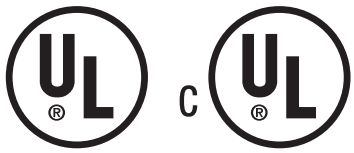
The Available Solution

Single phase input 200V class
Three phase input 200V class
Three phase input 400V class

SF-320 Series

Instructions



Sumitomo Heavy Industries, ltd.

No.
DM1001EUL-1

SAFETY

For the Best Results with SF-320 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 Sumitomo Heavy Industries,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 SF-320 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 Sumitomo Heavy Industries,Ltd.

⚠ **CAUTION:** Be sure to connect a motor thermal switch or overload device to the SF-320 series controller to assure that the inverter will shut down in the event of an overload or an overheated motor.

⚠ **CAUTION:** DANGEROUS VOLTAGE EXISTS UNTIL POWER LIGHT 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 permanently(fixed) hard wired to earth via two independent cable.

⚠MOTORS

a) Any motor used must be of suitable rating.
b) 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

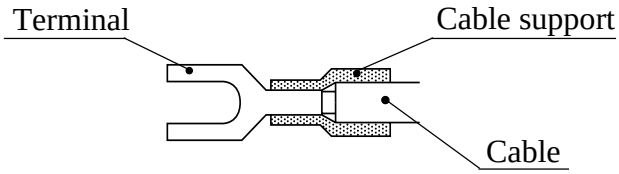
Hazardous (main) terminals for any interconnection (motor, contact breaker, filter etc) must be inaccesible in end installation.

⚠ CAUTION

The end application must be in accordance with manual page4-1 and 4-2, and the diagram measurements should 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)

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

LVD: Low Voltage Directive

Precautions for EMC (Electro Magnetic Compatibility)

It is required to satisfy the EMC directive (89/336/EEC) when using SF-320 inverter in EU country. To satisfy EMC directive and to comply with standard, the followings should be kept.

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

1. Power supply to SF-320 inverter
   1) Voltage fluctuation ±**10**% or less.
   2) Voltage unbalance ±**3**% or less.
   3) Frequency variation ±**4**% or less.
   4) Voltage distortion THD = **10**% or less.

2. Installation
   1) Use filter designed for SF-320 inverter.

3. Wiring
   1) Sielded wire(screened cable) is required for motor wiring, and length is less than 50m.
   2) Carrier frequency must be setting less than 5kHz to satisfy EMC requirement.
   3) Separate the main circuit wiring from signal/process circuit wiring.

4. Environment condition

When using a filter, keep the following condition.
   1) Ambient temperature : -10 to 40˚C
   2) Humidity : 20 to 90 % RH (no dew condensation)
   3) Vibrations : 5.9 m/s^2(0.6 G) 10-55Hz
   4) Location : 1000 meter or less altirude, indoor (no corrosive gas or dust)

TABLE OF CONTENTS

1. SAFETY PRECAUTIONS

1. Installation

⚠ CAUTION

⚠ Be sure to install the unit on flame resistant material such as metal. ..... p. 4-1
Otherwise, there is a danger of fire.

⚠ Be sure not to place anything inflammable in the vicinity. ..... p. 4-1
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. ..... p. 4-1
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). ..... p. 4-1
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. ..... p. 4-1
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. ..... p. 4-1
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. ..... p. 4-1
Otherwise, there is a danger of fire.

⚠ Be sure that the wall surface is a nonflammable material, such as steel plate. ..... p. 4-2

2. Wiring

⚠ WARNING

⚠ "Use 60/75°C Cu wire only" or equivalent. ..... p. 5-1

⚠ "Open Type Equipment". ..... p. 5-1

⚠ "AClass 2 circuit wired wiht Class 1 wire" or equivalent. ..... p. 5-1

⚠ "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240V maximum". ..... p. 5-1
For SF3202-∗∗∗-W models.

⚠ "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 480V maximum" ..... p. 5-1
For SF3204-∗∗∗-W models. ..... p. 5-1

⚠ Be sure to ground the unit. ..... p. 5-1
Ohterwise, there is a danger of clectric shock and/or fire.

⚠ Wiring work shall be carried out by electrical experts. ..... p. 5-1
Otherwise, there is a danger of electric shock and/or fire.

⚠ Implement wiring after checking that the power supply is off. ..... p. 5-1
It might incur electric shock and/or fire.

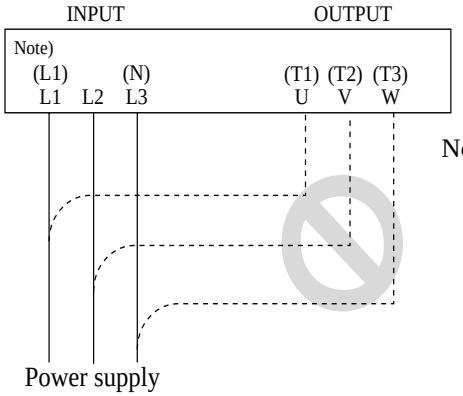
⚠ After installing the main body, carry out wiring. ..... p. 5-1
Otherwise, there is a danger of electric shock and/or injury.

⚠ CAUTION

⚠ Make sure that the input voltage is: p.5-2
Single/Three phase 200 to 240V 50/60Hz (Up to 2.2kW)
Three phase 200 to 240V 50/60Hz (Abore 2.2kW)
Three phase 380 to 460V 50/60Hz

⚠ 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, V, W).
Otherwise, there is a danger of injury and/or fire.



Note: L1,N : Single phase 200 to 240V 50/60Hz
L1,L2,L3: Three phase 200 to 240V 50/60Hz
Three phase 380 to 460V 50/60Hz

⚠ 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 fire.

⚠ <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.

3. Control and operation

⚠ WARNING

⚠	Be sure to turn on the input power supply after closing the front case. While being energized, be sure not to open the front case. Otherwise, there is a danger of electric shock.	..... p. 6-1
⚠	Be sure not to operate the switches with wet hands. Otherwise, there is a danger of electric shock.	..... p. 6-1
⚠	While the inverter is energized, be sure not to touch the inverter terminals even during stoppage. Otherwise, there is a danger of electric shock.	..... p. 6-1
⚠	If the retry 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.	..... p. 6-1, p. 8-11
⚠	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.	..... p. 6-1
⚠	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.	..... p. 6-1
⚠	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.	..... p. 6-1 p. 7-12
⚠	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.	..... p. 6-1
⚠	When the power is turned on when the 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. 7-4
⚠	When the Stop key function is ineffective, pressing the Stop key does not cancel the stop and trip. Be sure to provide an emergency stop switch separately. When the operation command destination is a digital operator, this selection is ineffective.	..... p. 8-12

⚠ CAUTION

⚠ Cooling fin 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 standard setting value(50Hz/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. 6-4
Otherwise, there is a danger of machine breakage.

- Was the short-cut bar between P1 and P removed?
- 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 5 minutes after turning off the input power supply, perform the maintenance and inspection. ..... p. 11-1
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. 11-1
(Be sure to use tools protected with insulation.)
Otherwise, there is a danger of electric shock and/or injury.

⚠ WARNING

⚠ When removing connectors, never pull the wires. (Wires for cooling fan and logic P.C.board) ..... p. 11-1
Otherwise, there is a danger of fire due to wire breakage and/or injury.

5. Others

⚠ WARNING

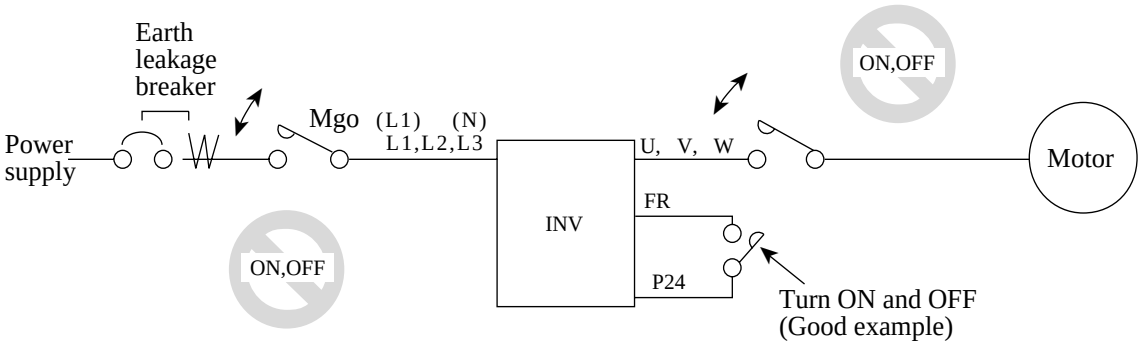
⚠ Never modify the unit.
Otherwise, there is a danger of electric shock and/or injury.

⚠ 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.**

⚠ **Do not attach or remove wiring or connectors when power is applied. Also, do not check signals during operation.**

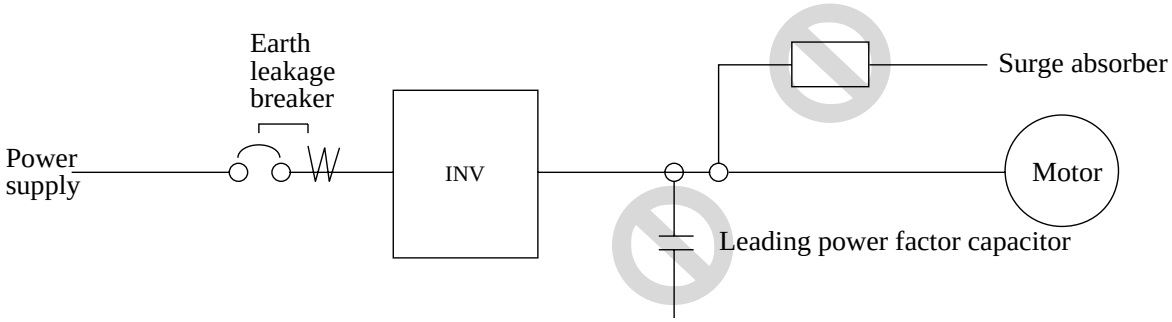
⚠ **Do not stop operation by switching off the electromagnetic contactors on the primary or secondary sides of the inverter.**



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, then install an electromagnetic contactor (Mgo) 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 5minutes before opening the cover.**

⚠ **MOTOR TERMINAL SURGE VOLTAGE SUPPRESSION FILTER (FOR THE 400 V 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 10 m or more) and cabling method may occur at the motor terminal.

A dedicated filter of the 400 V class for suppressing this surge voltage is available, Please order one.

⚠ **PROTECTION AGAINST NOISE INTERFERENCE FROM INVERTER**

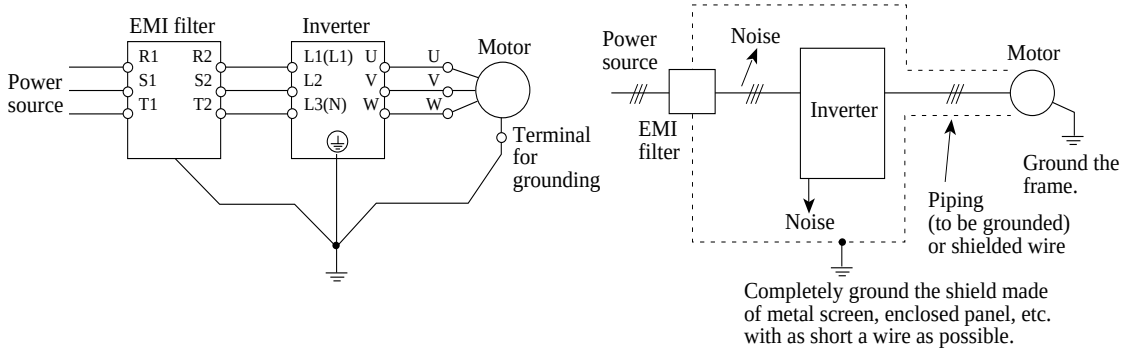
The inverter uses many semiconductor switching elements such as transistors and IGBTs. Thus, a radio set or measuring instrument located near the inverter is susceptible to noise interference.

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, 500 kVA 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 forward or reverse command ([FR],[RR] terminal), the inverter starts automatically. Do not set to b contact without a purpose.**

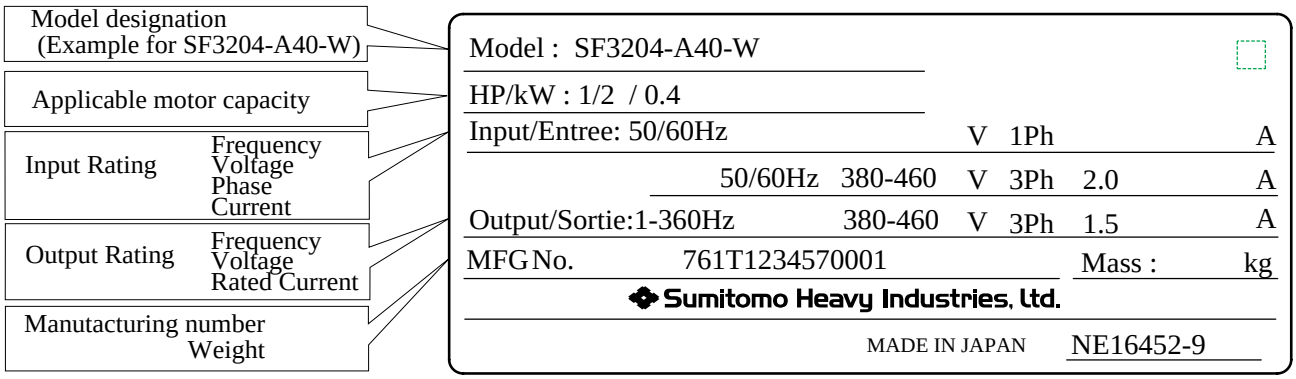
GENERAL CAUTION

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

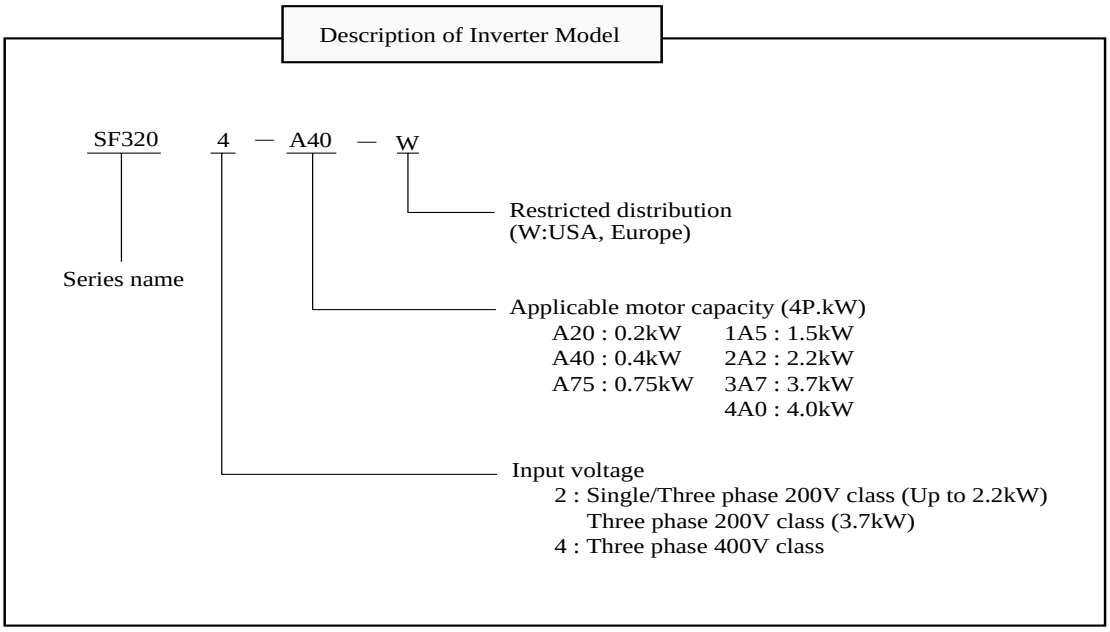
Before installation and wiring, be sure to check the following:

- 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 side of the unit.



Contents of Specifications Label

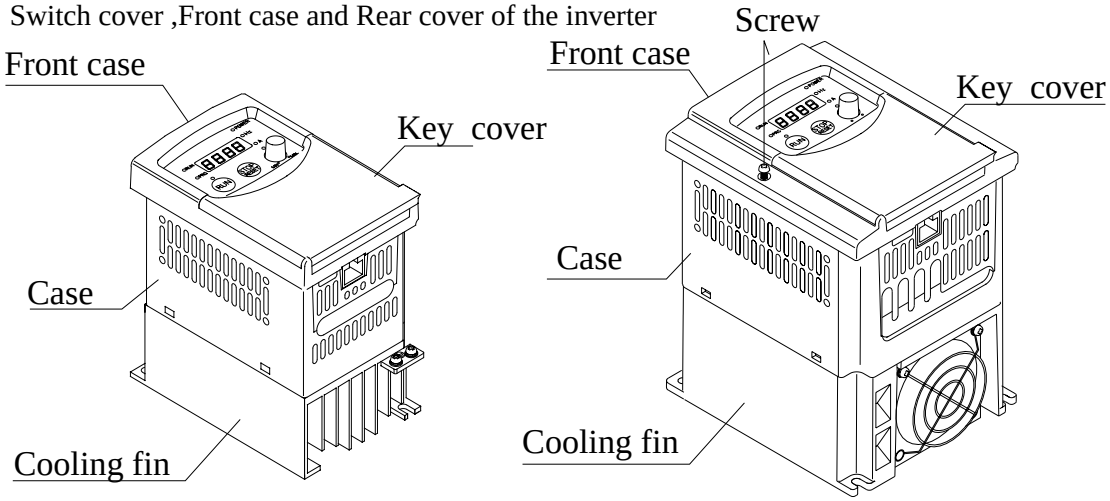
If you discover any problems, contact your sales agent immediately.



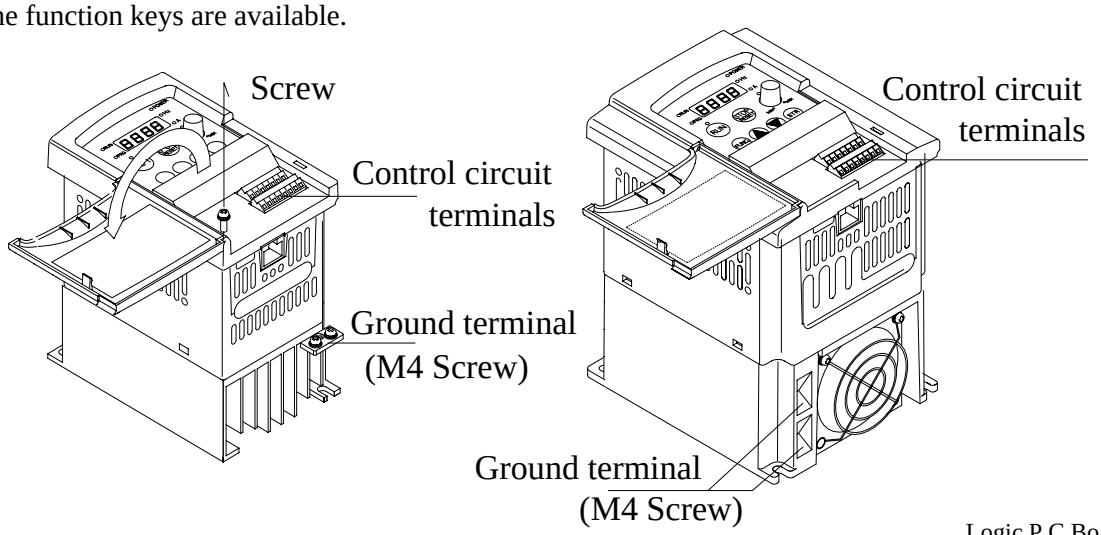
3. APPEARANCE AND NAMES OF PARTS

3.1 Mechanical guidance and parts name

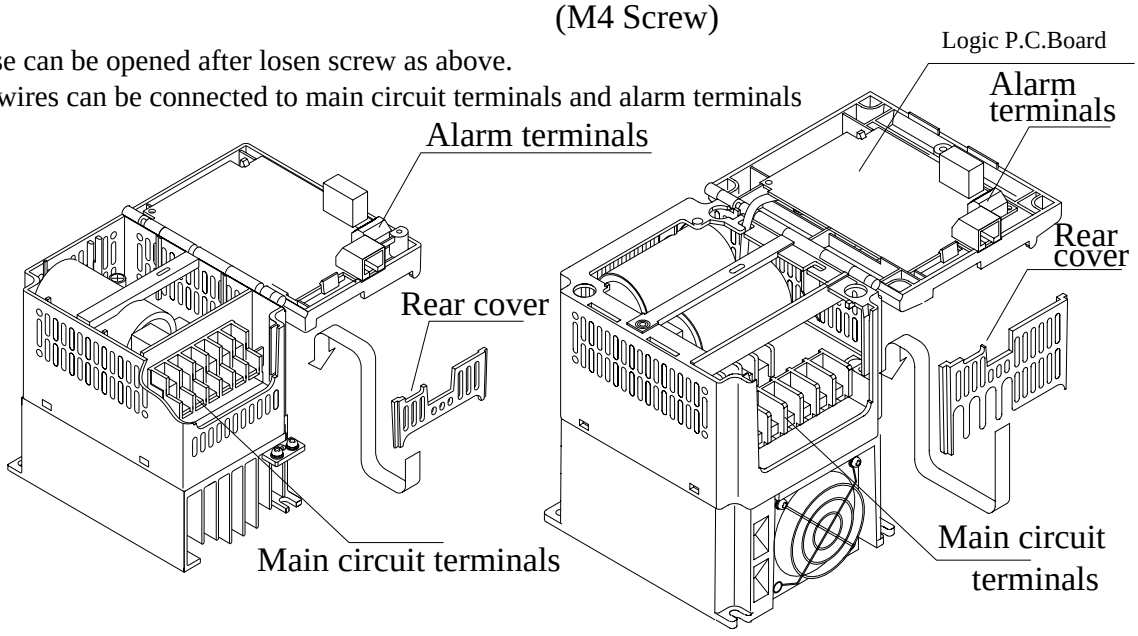
Switch cover ,Front case and Rear cover of the inverter

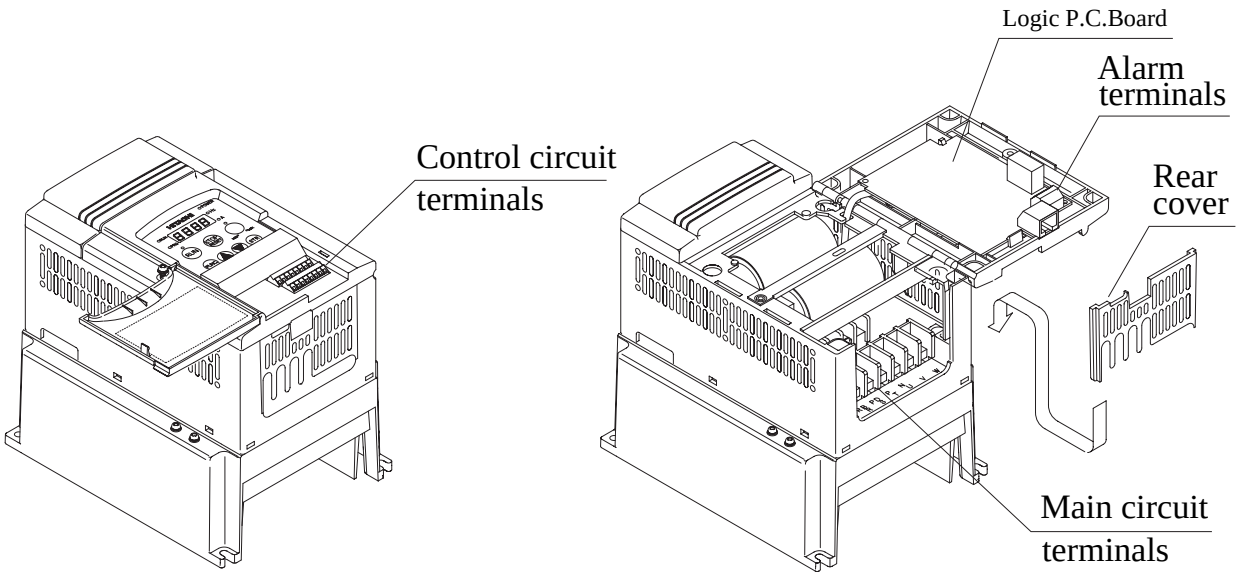


Key cover can be opened by hand without any tool.
And the signal wires can be connected to the control circuit terminals
Also the function keys are available.



