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J300$_5$ VECTOR INVERTER

INSTRUCTION MANUAL

HYUNDAI
HEAVY INDUSTRIES CO., LTD.

SAFETY

For the Best Results with J300 Series inverter, read this manual and all of the warning sign attached to the inverter carefully before installing and operating it, and follow the instructions exactly. Keep this manual handy for your quick reference.

Definitions and Symbols

A safety instruction (message) is given with a hazard alert symbol and a signal word; **WARNING** or **CAUTION**. Each signal word has the following meaning throughout this manual.

This symbol means hazardous high voltage. It used to call your attention to items or operations that could be dangerous to your and other persons operating this equipment.
Read these message and follow these instructions carefully.

This is the "Safety Alert Symbol.." This symbol is used to call your attention to items or operations that could be dangerous to your or other persons operating this equipment.
Read these messages and follow these instructions carefully.

WARNING **WARNING**
Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

CAUTION **CAUTION**
Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage of product.
The matters described under ⚠ **CAUTION** may, if not avoided, lead to serious results depending on the situation. Important matters are described in **CAUTION** (as well as **WARNING**), so be sure to observe them.

NOTE **NOTE :** Notes indicate an area or subject of special merit, emphasizing either the product's capabilities or common errors in operation or maintenance.

HAZARDOUS HIGH VOLTAGE

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there might be exposed components with cases or protrusions at or above line potential. Extreme care should be taken to protect against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on an electronic controllers or rotating electrical equipment.

PRECAUTIONS

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

⚠ **WARNING :** The user is responsible for ensuring that all driven machinery, drive train mechanism not supplied by Hyundai, Ltd., and process line material are capable of safe operation at an applied frequency of 150% of the maximum selected frequency range to the AC motor. Failure to do so can result in destruction of equipment and injury to personnel should a single point failure occur.

⚠ **WARNING :** For protection, install a leak breaker type with a high frequency circuit capable of large currents to avoid an unnecessary operation. The ground fault protection circuit is not designed to protect personal injury.

⚠ **WARNING :** HAZARD OF ELECTRICAL SHOCK. DISCONNECT INCOMING POWER BEFORE WORKING ON THIS CONTROL.

⚠ **WARNING :** SEPARATE MOTOR OVERCURRENT, OVERLOAD AND OVER HEATING PROTECTION IS REQUIRED TO BE PROVIDED IN ACCORDANCE WITH THE SAFETY CODES REQUIRED BY JURISDICTIONAL AUTHORITIES.

⚠ **CAUTION :** These instructions should be read and clearly understood before working on J300 series equipment.

⚠ **CAUTION :** Proper grounds, disconnecting devices and other safety devices and their location are the responsibility of the user and are not provided by Hyundai, Ltd.

⚠ **CAUTION :** Be sure to connect a motor thermal switch or overload devices to the J300 series controller to assure that inverter will shut down in the event of an overload or an overheated motor.

⚠ **CAUTION :** Dangerous voltage exists until charge lamp is off.

⚠ **CAUTION :** Rotating shafts and above ground electrical potentials can be hazardous. Therefore, it is strongly recommended that all electrical work conform to the National Electrical Codes and local regulations. installation, alignment and maintenance Should be performed only by qualified personnel.
Factory recommended test procedures, included in the instruction manual, should be followed.
Always disconnect electrical power before working on the unit.

⚠ **WARNING :** This equipment has high leakage current and must be perminatly hard wired to earth via two indipendent cable.

⚠ **MOTORS**

a) Class I motor must be connected to protective earth via low resistive path (<0.1Ω)
b) Any motor used must be of suitable rating.
c) Motors may have hazardous moving parts, in this event suitable protection must be provided.

⚠ **CAUTION :**

Alarm connection may contain hazardous live voltage even when inverter is disconnected.
In case of removing front cover for maintenance or inspection, confirm that incoming power for alarm connection is surely disconnected.

⚠ **CAUTION :**

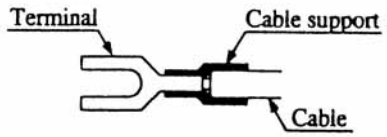
Hazardous (main) terminals for any interconnection (motor, contact breaker, filter etc.) must be inaccessible in end installation

⚠ **CAUTION :**

This equipment should be installed in an enclosure meeting requirements of IP4X (see EN60529).
The end application must be in accordance with BS EN60204-1(with reference to manual page 4-1 and 4-2, the diagram measurements to be suitably amended).

⚠ **CAUTION :**

Connection to field wiring terminals must be reliably fixed having two independent means of support. Using terminal with cable support (figure below), or cable gland, cable clamp etc.



⚠ **CAUTION :**

A double pole disconnection device must be fitted to the incoming mains supply close to the inverter. Additionally, a protection device meeting IEC947-1/IEC947-3 must be fitted at this point (protection device data shown in page 5-8).

⚠ **CAUTION :**

EMI filter is required for EMC directive.

The above instructions, together with any other requirements highlighted in this manual, must be complied with for continued LVD compliance.

Revision History Table

No	Revision Contents	The Date of lssue	Operation Manual Number

TABLE OF CONTENTS

1. SAFETY PRECAUTIONS

1. Installation

⚠ CAUTION

- Be sure to install the unit on flame resistant material such as metal
  Otherwise, there is a danger of fire. ---------- P.4-1
- Be sure not to place anything inflammable in the vicinity.
  Otherwise, there is a danger of fire. ---------- P.4-1
- Be sure not to let the foreign matter enter such as cut wire refuse, spatter from welding, iron refuse, wire, dust, etc.
  Otherwise, there is a danger of fire. ---------- P.4-1
- Be sure to install it in a place which can bear the weight according to the specifications in the text (4. Installation)
  Otherwise, it may fall and there is danger of injury. ---------- P.4-1
- Be sure to install the unit on a perpendicular wall which is not subject to vibration.
  Otherwise, it may fall and there is a danger of injury. ---------- P.4-1
- Be sure not to install and operate an inverter which is damaged or parts of which are missing.
  Otherwise, there is a danger of injury. ---------- P.4-1
- Be sure to install it in a room which is not exposed to direct sunlight and is well ventilated. Avoid environments which tend to be high in temperature, high in humidity or to have dew condensation, as well as places with dust, corrosive gas, explosive gas, inflammable gas, grinding-fluid mist, salt damage, etc.
  Otherwise, there is a danger of fire. ---------- P.4-1
- Be sure that the wall surface is a nonflammable material, such as steel plate. ---------- P.4-2

2. Wiring

⚠ WARNING

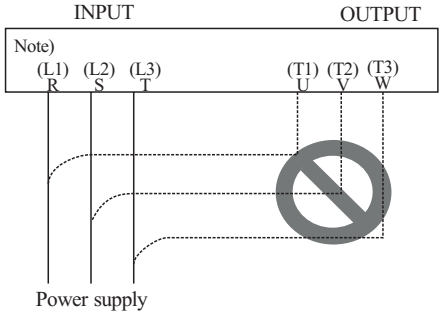
- Be sure to ground the unit.
  Otherwise, there is a danger of electric shock and/or fire. ---------- P.5-1
- Wiring work shall be carried out by electrical experts.
  Otherwise, there is a danger of electric shock and/or fire. ---------- P.5-1
- Implement wiring after checking that the power supply is off.
  It might incur electric shock and/or fire. ---------- P.5-1
- After installing the main body, carry out wiring.
  Otherwise, there is a danger of electric shock and/or injury. ---------- P.5-1

⚠ CAUTION

- Make sure that the input voltage is : ---------- P.5-2
  Three phase 200 to 220V/50Hz, 200 to 230V/60Hz
  Three phase 380 to 415V/50Hz, 400 to 460V/60Hz

- Be sure not to input a single phase to a 3 phase type. ---------- P.5-2
  Otherwise, there is a danger of fire.

- Be sure not to connect AC power supply to the output terminals ---------- P.5-2
  [U (T1), V(T2), W(T3)].
  Otherwise, there is a danger of injury and/or fire.



Note:
R(L1), S(L2), T(L3) : Three phase 200 to 220V/50Hz
200 to 230V/50Hz
Three phase 380 to 415V/50Hz
400 to 460V/60Hz

- Fasten the screws with the specified fastening torque. Check so that ---------- P.5-2
  there is no loosening of screws.
  Otherwise, there is a danger of tire.

- <u>Remarks for using earth leakage circuit breakers in the mains supply:</u>
  Frequency inverters with CE-filters (RFI-filter) and screened motor cables have a higher leakage current against earth. Especially in the moment of switching on this can cause unintentional triggerings of earth leakage circuit breakers. Because of the rectifier on the input side of the inverter there is the possibility to stall the switch-off function through amounts of DC-current. The following should be observed:
  Only short time-invariant and pulse current-sensitive earth leakage circuit breakers with higher trigger current should be used.
  Other components should be secured with separate earth leakage circuit breakers.
  Earth leakage circuit breakers in front of an inverter are not an absolute protection against direct touching.

- Be sure to set the fuse(s) (the same phase as the main power supply) ---------- P.5-2
  in the operation circuit.
  Otherwise, there is a danger of fire.

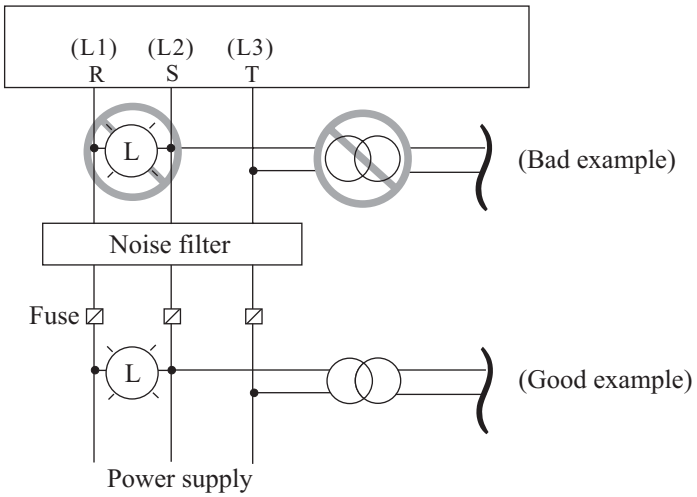
- As for motor leads, earth leakage breakers and electromagnetic ---------- P.5-2
  contactors, be sure to use the equivalent ones with the specified capacity (rated).
  Otherwise, there is a danger of fire.

CAUTION

Input phase failure protection

(1) J300-5 version inverter are provided with the phase failure protection on the power supply.

(2) When a buzzer, lamp, noise filter or transformer is connected between the input power terminals (L1, L2, L3) and input power fuses, input phase failure cannot be protected.



3. Control and operation

WARNING

- Be sure to turn on the input power supply after mounting the surface cover. ---------- P.6-1
  While being energized, be sure not to remove the cover.
  Otherwise, there is a danger of electric shock.

- Be sure not to operate the switches with wet hands. ---------- P.6-1
  Otherwise, there is a danger of electric shock.

- While the inverter is energized, be sure not to touch the inverter terminals even during stoppage. ---------- P.6-1
  Otherwise, there is a danger of electric shock.

- If the retry mode is selected, it may suddenly restart during the trip stop. ---------- P.6-1
  Be sure not to approach the machine. (Be sure to design the machine so that personnel safety will be secured even if it restarts.)
  Otherwise, there is a danger of injury.

- Even if the power supply is cut for a short period of time, it may restart operation after the power supply is recovered if the operation command is given. If it may incur danger to personnel, be sure to make a circuit so that it will not restart after power recovery. ---------- P.6-1
  Otherwise, there is a danger of injury.

- The Stop Key is effective only when the function is set. ---------- P.6-1
  Be sure to prepare the Key separately from the emergency stop.
  Otherwise, there is a danger of injury.

- After the operation command is given, if the alarm reset is conducted, it will restart suddenly. Be sure to set the alarm reset after checking the operation command is off. ---------- P.6-1
  Otherwise, there is a danger of injury.

- Be sure not to touch the inside of the energized inverter or to put a bar into it. ---------- P.6-1
  Otherwise, there is a danger of electric shock and/or fire.

- When the power is turned on when ther running command is on, the motor starts rotation and it is dangerous. Before turning the power on, confirm that the running command is not on. ---------- P.6-1

- When the Stop key function is ineffective, pressing the Stop key does not cancel the stop and trip. ---------- P.6-1
  Be sure to provide an emergency stop switch separately. When the operation command destination is a digital operator, this selection es ineffective.

⚠ CAUTION

- Radiating fin and discharging resistor will have high temperature. ---------- P.6-2
  Be sure not to touch them.
  Otherwise, there is a danger of getting burned.

- Low to high speed operation of the inverter can be easily set. Be sure to operate it after checking the tolerance of the motor and machine. ---------- P.6-2
  Otherwise, there is a danger of injury.

- If a motor is operated at a frequency higher than 60Hz, be sure to check the speeds of the motor and the machine with each manufacturer, and after getting their consent, operate them. ---------- P.6-2
  Otherwise, there is a danger of machine breakage.

- Check the following before and during the test run. ---------- P.6-3
  Otherwise, there is a danger of machine breakage.
  - Was the short-cut bar between +1and+connected?
  - Was the direction of the motor correct?
  - Was the inverter tripped during acceleration or deceleration?
  - Were the rpm and frequency meter correct?
  - Were there any abnormal motor vibrations or noise?

4. Maintenance, inspection and part replacement

⚠ WARNING

- After a lapse of more than 10 minutes after turning off the input power supply, perform the maintenance and inspection. ---------- P.10-1
  Otherwise, there is a danger of electric shock.

- Make sure that only qualified persons will perform maintenance, inspection and part replacement. (Before starting the work, remove metallic objects from your person (wristwatch, bracelet, etc.) ---------- P.10-1
  (Be sure to use tools protected with insulation.)
  Otherwise, there is a danger of electric shock and/or injury.

⚠ CAUTION

- When removing connectors, never pull the wires. (Wires for cooling fan and thermal relay) ---------- P.10-1
  Otherwise, there is a danger of fire due to wire breakage and/or injury.

5. Others

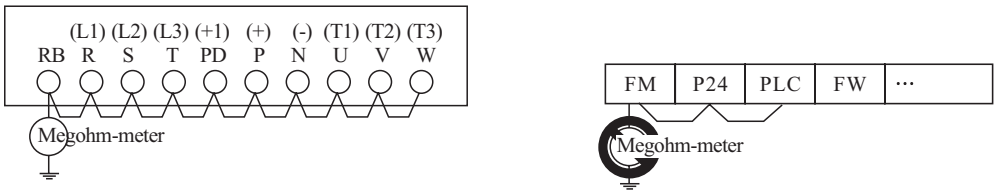
WARNING

- Never modify the unit.
  Otherwise, there is a danger of electric shock and/or injury.

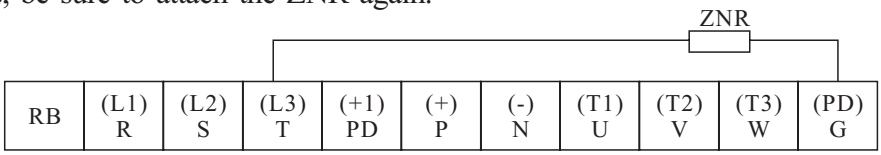
CAUTION

- **Withstand voltage tests and insulation resistance tests (megger tests) are executed before the units are shipped, so that there is no need to conduct these tests before operation.**

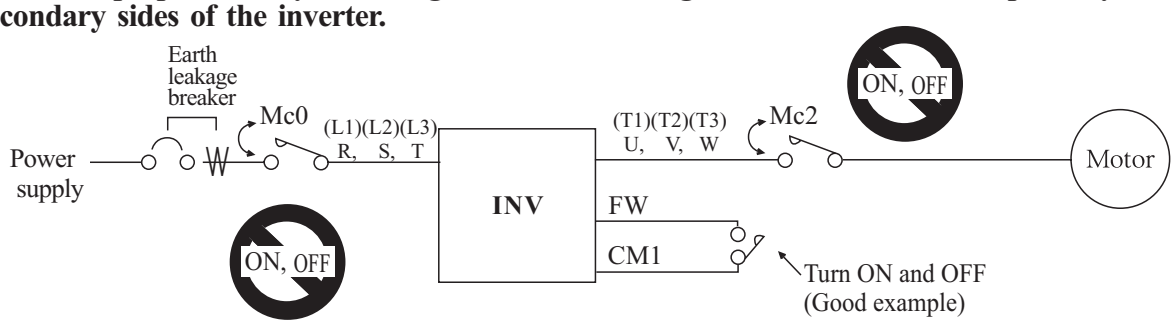
  When conducting megger tests as a part of daily inspection, be sure that these tests are only executed between the main circuit and the ground. Do not execute megger tests on the control circuit.



  Remove the ZNR connecting between G(PE) to T(L3) terminal before conducting the tests. After tests, be sure to attach the ZNR again.



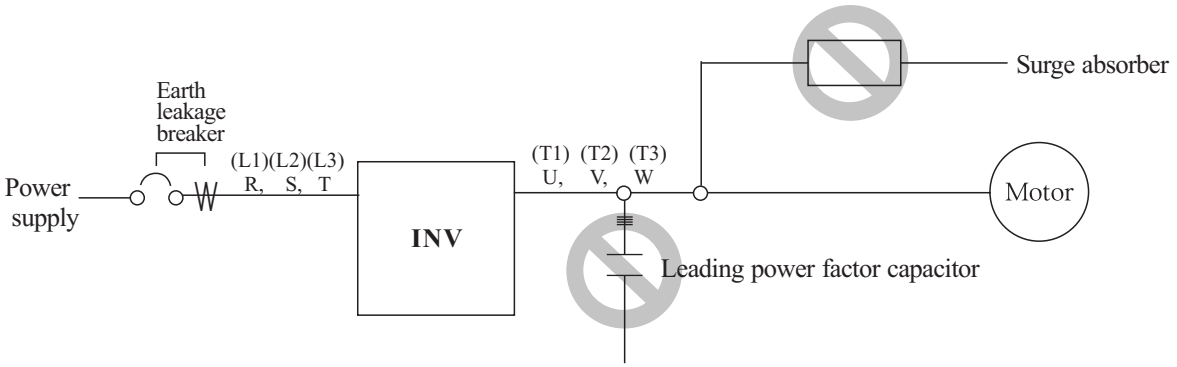
- **Do not attach or remove wiring or connectors when power is applied. Also, do not check signals during operation.**
- **Do not stop operation by switching off the electromagnetic contactors on the primary or secondary sides of the inverter.**



  When there has been an instantaneous power failure, and if an operation instruction has been given, then the unit may restart operation after the power failure has ended.
  If there is a possibility that such an occurrence may harm humans, than install an electromagnetic contactor (Mc0) on the power supply side, so that the circuit does not allow automatic restarting after the power supply recovers. If the optional remote operator is used and the retry function has been selected, this will also cause automatic restarting when an operation instruction has been input, so please be careful.

⚠ CAUTION

- **Do not insert leading power factor capacitors or surge absorbers between the output terminals of the inverter and the motor.**



- **Be sure to ground the grounding terminal, ⏚**

- **When inspecting the unit, after turning the power supply off be sure to wait unitl the CHARGE lamp beside the control terminal is off before opening the cover.**

  (If the lamp is lit or still flickering, then the internal capacitor's residual voltage is still dangerous.)

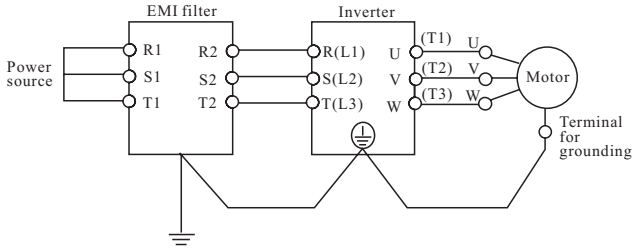
- **MOTOR TERMINAL SURGE VOLTAGE SUPPRESSION FILTER (FOR THE 400V CLASS)**

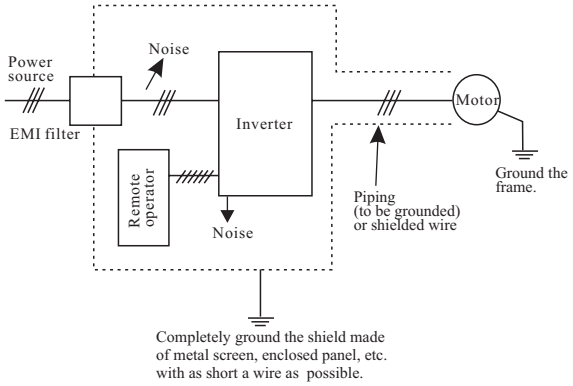
  In a system using an inverter of the voltage control PWM system, a surge voltage caused by the cable constants such as the cable length (especially when the distance between the motor and inverter is 10m or more) and cabling method may occur at the motor terminal.
  A dedicated filter of the 400V class for suppressing this surge voltage is available, please order one.

- **PROTECTION AGAINST NOISE INTERFERENCE FROM INVERTER**

  The inverter uses many semiconductor switching elements such as transistors and IGBTs. Thus, a radio set or measuring instrument located near the inverter is susceptible to noise interference. To protect the instruments from erroneous operation due to noise interference, they should be installed well apart from the inverter. It is also effective to shield the whole inverter structure. Addition of an EMI filter on the input side of the inverter also reduces the effect of noise from commercial power line on external devices.
  Note that external dispersion of noise from the power line can be minimized by connecting an EMI filter on the primary side of inverter.

CAUTION





- **EFFECTS OF DISTRIBUTOR LINES ON INVERTERS**

  In the cases below involving a general-purpose inverter, a large peak current flows on the power supply side, sometimes destroying the converter module. Where such situations are foreseen, or the paired equipment must be highly reliable, install an AC reactor between the power supply and the inverter.

  (A) The unbalance factor of the power supply is 3% or higher.
  (B) The power supply capacity is at least 10 times greater than the inverter capacity (and the power supply capacity, 500kVA or more).
  (C) Abrupt power supply changes are expected.
  Examples:
  (1) Several inverters are interconnected with a short bus.
  (2) A thyristor converter and an inverter are interconnected with a short bus.
  (3) An installed phase advance capacitor opens and closes.

  In cases (A), (B) or (C), we recommend installing an AC reactor of 3%(in a voltage drop at rated current) with respect to the supply voltage on the power supply side.

- **When occurring an EEPROM error (E 8), be sure to confirm the setting value again.**
- **When setting b contact to the reverse command ([REV] terminal), the inverter state automatically. Do not set to b contact.**

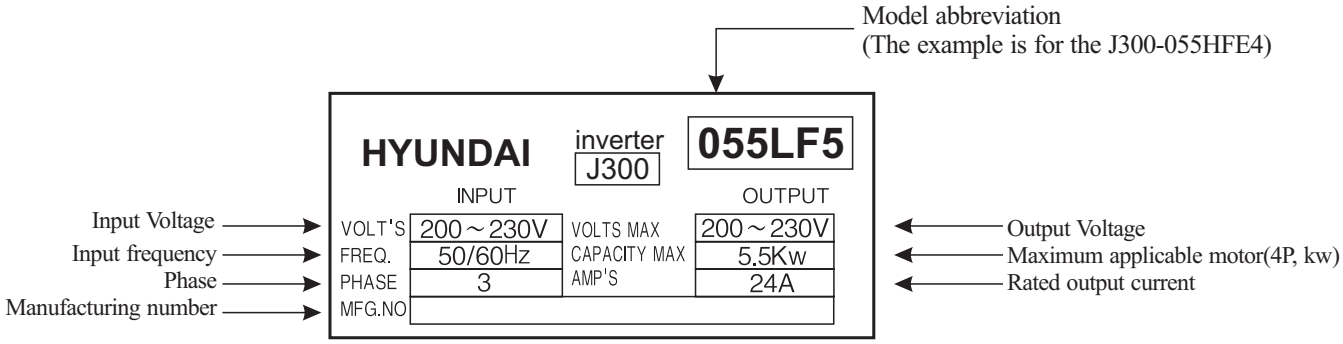
GENERAL CAUTION

In all the illustrations in this manual, covers and safety devices are occasionally removed to describe the details. When the product is operated, make sure that the covers and safety devices are placed as they were specified originally and operate it according to the instruction manual.

2. INSPECTION UPON UNPACKING

Before installation and wiring, be sure to check the following.

- Make sure that there was no damage during transportation the unit.
- After unpacking the unit, make sure that the package contains one inverter and one operation manual
- Make sure that the product is the one you ordered by checking the specifications label on the front of the cover.



Contents of Specifications Label

If you discover any problems, contact your sales agent immediately.

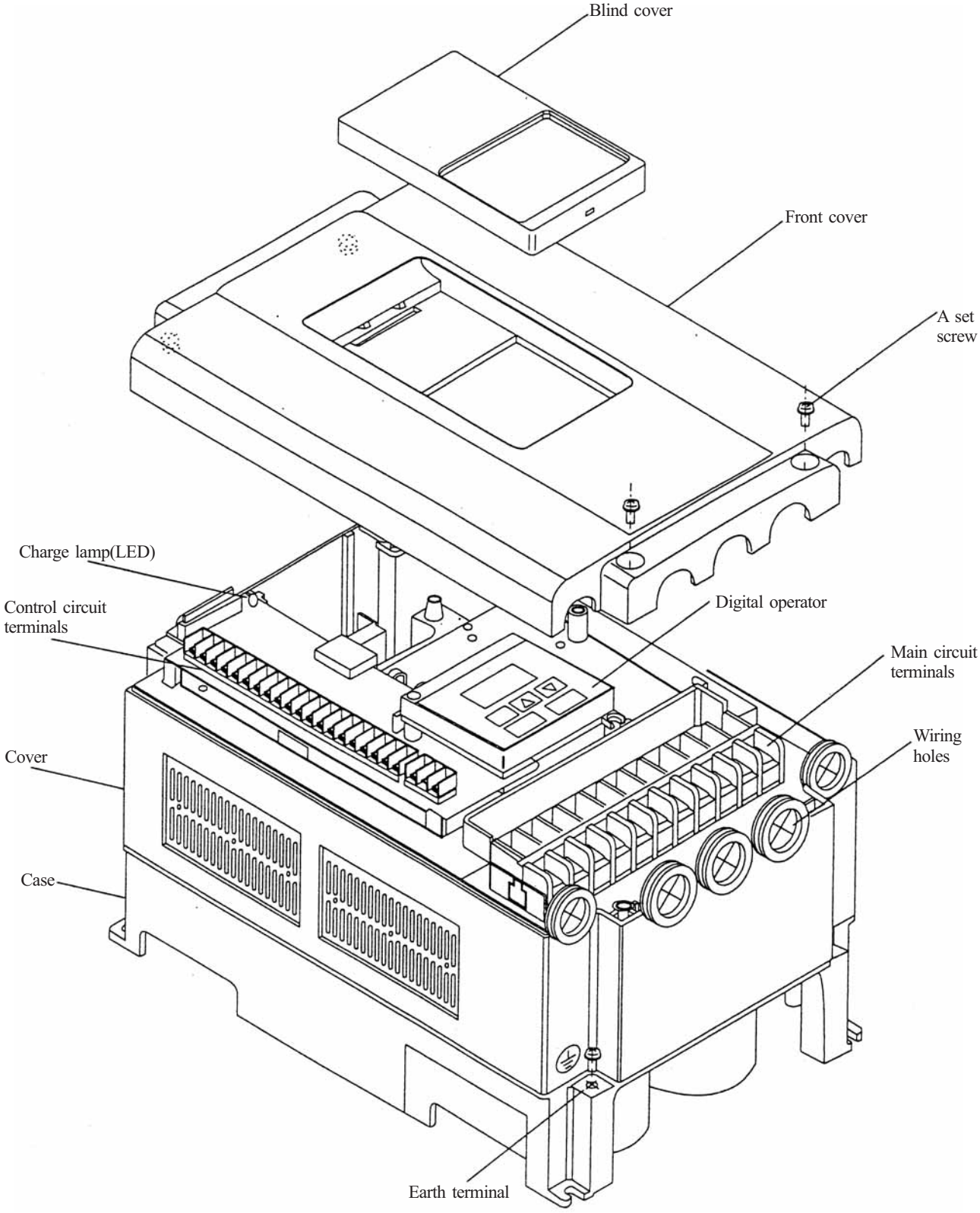
Description of Inverter Model

J300 - 055 H F 5

- J300: Series name
- 055: Applicable motor capacity (4P, kw)
  - 055 : 5.5kw
  - 075 : 7.5kw
  - 110 : 11kw
  - 150 : 15kw
  - 220 : 22kw
  - 300 : 30kw
  - 370 : 37kw
  - 450 : 45kw
  - 550 : 55kw
  - 750 : 75kw
  - 900 : 90kw
  - 1100 : 110kw
  - 1320 : 132kw
  - 1600 : 160kw
  - 2200 : 220kw
- H: Input voltage
  - H : Three phase 400V class
  - L : Three phase 200V class
- F: Structure type
  - F : with digital operator (Semi-closed, open type)
- 5: Version number

3. APPEARANCE AND NAMES OF PARTS

3.1 Names of Parts



4. INSTALLATION

CAUTION

- Be sure to install the unit on flame resistant material such as metal.
  Otherwise, there is a danger of fire.

- Be sure not to place anything inflammable in the vicinity.
  Otherwise, there is a danger of fire.

- Be sure not to let the foreign matter enter such as cut wire refuse, spatter from welding, iron refuse, wire, dust, etc.
  Otherwise, there is a danger of fire.

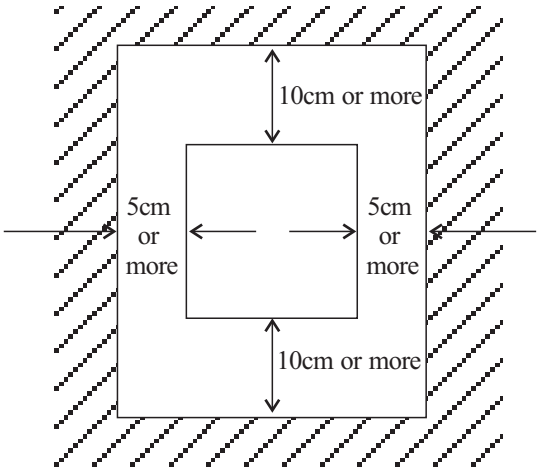
- Be sure to install it in a place which can bear the weight according to the specifications in the text(4. Installation).
  Otherwise, it may fall and there is a danger of injury.

- Be sure to install the unit on a perpendicular wall which is not subject to vibration.
  Otherwise, it may fall and there is a danger of injury.

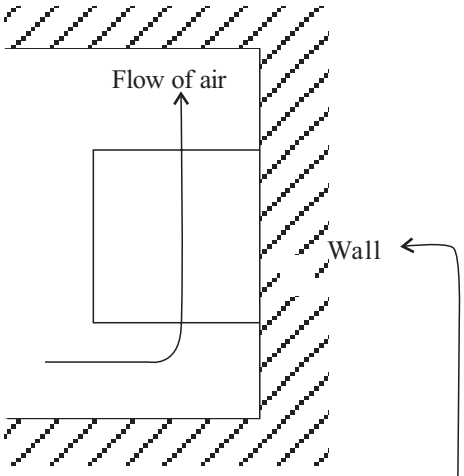
- Be sure not to install and operate an inverter which is damaged or parts of which are missing.
  Otherwise, there is a danger of injury.

- Be sure to install it in a room which is not exposed to direct sunlight and is well ventilated. Avoid environments which tend to be high in temperature, high in humidity or to have dew condensation, as well as places with dust, corrosive gas, explosive gas, inflammable gas, grinding-fluid mist, salt damage, etc.
  Otherwise, there is a danger of fire.

For cooling purposes, be sure that the inverter is installed vertically. In addition, be sure that it is separated from other components and walls. If foreign matter is introduced into the interior of the inverter, this may cause malfunctions, so make sure that no foreign matter can enter it.



(a)



(b)

Note : Install the inverter vertically.
Do not install it on the floor or horizontally.

⚠ CAUTION

Be sure that the wall surface is a nonflammable material, such as steel plate.

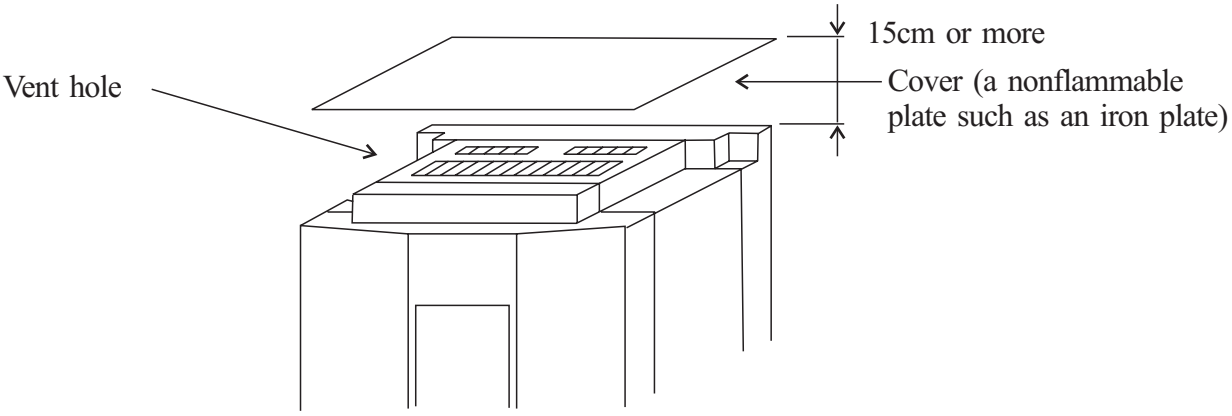
⚠ Be sure to check the ambient temperature.

Place of installation	Load characteristics	Ambient temperature	Applicable model
Within the enclosure (NOTE 1)	Constant torque	-10 to 50℃	055 to 2200HF (NOTE 6)
	Variable torque	-10 to 40℃	
Outside the enclosure (NOTE 2)	Constant torque	-10 to 40℃	055 to 150HF
	Variable torque	-10 to 40℃	

NOTE 1 : The inverter should be installed in a locked enclosure that meets the requirements in IP4X(see EN60529).
NOTE 2 : When an inverter (055HF to 150HF) is installed outside an enclosure, the top of the inverter needs to be covered with the optional blind cover.
NOTE 3 : The higher the ambient temperature inside the inverter, the shorter its life will be. If a heat generating unit is used near the inverter, try to keep it as far away as possible. Also, when installing the inverter in a box, be sure to carefully consider ventilation and the dimensions.
NOTE 4 : For EMC directive and Low Voltage directive, do not remove the front cover.
NOTE 5 : The end application must be in accordance with BS EN60204-1.
NOTE 6 : Each of inverters 220HF to 2200HF must be installed in a locked enclosure.

Precaution for installation and wiring

When executing the wiring work or another work, attach a cover on the vent hole (slit) on the top of the inverter to prevent wire chips, weld spatters, iron scraps, or dust from falling into the inverter.



5. WIRING

WARNING

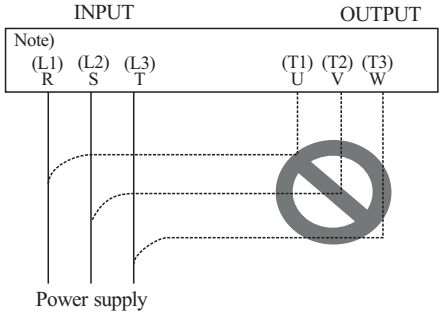
- Be sure to ground the unit.
  Otherwise, there is a danger of electric shock and/or fire.
- Wiring work shall be carried out by electrical experts.
  Otherwise, there is a danger of electric shock and/or fire.
- Implement wiring after checking that the power supply is off.
  It might incur electric shock and/or fire.
- After installing the main body, carry out wiring.
  Otherwise, there is a danger of electric shock and/or injury.

⚠ CAUTION

- Make sure that the input voltage is :
  Three phase 200 to 220V/50Hz, 200 to 230V/60Hz
  Three phase 380 to 415V/50Hz, 400 to 460V/60Hz

- Be sure not to input a single phase to a 3 phase type.
  Otherwise, there is a danger of fire.

- Be sure not to connect AC power supply to the output terminals [U (T1), V(T2), W(T3)].
  Otherwise, there is a danger of injury and/or fire.



Note:
R(L1), S(L2), T(L3) : Three phase 200 to 220V/50Hz
200 to 230V/50Hz
Three phase 380 to 415V/50Hz
400 to 460V/60Hz

- Fasten the screws with the specified fastening torque. Check so that there is no loosening of screws.
  Otherwise, there is a danger of tire.

- Remarks for using earth leakage circuit breakers in the mains supply:
  Frequency inverters with CE-filters (RFI-filter) and screened motor cables have a higher leakage current against earth. Especially in the moment of switching on this can cause unintentional triggerings of earth leakage circuit breakers. Because of the rectifier on the input side of the inverter there is the possibility to stall the switch-off function through amounts of DC-current.
  The following should be observed:
  Only short time-inveriant and pulse current-sensitive earth leakage circuit breakers with higher trigger current should be used.
  Other components should be secured with separate earth leakage circuit breakers.
  Earth leakage circuit breakers in front of an inverter are not an absolute protection against direct touching.

- Be sure to set the fuse(s) (the same phase as the main power supply) in the operation circuit.
  Otherwise, there is a danger of fire.

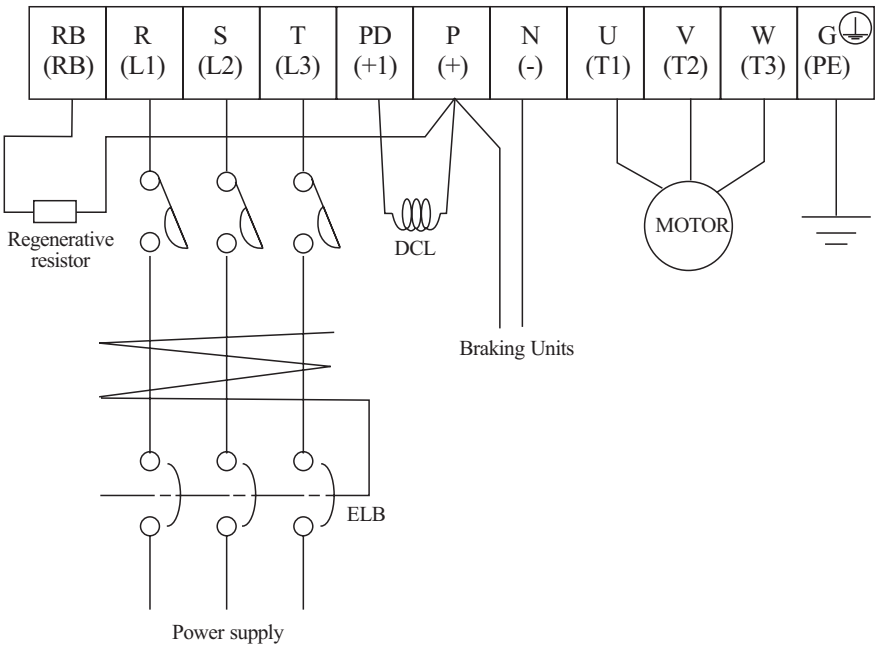
- As for motor leads, earth leakage breakers and electromagnetic contactors, be sure to use the equivalent ones with the specified capacity (rated).
  Otherwise, there is a danger of fire.

- Double pole disconnection device must be fitted to the incoming mains supply close to the inverter. And protection device meeting IEC947-1/IEC947-3 must be fitted at this point.

- Connection to wiring terminal must be reliabily fixed with two means of support.

The terminal board will be exposed when the front cover or terminal cover (220HF to 2200HF) is removed. Wire the inverter in this state.

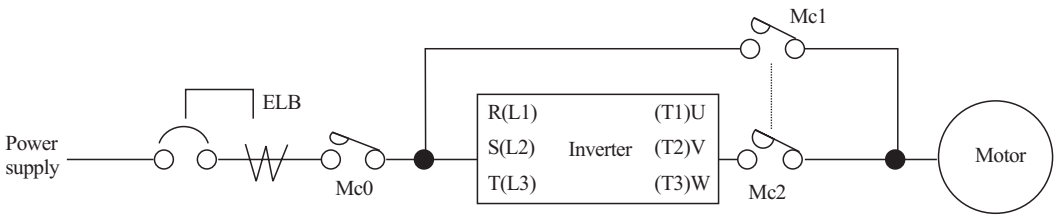
5.1 Wiring the Power Supply and Motor



- The inverter will be damaged if the power supply is connected to the motor terminals U(T1), V(T2) and W(T3), so be sure not to make any mistakes.

- If multiple motors are to be connected, be sure to attach a thermal relay to each motor.

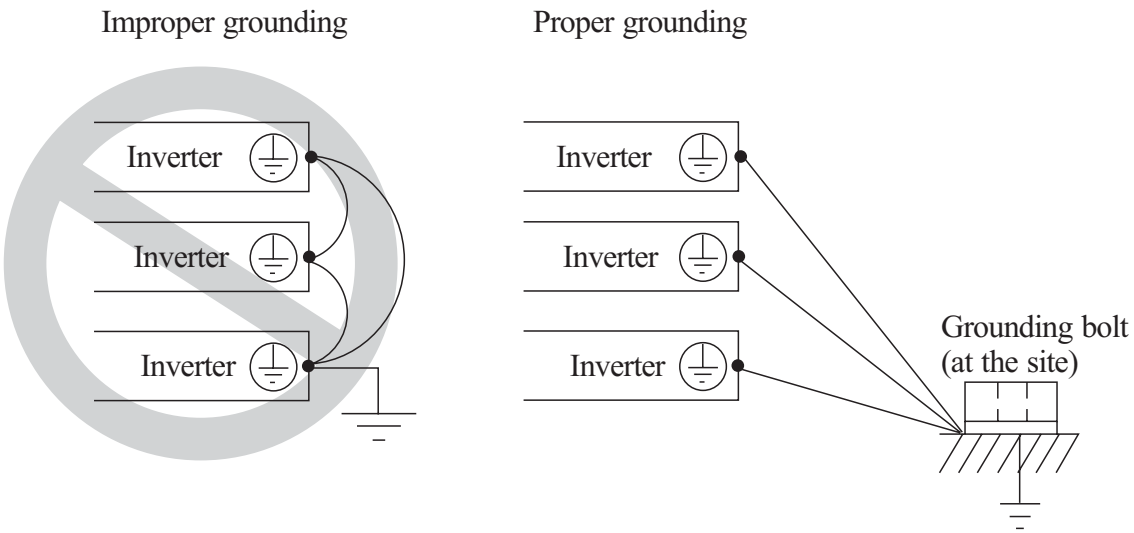
NOTE 1 : When changing the power supply of the motor between the inverter and commercial power, be sure to install mechanically interlocked switches Mc1 and Mc2.



NOTE 2 : Install an earth leakage breaker at the input of the inverter. (Select an earth leakage breaker whose sensitive current level is raised in high frequency range.)
When the cable length between the inverter and motor is long (more than 10m), the thermal relay may malfunction due to higher harmonics. Therefore, install an AC reactor on the output side of the inverter or use a current sensor in place of the thermal relay.

Note 3 : Be sure that the specified grounding is carried out. Be sure to separate the unit's grounding pole from those of other heavy electric machinery, and avoid using common grounding poles.

If multiple inverters are used, make sure that the grounding connections do not create a loop.

