on output frequency for 2nd motor. Range: frequency lower limit, 2nd motor (A262) to maximum frequency, 2nd motor (A204) (Hz). 0.00 setting disables frequency limit function. | ✗ | ✓ | 0.00 | ← | ← | |
| A062 (FQ lower limit) | Frequency lower limit | Set the lower limit on output frequency. Range: start frequency (b082) to frequency upper limit (A061) (Hz). 0.00 setting disables frequency limit function. | ✗ | ✓ | 0.00 | ← | ← | |
| A262 (FQ lower limit-M2) | Frequency lower limit, 2nd motor | Set the lower limit on output frequency for 2nd motor. Range: start frequency (b082) to frequency upper limit, 2nd motor (A261) (Hz). 0.00 setting disables frequency limit function. | ✗ | ✓ | 0.00 | ← | ← | |
| A063 (Jump FQ1 Center) A065 (Jump FQ2 Center) A067 (Jump FQ3 Center) | Jump frequency (center) 1 to 3 | Up to 3 output frequencies can be defined for the output to jump passed to avoid motor resonances (center frequency). Range: 0.00 to 400.00 (Hz) | ✗ | ✓ | 0.00 0.00 0.00 | ← | ← | |
| A064 (Jump FQ1 Width) A066 (Jump FQ2 Width) A068 (Jump FQ3 Width) | Jump frequency width (hysteresis) 1 to 3 | Define the distance from the center frequency at which the jump occurs. Range: 0.00 to 10.00 (Hz) | ✗ | ✓ | 0.50 0.50 0.50 | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A069 (Accel hold FQ) | Acceleration hold frequency | Set the frequency to hold acceleration. Range: 0.00 to 400.00 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 32 |
| A070 (Accel hold time) | Acceleration hold time | Set the duration of acceleration hold. Range: 0.0 to 60.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| A071 (PID enable) | PID enable | 00…OFF<br>01…ON(+)<br>02…ON(+/-) | ✗ | ✓ | 00 | ← | ← | 7 - 40 |
| A072 (PID P gain) | PID proportional gain | PID proportional gain. Range: 0.00 to 25.00 | ✓ | ✓ | 1.00 | ← | ← | |
| A073 (PID I gain) | PID integral time constant | PID integral time constant. Range: 0.0 to 3600.0 seconds. | ✓ | ✓ | 1.0 | ← | ← | |
| A074 (PID D gain) | PID derivative time constant | PID derivative time constant. Range: 0.00 to 100.00 seconds. | ✓ | ✓ | 0.00 | ← | ← | |
| A075 (PV scale convert) | PV scale conversion | Process Variable (PV) scale factor (multiplier). Range: 0.01 to 99.99 | ✗ | ✓ | 1.00 | ← | ← | |
| A076 (PV source select) | PV source | Selects source of Process Variable (PV).<br>01…[O/OI]<br>02…Modbus<br>10…Math | ✗ | ✓ | 01 | ← | ← | |
| A077 (Reverse PID action) | Reverse PID action | 00…OFF<br>01…ON | ✗ | ✓ | 00 | ← | ← | |
| A078 (PID limit) | PID variation range | Set the range of PID data variation with reference to the target value. Range: 0.0 to 100.0 (%) | ✗ | ✓ | 0.0 | ← | ← | |
| A081 (AVR select) | AVR function selection | Automatic (output) voltage regulation, select from three type of AVR functions.<br>00…ON<br>01…OFF<br>02…Decel-OFF | ✗ | ✗ | 02 | 01 | 02 | 7 - 14 |
| A281 (AVR select-M2) | AVR function selection, 2nd motor | | ✗ | ✗ | 02 | 01 | 02 | |
| A082 (AVR voltage sel) | AVR voltage selection | 200 V class inverter settings: 200/215/220/230/240 (V)<br>400 V class inverter settings: 380/400/415/440/460/480 (V) | ✗ | ✗ | 200 / 400 | 220 / 380 | 230 / 400 | |
| A282 (AVR voltage sel-M2) | AVR voltage selection, 2nd motor | | ✗ | ✗ | 200 / 400 | 220 / 380 | 230 / 400 | |
| A083 (AVR filter time) | AVR filter time constant | Define the time constant of the AVR filter. Range: 0.000 to 1.000 seconds. | ✗ | ✓ | 0.030 | ← | ← | |
| A084 (OED voltage gain) | AVR deceleration gain | The gain adjustment of the braking performance. Range: 50. to 200. (%) | ✗ | ✓ | 100. | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A085 (Energy-saving mode) | Energy-saving operation mode | 00…Normal<br>01…Eco | ✗ | ✗ | 00 | ← | ← | 7 - 44 |
| A086 (Energy-saving tune) | Energy-saving mode tuning | Range: 0.0 to 100.0 (%) | ✓ | ✓ | 50.0 | ← | ← | |
| A092 (Accel.time2) | Acceleration time (2) | Duration of 2nd segment of acceleration.<br>Range: 0.00 to 3600.00 seconds. | ✓ | ✓ | 10.00 | ← | ← | 7 - 35 |
| A292 (Accel.time2-M2) | Acceleration time (2), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | 7 - 35 |
| A093 (Decel.time2) | Deceleration time (2) | Duration of 2nd segment of deceleration.<br>Range: 0.00 to 3600.00 seconds. | ✓ | ✓ | 10.00 | ← | ← | |
| A293 (Decel.time2-M2) | Deceleration time (2), 2nd motor | | ✓ | ✓ | 10.00 | ← | ← | |
| A094 (Acc2/Dec2 sel) | Selection method to switch to Acc2/Dec2 profile | Three options for switching from 1st to 2nd acceleration / deceleration.<br>00…2CH-Terminal<br>01…Preset FQ<br>02…FWD-REV | ✗ | ✗ | 00 | ← | ← | |
| A294 (Acc2/Dec2 sel-M2) | Selection method to switch to Acc2/Dec2 profile, 2nd motor | | ✗ | ✗ | 00 | ← | ← | |
| A095 (Acc1-2 FQ) | Acc1 to Acc2 frequency transition point | Output frequency at which Acc1 switches to Acc2.<br>Range: 0.00 to 400.00 (Hz) | ✗ | ✗ | 0.00 | ← | ← | |
| A295 (Acc1-2 FQ-M2) | Acc1 to Acc2 frequency transition point, 2nd motor | | ✗ | ✗ | 0.00 | ← | ← | |
| A096 (Dec1-2 FQ) | Dec2 to Dec1 frequency transition point | Output frequency at which Dec2 switches to Dec1.<br>Range: 0.00 to 400.00 (Hz) | ✗ | ✗ | 0.00 | ← | ← | |
| A296 (Dec1-2 FQ-M2) | Dec2 to Dec1 frequency transition point, 2nd motor | | ✗ | ✗ | 0.00 | ← | ← | |
| A097 (Accel.curve select) | Acceleration curve selection | Set the characteristic curve of Acc1 and Acc2.<br>00…Linear<br>01…S curve<br>02…U curve<br>03…inv.U curve | ✗ | ✗ | 00 | ← | ← | 7 - 36 |
| A098 (Decel.curve select) | Deceleration curve selection | Set the characteristic curve of Dec1 and Dec2. Options are same as above A097. | ✗ | ✗ | 00 | ← | ← | |
| A131 (Accel.curve const) | Acceleration curve constant | Range: 01 to 10 | ✗ | ✓ | 02 | ← | ← | |
| A132 (Decel.curve const) | Deceleration curve constant | Range: 01 to 10 | ✗ | ✓ | 02 | ← | ← | |