Front case can be opened after losen screw as above.
And the wires can be connected to main circuit terminals and alarm terminals




Logic P.C.Board
Alarm terminals
Rear cover
Control circuit terminals
Main circuit terminals

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.

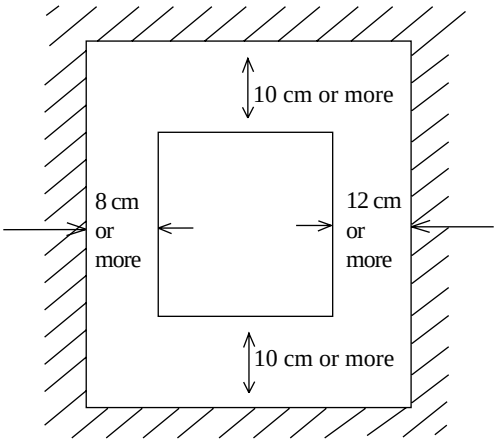
⚠ Be sure to install the unit on a perpendicular wall which is not subject to vibration.
Otherwise, it may fall and there is a danger of injury.

⚠ Be sure to install the unit with opening the front case and tighten the mounting screw bolt.Otherwise,it may fall and there is a danger of injury.

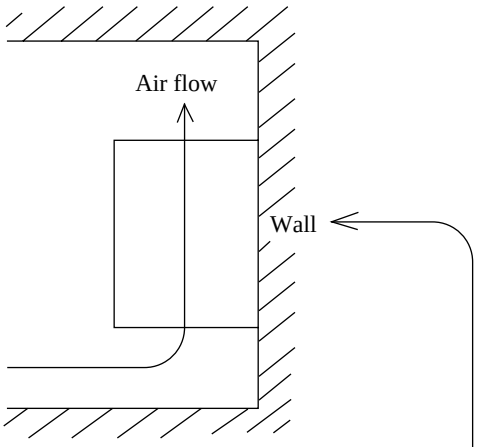
⚠ Be sure not to install and operate an inverter which is damaged or parts of which are missing.
Otherwise, there is a danger of injury.

⚠ 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.

Inverter should be mounted vertically on no-flamable wall to prevent from over heating and fire.
Make sure following clearance arround the inverter to keep cooling air flow.
Foreign object should not be dropped into the equipment especially conductive chips,which may cause not only mulfunction and damage but also electrical and fire hazard.



(a)

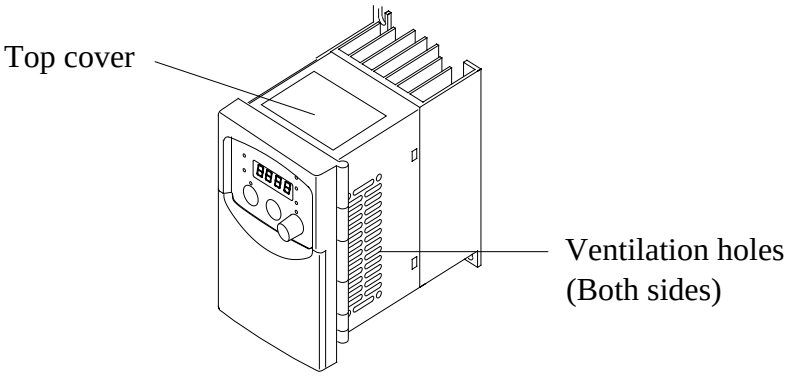


(b)

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.

Cover all ventilation holes on the inverter during installation to prevent from any foreign objects dropped into the equipment.
Be sure to remove those covers before start operation .



Be sure to check the ambient temperature -10 to 40℃.
In case of 50℃, set the carrier frequency 2 kHz or less and derate output current 80% or less.

Higher ambient temperature cause shorter equipment life.
If there are some hot equipment near the inverter, keep it away from inverter as far as possible.
When the inverter is installed in a cubicle and/or a box, temperature around inverter should be kept as above rating. Consider ventilation and clearance around the inverter.

For safety reason,front cover should be closed and don't open it during operation.
For safety requirement, the end application must be in accordance with BS EN60204-1.

5. WIRING

⚠ WARNING

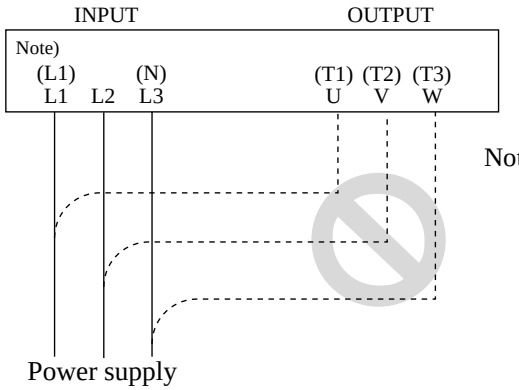
⚠ "Use 60/75°C Cu wire only" or equivalent.

⚠ "Open Type Equipment".
⚠ "AClass 2 circuit wired wiht Class 1 wire" or equivalent.
⚠ "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240V maximum".
For SF3202-∗∗∗-W models.
⚠ "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 480V maximum"
For SF3204-∗∗∗-W models.
⚠ Be sure to ground the unit.
Ohterwise, there is a danger of clectric 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:
Single/Three phase 200 to 240V 50/60Hz (Up to 2.2kW)
Three phase 200 to 240V 50/60Hz (Abore 2.2kW)
Three phase 380 to 460V 50/60 Hz

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



Note: L1,N : Single phase 200 to 240V 50/60Hz
L1,L2,L3: Three phase 200 to 240V 50/60Hz
Three phase 380 to 460V 50/60Hz

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

⚠ <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) in the operation circuit.
Otherwise, there is a danger of fire.

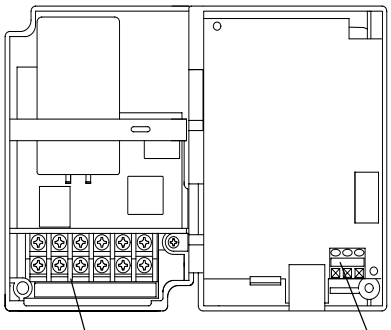
⚠ As for motor leads, earth leakage breakers and electromagnetic contactors, be sure to use the equivalent ones with the specified capacity (rated).
Otherwise, there is a danger of fire.

⚠ 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.

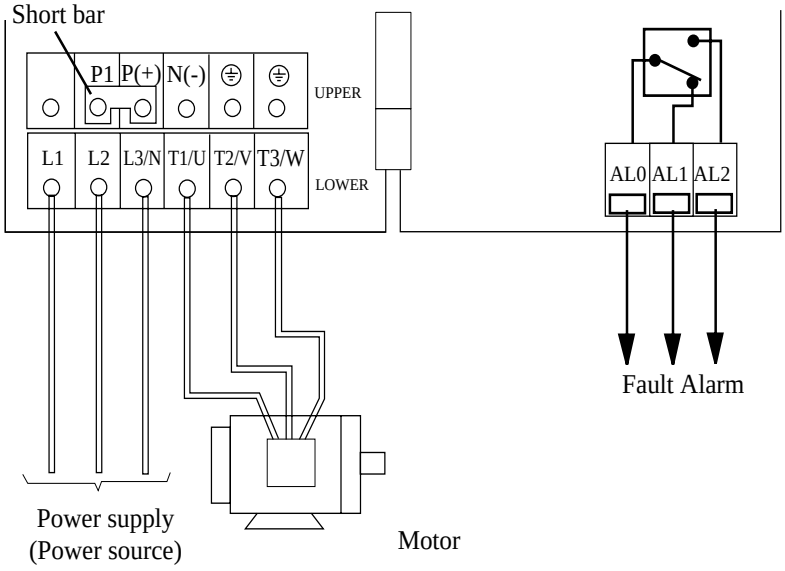
⚠ Connection to wiring terminal must be reliabily fixed with two means of support.

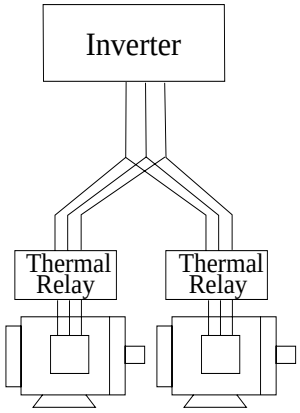
5.1 Wiring the power supply and motor

Main circuit terminals and alarm terminals will be exposed after front case open
Refer page 3-1 APPEARANCE AND NAME OF PARTS.



ex.SF3202-A40-W



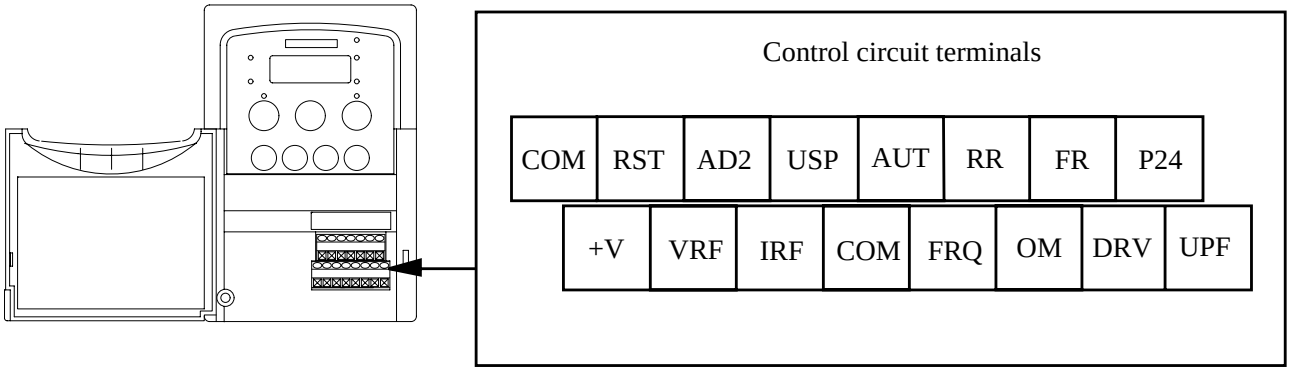


- Don't connect power source to any terminals except L1, L2, L3/N
- Don't connect any wires to no-assigned terminals on upper side.
  Those terminals are used for internal circuit.
- Refer to page 5-10 Terminal dimensions.
- When pallarel motor operation is required, put thermal relays for each motor.
- Make sure power source type and terminals as below

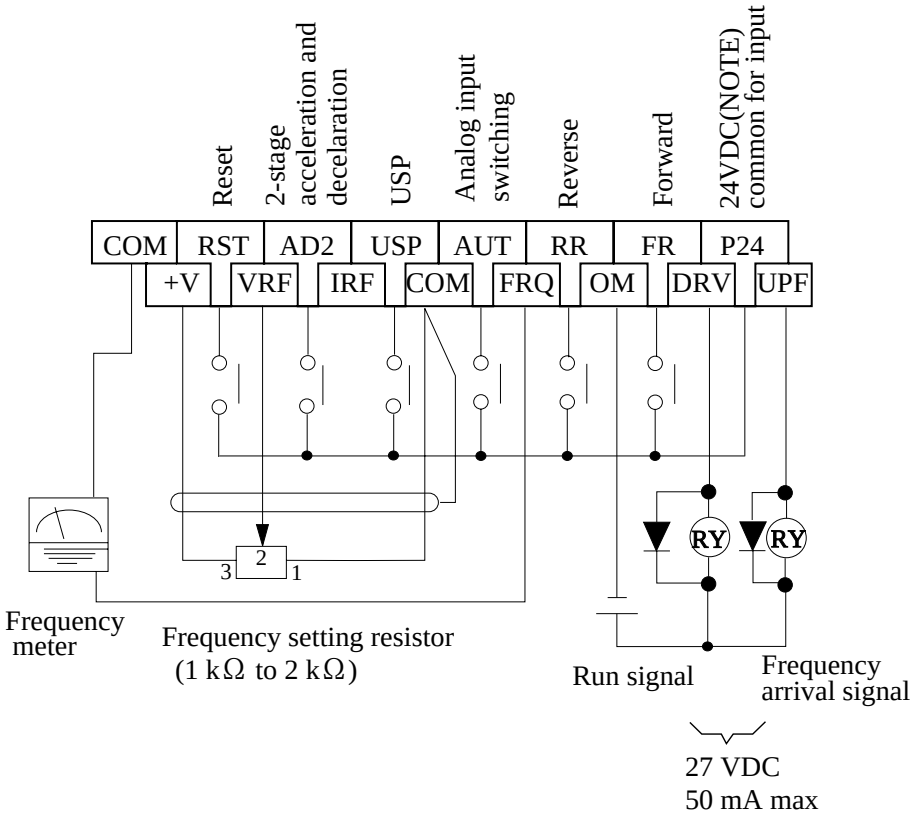
AC power type	Applicable terminals
Single Phase , 50/60Hz	Terminal L1, L3/N
Three Phase , 50/60Hz	Terminal L1, L2, L3/N

- Don't remove short bar between (P1) and P(+) terminals.

Control circuit terminals

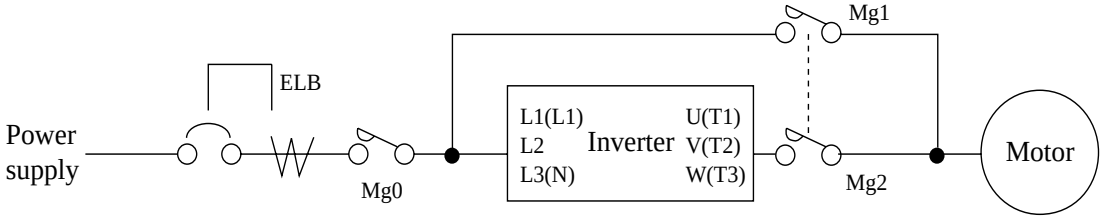


Control circuit terminal diagram (For example)



NOTE: See page 5-11 for changing function.

NOTE 1: When changing the power supply of the motor between the inverter and commercial power, be sure to install mechanically interlocked switches Mg1 and Mg2.

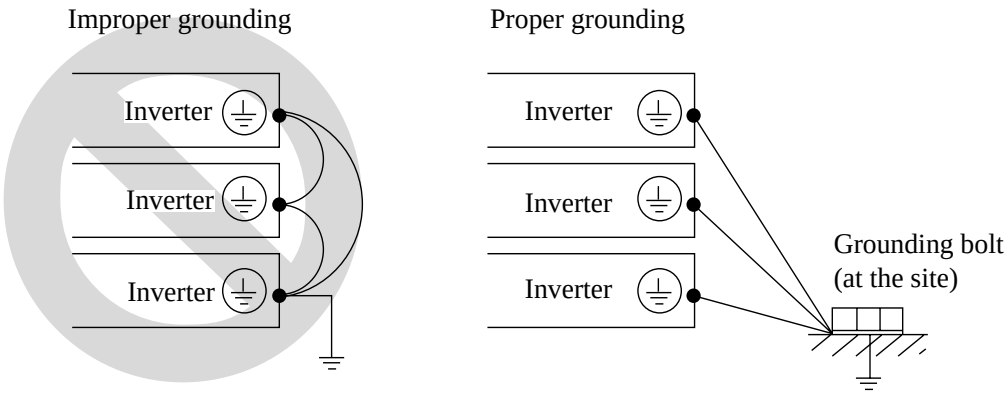


NOTE 2: Install an earth leakage breaker at the input of the inverter. (Select an earth leakage breaker whose sensitive current level is raised in high frequency range.)

When the cable between the inverter and motor is more than 10 m long, the thermal relay may malfunction due to high-frequency waves. To prevent this, install an AC reactor on the output side of the inverter or use a current sensor rather than a thermal relay.

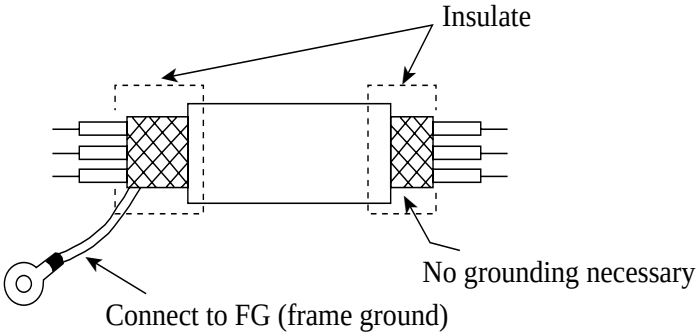
NOTE 3: Be sure that the specified grounding is carried out. Be sure to separate the unit's grounding pole from those of other heavy electric machinery, and avoid using common grounding poles.

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



NOTE 4: When a frequency arrival signal is used, be sure to install a surge absorbing diode in parallel with the relay. Otherwise, the surge voltage created when the relay goes ON or OFF may damage the output circuit.

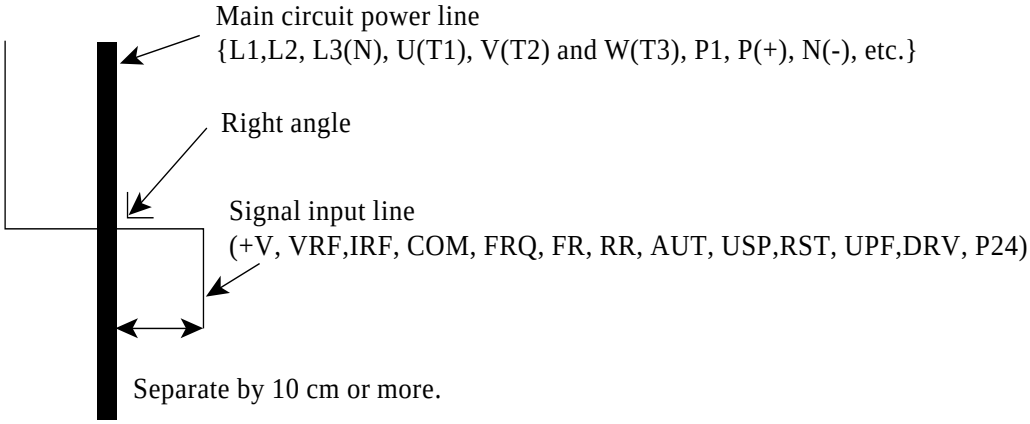
NOTE 5: Use a twisted and shielded wire for the signal line, and cut the shielded covering as shown in the diagram below. Make sure that the length of the signal line is 20 meters or less. If the line must be longer than 20 meters, please use a remote control device or a insulated signal converter.



NOTE 6: 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 7: Use relays which do not have contact defects at 24 V DC, 3 mA for the other terminals.

NOTE 8: Separate the main circuit wiring from the relay control circuit wiring. If they must cross, be sure that they cross at a right angle.

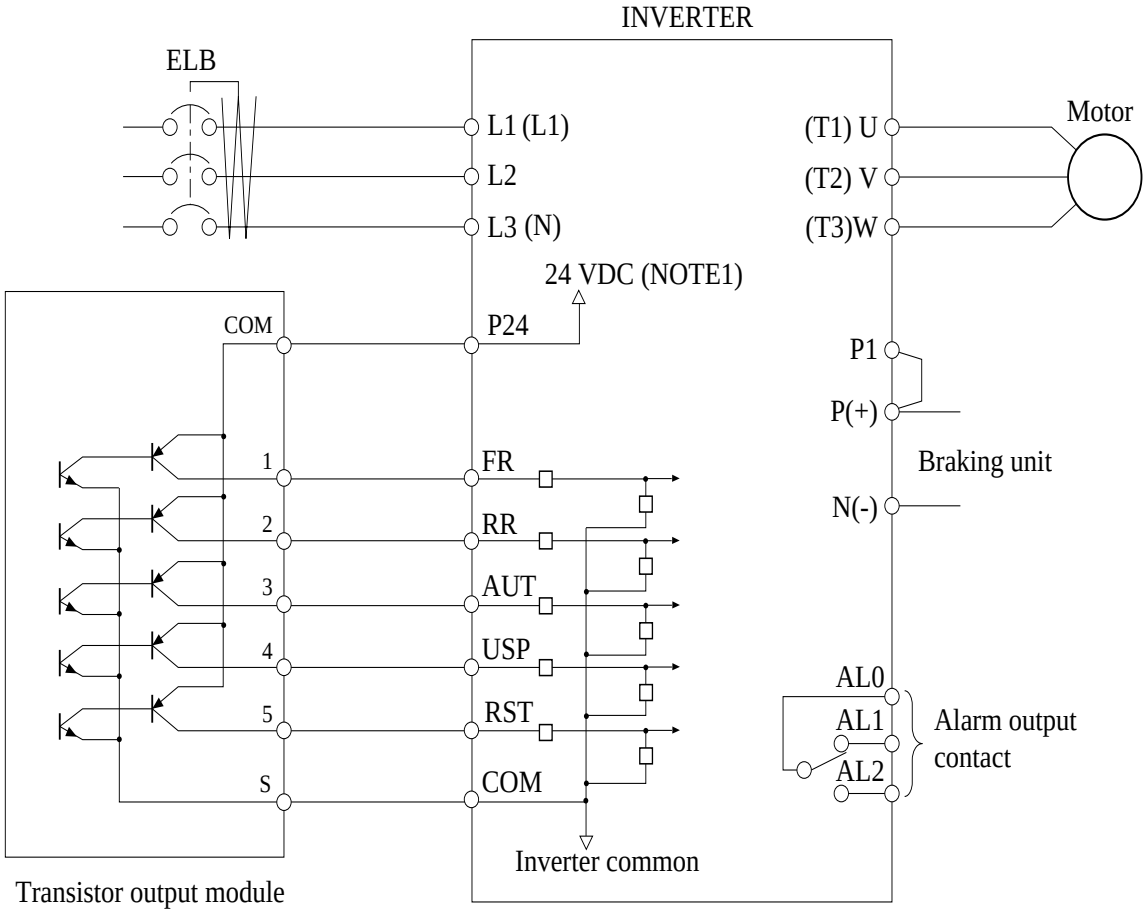


NOTE9: Do not short circuit the terminals P24 and COM,+V,IRF FRQ by mistake. Inverter may be damaged.