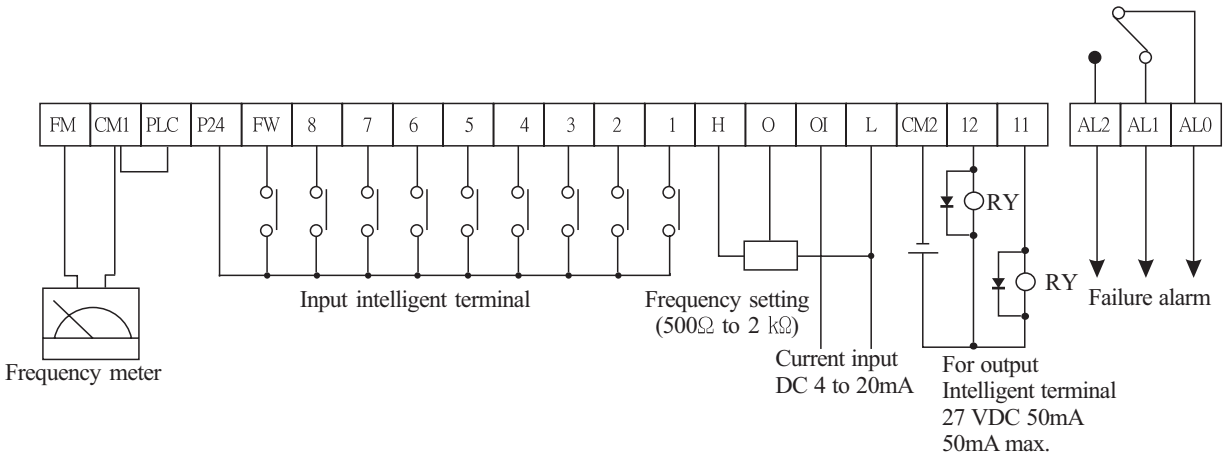


CAUTION

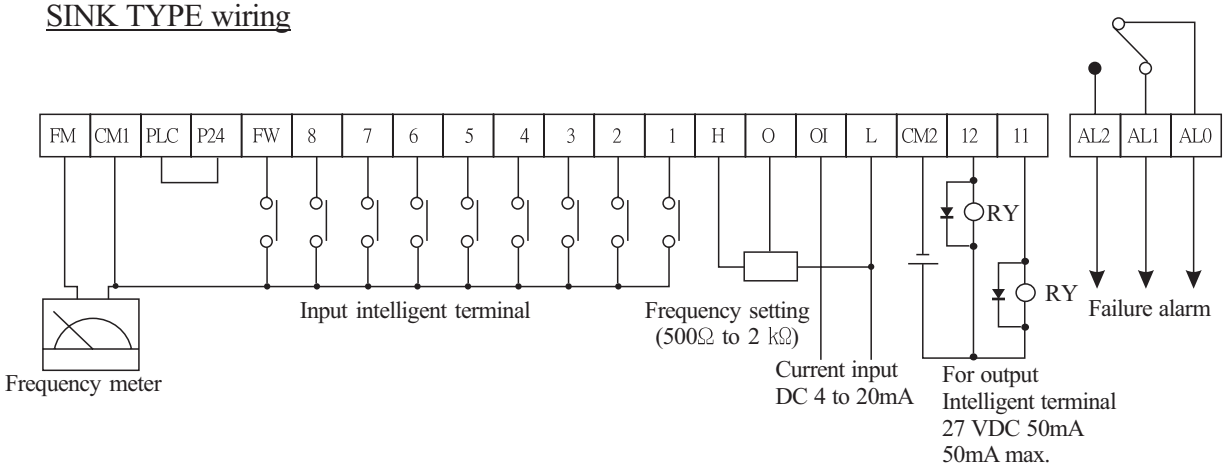
External or remote over load protection required, if multiple motor to be connected.

5.2 Wiring of Control Circuit Terminals

SOURCE TYPE wiring
(Factory settings for European version)

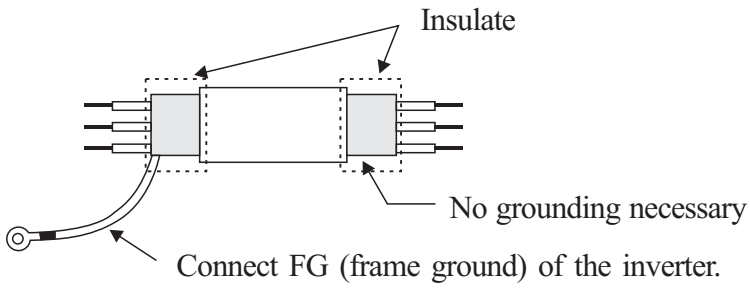


SINK TYPE wiring



NOTE 1 : When an output intelligent terminal is used, be sure to install a surge absorbing diode in parallel with the relay (RY). Otherwise, the surge voltage created when the relay (RY) goes ON or OFF may damage the output intelligent terminal circuit.

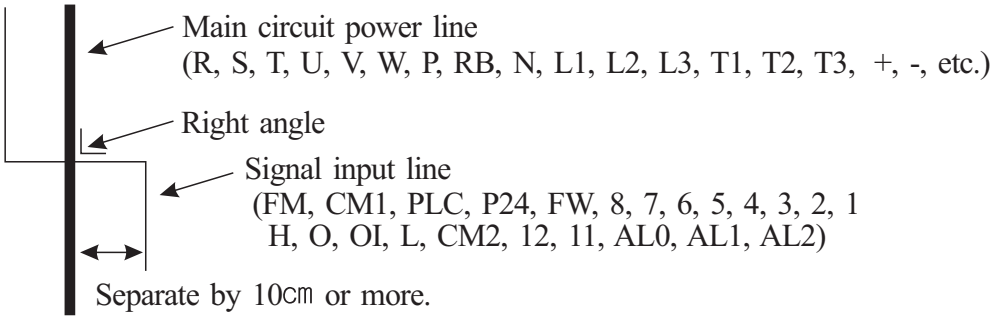
NOTE 2 : Use a twisted and shielded wire for the signal line, and cut the shielded covering as shown in the diagram below. Make sure that the length of the signal line is 20meters or less.



NOTE 3 : When the frequency setting signal is turned on and off with a contact, use a relay which will not cause contact malfunctions, even with the extremely weak currents and voltages, such as crossbar twin contacts, etc.

NOTE 4 : Use relays which do not have contact defects at 24V DC, 3mA for the other terminals.

NOTE 5 : Separate the main circuit wiring from the relay control circuit wiring. If they must cross, be sure that they cross at a right angle.



NOTE 6 : Do not short between the terminals H and L and between the terminals P24 and CM1 of the control circuit.

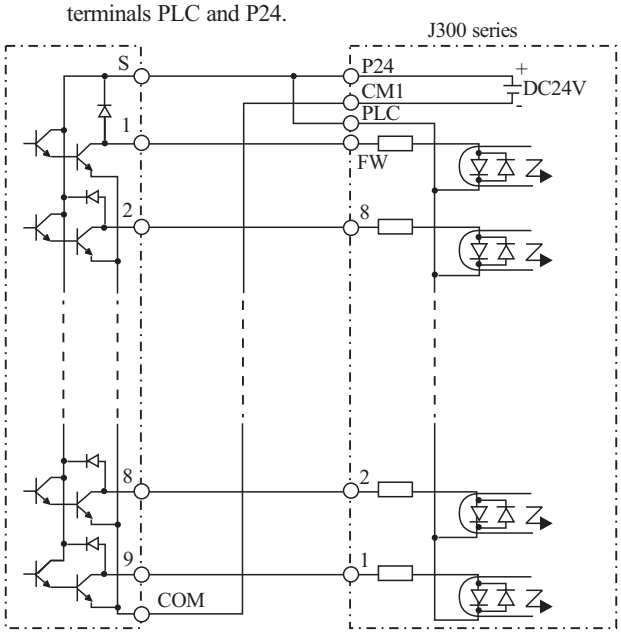
NOTE 7 : Insulate the common terminal L for frequency analog command input and the common terminal (COMMON) of the peripheral equipment such as the sequencer before starting use.

5.3 Connection to the Programmable Controller

(1) When the internal interface power source is used

① This is an example when the **sink type** transistor output(open collector output) module of the sequencer is connected

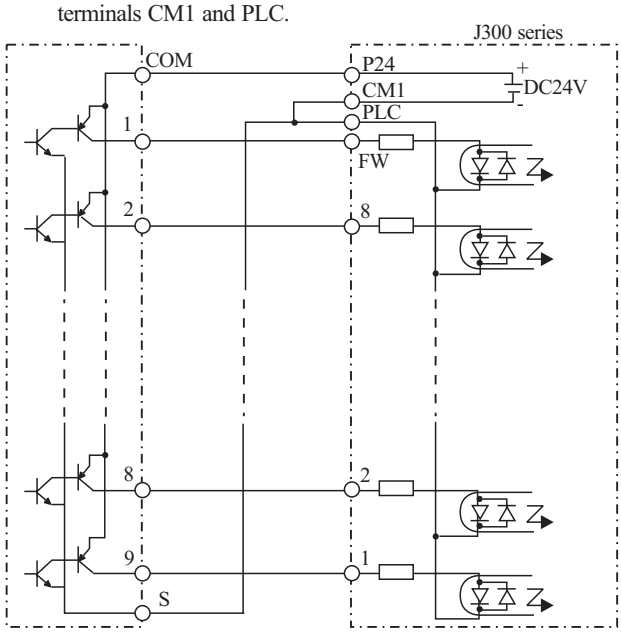
Note : Make sure of the short-circuit bar or wire between the terminals PLC and P24.



YTR48 type output module　　Inverter

② This is an example when the **source type** transistor output(open collector output) module of the sequencer is connected

Note : Make sure of the short-circuit bar or wire between the terminals CM1 and PLC.

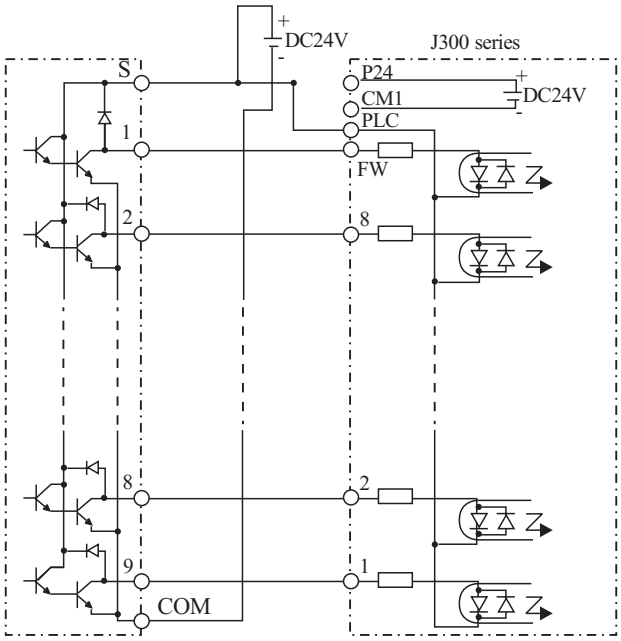


YTS48 type output module　　Inverter

(2) When the external interface power source is used

① This is an example when the **sink type** transistor output(open collector output) module of the sequencer is connected

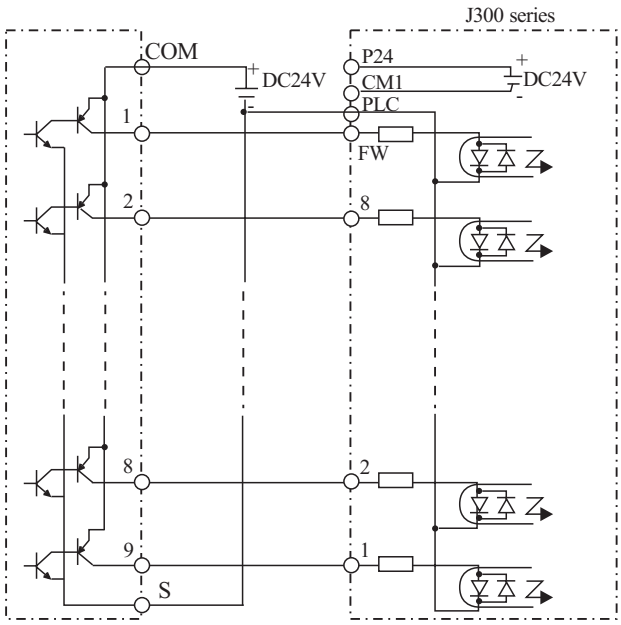
Note : Remove the short-circuit bar or wire between the terminals CM1 and PLC or P24 and PLC.



YTR48 type output module　　Inverter

② This is an example when the **source type** transistor output(open collector output) module of the sequencer is connected

Note : Remove the short-circuit bar or wire between the terminals CM1 and PLC or P24 and PLC.

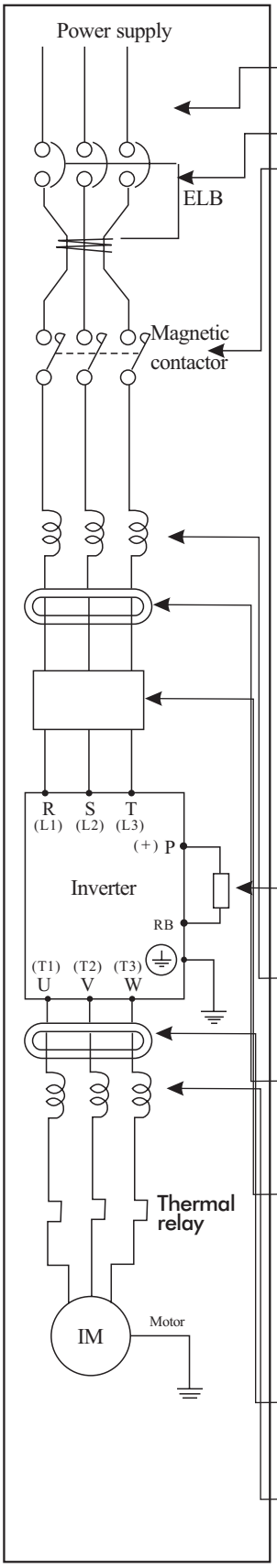


YTS48 type output module　　Inverter

Note : Be sure to turn the inverter on after the controller and external power source are turned on. (Otherwise, the data in the inverter may be changed.)

5.4 Wiring Equipment, Options (EMI filter, etc.)

Standard equipment (200V Class)



Motor output (kw)	Inverter model	Wiring: Power lines R, S, T, U, V W, P, N		Wiring: Power lines Extemol resistor RB1, 2, 3, P, RB	Wiring: Signal lines FM1, CM1, PCL, FW, 8, 7, 6, 5, 4, 3, CM2, 12, 11	Wiring: Signal lines P24, AL0, AL1, A2	Applicabie equipment: Earth leakage breaker(ELB)	Applicabie equipment: Electrom-agnetic contactor
5.5	J300-055LF	5.5mm² or more	8mm² or more	5.5mm² or more	0.75mm² shielded wire when the number of shielded wires to be used is 11 or more, the section of each shielded wire should be 0.5mm²	1.25mm² or more	HBH-53(50A)	HMC 27
7.5	J300-075LF	8mm² or more	14mm² or more	5.5mm² or more			HBH-53(50A)	HMC 37
11	J300-110LF	14mm² or more	22mm² or more	–			HBH-103(50A)	HMC 50
15	J300-150LF	22mm² or more	38mm² or more	–			HBH-103(100A)	HMC 70
22	J300-220LF	30mm² or more	60mm² or more	–			HBH-203(150A)	HMC 110
30	J300-300LF	60mm² or more	38mm² × 2	–			HBH-203(200A)	HMC 130
37	J300-370LF	38mm² × 2	38mm² × 2	–			HBH-203(225A)	HMC 150
45	J300-450LF	38mm² × 2	60mm² × 2	–			HBH-203(225A)	HMC 210
55	J300-550LF	60mm² × 2	60mm² × 2	–			HBH-403(350A)	HMC 260
(400V Class)								
5.5	J300-055HF	2mm² or more	3.5mm² or more	2mm² or more	0.75mm² shielded wire when the number of shielded wires to be used is 11 or more, the section of each shielded wire should be 0.5mm²	1.25mm² or more	HBH-33(30A)	HMC 20
7.5	J300-075HF	3.5mm² or more	3.5mm² or more	3.5mm² or more			HBH-33(30A)	HMC 20
11	J300-110HF	5.5mm² or more	5.5mm² or more	–			HBH-53(50A)	HMC 27
15	J300-150HF	8mm² or more	14mm² or more	–			HBH-53(50A)	HMC 37
18.5	J300-220HF	14mm² or more	14mm² or more	–			HBH-103(75A)	HMC 50
22	J300-220HF	14mm² or more	22mm² or more	–			HBH-103(75A)	HMC 50
30	J300-300HF	22mm² or more	30mm² or more	–			HBH-103(100A)	HMC 70
37	J300-370HF	38mm² or more	38mm² or more	–			HBH-103(100A)	HMC 80
45	J300-450HF	38mm² or more	60mm² or more	–			HBH-203(150A)	HMC 90
55	J300-550HF	60mm² or more	38mm² × 2	–			HBH-203(175A)	HMC110
75	J300-750HF	38mm² × 2	38mm² × 2	–			HBH-203(225A)	HMC150
90	J300-900HF	38mm² × 2	60mm² × 2	–			HBH-203(225A)	HMC180
110	J300-1100HF	60mm² × 2	80mm² × 2	–			HBH-403(350A)	HMC260
132	J300-1320HF	80mm² × 2	100mm² × 2	–			HBH-403(350A)	HMC300
160	J300-1600HF	100mm² × 2	150mm² × 2	–			HBH-403(400A)	HMC400
220	J300-2200HF	200mm² × 2	2000mm² × 2	–			HBH-603(600A)	HMC630

Part description	Function
AC reactor for improving the power factor (ACL-□I-□□□□)	This part is used when the unbalance voltage ratio is 3% or more and power supply is 500kVA or more, and there is a rapid change in the power supply. It also improves the power factor.
Radio noise filter (Zero phase reactor) (ZCL-A)	Using the inverter may cause noise on the peripheral equipment through the power lines. This part reduces noise.
EMI filter for inverter (□T3AK-□□□□)	This part reduces common noise generated between the power supply and the ground, as well as normal noise. Put it in the primary side of inverter. NOTE5
Regenerative resistor (RB0,RB1,RB2, RB3)	This part is used for applications that needs to increase the brake torque of the inverter or to frequently turn on and off and to run high inertia load.
Radio noise filter (Zero phase reactor) (ZCL-A)	This part reduces noise generated at the output of the inverter. (It is possible to use for both input and output)
AC reactor for reducing vibration (ACL-L-□□) (ACL-H-□□)	Running motors with the inverter generates vibration greater than that with commercial power supply. This part installed between the inverter and motor reduces torque ripple. When the cable length between the inverter and motor is long, a countermeasure for a malfunction of the termal relay is taken.

NOTE 1 : The applicable equipment is for a Hyundai standard four pole squirrel-cage motor.
NOTE 2 : Be sure to consider the capacity of the circuit breaker to be used.
NOTE 3 : Be sure to use bigger wires for power lined if the distance exceeds 20m.
NOTE 4 : Be sure to use an grounding wire of 3.5㎟ or more.
NOTE 5 : EMI filter is required for EMC directive but others are not for this purpose.
NOTE 6 : Install an earth leakage breaker meeting requirements of IEC947-1/IEC947-3 at the input.

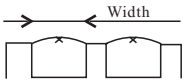
(*)Use 1.25㎟ wire for the alarm signal wire.
Classify the detective current of the earth leakage breaker depending on the total distance between the inverter and the motor.

(ℓ)	Detective current(mA)
100 m and less	30
300 m and less	100
600 m and less	200

NOTE 7 : When using CV wire and metal tube, the leakage current is around 30mA/km.
NOTE 8 : The leakage current becomes eight times because IV wires have a high dielectric constant. Therefore, use an one class larger earth leakage breaker according to the left table.

5.4 Terminal

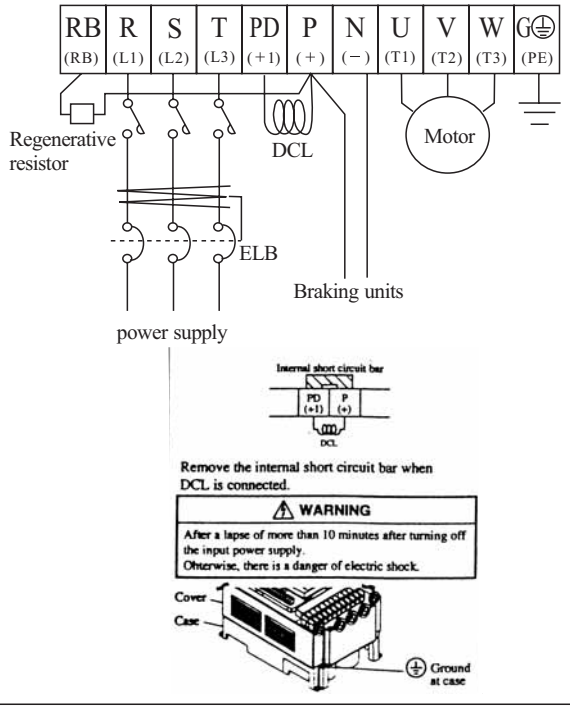
(1) Main circuit terminal



Terminal layout	Type	Screw diameter	Width (mm)
Insternal short circuit bar RB (RB) | R (L1) | S (L2) | T (L3) | PD (+1) | P (+) | N (-) | U (T1) | V (T2) | W (T3) | G (PE)	055, 075LF, HF	—	—
Insternal short circuit bar R (L1) | S (L2) | T (L3) | PD (+1) | P (+) | N (-) | U (T1) | V (T2) | W (T3) | G (PE)	110, 150LF, HF	—	—
Insternal short circuit bar G (PE) | R (L1) | S (L2) | T (L3) | PD (+1) | P (+) | N (-) | U (T1) | V (T2) | W (T3) | G (PE)	220, 370LF, HF	M6	17.5
	450, 550LF, HF	M8	23
Insternal short circuit bar G (PE) | R (L1) | S (L2) | T (L3) | PD (+1) | P (+) | N (-) | U (T1) | V (T2) | W (T3) | G (PE)	750, 900 HF	M10	35
	1100HF-2200HF	M10	40

Main circuit

Terminal symbol	Terminal description	Function
R, S, T (L1),(L2),(L3)	Main power	Connect the power supply
U, V, W (T1),(T2),(T3)	Inverter output	Connect the motor
P, R, B (+), (RB)	External regenerative resistor	Connect a regenerative resistor(option) (NOTE)
P, N (+),(-)	External regenerative braking unit	Connect a regenerative braking unit (option)
G (PE)	Ground	Ground(connect grounding to avoid electric shock)
PD (+1)	External choke coil	Connect a choke coil (DCL) for harmonics current reduction
⏚	Ground at case	Ground(connect grounding to avoid electric shock)



NOTE : Only the 055LF, 055HF, 075LF, 075HF are equipped with RB terminals and ⏚ ground at case.

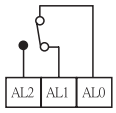
(2) Control circuit terminal

The intelligent I/O terminals 1 to 8 and 11and 12 are initialized as shown below at factory before shipment.

FM	CM1	PLC	P24	FW	REV	CF1	CF2	CH1	FRS	JG	AT	RS	H	O	OI	L	CM2	RUN	FA1	AL2	AL1	AL0
↑					↑	↑	↑	↑	↑	↑	↑	↑						↑	↑			
FM	CM1	PLC	P24	FW	8	7	6	5	4	3	2	1	H	O	OI	L	CM2	12	11	AL2	AL1	AL0

Control circuit

<table>
<tr><th></th><th>Terminal symbol</th><th>Terminal description and function</th><th colspan="2">Standard setting of intelligent terminal</th><th>Remarks</th></tr>
<tr><td rowspan="14">Input monitor signal</td><td>FM</td><td>Frequency monitor</td><td colspan="2" rowspan="5"></td><td rowspan="5">Dry contact
Close : ON (run)
Open : OFF (stop)

Min. ON time :
12 ms or more</td></tr>
<tr><td>CM1</td><td>Common for monitor</td></tr>
<tr><td>PLC</td><td>Common terminal for the external power source of the sequencer(PLC)</td></tr>
<tr><td>P24</td><td>Internal power source for the frequency monitor and intelligent input terminal</td></tr>
<tr><td>FW</td><td>Forward operation</td></tr>
<tr><td>8</td><td>Intelligent input terminal 8</td><td>REV</td><td>Reverse operation</td><td rowspan="9">Note:
If the power is turned on when the input terminals 1 to 5 are kept on, all the data stored in the inverter is initialized. Therefore, never turn the power on in such a state.</td></tr>
<tr><td>7</td><td>Intelligent input terminal 7</td><td>CF1</td><td>Multistage speed (First stage)</td></tr>
<tr><td>6</td><td>Intelligent input terminal 6</td><td>CF2</td><td>Multistage speed (Second stage)</td></tr>
<tr><td>5</td><td>Intelligent input terminal 5</td><td>CH1</td><td>2stage acc./dec.</td></tr>
<tr><td>4</td><td>Intelligent input terminal 4</td><td>FRS</td><td>Free run input signal</td></tr>
<tr><td>3</td><td>Intelligent input terminal 3</td><td>JG</td><td>Jogging</td></tr>
<tr><td>2</td><td>Intelligent input terminal 2</td><td>AT</td><td>Current input selection</td></tr>
<tr><td>1</td><td>Intelligent input terminal 1</td><td>RS</td><td>Reset (NOTE1)</td></tr>
<tr><td rowspan="4">Frequency command input</td><td>H</td><td>Power supply for frequency command</td><td colspan="2"></td><td>10 VDC</td></tr>
<tr><td>O</td><td>Voltage frequency command</td><td colspan="2"></td><td>0-5VDC(nominal), 0-10 VDC (nominal)(Input impedance 30kΩ)</td></tr>
<tr><td>OI</td><td>Current frequency command</td><td colspan="2"></td><td>DC 4-20mA (nominal)
Input impedance 250Ω</td></tr>
<tr><td>L</td><td>Common for frequency command</td><td colspan="2"></td><td></td></tr>
<tr><td rowspan="3">Output signal</td><td>CM2</td><td>Common for intelligent output terminal</td><td colspan="2"></td><td></td></tr>
<tr><td>12</td><td>Intelligent output signal 12</td><td>RUN</td><td>Run signal</td><td rowspan="2">27 VDC
50 mA max</td></tr>
<tr><td>11</td><td>Intelligent output signal 11</td><td>FA1</td><td>Frequency arrival signal</td></tr>
<tr><td rowspan="3">Fault alarm Output</td><td>AL0</td><td colspan="4" rowspan="3"> 

Normal: AL0-AL1 close
Abnormal, Power off :
AL0-AL1 open

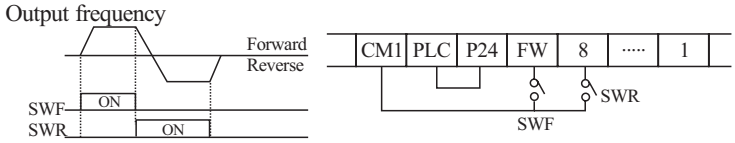
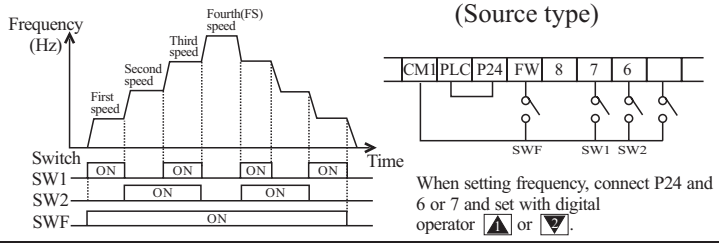
Contact rating
250 VAC 2.5A (Resistor load)
0.2A (cosØ=0.4)
30 VDC 3.0A (Resistor load)
0.7A (cosØ=0.4)

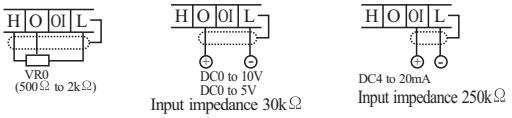
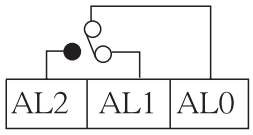
Min 100VAC
10mA
5VDC
100mA

⚠CAUTION
Alarm connection may contain hazardous live voltage even when inverter is disconnected. In case of removing flont cover for maintenance or inspection, confirm that incoming power for alarm connection is surely disconnected.</td></tr>
<tr><td>AL1</td></tr>
<tr><td>AL2</td></tr>
</table>

NOTE 1 : Terminal RS can use only contact a (normally open). It cannot use contact b(normally closed).

5.6 Control circuit Terminals

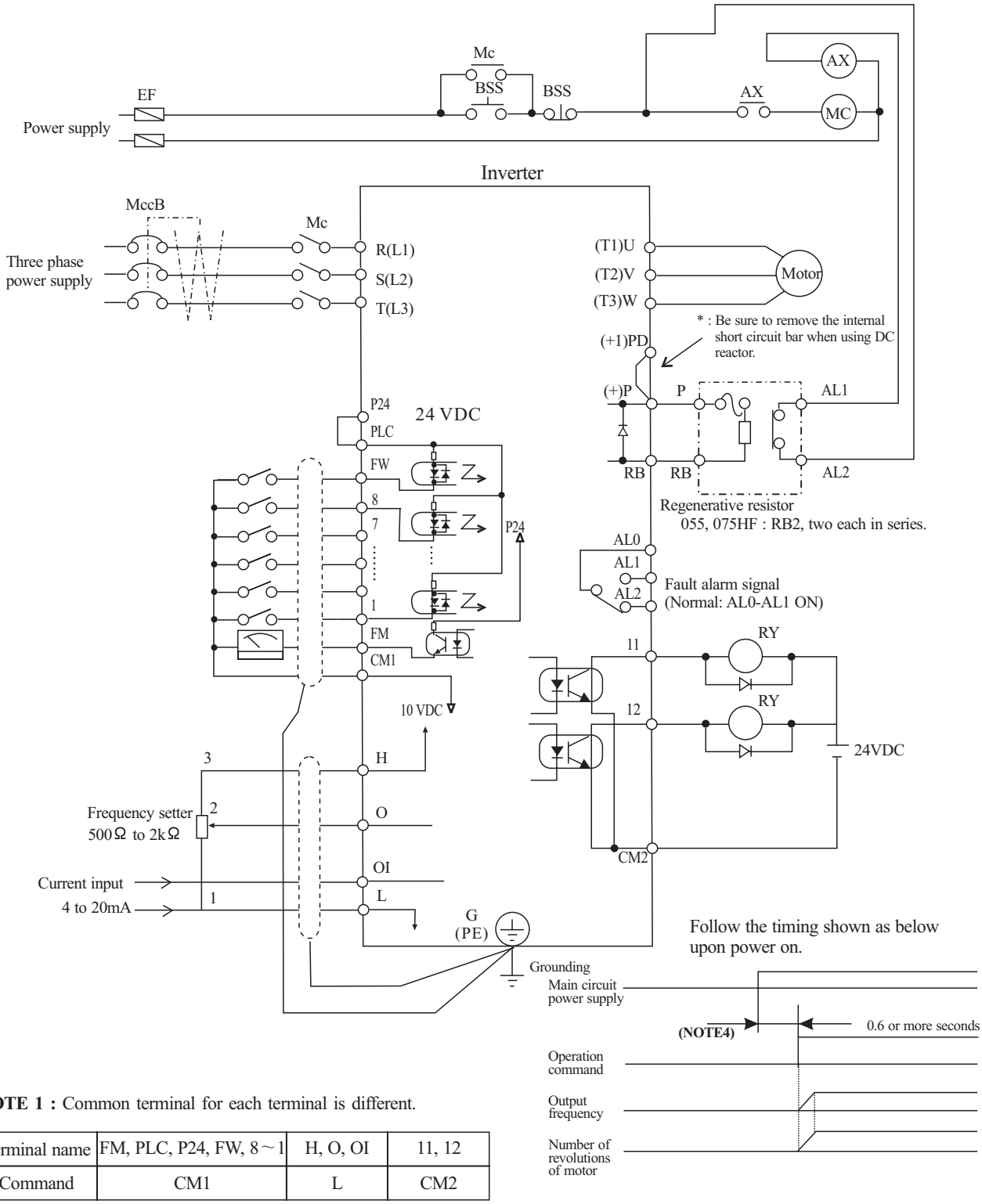
Terminal symbol		Terminal name		Description
FM		Monitor terminal		Analog : Output frequency, current, torque Digital : Output frequency x frequency converted value (Set in the remote operator monitor mode), max. pulse : 3.6kHz
CM1		Common terminal 1		Common terminal for the monitor terminal
PLC		Internal interface common		Common terminal for the external power source of the sequencer
P24		Input signal power source		Internal power source for the contact input terminal and frequency monitor terminal, 24 VDC. Common for the FW terminal and intelligent input terminals
FW		Forward run/stop terminal		
	REV	Reverse run/stop		
1 to 8	CF1	Multistage speed	SW1	
	CF2		SW2	
	CF3 (NOTE1)		SW3	
	JG	Jogging		Jogging run
	DB	External DC braking		DC braking input signal
	STN	Initialization		Initialization (shipment status at factory) input
	SET	2nd function		The output frequency setting, base and maximum frequencies, control method, motor constant, acceleration or deceleration time, manual torque boost setting, and electronic thermal setting are changed in batch.
	CH1	Two-stage acceleration or deceleration		The acceleration or deceleration time or selection of two-stage accration or deceleration is changed by turning the contact ON.
	FRS	Free run stop		The inverter stops and the motor stop free run FRS functions when the contact is opened. (European version)
	EXT	External trip		External trip input signal (The contact is open.)
	USP	Power-ON restart prevention		Restart prevention when the power is turned on in the RUN state (The contact is open.)
	CS	Commercial power source switching		Switch signal from the commercial power source to inverter drive (Note : When the terminal is used, a trip is also conceled.)
	SFT	Terminal software lock		The data of all functions except for output frequency setting is locked. See 12-9 [F-25].
	AT	Analog input command		Analog input voltage-current switching (When the contact is ON, current input signal to OI-L is acrive.)
	RS	Reset		Trip or alarm signal is reset.
	UP	Remote control function, acceleration		When the contact is turned ON, the operation is accelerated. (Available only when the frequency command is sent to the operator.)
	DWN	Remote control function, deceleration		When the contact is turned ON, the operation is decelerated. (Available the frequency command is sent to the operator.)

Terminal symbol		Terminal name	Description
H		Frequency command power terminal	Initialization of a voltage signal by an external command is between 0 and 10VDC. (Switching from 0 to 5V is executed by A48). When inputting 4-20mA, turn the input terminal at ON.  When a current is inputted from between OI and Land the value is 4mA, the output frequency may 0.6Hz. If this occurs, set a value more than the frequency which is outputted by [A4] start frequency setting. **(NOTE 3)**
O		Frequency command terminal (voltage command)	
OI		Frequency command terminal (current command)	
L		Frequency command common terminal	
CM2		Common terminal 2	Common terminal for intelligent output terminal
11 · 12	FA1	Frequency arrival signal	When each operator is used, and arrival signal can be outputted at an optional frequency.
	RUN	Signal during run	The transistor output is turned ON during running. (Outputted even during DC injection braking)
	OTQ	Over-torque signal	The transistor output is turned ON when the torque is more than the set value. The set value can be changed by the remote operator. Use this function only under the sensorless vector control.
AL0		Fault alarm terminal	 Normal : AL0-AL1 close Abnormal, Power off : AL0-AL1 open Contact rating 250 VAC 2.5 A (Resistor load) Min 100V ac 0.2 A (Cos ø = 0.4) 10mA 30 VDC 3.0 A (Resistor load) 5 VDC 0.7 A (Cos ø = 0.4) 10mA
AL1			
AL2			

NOTE 1 : To set four or more multispeeds, use the CF3 terminal.

NOTE 2 : When an inconvernience occurs in the above characteristics, adjust it using A80 and A81 . The sum of both analog input signals is outputted when selecting one of analog input current and voltage, make sure that the other is not inputted.

5.7 Terminal Connection Diagram



NOTE 1 : Common terminal for each terminal is different.

Terminal name	FM, PLC, P24, FW, 8～1	H, O, OI	11, 12
Command	CM1	L	CM2

NOTE 2 : The regenerative resistor has a temperature sensor. When it works, turn off power supply to the inverter 0 set the deceleration time longer.

NOTE 3 : When the operation command is input first and the main circuit power is turned ON, and direct start results and a trip occurs.

NOTE 4 : Do not input the operation command simultaneously when the main circuit is turned on.

6. OPERATION

6.1 Before Starting Operation

Prior to the test run, check the following

⚠ WARNING

- Be sure to turn on the input power supply after mounting the surface cover. While being energized, be sure not to remove the cover.
  Otherwise, there is a danger of electric shock.

- Be sure not to operate the switches with wet hands.
  Otherwise, there is a danger of electric shock.

- While the inverter is energized, be sure not to touch the inverter terminals even during stoppage.
  Otherwise, there is a danger of electric shock.

- If the re-try mode is selected, it may suddenly restart during the trip stop. Be sure not to approach the machine. (Be sure to design the machine so that personnel safety will be secured even if it restarts.)
  Otherwise, there is a danger of injury.

- Even if the power supply is cut for a short period of time, it may restart operation after the power supply is recovered if the operation command is given. If it may incur danger to personnel, be sure to make a circuit so that it will not restart after power recovery.
  Otherwise, there is a danger of injury.

- The stop key is effective only when the function is set. Be sure to prepare the key separately from the emergency stop.
  Otherwise, there is a danger of injury.

- After the operation command is given, if the alarm reset is conducted, it will restart suddenly. Be sure to set the alarm reset after checking the operation command is off.
  Otherwise, there is a danger of injury.

- Be sure not to touch the inside of the energized inverter or to put a bar into it.
  Otherwise, there is a danger of electric shock and/or fire.

CAUTION

- Radiating fin and discharging resistor will have high temperature. Be sure not to touch them. Otherwise, there is a danger of getting burned.
- Low to high speed operation of the inverter can be easily set. Be sure to operate it after checking the tolerance of the motor and machine.
  Otherwise, there is a danger of injury.
- If a motor is operated at a frequency higher than 60Hz, be sure to check the speeds of the motor and the machine with each manufacturer, and after getting their consent, operate them.
  Otherwise, there is a danger of machine breakage.

Note :

(1) Make sure that the power lines (input power supply R(L1), S(L2) and T(L3), and output terminals, U(T1), V(T2) and W(T3) are connected correctly.

(2) Make sure that there are no mistakes in the signal line connections.

(3) Make sure that the inverter case (⏚) is grounded.

(4) Make sure that terminals other than those specified are not grounded.

(5) Make sure that the inverter is installed vertically on a wall, and a nonflammable material such as a steel plate is used as a mounting surface.

(6) Make sure that there are no short-circuits caused by stray pieces of wire, solderless terminals or other objects left from wiring work. Also, make sure that no tools have been left behind.

(7) Make sure that the output wires are not short-circuited or grounded.

(8) Make sure that there are no loose screws or terminals.

(9) Make sure that the maximum frequency setting matches the machine specifications.

Be sure to refer to page 10-2 when conducting insulation resistance and withstand voltage tests. Never test terminals other than those which are indicated.

6.2 Test Run

CAUTION

Check the following before and during the test run.
Otherwise, there is a danger of machine breakage.

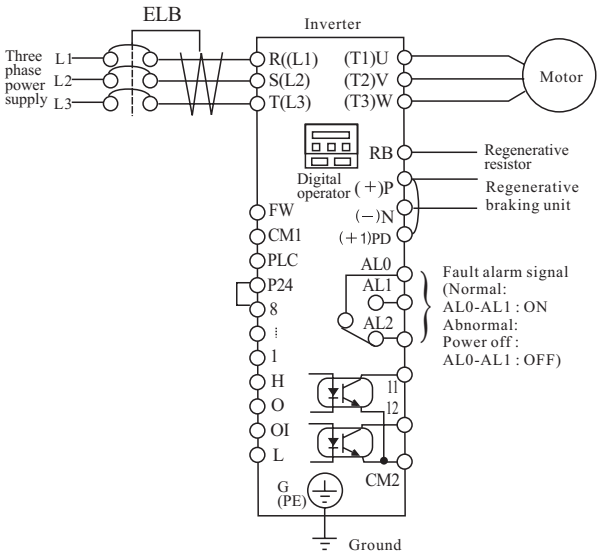
- Was the short-cut bar between+1 and + connected? (This check applies only when the DCL is not used.)
- Was the direction of the motor correct?
- Was the inverter tripped during acceleration of deceleration?
- Were ths SPEED (rpm) and frequency meter correct?
- Were there any abnormal motor vibrations or noise?

When over current tripping or overvoltage tripping occurs during the test run, increase the acceleration time or deceleration time.

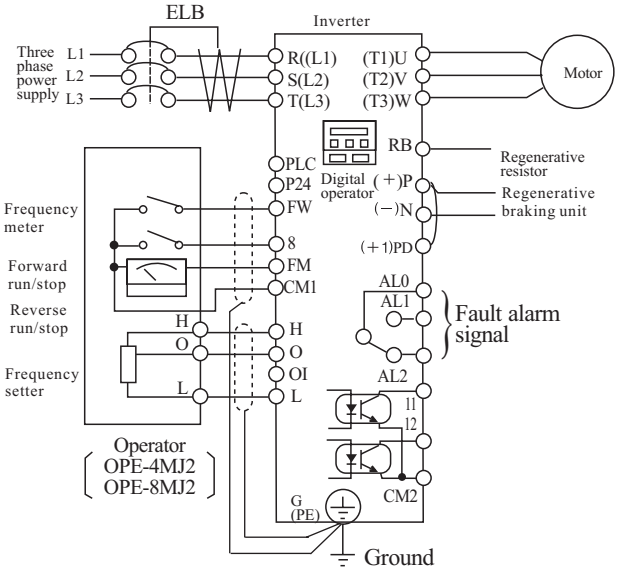
Factory settings
Maximum frequency : 60Hz Forward operation

An example of a general connection diagram is shown below

Operating with digital operator :
When setting frequency, run and stop with digital operator.
(The same way as remote operator (DOP) or copy with (DRW).)



Running from external command :
When setting frequency, run and stop from external command (FW, RV Terminal.)
The following shows run from the operation box (OPE-4MA, OPE-8MA)



Operating with digital operator:

Procedure

(1) Turn on ELB to supply power to the inverter. Make sure that the POWER LED on the digital operator turns ON.

(2) Press the 기능 FUNC key once to display d0 .

(3) Press ▼ of the digital operator four times to display F9 .

(4) Press the 기능 FUNC key and then press the ▼ key to set 00. Press the 기능 FUNC key to establish the data.

(5) Press the ▲ key four times to display d0 .

(6) Press ▲ of the digital operator five times to display F2 .

(7) Press the 기능 FUNC key and then the ▲ key so as to increase to frequency or the ▼ key so as to decrease the frequency.
(When the ▲ or ▼ key is pressed continuously, the frequency is changed continuously.)
When the 기능 FUNC key is pressed. F2 is displayed.

(8) Check the output frequerncy and rotation direction. When the ▲ or ▼ key is pressed to display F4 and then the 기능 FUNC key is pressed, the rotation direction can be checked. F indicates forward rotation and r indicates reverse rotation. When the rotation direction is checked, press the 기능 FUNC key. When the rotation direction cannot be found, operate the equipment at a low frequency to check the rotation direction.

(9) Press the 운전 RUN key. The equipment starts running.

(10) Press the 정지/리세트 STOP/REST key. The equipment decelerates and stops.

Running from external command:

(4) Press the 기능 FUNC key and then press the ▼ key to set 03. Press the 기능 FUNC key to establish the data.

(5) Press the ▲ key four times to display d0 .

(6) Short the terminals FW and P24 (CM1*) of the control terminal block.

(7) Apply a voltage between the terminals O and L to start running.

(8) Open the terminals FW and P24 (CM1*) of the control terminal block to stop deceleration.

*: Symbols are indicated for Sink type wiring
Refer to page 5-5.

- The failure alarm signal is generated from the terminal AL0 and AL1 when a failure happens. At this time the contents of the failure are displayed on the digital operator.

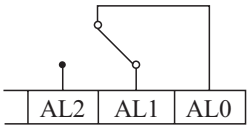
- Whether the alarm terminal output is to be turned on or off during normal run can be selected by the extension function [C21].

  The alarm output terminals at initial setting are as follows(2).

  The alarm output terminals are valiable as follows(2) by setting [C21].

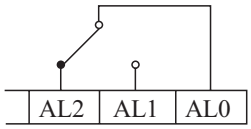
(1) Contact b

During normal operation



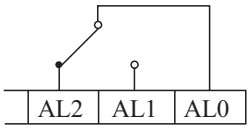
Contact	Power	Operation Status	AL0-AL1	AL0-AL2
b (initial setting)	ON	Normal	Closed	Open
	ON	Abnormal	Open	Closed
	OFF	-	Open	Closed

At occurrence of an alarm or power off



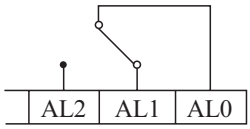
(2) Contact a - inital data

During normal operation or at power off



Contact	Power	Operation Status	AL0-AL1	AL0-AL2
a	ON	Normal	Open	Closed
	ON	Abnormal	Closed	Open
	OFF	-	Open	Closed

At occurrence of an alarm



- Contact specification

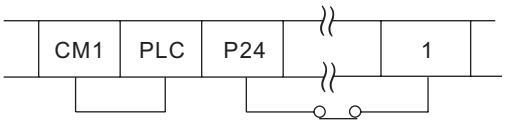
Maximum	Minimum
250VAC 2.5A(Resistor load) 0.2 A(cos ø =0.4)	100 VAC 10mA
30VDC 3.0A(Resistor load) 0.7 A(cos ø =0.4)	5 VDC 100mA

Working voltage : Max. 50V

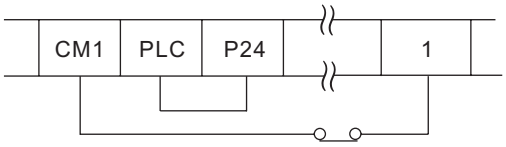
- Saving the alarm signal
  When an alarm signal is outputted, the alarm signal data is stored even if the input power is turned off and the contents can be checked by turning the power on once again. However, when the input power is turned off, the inverter control power is also turned off. As a result, when the power is turned on next, the alarm contact output is reset (deleted).
  Therefore, when saving the alarm contact output, let the external sequence receive and save it and then turn off the inverter input power.

