E6581815

GTR.eco

Specialized inverter for IPM gear motor

Instruction Manual

VF-nC3M

3-phase 200V class 0.1 to 2.2kW

Thank you for purchasing a specialized inverter for the IPM gear motor.
To ensure correct use of the inverter, carefully read this "Instruction Manual" before using it. Keep these instructions after reading them.

- Attention set makers -

Make sure that this instruction manual is in the hands of the end user of the inverter.

I. Safety precautions

The items described in these instructions and on the inverter itself are very important so that you can use the inverter safely, prevent injury to yourself and other people around you as well as to prevent damage to property in the area. Thoroughly familiarize yourself with the symbols and indications shown below and then continue to read the manual. Make sure that you observe all warnings given.

Explanation of markings

Marking	Meaning of marking
⚠ Warning	Indicates that errors in operation may lead to death or serious injury.
⚠ Caution	Indicates that errors in operation may lead to injury (*1) to people or that these errors may cause damage to physical property. (*2)

(*1) Such things as injury, burns or shock that will not require hospitalization or long periods of outpatient treatment.

(*2) Physical property damage refers to wide-ranging damage to assets and materials.

Meanings of symbols

Marking	Meaning of marking
	Indicates prohibition (Don't do it). What is prohibited will be described in or near the symbol in either text or picture form.
	Indicates an instruction that must be followed. Detailed instructions are described in illustrations and text in or near the symbol.
	-Indicates warning. What is warned will be described in or near the symbol in either text or picture form. -Indicates caution. What the caution should be applied to will be described in or near the symbol in either text or picture form.

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■ Limits in purpose

This inverter is used for controlling speeds for IPM gear motor of GTR-ECO series.

⚠ Safety precautions

- The inverter cannot be used in any device that would present danger to the human body or from which malfunction or error in operation would present a direct threat to human life (nuclear power control device, aviation and space flight control device, traffic device, life support or operation system, safety device, etc.). If the inverter is to be used for any special purpose, first get in touch with the supplier.
- This product was manufactured under the strictest quality controls but if it is to be used in critical equipment, for example, equipment in which errors in malfunctioning signal output system would cause a major accident, safety devices must be installed on the equipment.
- Do not use the inverter for loads other than those of properly applied our specified IPM gear motor. (Use in other than properly applied our specified IPM gear motor may cause an accident.)
- Please note not to touch the power circuit terminal and get electric shock because inverter works as IPM gear motor stops though the motor doesn't move while servo lock is operating.
- Even the inverter hold condition, there is danger of damaging the inverter according to the motor generation voltage when the motor is spent from the load side by 3000rpm or more.
  Please adopt the circuit configuration that the switch is set in the output side of the inverter.

■ General Operation

⚠ Warning		Reference section
Disassembly prohibited	• Never disassemble, modify or repair. This can result in electric shock, fire and injury. Call our company for repairs.	2.
Prohibited	• Do not open the terminal block cover while the inverter is on. The unit contains many high voltage parts and contact with them will result in electric shock. • Do not stick your fingers into openings such as cable wiring holes and cooling fan covers. This can result in electric shock or other injury. • Do not place or insert any kind of object into the inverter (electrical wire cuttings, rods, wires etc.). This can result in electric shock or fire. • Do not allow water or any other fluid to come in contact with the inverter. This can result in electric shock or fire. • Do not use the inverter connected multiple motors. The inverter cannot control multiple motors.	2.1 2. 2. 2.
Mandatory action	• After replacing the terminal block cover, turn the input power on. Turning on the input power without replacing the terminal block cover may lead to electric shock. • If the inverter begins to emit smoke or an unusual odor, or unusual sounds, immediately turn power off. If the equipment is continued in operation in such a state, the result may be fire. Call our company for repairs. • Always turn power off if the inverter is not used for long periods of time since there is a possibility of malfunction caused by leaks, dust and other material. If power is left on with the inverter in that state, it may result in fire.	2.1 3. 3.