NOTE10: Do not short-circuit the terminals +V and COM. The control power supply may cause a failure.

Connection to the Programmable Controller

(1) When the internal interface power source is used



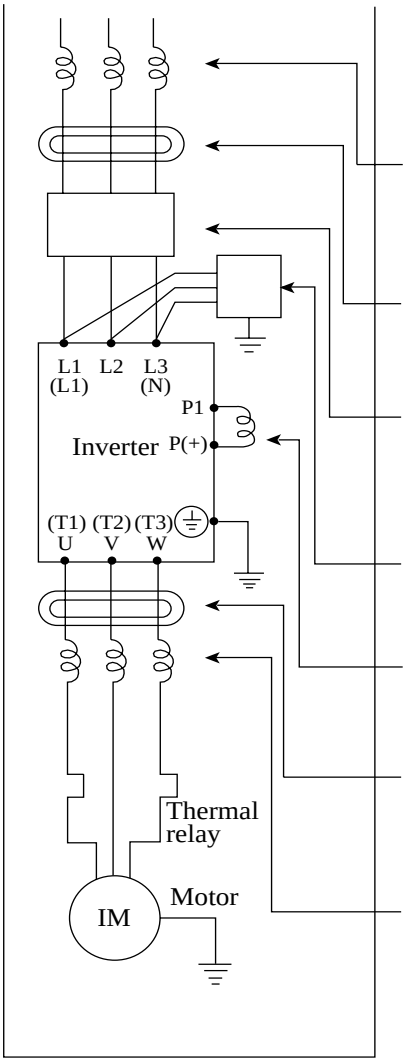
NOTE 1: Do not short circuit the terminals P24 and COM by mistake. The control power supply may cause a failure.

5.2 Wiring Equipment, Options

⚠ **CAUTION:** Provide the wiring equipment in accordance with the safety codes required by jurisdictional authorities.
If specified in the standard or laws and regulations, follow their instructions.

Motor output (kW)	Inverter model	Wiring		Applicable equipment
		Power lines	Signal lines	Fuse (class J) rated 600V
0.2	SF3202-A20-W	AWG16/1.3mm²	(*) 0.14 to 0.75 mm² Shielded wire	10A
0.4	SF3202-A40-W			10A
0.75	SF3202-A75-W	AWG14/2.1mm²		15A
1.5	SF3202-1A5-W	AWG12/3.3mm²		20A (single ph.) 15A (three ph.)
2.2	SF3202-2A2-W	AWG1O/5.3mm²		30A (single ph.) 20A (three ph.)
3.7	SF3202-3A7-W	AWG12/3.3mm²		30A
0.4	SF3204-A40-W	AWG16/1.3mm²		3A
0.75	SF3204-A75-W			6A
1.5	SF3204-1A5-W			10A
2.2	SF3204-2A2-W			10A
4.0	SF3204-4A0-W	AWG14/2.1mm²		15A

NOTE 1: Field wiring connection must be made by a UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involeved.
Connector must be fixed using the crimp tool specified by the connector manufacturer.
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 lines if the distance exceeds 20 m.
NOTE 4: Install an earth leakage breaker meeting requirements of IEC947-1/IEC947-3 at the input.
(*) Use 0.75 mm² wire for the alarm signal wire.
Wire stripping lenght : 5 to 6 mm.
Max wire sleeve diameter except for the alam signal wire 2 mm².



Part description	Function
AC reactor for improving the power factor	This part is used when the unbalance voltage ratio is 3% or more and power supply is 500 kVA or more, and there is a rapid change in the power supply. It also improves the power factor.
Radio noise filter (Zero phase reactor)	Using the inverter may cause noise on the peripheral equipment through the power lines. This part reduces noise.
EMI filter for inverter	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. **NOTE 1**
Capacitive filter	This part reduces radio frequency common noise. Put it in the primary side of inverter.
DC reactor	This part improves the power factor.
Radio noise filter (Zero phase reactor)	This part reduces noise generated at the output of the inverter. (It is possible to use for both input and output.)
AC reactor for preventing thermal relay maltfunction and reducing vibration	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 between the inverter and moter is too long, this part also prevents the thermal relay from malfunctioning.

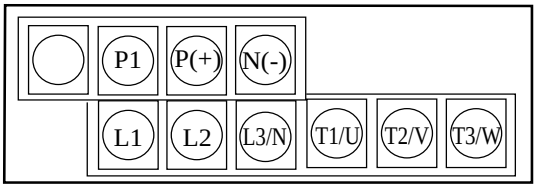
NOTE 1: EMI filter is required for EMC directive(Europe), but others are not for this purpose.
Reactor and others of the above table except EMI filter are for noise reduc tion.

5.3 Terminal

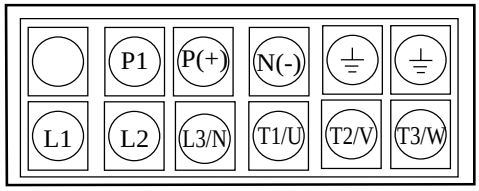
(1) Terminal dimensions

Main circuit terminal

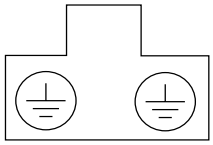
Main Circuit Terminal(SF3202-A75～3A7-W
SF3204-A40～4A0-W)

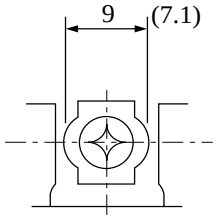


Main Circuit Terminal(SF3202-A20～A40-W)



Ground Terminal





Main circuit terminal

Control circuit terminal

COM	RST	USP	AUT	RR	FR	P24

+V	VRF	IRF	COM	FRQ	OM	DRV	UPF

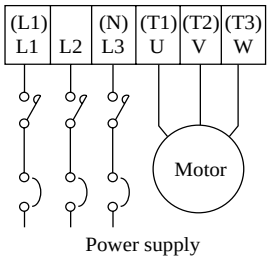
Alarm Circuit Terminal

AL0	AL1	AL2

Note:Value inside ( ) : SF3202-A20～A40-W

	Screw diameter	Width (mm)
Main circuit	M4(M3.5)	9 (7.1)
Control circuit	M2	——
Alarm circuit	M3	——
Grounding	M4	——

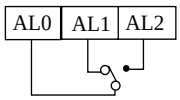
(2) Main circuit terminal function

Terminal symbol	Terminal description	Function	
L1,L2,L3 (L1),(N)	Main power	Connect the power supply L1,L2,L3 ·····Three phase L1,N·····Single phase	
U,V,W T1,T2,T3	Inverter output	Connect the motor	
P1,P	External DC Reactor	Usually the short-cut bar is attached between terminals P1 and P(+).When the DC Reactor is to be connected, be sure to remove the short-cut bar.	
⏚	Ground	Ground (connect grounding to avoid electric shock)	Make sure that the short-cut bar attached between P1 and P(+) is not removed except when the DC reactor is to be mounted .

Tightening torque

Screw	Tightening torque
M2	0.2 N•m (max. 0.25 N•m)
M3	0.5 N•m (max. 0.6 N•m)
M3.5	0.8 N•m (max. 0.9 N•m)
M4	1.2 N•m (max. 1.3 N•m)

(3)Control circuit

	Terminal symbol	Terminal description and function	Initial setting	Remarks
Input signal	RST	Intelligent input terminals Forward running command / Reverse running command / External trip Multistage speed (First stage) / Jogging / USP function (Note 1) Multistage speed (Second stage) / Analog input command / Reset (Note 2) Multistage speed (Third stage) / 2 stage acc./dec. time / Terminal software lock Multistage speed (Forth stage) / Free run stop / PTC (Note 3)	Reset input (Note 2)	Dry contact Close: ON (run) Open: OFF (stop) Min. ON time: 12 ms or more
	USP		USP	
	AUT		Analog input	
	RR		Reverse running command	
	FR		Forward running command	
	P24	Common for input signals		24VDC max. 30 mA
Monitor signal	FRQ	Analog frequency monitor/Digital frequency monitor/Analog output current monitor	Analog frequency monitor	
	COM	Common for monitor		
Frequency command input	+V	Power supply for frequency command		10 VDC max.10mA
	VRF	Voltage frequency command		0-10 VDC (nominal) (Input impedance 10 kΩ)
	IRF	Current frequency command		DC 4-20 mA (nominal) Input impedance 250 Ω
	COM	Common for frequency command		
Output signal	UPF	Intelligent output terminal Arrival signal at constant speed, Arrival signal at set speed, RUN signal,Overload signal, Deviation signal at PID control, Alarm signal	Arrival signal at constant speed	27 VDC 50 mA max
	DRV		Run signal	
	OM	Common for output signals		
Fault alarm output	AL0		Contact rating 250 VAC 2.5 A (Resistor load) / 0.2 A ($\cos\phi$=0.4) 30 VDC 3.0 A (Resistor load) / 0.7 A ($\cos\phi$=0.4)	Min 100 VAC 10 mA 5 VDC 100 mA
	AL1			
	AL2	Normal : AL0-AL1 close Abnormal, Power off : AL0-AL1 open (Initial setting)		

NOTE 1: USP: Prevention function of restart upon power on.
NOTE 2: The reset terminal can not be changed from "a contact" (NO) to "b contact" (NC).
NOTE 3: See page 7-14.

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 closing the front case. While being energized, be sure not to open the front case.
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 retry 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

⚠ Cooling fin 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 standard setting value(50Hz/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 L1(L1), L2 and L3(N), 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 ground terminal (⏚) 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.

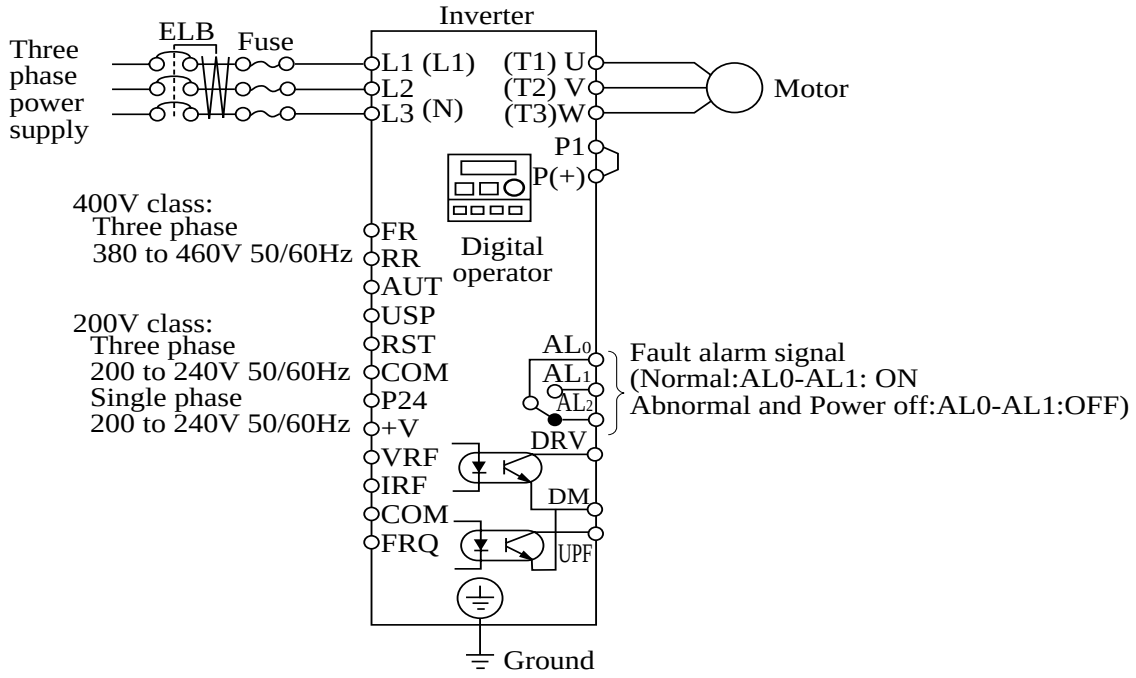
(10) With the front case opened, do not operate the inverter. Make sure that the front case is completely closed and locked with the screw before operating the inverter.

Never test withstand voltage tests. Because this inverter has the surge absorber between the main circuit terminal and the ground.

6.2 Test Run

An example of a general connection diagram is shown below.

Operating with digital operator:
To set frequency, run and stop is used by digital operator.
Frequency setting: Potentiometer on the digital operator
Run and stop: key pad on the digital operator



Procedure(Operating with digital operator)

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

(2) Set A 02 to 02.

(3) Set A 01 to 00.

(4) Check to turn on the lamp above the potentiometer and turn the potentiometer.

(5) Start running after pressing RUN once and turn on the RUN lamp.

(6) Check output frequency by monitor mode d 01.

(7) Press STOP RESET and decelerate to a stop.

⚠ CAUTION

Check the following after the test run is complete.
Otherwise, there is a danger of machine breakage.

- Was the direction of the motor correct?
- Was the inverter tripped during acceleration or deceleration?
- Were the frequency meter correct?
- Were there any abnormal motor vibrations or noise?

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

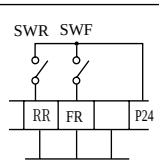
Factory settings
Maximum frequency: 60 Hz Forward operation

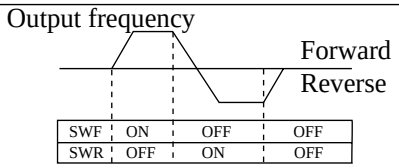
7. FUNCTION OF CONTROL CIRCUIT TERMINAL

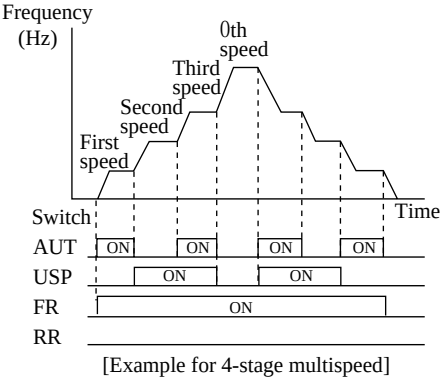
7.1 List of Control Circuit Terminals

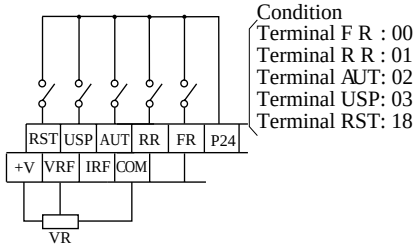
<table>
<tr><th colspan="2">Terminal symbol</th><th colspan="2">Function</th><th>Contents</th></tr>
<tr><td rowspan="11">Intelligent input terminals FR, RR, AUT, USP, RST</td><td>00</td><td colspan="2">Forward run/stop</td><td rowspan="2">SWF Contact (close): Forward run (open): Stop

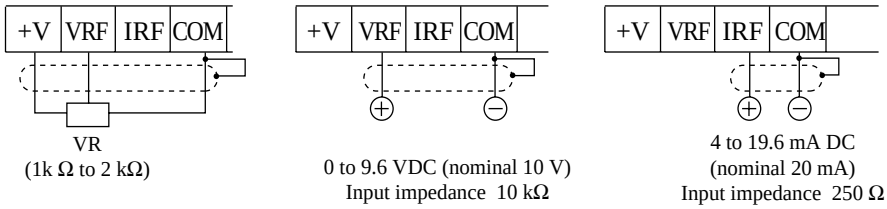
SWR Contact (close): Reverse run (open): Stop

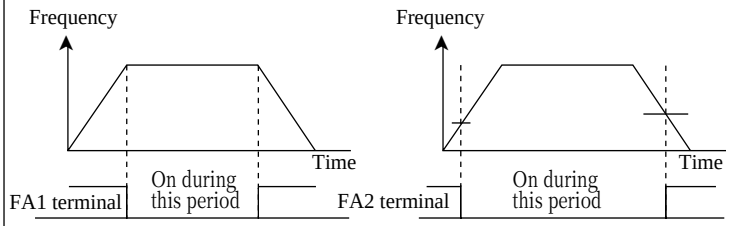


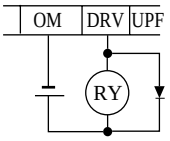
Both contacts SWF and SWR are close-stop.</td></tr>
<tr><td>01</td><td colspan="2">Reverse run/stop</td></tr>
<tr><td>02</td><td rowspan="4">Multistage speed</td><td>1</td><td rowspan="4"> 

[Example for 4-stage multispeed]

</td></tr>
<tr><td>03</td><td>2</td></tr>
<tr><td>04</td><td>3</td></tr>
<tr><td>05</td><td>4</td></tr>
<tr><td>06</td><td colspan="2">Jogging</td><td>Jogging run</td></tr>
<tr><td>19</td><td colspan="2">PTC thermister Thermal protection</td><td>When thermister is connected with this terminal, the thermal protection can be used. The common is terminal COM. NOTE: Refer to p.7-14 about details.</td></tr>
<tr><td>16</td><td colspan="2">Analog current input sellection</td><td>Analog input voltage-current swiching(When this terminal is ON,current input signal to IRF-COM is active.)</td></tr>
<tr><td>09</td><td colspan="2">2 stage acceleration and deceleration</td><td>When the assigned terminal is turned on, the acceleration and deceleration can be executed by the 2nd stage acceleration and deceleration time.</td></tr>
<tr><td>11</td><td colspan="2">Free run stop</td><td>When the assigned terminal is turned on, the inverter stops output and the motor enters the free run state.</td></tr>
<tr><td>12</td><td colspan="2">External trip</td><td>When the assigned terminal is turned on, the inverter enters the trip state, stops output, and displays E12 .</td></tr>
<tr><td>13</td><td colspan="2">Power reclos-ing restart prevention</td><td>When the assigned terminal is turned on, the restart when the power is turned on with the running command kept on can be prevented.</td></tr>
<tr><td>18</td><td colspan="2">Reset</td><td>When the assigned terminal is turned on, the trip state can be canceled. During turning on,the output is stopped. NOTE: The function cannot be used in the N.C. contact state.</td></tr>
<tr><td>15</td><td colspan="2">Software lock</td><td>When the assigned terminal is turned on, the data of each function is locked.</td></tr>
<tr><td colspan="2">P24</td><td colspan="2">24VDC common for input</td><td>Common terminal for the intelligent input terminals</td></tr>
</table>

<table>
<tr><th colspan="2">Terminal symbol</th><th>Function</th><th>Contents</th></tr>
<tr><td rowspan="4">Frequency command</td><td>+V</td><td>Power supply terminal to command a frequency</td><td rowspan="4">• The external voltage signal is 0 to 9.6 V (10 V nominal).
.
 

NOTE: If there is no setting for analog current input at the input intelligent terminal,the sum of both analog input signals is outputted. When selecting one of analog input current or voltage, make sure that the analog current input is allocated to the input intelligent terminal.</td></tr>
<tr><td>VRF</td><td>Frequency command terminal (voltage command)</td></tr>
<tr><td>IRF</td><td>Frequency command terminal (current command)</td></tr>
<tr><td>COM</td><td>Frequency command common</td></tr>
<tr><td>Monitor terminal</td><td>FRQ</td><td>Frequency monitor</td><td>• Analog frequency monitor/Digital frequency monitor/Analog output current monitor</td></tr>
<tr><td rowspan="6">Intelligent output terminal UPF, DRV (Note)</td><td>01
02</td><td>Frequency arrival signal

01 : FA1
02 : FA2</td><td>• When 01/02 is set for a terminal, at the time of constant speed arrival, two types of methods for outputting a frequency more than an optionally set frequency can be executed.
 
</td><td rowspan="5">Output terminal specification

Open collector output
27 V DC max
50 mA max
 
</td></tr>
<tr><td>00</td><td>RUN signal</td><td>• When 00 is set for a terminal, the inverter outputs when the motor is driven.</td></tr>
<tr><td>03</td><td>Overload signal</td><td>• This signal is outputted when the motor current is more than the set value.</td></tr>
<tr><td>04</td><td>Deviation signal at PID control</td><td>• This signal is outputted when the difference between reference and feed-back is greater than the set value at PID control.</td></tr>
<tr><td>05</td><td>Alarm signal</td><td>• When an alarm occurs,this signal is outputted .</td></tr>
<tr><td colspan="2">OM</td><td>Output Signal Common terminal</td><td>• Common terminal for intelligent output terminal
(Output terminals are open collector output and isolated from L common)</td></tr>
<tr><td colspan="2">AL0
AL1
AL2</td><td>Alarm terminal</td><td colspan="2">In the normal state: The contact between AL0 and AL1 is close.
In the abnormal state or when power is turn off, the contact (between AL0 and AL2 are close.)
Contact rating
250 V AC 2.5 A (resistance load) 0.2 A (cos ϕ = 0.4)
30 V DC 3.0 A (resistance load) 0.7 A (cos ϕ = 0.4)
[Minimum
100 V AC 10 mA 5 V DC 100 mA]</td></tr>
</table>

NOTE: "N.O. contact" is set by initialization for terminal UPF,DRV. When "N.C. contact" is to be used, switch the contact setting by C 31, C 32.

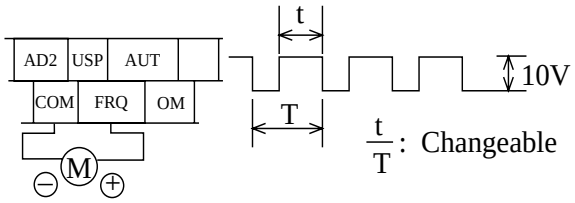
7.2 Function Contents of Monitor Terminal

Terminal name: Monitor terminal [FRQ] (Analog, digital) — **Function No. to be set** C 23 , b 81 b 86

Function contents

Monitor output frequency signal or the current of the inverter is output from the control circuit terminal.
Monitor output current signal is output as an analog signal only.

(1) Analog Frequency Monitor Signal
The meter outputs duty cycle in proportion to the output frequency with full scale at the maximum frequency.

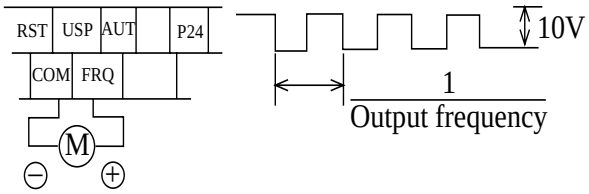


0 to 10V
1mA

T = 4 ms (constant)

NOTE: This is a dedicated indicator, so that it cannot be used as a line speed signal.
Indication accuracy after adjustment: About ±5% (The accuracy of some meters may exceed this value.)

(2) Digital Frequency Monitor Signal
Pulse train of a frequency which is converted the output frequency is output.
(The convert value is setting by b 86 .)
The duty is about 50%.



(3) Analog Current Monitor Signal
The duty cycle in proportion to the output current with full scale at 200% of the rated current of the inverter.
Specification of analog meter follows the analog frequency monitor specifications.

Setting contents

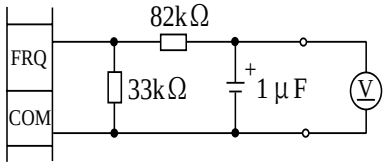
1. Select Frequency Monitor(Analog/Digital) or Current Monitor by C 23 .
2. When the analog meter is used, adjust the meter so that the needle of the meter indicates the maximum value at the time of maximum frequency by b 81 (analog meter adjustment).
3. In the case of digital frequency monitor, it is able to convert the scale by b 86 .