- When the alarm contact output is set ON during normal run, a time delay occurs until the contact is closed when the power is turned on. Therefore, when using the alarm contact output, set a time delay of about 2 seconds when the power is turned on.

Resetting (Any one of A, B and C is possible)



When the internal interface power source P24-CM1 is used (Source type wiring)



When the internal interface power source P24-CM1 is used (Sink type wiring)

A) Turn control terminal 1 on. (In the initialization at factory before shipment, intelligent input terminal 1 is allocated to the reset RS terminal.)

B) Press 정지/리세트 STOP/REST on the digital operator. (This is effective only when an alarm occurs.)

C) Open the power receiving breaker of the inverter, and make sure that the Charge lamp on the control board goes out. (See page 3-1.) Then, close the power receiving breaker.

NOTE : When the control circuit terminal RS is used, never short-circuit RS-P24 (CM1*) for four seconds or more. Otherwise, a communication error R-ERROR COMM<2> may occur (Although the digital operator display is , the inverter is normal). When the above error occurs, open the RS terminal and press the operator key.

* : For sink type wiring

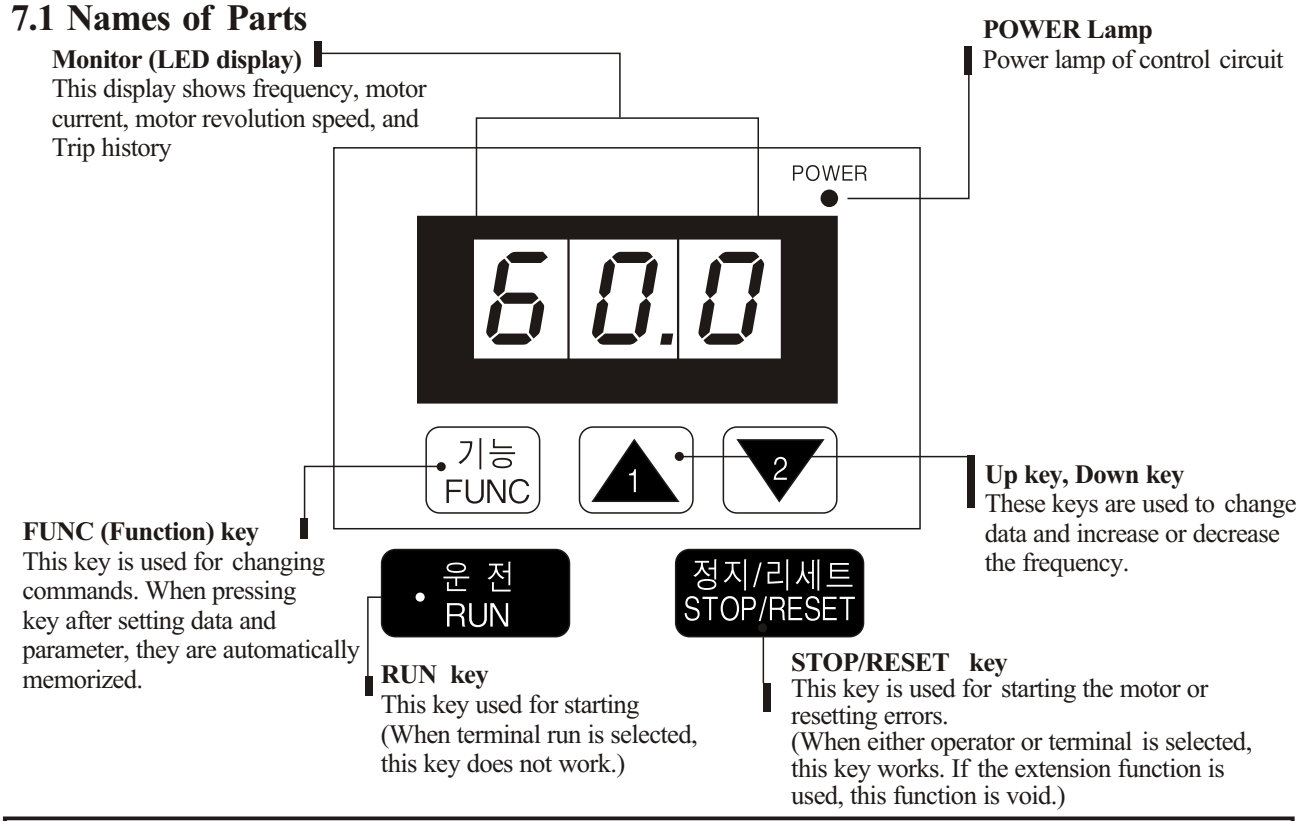
How to return to the initialization (state before shipment)

When returning the equipment to the initial state set at factory before shipment for some reason, see page 7-14

7. OPERATION OF THE DIGITAL OPERATOR

The standard type digital operator is modified so as to be used easily by minimizing key operations. Data can be set simply.

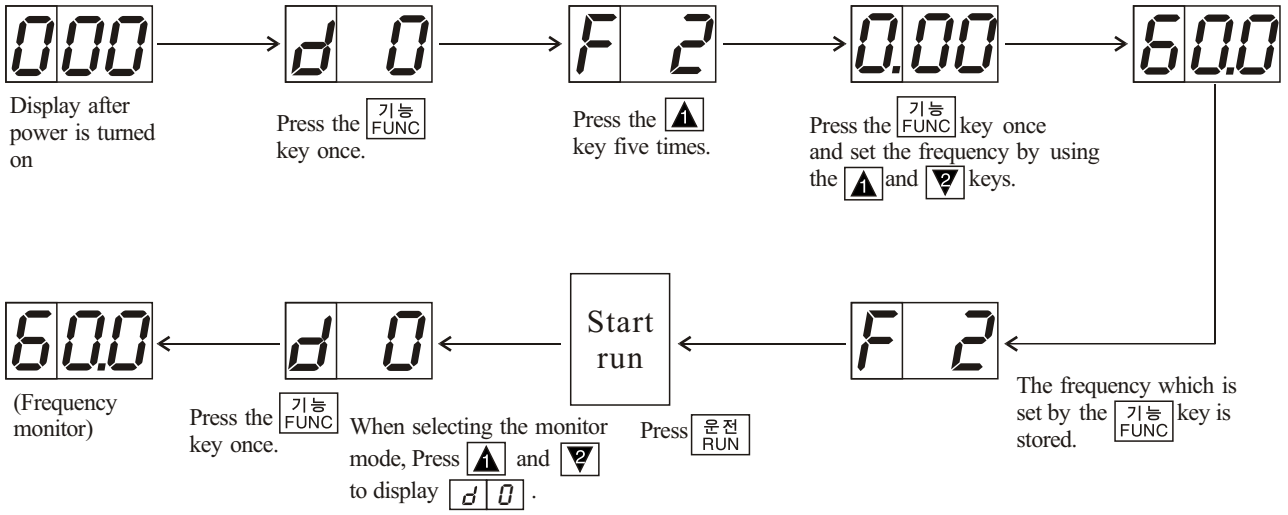
7.1 Names of Parts



WARNING

- The STOP/RESET key works only when a function is set. Prepare an emergency switch separately. The use of the STOP/RESET key as an emergency switch may cause an injury.

7.2 Operation Procedure
(Example that the frequency is set and the equipment starts running)

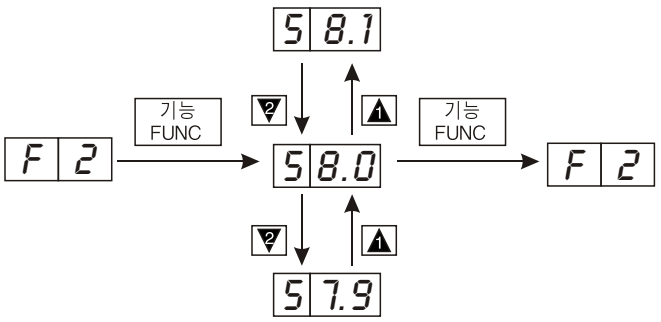


7.3 Key Description

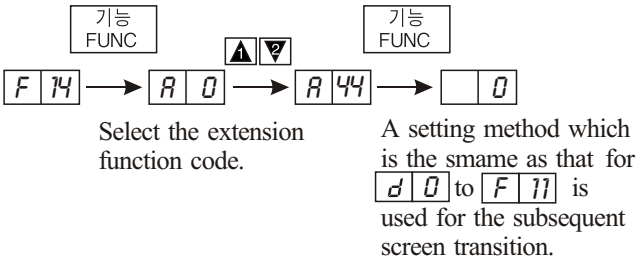
▲ ▼ (Data display / Code display / UP/DOWN key)

The key are used to select the code and change the data. When the ▲ key is pressed once, the monitor mode d 0 is displayed first and then d 1, d 2, d 11,… are one by one. If the ▲ key is pressed once again when F 14 is displayed, the display is returned to d 0.
If an optional code is selected when F 14 is displayed and the 기능 FUNC key is pressed, the extension function mode can be selected.

기능 FUNC [Function key] … This key allows the selection of commands and memorizes parameters. When this key is pressed once in the state of d 0, F 11 , the data state is set. When the key is pressed once in the state of F 14 the extension function code selection state is set.



d 0 ~ F 11 screen transition



F 14 screen transition

운전 RUN [RUN key] … This key starts the run.
The set value of F4 determines a forward run or a reverse run.

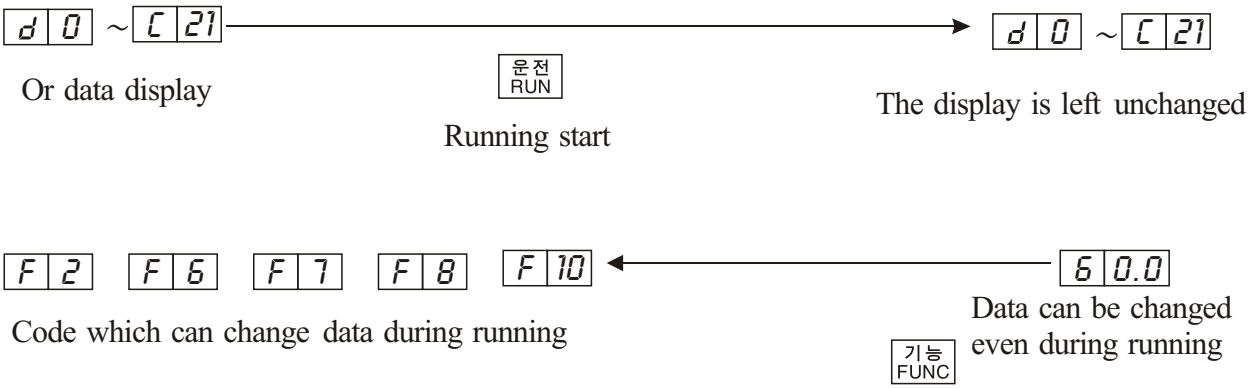
정지/리세트 STOP/REST [STOP/RESET key] … This key stops the run.
When a trip occurs, this key becomes the reset key.

7.4 Explanation of Screen Display

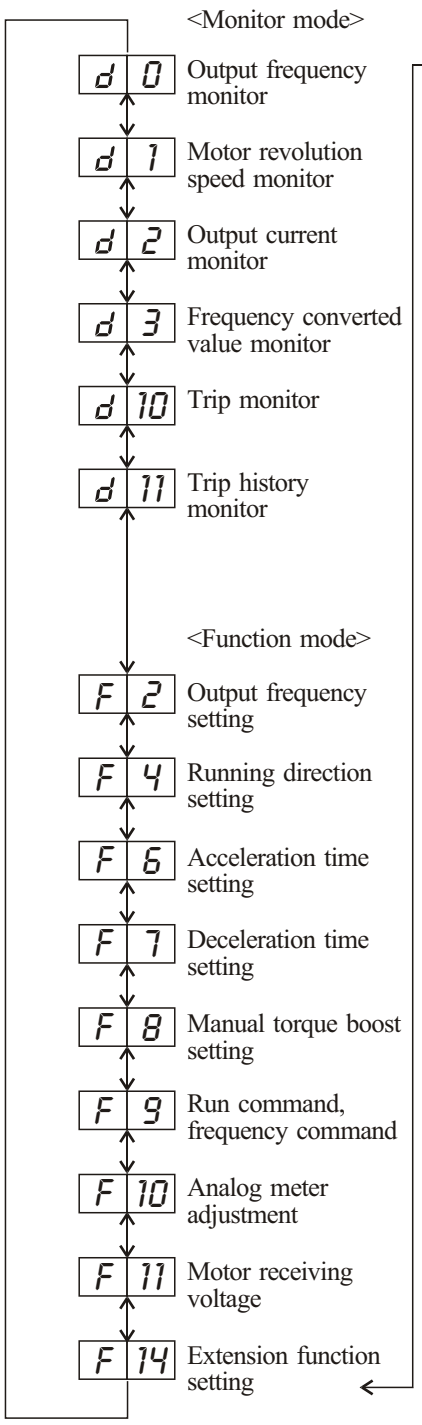
- When the inverter is turned on, the latest display appears. However, when the display unit for data of the commands F2 to F14 is turned off, the commands (F2 to F14) are displayed. (d10 and d11 excluded)

- Data during running in any function mode or extension function mode can be displayed. Even if data cannot be changed during running, data can be monitored.

- In each of the function modes [F 2], [F 6], [F 7], [F 8] and [F 10] data can be changed even during running. In other function modes and extension function mode, data cannot be set during running.



7.5 Transition of Each Code



When the 기능 FUNC key is pressed once to set the extension function, the screen is changed to the extension function code selection screen. When a code is selected from the codes A 0 to C 21 and the 기능 FUNC key is pressed, the screen is changed to the relevant extension function setting screen.

To extension function code setting

<Extension function mode>

A 0	Control method setting	A 58	Reduced voltage soft start setting
A 1	Motor capacity setting	A 59	Running mode selection
A 2	Motor poles setting	A 61	Jogging frequency setting
A 3	Speed control response constant setting	A 62	Base frequency setting
A 4	Start frequency adjustment	A 63	Maximum frequency setting
A 5	Maximum frequency limiter setting	A 64	Maximum frequency selection
A 6	Maximum frequency limiter setting	A 80	Frequency command/output frequency adjust(O-L terminal)
A 7	Jump frequency setting 1	A 81	Frequency command/output frequency adjust(OI-L terminal)
A 8	Jump frequency setting 2	A 86	Selection of reset terminal performance
A 9	Jump frequency setting 3	A 90	P gain setting of PID function
A 10	Carrier frequency setting	A 91	I gain setting of PID function
A 11	Frequency command sampling frequency setting	A 92	D gain setting of PID function
A 12	Multi speed first speed setting	A 94	Selection of PID function
A 13	Multi speed second speed setting	A 95	Setting method of PID reference value
A 14	Multi speed third speed setting	A 96	Setting of PID reference value
A 23	Electronic thermal level adjustment	A 97	Auto tuning setting
A 24	Electronic thermal characteristic selection	A 98	Motor data selection
A 25	Motor pole number setting for motor speed monitor	A 99	Ro-To option selection
A 26	External frequency setting start	C 0	Input terminal setting 1
A 27	External frequency setting end	C 1	Input terminal setting 2
A 34	Instantaneous restart selection	C 2	Input terminal setting 3
A 38	Dynamic braking usage ratio	C 3	Input terminal setting 4
A 39	Optional arrival frequency for acceleration	C 4	Input terminal setting 5
A 40	Optional arrival frequency for deceleration	C 5	Input terminal setting 6
A 44	Monitor signal selection	C 6	Input terminal setting 7
A 47	Frequency converted value setting	C 7	Input terminal setting 8
A 48	Analog input selection	C 10	Output terminal setting 11
A 49	Frequency arrival signal output method	C 11	Output terminal setting 12
A 54	Restarting after FRS signal selection	C 20	Input terminal a and b contact setting
		C 21	Output terminal a and b contact setting

7.6 Digital Operator Initialization List

(1) Monitor mode, function mode

- The standard set value of each code number is displayed.
- The extension functions shown on page 7-6 can be set by the F 14 extension function setting function.

Display order	Function name	Type	Screen display			Initial value	Settable for 2nd function	Set value
			Code display	Settable during running	Monitor/set value			
1	Output frequency monitor	Monitor	d0	–	0.00-9.99/10.0-99.9/100-400	–	–	
2	Motor revolution speed monitor	Monitor	d1	–	0.00-9.99/10.0-99.9/100-600	–	–	
3	Output current monitor	Monitor	d2	–	0.0-999	–	–	
4	Frequency converted value monitor	Monitor	d3	–	0.00-9.99/10.0-99.9/100.-999. 100-999/ ⌐10- ⌐39	–	–	
5	Trip Monitor	Monitor	d10	–	–	–	–	
6	Trip history monitor	Monitor	d11	–	–	–	–	
7	Output frequency setting	Set value	F2	∨	0.00-9.99/10.0-99.9/100-400	0.00	∨	
8	Running direction setting	Set value	F4	Not possible	F/r(forward run/reverse run)	F	–	
9	Acceleration time setting 1	Set value	F6	∨	0.01-9.99/10.0-99.9/100-999	30.0	∨	
10	Deceleration time setting 1	Set value	F7	∨	0.01-9.99/10.0-99.9/100-999	30.0	∨	
11	Manual torque boost setting	Set value	F8	∨	00-99	11	∨	
12	Run command, frequency command setting	Set value	F9	Not possible	00-15 NOTE 1	03	–	
13	Analog meter adjustment	Set value	F10	∨	00-250	172	–	
14	Motor receiving voltage	Set value	F11	Not possible	380-460 NOTE 2	440	–	
15	Extension function setting	Set value	F14	Not possible	A 0-A99/C 0-C21	A 0	–	

NOTE 1 : In the standard configuration, four values from 0 to 3 can be selected. When an optionsl PC board is mounted, 16 values from 0 to 15 can be selected. Refer to F-9.
For the 200V class, one of 200, 215, 220 and 230 can be selected

NOTE 2 : For the 400V class, one of 380, 400, 415, 440 and 460 can be selected.

(2) Extension function mode

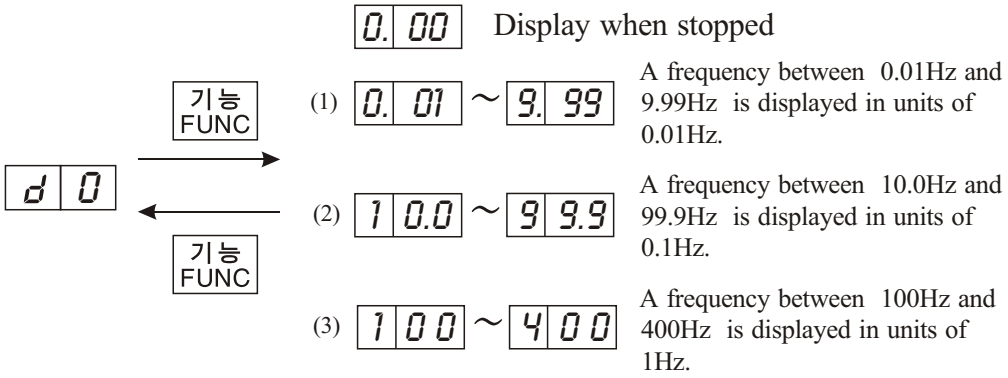
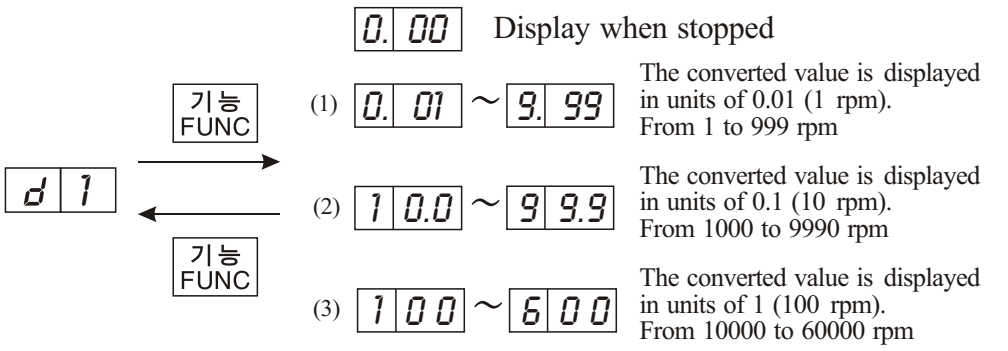
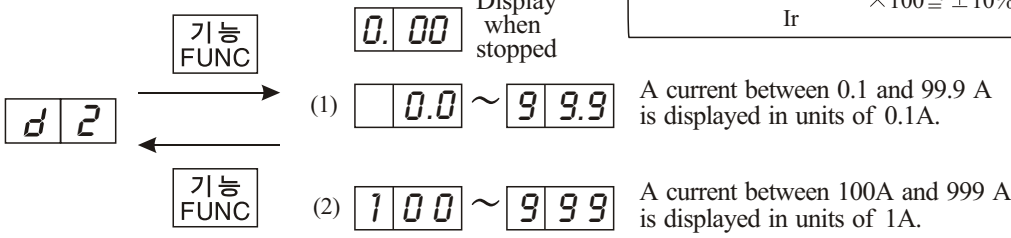
- Each function name and settable range to the extension function mode are shown below.
- Set the extension code to be changed by [F][14] .

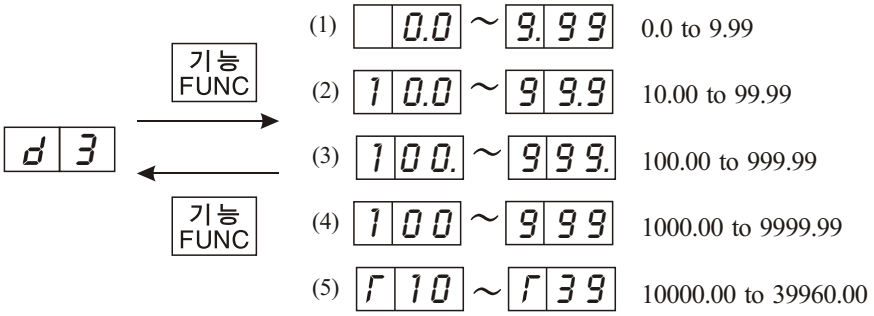
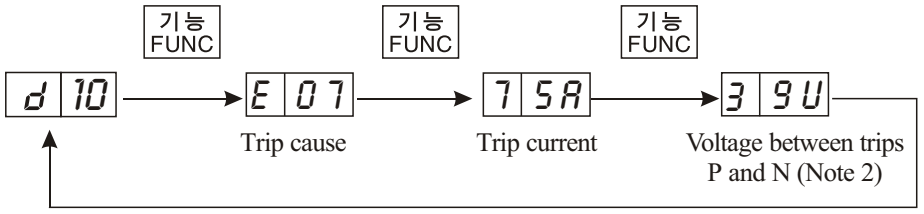
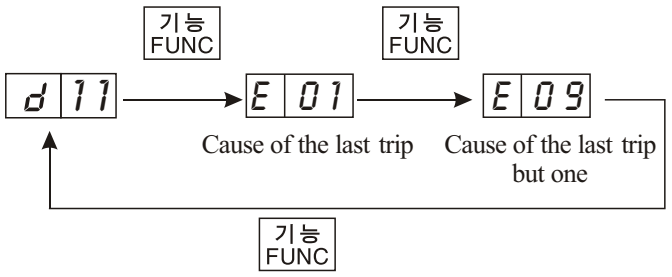
Display order	Externsion function name	Screen display				Settable for 2nd function	Remarks	Set value
		Code display	Settable during running	Setting range	Initial value			
1	Control method setting	A 0	—	0-5	0	V		
2	Motor capacity setting	A 1	—	0.75 to 220		V	Note 1	
3	Motor poles setting	A 2	—	2/4/6/8	4	V		
4	Speed control response constant setting	A 3	—	0.00-9.99/10.0-99.9/100	2.00	V		
5	Start frequency adjustment	A 4	—	0.10-9.99	0.50	—		
6	Maximum frequency limiter setting	A 5	—	0-120(400)	0	—		
7	Minimum frequency limiter setting	A 6	—	0-120(400)	0	—		
8	Jump frequency setting 1	A 7	—	0-400	0	—		
9	Jump frequency setting 2	A 8	—	0-400	0	—		
10	Jump frequency setting 3	A 9	—	0-400	0	—		
11	Carrier frequency setting	A10	—	2.0-16.0	(16.0)	—	See 7-18	
12	Frequency command sampling frequency	A11	—	1-8	8	—		
13	Multispeed first speed setting	A12	—	0-120(400)	0	—		
14	Multispeed second speed setting	A13	—	0-120(400)	0	—		
15	Multispeed third speed setting	A14	—	0-120(400)	0	—		
16	Electronic thermal level adjustment	A23	—	20-120	100	V		
17	Electronic thermal characteristic selection	A24	—	0-2	0	V		
18	Motor pole number setting for motor speed monitor	A25	—	2 to 48	4	—		
19	External frequency setting start	A26	—	0-120(400)	0	—		
20	External frequency setting end	A27	—	0-120(400)	0	—		
21	Instantaneous restart selection	A34	—	0-3	0	—		
22	Dynamic braking usage ratio	A38	—	0.0-99.9/100	(1.5)	—	See 7-21	
23	Optional arrival frequency for acceleration	A39	—	0-400	0	—		
24	Optional arrival frequency for deceleration	A40	—	0-400	0	—		
25	Monitor signal selection	A44	—	0-3	0	—		
26	Frequency converted value setting	A47	—	0.0-99.9	1.0	—		
27	Analog input selection	A48	—	0-1	1	—		
28	Frequency arrival signal output method	A49	—	0-2	0	—		
29	Restarting after FRS signal selection	A54	—	0-1	1	—		
30	Reduced voltage soft start setting	A58	—	0-6	6	—		
31	Running mode selection	A59	—	0-2	0	—		
32	Jogging frequency setting	A61	—	0-9.99	1.00	—		
33	Base frequency setting	A62	—	30-120(400)	60	V	Frequencies below the start frequency cannot be set	
34	Maximum frequency setting	A63	—	30-120(400)	60	V		
35	Maximum frequency selection	A64	—	120/400	120	—		
36	Frequency command/output frequency adjust(O-L terminal)	A80	—	0-255	—	—	Note 2	
37	Frequency command/output frequency adjust(OI-L terminal)	A81	—	0-255	—	—	Note 2	
38	Selection of reset terminal performance	A86	—	0, 1	0	—		
39	P gain setting of PID function	A90	—	0.1-0.5	1.0	—		
40	I gain setting of PID function	A91	—	0.0-15.0	1.0	—		
41	D gain setting of PID function	A92	—	0.0-100	0.0	—		
42	Selection of PID function	A94	—	0-4	0	—		
43	Setting method of PID reference value	A95	—	0, 1	0	—		
44	Setting of PID reference value	A96	—	0.00-200	0.00	—		
45	Auto tuning selection	A97	—	0-2	0	—		
46	Motor data selection	A98	—	0-2	1	V		
47	Ro-To option selection	A99	—	0-1	0	—		
48	Input terminal setting 1	C 0	—	0-3, 5-9, 11-16, 18-28	18	—		
49	Input terminal setting 2	C 1	—	0-3, 5-9, 11-16, 18-28	16	—		
50	Input terminal setting 3	C 2	—	0-3, 5-9, 11-16, 18-28	5	—		
51	Input terminal setting 4	C 3		0-3, 5-9, 11-16, 18-28	11	—		
52	Input terminal setting 5	C 4	—	0-3, 5-9, 11-16, 18-28	9	—		
53	Input terminal setting 6	C 5	—	0-3, 5-9, 11-16, 18-28	2	—		
54	Input terminal setting 7	C 6	—	0-3, 5-9, 11-16, 18-28	1	—		
55	Input terminal setting 8	C 7	—	0-3, 5-9, 11-16, 18-28	0	—		
56	Output terminal setting 11	C10	—	0-2	0	—		
57	Output terminal setting 12	C11	—	0-2	1	—		
58	Input terminal a and b contact setting	C20	—	00-FF	00	—		
59	Output terminal a and b contact setting	C21	—	00-07	00	—		

NOTE 1 : The most applicable motor capacity of the inverter is set.
NOTE 2 : The initial setting of each inverter is adjusted when shipping from the works.

7.7 Explanation of Modes

(1) Monitor mode contents

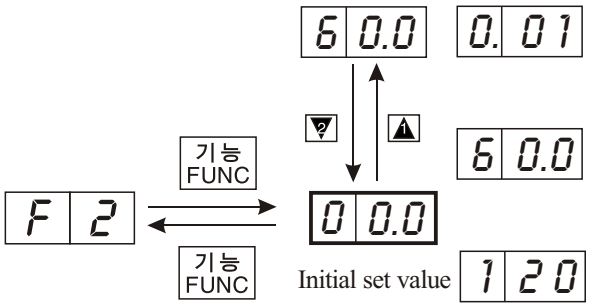
Monitor mode contents	Contents and display
d 0 **Output frequency monitor**	The frequency outputted by the inverter is monitored. The display is as shown below. 
d 1 **Motor rotation speed monitor**	The rotational frequency converted value of the frequency outputted by the inverter is displayed. (Note that the value is not the real rotational frequency of the motor.) The converted value is displayed as shown below using "rotational frequency/100."  NOTE: Motor pole number can set by A 25
d 2 **Output current monitor**	The current outputted by the inverter is monitored. The display is as shown below ● The output display accuracy is about ±10%. ● Inverter output current : IM Monitor display current : IM' Rated current of the inverter : Ir $\frac{IM' - IM}{Ir} \times 100 \leqq \pm 10\%$ 

Monitor mode contents	Contents and display
d3 **Frequency converted value monitor**	The product of the value of frequency converted value setting (A47) and that of output frequency (d0) is displayed on the monitor. 
d10 **Trip monitor**	When a trip occurs, the cause of the trip is displayed in this code. As a general display, the contents of the latest trip are displayed. Whenever the 기능 FUNC key is pressed, the content of each is displayed.  **NOTE 1 :** When there is no trip, _ _ _ is displayed. **NOTE 2 :** The above example of the voltage between P(+) and N(-) indicates 390 to 399V. **NOTE 3 :** When the 정지/리세트 STOP/REST key is pressed after a trip occurs, 0.00 is displayed.
d11 **Trip history monitor**	The causes of the last trip and the last trip but one are displayed. When the command is displayed and the 기능 FUNC key is pressed, the trip cause is displayed.  **NOTE 1 :** When there is not a trip, history, _ _ _ is displayed. **NOTE 2 :** How to delete trip history data See page 7-14.

(2) Function mode

Monitor mode contents	Contents and display
F 2 **Output frequency setting**	Methods for setting the output frequency are as follows : 1. Digital operator ---------- Refer to this setting. 2. Control circuit terminal ---------- Refer to this setting. (multistage speed command) 3. External analog input ---------- Refer to page 6-2. (o to 10V, 0 to 5V, 4 to 20mA) 4. Remote operator ---------- Refer to the explanation of each remote operator. (new type, general purpose) 5. Optional PCB ---------- Refer to each optional PCB operation.

(1) Setting from the digital operator



A frequency between 0.01Hz and 9.99Hz is set in units of 0.01Hz.

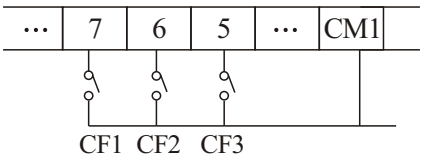
A frequency between 10.0Hz and 99.9Hz is set in units of 0.1Hz.

A frequency between 100Hz and 400Hz is set in units of 1Hz.

When the ▲ or ▼ key is pressed continuously, the value is changed continuously.

(2) Setting from the control circuit terminal (multispeed setting)
The output frequency at the multispeed can be set as specified below. When the running mode is the process stepping mode, switch it to the multistage speed mode by the remote operator.

① Connect the multispeed terminal for setting the frequency to CM1.
(The relationship between multispeeds 1 to 7 and the control circuit terminals is as shown below.)



Example of terminal connection for source type
Refer to page 5-5.

Multispeed	Control circuit terminal		
	1	2	3(*1)
Multispeed 1	ON	OFF	OFF
Multispeed 2	OFF	ON	
Multispeed 3	ON	ON	
Multispeed 4	ON	OFF	ON
Multispeed 5	OFF	ON	
Multispeed 6	ON	ON	
Multispeed 7	OFF	OFF	

*1: By initialization, the multispeed can be set up to the third stage. When CF3 is set by terminal allocation (in this case, intelligent input terminal 5 is allocated), up to the 7th stage can be set (set by the extension function mode C4).
Intelligent input terminal allocation: C0 to C7
Set value : 3(CF3)

② Set an optional output frequency using the ▲ or ▼ key.

③ Press the 기능 FUNC key once to store the set output frequency.

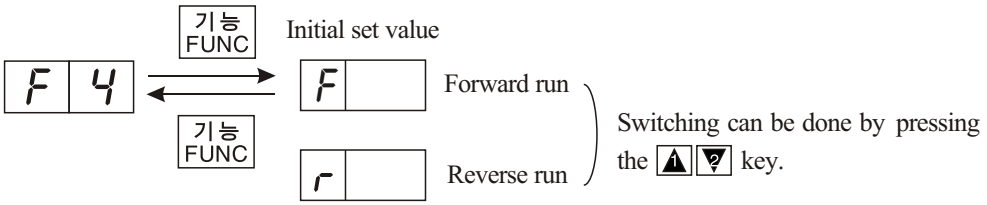
NOTE 2 : F 2 is displayed.

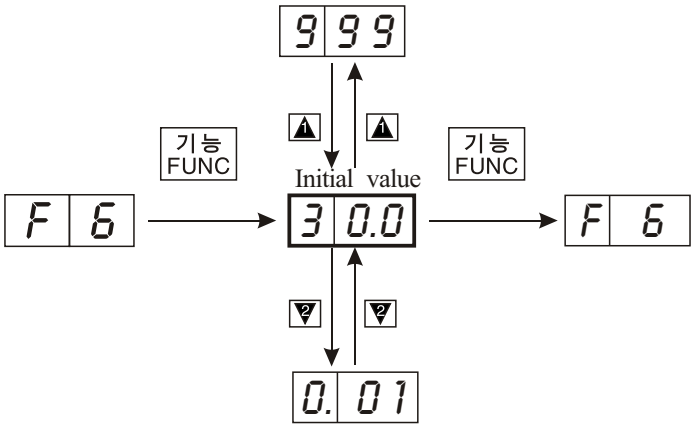
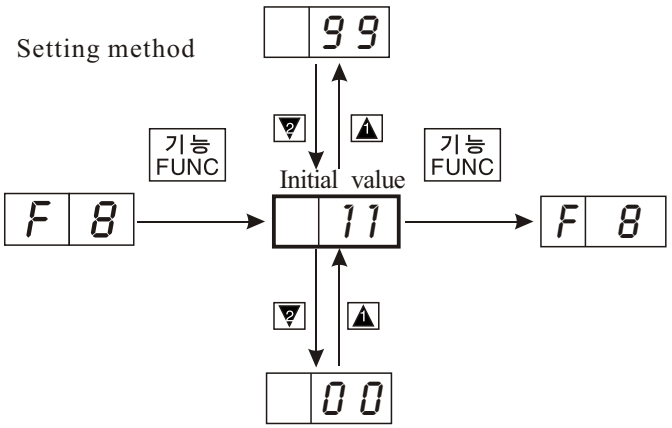
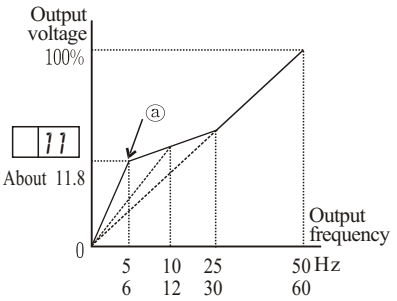
④ Press the ▲ key once. (Check whether the output frequency, which is set, is displayed.)

⑤ By repeating (1) to (4), the output frequency in the multispeed mode can be set.

NOTE 3 : Whenever any data is changed, be sure to press the 기능 FUNC key before starting the next setting.
Note that when the 기능 FUNC key is not pressed, the data will not be set.

NOTE 4 : When setting to over 120Hz, the changing over maximum frequency is necessary.
Remote operator or copy unit must be used
(When the value is switched to 400 by F-30, an output frequency of up to 400 Hz can be set.)

Monitor mode contents	Contents and display
F 4 **Running direction**	Set the motor direction. Set the motor direction when running by pressing the [운전 RUN] key. **NOTE :** The setting during run is impossible. 

Monitor mode contents	Contents and display
F 6 F 7 **Acceleration time 1 and 2 Deceleration time 1 and 2**	These commands set and display Acc. time (F 6) and Dec. time (F 7).  ・Acceleration time 2 and deceleration time 2 are set when CH1 is connected with CM1. ・When a time of more than 1,000 seconds is set by the remote operator, _ _ is displayed on the digital operator.
F 8 **Manual torque boost setting**	Set torque boost ・Motor torque can be adjusted to increase the output voltage when the starting torque is not sufficient in V/F control. Pay attention not to cause the motor to burnout and an inverter trip. ・Setting is effective only when V/F control is selected. Setting method   (V-Boost F 20.0% is set with the remote operator.) With the remote operator (DOP, DRW, HOP, or HRW), point ⓐ in the torque boost graph can be changed within the range of 0% to 50% with reapect to the base frequency.

Monitor mode contents	Contents and display

F 9

Run comm-anding method

Frequency comm-anding method

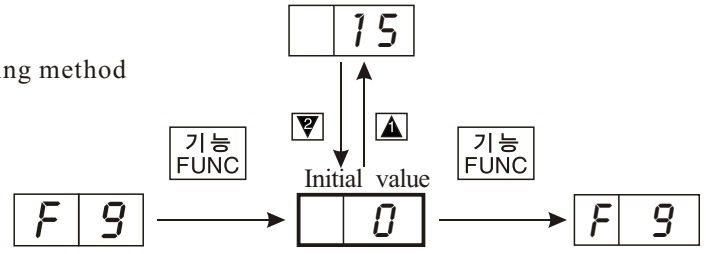
Switching the run command and frequency command setting modes

Set the run command and frequency command sending destinations. The standard specification selection range is from 00 to 03.

Initial value →

Set value	Run command to	Frequency command to
00	Digital operator	Digital operator
01	Digital operator	Terminal block
02	Terminal block	Digital operator
03	Terminal block	Terminal block
04	Digital operator	Option 1
05	Option 1	Digital operator
06	Option 1	Option 1
07	Digital operator	Option 2
08	Option 2	Digital operator
09	Option 2	Option 2
10	Terminal block	Option 1
11	Option 1	Terminal block
12	Terminal block	Option 2
13	Option 2	Terminal block
14	Option 1	Option 2
15	Option 2	Option 1

Setting method



NOTE1 : The run command and frequency command sending destinations can be set to any of the terminal, operator, option 1, and option 2. Select the relevant set value.

NOTE2 : When option 1 or option 2 is selected for "Run command to" and "Frequency command to," the digital operator and terminal block cannot issue commands. Set option 1 or option 2 (set values 04 - 15) only for operation or frequency commands from the optional PC board.

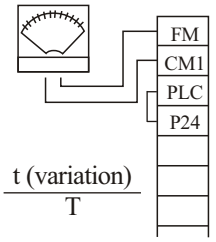
Monitor mode contents	Contents and display

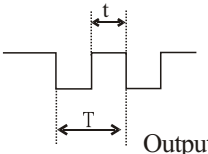
F 10

Analog meter adjust-ment

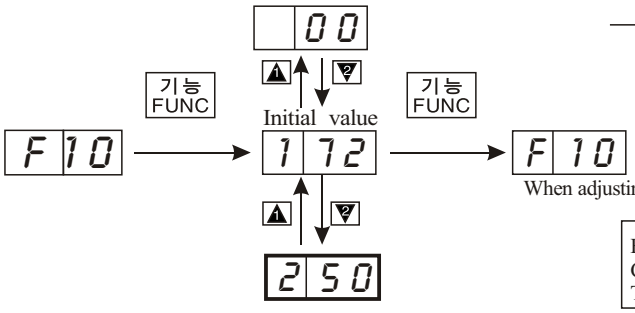
Adjust the analog meter connected to the frequency monitor terminal. (Initial setting of the [FM] terminal: Analog frequency monitor) When operation starts, t/T output between FM and CM1 terminals is proportional to the output data. Adjust the meter so that it indicates the maximum point when the output is at the maximum.

(Source type wiring Refer page 5-3)





$$\text{Output} = \frac{t\ (\text{variation})}{T}$$



When adjusting the analog meter furthermore, repeat the same operation.

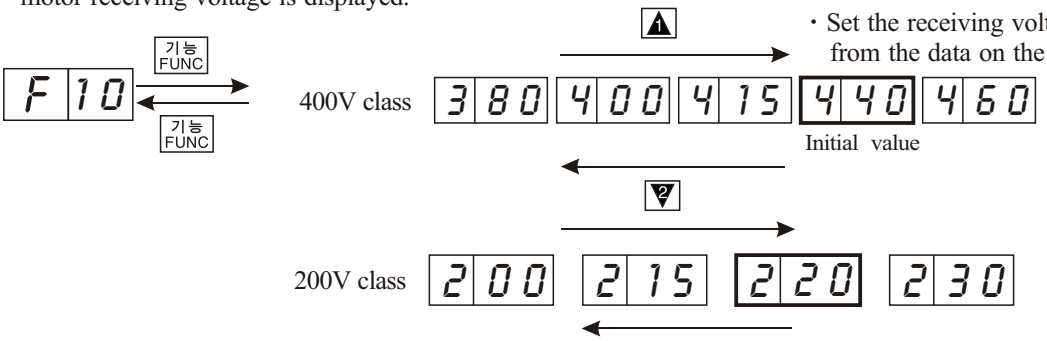
Maximum level of analog meter
Frequency monitor : (A63 maximum frequency setting)
Current monitor : (200% of inverter rated current)
Torque monitor : (200% of rated torque)

NOTE 1 : This function is valid only when the analog monitor is used. (Freqency monitor, current monitor, torque monitor)
NOTE 2 : The adjusted value when the input terminal STN (initialization) is used is the initial value.

F 11

Motor receiving voltage setting

・Set the motor receiving voltage. When the 기능 FUNC key is pressed once, the current set value of the motor receiving voltage is displayed.

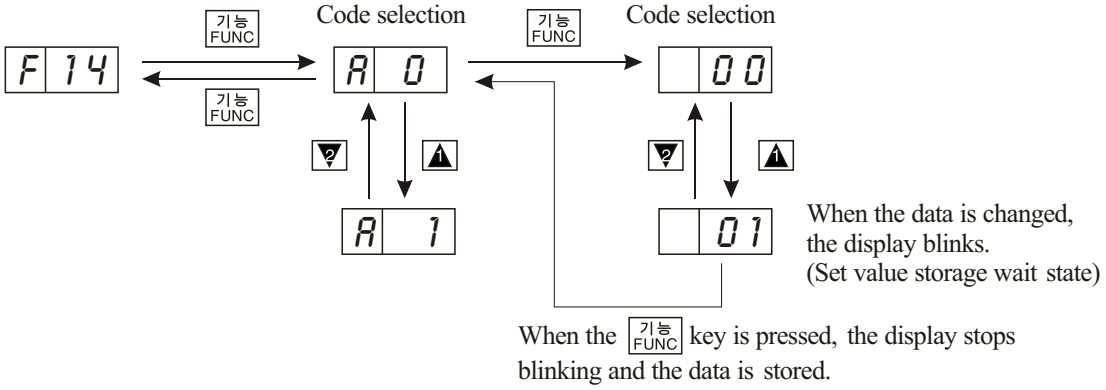


・Set the receiving voltage from the data on the left

F 14

Extension function setting

Select the item of each extension function. After setting, the display is returned to the code display.
◎After data is changed, be sure to press the 기능 FUNC key to store it.



Returning to the initialization (State set at factory before shipment)

When returning the equipment to the initial state set at factory before shipment for some reason, follow the following procedure.

(1) Allocate STN (set value [7]) to one of the input intelligent terminals.
(Use [C 1] to [C 7] in the extension function mode to set the intelligent terminals.)
(However, [C 0] cannot be used since resetting RS is initially set.)

(2) Short-circuit the STN terminal and (CM1*), then turn power off and on. (When the power is turned off, do not turn it on again until the CHARGE lamp of the logic PCB goes off.)

(3) Keep the STN terminal open for more than 6 seconds. (When keying, resetting, or turning power off is performed within 6 seconds, the equipment may not be initialized.)