| "A" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| A141 (A-input calc.FQ) | A input selection for calculate function | 00…Operator<br>01…VR<br>02…[O/OI]<br>04…Modbus | ✕ | ✓ | 00 | ← | ← | 7 - 37 |
| A142 (B-input calc.FQ) | B input selection for calculate function | 00…Operator<br>01…VR<br>02…[O/OI]<br>04…Modbus | ✕ | ✓ | 02 | ← | ← | |
| A143 (Calculation symbol) | Calculation symbol | Set the operator between A input source (A141 selects) and B input source (A142 selects).<br>00…ADD<br>01…SUB<br>02…MUL | ✕ | ✓ | 00 | ← | ← | |
| A145 (Add frequency) | ADD frequency | An offset value that is applied to the output frequency when the [ADD] terminal is ON.<br>Range: 0.00 to 400.00 (Hz) | ✕ | ✓ | 0.00 | ← | ← | 7 - 38 |
| A146 (Add direction) | ADD direction selection | 00…ADD<br>01…SUB | ✕ | ✓ | 00 | ← | ← | |
| A154 (Decel hold FQ) | Deceleration hold frequency | Set the frequency to hold deceleration.<br>Range: 0.00 to 400.00 (Hz) | ✕ | ✓ | 0.00 | ← | ← | 7 - 32 |
| A155 (Decel hold time) | Deceleration hold time | Set the duration of deceleration hold.<br>Range: 0.0 to 60.0 seconds. | ✕ | ✓ | 0.0 | ← | ← | |
| A156 (PID sleep level) | PID sleep function action threshold | Set the starting threshold for the PID sleep function.<br>Range: 0.00 to 400.00 (Hz) | ✕ | ✓ | 0.00 | ← | ← | 7 - 40 |
| A157 (PID sleep delay) | PID sleep function action delay time | Set the delay time for the PID sleep function to start.<br>Range: 0.0 to 25.5 seconds. | ✕ | ✓ | 0.0 | ← | ← | |
| A158 (PID sleep Release) | PID sleep function return threshold | Set the ending threshold for the PID sleep function.<br>Range: 0.00 to 400.0 (Hz) | ✕ | ✓ | 0.00 | ← | ← | |
| A161 (VR start FQ) | [VR] input active range start frequency | The output frequency corresponding to the [VR] input range starting point.<br>Range: 0.00 to 400.00 (Hz) | ✕ | ✓ | 0.00 | ← | ← | 7 - 23 |
| A162 (VR end FQ) | [VR] input active range end frequency | The output frequency corresponding to the [VR] input range ending point.<br>Range: 0.00 to 400.00 (Hz) | ✕ | ✓ | 0.00 | ← | ← | |
| A163 (VR start %) | [VR] input active range start ratio | The starting point (offset) for the [VR] input range.<br>Range: 0. to A164 (%) | ✕ | ✓ | 0. | ← | ← | |
| A164 (VR end %) | [VR] input active range end ratio | The ending point (offset) for the [VR] input range.<br>Range: A163 to 100. (%) | ✕ | ✓ | 100. | ← | ← | |
| A165 (VR start FQ select) | [VR] input start frequency enable | 00…Start FQ<br>01…0Hz | ✕ | ✓ | 01 | ← | ← | |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b001 (Restart mode UV) | Restart mode on undervoltage trip | Select inverter restart method.<br>00…TRIP<br>01…0Hz Start<br>02…f-match<br>03…f-match-Trip | ✗ | ✓ | 00 | ← | ← | 7 - 55 |
| b002 (Allowable UV time) | Allowable undervoltage time | Set the amount of time a power input undervoltage can occur without trip.<br>Range: 0.3 to 25.0 seconds.<br>If undervoltage occurs longer than this time, the inverter trips even if the restart mode is selected. | ✗ | ✓ | 1.0 | ← | ← | |
| b003 (Retry wait time UV) | Retry wait time before motor restart | Set the delay time from undervoltage condition going away to the inverter restarting.<br>Range: 0.3 to 100.0 seconds. | ✗ | ✓ | 1.0 | ← | ← | |
| b004 (UV trip on stop) | Instantaneous undervoltage trip alarm enable | 00…OFF<br>01…ON<br>02…Decel-OFF | ✗ | ✓ | 00 | ← | ← | |
| b005 (No. of restart UV) | Number of restarts on undervoltage trip | 00…16 times<br>01…No limit | ✗ | ✓ | 00 | ← | ← | |
| b007 (Restart min.FQ) | Restart frequency threshold | Set the frequency the motor restarts from 0 Hz at free-running status.<br>Range: 0.00 to 400.00 (Hz) | ✗ | ✓ | 0.50 | ← | ← | |
| b008 (Restart mode OV/OC) | Restart mode on overvoltage / overcurrent trip | Select inverter restart method.<br>00…TRIP<br>01…0Hz Start<br>02…f-match<br>03…f-match-Trip | ✗ | ✓ | 00 | ← | ← | 7 - 57 |
| b010 (No. of restart OV/OC) | Number of retry on overvoltage / overcurrent trip | Range: 1 to 3 times | ✗ | ✓ | 3 | ← | ← | |
| b011 (Retry wait time OV/OC) | Retry wait time on overvoltage / overcurrent trip | Range: 0.3 to 100.0 seconds. | ✗ | ✓ | 1.0 | ← | ← | |
| b012 (E.Thermal Level) | Level of electronic thermal | Set a level of electronic thermal.<br>Range: (0.20 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 1.00 × inverter rated current | ← | ← | 7 - 67 |
| b212 (E.Thermal Level-M2) | Level of electronic thermal, 2nd motor | | ✗ | ✓ | 1.00 × inverter rated current | ← | ← | |
| b013 (E.Thermal Character) | Electronic thermal characteristic | 00…Reduced TRQ<br>01…Const TRQ<br>02…Free set | ✗ | ✓ | 01 | ← | ← | |
| b213 (E.Thermal Charact-M2) | Electronic thermal characteristic, 2nd motor | | ✗ | ✓ | 01 | ← | ← | |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b015 (Free E.Thermal FQ-1) | Free setting electronic thermal frequency 1 | Range: 0. to b017 (Hz) | ✗ | ✓ | 0. | ← | ← | 7 - 68 |
| b016 (Free E.Thermal I-1) | Free setting electronic thermal current 1 | Range: (0.00 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 0.00 | ← | ← | |
| b017 (Free E.Thermal FQ-2) | Free setting electronic thermal frequency 2 | Range: b015 to b019 (Hz) | ✗ | ✓ | 0. | ← | ← | |
| b018 (Free E.Thermal I-2) | Free setting electronic thermal current 2 | Range: (0.00 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 0.00 | ← | ← | |
| b019 (Free E.Thermal FQ-3) | Free setting electronic thermal frequency 3 | Range: b017 to 400. (Hz) | ✗ | ✓ | 0. | ← | ← | |
| b020 (Free E.Thermal I-3) | Free setting electronic thermal current 3 | Range: (0.00 to 1.00) × inverter rated current Amps. | ✗ | ✓ | 0.00 | ← | ← | |
| b021 (OL restrict mode) | Overload restriction operation mode | Select the restriction operation mode during overload conditions.<br>00…OFF<br>01…ON-Acc/Cnst<br>02…ON-Cnst | ✗ | ✓ | 01 | ← | ← | 7 - 69 |
| b221 (OL restrict mode-M2) | Overload restriction operation mode, 2nd motor | | ✗ | ✓ | 01 | ← | ← | |
| b022 (OL restrict level) | Overload restriction level | Set the level of overload restriction.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✗ | ✓ | 1.50 × inverter rated current | ← | ← | |
| b222 (OL restrict level-M2) | Overload restriction level, 2nd motor | | ✗ | ✓ | 1.50 × inverter rated current | ← | ← | |
| b023 (Decel.rate OL restrict) | Deceleration rate at overload restriction | Set the deceleration rate when inverter detects over b022 / b222.<br>Range: 0.1 to 3000.0 seconds. | ✗ | ✓ | 1.0 | ← | ← | |
| b223 (Decel.rate OL rstr-M2) | Deceleration rate at overload restriction, 2nd motor | | ✗ | ✓ | 1.0 | ← | ← | |
| b024 (OL restrict 2 mode) | Overload restriction operation mode 2 | Select the restriction operation mode during overload conditions.<br>00…OFF<br>01…ON-Acc/Cnst<br>02…ON-Cnst | ✗ | ✓ | 01 | ← | ← | |
| b025 (OL restrict 2 level) | Overload restriction level 2 | Set the level of overload restriction.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✗ | ✓ | 1.50 × inverter rated current | ← | ← | |
| b026 (Decel.rate OL 2 rstr) | Deceleration rate 2 at overload restriction | Set the deceleration rate when inverter detects over b025.<br>Range: 0.1 to 3000.0 seconds. | ✗ | ✓ | 1.0 | ← | ← | |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b027 (OC suppress select) | OC suppression selection | 00…OFF<br>01…ON | ✗ | ✓ | 01 | ← | ← | 7 - 70 |
| b028 (Curnt Active F-match) | Current level of active frequency matching | Set the current level of active frequency matching restart.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✗ | ✓ | 1.00 × inverter rated current | ← | ← | 7 - 55 |
| b029 (Decel.rate act.F-match) | Deceleration rate of active frequency matching | Set the deceleration rate when active frequency matching restart.<br>Range: 0.1 to 3000.0 seconds. | ✗ | ✓ | 0.5 | ← | ← | |
| b030 (Start FQ act.F-match) | Start frequency of active frequency matching | 00…Off FQ<br>01…Max.FQ<br>02…Set FQ | ✗ | ✓ | 00 | ← | ← | |
| b031 (Softlock select) | Software lock mode selection | Prevents parameter changes.<br>00…Lock(SFT)<br>01…Only FQ(SFT)<br>02…Lock<br>03…Only FQ<br>10…RUN chg mode<br>See the "Run Mode Edit - B" column in the table in this chapter for the accessible parameters in this high level access mode. | ✗ | ✓ | 01 | 10 | 01 | 7 - 50 |
| b034 (RNT/ONT time) | Run/power ON warning time | Range:<br>0. (Warning disabled),<br>1. to 65535. ( × 10 hrs) | ✗ | ✓ | 0. | ← | ← | 7 - 76 |
| b035 (Rotation restrction) | Rotation direction restriction | 00…Free<br>01…FWD<br>02…REV | ✗ | ✗ | 00 | ← | ← | 7 - 12 |
| b036 (Reduced V start) | Reduced voltage start selection | Range:<br>0 (the function disabled),<br>1 (approx. 4 ms) to 250 (approx. 1 sec) | ✗ | ✓ | 3 | ← | ← | 7 - 29 |
| b037 (Display restriction) | Function code display restriction | 00…All<br>01…Utilized<br>03…Compare<br>04…Basic<br>05…Monitor | ✗ | ✓ | 00 | ← | ← | 7 - 53 |
| b038 (Initial display) | Initial display selection | 000…Func. code that SET key pressed last displayed<br>001 to 060…d001 to d060 displayed<br>201…F001 displayed<br>202…B display of WOP | ✗ | ✓ | 001 | ← | ← | 7 - 52 |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b050 (Ctrld decel.select) | Controlled deceleration on power loss selection | 00…OFF<br>01…ON<br>02…V-Cnst(STOP)<br>03…V-Cnst(RUN) | ✗ | ✗ | 00 | ← | ← | 7 - 64 |
| b051 (DC Volt ctrld.decel) | DC bus voltage trigger level of controlled deceleration | Set the DC bus voltage that starts controlled deceleration operation.<br>Range: 0.0 to 400.0 / 800.0 (VDC) | ✗ | ✗ | 220.0/ 440.0 | ← | ← | |
| b052 (OV lvl ctrld.decel) | Overvoltage threshold of controlled deceleration | Set the OV-LAD stop level of controlled deceleration operation.<br>Range: 0.0 to 400.0 / 800.0 (VDC) | ✗ | ✗ | 360.0/ 720.0 | ← | ← | 7 - 64 |
| b053 (Decel time ctrld.dec) | Deceleration time of controlled deceleration | Range: 0.01 to 300.00 seconds. | ✗ | ✗ | 1.00 | ← | ← | |
| b054 (FQ drop ctrld.decel) | Initial frequency drop of controlled deceleration | Set the initial frequency drop of controlled deceleration.<br>Range: 0.00 to 10.00 (Hz) | ✗ | ✗ | 0.00 | ← | ← | |
| b060 (Windw comp [O/OI] max) | Maximum-limit level of window comparator (O/OI) | Range: {b061+(b062 × 2)} to 100. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 81 |
| b061 (Windw comp [O/OI] min) | Minimum-limit level of window comparator (O/OI) | Range: 0. to {b060 - (b062 × 2)} (%) | ✓ | ✓ | 0. | ← | ← | |
| b062 (Windw comp [O/OI] hys) | Hysteresis width of window comparator (O/OI) | Range: 0. to {(b060 - b061) / 2} (%)<br>(Maximum of 10 %) | ✓ | ✓ | 0. | ← | ← | |
| b070 (Discon Level) | Operation level at O/OI disconnection | Range: 0 to 100 (%), or "no" (ignore) | ✗ | ✓ | no | ← | ← | |
| b078 (Clear kWh data) | Cumulative power clearance | 00…OFF<br>01…CLR | ✓ | ✓ | 00 | ← | ← | 7 - 6 |
| b079 (kWh display gain) | Cumulative power display gain | Range: 1. to 1000. | ✓ | ✓ | 1. | ← | ← | |
| b082 (Start Frequency) | Start frequency | Set the starting frequency for the inverter output.<br>Range: 0.01 to 9.99 (Hz) | ✗ | ✓ | 0.50 | ← | ← | 7 - 29 |
| b083 (Carrier Frequency) | Carrier frequency | Set the PWM carrier frequency (internal switching frequency).<br>Range: 2.0 to 15.0 (kHz)<br>(The settings may require a derating of the output current. See section 12.3.) | ✗ | ✓ | 2.0 *4) | ← | ← | 7 - 16 |

