otomasyon AVM

High Performance Vector Control Inverter

VVVF Inverter

SAMCO-vm06

Instruction Manual (Basic)



SANKEN ELECTRIC CO., LTD.

Thank you for purchasing the Sanken High Performance Vector Control Inverter SAMCO-VM06.

This inverter is designed to drive an induction motor at a variable speed. The inverter has a built-in microprocessor providing a wide range of functions and easy operability. To ensure many years of trouble-free operation and maintain optimum performance, be sure to read through this manual before using the product.

[For Safe Use]

- Safety instructions are given in this manual and on the product for safe use. Read the instructions thoroughly and use it correctly before using this product.
- After reading, keep this manual near to the machines for convenient reference.

Expressions and meanings of safety notes

Make sure the [safety notes] are fully read and correctly used prior to installation, operation, maintenance inspection. Critical safety instructions are marked “Danger” or “Caution” as follows.

⚠	**Danger**	This symbol indicates a hazard that could lead to death or serious injury if the warning is ignored and the product is handled incorrectly.
⚠	**Caution**	This symbol indicates a hazard that could lead to injury or damage to property if the warning is ignored and the product is handled incorrectly.

Even ignoring an instruction marked ⚠ “Caution” can have serious consequences under some circumstances. Be sure to abide by all instructions in this manual, irrespective of the degree of danger.

Meanings of symbols



This symbol indicates a potential danger.
The specific content of danger is indicated within △. (This example indicates a general danger.)

 **General danger**  **Electric shock danger**  **Fire danger**



This symbol indicates the need for caution.
The specific content of caution is indicated within △. (This example indicates a general caution.)

 General caution  Caution: risk of electric shock  Caution: risk of rotating objects



This symbol indicates a prohibition (strictly prohibited).
The specific content of prohibition is indicated within ⃠. (This example indicates a general prohibition.)

 **General prohibition**  **Disassembly is prohibited**  **The use of open fire is prohibited.**



This symbol indicates an action that must be performed (the project that must be performed).
The specific content is indicated within ●. (This example indicates a general compulsory item.)

 **General compulsory item**  **Must be grounded**

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1. Safety Notes

1-1 Important notes

Danger	
	■ **Caution: risk of electric shock** It is absolutely prohibited to remove the cover The risk of casualties exists because there are high-voltage circuits inside, accidental touch of which would cause electric shock.
	■ **Caution: Fire Hazard!** Immediately stop the device when peculiar smell, abnormal noise, smoke or sparks, etc. are found in the device (turn the power switch to "off" position), and then set the input side circuit breaker which is set outside to OFF. And contact the sale store or business office of the Company where the device is purchased. In case of a fire, please use extinguisher for electrical fire (dry powder), but do not use water for fire fighting.

1-2 Notes on use

Caution	
	■ **Before starting the inverter, confirm the safety status of the load first, and then start running operation following the instruction manual.** Arbitrary power-on has the risk of accidents such as electric shock etc.
	■ **Do not smoke or use fireworks around the inverter.** As the explosions and damage may result in personal injury and fire.
	■ **Do not keep containers which contain water such as vase etc. above the equipment.** In case the vase is overturned, the water flowing out will penetrate inside the device and cause fire.
	■ **Do not sit or stand on top of the equipment, and do not lean on it or treat it as a footboard.** Otherwise, personal injury may be caused by overturn of the equipment..
	■ **Do not insert sticks, fingers etc. into the fan.** Because the rotating fan would cause personal injury.
	■ **During operation, do not short-circuit the input terminal and output terminal.** As the current return will result in electric arc, the arc light can cause personal burns and visual impairment.
	■ Its use in the following applications is absolutely prohibited. a) Medical equipment which are directly related to life. b) Trolley buses which may lead to personal injury. c) Important computer systems for the community, public utilities. d) Equipment with these as standards. When used in the above-mentioned load equipment, please consult the Company in advance. For equipment which have significant impact on personal safety and the maintenance of public functions, special measures are required on the use, maintenance and management, such as multiple of the system, setting up generating equipment for emergency use etc..

1-3 Notes on Installation

Caution	
	■ **It is absolutely prohibited to store or use the inverter under the environmental conditions described below.** Failure to observe this warning may result in a fault, damage, or deterioration, which could lead to fire. • Very hot, cold, or humid locations, of which the environmental conditions are beyond that of sample or that are recorded in the instruction manual. • In direct sunlight. • Near a heater or other heat source. • In a location subject to vibration or physical shock. • Near machinery that generates sparks • In a location subject to dust, corrosive or inflammable gases, salt, and water droplets. • Outdoors. • Higher than 3000 meters above sea level. • Other similar environments.
	■ **Mount the inverter on a metal surface or other non-flammable surface.** Failure to observe this warning may result in a fire.
	■ **Install the inverter in a location that can bear its weight.** Failure to observe this warning may result in injury if the inverter falls down.
	■ **Do not plug up the air inlet/exhaust. (Refer to "Installation" in the instruction manual for implementation).** If the air inlet/exhaust is blocked, a fire may be resulted due to internal temperature rise of the equipment.
	■ **Do not place the inverter near flammable materials.** Failure to observe this warning may result in a fire.
	■ **Do not allow foreign objects into the inverter or attach to the cooling fans.** Failure to observe this warning may result in a fire or an accident.
	■ **Do not operate an inverter which is damaged, lacking parts or dented.** Failure to observe this warning may result in an electric shock, injury, fire or accident.

1-4 Notes on Handling and Moving

Caution	
	■ **During handling and moving, do not tilt the equipment.** Otherwise, personal injury may be resulted due to falling down of equipment.
	■ **Prior to handling and movement, confirm the weight marking attached to the equipment first, if necessary, please prepare alternative handling machine for work.** Failure to observe this warning may result in personal injury.

1-5 Notes on wiring

Danger	
	■ **Wiring must be performed by qualified personnel.** Failure to observe this warning may result in an electric shock or fire due to incorrect wiring.
	■ **Do not connect AC power to an output terminal (U, V, or W).** Failure to observe this warning may result in personal injury or fire.
	■ **Do not use if rated voltage is exceeded.** Failure to observe this warning may result in personal injury or fire.
	■ **Do not connect a resistor directly to the DC terminals (P and X).** Failure to observe this warning may result in a fire.
	■ **Connection between the ground terminals must be reliable.** Failure to observe this warning may result in electric shock if ungrounded. For the thickness of grounding wires, please refer to the wire sizes specified in the instruction manual.
	■ **Please tighten the terminal block screws according to specified tightening torques.** Failure to observe this warning may result in a fire.
	■ **Check that the AC power supply voltage is equal to the rated voltage of the inverter.** Failure to observe this warning may result in personal injury or fire.
	■ **For cable types and diameters, please use the cables specified in the instruction manual.** Failure to observe this warning may result in heating or a fire if the diameters of wires are too small.
	■ **Secure the inverter before wiring.** Failure to observe this warning may result in electric shock or personal injury.

Caution	
	■ **The inverter, motor or wiring may cause interference. Please note misoperation of peripheral devices.** Failure to observe this warning may result in accidents.
	■ **If the input and output are terminal blocks, the wire heads must be connected with crimp terminals.** Failure to observe this warning may result in electric shock or fire.

1-6 Notes on Operation

Danger	
	■ **Attach the front cover before (**Turning the power on) **And, do not remove the front cover when the power is on.** Failure to observe this warning may result in electric shock.
	■ **Do not touch any switch with wet hands.** Failure to observe this warning may result in electric shock.
	■ **Do not touch any inverter terminal when the inverter is energized even if the motor is not operating.** Failure to observe this warning may result in electric shock.
	■ **Do not get close to the machinery driven by the inverter after an alarm stop because it will restart suddenly if the restart function is selected. (Design the system to ensure personal safety at restart.)** Failure to observe this warning may result in personal injury.
	■ **Provide a separate emergency stop switch.** Failure to observe this warning may result in personal injury.
	■ **If alarm reset is done in the operation signal status, the equipment will restart suddenly. Therefore, please cut off the operation signal before releasing an alarm.** Failure to observe this warning may result in personal injury.

Caution	
	■ **Do not touch the radiator fins or DC reactor because they become very hot.** Failure to observe this warning may result in burns.
	■ **It is easy to set the inverter drive speed from low to high, so be sure to confirm the operating range of the motor and machinery driven by the inverter before making such settings.** Failure to observe this warning may result in personal injury.
	■ **Please set separate brake if it is required to keep brake.** Failure to observe this warning may result in personal injury.
	■ **Do not start or stop the inverter by turning the main circuit ON or OFF.** Failure to observe this warning may result in equipment faults.

1-7 Notes on Maintenance and Inspection

Caution	
	■ **Works such as maintenance, inspection and replacement of parts etc. can only be carried out by professional electricians.** [Take off any metal item (such as watch, bracelet, etc.) before working on the equipment.] [Use insulated tools.] Failure to observe this warning may result in electric shock or burns.
	■ **Turn off the input power for maintenance or inspection. After the CHARGE lamp goes out, check that the voltage between DC terminals P and X is less than 30 VDC.** Failure to observe this warning may result in electric shock or personal injury.

1-8 Disposal

Caution	
	■ **When disposing this product, please entrust a specialized industrial waste disposal service (*) to handle.** If not handled by professionals, personal injury may be caused by capacitor explosion or harmful gases produced in explosion. （*）So-called professional waste disposal service refers to the [Industrial Waste Recycling and Carrying Body] and [Industrial Waste Disposal Body]. Those who carry out recycling, handling and disposal of industrial waste without prior approval will be subject to legal action. ([Subject to laws regarding disposal and cleaning of industrial products])

1-9 Others

Danger	
	■ **Reformation of the product without authorization is strictly prohibited.** Failure to observe this warning may result in an electric shock, personal injury, fault, damage or fire.
	■ **This product is designed for operation of a three-phase induction motor. Therefore it can not be used for single-phase motor or other purposes.** Failure to observe this warning may result in a fire or an accident.
	■ **Do not use this product for life-support equipment, or other purposes directly related to dangers to people.** Failure to observe this warning may result in an accident.
	■ **Install a safety device when this product is applied to facilities where the failure of this product may cause a serious accident or damage.** Failure to observe this warning may result in an accident.

2. Checking the Product and Precautions on Use

2-1 Checking the Product

After unpacking the product, check the following:
Check that the product has not been damaged during delivery, such as depression of casing etc..
If such problems are found, please contact the retailer.

Danger	
■	**Do not use if rated voltage is exceeded.** Failure to observe this warning may result in personal injury or fire.
■	**Check that the AC power supply voltage is equal to the rated voltage of the inverter.** Failure to observe this warning may result in personal injury or fire.

Product body



Figure 2-1 Outside View

Instruction Manual
this manual

2-2 The contents of the model

The model on the nameplate

VM06 — 0015 — L 4

〔Series Name〕
〔Capacity〕

0015：1.5kW-120% / 0.75kW-150%
0075：7.5kW-120% / 5.5kW-150%
0150：15kW-120% / 11kW-150%
0220：22kW-120% / 18.5kW-150%
0450：45kW-120% / 37kW-150%
0750：75kW-120% / 55kW-150%
1100：110kW-120% / 90kW-150%
1600：160kW-120%/132kW-150%
2500：250kW-120%/200kW-150%

〔LCD panel〕
L:Configuration
N:no

〔Voltage Class〕
4:3φ-400V series
2:3φ-200V series

2-3 Precautions on Use

1. **Use the product in a location satisfying the standard environmental specifications (temperature, humidity, vibration, dust, water drop, and toxic gases etc.).**

2. **Before starting up the product for the first time, carefully check the wiring. Make sure that the power cable (input) and motor cable (output) are connected correctly. Otherwise, the inverter will be damaged.**

3. **Since the ambient temperature of the installation location greatly affects the life of the inverter, it is recommended to lower the ambient temperature before operation.**

4. **When installing the product in an enclosure, check the closure size and ensure sufficient ventilation.**

5. **Capacitors and surge suppressors used for improving the inverter's output power factor may be heated or even damaged because of high-order harmonic components output by the inverter. In addition, when current overload occurs in the inverter, over-current protection action will be automatically executed. Therefore, please do not connect capacitors and surge suppressors at the output side of the inverter. To improve power factor, install the DC reactor at the DC side or AC reactor at the primary side (i.e. input end) of the inverter.**

6. **When implementing a megger test, follow the method given in this instruction manual (10-4 "Megger Test.").**

7. **When using leakage circuit breaker protection switch, select a product for corresponding high-order harmonic and surge.**

8. **Avoid inserting a magnetic contactor between the inverter and the motor. If the magnetic contactor is turned on and off while the inverter is operating, an excess current will be generated.**

9. **Select larger capacity since the operating characteristics of full electromagnetic-type MCCB changes with higher harmonic current.**

2-4 Names of Parts

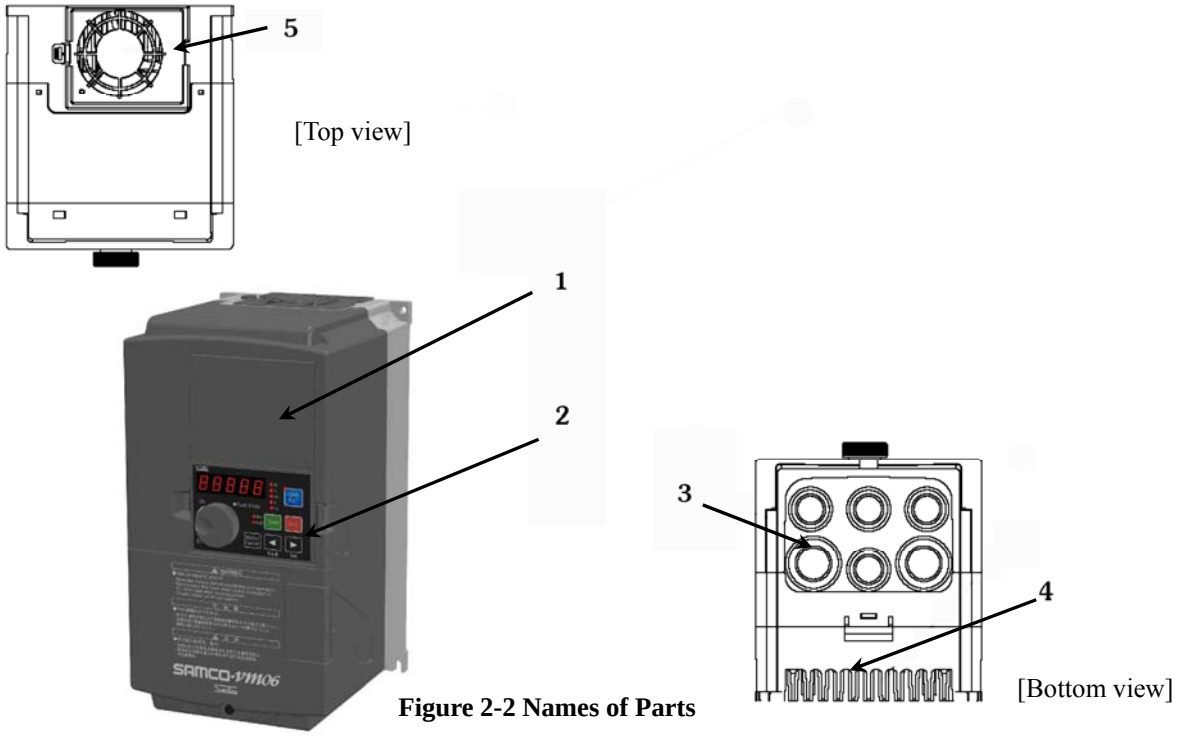


Figure 2-2 Names of Parts

Table 2-1 Names of Parts

No.	Name	Function
1	LCD display part(option)	Refer to [Chapter 5 Operation Panel]
2	Operation Panel	Refer to [Chapter 5 Operation Panel]
3	Wiring Hole	Refer to [Chapter 4 Wiring]
4	Air Inlet	Cooling air suction hole
5	Exhaust hole (fan)	Cooling air exhaust hole

3. Installation

3-1 Installation Location and Storage

This equipment is an electronic control device. Please pay full attention to environment of the device before it is used.

Caution	
■	**Mount the inverter on a metal surface or other non-flammable surface.** Failure to observe this warning may result in a fire.
■	**Do not plug up the air inlet / exhaust hole.** If the air inlet/exhaust is blocked, a fire may be resulted due to internal temperature rise of the device.
■	**Do not place the device near flammable materials.** Failure to observe this warning may result in a fire.
■	**Do not install the device where larger vibration exists.** Otherwise, personal injury may be caused due to falling of the mainframe.
■	It is absolutely prohibited to store or use the inverter under the environmental conditions described below. Failure to observe this warning may result in a fault, damage, or deterioration, which could lead to fire. • In direct sunlight. • Near a heater or other heat source. • In a location subject to vibration or physical shock. • Near machinery that generates sparks • In a location subject to dust, corrosive or inflammable gases, salt, and water droplets. • Outdoors. • Higher than 3000 meters above sea level. • Other similar environments.

Table 3-1 Work Environment Parameters

Ambient temperature	Mode B(120% 1min)	-10℃-40℃
	Mode A(150% 1min)	-10℃-50℃
Relative humidity	Below 95%RH （no frost）	
Vibration	Below 5.9m/s2 (0.6G)	
Working environment	Below 3000m above sea level (When above 1000m, the current will be reduced for use)	
Working place	Indoor (free from corrosive and flammable gases, oil mist, and dust)	

Table 3-2 (1) Capacity Modes

Capacity	Mode B	Mode A
0015	1.5kW (120%)	0.75kW (150%)
0022	2.2kW (120%)	1.5kW (150%)
0037	3.7 kW (120%)	2.2kW (150%)
0040	4.0kW (120%)	2.2kW (150%)
0055	5.5kW (120%)	4.0kW (150%) ※1
0075	7.5kW (120%)	5.5kW (150%)
0110	11kW (120%)	7.5kW (150%)
0150	15kW (120%)	11kW (150%)
0185	18.5kW (120%)	15kW (150%)
0220	22kW (120%)	18.5kW (150%)
0300	30kW (120%)	22kW (150%)
0370	37kW (120%)	30kW (150%)
0450	45kW (120%)	37kW (150%)
0550	55kW (120%)	45kW (150%)
0750	75kW (120%)	55kW (150%)

Table 3-2 (2) Capacity Modes

Capacity	Mode B	Mode A
0900	90kW (120%)	75kW (150%)
1100	110kW (120%)	90kW (150%)
1320	132kW (120%)	110kW (150%)
1600	160kW (120%)	132kW (150%)
2000	200kW (120%)	160kW (150%)
2200	220kW (120%)	185kW (150%)
2500	250kW (120%)	200kW (150%)
2800	280kW (120%)	220kW (150%)
3150	315kW (120%)	250kW (150%)

※ **1: In 200V series, is 3.7kW (150%)**

Table 3-3 Storage Environment

Storage temperature	-20℃-+65℃ This temperature is for short periods, such as during transportation. Ambient temperature must be 30°C or lower for more than 3 months of storage in consideration of the deterioration of the electrolytic capacitor.
Relative humidity	Below 95%RH (no frost)
Storage environment	Places free of direct sunlight, corrosive or inflammable gases, oil mist, dust, steam, water droplet, vibration, or high salinity.

Table 3-4 Main body mounting screws

200V systems

Capacity	Screws	Recommended Screw Tightening Torque
VM06-0015-∗2	M4	1.5N•m (1-1.9N•m)
VM06-0020-∗2		
VM06-0040-∗2		
VM06-0055-∗2		
VM06-0075-∗2	M5	2.9N•m (1.6-3.5N•m)
VM06-0110-∗2		

400V systems

Capacity	Screws	Recommended Screw Tightening Torque
VM06-0015-∗4	M4	1.5N•m (1-1.9N•m)
VM06-0020-∗4		
VM06-0040-∗4		
VM06-0055-∗4		
VM06-0075-∗4	M5	2.9N•m (1.6-3.5N•m)
VM06-0110-∗4		
VM06-0150-∗4		
VM06-0185-∗4		
VM06-0220-∗4	M5	2.9N•m (1.6-3.5N•m)
VM06-0300-∗4		
VM06-0370-∗4		

VM06-0450-*4	M6	4.3N•m (2.3-5.6N•m)
VM06-0550-*4		
VM06-0750-*4	M8	10.8N•m (5.4-13.8N•m)
VM06-0900-*4		
VM06-1100-*4	M12	42N•m (35-50N•m)
VM06-1320-*4		
VM06-1600-*4		
VM06-2000-*4		
VM06-2200-*4		
VM06-2500-*4		
VM06-2800-*4		
VM06-3150-*4		

3-2 Installation Direction and Space

(1) This inverter is of the wall mounting type.

(2) Install the inverter vertically on a flat mounting surface.

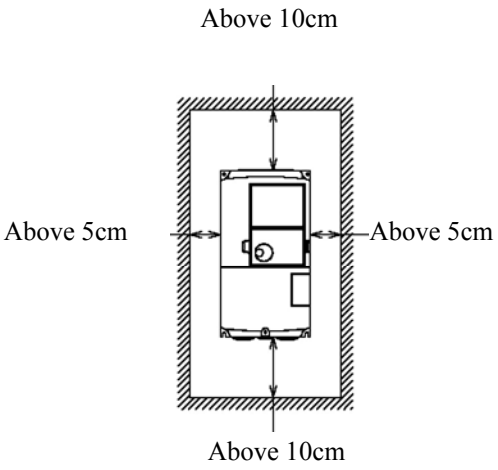
(3) Since the inverter generates heat, provide adequate space around it to ensure good heat dissipation conditions.

(4) When installing the inverter in a control cabinet, provide a ventilation fan to keep the ambient temperature below 40°C.

(5) When installing the inverter in a control cabinet, mounting the radiator fins outside the control cabinet will help to reduce the internal temperature of the cabinet.

(6) This inverter is of IP20 structure.

Please select according to intended use.



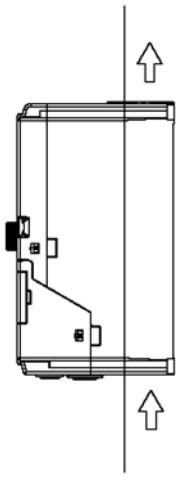
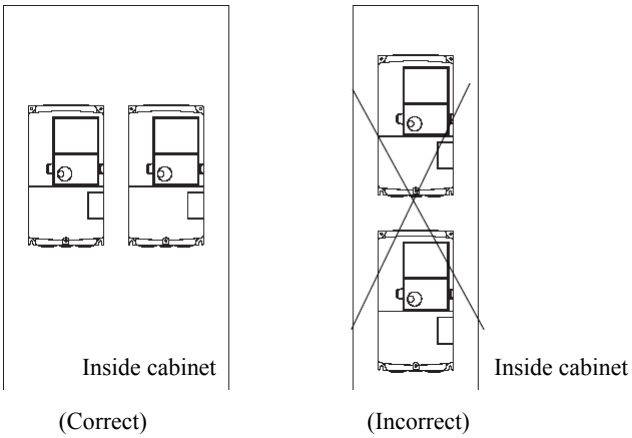


Figure 3-1 Surrounding Space **Figure 3-2 Arranging method of radiator fins outside the cabinet**

When several inverters are set in a control cabinet, be sure to locate the ventilation fans properly to allow free air circulation.
If the ventilation fans are located improperly, the ambient temperature will rise and affect the cooling of the inverter.



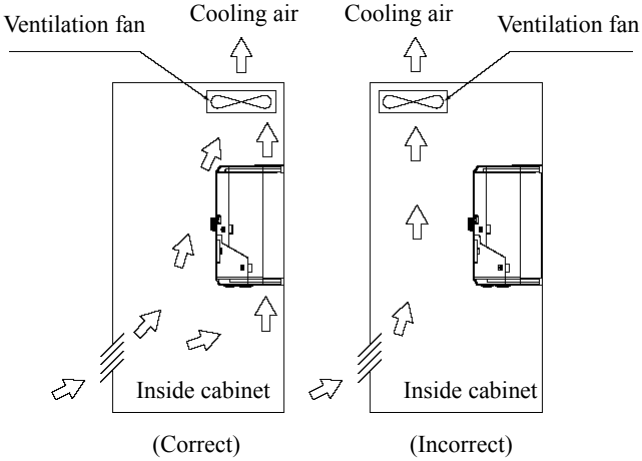


Figure 3-3 Arranging method inside the cabinet **Figure 3-4 Ventilation fan position in cabinet**

3-3 Removal and Installation of the Front Cover

3-3-1 Small-capacity model (VM06-0015~0110-*2/VM06-0015~0185-*4)

(1) Removal of front cover (lower)

Unscrew the M4 screws, and pull the cover toward you while pressing the Dent portion on both sides of the front cover (lower).

- Please carry out this work during the main circuit wiring, control circuit wiring, and SW1 switching.

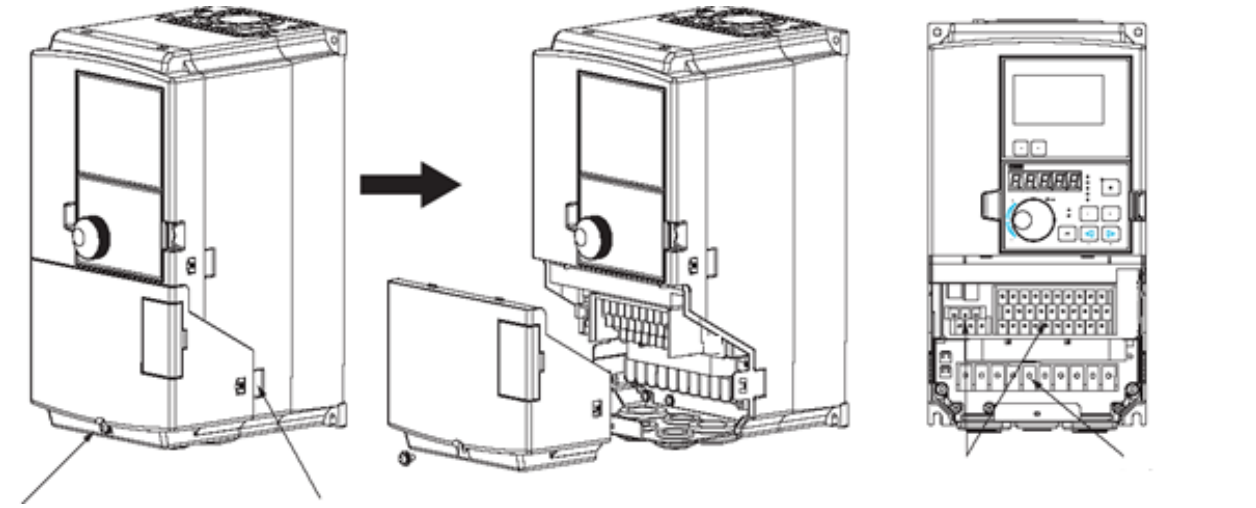


Figure 3-5 Removal of front cover (lower)

(2) Removal of front cover (upper)

After the front cover (lower) has been removed, pull the cover toward you while pressing the Dent portion on both sides of the front cover (upper).

- Please carry out this work during the control circuit wiring (RX and TX), installation and removal of optional boards, and SW2 switching.

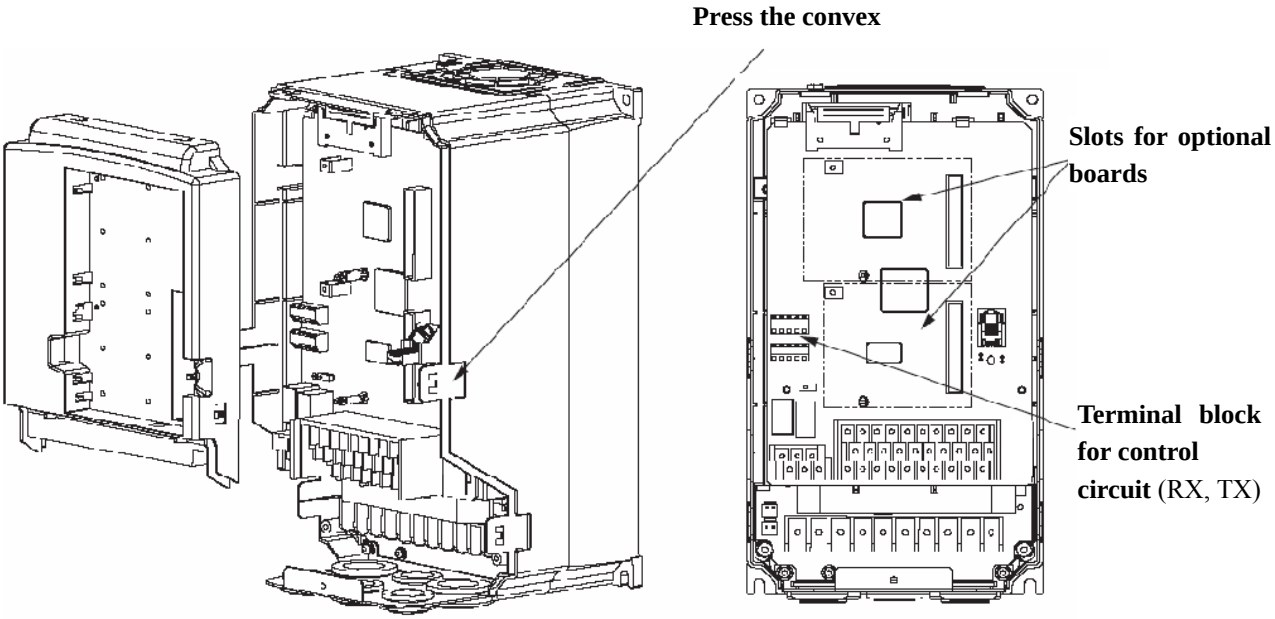


Figure 3-6 Removal of front cover (upper)

(3) Installation

When installing, work in reverse order.

3-3-2 Middle- or large-capacity model（VM06-0220~0900*4）

(1) Removal of front cover (lower) and internal sealing plate (iron)

Unscrew the M4 screw on the front cover (lower) and pull down gently, and then the front cover (lower) will be removed. Then, unscrew 4 M4 screws and remove the sealing plate.

- Please carry out this work during the main circuit wiring, control circuit wiring, and SW1 switching.

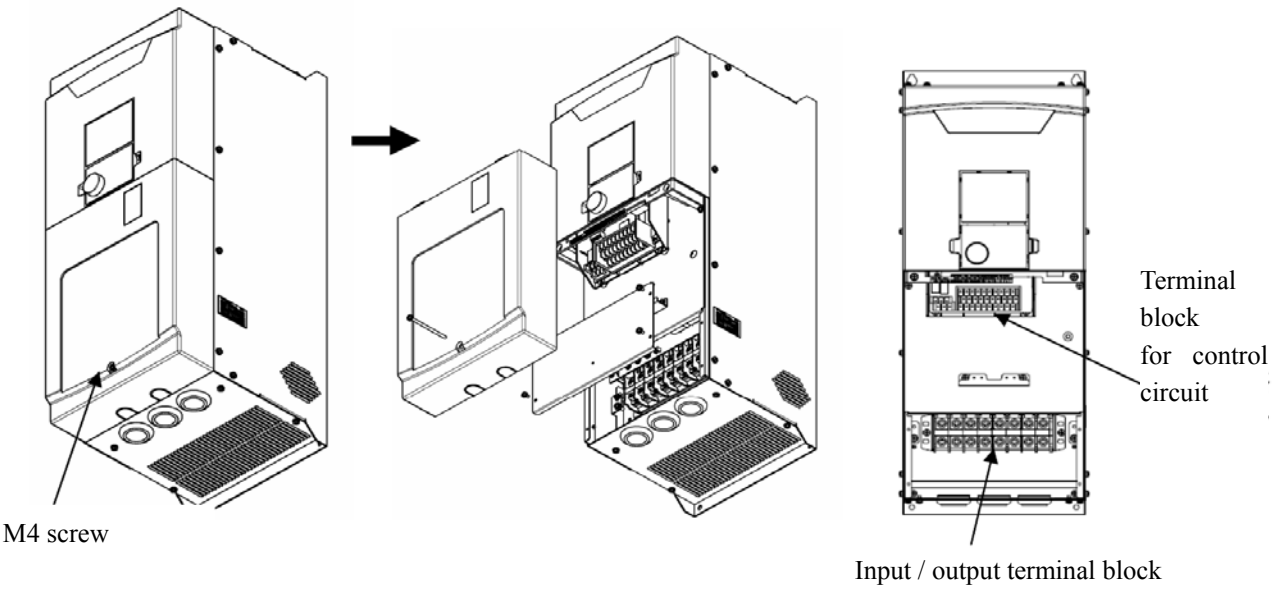


Figure 3-5 Removal of front cover (lower) and internal sealing plate (iron)

(2) Removal of front cover (upper)

After the front cover (lower) has been removed, unscrew 2 M4 screws on the front cover (upper), and gently push up front cover (upper), it will be removed.

- Please carry out this work during the control circuit wiring (RX and TX), installation and removal of options, and SW2 switching.

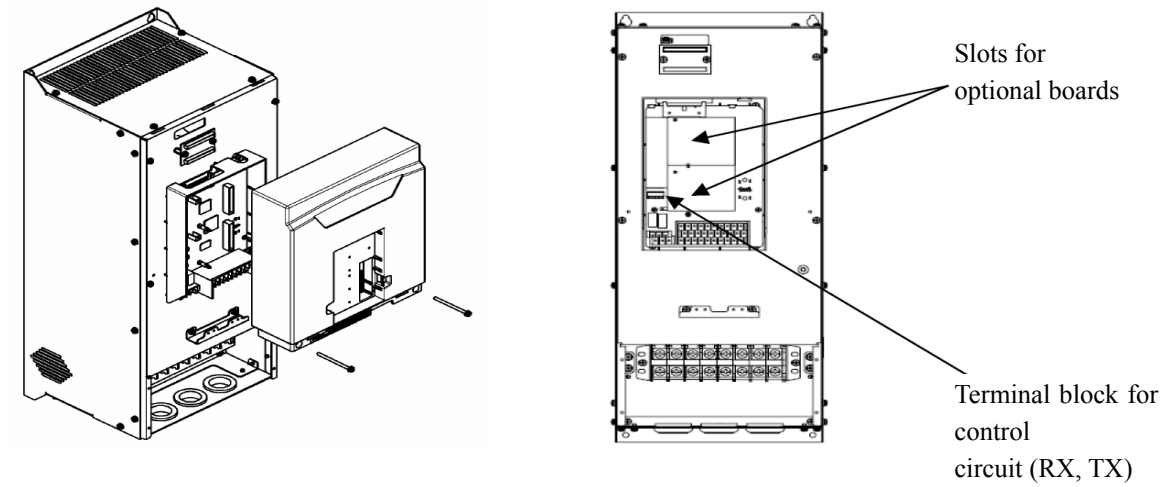


Figure 3-6 Removal of front cover (upper)

(3) Installation

When installing, work in reverse order.

3-3-3 Middle- or large-capacity model（VM06-1100~3150-*4）

(1) Removal of front cover (lower)

Unscrew the M4 screw, gently lift up and take off the cover.

- Please carry out this work during the main circuit wiring, control circuit wiring, and SW1 switching.

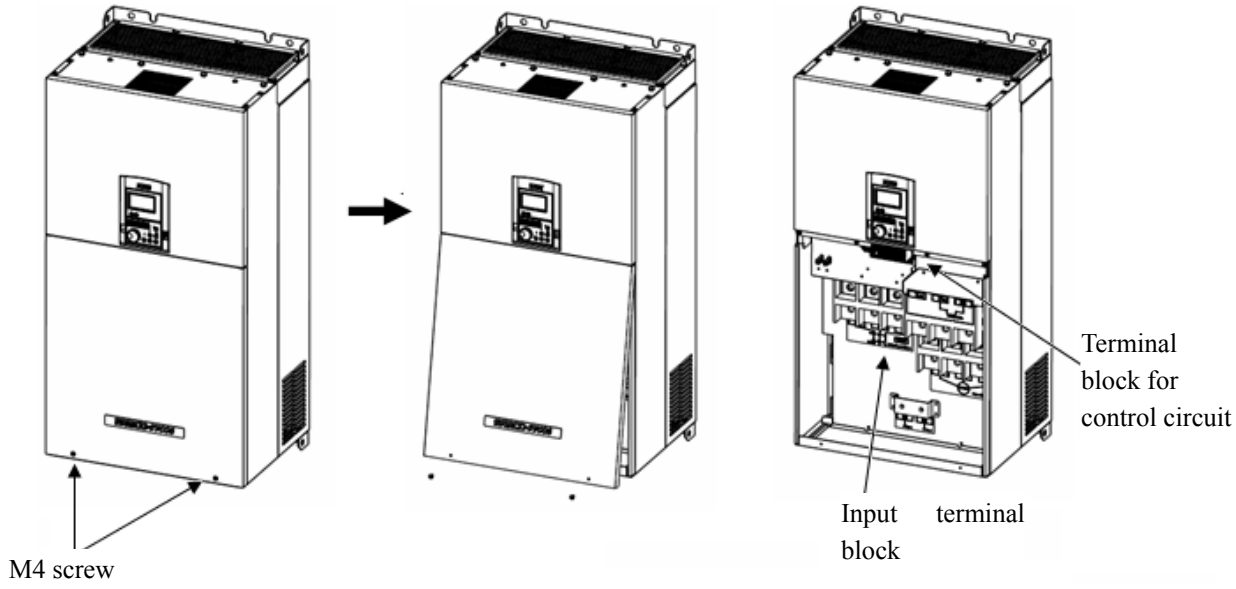
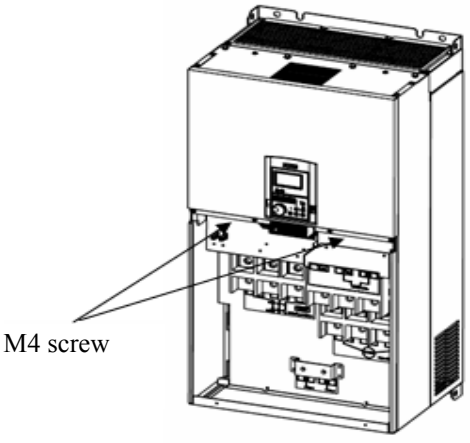


Figure 3-7 Removal of front cover (lower)

(2) Removal of front cover (upper)

After the front cover (lower) has been removed, unscrew M4 screws (4) on the front cover (upper), gently lift up and take off the front cover.