(4) Turn the power off after more than 6 seconds. (When the power is turned off within 6 seconds, the equipment may not be initialized.)

How to Delete Trip History Data ([d 10] , and [d 11])

To delete trip history data for some reason, follow the instructions shown below using the remote operator (DOP or HOP) or copy unit (DRW or HRW).

1. Using the remote operator (DOP-OA) or copy unit (DRW-OA)

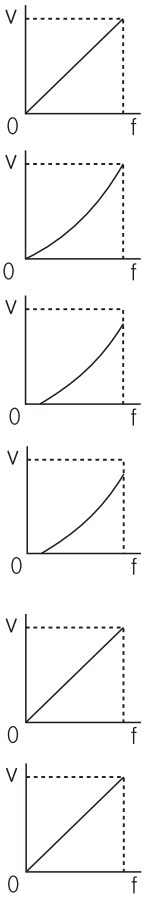
(1) Display [INIT TCNT] (trip history count clear) or the function mode initial setting [F-38 INIT] .
(2) Move the cursor to beneath the initiasl set values. Select CLR and store it.
(3) Turn the power off once and then turn it on. or close the reset terminal RS-(CM1*) for approx. a second. By this, trip history data is delected.
(4) When trip history is deleted, data of [F-38] is set to [CNT]. Trip counting restarts.

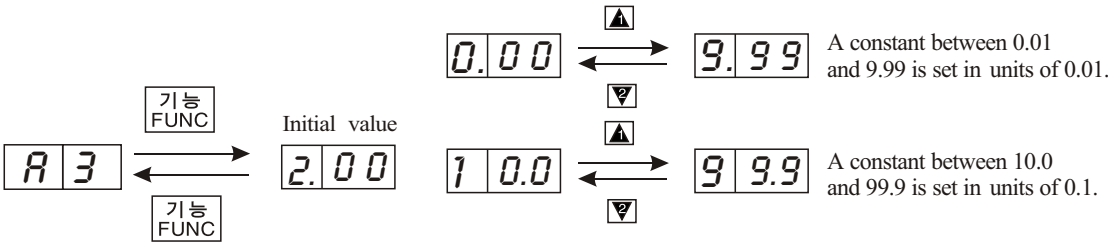
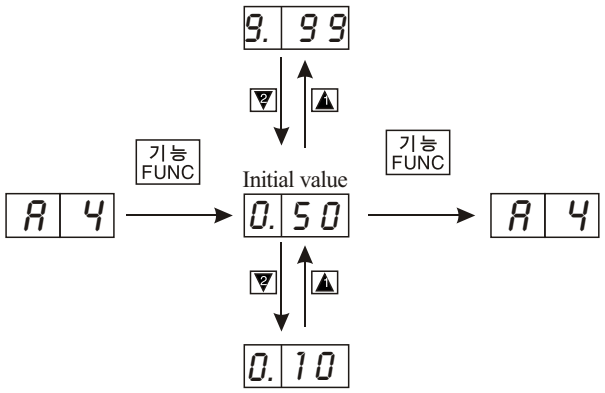
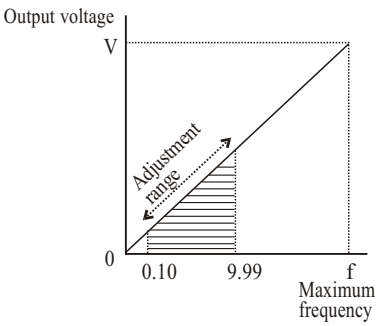
2. Using high-performance remote operator (HOP-OJ) or high-performance copy unit(HRW-OJ)

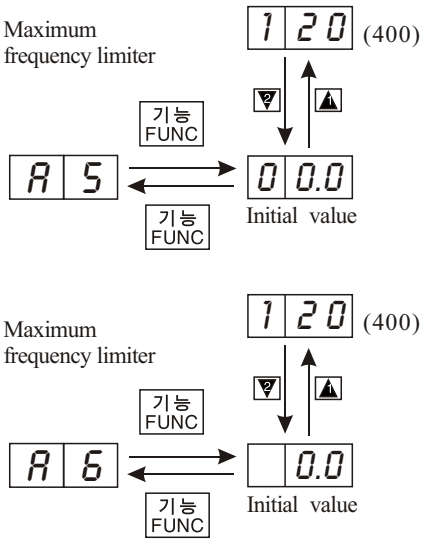
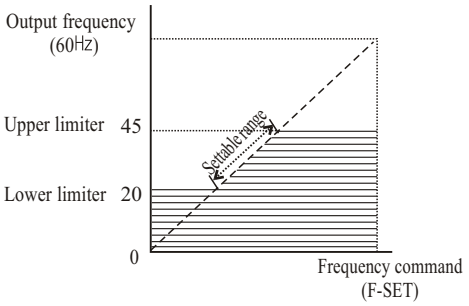
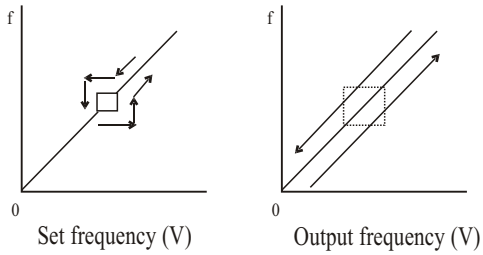
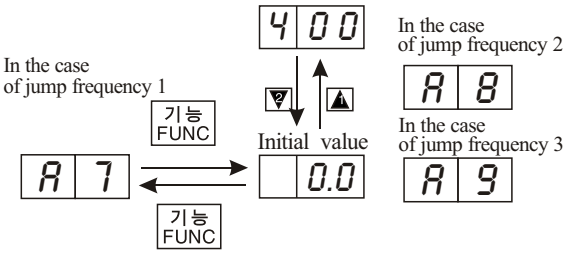
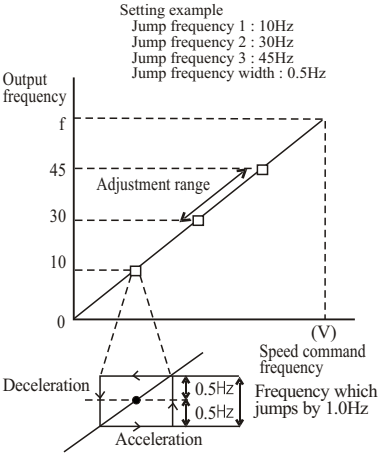
(1) Display [TCNT 0: CNT] (trip history count clear) or the function mode initial setting [2-1 INIT].
(2) Enter a count clearing value [0: CLR] from the 10-key pad.
(3) Turn the power off once and then turn it on. or close the reset terminal RS-(CM1*) for approx. a second. By this, trip history data is deleted.
(4) When trip history is deleted, data of [2-1 INIT] is set to [CNT]. Trip counting restarts.

NOTE : Symbols * are indicated for Sink type wiring.

(3) Extension function mode contents

Monitor mode contents	Contents and display
A 0 **Control method setting**	Set the control method. Select one of the following control codes. 기능 FUNC A 0 기능 FUNC Initial set value 0 ---- V/f control (VC) Constant torque characteristics 1 ---- V/f control (VP1) Reduced torque characteristics, 1.5 power 2 ---- V/f control (VP2) Reduced torque characteristics, 1.7 power 3 ---- V/f control (VP3) Reduced torque characteristics, 2.0 power 4 ---- Sensorless vector control (SLV) 5 ---- Vector control with sensor (V2) **NOTE :** Vector control INV only (Feedback board is nesessary) 
A 1 A 2 **Motor capacity, motor pole count setting**	Set the motor capacity and number of motor poles according to the motor to be used. The maximum rating of the applicable 4-pole motor for each inverter is set initially. Motor capacity No. Of motor poles A 1 기능 FUNC 1 1.0 7.5 0 5.5 0 3.7 0 A 2 8 6 Initial value 4 2 **NOTE:** When the data does not match that of the motor, satisfactory characteristics may not be obtained during the sensorless vector running. The full performances may not be demonstrated if the rating of a motor used is tow or less than the maximum applicable rating when the sensor-less vector function is used. The sensor-less vector operation is disabled when two or more motors are running. Set this data properly according to the motor used if its rating is not the same as the maximum applicable rating in V/f operation.

Monitor mode contents	Contents and display
A 3 **Speed Control response constant setting**	Set the response speed (ASR system gain) between the inverter and motor. When increasing or decreasing the current motor response speed, adjust the ASR system gain. When the set value is decreased, the response speed is increased. When the set value is increased, the response speed is decreased. 
A 4 **Start frequency adjustment**	Set the frequency for starting output of the inverter. Set a frequency between 0.1Hz and 9.99Hz in units of 0.01Hz.   When the start frequency is increased, the acceleration or deceleration time is decreased.

Monitor mode contents	Contents and display
A5 A6 **Frequency upper, lower limiter**	Set the limits of frequency setting within the A4 start frequency adjustment range and A63 maximum frequency setting range. When a value beyond the limits is inputted from the operator, it will not be stored. Even if a value beyond the limits is inputted as external analog input, the set value will not be changed.  Setting example (When an upper limit of 45Hz and a lower limit of 20Hz are set)  **NOTE :** Setting conditions 0Hz or upper limit ≥ lower limit When 0 Hz is set, the limiters will not operate.
A7 A8 A9 **Jump frequency setting 1** **Jump frequency setting 2** **Jump frequency setting 3**	To avoid a resonance with the load, the frequencies at up to 3 points can be jumped. The setting order and the execution order may be changed. The frequency equivalent to the jump frequency setting width (±0.5Hz) (Note1) cannot be set as a jump frequency. **NOTE 1 :** The jump frequency can be set by the remote operator. **NOTE 2 :** As to the frequencies which are set by the jump frequency setting function, the set frequencies are jumped but the output frequencies pass.   

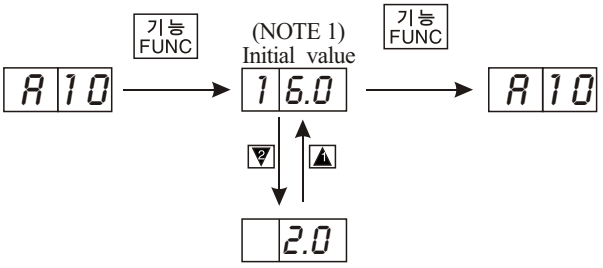
Monitor mode contents	Contents and display

A 10

Carrier frequency setting

Set the switching frequency of the power module.

NOTE1: The initial value of carrier frequency varies with the inverter capacity



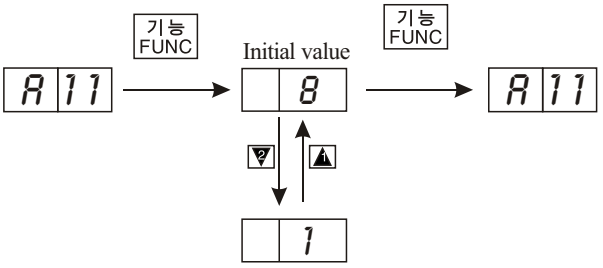
Carrier frequency initial value

Applicable Inverter(kw)	Carrier frequency(kHz)
1.5～15	16.0
22	12.0
30～37	10.0
45～55	6.0
75～110	3.0
132～220	2.0

A 11

Frequency command sampling frequency setting

Set the frequency commands (voltage frequency command (O-L terminal signal), current frequency command (OI-L terminal signal), and the number of samplings.



NOTE : How to set

- 1 : The number of samplings is set to 1. The reaction time becomes shorter, but the output frequency becomes likely to vary.
- 8 : The number of samplings is set to 8. The reaction time becomes longer, but the output frequency becomes stable.

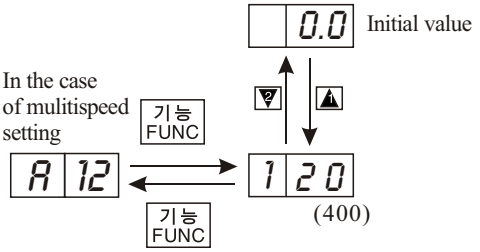
A 12
A 13
A 14

Multispeed setting 1

Multispeed setting 2

Multispeed setting 3

Set the output frequency of each multispeed speed. When setting four or more speeds, refer to the item of F 2 output frequency setting.



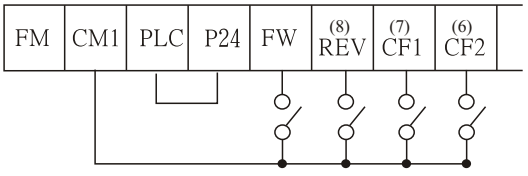
In the case of multispped setting 2

A 13

In the case of multispped setting 3

A 14

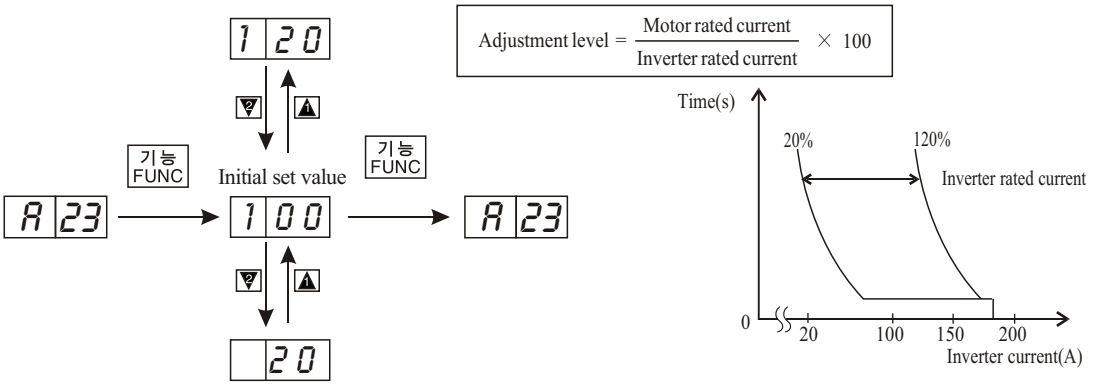
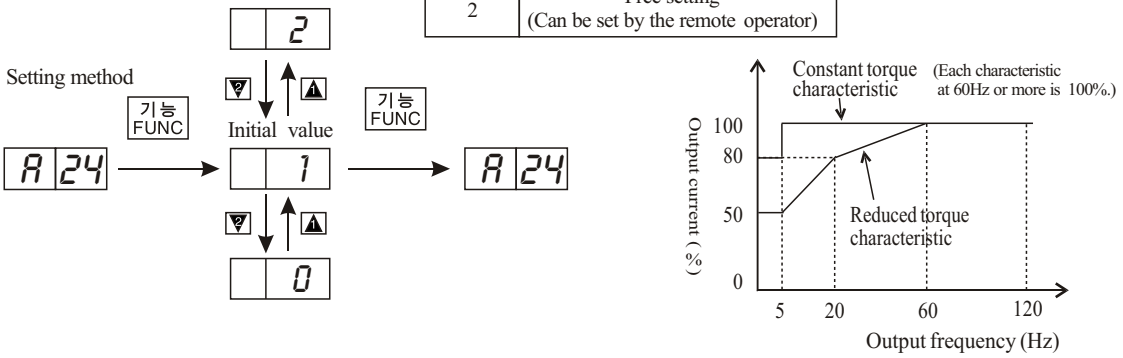
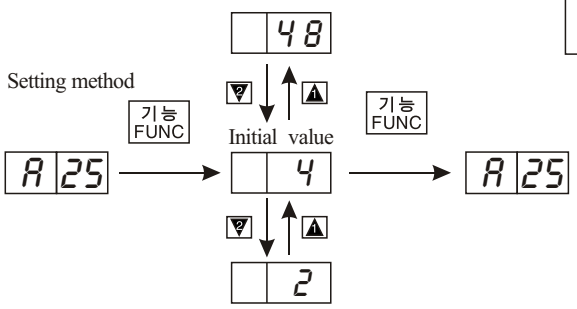
Example of the connection method for European version Refer to page 5-5.



Example of Multispeed setting

Multispeed	Control circuit terminal	
	(7)CF1	(6)CF2
Multispeed 1	ON	OFF
Multispeed 2	OFF	ON
Multispeed 3	ON	ON

NOTE: When using four or more multispeed commands, use the multispeed terminal (CF3) as an input terminal.

Monitor mode contents	Contents and display
A 23 **Electronic thermal level adjust-ment**	Set the electronic thermal level. Set the thermal level in accordance with the rated current of the motor in units of 1 (%). 
A 24 **Electronic thermal character-istic selection**	Select the electronic thermal characteristics. Set the thermal characteristics in accordance with the load to be used. For free setting of set value 2, the current and frequency can be set by each remote operator. Initial value Set value / Function: 0 Constant torque characteristic; 1 Reduced torque characteristic; 2 Free setting (Can be set by the remote operator) 
A 25 **Motor pole number setting for motor speed monitor**	Set the pole number of motor to convert output frequency into motor rotation speed on monitor mode funciton d 1 Settable numbers: 2,4,6,8,10,12,14,16,18,20,24,32,36,48 

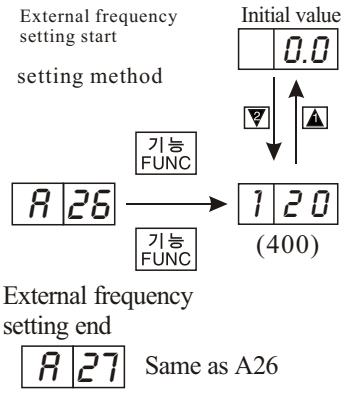
Monitor mode contents	Contents and display

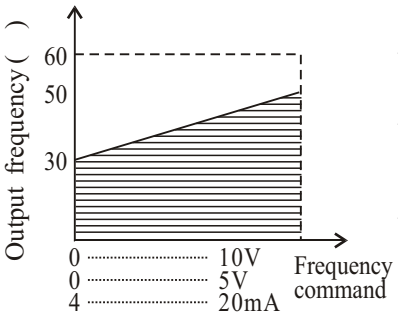
A26
A27

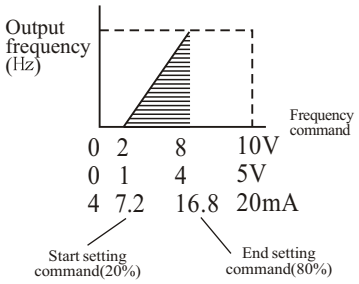
External frequency setting start

External Frequency setting end

Set the frequency for starting output for an external frequency command (0 to 10V, 0 to 5V, 4 to 20mA) and the frequency for ending output. When 0 Hz is set, this function will be canceled.







NOTE 1 : The standard setting is 0Hz. In this case, the selected V/f pattern is used for running.

NOTE2 : When changing the V/f pattern after A26(start) and A27 (end) are set, readjust A26(start) and A27 (end)

NOTE 3 : When A26(start) > A27(end) is set and the frequency command value is minimized(0V or 4mA) the output frequency may be lowered than the value which is set by A26 by 0.1 to 0.3Hz. The reason is that it is judged that there is some frequency due to noise on the signal line and it is a normal operation.

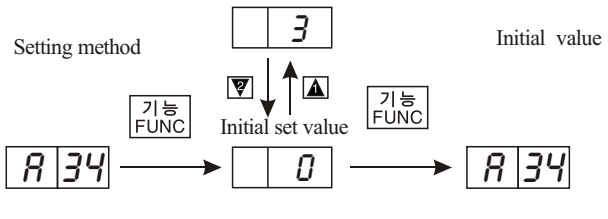
NOTE 4 : The setting shown left is also possible with F31 of the remote operator.

A34

Instantaneous restart selection

(Restart selection)

Set the inverter retry method when a power error occurs.
Select the set value of the retry method to be used.



Set value	Function
0	Alarm output after tripped
1	Deceleration stop at the time of restart
2	Frequency matching start at the time of restart (Note1)
3	0Hz start at the time of restart

NOTE1 : When the base frequency is one following ones, frequency matching may restart at 0Hz.
When the base frequency is 60Hz : Driven at 40Hz or less
When the base frequency is 50Hz : Driven at 30Hz or less
For other precautions, refer to Chapter 1, "Instantaneous stop restart" of Appendix 2.

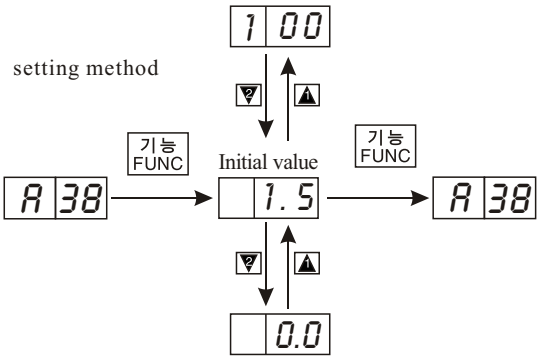
NOTE2 : Since the retry mode is selected, the equipment restarts for trips of overcurrent, overvoltage, or undervoltage.
For undervoltage, 16 retries (17th trip) are executed.
For overcurrent or overvoltage, 3 retries (fourth trip) are executed.
Do not use this function for a case that a fallen substance should be held by the machine brake when the motor is in the free-run mode.

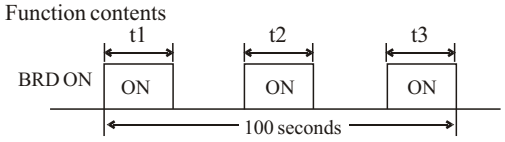
Monitor mode contents	Contents and display

A38

Dynamic braking usage ratio

Set the usage ratio(%) for 100 seconds of BRD When the BRD operation exceeds this setting the operation will be stooped.





$$T = \frac{(t1 + t2 + t3)}{100\ \text{seconds}} \quad 100$$

NOTE 1 : The internal BRD circuit is not mounted in an inverter other than the types 055HF, 055LF, 075HF and 075LF
NOTE2 : When 0% is set, the BRD will not be operated
NOTE 3 : When T exceeds the set value, the BRD will be stopped.
NOTE 4 : When mounting da external BRD unit, set the usage ration to 00 and remove the internal and external resistors.
NOTE 5 : The initial settings of 110～550LF, 110～2200HF are 0.0%
NOTE 6 : Conditions when using the external resistor are shown in the table

Inverter requiring an external resistor

200V Class

Model	055, 075LF
External resistor	17 ohm or more
Usage ratio	Max. 10(%)

400V Class

Model	055, 075HF
External resistor	70 ohm or more
Usage ratio	Max. 10(%)

NOTE 7 : This function cannot be used for the inverter types 110 to 1100HF which have no built-in BRD (dynamic braking) circuit.

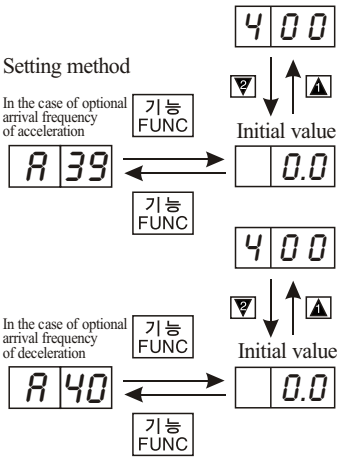
A39

A40

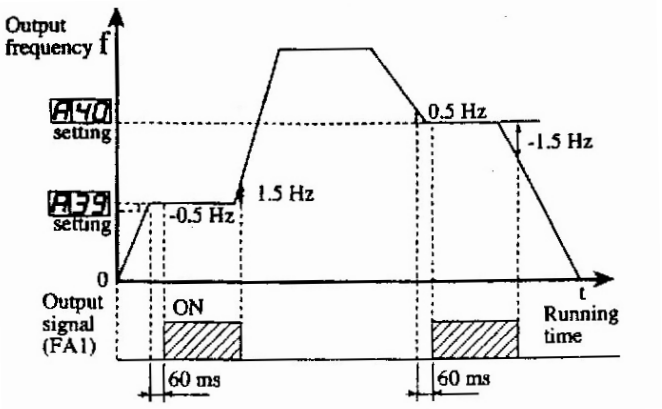
Arrival optional frequency at acceleration

Arrival optional frequency at deceleration

When A49 frequency arrival signal output method 2 is selected, an output signal is outputted at an optional frequency. When frequency arrival signal output method 1 is selected, an output signal is outputted at an optional frequency or more. For acceleration A39 and deceleration A40 , the frequency is set in units of 0.1Hz (in units of 1 Hz for 100Hz or more).



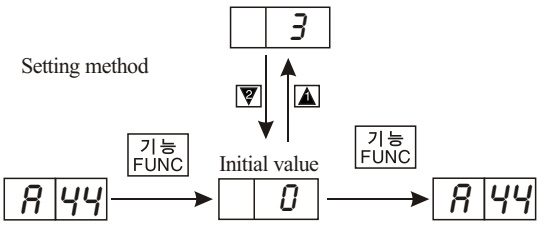
At the time of acceleration, an output signal is turned ON in a range from the set frequency -0.5 Hz to the set frequency +1.5 Hz. At the time of deceleration, an output signal is turned ON in a range from the set frequency +0.5Hz to the set frequency -1.5Hz.



Monitor mode contents	Contents and display

A44 Monitor signal selection

Select the output monitors signal at the control circuit terminal FM from the table indicated below.



Initial value

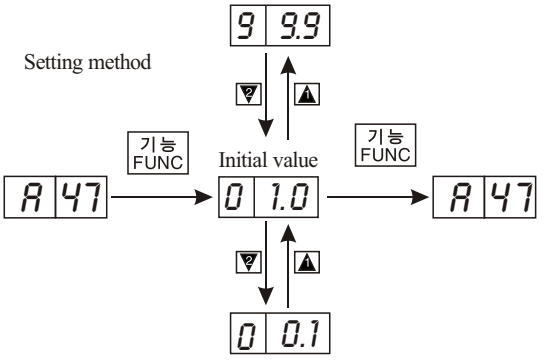
Set value	Function
0	Analog output frequency monitor
1	Analog current monitor
2	Analog torque monitor (Note)
3	Digital output frequency monitor

Output monitor signal		Output full-scale value
Analog	Frequency monitor	A63 Maximum frequency
	Current monitor	200% of the rated current
	Torque monitor	200% of the rared torque

NOTE: Use the analog torque monitor function only in the sensorless state. Under the V/f control, an appropriate value is outputted. The accuracy is ±20%(a rough value).

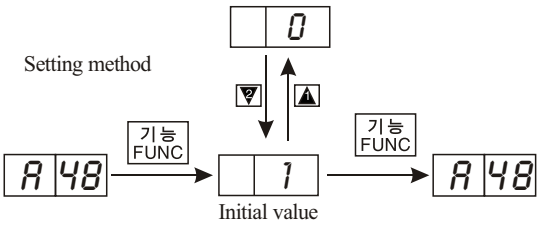
A47 Frequency converted value setting

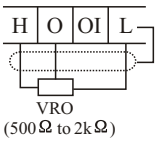
Set a converted value for frequecny converted valued monitoring. The preduct of this setting and the ouptit frequency (d0) is displayed as the value for the frequency converted value monitor(d3).

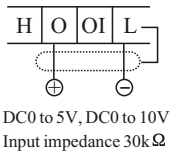


A48 Analog input selection

Set the maximum voltage to be supplied between the terminals 0 and L.







Terminal connection example

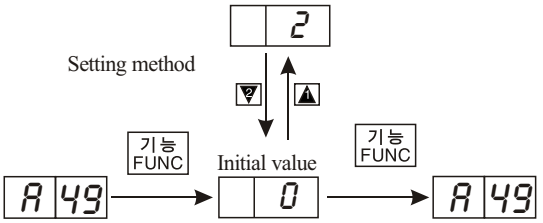
Initial value

Set value	Function
0	Max. 5V input
1	Max. 10V input

Monitor mode contents	Contents and display

A49 Frequency arrival signal output method

When selecting the frequency arrival signal at the output terminal, select the arrival signal output method.

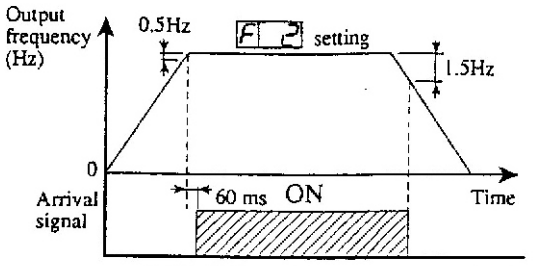


Set value	Function
0	At the time of constant speed arrival
1	Optionally set frequency or more
2	Only optionally set frequency

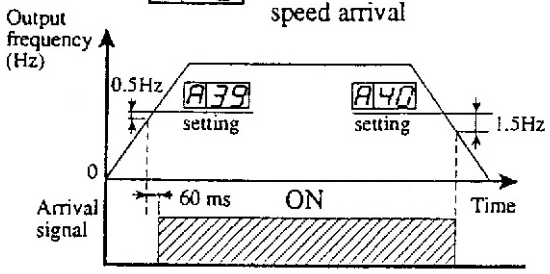
Set optional frequencies of set value 1 and set value 2 by A39 and A40.

NOTE 1 : The frequency arrival signal can be allocated only to one of the intelligent output terminals.
It cannot be outputted to an individual output terminal for acceleration and deceleration

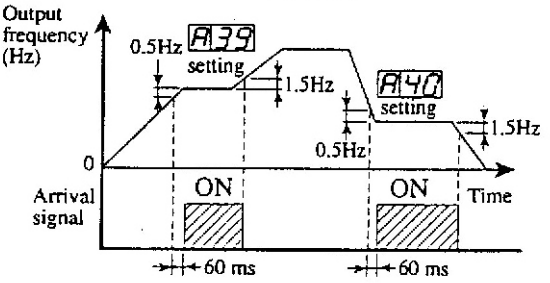
NOTE 2 : Selection of arrival signal output method for relay option board(J-RY) can be done by remote oprator and F-48 function.



0 : At the time of constant speed arrival



1 : Optionally set frequency or more

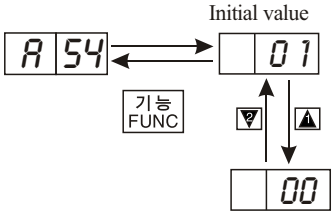


2 : Only optionally set frequency

A54 Restarting after FRS signal selection

Select an operation after a free run stop.
Set 00 and 01 with the ▲ and ▼ keys.

Setting method



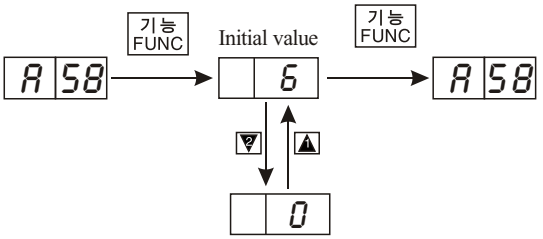
Set value	Function
0	f matching
1	0 start

Initial value

Monitor mode contents	Contents and display

A58 Reduced voltage soft start setting

Adjust reduced voltage start.

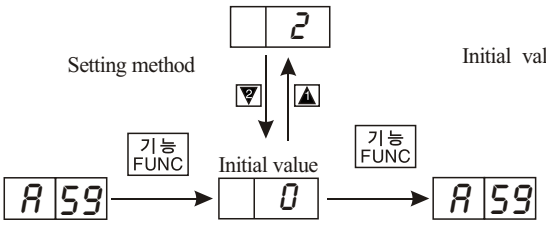


NOTE : How to set

- 0 : There is no reduced voltage. The rush current at the start of the inverter is increased but the motor reaction time is decreased.
- 6 : The effect of the reduced voltage is large. The rush current is reduced but the motor reaction time is increased.

A59 Running mode selection

Select the running mode. Set the running mode to be used.

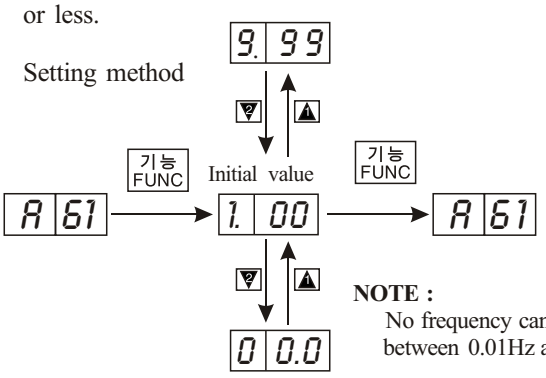


Set value	Function
0	Normal running mode
1	Energy conservation running mode
2	Fuzzy most suitable acceleration and deceleration mode

NOTE : When the fuzzy most suitable acceleration and deceleration are selected and the load inertia (motor shaft conversion) is more than about 20 times of that of the individual motor, an overvoltage trip may occur. If this occurs, reset the mode to the normal running mode. For other precautions, refer to " Precautions for fuzzy most suitable acceleration and deceleration" of Appendix 1.

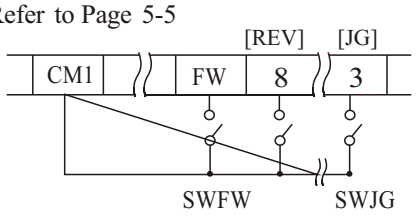
A61 Jogging frequency setting

- Set the running command so as to be inputted to the terminal. (Set F 9 to 02 or 03.)
- Since jogging is a direct input operation and may be easily tripped, set the jogging frequency to 5Hz or less.

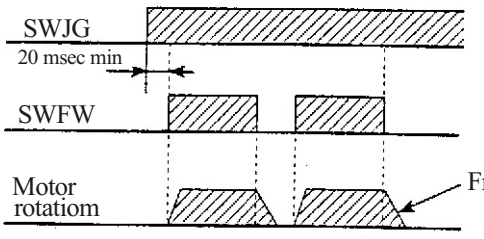


NOTE : No frequency can be set between 0.01Hz and 0.09Hz.

Example of the connection method for European version
Refer to Page 5-5

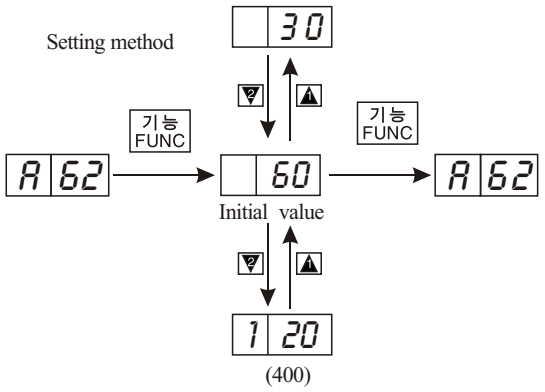
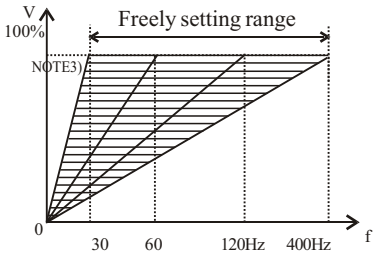
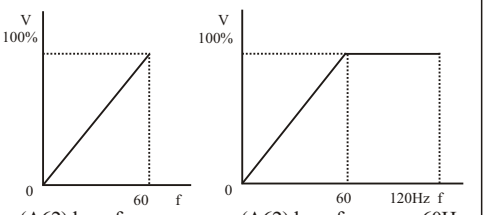
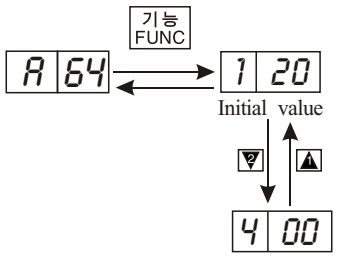


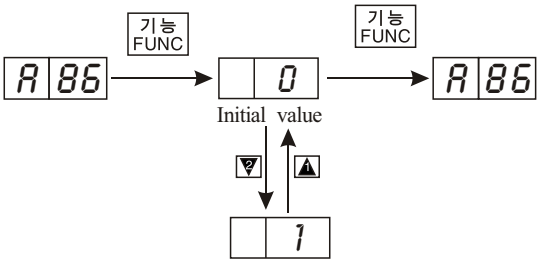
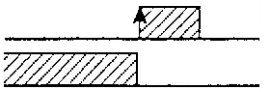
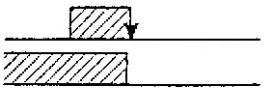
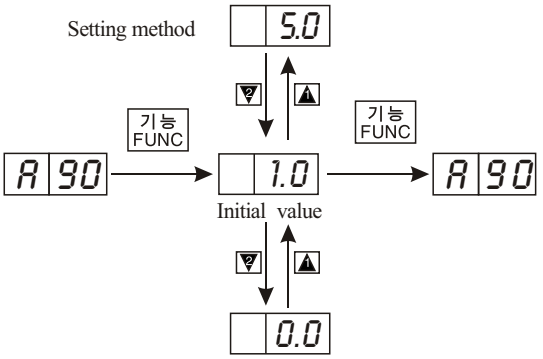
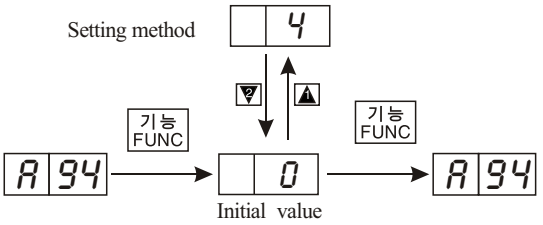
- Operation timing



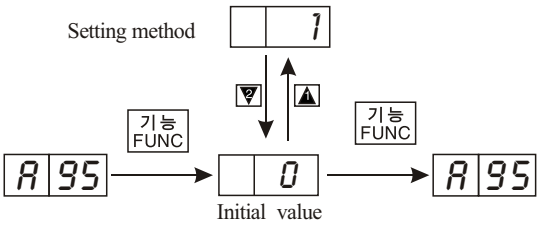
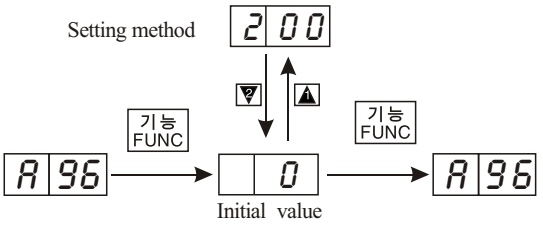
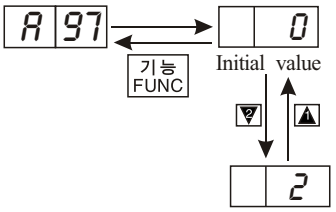
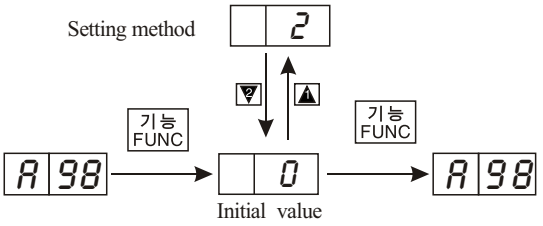
The free run operation is performed immediately after SWFW is turned OFF.

No jogging operation is performed when the set value is smaller than the start frequency A 4 .

Monitor mode contents	Contents and display
A62 A63 **Base frequency setting** **Maximum frequency setting**	Set the A62 base frequency and A63 maximum frequency.  When the frequency is set so that the base frequency is larger than the maximum frequency, the base frequency is forced to be made equal to the maximum frequency at the start of running.  Setting example  (A62) base frequency and (A63) maximum frequency : 60Hz (A62) base frequency:60Hz (A63) maximum frequency : 120Hz **NOTE 1:** When a frequency more than the base frequency 60 Hz is used, the motor is not a general purpose motor but a special motor. Therefore, the maximum applicable motor set value is different. When the kW display is the same, the inverter capacity may be increased. **NOTE 2 :** Set the base frequency according to the specifications of the motor. When the base frequency is set to less than 50 Hz, the motor may be burned.
A64 **Maximum frequency selection**	Select 120Hz or 400Hz as the upper limit that can be set in the maximum frequency setting (A63) 
A80 A81 **Frequency command output frequency adjust (O-L, OI-L)**	Adjust the relationship between the external frequency command and the inverter output frequency. A80 : Voltage command (O-L) A81 : Current command (OI-L) This function is factory-set to the appropriate position. If this setting changed unnecessarily, the correct relationship between the external frequency command and output frequency is no longer maintained. This will result in poor control performance. Adjust the setting of this function only when the output frequency does not conform to the external command. Adjustment method Voltage command : Put voltage command (10V of 5V) to O-L terminal, and adjust A80 unit output frequency comes to maximum. Current command : Put current command (4-20mA) to OI-L terminal, and adjust A81 unit output frequency comes to maximum.

Monitor mode contents	Contents and display
A86 **Selection of reset terminal perfor-mance**	Possible to select a performance of a release timing of alarm signal when giving reset signal from [RS] terminal  Set value / Performance 0 — Reset signal from [RS] terminal Alarm output  1 — Reset signal from [RS] terminal Alarm output 
A90 A91 A92 **Propor-tional gain setting** **Integral gain setting** **Differential gain setting**	• These functions are used to set PID control operation gains. • A90 P (Proportional) gain, A91 I(Integral) gain, A92 D(Differential) gain • Set each gain.  Gain adjusting range: P 0.0 to 5.0; I 0.0 to 15.0s; D 0 to 100.0
A94 **PID control selection**	• This function is used to control the PID functions incorporated in the inverter. • This function is also used to select a feed-back signal input and set a magnification of the integral gain setting value. • For details of PID control, refer to "Appendix 8 PID Control Functions".  **Note 1 :** Set "0" for the use of a PID optional board. **Note 2 :** Do not assign a feed-back signal input and an target frequency command to the same terminal. If assigned, the PID function will be disabled.

Setting value	Feed-back signal input terminal	I(Integral) gain magnification
0	Built-in PID function disabled	
1	Analog current(OI-L)	X 1
2	Analog voltage (O-L)	X 1
3	Analog current(OI-L)	X 10
4	Analog voltage (O-L)	X 10

Monitor mode contents	Contents and display
A 95 **Target value setting method selection**	This function is used to select a method to enter the target value for executing each PID function  Set value / Performance: 0 — The target value depends on the A 96 level set value. 1 — The target value is set using the F 9 frequency setting method. NOTE 1 : Set "1" when a PID optional board (J-PI) is used. The value entered to the OS terminal of J-PI is assumed as the target value. NOTE 2 : The target value at set "1" is O-L, OI-L input signal, F 2 setting or multispeed setting.
A 96 **Internal target value level setting**	• This funvtion is used to set a target value level of PID controlling within 0 to 200%. • This function is valid when 0 is set for A 95  If an analog voltage is entered as a feedback value, the feedback voltage (0 to 10V) corresponds to this target value level setting(0 to 200%). In other words, if, when 5V is entered as the target feedback value of a sensor, it is converted to an internal target value, set 100% as this internal target value.
A 97 **Auto tuning setting**	Select whether to start auto tuning as well as a mode. When 1 or 2 is set, auto tuning is started during the first operation.  Set value / Function: 0 — Auto tuning is not performed. ← Initial value 1 — Normal measurement mode (The motor runs) 2 — R1, R2, or L measurement mode (The motor dose not run.) (For details of auto tuning, see Appendix 1.)
A 98 **Motor data selection**	Select the motor constant used for sensorless vectror control ((SLV).  Set value / Data used: 0 — Old general purpose motor data ← Initial value 1 — New general purpose motor data ("The Motor") 2 — Auto tuning data

Monitor mode contents	Contents and display
A 99 **Ro-T-option selection**	Unusable

Monitor mode contents	Contents and display

C0 to C7

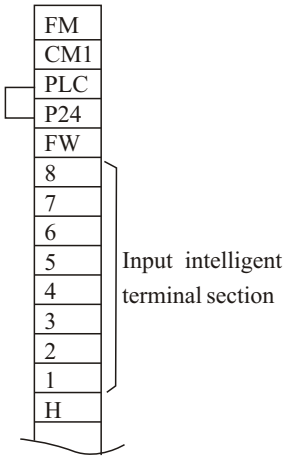
Input terminal setting 1 to 8

A terminal function is allocated to each of the input intelligent terminals 1 to 8.
When using a function other than the standard set functions or changing the terminal order, set the function for each terminal. The minimum input signal acceptance time of the input intelligent terminals is about 20 ms.

Array of codes and intelligent terminals

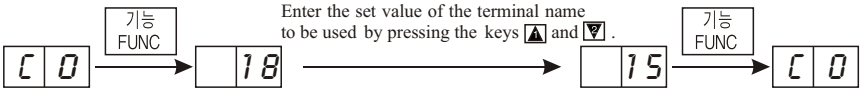
Code	Function name	Terminal rating plate	Initial setting Europe
C0	Input terminal setting 1	1	18
C1	Input terminal setting 2	2	16
C2	Input terminal setting 3	3	5
C3	Input terminal setting 4	4	11
C4	Input terminal setting 5	5	9
C5	Input terminal setting 6	6	2
C6	Input terminal setting 7	7	1
C7	Input terminal setting 8	8	0

PCB terminal array



Setting method

- Press the 기능 FUNC key once for the terminal code to be set.
- The set values of the terminals which are set at present are displayed. Display the set value of the terminal to be used from the function list indicated below by pressing the key ▲ and ▼ and then press the 기능 FUNC key.
- The display is returned to the code display and the terminal function is changed.