*4) The initial data for PM mode will be different.

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b084 (Initialize Mode) | Initialization mode (parameters or trip history) | Select initialized data.<br>00…no<br>01…Trip data<br>02…Parameters<br>03…Trip+Param | ✗ | ✗ | 00 | ← | ← | 7 - 83 |
| b085 (Initial data select) | Initial data selection | Select default parameter values on initialization.<br>00…Mode0<br>01…Mode1<br>03…Mode3 | ✗ | ✗ | 00 | 03 | 01 | |
| b086 (FQ scale factor) | Frequency scaling conversion factor | Specify a constant to scale the displayed frequency for d007 monitor.<br>Range: 0.01 to 99.99 | ✓ | ✓ | 1.00 | ← | ← | 7 - 5 |
| b087 (STOP key enable) | STOP/RESET key enable | Select whether the STOP/RESET key is enabled.<br>00…ON<br>01…OFF<br>02…Only RESET | ✗ | ✓ | 00 | ← | ← | 7 - 50 |
| b088 (Restart after FRS) | Restart mode after FRS | Selects how the inverter resumes operation when free-run stop (FRS) is cancelled.<br>00…0Hz Start<br>01…Actv.f-match | ✗ | ✓ | 00 | ← | ← | 7 - 62 |
| b089 (Auto.Carrier reduce) | Automatic carrier frequency reduction | 00…OFF<br>01…ON(current)<br>02…ON(heatsink) | ✗ | ✗ | 00 | ← | ← | 7 - 73 |
| b091 (Stop mode select) | Stop mode selection | 00…Decel-Stop<br>01…Free RUN | ✗ | ✓ | 00 | ← | ← | 7 - 13 |
| b094 (Initial target data) | Initialization target data setting | 00…All<br>01…Exp.COM,TERM | ✗ | ✗ | 00 | ← | ← | 7 - 83 |
| b100 (Free V/F -F1) | Free V/f setting, frequency 1 | Range: 0. to b102 (Hz) | ✗ | ✗ | 0. | ← | ← | 7 - 26 |
| b101 (Free V/F -V1) | Free V/f setting, voltage 1 | Range: 0.0 to 300.0 / 600.0 (V) | ✗ | ✗ | 0.0 | ← | ← | |
| b102 (Free V/F -F2) | Free V/f setting, frequency 2 | Range: b100 to b104 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b103 (Free V/F -V2) | Free V/f setting, voltage 2 | Range: 0.0 to 300.0 / 600.0 (V) | ✗ | ✗ | 0.0 | ← | ← | |
| b104 (Free V/F -F3) | Free V/f setting, frequency 3 | Range: b102 to b106 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b105 (Free V/F -V3) | Free V/f setting, voltage 3 | Range: 0.0 to 300.0 / 600.0 (V) | ✗ | ✗ | 0.0 | ← | ← | |
| b106 (Free V/F -F4) | Free V/f setting, frequency 4 | Range: b104 to b108 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b107 (Free V/F -V4) | Free V/f setting, voltage 4 | Range: 0.0 to 300.0 / 600.0 (V) | ✗ | ✗ | 0.0 | ← | ← | |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b108 (Free V/F -F5) | Free V/f setting, frequency 5 | Range: b106 to b110 (Hz) | ✗ | ✗ | 0. | ← | ← | 7 - 26 |
| b109 (Free V/F -V5) | Free V/f setting, voltage 5 | Range: 0.0 to 300.0 / 600.0 (V) | ✗ | ✗ | 0.0 | ← | ← | |
| b110 (Free V/F -F6) | Free V/f setting, frequency 6 | Range: b108 to b112 (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b111 (Free V/F -V6) | Free V/f setting, voltage 6 | Range: 0.0 to 300.0 / 600.0 (V) | ✗ | ✗ | 0.0 | ← | ← | |
| b112 (Free V/F -F7) | Free V/f setting, frequency 7 | Range: b110 to 400. (Hz) | ✗ | ✗ | 0. | ← | ← | |
| b113 (Free V/F -V7) | Free V/f setting, voltage 7 | Range: 0.0 to 300.0 / 600.0 (V) | ✗ | ✗ | 0.0 | ← | ← | |
| b130 (Over-V supp.select) | Deceleration overvoltage suppression enable | 00…OFF<br>01…V-const<br>02…Accel<br>03…Acc/Cnst | ✗ | ✓ | 00 | ← | ← | 7 - 71 |
| b131 (Over-V supp.level) | Deceleration overvoltage suppression level | DC bus voltage of suppression starting.<br>Range: 330. to 390. / 660. to 780. (VDC) | ✗ | ✓ | 360. / 720. | ← | ← | |
| b132 (Over-V supp.const) | Deceleration overvoltage suppression const. | Acceleration rate when b130=02,03.<br>Range: 0.10 to 30.00 seconds. | ✗ | ✓ | 1.00 | ← | ← | |
| b133 (Over-V supp.P-gain) | Deceleration overvoltage suppression proportional gain | Proportional gain when b130=01.<br>Range: 0.00 to 5.00 | ✓ | ✓ | 0.20 | ← | ← | |
| b134 (Over-V supp.I-gain) | Deceleration overvoltage suppression integral time | Integral time when b130=01.<br>Range: 0.0 to 150.0 seconds. | ✓ | ✓ | 1.0 | ← | ← | |
| b150 (Disp.ex.ope connected) | Display external operator connected | When an external operator is connected via RS-422 port, the NES1-OP is locked and shows only one "d" parameter.<br>Range: 001 to 060 | ✓ | ✓ | 001 | ← | ← | 7 - 52 |
| b160 (1st data of d050) | 1st parameter of Dual Monitor | Set any two "d" parameters in b160 and b161, then they can be monitored in d050.<br>The two parameters are switched by up/down keys.<br>Range: 001 to 018 | ✓ | ✓ | 001 | ← | ← | 7 - 7 |
| b161 (2nd data of d050) | 2nd parameter of Dual Monitor | | ✓ | ✓ | 002 | ← | ← | |
| b163 (FQ set in monitor) | Frequency set in monitoring | 00…OFF<br>01…ON | ✓ | ✓ | 01 | ← | ← | 7 - 3 |