NOTE: The converted value of digital frequency monitor is limited to about 3.6 kHz.

Accuracy of output current monitor

Accuracy : ±20%
(A half base frequency or higher)
The indication value may exceed this accuracy by the load current condition.
Use the moving tron type ammeter for the precise current measurement.

Circuit for FM signal monitor for process control (just only monitor)



7.3 Function Contents of Intelligent Input Terminals

Terminal name: Forward running/stop — **Function No. to be set** C 01 to C 05, A 02

Function content

- When the running command is inputted via the assigned terminal, the terminal executes the forward running command or stop command.

Terminal setting method

Digital operator

Set the set value 00 in one of the input terminals C 01 to C 05 .

⚠ WARNING

When the power is turned on when the 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.

Precautions

- When the running command is inputted via the forward running terminal and reverse running terminal at the same time, the running command enters a state which is the same as stop.
- Note that when the forward running terminal is set to "N.C. contact", the running automatically starts.
- Set the value 01 to the A 02 ,then this terminal is available.

Terminal name: Reverse running/stop — **Function No. to be set** C 01 to C 05, A 02

Function content

- When the running command is inputted via the assigned terminal, the terminal executes the reverse running command or stop command.

Terminal setting method

Digital operator

Set the set value 01 in one of the input terminals C 01 to C 05 .

⚠ WARNING

When the power is turned on when the 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.

Precautions

- When the running command is inputted via the forward running terminal and reverse running terminal at the same time, the running command enters a state which is the same as stop.
- Note that when the reverse running terminal is set to "N.C. contact", the running automatically starts.
- Set the value 01 to the A 02 ,then this terminal is available.

Terminal name: Multistage speed | **Function No. to be set** | C 01 to C 05, F 01 / A 20 to A 35

Function content

- When [FR], [RR], [AUT], and [USP] are selected as intelligent input terminals, Multispeed 1 to Multispeed 15 can be set. When the frequency command from the normal operator (or terminal) is combined with them, up to 16 stages of running are available.
- When the control terminal is set at each speed by the switch, the numerical value displayed at d 01 indicates the output frequency at the time of each multispeed. Set the speed as shown below.

(1) Turn the running command off.

(2) Turn each switch on and set it to Multispeed n. Display the data section of F 01 .

(3) Set an optional output frequency by pressing the ▲ and ▼ keys.

(4) Press the STOP RESET key once so as to store the set frequency. If this occurs, F 01 indicates the output frequency of Multispeed n.

(5) Press the FUNC key once. (Confirm that the indication is the same as the set frequency.)

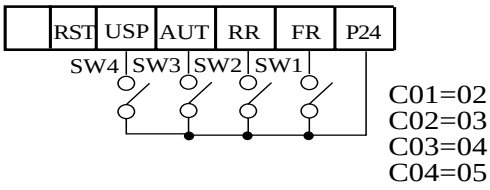
(6) When the operations in (1) to (4) are repeated, the frequency of Multispeed n can be set. It can be set also by one of A 20 to A 35 .

Terminal setting method

Digital operator

Set the set values 02 to 05 in the input terminals C 01 to C 05 .

Example of the input terminal connection

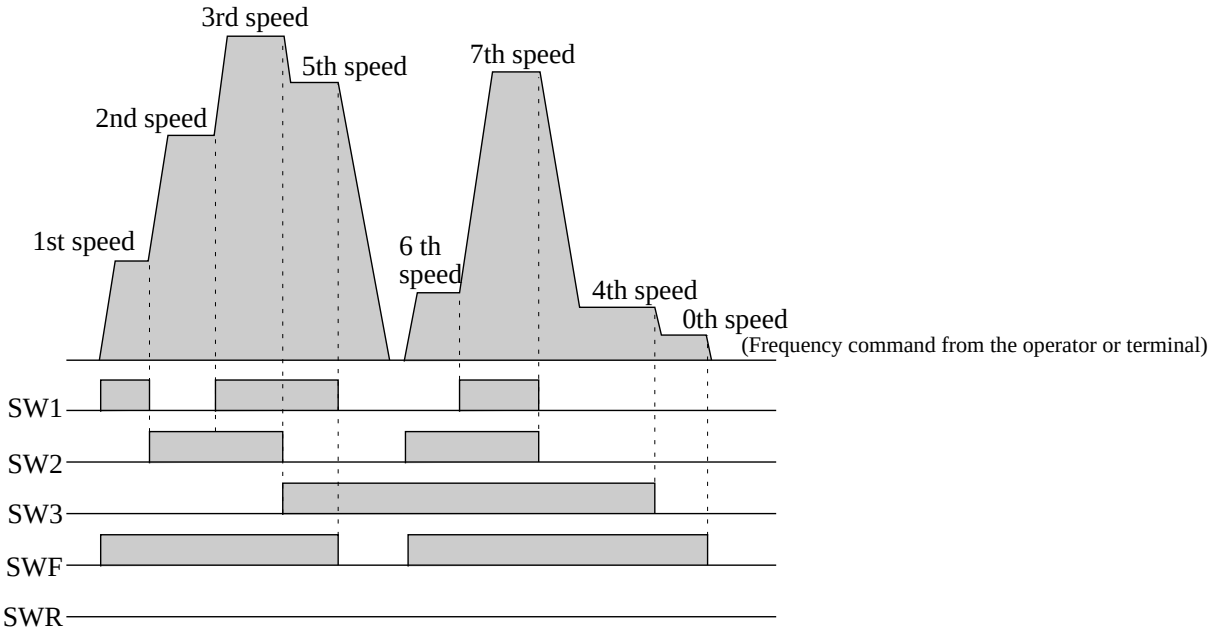


Setting of multispeed

Multispeed	Control circuit terminal			
	SW4	SW3	SW2	SW1
Multispeed 0	OFF	OFF	OFF	OFF
Multispeed 1	OFF	OFF	OFF	ON
Multispeed 2	OFF	OFF	ON	OFF
Multispeed 3	OFF	OFF	ON	ON
Multispeed 4	OFF	ON	OFF	OFF
Multispeed 5	OFF	ON	OFF	ON
Multispeed 6	OFF	ON	ON	OFF
Multispeed 7	OFF	ON	ON	ON
Multispeed 8	ON	OFF	OFF	OFF
Multispeed 9	ON	OFF	OFF	ON
Multispeed 10	ON	OFF	ON	OFF
Multispeed 11	ON	OFF	ON	ON
Multispeed 12	ON	ON	OFF	OFF
Multispeed 13	ON	ON	OFF	ON
Multispeed 14	ON	ON	ON	OFF
Multispeed 15	ON	ON	ON	ON

Precautions

- After any data is changed, be sure to press the STOP RESET key every time and then set the next one. Note that when the STOP RESET key is not pressed, no data will be set.
- When a frequency more than 50Hz(60Hz) is to be set, it is necessary to switch the maximum frequency A 04 .



[Example for 8-stage multispeed]

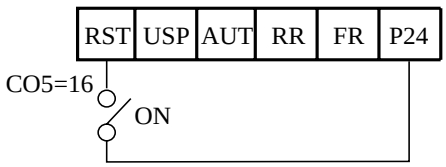
Terminal name: Analog input command **Function No. C 01 to C 05 to be set A 01**

Function content

- When the assigned terminal is turned on, it is possible to set the output frequency by current input signal (DC4~20mA) at IRF-COM.

Function switching method

While the switch between the assigned terminals and P24 is on, it is possible to set the output frequency by the current input signal
at IRF-COM.
When the terminal is turned off, the voltage input signal at VRF-COM is available.



Terminal setting method

Digital operator

Set the set value 16 in one of the input terminals C 01 to C 05 .

Precautions

- If there is no setting for analog input switching at the input intelligent terminal, the sum of both analog input value is outputted.
  When selecting one of analog input value (current or voltage), make sure that the analog input switching is allocated to the input intelligent terminal.
- Be sure to set the value 01 to A 01.

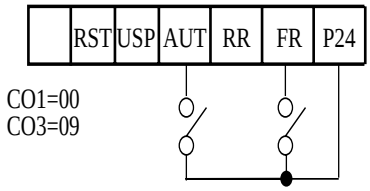
Terminal name: Second stage acceleration and deceleration **Function No. C 01 to C 05, to be set A 92, A 93, A 94**

Function content

- When the assigned terminal is turned on, the equipment can be accelerated or decelerated (acceleration time 2, deceleration time 2) by the 2 stage acceleration and deceleration time.

Function switching method

- While the switch between the assigned terminal and P24 is on, the equipment operates by the 2 stage acceleration and deceleration time (acceleration time 2, deceleration time 2).
- When the terminal is turned off, the equipment is returned to the original acceleration and deceleration time (acceleration time 1, deceleration time 1).



Terminal setting method

Digital operator

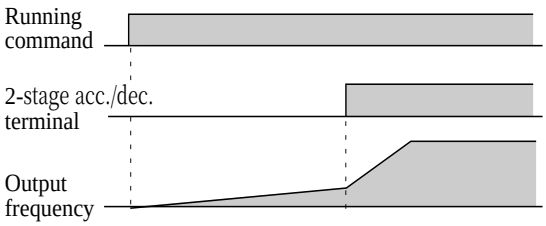
Set the set value 09 in one of the input terminals C 01 to C 05 .

2 stage acceleration and deceleration time setting method

Use A 92 (acceleration time 2) and A 93 (deceleration time 2) to set the 2 stage acceleration and deceleration time (acceleration time 2, deceleration time 2).

Between assigned terminals and P24	Acceleration and deceleration time for operation
OFF state	Acceleration time 1, Deceleration time 1
ON state	Acceleration time 2, Deceleration time 2

Precautions



Setting A 94 to 00 enable to switch by this terminal.

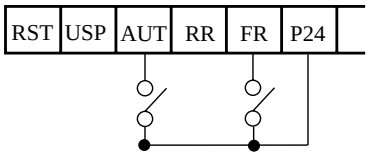
Terminal name: Free run stop | **Function No. to be set** C 01 to C 05, b 03, b 88, C 11 to C 15

Function content

- When the assigned terminal is turned on, the inverter stops output and the motor enters the free run state.

Function switching method

- While the switch between the assigned terminal and P24 is on, the equipment operates the 「Free run stop」 operation.



CO1= 00
CO3= 11

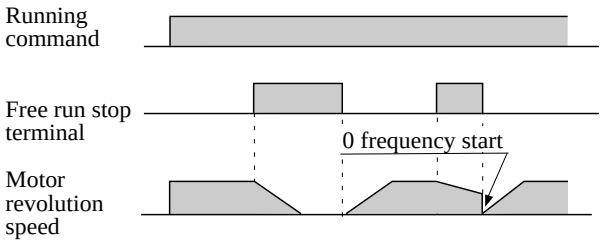
NOTE: When "b contact" is to be used, switch the contact setting by C 11 to C 15 .
The contact setting cannot be switched only by selecting 「Free run stop:11」 by switching C 01 to C 05 .

Terminal setting method

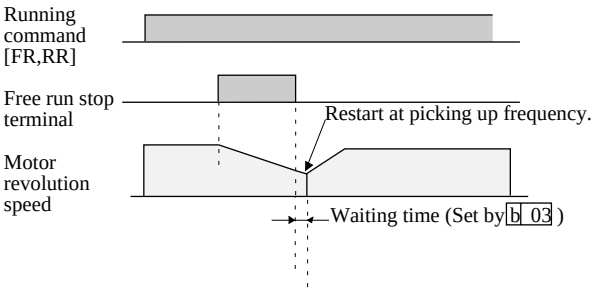
Digital operator

Set the set value 11 in one of the input terminals C 01 to C 05 .

When b 88 is set 00 ,0 frequency start after resetting 「Free run stop」 .



When b 88 is set 01 , restart from the frequency,which is picked up from the free running motor .



Terminal name: External trip | **Function No. to be set** C 01 to C 05

Function content

- When the assigned terminal is turned on, the inverter enters the trip state by an indication of E 12 and stops output.

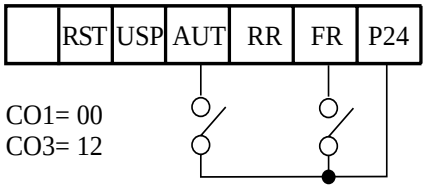
Terminal setting method

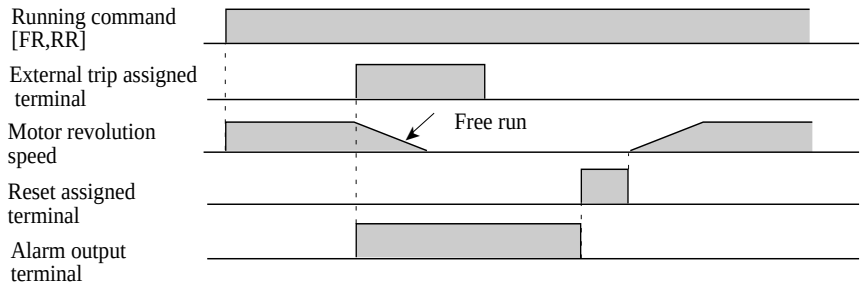
Digital operator

Set the set value 12 in one of the input terminals C 01 to C 05 .

Function switching method

When the switch between the assigned terminal and P24 is turned on, the equipment enters the trip state.
Even when the switch is turned off, the trip state will not be canceled. Reset the equipment or turn the power off and on again to cancel the trip state.





Terminal name: Prevention function of restart upon power on [USP function]

Function No. C 01 to C 05 to be set

Function content

- If the running command is set when power is turned on, the inverter starts running immediately after it is activated. The USP function prevents it so that the inverter will not execute sudden running.
- To reset an alarm and restart running, turn the running command off or perform a reset operation by the 「Reset」 terminal or the (STOP RESET) key.
  Refer to the time chart indicated below.

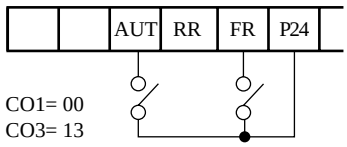
Terminal setting method

Digital operator

Set the value 13 in one of the input terminals C 01 to C 05 .

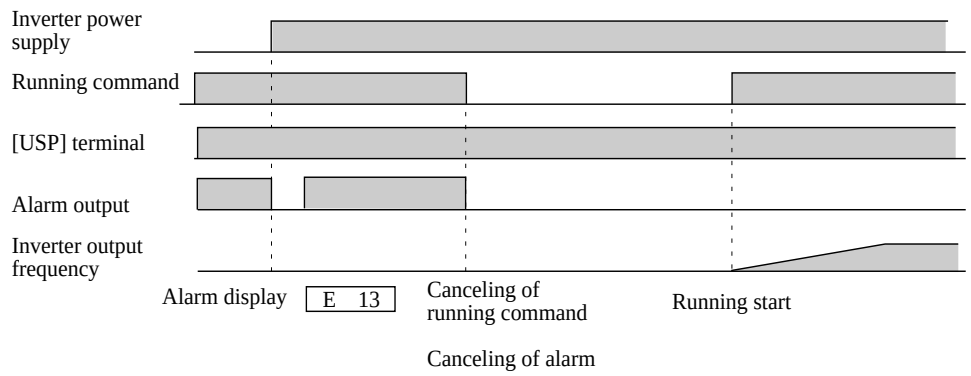
Function switching method

While the switch between the assigned terminal and P24 is on, the equipment executes the USP operation. If the power is turned on when the running command is inputted, the equipment enters the USP trip state (E 13).



Precautions

- Note that when a USP error occurs and it is canceled by resetting in the state that the running command from the terminal is inputted, the inverter restarts running immediately.
- Even when the trip state is canceled by turning the 「Reset」 terminal on and off after an under voltage protection (E 9) occurs, this function will be performed.
- When the running command is inputted immediately after the power is turned on, a USP error will be caused. When this function is used, input the running command after three (3) seconds since the power is turned on.



Terminal name: Reset | **Function No. to be set** C 01 to C 05

Function content

- The trip content can be canceled.

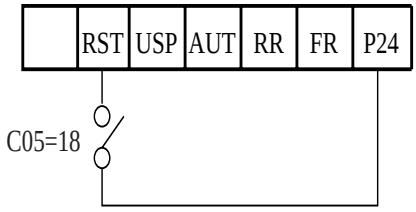
Terminal setting method

Digital operator

Set the set value 18 in one of the input terminals C 01 to C 05 .

Function switching method

- When the switch between the assigned terminals and P24 is turned on and off, the equipment executes the reset operation.

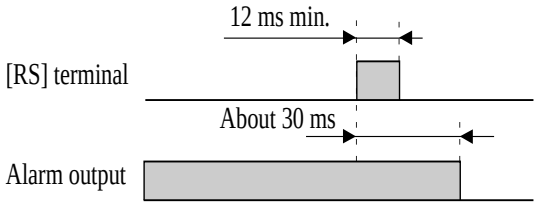


WARNING

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 that the operation command is off.
Otherwise, there is a danger of injury.

Precautions

- When the RESET assigned terminal is turned off from on, it becomes valid.
- The STOP RESET key of the digital operator is valid only when an alarm occurs.
- Only “N.O. contact” can be set to the RESET assigned terminal. The terminal cannot be used in the “N.C. contact” state.
- Even when the power is turned off or on, the function of the terminal is the same as that of the reset terminal.



- The RUN key on the inverter is available for a few second after reset signal coming with the remote operator connected.
- When the RESET assigned terminal is turned on while the motor is running ,the motor will be free running.

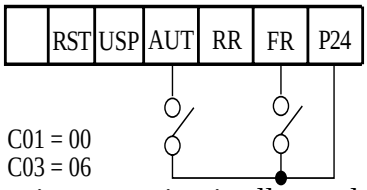
Terminal name: Jogging | **Function No. to be set** C 01 to C 05, A 02, A 38, A 39

Function content

- When the assigned terminal is turned on and the run command is issued ,the inverter perform the jogging operation.

Function switching method

- While the switch between the assigned terminal and P24 is on, the equipment operates the jogging operation.
  The frequency at jogging operation is set by A 38 .
- Set the value 01 (terminal mode) in the A 02 (Run command) .
- Since jogging is a direct input operation, set the jogging frequency A 38 to 5 Hz or less to prevent tripping.

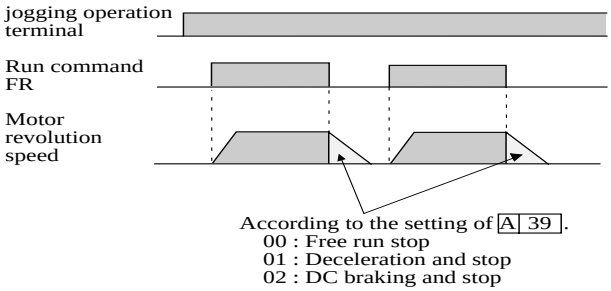


When jogging operation is allocated to the terminal AUT

Terminal setting method

Digital operator

Set the set value 06 in one of the input terminals C 01 to C 05 .



NOTE: No jogging operation is performed when the set value of jogging frequency A 38 is smaller than the start frequency b 82 ,or the value is 0 Hz.

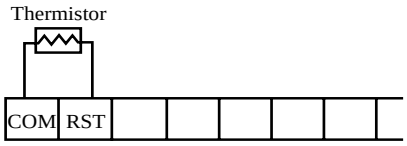
Precautions

- Be sure to stop the motor when switching this jogging operation function for certain operation.

Terminal name: PTC(ITC) **Function No. C 05**

Function content

- When the registance value of the thennistor connected with this terminal is more than 3 k ohm ±10%, the equipment operates the trip operation(Cut off the output and indicates the trip status [E 35]).
  Use this function to protect the motor driven by this equipment.
  (Thermal protection)



C05=19

Terminal setting method

Digital operator
Set the set value 19 in the input terminals C 05 .

NOTE: This function is assigned to the input terminal RST only.
If this function is assigned without connection the thermistor, the equipment operates the trip operation.
Be sure the thermistor is connected with the terminal 5, and then restart.

Terminal name: Terminal software lock | **Function No. to be set** | C 01 to C 05, b 31

Function content

- When the assigned terminal is turned on, the data of all the functions except the output frequency is locked. When the data is locked, no data can be changed.

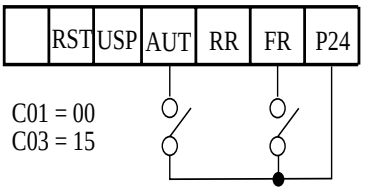
Terminal setting method

Digital operator

Set the set value 15 in one of the input terminals C 01 to C 05.

Function switching method

When the switch between the set terminal and P24 is turned on, the equipment enters the software lock state.



When terminal software lock is allocated to the terminal AUT

Precautions

- When the assigned terminal is turned on, only the output frequency can be changed.
- Software lock can be made possible also for the output frequency by b 31 .
- Software lock by the operator is also possible without the assigned terminal being used. (b 31)

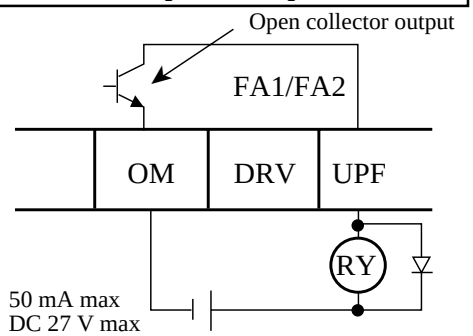
7.4 Function Contents of Intelligent Output Terminals (Initial setting is "N.O. contact" state)

Terminal name: Frequency arrival signal [FA1]/ [FA2] **Function No. to be set** **C 21, C 22, C 42, C 43**

Function content

- When [FA1]/[FA2] is selected as an intelligent output terminal, at the time of constant speed arrival, two types of methods for outputting a frequency more than an optionally set frequency can be executed.Select the output method by C 21, C 22. Set an optionally set frequency by C 42 (setting at the time of acceleration) or C 43 (setting at the time of deceleration).

Connection example of output terminal



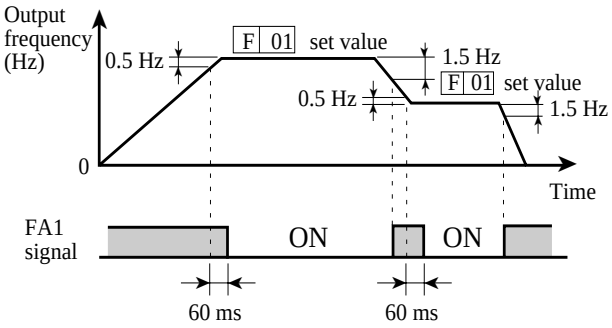
Terminal setting method

Digital operator

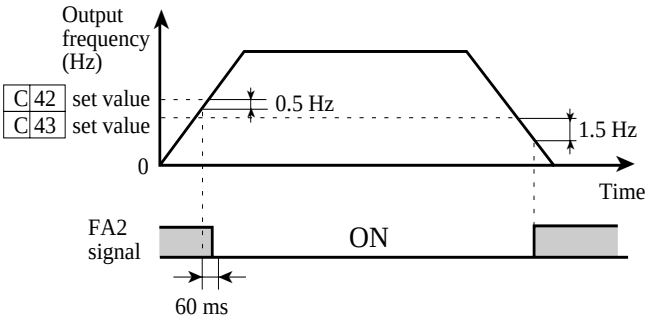
Set the set value 01/ 02 in the output terminal C 21 / C 22 .