⚠ Caution		Reference section
Contact prohibited	• Do not touch heat radiating fins or discharge resistors. These devices are hot, and you'll get burned if you touch them.	3.
Mandatory action	• Use an inverter that conforms to our specified IPM gear motor. If the inverter being used does not conform to those specifications, not only will the IPM gear motor not rotate correctly, it may also cause serious accidents through overheating and fire.	1.1

■ Transportation & installation

⚠ Warning		Reference section
Prohibited	• Do not install or operate the inverter if it is damaged or any component is missing. This can result in electric shock or fire. Call our company for repairs.	1.4.4
	• Do not place any inflammable objects nearby. If a flame is emitted due to malfunction, it may result in a fire.	1.4.4
	• Do not install in any location where the inverter could come into contact with water or other fluids. This can result in electric shock or fire.	1.4.4
Mandatory action	• Must be used in the environmental conditions prescribed in the instruction manual. Use under any other conditions may result in malfunction.	1.4.4
	• Mount the inverter on a metal plate. The rear panel gets very hot. Do not install in an inflammable object, this can result in fire.	1.4.4
	• Do not use the inverter without the terminal block cover. This can result in electric shock. Failure to do so can lead to risk of electric shock and can result in death or serious injury.	1.4.4
	• An emergency stop device must be installed that fits with system specifications (e.g. shut off input power then engage mechanical brake). Operation cannot be stopped immediately by the inverter alone, thus risking an accident or injury.	1.4.4
	• All options used must be those specified by Toshiba. The use of any other option may result in an accident.	1.4.4
	• When using switchgear for the inverter, it must be installed in a cabinet. Failure to do so can lead to risk of electric shock and can result in death or serious injury.	10

⚠ Caution		Reference section
Prohibited	• When transporting or carrying, do not hold by the front panel covers. The covers may come off and the unit will drop out resulting in injury.	2.
	• Do not install in any area where the unit would be subject to large amounts of vibration. That could result in the unit falling, resulting in injury.	1.4.4

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⚠ Caution		Reference section
Mandatory action	• When removing and installing the terminal cover with a screwdriver, be sure not to scratch your hand as this results in injury.	1.3.2
	• Pressing too hard on the screwdriver may scratch the inverter.	1.3.2
	• Always cut the power supply when removing the wiring cover.	1.3.2
	• After wiring is complete, be sure to replace the terminal cover.	1.3.2
	• The main unit must be installed on a base that can bear the unit's weight. If the unit is installed on a base that cannot withstand that weight, the unit may fall resulting in injury.	1.4.4
	• If braking is necessary (to hold motor shaft), install a mechanical brake. The brake on the inverter will not function as a mechanical hold, and if used for that purpose, injury may result.	1.4.4

■ Wiring

⚠ Warning		Reference section
Prohibited	• Do not connect input power to the output (motor side) terminals (U/T1,V/T2,W/T3). That will destroy the inverter and may result in fire.	2.2
	• Do not connect resistors to the DC terminals (across PA/+ - PC/- or PO-PC/-). That may cause a fire.	2.2
	• Within 15 minutes after turning off input power, do not touch wires of devices (MCCB) connected to the input side of the inverter. That could result in electric shock.	2.2
	• Do not shut down the external power supply on ahead when VI terminal is used as logic input terminal by external power supply (F127=200). It could cause unexpected result as VI terminal is ON status.	2.2 6.3.1
Mandatory action	• Electrical installation work must be done by a qualified expert. Connection of input power by someone who does not have that expert knowledge may result in fire or electric shock.	2.1
	• Connect output terminals (motor side) correctly. If the phase sequence is incorrect, the motor will operate in reverse and that may result in injury.	2.1
	• Wiring must be done after installation. If wiring is done prior to installation that may result in injury or electric shock	2.1
	• The following steps must be performed before wiring. (1) Turn off all input power. (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. (3) Use a tester that can measure DC voltage (400VDC or more), and check to make sure that the voltage to the DC main circuits (across PA/+ - PC/-) is 45V or less. If these steps are not properly performed, the wiring will cause electric shock.	2.1
	• Tighten the screws on the terminal board to specified torque. If the screws are not tightened to the specified torque, it may lead to fire.	2.1
	• Check to make sure that the input power voltage is +10%, -15% of the rated power voltage written on the rating label (±10% when the load is 100% in continuous operation). If the input power voltage is not +10%, -15% of the rated power voltage (±10% when the load is 100% in continuous operation) this may result in fire.	1.4.4
	• Confirm to logic setting of slide switch SW1 (LOGIC) and parameter F127 (sink/source switching) when F, R, S1, S2 terminals and VI terminal are used as logic input terminal. If it is not set, it could result in malfunction.	2.2 2.3 6.3.1
	• The maximum wiring distance between the inverter and the motor is 50m	2.1
Be Grounded	• Ground must be connected securely. If the ground is not securely connected, it could lead to electric shock or fire when a malfunction or current leak occurs.	2.1 2.2 10.