| "b" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| b164 (Auto return init.disp) | Automatic return to the initial display | After 10 minutes from the last key operation, display returns to the initial parameter set by b038.<br>00…OFF<br>01…ON | ✓ | ✓ | 00 | ← | ← | 7 - 52 |
| b165 (Ex.ope comm loss act) | Operation at external operator connection loss | 00…Trip<br>01…Decel-Trip<br>02…Ignore<br>03…Free RUN<br>04…Decel-Stop | ✓ | ✓ | 02 | ← | ← | 7 - 51 |
| b166 (Data R/W select) | Data Read/Write selection | 00…R/W OK<br>01…R/W protected | ✗ | ✓ | 00 | ← | ← | 7 - 52 |
| b171 (Inverter mode select) *5) | Inverter mode selection | 00…No<br>01…Std.IM<br>03…PM | ✗ | ✗ | 00 | ← | ← | 7 - 86 |
| b180 (Initialize trigger) | Initialization trigger | Select to perform initialization or not.<br>00…No action<br>01…Initialize | ✗ | ✗ | 00 | ← | ← | 7 - 83 |

*5) It is displayed in NE-S1 Ver. 2.0 or later.

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C001 (Input [1] Function) | Intelligent input [1] function | Select input terminal [1] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 00 [FW] | ← | ← | 7 - 17 |
| C002 (Input [2] Function) | Intelligent input [2] function | Select input terminal [2] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 01 [RV] | ← | ← | |
| C003 (Input [3] Function) | Intelligent input [3] function | Select input terminal [3] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 02 [CF1] | ← | ← | |
| C004 (Input [4] Function) | Intelligent input [4] function | Select input terminal [4] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 03 [CF2] | ← | ← | |
| C005 (Input [5] Function) | Intelligent input [5] function | Select input terminal [5] function from 34 options (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 18 [RS] | ← | ← | |
| C011 (Input [1] actv. state) | Intelligent input [1] active state | Select logic conversion. 00…Norm.Open 01…Norm.Closed | ✗ | ✓ | 00 | ← | ← | |
| C012 (Input [2] actv. state) | Intelligent input [2] active state | | ✗ | ✓ | 00 | ← | ← | |
| C013 (Input [3] actv. state) | Intelligent input [3] active state | | ✗ | ✓ | 00 | ← | ← | |
| C014 (Input [4] actv. state) | Intelligent input [4] active state | | ✗ | ✓ | 00 | ← | ← | |
| C015 (Input [5] actv. state) | Intelligent input [5] active state | | ✗ | ✓ | 00 | ← | ← | |
| C021 (Output [11] function) | Intelligent Output [11] function | Select output terminal [11] function from 27 programmable functions (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 01 [FA1] | ← | ← | 7 - 18 |
| C026 (Alarm relay Function) | Intelligent relay function | Select intelligent relay terminal function from 27 programmable functions (see "13.1.6 Input/Output function summary table"). | ✗ | ✓ | 05 [AL] | ← | ← | |

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C027 ([FM] Function) | [FM] terminal selection (Pulse/PWM output) | 00…Output FQ<br>01…Output I<br>03…Pulse FQ<br>04…Output V<br>05…Power<br>06…Thermal<br>07…LAD-FQ<br>08…Pulse I<br>10…Heatsink tmp | ✗ | ✓ | 07 | ← | ← | 7 - 24 |
| C030 (Digital I Ref.) | Digital current monitor reference value | Set the current value output pulse frequency is 1440 Hz when C027=08.<br>Range: (0.20 to 2.00) × inverter rated current Amps. | ✓ | ✓ | 1.00 × inverter rated current | ← | ← | |
| C031 (Output [11] actv.state) | Intelligent output [11] active state | Select logic conversion.<br>00…Norm.Open<br>01…Norm.Closed | ✗ | ✓ | 00 | ← | ← | 7 - 19 |
| C036 (Alarm RLY active state) | Intelligent relay active state | | ✗ | ✓ | 01 | ← | ← | |
| C038 (LOC out mode select) | Output mode of low current detection | 00…ACC/DEC/CST<br>01…Const | ✗ | ✓ | 01 | ← | ← | 7 - 79 |
| C039 (LOC out level) | Low current detection level | Set the level of low current detection.<br>Range: (0.00 to 2.00) × inverter rated current Amps. | ✓ | ✓ | 1.00 × inverter rated current | ← | ← | |
| C040 (Overload warn mode) | Output mode of overload warning | 00…ACC/DEC/CST<br>01…Const | ✗ | ✓ | 01 | ← | ← | 7 - 70 |
| C041 (Overload warn level) | Overload warning level | Sets the overload warning signal level.<br>Range: (0.00 to 2.00) × inverter rated current Amps. | ✓ | ✓ | 1.15 × inverter rated current | ← | ← | |
| C241 (Overload warn level-M2) | Overload warning level, 2nd motor | | ✓ | ✓ | 1.15 × inverter rated current | ← | ← | |
| C042 (FQ arrive accel.1) | Frequency arrival setting for acceleration | Set the frequency arrival setting threshold for the output frequency during acceleration.<br>Range: 0.00 to 400.00 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 74 |
| C043 (FQ arrive decel.1) | Frequency arrival setting for deceleration | Set the frequency arrival setting threshold for the output frequency during deceleration.<br>Range: 0.00 to 400.00 (Hz) | ✗ | ✓ | 0.00 | ← | ← | |

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C044 (PID deviation) | PID deviation level | Set the allowable PID deviation (absolute value). Range: 0.0 to 100.0 (%) | ✗ | ✓ | 3.0 | ← | ← | 7 - 40 |
| C052 (PID FBV high limit) | PV comparison signal output high limit | When the PV exceeds this value, the [FBV] function signal turns OFF. Range: 0.0 to 100.0 (%) | ✗ | ✓ | 100.0 | ← | ← | |
| C053 (PID FBV low limit) | PV comparison signal output low limit | When the PV goes below this value, the [FBV] function signal turns ON. Range: 0.0 to 100.0 (%) | ✗ | ✓ | 0.0 | ← | ← | 7 - 40 |
| C061 (E.Thermal warning) | Electronic thermal warning level | Range: 0. to 100. (%) (Setting "0." means disabled.) | ✗ | ✓ | 90. | ← | ← | 7 - 68 |
| C063 (0Hz detection level) | Zero speed detection level | Range: 0.00 to 100.00 (Hz) | ✗ | ✓ | 0.00 | ← | ← | 7 - 76 |
| C064 (Heatsink warning) | Heatsink overheat warning | Range: 0. to 110. (°C) | ✗ | ✓ | 100. | ← | ← | 7 - 78 |
| C070 (Comm.Select) | Selection of OPE/Modbus | 00…OPE<br>01…Modbus | ✗ | ✗ | 00 | ← | ← | 8 - 6 |
| C071 (Comm.baud rate) | Communication speed | 04…4800bps<br>05…9600bps<br>06…19.2kbps<br>07…38.4kbps | ✗ | ✓ | 05 | ← | ← | |
| C072 (Modbus address) | Modbus address | Set the address of the inverter on the Modbus network. Range: 1. to 247. | ✗ | ✓ | 1. | ← | ← | |
| C074 (Parity) | Communication parity | 00…No<br>01…Even<br>02…Odd | ✗ | ✓ | 00 | ← | ← | |
| C075 (Stop bit) | Communication stop bit | 01…1-bit<br>02…2-bit | ✗ | ✓ | 01 | ← | ← | |
| C076 (Comm.error mode) | Communication error selection | Select inverter response to communication error.<br>00…Trip<br>01…Decel-Trip<br>02…Ignore<br>03…Free RUN<br>04…Decel-Stop | ✗ | ✓ | 02 | ← | ← | |
| C077 (Comm.timeout) | Communication error detection time | Set the communications watchdog timer period. Range: 0.00 to 99.99 seconds. (Setting "0.00" means disabled.) | ✗ | ✓ | 0.00 | ← | ← | |
| C078 (Comm.wait time) | Communication wait time | Set the inverter wait time from receiving a message to transmitting a message. Range: 0. to 1000. milliseconds. | ✗ | ✓ | 0. | ← | ← | |