- Please carry out this work during the control circuit wiring (RX and TX), installation and removal of options, and SW2 switching.



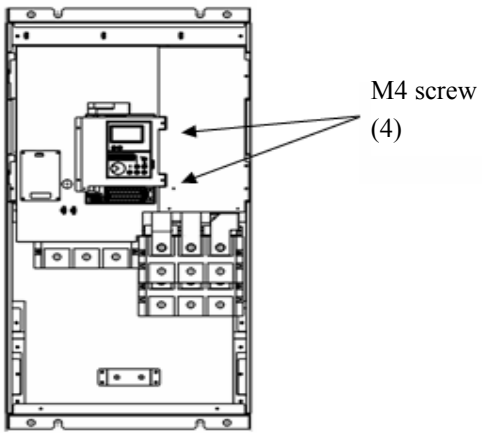


Figure 3-8 (1) Removal of front cover (upper) **Figure 3.8 (2) During wiring, installation and removal of options**

(3) Installation

When installing, work in reverse order.

3-4 Removal and Installation of the Operation Panel

3-4-1 Removal of Operation Panel

Hook ① and ② on the cover with your fingers, and take off the panel, pull it toward you while pressing the jack catch on ② side.

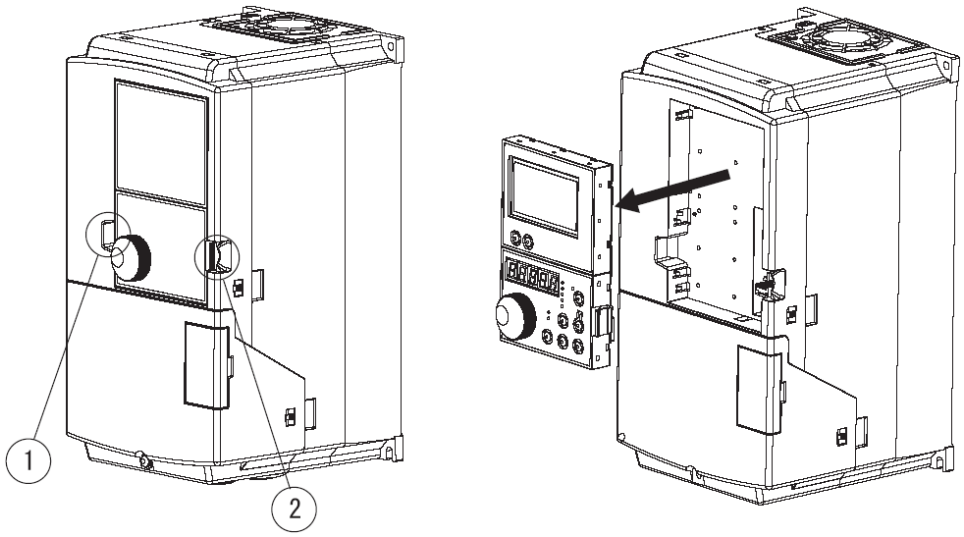


Figure 3-9 Removal of Operation Panel

3-4-2 Installation of Operation Panel

When installing, simply insert the operation panel straightly.
At this point, check from front cover, if the operation panel is not protruding, it is fully installed.
Otherwise, protruding operation panel may result in unreliable contact of connector.

- If the removed operation panel is installed outside the control cabinet, please use a 8-pin direct plug-in combination cable (both ends of RJ45 type) which is shielded within 5m and available from market for connection.

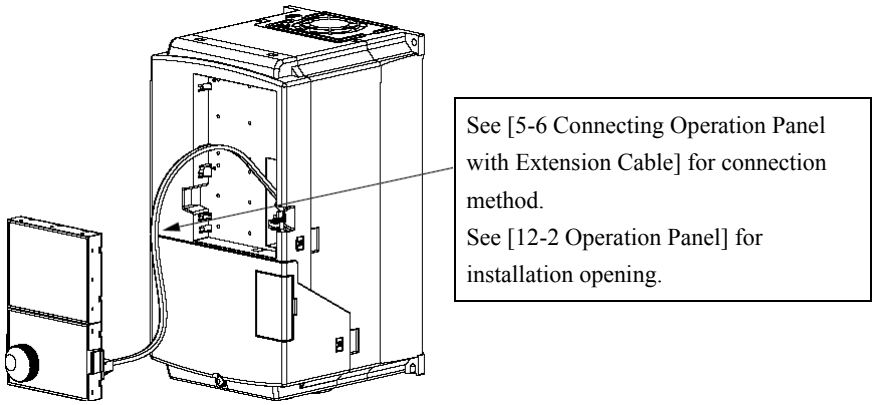


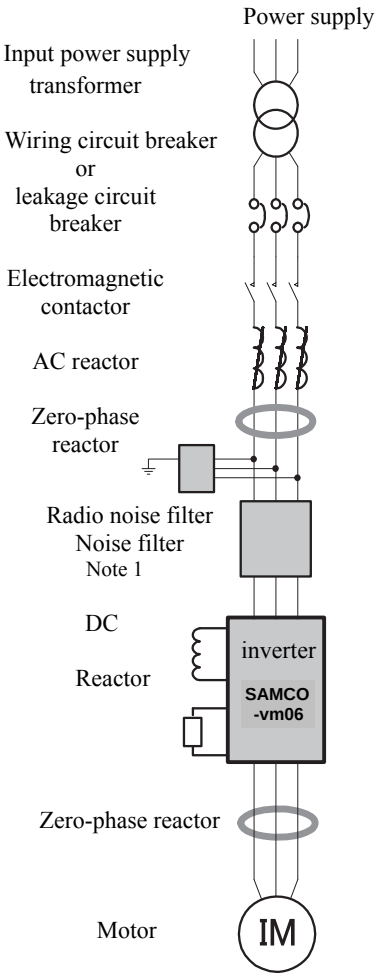
Figure 3-10 Installation of Operation Panel outside Cabinet

4. Wiring

■ **Read the Notes on Wiring (1-5) before wiring.**
Failure to observe this warning may result in personal injury or fire.

4-1 Connection with peripheral devices

Name	Purposes and Detailed Description
Input power supply transformer	When there is need for matching the system power supply voltage with rated inverter input voltage, please provide the input power supply transformer. When several inverters are used, please provide the input power supply transformer to reduce the impact of high-order harmonic on other load devices.
Wiring circuit breaker or leakage circuit breaker	Please connect wiring circuit breaker or leakage circuit breaker in the overload protection circuit during protection and wiring of the power supply system. When using leakage circuit breaker, select a product for corresponding high-order harmonic.
Electromagnetic contactor	The coil must be provided with a surge absorber.
Surge absorber	Please install the surge absorber for suppression of surge generated on opening and closing of electromagnetic contactors and control relays.
AC reactor DC reactor	To achieve the following objectives, please install the reactor ·Improve the inverter's input power factor ·Reduce the impact on inverter due to unbalance between phases of power supply voltage · Prevent tripping of inverter due to action of phase lead compensation capacitors in the system · When the capacity of power supply is large (above 500 kVA)
Zero-phase reactor Line noise filter	Reduce the interferences coming into input power supply system of the inverter and generated by wiring. It is recommended that elements such as zero-phase reactor etc. be inserted as close to inverter as possible.
Radio noise filter	Used to suppress the radio noise radiating to power supply side of the inverter.
Noise filter	Reduce the interferences coming into input power supply system of the inverter and generated by wiring. It is recommended that noise filter be installed as close to inverter as possible.



Note 1: For SVC06 series inverter with built-in EMC filter, please place the EMC filter selector switch to "ON".
Note 2: See model selection samples of options of Sanken Inverter for related options.

4-2 About Wiring

Before carrying out wiring work, turn the inverter's input power supply to "OFF" (disconnected) first, and then check with a circuit tester that no applied voltage is present. Check also that the CHARGE lamp is not lit.

(1) Be sure to connect a MCCB (circuit breaker) between the power supply and the input power supply terminals (R, S, T). (Use a leakage circuit breaker specific to high-order harmonic when necessary.) In addition, to ensure the system safety, connect a MC (magnetic contactor) between the MCCB and the input power terminals (R, S, T).

(2) The phase order does not need to be considered when wiring the input power terminals (R, S, and T).

(3) Connect the motor to the output terminals (U, V, W) correctly.

The harmonic component leakage current increases by stray capacitance of wiring and causes adverse affects on the inverter itself and peripheral mechanical equipment when the total length of wiring between inverter and motor is too long.

The total length of wiring between inverter and motor shall not exceed the values described in Table 4-1.

Table 4.1 Length of wiring between the inverter and the motor

Length of wiring between the inverter and the motor	50m	100m	200m
Carrier frequency (Specified by F1009)	F1009=130 or less	F1009=90 or less	F1009=40 or less

- When driving several motors at the same time, the total length of wiring to motors shall not exceed the values described in Table 4-1. However, for vector control, the maximum wiring length shall be controlled within 100m. (For length of more than 30m, please implement autotuning mode2)
- The surge voltage generated by the inverter element switching is superimposed and terminal voltage of the motor is impressed. The following measures should be considered to prevent deterioration of motor isolation especially for 400V class motors when the length of wiring between the inverter and the motor is long.
  ① Use reinforced motor isolation.
  ② Length of wiring between the inverter and the motor should be as short as possible (Generally about 10 - 20m) .

(4) See 4-5-4 for capacity of MCCB and MC and wire sizes.
Use sleeved crimp terminals for the power and motor cables.

(5) Use shielded or twisted-pair wires for wiring to the control circuit terminals. Keep the wires well away from the main and high-voltage circuits (including logic circuit of 200 V relay).

(6) Use a micro-signal contact or two-contact relay for the control circuit terminal to prevent poor contact.

(7) Ground the ground terminal (⏚) securely.
In addition, use the ground terminal of the inverter for grounding. (Do not use the casing or the chassis.)

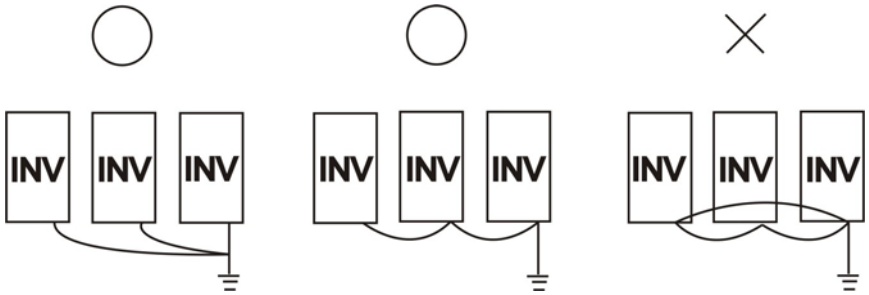
According to technical standards for electrical equipment, 200 V series shall be connected to the grounding electrode for type D grounding; while 400 V series connected to the grounding electrode for type C grounding.

Table 4-2 Types of grounding

Voltage	Types of grounding	Grounding resistance
200V series	Type D grounding	100Ω or less
400V series	Type C grounding	10Ω or less

- Do not share the grounding wire with the welding machine or the power equipment.
- Use the grounding wire prescribed in the technical standards for electrical equipment, and shorten wiring length as much as possible.

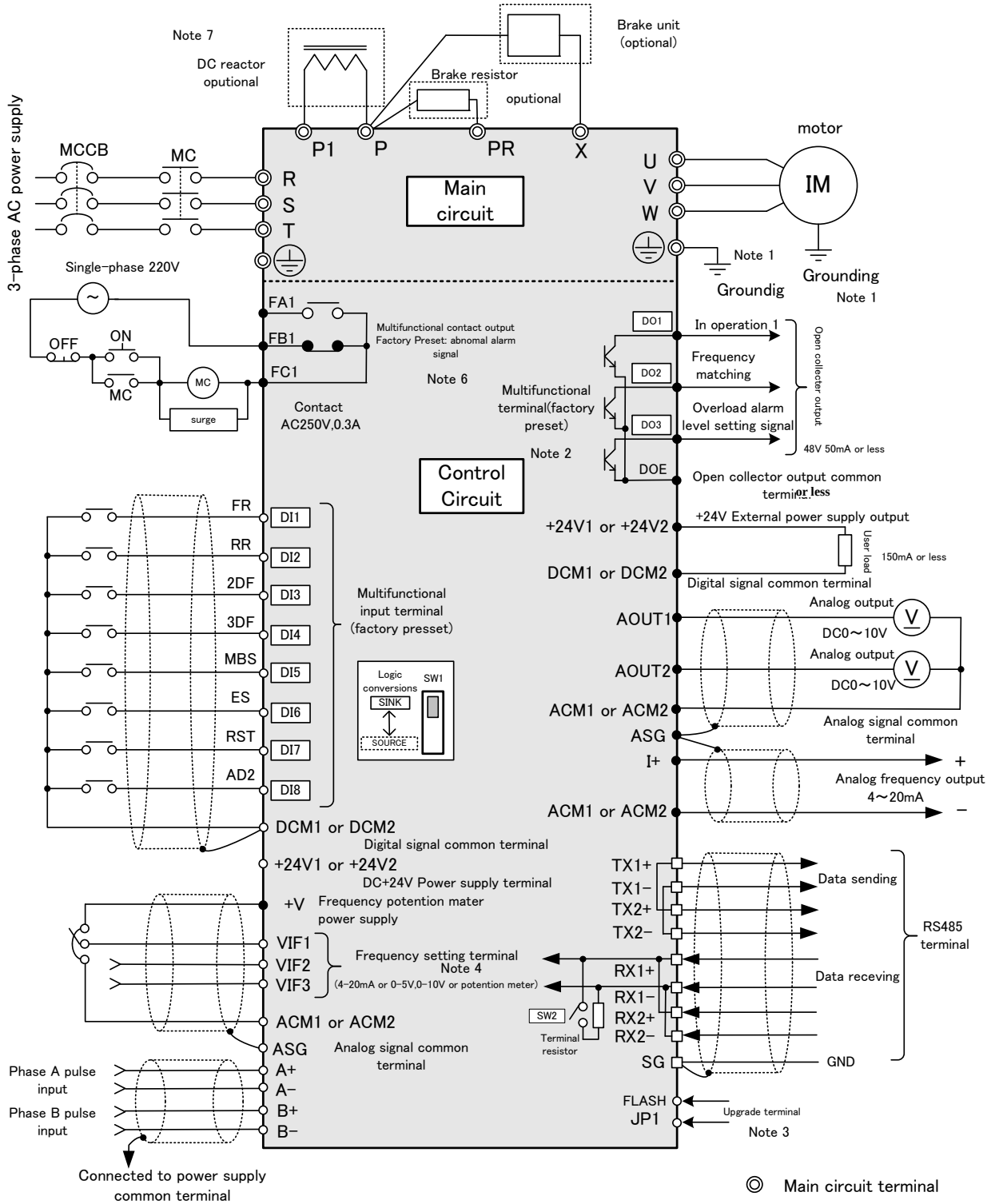
● Be careful not to loop the grounding wire when using multiple inverters.



(a) Correct (b) Correct (c) Incorrect

(8) During wiring, please note that the inside of inverter shall be free from chips of wires.

4-3 Terminal connection diagram



◎ Main circuit terminal

○ Control circuit input terminal

● Control circuit output terminal

□ Communication circuit terminal

Note1::Ground the inverter snd motor before use

Note2:The output terminals are multifunctional terminals that can be assigned individually with function codes F1509 to F1511.

Note3:Terminal for upgrading. Normally left open.

Note4:Switch the function with function code F1002. The terminal can be used as an input terminal for various feedback signals.

Note5:The input terminals are multifunctional terminals that can be assigned individually with function codes F1414 to F1421.

Note6:Multifunctional contact output terminals is also a maltifunctional terminal that can be assigned individually with function code F1513 to F1514.

Note7:18.5k or above standard DC reactor

4-3 Terminal connection diagram

- Please use shielded wires for analog input and output wires, contact input wire (digital multi-function input terminals). (The set values of functional terminals are factory preset values.)
- In order to prevent misoperation due to interference, during wiring, signal lines and power lines should be separated as much as possible (about more than 10cm).
- When using operation panel to operate the inverter, it can be realized simply through the main circuit wiring. (Without the need to operate from the outside or to input frequency instructions).
- Please connect MCCB (circuit breaker) etc. between the power supply and input terminal for circuit protection.
- When inverter protection function starts or other accident occurs, in order to cut off the inverter power supply to prevent further expansion of a fault or accident, please connect a MC (magnetic contactor) between the MCCB and the input terminal. And the MC connection location, if possible, shall be close to the inverter.

4-4 Composition of Main Circuit Terminals

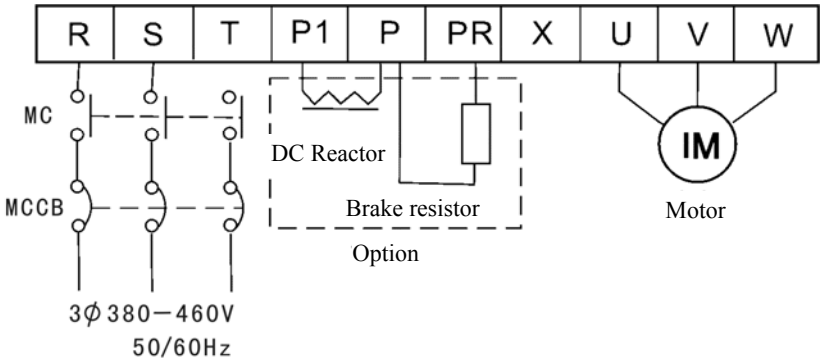
4-4-1 Description of Main Circuit Terminals

Terminal Symbol	Name	Description
R,S,T	Input power supply terminals	Terminals connected to a three-phase commercial power supply
U,V,W	Inverter output terminals	Terminals connected to a three-phase induction motor
P,P1	DC reactor connection terminals	Terminals connected to a DC reactor *1
P,PR	Brake resistor connection terminals	Terminals connected to a brake resistor between P-PR
P,X	DC side voltage terminals	Terminals connected to a brake unit P is the DC positive terminal, X the DC negative terminal
⏚	Ground terminal	Terminal for grounding of inverter casing

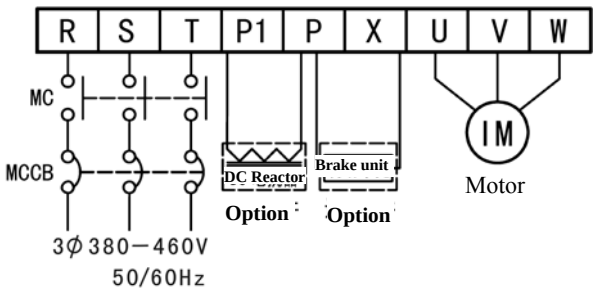
***1 When connecting the reactor, please remove the jumper between P1 and P.**

4-4-2 Connection Diagram of Main Circuit Terminals

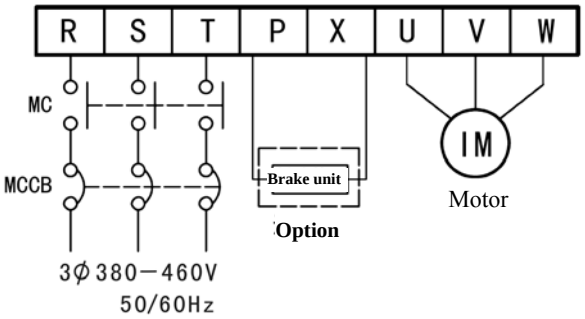
(1) VM06-0015~0110-*2/VM06-0015-0185-*4



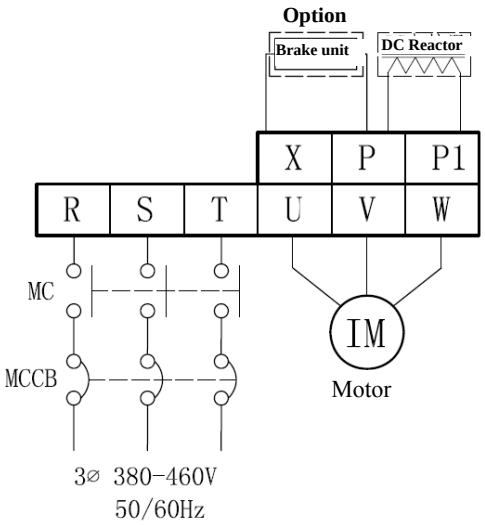
(2)VM06-0220~0370-*4



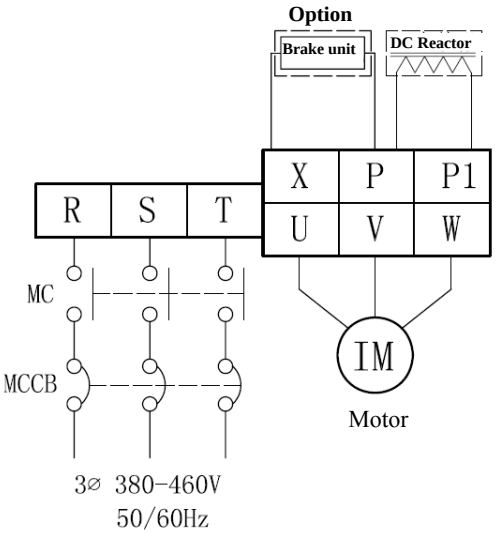
(3) VM06-0450~0900-*4



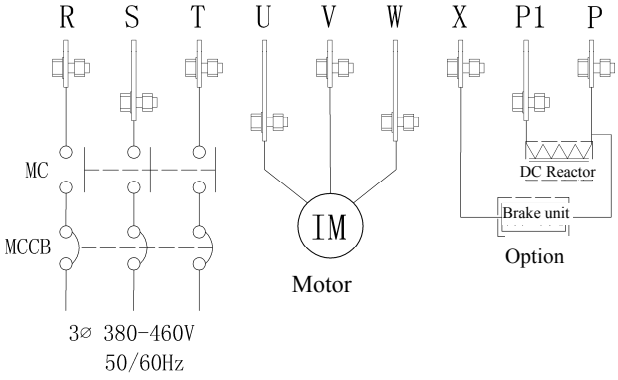
(4) VM06-1100~1320-*4



(5)VM06-1600~2200-*4



(6)VM06-2500~3150-*4



4-4-3 External brake resistor selection example

200V systems

Model	External brake resistor (recommended)		External brake resistor (limit value)	
	Resistance	Capacity ※1	Resistance	Capacity ※1
VM06-0015-*2	120Ω or more	150W	95Ω or more	150W
VM06-0022-*2	60Ω or more	300W	47Ω or more	300W
VM06-0037-*2	60Ω or more	300W	32Ω or more	450W
VM06-0055-*2	40Ω or more	400W	20Ω or more	750W
VM06-0075-*2	20Ω or more	800W	14Ω or more	1000W
VM06-0110-*2	20Ω or more	800W	10Ω or more	1500W

400V systems

Model	External brake resistor (recommended)		External brake resistor (limit value)	
	Resistance	Capacity ※1	Resistance	Capacity ※1
VM06-0015-*4	700Ω or more	100W	380Ω or more	150W
VM06-0022-*4	320Ω or more	200W	190Ω or more	300W
VM06-0040-*4	160Ω or more	400W	130Ω or more	500W
VM06-0055-*4	120Ω or more	600W	80Ω or more	800W
VM06-0075-*4	80Ω or more	800W	52Ω or more	1100W
VM06-0110-*4	60Ω or more	1000W	38Ω or more	1500W
VM06-0150-*4	40Ω or more	1500W	32Ω or more	1800W
VM06-0185-*4	40Ω or more	1500W	32Ω or more	1800W

***1 In this example, the maximum duty cycle of the brake resistor is assumed to be 10% ED.**
As shown in the example, to protect the brake resistor, F1115 (utilization rate of brake resistor) shall be set at 10% ED or less. When % ED needs to be set above 10 %, brake resistor capacity should be increased proportionally.
Example) When setting 20 % ED, the capacity should be doubled.

4-4-4 Capacities of MCCB and MC and Wire Size

200V systems

Model	MCCB (Leakage circuit breaker) [A]	MC (Electromagnetic contactor)		Main circuit							Control circuit	
		Rated current [A]	Rated making current [A]	Recommended wire size [mm^2]				Screw diameter	Tightening torque [N•m]	Max. wire size [mm^2]	Screw diameter	Max. wire size [mm^2]
				Input wire	P and P1 wires	Output wire	grounding wire					
VM06-0015-∗2	15	11	20	1.25(1.25)	1.25(1.25)	1.25(1.25)	5.5	M4	1.2	5.5	M3	1.25
VM06-0022-∗2	20	11	20	1.25(1.25)	1.25(1.25)	1.25(1.25)	5.5					
VM06-0037-∗2	30	17	32	2.0 (1.25)	2.0 (1.25)	1.25(1.25)	5.5					
VM06-0055-∗2	50	25	50	3.5 (1.25)	3.5 (2.0)	3.5 (1.25)	5.5					
VM06-0075-∗2	60	32	60	5.5 (3.5)	5.5 (3.5)	3.5 (2.0)	5.5	M5	2.0	14		
VM06-0110-∗2	75	50	80	14 (8)	14 (5.5)	8 (3.5)	5.5					

400V systems

Model	MCCB (Leakage circuit breaker) [A]	MC (Electromagnetic contactor)		Main circuit							Control circuit	
		Rated current [A]	Rated making current [A]	Recommended wire size [mm^2]				Screw diameter	Tightening torque [N•m]	Max. wire size [mm^2]	Screw diameter	Max. wire size [mm^2]
				Input wire	P and P1 wires	Output wire	grounding wire					
VM06-0015-∗4	10	7	20	2.0 (2.0)	2.0 (2.0)	2.0 (2.0)	5.5	M4	1.2	5.5	M3	1.25
VM06-0022-∗4	15	7	20	2.0 (2.0)	2.0 (2.0)	2.0 (2.0)	5.5					
VM06-0040-∗4	20	7	20	2.0 (2.0)	2.0 (2.0)	2.0 (2.0)	5.5					
VM06-0055-∗4	30	7	20	3.5 (2.0)	3.5 (2.0)	2.0 (2.0)	5.5					
VM06-0075-∗4	30	17	32	5.5 (2.0)	5.5 (2.0)	3.5 (2.0)	5.5					
VM06-0110-∗4	50	25	50	5.5(2.0)	5.5 (2.0)	5.5 (2.0)	5.5					
VM06-0150-∗4	60	25	50	8.0 (3.5)	8.0 (3.5)	8.0 (3.5)	14	M5	2.0	14		
VM06-0185-∗4	75	32	60	14(5.5)	14(5.5)	8.0(5.5)	14					
VM06-0220-∗4	100	48	80	14(5.5)	22(14)	8.0(5.5)	14	M6	2.0	22		
VM06-0300-∗4	125	65	100	22(14)	22(14)	8.0(5.5)	14					
VM06-0370-∗4	150	75	135	38(14)	22(14)	14(5.5)	14					
VM06-0450-∗4	150	75	135	22×2(22)		22(8)	22	M8	4.5	60		
VM06-0550-∗4	175	150	200	60(38)		22(14)	22					
VM06-0750-∗4	225	150	200	60(38)		38(14)	22	M8	4.5	80		
VM06-0900-∗4	250	150	200	60(38)		60(22)	22					
VM06-1100-∗4	250	180	260	100(60)	150(60)	100(60)	38	M10	18	150		
VM06-1320-∗4	300	180	260	150(60)	150(100)	150(60)	38					
VM06-1600-∗4	350	265	350	150(100)	200(100)	150(100)	38	M16	80	325		
VM06-2000-∗4	450	400	420	200(150)	325(150)	200(100)	38					
VM06-2200-∗4	500	600	660	250(150)	325(200)	250(150)	38					
VM06-2500-∗4	600	600	660	325(150)	150×2(200)	325(150)	60		100	-		

Model	MCCB (Leakage circuit breaker) [A]	MC (Electromagnetic contactor)		Main circuit							Control circuit	
		Rated current [A]	Rated making current [A]	Recommended wire size [mm^2]				Screw diameter	Tightening torque [N•m]	Max. wire size [mm^2]	Screw diameter	Max. wire size [mm^2]
				Input wire	P and P1 wires	Output wire	grounding wire					
VM06-2800-*4	600	600	660	150×2(200)	250×2(200)	150×2(200)	60	M16	100	-	M3	1.25
VM06-3150-*4	700	600	660	200×2(200)	250×2(200)	200×2(200)	60					

Note 1: The values for wires in the main circuit are for 600 V IV PVC-insulated wires (60ºC) when the inverter ambient temperature is 40ºC. The values in parentheses are for 600 V bridged-polyethylene insulated wires (90ºC).

Note 2: The maximum wire size indicates the maximum wire cross-sectional area that can be used with the terminal block.

Note 3: If possible, use thick and short conductors for grounding wire.

4-4-5 Mould Case Circuit Breaker (MCCB) selection example

200V system

Model	Motor Power	Without DC reactor		With DC reactor	
		Mould Case Circuit Breaker (MCCB)	Earth Leakage Circuit Breaker (ELB)	Mould Case Circuit Breaker (MCCB)	Earth Leakage Circuit Breaker (ELB)
VM06-0015-*2	1.5kW	NF32 15A	NV32 15A	NF32 15A	NV32 15A
VM06-0022-*2	2.2kW	NF32 20A	NV32 20A	NF32 15A	NV32 15A
VM06-0037-*2	3.7kW	NF32 30A	NV32 30A	NF32 20A	NV32 20A
VM06-0055-*2	5.5kW	NF50 50A	NV63 50A	NF50 40A	NV63 40A
VM06-0075-*2	7.5kW	NF63 60A	NV63 60A	NF50 50A	NV63 50A
VM06-0110-*4	11kW	NF100 75A	NV125 75A	NF100 75A	NV125 75A

400V system

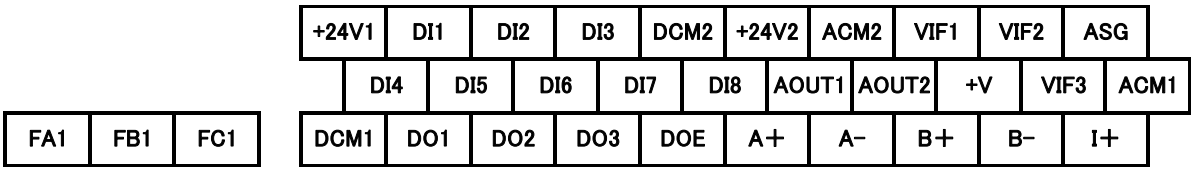
Model	Motor Power	Without DC reactor		With DC reactor	
		Mould Case Circuit Breaker (MCCB)	Earth Leakage Circuit Breaker (ELB)	Mould Case Circuit Breaker (MCCB)	Earth Leakage Circuit Breaker (ELB)
VM06-0015-*4	1.5kW	NF32 10A	NV32 10A	NF32 10A	NV32 10A
VM06-0022-*4	2.2kW	NF32 15A	NV32 15A	NF32 10A	NV32 10A
VM06-0040-*4	4.0kW	NF32 20A	NV32 20A	NF32 15A	NV32 15A
VM06-0055-*4	5.5kW	NF32 30A	NV32 30A	NF32 20A	NV32 20A
VM06-0075-*4	7.5kW	NF32 30A	NV32 30A	NF32 30A	NV32 30A
VM06-0110-*4	11kW	NF50 50A	NV63 50A	NF50 40A	NV63 40A
VM06-0150-*4	15kW	NF63 60A	NV63 60A	NF50 50A	NV63 50A
VM06-0185-*4	18.5kW	NF100 75A	NV125 75A	NF63 60A	NV63 60A
VM06-0220-*4	22kW	NF100 100A	NV125 100A	NF100 75A	NV125 75A
VM06-0300-*4	30kW	NF125 125A	NV125 125A	NF100 100A	NV125 100A
VM06-0370-*4	37kW	NF250 150A	NV250 150A	NF250 125A	NV125 125A
VM06-0450-*4	45kW	-	-	NF250 150A	NV250 150A
VM06-0550-*4	55kW	-	-	NF250 175A	NV250 175A
VM06-0750-*4	75kW	-	-	NF250 225A	NV250 225A
VM06-0900-*4	90kW	-	-	NF250 225A	NV250 225A
VM06-1100-*4	110kW	-	-	NF250 225A	NV250 225A
VM06-1330-*4	132kW	-	-	NF400 400A	NV400 400A
VM06-1600-*4	160kW	-	-	NF400 400A	NV400 400A
VM06-2000-*4	200kW	-	-	NF400 400A	NV400 400A
VM06-2200-*4	220kW	-	-	NF630 500A	NV630 500A
VM06-2500-*4	250kW	-	-	NF630 600A	NV630 600A
VM06-2800-*4	280kW	-	-	NF630 600A	NV600 600A
VM06-3150-*4	315kW	-	-	NF800 700A	NV800 700A

4-5 Composition of Control Circuit Terminals

4-5-1 Wire size and terminal arrangement

Terminal screw diameter: M3
Recommended wire size 0.75 [mm^2]
Tightening torque: 0.5[N•m]

The arrangement of control circuit terminals is as shown in the following.



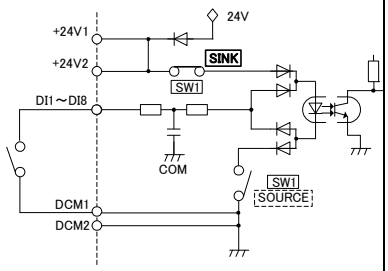
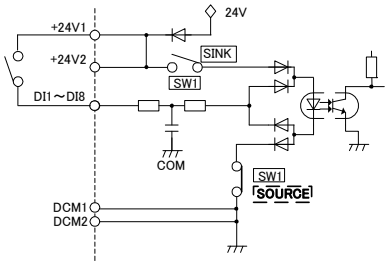
- The common end of control circuit terminals shall not be grounded to the earth. In addition, DCM1/DCM2 shall not be in common use with ACM1/ACM2. (Because they are insulated with each other).

- Use shielded wires for wiring connected to the control circuit terminals, and connect one end of the shielding to each common terminal or dedicated terminal, and leave the other end open. (refer to 4-3 Terminal connection diagram).

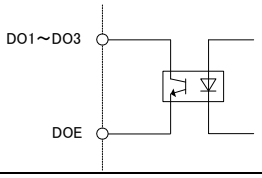
- Do not input the voltage to multifunctional terminals (DI1-DI8).

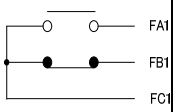
4-5-2 Functions of Control Circuit Terminals

Table 4-3 Description of Control Circuit Terminals

Type	Terminal Symbol	Terminal Name	Function Description	Rated Specification	Notes
Contact input	DCM1 DCM2	Digital signal common terminals	Common terminals for digital input and output signals and for +24V1 and +24V2 power supplies	Total current consumed: 100mA or less	
	DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8	Digital multifunctional input terminals	(1) The functions selected can be set through function codes F1414-F1421. (2) Input mode and SINK/SOURCE can be switched through SW1. <SINK connection>  <SINK connection>  	Input resistor: about 6.6 kΩ When short-circuited: about DC3-5mA <For SINK connection> (1) Signal input “on” by short-circuiting either DCM1 or DCM2. (2) Signal input “off” by opening either DCM1 or DCM2. <For SOURCE onnection> (1) Signal input “on” by short-circuiting either +24V1 or +24V2. (2) Signal input “off” by opening either +24V1 or +24V2.	
Analog input	ACM1 ACM2	Analog signal common terminals	Common terminals for analog input and output signals	Total current consumed: 100mA or less	
	ASG	Analog signal shield common terminals	Shielding layer connected to analog signal wire		ACM1 is interconnected with ACM2 internally.
	+V	Analog input potentiometer wiring terminal	Connected to a potentiometer of 5kΩ 0.3W of above (It can not be connected to any element other than the potentiometer)	DC10-14V	Unable to provide power supply

	VIF1 VIF2 VIF3	Analog input terminals	(1) By selecting a function code corresponding to each function, current / voltage of the 3 channels can be switched separately. (2) When the frequency setting is selected, the current / voltage input can be determined by setting the contents of F1002. (3) When carrying out frequency setting through voltage input, set the gain frequency corresponding to 5V or 10V with voltage input. When "External analog forward / reverse run" is selected, set the gain frequency corresponding to 10V (5+5V) or 0V (5-5V) with external analog value. (4) When carrying out frequency setting through current input, set the gain frequency corresponding to 20mA.	For voltage input: input resistor: about 34 kΩ Maximum allowable voltage: DC12V For current input: input resistor: about 250 kΩ Maximum allowable current: 30mA	
Pulse input	A+ A-	Pulse power supply input + side Pulse phase A input - side	PG's pulse input signal Open collector / push-pull input phase A		
	B+ B-	Pulse phase B input + side Pulse phase B input - side	PG's pulse input signal (+ side and – side) Open collector / push-pull input phase B		

Type	Terminal Symbol	Terminal Name	Function Description	Rated Specification	Notes
power supply	+24V1 +24V2	Power supply output	(1) Supply DC24V power to the user (2) The common terminal is DCM1 or DCM2 (+24V1 and +24V2 are the same power supply)	Power supply voltage: DC48V Maximum allowable overload current: 150 mA in total	Please pay full attention to the short-circuit of power supply, etc..
Digital output	DOE	Multifunctional output common terminal	This terminal is DO1 - DO3 shared common terminal	Allowable load: DC48V,50mA	The so-called power-on state means that the open collector output transistor is ON (conducting state).
	DO1 DO2 DO3	Multifunctional output terminals	(1) Open collector output (2) Send signals through functions selected by function codes 		
Analog output	AOUT1 AOUT2	Analog output terminals	(1) Select a output item from F1501 (AOUT1) or F1504 (AOUT2) or analog output. (2) The signal output can be adjusted by F1502 (AOUT1) or F1505 (AOUT2), and the output coefficient varies from 0 - 20. (3) This common terminal is shared by ACM1 and ACM2.	Signal output: DC0-10V Maximum allowable current: 15mA	If the output current increases, the output voltage will decrease. In this case, the signal output can be adjusted using output coefficient.
Current output	I+ ACM1	Current output terminals	(1) The current proportional to output frequency of the inverter passes through between I+, ACM1 or ACM2 terminals. (4-20mA) (2) The current output coefficient is adjustable between 0-20 through F1515.	Current output range: 4-20mA Load resistance: 500Ω or less	(1) Adjust F1515 so that the current output under maximum output frequency is 20mA or below. (2) Please select load resistance of 500Ω or below.
Communication terminal	TX1+ TX1-	RS485 inverter signal sending terminals	The terminals are used for sending communication signals by inverter. • TX1+ and TX2+ are terminals with the same function, and so are TX1- and TX2-. When communicating with several inverters, they can be used as other connection terminals of a inverter.	Communication speed for RS485 full-duplex communication mode: 1200-57600bps Total length: 500m ※ If switch SW2 is connected, then the terminating resistor 100Ω will be connected.	(1) TX1+ is interconnected with TX2+ internally. (2) TX1- is interconnected with TX2- internally.
	TX2+ TX2-				
	RX1+ RX1-	RS485 inverter signal receiving	The terminals are used for receiving communication		(1) RX1+ is interconnected with RX2+ internally.