Setting example : The RS (reset) function is changed to the SFT (terminal software lock) function.

Input terminal function list

Set value	Abbreviation	Function name
0	REV	Reverse
1	CF1	Multispeed 1
2	CF2	Multispeed 2
3	CF3	Multispeed 3
5	JG	Jogging
6	DB	External DC braking
7	STN	Initialization
8	SET	2nd function
9	CH1	2-stage acceleration and deceleration

Set value	Abbreviation	Function name
11	FRS	Free Run
12	EXT	External trip
13	USP	USP function
14	CS	Commercial power source switching
15	SFT	Terminal software lock
16	AT	Analog input voltage/current switching
18	RS	Reset
27	UP	Remote operation function, acceleration
28	DWN	Remote operation function, deceleration

Precautions for terminal setting

Sane terminals cannot be set between C0 and C7.
When moving a terminal name to another terminal, set another terminal which is not to be used at the setting source before inputting the set value to the setting destination and then select the terminal name which is to be set at the setting destination.

Monitor mode contents	Contents and display

C10
C11

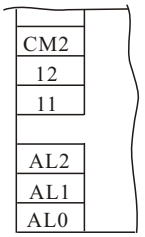
Output terminal setting 11 and 12

A terminal function is allocated to each of the output intelligent terminals 11 and 12. When using a function other than the standard set functions or changing the terminal order, set the function for each terminal.

Arrary of codes and intelligent terminals

Code	Function name	Terminal rating plate	Initial setting
C10	Output terminal setting 11	11	0
C11	Output terminal setting 12	12	1

PCB terminal array



The setting method is the same as that of the input terminals A18 to A25

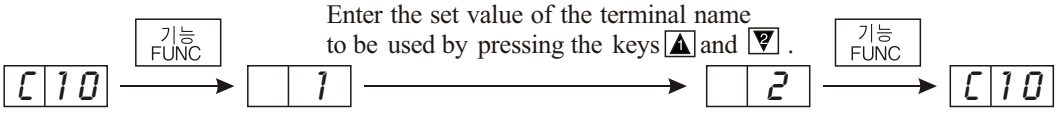
Input terminal function list

Set value	Abbreviation	Function name
0	FA1	Frequency arrival signal
1	RUN	Signal during running
2	OTQ	Overtorque signal (Note)

NOTE: The torque of the overtorque signal can be set by the remote operator. The initial values of motoring and regeneration are 100% torque. The overtorque signal can be used only under the sensorless vector control.

Setting method

- Press the 기능 FUNC key once for the terminal code to be set.
- The set values of the terminals which are set at present are displayed. Display the set value of the terminal to be used from the function list indicated below by pressing the key ▲ and ▼ and then press the 기능 FUNC key.
- The display is returned to the code display and the terminal function is changed.



Precautions for terminal setting

- Same terminals cannot be set between C10 and C11.
  When moving a terminal name to another terminal, set another terminal which is not to be used at the setting source before inputting the set value to the setting destination and the select the terminal name which is to be set at the setting destination.

Monitor mode contents	Contents and display
C 20 **Input terminal a and b contact setting**	The input intelligent terminals 4 to 1 can be changed individually to the a contact or b contact specification. Select the set value by pressing the keys ▲ and ▼ by combining the contacts a and b with reference to the table indicated below. { Example : When the set value is A : ┬ Contact a : Input terminals 3, 1 └ Contact b : Input terminals 4, 2 } Setting method C 20 → 기능 FUNC → 00 → Press the ▲ key 10 times. → 0A → 기능 FUNC → C 20 Select the contact specification with reference to the table indicated below.

Initial setting

Initial value: 00

Set the high order to 0.

Set value	F	E	d	C	b	A	9	8	7	6	5	4	3	2	1	0
Input terminal 4	b	b	b	b	b	b	b	b	a	a	a	a	a	a	a	a
Input terminal 3	b	b	b	b	a	a	a	a	b	b	b	b	a	a	a	a
Input terminal 2	b	b	a	a	b	b	a	a	b	b	a	a	b	b	a	a
Input terminal 1	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a

a: Contact a specification (Shorted when power is turned ON)
b: Contact b specification (Opened when power is turned ON)

Input terminal a and b contacts function list

C 21 **Output terminal a and b contact setting**	The output intelligent terminal 11 and 12 and alarm output terminal can be changed individually to the a contact or b contact specification. Select the set value by pressing the keys ▲ and ▼ by combining the contacts a and b with reference to the table indicated below. Setting method { Example : When the set value is 07 : ┌ Alarm output ; Contact b └ Terminals 11 and 12 ; Contact b } C 21 → 기능 FUNC → 04 → Press the ▲ key 3 times. → 07 → 기능 FUNC → C 21

Initial setting

Initial value: 04

Set the high order to 0.

Set value	7	6	5	4	3	2	1	0
Output terminal 11	b	a	b	a	b	a	b	a
Output terminal 12	b	b	a	a	b	b	a	a
Alarm	b	b	b	b	a	a	a	a

Output terminals 11 and 12
a: Contact a specification (Shorted when power is tumed ON)
b: Contact b specification (Opened when power is tumed ON)

(NOTE)

Output terminal code list

NOTE: For details of the Alarm terminal, see page 6-5.

8. PROTECTION FUNCTIONS

The J300 series inverters are equipped with protection functions against overcurrent, overcoltage, and undervoltage which protect the inverter. If the protection functions are engaged, the output is shut down, motor runs free and holds that condition until it is reset.

Description	Contents		Display
Over current protection	A current due to the alternating current CT between the power module and output terminal {U(T1), V(T2), W(T3)} is detected. When the motor is restricted or decelerated suddenly, a large current flows through the inverter and causes a fault. Therefore, when an abnormal current is detected by the alternating current CT and it exceeds a specified value, the output is cut off. (An abnormal current is also detected in the power module. Refer to E31, E32, E33 and E34)	Constant speed	E01
		Dec.	E02
		Acc.	E03
		Stop	E04
Overload protection (NOTE 1)	When a motor overload is detected by the electronic thermal function, the output of the inverter is cut off.		E05
Braking resistor overload	When the braking time exceeds the setting by E38 braking duty factor, an overvoltage the output of the inverter is cut off		E06
Overvoltage protection	When the converter voltage exceeds a certain level due to regenerative energy from the motor, this protection function engages, and the output of inverter is cut off.		E07
EEPROM error (NOTE 2)	When the memory built in has problems due to noise or excessive temperature rise, this protective function engages, and the output of inverter is cut off.		E08
Undervoltage protection	A decrease of the input voltage of an inverter results in improper function of the control circuit. It also generates motor heat and causes low torque. Output is cut off when the input voltage goes down to less than 300V to 320V.		E09
CT error	Abnormality on built-in CT and the output of the inverter is cut off.		E10
CPU error	Malfunction or abnormality on built-in CUP and the output of the inverter is cut off.		E11
External trip	An abnormality signal from external equipment cuts off the output of the inverter. (When external trip function is selected)		E12
USP error	It indicates an error when power is turned on while the inverter is being run (When external trip function selected)		E13
Ground fault protection	The inverter is protected by detection of ground faults between the inverter output and the motor upon power on. There may be the possibility of power module failure.		E14
Input overvoltage	When the input voltage is higher than the specified value, it is detected 100 seconds after power is turned on and the output is cut off. However, when a voltage higher than approx. 250 to 270 (200V class), 500 to 530V(400V class) is inputted, it is higher than the rated value of the part in use, so that the part may not be protected and damaged.		E15
Instantaneous power failure (NOTE4)	When an instantaneous power failure for more than 15ms occurs, the output is cut off. When the instantaneous power failure time is long, the fault signal is released. Note that when restart is selected, the equipment restarts when the running command remains.		E16

Description	Contents		Display
Optional connection error	An error occurs in the optional connection (connector, etc.)	Option 1	E17
		Option 2	E18
Optional PCB error	An error message outputted from the optional PCB **NOT 5**	Option 1	E19
		Option 2	E20
Power module protection	The detector which is built in the power module operates. When the output side of the inverter is shorted or the motor is restricted, a large current flows through the inverter and causes a fault. therefore, when a current in the power module or an abnormal temperature of the main device is detected and it exceeds a specified value, the output is cut off.	Constant speed	E31
		Deceleration	E32
		Acceleration	E33
		Stop	E34

NOTE 1 : If a trip occurs, press the RESET key or short the reset terminal RS-CM1 assigned as control circuit terminal after a delay of 10 seconds.

NOTE 2 : A trip can be cleared by pressing the RESET key or shorting the reset terminal RS-CM1 assigned as a control circuit terminal. Resetting the power supply cannot clear a trip. (To reset the power supply is to turn power off and turn it on again after the CHARGE lamp at the upper right corner of the control PC board goes off.) Check again whether the set data is correct.

NOTE 3 : Power OFF during motor deceleration may cause an input phase failure error.

NOTE 4 : The instantaneous ride-thru period of 15ms may be shorted depending on the power supply voltage or load.

NOTE 5 : When the J-FB is installed, an error is displayed for each factor as shown below.

Encoder line break : E60
Overspeed : E61
Positioning : E62
Thermistor line break : E64
Motor overheat : E65
Malfunction of abnormality on built-in CUP of the option : E67

Display	Contents
- -	It is displayed when the reset signal is kept supplied or an error occurs between the digital operator and inverter. When one of the keys [?], [▲], and [기능 FUNC] is pressed, it is recovered. When it is not recovered, turn power on once again.
_ _	It is displayed when a data set value more than 3 digits in length (for example, E06 1000) is set.
- -	It is displayed when power is tuned off.
_ _	There is no trip history available.
0 00	This is not an abnormal operation because the instantaneous stop restart function is being performed. (When 1 to 3 is selected by the extension function E34 .)
_ _0	The autotuning operation terminates normally.
_ _J	The autotuning operation terminates abnormally.
_ _U	Waiting due to insufficient voltage. After recovery, the original display appears.

9. TROUBLESHOOTING

9.1 Error Messages and Diagnosis

When the inverter goes wrong, it operates as indicated below. Find the cause and take contermeasures.

Error Messages and Diagnosis

Symptom					Cause (explanation of message)	How to reset (NOTE 1)	Check	Countermeasure
Circuit breaker (MCB)	Electromagnetic contactor (Mg)	Thermal relay (THRY)	Display on the LCD of the digital operator (display on the LCD of the remote operator)	Failure alarm relay				
			E 0 1 (OC. Drive)	○	Overcurrent detected by the AC CT while the motor was running at a constant speed (overcurrent during operation)	A	Check whether a load was changed rapidly.	Do not change loads rapidly.
							Check whether there is a shorted output or ground fault.	Check whether the output lines or motor is shorted.
			E 0 2 (OC. Decel)	○	Overcurrent detected by the AC CT during motor deceleration(overcurrent during deceleration)	A	Check whether the speed was decreased rapidly.	Set a longer deceleration time.
							Check whether there is a shorted output or ground fault	Check whether the output lines or motor is shorted.
			E 0 3 (OC. Accel)	○	Overcurrent detected by the AC CT during motor acceleration(overcurrent during acceleration)	A	Check whether a load was changed rapidly.	Do not change loads rapidly.
							Check whether there is a shorted output or ground fault	Check whether the output lines or motor is shorted.
							Check whether the start frequency is too high	Lower the start frequency.
							Check whether the torque boost is too high	Lower the torque boost
							Check whether the motor is locked.	Check the motor or loads
			E 0 5 (Over. L)	○	Overcurrent inverter (operation under an overload)	A	Check for an overload.	Lower the load ratio.
							Check whether the electronic thermal level is correct. (Check whether the level has been changed.)	Set an appropriate level.

NOTE 1 : How to reset

A: Stop the inverter. Then, connect the <RS> and <CM1> control terminals or press the **STOP/RESET** key on the operator.

B : Opeate the circuit breaker and electromagnetic contactor (turn the power on again).

C : Stop the inverter. Then, reset the thermal relay.

Symptom					Cause (explanation of message)	How to reset	Check	Countermeasure
Circuit breaker (MCB)	Electromagnetic contactor (Mg)	Thermal relay (THRY)	Display on the LCD of the digital operator (display on the LCD of the remote operator)	Failure alarm relay				
			E06 (OL. BRD)	○	The regenerative braking time is longer by the value set by BRD%ED.	A	Check the braking resistor use ratio set in A38.	• Set a longer deceleration time. • Set a larger operation duty cycle. • Set A38 to 0.0.
			E07 (Over. V)	○	Overvoltage in the DC smoothing circuit	A	Check whether the speed was decreased rapidly.	Set a longer deceleration time.
							Check whether the motor was run from the load side.	Do not use consecutive regenerative loads.
							Check whether there is a ground fault.	Check whether the output lines or motor is shorted.
			E08 (EEPROM)	○	EEPROM error	A	Check whether there is a large-noise source near the inverter.	Move the noise source away.
							Check whether the ambient temperature is too high.	Replace the cooling fan.
			E09 (Under. V)	○	Defective power supply (insufficient voltage)	A	Check whether the voltage is lowered.	Check the power supply.
							Check whether the MCB or Mg has a poor contact.	Replace the MCB or Mg.
							Check whether 10 or more instantaneous power outages within 100 ms occurred in 10 minutes.	Check the power supply.
			E10 (CT)	○	CT error	A	Check whether the CT is defective.	Repair the CT.
			E11 (CPU)	○	CPU error	A	Check whether there is a large-noise source near the inverter.	Move the noise source away.
							Check whether the inverter is defective.	Repair the inverter.
			E12 (EXTERNAL)	○	External trip	A	Check whether there was a defective external unit when the external trip function was selected.	Eliminate the error from the external unit.
			E13 (USP)	○	USP error	A	Check whether power was turned on while the inverter was running when the USP function was selected.	Eliminate the error from the external unit.

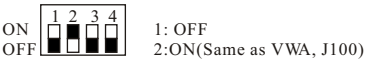
Symptom					Cause (explanation of message)	How to reset (NOTE 1)	Check	Countermeasure
Circuit breaker (MCB)	Electromagnetic contactor (Mg)	Thermal relay (THRY)	Display on the LCD of the digital operator (display on the LCD of the remote operator)	Failure alarm relay				
			E 1 4 (GND. Fit)	◯	Ground fault on the output side of the inverter	A	Check the wiring between the inverter and motor and also check the motor for a ground fault. (Use a megger)	Correct the portions having a ground fault.
			E 1 5 (OV. SRC)	◯	Excessive received voltage	A	Check whether an excessive voltage was received during an operation other than deceleration	・Lower the voltage to be received. ・Reduces fluctuations of the received voltage. ・Install an AC reactor on the input side.
			E 1 6 (Inst. P-F)	◯	Defective power supply (instantaneous power outage)	A	Check whether the voltage is lowered.	Restore the power supply to normal.
							Check whether the MCB or Mg has a poor contact.	Replace the MCB or Mg.
			E 1 7 (NG. OP1)	◯	Incorrectly connected option-1 PC board	A	Check the connectors and other connections for abnormal conditions.	Repair the defective connections.
			E 1 8 (NG. OP2)	◯	Incorrectly connected option-2 PC board	A	Check the connectors and other connections for abnormal conditions.	Repair the defective connections.
			E 1 9 (OP1)	◯	Defective option-1 PC board	A	Refer to the instruction manual.	
			E 2 0 (OP2)	◯	Defective option-2 PC board	A	Refer to the instruction manual.	
			E 3 1 (PM. Drive)	◯	(NOTE 1) Failure detected by a detector in the power module while the motor was running at a constant speed, or excessive temperature rise in the inverter	A	Check whether a load was changed rapidly	Do not change loads rapidly
							Check whether there is a shorted output or ground fault.	Check whether the output lines or motor is shorted.
			E 3 2 (PM. Decel)	◯	(NOTE 1) Failure detected by a detector in the power module during motor deceleration, or excessive temperature rise in the inverter	A	Check whether the speed was decreased rapidly.	Set a longer deceleration time.
							Check whether there is a shorted output or ground fault.	Check whether the output lines or motor is shorted.

NOTE 1 : The failures detectable in the power module are overcurrents, excessively hot main devices, and insufficient voltages from the gate circuit power supply.

Symptom					Cause (explanation of message)	How to reset (NOTE 1)	Check	Countermeasure
Circuit breaker (MCB)	Electromagnetic contactor (Mg)	Thermal relay (THRY)	Display on the LCD of the digital operator (display on the LCD of the remote operator)	Failure alarm relay				
			E 3 3 (PM. Accel)	◯	(NOTE 1) Failure detected by a detector in the power module during motor acceleration, or excessive temperature rise in the inverter	A	Check whether the speed was increased rapidly.	Set a longer acceleration time.
							Check whether a load was changed rapidly.	Do not change loads rapidly.
							Check whether there is a shorted output or ground fault.	Check whether the output lines or motor is shorted.
							Check whether the start frequency is too high.	Lower the start frequency.
							Check whether the torque boost is too high	Lower the torque boost.
							Check whether the motor is locked.	Check the motor or loads.
			E 3 4 (PM. ERR)	◯	(NOTE 1) Failure detected by a detector in the power module while the motor was stopping, or excessive temperature rise in the inverter	A	Check whether the installation is vertical and the wall is a nonflammable wall such as an iron plate.	Check the installation
							Check whether the cooling fan is running and the ambient temperature is too high	Replace the cooling fan.
							Check the internal power supply.	Repair the internal power supply.
							Check the main devices.	Repair main devices.
			E 6 0 (OP1 0) to **E 6 2** (OP1 2)	◯	Defective J-FB PC board	A	Refer to the manual supplied with the J-FB PC board.	
			E 6 4 (OP1 4) to **E 6 5** (OP1 5)	◯	Defective J-FB PC board	A	Refer to the manual supplied with the J-FB PC board.	
			E 6 7 (OP1 7)	◯	Defective J-FB PC board	A	Refer to the manual supplied with the J-FB PC board.	

NOTE 1 : The failures detectable in the power module are overcurrents, excessively hot main devices, and insufficient voltages from the gate circuit power supply.

Symptom					Cause (explanation of message)	How to reset (NOTE 1)	Check	Countermeasure
Circuit breaker (MCB)	Electromagnetic contactor (Mg)	Thermal relay (THRY)	Display on the LCD of the digital operator (display on the LCD of the remote operator)	Failure alarm relay				
		◯	—	—	—	C	Check for an overload	Lower the load ratio.
							Check whether the thermal relay is set to an appropriate value.	Set the thermal relay to an appropriate value.
◯			—	—	—	B	Check whether there is a short or ground fault in the power supply.	Remove the short or ground fault.
							Check whether the MCB capacity is sufficient.	Increase the MCB capacity.
							Check whether the inverter module or converter module is defective.	Repair the inverter module or converter module.
	◯		—	—	Power outage	B	Check for a power outage.	Restore the power supply to normal.
							Check whether the MCB or Mg has a poor contact.	Replace the MCB or Mg.

Symptom		Probable cause	Countermeasure
The motor will not run	The inverter outputs U(T1), V(T2) and W(T3) are not supplying voltage.	• Is power being supplied to terminals R(L1), S(L2), and T(L3)? If it is, the POWER lamp should be on.	• Check terminals R(L1), S(L2), T(L3), U(T1), V(T2), and W(T3) • Turn on the power supply.
		• Is the display E [*][*] ?	• Press [▽] [△] and check the content. Then press the reset key.
		• Is the operation instruction RUN ON? • Is terminal FW (or REV) connected to terminal P24?	• Set to ON. • Connect terminal CM1 to terminal FW (or REV) on the printed-circuit board. (When the terminal mode is selected.)
		• Has the frequency setter been turned on by pushing [기능 FUNC] key and then [▽] [△] key. • Are the printed-circuit board terminals H, O and L connected to the potentiometer? • Are the terminals connected to the external and internal interface power source the terminal mode is selected?	• Push down keys and set. • When terminal mode is selected, connect the potentiometer to H, O, and L, and then set. • In the case of the internal interface power source, short the terminals P24 and PLC or CM1 and PLC. • In the case of the external interface power source, turn the PLC terminal on.
		• Has RS/FRS been left ON?	• Release reset. • Contact FRS.
		• Is the mode key [F][9] setting correct?	• Read the explanation of the function mode once again. (Page 7-12) F9 frequency/run commanding method
	Inverter outputs U(T1), V(T2) and W(T3) are not supplying voltage.	• Has the motor seized or is the load too great?	• Release seizure or lighten the load. • Test the motor independently.
	The optional remote operator is used. (copy unit)	• Are the remote operator and equipment body switched correctly? • Is the setting of the DIP switch on the back of the remote operator correct?	• Check the operation of the optional remote operator. (copy unit)  1: OFF 2:ON(Same as VWA, J100)
The direction of the motor is reversed.		• Are the remote operator and equipment U(T1), V(T2) and W(T3) correct? • Is the phase sequence of the motor forward or reverse in respect to U(T1), V(T2) and W(T3)?	• Make the connections according to the phase sequence of the motor. (In general, forward should be in the sequence: U(T1), V(T2) and W(T3).)
		• Are the terminals on the printed-circuit board correct?	• Short the FW terminal for forward rotation or the intelligent input terminal 8 (the intelligent input terminal 8 is allocated to run command REV by initialization at factory before shipment) for reverse rotation to the CM1 terminal (Sink type).

Symptom		Probable cause	Countermeasure
The rpm of the motor will not increase.		• After checking the wiring of the frequency setter, the rpm still does not increase when the setter is turned.	• Replace the frequency setter.
		• Are terminals 7 and CM1, terminal 6 and P24 ON (Sink type)?	• Trun off terminal 7 and 6. (When the frequency and multistage speed are fixed at a given frequency, the speed potentiometer will be invalid.)
		• Is the load too great?	• Decrease the load. • When the load is too great, the limiting function will be activated, so that the rotational speed will be lower than the setting.
The rpm of the motor does not match the inverter		• Is the maximum frequency setting correct? • Are the number of motor poles, the gear ratio, and pulley ratio correct?	• Check the speed-change ratio.
The data is incorrect.	The data is returned to the initial setting.	• The STN terminal is turned ON and the power is turned on. • The input terminal 1 to 5 are turned ON and then power is turned on.	• Turn the STN terminal OFF. • Input the data again • Replace the logic PCB.
	The data has not changed.	• Was the power turned off without pushing the 기능 FUNC key after the data was changed with ▽ △ keys.	• Input the data and push the 기능 FUNC key once.
		• The data is memorized upon power off. Is the time from power OFF to ON less then six seconds?	• Take six seconds or more when turning power OFF and ON after changing the data.
	Data copied by the copy unit is not input.	• Is the power turned off for five seconds or more after the display changed from REMT to INV.(HRW-OJ)	• Copy again and turn the power off five seconds or more after copying.
The data is not changed.	Frequency setting can not be changed. Run and stop can not be done.	• The change of the terminal mode and digital operator mode were correct?	• Confirm the change in F 9 setting mode.
	The data can not be changed.	• Is the input terminal SFT ON? • Is the software lock mode set at MD2 or MD3?	• Turn the SFT terminal OFF. • Turn the switch OFF.
		Note : If software lock is ON because of use with an explosion proof motor, do not release the software locks.	

Symptom		Probable cause	Countermeasure
Overload (Electronic thermal trip) (Low frequency zone)		• Is the F 8 torque boost too high? • Do the electronic thermal characteristics match the set characteristics of the motor?	• Decrease the torque boost. • Reset the electronic thermal characteristics and level.
The input voltage trips.		• Is the input voltage high ? • Is the equipment stopped with the inverter DC voltage increased after sudden deceleration ?	• Lower the input voltage. • Set a deceleration time which is a little longer. • Increase the AVR set value above the current input voltage and lower the V gain by the ratio.

10. MAINTENANCE AND INSPECTION

10.1 Maintenance and Inspection Precautions

⚠ WARNING

- Be sure to turn off the power supply during maintenance and inspection.

  After the power supply has been turned off, you must always wait 10 minutes so that DC bus capacitors can discharge then start maintenance and inspection after the CHARGE lamp on the printed-circuit board has gone out. (Immediately after the lamp has gone out, there will be a residual voltage of about 50V DC in the DC bus intermediate circuit.)
  Perform the work after the CHARGE lamp has stopped flickering.

  Make sure that only qualified persons will perform maintenance, inspection and part replacement. (Before starting the work, remove metallic objects from your person (wristwatch, bracelet, etc.) (Be sure to use tools protected with insulation.)
  Otherwise, there is a danger of electric shock and/or injury.

⚠ CAUTION

- When removing connectors, never pull the wires. (Wires for cooling fan and thermal relay)
  Otherwise, there is a danger of fire due to wire breakage and/or injury.

• General precautions

Always keep the unit clean so that dust or other foreign matter does not enter the inverter. Take special care in regard to breaking lines and connection mistakes. Firmly connect terminals and connectors. Keep electronic equipment away from moisture and oil. Dust, steel filing and other foreign matter can damage insulation, causing unexpected accidents, so take special care.

10.2 Inspection Items

(1) Daily inspection
(2) Periodic inspection (Approximately once a year) } See 10-3.
(3) Insulation resistance tests, withstand voltage tests

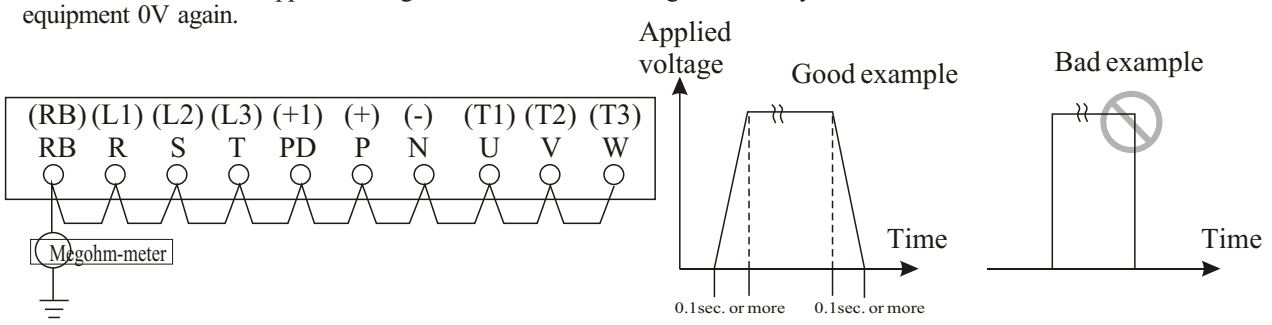
Conduct these tests by short circuiting the terminals as shown below, and by following the conditions described.

·In regard to insulation resistance tests, measure the terminals below and the grounding at 500VDC, and make sure that **5**MΩ or greater is indicated.

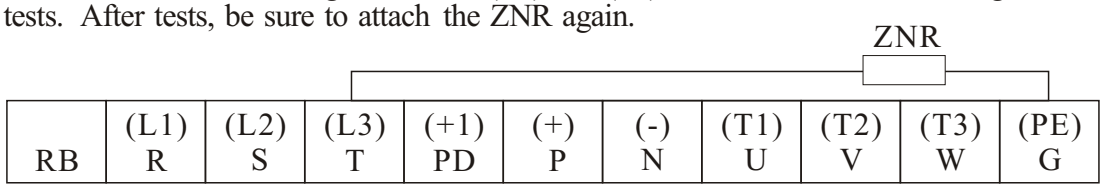
·Do not perform the withstand voltage test. When it should be done. in regard to withstand voltage tests, supply the terminals below and the grounding with 1500VAC(200V class)
2000VAC(400V class) for one minute, and make sure that there are no abnormalities.

·Do not perform the withstand voltage test and withstand voltage tests for terminals other than those indicated below.

·Increase or decrease the applied voltage for the withstand voltage test slowly and turn the equipment 0V again.



·Remove the ZNR connecting between G(PE) to T(L3) terminal before conducting the tests. After tests, be sure to attach the ZNR again.



Insulation Resistance Tests and Withstand Voltage Tests

NOTE 1 : If the inverter is used under high temperature and heavy load conditions, its operating life will be significantly reduced.

NOTE 2 : If the inverter has been stored for three years ro more, apply the following conditions.

① Apply 80% of the rated voltage of the capacitor for 1 hour at normal temperature.
② Increase the voltage to 90% and apply it for 1 hour.
③ Apply the rated voltage for 5 hours.

NOTE 3 : Precautions in handling printed-circuit boards.
When maintenance and inspection of printed-circuit boards is necessary, be sure to follow the precautions below.

- Prevent damage caused by static electricity. The IGBT of the inverter module, the MCUs and ICs on a printed-circuit board can be destroyed by static electricity, so be sure to ground work benches, soldering irons, and yourself before working on printed-circuit board.

Daily Inspection and Periodic Inspection (1/3)

Inspection location	Inspection item	Inspection content	Inspection cycle		Inspection method	Criteria	Standard replacement period	Instruments
			Daily	Periodic				
Overall	Ambient environment	Check ambient temperature, humidity, dust, corrosive gases, oil mist, etc.	V			Ambient temperature between -10 to +50℃ : no icing Ambient humidity 20 to 90% ; no dew condensation.	—	Thermometer
	Devices overall	Check for abnormal vibrations and noise.	V		Visual and aural inspection.			Hygrometer
	Power supply voltage	Check the input line voltage.	V		Measure the voltage between inverter terminals R(L1), S(L2) and T(L3)	No abnormalities. 200 to 220 V, 50 Hz 200 to 230 V, 60 Hz 380 to 415 V, 50 Hz 400 to 460 V, 60 Hz		Tester
Main circuit	Overall	(1) Insulation resistance test (between main circuit terminals and grounding terminal)		V	(1) Increase tightening Making a check on the torque is needed for the increase tightening of the modules such as a power module, diode module. Do not execute increase tightening with no torque gauge prepared. (2) Tighten. (3) Visual inspection.	No abnormalities in (1) and (2). Tightening torque (kgf.cm) • M3 : 8 - 10 • M4 : 12 - 15 • M5 : 20 - 25 • M6 : 25 - 30 • M8 : 100 - 135 Tightening torque for IPM and Diode modules (kgf.cm) • M4 : 10 - 15 • M5 : 15 - 20 • M6 : 20 - 25	—	500V class Megohm meter
		(2) Check installation for looseness.		V				
		(3) Check for evidence of overheating in the various components.		V				
		(4) Clean.		V				

Daily Inspection and Periodic Inspection (2/3)

Inspection location	Inspection item	Inspection content	Inspection cycle		Inspection method	Criteria	Standard replacement period	Instruments
			Daily	Periodic				
Main circuit	Terminal board	No damage.		V	Visual inspection.	No abnormalities	-	—
	Smoothing capacitor	(1) Check for leaking (2) Check for swelling	V V		Visual inspection of (1) and (2).	No abnormalities in (1) and (2).	5 years (Note 1)	—
	Relays	(1) Check for stuttering noise when operating		V	(1) Aural inspection	(1) No abnormalities.	5 years	—
	Resistors	(1) Check for large cracks or changes in color		V	(1) Visual inspection	(1) No abnormalities.	-	—
	Cooling fan	(1) Check for abnormal vibrations and noise (2) Check for dust	V V		(1) Rotate manually with power off and increase tightening (2) Visual inspection	(1) Smooth rotation (2) No abnormalities.	2 - 3 years	—

Daily Inspection and Periodic Inspection (3/3)

Inspection location	Inspection item		Inspection content	Inspection cycle		Inspection method	Criteria	Standard replacement period	Instruments
				Daily	Periodic				
Control circuit	Operation check		(1) Check the balance of the output voltage of individual phases when operating the inverter independently. (2) Conduct a sequence protection operation test, and make sure that there are no errors in the protection and display circuits.		V V	(1) Measure the voltage between the phases of inverter output terminals U, V, and W. (2) Simulate operation of the inverter protection circuit.	(1) Within 2% voltage difference between phases. (2) Operate without any abnormalities	—	—
	Component check, including printed-circuit boards	Overall	(1) No abnormal odor or changes in color. (2) No significant corrosion.		V V	Visual inspection	No abnormalities	—	—
		Capacitor	No fluid leakage or deformation.	V		Visual inspection	No abnormalities	5 years (Note 1)	—
Display	Digital operation panel		(1) No illegible display (2) No lack of character (3) No blown out LEDs	V V V		Visual inspection	Normal operation Display can be read out	7 years	—

Note 1 : The life of the capacitor is affected by the ambient temperature. Refer to the ambient temperature- capacitor life curve show in Appendix 5.
Note 2 : The inverter must be cleaned periodically. If dust accumulates on the fan and heat sink, it can cause overheating of the inverter.

10.3 Measurement Method for I/O Voltage, Current, and Power

General measuring instruments for I/O voltage, current, and power are indicated below. The voltage to be measured is the fundamental wave effective voltage and the power to be measured is the total effective value.

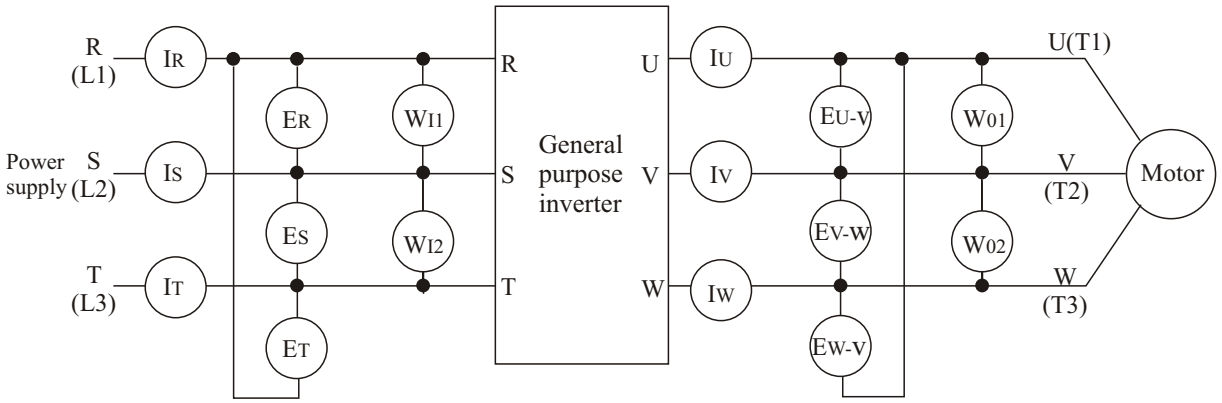
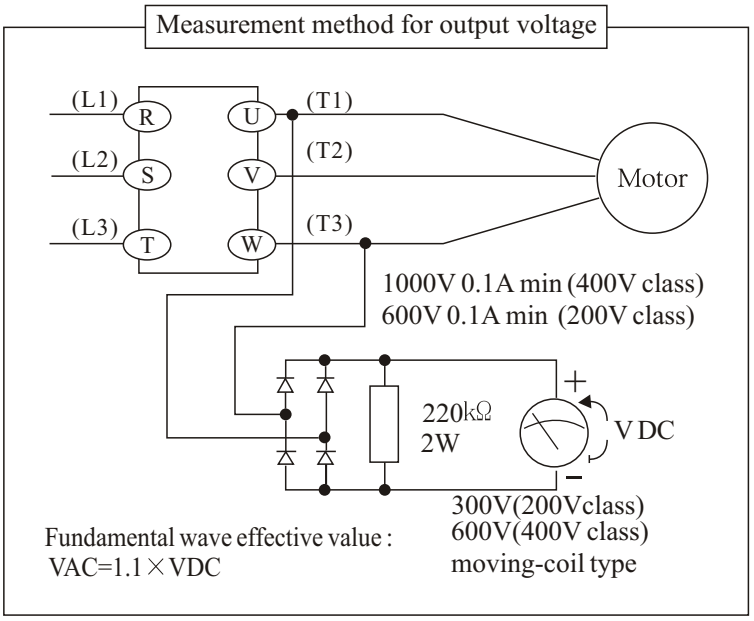


Table 3 Parts to be measured

Measurement item	Parts to be measured	Measuring instrument	Remarks	
Supply voltage E_1	Between R and S, S and T, T and R (E_R),(E_S),(E_T)	Moving-iron type voltmeter or rectifier type voltmeter	Fundamental wave effective value	
Supply current I_1	R , S, T (I_R), (I_S), (I_T)	Moving-iron type ammeter	Total effective value	
Supply power W_1	Between R and S, S and T, T (W_{11}) (W_{12})	Electrodynamic type wattmeter	Total effective value	
Supply power factor Pf_1	Calculate the supply power factor from the measured supply voltage E_1, supply current I_1, and supply power W_1. $Pf_1 = \frac{W_1}{\sqrt{3} \cdot E_1 \cdot I_1} \times 100(\%)$			
Output voltage E_0	Between U and V, V and W W and U (E_U), (E_V), (E_W)	Rectifier type voltmeter	Total effective value	
Output current I_0	U, V, W (I_U),(I_V),(I_W)	Moving-iron type ammeter	Total effective value	
Output power W_0	Between U and V, V and W (W_{01}),(W_{02})	Electronic type wattmeter	Total effective value	
Output power factor Pf_0	Calculate the output power factor from the output voltage E, output current I, and output power W. $Pf_0 = \frac{W_0}{\sqrt{3} \cdot E_0 \cdot I_0} \times 100(\%)$			

NOTE 1 : Use a meter indicating a fundamental wave effective value for voltage, and meters indicating total effective values for current and power.
NOTE 2 : The inverter output waveform is a distorted wave, and low frequencys may cause errors. However, the measuring instruments and methods indicated above provide comparatively accurate values.
NOTE 3 : A tester (general purpose) may not be suited often to measurement of a distorted wave.



11. STANDARD SPECIFICATIONS

11.1 Common Standarsd Specifications

Item			Description																																	
Input voltage			200V class										400V class																								
Model Name(Type)					055 LF5	075 LF5	110 LF5	150 LF5	220 LF5	300 LF5	370 LF5	450 LF5	550 LF5			055 HF5	075 HF5	110 HF5	150 HF5	220 HF5	300 HF5	370 HF5	450 HF5	550 HF5	750 HF5	900 HF5	1100 HF5	1320 HF5	1600 HF5	2200 HF5						
Enclosure (NOTE1)			Semienclosed type (IP20)										Open type (IP00)																								
Maxinun applicablt Motor(4P,KW)					5.5	7.5	11	15	22	30	37	45	55			5.5	7.5	11	15	22	30	37	45	55	75	90	110	132	160	220						
Continuous outpat(KVA)	200V,400V				8.3	11	16	22	33	42	50	63	76			9.0	11	16	22	33	40	52	62	76	103	122	150	180	225	305						
	220V,440V				9.1	12	18	24	36	46	55	69	83			9.9	12	17	24	36	44	57	68	83	113	134	165	198	247	335						
Rated AC input power supply(V)			Three-phase(3wires earthnutral) 200~220/200~230V±10%,50/60Hz±5%										Three-phase(3wires earthnutral) 380~415/400~460V±10%, 50/60Hz±5%																								
Rated output volltage(V) (NOTE2)			Three-phase, 200~230V (Corresponding to the input voltage)										Three-phase, 380~460V(Corresponding to the input voltage)																								
Rated outpat carrentg (A)					24	32	46	64	95	121	145	182	220			13	16	23	32	48	58	75	90	110	149	176	217	260	325	440						
Output frequency range (NOTE3)			0.1~400Hz																																	
Frequency accuracy			Digital command ±0.01% and analog command ±0.01% for the maximum frequency command																																	
Frequency setting resolution			Digital setting : 0.01Hz/60Hz, Analog setting : Maximum frequency/1000																																	
Voltage/frequency characteristics			V/F variable, high start torque, standard starting torque(constant torque, reduced torque)																																	
Overload curtent rated			150% for 1 minute																																	
Acceleration/deceleration time			0.01 to 3000 seconds, acceleration and deceleration individually set																																	
Starting torque (NOTE4)			150% or more (1Hz)																																	
Braking torque	Dynamic braking(NOTE5) Feedback to capacitor		About 20%				About 10 to 15%						About 20%												About 10 to 15%											
	Dynamic braking using external regenerative resistor		Braking resistor optional				Using external BRD unit						Braking resistor optional												Using external BRD unit											
	DC injection braking		Operated at the DC braking frequency or by external input																																	
Input sig-nals	Frequency setting	Digital operator	Set by and																																	
		External signals	2 W 500Ω to 2kΩ potentiometer, 0 to 5 VDCkΩ, 0 to 10 VDC (nominal)(input impedance 30kΩ) 4 to 20mA (nominal)(input impedance 30kΩ)																																	
	Forward/ reverse run, stop	Digital operator	RUN / STOP (Only for forward run or reverse run, the function mode should be switched.)																																	
		External signals	FW forward run command)/ stop																																	
	Intelligent input terminal		REV(revrse run command), FRS(free run stop command), CF1 to CF3(multistage speed setting), USP(USP function0, JG(iogging command), CH1(2-stage acceleration and deceleration), DB(external DB command) RS(reset input), STN(initialization), SFT(software lock), AT(current input selection), EXE(external trip), UP(remote control, acceleration), DOWN(remote control, deceleration)																																	

Item		Description
Output signals	Intelligent output terminal	FA1(speed arrival signal), RUN(signal during run), OTQ(overtorque signal)
	Frequency monitoring	Analog output frequency monitor(0 to 10 VDC, 1mA full scale), digital frequency signal by remote operator, analog current monitor, analog torque monitor
Fault alarm contact(AL0-AL1)		OFF when an iverter alarm occurs
Other characteristics		AVR function, data batch setting, V/F characteristic switching curve acceleration and deceleration, upper and lower limiters, 8-stage speed, start frequency fine adjustment, trip history monitor (up to three times stored), fuzzeleration and deceleration, autotuning, etc.

Item										
Max carrier freguency (kHz)	16	12	10	6	16	12	10	6	3	2

Item		Description
Protection functions		Overcurrent, overvoltage, undervoltage, electronic thermal, abormal temperature, grounding current, overload restriction, etc.
General specifications	Circumstance temperature	-10~50℃
	Humidity	20~90%RH

Item					
General specifications	Vibrations (NOTE6)	$5.9m/s^2$ (0.6G)10~55Hz	$2.0m/s^2$ (0.2G)10~55Hz	$5.9m/s^2$ (0.6G)10~55Hz	$2.0m/s^2$ (0.2G)10~55Hz

Item		Description
General specifications	Operation location	Height of 1000m or less, indoors(free of corrosive gas and dust)
	Paint color	Regel gray NO.1(Munsell 9.1 Y 7.4/0.6 semigloss, cooling fan of aluminum ground color)
Options		Remote operator, copy unit, cable for digital operator, braking resistor, reactor for improving power factor, noise filter forconduit tube connection, fitting for remocing cooling fins

Item																											
Estimated mass(kg)			7.5	7.5	13	13	21	37	37	51	51			7.5	7.5	13	13	21	36	36	46	46	70	70	80	80	130	130

NOTE 1 : Protective structure is based upon JEM 1030-1977.

NOTE 2 : The output voltage will decrease if input voltage decreases.

NOTE 3 : Confirm with the motor manufacturer the motors maximum rpm when using a motor running at frequency higher than 50/60 Hz.

NOTE 4 : When using the standard four-pole motor, select the high start torque (SLV) at the rated voltage. (For details, contact the dealer you purchased the product.)

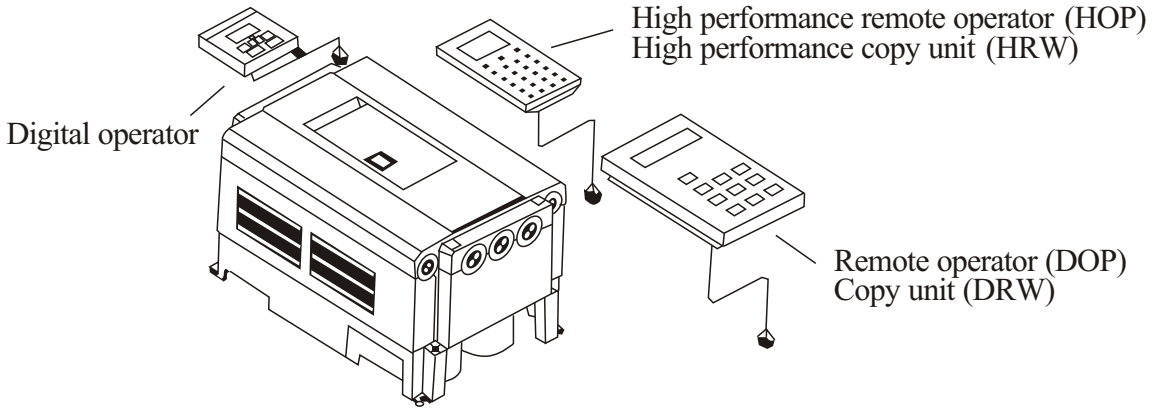
NOTE 5 : Torque will be reduced when the base frequency exceeds 50/60Hz.
The dynamic braking torque is about 60% for 055HF or about 50% for 075HF when the 400V class RB2×2series (70Ω or more) is used.