Precautions

- At the time of acceleration, an output signal at a frequency between the set frequency - 0.5 Hz to + 1.5 Hz is turned on.
- At the time of deceleration, an output signal at a frequency between the set frequency + 0.5 Hz to - 1.5 Hz is turned on.



At the time of constant speed arrival



More than optionally set frequency

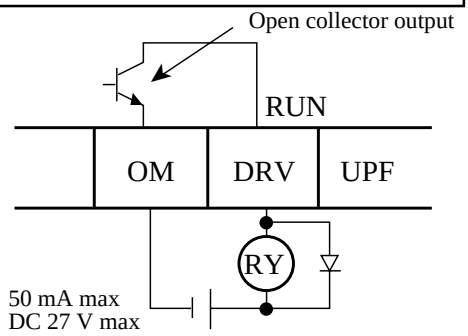
NOTE: When an arrival signal is outputted, a delay of about 60 ms occurs.

Terminal name: Run signal **Function No. to be set** C 21 , C 22

Function content

- When is selected as an intelligent output terminal, the inverter outputs a RUN signal when the motor is driven.

Connection example of output terminal



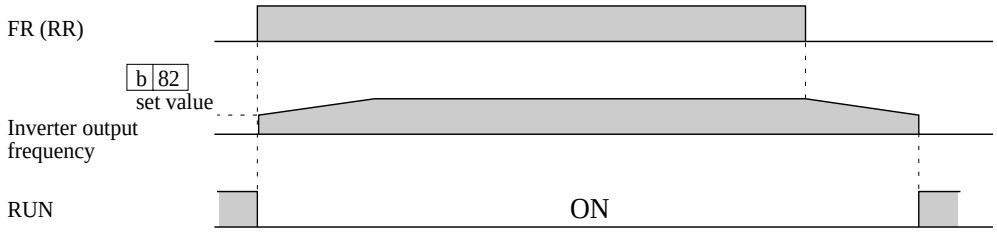
Terminal setting method

Digital operator

Set the set value 00 in the output terminal C 21, C 22 .

Precautions

- RUN signal is outputted simultaneously when a frequency is outputted.

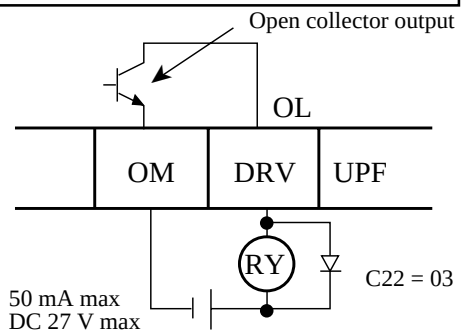


Terminal name: Overload advance notice signal [OL] **Function No. to be set** C 21, C 22 C 41

Function content

- When an output current more than the set current flows, the terminal outputs a signal.

Connection example of output terminal



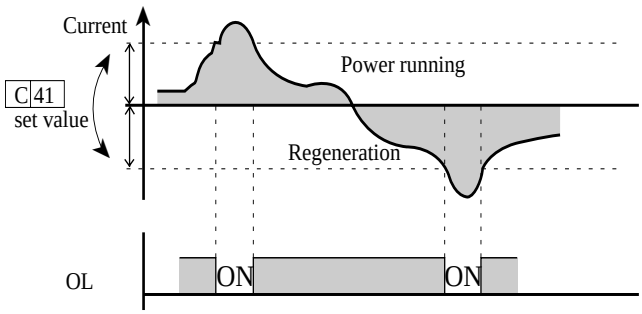
Terminal setting method

Digital operator

Set the set value 03 in the output terminal C 21 /C 22.

Precautions

A value of 100% is set by initialization. To change the level, change C 41 (overload level).
The accuracy of this level is same as the function of the output current monitor. (See 7-3)

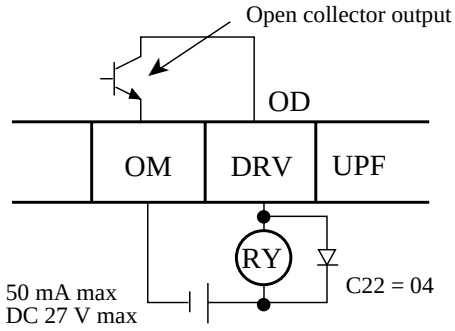


Terminal name:Deviation signal at PID control [OD]	Function No. to be set	C 21, C 22 C 44

Function content

- This signal is outputted when the difference between reference and feed-back is greater than the set value at PID control.

Connection example of output terminal



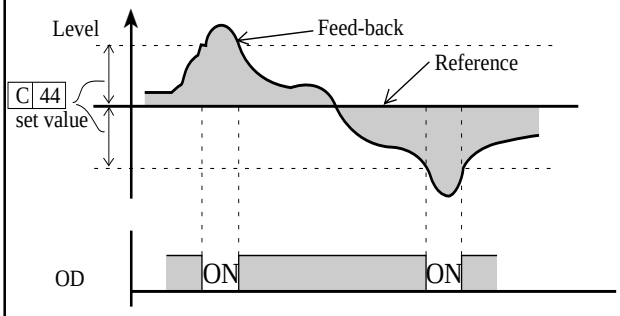
Terminal setting method

Digital operator

Set the set value 04 in the output terminal C 21 /C 22.

Precautions

The difference value is set 3% by initialization. To change this value, change C 44 (deviation level).



Terminal name: Alarm terminal [AL] | **Function No. to be set** C 21, C 22

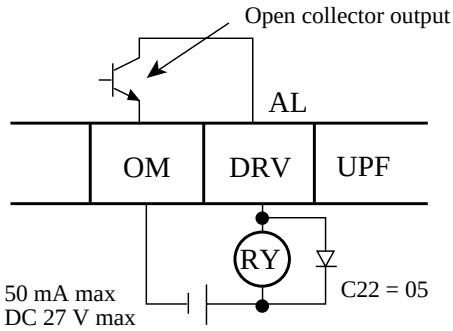
Function content

- When an alarm occurs, the function outputs an alarm signal from the output terminal which is assigned to the intelligent output termnal(Open collector output).

Terminal setting method

Digital operator

- Set the value 05 in the output terminal C 21 / C 22 .



Precautions

- When the alarm output is set to N.C., a time delay occurs until the contact is closed when the power is turned on. Therefore, when the alarm contact output is to be used, set a delay of about 2 seconds when the power is turned on.
- This terminal is an open collector output, so the electric specification of [AL] is different from the contact output terminal [AL1],[AL2]-[AL0].
- The sequence of this terminal is same as [AL0]-[AL1] .
- See the description of [AL1],[AL2]-[AL0].
- When the power supply is turned off, the alarm signal output is valid while the power of control circuit is live.

NOTE: This signal output has the delay time (generally 300ms) from the fault alarm output.

7.5 Function Contents of Alarm Terminals

Terminal name: Alarm terminal [AL1, AL2-AL0] — **Function No. to be set** C 33

Function content

- When an alarm occurs, the function outputs an alarm signal from the terminals [AL0], [AL1], and [AL2] via the c contact. If this occurs, the operator displays the alarm content.

Terminal setting method

Digital operator

- "N.O. contact" or "N.C. contact" can be selected by C 33.
- The initialization is "N.C. contact".

Precautions

- Holding of an alarm signal
  When an alarm signal is outputted, the alarm content will be stored even if the input power is turned off. Therefore, by turning the power on again, the content can be confirmed. However, when the input power is turned off, the alarm output will be reset (canceled) when the power is turned on again. Therefore, to hold the alarm output, hold the alarm once by the external sequence.
- When the alarm contact output is set to N.C., a time delay occurs until the contact is closed when the power is turned on. Therefore, when the alarm contact output is to be used, set a delay of about 2 seconds when the power is turned on.

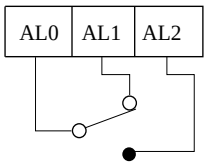
Contact specification

Maximum	Minimum
AC 250V, 2.5A (load R) 0.2A (cosø=0.4)	AC 100 V, 10 mA
DC 30 Vm, 3.0A (load R) 0.7A (cosø=0.4)	DC 5 V, 100 mA

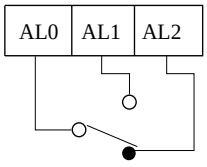
The alarm output terminals are connected as shown in Fig. (a) at the time of initialization. They can be changed as shown in Fig. (b) by setting C 33.

(a)N.C. contact (at the time of initialization)

During normal running



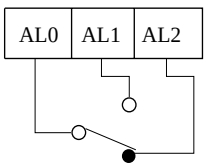
When an alarm occurs or power is turned off



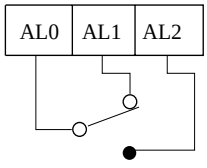
Contact	Power	Running state	AL0-AL1	AL0-AL2
N.C. (Initialized value)	ON	Normal	Closed	Open
	ON	Trip	Open	Closed
	OFF	—	Open	Closed

(b) N.O. contact

During normal running or when power is turned off



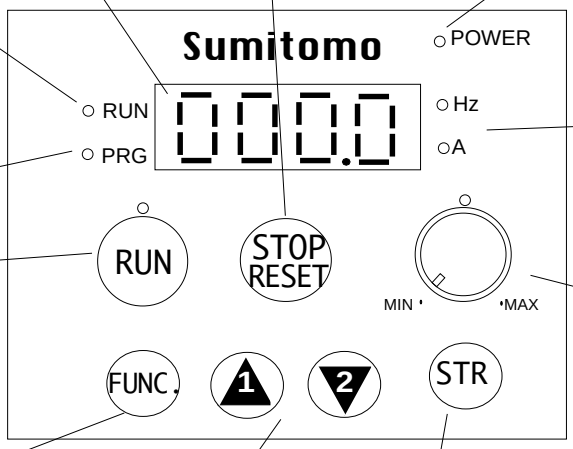
When an alarm occurs



Contact	Power	Running state	AL0-AL1	AL0-AL2
N.O.	ON	Normal	Open	Closed
	ON	Trip	Closed	Open
	OFF	—	Open	Closed

8. OPERATION OF THE DIGITAL OPERATOR

8.1 Name of Keys



Monitor (LED display)
This display shows frequency, motor current, DC voltage, motor direction, and parameters.

STOP/RESET key
This key is used for stopping the motor or resetting errors.
(When either operator or terminal is selected, this key works. If the extension function is used, this function is void.)

POWER Lamp
Power lamp of control circuit

RUN Lamp
This lamp is turnning on while the inverter is running or the run command is active.

PRG Lamp
This lamp is turnning on while the parameter are setting.

Hz or A Lamp
Hz or A lamp is turnning on during displaying frequency or current.

RUN key
This key is used for starting.
(When terminal run is selected, this key does not work and the lamp is turnning off.
The lamp is turning on while the key is avilable.)

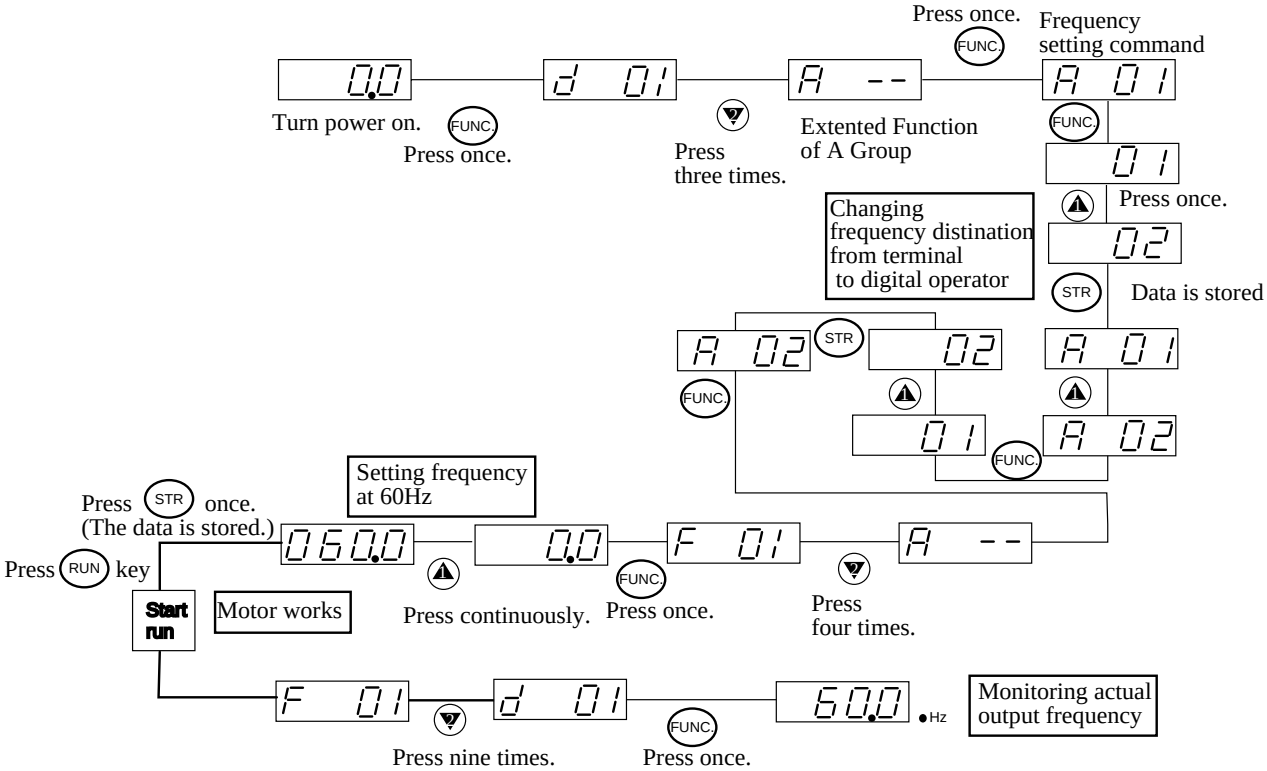
Potentiometer
This potentiometer sets the frequency.
(The lamp is turnning on while the potentiometer is available.)

FUNC (Function) key
This key is used for setting up data and parameters.

Up key, Down key
These keys are used to change data and parameters.

STR key
When pressing this key after setting data and parameter,they are memorized.

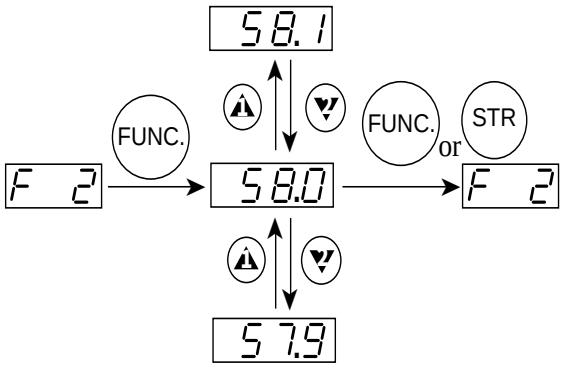
8.2 Operation Procedure (Example for the digital operator.)



8.3 Key Description

FUNC. [Function key] . . . This key allows the change from parameter area to data area and extended function entrance alternately.

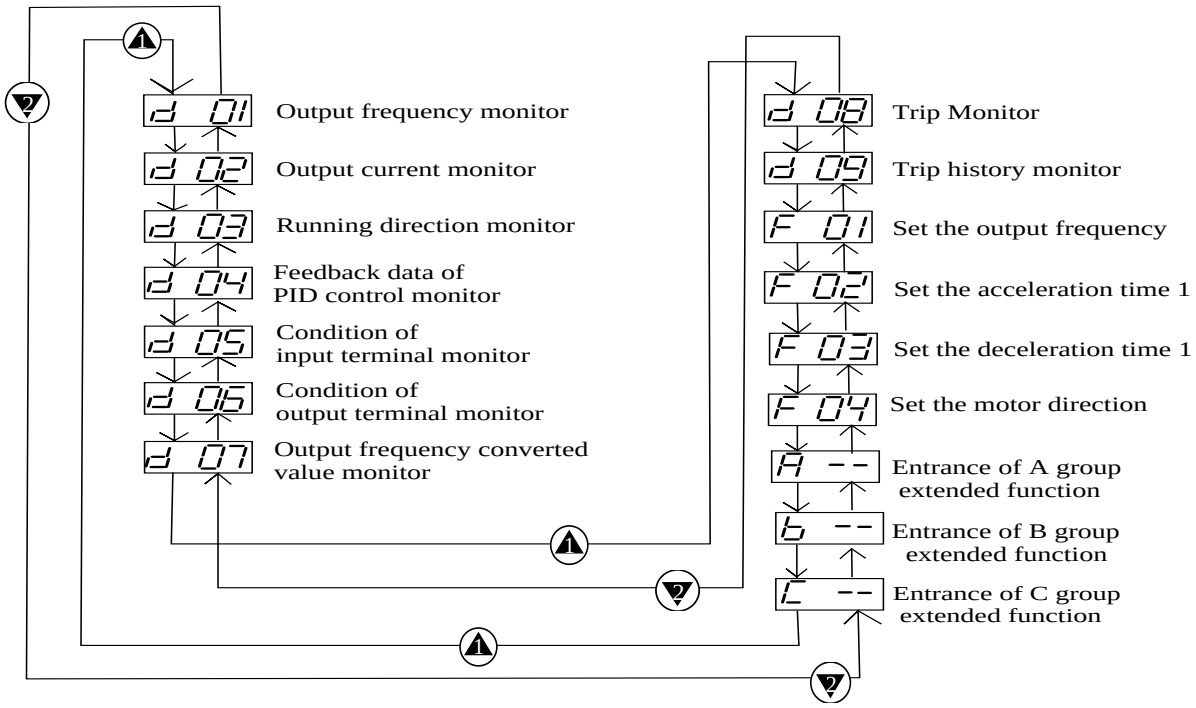
When each time the key is pressed, the display changes as follows.



NOTE: After the data is changed, be sure to press the STR key.

▲ ▼

[Up key, Down key] . . .These keys change the values of data, and parameters.



RUN [RUN key] . . . This key starts the run.

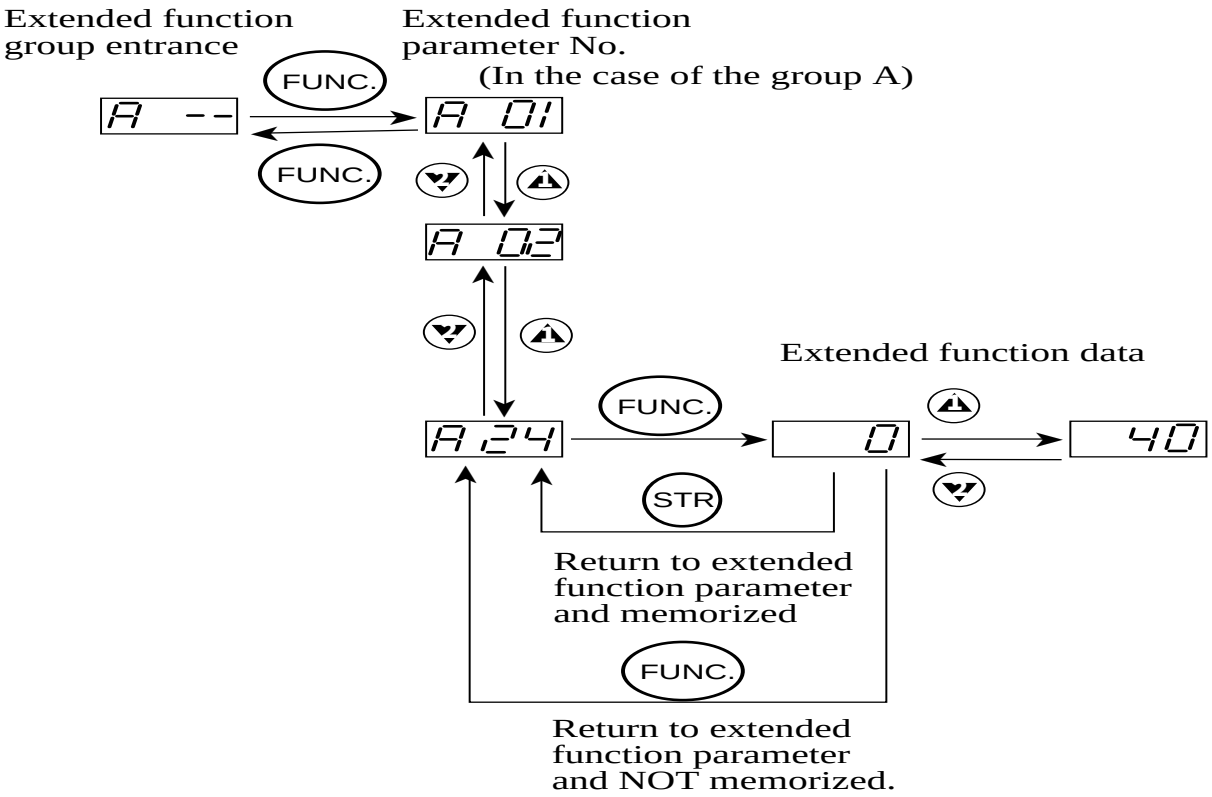
The set value of F 04 determines forward run or reverse run.

STOP RESET [STOP/RESET key] . . . This key stops the run.

When a trip occurs, this key becomes the reset key.

Data setting for extended function

When an extended function is to be used, select the extended function group from A -- b -- C -- by using the keys ▲ and ▼ so as to enter the extended function mode.



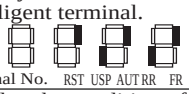
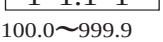
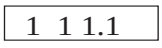
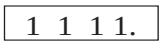
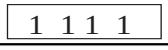
Explanation of display at power on

When the inverter is turned on, the display which is displayed when the power is turned off before it is turned on appears. (Except the extended function mode.)

8.4 Initialization List of Digital Operator

(1)Monitor mode,function mode
The initial value and settable range of each mode are displayed.

(1-1) Monitor mode

Display order	Function name	Type	Parameter display	Settable during running	Range of set value	Initializ-ation
1	Output frequency monitor	Monitor-ing	d01	—	Display from 0.5Hz to 360.0Hz. Light on Hz LED.	—
2	Output current monitor	Monitor-ing	d02	—	Display from 0.01 to 999.9A Light on A LED.	—
3	Running direction monitor	Monitor-ing	d03	—	F ---Forward ▭---Stop r ---Reverse	—
4	Feedback data of PID control monitor	Monitor-ing	d04	—	Display the converted feed back value scaled by A75 .	—
5	Condition of input intelligent terminal monitor	Monitor-ing	d05	—	Display the condition of input intelligent terminal.  ON OFF terminal No. RST USP AUT RR FR	—
6	Condition of output intelligent terminal monitor	Monitor-ing	d06	—	Display the condition of output intelligent terminal and alarm.  ON OFF terminal No. AL DRV UPF	—
7	Output frequency converted value monitor	Monitor-ing	d07	—	Display the output frequency converted value scaled by b86 . Display =(output frequency) ✻(b86 value) (1)0.01〜99.99  (11.11) (2)100.0〜999.9  (111.1) (3)1000〜999.9  (1111) (4)10000〜99990  (11110)	—

Accuracy of output current monitor

Accuracy : ±20%
(A half base frequency or higher)
The indication value may exceed this accuracy by the load current condition.
Use the moving tron type ammeter for the precise current measurement .