	RX2+ RX2-	terminals	signals by inverter. • RX1+ and RX2+ are terminals with the same function, and so are RX1- and RX2-. When communicating with several inverters, they can be used as other connection terminals of a inverter.		(2) RX1- is interconnected with RX2- internally.
	SG	RS485 communication common terminal	This is a RS485 communication common terminal. Connected to SG terminal of each communication device.		There is a terminal in each of TX and RX terminals
Contact output	FA1 FB1 FC1	Abnormal alarm signal output and multifunctional contact output  	(1) These contact output terminals indicate that the protective function has stopped the inverter. (2) F1513: multifunctional contact outputs according to the relay 1 contact output setting.	Contact capacity AC250V/0.3A Alarm contact setting: FA1,2-FC1,2 open Abnormal: FA1,2-FC1,2 closed	
	JP1	Upgrade jumper	Do not connect anything to this terminal except when upgrading.		

4-5-3 Multifunctional Input / Output

The so-called multifunctional input / output means freely assigning various functions to multifunctional input / output terminals through the data selection of function codes.

The multifunctional input / output is divided into the input terminal of contact input and output terminal of open collector.

(1) Multifunctional input terminals

Digital multifunctional input terminals DI1 - DI8 can be set to any one of the functions by using the function codes F1414 - F1421 corresponding to various functions.

In addition, a multiplexed terminal may have several functions.

When the function code is set to F1414=13, for example, jog operation can be enabled simply by turning the DI1 terminal on.

Table 4-4 Multifunctional input codes

Function code No.	Input terminal name	Data range	Initial value (symbol)
F1414	DI1	0-255	1 (FR）
F1415	DI2		2 (RR)
F1416	DI3		3 (2DF)
F1417	DI4		4 (3DF)
F1418	DI5		5 (MBS)
F1419	DI6		6 (ES)
F1420	DI7		7 (RST)
F1421	DI8		8 (AD2)

- See description of selection functions of the input terminals DI1 - DI8 for details.

(2) Multifunctional output terminals

Digital multifunctional output terminals DO1-DO3 can be set as the open collector outputs of any one of the functions by using the function codes F1509 - F1511 corresponding to various functions.

Table 4-5 Multifunctional output codes

Function code No.	**Input terminal name**	**Data range**	**Initial value (function)**
F1509	DO1	0-99	1 (In operation 1)
F1510	DO2		5 (Frequency matching)
F1511	DO3		8 (Overload alarm level setting)

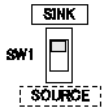
- See description of selection functions of D01 - D03 for details.

4-5-4 Control logic switching

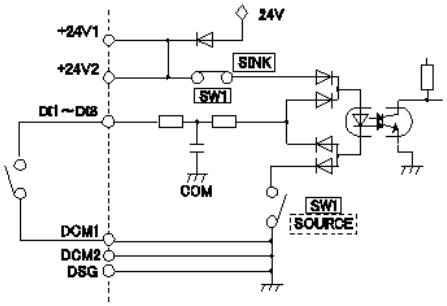
Through the switching of switches on the main control board, multifunctional input terminals DI1 - DI8 can be switched between SINK and SOURCE. When switching, use switch SW1 on the main control board.

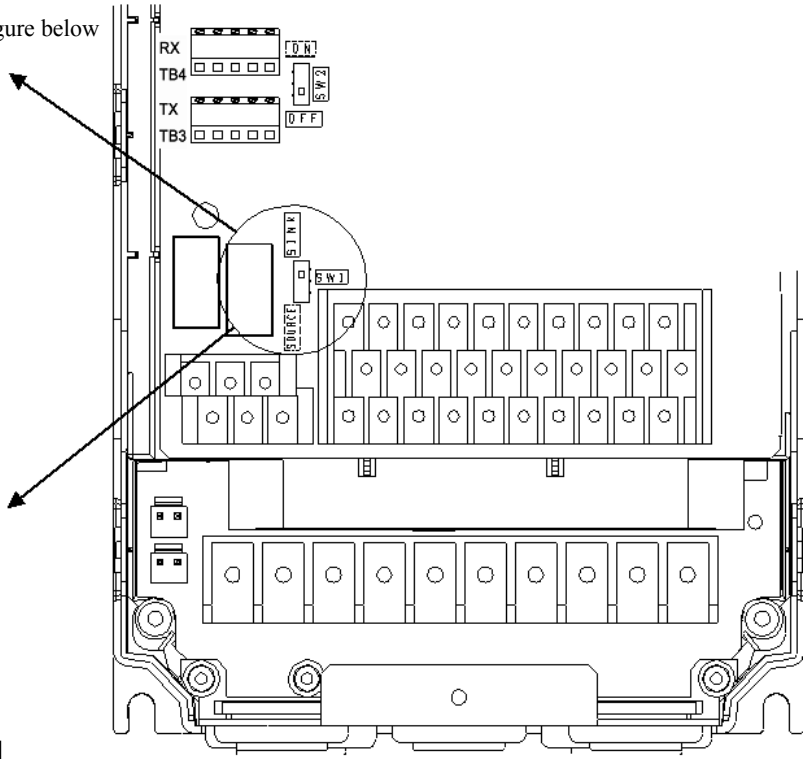
- The so-called SINK connection refers to the logic that when curren flows from the signal input terminal, the signal will be ON (connected).
  For contact input signal, DCM1/DCM2 is a common terminal.
- The so-called SOURCE connection refers to the logic that when current flows into the signal input terminal, the signal will be ON (connected).
  For contact input signal, +24V1/+24V2 is a common terminal.

- **SINK connection (initial state)**

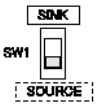


Wiring connection as shown in the figure below

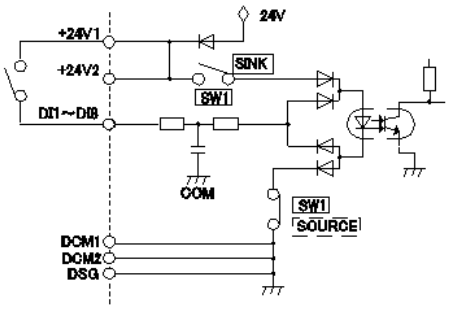




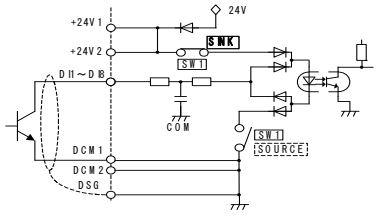
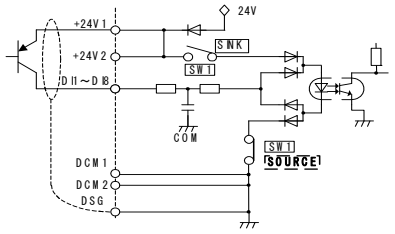
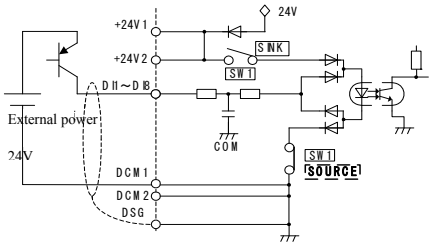
- **SOURCE connection**



Wiring connection as shown in the figure below



- **When the transistor is used for external control signals, please set and wire transistors of different types as shown in the following table.**

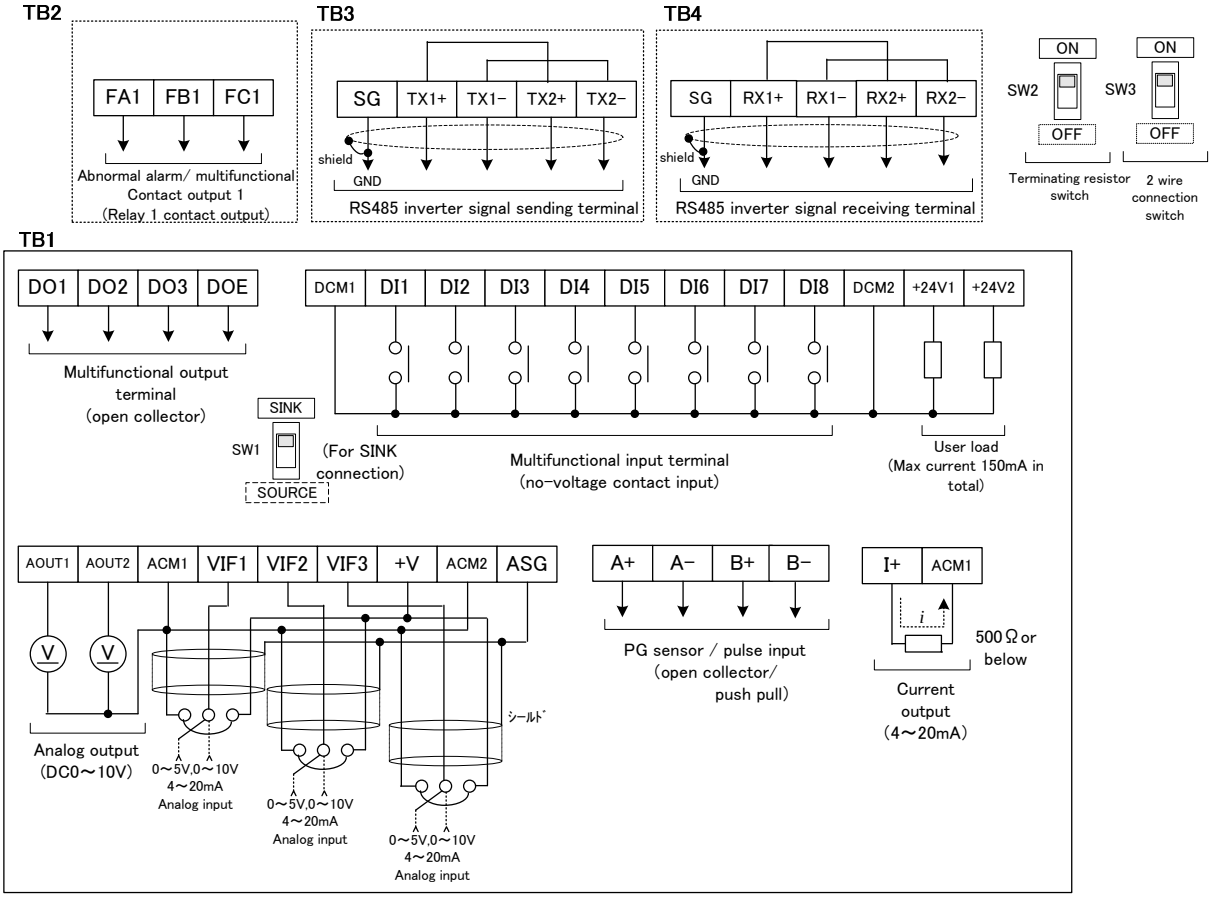
Transistor	Using internal power supply of the inverter	Using external 24V power supply (※)
NPN Type	Set SW1 as SINK 	Unable to connect
PNP Type	Set SW1 as SOURCE 	Set SW1 as SOURCE 

***Please do not connect the inverter's power supply (+24V1 or +24V2) to the external power supply.**

Note: Do not switch the switches in power-on state.

4-5-5 Connection of Control Circuit Terminals

Figure 4-1 Connection Diagram of Control Circuit Terminals



1) Potentiometer for frequency setting

- Please install a 5kΩpotentiometer of 0.3w or above, set the 1st speed frequency and select the frequency settings of current and voltage by selecting function code F1002.
- Please use shielded wires for wiring, please connect one end of the control terminal shield to the shield terminal ASG, while leave the other end open.
- They can be connected to the potentiometer respectively, the power supply terminal of the potentiometer is the + V common terminal.

  The + V terminal can not provide power to the external as it is not a terminal used for supplying power. It is a dedicated terminal used for connecting the specified potentiometer.

2) Multifunctional output (open collector output)

- The figure below shows an example of using multifunctional output terminals D01 to D03.

  ***When using a relay, be sure to install a surge suppressor (reverse-parallel connected diode).**

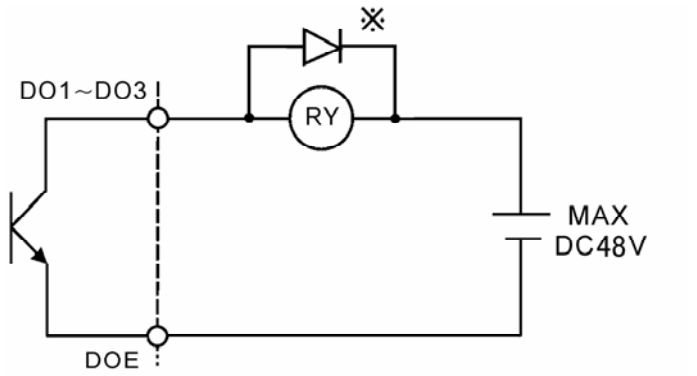


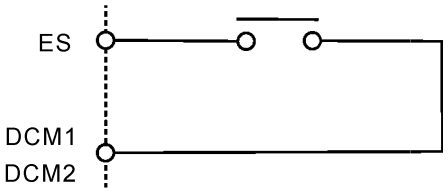
Figure 4-2 Example of using multifunctional output (open collector output)

Note: The maximum output current of the multifunctional output is 50 mA.

3) Signal mode switching for emergency stop (multifunctional input ES terminal)

- The figure below shows an example of signal switching when the multifunctional input terminal is set for the external emergency stop (ES) command.
- A signal action is selected using the function code F1413: ES input terminal function.

● When the "normally open" signal is input: F1413=1



● When the "normally closed" signal is input: F1413=2

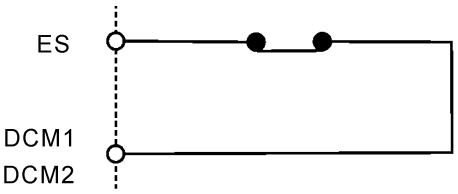
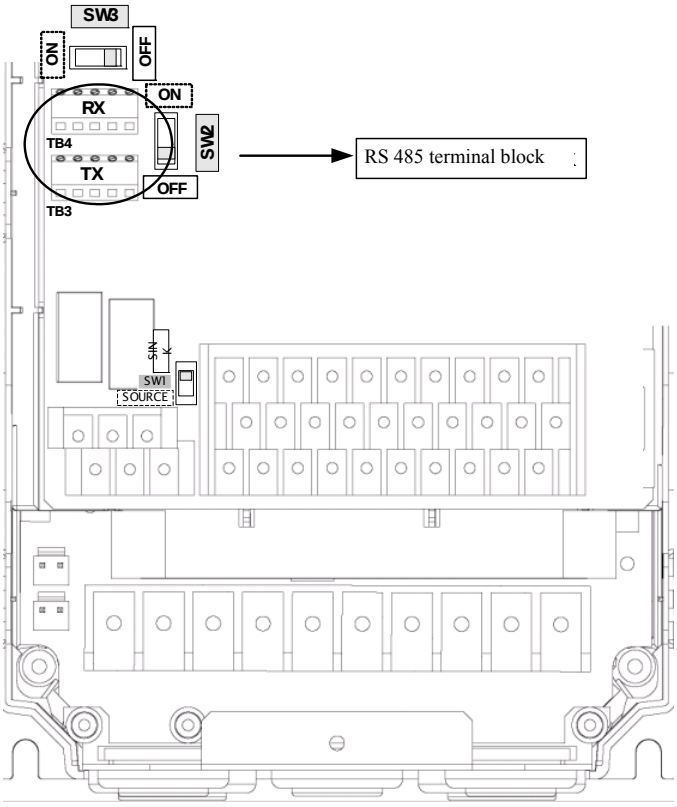


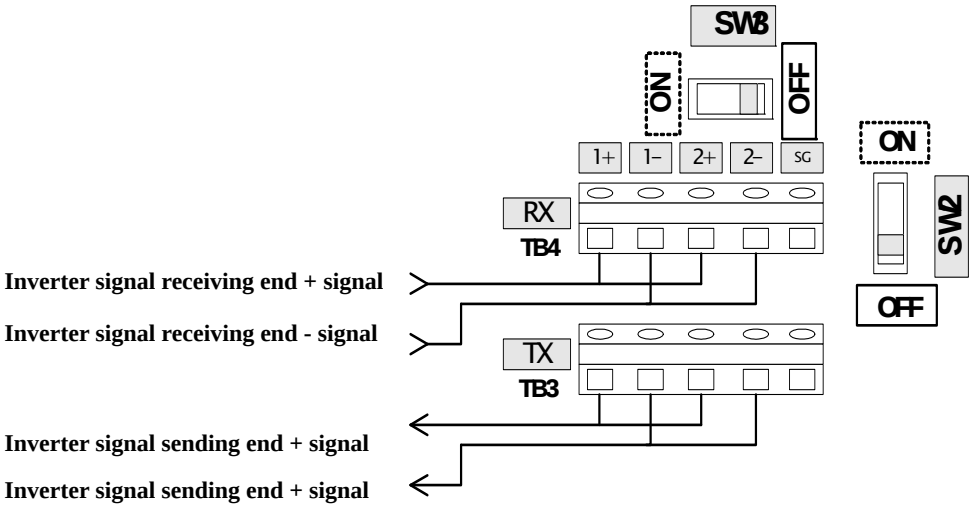
Figure 4-3 ES terminal signal mode switching

4-5-6 Communication function terminal



1) RS485 communication

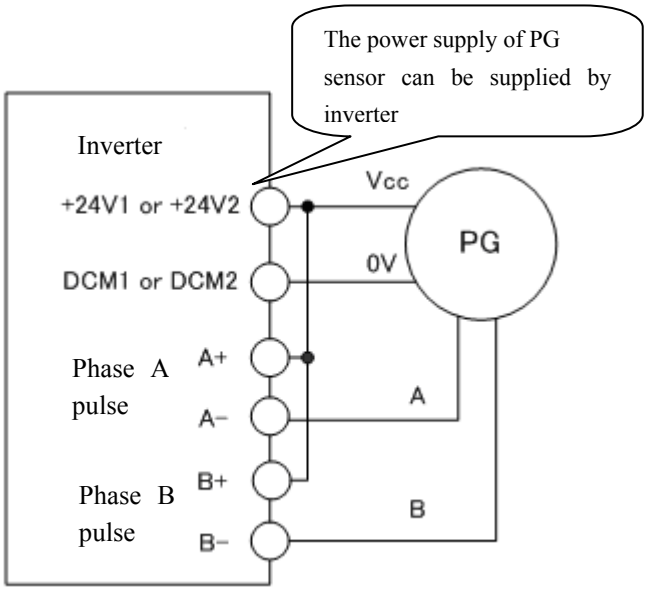
- The communication control with peripheral devices can be realized by using RS485 communication terminal block on the following main control board.
- SW2 is a switch for turning ON / OFF the terminating resistor. Please set only the farthest terminating resistor switch of the inverter to ON. (Factory preset= OFF: terminating resistor OPEN).



Note: Please refer to Description of Communication Functions for details of the communication functions.

4-5-7 Connection of PG sensor

1) Connection example when the control terminal of main control board is used (open-collector mode)

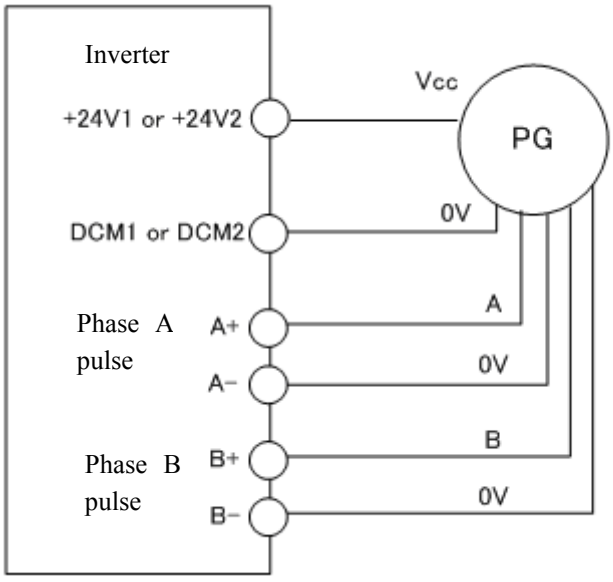


*1: Set function code F8109 (PG: PG switching) to 1.

*2: Both phase A pulse and phase B pulse can be input.

*3: Please use as shown in the example above when the power supply of PG sensor is 24V. And, as shown in the connection diagram, using the inverter to provide 24V power supply eliminates the need for an external power supply.

2) Connection example when the control terminal of main control board is used (push-pull mode)



*1: When the power supply of PG sensor is 24V, the inverter can be used for supplying 24V power to the user.

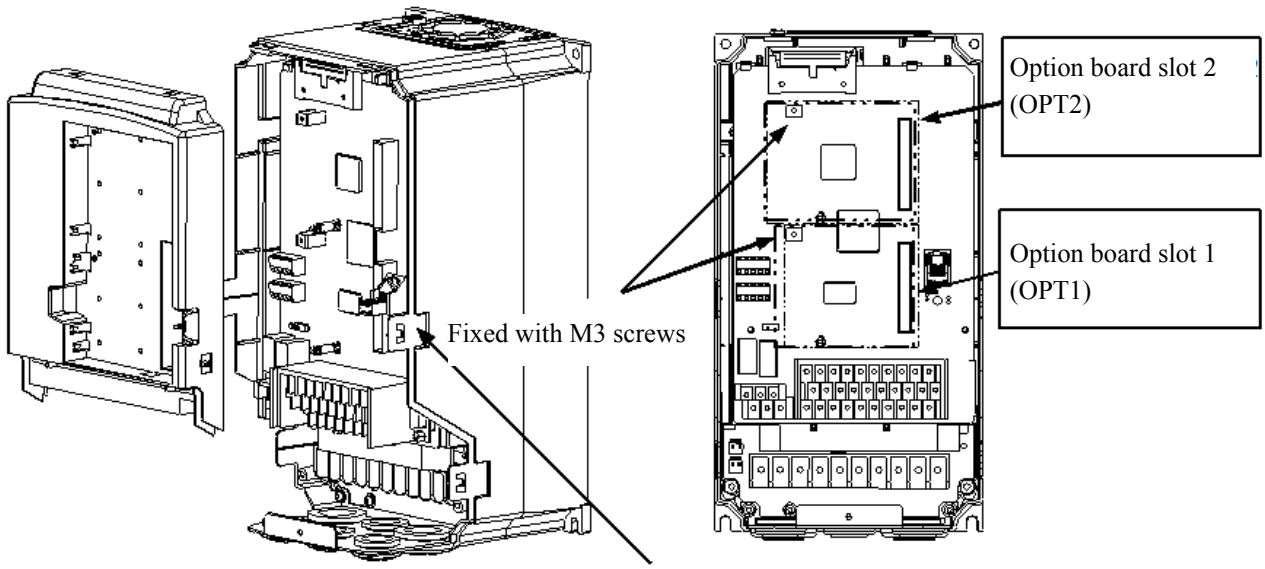
4-6 Installation and Wiring of Option Board

4-6-1 Overview of Option Board

- 2 option boards can be installed on one inverter at the same time.
  2 slots are provided in the inverter, but the shape of option board may vary between different option boards.
  Insert each option board to the specified slot.
  And sometimes, combination state of the option board may also have impacts on installation and functions.
  See the instruction manual of each option board for detailed functions of each option board.

4-6-2 Installation method of Option Board

Remove the front cover (upper) before installing or removing an option board.
After the front cover (lower) has been removed, pull the cover toward you while pressing the sunk parts on both sides of the front cover (upper), and the front cover (upper) will be removed.



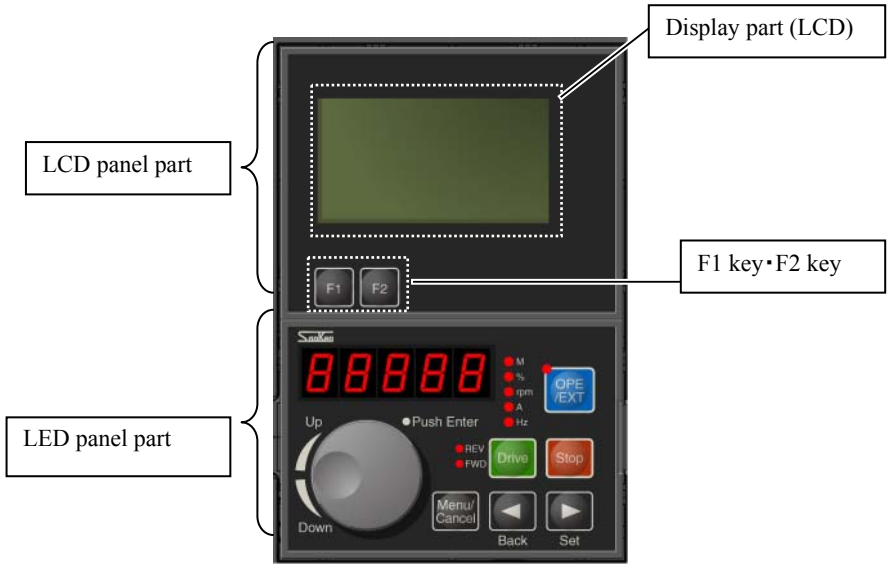
When inserting an option board into the slot, check if the connection of mainframe side connector with the option board side connector is firm and reliable.
After the option board has been installed, fix the option board with attached screws (M3).
Shielded wires shall be used for wiring connected to terminals, with each common terminal connected to the shield.
Wiring shall be carried out according to the instruction manual of each option board.

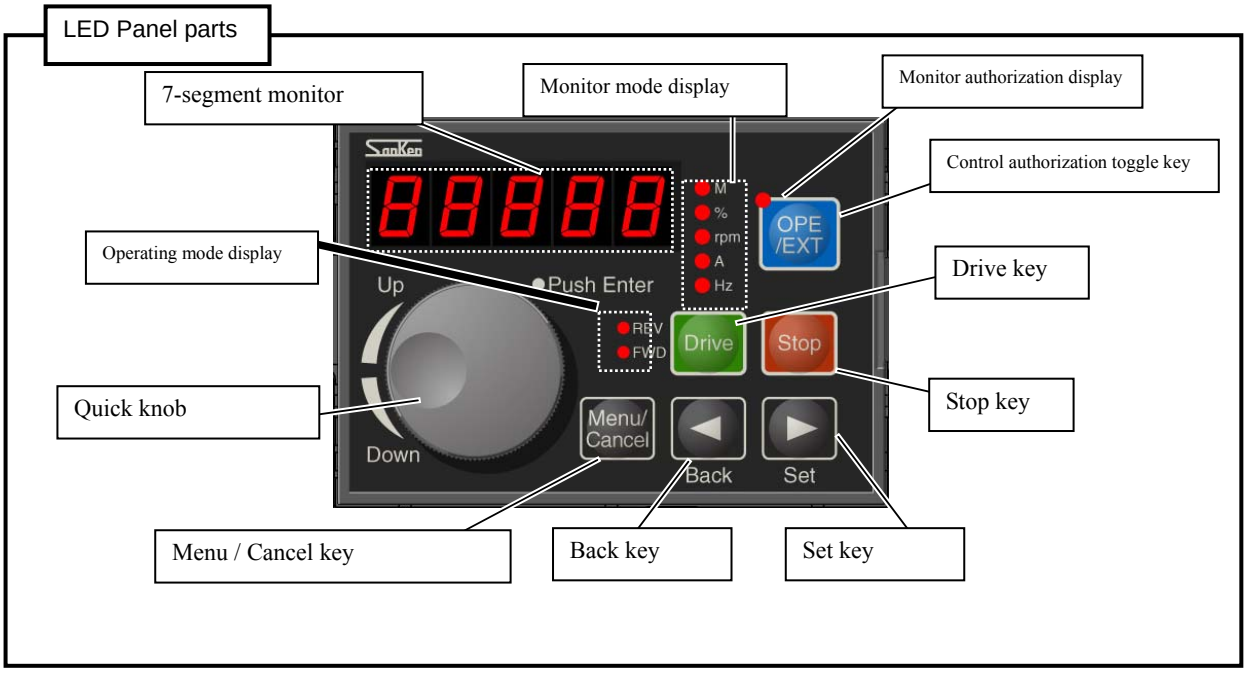
4-6-3 Auxiliary Power Supply Option

Auxiliary power supplies (control circuit power supply) can be used as factory option configuration for VM06-1100 above models. With the auxiliary power supply board, the control power supply can be separately supplied, alarm display contents can be confirmed even if the main circuit power supply fails.

5. Operation Panel

5-1 Names and Functions of Parts of the Operation Panel





*The LCD panel may have different configurations depending on varieties of the inverter.

5-1-1 LCD display part of the operation panel

The LCD display is a part of the LCD monitor. In conjunction with 7-segment monitor, the operation status and the function code settings etc. can be indicated. See 5-2-2 for display contents.

5-1-2 LCD operation part

Key Name	Key mark	Function Summary
F1 key	F1	Switch the LCD display interface to the previous page.
F2 key	F2	Switch the LCD display interface to the next page.

*Depending on display contents, sometimes the interface can not be switched.

*Sometimes the interface displayed automatically returns to the initial interface due to operation on the operation panel or alarm.

5-1-3 LED display part

Display	Display contents
7-segment monitor	Frequency, output current, speed, load factor monitoring display, alarm contents, warning contents, operation error, function code number, function code settings and so on.
Monitor mode display	The unit of numerical values displayed by the 7-segment monitor.
Operation mode display	The operation status of inverter (forward running, reverse running, stop, frequency lock).
Control authorization display	Whether the operation command sent from the operation panel is active or not.

5-1-4 LED operation part

(1) Key operation

Key Name	Key Mark	Function Summary
Drive key	Drive	• Starts forward or reverse running operation.
Stop key	Stop	• Stops operation. • Can be used for releasing alarm signal in alarm condition.
Menu / Cancel key	Menu/ Cancel	• In Status Display mode, changes the Status Display mode to Function Code Display mode.
		• In Function Code Display mode, returns to the menu state of previous page.
Set key	Set	• In Status Display mode, changes contents displayed on the 7-segment monitor.
		• In Function Code Display mode, confirms the value input.
Back key	Back	• In Status Display mode, changes display contents of the 7-segment monitor.
		• In Function Code Display mode, returns to the menu state of previous page.
Control authorization toggle key	OPE /EXT	• Toggles the operation control authorization.

(2) Quick knob operation

Operation Name	Operation Indication	Function Summary
Turning (clockwise)		The value displayed by 7-segment monitor increases.
Turning (counter-clockwise)		The value displayed by 7-segment monitor decreases.
Pressing	(press)	Confirm the value displayed by 7-segment monitor.

5-2 Switching of Statuses

The operation panel has two display modes: [Status display mode] and [function code display mode], and the modes can be toggled by pressing the key Menu/Cancel.

Table 5-1 7-segment monitor display modes

Display Mode	Display Contents
Status Display	• The inverter status during operation • stop (such as frequency, output current, speed, load factor, monitoring display, alarm and warning contents)
Function Code Display	Function code No. and data

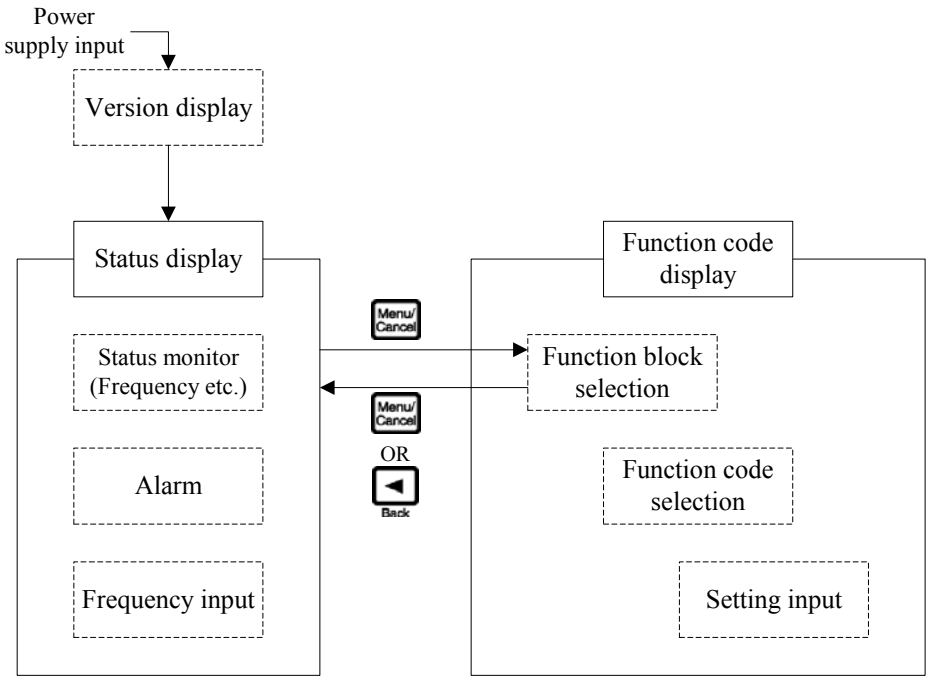


Figure 5-1 Status transition diagram (summary)

5-3 Status Display Mode

In status display mode, inverter status monitoring, alarm display, setting of output frequency and operations such as running and stop of inverter can be implemented.

5-3-1 Version display

Shortly after the power-on of the equipment, the software version of inverter will be displayed on 7-segment monitor. The following is: display example for software version: VER 1.00.



If, for some reason, the host can not communicate with the operation panel when connected to the power, the 7-segment monitor will display the software version of the operation panel. Now the monitor displays

5-3-2 Inverter status mode

The inverter status mode will be displayed.

In the operation mode display, various operation and stop states of the inverter are displayed.

Table 5-2 Display contents of operation mode

Operation Status	Display Contents
Stopped	● REV ● FWD
Forward running	● REV ○ FWD
Deceleration to stop from forward run Forward run waiting DC braking (forward)	● REV ◐ FWD
Reverse running	○ REV ● FWD
Deceleration to stop from reverse run Reverse run waiting DC braking (reverse)	◐ REV ● FWD
Frequency locking	○ REV ○ FWD
Position control running (Zero-servo running)	◐ REV ◐ FWD

○ Lit ◐ Flashing ● Unlit

Monitor mode display refers to the contents displayed on the 7-segment monitor

Table 5-3 Display contents of monitor mode

Display Contents	Unit	Display Contents	Display of 7-segment Monitor
Frequency	Hz	○Hz ●A ●rpm ●% ●M	Running: the lit lamp indicates output frequency Stopped: the flashing lamp indicates set frequency
Output current	A	●Hz ○A ●rpm ●% ●M	Running: the lit lamp indicates output current Stopped: the flashing lamp indicates 0.0
Speed	rpm	●Hz ●A ○rpm ●% ●M	Running: the lit lamp indicates speed (*1) Stopped: the flashing lamp indicates speed (*1)
Load factor	%	●Hz ●A ●rpm ○% ●M	Running: the lit lamp indicates load factor Stopped: the flashing lamp indicates 0.0
Status monitor display (No unit)	-	●Hz ●A ●rpm ●% ○M	Running: the lit lamp indicates the value selected by F1202 Stopped: the flashing lamp indicates the value selected by F1202

○ Lit ◐ Flashing ● Unlit

*1 Depending on the motor control modes, the display contents may be somewhat different. The display contents are as shown in Table 5-4

Table 5-4 Display contents of speed

Motor control mode	Running	Stopped
Sensorless vector control	Estimated speed of motor	0
Others （V/f, vector etc.）	Detecting speed of PG sensor	Detecting speed of PG sensor

During the inverter's status monitoring display, display contents of 7-segment monitor are shifted every time when the ◄ (Back) key or ► (Set) key is pressed. Display contents of 7-segment monitor can also be shifted through function codes. See the function code F1201 in [7-3 Description of Functions] for details.

Key	Switch action
◄ Back	Display in order of: frequency → output current → speed → load factor → status monitor display → frequency → …
► Set	Display in order of: frequency → status monitor display → load factor → speed → output current → frequency → …

During selection of an operation command from an external terminal or from communication through the function code, as the [OPE/EXT] key is pressed, running operation can be carried out instantly by the operation panel.
Each time the [OPE/EXT] key is pressed, the [operation command from the operation panel] and the [operation command from an external terminal or communication] will be interchanged.
Control authorization is indicated by a lit lamp where the running operation is controlled by operation panel.

Table 5-5 Control authorization displays

Operation Command	Control authorization display
Operation Panel	○
External terminal / communication	●

○ Lit ◐ Flashing ● Unlit

*See the function code F1101 in [7-3 Description of Functions] for details of the operation command from an external terminal / operation command from communication.
*Sometimes this function is not available if set through the inverter's function code.

5-3-3 Alarm display

When the alarm has stopped, the type of alarm will be displayed on the 7-segment monitor of the inverter. At this point, the monitor mode displays that all the LEDs are flashing. See [8-4 Alarm Status] for the details of alarm display.

Display Contents	Monitor mode display	7-segment Monitor Displays
Alarm display	◐Hz ◐A ◐rpm ◐% ◐M	The type of an alarm is indicated by the lit lamp

○ Lit ◐ Flashing ● Unlit

*During alarm display, the display on 7-segment monitor can not be switched even by pressing [Back] key or [Set] key.
*During alarm display, pressing [Menu/Cancel] key can switch current display to function code display mode.