NOTE 6 : According to the test method shown is JIS C 0911 (1984)

12. FUNCTIONS WHEN USING THE OPTIONAL REMOTE OPERATOR

12.1 Connecting the remote operator

Be sure to turn the power supply off when connecting the connector.



(1) Insert the connector straight into the remote operator and inverter unit printed-circuit board.

(2) Turn on the power supply.

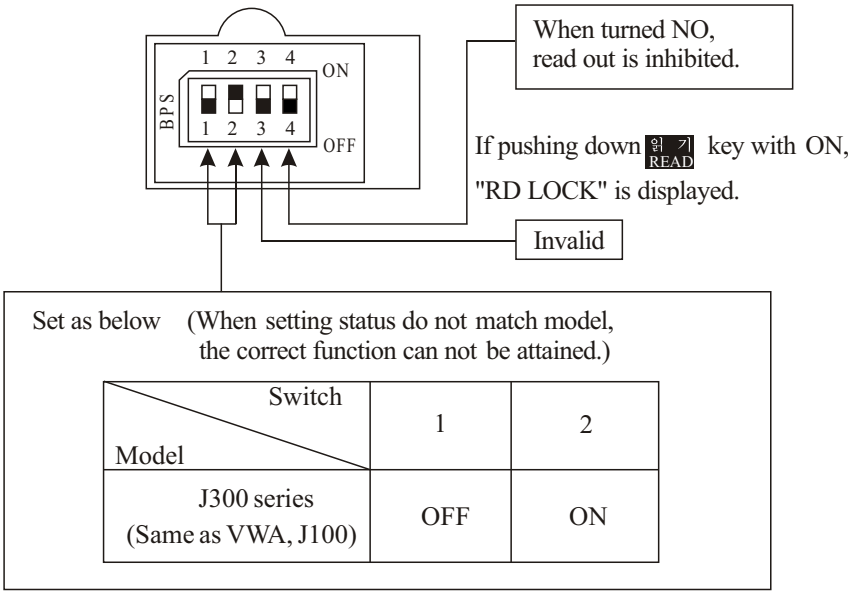
(3) Make sure that the liquid crystal display of the remote operator is lit.

When the power supply of the inverter is turned on, FS000.0..... of the monitoring mode will be displayed. If, however, any of the following is displayed when the inverter is turned off, they will be displayed when power is turned on again.

- Frequency setting, multi-speed setting or other frequency displays, motor rotational speed display, frequency conversion display, or output current display .

NOTE : When conflicting data is set, a warning WARN..... will be displayed. For 6 seconds thereafter, do not perform the key operation, reset operation, running operation, power-OFF operation. (Otherwise, a communication error may occur in the operator.)

NOTE : See the operation manual of the remote operator for instructions.
In addition, see the following pages for details on its various function. Set the dipswitches mounted on the backside of the remote operator and copy unit as below.



Set as below (When setting status do not match model, the correct function can not be attained.)

Switch / Model	1	2
J300 series (Same as VWA, J100)	OFF	ON

12.2 Monitor mode

Monitor mode list when the remote operator (DOP) and copy unit (DRW) are used

・Monitor mode initial values and display contents
Initial display contents, initialization, and change ranges are displayed in the table indicated below.

Y : Setting can be changed during operation
N : Setting can be changed during operation:
– : Display only

Display sequence	Monitor name	Display content	Initial value	Setting range	Setting and change are possible?	Remarks
1	Frequency setting and output frequency	FS0000.0 ⬚ 0.0	0.0	0 to120 (400)	Y	(1) displays the setting. (2) displays the output. ● ⬚ is displayed when run instruction is NO. F: Forward run R: Reverse run
		TM 0.0 ⬚ 0.0	0.0			
	Multistage-speed setting and output frequency	1S0000.0 ⬚ 0.0 2S0000.0 ⬚ 0.0 3S0000.0 ⬚ 0.0	0.0			
	Jogging frequency setting	JG0000.0 ⬚ 0.0	1.0	0 to 9.9	Y	A trip occurs easily at 5Hz or more.
	Expansion multistage speed	4S0000.0 ⬚ 0.0 7S0000.0 ⬚ 0.0	0.0	0 to 120 (400)	Y	・Valid when the multistage speed terminal 3 is selected. ・The multistage speed are displayed when the input terminal is connected ・For terminal setting refer to F-34 "Input terminal setting
2	Acceleration time setting	ACC1 0030.00S	30.0s	0.01 to 3000.00	Y	
3	Deceleration time setting	DEC1 0030.00S	30.0s	0.01 to 3000.00	Y	
4	Frequency setting command	F-SET-SELECT REM	REM	TRM/REM OP1/OP2	N	REM: Setting from the remote operator TRM: Setting from the inverter terminal
5	Operation command	F/R-SELECT REM	REM	TRM/REM OP1/OP2	N	
6	Motor pole count setting and revolution speed monitor	RPM 4P ORPM	4P	2 to 48	Y	Synchronized speed display
7	Frequency converted value setting and converted value monitor	/ 01.0 0.00	1.0	0 to 99.9	Y	The arithmetic value by the frequency converted value is displayed. (NOTE 1)
8	Current monitor	Im 0.0A 0.0%	—	—	—	The(1)section depends on the INV rated current. The(2)section displays the rate to the rated output current.
9	Torque monitor	Torque 0%	—	—	—	
10	Manual torque boost adjustment	V-Boost Code<11>	11	0 to 99	Y	
11	Manual torque boost frequency adjustment	V-Boost F 10.0%	10.0%	0 to 50.0	Y	
12	Output voltage gain adjustment	V-Gain 100%	100%	20 to 100	Y	
13	Jogging frequency adjustment	Jogging 1.00	1.0	0 to 9.99	Y	A trip occurs easily at 5Hz or more.
14	Analog meter adjustment	ADJ 172	172	0 to 250	Y	
15	Terminal input status monitor	TERM L L L L L L L L L Terminal ... FW 8 7 6 5 4 3 2 1)	—	When the terminal is ON:H When the terminal is OFF:L	—	

Note 1. The terminal output when digital output frequency monitor is set at the FM terminal of the control circuit is the "output frequency x frequency converted value"
The upper limit of output is 3.6kHz.

Display sequence	Misplay name	Display content	Trip cause, contents	Remaks
16	Warning monitor	WARN #	Normal state	When the equipment is normal, # is displayed. When a value which is larger than the upper or smaller then the lower limit is set, a warning is displayed.
		WARN F1w>Fs	Frequency setting error	
17	Alarm display	ERR1 #		Not occurred
	Trip monitor	ERR1 OVER. V	<Trip cause 1> Trip cause	The message is displayed on a priority basis when an alarm occurs. Trip cause Overvoltage trip
		ERR1 31.0	Output frequency when tripped	
		ERR1 12.5A	Output current when tripped	
		ERR1 787.0 Vdc	Voltage between P and N when tripped	
		ERR1 RUN OY 10D	Cumulative years and months when tripped	
18	Total alarm count	ERROR COUNT 0		Not occurred
		ERROR COUNT 25	Total trip count	
19	Trip history monitor	ERR2 #		Not occurred
	Last trip contents	ERR2 OC.Acce1	<Trip cause21> Trip cause	Trip cause Overcurrent trip for acceleration
		ERR2 5.0	Output frequency when tripped	
		ERR2 20.1A	Output current when tripped	
		ERR2 580.0Vdc	Voltage between P and N when tripped	
		ERR2 RUN OY 7D	Cumulative years and months when tripped	
	Contents of last trip but one	ERR3 #		Not occurred
		ERR3 EXTERNAL	<Trip cause 3> Trip cause	Trip cause External trip
		ERR3 0.0	Output frequency when tripped	
		ERR3 0.0A	Output current when tripped	
		ERR3 560.0Vdc	Voltage between P and N when tripped	
		ERR3 RUN OY 1D	Cumulative years and months when tripped	

12.3 Function mode

Function mode list when the remote operator is used

・Function mode initial values and display contents
Initial display contents, initialization, and change ranges are displayed in the table indicated below.

Display sequence	(Function mode 1)		(Function mode 2)	Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents			
1	F-00	Base frequency setting	F-BASE 60Hz	60Hz	30 to 120 (400)	・When 120Hz is switched to 400Hz by F-30, a frequency more than 120Hz can be set.
2	F-01	Maximum frequency setting	F-MAX 60Hz	60Hz	30 to 120 (400)	
3	F-02	Start frequency adjustment	Fmin 0.50Hz	0.5Hz	0.1 to 9.9	・The equipment starts running at this set value.
4	F-03 Input voltage	Motor input voltage setting	AVR AC 440 V	440	380, 400, 415, 440, 460	・The motor input voltage is set.
		AVR function for deceleration	AVR DEC OFF	OFF	ON/OFF	・ON or OFF of the AVR function for deceleration is set. When dynamic braking torque is necessary fir deceleration OFF is set.
5	F-04	Control method setting	CONTROL VC	VC	VC, Vp1, VP2, Vp3, SLV, V2	・VC, Vp1, Vp2, Vp3 : V/F characteristics SLV : Sensorless vector control V2: Sensor vector control
6	F-05 Motor constant (NOTE1)	Autotuning setting	AUX AUTO NOR	NOR	NOR/AUT/NRT	・At the first running after AUT/NRT is set, the autotuning measurement operations executed
		Motor data selection	AUX DATA NOR	NOR	NOR:Old Hitachi general purpose TOM:New Hitachi general purpose AUT:Auto-tuning data	・The autotuning motor data before starting autotuning measurement is data equivalent to NOR
		Motor capacity setting	AUX K 005.50 kw	Rated capacity of each inverter	0.75 to 220	・Set capacity smaller than the rated capacity as capacity data.
		Motor pole count setting	AUX P 4p	4p	2, 4, 6, 8	・The number of poles of the motor to be used is set.
		Motor constant R1 setting	AUX R1 1.004	Rated capacity of each inverter	0 to 65.535	
		Motor constant R2 setting	AUX R2 0.776	Rated capacity of each inverter	0 to 65.535	
		Motor constant L setting	AUX L 13.16 mH	Rated capacity of each inverter	0 to 655.35	

NOTE 1 : The motor constants R1, R2, L, M, J, Kp, Ti, and KPP vary with the capacity.

Display sequence	(Function mode 1)		(Function mode 2)		Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents				
6	F-05 Motor constant	Motor M setting constant	AUX M	123.60 mH	Rated capacity of each inverter	0 to 655.35	・Primary self inductance per phase.
		Motor J setting constant	AUX J	0.44kgm^2	Rated capacity of each inverter	0 to 655.35	・Motor and machine inertia
		Motor constant Kp setting	AUX Kp	002.00	2.0	0 to 100.00	・Smaller: High response ・Larger : Low response
		Motor constant Ti setting	AUX Ti	00100 ms	100 ms	0 to 10000	・Set this item after the feedback option PCB is installed.
		Motor constant KPP setting	AUX KPP	001.00	1.0	0 to 100.00	・Set this item after the feedback option PCB is installed.
7	F-06 Acceler-ation time	Accelera-tion time setting	ACC 1	0030.00 s	30.00 s	0.01 to 3000	・When the fuzzy most suitable acceleration and deceleration (F-10) are set, the time displayed here is invalid, though it can be set.
		2-stage acceleration time setting	ACC 2	0015.00 s	15.00 s	0.01 to 3000	・The acceleration time can be used when the input terminal CH1 is shorted. ・For input terminal selection, refer to F-34 input terminal
		Curve pattern selection for acceleration	ACC LINE	L	L	L (straight line) S (S curve) U (U curve) RU (reverse U curve)	・The curve pattern is set for acceleration and deceleration respectively.
		Acceleration and deceleration curve constant selection	ACC GAIN	02	2(common to acceleration and deceleration)	1 to 10	・When the constant is set for one of acceleration and deceleration, it is common to both acceleration and deceleration. ・See appendix 4.
8	F-07 Deceler-ation time	Decelera-tion time setting	DEC 1	0030.00 s	30.00 s	0.01 to 3000s	・When the fuzzy most suitable acceleration and deceleration (F-10) are set, the time displayed here is invalid, though it can be set.
		2-stage acceleration time setting	DEC 2	0015.00 s	15.00 s	0.01 to 3000	・The deceleration time can be used when the input terminal CH1 is shorted. ・For input terminal selection, refer to F-34 input terminal
		Curve pattern selection for deceleration	DEC LINE	L	L	L (straight line) S (S curve) U (U curve) RU (reverse U curve)	・The curve pattern is set for acceleration and deceleration respectively.
		Acceleration and deceleration curve constant selection	DEC GAIN	02	2(common to acceleration and deceleration)	1 to 10	・When the constant is set for one of acceleration and deceleration, it is common to both acceleration and deceleration. ・See appendix 4.

Display sequence	(Function mode 1)		(Function mode 2)		Initialization	Setting, change contents	Setting contenta
	Function No.	Function name	Initialization display contents				
9	F-08 Acceler-ation halt	Acceleration stop frequency setting	Fsp F	0000.0 Hz	0 Hz	0 to 400.0	・The frequency at which the acceleration operation is stopped temporarily is set.
		Acceleration stop time setting	Fsp TIME	00.0 s	0 s	0 to 60.0	・The time that the acceleration is stopped temporarily at a certain frequency during acceleration is set.
10	F-09	Pattern commanding method selection	PARAM	REM	REM	REM/* OP1/OP2 (Option connected)	・The parameter setting commanding source is selected. REM (each operator), OP1 (option 1), OP2 (option 2)
11	F-10 Running mode	Running mode selection	RUN MODE	NOR	NOR	NOR/OEN/GOD	NOR : Normal running OEN : Energy conservation running GOD : Fuzzy most suitable acceleration and deceleration running
		Restarting after FRS signal selection	RUN FRS	ZST	ZST	FST/ZST	FST : Restart after frequency maching ZST : 0Hz start
12	F-11 Multi-stage speed	Multistage speed 1 speed setting	SPD 1	0000.00Hz	0 Hz	0 to 120.0 (400)	・The input terminals CF1 is set and used
		Multistage speed 2 speed setting	SPD 2	0000.00Hz	0 Hz	0 to 120.0 (400)	・The input terminals CF2 is set and used
		Multistage speed 3 speed setting	SPD 3	0000.00Hz	0 Hz	0 to 120.0 (400)	・The input terminals CF1 and CF 2 set and used
		Multistage speed 4 speed setting	SPD 4	0000.00Hz	0 Hz	0 to 120.0 (400)	・The input terminals CF1 and CF 3 are set and used
		Multistage speed 5 speed setting	SPD 5	0000.00Hz	0 Hz	0 to 120.0 (400)	・The input terminals CF2 and CF 3 are set and used
		Multistage speed 6 speed setting	SPD 6	0000.00Hz	0 Hz	0 to 120.0 (400)	・The input terminals CF1, CF2, and CF 3 are set and used.
		Multistage speed 7 speed setting	SPD 7	0000.00Hz	0 Hz	0 to 120.0 (400)	・The input terminals CF3 is set and used
13	F-20 DC braking	DC braking selection	DCB SW	OFF	OFF	ON/OFF	・DC braking ON : DC braking available OFF : DC braking unavailable
		DC braking type selection	DCB KIND	LVL	LVL	LVL/EDG	・DC braking method selection LVL : Level operation EDG : Edge operation
		DC braking frequency selection	DCB F	0000.5 Hz	0.5Hz	0 to 400.0 Hz	・The frequency at which the DC braking starts is set.
		DC braking force selection (at stop)	DCB V-STA	00	0	0 to 20	・The DC braking force at start is set.
		DC braking force selection (at stop)	DCB V-STP	00	0	0 to 20	・The DC braking force at stop is set.
		DC braking force selection (at start)	DCB V-STA	000.0 s	0 s	0 to 600.0	・The DC braking force at start is set.

Display sequence	(Function mode 1)		(Function mode 2)		Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents				
13	F-20 DC braking	DC braking time selection (at stop)	DCB T-STP	000.0 s	0 s	0 to 600.0	・The DC braking time at stop is set.
		DC braking output cut-off time adjustment	DCB STOP-T	0.00 s	0 s	0 to 5.00	・The output frequency is lowered to the DC braking frequency and the free run time during execution of DC braking is set.
14	F-21	Dynamic braking setting	BRD-%ED	000.0%	0.0%	0 to 100.0	・The allowable usage ratio of the braking resistor for 100 seconds is set. (NOTE 1)
15	F-22 The allowable usage ratio of the braking resistor for 100 seconds is set.	Allowable instantaneous power failure time setting	IPS TIME	1.0s	1.0s	0.3 to 25 s	When an instantaneous power failure occurs, the allowable time until the power failure is recovered is set.
		Reclosing stand by after instantaneous power failure recovered	IPS WAIT	001.0 s	1.0 s	0.3 to 100.0 s	The waiting time until the rerunning starts after an instantaneous power failure occurs and is recovered is set.
		Instantaneous power failure restart selection	IPS POWER	ALM	ALM	ALM/FTP/ RST/ZST	ALM : Alarm output ZST : 0Hz start retry FTP : Retry after frequency matching stopped RST : Rerunning start retry
		Trip selection during stop at under voltage	IPS TRIP	OFF	OFF	ON/OFF	When an instantaneous power failure occurs: ON : Trip OFF : Non-trip
16	F-23 Electronic thermal	Electronic thermal characteristic selection	E-THM CHAR	CRT	CRT	CRT/SUB/FRE	・Electronic thermal characteristic setting CRT : Constant torque characteristic SUB : Reduced torque characteristic FRE : Free characteristic
		Electronic thermal level setting	E-THM LEVEL	100%	100%	20 to 120%	

NOTE 1 : Initial setting of usage ratio 1.5%…055-075HF 0%…110-2200HF

Display sequence	(Function mode 1)		(Function mode 2)	Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents			
16	F-23 Electronic thermal (NOTE 3)	Electronic thermal characteristic free setting current (1)	E-THM A1 14.4 A	Rated capacity of each inverter	0 to 600.0 A	
		Electronic thermal characteristic free setting current (1)	E-THM F1 0000 Hz	Rated capacity of each inverter	0 to 400 Hz	
		Electronic thermal characteristic free setting current (2)	E-THM A2 21.6 A	Rated capacity of each inverter	0 to 600.0 A	
		Electronic thermal characteristic free setting current (2)	E-THM F2 5 Hz	Rated capacity of each inverter	0 to 400Hz	
		Electronic thermal characteristic free setting current (3)	E-THA A3 24.0 A	Rated capacity of each inverter	0 to 600.0 A	
		Electronic thermal characteristic free setting current (3)	E-THM F3 73 Hz	Rated capacity of each inverter	0 to 400 Hz	
17	F-24 Overload restriction	Overload restriction level setting	OLOAD LECEL 125%	125%	50 to 150%	Under the sensorless vector control, an overload is detected form both the overload restriction and torque limiter. (NOTE 2)
		Overload restriction constant setting	OLOAD CONST 01.0	1.0	0.3 to 31.0	When the setting is 31.0 in SLV or V2 contorl mode, the overload restriction has no effect.
		Valid selection for overload restriction acceleration	OLOAD ACC ON	ON	ON : Valid for acceleration keep the function ON for operation.	Even if the function is set to OFF, the overload restriction is invalid only for the first acceleration when the forward and reverse run command is turned on.
18	F-25	Software lock selection	S-LOCK MD1	MD 1	MD0/MD1 MD2/MD3	MD0, MD1 : Terminal software lock (SFT) MD2, MD3 : Software lock (NOTE 1)

NOTE 1 : When Md0 is set and the input terminal SFT is turned ON, the data of all functions is locked. When MD2 is set (stored), the data of all the functions is locked. During locking, no data can be changed. MD1, MD3 can set only the output frequency.

Display sequence	(Function mode 1)		(Function mode 2)		Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents				
19	F-26 Frequency limiter	Frequency lower limiter setting	LIMIT L	0000.0 Hz	0 Hz	0 to 120.0 (400)Hz	・The lower limit of the frequency to be set is set. When the lower limit is 0, the setting is invalid.
		Frequency upper limiter setting	LIMT H	0000.0 Hz	0 Hz	0 to 120.0 (400)Hz	・The upper limit of the frequency to be set is set. When the upper limit is 0, the setting is invalid.
20	F-27 Jump frequency	Jump frequency setting(1)	JUMP F1	0000.0 Hz	0 Hz	0 to 400Hz	・The section where frequencies are to be jumped is set. ・Up to three locations can be set. ・When the number of locations is 0, the setting is invalid.
		Jump frequency setting(2)	JUMP F2	0000.0 Hz	0 Hz	0 to 400Hz	
		Jump frequency setting(3)	JUMP F3	0000.0 Hz	0 Hz	0 to 400Hz	
		Jump frequency width setting	JUMP W	0.5Hz	0.5 Hz	0 to 9.9 Hz	・The frequency width where frequencies are jumped is set.
21	F-28	STOP key validity selection during terminal running	STOP-SW	ON	ON	ON : STOP key valid OFF : STOP key invalid	・Whether or not to make the STOP key valid during terminal running is selected. In the Remote mode, the STOP key is always valid.
22	F-29	Running direction selection	F/R SW	FRE	FRE	FWD/REV/FRE	・FWD : Only forward run REV : Only reverse run FRE : Both forward run and reverse run valid
		Reverse run prevention selection	F/R PREV	OFF	OFF	ON/OFF	・Revers run prevention ON : OFF :
		Reduced voltage soft start setting	F/R RVS	6	6	0 to 6	
23	F-30	Maximum frequency selection	F-MAX-L	120Hz	120 Hz	120/400 Hz	・Maximum frequency switching : 120 : 120Hz 400: 400Hz
24	F-31 External analog frequency command	Analog input voltage selection	IN ANA	10 V	10 V	10/5	・Input voltag maximum level 10 : Max. 10V 5: Max. 5V
		External frequency start setting	IN EXS	0000.0 Hz	0 Hz	0 to 120.0 (400)	・Frequency at which the external external input starts
		External frequency end setting	IN EXE	0000.0 Hz	0 Hz	0 to 120.0 (400)	・Frequency at which the external input is maximized
		External frequency start setting rate	IN EX%S	000%	0%	0 to 100	・Input start level
		External frequency end setting rate	IN EX%E	100%	100%	0 to 100	・Input maximum level
		External command start point selection	IN LEVEL	0Hz	0Hz	0 Hz/Exs	・EXS : Start at EX%S setting rate or less

Display sequence	(Function mode 1) Function No.	(Function mode 1) Function name	(Function mode 2) Initialization display contents		Initialization	Setting, change contents	Setting contents
		Frequency command sampling frequency setting	IN F-SAMP	8	8	1 to 8	
25	F-32 Frequency arrival output signal	Arrival signal output pattern selection	ARV PTN	CST	CST	CST/PAT/ANY	CST : Output at constant frequency arrival PAT : Output of more than set frequency ANY : Output of only set frequency
		Arrival frequency rate setting for acceleration	ARV ACC	0.0 Hz	0 Hz	0 to 400.0	
		Arrival frequency rate setting for deceleration	ARV DEC	0.0 Hz	0 Hz	0 to 400.0	
26	F-33 Over-torque signal (NOTE1)	Overtorque signal rate setting (for power running)	OV-TRQ V	100%	100%	0 to 200	・During control of SLV and V2:Power running overtorque level ・During control of VC and VP1 to VP3: Warning level for power running regenerative overload ・When 0 is set: Any signal is not output.
		Overtorque signal rate setting (for regen-eration)	OV-TRQ R	100%	100%	0 to 200	・During control of SLV and V2:Regenerative overtorque level ・During control of VC and VP1 to VP3: No effect running regenerative overload ・When 0 is set: Any signal is not output.
27	F-34 Intelligent terminal input terminal setting	Input terminal 1 setting	IN-TM 1	RS	RS reset terminal	RS and 17 other terminals	
		Input terminal 2 setting	IN-TM 2	AT	AT current input selection terminal	AT and 17 other terminals	
		Input terminal 3 setting	IN-TM 3	JG	JG jogging terminal	JG and 17 other terminals	
		Input terminal 4 setting	IN-TM 4	FRS	FRS free run terminal	FRS and 17 other terminals	
		Input terminal 5 setting	IN-TM 5	CH1	CH1 2-stage acceleration and deceleration terminal	CH1 and 17 other terminals	

NOTE 1 : When setting 20% or less, the error will increase (±20% or more).
Therefore, set 20% or mote.

Display sequence	(Function mode 1)		(Function mode 2)	Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents			
27	F-34 Intelligent terminal input terminal setting	Input terminal 6 setting	IN-TM 6 CF2	CF2 Multi-stage input terminal	CF2 and 17 other terminals	
		Input terminal 7 setting	IN-TM 7 CF1	CF1 Multi-stage input terminal	CF1 and 17 other terminals	
		Input terminal 8 setting	IN-TM 8 REV	REV reverse run command input terminal	REV and 17 other terminals	
		Input terminal 1 ON/NC setting	IN-TMO/C-1 NO	NO	NO/NC	・Input terminal setting NO: ON when short circuited NC: ON when opened
		Input terminal 2 ON/NC setting	IN-TMO/C-2 NO	NO	NO/NC	・Input terminal setting NO: ON when short circuited NC: ON when opened
		Input terminal 3 ON/NC setting	IN-TMO/C-3 NO	NO	NO/NC	・Input terminal setting NO: ON when short circuited NC: ON when opened
		Input terminal 4 ON/NC setting	IN-TMO/C-4 NC	NC	NO/NC	・Input terminal setting NO: ON when short circuited NC: ON when opened
28	F-35 Intelligent terminal output terminal setting	output terminal 11 setting	OUT-TM 1 FA1	FA1	FA1/RUN/OTQ	Output terminal setting FA1: Frequency arrival signal RUN: Signal during run OTQ: Overtorque signal
		output terminal 12 setting	OUT-TM 2 RUN	RUN	FA1/RUN/OTQ	Output terminal setting FA1: Frequency arrival signal RUN: Signal during run OTQ: Overtorque signal
		Alarm output NO/NC setting	OUT-TM O/C-A NC	NC	NC/NO	・Alarm output terminal contacts a and b setting NC: b contact NO: a contact
		Output terminal 11 NO/NC setting	OUT-TM O/C-1 NO	NO	NO/NC	・Output terminal 1 contacts a and b setting NC: b contact NO: a contact Refer to C21
		Output terminal 12 NO/NC setting	OUT-TM O/C-2 NO	NO	NO/NC	・Output terminal 12 contacts a and b setting Short- NC: b contact NO: a contact
27	F-36	Carrier frequency setting	CARRIER 16.0 kHz	16.0 kHz	2.0 to 16.0Hz Selectable in 0.1 steps	・The IPM carrier frequency is set. ・The setting value varies with the capacity.

Display sequence	(Function mode 1)		(Function mode 2)	Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents			
30	F-37	Monitor signal selection	MONITOR A-F	A-F	A-F/A-T/D-F	・The FM terminal monitor signal output is selected. A-F: Analog frequency T: Torque monitor A: Current monitor D-F: Digital frequency
31	F-38 Initiali-zation	Trip history count clear	IN-TCNT CNT	CNT	CNT/CLR	・Trip count deletion selection CNT: Trip counting continued. CLR: The trip count is cleared.
		Debug mode display selection	INIT DEBG OFF	OFF	ON/OFF	・Debug mode setting ON or OFF OFF: The debug mode is turned off. ON: The debug mode is turned on.
		Digital operator rotation direction selection	INIT DOPE FWD	FWD	FWD/REV	・The digital operator running direction is set. FWD: Forward run REV: Reverse run
		Selection of reset performance	INIT RESET NO	NO	NO/OFF	NO: Alarm release when reset on OFF: Alarm release when reset off
32	F-39 Option setting	Encode pulse number setting	OP P 01024 pulse	1024	255 to 65535	Effective with option board (J-FB)
		Control mode selection	OP MODE ASR	ASR	ASR/APR	
		Ro-To option selection	OP RO-TO OFF	OFF	OFF/ON	Keep OFF.(No use)
27	F-36	Stop position setting switching	OR POS IN	IN	IN/OUT	Effective with option board (J-FB)
		Stop position setting	OR P 00000 pluse	0	0 to 4095	
		Speed setting	OR FC 0005.0Hz	5.0Hz	0 to 400 Hz	
		Direction setting	OR TURN FWD	FWD	FWD/REV	
		Completion range setting	OR L 000005 pulse	5	0 to 10000	
		Completion delay time setting	OR TW 0.00 s	0	0 to 9.99	

Display sequence	(Function mode 1)		(Function mode 2)		Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents				
34	F-41 Electr-onic gear setting	Position setting switching	PO EGRP	FB	FB	FB/REF	・Effective with option board(J-FB)
		Numerator of ratio	PO EGR-N	00001	1	1 to 9999	
		Denomi-nator	PO EGR-D	00001	1	1 to 9999	
		Feed for-ward gain	PO FFWG	0000.00	0	0 to 655.35	
		Position loop gain	PO G	000.50 rad/s	000.50 rad/s	0 to 100	
35	F-42 Torque limit setting (Note 1)	Torque limit setting switching	TRQ LIMIT	REM	REM	REM/OP1/OP2	・REM : Each operator. ・PO1 : Option 1 ・PO2 : OPTION 2
		Plus torque limit	TRQ FWD	150%	150%	20 to 150%	
		Minus torque limit	TRQ REV	150%	150%	20 to 150%	・Regenerative mode
36	F-43 PID control setting	PID target value input method switching selection	PID IN-SEL	IN	IN	IN/OUT	
		PID target value setting	PID LVL	000.00%	0%	0 to 200%	
		P gain setting	PID P	1.0	1.0	0.1 to 5.0	
		I gain setting	PID I	01.0S	1.0	0 to 15.0	
		D gain setting	PID D	000.0	000.0	0 to 100	
		Selection	PID MODE	MD0	MD0	MD0 to 4	
37	F-46 Commu-nication protocol setting	Transmission speed selection	COM BAU	00600bps	00600bps	300/600/1200/ 2400/4800/9600/ 19200	・Effective with option board(J-CM)
		Station number selection	COM NUMBER	01	1	1 to 32	
		Transfer bit length selection	COM LENGTH	8	8	8/7	
		Parity ON/OFF selection	COM PAR-SEL 1	ON	ON	ON/OFF	
		Parity even/odd selection	COM PAR-SEL2	EVN	EVN	EVN/ODD	
		Stop bit length selection	COM STOPBIT	2	2	2/1	

NOTE 1 : Smaller levels of torque limit and overload restriction are given top priority and valid for any control method.

Display sequence	(Function mode1)		(Function mode 2)	Initialization	Setting, change contents	Setting contents
	Function No.	Function name	Initialization display contents			
38	F-47 Option PCB error setting	Main body operation selection for option PCB error 1	OP-ERR1 STP	STP	STP/RUN	Effective with option board
		Main body operation selection for option PCB error 2	OP-ERR2 STP	STP	STP/RUN	
39	F-48 Selection of relay output	Setting for RYA terminal	RELAY RYA RUN	RUN	CST/PAT	Effective with option board(J-RY) CST : Arrival signal (constant speed) PAT : Arrival signal (set frequency or more) ANY : Arrival signal (set frequency only) RUN : Running signal OTQ : Over torque signal at SLV, SLV2/Overload signal at V/F control NOR : No output
		Setting for RYB terminal	RELAY RYB CST	CST	OTQ/NOR	
		Setting for RYC terminal	RELAY RYC OTQ	OTQ		

12.4 Protection function display list when the remote operator is used

There are protection functions for overcurrent, overvoltage, and undervoltage provided to protect the inverter. When one of the functions is performed, the output is cut off, and the motor is put into the free run state, and the status is kept until the inverter is forced to reset.

Name	Digital operator display	Remote operator (DOP), copy unit (DRW)display ERR1 ····
Overcurrent protection	Constant speed E01	OC. Drive
	Deceleration E02	OC. Dece1
	Acceleration E03	OC. Acce1
	Stop E04	Over. C
Overload protection	E05	Over. L
Braking resistor overload	E06	OL. BRD
Overvoltage protection	E07	Over. V
EEPROM error	E08	EEPROM
Undervoltage protection	E09	Under. V
CT error	E10	CT
CPU error	E11	CPU
External trip	E12	EXTERNAL
UPS error	E13	USP

Name	Digital operator display		Remote operator (DOP), copy unit (DRW)dispkay ERR1 ····
Ground fault protection		E14	GND. FIt
Input overvoltage		E15	OV. SRC
Instantaneous power failure		E16	Inst. P-F
Option connection error	Option 1	E17	NG. OP1
	Option 2	E18	NG. OP2
Option PCB error (NOTE1)	Option 1	E19	OP1
	Option 2	E20	OP2
Power module protection	Constant speed	E31	PM. Drive
	Deceleration	E32	PM. Decel
	Acceleration	E33	PM. Accel
	Stop	E34	PM. ERR
Undervoltage standby		_ _U	UV. WAIT

For error contents, see page 8-1.

Other displays

Display	Cause	Description
R-ERROR COMM<*>	Communication error *-1. Protocol error -2. Time-out error	This is displayed when an error occurs between the inverter and remote operator. When the STOP key or another key is pressed, the original display appears. When the original display does not appear, turn the power off and then on once again. Check whether any connectors are loose.
R-ERROR INV . RUN	During inverter running	If one of the displays on the left occurs when the copy unit is used to read or copy, take the corresponding countermeasure. ・INV. RUN : Stop the running. ・INV. TRIP : Press the STOP key to release the trip. ・INV. TYPE : The inverter type of the copy source is different from that of the copy destination. Use the same type of inverter to read or copy.
R-ERROR INV . TRIP	Under inverter trip	
R-ERROR INV . TYPE	Inverter type mismatch	
R-ERROR RD LOCK	Inverter read lock	The fourth switch of the DIP switch on the back of the remote operator is ON. When reading data, turn the switch OFF.
RESTART ***.* s ADJUST ***.* s	Instantaneous power failure restart function in operation	This indicates that the instantaneous power failure restart function is being performed. ・RESTART : 0 start is in execution ・ADJUST : Frequency matching is in execution.
UV WAIT	Under voltage	The supply voltage is lowered to the undervoltage level. When this display appears, turn the power on once again
POWER OFF	Power OFF	The undervoltage after the power is turned off is displayed.
Tuning OK Tuning NG	Autotuning function end display	This is displayed after the autotuning measurement is finished. ・Tuning OK : The measurement terminates normally. ・Tuning NG : The measurement fails.

NOTE 1 : When the J-FB is installed, and error is display for each factor as shown below.

	Digital operator display	DOP, DRW
Encoder line break :	E60	OP1 0
Overspeed :	E61	OP1 1
Positioning error :	E62	OP1 2
Thermistor line break :	E64	OP1 4
Motor overheat :	E65	OP1 5
Malfunction or abnormality on built-in CPU of the option :	E67	OP1 7

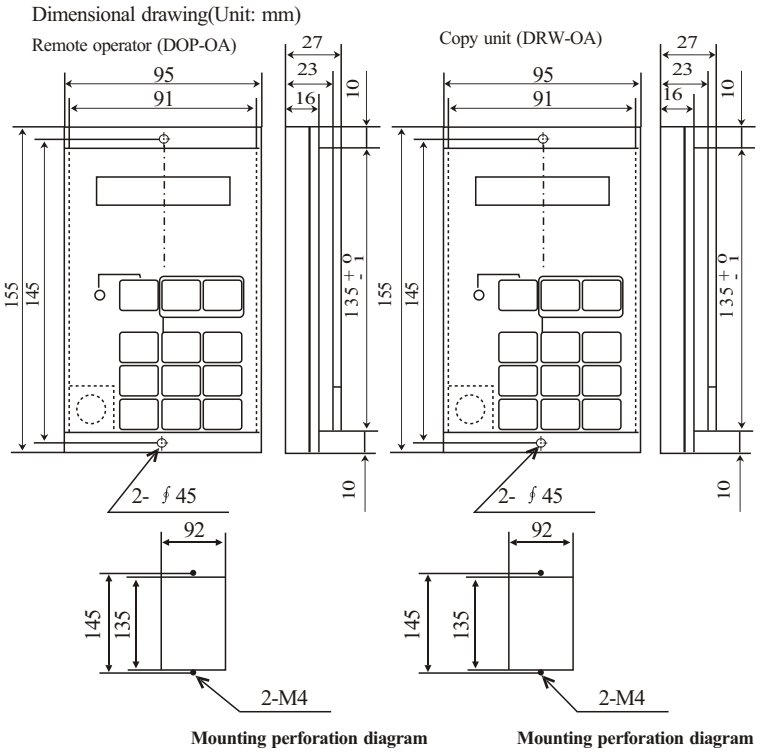
12.5 Warning Error List

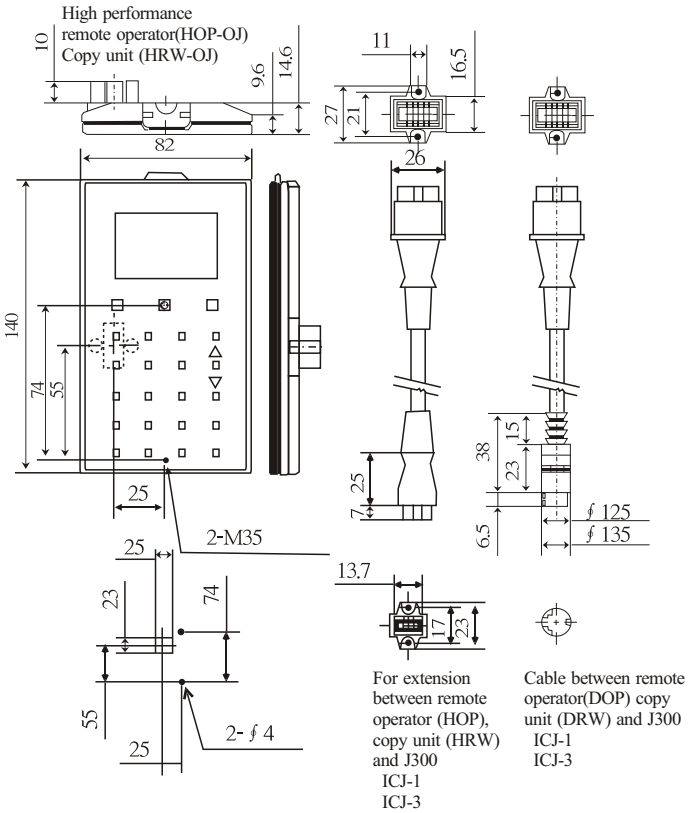
The following warning errors are displayed on the warning monitor in the monitor mode. Check the set value. When an attempt is made to set a value larger than the set range, the set value may be rewritten as shown below.

	Warning error display	Forced rewriting	Description	Alarm output	Recovery method
1	Fmax > Fch	Fmax Fch	Fch : Frequency for maximum frequency switching(120, 400) Fmax : Maximum frequency Fmin : Start frequency Fb : Base frequency Fs : Set frequency Fm : Multistage speed setting frequency Flw : Lower limiter frequency Fup : Upper limiter frequency Fp : Jump frequency Fes : External set analog start frequency Fee : External set analog end frequency Fj : Jogging frequency	OFF	Change the frequency to the correct value. (Note that when the equipment is operated without the frequency being corrected, the set contents are automatically rewritten to the contents for " Forced Rewriting".
2	Fb > Fmax	Fb Fmax			
3	Fs > Fmax	Fs Fmax			
4	Fm > Fmax	Fm Fmax			
5	Flw > Fmax	Flw Fmax			
6	Fup > Fmax	Fup Fmax			
7	Fes > Fmax	Fes Fmax			
8	Fee > Fmax	Fee Fmax			
9	Fs > Fup	Fs Fup			
10	Fm > Fup	Fm Fup			
11	Fmin > Fup	Fmin Fup			
12	Flw > Fs	Flw Fs			
13	Flw > Fm	Flw Fm			
14	Fmin > Fs	Fmin Fs			
15	Fmin > Fm	Fmin Fm			
16	Fmin > Fj	Fmin Fj			
17	Fmin > Flw	Fmin Flw			
18	Fp > Fs	Fp Fs			
19	Fp > Fj	Fp Fj			
20	Fp > Fm	Fp Fm			

12.6 Dimensions

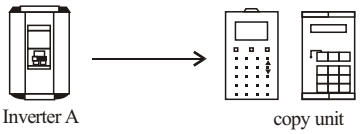
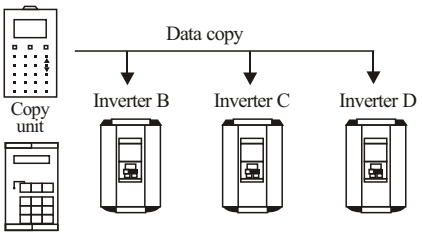
Remote operator, copy unit

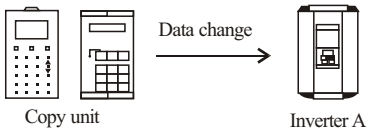
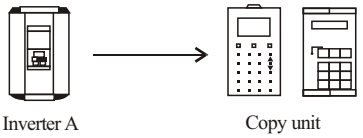




NOTE 1 : The cables for the VWS3A and VWA series art different in cable shape from those for the J300. The cables for the J300 ae the same as those for the J100. To change only cables, various cables are in stock.

12.7 Copy Unit Function

Operation example (Procedure to transfer the data of inverter A to B, C and D inverters)			
Seq-uence	Operation	Key	Operation result
1	Set data is read out from the inverter A (It is stored into the memory)	READ	
2	Turn off the power supply to inverter A and remove the cable.	———	
3	Connect the cable to inverter B and turn on the power.	———	
4	Copy data stored in the copy unit is written to inverter B.	COPY 1)	
5	Cut off the power supply to inverter B. (*1)	———	
6	Perform the above processes from 3 to 5 sequentially for inverters C and D. That is, the same process as at for inverter B.	———	

Operation example(Process to change and transfer to inverters B, C and D)			
1	Connect the cable and press the remote key. Change the data of the inverter with copy unit.	MON FUNC STR 1 2	
2 6	Read out the data from inverter A (It is stored into the memory area of the copy unit). The following procedures are the same those of the operation 1. Change the data setting first.	READ	

*1 When pressing any key or resetting the unit after COPY key is pressed, be sure to wait for at least six seconds.
(When any key is pressed, the unit is reset, or the power is turned off within six seconds, the data may not be copied.)

12.8 Data to be copied by the copy unit

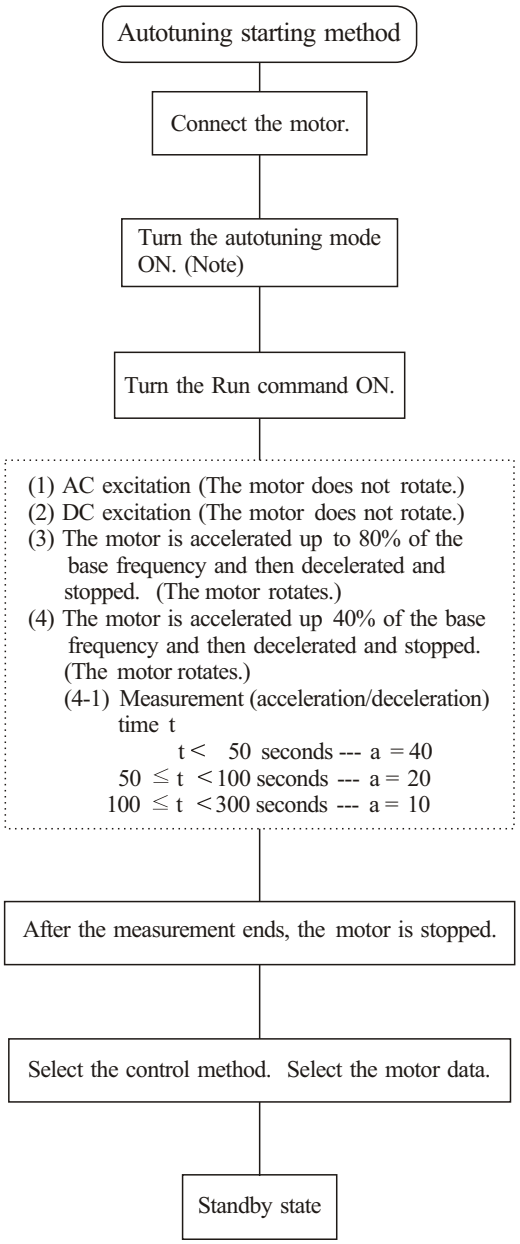
Precautions for copying
The copy units, DRW and HRW cannot copy some of parameters.
For the details, sett Appendix 7.