⚠ Caution		Reference section
Prohibited	• Do not attach equipment (such as noise filters or surge absorbers) that have built-in capacitors to the output (motor side) terminals. That could result in a fire.	2.1

■ Operations

⚠ Warning		Reference section
Prohibited	• Never touch the internal terminals in the upper right while the front cover is open. There is a risk of shock because it carries a high voltage.	1.3.1
	• Do not touch inverter terminals when electrical power is going to the inverter even if the motor is stopped. Touching the inverter terminals while power is connected to it may result in electric shock.	3.
	• Do not touch switches when the hands are wet and do not try to clean the inverter with a damp cloth. Such practices may result in electric shock.	3.
	• Do not go near the motor in alarm-stop status when the retry function is selected. The motor may suddenly restart and that could result in injury. Take measures for safety, e.g. attaching a cover to the motor, against accidents when the motor unexpectedly restarts.	3.
Mandatory action	• After replacing the terminal block cover, turn the input power on. When installed inside a cabinet and using with the front cover removed, always close the cabinet doors first and then turn power on. Turning on the power with the terminal block cover or cabinet doors open may result in electric shock.	3.
	• Make sure that operation signals are off before resetting the inverter after malfunction. If the inverter is reset before turning off the operating signal, the motor may restart suddenly causing injury.	3.

⚠ Caution		Reference section
Prohibited	• Observe all permissible operating ranges of motors and mechanical equipment. (Refer to the motor's instruction manual.) Not observing these ranges may result in injury.	3.
	• Do not set the stall prevention level (F601) extremely low. If the stall prevention level parameter (F601) is set at or below the no-load current of the motor, the stall preventive function will be always active and increase the frequency when it judges that regenerative braking is taking place. Do not set the stall prevention level parameter (F601) below 30% under normal use conditions.	6.18.2
Mandatory action	• Use an inverter that conforms to the IPM Gear Motor of our products “GTR-ECO series” being operated. If the inverter being used does not conform to those specifications, not only will the IPM Gear Motor not rotate correctly, but it may cause serious accidents through overheating and fire.	1.4.1
	• Current may leak through the inverter's input/output wires because of insufficient electrostatic capacity on the motor with bad effects on peripheral equipment. The leakage current’s value is affected by the carrier frequency and the length of the input/output wires. Test and adopt the remedies of section 1.4.3 against leak current.	1.4.3

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■ When operation by using remote keypad is selected

⚠ Warning		Reference section
Mandatory action	• Set the parameter Communication time-out time (F803) and Communication time-out action (F804). If these are not properly set, the inverter can not be stopped immediately in breaking communication and this could result in injury and accidents. • An emergency stop device and the interlock that fit with system specifications must be installed. If these are not properly installed, the inverter can not be stopped immediately and this could result in injury and accidents.	6.21

■ When sequence for restart after a momentary failure is selected (inverter)

⚠ Caution		Reference section
Mandatory action	• Stand clear of motors and mechanical equipment. If the motor stops due to a momentary power failure, the equipment will start suddenly after power recovers. This could result in unexpected injury. • Attach caution label about sudden restart after a momentary power failure on inverters, motors and equipment for prevention of accidents in advance.	6.11.1

■ When retry function is selected (inverter)

⚠ Caution		Reference section
Mandatory action	• Stand clear of motors and equipment. If the motor and equipment stop when the alarm is given, selection of the retry function will restart them suddenly after the specified time has elapsed. This could result in unexpected injury. • Attach caution label about sudden restart in retry function on inverters, motors and equipment for prevention of accidents in advance.	6.11.3

■ Maintenance and inspection

⚠ Warning		Reference section
Prohibited	• Do not replace parts. This could be a cause of electric shock, fire and bodily injury. To replace parts, call our company.	14.2
Mandatory action	• The equipment must be inspected every day. If the equipment is not inspected and maintained, errors and malfunctions may not be discovered and that could result in accidents. • Before inspection, perform the following steps. (1) Turn off all input power to the inverter. (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. (3) Use a tester that can measure DC voltages (400VDC or more), and check to make sure that the voltage to the DC main circuits (across PA/+ - PC/-) is 45V or less. If inspection is performed without performing these steps first, it could lead to electric shock.	14. 14. 14.2

■ Disposal

⚠ Caution		Reference section
Mandatory action	• If you dispose of the inverter, have it done by a specialist in industry waste disposal(*). If you dispose of the inverter in an inappropriate way, this can result in explosion of capacitor or produce noxious gases, resulting in injury. (*) Persons who specialize in the processing of waste and known as "industrial waste product collectors and transporters" or "industrial waste disposal persons. "If the collection, transport and disposal of industrial waste is done by someone who is not licensed for that job, it is a punishable violation of the law. (Laws in regard to cleaning and processing of waste materials)	16.