5-3-4 Frequency input

The frequency setting of the inverter can be input by using the quick knob with one of the following two methods.

(1) Frequency setting A

Turn the quick knob, and press when the required frequency is obtained, thus the frequency is changed. This is the method of frequency setting A.

- This is an effective method for setting a desired frequency.
- Cancellation can be made during frequency setting.
- In status monitor display, the method of frequency setting A can be used either during in running or stopping stopped state of the equipment.
- This method can not be used during alarm display.

Operation example: changing from 5 Hz to 50 Hz

Operation	Display	Description
	5.00 or 5.00	Display of status monitor (frequency display)
(press)	5.00	Press the quick knob, and the current set frequency will be displayed
	5.00 ⇒ 5.01 ⇒ 5.02 ⇒…	Turn the quick knob, and the value displayed will increase or decrease.
	5.02 ⇒ 6.02 ⇒ 7.02 ⇒…	Quickly turn the knob, and the displayed digit number of increase or decrease will be changed.
	50.00	The frequency desired will be displayed.（※1）
Set or (press)	50.00 or 50.00	Press the Set key or quick knob, then the set value will be stored as a new frequency value. And the interface will return to status monitor display mode. If this is done during running operation, then the output frequency will start to change to the newly set value.

50.00 **:Lit** 50.00 **:Brightness periodically changes** 50.00 **: Flashing**

*1 If it is not necessary to set frequency, press Back key or Menu/Cancel key to return to the status monitor display mode.

(2) Frequency setting B

Frequency setting B is a method for changing frequency by dialing the quick knob each time.

- This is an effective method for fine-tuning of the set frequency during observation of the load conditions.
- In status monitor display, this method can be used either in running or stopped state of the equipment.
- This method can not be used during alarm display.

Operation example: changing the frequency from 5 Hz to 50 Hz

Operation	Display	Description
	5.00 or 5.00	Display of status monitor (frequency display)
(long press)	5.00	Press the quick knob, and the current set frequency will be displayed
	5.00 ⇒ 5.01 ⇒ 5.02 ⇒…	Turn the quick knob, and the value displayed will increase or decrease. The frequency changed by turning the quick knob will be stored immediately as a new frequency value. If this is done during running operation, then the output frequency will start to change to the newly set value.
	5.02 ⇒ 6.02 ⇒ 7.02 ⇒…	Quickly turn the knob, and the displayed digit number of increase or decrease will be changed.
	50.00	The frequency desired is reached.
Set or (press)	50.00 or 50.00	Press the Set key or quick knob, then the display screen will return to status monitor display. Also, the display screen will return to the status monitor display if the quick knob is not operated in seconds (* 1). (*2)

50.00 :Lit 50.00 : Brightness periodically changes 50.00 : Flashing

*1 Under no-operation condition, the time before the display screen returns to status display can be changed through function codes, see the contents of function code F1607 in [7-3 Description of Functions].

*2 Although the display can be switched back to the status monitor display through Back (Back) key or Menu/Cancel key, the set frequency is still active.

5-4 Function code display mode

Function code display mode can be used to set various functions of inverter.

5-4-1 Status transition diagram

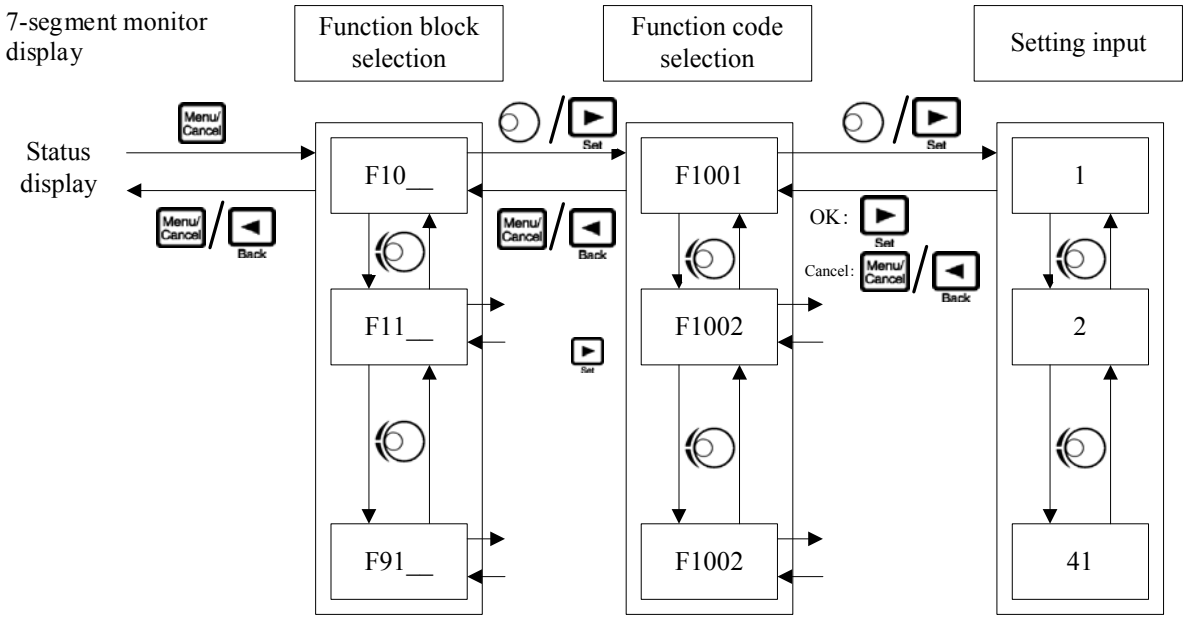


Figure 5-2 Function code display mode transition diagram

5-4-2 Basic operation

The basic operation is used for changing the value of a function code.

Operation example: setting F1414=10

Operation	Display	Description
	50.00 or 50.00	Display of status monitor (frequency display)
Menu/Cancel	F 10_ _	Pressing the Menu/Cancel key shows the function block selection
	F 10_ _ ⇒ F 11_ _ ⇒ F 12_ _ ⇒···	Turn the quick knob, then the function block number will change accordingly.
	F 14_ _	Select the target function module.
Set or (press)	F 1401	Press the Set (Set) key or quick knob, then the selected function code will be displayed
	F 14 14	By turning the quick knob, you can select the target function code.
Set or (press)	1	Press the Set (Set) key or quick knob, and the set value of function code will be displayed.
	10	Turn the quick knob, and select the new settings
Set	F 14 14	Press the Set (Set) key to confirm the new setting, and the display screen will return to function code selection. (※1)
Back or Menu/Cancel	F 14_ _	Press the Set (Set) key or Menu/Cancel key, and the display screen will return to function code selection.
Back or Menu/Cancel	50.00 or 50.00	Press the Back (Set) key or Menu/Cancel key, and the display screen will return to status monitor mode.

*1 If a new value is not required, the display can be switched back to the function code selection interface through Back (Back) key or Menu/Cancel key.

5-4-3 Confirming operation

For some function codes, operation needs to be re-confirmed to prevent data rewriting due to misoperation.

Operation example: setting F1001=10

Operation	Display	Description
	50.00 or 5000	Display of status monitor (frequency display)
Menu/Cancel	F 10_ _	Press the key, the screen will display function block selection
	F 10_ _	By turning the quick knob, you can select the target function module.
Set or (press)	F 1001	Press Set (Set) key or quick knob, then the function code will be displayed on display screen.
	F 1001	Turn the quick knob to select the target function code.
Set or (press)	1	Press the Set (Set) key or quick knob, then the set value of function code will be displayed on display screen.
	10	Turn the quick knob to select the new setting
Set	10 rEAdY	Pressed the Set (set) key, then the set value and rEAdY will be alternately displayed, suggesting that the setting is being confirmed (※ 1)
Set	F 1001	Press the Back (Set) key again to confirm the new setting, and the display will return to function code selection interface. (※1)
Back or Menu/Cancel	F 10_ _	Press the Back (Back) key or Menu/Cancel key, and the display will return to function block selection interface.
Back or Menu/Cancel	50.00 or 5000	Press the Back (Back) key or Menu/Cancel key, and the display will return to status monitor mode interface.

*1 During alternate display period, if it is desired to interrupt input as any mistake in operation is found, operate the (Back) key Back or key Menu/Cancel to return the display to the function code selection state.

5-4-4 Signed operation

For some function codes, they can be set with values containing signs (polarity).

Operation example: setting F1503=-5.0

Operation	Display	Description
	50.00 or 50.00	Display of status monitor (frequency display)
Menu/Cancel	F 10_ _	Press Menu/Cancel key, then the screen will display function block selection interface
	F 15_ _	Turn the quick knob to select the target function module.
Set or （press）	F 1501	Press the Set（Set）key or quick knob, then the function code selection will be displayed.
	F 1503	Turn the quick knob to select the target function code.
Set or （press）	0.0	Press the Set（Set）key or quick knob, then the set value of function code will be displayed.
	-5.0	Turn the quick knob to select the new setting, and the sign will be displayed only when it is negative. (If the value is + 5.0, it will be displayed as 5.0)
Set	F 1503	Press the Set（Set）key to confirm the new setting, and the display will return to function code selection interface.（*1）
Back or Menu/Cancel	F 15_ _	Press the Back（Back）key or Menu/Cancel key, and the display will return to function block selection interface.
Back or Menu/Cancel	50.00 or 50.00	Press the Back（Back）key or Menu/Cancel key again, and the display will return to status monitor mode interface.

* 1 Please press Back or Menu/Cancel key to return to the function code selection interface.

5-5 Special functions

5-5-1 Copy function operation

The so-called copy function is the function which transfers the function code data to other inverters after transferring the function code data from one inverter side to the operation panel.

The copy function is an effective function where several inverters need to be set with the same function code data.

Only 1 inverter is set, while other inverters can also receive the same function code data, thus the same function code setting can be easily implemented.

※ The copy function can be implemented only when the inverter stops working. Therefore, this operation shall be carried out after the inverter has been stopped.

Operation example: copying from the inverter to the operation panel

Operation	Display	Description
	F 1601	Select function code F1610 (copy function)
Set or (press)	0	Press Set （Set）key or quick knob, then the set value of function code will be displayed.
	1	Turn the quick knob to select 1 When F1601 = 1, the current value of the function code data will be transferred to the operation panel (※ 1)
Set	SEnd	Press the Set (Set) key to start transferring data. And a flashing SEnd is displayed on 7-segment monitor.
After transfer is completed	F 1601	When data transfer is completed, the display will return to function code selection interface.

*1: When the value is set to 2 or 3, then the saved contents of the operation panel will be transferred to the inverter.
And then, a flashing rEAd will be displayed on 7-segment monitor.

See the contents of function code F1601 in [7-3 Description of Functions] for detailed description of the function and its operation method.

5-5-2 Changed code display operation

Considering current function code data may be different from the factory presets of product or the user's initial value, the function for displaying a changed function code and its data.

This is an effective function for inquiring the difference between current function code and product's factory preset or the user initial value.

Confirmation of maintenance and other function codes can be easily achieved by this function.

Operation example: displaying difference with product's factory preset data

Operation	Display	Description
	F 1602	Select function code F1602 (changed code display function)
Set or (press)	0	Press Set (Set) key or quick knob, then the set value of function code will be displayed.
	1	Turn the quick knob to select 1 If F1602 = 1, the current function code data will be compared with the factory preset function code data.
Set	Find	Press the Set (Set) key to start searching the number of a function code which has been changed and is different from the factory preset function code data. While the function is searching, a flashing Find will be displayed on 7-segment monitor.
After searching	FXXXX or End	After searching, the changed function code starts flashing on display screen. If there is no changed function code, a flashing End will be displayed on screen.
	FXXXX or End	If there are more than one changed function codes, they can be switched by adjusting the quick knob.
Set Or (press)	XXXXX	Press the Set (Set) key or quick knob, then the set value of function code will be displayed flashing.
Set or Menu/Cancel	FXXXX	Press the Back (Set) key or Menu/Cancel key to return to the changed function code (flashing display state).
Set or Menu/Cancel	F 1602	Press the Back (Set) key or Menu/Cancel key to return to function code selection interface.

See the contents of function code F1602 in [7-3 Description of Functions] for detailed description of the function and its operation method.

5-5-3 Function code initialization operation

The inverter's function code settings can be returned to factory presets through this function.

Inverter's initial value can be set to the factory preset or the data determined by the user (i.e. user's initial value). Also, the initial value can be selected between the factory presets and the user's initial value. By setting the user's initial value, the function code data can be initialized to the user's initial value even if it is overwritten for some reason, allowing for resetting the function code within a minimum range.

Operation example: recovering to the factory presets

Operation	Display	Description
	F 1604	Select function code F1604 (data initialization)
[Set] or (press)	0	Press the [Set] (Set) key or quick knob, then the set value of function code will be displayed.
	1	Turn the quick knob to select 1 If F1604 = 1, all the function code data will recover to the factory presets
[Set]	1 rEAdY	Pressed the [Set] (Set) key, then the set value and rEAdY will be alternately displayed, suggesting that the settings is being confirmed (∗ 1)
[Set]	in it	Press the [Set] (Set) key to start initialization of the function code. During initialization, a flashing in it will be displayed on 7-segment monitor.
After initialization	F 1604	When initialization is completed, the interface will return to function code selection.

∗1: In the alternate display, if an operation error occurs and it is hoped to interrupt input, then the interface can be returned to the function code selection state by pressing the [Back] (Back) key or [Menu/Cancel] key.

See the contents of function code F1604 in [7-3 Description of Functions] for detailed description of the function and its operation method.

5-5-4 Alarm contents reading operation

Alarm history record display is a function for displaying alarms occurred in the past.

The latest 5 alarms will be recorded. If a new alarm occurs, then the first alarm will be deleted.

Operation example: reading alarm contents

Operation	Display	Description
	F 1805	Select function code F1805 (alarm contents reading)
Set or (press)	0	Press the Set (Set) key or quick knob, then the set value of function code will be displayed.
	1	Turn the quick knob to select 1, then if F1805 = 1, the alarm contents will be read.
Set	1 XXXXX or End	Press the Set (Set) key to execute the alarm reading function. Alarm history record number and alarm contents XXXXX are alternately displayed, and End will be displayed if there is no alarm record.
	2 XXXXX or End	Turn the quick knob, the alarm displayed will be shifted continually. In alarm history record, the alarm with the smallest number is the latest alarm.
Back or Menu/Cancel	0	Press the (Set) key Back or Menu/Cancel key, then the interface will return to function code value setting.
Back or Menu/Cancel	F 1805	Press the (Set) key Back or Menu/Cancel key to return to function code selection interface.

When the set function code F1805 = 9, then the alarm history record can be deleted.

5-5-5 Alarm status confirmation operation

Alarm status confirmation is a function for displaying the inverter's status when an alarm occurs.

It can be used to confirm the latest 5 alarm statuses through function codes F1806 - F1810. If a new alarm occurs, then the first alarm will be deleted. F1806 is the latest alarm, while the F1810 is the first alarm.

Operation example: Confirming the inverter status when the latest alarm occurs

Operation	Display	Description
	F 1806	Select function code F1806 (alarm status confirmation)
Set	ALtyP YYYYY or End	Press Set (Set) key, then the alarm name YYYYY and ALtyP indicating display of [alarm name] will be displayed alternately. The End will be displayed if the alarm status is not recorded.
	XXXXX YYYYY or End	After the alarm has been stored, turn the quick knob to switch the contents displayed. Now, the detonation XXXXX (※1) and the value YYYYY (※2) when alarm occurred will be displayed
Back or Menu/Cancel	0	Press Back (Set) key or Menu/Cancel key, then the interface will return to function code setting.
Back or Menu/Cancel	F 1806	Press the Back (Set) key or Menu/Cancel key to return to function code selection interface.

If the function code is set to F1805 = 9, alarm records will be eliminated. At this time, all the alarm records from F1806 to F1810 will be deleted.

*1: The denotations are shown in the table below

Denotation	Meaning	Unit
ALtyP	Alarm name	-
FrE	Output frequency	Hz
ioUt	Output current	A
uoUt	Output voltage	V
udC	DC voltage	V
P	Output power	kW
t	Radiator temperature	℃

*2: The value displayed indicates the inverter status before occurrence of an alarm. Therefore, if an alarm is caused by transient over-current or over-voltage, the stored value is somewhat different from the current value or voltage value at the occurrence of the alarm (factors causing alarm).

5-5-6 7-segment monitor display list

Monitor display	Description
in it	During initialization, the data is displayed flashing.
in itY	During initialization of user data, the data is displayed flashing.
dEC id	During confirmation of user data, the data is displayed flashing.
rEAdY	The detonation indicates the need for reconfirmation operation using function code
F ind	It is displayed flashing during search of the function code, of which the user data is discrepant from default settings.
SEnd	It is displayed flashing during transfer of the host function code data to operation panel.
rEAd	It is displayed flashing during transfer of the operation panel function code data to host.
End	It is displayed flashing when the desired data can not be found through the function code search and alarm history record.
tUnE	Indicates auto tuning
2Ero	Indicates zero speed running (in position control mode or zero-servo running).

* In addition to the above, alarms, warnings, errors etc. are also displayed on 7-segment monitor. See Chapter 8 for details of these contents.

5-6 Connecting operation panel with extension cable

If the operation panel is connected to inverter with the extension cable, then the operation panel can be installed in other instrument frame. (See Chapter 12: outside view of 12-2 Operation Panel for installation opening drawing).
The extension cable length shall not be more than 5m. And use a standard 8-pin direct plug-in cable (both ends of RJ45 type) which is shielded and available from market for connection.

Note: Please do not connect devices other than operation panel, such as the computer network cable etc.. Connecting to other devices may lead to damage to inverter or the connected device.

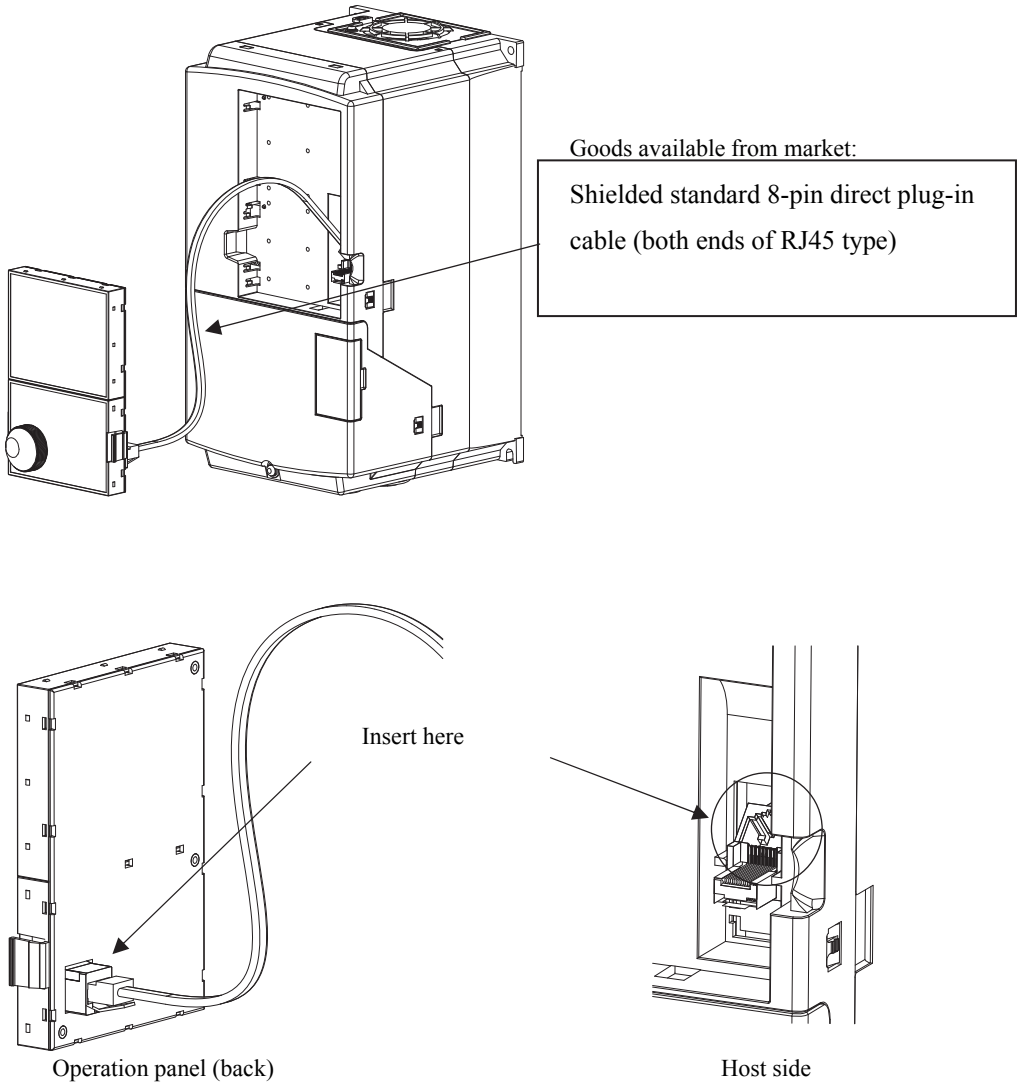


Figure 5-3 Usage of extension cable

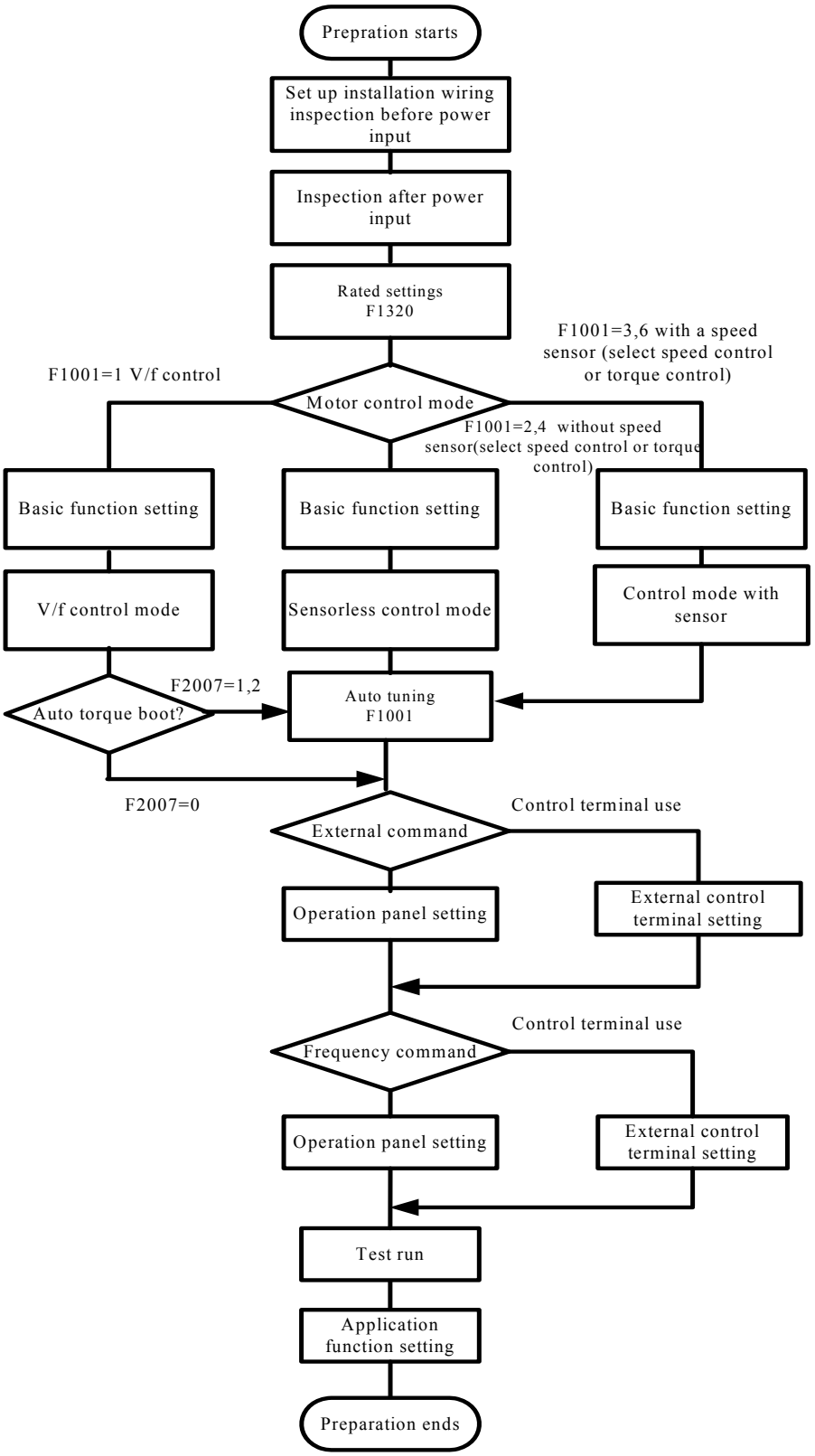
6. Operation



- **Wiring shall not be made after connecting to power supply.**
  Failure to observe this warning may result in personal injury, fire or electric shock.
- **Before undertaking the work, safety notes must be checked.**
  Failure to observe this warning may result in personal injury or fire.
- **Grounding of the inverter and motor must be carefully implemented.**
  Failure to observe this warning may result in electric shock or fire.
- **Please install the cover of the inverter before connecting the power.**
  Do not remove the cover when it is powered on.
- **Works such as maintenance inspection and replacement of parts etc. can only be carried out by professional maintenance personnel.**
  Failure to observe this warning may result in electric shock or personal injury.

6-1 Operation steps

The following flowchart shows all the operation steps before and after operation of the inverter.
Please follow the following flow chart to carry out test run.



6-2-1 Confirmation before power input

6-2-2 Confirmation after power input

6-2-3 Basic setting (1)

6-2-4 Motor control mode

6-2-5 Basic setting (2)

6-2-6 Motor parameter auto tuning

6-2-7 Basic setting (3)

6-2-8 Operation confirmation

Figure 6-1 Operation step flow

6-2 Test run

6-2-1 Confirmation before power input

● Please check the following items after installation wiring and other works and before power-on.

Table 6-1 Confirmation items before power input

Item	Content
Power supply voltage confirmation	● If the power supply voltage coincides with the inverter's capacity and voltage.
Main wiring confirmation	● If the connection of input wirings R, S and T is correct. ● If the connection of output wirings U, V and W with the motor's U, V and W is correct. ● If grounding of the ground terminals of inverter and motor is reliable. ● If there is any place where short-circuit is caused by wiring debris. ● If there is any loose screw or connection terminal. ● If there is any short-circuit or grounding place in output end or sequence circuit.
Control wiring confirmation	● If wiring of control terminals is correct. ● If the control signal is in OFF (disconnected) state.

6-2-2 Confirmation after power input

● If it is confirmed that there is no problem before the power supply input, connect to the power supply. And then check the following:

Table 6-2 Confirmation items after power input

Item	Content
Status of operation panel	After the display of software version, check if the operation panel status is as shown in the figure below.（*1）  When the LED panel displays "" stopped state, and 7-segment monitor shows all the digits represent of numerical values are flashing, indicating the equipment is stopped.
Fan drive status	If the cooling fan at the top of inverter host is in stopped state. (Note) Do not drive the fan immediately after power input. Because it is subject to temperature control, if the designated temperature is exceeded, the fan will run. * Setting the function code F1318 (Fan ON / OFF) =1 will make the fan ON all the time, i.e., the fan will fun all the time.

*1: In a LCD application, display indicates language selection.

If the quick knob is pressed, the language list will be displayed. Therefore use the quick knob to choose and press Set key to confirm.

6-2-3 Basic setting (1)

Carry out setting after the basic operation settings have been confirmed.
The selection of rated values can be made by switching through the following function code.

Table 6-3 Basic function (1)

Function code	Name		Overload capacity	Maximum frequency	Remarks
F1320	Rating selection	1: Mode A (Heavy overload)	150%1min	590Hz	Used for setting the rated values of inverter
		2: Mode B (Light overload)	120%1 min	240Hz	

If the function code is set to 2, but the overload capacity is reduced even though the value has increased by one, .See Standard Specifications in Chapter 11 for details.

6-2-4 Motor control setting

Please refer to the function code F1001 to set the desired motor control mode as the inverter has all the motor control modes shown in the following table.

Table 6-4 Motor control mode

Function code F1001	Control mode	Speed sensor Yes / No	Basic control mode	Remarks
1	V/f control	No	V/f control	Torque boost
2	Speed control		Vector control	
4	Torque control		Vector control	
40	V • f separation control		V/f control	
3	Speed control	Yes	Vector control	
5	Torque control		Vector control	
6	Position control		Vector control	Some are optional functions

Table 6-5 Auto torque boost

Function code	Name	Settings	Remarks
F2007	Auto torque boost	0: No 1: Voltage compensation 2: Slip compensation	

(1) V/f control
The set V (voltage) / f (frequency) is a constant control output for making the motor operate.

(2) Sensorless control (speed, torque)
The so-called speed sensorless control mode, is a mode that controls always at a constant speed no matter what the state of the load is, and also a control mode that can generate high torque at a low frequency range.

(3) V . f separation control
A function which can set the inverter's output voltage independently. This control mode is also a V / f control mode. According to V • f separation selection, its separation mode can be divided into two modes: complete separation and V • f Separate control.

(4) Sensor control (speed, torque and position)
By feeding back the pulse signal sent by pulse generator (PG) from the motor to inverter, the motor's position and speed can be measured. This enables high-precision speed control, torque control and position control.

(5) Auto torque boost control

The inverter is provided with voltage compensation function and slip compensation function. The former is used for auto-regulating the inverter output voltage, while the latter is used for slip frequency compensation based on the load.

Use F2007 to select the above functions.

6-2-5 Basic setting (2)

Please follow the operation steps to set the following function codes.

Table 6-6 Basic function (2)

Function Code	Name	Content	Remarks
F1005	Base voltage	200V Series 0: no AVR, 50-240V	Please check the rated voltage
		400V Series 0: no AVR, 50-460V	
F1006	Reference frequency	0.1-600Hz	
F1007	Upper frequency limit	5-590Hz	
F1009	Carrier frequency	0-130	
F1101	Operation command selection	1. Operation Panel 2. External terminal 3. Communication	
F1110	Motor rotation direction	1: Forward, 2: Reverse	
F1701	Output current limiting function	Mode A (heavy load) 0: no function 50—200 Mode B (light load) 0: no function 50—150	
F1702	Electric thermistor	0: No function 20-105%	

※ Please confirm the factory presets which can be set again only when the need for change really exists.

6-2-6 Motor parameter auto tuning

The so-called auto tuning mode is a function which automatically measures the parameters of the connected motor which will be stored to the inverter's memory.

This function is a useful function when it is hoped to implement vector control and auto torque control with the motor parameters not fully known. It is also a useful function when it is hoped to implement speed control and torque control if the distance between the inverter and motor is more than 30m.

<For F1001=10, 11 (Motor parameter auto tuning)>

- The auto tuning function has two modes for selection.

Table 6-7 Auto tuning mode

Function Code F1001	Function	Motor Parameters	Remarks
10	Auto tuning mode 1: Measure when the motor shaft is fixed	Primary resistance R1 Secondary resistance R2 Leakage inductance I Excitation inductance M	For cases where the motor can not operate
11	Auto tuning mode 2: Measure when the motor is operating	Primary resistance R1 Secondary resistance R2 Self-inductance L Excitation current I.	For cases where the motor can operate

Before setting the above auto tuning, set the following function codes in order.

Table 6-8 Auto tuning setting

Function Code	Content	Settings	Remarks
F5001	Motor poles, voltage, and capacity	XYZZZ X: Polarity, Y : Rated voltage Z: Motor capacity	See the following description for details. *1
F5002	Motor current rating	30 — 110% of the inverter current rating (0.1A stepping)	
F5003	Motor frequency rating	10 — 600 Hz	
F5004	Motor speed rating	0 -24000 rpm (1rpm stepping)	
F5005	Motor insulation type	1: Type A 2: Type E 3: Type B 4: Type F 5: Type H	
F5006	The motor's rated voltage during auto tuning of motor parameters	0: Use function code F 5001 Selected voltage 100 -460 (the voltage of F 5001 is inactive)	
F5007	Rated motor slip	0-50%	

*If motor parameters are known, please enter the parameters into the following function codes.

F 5009 Motor's primary resistance (Ω or m Ω)

F 5010 Motor's secondary resistance (Ω or m Ω)

F 5011 Motor's primary inductance (mH)

F 5012 Motor's secondary inductance (mH)

F 5013 Motor's mutual inductance (mH)

F 5014 Motor's excitation current (A)

F 5015 Motor inertia (kgm^2)

F 5016 Load inertia ratio

[Motor parameter auto tuning steps]

(1) Setting of motor ratings

Set all the motor ratings into function codes F5001 — F5005 correctly.

- Press Menu/Cancel key to display function codes
- Turn the quick knob to select F5001
- Press Set (Set) key to input numerical values.
- After input, press the Set (Set) key again to confirm.

Set function codes F5002 — F5005 in order in the same way.

① F5001 Motor poles, voltage, and capacity

- The configurable values and contents denoted are as follows.

1) Number of poles: 2 — 8 (4 types).

2	4	6	8

2) Rated voltage: the setting range of rated voltage is denoted by serial numbers. Unit: [V].

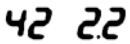
No.	1	2	3	4	5	6	7	8
Corresponding rated voltage	200	220	230	380	400	415	440	460

3) Motor capacitor: the setting range of motor capacitor is denoted as follows. Unit: [kW].

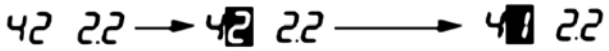
0.37	△0.4	0.55	0.75	△1.1	△1.5	△2.2
△3.0	△3.7	△4.0	△5.5	△7.5	11.0	15.0
18.5	22.0	30.0	37.0	45.0	55.0	75.0
90.0	110	132	160	185	200	220
250	280	315	355			

The symbol △ indicates a space.

Example) When using a motor of 4 poles, 220V, 2.2KW, the 7-segment monitor displays the following:



Operation example) in case where a motor of 4 poles, 200V, 2.2KW is used, operation for changing the rated voltage is as follows:



Note: During vector control and auto torque boost control, standard values of various control constants necessary for inverter control need to be obtained from the settings of the function code, thus please make correct setting according to the motor used.

In addition, the basic range of configurable value for vector control is shown as follows. Please consult separately about use of other specifications for vector control.

Number of poles: 2, 4, and 6

Rated voltage: No. 3 or below for 200V series inverters

No. 4 or above for 400V series inverters

Motor capacity: If the motor does not have a capacity equal to or one level lower than the inverter, Exxxx or Er···E· may be displayed.

② Setting of F5001 — F5005

- Set rated current, frequency, speed and insulation type of the connected motor.
  Under normal circumstances, please set according to the motor ratings. If the value set is incorrect, the motor parameters auto tuning results and the control characteristics of torque control will become adverse.

Note 1): The settings are interdependent with the settings of motor poles, voltage, capacity (F5001). Therefore, if F5001 is changed, then function codes F5002 — F5005, F5009 — F5015 which are associated with the motor parameters will be automatically set with the settings of F5001 as the standard values.

Note 2): These settings can not be used in V / f control mode.

Note 3): The special motors shall be set according to F5006 Special Motor Voltage Rating.

(2) The setting of motor parameter auto tuning mode

Set the auto tuning modes 1 and 2 through F1001 (F1001 = 10 and F1001 = 11). (Check the status of mechanical system).

- Press [Menu/Cancel] key to display function codes
- Press the quick knob to select F1001
- Press the [►] (Set) key, and key in number, and then press the [►] (Set) value to confirm.

(3) Auto tuning starts

Auto tuning will begin if the operation signal is input, and the operation panel displays "TUNE" during this process and returns to “Stopped” display upon completion of the process. In addition, in auto tuning mode 2, operation starts in the rotation direction of operation signals until the motor frequency rating (F5003) is reached, and then operation will continue within 50% of the motor frequency rating.

Press [Drive] key to start the auto tuning.

(4) Motor parameter auto tuning ends

If the auto tuning goes smoothly, then the operation panel will return to the initial interface.

After completion of auto tuning, the parameters obtained through auto tuning will be set into the function code.

(5) Auto tuning error

① If the auto tuning fails, then "Er 5. " will be displayed on the operation panel.

During auto tuning, please confirm the contents displayed on operation panel. If a "Er 5 is displayed, please confirm the following contents and conduct auto tuning again.

- Reconfirm the settings of F5001 — F5005
- When using special motors, change the range of F5008 if auto tuning is out of range.

Note 1): Enlarging auto tuning range of F5008 will make the error of auto tuning become bigger, therefore please set appropriate auto tuning range.

② When using PG sensors, if the detected rotation is in the opposite direction, a “PGnG” will be displayed.

Please confirm the phase of PG pulse. Use operation panel to cancel the “PGnG”warning.

Note 1) Turning up the auto tuning range of F5008 may result in bigger error of auto tuning. Therefore, please set the auto tuning range.

(6) Forced ending of auto tuning

The auto tuning mode can be forcibly ended according to stop signal.

Pressing [Stop] key can also realize forced ending.

[Note: Notes on carrying out motor parameter auto tuning mode]

① Before carrying out auto tuning mode 2, be sure to disengage the load shaft of motor. If the load is not disengaged (for example, one-piece brake motor), then the auto tuning mode 2 can not carry out correct auto tuning.

② If F5001 — F5008 are not correctly set, then the right auto tuning can not be implemented.

③ Please carry out the auto tuning under normal temperature of the motor. As other test run items have been conducted, the motor may be overheated. And correct auto tuning can not be achieved in this condition.

④ The actions of auto tuning mode are executed based on normal operation steps, therefore sometimes it does not act according to the settings of function codes. In this case, please confirm if there is any conflict between data settings of function codes as in normal operation.

Example) If the frequency setting is lower than operation start frequency, the operation can not be started. Although the frequency setting is inactive in auto tuning mode action, it is active as an operation start condition.

Example) The auto tuning mode will not act if the frequency setting is higher than the upper frequency limit or lower than the lower frequency limit.

⑤ Performance of the auto-tuning with small motor in the extreme compared with the capacity of the inverter may possibly burn out the motor. Please make sure to choose appropriate motor that is equivalent to 2 levels lower than the capacity of the inverter.