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C081 ([O/OI] input adj.) | O/OI input gain calibration | Set the scale factor between the external frequency command on terminals L–O/OI, and the output frequency. Range: 0.0 to 200.0 (%) | ✓ | ✓ | 100.0 | ← | ← | 7 - 22 |
| C091 ( - ) | (The parameter for factory use) | **(Do not change)** | ✓ | ✓ | 00 | ← | ← | - |
| C101 (UP/DWN memory mode) | Up/Down memory mode selection | Select keep the last frequency command adjusted by UP/DWN key or not. 00…Not save 01…Save | ✗ | ✓ | 00 | ← | ← | 7 - 38 |
| C102 (Reset mode select) | Reset selection | Select response method when [RS] terminal turns ON/OFF. 00…ON-RESET 01…OFF-RESET 02…ON in Trip | ✓ | ✓ | 00 | ← | ← | 7 - 60 |
| C103 (Restart after reset) | Restart mode after reset | Select the restart mode after resetting. 00…0Hz Start 01…Actv.f-match | ✗ | ✓ | 00 | ← | ← | |
| C104 (UP/DWN clear mode) | UP/DWN clear mode | Select the frequency set value when [UDC] terminal turns to ON. 00…0Hz 01…Pow-ON data | ✗ | ✓ | 00 | ← | ← | 7 - 38 |
| C105 (FM gain adjust) | FM gain adjustment | Range: 50. to 200. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 24 |
| C130 (Output [11] ON delay) | Intelligent output [11] on delay | Range: 0.0 to 100.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | 7 - 20 |
| C131 (Output [11] OFF delay) | Intelligent output [11] off delay | | ✗ | ✓ | 0.0 | ← | ← | |
| C140 (Alarm-RLY ON delay) | Intelligent relay output on delay | Range: 0.0 to 100.0 seconds. | ✗ | ✓ | 0.0 | ← | ← | |
| C141 (Alarm-RLY OFF delay) | Intelligent relay output off delay | | ✗ | ✓ | 0.0 | ← | ← | |
| C142 (Log.out 1 operand A) | Logic output operand A | Select from all the programmable functions available for logic outputs except LOG, NO. | ✗ | ✓ | 00 | ← | ← | 7 - 77 |
| C143 (Log.out 1 operand B) | Logic output operand B | | ✗ | ✓ | 00 | ← | ← | |
| C144 (Log.out 1 operator) | Logic output operator | Select a logic operator to calculate [LOG] output state. 00…AND 01…OR 02…XOR | ✗ | ✓ | 00 | ← | ← | |

| "C" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| C151 (Button sens.) | Button sensitivity selection | Range: 0. to 250. (×2 ms) / no | ✗ | ✓ | 10. | ← | ← | 7 - 54 |
| C152 (Scroll sens.) | Scroll sensitivity selection | Range: 1. to 20. | ✗ | ✓ | 10. | ← | ← | |
| C155 (Ground fault set) | Ground fault detection | 00…OFF<br>01…ON | ✗ | ✓ | 01 | ← | ← | 7 - 82 |
| C157 (Out phase-loss set) | Output phase loss detection | 00…OFF<br>01…ON | ✗ | ✓ | 00 | ← | ← | 7 - 82 |
| C160 (Input [1] resp.time) | Intelligent input [1] response time | Set response time of each input terminal.<br>Range: 0. to 200. (×2 ms) | ✗ | ✓ | 1. | ← | ← | 7 - 18 |
| C161 (Input [2] resp.time) | Intelligent input [2] response time | | ✗ | ✓ | 1. | ← | ← | |
| C162 (Input [3] resp.time) | Intelligent input [3] response time | | ✗ | ✓ | 1. | ← | ← | |
| C163 (Input [4] resp.time) | Intelligent input [4] response time | | ✗ | ✓ | 1. | ← | ← | |
| C164 (Input [5] resp.time) | Intelligent input [5] response time | | ✗ | ✓ | 1. | ← | ← | |
| C169 (Multi-spd determ.time) | Multi-speed determination time | Range: 0. to 200. (×10 ms) | ✗ | ✓ | 0. | ← | ← | 7 - 33 |

| "H" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| H001 *6) (Auto-tuning select) | Auto-tuning selection | 00…OFF<br>01…ON<br>02…ON(Rotation) | ✕ | ✕ | 00 | ← | ← | 7 - 88 |
| H003 (Motor capacity) | Motor capacity | 0.10 / 0.20 / 0.40 / 0.55 / 0.75 / 1.10 / 1.50 / 2.20 / 3.00 / 3.70 / 4.00 / 5.50 (kW) | ✕ | ✕ | *7) | ← | ← | 7 - 49 |
| H203 (Motor capacity-M2) | Motor capacity, 2nd motor | | ✕ | ✕ | | ← | ← | |
| H004 (Motor poles) | Motor poles setting | 2 / 4 / 6 / 8 (poles) | ✕ | ✕ | 4 | ← | ← | |
| H204 (Motor poles-M2) | Motor poles setting, 2nd motor | | ✕ | ✕ | 4 | ← | ← | |
| H006 (M.stabil.const) | Motor stabilization constant | Range: 0. to 255. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 44 |
| H206 (M.stabil. const-M2) | Motor stabilization constant, 2nd motor | | ✓ | ✓ | 100. | ← | ← | |
| H101 *6) (PM voltage) | PM motor rated voltage | Range: 100.0 to 240.0 (V) (200 V class inverter settings)<br>200.0 to 480.0 (V) (400 V class inverter settings) | ✕ | ✕ | 200.0 / 400.0 | ← | ← | 7 - 87 |
| H102 *6) (PM motor code select) | PM motor code setting | 00…Normal<br>01…Auto-Tuning | ✕ | ✕ | 00 | ← | ← | |
| H103 *6) (PM motor capacity) | PM motor capacity | 0.10 / 0.20 / 0.40 / 0.55 / 0.75 / 1.10 / 1.50 / 2.20 / 3.00 / 3.70 / 4.00 / 5.50 / 7.50 (kW) | ✕ | ✕ | *7) | ← | ← | |
| H104 *6) (PM motor poles) | PM motor pole setting | 2 / 4 / 6 / 8 / 10 / 12 / 14 / 16 / 18 / 20 / 22 / 24 / 26 / 28 / 30 / 32 / 34 / 36 / 38 / 40 / 42 / 44 / 46 / 48 (poles) | ✕ | ✕ | 01 (4P) | ← | ← | |
| H105 *6) (PM rated current) | PM rated current | Range: (0.20 to 1.00) × inverter rated current Amps. | ✕ | ✕ | *7) | ← | ← | |
| H106 *6) (PM const R) | PM const R (Resistance) | Range: 0.001 to 65.535 (Ω) | ✕ | ✕ | *7) | ← | ← | |
| H107 *6) (PM const Ld) | PM const Ld (d-axis inductance) | Range: 0.01 to 655.35 (mH) | ✕ | ✕ | *7) | ← | ← | |
| H108 *6) (PM const Lq) | PM const Lq (q-axis inductance) | Range: 0.01 to 655.35 (mH) | ✕ | ✕ | *7) | ← | ← | |
| H109 *6) (PM const Ke) | PM const Ke (Induction voltage constant) | Range: 0.1 to 6553.5 (mV/(rad/s)) | ✕ | ✕ | *7) | ← | ← | |
| H110 *6) (PM const J) | PM const J (Moment of inertia) | Range: 0.001 to 9999.000 ($kgm^2$) | ✕ | ✕ | *7) | ← | ← | |