■ Attach caution labels

Shown here are examples of warning labels to prevent, in advance, accidents in relation to inverters, motors and other equipment.

Be sure to affix the caution label where it is easily visible if the inverter has been programmed for restart sequence of momentary power failure (6.11.1) or the retry function (6.11.3).

If the inverter has been programmed for restart sequence of momentary power failure, place warning labels in a place where they can be easily seen and read.

(Example of caution label)

⚠ Caution (Functions programmed for restart)

Do not go near motors and equipment.
Motors and equipment that have stopped temporarily after momentary power failure will restart suddenly after recovery.

If the retry function has been selected, place warning labels in a location where they can be easily seen and read.

(Example of caution label)

⚠ Caution (Functions programmed for retry)

Do not go near motors and equipment.
Motors and equipment that have stopped temporarily after an alarm will restart suddenly after the specified time has elapsed.

II. Introduction

Thank you for your purchase of the drive inverter "VF-nC3M" of NISSEI GTR-ECO series IPM gear motor.

This instruction manual is for the Ver. 104 or later CPU of the inverter.
Please be informed that CPU version will be frequently upgraded.

—— Contents ——

1. Read first

1.1 Check product purchase

Before using the product you have purchased, check to make sure that it is exactly what you ordered.

Caution	
Mandatory action	Use an inverter that conforms to the specifications of power supply and three-phase induction motor being used. If the inverter being used does not conform to those specifications, not only will the three-phase induction motor not rotate correctly, it may also cause serious accidents through overheating and fire.

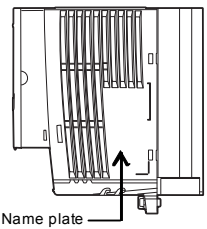
Rating label

Brand name
Model
Power supply
Motor capacity

NISSEI CORPORATION VF-nC3M 3PH-200/240V-0.4kW/0.5HP

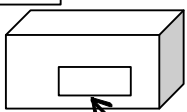
Inverter main unit

Danger label



Name plate

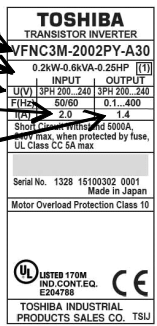
Carton box



Type indication label

Name plate

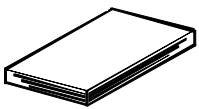
Inverter Type
Inverter rated output capacity
Power supply
Rated input current
Rated output current



Danger label

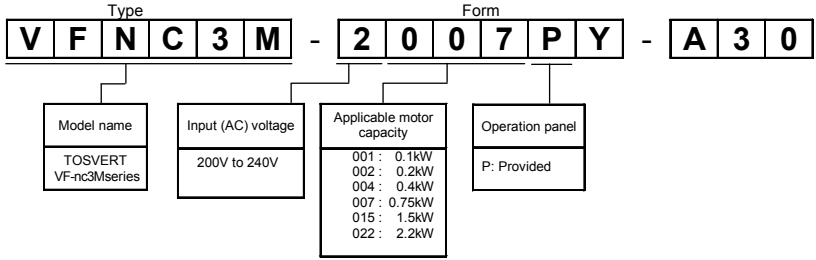
Instruction manual

E6581815



1.2 Contents of the product

Explanation of the name plate label.



Note 1) Always shut power off first then check the ratings label of inverter held in a cabinet.

1.3 Names and functions

1.3.1 Outside view

With cover closed

[Front view]

Charge lamp

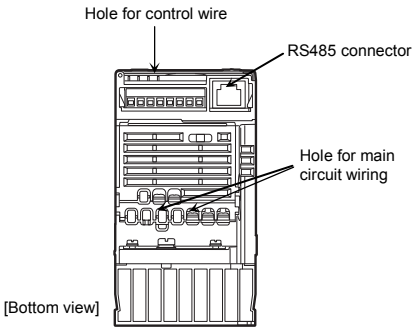
Indicates there is a high voltage still in the inverter. Do not open the terminal block cover when this lamp is lit because it is dangerous.