⑥ During action of auto tuning mode 2, if the operation signal is input again during deceleration, then the motor will rerun at the frequency of F5003. Therefore do not enter operation command before the auto tuning is fully completed.

⑦ During auto tuning, when this function is stopped or temporarily stopped because of alarm, please return back to the auto tuning mode.

⑧ During action of auto tuning mode 2, if it enters the idling state temporarily because of MBS signals input by multifunctional input terminals, after that, correct auto tuning can not be achieved by continuing auto tuning action even if the signal is released.

⑨ The acceleration / deceleration time of auto tuning mode 2 acts with the 1st acceleration / deceleration time as standard.

⑩ Depending on the results of parameter auto tuning for motor with shaft fixed, auto tuning with shaft fixed may be reconducted.

6-2-7 Basic setting (3)

Please set the function codes used for setting the operation command and frequency command.

Table 6-9 Basic function (2)

Function code	Name	Content	Remarks
F1002	1st speed frequency selection	1: Operation panel 2: External analog VIF1 voltage (0—5 V) 3: External analog VIF1 voltage (0—10 V or potentiometer) 4: External analog VIF2 voltage (0—5 V) 5: External analog VIF2 voltage (0—5V or potentiometer) 6: External analog VIF3 voltage (0—5 V) 7: External analog VIF3 voltage (0—5V or potentiometer) 8: External analog VIF1 current (4—20mA) 9: External analog VIF2 current (4—20mA) 10: External analog VIF3 current (4—20mA) 11: External analog VIF1 voltage +VIF2 voltage 12: External analog VIF1 voltage +VIF3 voltage 13: External analog VIF2 voltage +VIF3 voltage 14: External analog VIF1 voltage -VIF2 voltage 15: External analog VIF2 voltage –VIF1 voltage 16: External analog VIF1 voltage-VIF3 voltage 17: External analog VIF3 voltage –VIF1 voltage 18: External analog VIF1 voltage +VIF2 current 19: External analog VIF1 voltage -VIF2 current 20: External analog VIF1 current -VIF2 voltage 21: Terminal block stepping 22:Communication 25:Pulse train input 26:External analog VIF1 forward / reverse operation (0 — 10V, 5V reference) 27: External analog VIF2 forward / reverse operation (0 — 10V, 5V reference) 28:External analog VIF3 forward / reverse operation (0 — 10V, 5V reference)	Please set the setting to values other than 1 when using control terminals.
F1101	Operation command selection	1: Operation panel 2: External terminal 3: Communication	

Note 1) During test run, confirm the factory presets through the operation panel without additional configuration.
Note 2) Before setting external operation signals, check that the control terminals are in OFF (disconnected) state.

Frequency command selection can be switched using the status of multifunctional input terminals. Depending on the status of multifunctional input 1DFA or 1DFB, the frequency command shall be determined according to the method set by F1002, or F1034 — F1036. See F1034—F1036 in Chapter 7-3 for details.

1DFA terminal	1DFB terminal	1st speed frequency action
OFF	OFF	The method selected by F1002
ON	OFF	The method selected by F1034
OFF	ON	The method selected by F1035
ON	ON	The method selected by F1036

Operation command values can be changed using the status of multifunctional input terminals. According to the status of multifunctional input ROPE or RCOM, the operation commands as shown in the table below can be selected. See F1101 in Chapter 7-3 for details.

ROPE terminal	RCOM terminal	Operation Command
OFF	OFF	The method selected by F1101
ON	OFF	Operation Panel
OFF	ON	Communication
ON	ON	Terminal block (FR terminal or RR terminal)

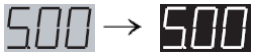
6-2-8 Operation confirmation

After setting has been made by following the steps for test run, the operation shall be confirmed as follows.
Once the inverter or motor is in abnormal conditions, please stop operating immediately. See [Chapter 9 Fault Analysis] for details.

(1) Test run steps

Please refer to the operation methods of operation panel for implementation of 5Hz operation.

Table 6-10 Test run steps

	Operation	Display
1	Power supply input	
2	press → → press	
3	Drive	
4	Stop	

*The state where F1101 (operation command selection) is set to 1 (operation by operation panel)

① After power input, check that the frequency "" displayed on the operation panel is flashing.

② Set the frequency to a low frequency of about 5Hz through the quick knob. (Check that the set frequency displayed on LED monitor is flashing)

③ Press Drive (Drive) key to start forward running operation.(Check that the set frequency displayed on LED monitor is flashing)

④ Press Stop (Stop) key to stop operation of the equipment.

(2) Confirmation items during test run

Please confirm the contents listed in the table below

Table 6-11 Confirmation items during test run

	Item	Result
1	Motor rotation direction	Is it the specified rotation direction?
2	Motor operation 1	Are the acceleration and deceleration smooth?
3	Motor operation 2	Is there any abnormal sound or vibration?
4	Inverter fan operation	Is the fan running?
5	Inverter display and others	Are the display on operation panel and equipment normal?

*When it is confirmed that there is no problem, please increase the set frequency before operation. Similarly, for the operation with increased frequency, the above confirmation items shall also be checked.

(3) Operation preparation

After confirmation of test run and normal operation confirmation of motor, please implement the connection with the mechanical system.

1 Please set the function codes related to machine action.

2 Check the interface matched with peripheral mechanical equipment.

(4) Operation confirmation

Before delivery, various functions of the inverter have been set up as shown in the function code list.

If change of settings of operation command is required, please refer to [5-6 Basic Operation] for implementation.

(5) Operation methods besides commands from operation panel

■Operation by commands from external signals

1 When controlling operation / stop according to external signals, please set the function code F1101 to 2, that is, F1101 = 2.

2 When carrying out frequency setting by external potentiometer, 4 — 20mA, 0 — 10V etc., please set the function code F1002 = 2 — 20.

3 Please refer to [4-6 Connection Diagram of Control Circuit Terminals] for correct use of external signals.

Note 1: If both input signals FR (Forward) and RR (Reverse) are input at the same time, then the inverter will not operate. And if both signals are simultaneously input during operation, then [Output Frequency Lock] will act. If this is done during accelerating or decelerating, the change of output frequency will also be locked. And when the output frequency is locked, the FWD and REV on the operation panel will be lit.

Note 2: If the operation signal is turned off and a signal to drive the motor in the opposite direction from the present direction of rotation is input before the inverter stops, the inverter operates according to the value of F1001 (motor control mode selection).

• F1001 = 1 (V / f control mode) and F1309 = 0

The inverter operates according to the function code settings when starting and stopping. Consequently, the change in output frequency around 0 Hz may not follow a straight line, depending on settings such as the starting frequency. Since DC braking does not work when reversing the direction of rotation, set the DC braking start frequency low.

• F1001 = 1 (V / f control mode) and F1309 = 1

A process of continuous deceleration to acceleration in the opposite direction, which has nothing to do with the relevant function codes for starting and stopping.

F1001 = 2 (Speed sensorless control mode), 3 (speed sensor control mode): Braking excitation or starting excitation is not applied when switching the direction of rotation. This allows “forward and reverse run” in a continuous operation.

Note 3: During torque control, the direction of motor rotation depends on the load side, therefore, both FR (Forward run) and RR (Reverse run) signals are provided with the function of setting ON / OFF of torque control. Because this function has nothing to do with the direction of rotation, please only use one of FR and RR during torque control.

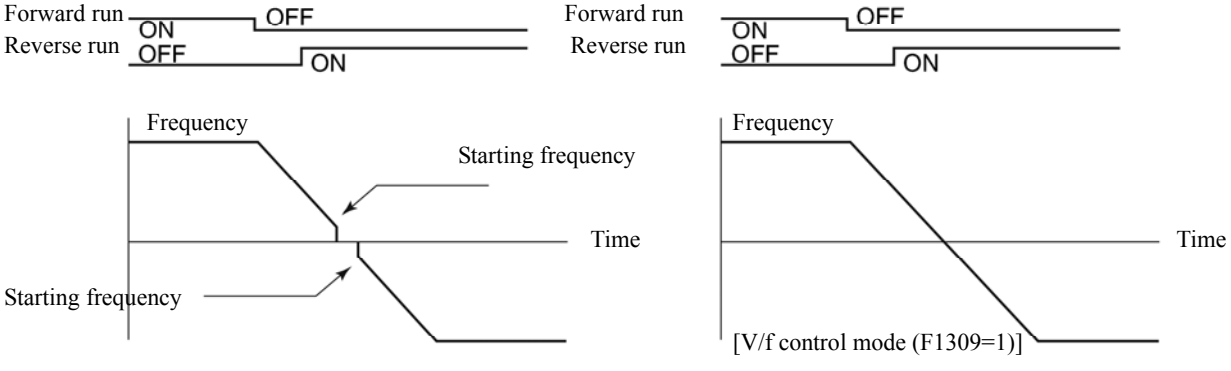


Figure 6-2 External operation command action

6-3 Special functions

6-3-1 JOG operation

(1) Short-circuiting the multifunctional terminal JOG with DCM1, 2 forms a JOG operation mode.

(2) For JOG operation, please set the F1101 = 2, and then short-circuit the multifunctional terminal FR or RR with DCM1, 2 after short-circuiting the multifunctional terminal JOG with DCM1, 2. (JOG operating is active only in operation by external signal command.)

(3) Use F1021 to set frequency, and F1020 to set the acceleration / deceleration time.

(4) During operation, the JOG signal will not work even if it is input. The JOG signal must be input at the same time or in advance. Also, during JOG operation, the jog operation will still continue even if the short circuit between JOG and DCM1, 2 is disconnected. (To stop, set the operation signal to OFF.).

(5) In JOG operation mode, the setting of F1102 = 2 (Flying start) becomes inactive, and the setting of F1102 = 1 (Starting frequency) is active. Other actions shall be made according to settings of corresponding function codes.

(6) Once the JOG operation is started, it will continue until the inverter stops. Therefore, during slowdown of JOG operation, if acceleration is started again before the inverter stops, it is still in JOG operation regardless of status of the JOG terminal.

For normal operation after stopping the inverter, please turn the operation command ON (connected) only after the inverter has fully stopped and the JOG terminal is OFF (disconnected).

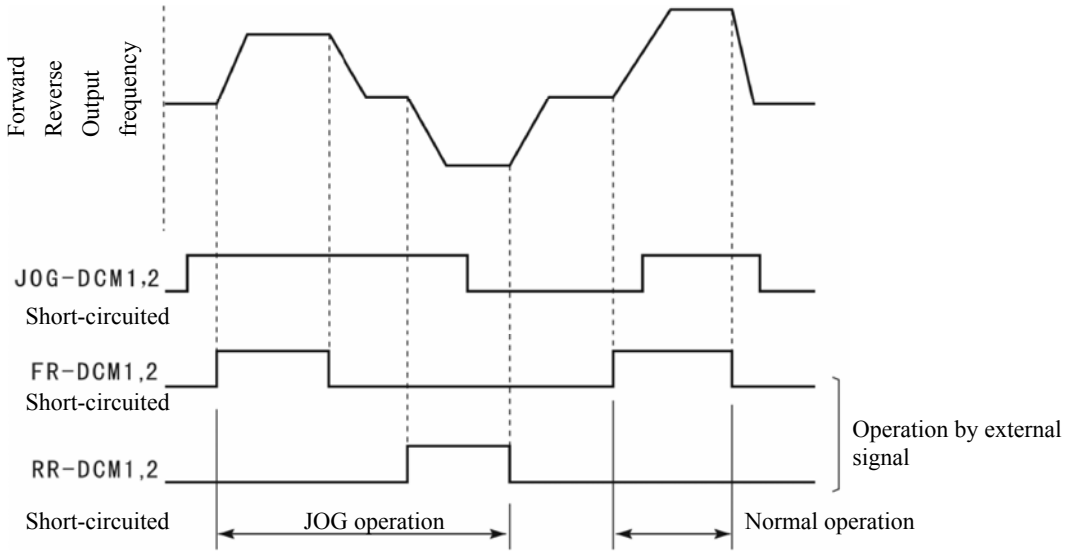


Figure 6-3 JOG action

6-3-2 Hold operation.

(1) To use a push-button switch or other momentary contact to control operation, wire the circuit as shown in Figure 6-1 and set the appropriate function codes (codes related to the multifunctional input terminals and F1101 = 2).

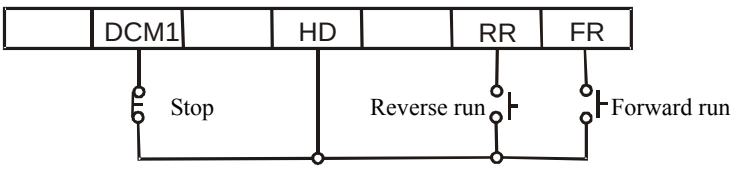


Figure 6-4 Operation signal hold circuit

(2) When the external signal terminals are used to operate and stop the inverter, and you do not want the motor to automatically restart after recovery from a power failure, use the above circuit and set F1108=0.
(3) When operating with the hold function, the inverter does not restart after recovery from the following conditions.
    ① Recovery from free run stop with MBS multifunctional input terminal
    ② Recovery from alarm stop with the auto alarm recovery function
    ③ Recovery from a momentary power failure by the “restart after momentary power failure” function

6-3-3 Notes on free run stop terminal (MBS)

The free run stop terminal is provided for systems in which mechanical braking is used to stop the motor. When setting the motor to the free run status using this terminal, be sure to turn OFF any operation signal.

If the free run stop signal is released with an operation signal on, the inverter restarts according to normal operating procedure and the function code settings. Therefore, depending on the free run speed of the motor, an unexpected over current or overvoltage may occur and result in an alarm stop.

For example: if flying start is not set as the starting method and the free run stop signal is released when the motor is still slowly rotating, the inverter will restart from the starting frequency or after DC braking depending on the starting method.

6-4 Definition of Technical Terms

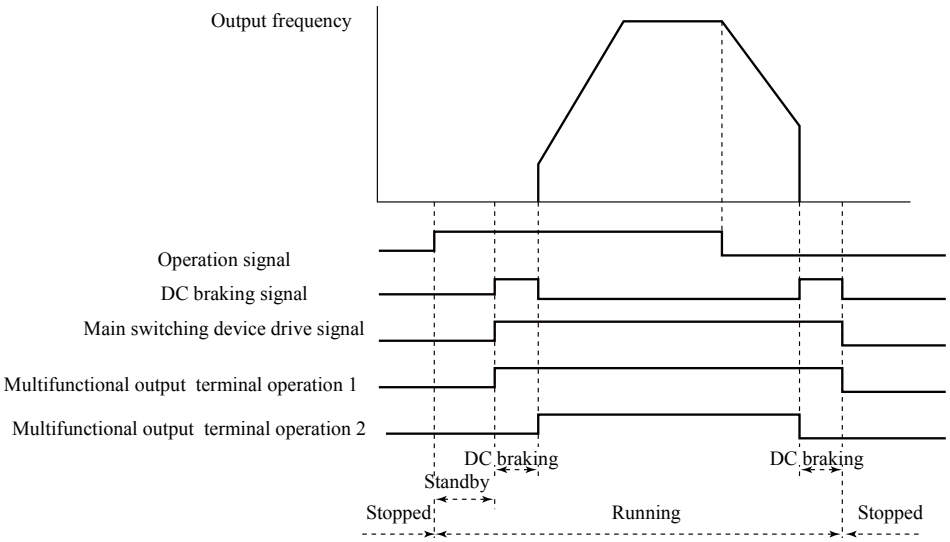


Figure 6-5 Operation action

Table 6-12 Explanation of Terms

Term	Definition
Operation	General term describing both “forward run” and “reverse run” implying that the inverter is in operation.
Operation signal	Signal requesting inverter operation, which is input by pressing the Drive (drive) key on the operation panel or using signals input through multifunctional control input terminals FR and RR.
In operation (operating)	Condition where the operation signal is being input or a drive signal is being output to the main switching device. In the stop status, the operation signal is OFF, but the main switching device operates until DC braking, etc. is completed.
In constant speed (operation)	Condition when the inverter is in operation at the frequency setting value.
Stopped	Condition where the operation signal is not being input and the drive signal is not being output to the main switching device. Even when the operation signal input is on, the input to the multifunctional control input terminal MBS disables the drive signal output to the main switching device.
Standby	Condition where the operation signal is being input but there is no output for some reason, for example, while waiting for the start delay time to expire or when the set frequency is lower than the operation start frequency.
DC braking	Condition where DC braking is applied when starting and stopping.
Frequency setting value or set frequency	Frequency set on F2101-F2116 and F1021. Frequency value corresponding to an external signal when setting F1002=2-21 and 25-28 with external signals for frequency setting.
Output frequency or frequency output value	Actual inverter output frequency. ・ V/f mode When the load is stable, the output frequency normally coincides with the frequency setting value. ・ When used in vector control mode or for slip compensation in V/f mode, even if the load is stable, the output frequency does not coincide with the frequency setting value but keeps changing.
Command frequency	Frequency value used by the inverter. As a command value frequency, its change in frequency setting value not only depends on the results of controls such as the acceleration/deceleration function and the current limiting function but also the actual output frequency. The command frequency normally coincides with the set frequency at the end of acceleration/deceleration. ・ V/f mode: If there is feedback operation such as PID control mode, the command frequency equals the output frequency. ・ When used in vector control mode or for slip compensation in V/f mode, the command frequency and the output frequency may not match in this mode because the synchronous speed specified by the number of motor poles and the command frequency is used as the speed command.

7. Function Code

7-1 Representation and Description of Function Codes

By changing the function code, the inverter action can be changed.
Function codes are functionally classified into "function blocks." To change the function code, first select the function block, and then select the serial number of the function code to be changed.
A function code can be set through operation panel (see sections 5-4 and 5-5), or communication (see section 7-4).

Function	Function Block	Function Block Name
Basic operation functions	F10XX	Basic functions
	F11XX	Starting • braking function
	F12XX	LED display function
	F13XX	Auxiliary functions
Input/output-related function	F14XX	Input function
	F15XX	Output function
System-related functions	F16XX	System functions
	F17XX	Protection function
	F18XX	Information function
Special functions	F19XX	Energy-saving function
	F20XX	V/f characteristics
Scheduled operation function	F21XX	Multi-speed function
	F22XX	Scheduled operation function
LCD display function	F23XX	LCD display function
PID function	F30XX	Basic PID1 functions
	F31XX	Basic PID2 functions
	F32XX	Combined function of PID1 and PID2
	F33XX	PID control parameter reading
Communication function	F40XX	Serial communication function
	F41XX	MODBUS communication function
Motor Parameters	F5XXX	Motor Parameters
Vector control	F60XX	Vector control function
Torque control	F61XX	Torque control function
Extended functions	F81XX	PG function
	F89XX	Other functions (for factory-adjustment)

7-2 Function Code List

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
Basic operation functions					
1001	Motor control mode selection	1: V/f control mode 2: Speed control (speed sensorless vector control) 3: Speed control (speed sensor vector control) 4: Torque control (speed sensorless vector control) 5: Torque control (speed sensor vector control) 6: Position control (speed sensor vector control) 10: Auto tuning mode 1 11: Auto tuning mode 2 40: V • f separation control	1	1	
1002	1st speed frequency setting selection	1: Operation panel 2: External analog VIF1 voltage (0—5 V) 3: External analog VIF1 voltage (0—10 V or potentiometer) 4: External analog VIF2 voltage (0—5 V) 5: External analog VIF2 voltage (0—10V or potentiometer) 6: External analog VIF3 voltage (0—5 V) 7: External analog VIF3 voltage (0—10V or potentiometer) 8: External analog VIF1 current (4—20mA) 9: External analog VIF2 current (4—20mA) 10: External analog VIF3 current (4—20mA) 11: External analog VIF1 voltage +VIF2 voltage 12: External analog VIF1 voltage +VIF3 voltage 13: External analog VIF2 voltage +VIF3 voltage 14: External analog VIF1 voltage -VIF2 voltage 15: External analog VIF2 voltage –VIF1 voltage 16: External analog VIF1 voltage-VIF3 voltage 17: External analog VIF3 voltage –VIF1 voltage 18: External analog VIF1 voltage +VIF2 current 19: External analog VIF1 voltage -VIF2 current 20: External analog VIF1 current -VIF2 voltage 21: Terminal block stepping 22: Communication 25: Pulse train input 26: External analog VIF1 forward / reverse run operation (0 — 10V, 5V reference) 27: External analog VIF2 forward / reverse run operation (0 — 10V, 5V reference) 28: External analog VIF3 forward / reverse run operation (0 — 10V, 5V reference) 29: Pulse train input (subPG：option)	1	1	
1003	V/f pattern selection	1: Linear pattern 2: Square-law decreasing pattern (weak) 3: Square-law decreasing pattern (strong)	1	1	
1004	Torque boost	0-20%（maximum voltage ratio）	0.1%	※1	
1005	Base voltage	200V series: 0: No AVR 50-240V 400V series: 0: No AVR 50-460V	1V	※1	
1006	Base frequency	0.1-600Hz	0.01Hz	※1	

The setting values can not be changed during operation.

※ **1: The representative parameters that are suitable for various models have been input.**

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
1007	Upper frequency limit	5-590Hz	0.01Hz	60	
1008	Lower frequency limit	0.05-200Hz	0.01Hz	0.05	
1009	Carrier frequency adjustment	0-130	1	※1	
1010	Acceleration/deceleration curve	1: Linear 2: S-shaped 3: Reduction of acceleration/deceleration	1	1	
1011	Reference frequency for acceleration/deceleration	1-120Hz	0.01Hz	※1	
1012	1st acceleration time	0-6,500 sec.	0.1 s	※2—1	
1013	2nd acceleration time	0-6,500 sec.	0.1 s	※2—2	
1014	3rd acceleration time	0-6,500 sec.	0.1 s	※2—3	
1015	4th acceleration time	0-6,500 sec.	0.1 s	※2—4	
1016	1st deceleration time	0-6,500 sec.	0.1 s	※2—5	
1017	2nd deceleration time	0-6,500 sec.	0.1 s	※2—6	
1018	3rd deceleration time	0-6,500 sec.	0.1 s	※2—7	
1019	4th deceleration time	0-6,500 sec.	0.1 s	※2—8	
1020	JOG acceleration/deceleration time	0-20 sec.	0.1 s	0.1	
1021	JOG frequency	0-60Hz	0.01Hz	5	
1022	1st Start of S-shaped acceleration	0-200%	1%	50	
1023	1st End of S-shaped acceleration	0-200%	1%	50	
1024	Gradient of middle of 1st S-shaped Acceleration	0-100%	1%	0	
1025	1st Start of S-shaped deceleration	0-200%	1%	50	
1026	1st End of S-shaped deceleration	0-200%	1%	50	
1027	Gradient of middle of 1st S-shaped Deceleration	0-100%	1%	0	
1028	2nd Start of S-shaped acceleration	0-200%	1%	50	
1029	2nd End of S-shaped acceleration	0-200%	1%	50	
1030	2nd S-shaped Acceleration Middle Gradient Gradient of middle of 2nd t S-shaped Acceleration	0-100%	1%	0	
1031	2nd Start of S-shaped deceleration	0-200%	1%	50	
1032	2nd End of S-shaped deceleration	0-200%	1%	50	
1033	Gradient of middle of 2nd S-shaped Deceleration	0-100%	1%	0	
1034 1035 1036	1st speed frequency selection A 1st speed frequency selection B 1st speed frequency selection C	1: Operation panel 2: External analog VIF1 voltage (0—5 V) 3: External analog VIF1 voltage (0—10 V or potentiometer) 4: External analog VIF2 voltage (0—5 V) 5: External analog VIF2 voltage (0—10V or potentiometer) 6: External analog VIF3 voltage (0—5 V) 7: External analog VIF3 voltage (0—10V or potentiometer) 8: External analog VIF1 current (4—20mA) 9: External analog VIF2 current (4—20mA) 10: External analog VIF3 current (4—20mA) 21: Terminal block stepping 22: Communication 25:Pulse train input 26:External analog VIF1 forward / reverse run operation (0 — 10V, 5V reference) 27:External analog VIF2 forward / reverse run operation (0 — 10V, 5V reference) 28:External analog VIF3 forward / reverse run operation (0 — 10V, 5V reference) 29: Pulse train input (subPG： option)	1	1 1 1 1	
1101	Operation command selection	1: Operation panel 2: External terminal 3: Communication	1	1	
1102	Starting method	1: Starting frequency 2: Flying start 3: Starting frequency after DC braking	1	1	
1103	Starting frequency	0.05-60Hz	0.01Hz	1	
1104	Operation start frequency	0-20Hz	0.01Hz	0	
1105	Start delay time	0-5 sec.	0.1 s	0	
1106	Start standby time	0-120 sec.	0.1 s	0	
1107	Start standby frequency	0.05-60Hz	0.01Hz	5	
1108	Restart after momentary power failure	0: Do not restart 1: Restart 2: Compensation for momentary power failure	1	0	

7-2 Function Code List - Basic Operation Functions

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
1109	Direction of rotation of motor	1: Forward and reverse run 2: Forward run only 3: Reverse run only	1	1	
1110	Direction of rotation of motor	1: Forward run 2: Reverse run	1	1	
1111	Braking method	1: Deceleration to stop 2: Deceleration to stop + DC braking 3: Free run stop	1	1	
1112	DC braking start frequency	0.05-20Hz	0.01Hz	0.5	
1113	DC braking time	0.1 -10 sec.	0.1 s	2	
1114	DC braking force	1-10	1	5	
1115	Duty cycle of brake resistor	0: No brake resistor 2-25%ED 98: No discharge resistor protection (with discharge) 99: External brake unit	1%ED	※1	
1116	Discharge resistor on signal output time	0.01 -10.00 sec.	0.01 s	0.1	
1201	Monitor display selection	1: Frequency [Hz] 2: Output current (A) 3: Speed of rotation [rpm] 4: Load factor [%] 5: No unit display	1	1	
1202	State display selection	1: No units (multiple of F1203) 2: Output voltage [V] 3: DC voltage [V] 4: Active power [kW] 5: Apparent power [kVA] 6: Radiator temperature [℃] 7: Command speed [rpm] 8: PID1 feedback value [Hz] 9: PID2 feedback value [Hz] 10: VIF1 analog input value [Hz] 11: VIF2 analog input value [Hz] 12: VIF3 analog input value [Hz] 13: Output torque [%] 14: Partial excitation current [A] 15: Partial torque current [A] 16: Detecting position [mm] 29: Command frequency [Hz] 30: Command torque [%] 35: Detection speed [rpm](subPG)(option) 44:Target frequency[HZ] 45:Output frequency[HZ]	1	1	
1203	Multiple for no-units display	0-100 (multiple of the output frequency)	0.01	1	
1301	1st jump bottom frequency	0-600 [Hz]	0.01 [Hz]	0	
1302	1st jump top frequency	0-600 [Hz]	0.01 [Hz]	0	
1303	2nd jump bottom frequency	0-600 [Hz]	0.01 [Hz]	0	
1304	2nd jump top frequency	0-600 [Hz]	0.01 [Hz]	0	
1305	3rd jump bottom frequency	0-600 [Hz]	0.01 [Hz]	0	
1306	3rd jump top frequency	0-600 [Hz]	0.01 [Hz]	0	
1307	Auto alarm recovery	0: No auto reset function 1: Auto reset function	1	0	
1308	Instability elimination	0-20	1	0	
1309	Operation direction switching in V / f control mode	0: Start from the direction opposite to current direction after a stop 1: Continuous operation	1	0	
1315	Shortest operation time function	0 -99.99 sec.	0.01 s	0	
1316	2nd Upper frequency limit	5-590 [Hz]	0.01 [Hz]	60	
1317	3rd Upper frequency limit	5-590 [Hz]	0.01 [Hz]	60	
1318	Cooling fan ON/OFF control	0: ON/OFF control 1: Normally ON	1	0	
1319	Functions corresponding to high altitude areas	1: 1,000m or below 2: 1,000m-1,500m or below 3: 1,500m-2,000m or below 4: 2,000m-2,500m or below 5:2,500m-3,000m	1	1	
1320	Rating selection	1: Mode A (heavy load mode) 150% 1 minute 2: Mode B (light load mode) 120% 1 minute	1	2	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
Input/output-related function					
1401	Bias frequency (VIF1)	0-±600 [Hz] (frequency at 0V or 4mA)	0.1 [Hz]	0	
1402	Gain frequency (VIF1)	0-±600 [Hz] (frequency at 5V or 10V or 20mA)	0.1 [Hz]	60	
1403	Bias frequency (VIF2)	0-±600 [Hz] (frequency at 0V or 4mA)	0.1 [Hz]	0	
1404	Gain frequency (VIF2)	0-±600 [Hz] (frequency at 5V or 10V or 20mA)	0.1 [Hz]	60	
1405	Bias frequency (VIF3)	0-±600 [Hz] (frequency at 0V or 4mA)	0.1 [Hz]	0	
1406	Gain frequency (VIF3)	0-±600 [Hz] (frequency at 5V or 10V or 20mA)	0.1 [Hz]	60	
1407	External analog input filter time constant (VIF1)	1-500（set value 1=10ms）.	1	10	
1408	External analog input filter time constant (VIF2)	1-500（set value 1=10ms）.	1	10	
1409	External analog input filter time constant (VIF3)	1-500（set value 1=10ms）.	1	10	
1410	Set frequency gain	0-100	1	0	
1411	Analog input switching for set frequency gain	0: No analog input 1: External analog VIF1 voltage (0—5 V) 2: External analog VIF1 voltage (0—10 V or potentiometer) 3: External analog VIF2 voltage (0—5 V) 4: External analog VIF2 voltage (0—10 V or potentiometer) 5: External analog VIF3 voltage (0—5 V) 6: External analog VIF3 voltage (0—10 V or potentiometer) 7: External analog VIF1 current (4—20mA) 8: External analog VIF2 current (4—20mA) 9: External analog VIF3 current (4—20mA)	1	0	
1412	MBS terminal input mode	1: Level triggered 2: Edge triggered	1	1	
1413	ES input terminal function	1: NO external thermistor signal 2: NC external thermistor signal	1	1	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
1414 1415 1416 1417 1418 1419 1420 1421	Selection of input terminal DI1 Selection of input terminal DI2 Selection of input terminal DI3 Selection of input terminal DI4 Selection of input terminal DI5 Selection of input terminal DI6 Selection of input terminal DI7 Selection of input terminal DI8	0: Unused 1:FR， 2:RR， 3:2DF， 4:3DF 5:MBS， 6:ES， 7:RST， 8:AD2， 9:AD3 10:JOG， 11:5DF， 12:9DF， 13:FR+JOG， 14:RR+JOG， 15:FR+AD2， 16:RR+AD2， 17:FR+AD3， 18:RR+AD3， 19:FR+2DF， 20:RR+2DF， 21:FR+3DF， 22:RR+3DF， 23:FR+2DF+3DF， 24:RR+2DF+3DF， 25:FR+AD2+2DF， 26:RR+AD2+2DF， 27:FR+AD2+3DF， 28:RR+AD2+3DF， 29:FR+AD2+2DF+3DF， 30:RR+AD2+2DF+3DF， 32:RR+AD3+2DF， 34:RR+AD3+3DF， 31:FR+AD3+2DF， 33:FR+AD3+3DF， 35:FR+AD3+2DF+3DF， 39:FR+5DF， 45:CP（Optional）， 36:RR+AD3+2DF+3DF， 47:PC， 58:FR+CCL， 37:PTR， 64:FR+MBS， 40:HD， 67:2DF+AD2， 46:CCL， 69:3DF+AD2， 57:P0， 59:FR+RCCL， 74:2MAX， 65:RR+MBS， 76:VFPID， 68:2DF+AD3， 83:For factory adjustment 70:3DF+AD3， 85:PIDL， 71:A×10（Optional）， 87:RPID1， 72:A×100（Optional）， 89:PID2EX， 75:3MAX， 92:ICLEAR 77:PIDLCK， 114:1DFA， 84:S2， 116:1DFA+1DFB， 86:PIDH， 118:RCOM, 88:PID1EX， 120:1DFA+ROPE, 91:IHOLD， 109:RCCL， 115:1DFB， 117:ROPE， 119:ROPE+RCOM, 121:1DFB+RCOM, 122:1DFA+1DFB+ROPE+RCOM， 253-255:For factory adjustment		1 2 3 4 5 6 7 8	
1422	Reference frequency for pulse input	1000-60000 Hz	1 Hz	1000	
1423	Effective number of bits for VIF1 detection	8-12bit	1bit	12	
1424	Effective number of bits for VIF2 detection	8-12bit	1bit	12	
1425	Effective number of bits for VIF3 detection	8-12bit	1bit	12	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
1501	Internal analog output function 1	0: No function 1: Set frequency (Hz) 2: Output frequency [Hz] 3: PID1 feedback value [Hz] 4: PID2 feedback value [Hz] 5: Output current (A) 6: Output voltage [V] 7: DC voltage [V] 8: Radiator temperature [℃] 9: Load factor [%] (electric thermistor integrated value) 10: Load factor [%] (ratio to rated current) 11: VIF1 analog input value [V] 12: VIF2 analog input value [V] 13: VIF3 analog input value [V] 14: Speed [rpm] 15: Active power [kW] 16: Apparent power [kVA] 17: PID1 command value [Hz] 18: PID1 input deviation value [Hz] 19: PID2 command value [Hz] 20: PID2 input deviation value [Hz] 21: For factory adjustment 22: For factory adjustment 23: For factory adjustment 24: External PID1 output value [Hz] 25: External PID2 output value [Hz] 26: For factory adjustment 35: Command frequency (Hz) 36: Command torque [%] 39:Speed[rpm](subPG)(option) 99: For factory adjustment	1	0	
1502	Internal analog output coefficient 1	0-20	0.01	1	
1503	Internal analog output bias 1	0-±10.0V	0.1V	0	
1504	Internal analog output function 2	0: No function 1: Set frequency (Hz) 2: Output frequency [Hz] 3: PID1 feedback value [Hz] 4: PID2 feedback value [Hz] 5: Output current (A) 6: Output voltage [V] 7: DC voltage [V] 8: Radiator temperature [℃] 9: Load factor [%] (accumulated value of the electric thermistor) 10: Load factor [%] (ratio to rated current) 11: VIF1 analog input value [V] 12: VIF2 analog input value [V] 13: VIF3 analog input value [V] 14: Speed [rpm] 15: Active power [kW] 16: Apparent power [kVA] 17: PID1 command value [Hz] 18: PID1 input deviation value [Hz] 19: PID2 command value [Hz] 20: PID2 input deviation value [Hz] 21: For factory adjustment 22: For factory adjustment 23: For factory adjustment 24: External PID1 output deviation value [Hz] 25: External PID2 output value [Hz] 26: For factory adjustment 35: Command frequency (Hz) 36: Command torque [%] 39:Speed[rpm](subPG)(option) 99: For factory adjustment	1	0	
1505	Internal analog output coefficient 2	0-20	0.01	1	
1506	Internal analog output bias 2	0-±10.0V	0.1V	0	
1507	Approach frequency	0-600Hz	0.01Hz	10	
1508	Frequency matching range	0-10Hz	0.01Hz	0	

7-2 Function Code List – Input/Output-Related Functions

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
1509 1510 1511	Selection of output terminal DO1 Selection of output terminal DO2 Selection of output terminal DO3	0: Unused 1: In operation 1 2: Undervoltage, 3: End of simple scheduled operation 4: In operation 2, 5: Frequency matching (1st speed frequency) 6: Frequency matching (1st to 16th speed frequencies) 7: Frequency approach 8: Overload alarm level setting signal (the value of F1704) 9: Electric thermistor pre-alarm signal (80% of electric thermistor) 10: Radiator overheat pre-alarm signal， 13: Excitation and DC braking signals 14: Lower frequency limit matching signal， 15: Upper frequency limit matching signal， 16: Servo on ready signal (option), 17: Zero servo completion signal (option), 18: FR signal, 19: RR signal, 20: 2DF signal, 21: 3DF signal, 22: 5DF signal, 23: 9DF signal, 24: AD2 signal, 25: AD3 signal, 26: JOG signal, 27: MBS signal, 28: ES signal, 29: RST signal, 31: Positioning completion signal (option) , 32: Discharge resistor on signal, 34: Frequency counter (output frequency), 35: Frequency counter (command frequency), 36: Overload alarm level setting signal (Including when in acceleration/deceleration), 42: Torque matching signal， 43: Low speed detection signal 47: Motor speed counter 48: Forward run detection signal 49: Reverse run detection signal		1 5 8	
1512	Counter output multiple	1-100	1	1	
1513	Relay 1 contact output selection	0: Alarm contact 1: In operation 1, 2: Undervoltage, 3: End of simple scheduled operation 4: In operation 2, 5: Frequency matching (1st speed frequency) 6: Frequency matching (1st to 16th speed frequencies) 7: Frequency approach 8: Overload alarm level setting signal (the value of F1704) 9: Electric thermistor pre-alarm signal (80% of electric thermistor) 10: Radiator overheat pre-alarm signal， 13: Excitation and DC braking signals 14: Lower frequency limit matching signal， 15: Upper frequency limit matching signal， 16: Servo on ready signal 17: Zero servo completion signal, 18: FR signal, 19: RR signal, 20: 2DF signal, 21: 3DF signal, 22: 5DF signal, 23: 9DF signal, 24: AD2 signal, 25: AD3 signal, 26: JOG signal, 27: MBS signal, 28: ES signal, 29: RST signal, 31: Positioning completion signal, 32: Discharge resistor on signal, 36: Overload alarm level setting signal (Including when in acceleration/deceleration), 42: Torque matching signal， 43: Low speed detection signal 48: Forward run detection signal 49: Reverse run detection signal	1	0	
1514	Relay 2 contact output selection	Reserved			
1515	Current output multiple	0-20	0.01	1	
1516	Torque matching level	0-±200%	0.1 %	100	
1517	Torque matching range	0-50%	0.1 %	25	
1518	Low speed matching level	0-2,000rpm	1rpm	100	
1519	Low speed matching range	0-100rpm	1rpm	10	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
1520	Current output function	0: No function 1: Set frequency (Hz) 2: Output frequency [Hz] 3: PID1 feedback value [Hz] 4: PID2 feedback value [Hz] 5: Output current (A) 6: Output voltage [V] 7: DC voltage [V] 8: Radiator temperature [℃] 9: Load factor [%] (electric thermistor integrated value) 10: Load factor [%] (ratio to rated current) 11: VIF1 analog input value [V] 12: VIF2 analog input value [V] 13: VIF3 analog input value [V] 14: Speed [rpm] 15: Active power [kW] 16: Apparent power [kVA] 17: PID1 command value [Hz] 18: PID1 input deviation value [Hz] 19: PID2 command value [Hz] 20: PID2 input deviation value [Hz] 21: For factory adjustment 22: For factory adjustment 23: For factory adjustment 24: External PID1 output value [Hz] 25: External PID2 output value [Hz] 26: For factory adjustment 35: Command frequency (Hz) 36: Command torque [%] 39: Speed [rpm](subPG)(option) 99: For factory adjustment	1	0	
1521	Current output bias	0~±16mA	0.1mA	0	