*6) It is displayed in PM mode.
*7) Specified by the capacity of each inverter model

| "H" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| H111 *6) (PM const R –Auto) | PM const R (Resistance, Auto) | Range: 0.001 to 65.535 (Ω) | ✗ | ✗ | *7) | ← | ← | 7 - 87 |
| H112 *6) (PM const Ld –Auto) | PM const Ld (d-axis inductance, Auto) | Range: 0.01 to 655.35 (mH) | ✗ | ✗ | *7) | ← | ← | |
| H113 *6) (PM const Lq –Auto) | PM const Lq (q-axis inductance, Auto) | Range: 0.01 to 655.35 (mH) | ✗ | ✗ | *7) | ← | ← | |
| H114 *6) (PM const Ke –Auto) | PM const Ke (Induction voltage constant, Auto) | Range: 0.1 to 6553.5 (mV/(rad/s)) | ✗ | ✗ | *7) | ← | ← | |
| H116 *6) (PM speed response) | PM speed response | Range: 1. to 1000. (%) | ✓ | ✓ | 100. | ← | ← | 7 - 92 |
| H117 *6) (PM starting current) | PM starting current | Range: 20. to 100. (%) | ✗ | ✗ | 70. | ← | ← | |
| H118 *6) (PM starting time) | PM starting time | Range: 0.01 to 60.00 seconds | ✗ | ✗ | 1.00 | ← | ← | |
| H119 *6) (PM stabil.const) | PM stabilization constant | Range: 0. to 120. (%) | ✓ | ✓ | 100. | ← | ← | |
| H121 *6) (PM min. freq. Ratio) | PM minimum frequency ratio | Range: 0. to 50. (%) | ✓ | ✓ | 8. | ← | ← | |
| H122 *6) (PM No-Load current) | PM no-load current | Range: 0. to 100. (%) | ✓ | ✓ | 10. | ← | ← | |
| H123 *6) (PM starting method) | PM starting method selection | 00…Normal<br>01…Search | ✗ | ✗ | 00 | ← | ← | |
| H133 *6) (PM Pos. time) | PM initial magnet position estimation detect time | Range: 0.03 to 2.50 seconds | ✗ | ✗ | 0.05 | ← | ← | |
| H134 *6) (PM Pos. voltage gain) | PM initial magnet position estimation voltage gain | Range: 0 to 120 (%) | ✗ | ✗ | 100 | ← | ← | |
| H135 *6) (PM Step-out Set) | PM step-out protection selection | 00…Off<br>01…TRIP<br>02…0Hz Start | ✓ | ✓ | 00 | ← | ← | |
| H136 *6) (PM Step-out Level) | PM step-out protection level | Range: 1 to 100 (%) | ✓ | ✓ | 50 | ← | ← | |

*6) It is displayed in PM mode.
*7) Specified by the capacity of each inverter model

| "H" Function | | | Run Mode Edit | | Defaults | | | |
|---|---|---|---|---|---|---|---|---|
| Func. Code (WOP) | Name | Description | A | B | Initial data standard 200/400 | Initial data CHN 200/400 | Initial data EU 200/400 | Page |
| H141 *6) (OC Level Set) | PM overcurrent detection level | Range: (1.00 to 2.50) × inverter rated current Amps. | ✗ | ✓ | 2.35 × inverter rated current | ← | ← | 7 - 92 |
| H142 *6) (Start OC Level Set) | PM starting overcurrent detection level | Range: (1.00 to 2.50) × inverter rated current Amps. | ✗ | ✓ | 1.80 × inverter rated current | ← | ← | |

*6) It is displayed in PM mode.

### 13.1.6 Input/Output function summary table

**Input Function Summary Table** – This table shows all intelligent input functions at a glance. Detailed description of these functions, related parameters and settings are in “7.3.1 Intelligent input terminal setting”.

| 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 | Multi-speed selection, Bit 1 | ON | Binary encoded speed select, Bit 1, logical 1 |
| | | | OFF | Binary encoded speed select, Bit 1, logical 0 |
| 03 | CF2 | Multi-speed selection, Bit 2 | ON | Binary encoded speed select, Bit 2, logical 1 |
| | | | OFF | Binary encoded speed select, Bit 2, logical 0 |
| 04 | CF3 | Multi-speed selection, Bit 3 | ON | Binary encoded speed select, Bit 3, logical 1 |
| | | | OFF | Binary encoded speed select, Bit 3, logical 0 |
| 06 | JG | Jogging | ON | Inverter is in Run Mode, output to motor runs at jog frequency (A038). |
| | | | OFF | Inverter is in Stop Mode. |
| 07 | DB | External DC braking | ON | External DC braking will be applied. |
| | | | OFF | External 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 | Two-stage Acceleration and Deceleration | ON | Frequency output uses two-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 to stop. |
| | | | OFF | Output operates normally, so controlled deceleration stop motor. |
| 12 | EXT | External Trip | ON | When assigned input transitions OFF to ON, inverter latches trip event and displays “E12”. |
| | | | 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 standard panel and remote operators are prevented from changing parameters. |
| | | | OFF | The parameters may be edited and stored. |
| 18 | RS | Reset Inverter | ON | The trip condition is reset, the inverter 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 | FW, RV (3-wire interface) | ON | Selects the direction of motor rotation: ON = Reverse. 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 = Forward. While the motor is rotating, a change of "F/R" will start a deceleration, followed by a change in direction. |

| Input Function Summary Table | | | | |
|---|---|---|---|---|
| **Option Code** | **Terminal Symbol** | **Function Name** | **Description** | |
| 23 | PID | PID Disable | ON | Temporarily disables PID loop control. |
| | | | OFF | Has no effect on PID loop operation. |
| 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 | ON | Accelerates (increases output frequency) motor from current frequency. |
| | | | OFF | Output to motor operates normally. |
| 28 | DWN | Remote Control Down Function | 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 frequency command parameter F001. Setting "C101" must be set “00” to enable this function to work. |
| | | | OFF | UP/DWN frequency memory is not changed. |
| 31 | OPE | Operator Control | ON | Forces to change the source of the frequency source (A001) and the run command source (A002) to operate both as "02" setting internally. |
| | | | OFF | The Frequency source set by "A001" and the run command source set by "A002" is used. |
| 32 | SF1 | Multi-speed selection, 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 selection, 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 selection, 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 | Overload restriction function uses second settings (b024 to b026). |
| | | | OFF | Overload restriction function uses first settings (b021 to b023 / b221 to b223). |
| 50 | ADD | ADD frequency enable | ON | Adds the "A145" (add frequency) value to the output frequency. |
| | | | OFF | Does not add the "A145" value to the output frequency. |
| 51 | F-TM | Force Terminal Mode | ON | Forces to change the source of the frequency source (A001) and the run command source (A002) to operate both as "01" setting internally. |
| | | | OFF | Source of output frequency set by "A001" and source of Run command set by "A002" is used. |
| 53 | KHC | Clear watt-hour data | ON | Clear cumulative 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 "b038" is shown. |
| | | | OFF | All the monitors and parameters can be shown. |
| no | NO | No function | ON | (input ignored) |
| | | | OFF | (input ignored) |

**Output Function Summary Table** – This table shows all intelligent output functions at a glance. Detailed descriptions of these functions, related parameters and settings are in “7.3.4 Intelligent output terminal setting”.

| 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 frequency command. |
| | | | 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 frequency (C042 and C043), even if in acceleration or deceleration ramps. |
| | | | OFF | When output to motor is OFF, or at a level below the set frequency. |
| 03 | OL | Overload Advance Notice Signal | ON | When output current is more than the set threshold (C041) for the overload signal. |
| | | | OFF | When output current is equal to or less than the set threshold (C041) for the overload signal. |
| 04 | OD | Output Deviation for PID Control | ON | When PID deviation is equal to or more than the set threshold (C044) for the deviation signal. |
| | | | OFF | When PID deviation is less than the set threshold (C044) 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 (C042 and C043), during acceleration and deceleration. |
| | | | 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 "b034" set value. |
| | | | OFF | Total running time of the inverter does not exceed the "b034" set value. |
| 12 | ONT | Power ON time Expired | ON | Total power ON time of the inverter exceeds the "b034" set value. |
| | | | OFF | Total power ON time of the inverter does not exceed the "b034" set 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 is equal to or falls below the threshold specified by "C063". |
| | | | OFF | Output frequency is higher than the threshold specified by "C063". |
| 27 | Dc | Analog Input Disconnect Detection | ON | When analog input signal loss is detected. |
| | | | OFF | When analog input signal loss is not 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 "C053". |
| | | | OFF | Transitions to OFF when the PID Process Variable (PV) exceeds "C052", and transitions to OFF when the inverter goes from Run Mode to Stop Mode. |
| 32 | NDc | Network Disconnect Detection | ON | When the communications watchdog timer (period specified by "C077") has time out. |
| | | | OFF | When the communications watchdog timer is satisfied by regular communications activity. |
| 33 | LOG | Logic Output Function | ON | When the Boolean operation specified by "C142" to "C144" has a logical “1” result. |
| | | | OFF | When the Boolean operation specified by "C142" to "C144" 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. |

| Output Function Summary Table | | | | |
|---|---|---|---|---|
| **Option Code** | **Terminal Symbol** | **Function Name** | **Description** | |
| 42 | OHF | Heatsink Overheat Warning | ON | Temperature of the heatsink exceeds the "C064" set value. |
| | | | OFF | Temperature of the heatsink does not exceed the "C064" set value. |
| 43 | LOC | Low current detection | ON | Motor current is less than the specified by "C039". |
| | | | OFF | Motor current is not less than the specified by "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 | WC | Window Comparator for Analog Input | ON | Analog input value is inside of the window comparator. |
| | | | OFF | Analog input value is outside of the window comparator. |
| 58 | FREF | Frequency Command Source Signal | ON | Frequency command is given from the operator. |
| | | | OFF | Frequency command is not given from the operator. |
| 59 | REF | Run Command Source Signal | ON | Run command is given from the operator. |
| | | | OFF | Run command is not given from the operator. |
| 60 | SETM | 2nd Motor Selection | ON | 2nd motor is being selected. |
| | | | OFF | 2nd motor is not being selected. |
| no | NO | No function | ON | - |
| | | | OFF | - |

## 13.2 Top cover for exclusive use of NE-S1 series: NES1-FFM-M

・Prepared exclusive top cover NES1-FFM-M (Afterward FFM) to improve usability of the inverter.
The applicable models are as follows. There are respective effects.