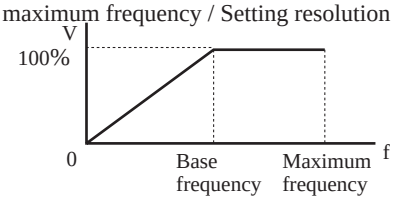
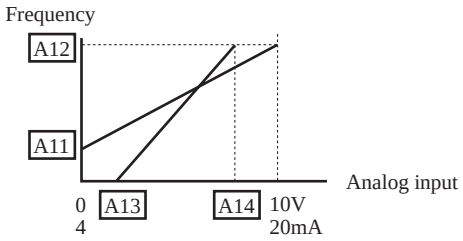
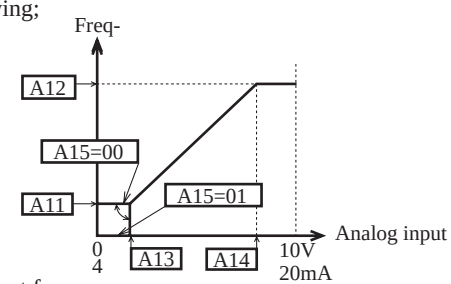
Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
8	Trip monitor	Monitor-ing	d08	—	Display latest trip contents -Display order and operation Alarm cause ↓ press FUNC key Output frequency at trip ↓ press FUNC key Motor current at trip ↓ press FUNC key DC voltage at trip ↓ press FUNC key “d08” display -There is no latest trip — — —	
9	Trip history monitor	Monitor-ing	d09	—	Display last 2times trip except latest trip. Displays only alarm cause “d09” display ↓ press FUNC key Cause of the last trip ↓ press FUNC key Cause of the last trip but one ↓ press FUNC key “d09” display If there is no trip,display — — —	

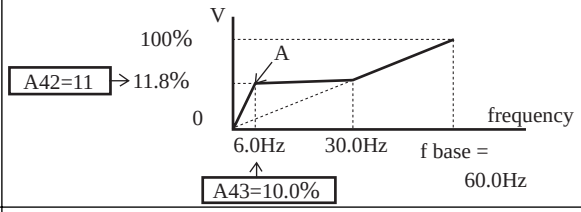
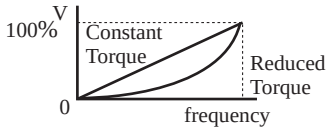
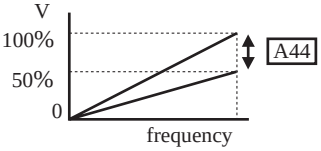
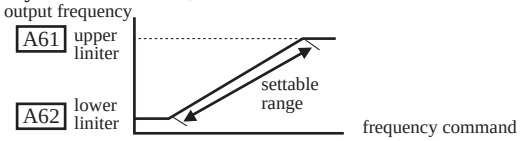
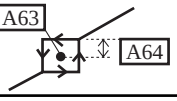
(1-2)Basic function mode

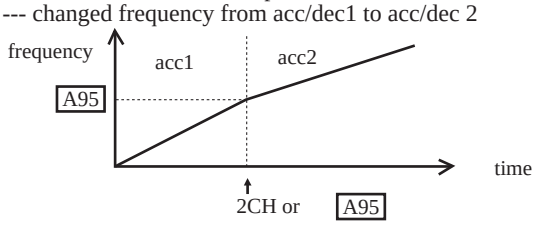
This mode can be set the basic function

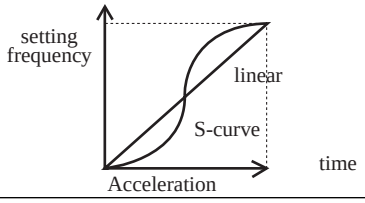
Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
1	Output frequency setting	Set value	F01	possible	0.5-360.0Hz / Resolution ±0.1Hz (1)Digital Operator on the front case In this function,the output frequency can be set in the inverter by using the key pad. But it is necessary to set the frequency distination to the digital operator(“A01”=02). (2)Multispeed The output frequency in the multispeed mode can be set as specified following; Connect the multispeed terminal for setting the frequency,that is to say,to set the frequency of each multispeed must be made the relation between multipeed 1 to 15 on the terminal. (3) Terminal, Potentiometer In setting the frequency from the terminal(VRF-COM, IRF-COM) or the potentiometer on the front case,data of this function is just monitored the frequency from each device.	0.0Hz
2	Acceleration 1	Set value	F02	possible	0.1 second to 3000 seconds [Resolution of setting] 0.1 - 999.9 --------0.1 second 1000 - 3000 -------1 second	10 seconds
3	Deceleration 1	Set value	F03	possible	0.1 second to 3000 seconds [Resolution of setting] 0.1 - 999.9 --------0.1 second 1000 - 3000 -------1 second	10 seconds
4	Running direction setting	Set value	F04	Not possible	Set the motor direction Set the motor direction when running by pressing (RUN) key. 00---forward run 01---reverse run	00
5	Extended function of A group setting	Set value	A－－	possible	Extended function of A group can be entered from “A--” function.A group regards control setting or function setting.	
6	Extended function of b group setting	Set value	b－－	possible	Extended function of B group can be entered from “b--” function. B group regards protection setting or others.	
7	Extended function of C group setting	Set value	C－－	possible	Extended function of C group can be entered from “C--” function.C group regards intelligent terminal setting.	

(2)Extended function mode A group

Display order	Function name	Type	Parameter display	Settable during running	Range of set value	Initializ-ation
Basic parameter setting						
1	Frequency distination setting	Set value	A01	Not possible	Method to command output frequency is selected by this function. 00 ---- Potentiometer on the front case 01 ---- Control terminal on the logic board 02 ---- Digital operator	01
2	Running command distination setting	Set value	A02	Not possible	Method to command running is selected by this function. 01 ---- Control terminal on the logic board 02 ---- Digital operator	01
3	Base frequency setting	Set value	A03	Not possible	50 to maximum frequency / Setting resolution 1Hz 	60Hz
4	Maximum frequency setting	Set value	A04	Not possible	base frequency to 360Hz / Setting resolution 1Hz (NOTE 1)	60Hz
Analogue input setting						
5	External frequency setting start	Set value	A11	Not possible	0 to 360Hz /Setting resolution 0.1Hz This function set the start frequency when the inverter receives 0V or 4mA analog input 	0Hz
6	External frequency setting End	Set value	A12	Not possible	0 to 360Hz /Setting resolution 0.1Hz This function set the end frequency when the inverter receives 10V or 20mA analog input.	0Hz
7	External frequency setting start rate	Set value	A13	Not possible	0 to 100% /Setting resolution 1% This function set the rate of starting point of analog input for full scale(10V or 20mA). In other words,the bias of analog input can be set.	0%
8	External frequency setting end rate	Set value	A14	Not possible	0 to 100% /Setting resolution 1% This function set the rate of endding point of analog input for full scale(10V or 20mA). In other words,the bias of analog input can be set.	100%
9	External frequency start pattern setting	Set value	A15	Not possible	This function should set the starting pattern if the start frequecy and starting rate of analog input are set some value as following;  00 ---- Start frequency 01 ---- 0Hz start	01
10	Time constant of the filter of analog input setting	Set value	A16	Not possible	1 to 8 This value is average time of calculating filter.For example,8 is 8times average for analog input.	8
Multispeed frequency setting						
11	Multispeed frequency setting	Set value	A20-A35	possible	0.5 to 360.0Hz/ setting resolution 0.1Hz These parameter are set frequency of multistage speed. Standard(0th) speed can be set A20 parameter, and they can be set from first multispeed (A21) to fifteenth multispeed(A35).	All parameters are 0Hz

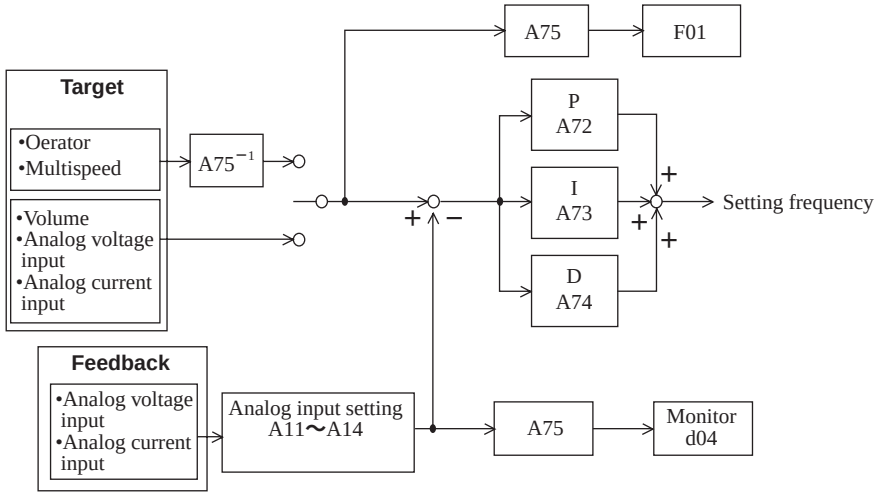
Display order	Function name	Type	Parameter display	Settable during running	Range of set value	Initializ-ation
12	Jogging frequency setting	Set value	A38	possible	0.5 to 9.99Hz / setting resolution 0.01Hz The jogging frequency is inching operation by external signal from terminal.	1.0Hz
13	Stop mode of jogging	Set value	A39	Not possible	00 --- Freerun stop after stop signal 01 --- Deceleration stop after stop signal 02 --- Dc braking after stop signal	00
V/F characteristic						
14	Selection of method of torque boost	Set value	A41	Not possible	Selected which is manual torque boost or automatic torque boost. 00 ----- Manual torque boost 01 ----- Automatic torque boost	00
15	Value of manual torque boost setting	Set value	A42	possible	Set voltage of manual 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. 	11
16	Manual torque boost frequency adjustment	Set value	A43	possible	Set the point A in the above torque boost graph within the range of 0% to 50% of the base frequency.	10.0%
17	V/F characteristic setting	Set value	A44	Not possible	Set V/F characteristic 00 --- Constant torque characteristic 01 --- Reduced torque characteristic 	00
18	V-Gain setting	Set value	A45	possible	Set the voltage gain of V/F characteristic 	100
DC braking setting						
19	Selection of DC braking operation	Set value	A51	Not possible	Selected which DC braking is avilable or not. 00 --- not available 01 --- available	00
20	DC braking frequency setting	Set value	A52	Not possible	0.5 to 10.0 Hz / setting resolution 0.1Hz The frequency at which the DC braking is set.	0.5
21	DC braking waiting time setting	Set value	A53	Not possible	0.1 to 5.0 seconds / setting resolution 0.1 second This time is interval from end of running to start of DC braking.At this interval the motor is free running. 	0.0
22	DC braking force setting	Set value	A54	Not possible	0 to 100% / setting resolution 1% Set the force of DC braking	0
23	DC braking time setting	Set value	A55	Not possible	0.1 to 60 seconds / setting revolution 0.1 second Set time during DC braking operates.	0.0
Function in relation to frequency						
24	Frequency upper limiter setting	Set value	A61	Not possible	0.5 to 360.0 Hz / setting resolution 0.1Hz Set the limits of frequency setting within the maximum frequency. If 0.0Hz is set, lower limiter is not available. 	0.0Hz
25	Frequency lower limiter setting	Set value	A62	Not possible	0.5 to 360.0 Hz / setting resolution 0.1Hz Set the limits of frequency setting within upper limiter frequency. If 0.0Hz is set, lower limiter is not available.	0.0Hz
26	Jump frequency setting	Set value	A63,A65, A67	Not possible	0.0 to 360.0 Hz /setting resolution 0.1Hz.0.0 Hz is not available To avoid a resonance with load,the frequencies at up to 3 points can be jumped.The frequency equivalent to the jump frequeny setting cannot be set.	0.0Hz
27	Jump frequency width setting	Set value	A64,A66, A68	Not possible	0.0 to 10.0 Hz /setting resolution 0.1Hz The frequency width where frequencies are jumped is set. 	0.5Hz

Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
PID control						
28	Selection of PID control	Set value	A71	Not possible	This parameter selects which PID control operates or not. 00 --- PID control is not available 01 --- PID control is available	00
29	P(proportion) gain setting	Set value	A72	possible	0.2 to 5.0 times /setting resolution 0.1 time This function is used to set proportional gain of PID control operation.	1.0
30	I(Integral) gain setting	Set value	A73	possible	0.0 to 150.0 seconds /setting resolution 0.1 second This function is used to set integral gain of PID control operation	1.0
31	D(Differential) gain setting	Set value	A74	possible	0.0 to 100.0 seconds /setting resolution 0.1 second This function is used to set differential gain of PID control operation.	0.0
32	Scale conversion of PID control setting	Set value	A75	Not possible	0.01 to 99.99 / setting resolution 0.01 This function is used to convert target value which feedback is fit.	1.0
33	feedback destination setting	Set value	A76	Not possible	Set the destination which feedback come from. 00 --- IRF terminal(current input) 01 --- VRF terminal(voltage input) (NOTE 2 : PID feedback diagram)	00
AVR function						
34	Selection of AVR function	Set value	A81	Not possible	Select the operation of AVR function 00 --- AVR function is available at all range of operation 01 --- AVR function is not available at all range of operation 02 --- AVR function is not available at deceleration AVR function is that the output voltage from the inverter keeps constant even if input power varies.	02
35	Selection of voltage of AVR function for the motor	Set value	A82	Not possible	200/220/230/240/ for 200V class inverter 380/400/415/440/460 for 400V class inverter This function is used to select the output voltage which is given the motor.However the inverter cannot output the voltage over input power source.	230/ 460
Second acceleration(acc) and deceleration(dec) function						
36	Second acceleration time setting	Set value	A92	possible	0.1 to 999.9seconds / setting resolution 0.1 second 1000 to 3000 seconds /setting resolution 1 second Acceleration 2 is worked by 2CH terminal input or setting changed frequency.	15.0
37	Second deceleration time setting	Set value	A83	possible	0.1 to 999.9seconds / setting resolution 0.1 second 1000 to 3000 seconds /setting resolution 1 second Deceleration 2 is worked by 2CH terminal input or setting changed frequency.	15.0
38	Selection of method to use second acceleration / deceleration (acc2/dec2)	Set value	A84	Not possible	00 --- Acc2/Dec2 command input from terminal 01 --- changed frequency from acc/dec1 to acc/dec 2 	00
39	Changed frequency from acc1 to acc2 setting	Set value	A95	Not possible	0.0 to 360.0Hz / setting frequency 0.1Hz When output frequency reaches this frequency ,acceleration time changes from acc1 to acc2. (NOTE 3)	0.0
40	Changed frequency from dec1 to dec2 setting	Set value	A96	Not possible	0.0 to 360.0Hz / setting frequency 0.1Hz When output frequency reaches this frequency ,acceleration time changes from dec2 to dec1. (NOTE 3)	0.0

Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
41	Pattern of acceleration setting	Set value	A97	Not possible	Set the pattern of acceleration 1 and accelration2 00 --- linear 01 --- S-curve 	00
42	Pattern of deceleration setting	Set value	A98	Not possible	Set the pattern of acceleration 1 and decelration2 00 --- linear 01 --- S-curve	00

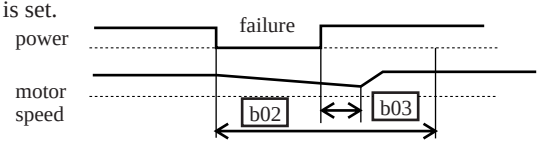
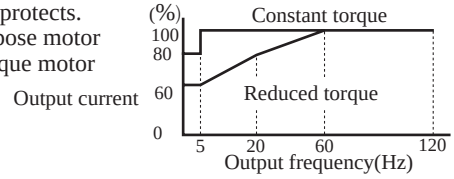
NOTE 1 : To keep the motor stability,the output frequency exceeds the maximum frequency set by [A 04].(Max.1.5Hz)
Adjust the output frequency setting.

NOTE 2 : PID feedback diagram



NOTE 3 : When the acceleration or the deceleration time is set small value (less than 1.0 s),the actual changed frequency delays to the set value.

(3) Extended function mode of B group

Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
Restart mode						
1	Selection of restart mode (NOTE 1)	Set value	b01	Not possible	Select the inverter retry method. 00 --- Alarm output after tripped 01 --- 0Hz start at the time of restart 02 --- Frequency matching start at the time of restart 03 --- Frequency matching at the time of restart and then deceleration stop and display Trip information. Trips of restart are overcurrent trip,overvoltage trip and undervoltage trip.The number of restart is 3 times at overcurrent trip and overvoltage trip, and 16 times at undervoltage trip.	00
2	Allowable undervoltage power failure time setting	Set value	b02	Not possible	0.3 to 25 seconds / setting resolution 0.1 second When an undervoltage power failure occurs,the allowable time until the power failure is recover is set. If the time of the undervoltage power failure is over this parameter, the inverter trips even if the restart mode is selected.	1.0
3	Retry waiting time setting	Set value	b03	Not possible	0.3 to 100 seconds /setting resolution 0.1 second The restart waiting time after an undervoltage power failure is recovered is set. 	1.0
Electronic thermal						
5	Level of electronic thermal setting	Set value	b12	Not possible	Set a level of electronic thermal which is range between 50% to 120% for the rated current of the inverter. It can be set by ampere. Range of setting ----- 0.5✻(Rated current of the inverter) to 1.2✻(Rated current of the inverter) setting resolution ------- 0.01A	Rated current for each inverter
6	Selection of electronic thermal characteristic	Set value	b13	Not possible	Select the characteristic of electronic thermal whether CRT(constant torque characteristic) or SUB(reduced torque characteristic) The thermal characteristic accords with the load to be used because the motor protects. 00 — General purpose motor 01 — Constant torque motor 	00
Overload restriction						
7	Selection of overload restriction operation mode	Set value	b21	Not possible	This function is used to select the mode to operate overload restriction. 00 --- Not available 01 --- Available at acceleration and constant speed 02 --- Available at constant speed At deceleration,overload restriction function is not available always.	01
8	Level of overload restriction setting	Set value	b22	Not possible	Set a level of overload restriction which is range between 50% to 150% for the rated current of the inverter. It can be set by ampere. Range of setting ----- 0.5✻(Rated current of the inverter) to 1.5✻(Rated current of the inverter) setting value -------Current (A) setting resolution ------- 1% of the rated current	Rated current✻ 1.25 for each inverter
9	Rate of deceleration at overload restriction	Set value	b23	Not possible	Set the deceleration rate at operation of overload restriction function 0.1 to 30.0 / setting resolution 0.1. 	1.0

NOTE 1 : In case the restart mode [b 01] is set [00] , if inverter is reset by long power failure with the run command setting,inverter restarts immediately after power coming. See the other warning at p.1- 3.

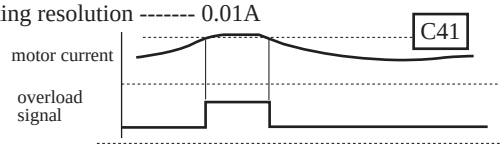
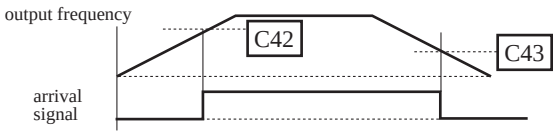
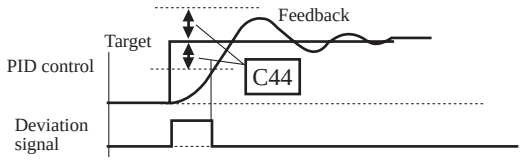
Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
Other protection						
10	Selection of software lock mode	Set value	b31	Not possible	Software lock is the function that cannot be changed any parameter except this function. This function is set by the set-maker in order to avoid that end-user change the parameter and missoperation of the system. 00 --- It is impossible to change all parameter except this function when SFT from terminal is on. 01 --- It is impossible to change all parameter except this function and frequency setting function when Software lock assigned terminal is on. 02 --- It is impossible to change all parameter except this function as soon as 02 is set. 03 --- It is impossible to change all parameter except this function and frequency setting function as soon as 03 is set.	01
11	Reactive Current setting (NOTE 3)	Set value	b32	Not possible	Setting resolution : 1% Amps of inverter rated current. Set the no load current of motor at the down sized motor, multiple motor or 230V / 460V motor driving.	Rated Current *0.58 for each inverter
Others						
13	Analog meter adjustment	Set value	b81	possible	This function is used to adjust the analog meter connected to the frequency monitor(FRQ). 0 to 255 / setting resolution 1	80
14	Start frequency adjustment	Set value	b82	Not possible	0.5 to 9.9 Hz / setting resolution 0.1Hz Set the frequency for starting output of the inverter.	0.5
15	Carrier frequency setting (NOTE 1)	Set value	b83	Not possible	0.5 to 16.0 kHz / setting resolution 0.1kHz Set the carrier frequency for PWM waveform output of the inverter. When the carrier frequency over 12kHz is set,the rated current of the inverter has to be reduced.	5
16	Selection data initialization or clear of trip history (NOTE 2)	Set value	b84	Not possible	Select whether it is data initialization or trip history clear. 00 -- Trip history clear 01 -- Data initialization The method of this function is that ; 1)set the this function 00 or 01, 2) FUNC , ▲ ▼ on the operator are pressed at same time, 3)and then continue this condition and press STOP RESET key. 4)Wait 2 seconds holding the key FUNC , ▲ ▼ , the display will blink d 00 . Then release the all keys. 5) Then the initialize operation starts.	00
17	Selection of initialized data	Set value	b85	Not possible	Select the initialized data 02 00 --- Japan version 01 --- Europe version 02 --- US version 03 --- Exclusive version (Do not set)	02
18	Frequency converted value setting	Set value	b86	possible	Set the frequency converted value which is related d07 monitor 0.1 to 99.9 / setting resolution 0.1	1.0
19	Selection of STOP key meaning	Set value	b87	Not possible	Decide the STOP key meaning when running destination is terminal 00 -- STOP key is available at terminal condition 01 -- STOP key is not available at terminal condition	00
20	Selection of operation at FRS signal canceled	Set value	b88	Not possible	Select the operation after freerun function is canceled. 00 --- Restart from 0Hz 01 ---Restart from the frequency which is picked up at the real speed of the motor.	00
21	Selection of the contents for digital operator	Set value	b89	possible	Select the monitoring data for using the digital operator. 01 --- Output frequency monitoring (d 01) 02 --- Output current monitoring (d 02) 03 --- Running direction monitoring (d 03) 04 --- Feedback data of PID control monitoring (d 04) 05 --- Condition of input intelligent terminal monitoring (d 05) 06 --- Condition of output intelligent terminal monitoring (d 06) 07 --- Scale conversion data of output frequency monitoring (d 07)	01

NOTE 1 : While the DC braking is performed,the carrier frequency is held to 1kHz automaticaly.
NOTE 2 : This function is not performed when the remote operator is connected.
Take off the remote operator and operate from the key pad on the inverter.
NOTE 3 : The set value links with the detection current of output current monitor, electric thermal protection and overload limit.

(4)Extended function of C group

These function have relation with terminal.

Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
Input terminal(function)						
1	Function of terminal FR setting	Set value	C01	Not possible	Set the function of input terminal FR (codes) 00 -- Forward command 01 -- Reverse command 02 -- Multispeed1 03 -- Multispeed2 04 -- Multispeed3 05 -- Multispeed4 06 --Jogging command 09 -- 2-stage acceleration and deceleration 11 -- Free run command 12 -- External trip 13 -- USP function 15 -- Software lock 16 -- Analog input voltage/current switching 18 -- Reset	00
2	Function of terminal RR setting	Set value	C02	Not possible	Set the function of input terminal RR (codes)-- same C01	01
3	Function of terminal AUT setting	Set value	C03	Not possible	Set the function of input terminal AUT (codes)-- same C01	16
4	Function of terminal USP setting	Set value	C04	Not possible	Set the function of input terminal USP (codes)-- same C01	13
5	Function of terminal RST setting	Set value	C05	Not possible	Set the function of input terminal RST (codes)-- same C01 and there is additional code. 19 -- PTC(motor thermistor input)	18
Input terminal(condition)						
6	Condition of terminal FR setting	Set value	C11	Not possible	Set the condition of input terminal FR which is normally open or normally close. 00 -- normally open [NO] 01 -- normally close [NC]	00
7	Condition of terminal RR setting	Set value	C12	Not possible	Set the condition of input terminal RR which is normally open or normally close.	00
8	Condition of terminal AUT setting	Set value	C13	Not possible	Set the condition of input terminal AUT which is normally open or normally close.	00
9	Condition of terminal USP setting	Set value	C14	Not possible	Set the condition of input terminal USP which is normally open or normally close.	01
10	Condition of terminal RST setting	Set value	C15	Not possible	Set the condition of input terminal RST which is normally open or normally close. When assigned RESET , normally open only. See page 7-1,7-12.	00
Output terminal(function)						
11	Function of terminal UPF setting	Set value	C21	Not possible	Set the function of output terminal UPF (code) 00 --- RUN(signal during running) 01 --- FA1(frequency arrival signal:at the time of constant speed arrival) 02 ---FA2(frequency arrival signal:at the time of set frequency or more) 03 --- OL(overload signal) 04 --- OD(deviation signal at PID control) 05 --- AL(alarm signal)	01
12	Function of terminal DRV setting	Set value	C22	Not possible	Set the function of output terminal DRV (code) ----- same C21	00
13	Function of FRQ terminal setting	Set value	C23	Not possible	Set the function of frequency monitor FRQ (code) 00 --- Monitor of analog output frequency 01 --- Monitor of analog output current 02 --- Monitor of digital output frequency	00

Display order	Function name	Type	Parameter display	Settable during running	Range of set value and contents	Initializ-ation
Output terminal(condition)						
14	Condition of terminal UPF setting	Set value	C31	Not possible	Set the condition of intelligent output terminal UPF which is normally open or normally close. 00 -- normally open 01 -- normally close	00
15	Condition of terminal DRV setting	Set value	C32	Not possible	Set the condition of intelligent output terminal DRV which is normally open or normally close. 00 -- normally open 01 -- normally close	00
16	Condition of terminal AL setting	Set value	C33	Not possible	Set the condition of alarm relay which is normally open or normally close. (See 7-21) 00 -- normally open 01 -- normally close	01
Function relation with output terminal						
17	Level of overload signal setting	Set value	C41	Not possible	Set the level of overload signal which is range between 0% and 200% for rated current of the inverter. Range of setting ----- 0.0∗(Rated current of the inverter) to 2.0∗(Rated current of the inverter) setting resolution ------- 0.01A 	Rated current of each inverter
18	Arrival frequency setting for acceleration	Set value	C42	Not possible	Set the frequency that the arrival signal should be outputted at acceleration. 0.0 to 360Hz 	0.0
19	Arrival frequency setting for deceleration	Set value	C43	Not possible	Set the frequency that the arrival signal should be outputted at acceleration. 0.0 to 360Hz	0.0
20	Level of deviation signal setting	Set value	C44	Not possible	This function sets deviation level between target and feedback at PID control. 0.0 to 100.0% / setting resolution 0.1% 100% means fullscale 	3.0

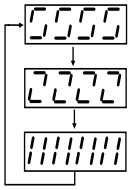
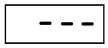
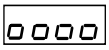
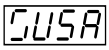
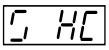
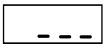
9. PROTECTIVE FUNCTIONS

The SF-320 series inverters trip by protective functions against overcurrent, overvoltage, and undervoltage which protect the inverter. If the protective functions are engaged, the output is shut down, motor runs free and holds that condition until it is reset.

Trip	Contents	Display
Over current protection	When output of an inverter is short circuited, the motor is locked or drives sudden heavy load,the inverter output current exceeds a certain level,and the inverter output is cut off.	-Constant speed E 0 1 -at Deceleration E 0 2 -at Acceleration E 0 3 -at the others E 0 4
Overload protection	When a motor overload is detected by the electronic thermal function, the output of the inverter is cut off.	E 0 5
Overvoltage protection	When the inverter DC bus voltage exceeds a certain level due to regenerative energy from the motor,this protection engages and the output of the inverter is cut off.	E 0 7
EEPROM error (NOTE1)	When the memory built in has problems due to noise or excessive temperature rise,this protection engages and the output of the inverter is cut off.	E 0 8
Undervoltage protection	A decrease of DC bus voltage of an inverter results in improper function of the control circuit. It also generates the motor heat and causes low torque. Output is cut off when the DC bus voltage goes down to less than a certain level.	E 0 9
CPU error1	Malfunction or abnormality on built-in CPU and the output of the inverter is cut off.	E 1 1 E 2 2
External trip	An abnormality signal from external equipment cuts off the output of the inverter. It is necessary to assign the external trip on the intelligent terminal.	E 1 2
USP error	It indicates an error when power is turned on while the inverter is being run. (When USP function is selected)	E 1 3
Ground fault protection	The inverter is protected by detection of ground faults between the inverter output and the motor upon power on before the inverter works. This protection is provided for the inverter,not for humans.	E 1 4
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.	E 1 5
Thermal protection	When the temperature of the inverter module is higher,the thermal sensor in the inverter module detects the higher temperature of power chip and the inverter is cut off.	E 2 1

NOTE 1: If an EEPROM error occurs, be sure to confirm the setting value again.
If the power is turned off while the RST terminal is held [ON],the EEPROM error occurs at the power is turned on in the next time. (In case, RST terminal is assigned to Reset function.)

Other

Contents	Display
Under stand-by condition at power on. At reset signal coming.	
It is displayed when the under voltage or the power is shut off.	
It displays the rest time of retry waiting time after the power recovery of undervoltage when selecting the retry mode.	
During the initialization of the parameters	
During the initialization of the trip history data	
During the copy operation by the copy unit.	
No data(Trip history, PID feedback data).	

10. TROUBLESHOOTING

Symptom		Probable cause	Countermeasure
The motor will not run.	The inverter outputs U, V and W are not supplying voltage.	• Is the parameter setting of the frequency command destination [A01] correct? • Is the parameter setting of the running command destination [A02] correct ?	• Make sure of the parameter setting [A01]. • Make sure of the parameter setting [A02].
		• Is power being supplied to terminals R, S, and T? If it is, the POWER lamp should be on.	• Check terminals L1, L2 and L3(N), U, V, and W. • Turn on the power supply.
		• Is the display E □□?	• Press (FUNC) and check the content. Then press the reset key.
		• Is the allocation of intelligent input terminal correct ? • Is the operation instruction RUN ON? • Is terminal FR (or RR) connected to terminal P24? .	• Make sure of the allocation of the terminal [C 01] ~ [C 05]. • Set to ON. • Connect terminal P24 to terminal FR (or RR) . (When the terminal mode is selected.)
		• Has the frequency setter been turned on by pushing (▲)(▼) key to select [F 01] and then (▲)(▼) key. • Are the control circuit terminals +V, VRF and COM connected to the potentiometer? .	• Push down keys and set. • When terminal mode is selected, connect the potentiometer to +V, VRF, and COM, and then set.
		• Has reset / free run stop terminals been left ON?	• Release reset.
	Inverter outputs U, V, and W are supplying voltage.	• Has the motor the load too heavy?	• Reduce the load. • Test the motor independently.
The direction of the motor is reversed.		• Are the connections of output terminals U, V, and W correct? • Is the phase sequence of the motor forward or reverse in respect to U, V, and W?	• Make the connections according to the phase sequence of the motor. (In general, forward should be in the sequence: U, V, and W.)
		• Are the control terminal connection correct? . • Is the parameter [F 04] set correctly ?	• Terminal FR for forward, and RR for reverse. (When the terminal mode is selected.)

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.
		• Is the load too heavy?	• Reduce the load. • When the load is too heavy, the overload restriction will be activated, so that the rotational speed will be lower than the setting.
Rotation is unstable.		• Is the fluctuation in load too great? • Is the power supply voltage fluctuating? • Is some peculiar frequency causing the problem?	• Increase the capacity. (Both of the motor and inverter.) • Decrease the fluctuation. • Change the output frequency slightly. • Change the carrier frequency(b83 p.8-12)
The rpm of the motor does not match the inverter.		• Is the maximum frequency setting correct ?	• Check the V/F pattern against the motor specifications.
The data is incorrect.	The data has not changed.	• Was the power turned off without pushing the STR key after the data was changed with ▲ ▼ keys.	• Input the data and push the STR key once.
		• The data is memorized upon power off. Is the time from power OFF to ON less than six seconds?	• Take six seconds or more when turning power OFF and ON after changing the data.

Symptom		Probable cause	Countermeasure
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[A 01] , [A 02] setting mode. (See page 8-7.)
	The data can not be changed.	• Is software lock ON? • Is software lock ON with software lock selection [b 31]	• Open software lock terminal and P24. • Change the data of [b 31]. • Turn the switch OFF.

Precautions for data setting

When changing any set data by one of the following methods , keep the equipment unoperated for 6 seconds or more after the selected method is executed. When any key is pressed, or the reset operation is performed, or the power is turned off within 6 seconds, correct data may not be set.

1) Changing the data and pressing the (STR) key to store the data

11. MAINTENANCE AND INSPECTION

11.1 Maintenance and Inspection Precautions

⚠ WARNING

⚠ After a lapse of more than 5 minutes after turning off the input power supply, perform the maintenance and inspection.
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.)
(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 logic P.C. board)
Otherwise, there is a danger of fire due to wire breakage and/or injury.

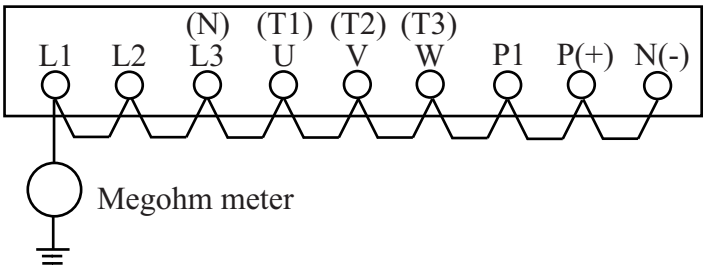
- General precautions

  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 filings and other foreign matter can damage insulation, causing unexpected accidents, so take special care.

11.2 Inspection Items

(1) Daily inspection
(2) Periodic inspection (Approximately once a year)
(3) Insulation resistance test

Conduct the insulation resistance test by short circuiting the terminals as shown below.



Use 500V DC megohm meter, and make sure that 5M ohm or greater is indicated.

> Never test withstand voltage test. Because this inverter has the surge absorber between the main circuit terminal and the ground.

We recommend that the following parts be stocked to reduce down time.

Recommended Spare Parts

Part description	Symbol	Quantity		Remarks
		Used	Spare	
Cooling fan	FAN	1	1	SF3202-2A2-W -3A7-W SF3204-1A5-W to -4Ao-W
Case		1	1	Front case Key cover Case Rear cover

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.	✓			Ambient temperature between -10 to +40¡C; no icing. Ambient humidity 20 to 90%; no dew condensation.		Thermometer
	Devices overall	Check for abnormal vibrations and noise.	✓		Visual and aural inspection.			Hygrometer
	Power supply voltage	Check the input line voltage.	✓		Measure the voltage between inverter terminals L1, L2 and L3(N).	No abnormalities. (200V class) 200 to 240V 50/60Hz (400V class) 380 to 460V 50/60Hz		Tester
Main circuit	Overall	(1) Check installation for looseness.		✓		Tightening torque (except for terminal block) • M3: 0.5 - 0.6 N•m • M4: 0.98 - 1.3 N•m .		
		(2) Check for evidence of overheating in the various components.		✓	(1) Tighten.			
		(3) Clean.		✓	(2) Visual inspection.			

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 block	No damage.		✓	Visual inspection	No abnormalities.		
	Smoothing capacitor	(1) Check for leaking (2) Check for swelling	✓ ✓		Visual inspection of (1) and (2).	No abnormalities in (1) and (2).		
	Relays	(1) Check for stuttering noise when operating		✓	(1) Aural inspection.	(1) No abnormalities.		
	Resistors	(1) Check for large cracks or changes in color		✓	(1) Visual inspection\	(1) No abnormalities.		Tester
	Cooling fan	(1) Check for abnormal vibrations and noise (2) Check for dust	✓ ✓		(1) Rotate manually with power off. (2) Increase tightening	(1) Smooth rotation (2) No abnormality	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.		✓	(1) Measure the voltage between the phases of inverter output terminals U, V, and W.	(1) Within 2% voltage difference between phases.	—	—
			(2) Conduct a sequence protection operation test, and make sure that there are no errors in the protection and display circuits.		✓	(2) Simulate operation of the inverter protection circuit.	(2) Operate without any abnormalities.		
	Component check, including printed-circuit boards	Overall	(1) No abnormal odor or changes in color.		✓	Visual inspection	No abnormalities		—
			(2) No significant corrosion.		✓				
		Capacitor	No fluid leakage or deformation.	✓		Visual inspection			—
Display	Digital operation panel		(1) No illegible display	✓		Visual inspection	Normal operation		—
			(2) No lack of character	✓			Display can be read out.		
			(3) No blown out LEDs	✓					

NOTE: 1. The life of capacitor will be affected by the amibient temperature. See Appendix 4 Capacitor Life Curve.

2. The inverter must be cleaned periodically. If dust accumulates on the fan and heat sink, it can cause overheating of the inverter.

11.3 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.

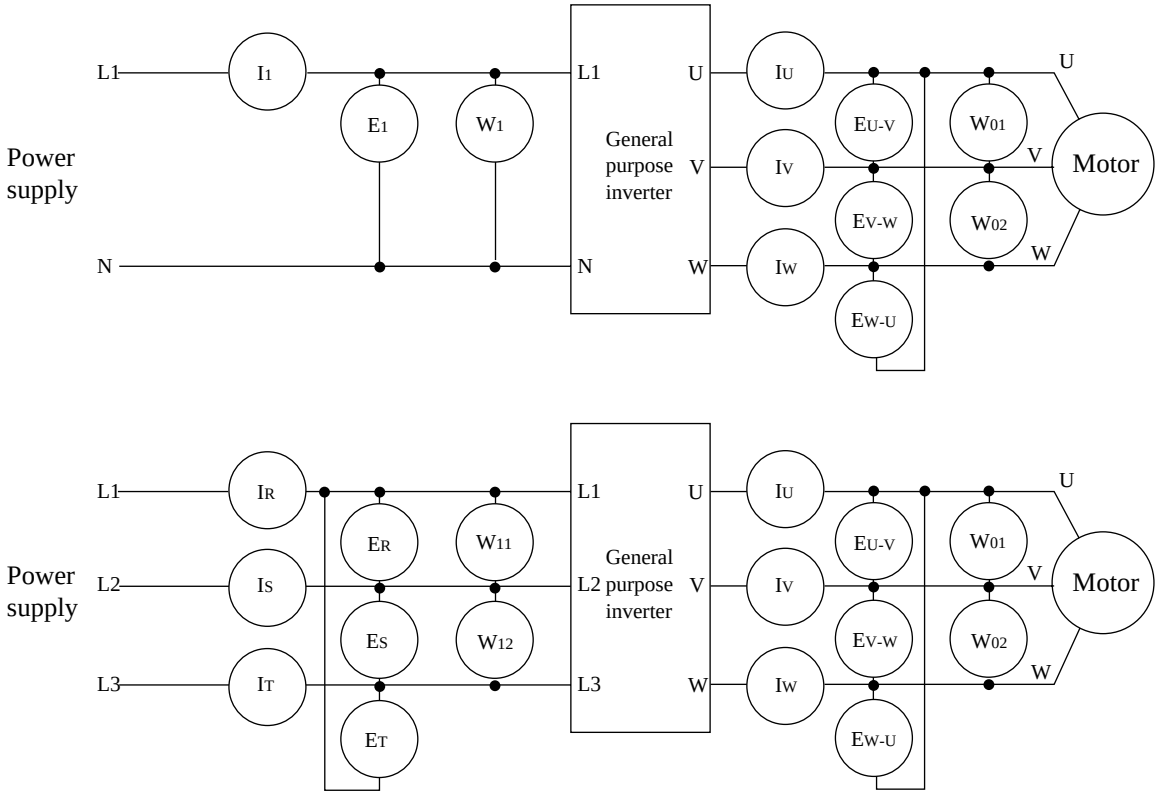


Table 3 Parts to be measured

Measurement item	Parts to be measured	Measuring instrument	Remarks	Reference value
Supply voltage E_1	Between L1 and L2, L2 and L3, L3 and L1 (E_R) (E_S) (E_T)	Moving-iron type voltmeter or rectifier type voltmeter	Fundamental wave effective value	Commercial supply voltage (200 V class) 200-240 V, 50/60 Hz (400 V class) 380-460 V 50/60 Hz
Supply current I_1	L1, L2, L3 (I_R)(I_S)(I_T)	Moving-iron type ammeter	Total effective value	
Supply power W_1	Between L1 and L2, L2 and L3 (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. $Pf_1=\frac{W_1}{\sqrt{3}\bullet E_1\bullet I_1}\times 100(\%)$			
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. $Pf_0=\frac{W_0}{\sqrt{3}\bullet E_0\bullet I_0}\times 100(\%)$			

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.

12. STANDARD SPECIFICATIONS

Model name [200V Class]		SF3202 -A20-W	SF3202 -A40-W	SF3202 -A75-W	SF3202 -1A5-W	SF3202 -2A2-W	SF3202 -3A7-W
Protective structure (NOTE 1)		IP20					
Maximum motor size (4P, kW)(NOTE 2)		0.2	0.4	0.75	1.5	2.2	3.7
Maximum capacity (kVA)	230 V	0.5	1.0	1.5	2.8	3.9	6.3
	240 V	0.5	1.0	1.6	2.9	4.1	6.6
Input supply phase		A20~2A2-W ; Single-phase / Three-phase 3A7-W ; Three-phase					
Rated input AC voltage (V)		200V -10%~240V +5% , 50/60 Hz ±5%					
Rated output voltage (V) (NOTE 3)		Three-phase 200 to 240V (Corresponds to input voltage.)					
Rated input current (A) (Single-phase / Three phase)		3.1 / 1.8	5.8 / 3.4	9.0 / 5.2	16.0 / 9.3	22.5 / 13.0	- / 20.0
Rated output current (A) (NOTE 4)		1.4	2.6	4.0	7.1	10.0	15.9
Output frequency range (NOTE 5)		0.5 to 360 Hz					
Frequency accuracy(at 25 ±10°C)		Digital command:±0.01% of Max. frequency Analog command:±0.2 % of Max. frequency					
Frequency setting resolution		Digital setting : 0.1 Hz , Analog setting : Max. frequency devided by 1000					
Voltage/frequency characteristics		Constant or Reduced torque with any variable voltage/frequency.					
Overload current capacity		150%, 60 seconds					
Acceleration/deceleration time		0.1 to 3000 seconds, in selectable linear or non-linear mode, second acceleration/deceleration usable.					
Starting torque		100% or more (When torque boost has been set)					
Braking torque	Dynamic braking (NOTE 6) Feedback to capacitor	Approx. 100%			Approx. 70%	Approx. 20%	
	DC injection braking	Braking is ON at the min. frequency or less. Braking can be selected by the operator. (Min. frequency, braking time and braking force can be set.)					

Model designation [200V Class]			SF3202 -A20-W	SF3202 -A40-W	SF3202 -A75-W	SF3202 -1A5-W	SF3202 -2A2-W	SF3202 -3A7-W
Input signals	Frequency setting	Digital operator	Settings with the potentiometer or ▲ ▼ in the key pad.					
		External signals	0 - 10 VDC (Input impedance 10 kΩ) 4 - 20 mA(Input impedance 250Ω) 1kΩ to 2 kΩ (1 W) Variable resistor					
	Forward/ reverse run, stop	Digital operator	RUN/STOP switch (The forward run when shipped from the factory)					
		External signals	Intelligent input terminal (FR / RR)					
	Intelligent input terminal		Forward run/stop, Reverse run / stop Multi-stage speed, Jogging command Analog current input selection, Change of 2nd accel/decel time Free run, External trip, USP function Reset, Software lock, Thermal protection					
Output signals	Intelligent output terminal		FA1/FA2 : Frequency arrival signal RUN: RUN signal OL: Overload previous notice siganl OD : Deviation signal at PID control AL : Alarm signal					
	Frequency monitoring		Analog meter (0 - 10 VDC 1 mA full-scale) Selection of the digital frequency signal ,analog frequency signal or analog output current monitor.					
Fault alarm contact			ON when the inverter trips.(1c contact)					
Other functions			automatic voltage regulation,retry,analog gain/vias adjustment, frequency jump,upper/lower limiter, output frequency display, trip history monitoring, carrier frequency setting(0.5~16kHz) , PID control, automatioc torque boost , etc.					
Protection functions			overcurrent, overvoltage, undervoltage, electronic thermal, temperature abnormality, ground fault upon starting, overload limit					

Model name [200V Class]		SF3202 -A20-W	SF3202 -A40-W	SF3202 -A75-W	SF3202 -1A5-W	SF3202 -2A2-W	SF3202 -3A7-W
General specifi-cations	Ambient temperature (NOTE 7)	-10 to 50°C					
	Storage temperature/ Humidity	-25 to 70°C (during short-term transportation period) / 20 to 90% RH (no dew condensation)					
	Vibration	5.9 m/S^2 (0.6G) 10 - 55 Hz					
	Installation location	1,000 meter or less altitude, indoors					
Options		reactor for improving power factor, noise filter for inverters					
Estimated mass (kg)		0.85		1.3	2.2	2.8	

NOTE 1: Protective structure is based upon EN60529.

NOTE 2: The applicable motor is a Sumitomo standard four-pole motor and a AF motor. When using another motor, make sure that the rated motor current does not exceed the rated inverter current.

NOTE 3: The output voltage will decrease if input voltage decreases.

NOTE 4: So be sure to set the value [b 12] (Level of the electric thermal) and [b 22] (Level of overload restriction setting) for each motors.

NOTE 5: Confirm with the motor manufacturer the motors maximum rpm when using a motor running at frequency higher than 50/60 Hz.

NOTE 6: Torque will be reduced when the base frequency exceeds 50 Hz.

NOTE 7: In range of 40 to 50℃, reduce carrier frequency 2kHz and derate output current 80% , and remove the top cover.