7-2 Function Code List – Input/Output-Related Functions

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
System-related functions					
1601	Copy function	0: No function 1: Transfer the current code data to the operation panel 2: Transfer the contents stored by operation panel to the inverter (Excluding motor parameters measured) 3: Transfer the contents stored by operation panel to the inverter (Including motor parameters measured)	1	0	
1602	Changed code display function	0: No function 1: Display differences from factory preset 2: Display differences from user's initial value	1	0	
1603	Function lock	0: Code data changeable (No lock function) 1: Code data unchangeable (except F1603) 2: Code data (except frequency setting-related) unchangeable (except F1603, F1021, F2101 — F2116) 3: Code data unchangeable (except F1603 and function codes using communication)	1	0	
1604	Data initialization	0: No function 1: Initialize factory presets 2: Invalid parameter by auto tuning 3: Initialize user's data 99: Set user's initial value	1	0	
1605	Quick knob long-pressing cancel selection	0: Long-pressing cancel disabled 1: Long-pressing cancel enabled	1	0	
1606	Function code setting key selection	1: "Set" key only 2: "Quick knob" only 3: Both quick knob and Set key	1	1	
1607	Target frequency setting time-out	0: Timeout disabled 1 — 60: Timeout (sec.)	1	5	
1701	Output current limiting function	Mode A: 0: No function / 50-200% Mode B: 0: No function / 50-150%	1%	150 120	
1702	Electric thermal setting	0: No function 20-105%	1%	100	
1703	Output current limiting at constant speed	0: No function 1: Yes, V/F mode, (Currently selected acceleration/deceleration time) 2: Yes, V/F mode, (1st acceleration/deceleration time) 3: Yes, V/F mode, (2nd acceleration/deceleration time) 4: Yes, V/F mode, (3rd acceleration/deceleration time) 5: Yes, V/F mode, (4th acceleration/deceleration time) 6: Yes, V/f mode and speed vector control mode (1st acceleration/deceleration time) 7: Yes, V/f mode and speed vector control mode (2nd acceleration/deceleration time) 8: Yes, V/f mode and speed vector control mode (3rd acceleration/deceleration time) 9: Yes, V/f mode and speed vector control mode (4th acceleration/deceleration time)	1	0	
1704	Overload alarm level setting value	Mode A: 20-200% Mode B: 20-150%	1%	150 120	
1705	Motor type	1: General-purpose motor 2: Exclusive motor for the inverter	1	1	
1706	Function to switch between "OV" and "LV" alarms when stopped	0: "OV" enabled, "LV" disabled when stopped 1: "OV" disabled, "LV" enabled when stopped 2: "OV" disabled, "LV" disabled when stopped 3: "OV" enabled, "LV" enabled when stopped	1	0	
1707	Missing Phase detection function	0: No input phase loss, no output phase loss 1: Input phase loss, no output phase loss 2: No input phase loss, output phase loss 3: Input phase loss, output phase loss	1	3	
1708	Overvoltage stalling prevention function	0: No overvoltage stalling prevention function. 1: Overvoltage stalling prevention function.	1	1	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
1709	Feedback signal disconnection detection time	0: Only warning 0.01 -119.99 sec. 120: No detection	0.01 s	5	
1710	Carrier frequency variable by lowering temperature (Active when only mode A is selected)	0: Disabled 1: Enabled	1	0	
1801	Inverter host software version query	Read only		Version	
1802	Memory Version query	Read only		Version	
1803	Operation panel software version query	Read only		Version	
1804	Operation time display	Read only	1 hour	---	
1805	Reading alarm data	0: No function 1: Read start 9: Record erase	1	0	
1806	Alarm status confirmation 1	Read only	1	---	
1807	Alarm status confirmation 2	Read only	1	---	
1808	Alarm status confirmation 3	Read only	1	---	
1809	Alarm status confirmation 4	Read only	1	---	
1810	Alarm status confirmation 5	Read only	1	---	
Special functions					
1901	Energy-saving mode selection	0: No function 1: Simple energy-saving mode (V/f mode) 2: Auto energy-saving mode	1	0	
1902	Simple energy saving rate	0-50%	1%	0	
1903	Simple energy saving time	0 -65,000 sec.	1 s	10	
2001	V•f separation function selection	1: V · f proportional separation 2: Complete separation	1	1	
2002	V•f separation command voltage	0: Disabled (command is given by VIF1) 0.01-10.00V	0.01V	0	
2003	Arbitrary V/f pattern intermediate voltage 1	0-460V	1V	0	
2004	Arbitrary V/f pattern intermediate voltage 2	0-460V	1V	0	
2005	Arbitrary V/f pattern intermediate frequency 1	0.05-600Hz	0.01Hz	20	
2006	Arbitrary V/f pattern intermediate frequency 2	0.05-600Hz	0.01Hz	40	
2007	Automatic torque boost selection	0: No automatic torque boost 1: Voltage compensation function 2: Slip frequency compensation	1	0	
2008	Slip compensation response time constant	0-1000（set value 1=10ms）.	1	10	
2009	Slip compensation multiple	0.01-2	0.01	1	
Graph operation function					
2101	1st speed frequency	0-590Hz	0.01Hz	0	
2102	2nd speed frequency	0-590Hz	0.01Hz	10	
2103	3rd speed frequency	0-590Hz	0.01Hz	20	
2104	4th speed frequency	0-590Hz	0.01Hz	30	
2105	5th speed frequency	0-590Hz	0.01Hz	40	
2106	6th speed frequency	0-590Hz	0.01Hz	50	
2107	7th speed frequency	0-590Hz	0.01Hz	60	
2108	8th speed frequency	0-590Hz	0.01Hz	0	
2109	9th speed frequency	0-590Hz	0.01Hz	0	
2110	10th speed frequency	0-590Hz	0.01Hz	5	
2111	11th speed frequency	0-590Hz	0.01Hz	15	
2112	12th speed frequency	0-590Hz	0.01Hz	25	
2113	13th speed frequency	0-590Hz	0.01Hz	35	
2114	14th speed frequency	0-590Hz	0.01Hz	45	
2115	15th speed frequency	0-590Hz	0.01Hz	55	
2116	16th speed frequency	0-590Hz	0.01Hz	0	
2201	Selection of Scheduled operation	0: Normal operation 1: Simple scheduled operation 2: Disturbed operation	1	0	
2202	Simple scheduled operation repetitions	0: Continuous 1-250: Repetition count	1	1	
2203	Operation timer T1	0 -65,000 sec.	1 s	10	
2204	Operation timer T2	0 -65,000 sec.	1 s	10	
2205	Operation timer T3	0 -65,000 sec.	1 s	10	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
2206	Operation timer T4	0 -65,000 sec.	1 s	10	
2207	Operation timer T5	0 -65,000 sec.	1 s	10	
2208	Operation timer T6	0 -65,000 sec.	1 s	10	
2209	Operation timer T7	0 -65,000 sec.	1 s	10	
2210	Operation timer T8	0 -65,000 sec.	1 s	10	
2211	Operation timer T9	0 -65,000 sec.	1 s	10	
2212	Operation timer T10	0 -65,000 sec.	1 s	10	
2213	Operation timer T11	0 -65,000 sec.	1 s	10	
2214	Operation timer T12	0 -65,000 sec.	1 s	10	
2215	Operation timer T13	0 -65,000 sec.	1 s	10	
2216	Operation timer T14	0 -65,000 sec.	1 s	10	
2217	Operation timer T15	0 -65,000 sec.	1 s	10	
2218	Operation stop time T0	0 -65,000 sec.	1 s	10	
2219	Midway stop deceleration time	1: 1st deceleration time (value of F1016) 2: 2nd deceleration time (value of F1017) 3: 3rd deceleration time (value of F1018) 4: 4th deceleration time (value of F1019)	1	1	
2220	Midway start acceleration time	1: 1st acceleration time (value of F1012) 2: 2nd acceleration time (value of F1013) 3: 3rd acceleration time (value of F1014) 4: 4th acceleration time (value of F1015)	1	1	
2221	Forward/reverse and acceleration/deceleration in T1	X Y X 1: Forward run 2: Reverse run Y 1 - 4: Acceleration/deceleration time specified	---	11	
2222	Forward/reverse and acceleration/deceleration in T2		---	11	
2223	Forward/reverse and acceleration/deceleration in T3		---	11	
2224	Forward/reverse and acceleration/deceleration in T4		---	11	
2225	Forward/reverse and acceleration/deceleration in T5		---	21	
2226	Forward/reverse and acceleration/deceleration in T6		---	21	
2227	Forward/reverse and acceleration/deceleration in T7		---	21	
2228	Forward/reverse and acceleration/deceleration in T8		---	11	
2229	Forward/reverse and acceleration/deceleration in T9		---	11	
2230	Forward/reverse and acceleration/deceleration in T10		---	11	
2231	Forward/reverse and acceleration/deceleration in T11		---	11	
2232	Forward/reverse and acceleration/deceleration in T12		---	21	
2233	Forward/reverse and acceleration/deceleration in T13		---	21	
2234	Forward/reverse and acceleration/deceleration in T14		---	21	
2235	Forward/reverse and acceleration/deceleration in T15		---	21	
2236	Disturb modulation analog input switching	0: No analog input 1: External analog VIF1 voltage (0—5 V) 2: External analog VIF1 voltage (0—10 V or potentiometer) 3: External analog VIF2 voltage (0—5 V) 4: External analog VIF2 voltage (0—10V or potentiometer) 5: External analog VIF3 voltage (0—5 V) 6: External analog VIF3 voltage (0—10V or potentiometer) 7: External analog VIF1 current (4—20mA) 8: External analog VIF2 current (4—20mA) 9: External analog VIF3 current (4—20mA)	1	0	
2237	Disturb modulation rate	0-50%	1%	0	
Display Function					
2301	LCD contrast adjustment	1-63	1	48	
2302	Language selection of LCD	0: Startup options (English display) 1: English 2: Chinese 3: Japanese	1	0	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
2303 2304 2305	LCD's 1st display parameter setting LCD's 2nd display parameter setting LCD's 3rd display parameter setting	0: No display 1: Frequency (Hz) 2: Output current (A) 3: Speed [rpm] 4: Load factor [%] 5: Output voltage [V] 6: DC voltage [V] 7: Active power [kW] 8: Apparent power [kVA] 9: Radiator temperature [℃] 10: Command speed [rpm] 11: PID1 feedback value [Hz] 12: PID2 feedback value [Hz] 13: VIF1 analog input value 14: VIF2 analog input value 15: VIF3 analog input value 16: Output torque [%] 17: Partial excitation current [A] 18: Partial torque current [A] 19: Detecting position [mm] 32: Command frequency (Hz) 33: Command torque [%] 38:Speed [rpm](subPG)(option) 42:Target frequency[HZ] 43:0utput frequency[HZ]	1	1 2 4	
2306	LCD backlight out time	0: Off 1— 600 minutes: the time until it goes off 999: Normally on	1 minute	10	
PID function					
3001	PID1 command value input switching	1: Frequency 2: External analog VIF1 voltage (0—5 V) 3: External analog VIF1 voltage (0—10 V or potentiometer) 4: External analog VIF2 voltage (0—5 V) 5: External analog VIF2 voltage (0—10V or potentiometer) 6: External analog VIF3 voltage (0—5 V) 7: External analog VIF3 voltage (0—10V or potentiometer) 8: External analog VIF1 current (4—20mA) 9: External analog VIF2 current (4—20mA) 10: External analog VIF3 current (4—20mA) 11: Function code setting (F3017) 98: Pulse train input subPG(option) 99: Pulse train input	1	1	
3002	PID1 feedback input switching	0: No input 1: External analog VIF1 voltage (0—5 V) 2: External analog VIF1 voltage (0—10 V or potentiometer) 3: External analog VIF2 voltage (0—5 V) 4: External analog VIF2 voltage (0—10V or potentiometer) 5: External analog VIF3 voltage (0—5 V) 6: External analog VIF3 voltage (0—10V or potentiometer) 7: External analog VIF1 current (4—20mA) 8: External analog VIF2 current (4—20mA) 9: External analog VIF3 current (4—20mA) 10: Communication mode 98: subPG feedback PID (option) 99: PG feedback PID	1	0	
3003	PID1 control proportional gain	0-100	0.01	0.1	
3004	PID1 control integral time	0.01 -100 sec.	0.01 s	0.1	
3005	PID1 control differential time	0 -100 sec.	0.01 s	0	
3006	PID1 control integral separation judgment value	5 — 100% (upper frequency limit reference)	0.1%	20	
3007	PID1 feedback signal input filter time constant	1-500（set value 1=10ms）.	1	10	
3008	Indirect PID1 input reference	5 — 100% (target value reference)	0.1%	20	
3009	PID1 deviation limit value	0: No limit 1 — 100% (upper frequency limit reference)	0.1%	100	
3010	PID1 output limit value	0: No limit 1 — 100% (upper frequency limit reference)	0.1%	100	
3011	PID1 operation polarity switching	1: Command value – feedback value 2: Feedback value – command value	1	1	
3012	PID1 gain polarity switching	1: The positive or negative deviation indicates the same gain 2: The positive or negative deviation indicates different gains	1	1	
3013	PID1 command value gain	0-50	0.01	1	

7-2 Function Code List – PID Function

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
3014	PID1 feedback value gain	0-50	0.01	1	
3015	PID1 control proportional gain (negative: F3012=2)	0-100	0.01	0.1	
3016	PID1 control integral time (negative: F3012=2)	0.01 -100 sec.	0.01 s	0.1	
3017	PID1 control command value	0-6,000	0.1	0	
3018	PID1 control feedback value (communication function)	0-6,000	0.1	0	
3019	Frequency corresponding to PID1 control maximum command value	0-600Hz	0.01Hz	60	
3101	PID2 command value input switching	1: Frequency 2: External analog VIF1 voltage (0—5 V) 3: External analog VIF1 voltage (0—10 V or potentiometer) 4: External analog VIF2 voltage (0—5 V) 5: External analog VIF2 voltage (0—10V or potentiometer) 6: External analog VIF3 voltage (0—5 V) 7: External analog VIF3 voltage (0—10V or potentiometer) 8: External analog VIF1 current (4—20mA) 9: External analog VIF2 current (4—20mA) 10: External analog VIF3 current (4—20mA) 11: Function code setting (F3117) 98: Pulse train input subPG(option) 99 :Pulse train input	1	0	
3102	PID2 feedback input switching	0: No input 1: External analog VIF1 voltage (0—5 V) 2: External analog VIF1 voltage (0—10 V or potentiometer) 3: External analog VIF2 voltage (0—5 V) 4: External analog VIF2 voltage (0—10V or potentiometer) 5: External analog VIF3 voltage (0—5 V) 6: External analog VIF3 voltage (0—10V or potentiometer) 7: External analog VIF1 current (4—20mA) 8: External analog VIF2 current (4—20mA) 9: External analog VIF3 current (4—20mA) 10: Communication mode 98:subPG feedback PID (option) 99: PG feedback PID	1	0	
3103	PID2 control proportional gain	0-100	0.01	0.1	
3104	PID2 control integral time	0.01 -100 sec.	0.01 s	0.1	
3105	PID2 control differential time	0 -100 sec.	0.01 s	0	
3106	PID2 control integral separation judgment value	5 — 100% (upper frequency limit reference)	0.1%	20	
3107	PID2 feedback signal input filter time constant	1-500（set value 1=10ms）.	1	10	
3108	Indirect PID2 input reference	5 — 100% (target value reference)	0.1%	20	
3109	PID2 deviation limit value	0: No limit 1 — 100% (upper frequency limit reference)	0.1%	100	
3110	PID2 output limit value	0: No limit 1 — 100% (upper frequency limit reference)	0.1%	100	
3111	PID2 operation polarity switching	1: Command value – feedback value 2: Feedback value – command value	1	1	
3112	PID2 gain polarity switching	1: The plus or minus deviation indicates the same gain 2: The plus or minus deviation indicates different gains	1	1	
3113	PID2 command value gain	0-50	0.01	1	
3114	PID2 feedback value gain	0-50	0.01	1	
3115	PID2 control proportional gain (negative: F3012=2)	0-100	0.01	0.1	
3116	PID2 control integral time (negative: F3012=2)	0.01 -100 sec.	0.01 s	0.1	
3117	PID2 control command value	0-6,000	0.1	0	
3118	PID2 control feedback value (communication function)	0-6,000	0.1	0	
3119	Frequency corresponding to PID2 control maximum command value	0-600Hz	0.01Hz	60	
3123	PID start mode selection	1: Direct input mode 2: Condition input mode	1	1	
3124	PID end mode selection	1: Direct end mode 2: Condition end mode	1	2	
3125	PID end setting value	1 — 100% (upper frequency limit standard)	0.1%	20	
3127	For factory adjustment				
3201	PID control action selection	0: Open loop control 1: PID1 control 2: PID2 control 3: For factory adjustment 4: External terminal switching PID control 5: Timing switch PID control	1	0	
3202	For factory adjustment				

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
3203	External PID control selection	0: No external PID control 1: External control PID1 2: External control PID2 3: For factory adjustment 4: external controls PID1 and PID2 5: For factory adjustment 6: For factory adjustment	1	0	
3204	External PID operation mode selection	1: Operation interlocked with inverter operation 2: PID output after power input 3: PID output controlled by external terminals	1	1	
3205	PID constitution selection	0: Without command value addition calculation 1: With command value addition calculation	1	0	
3206	Command value addition calculation PID control gain	0.01-100	0.01	1	
3207	PID1/PID2 switching time	0.1 -6,000 minutes	0.1 minute	0.1	
3301	Reading PID1 command value	Read only	1	---	
3302	Reading PID1 feedback value	Read only	1	---	
3303	Reading PID1 input deviation	Read only	1	---	
3304	Reading PID1 output value	Read only	1	---	
3305	Reading PID2 command value	Read only	1	---	
3306	Reading PID2 feedback value	Read only	1	---	
3307	Reading PID2 input deviation	Read only	1	---	
3308	Reading PID2 output value	Read only	1	---	
3309	For factory adjustment				
3310	For factory adjustment				
3311	For factory adjustment				
3312	For factory adjustment				
Communication function					
4001	Message checksum	0: No 1: Yes	1	1	
4003	Pull-up/down function	0: No 1: Yes	1	0	
4004	Communication response time	10-6000ms	1ms	10	
4005	Serial communication function	0:No function 1: Dedicated protocol communication function 2: ModBus communication function	1	0	
4006	Inverter No.	0—254; for ModBus only (0—32; for RS485 communication)	1	1	
4007	Communication speed	1: 1,200bps 2: 2,400bps 3: 4,800bps 4: 9,600bps 5: 19,200bps 6: 38,400bps 7: 57,600bps	1	4	
4008	Parity bit	0: No 1: Odd 2: Even	1	1	
4009	Stop bit	1: 1 bit 2: 2 bits	1	1	
4010	End bit	0: CR+LF 1: CR	1	0	
4011	Inverter's response to specified commands	0: Sent 1: Not sent (Error response sent) 2: Not sent (No error response sent)	1	0	
4101	ModBus communication timeout setting	0: No function 0.01 -600 sec.	0.01 s	0	
4102	ModBus communication timeout action	0: Keep the status 1: Stop alarm	1	0	
4103	ModBus register address switching	1: register number A 2: register number B	1	1	

7-2 Function Code List – Motor Parameters / Vector Control

Code No.	Function Name	Data Content		Setting Resolution	Factory Presets	User Setting Value
Motor Parameters						
5001	Motor poles voltage· capacity	X Y ZZZ X: Poles Y: Rated voltage Z: Motor capacity		—	※ 1	
5002	Motor current rating	0.1-999.9A About 30 — 110% of the inverter current rating		0.1A	※ 1	
5003	Motor frequency rating	10—600Hz		1Hz	※ 1	
5004	Motor speed rating	0-24,000 rpm		1rpm	※ 1	
5005	Motor insulation type	1: Type A 2: Type E 3: Type B 4: Type F 5: Type H		1	※1	
5006	The motor's rated voltage during auto tuning of motor parameters	0: The voltage selected by F5001 100-460V		1V	0	
5007	Rated motor slip ratio	0-50%		0.1%	2	
5008	The setting of motor parameter auto tuning range	0: No range 50-300%		0.1%	200	
5009	Motor stator resistance	55kW or below	0.001-65Ω	0.001Ω	※1	
		75kW or above	0.01-650mΩ	0.01mΩ		
5010	Motor rotator resistance	55kW or below	0.001-65Ω	0.001Ω	※1	
		75kW or above	0.01-650mΩ	0.01mΩ		
5011	Motor stator inductance	55kW or below	0.1-6,000mH	0.1mH	※1	
		75kW or above	0.01-600mH	0.01mH		
5012	Motor rotator inductance	55kW or below	0.1-6,000mH	0.1mH	※1	
		75kW or above	0.01-600mH	0.01mH		
5013	Motor's mutual inductance	55kW or below	0.1-6000mH	0.1mH	※1	
		75kW or above	0.01-600mH	0.01mH		
5014	Motor excitation current	0.01-650A		0.01A	※1	
5015	Motor's moment of inertia	0-65kgm^2		0.001kgm^2	※1	
5016	Load's inertia moment ratio	1-200		0.01	1	
Vector control						
6001	Torque limiter (power running)	Mode A	0-200%	1%	150	
		Mode B	0-150%	1%	120	
6002	Torque limiter analog input function (power running)	0: F6001 1: External analog VIF1 voltage (0—5 V) 2: External analog VIF1 voltage (0—10 V or potentiometer) 3: External analog VIF2 voltage (0—5 V) 4: External analog VIF2 voltage (0—10V or potentiometer) 5: External analog VIF3 voltage (0—5 V) 6: External analog VIF3 voltage (0—10V or potentiometer) 7: External analog VIF1 current (4—20mA) 8: External analog VIF2 current (4—20mA) 9: External analog VIF3 current (4—20mA)		1	0	
6003	Torque limiter (regeneration)	Mode A	0-200%	1%	100	
		Mode B	0-150%			
6004	Torque limiter analog input function (regeneration)	0:F6003 1: External analog VIF1 voltage (0—5 V) 2: External analog VIF1 voltage (0—10 V or potentiometer) 3: External analog VIF2 voltage (0—5 V) 4: External analog VIF2 voltage (0—10V or potentiometer) 5: External analog VIF3 voltage (0—5 V) 6: External analog VIF3 voltage (0—10V or potentiometer) 7: External analog VIF1 current (4—20mA) 8: External analog VIF2 current (4—20mA) 9: External analog VIF3 current (4—20mA)		1	0	
6005	Multiple for starting excitation current	0.1—2 (for applicable motor)		0.01	1	
6006	Starting excitation time	0: No starting excitation 0.1 -10 sec.		0.1 s	※1	

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
6007	Multiple for braking excitation current	0.1—2 (for applicable motor)	0.01	1	
6008	Braking excitation time	0: No braking excitation 0.1 -10 sec.	0.1 s	1	
6009	Current control gain compensation	0.5-1.5	0.01	1	
6010	Speed control ASR proportional gain	0.01-150%	0.01%	※1	
6011	Speed control ASR integral time	0 -20 sec.	0.001 s	※1	
6012	Speed detection filter cut-off frequency	0: No function 0.01-500Hz	0.01Hz	0	
6013	Torque detection filter cut-off frequency	0: No function 0.1-5,000Hz	0.1Hz	0	
6014	Motor vibration reduction rate	0: No function 1: 75% 2: 50% 3: 25%	1	0	
6015	Lower frequency limit for motor vibration reduction function	0-240Hz	0.01Hz	0	
6016	Upper frequency limit for motor vibration reduction function	0-240Hz	0.01Hz	0	
6017	Starting torque	0-100%	0.1%	30	
6018	Starting torque duration time	0 -6500 sec.	0.1 s	1	
6019	Variable 2nd gain for speed control	0: No variable gain function 0.01-150%	0.01%	15	
6020	Frequency bottom of variable gain for speed control	0-240Hz	0.01Hz	10	
6021	Frequency top of variable gain for speed control	0-240Hz	0.01Hz	30	
Torque control					
6101	Torque command selection	1: Operation panel 2: External analog VIF1 voltage (0—5 V) 3: External analog VIF1 voltage (0—10 V or capacity) 4: External analog VIF2 voltage (0—5 V) 5: External analog VIF2 voltage (0—10 V or capacity) 6: External analog VIF3 voltage (0—5 V) 7: External analog VIF3 voltage (0—10 V or capacity) 8: External analog VIF1 current (4—20mA) 9: External analog VIF2 current (4—20mA) 10: External analog VIF3 current (4—20mA)	1	1	
6102	Torque command	Mode A 0-±200.0% Mode B 0-±150.0%	0.1%	10	
6103	Positive upper value of Torque command	20.0-200.0%	0.1%	100	
6104	Positive lower value of torque command	0-20.0%	0.1%	5	
6105	Negative upper value of torque command	20.0-200.0%	0.1%	100	
6106	Negative lower value of torque command	0-20.0%	0.1%	5	
6107	Bias torque command (VIF1)	0-±200.0%（torque command of 0V or 4mA）	0.1%	0	
6108	Gain torque command (VIF1)	0-±200.0%（torque command of 5V or 10V or 20mA）	0.1%	100	
6109	Bias torque command (VIF2)	0-±200.0%（torque command of 0V or 4mA）	0.1%	0	
6110	Gain torque command (VIF2)	0-±200.0%（torque command of 5V or 10V or 20mA）	0.1%	100	
6111	Bias torque command (VIF3)	0-±200.0%（torque command of 0V or 4mA）	0.1%	0	
6112	Gain torque command (VIF3)	0-±200.0%（torque command of 5V or 10V or 20mA）	0.1%	100	
6113	Torque characteristics selection in constant power zone	0: Constant torque constant power limit 1: Constant torque limit	1	0	
6114	Speed limit selection	0: Speed limit under 1st speed frequency command 1: Speed limit in function codes	1	1	
6115	Speed limit value in torque control (Forward run side)	0-8,000 rpm	1rpm	1,800	
6116	Speed limit value in torque control (Reverse run side)	0-8,000 rpm	1rpm	1,800	
6117	Torque control proportional gain	0.01-150%	0.01%	※ 1	
6118	Torque control integral time	0-500ms	0.1ms	50	
6119	Lower torque limiting value in speed limiting	0-100%	0.1%	30	

7-2 Function Code List - Extended Functions

Code No.	Function Name	Data Content	Setting Resolution	Factory Presets	User Setting Value
Extended functions					
8101	Point to Point control position limiter	1-32,767mm	1mm	32,767	
8102	Effective number of bits for Point to Point control position (Unit=mm)	1: Integer 2: 1 digit after decimal point is effective 3: 2 digits after decimal point are effective	1	1	
8103	Simple Backlash calibration	0-±5,000 pulses	1 pulse	0	
8104	Command pulse format (Optional function)	1: Forward / reverse run pulse train 2: Sign pulse train 3: 2-phase pulse train	1	1	
8105	Command pulse logic (Optional function)	1: Positive logic 2: Negative logic	1	1	
8106	PG pulse output divisor (Optional function)	1: 1/1 2: 1/2 3: 1/4 4: 1/8 5: 1/16	1	1	
8107	Deviation counter clear mode	1: Level operation 2: Rising edge operation	1	2	
8108	PG pulse multiplication value	1: ×1 2: ×2 3: ×4	1	3	
8109	PG output formation selection	1: Corresponding to open collector PG 2: Corresponding to open collector PG (optional) 3: Corresponding to bus driver PG (optional)	1	1	
8110	Position control gain	0.1-50 rad/s	0.1rad/s	1	
8111	Positioning completion width	0-32,767 pulses	1 pulse	100	
8112	Error level limit	0-1,000（set value 1=100 pulses）.	1	100	
8113	Quick acceleration/deceleration for position control	0: Disabled 1: Enabled	1	1	
8114	Number of pulses within 1 mm	0: Pulse is specified with F8115 1-32,767 pulses	1 pulse	0	
8115	Point to point control command	0: No function 1-32,767 pulses 0.01-32,767mm（※3）	（※3）	0	
8116	Electric gear ratio function selection (Optional function)	0: Inactive 1: Active	1	0	
8117	Electric gear A data (optional function)	1-100	1	1	
8118	Electric gear B data (optional function)	1-100	1	1	
8119	Zero-servo control function selection	0: Inactive 1: Active 2: Switching on external terminal (P0) zero-servo	1	0	
8120	Zero speed	1-3,000 rpm	1rpm	30	
8121	Zero speed servo complete width	5 — 1,0000 pulses	1 pulse	10	
8122	Number of PG pulses	20 — 2,048 pulses	1 pulse	1000	
8123	For factory adjustment				
8124	For factory adjustment				
8125	PG pulse A-B polarity reversal	0: Inactive 1: Polarity reversal	1	0	
8126	Speed control ASR proportional gain in zero-servo	0: Act according to the set value of F6010 0.01-150%	0.01%	15	
8127	subPG time constants of filter (option)	2~500ms	1ms	2	
8128	subPG pulse number (option)	20~6000ppr	1ppr	1000	
8129	subPG single-phase/two-phase switching (option)	1. single-phase pulse input 2. two-phase pulse input	1	2	
8999	For factory adjustment				

The setting values can not be changed during operation.

***1: The representative parameters that are suitable for various models have been input.**

The following values have been input from * 2-1 to * 2-8 in various models of inverters.

Model	*2-1 F1012	*2-2 F1013	*2-3 F1014	*2-4 F1015	*2-5 F1016	*2-6 F1017	*2-7 F1018	*2-8 F1019
VM06-0015~0110-*2 VM06-0015~0110-*4	5	10	15	20	5	10	15	20
VM06-0150~0185-*4	15	30	45	60	15	30	45	60
VM06-0220~0750-*4	30	60	90	120	30	60	90	120
VM06-0900~1100-*4	60	120	180	240	60	120	180	240
VM06-1320~3150-*4	75	150	225	300	75	150	225	300

***3: Data content and setting resolutions change with function codes. See 7-3 Description of Functions for details.**

8. Protection & Error Function

8-1 Operation error

- The operation error is displayed in the operation of operator panel (key, quick-turn knob), or some unallowed operations or code inputs in function code data inputting (operation, code input).

  When an operation error is displayed, the operation and code input are noneffective.

- The operation error can be displayed either in operation state or stop state. The display will automatically disappear after 3 seconds, and the inverter will return to the status before the operation error.

- During display of operation error, inverter will keep running (*1). The control from external terminals or communication is still effective. But, only the stop key Stop on the operator panel is effective.

  ∗1 **It can also be displayed in stop status.**

8-1-1 List of error operation

8-1 List of error operation

Monitor display	Description
Er A	The frequency cannot be set on the operator panel.
Er b	Specify the undefined function code number. (not displayed on standard operator panel)
Er C	The entered values exceed the allowable range. Or the motor parameters of F5001 (motor poles, voltage and capacity) are not registered.
Er d	User initialization data is not registered. Please use F1604=99 to set the initial user data definition.
Er E	Cannot start with the operator panel.
Er H	The entered setting value conflicts with the optional board.
Er J	The entered setting value conflicts with the optional board.
Er L	Since the inverter is in operation, the function code data cannot be changed.
Er n	Since the operator panel is locked, the function code data cannot be changed.
Er o	Since software editions are different, the data cannot be transmitted. (copy function)
Er P	A password is required, please confirm with the sellers.
Er r	The memory content on operator panel cannot be sent to the master computer. (copy function)
Er S	Automatic testing of motor parameters cannot be carried out for the connected motor.
Er t	The current function code data cannot be sent to the operator panel. (copy function)
Er u	The function code cannot be changed because of undervoltage.
Er 10	No communication between operator panel and inverter computer. Please disconnect the power supply, and confirm the connection of operator panel and optional board. Consult the seller when the error is displayed repeatedly.
oFF L	No communication between operator panel and inverter computer. Please disconnect the power supply, and confirm the connection of operator panel and printed circuit board. Consult the seller when the error is displayed repeatedly.

8-2 Conflict & interference error

- During function code entering, a conflict & interference error will be displayed when the entered data conflicts with the settings of other function codes. The displayed 4-digit number is the number of conflict & interference function code.
- The entered data is invalid when a conflict & interference error is displayed. Please correct it to a value without a conflict, or change the values of the conflict & interference function code.
- For function code and error display related to conflict and interference, please refer to Table 8.2.

8-2-1 List of conflict & interference error

Table 8.2 List of conflict & interference error

Setting function code			Error code	Description
No.	Name	Setting		
1001	Motor control mode selection	All (exclude 1 and 40)	E5001	The setting motor cannot be used in vector control
			E1007/E1316/E1317	Exceed the upper frequency limit
		2	E1901	Simple energy-saving function (only in V/f mode) cannot be used in vector control mode
		3	E1002	Cannot set PG input repeatedly
			E1901	Simple energy-saving (only in V/f mode), cannot be used in vector control mode
		4	E1901	Energy-saving mode cannot be used in torque control
			E2201	Pattern, disturb operation cannot be used in torque control
			E3201	PID control action cannot be used in torque control
		5	E1002	Cannot set PG input repeatedly
			E1901	Energy-saving mode cannot be used in torque control
			E2201	Pattern, disturb operation cannot be used in torque control
			E3201	PID control action cannot be used in position control
		6	E1002	Cannot set PG input repeatedly
			E1101	Position control mode is only effective when operation command is external terminal
			E1901	Energy-saving mode cannot be used in position control
			E2201	Pattern, disturb operation cannot be used in position control
			E3201	PID control action cannot be used in torque control
		10,11	E1901	Energy-saving mode cannot be set when motor parameter are measured automatically
			E2201	Pattern, disturb operation cannot be set during automatic measurement
			E3201	PID control action cannot be set during automatic measurement
		40	E1901	Energy-saving mode cannot be set during V•f separation control
			E2201	Pattern, disturb operation cannot be set in V•f separation mode
			E3201	PID control action cannot be set in V•f separation mode
		All	Exxxx	Cannot set analog input repeatedly

Setting function code			Error code	Description
No.	Name	Setting		
1002	1st speed frequency setting	2-20 26-28	Exxxx	Cannot set analog input repeatedly
		25	E1001	When 1st speed frequency is pulse train input, the required PG sensor control mode cannot be used
1003	V/f pattern	2, 3	E2007	Automatic torque compensation and square ratio lowing mode cannot be used together
1007	Upper frequency limit	All	E1008	Upper frequency limit cannot be smaller than lower frequency limit
			E1001	Exceed the possible upper frequency limit
1008	Lower frequency limit	All	E1007/E1316/E1317	Lower frequency limit cannot be larger than upper frequency limit
1010	Acceleration / deceleration curve	2, 3	E2007	Automatic torque compensation and S acceleration / deceleration degression cannot be used together
1101	Operation command selection	1, 3	E1001	During position control (F1001=6), only terminal board command (F1101=2) can be used
1301	1st jump bottom frequency	All	E1302	No larger than the value of 1st jump top frequency
1302	1st jump top frequency	All	E1301	No smaller than the value of 1st jump bottom frequency
1303	2nd jump bottom frequency	All	E1304	No larger than the value of 2nd jump top frequency
1304	2nd jump top frequency	All	E1303	No smaller than the value of 2nd jump bottom frequency
1305	3rd jump bottom frequency	All	E1306	No larger than the value of 3rd jump top frequency
1306	3rd jump top frequency	All	E1305	No smaller than the value of 3rd jump bottom frequency
1316	2nd upper frequency limit	All	E1008	Upper frequency limit cannot be smaller than lower frequency
			E1001	Exceed the possible upper frequency limit/motor parameter sheet error
1317	3rd upper frequency limit	All	E1008	Upper frequency limit cannot be smaller than lower frequency
			E1001	Exceed the possible upper frequency limit/motor parameter sheet error
1411	Analog input switching for set frequency gain	All	Exxxx	Cannot set analog input repeatedly
1901	Energy-saving mode selection	1	E1001	Only V/f control can use simple energy-saving mode
			E2007	Automatic torque compensation and simple energy-saving mode cannot be used together
			E3201	PID control action and simple energy-saving mode cannot be used together
		2	E1001	Only V/f control speed control can use simple energy-saving mode
			E2007	Automatic torque compensation and auto energy-saving mode cannot be used together
2002	V•f separation command voltage	0	Exxxx	Cannot set analog input repeatedly
2007	Auto torque compensation selection	Beyond 0	E1003	Automatic torque compensation, cannot be used unless V/f mode is linear
			E1010	Automatic torque compensation, cannot be used unless acceleration / deceleration curve is linear
			E1901	Automatic torque compensation and energy-saving mode cannot be used together
2201	Graph operation selection	1,2	E1001	In current control mode, graph or disturb operation cannot be used
		All	Exxxx	Cannot set analog input repeatedly
2236	Disturb modulation analog input switching	All	Exxxx	Cannot set analog input repeatedly
3001	PID1 command value input switching	All	Exxxx	Cannot set analog input repeatedly
3002	PID1 feedback input switching	All	Exxxx	Cannot set analog input repeatedly
3101	PID2 command value input switching	All	Exxxx	Cannot set analog input repeatedly
3102	PID2 feedback input switching	All	Exxxx	Cannot set analog input repeatedly

8-2 Conflict & Interference Error

Setting function code			Error code	Description
No.	Name	Setting		
3201	PID control action selection	Beyond 0	E1001	PID control action can only be used in V/f control or speed control
			E1901	Simple energy-saving mode and PID control operation cannot be used together
		1	E3203	Same PID control cannot be used both internally and externally
		2	E3203	Same PID control cannot be used both internally and externally
		4, 5	E3203	Same PID control cannot be used both internally and externally
		All	Exxxx	Cannot set analog input repeatedly
3203	External PID control selection	1	E3203	Same PID control cannot be used both internally and externally
		2	E3203	Same PID control cannot be used both internally and externally
		4, 5	E3203	Same PID control cannot be used both internally and externally
		All	Exxxx	Cannot set analog input repeatedly
5001	Motor poles, voltage and capacity	All	Exxxx	The motor is not applicable when its capacity has a large difference with inverter capacity
		All	Exxxx	Vector control mode is only applicable to 2-, 4- and 6-pole motors
			E1007/E1316/ E1317	Exceed the possible upper frequency limit
5011	Motor primary inductance	All	E5013	Mutual inductance should be smaller than primary inductance
5012	Motor secondary inductance	All	E5013	Mutual inductance should be smaller than secondary inductance
5013	Motor mutual inductance	All	E5011	Mutual inductance should be smaller than primary inductance
			E5012	Mutual inductance should be smaller than secondary inductance
6002	Torque limiter analog input function (power running)	All	Exxxx	Cannot set analog input repeatedly
6004	Torque limiter analog input function (brake)	All	Exxxx	Cannot set analog input repeatedly
6015	Lower frequency limit for motor vibration reduction function	All	E6016	Cannot exceed the upper frequency limit
6016	Upper frequency limit for motor vibration reduction function	All	E6015	Cannot exceed the lower frequency limit
6101	Torque command selection	All	Exxxx	Cannot set analog input repeatedly
6103	Positive upper value of torque command	All	E6104	Cannot exceed the lower limit value
6104	Positive lower value of torque command	All	E6103	Cannot exceed the upper limit value
6105	Negative upper value of torque command	All	E6106	Cannot exceed the lower limit value
6106	Negative lower value of torque command	All	E6105	Cannot exceed the upper limit value

***Exxxx represents analog input repetition function code.**

8-3 Warning Status

- This warning status alerts you that the protection function of the inverter has been activated. However, the inverter keeps on running. If the inverter runs for a long time in this status, the inverter may enter the alarm status and stop running.
- In the status display mode, details of the warning and the status indication alternate on the display when a warning has occurred. When the status display mode is not selected, the alternating display appears on the display if the warning is still active after the status display mode is resumed.
- All keys are valid during the warning status because the inverter continues to run.