1. Effect to improve the current derating properties
2. Effect to improve Capacitor life
3. Effect not to let dust invade the inverter from the upper part
4. Effect to reduce an installation area at the time of plural mount installation

Applicable model：NES1-015 to 022SB/LB, 007 to 040HB
Note) Please do not be attached to the inverter which is not an applicable model. There might be an injury, the fire. In addition, cause the inverter fault.

### 13.2.1 Mounting method

・Because of mounting method varies according to inverter, please be careful.
① NES1-015 to 022SB/LB,022HB,040HB
② NES1-015HB
③ NES1-007HB
・The inverter included in ①, fit FFM in the cover upper surface of the main body of inverter.
・The inverter included in ②, after having removed the back side rib of FFM in figure 2 (shaded area) surgically by nippers, fit FFM in the cover upper surface of the main body of inverter.
・The inverter included in ③, after having removed the back side rib of FFM in figure 2 and 3 (shaded area) surgically by nippers, fit FFM in the cover upper surface of the main body of inverter.

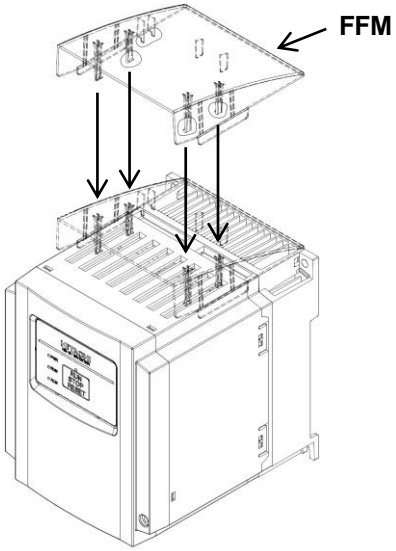



**Figure 1. Mounting method of FFM**

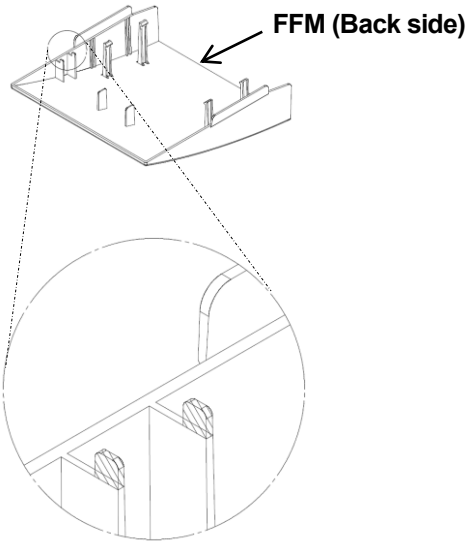



**Figure 2. Part (shaded area) to remove surgically**

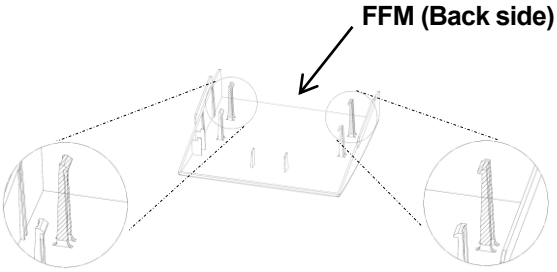



**Figure 3. Part (shaded area) to remove surgically**

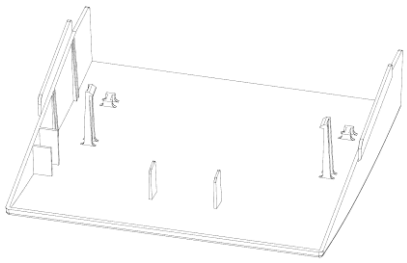


**Figure 4. After removing parts in Figure 2 and 3**

## 13.2.2 Improvement of the derating

- Derating properties are improved by attaching optional FFM to an applicable model. All models with attaching FFM (except NES1-040HB) will be no longer required for carrier derating and current derating at ambient temperature of 50 ℃.
  The detail refers to figure 5, 6 and figure 7.

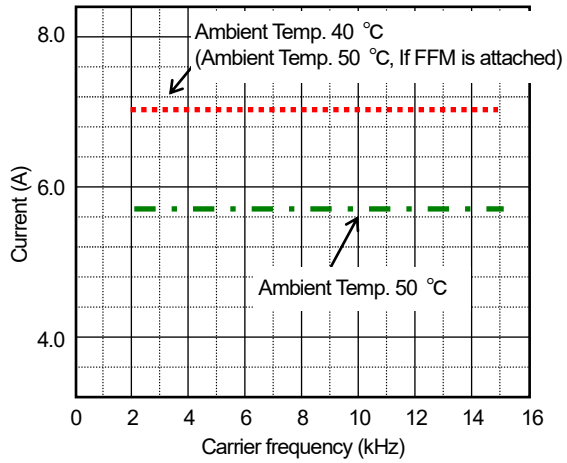



Figure 5. Derating of NES1-015SB

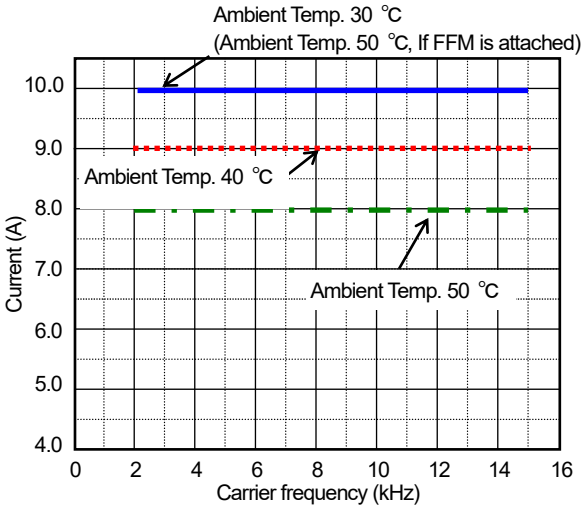
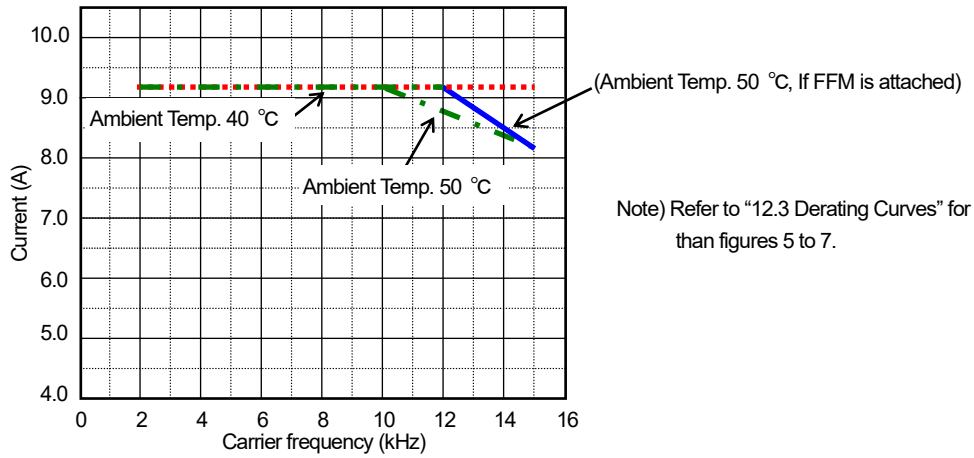



Figure 6. Derating of NES1-022SB




Note) Refer to "12.3 Derating Curves" for models other than figures 5 to 7.

Figure 7. Derating of NES1-040HB

## 13.2.3 Capacitor life improvement

- If FFM is attached to an applicable model, the capacitor (on the control board) life doubles approximately.
  The detail refers to figure 8.