Model name [400V Class]		SF3204 -A40-W	SF3204 -A75-W	SF3204 -1A5-W	SF3204 -2A2-WA	SF3204 -4A0-W
Protective structure (NOTE 1)		IP20				
Maximum motor size (4P, kW)(NOTE 2)		0.4	0.75	1.5	2.2	4.0
Maximum capacity (kVA)	460 V	1.1	1.9	3.0	4.3	6.8
Input supply phase		Three-phase (For Low Voltage directive, supply 4 wire earthed neutral)				
Rated input AC voltage (V)		380V -10%~460V +10% , 50/60 Hz ±5%				
Rated output voltage (V) (NOTE 3)		Three-phase 380 to 460V (Corresponds to input voltage.)				
Rated input current (A)		2.0	3.3	5.0	7.0	11.0
Rated output current (A)(NOTE 4)		1.5	2.5	3.8	5.5	8.6
Output frequency range (NOTE 5)		0.5 to 360 Hz				
Frequency accuracy(at 25 ±10°C)		Digital command:±0.01% of Max. frequency Analog command:±0.2 % of Max. frequency				
Frequency setting resolution		Digital setting : 0.1 Hz , Analog setting : Max. frequency devided by 1000				
Voltage/frequency characteristics		Constant or Reduced torque with any variable voltage/frequency.				
Overload current capacity		150%, 60 seconds				
Acceleration/deceleration time		0.1 to 3000 seconds, in selectable linear or non-linear mode, second acceleration/deceleration usable.				
Starting torque		100% or more (When torque boost has been set)				
Braking torque	Dynamic braking (NOTE 6) Feedback to capacitor	Approx.100%		Approx. 70%	Approx.20%	
	DC injection braking	Braking is ON at the min. frequency or less. Braking can be selected by the operator. (Min. frequency, braking time and braking force can be set.)				

Model name [400V Class]			SF3204 -A40-W	SF3204 -A75-W	SF3204 -1A5-W	SF3204 -2A2-W	SF3204 -4A0-W
Input signals	Frequency setting	Digital operator	Settings with the potentiometer or ▲ ▼ in the key pad.				
		External signals	0 - 10 VDC (Input impedance 10 kΩ) 4 - 20 mA(Input impedance 250Ω) 1kΩ to 2 kΩ (1 W) Variable resistor				
	Forward/ reverse run, stop	Digital operator	RUN / STOP switch (The forward run (FW) when shipped from the factory)				
		External signals	Intelligent input terminal (FR / RR)				
	Intelligent input terminal		Forward run/stop, Reverse run / stop, Multi-stage speed, Jogging command, Analog current input selection, Change of 2nd accel/decel time Free run, External trip, USP function Reset, Software lock, Thermal protection				
Output signals	Intelligent output terminal		FA1/FA2 : Frequency arrival signal RUN: RUN signal OL: Overload previous notice siganl OD : Deviation signal at PID control AL : Alarm signal				
	Frequency monitoring		Analog meter (0 - 10 VDC 1 mA full-scale) Selection of the digital frequency signal ,analog frequency signal or analog output current monitor.				
Fault alarm contact			ON when the inverter trips.(1c contact)				
Other functions			automatic voltage regulation,retry,analog gain/vias adjustment, frequency jump,upper/lower limiter, output frequency display, trip history monitoring, carrier frequency setting(0.5~16kHz) , PID control, automatioc torque boost , etc.				
Protection functions			overcurrent, overvoltage, undervoltage, electronic thermal, temperature abnormality, ground fault upon starting, overload limit				

Model name [400V Class]		SF3204 -A40-W	SF3204 -A75-W	SF3204 -1A5-W	SF3204 -2A2-W	SF3204 -4A0-W
General specifi-cations	Ambient temperature (NOTE 7)	-10 to 50°C				
	Storage temperature/ Humidity	-25 to 70°C (during short-term transportation period) / 20 to 90% RH (no dew condensation)				
	Vibration	5.9 m/S^2 (0.6G) 10 - 55 Hz				
	Installation location	1,000 meter or less altitude, indoors				
Options		reactor for improving power factor, noise filter for inverters				
Estimated mass (kg)		1.3	1.7		2.8	

NOTE 1: Protective structure is based upon EN60529.

NOTE 2: The applicable motor is a Sumitomo standard four-pole motor and a AF motor. When using another motor, make sure that the rated motor current does not exceed the rated inverter current.

NOTE 3: The output voltage will decrease if input voltage decreases.

NOTE 4: So be sure to set the value [b 12] (Level of the electric thermal) and [b 22] (Level of overload restriction setting) for the motor.

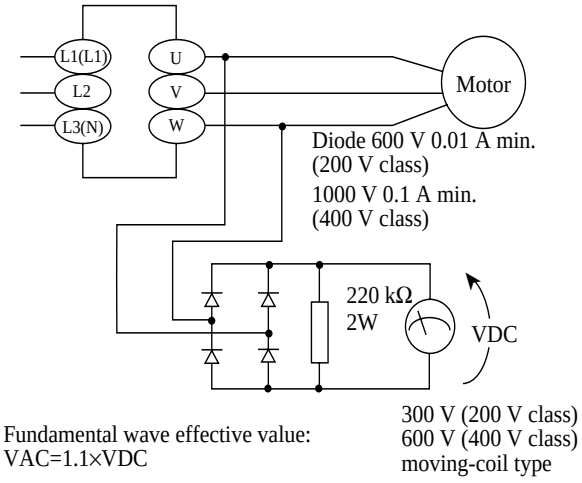
NOTE 5: Confirm with the motor manufacturer the motors maximum rpm when using a motor running at frequency higher than 50/60 Hz.

NOTE 6: Torque will be reduced when the base frequency exceeds 50 Hz.

NOTE 7: In range of 40 to 50**℃**, reduce carrier frequency 2kHz and derate output current 80% , and remove the top cover.

Measurement method for output voltage

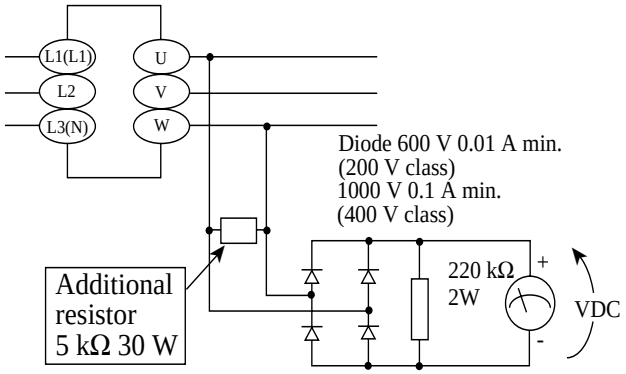
With a load



Fundamental wave effective value:
VAC=1.1×VDC

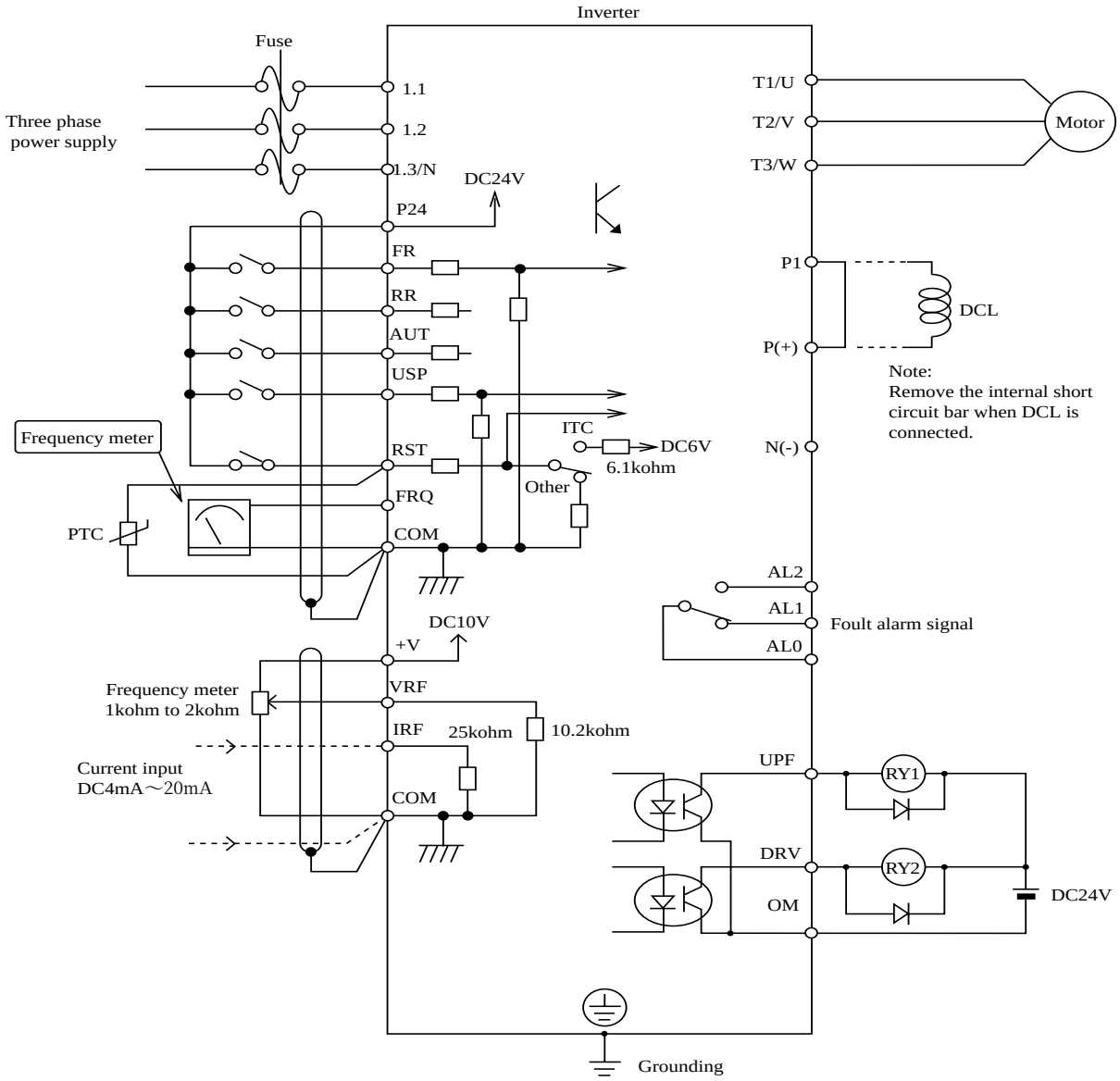
300 V (200 V class)
600 V (400 V class)
moving-coil type

Without a load



300 V (200 V class)
600 V (400 V class)
moving-coil type

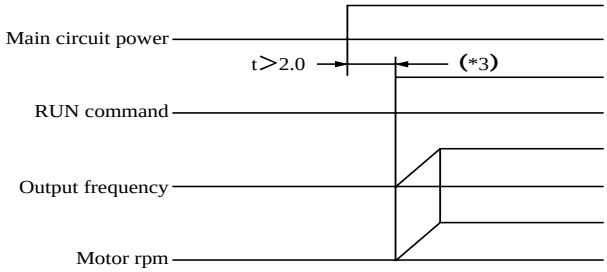
Terminal Connection Diagram



*1: Note that the common terminal differs depending on the teminal name.

Terminal name	FR RR AUT USP RST	FRQ +V VRF IRF	UPF DRV
Common	P24	COM	OM

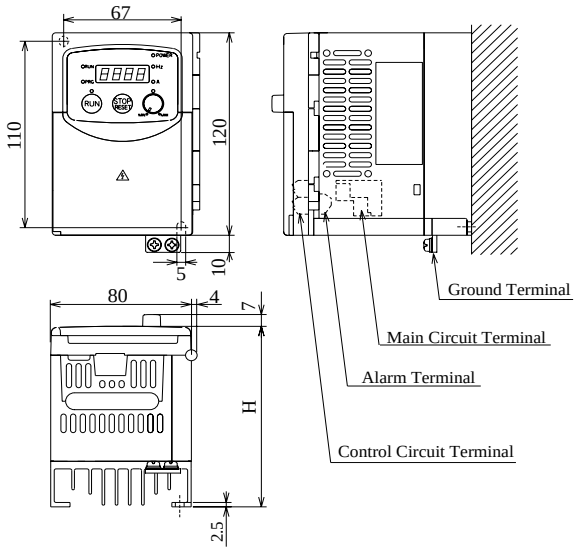
Turn on the main power at the timing shown below.



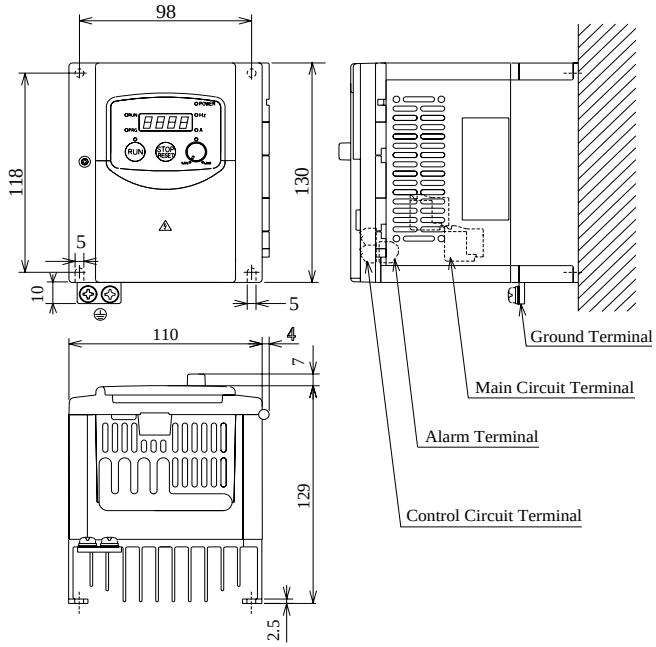
*2: Use the above timing to turn on the main power and input the RUN command . If the main power ON and the RUN command input occur simultaneously, the motor starts to ran 2.0 sec. later because the control power supply is delayed.

External Dimensions

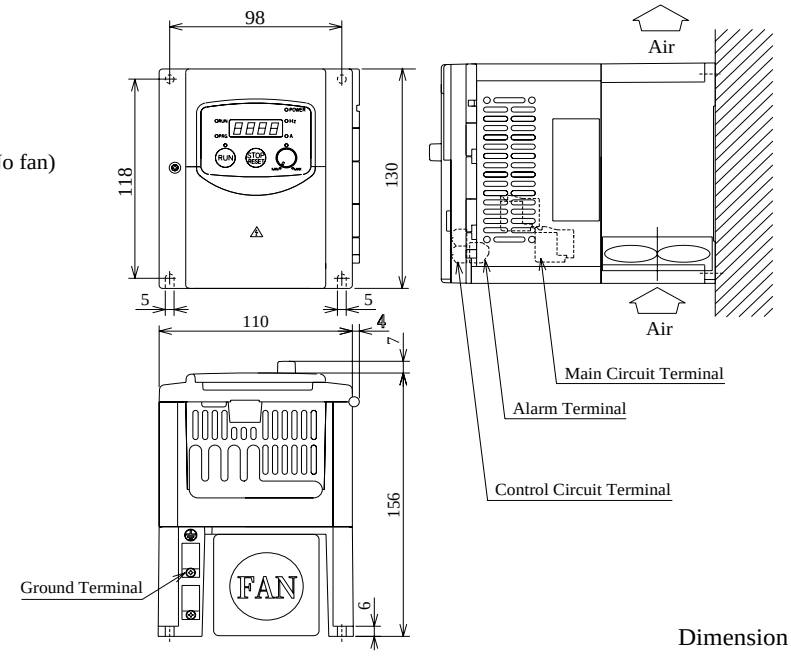
MODEL	H
SF3202-A20-W	107
SF3202-A40-W	107



MODEL
SF3204-A40-W
SF3202-A75-W

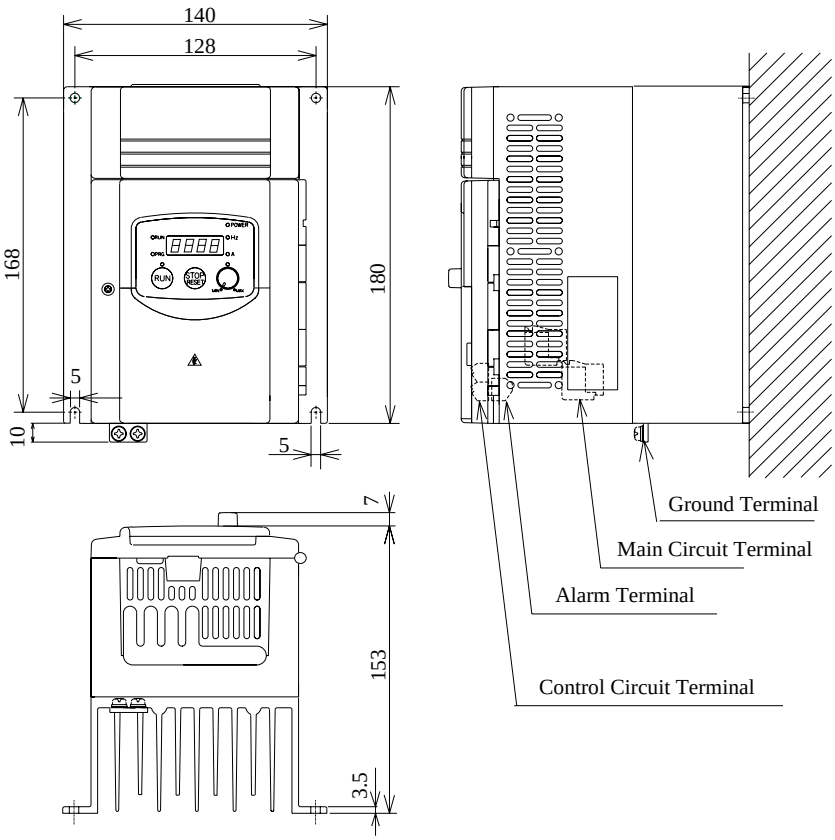


MODEL
SF3204-A75-W (No fan)
SF3204-1A5-W

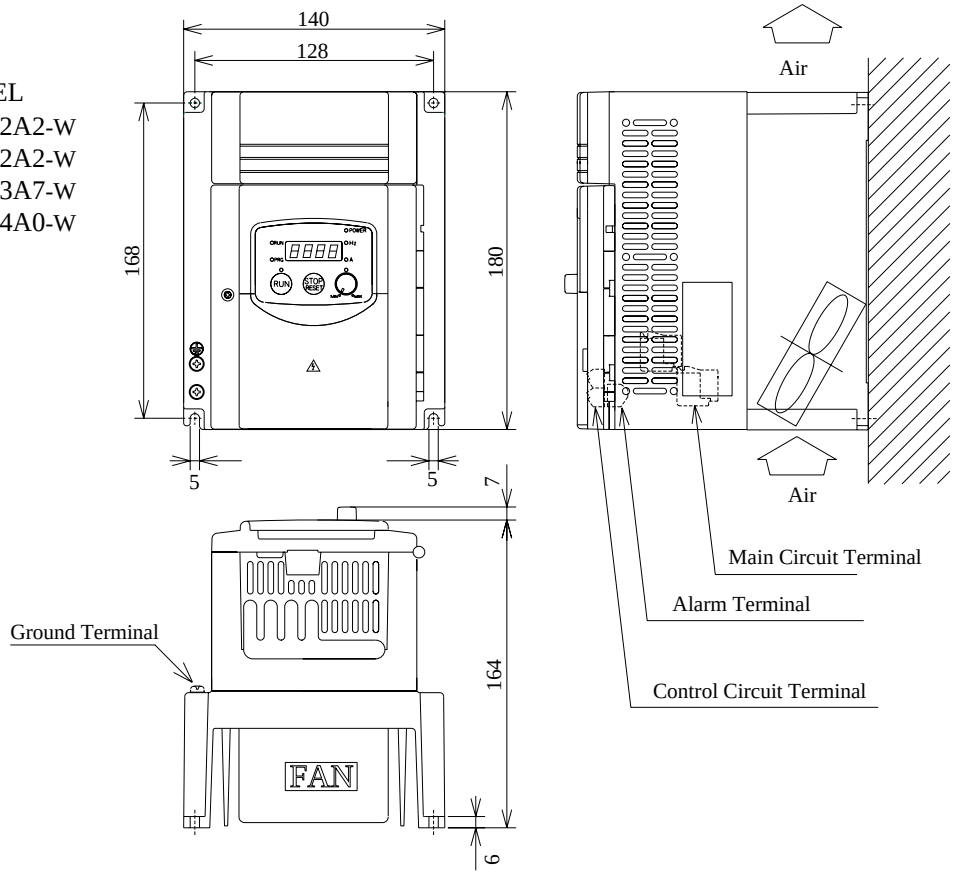


Dimension in mm

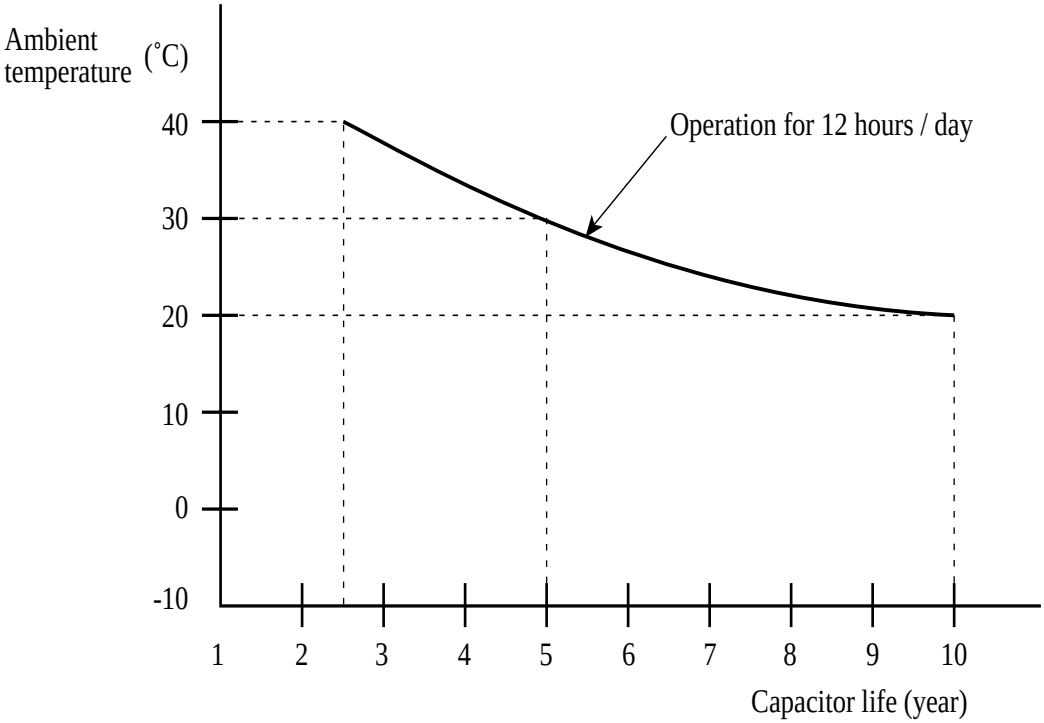
MODEL
SF3202-1A5-W



MODEL
SF3202-2A2-W
SF3204-2A2-W
SF3202-3A7-W
SF3204-4A0-W



Appendix 1 Capacitor Life Curve



* When the inverter is stored in the cabinet, the ambient temperature is the temperature in the cabinet.