8-3-1 List of warnings

8-3 List of warnings

Warning display	Warning content	Description
SC	Current limiting during acceleration / deceleration	Acceleration (deceleration) time too short
SCn	Current limiting during constant speed operation	Load too heavy, output frequency too high
Su	During overvoltage prevention	Deceleration time too short
oL	Overload warning	Load too heave, continuous operation will cause an inverter shutdown.
tH	Radiator temperature warning	Temperature of the radiator is rising. Check the ambient temperature and operation of the cooling fan. The warning is issued at a temperature 10℃ below the abnormal radiator fin temperature (OH) (The abnormal radiator fin temperature differs depending upon the output frequency, output current and other factors)
dboH	Overheating of brake resistor	Brake resistor capacity too low. (%ED is small) Brake resistor stops to prevent heat damage.
FbEr	Disconnection of feedback cable	I.e. feedback circuit abnormality. Please check feedback value and feedback signal.
CtLEr	Motor rotation direction	Since an operation command unallowed by the specified rotation direction has been input, please confirm the setting of motor rotation direction.
oPtEr	Option error	Two mounted option boards are conflicting with each other. (The option board mounted on OPT2 will be invalid.)
u iEr	Conflict warning for analog input setting	Set voltage input and current input for same analog input channels. Please confirm the function code selected by analog input.
PGnG	PG line error detection	A reverse direction is detected by PG feedback. Please confirm the phase of PG pulse.

8-4 Alarm Status

- The alarm status occurs when the protection function stops the inverter.
- During alarm status, all values on the display (Hz, A, rpm, %, M) flash indicating the alarm status.
- When Status Display mode is selected, details of the alarm are indicated on the 7-segment display. If the Status Display mode is not selected, details of the alarm are indicated on the 7-segment display if the alarm status continues after the Status Display mode is resumed. Details of the alarm cannot be deleted.

8-4-1 List of alarms

Table 8-4-1 List of alarms

7-segment monitor display	Alarm description	Check points	Actions
AL 1 ※2	Memory abnormality	Turn off the power and wait until the CHARGE lamp turns off, turn the power on again and check the alarm.	Contact your supplier.
AL 2 ※1 AL 3 ※1	System abnormality	Excessive external noise? Are signal and power lines separated far enough?	Install a noise collector or filter Keep the signal line far away from the power line
AL 4 ※2	System abnormality	Abrupt capacitor discharge? Turn off the power so the CHARGE lamp turns off, turn the power on again and check the alarm.	Reconfirm the modified code data. Turn the power on and off several times. If the alarm cannot be cancelled, reset the system using F1604=1 and then turn the power off and on again. All the function data is initialized to the factory presets.
AL 5 ※2 AL 9 ※2	System abnormality	Excessive external noise? Are signal and power lines separated far enough?	Install a noise collector or filter Keep the signal line far away from the power line
AL 10	System abnormality	Abrupt capacitor discharge? Turn off the power so the CHARGE lamp turns off, turn the power on again and check the alarm.	Contact your supplier.
ACEr	Overload prevention during acceleration	Setting for output current limiting function (F1701) too small?	Increase the setting value of F1701 Prolong acceleration and deceleration time
CnEr	Overload prevention during constant speed		
dCEr	Overload prevention during deceleration		
ES	External thermal alarm	Motor overheated? Function settings are correct?	Reduce the load Re-set the function codes correctly (F1413)

7-segment monitor display	Alarm description	Check points	Actions
oH	Radiator temperature abnormality	Fan stopped? Ambient temperature too high?	Check fan operation Increase the ventilation
LuA	Undervoltage during acceleration	Does power supply satisfy conditions? Has the voltage dropped?	Examine/improve power supply conditions.
Lun	Undervoltage during constant speed		
Lud	Undervoltage during deceleration		
oCH	Main switch element temperature abnormality	Fan stopped? Ambient temperature too high?	Check fan operation Increase the ventilation
oCA ※3	Overcurrent during acceleration	Abrupt acceleration / deceleration rate? Output short-circuited or ground fault? Main switch elements abnormality?	Prolong acceleration and deceleration time. Correct short-circuit or ground fault. Contact your supplier when alarms are issued repeatedly.
oCn ※3	Overcurrent during constant speed		
oCd ※3	Overcurrent during deceleration		
oCPA	Momentary overload during acceleration	Excessive acceleration rate? Setting for current limiting function (F1701) too high?	Prolong acceleration time Decrease the setting value
oCPn	Momentary overload during constant speed	Abrupt change (increase) in load? Setting for current limiting function (F1701) too high?	Eliminate the abrupt change (increase) Decrease the setting value
oCPd	Momentary overload during deceleration	Excessive deceleration rate with a GD^2? Setting for current limiting function (F1701) too high?	Prolong acceleration time Decrease the setting value
oLA	Overload during acceleration	Motor operated with an excessive load? Electrothermal level set properly? Load GD^2 too large?	Reduce the load Increase the capacity of the inverter and motor
oLn	Overload during constant speed		
oLd	Overload during deceleration		
ouA	Overvoltage during acceleration	Did start-up occur during idle run?	Flying start.
oun	Overvoltage during constant speed	Is motor being turned by other force?	Redesign the system so that the motor is not driven by external force. Use a brake resistor with a larger capacity.
oud	Overvoltage during deceleration	Excessive deceleration?	Prolong the deceleration time (so that GD^2 of the load is met)
ouP	Brake resistor overvoltage protection	Braking frequency too high?	Reduce the braking frequency Increase the brake resistor capacity
GAL 1	Disconnection of feedback signal cable (during PID control action)	Feedback signal cable disconnected? Feedback signal correct? Gain frequency correct? （F1402, F1404, F1406）	Check feedback signal cable and connect securely. Set gain frequency properly （F1402, F1404, F1406）

8-4 Alarm Status

7-segment monitor display	Alarm description	Check points	Actions
GAL 2	Overspeed	Over-shoot or under-shoot happened?	Confirm speed command value or torque command value
GAL 3	Modbus communication timeout	Communication cable disconnected?	Confirm communication cables are connected securely
PonG ※2	Power supply abnormality	+24V power supply output from the control circuit overloaded or shorted?	Check the +24V output power supply for load conditions
oPn o	Missing output phase	Missing an output phase?	Connect the output cables securely
oPn i	Missing input phase	Missing an input phase?	Check and improve the input current
Gnd F	Check grounding short-circuit current	Short-circuited when grounding?	Confirm output cable and motor insulation performance
PGEr	Disconnection of PG pulse feedback signal cable Position deviation counter abnormality	Feedback signal cables are well connected? Is motor being driven by other force?	Connect the feedback signal cable securely Redesign the system so that the motor is not driven by external force.
FAn L	Cooling fan abnormality	Cooling fan is working?	Check the fan performance
rYoFF	Main relay abnormality	Turn off the power and wait until the CHARGE lamp turns off, turn the power on again and check the alarm.	Contact the supplier

*1: **Since all function data are initialized to the factory presets, settings will need to be input again.**
*2: **After several times of power on/off, contact your supplier if the alarm is displayed again.**
*3: **Even though a protective function against short-circuit of the main switch element is installed, repeated short-circuiting may cause deterioration of the elements and lead to damages to the inverter. Therefore the inverter can only be restarted after checking and removing the cause of the problem.**
* **If the display on the operation panel goes out for some reason, turn off power supply to the inverter to check the wiring; then turn the power on after CHARGE lamp has gone out. (Short-circuiting caused by improper connection of control terminals and so on)**

9. Fault Analysis

Problem		Check points
Motor does not rotate	Main circuit	• Voltages at input terminals R, S and T are normal? • Is the motor wired correctly?
	Load side	• Load too heavy? • Motor locked?
	Operator panel	• Starting frequency setting too high (F1103)? • Operation start frequency (F1104) setting too high? • Is operation command selected for control by external signal (F1102=2)? • Upper frequency limit set too low (F1007)? • 2nd upper frequency limit (F1316) and 3rd upper frequency limit selected by multi-function input signal are setting too low? • Check if no setting is specified for the direction of rotation of motor (F1109)?
	Input signal	• Are operation signals (FR, RR) being input? • FR and RR signals are input simultaneously? • Idle run stop signal input (MBS)? • Analog signal for frequency setting is zero?
Rotation direction different from what it should be	Wrong wiring of output terminals U, V and W? Is the wiring for forward and reverse run mixed up?	
Rotation speed does not increase	• Upper frequency limit (F1007) activated? • Output current limiting function activated? → Is setting of F1701 too low? / Torque boost (F1004) too high? • Load too heavy? • PG sensor connected correctly?	
Rotation is not constant	• Load fluctuating? • Frequency setting (analog) signal fluctuating? • Are the capacity and number of poles appropriate for the inverter capacity specified for use in the sensorless vector control mode? • PG sensor set correctly?	
Acceleration / deceleration is not constant	• Acceleration / deceleration time too short? • Output current limiting function activated? • Load too heavy?	
Motor heating up	• Wrong setting for V/f mode? • Torque compensation too high?	
Rotation speed changes abnormally during operation	• Is the load fluctuating? • Output current limiting function activated? Is setting of F1701 too low?	
No display on the interface of operator panel	• Voltages at input terminals R, S and T are normal? • Connection between inverter and operator panel satisfies the standard?	

10. Maintenance & Inspection

■ **Never touch the internal parts.**
Failure to obey may result in electrical shock, personal injury and other dangers.

Careful checking and maintenance are essential to ensure that the SAMCO-VM06 general-purpose inverter can operate correctly with a long service life.

10-1 Precautions on Checking and Maintenance

- Capacitors retain a high voltage charge for a while after the power is turned off. Before carrying out inspection, please firstly make sure that the CHARGE lamp is off, then make sure that the voltage across terminals P and X is lower than DC30V using a circuit tester.

10-2 Inspection Items

- The motor works as expected;
- The cooling system is free from any problems (such as abnormal heating);
- There is no abnormality at the location of installation; and
- There is no abnormal vibration or noise.

Table 10-1 Inspection must be carried out following the periodic inspection list.

Table 10-1 Periodic inspection list

Inspection item		Inspection details	Method & Instrument	Criteria
General	**Ambient environment**	• Ambient temperature, relative humidity • Confirm operating environment	• Visual inspection, measuring instrument • Thermometer & hygrometer	• Satisfy standard specifications
	Power supply voltage	• Power supply voltage of the inverter is normal.	• Measure interphase voltage of R, S and T input terminals. • Use tester and multimeter	• Satisfy standard specifications of input
	Appearance Structural parts	• No abnormal vibration or noise • No loosening of bolts • No deformation or breakage • No adhesion of dust or dirt	• Tighten bolts • Visual inspection	• No abnormal
Main Circuit	**General**	• Megger check • No loosening of bolts • No adhesion of dust or dirt	• Tighten bolts • Visual inspection	• No abnormal
	Connection conductors and wires	• No deformation or dirt • No discoloration because of overheating	• Visual inspection	• No abnormal
	Main module	• Check resistance between terminals	• Disconnect the main wiring of the inverter and measure each terminal with tester (x1 range) • Use analog tester	• Refer to Table 10-2 Main circuit power module checklist

Inspection item		Inspection details	Method & Instrument	Criteria
Main Circuit	**Terminal board**	• No burning or breakage	• Visual inspection	• No abnormal
	Main electrolytic capacitor	• No liquid leakage • No loosening of safety valve	• Visual inspection	• No leakage, deformation or crack • No action of the safety valve
	Relay electromagnetic contactor	• No chatter during operation • No rough surface on the contact • No abnormal noise when the switch is ON	• Visual and hearing inspection	• No abnormal
	Resistor	• No disconnection • No odor or crack because of overheating	• Odor and visual inspection • Remove one-end and check with tester • Use tester or multimeter	• No abnormal • Within ±10% of indicated resistance value
	Transformer	• No abnormal beat sound or odor	• Odor, visual and hearing inspection	• No abnormal
Control circuit display	**Connector**	• No loosening of connectors • No crack, breakage or deformation	• Visual inspection	• No abnormal
	Capacitor	• No leakage, breakage or deformation	• Visual inspection	• No abnormal
	Board	• No discoloration or dirt	• Visual inspection	• No abnormal
	Display	• No break in the LED lamp on operation panel • No abnormality in key operation • Favorable display of characters on LCD panel	• Visual inspection	• Make sure the lamp lights up. • Make sure operations.
Cooling system	**Fan**	• No abnormal vibration or noise • No OH alarm • No loosening of bolts, wiring or connectors	• Visual and hearing inspection • Tighten bolts, wiring and connectors.	• No abnormal
	Ventilation flue	• No blockage in cooling fan inlet and outlet or contamination adhesion of foreign objects.	• Visual inspection • Tactile inspection	• No abnormal
	Fin	• No abnormal heating	• Tactile inspection or check the temperature • Use thermometer	• No abnormal
Motor	**General**	• No abnormal vibration or noise	• Visual and hearing inspection	• No abnormal
	Insulation resistance	• Megger check	• Disconnect the inverter output wiring U, V and W, then make an inspection • Use megger tester	• Higher than 5MΩ

Table 10-2 Main circuit power module checklist

Input/Output	Terminals		Measured value
	Multimeter +	Multimeter -	
Input (R, S, T)	P	R、S 、T	Conducted
	R 、S、 T	P	Not conducted
	X	R、 S 、T	Not conducted
	R 、S 、T	X	Conducted
Output (U, V, W)	P	U、 V、 W	Conducted
	U 、V 、W	P	Not conducted
	X	U、 V、 W	Not conducted
	U 、V 、W	X	Conducted

10-3 Part Replacement

When replacing a part, please contact your supplier or our sales department.

10-3-1 Fan Replacement

When cooling fan is used continuously under the environments with high temperature (40℃ and above) and plenty of dust, the service life will be shortened obviously. Therefore, the fan must be checked regularly. Furthermore, the fan should be replaced duly when there is an abnormal vibration or sound.

■ **Turn OFF the power for replacement. Make sure that the fan is stopped before making a replacement.**
Failure to obey may result in personal injury or electric shock.

（1） Steps for replacing fan of VM06-0015 ~ 0110
The fan is on the top of the device.

Step 1 Remove one screw (M3).
Step 2 Hook the cover board with a finger and pull to remove it.
Step 3 Pull out the fan and remove the connector, then make a replacement.
After the replacement, reinstall the fan with a sequence of 3 →2→ 1.

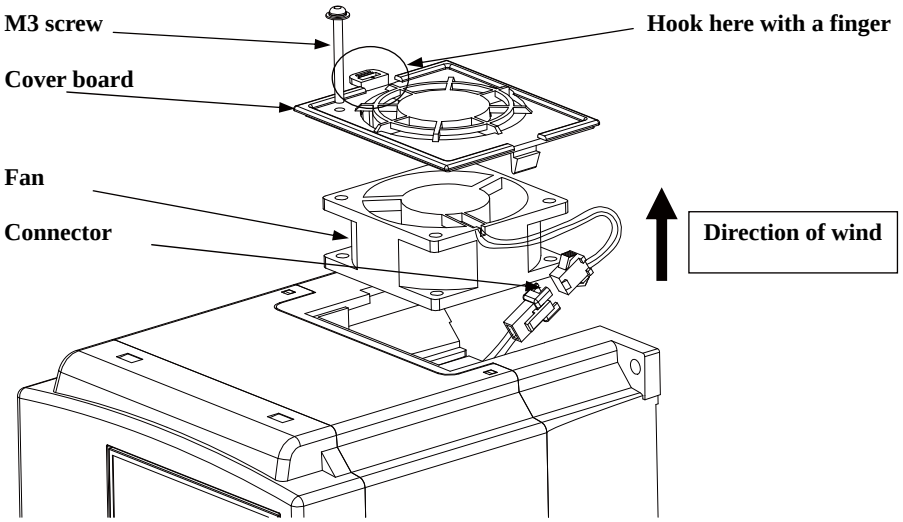


Figure 10-1 **Replacement steps of fan**（VM06-0015 ~0110）

（2） Steps for replacing fan of VM06-0150 ~0185
The fan is on the top of the device.

Step 1 Remove two screws (M3).
Step 2 Hook the cover board with a finger and pull to remove it.
Step 3 Pull out the fan and remove the connector, then make a replacement.
After the replacement, reinstall the fan with a sequence of 3 →2→ 1.

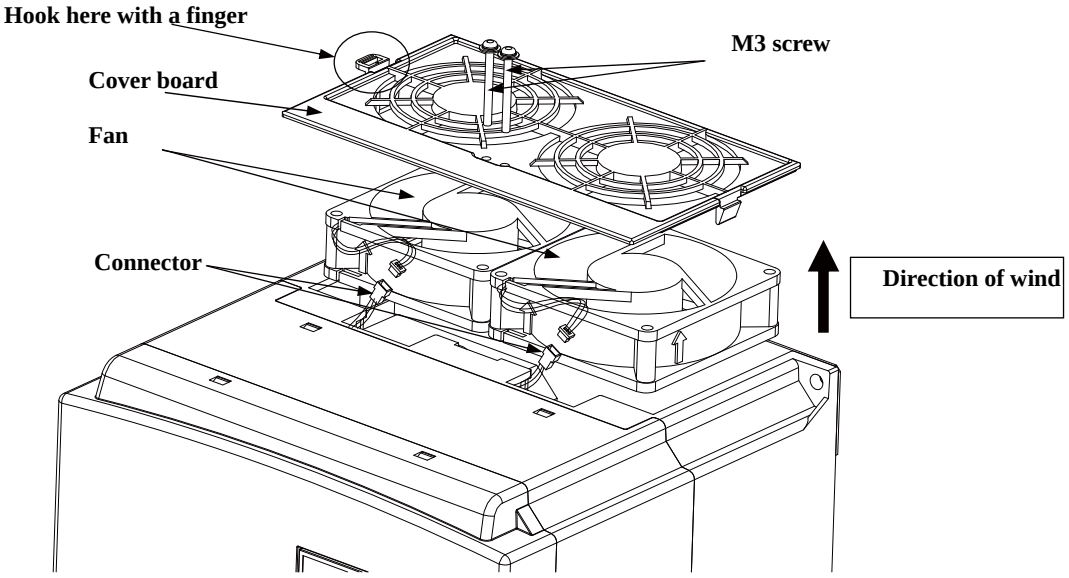


Figure 10-2 **Replacement steps of fan**（VM06-0150 ~0185）

（3）Steps for replacing fan of VM06-0220 ~0370
The fan is on the top of the device.
Step 1 Remove four screws (M4×8).
Step 2 Pull out the cover board with a finger.
Step 3 Remove four screws (M4×45).
Step 4 Pull out the fan and remove the connector, then make a replacement.
After the replacement, reinstall the fan with a sequence of 3 →2→ 1.

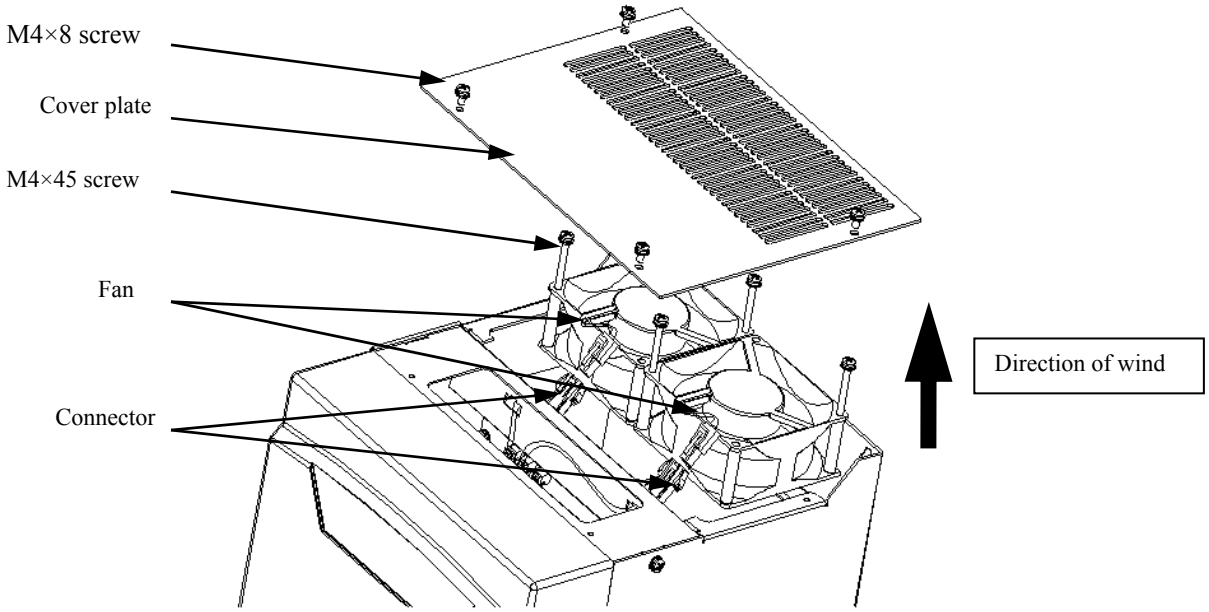


Figure 10-3 **Replacement steps of fan**（VM06-0220 ~0370）

（4）Steps for replacing fan of VM06-0450 ~0550
The fan is on the top of the device.

Step 1 Remove four screws (M4×8).
Step 2 Pull out the cover board with a hand.
Step 3 Remove two screws (M4×60).
Step 4 Pull out the fan and remove the connector, then make a replacement.
After the replacement, reinstall the fan with a sequence of 4→3 →2→ 1.

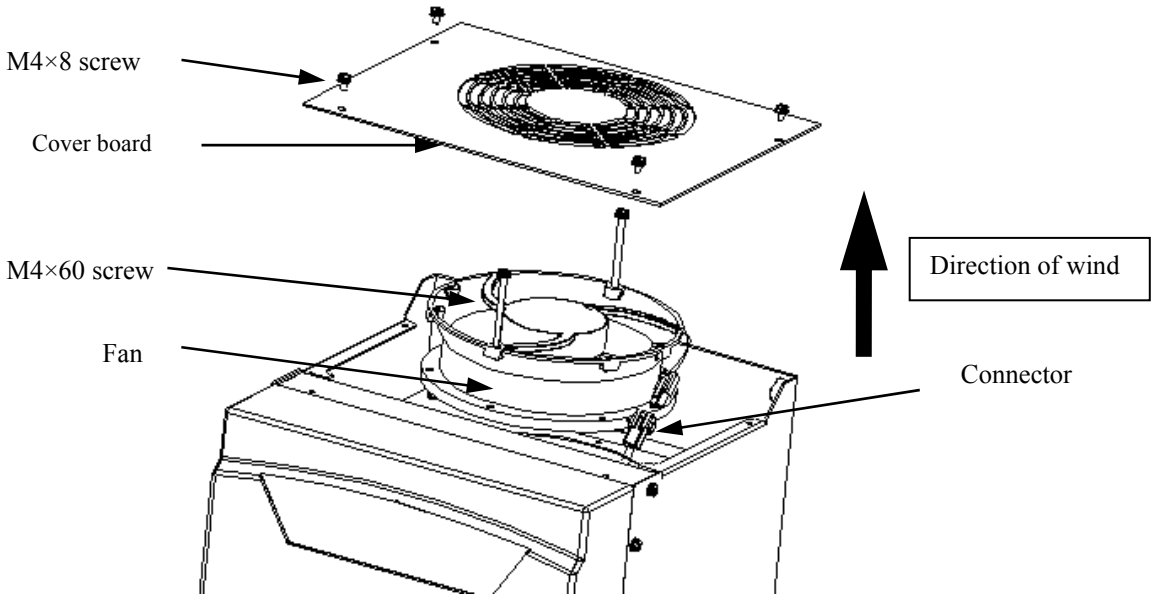


Figure 10-4 **Replacement steps of fan**（VM06-0450 ~0550）

（5）Steps for replacing fan of VM06-0750 ~0900
The fan is on the top of the device.
Step 1 Remove four screws (M4×8).
Step 2 Pull out the cover board with a hand.
Step 3 Remove four screws (M4×60).
Step 4 Pull out the fan and remove the connector, then make a replacement.
After the replacement, reinstall the fan with a sequence of 4→3 →2→ 1.

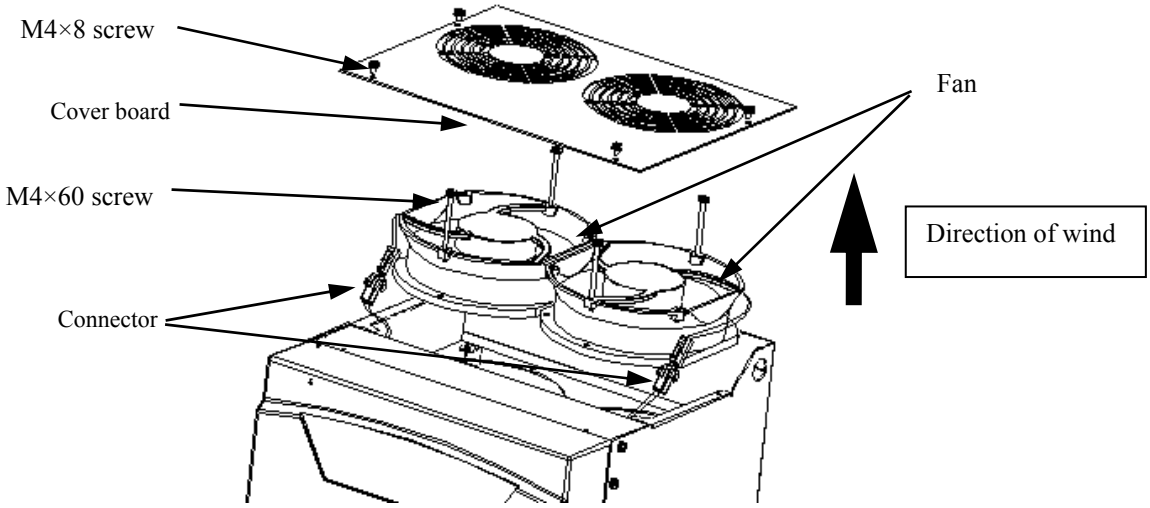


Figure 10-5 Replacement steps of fan（VM06-0750 ~0900）

（6）Steps for replacing fan of VM06-1100 ~3150

The fan is on the top of the device.

Step 1 Remove the screws (M4).

Step 2 Pull out the cover board with a hand.

Step 3 Remove the screws and the connector.

After the replacement, reinstall the fan with a sequence of 3 →2→ 1.

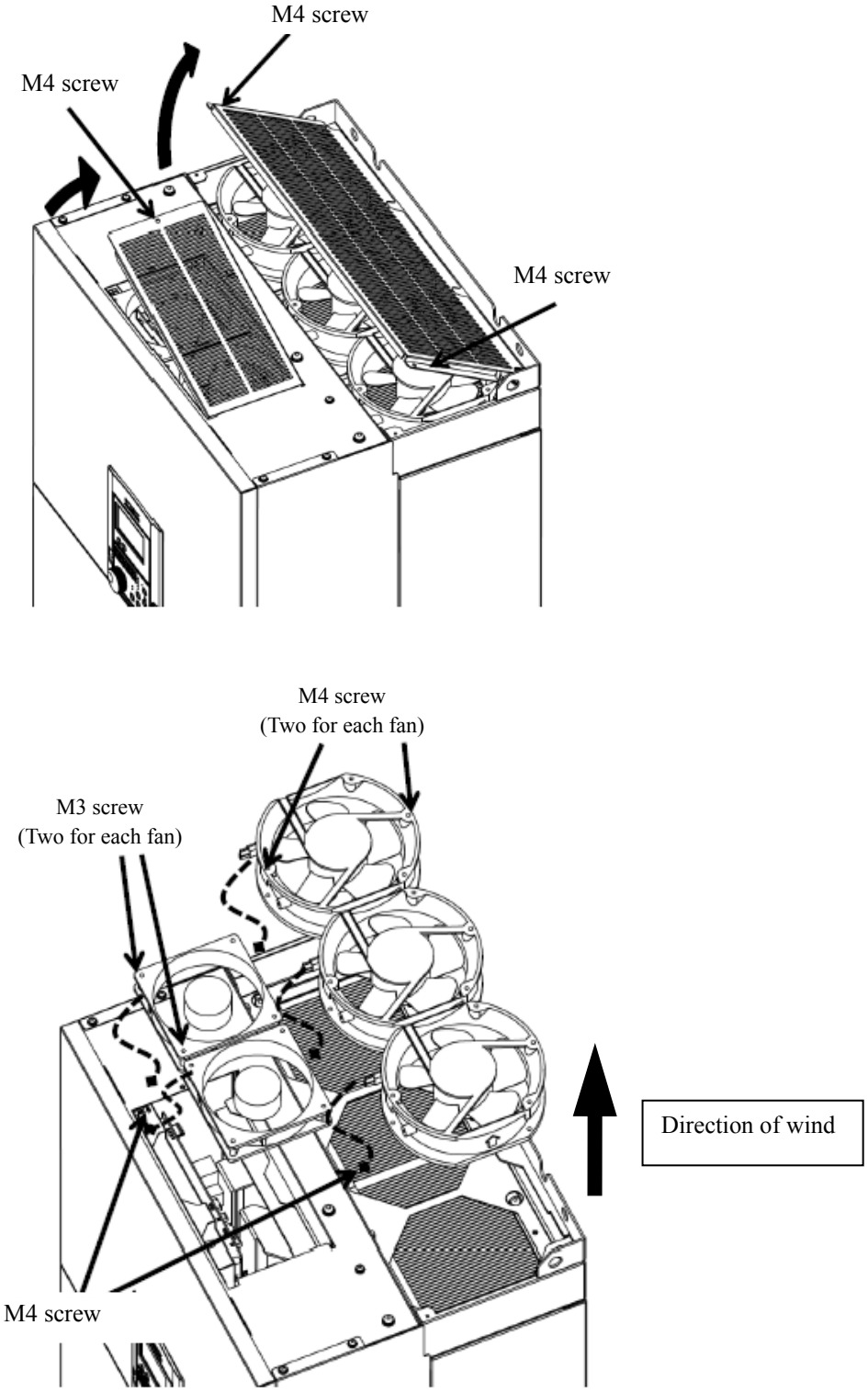


Figure 10-6 Replacement steps of fan（VM06-1100 ~3150）

10-3-2 Smoothing Capacitors

Aluminum electrolytic capacitors for smoothing deteriorate over time. It must be replaced approximate every ten years. Since the service life varies greatly depending on the ambient temperature, load and using frequency, this time period is only an approximate limit rather than a guaranteed limit.

When used continuously in a high temperature (averagely 40℃ and above), the service life will be shortened.

The inverter must receive transmitted electricity at least once a year when it is stored and not energized.

The capacitors must be inspected at least once a year, and once in 6 months when they are near the end of their lifetime.

10-4 Megger Test

- When performing a megger test on the motor and the sequential circuit, be careful not to apply the test voltage to the inverter.
- For the inverter itself, perform the megger test only on the main circuit as shown below. Do not conduct a megger test on the control circuit.

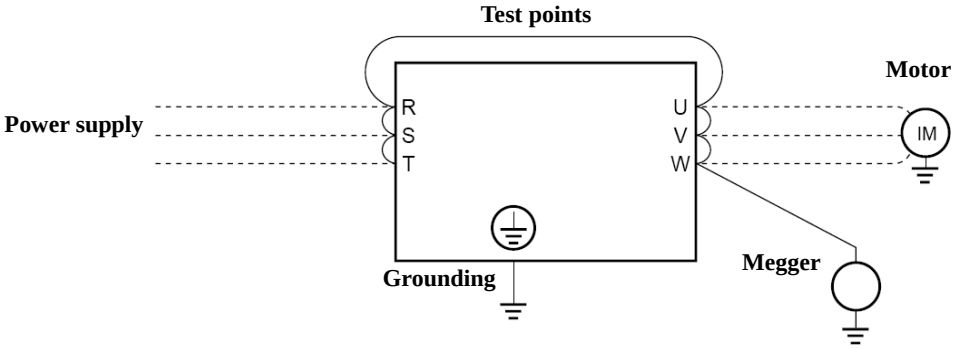


Figure 10-3 **Circuit diagram for megger test**

Use a multimeter (high resistance range) for continuity testing of the control circuit. Do not use the testing instruments such as megger or buzzer.

Note: Use a megger for measurement when the connector status is OFF (in 4-4EMC filter).