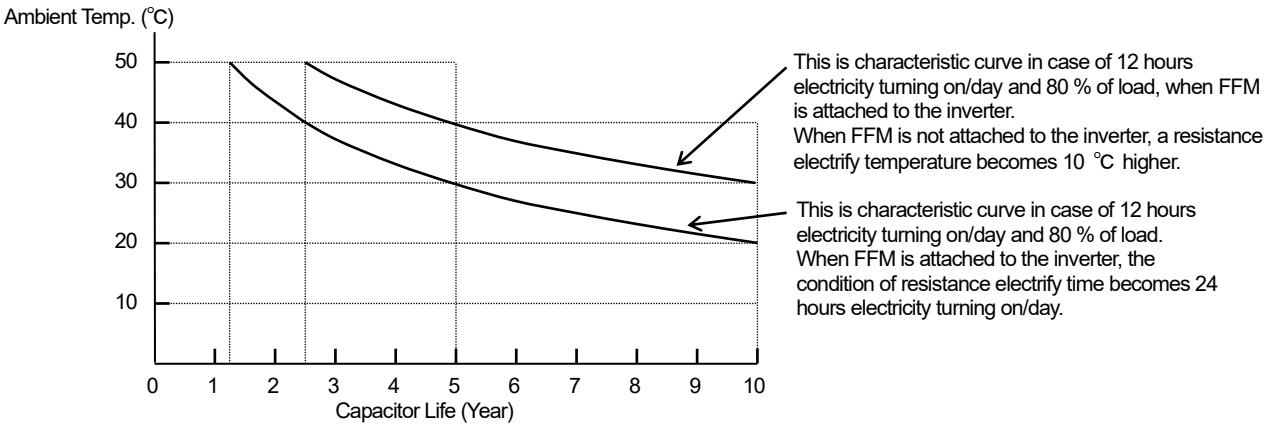



Figure 8. The Characteristic Curve of Capacitor Life

### 13.2.4 Reduction of the dust invades

- Because the NE-S1 series inverter has a top opening that becomes the window shade construction, it is in the structure that the dust from the top is hard to invade the products inside directly. The dust from the top becomes harder to invade the inverter inside by attaching optional FFM to an applicable model.
  The detail refers to figure 9.

Figure 9. FFM installation state

## 13.2.5 Reduction of the inverter installation area

- The inverter needs to install with the space for ventilation more than 10 cm from the inverter upper and lower surface. If the optional FFM to an applicable model is attached, the air will be exhausted to the front. Therefore, upper space can be only 2 cm that is height of FFM (Refer to Figure 10).
  In this case, please keep the clearance from the front cover to such as cabinet door (Refer to Figure 11).
  In addition, as well as a case to set up inverters lengthwise, the space more than 10 cm becomes needless even if a wiring duct is installed above the inverter.
  Therefore, you can reduce requisite space at the installation (Refer to Figure 12).

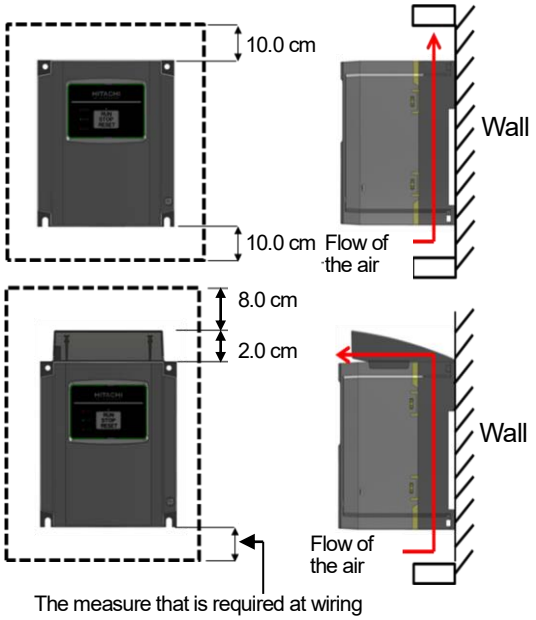
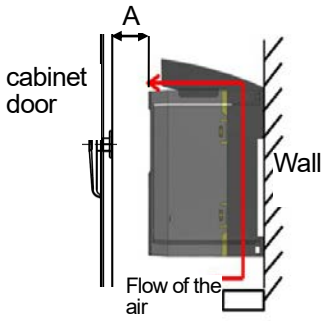


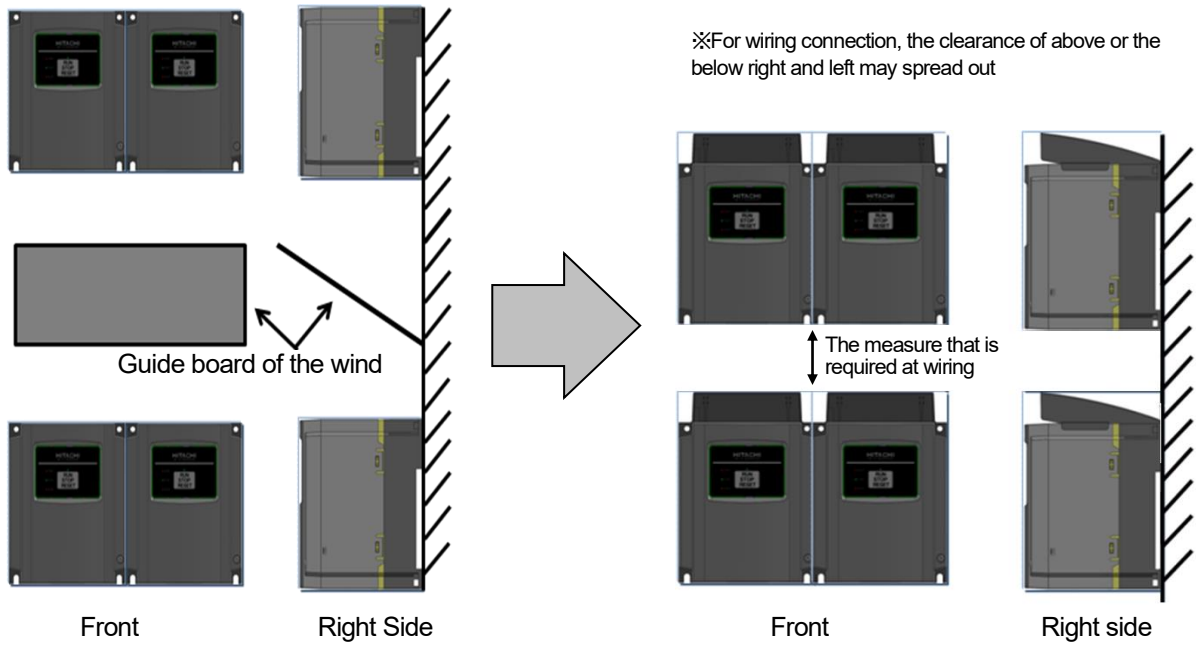

Figure 10. Reduction of the inverter upper part space




Minimum clearance to be kept as indicated "A" as follows.
NES1-007H : 2.0 cm
NES1-015S/L/H : 0.8 cm
NES1-022S/L/H : 0.0 cm
NES1-040H : 0.0 cm

(Note)
When connecting the NES1-OP, the height of the volume for frequency setting is required.

Figure 11. Minimum requisite clearance from front cover of the inverter




Conventional installation method (Standard Model)

Installation method if the FFM is attached

Figure 12. Reduction of the several inverters installation area

# Appendix

(Memo)

## Appendix-A　Disassembly method of NES1-OP

(1) After having removed the front cover, remove two places of screws.

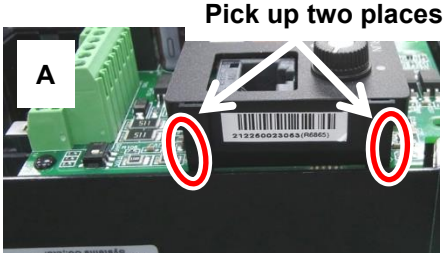

**Remove two places of screws.**


(2) Pick up the side of the operator cover, and remove a NES1-OP.

*Take it off the inverter right side by all means if you exclude a NES1-OP.

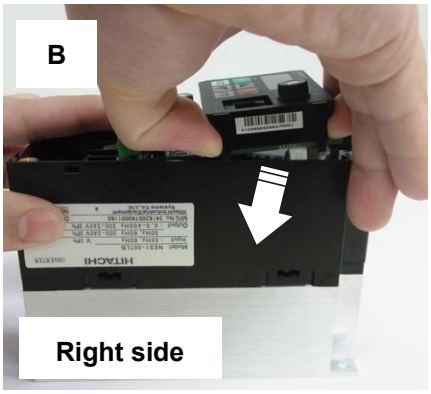
Pick up the point that I ordered in a figure A below, and flatter PCB, and take off two places of claws of the operator to open it outside of inverter (cf. figure A,B). If the claw of the right-side surface comes off, remove the left side surface equally next (cf. figure C,D).

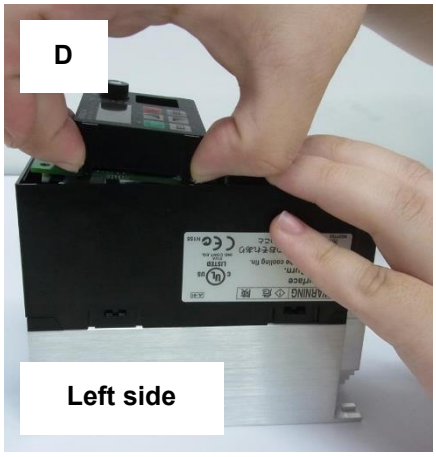
**Pick up two places**




**Take off two places of claws of NES1-OPE to open it outside of inverter**

**The condition that two places of claws of NES1-OPE were off.**



## S



## T



## U



## V



## W



## Z