Appendix 1 Manual for New Functions

1. Autotuning

[Outline of the function]

This is a function for automatically setting the motor circuit constant necessary for the sensorless vector. When the autotuning function is performed by a motor which is designed according to JIS C 4210 and then the sensorless vector is controlled, even a motor (Hyundai general purpose motor) whose constant is unknown at an output frequency of 1Hz can generate a torque of 150%.
An Hyundai general purpose motor is given a constant which is a default value. Therefore, in every case, the characteristics will be obtained without trouble. When the characteristics cannot be obtained, measure the motor circuit constant by the autotuning function



(1) Before executing the autotuning function, make sure the following set values.
① a) Base frequency
b) Motor capacity
c) No. of motor poles
Set the values according to a motor which uses a, b, and c.
② Make sure that 0Hz is not set. (When 0Hz is set, the autotuning function will not be performed.)
③ Cancel all the DC braking settings.
(DC braking is not set by initialization.)
④ Make an motor input voltage setting
(F-03 AVR AC ☐) according to the motor rating

(2) Drive the motor for about 60 to 120 seconds.
(During autotuning, the motor auto-matically runs in the order of (1) to (4) given on the left and the motor constant is measured. Therefore, make sure before starting operation that no problems are caused to the load to be connected during the automatic running from (1) to (4))

Example :
When the base frequency is 120Hz, the motor runs up to 80% of the base frequency in (3), that is, 96Hz and then decelerates and stops.

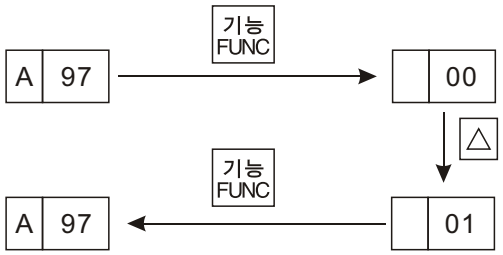
The status for using the autotuning data is set.

Running under sensorless vector control is available.

Autotuning start

[Setting method]

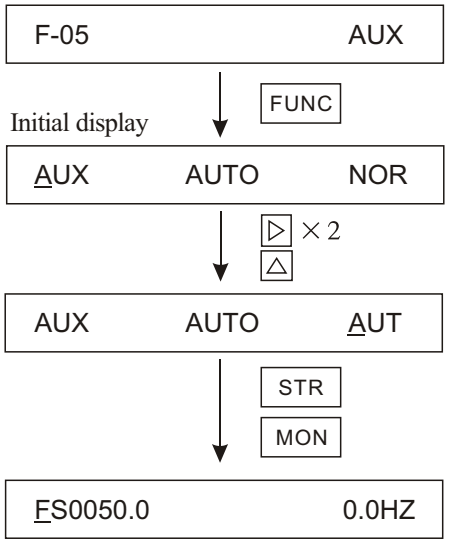
(1) Digital operator



Display the A97 software switch and set it to the data (01) for starting autotuning setting.

When the equipment starts running after the data is set, the autotuning measurement is executed.

(2) Remote operator



F-05 motor constant setting is displayed.
Display the AUX AUTO screen and select AUT or NRT.

Autotuning
NOR : Setting OFF and autotuning end
AUT : Autotuning measurement start (Motor rotates)
NRT : Autotuning measurement start (Motor does not rotates)

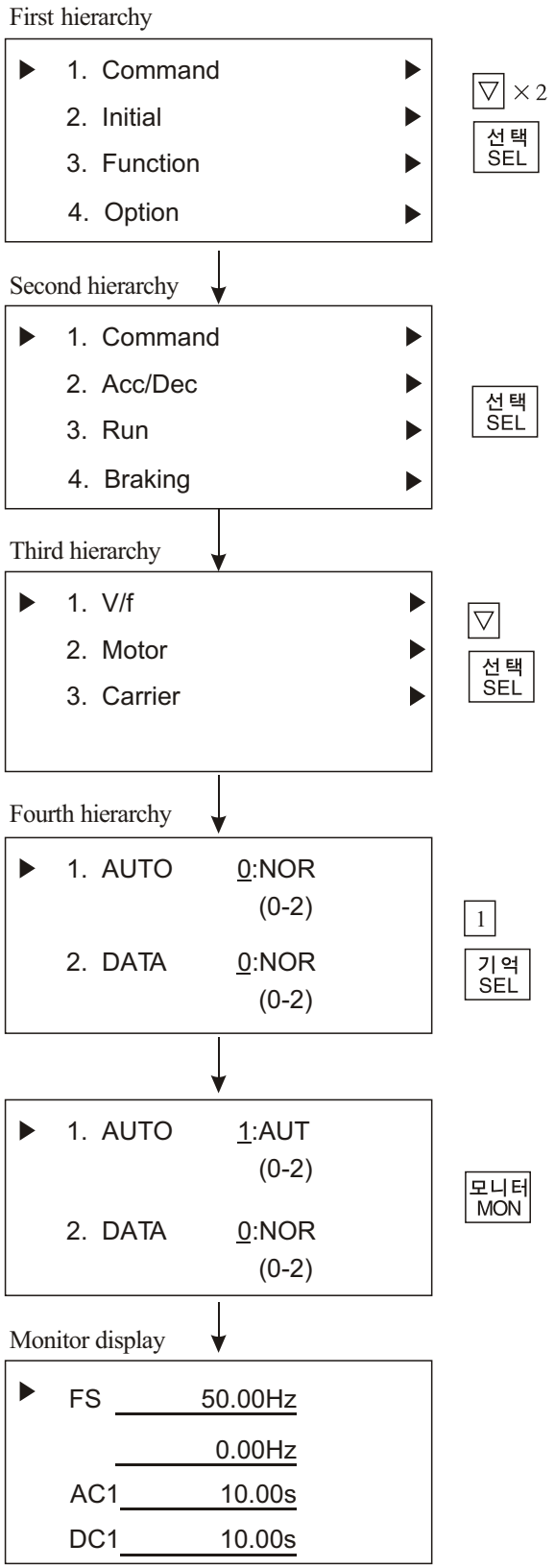
When the equipment starts running after the data is set, the autotuning measurement is executed.

When the autotuning operation terminates, "Display at end" indicated on A-4 page is displayed. When the autotuning operation terminates normally, see the " running method by autoutuning data" indicated on A-5 page. When the autotuning fails, set "measurement start" once again and perform rerunning.
When A97 is set to 02 on the digital operator or NRT is selected on the remote operator, auto tuning is performed in a mode in which the motor does not run (only AC excitation and DC excitation are possible). Then, the value of motor constants R1, R2 and L are measured.

Precautions

1. When the autotuning function is executed is executed in the state that the DC braking is set, the accurate motor constant will not be set. Cancel the DC braking the then start measurement.
2. By the autotuning function, a capacity between the applicable motor capacity and motor capacity under one frame can be set.
3. When acceleration or speeding up is not to be performed in the operation for accelerating up to 80% of the base frequency, lower the set value of manual torque boost.
4. The autotuning measurement time is about 2 minutes or so. However, the measurement time may be increased depending on the load inertia. When the measurement time exceeds 5 minutes, press the STOP key so as to decrease the set value of manual torque boost and enter the run command once again.
5. Be sure if motor is in standstill before you carry out an autotuning. Autotuning data carried out when motor is still running may be not correct.
6. Do not interrupt an autotuning with power off or any stop command except emergency case. It may case data lose. In it is occurred, make an initialization and reprogram what you need, and carry out autotuning again.

(3) New remote operator

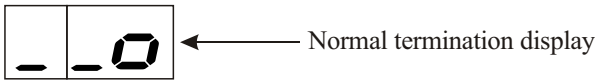


Display when the autotuning terminates

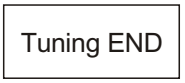
[Display in the normal state]

- When the autotuning terminates normally, the following is displayed. When one of the keys is pressed, the original screen is displayed.

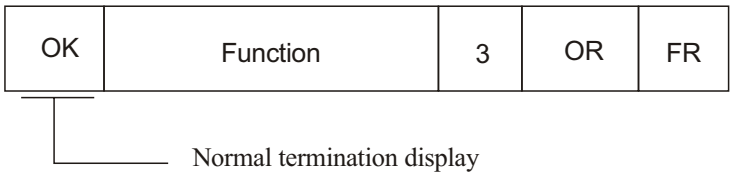
  - Digital operator



  - Remote operator



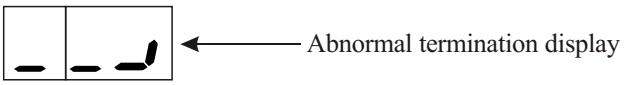
  - New remote operator



[Display in the normal state]

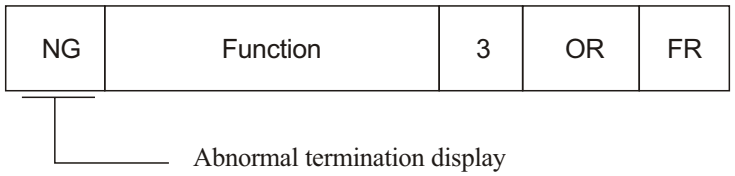
- If the autotuning is executed when the motor is not connected to the inverter, the following is displayed and the measurement is stopped. As a motor constant when the measurement fails, the last value is set. When one of the keys is pressed. the original screen is displayed.
  When executing the measurement once again, change the autotuning measurement setting to "Start" and enter the run command in the same way.

  - Digital operator



  - Remote operator

  - New remote operator



When running the inverter using the autotuning data after the autotuning measurement terminates, make settings by the method indicated on the next page.

Running method by autotuning data

When running the inverter using the autotuning data :

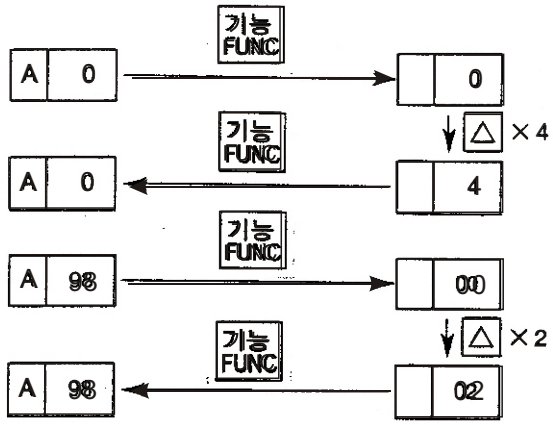
1. A-0 : The control method is set at SLV (sensorless vector control).
2. A-98 : The motor data is set on the autotuning side by the software switch.

Make the above two setting.

NOTE : When no torque is outputted during the sensorless vector run after the above setting are made, make the following setting. Increase the set value of R1 of each remote operator (motor constant) before starting running.

[Setting method]

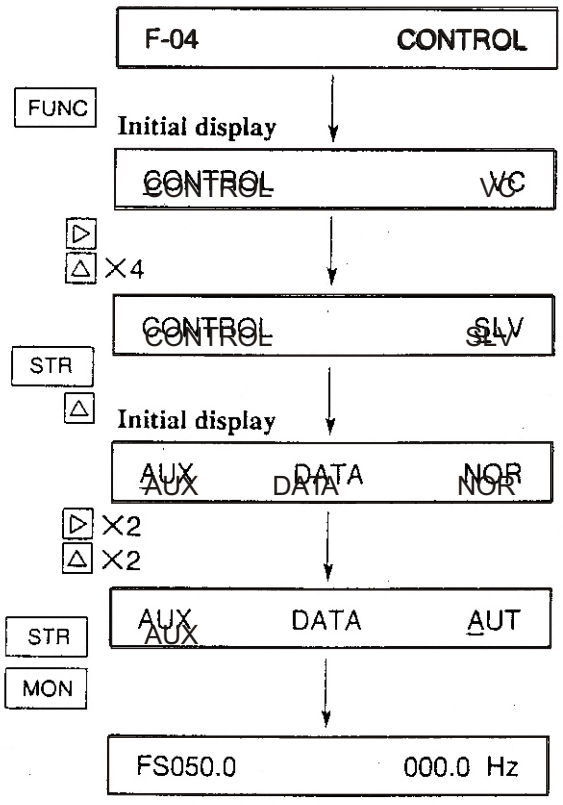
(1) Digital operator



1. Select [4] (sensorless vector control) by the [A00] control method.
   0 : Constant torque characteristic
   1 : Reduced torque characteristic (1.5 power)
   2 : Reduced torque characteristic (1.7 power)
   3 : Reduced torque characteristic (2.0 power)
   4 : Sensorless vector control
2. Set the motor constant data to the data which is [A98] measured by the autotuning function using the software switch.
   (Refer to the [A98] software switch of the operation manual.)
   (When executing the second setting, change the switch.)

By the above two setting, running by the autotuning data is available

(2) Remote operator



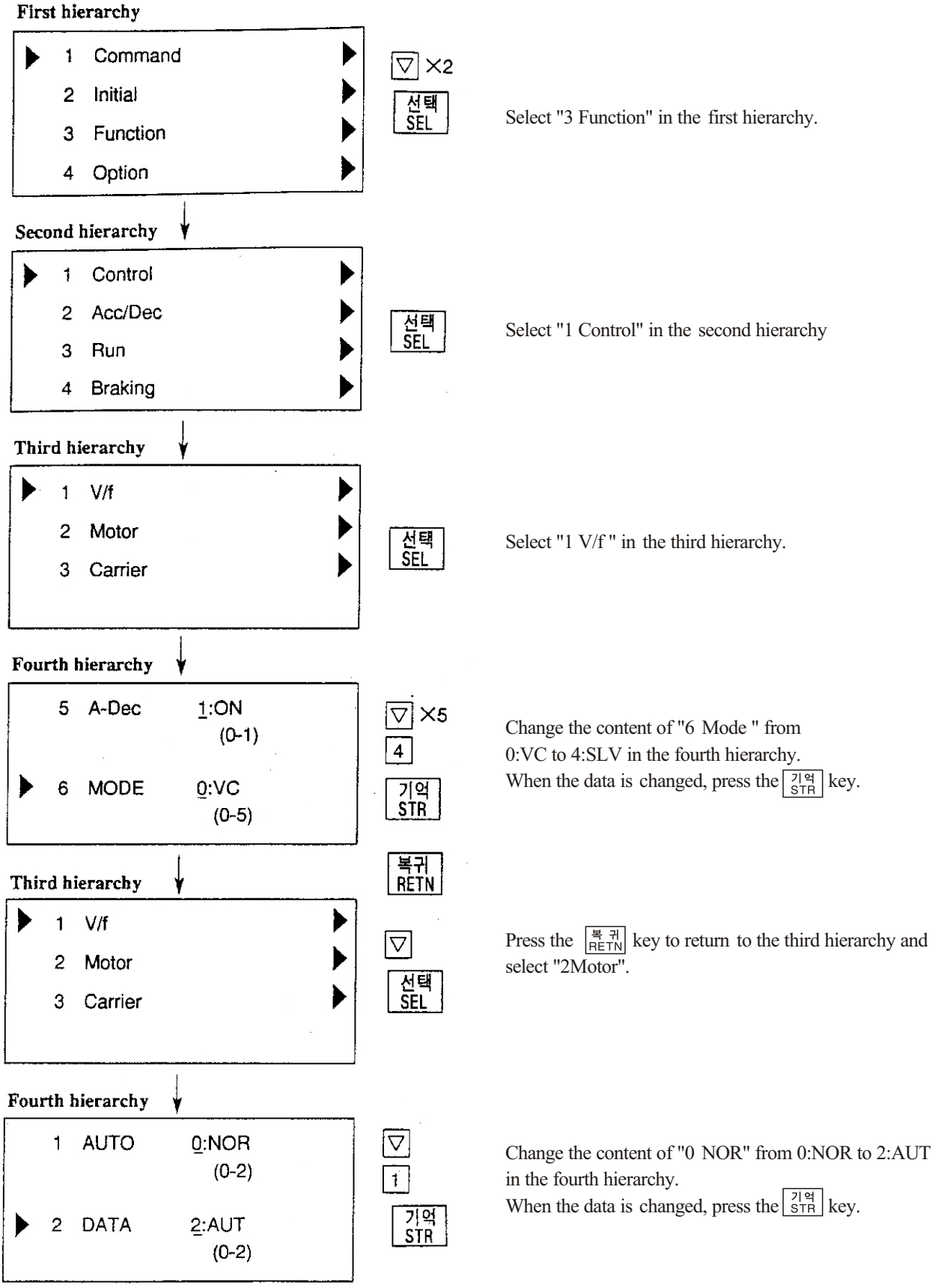
1. Select [SLV] (sensorless vector control) by the F-04 control method.

   VC: Constant torque characteristic
   VP1: Reduced torque characteristic (1.5 power)
   VP2 : Reduced torque characteristic (1.7 power)
   VP3 : Reduced torque characteristic (2.0 power)
   SlV : Sensorless vector control

2. Set the [AUT] autotuning data by motor data selection of the F-05 motor constant.

By the above two setting, running by the autotuning data is available

(4) New remote operator



When the monitor mode is selected, running by the autotuning data starts.

[NOTES]

*1 : If the desired characteristic cannot be obtained in a sensorless vector control operation with auto tuning measured data, adjust the motor constant according to the detected symptom shown below.
(DOP, DRW, HOP and HRW functions of the remote operator are needed for this adjustment)

Operation Status	Symptom	Adjustment	Adjusting Item (DOP/DRW Function No.)
Power running (status with an acceleration torque)	When low frequency (a few Hz) torque is insufficient	Increase the motor constant R1 in relation to auto tuning data step by step within 1.2 times.	[F-05 AUX R1]
	When the speed fluctuation coefficient becomes minus	Increase the motor constant R2 in relation to auto tunning data step by step within 1.2 times.	[F-05 AUX R2]
	When the speed fluctuation coefficient becomes plus	Decrease the motor constant R2 in relation to auto tuning data step by step within 0.8 times.	[F-05 AUX R2]
Regeneration (status with a decelerating torque)	When low frequency (a few Hz) torque is insufficient	① Increase the motor constant R1 in relation to auto tuning data step by step within 1.2 times.	[F-05 AUX R1]
		② Derease the motor constant M in relation to auto tuning data step by step within 0.8 times.	[F-05 AUX M]
		③ Decrease the carrier frequency set value.	[F-36 CARRIER] (AIO for digital operator)
		Combine the methods ① to ③ above to adjust the motor constant.	

*2 : If, when the sensorless vector is controlled, 2 frames or less maximum applicable motors are operated, then the characteristic may not be satisfactory.

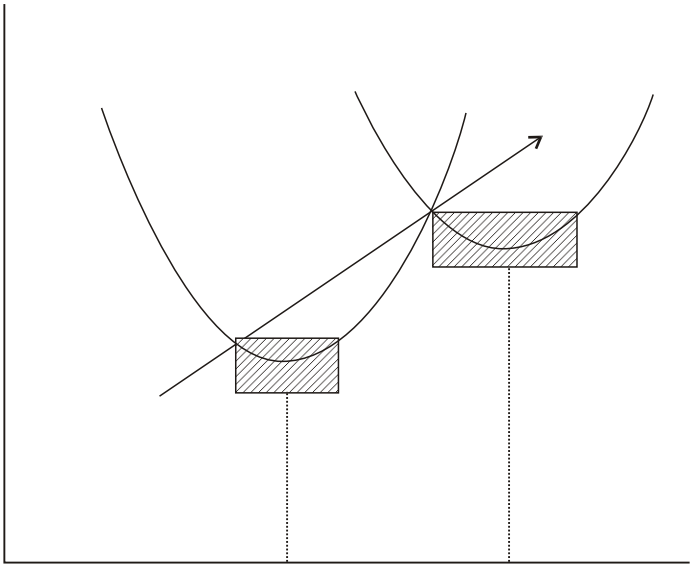
*3 : No sensorless vector control operation is possible if plural motors are operated.

2. Energy conservation running

[Outline of the function]

This is a function for automatically setting the output voltage corresponding to the load during the V/F control running and suppressing useless power.
The function is effective for a load of reduced torque characteristics such as a fan and pump.

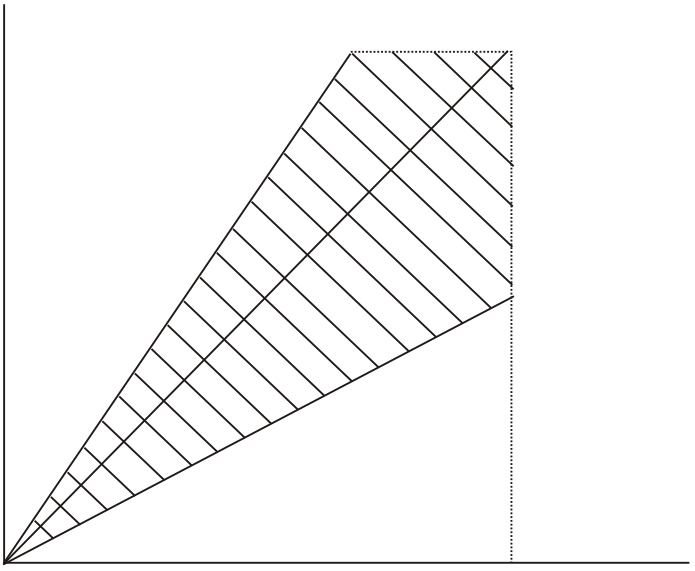
When the load of an induction motor is constant as shown in the drawing on the right, there is a voltage at which the current is minimized. When the current is minimized, the power is also minimized. The function auto-matically searches this voltage.



[Precautions]

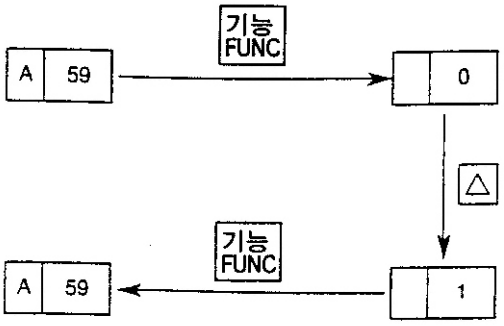
1. The output voltage is decreased so as to minimize the current. The search limits are the voltage of torque constant characteristic ±50% .

2. The function is performed under comparatively slow control. Therefore, when a sudden load change (such as an impact load) occurs, the motor may stall.



[Setting method]

(1) Digital operator

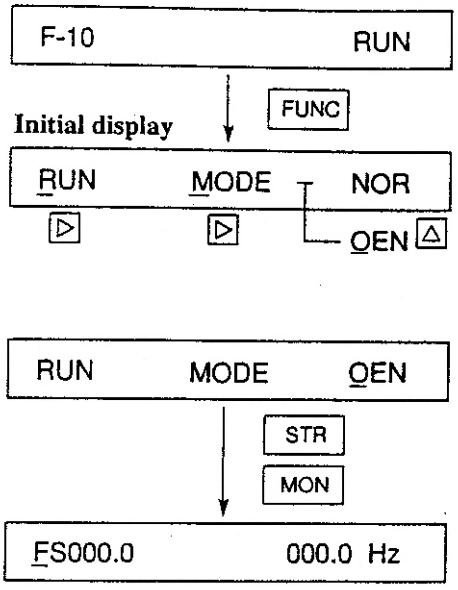


Select [ ] [1] by [A] [59] running mode selection.
Running mode selection

0 : Normal running
1 : Energy conservation running
2 : Fuzzy most suitable acceleration and deceleration running

When the running starts after the data is set, the energy conservation running is performed.

(2) Remote operator

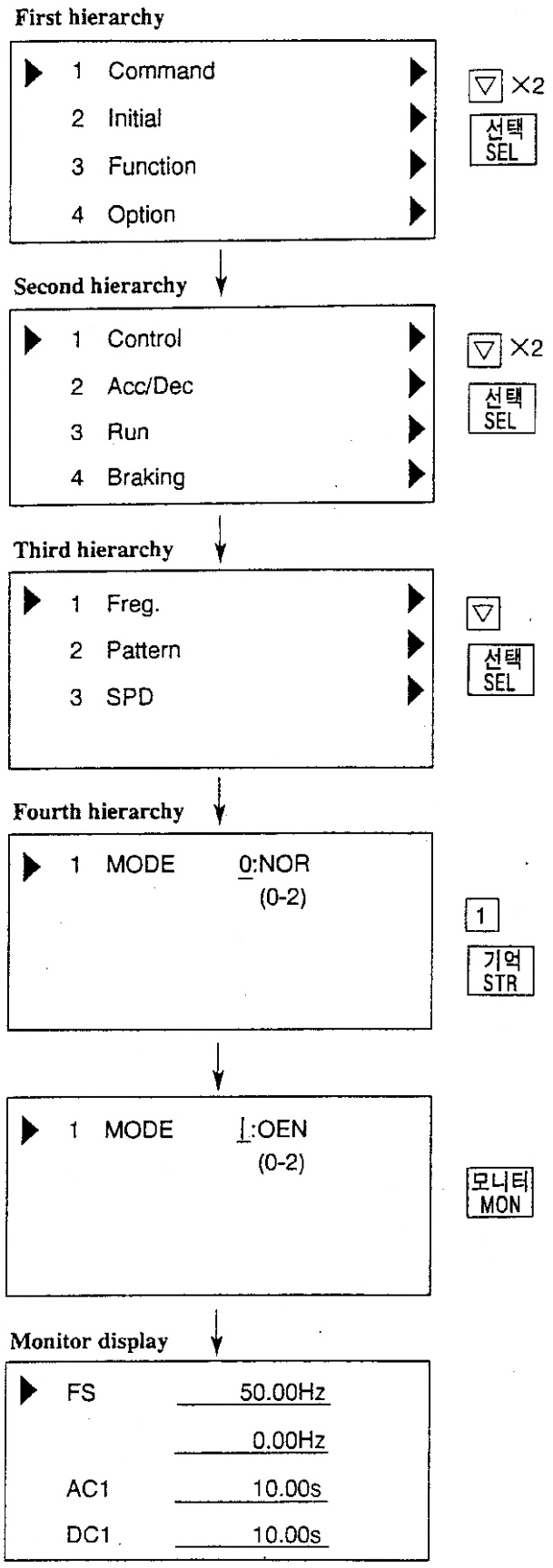


F-10 running mode selection is displayed. Display the RUN MODE screen and select "OEN".

Running mode selection
NOR : Normal running
OEN : Energy conservation running
GOD : Fuzzy most suitable acceleration and deceleration running

When the running starts after the data is set, the energy conservation running is performed.

(3) New remote operator



3. Fuzzy most suitable acceleration and deceleration

[Outline of the function]

The fuzzy most suitable acceleration and deceleration function realizes acceleration and deceleration characteristics using the inverter capability at its maximum under fuzzy control to eliminate troublesome setting of the acceleration and deceleration time.

The acceleration time is a time for acceleration at the current specified by the overload restriction constant.

The deceleration time is a time for decelerating so that the current does not exceed 150% of the specified one or the DC voltage in the inverter circuit does not exceed 770V.

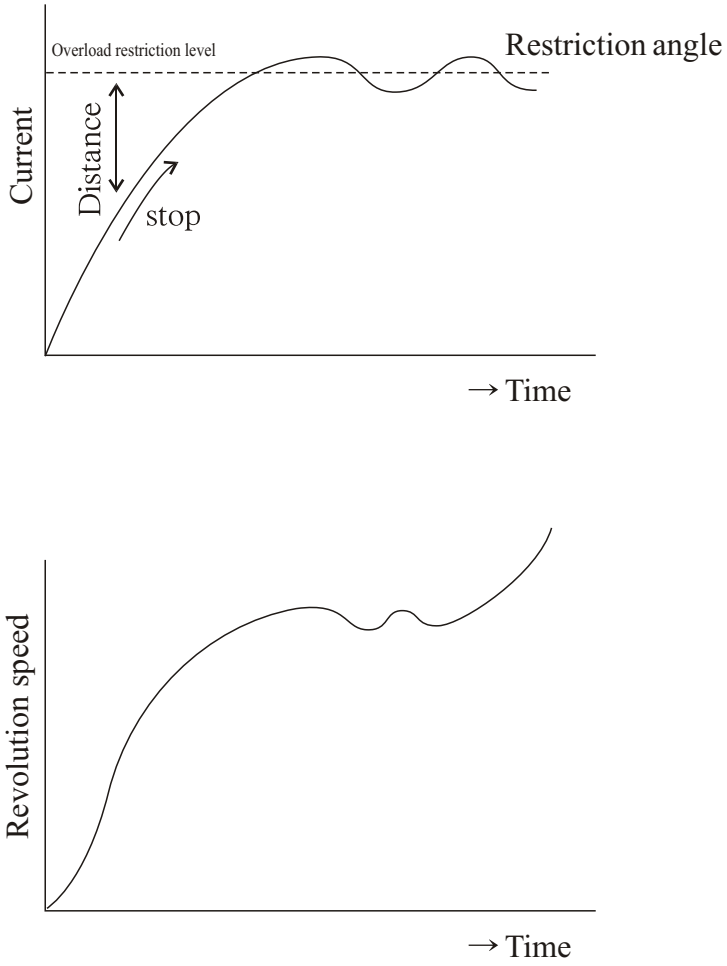
The function sets the acceleration and deceleration time automatically in response to a change in the load or inertia in real time.

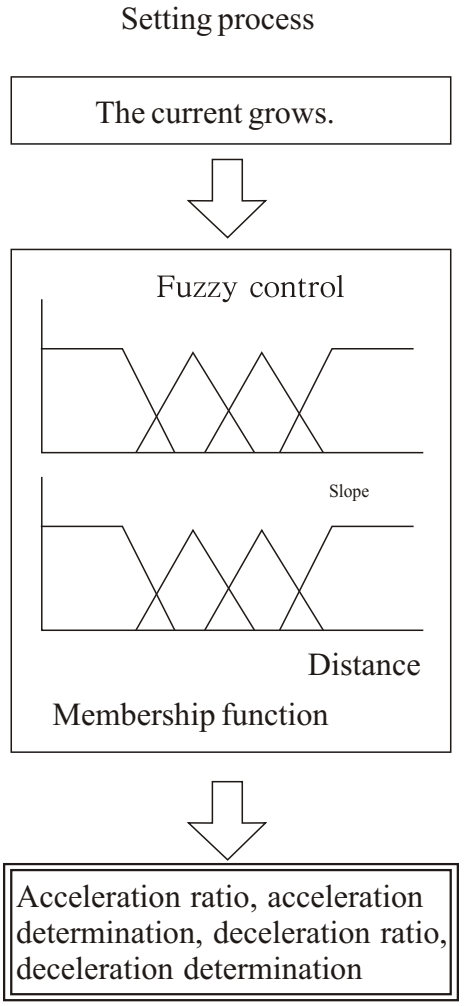
[Precautions]

1. This function is not suitable for a machine which requires a constant acceleration and deceleration time. The acceleration and deceleration time varies with the magnitude of the load or inertia.
2. When the inertia of the machine is more than about 20 times of that of the motor shaft, a trip may occur.
3. The acceleration and deceleration time of the same motor always varies with a change of the current.
4. The fuzzy most suitable acceleration and deceleration setting function is valid only under the V/F control. In the high start torque running mode (under the sensorless vector control), the normal running is performed.
5. If the jogging running is executed when the fuzzy most suitable acceleration and deceleration setting function is selected, the jogging operation cannot be performed due to the fuzzy control.
6. When the load is more than the rated one, the deceleration time may be increased.
7. When acceleration and deceleration (the cycle is 2 [s] or less) are repeated frequently, a trip may occur.
8. If an external braking unit is used, the motor cannot stop within the deceleration time set with a braking resistor. In such a case, do not use the fuzzy acceleration/deceleration function

[Principle]

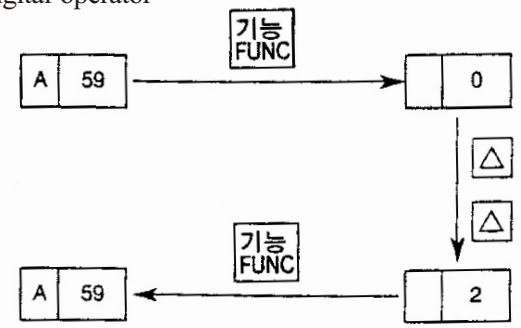
The acceleration and deceleration ratio or acceleration and deceleration are set in accordance with the fuzzy rule from the distance to the overload restriction level and the start slopes of current and voltage.





[Setting method]

(1) Digital operator

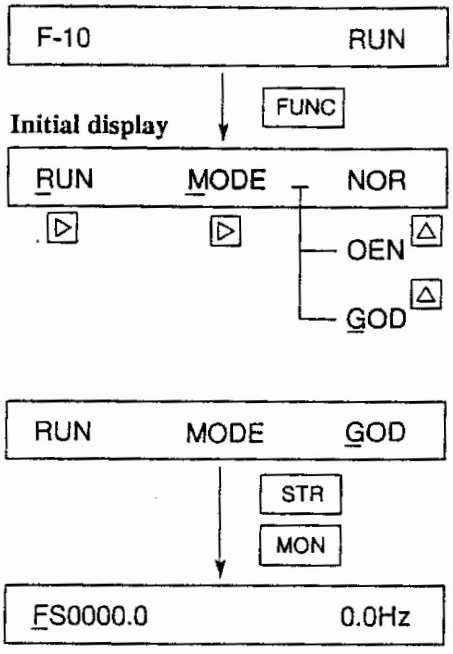


Select [ ][2] by [A][59] running mode selection.
Running mode selection

0 : Normal running
1 : Energy conservation running
2 : Fuzzy most suitable acceleration and deceleration running

When the running starts after the data is set, the most suitable acceleration and deceleration running is performed.

(2) Remote operator



F-10 running mode selection is displayed. Display the RUN MODE screen and select "GOD".

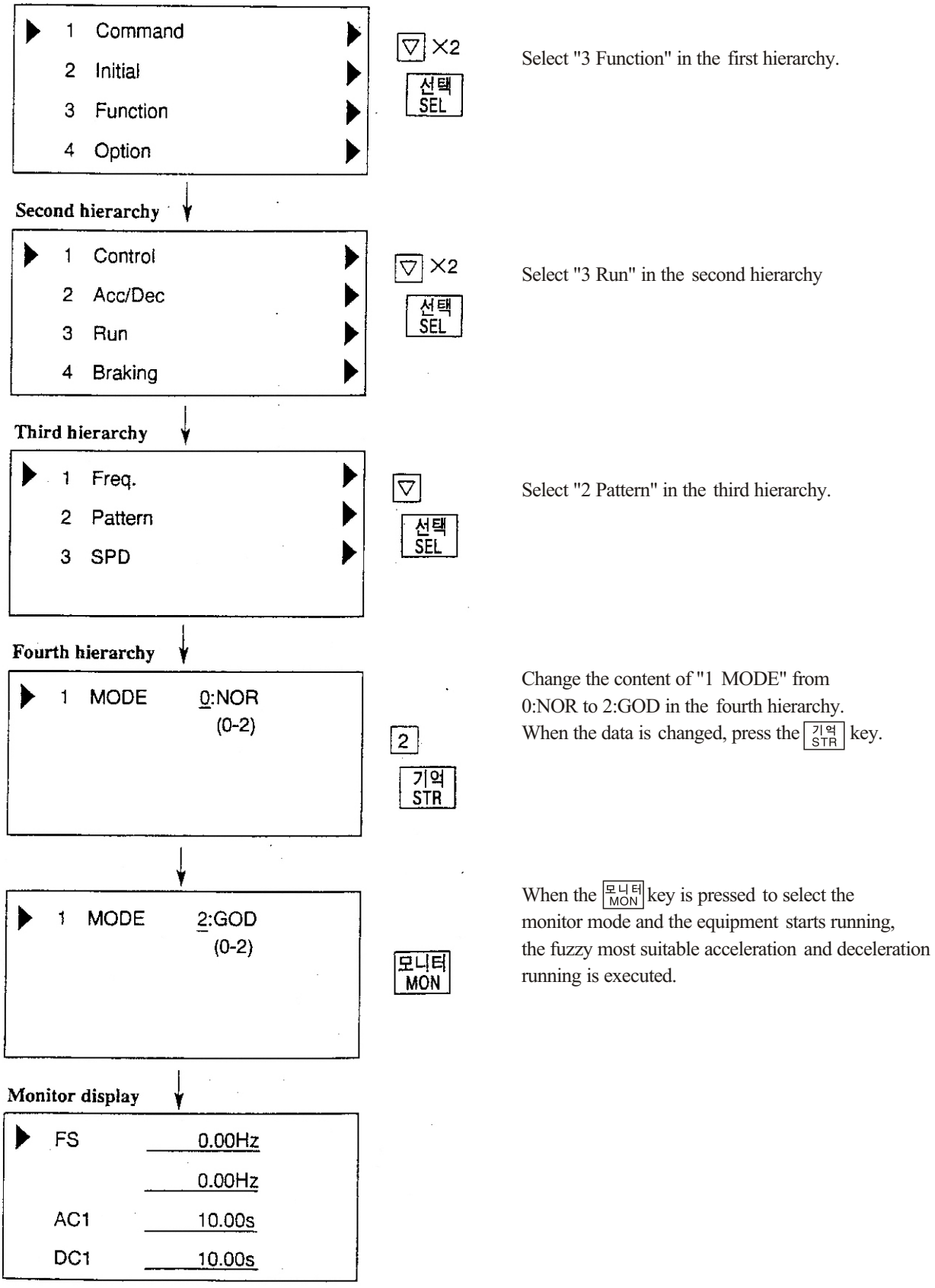
Running mode selection
NOR : Normal running
OEN : Energy conservation running
GOD : Fuzzy most suitable acceleration and deceleration running

When the running starts after the data is set, the most suitable acceleration and deceleration running is performed.

* When the running starts after the data is set, the acceleration and deceleration time display is as shown below. During the fuzzy most suitable acceleration and deceleration running, the acceleration and deceleration time display is the monitor mode is invalid. (The time can be set but the display is invalid. It becomes valid once again during the normal running.)

(3) New remote operator

First hierarchy



Appendix 2 Instantaneous Power Failure Restart and Commercial Power Source Switching

1. Instantaneous power failure restart

[Function Outline]

This function allows an inverter operation to be selected according to the subject system as follows when an instantaneous power failure occurs.

- Retry mode : When FTP/RST/ZST is set at IPS POWER
- Alarm mode : When ALM is set at IPS POWR
- f matching : The rotation speed and the phase are detected while the motor is on a free running to restart the operation accordingly.

⚠ WARNING

- When the inverter stop due to a trip with retry mode selected, the motor restarts suddenly. Stand cleat of the machine. Otherwise, you may be injured. (Design the machine in such a way that persons are protected against a restart of the machine.)

[Setting Method]

Remote operator [F-22]		Digital operator	At instantaneous power failure	At low voltage	At overcurrent/ overvoltage/ power module error	At other error
IPS TIME	0.3 to 25.0	—	Set an allowable instantaneous power failure time	—	—	—
IPS WAIT	0.3 to 100.0	—	Set a wait time after an instantaneous power failure/power restoration in the retry mode or after an error.			—
IPS POWER	ALM	0	Tripping with an instantaneous power failure within the IPS TIME. If an operation command is issued for an instantaneous power failure detected out of the IPS TIME, restart the operation (0Hz start).	Tripping	Tripping	Tripping
	FIP	1	The f matching stops with an instantaneous power failure detected within the IPS TIME. The inverter trips with an instantaneous power failure detected out of the PIS TIME.	The f matching stops if power is restored within 40s. The inverter trips unless power is restored within 40s.	The f matching is retried.	
	RST	2	The f matching is restarted if the instantaneous power failure is within the IPS TIME. The inverter trips if the instantaneous power failure is not within the IPS TIME.	The f matching is restarted if power is restored within 40s. The inverter trips unless power is restored within 40s.		
	ZST	3	The inverter is restarted at 0 Hz if the instantaneous power failure is within the PIS TIME. The inverter trips if the instantaneous power failure is not within the IPS TIME.	The inverter is started at 0Hz if power is restored within 40s. The inverter trips unless power is restored within 40s.		
IPS TRIP	OFF	—	No retry at an instantaneous power failure and on trip at low voltage during the inverter stop.		—	—
	ON	—	Retry or under voltage trip is performend during the inverter stop or running.		—	—

⚠ WARNING

- If the retry mode is selected, do not approach the inverter unnecessarily. It will be restarted suddenly after it trips/stops. (Design the inverter so that the safety can be assured even in such a restart.) Otherwise, bodily injury will result.

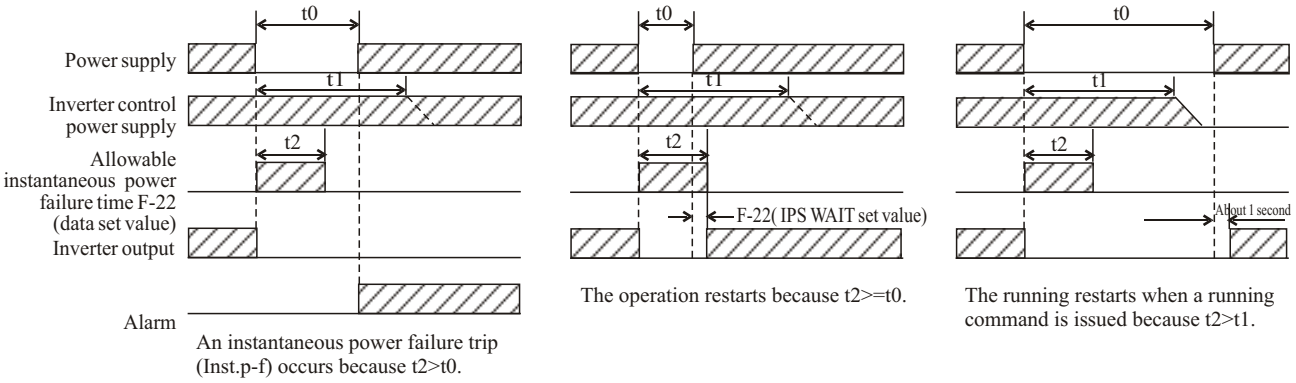
NOTE : Since the retry mode is selected, the equipment, over voltage, or under voltage. For undervoltage, 16 retries (17th trip) are executed. For overcurrent or overvoltage, 3 retries (fourth trip) are executed. Do not use this function for a case that a fallen substance should be held by the machine brake when the motor is in the free-run mode.

In the following cases, the equipment may start at the lowest frequency (called 0 start).

① When the reclosing standby time (function mode F-22, IPS WAIT) after the instantaneous power failure is recovered is set to 3 seconds or more
② When the output frequency is more than 60Hz
③ When the base frequency is 60Hz : Driven at 30Hz or less
When the base frequency is 50Hz : Driven at 25Hz or less
④ When the induced voltage of the motor attenuates earlier (for example, a pump or high-speed gear which causes the motor to decelerate for several seconds or less)

NOTE : The inverter control power holding time may be slightly different depending on the inverter rating, the load status, remote operator (copy unit) connection status, and input voltage.

< Time chart for retry mode>



An instantaneous power failure trip (Inst.p-f) occurs because t2>t0.

The operation restarts because t2>=t0.

The running restarts when a running command is issued because t2>t1.

2. Commercial power source switching

Digital operator

Data set for commercial power source switching

Function code [F 9]

Set value	Run command to	Frequency command to
03	Terminal	Terminal

=>Set the terminal mode

Extension function code [C 3]

Function name	Terminal rating plate	Set value
Input terminal setting 3	3	14

=>Select the CS terminal

NOTE: Allocate the commercial power source switching input terminal CS to one of the input terminal setting 1 to 8 ([C 0] to [C 7]). In this example, the terminal CS is allocated to the input terminal setting 3.