10-5 Electrical measurement of main circuit

- Since the voltages and currents of the main inverter circuit at the input (power supply) and output (motor) contain harmonic components, measured values may differ depending on the meter used. When using a commercial frequency meter, select one of the types listed in the table below.
- The power factor cannot be measured with a commercial power-factor meter that measures the phase difference between voltage and current. Measure the voltage, current and power separately at input/output and calculate the power factor using the following formula:

$$\text{Power factor [\%]} = \frac{\text{Power [kW]}}{\sqrt{3} \times \text{Voltage [V]} \times \text{Current [A]}} \times 100$$

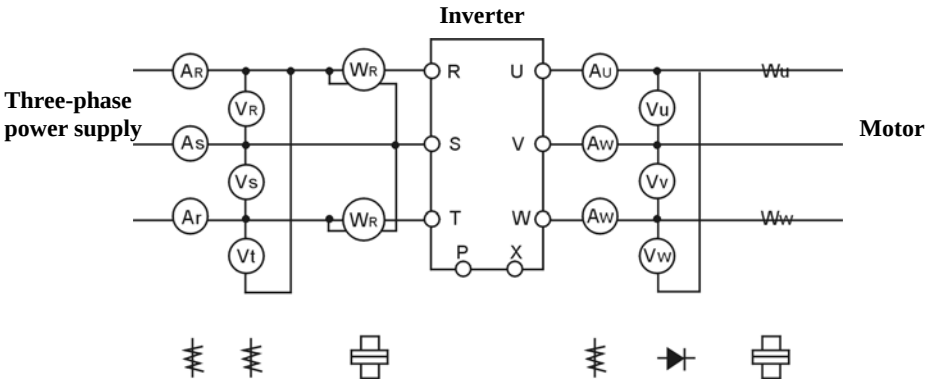


Figure 10-4 **Power measurement circuit for main circuit**

Table 10-4 **Main circuit measuring instruments**

Symbol	Item	Measuring instruments
	Power supply current	Moving-iron type AC ammeter
	Power supply voltage	Moving-iron type AC voltmeter
	Power supply power	Electrodynamic single-phase power meter or Digital power meter
	Power supply power factor	Digital power meter (can be calculated with the measured power supply voltage, current and power)
	Output voltage	Rectifier type AC voltmeter or digital power meter
	Output current	Moving-iron type AC ammeter or digital power meter
	Output power	Electrodynamic single-phase power meter or Digital power meter
	Output power factor	Digital power meter (can be calculated with the measured power supply voltage, current and power)

11. Specification

11-1 Standard specification

200V

Item				Specification					
Model（VM06-□□□□-*2）				0015	0022	0037	0055	0075	0110
mOutput specification	Mode B Light load	Standard applicable motor [KW]		1.5	2.2	3.7	5.5	7.5	11
		Rated capacity [KVA]	*1	2.7	3.7	5.8	8.5	11.4	16.8
		Rated current [A]		7.0	9.6	15.1	22.3	30	44
		Overload current rating	*2	120%-1min					
		Output frequency range	*3	0.05-240Hz（Starting frequency 0.05-60Hz variable）					
	Mode A Heavy load	Standard applicable motor [KW]		0.75	1.5	2.2	3.7	5.5	7.5
		Rated capacity [KVA]	*1	1.9	3	4.3	6.7	9.1	12.6
		Rated current [A]		5.1	8	11.2	17.6	24	33
		Overload current rating	*2	150%-1min					
		Output frequency range	*3	0.05-590Hz（Starting frequency 0.05-60Hz variable）					
	Rated output voltage		*4	3φ 200V-220V					
Input power supply	Voltage & Frequency			3φ 200V-230V 、 50/60Hz					
	Allowable fluctuation			Voltage: -15%、+10% Frequency: ±5% Voltage unbalance: within 3%					
	Power supply impedance			1% and above（Use optional reactor if less than 1%）					
	Mode B Light load	Required power capacity [KVA] *5		2.3	3.1	4.9	7.7	10.4	16.4
		Input current [A] *6	With DCL	5.9	8.1	12.8	20.3	27.3	43.1
			Without DCL	9.1	12.5	19.6	31.2	42	61.6
	Mode A Heavy load	Required power capacity [KVA] *6		1.5	2.6	3.6	5.7	8.3	11.4
		Input current [A] *6	With DCL	4.3	6.8	9.5	14.9	21.8	30
			Without DCL	6.6	10.4	14.6	22.9	33.6	46.2
Protective structure				Totally enclosed（IP20）					
Cooling method				Forced air cooling					
Approximate weight				4kg				6kg	7kg
Carrier frequency				Sine wave PWM（carrier frequency 1k-14kHz）※7					
DC reactor				option					

*1 **Rated capacity at the output voltage of 220V**
*2 **One minute is allowed every 10 minutes**
*3 **During vector control, PG sensorless is 0.25Hz-240Hz /PG sensor is 0.05Hz-240Hz (depends on the number of poles)**
*4 **Output voltage cannot exceed power supply voltage**
*5 **Vary with the impedance changes of the power supply including a DC reactor**
*6 **Vary with the impedance of the power supply**
*7 **The maximum value of carrier frequency varies with the inverter capacity mode and operation status.**

400V

Item				Specification							
Model（VM06-□□□□-**4）				0015	0022	0040	0055	0075	0110	0150	0185
Output specification	Mode A Heavy load	Standard applicable motor [KW]		0.75	1.5	2.2	4	5.5	7.5	11	15
		Rated capacity [KVA]	*1	1.7	2.8	4.2	6.2	8.7	11.8	17.3	22.2
		Rated current [A]	*2	2.5	4	6	9	12.6	17	25	32
		Overload current rating	*3	150%-1min							
		Output frequency range	*4	0.05-590Hz（Starting frequency 0.05-60Hz variable）							
	Mode B Light load	Standard applicable motor [KW]		1.5	2.2	4	5.5	7.5	11	15	18.5
		Rated capacity [KVA]	*1	2.8	4.2	6.2	8.7	11.8	17.3	22.2	26.3
		Rated current [A]	*2	4	6	9	12.6	17	25	32	38
		Overload current rating	*3	120%-1min							
		Output frequency range	*4	0.05-240Hz（Starting frequency 0.05-60Hz variable）							
	Rated output voltage		*5	3φ 380V-460V							
Input power supply	Voltage & Frequency			3φ 380V-460V 、 50/60Hz							
	Allowable fluctuation			Voltage: -15%、+10% Frequency: ±5% Voltage unbalance: within 3%							
	Power supply impedance			1% and above（Use optional reactor if less than 1%）							
	Mode A Heavy load	Required power capacity [KVA] *6		2.4	3.8	5.8	8.7	12.1	16.4	24.2	31
		Input current [A] *7	With DCL	2.1	3.6	5.5	8.2	11.5	15.5	24.5	31.4
			Without DCL	3.5	5.6	8.4	12.6	17.6	23.8	35	44.8
	Mode B Light load	Required power capacity [KVA] *6		3.8	5.8	8.7	12.1	16.4	24.2	31	36.8
		Input current [A] *7	With DCL	3.6	5.5	8.2	11.5	15.5	24.5	31.4	37.2
			Without DCL	5.6	8.4	12.6	17.6	23.8	35	44.8	53.2
Protective structure				Totally enclosed（IP20）							
Cooling method				Forced air cooling							
Approximate weight *8				4kg				6kg		7kg	
Carrier frequency				Sine wave PWM（carrier frequency 1k-14kHz）※9							
DC reactor				option							

*1 **Rated capacity at the output voltage of 400V**
*2 **When input voltage is 400VAC and above, the rated current will be decreased according to the output power**
*3 **One minute is allowed every 10 minutes**
*4 **During vector control, PG sensorless is 0.25Hz-240Hz /PG sensor is 0.05Hz-240Hz (depends on the number of poles)**
*5 **Output voltage cannot exceed power supply voltage**
*6 **Vary with the impedance changes of the power supply including a DC reactor**
*7 **Vary with the impedance of the power supply**
*8 **When an EMC filter is embedded**
*9 **The maximum value of carrier frequency varies with the inverter capacity mode and operation status.**

11-1 Inverter Standard Specification

Item				Specification						
Model（VM06-□□□□-*4)				0220	0300	0370	0450	0550	0750	0900
Output specification	Mode A Heavy load	Standard applicable motor [KW]		18.5	22	30	37	45	55	75
		Rated capacity [kVA] *1		26	32	42	51	62	76	102
		Rated current [A] *2		38	46	61	74	90	110	147
		Overload current rating *3		150%-1min						
		Output frequency range *4		0.05-590Hz（Starting frequency 0.05-60Hz variable)						
	Mode B Light load	Standard applicable motor [KW]		22	30	37	45	55	75	90
		Rated capacity [KVA] *1		31	41	51	62	76	98	120
		Rated current [A] *2		46	61	74	90	110	147	173
		Overload current rating *3		120%-1min						
		Output frequency range *4		0.05-240Hz（Starting frequency 0.05-60Hz variable)						
	Rated output voltage *5			3φ 380V-460V						
Input power supply	Voltage & Frequency			3φ 380V-460V, 50/60Hz						
	Allowable fluctuation			Voltage: -15%、+10% Frequency: ±5% Voltage unbalance: within 3%						
	Power supply impedance			1% and above（Use optional reactor if less than 1%）						
	Mode A Heavy load	Required power capacity [KVA] *6		26	33	42	51	64	82	106
		Input current [A] *7	With DCL	38	47	60	74	93	119	153
			Without DCL	55	70	93				
	Mode B Light load	Required power capacity [KVA] *6		33	42	51	64	82	106	119
		Input current [A] *7	With DCL	47	60	74	93	119	153	172
			Without DCL	70	93	104				
Protective structure				Totally enclosed（IP20）						
Cooling method				Forced air cooling						
Approximate weight *8				19kg			35kg		45kg	
Carrier frequency				Sine wave PWM（carrier frequency 1k-10kHz）※9						
DC reactor				option			Embedded			

*1 **Rated capacity at the output voltage of 400V**
*2 **When input voltage is 400VAC and above, the rated current will be decreased according to the output power**
*3 **One minute is allowed every 10 minutes**
*4 **During vector control, PG sensorless is 0.25Hz-240Hz /PG sensor is 0.05Hz-240Hz (depends on the number of poles)**
*5 **Output voltage cannot exceed power supply voltage**
*6 **Vary with the impedance changes of the power supply including a DC reactor**
*7 **Vary with the impedance of the power supply**
*8 **When an EMC filter is embedded**
*9 **The maximum value of carrier frequency varies with the inverter capacity mode and operation status.**

Item				Specification							
Model（VM06-□□□□-*4）				1100	1320	1600	2000	2200	2500	2800	3150
Output specification	Mode A Heavy load	Standard applicable motor [KW]		90	110	132	160	185	200	220	250
		Rated capacity [KVA] *1		120	146	175	211	249	267	295	327
		Rated current [A] *2		173	211	253	304	360	386	426	472
		Overload current rating *3		150%-1min							
		Output frequency range *4		0.05-400Hz（Starting frequency 0.05-60Hz variable）							
	Mode B Light load	Standard applicable motor [kW]		110	132	160	200	220	250	280	315
		Rated capacity [KVA] *1		146	180	211	267	295	327	374	409
		Rated current [A] *2		211	253	304	386	426	472	540	590
		Overload current rating *3		120%-1min							
		Output frequency range *4		0.05-200Hz（Starting frequency 0.05-60Hz variable）							
	Rated output voltage *5			3φ 380V-460V							
Input power supply	Voltage & Frequency			3φ 380V-460V, 50/60Hz							
	Allowable fluctuation			Voltage: -15%、+10% Frequency: ±5% Voltage unbalance: within 3%							
	Power supply impedance			1% and above（Use optional reactor if less than 1%）							
	Mode A Heavy load	Required power capacity [KVA] *6		120	146	180	211	249	267	295	327
		Input current [A] *7	With DCL	161	196	235	283	335	359	396	439
			Without DCL								
	Mode B Light load	Required power capacity [KVA]*6		146	180	211	267	295	327	374	409
		Input current [A] *7	With DCL	196	235	283	359	396	439	502	549
			Without DCL								
Protective structure				Totally enclosed（IP20）							
Cooling method				Forced air cooling							
Approximate weight *8				62kg		110kg			140kg		
Carrier frequency				Sine wave PWM（carrier frequency 1k-8kHz）※9							
DC reactor				Standard							

*1 **Rated capacity at the output voltage of 400V**
*2 **When input voltage is AC400V and above, the rated current will be decreased according to the output power**
*3 **One minute is allowed every 10 minutes**
*4 **During vector control, PG sensorless is 0.25Hz-240Hz /PG sensor is 0.05Hz-240Hz (depends on the number of poles)**
*5 **Output voltage cannot exceed power supply voltage**
*6 **Vary with the impedance changes of the power supply including a DC reactor**
*7 **Vary with the impedance of the power supply**
*8 **When an EMC filter is embedded**
*9 **The maximum value of carrier frequency varies with the inverter capacity mode and operation status.**

11-2 Inverter general specification

400V

Control mode			Vector control／sensorless vector control／V/f control
Driving performance *1	Speed control range	With PG sensor	0.05Hz-240Hz（1：1000/50Hz reference） *5
		Without PG sensor	0.25Hz-240Hz（1：200/50Hz reference） *5
	Speed Response/precision	With PG sensor	Response characteristic: 250rad/sec Precision: ±0.01%
		Without PG sensor	Response characteristic: 100rad/sec Precision: ±0.5%
	Torque control range	With PG sensor	1：50（rated torque ratio）
		Without PG sensor	1：20（rated torque ratio）
	Torque precision	With PG sensor	±10%（of rated torque）
		Without PG sensor	±20%（of rated torque）
Control specification	Frequency setting resolution	Digital setting	0.01Hz
		Analog setting	0.05%（12bit0-10V，4-20mA）, 0.1%（11bit0-5V）of the maximum output frequency
	Frequency precision	Digital setting	±0.01% of output frequency（at -10-40℃）
		Analog setting	±0.2% of the maximum output frequency（at 25℃±10℃） *2
	PG input		Open collector, push-pull mode (power supply voltage 24V) Max. number of pulses: 491.52kHz *3
	DC braking		Starting frequency (0.05-20Hz), operation time (0.1-10s), braking force (1-10 grades)
	Additional functions		Restart after momentary power failure, speed tracking start, multi-speed operation, frequency jump, auto alarm recovery, PID control operation, simple scheduled operation, energy-saving operation and others
Operation specification	Start/stop setting		Operation panel, serial communication (RS485, Mod-bus), control circuit terminals
	Frequency command setting	Digital setting	Operation panel, serial communication (RS485, Mod-bus), step setting from terminal board
		Analog setting	3 channels, 0-5V, 0-10V, 4-20mA, potentiometer (5kΩ, 0.3W and above)
	Input signal		Frequency command, forward run command, reverse run command, acceleration/deceleration time setting, idle-run stop、alarm reset, emergency stop, jogging selection, step frequency setting, operation signal hold and others [Digital input: 8 channels (arbitrary allocation)], [Analog input: 3 channels for current and voltage]
	Output signal	Contact output	Alarm batch and multifunctional contact output (1C contact, 250VAC, 0.3A)
		Monitor signal	Operating, frequency matching, overload alarm, undervoltge, frequency approach and etc. [Open-collector output: 3 channels (arbitrary allocation), Analog output: 2 channels]
LED display			Frequency, output current, speed, load factor, no unit: (output voltage, power and etc.), operating, alarm
LCD display			Various status, code, alarm, message display (English, Japanese, Chinese)
Communication I/F			RS485、Mod-bus-RTU
External power supply output			DC24V、150mA（control terminal board）
Protection function			Current limiting, overcurrent shutoff, motor overload, external thermal alarm, undervoltage, overvoltage, momentary power failure, fin overheat, missing phase
Warning function			Overvoltage prevention, current limiting during acceleration/deceleration, brake resistor overheat, overload, overheating of radiator fins
Environment	Ambient temperature		-10℃-+50℃（no frost）; heavy load, -10℃-+40℃（no frost）; light load
	Storage temperature		-20℃-+65℃（short-term storage during transportation）*4
	Relative humidity		95%RH or less（no condensation）
	Elevation		3000m or lower（Decrease the current when higher than 1000m）
	Vibration		5.9m/s^2（0.6G） or less（JIS C 60068-2-6 standard; IEC60068-2-6）
	Gas medium		Indoor (no corrosive or inflammable gases, oil mist, or dust)

*1 **Vary with the environment, condition, motor in use or sensor.**
*2 **The maximum output frequency is at 5V, 10V, and 20mA.**
*3 **An optional board is required for linear driver input.**
*4 **Applicable temperature for medium-term and long-term transportation.**
*5 **When 2-pole motor is set, the maximum value of frequency setting range is 120Hz.**

11-3 Communication function specification

Electrical characteristics		RS485 communication	
Communication protocol		SANKEN protocol	Modbus-RTU communication protocol
Communication type		4-wire / 2-wire bus type （RS485 standard）	
Transmission distance		Total 500m, terminal resistor is required	
Number of units connected		Max. 32	Max. 247 *Note
Connection cable		Shielded twisted-pair cable recommended	
Communication type		Full-duplex / Half-duplex	
Communication speed [bps]		57600/38400/19200/9600/4800/2400/1200 selectable	
Synchronization		Asynchronous start/stop	
Data format		ASCⅡ code or BINARY	BINARY
Data length		8bit	
Stop bit length		1bit or 2bit selectable	
Parity check		Yes (odd, even), No, Selectable	
Error check		SUM check	CRC code check
Message end code	ASCⅡ	CR+LF/CR selectable	No
	BINARY	No	

*** Note: A relay is required when exceeding 32**

11-4 Storage Environment

Storage environments of SAMCO-VM06 are as follows:

Table 11-1 Storage environment

Item	Description	Remark
Storage temperature	-20-65℃	Short term during transportation
Relative humidity	95%RH or lower	
Gas medium	No corrosive, gases, oil mist, dripping, dust or direct sunlight	
Gas pressure	86-106Pa	

(1) Temporary storage

① Never place it directly on the ground.

② If equipment is stored in an environment which is worse than above mentioned, pack and seal the equipment with polyvinyl resin plastic film, add an internal desiccant to prevent humidity.

(2) Long-term storage

① When storage time exceeds 3 months, in order to prevent the deterioration of the electrolytic capacitors caused by temperature, please adjust the ambient temperature to -10-+30℃.

② Use desiccant, and keep the relative humidity in the package lower than 70%.

12. External Dimension

12-1 Master dimension

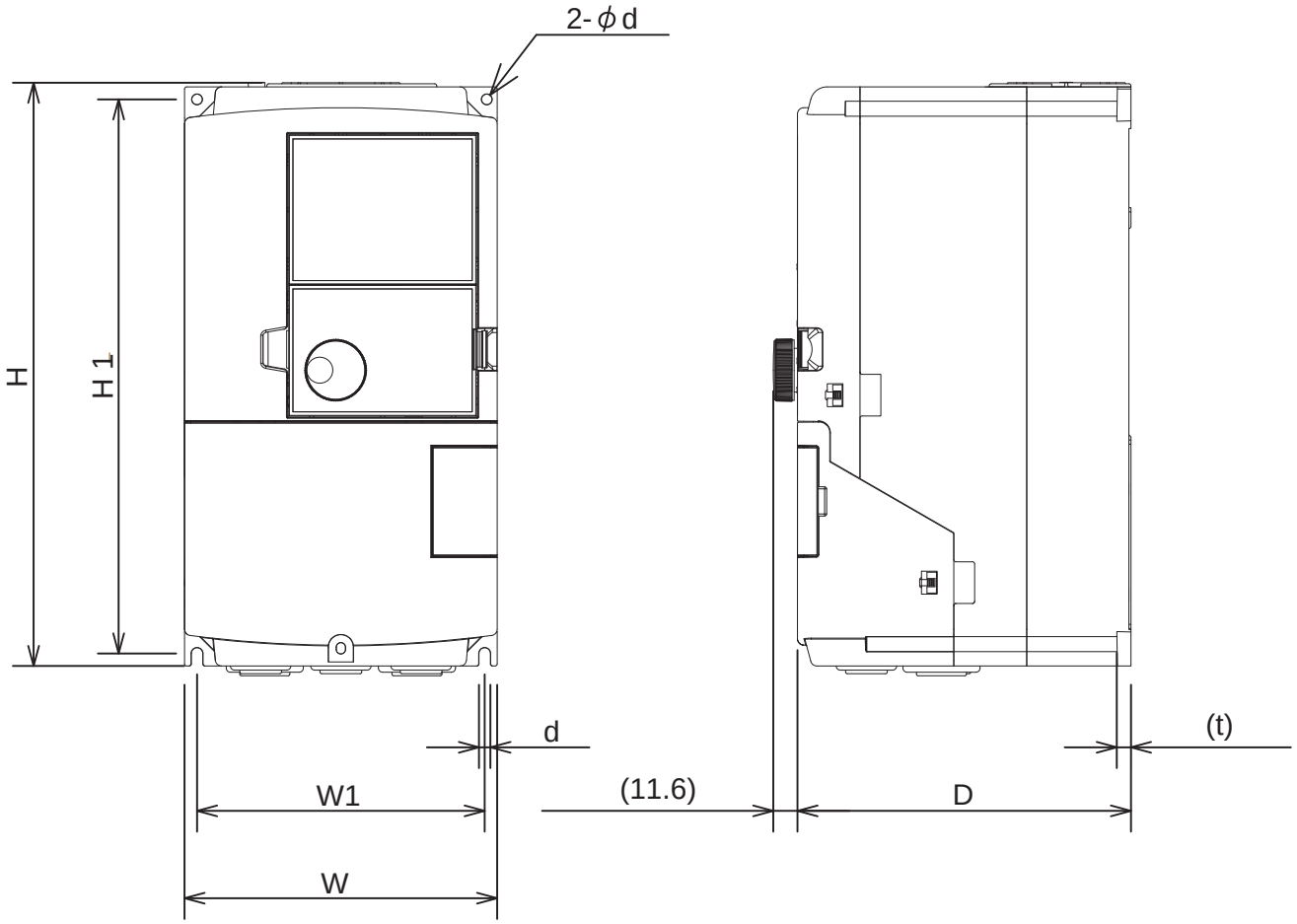


Table 12-1 List of overall dimension

Capacity	H	H1	W	W1	D	d	t
VM06-0015-*2	280	266	150	138	160	5	7
VM06-0022-*2							
VM06-0037-*2							
VM06-0055-*2							
VM06-0075-*2	300	286	200	187	195	5.5	7
VM06-0110-*2							
VM06-0015-*4	280	266	150	138	160	5	7
VM06-0022-*4							
VM06-0040-*4							
VM06-0055-*4							
VM06-0075-*4	300	286	200	187	195	5.5	7
VM06-0110-*4							
VM06-0150-*4	330	316	220	208	195	5.5	7
VM06-0185-*4							

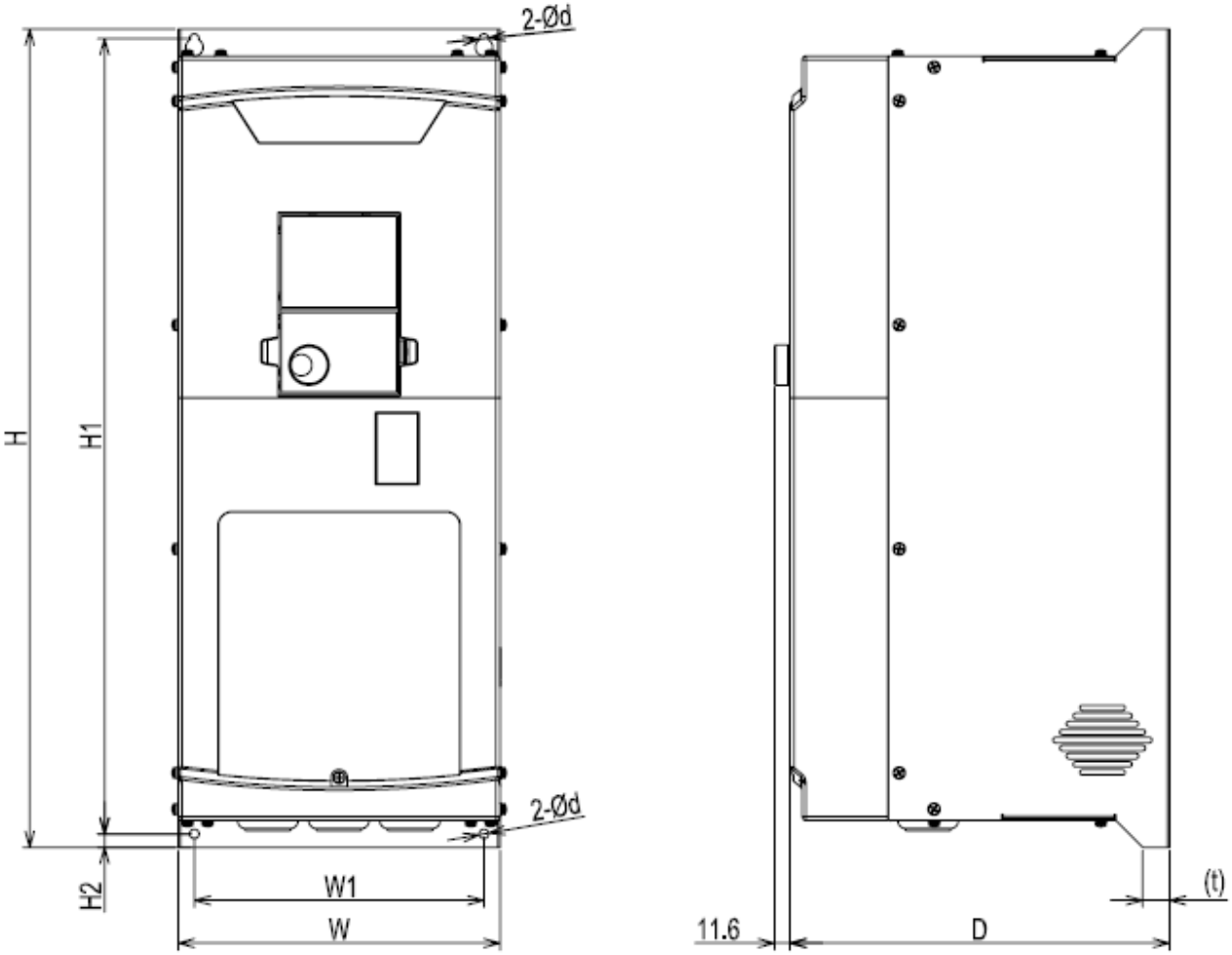


Table 12-2 List of overall dimension

Capacity	H	H1	H2	W	W1	D	d	t
VM06-0220-*4	610	593	10	240	216	283	7	20
VM06-0300-*4								
VM06-0370-*4								
VM06-0450-*4	740	722	10	280	256	295	8	20
VM06-0550-*4								
VM06-0750-*4	810	786	12	320	296	318	12	30
VM06-0900-*4								

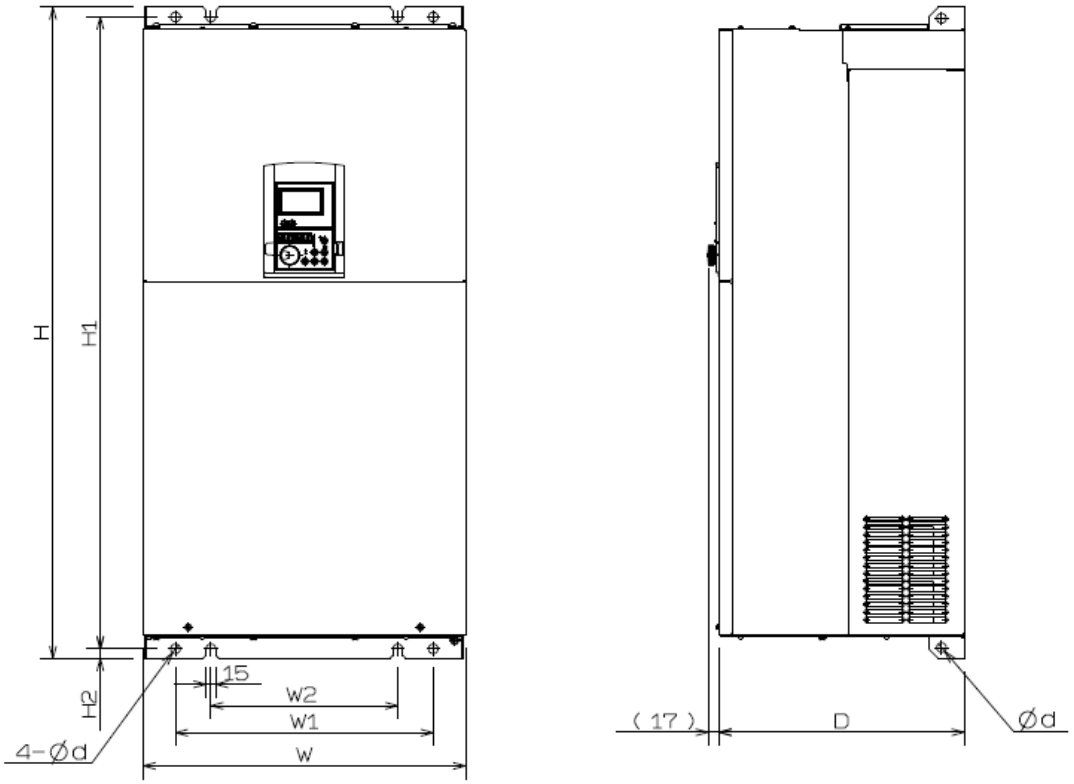
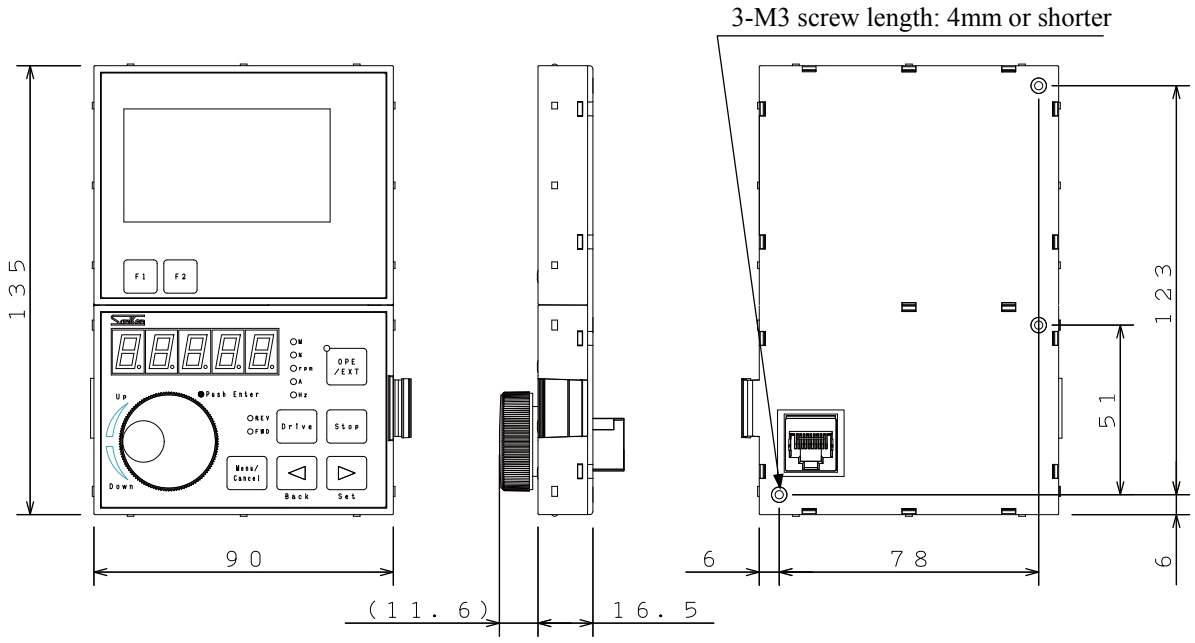


Table 12-3 List of overall dimension

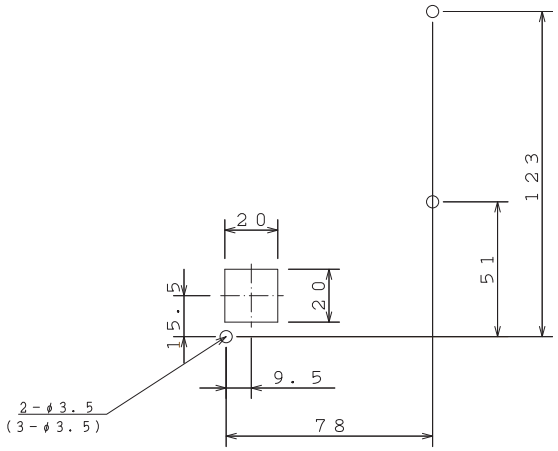
Capacity	H	H1	H2	W	W1	W2	D	d
VM06-1100-*4	900	870	15	350	250	140	340	15
VM06-1320-*4								
VM06-1600-*4	1010	980	15	500	400	290	380	15
VM06-2000-*4								
VM06-2200-*4								
VM06-2500-*4	1010	980	15	680	580	470	380	15
VM06-2800-*4								
VM06-3150-*4								

12-2 Operation panel

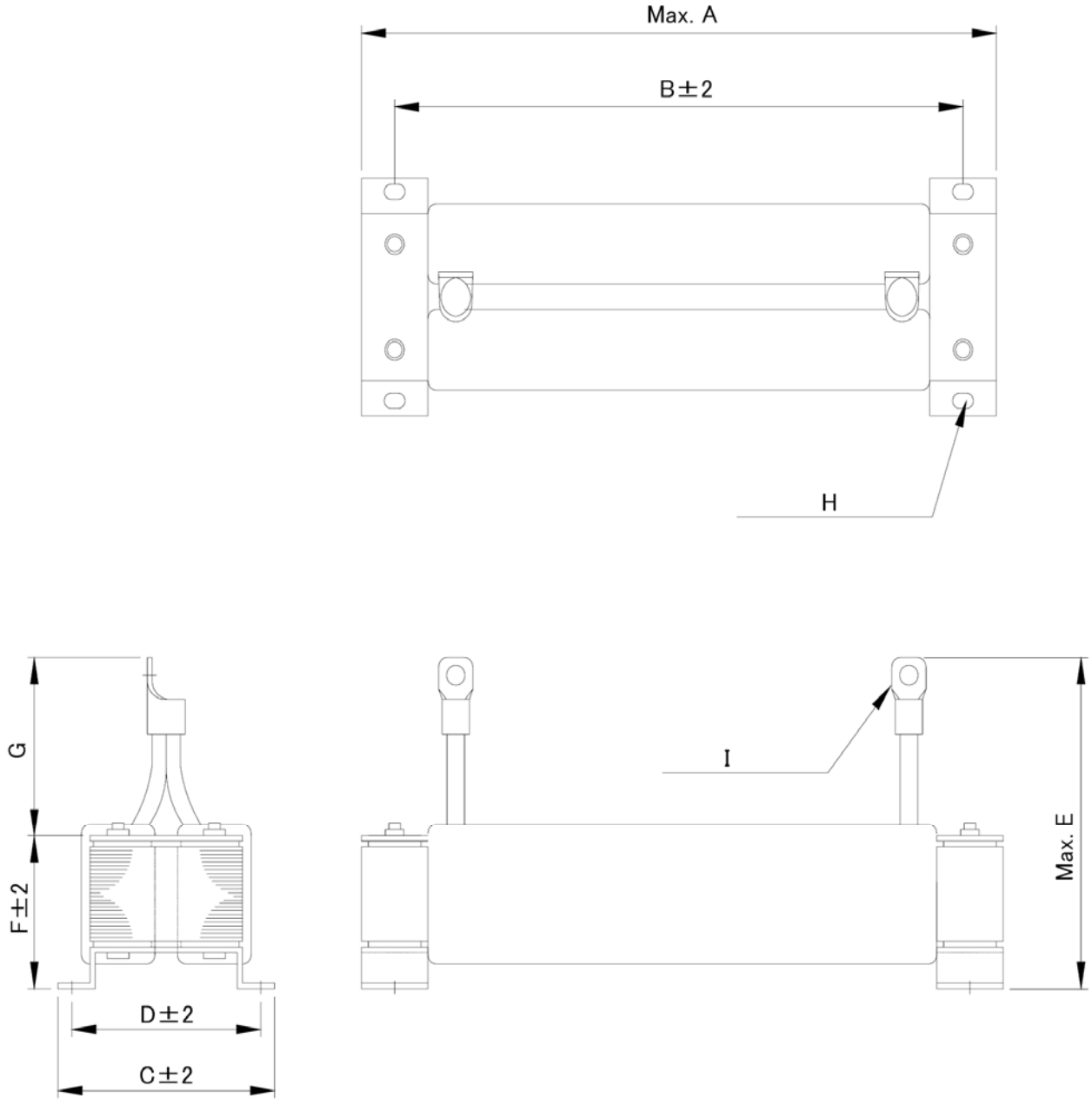
（1） Operation panel



(2) External installation of operation panel: Dimensional diagram of opening hole



12-3 DC reactor dimension



capacity	Subsidiary DC reactor type	A	B	C	D	E	F	G	H	I
VM06-1100-*4	VM-DCL-110K	330	295	130	105	180	82	85	4-9φ×15L	M10
VM06-1320-*4	VM-DCL-132K									
VM06-1600-*4	VM-DCL-160K	410	360	185	155	200	90		4-9φ×25L	M16
VM06-2000-*4	VM-DCL-200K									
VM06-2200-*4	VM-DCL-220K	420	365			220		110		
VM06-2500-*4	VM-DCL-250K									
VM06-2800-*4	VM-DCL-280K									
VM06-3150-*4	VM-DCL-315K	380	320	215	185	235	96	130		

(Unit: mm)

13. Peripheral Equipments & Options

■ **Please work on the equipment only when the safety precautions are confirmed.**
Failure to observe may result in personal injury and fire.

The followings are options for SAMCO-VM06 series. Please configure the peripheral equipments (including options) according to the situation and purpose.

Table 13-1 **Options of peripheral mechanical equipments**

Name	Details of purposes
① AC reactor / DC reactor	Purposes include: • to improve the input power factor of the inverter • to reduce the influence of interphase unbalance for power supply voltage • to prevent the inverter trip caused by open/close action of phase-lead compensating capacitor in the system • Large power supply capacity (500kVA or above) ■ Model name • AC reactor S□-ACL-●●K • DC reactor S□-DCL-●●K □：400 series F, 200V series T
② zero-sequence reactor Transmission interference filter	Reduce the cable interference influence caused by wiring into the inverter power supply system. We recommend that these elements are installed near the inverter as possible. ■ Model name RC5078 RC5096[SOSHIN motor (company) product]
③ Radio noise filter	Used to restrain the radiation of radio noise to the inverter power supply. ■ Model name 200V grade: 3XYEB-105.104 400V grade: 3XYHB-105.104 【OKAYA motor (company) product】
④ Noise filter *Note 1	Reduce the cable interference influence caused by wiring into the inverter power supply system. We recommend that these elements are installed near the inverter as possible. ■ EMC filter recommended (consult separately)
⑤ Braking resistance	P-PR terminal used to connect inverter; it will consume the regenerated energy by a resistor. ■ Please consult separately.

※1 **Input power supply / transformer**
- **When system power voltage and inverter rated input voltage are required to be suited, please set according to the requirements.**
- **When several inverters are used simultaneously, it must be configured to reduce the influence of higher harmonic current to other loaded equipments.**

※2 **Wiring breaker or leakage breaker protective switch**
- **Please connect it with the protection or overload protection circuit of power supply system.**
- **When a leakage breaker protection switch is required, please select corresponding higher harmonic products.**

※3 **Electromagnetic contactor**
- **A surge absorber must be configured on the winding.**
- **Please install a surge absorber to restrain the surge caused by open/close actions of electromagnetic contactor or controlling relay.**

*** Note** 1: **When an internal EMC filter is used, please set the selector switch to ON.**

13. Peripheral mechanical equipments & options

■ The following optional boards built into the inverter are available.

Table 13-2 Option Card

Option Name	Type	Function	Applicable inverter
PG Option card	SC-PG1	Detect and feedback the motor speed with the detector (PG), to operate speed control function and position control function. ・ Line driver output corresponding to PG ・ Pulse (differential pulse) input for phase A & B ・ Pulse monitoring output ・ PG power supply: +5V or 12V	SVC06 all models
	SC-PG2	Detect and feedback the motor speed with the detector (PG), to operate speed control function and position control function. ・ Open-collector/push-pull output corresponding to PG ・ Pulse input for phase A & B ・ Pulse monitoring output ・ PG power supply: +12V	
	SC-PG3	Detect and feedback the motor speed with the detector (PG), to operate speed control function and position control function. ・ Open-collector/push-pull output corresponding to PG ・ Pulse input for phase A & B ・ Pulse monitoring output ・ PG power supply: +24V	
PROFIBUS communication board	SC-PB	The inverter can be used as a slave-station of PROFIBUS with this option, therefore realizing the monitor and control of inverter parameter setting and status by the upper master station through the PROFIBUS bus.	

■ The inverter can mount 2 optional boards simultaneously.
There are two slots in the inverter; each optional board must be plugged into the specified slot because different optional boards have different shapes.
Furthermore, the combination status of the optional boards may also influence the installation or function.
For details of each option, please refer to the instructions for each optional board.

Optional board compatibility sheet

Table 13-3 Option card combination compatibility

Slot 2 \ Slot 1	Not plugged	SC-PG1	SC-PG2	SC-PG3	SC-PB
Not plugged	-	○	○	○	○
SC-PG1	○	×	×	×	○
SC-PG2	○	×	×	×	○
SC-PG3	○	×	×	×	○
SC-PB	○	○	○	○	×

○: Available ×: Not available

Memorandum

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