Remote operator (DOP) or copy unit (DRW)

Monitor mode

F-SET-SELECT TRM

F/R-SELECT TRM

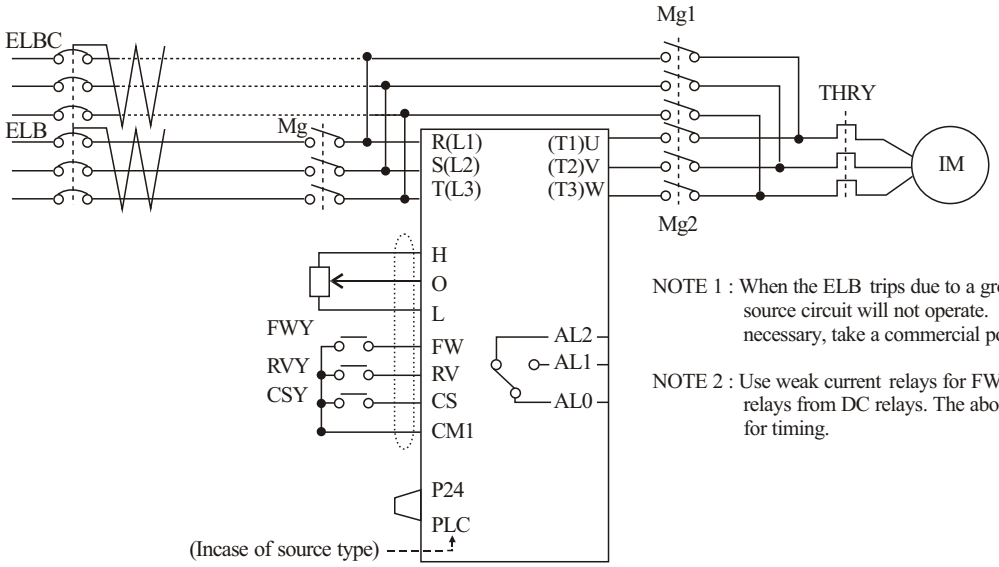
=>Set TRM (terminal mode)

Function mode F-34

IN-TM3 CS

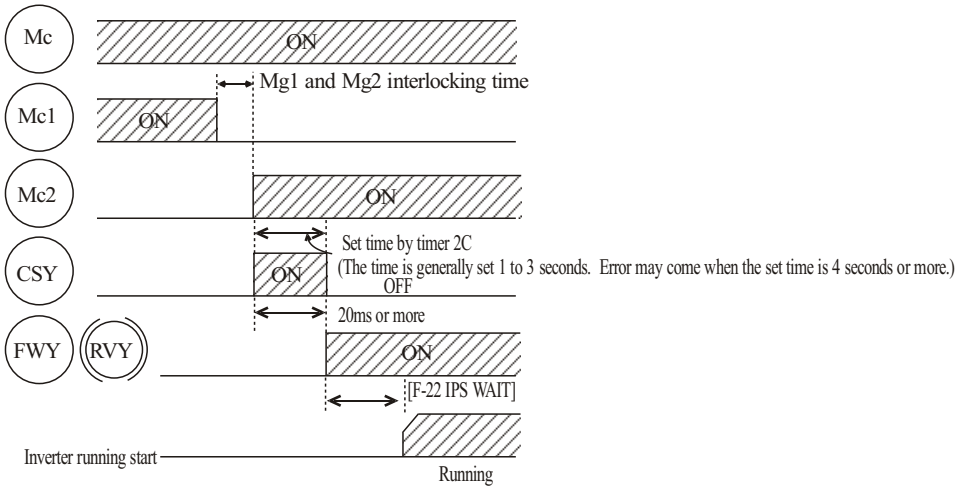
=>Select the CS terminal.

NOTE : Allocate the commercial power source switching input terminal CS to one of the input terminal settings 1 to 8 (IN-TM1 to IN-TM8). In this example, the terminal CS is allocated to the input terminal setting 3.



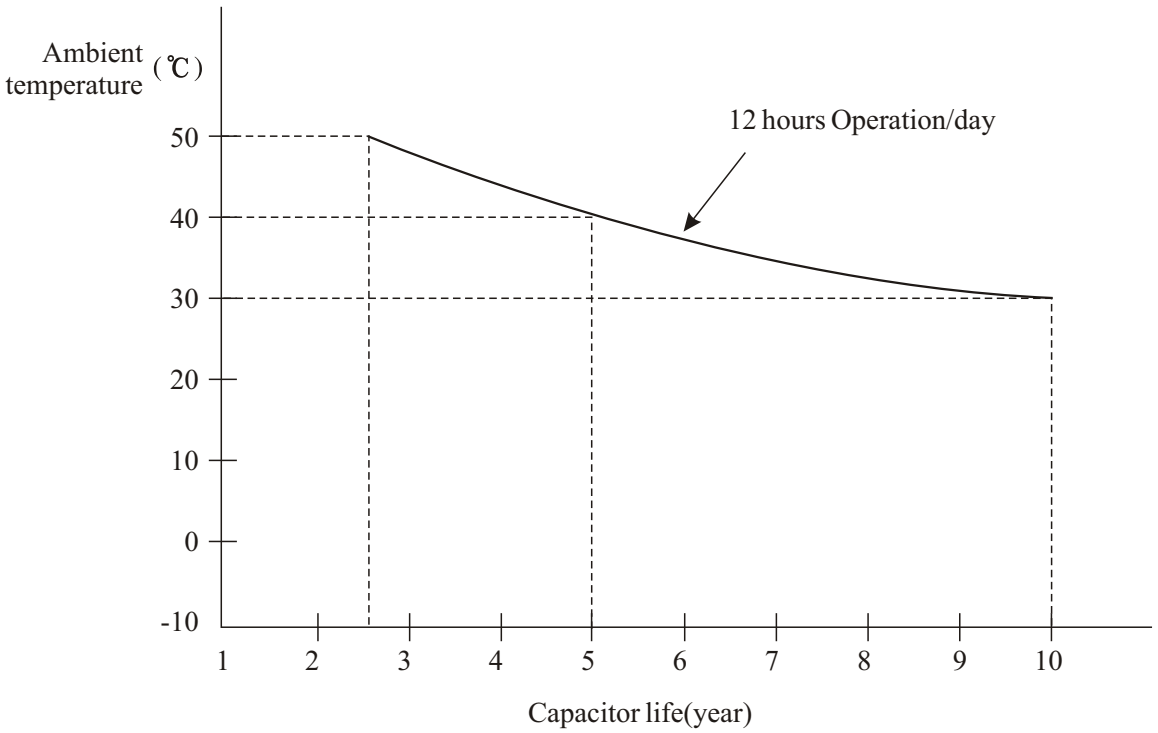
NOTE 1 : When the ELB trips due to a ground-fault, the commercial power source circuit will not operate. Therefore, when a backup is necessary, take a commercial power source circuit from the ELBC.

NOTE 2 : Use weak current relays for FWY, RVY and CSY. Separate AC relays from DC relays. The above sequence is a reference drawing for timing.



Connection example diagram and timing for commercial power source switching running

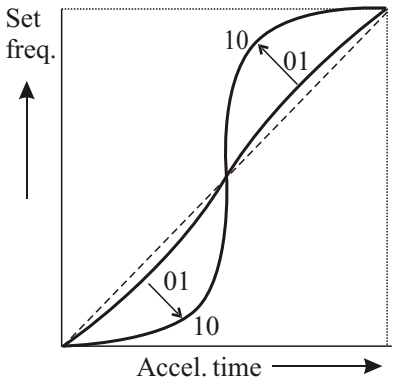
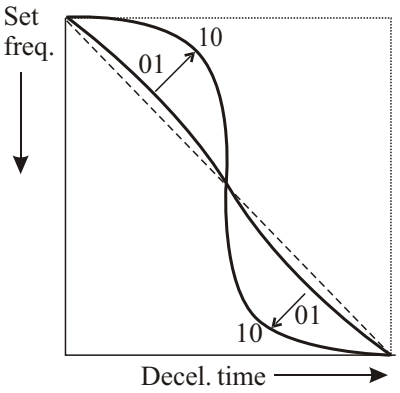
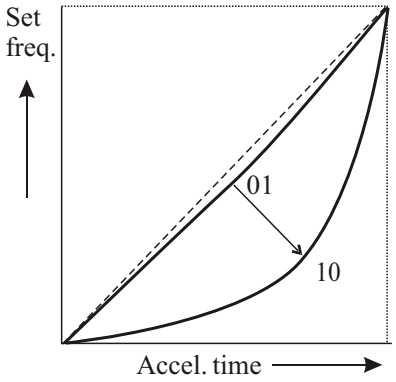
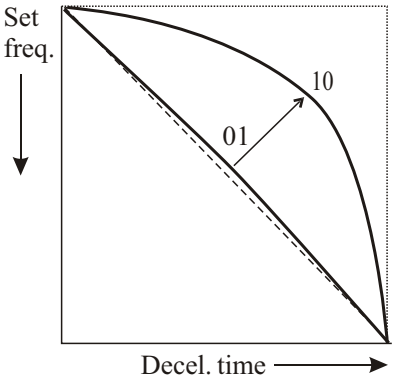
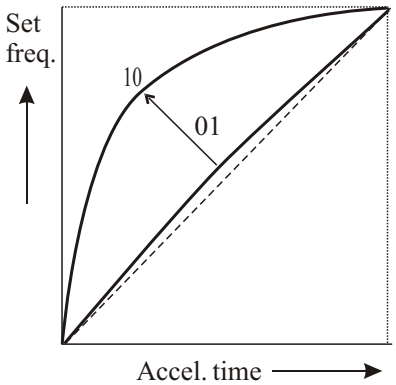
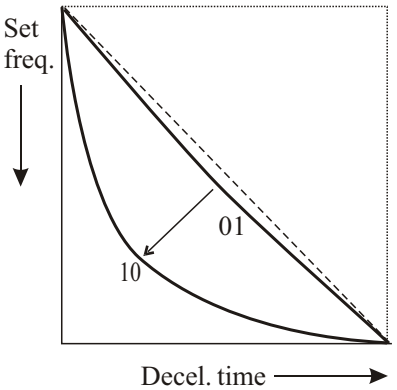
Appendix 3 Capacitor Life Curve

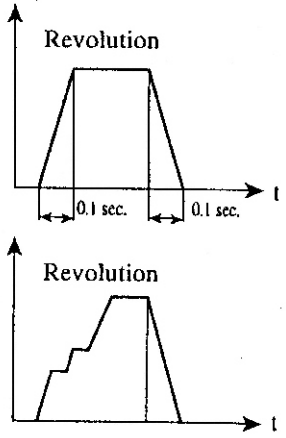


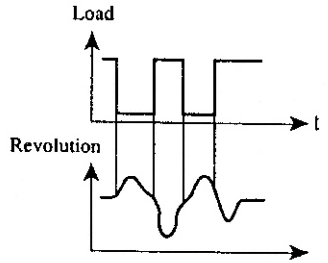
* The ambient temperature herein means the temperature around the inverter body. If the inverter is housed in a panel, the ambient temperature corresponds to the temperature in the panel.
* Even when the ambient temperature is within the rating, the capacitor life is shortened if ventilation is impeded due to bad installation conditions or dust.

Appendix 4 Acceleration/Deceleration Curve Constants

This function can vary the curvature when the acceleration curve pattern (or deceleration curve pattern) is selected to S curve, U curve or RU (reverse U) curve in the function mode (F-60).
If the acceleration curve pattern or deceleration curve pattern is selected, the selected pattern applies to both acceleration and deceleration.
The larger number causes a greater curvature.

Curve pattern	Acceleration	Deceleration
S curve		
U curve		
RU curve		

No.	Operation conditions	Phenomena	Improvements (NOTE: The setting methods shown below apply to DOP and DRW operations.)	Display, etc.
1	Trial running of motor only	The motor runs unsmoothly, and the revolution fails to increase. The motor current pulsates.	1. When V/f control or sensor-less vector control is selected Function mode • F-36 CARRIER 16.0 kHz → 8.0 kHz Decrease the initial value.	12.3 Function mode F-36 (P.12-12)
2	Light load, low inertia load			
3	Acceleration and deceleration of light load or low inertia load	 The motor revolution fails to increase smoothly	2. When V/f control is selected Function mode • F-04 CONTROL VC • F-05 AUX R1 00.223 → 00.323 Increase the initial value. 3. When sensor-less vector control is selected Function mode • F-04 CONTROL SLV • F-05 AUX DATA NOR ① AUX J 001.22 kgm2 → 000.22 kgm2 Decrease the initial value. ② AUX Kp 002.00 → 003.00 Increase the initial value. Use ① and ② solely or combine any of ① and ② to adjust the motor constant.	12.3 Function mode F-04 (P.12-5) 12.3 Function mode F-05 (P.12-5) NOTE: Select AUT if the automatic tuning data is used.) Use the second function for switching operation of two motors.

No.	Operation conditions	Phenomena	Improvements NOTE: The setting methods shown below apply to DOP and DRW operations.	Display, etc.
4	Quickly varying load	 The motor revolution varies when the load varies.	When sensor-less vector control is selected Function mode • F-04 CONTROL SLV • F-05 AUX DATA NOR ① AUX J 001.22 kgm² → 003.22 kgm² Increase the initial value. ② AUX Kp 002.00 → 001.00 Decrease the initial value.	NOTE: Select AUT if the automatic tuning data is used.)

NOTE: When sensor-less vector is selected, driving of motor at low speed whose constant is different from the factory settings may cause reverse run.
In this case, measure the motor constant using the automatic tuning mode or reduce the setting value of primary resistor (R1) of the motor.

No.	Operation conditions	Phenomena	Improvements NOTE: The setting methods shown below apply to DOP and DRW operations.	Display, etc.
5	Parallel motor operation	Operation cannot be started at high torque, since the inverter does not know the load sharing of the motors.	1. When sensor-less vector control is selected **Function mode** • F-04 CONTROL SLV → VC Reset to V/f control. Select the motor capacity which is the most approximate to the total capacity of the motors used." (For example, 7.5 kW, 5.5 kW, and 3.7 kW.) **Function mode** Total capacity of the motors: 7.5 + 5.5 + 3.7 = 16.7kW • F-05 AUX K 022.00 kW → 015.00 kW Select the most approximate value to the total capacity. If two or more motors are changed in operation, select the most approximate value to the motor capacity. Example 1: One 5.5 kW motor is used • F-05 AUX K 022.00 kW → 005.50 kW Select the most approximate value. Example 2: One 5.5 kW motor is changed into parallel operation of four 5.5 kW motors Total capacity of the motors: 5.5 x 4 = 22.0 kW • F-04 AUX K 005.50 kW → 022.00 kW Select the most approximate value.	12.3 Function mode F-04 (P.12-5) A 1 The sensor-less vector control is not applicable to multi-motor parallel operation.

Appendix 6 Supplementaly Explanation of the Function Mode

- The explanation of the function mode is displayed on the DOP or DRW type of the remote operator.
  As for the operating methods with other remote operators, refer to the corresponding table of the operator display.
- After data is changed, be sure to push down the [기억 STR] key.
  No data is stored in the inverter body.
- Change data when the inverter is stopped. (except when the inverter is stopped during trip, and stopped when ON between the reset terminal RS and CM1.)
- In the function mode, the motor can not be started running.
  Select the monitor mode beforehand.

Function name : Second function setting Function No. F-34
Intelligent input terminal [SET] to be set (F-00, F-01, F-04, F-05)

Function contents

It is possible to run two motors with one inverter by switching the control circuit terminal [SET]. The changing of the SET terminal can be executed only when the inverter is stopped.

Function which can be set with the second function

[Monitor mode]
1. Output frequency setting
2. Acceleration and deceleration time setting(NOTE) (Function time)
   F-06 Acceleration time setting
   F-07 Deceleration time setting
3. Manual torque boost setting

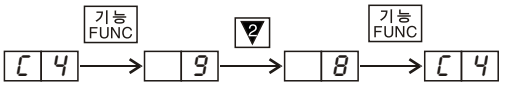
[Function mode]
1. F-00 Basic frequency setting
2. F-01 Maximum frequency setting
3. F-04 Control method
4. F-05 Motor constant setting

NOTE :
When selecting the second function, 2-stage acceleration and deceleration time setting can not be set and used. When setting and using the 2-stage acceleration and deceleration time, select the first function (when [SET] terminal is OFF).

Setting contents

1. Setting method 1 : Digital operator
Set [8] in any of the input terminals [C0] to [C7]

[Setting example]
Set the 2-stage accel. and decel. function of [C4] to the second function.



Setting method 2 : Remote operator
Set the settings [SET] in any of the input terminals 1 to 8.
When using the high performance remote operator, input [8] SET with the ten key.

2. Function changing method
After the input terminal of the setting function code and SET are short circuited, the second function setting can be started.
When the short cuicuit is recovered, the function returns to the original setting (the first function)

3. Setting method of each function
Set sam as the normal setting.
When checking the function mode, confirm it with the terminal status ON/OFF

Inital settings
Initial settings which can be set with the second function is same as the factory settings.

Appendix 7 List for display and data read/copy with each operators

(1) Monitor mode

Function mode		Display with HOP, HRW	Display with DOP, DRW	Function No.with digital operator			Data read/copy	
				Alterability	No.	Data	HRW	DRW
Frequency setting	First setting	FS 0.00Hz	FS0000.0 0.0Hz	Y	F2	0.00	Y	Y
	Second setting	FS 0.00Hz	FS0000.0 0.0Hz	Y	F2	0.00	Y	N
Multistage speed setting		1S 0.00Hz 7S 0.00Hz	1S0000.0 (2) 0.0Hz 7S0000.0 0.0Hz	Y	F2	0.00	Y	N
Analog frequency setting		TM 0.00Hz	TM 0.0 (4) 0.0Hz	Y	F2	0.00	Y	N
Jogging frequency setting		JG 1.00Hz	JG 1.00 (5) 0.0Hz	Y	F2	1.00	Y	Y
Option 1 frequency setting *1		01 0.00Hz	01 0.0 (6) 0.0Hz	Y	F2	0.00	Y	N
Option 2 frequency setting *1		02 0.00Hz	02 0.0 (7) 0.0Hz	Y	F2	0.00	Y	N
Output frequency setting		0.00Hz	FS0000.0 0.0Hz (8)	Y	d0	0.00	—	—
Acceleration time setting	First setting	AC1 30.00s	ACC1 0030.00s	Y	F6	30.0	Y	Y
	Second setting	AC1 30.00s	ACC1 0030.00s	Y	F6	30.0	Y	N
2-step deceleration time setting		AC2 15.00s	ACC2 0015.00s	Y	F6	15.0	Y	N
Deceleration time setting	First setting	DC1 30.00s	DEC1 0030.00s	Y	F7	30.0	Y	Y
	Second setting	DC1 30.00s	DEC1 0030.00s	Y	F7	30.0	Y	N
2-step deceleration time setting		DC2 15.00s	DEC2 0015.00s	Y	F7	15.0	Y	N
Motor pole number setting		RPM 1:4P	RPM 4P (13) ORPM (14)	Y	A25	4	Y	Y
Motor rpm monitored		ORPM		Y	d1	0.00	—	—
Converted frequency setting		/Hz 1.0	/Hz 01.0 (15) 0.00 (16)	Y	A47	1.00	Y	Y
Converted frequency monitor		0.00		Y	d3	0.00	—	—
Output current monitor		Im 0.0A	Im 0.0A (17) 0.0% (18)	Y	d2	0.00	—	—
Output current rate monitor		0.0%		N	—	—	—	—
Torque monitor		Torque 0%	Torque 0%	N	—	—	—	—
Manual torque boost adjustment	First setting	V-Boost 11	V-Boost Code〈11〉	Y	F8	11	Y	Y
	Second setting	V-Boost 11	V-Boost Code〈11〉	Y	F8	11	Y	N
Manual torque boost frequency adjustment	First setting	V-Boost F 10.0%	V-Boost F 10.0%	N	—	—	Y	N
	Second setting	V-Boost F 10.0%	V-Boost F 10.0%	N	—	—	Y	N
Output voltage gain adjustment		V-Gain 100%	V-Gain 100%	N	—	—	Y	Y
Jogging frequency setting		Jogging 1.00Hz	Jogging 1.00Hz	Y	A61	1.00	Y	Y
Analog meter adjustment		ADJ 172	ADJ 172	Y	F10	172	Y	N
Terminal input status monitor		TERM LLLLLLLLL	TERM LLLLLLLLL	N	—	—	—	—
Alarm display	First setting	WARN #	WARN #	N	—	—	Y	N
	Second setting	WARN #	WARN #	N	—	—	Y	N

*1 Represents an indication for commanding frequency fromthe optional PCB.

Function mode	Display with HOP, HRW	Display with DOP, DRW	Function No.with digital operator			Data read/copy	
			Alterability	No.	Data	HRW	DRW
Trip cause factor 1	ERR1 #	ERR1 #	Y	d10	---	N	N
Trip frequency 1	ERR1 0.0Hz	ERR1 0.0Hz	N	—	—	N	N
Trip current 1	ERR1 0.0A	ERR1 0.0A	Y	d10	---	N	N
Trip time P-N voltage 1	ERR1 0.0Vdc	ERR1 0.0Vdc	Y	d10	---	N	N
Integrated count 1 of cause time running days	ERR1 0 Y OD	ERR1 0 Y 0D	N	—	—	N	N
Integrated error count	ERR COUNT 0	ERR COUNT 0	N	—	—	N	N
Trip cause factor 2	ERR2 #	ERR2 #	Y	d11	---	N	N
Trip frequency 2	ERR2 0.0Hz	ERR2 0.0Hz	N	—	—	N	N
Trip current 2	ERR2 0.0A	ERR2 0.0A	N	—	—	N	N
Trip time P-N voltage 2	ERR2 0.0Vdc	ERR2 0.0Vdc	N	—	—	N	N
Integrated count of error time running days	ERR2R O Y 0D	ERR2 0 Y 0D	N	—	—	N	N
Trip cause factor 3	ERR3 #	ERR3 #	Y	d11	---	N	N
Trip frequency 3	ERR3 0.0Hz	ERR3 0.0Hz	N	—	—	N	N
Trip current 3	ERR3 0.0A	ERR3 0.0A	N	—	—	N	N
Trip time P-N voltage 3	ERR3 0.0VDC	ERR3 0.0Vdc	N	—	—	N	N
Integrated count of error time running days	ERR 3 R 0 Y 0D	ERR3 R 0 Y 0D	N	—	—	N	N

(2) Function mode

Y : Possible
N : Notpossible

Function mode		Display with HOP, HRW		Display with DOP, DRW		Function No.with digital operator			Data read/copy	
		Layer	Data display	No.	Data display	Alterability	No.	Data	HRW	DRW
Frequency command		1-	1 F-SET 1:REM	Monitor	F-SET-SELECT REM	Y	F 9	00	Y	Y
Operation command			2 F/R 1:REM	Monitor	F/R-SELECT REM				Y	Y
Parameter selection			3 PARM 0:REM	F-09	PARAM REM	N	—	—	Y	Y
Trip history count clear		2-	1 TCNT 0:CNT	F-38	INIT TCNT CNT	N	—	—	Y	Y
Debug mode display selection			2 DEBG 0:OFF		INIT DEBG OFF	N	—	—	N	N
Digital operator rotating direction selection			3 DOPE 0:FWD		INIT DOPE RWD	Y	F4	F	Y	Y
Reset performance selection			4 RESET 0:ON		INIT RESET ON	Y	A86	0	Y	Y
Base frequency setting	First setting	3-1-1-	1 F-BASE 60Hz	F-00	F-BASE 0060Hz	Y	A62	60	Y	Y
	Second setting		1 F-BASE 60Hz		F-BASE 0060Hz	Y	A62	60	Y	N
Max. frequency setting	First setting		2 F-MAX 60Hz	F-01	F-MAX 0060Hz	Y	A63	60	Y	Y
	Second setting		2 F-MAX 60Hz		F-MAX 0060Hz	Y	A63	60	Y	N
Start frequency setting			3 Fmin 0.5Hz	F-02	Fmin 0.50Hz	Y	A 4	0.50	Y	N
Motor voltage setting			4 A-AC 3:220V	F-03	AVR AC 220V	Y	F11	200	Y	Y
AVR function ON/OFF during deceleration			5 A-DEC 0:ON		AVR DEC ON	N	–	–	Y	Y

Function mode		Display with HOP, HRW		Display with DOP, DRW		Function No.with digital operator			Data read/copy	
		Layer	Data display	No.	Data display	Alterability	No.	Data	HRW	DRW
Control method	First setting	3-1-1-	6 MODE 0:VC	F-04	CONTROL VC	Y	A0	0	Y	Y
	Second setting		6 MODE 0:VC		CONTROL VC	Y	A0	0	Y	N
Auto tuning setting		3-1-2-	1 AUTO 0:NOR	F-05	AUX AUTO NOR	Y	A97	0	Y	N
Motor data selection	First setting		2 DATA 0:NOR		AUX DATA NOR	Y	A98	0	Y	N
	Second setting		2 DATA 0:NOR		AUX DATA NOR	Y	A98	0	Y	N
Motor capacity selection	First setting		3 K 6:5.50kw		AUX K 0050kw	Y	A1	5.50	Y	Y
	Second setting		3 K 6:5.50kw		AUX K 0050kw	Y	A1	5.50	Y	N
Motor pole number selection	First setting		4 P 1:4P		AUX P 4P	Y	A2	04	Y	Y
	Second setting		4 P 1:4P		AUX P 4P	Y	A2	04	Y	N
Motor constant R1 setting	First setting		5 R1 0.251		AUX R1 0.0251	N	–	–	Y	Y
	Second setting		5 R1 0.251		AUX R1 0.0251	N	–	–	Y	N
Motor constant R2 setting	First setting		6 R2 0.194		AUX R2 0.0194	N	–	–	Y	Y
	Second setting		6 R2 0.194		AUX R2 0.0194	N	–	–	Y	N
Motor constant L setting	First setting		7 L 3.29mH		AUX L 003.29mH	N	–	–	Y	Y
	Second setting		7 L 3.29mH		AUX L 003.29mH	N	–	–	Y	N
Motor constant M setting	First setting		8 M 30.90mH		AUX M 030.90mH	N	–	–	Y	Y
	Second setting		8 M 30.90mH		AUX M 030.90mH	N	–	–	Y	N
Motor constant J setting	First setting		9 J 0.44		AUX J 000.44kgm2	N	–	–	Y	Y
	Second setting		9 J 0.44		AUX J 000.44kgm2	N	–	–	Y	N
Motor constant Kp setting	First setting		a kp 2.00		AUX kp 2.00	Y	A3	2.00	Y	Y
	Second setting		a kp 2.00		AUX kp 2.00	Y	A3	2.00	Y	N
Motor constant Ti setting	First setting		b Ti 100ms		AUX Ti 00100ms	N	–	–	Y	Y
	Second setting		b Ti 100ms		AUX Ti 00100ms	N	–	–	Y	N
Motor constant Kpp setting	First setting		c kpp 1.00		AUX kpp 001.00	N	–	–	Y	Y
	Second setting		c kpp 1.00		AUX kpp 001.00	N	–	–	Y	N
Carrier frequency setting		3-1-3-	1 CARRY 16.0kHz	F-36	CARRIER 16.0kHz	Y	A10	16.0	Y	Y
Acceleration time setting	First setting	3-2-1-	1 A1 30.00s	F-06	ACC1 0030.00s	Y	F6	30.0	Y	Y
	Second setting		1 A1 30.00s		ACC1 0030.00s	Y	F6	30.0	Y	N
2-step acceleration setting			2 A2 15.00s		ACC2 0015.00s	Y	F6	15.0	Y	N
Acceleration time curve pattern setting			3 LINE 0:L		ACC LINE L	N	–	–	Y	Y
Acceleration/deceleration curve constant selection			4 GAIN 2		ACC GAIN 02	N	F7	30.0	Y	Y

Function mode		Display with HOP, HRW		Display with DOP, DRW		Function No.with digital operator			Data read/copy	
		Layer	Data display	No.	Data display	Alterability	No.	Data	HRW	DRW
Deceleration time setting	First setting	3-2-2	1 D1 30.00 s	F07	DEC 1 0030.00 s	Y	F7	30.0	Y	Y
	Second setting		1 D1 30.00 s		DEC 1 0030.00 s	Y	F7	30.0	Y	N
2-step deceleration time setting			2 D2 15.00 s		DEC 2 0015.00 s	Y	F7	15.0	Y	N
Deceleration time curve pattern selection			3 LINE 0:L		DECLINE L	N	–	–	Y	Y
Acceleration/deceleration curve constant selection			4 GAIN 2		DEC GAIN 02	N	–	–	Y	Y
Acceleration time stop frequency setting		3-3-1	1 F 0.0Hz	F08	Fsp F 0000.0Hz	N	–	–	Y	Y
Acceleration time stop time setting			2 TIME 0.0 s		Fsp T IME 00.0 s	N	–	–	Y	Y
Multi-step speed/process stepping election		3-3-2		F10						
Operation mode selection			1 MODE 0:NOR		RUN MODE NOR	Y	A59	0	Y	N
Free run stop			2 FRS 1:ZST		RUN FRS ZST	Y	A54	01	Y	Y
1st speed of multistage speed		3-3-3	1 S1 0.00 Hz	F11	SPD 1 0000.00 Hz	Y	A12	0.0	Y	N
2nd speed of Multistage speed			2 S2 0.00 Hz		SPD 2 0000.00 Hz	Y	A13	0.0	Y	N
3rd speed of Multistage speed			3 S3 0.00 Hz		SPD 3 0000.00 Hz	Y	A14	0.0	Y	N
4th-7th speed of Multistage speed			4 S4 0.00 Hz to 7 S7 0.00 Hz		SPD 4 0000.00 Hz to SPD 7 0000.00 Hz	Y	F2	0.0	Y	N
DC braking selection		3-4-1	1 SW 0:OFF	F20	DCB SW OFF	N	–	–	Y	Y
DC braking type selection			2 KIND 1:LVL		DCB KIND LVL	N	–	–	Y	Y
DC braking frequency selection			3 F 0.5 Hz		DCB F 0000.5 Hz	N	–	–	Y	Y
DC braking power selection (starting time)			4 V-STA 0		DCB V-STA 00	N	–	–	Y	Y
DC braking time selection (stopping time)			5 V-STP 0		DCB V-STP 00	N	–	–	Y	Y
DC braking time selection(starting time)			6 V-STA 0.0 s		DCB V-STA 000.0 s	N	–	–	Y	Y
DC braking time selection(stopping time)			7 T-STP 0.0 s		DCB T-STP 000.0 s	N	–	–	Y	Y
DC braking output OFF time adjustment			8 STOP-T 0.00 s		DCB STOP-T 0.00 s	N	–	–	Y	Y
Regeneration braking setting		3-4-2	1 %ED 1.5%	F21	BRD-%ED 001.5%	Y	A38	1.5	Y	Y
Electronic thermal characteristics selection	First setting	3-5-1	1 CHAR 1:CRT	F23	E-THM CHAR CRT	Y	A24	1	Y	Y
	Second setting		1 CHAR 1:CRT		E-THM CHAR CRT	Y	A24	1	Y	N
Electronic thermal level setting	First setting		2 LEVEL 100%		E-THM LEVEL 100%	Y	A23	100	Y	Y
	Second setting		2 LEVEL 100%		E-THM LEVEL 100%	Y	A23	100	Y	N
Electronic thermal characteristics free setting (current value 1)			3 A1 15.8 A		E-THM A1 15.8 A	N	–	–	Y	N
Electronic thermal characteristics free setting (frequency1)			4 F1 0 Hz		E-THM F1 0000 Hz	N	–	–	Y	N
Electronic thermal characteristics free setting (current value 2)			5 A2 15.8 A		E-THM A2 15.8 A	N	–	–	Y	N

Function mode	Display with HOP, HRW		Display with DOP, DRW		Function No.with digital operator			Data read/copy	
	Layer	Data display	No.	Data display	Alterability	No.	Data	HRW	DRW
Electronic thermal characteristics free setting(frequency2)	3-5-1	6 F2 0Hz	F-23	E-THM F2 0000Hz	N	—	—	Y	N
Electronic thermal characteristics free setting(current value3)		7 A3 24.0A		E-THM A3 24.0A	N	—	—	Y	N
Electronic thermal characteristics free setting(frequency3)		8 F3 73Hz		E-THM F3 0073Hz	N	—	—	Y	N
Overload limit level setting	3-5-2	1 LEVEL 125%	F-24	OLOAD LEVEL 125%	N	—	—	Y	Y
Overload limit constant setting		2 CONST 1.0		OLOAD CONST 01.0	N	—	—	Y	Y
Overload limit selection during acceleration		3 ACC 1:ON		OLOAD ACC ON	N	—	—	Y	Y
Frequency lower limiter setting	3-5-3	1 LIML 0.0Hz	F-26	LIMIT L 0000.0Hz	Y	A 5	0.0	Y	Y
Frequency upper limiter setting		2 LIMH 0.0Hz		LIMIT H 0000.0Hz	Y	A 6	0.0	Y	Y
Jump frequency (1)		3 F1 0.0Hz		JUMP F1 0000.0Hz	Y	A 7	0.0	Y	Y
Jump frequency (2)		4 F2 0.0Hz		JUMP F2 0000.0Hz	Y	A 8	0.0	Y	Y
Jump frequency (3)		5 F3 0.0Hz		JUMP F3 0000.0Hz	Y	A 9	0.0	Y	Y
Jump frequency width setting		6 WIDTH 0.5Hz		JUMP W 0.5Hz	N	—	—	Y	Y
Allowable instantaneous time	3-5-4	1 TIME 1.0s	F-22	IPS TIME 01.0s	N	—	—	Y	Y
Reclosing stand-by after instantaneous power failure recovered		2 WAIT 1.0s		IPS WAIT 001.0s	N	—	—	Y	Y
Instantaneous power failure restart selection		3 POWER 0:ALM		IPS POWR ALM	Y	A34	.0	Y	Y
Trip selection during stop at under voltage		4 TRIP 1:OFF		IPS TRIP OFF	N	—	—	Y	Y
Max. frequency selection	3-5-5	1 MAXF 0:120Hz	F-30	F-MAX-L 120Hz	Y	A64	120	Y	Y
Software lock selection		2 SLOCK 1:MD1	F-25	S-LOCK MD1	N	—	—	Y	Y
STOP key validity selection		3 STOP 1:ON	F-28	STOP-SW ON	N	—	—	Y	Y
Running direction selection		4 F/R 2:FRE	F-29	F/R SW FRE	N	—	—	Y	Y
Reverse run prevention		5 PREV 0:OFF		F/R PREV OFF	N	—	—	Y	Y
Reduced voltage soft start setting		6 RVS 6		F/R RVS 6	Y	A58	6	Y	N
Analog input voltage selection	3-6-1	1 V 1:10	F-31	IN ANA 10V	Y	A48	1	Y	Y
External frequency start setting		2 EXS 0.0Hz		IN EXS 0000.0Hz	Y	A26	0.0	Y	Y
External frequency end setting		3 EXE 0.0Hz		IN EXe 0000.0Hz	Y	A27	0.0	Y	N
External frequency start rate setting		4 EX%S 0%		IN EX%S 000%	N	—	—	Y	N
External frequency end rate setting		5 EX%E 100%		IN EX%E 100%	N	—	—	Y	N
External frequency start point setting		6 LEVEL 0Hz		IN LEVEL 0Hz	N	—	—	Y	Y
Frequency command sampling frequency setting		7 F-SAMP 8		IN F-SAMP 8	Y	A11	8	Y	N
Arrival signal output pattern selection	3-6-2	1 PTN 0:CST	F-32	ARV PTN CST	Y	A49	0	Y	Y
Arrival frequency setting for acceleration		2 ACC 0.0Hz		ARV ACC 0.0Hz	Y	A39	0	Y	Y
Arrival frequency setting for deceleration		3 DEC 0.0Hz		ARV DEC 0.0Hz	Y	A40	0	Y	Y
Over torque signal rate for plus torque		4 V 100%	F-33	OV-TRQ V 100%	N	—	—	Y	N
Over torque signal rate for minus torque		5 R 100%		OV-TRQ R 100%	N	—	—	Y	N

Function mode	Display with HOP, HRW			Display with DOP, DRW		Function No.with digital operator			Data read/copy	
	Layer	Data display		No.	Data display	Alterability	No.	Data	HRW	DRW
Input terminal 1 setting	3-6-3	1 I-1	18:RS	F-34	IN-TM 1 RS	Y	C O	18	Y	N
Input terminal 2 setting		2 I-2	16:AT		IN-TM 2 AT	Y	C 1	16	Y	N
Input terminal 3 setting		3 I-3	5:JG		IN-TM 3 JG	Y	C 2	5	Y	N
Input terminal 4 setting		4 I-4	11:FRS		IN-TM 4 FRS	Y	C 3	11	Y	N
Input terminal 5 setting		5 I-5	9:CH1		IN-TM 5 CH1	Y	C 4	9	Y	N
Input terminal 6 setting		6 I-6	2:CF2		IN-TM 6 CF2	Y	C 5	2	Y	N
Input terminal 7 setting		7 I-7	1:CF1		IN-TM 7 CF1	Y	C 6	1	Y	N
Input terminal 8 setting		8 I-8	0:REV		IN-TM 8 REV	Y	C 7	0	Y	N
Input terminal 1 NO/NC setting		9 I-OC1	0:NO		IN-TM 0/C-1 NO	Y	C20	00	Y	N
Input terminal 2 NO/NC setting		a I-OC2	0:NO		IN-TM 0/C-2 NO				Y	N
Input terminal 3 NO/NC setting		b I-OC3	0:NO		IN-TM 0/C-3 NO				Y	N
Input terminal 4 NO/NC setting		c I-OC4	0:NO		IN-TM 0/C-4 NO				Y	N
Output terminal 11 setting		d 0-1	0:FA1		OUT-TM 1 FA1	Y	C10	0	Y	N
Output terminal 12 setting		e 0-2	1:RUN		OUT-TM 2 RUN	Y	C11	1	Y	N
Alarm output NO/NC setting		f 0-OCA	1:NO		OUT-TM O/C-A NO	Y	C21	00	Y	N
Output terminal 11 NO/NC setting		g 0-OC11	0:NO		OUT-TM 0/C-1 NO				Y	N
Output terminal 12 NO/NC setting		h 0-OC2	0:NO		OUT-TM 0/C-2 NO				Y	N
Monitor signal selection	3-6-4	1 SEL	0:A-F	F-37	MONITOR A-F	Y	A44	0	Y	Y
Host operation at OP1 error	4-1	1 OP1	1:STP	F-47	OP-ERR1 STP	N	—	—	Y	N
Host operation at OP2 error		2 OP2	1:STP		OP-ERR2 STP	N	—	—	Y	N
Encode pulse number setting	4-2	1 ENC-P	1024pls	F-39	OP P 01204pulse	N	—	—	Y	N
Control mode selection		2 MODE	0:ASR		OP MODE ASR	N	—	—	Y	N
RO-TO option selection		3 RO-TO	0:OFF		OP RO-TO OFF	Y	A99	0	Y	Y
Stop position setting switch	4-3	1 POS	0:IN	F-40	OR POS IN	N	—	—	Y	Y
Stop position setting		2 P	0pls		OR P 00000pulse	N	—	—	Y	N
Speed setting		3 FC	5.0Hz		OR FC 0005.0Hz	N	—	—	Y	N
Direction setting		4 TURN	0:FWD		OR TURN FWD	N	—	—	Y	Y
Completion rang setting		5 LIMIT	5pls		OR L 00005pulse	N	—	—	Y	N
Completion delay time setting		6 TW	0.0ms		OR TW 0.00s	N	—	—	Y	N
Electronic gear setting position selection	4-4	1 EGRP	0:FB	F-41	PO EGRP FB	N	—	—	Y	Y
Numerator of electronic gear ration		2 EGR-N	1		PO EGR-N 00001	N	—	—	Y	N
Denominator of electronic gear ratio		3 EGR-D	1		PO EGR-D 00001	N	—	—	Y	N
Feed forward gain		4 FFWG	0.00		PO FFWG 000.00	N	—	—	Y	N
Position loop gain		5 G	0.50rad		PO G 000.50rad/s	N	—	—	Y	N
Torque limiter setting selection	4-5	1 LIMIT	0:IN	F-42	TRQ LIMIT IN	N	—	—	Y	N
Plus torque limiter setting		2 FWD	150%		TRQ FWD 150%	N	—	—	Y	N
Minus torque limiter setting		3 REV	150%		TRQ REV 150%	N	—	—	Y	N
PID target value setting method selection	4-6	1 I-SEL	0:IN	F-43	PID IN-SEL IN	Y	A95	0	Y	Y
PID target value setting		2 LVL	0.00%		PID LVL 000.00%	Y	A96	000	Y	N
P gain setting		3 P	1.0		PID P 1.0	Y	A90	1.0	Y	N
I gain setting		4 I	1.0s		PID I 1.00s	Y	A91	1.0	Y	N
D gain setting		5 D	10.0		PID D 0100.0	Y	A92	0.0	Y	N
PID selection		6 MODE	0:MDO		PID MODE MDO	Y	A94	0	Y	N

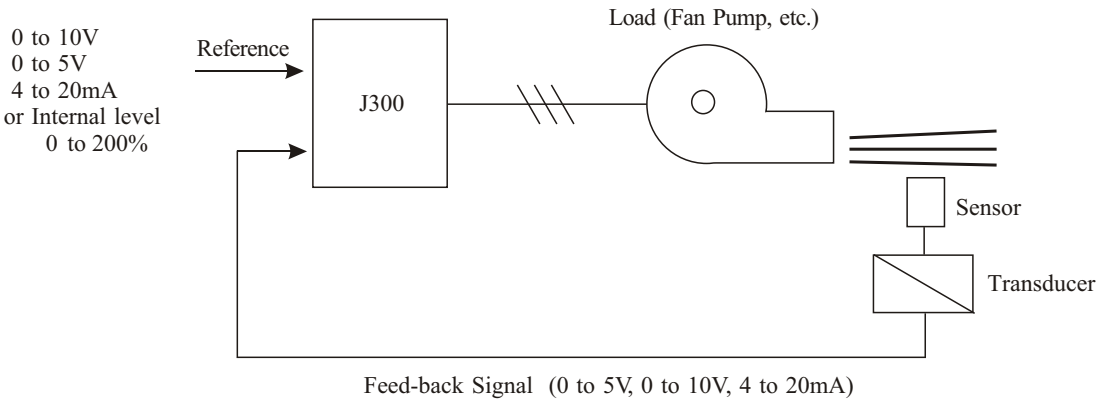
Function mode	Display with HOP, HRW		Display with DOP, DRW		Function No.with digital operator			Data read/copy	
	Layer	Data display	No.	Data display	Alterability	No.	Data	HRW	DRW
Transmission speed selection	4-7	1 BAUD 1:600 bps	F-46	COM BAUD 0600 bps	N	—	—	Y	N
Station number selection		2 NUMBER 1		COM NUMBER 01	N	—	—	Y	N
Bit length selection		3 LENGTH 0:8		COM LENGTH 8	N		—	Y	Y
Parity ON/OFF selection		4 PAR-1 1 : ON		COM PAR-SEL1 ON	N	—		Y	Y
Odd/even parity selection		5 PAR-2 0 : EVN		COM PAR-SEL2 EVN	N	—	—	Y	Y
Stop bit length selection		6 STOPBIT 0 : 2		COM STOPBIT 2	N	—	—	Y	Y
Relay output terminal RYA signal selection	4-8	1 RYA 3 : RUN	F-48	RELAY RYA RUN	N	—	—	Y	N
Relay output terminal RYB signal selection		2 RYB 0 : CST		RELAY RYB CST	N	—	—	Y	N
Relay output terminal RYC signal selection		3 RYC 4 : OTQQ		RELAY RYC OTQ	N	—	—	Y	N
Extension function setting	Setting only for digital operator				Y	F14	A 0	N	N
Voltage command adjustment	Setting only for digital operator				Y	A80		N	N
Current command adjustment	Setting only for digital operator				Y	A81		N	N

Appendix 8 PID Function

1. Function

The PID (Proportional, Integral, Differential) control functions can apply to controlling of the air (water) amount of a fan pump, etc., as well as controlling of pressure within a fixed value.
Set the reference signal according to the frequency setting method or the internal level.
Set the feed-back signal according to the analog voltage input (0 to 5V or 0 to 10V) or analog current input (4 to 20mA).

[Wiring Sketch]



2. PID Gain

If the response is not stabilized in a PID control operation, adjust the gains as follows according to the symptom of the inverter.

- The change of controlled variable is slow even when the target value is changed.
  — Increase the P gain.

- The change of controlled variable is fast, but not stable.
  — Decrease the P gain.

- It is difficult to make the target value match with the controlled variable.
  — Decrease the I gain.

- Both the target value an the controlled variable are not stable. They match after oscillation.
  — Increase the I gain.

- The response is slow even when the P gain is increased.
  — Increase the D gain.

- The response is not stabilized due to oscillation even when the P gain is increased.
  — Decrease the D gain.

3. Data Setting Method

(1) Digital operator
Refer to A 90 A 91 A 92 A 93 A 94 A 95 A 96 of the extended function mode contents (7-26, 7-27)

(2) Remote operator

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Setting item	Setting range	
PID IN-SEL	IN	The PID LVL set value is assumed as the target value.
	OUT	The target value depends on the frequency setting method.
PID LVL	0 to 200%	
PID P	0 to 5.0	
PID I	0 to 15.0	
PID D	0 to 100.0	
PID MODE	MD0	Built-in PID control OFF
	MD1	An analog current input is used as the feed-back signal.
	MD2	An analog current input is used as the feed-back signal.
	MD3	An analog current input is used as the feed-back signal. I gain × 10.
	MD4	An analog current input is used as the feed-back signal. I gain × 10.

Notes : ・If the target value signal is to be entered to an external terminal, the signal should not be assigned to the terminal used by the feed-back signal input. If assigned, on PID operation is possible.
・The [PID LVL] value (0 to 200%) corresponds to 0 to 10V of analog voltage input. In other words, if the target value input of 5V is converted to an internal level, set 100% for the [PID LVL].
・If target values are to be entered with current (OI-L input), turn on the AT terminal.