Cover

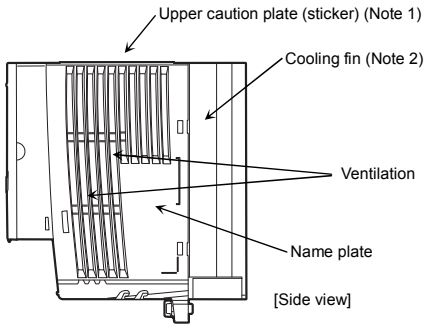
This is the body or terminal block cover.
Always close this cover before operation to avoid accidentally touching the terminal block.

Door lock hole

You can lock the door by shutting it an passing a wire key through this hole.



[Bottom view]

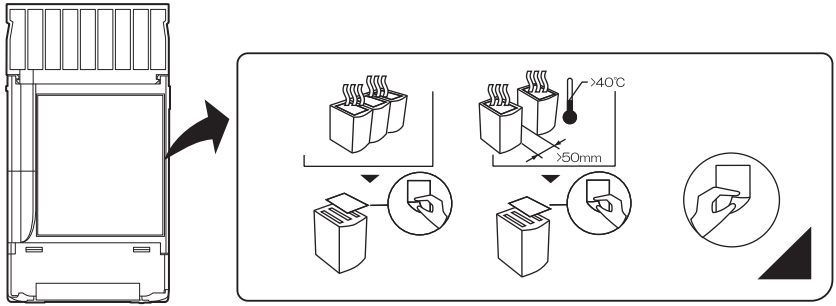


[Side view]

Note 1) Remove the seal as shown on the next page when installing the inverter side by side with other inverters where the ambient temperature will rise above 40°C.

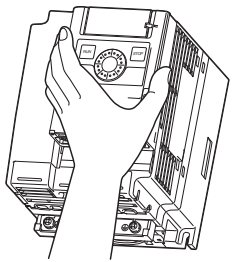
Note 2) Some models are wrapped in plastic.

Example of the label

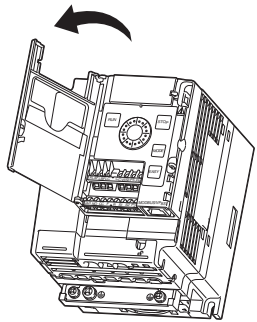


[Opening the cover]

(1)



(2)



★About the monitor display

The LED on the operation panel uses the following symbols to indicate parameters and operations.

LED display (numbers)

0	1	2	3	4	5	6	7	8	9	-
0	1	2	3	4	5	6	7	8	9	-

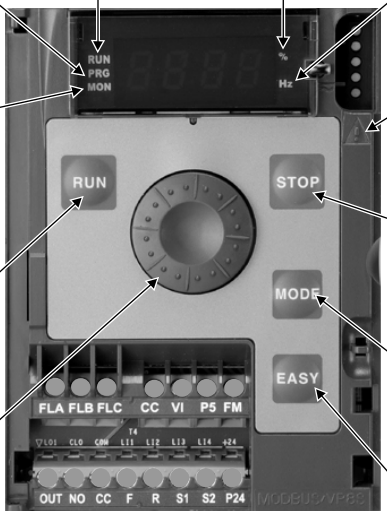
LED display (letters)

Aa	Bb	C	c	Dd	Ee	Ff	Gg	H	h	I	i	Jj	Kk	Ll
A	b	C	c	d	E	F	G	H	h	I	ı	J		L

Mm	Nn	O	o	Pp	Qq	Rr	Ss	Tt	Uu	Vv	Ww	Xx	Yy	Zz
n	n	o	o	P	q	r	S	t	U	u			y	

Warning	
Prohibited	• Never touch the internal terminals in the upper right while the front cover is open. There is a risk of shock because it carries a high voltage.

[With cover open]



RUN lamp
Lit when a frequency is not output with the ON run command. This lamp blinks when operation starts.

% lamp
Displayed numbers are percents.

PRG lamp
When lit, the inverter is in parameter setting mode. When blinking, the inverter is in AUH or Gr-U.

Hz lamp
Displayed numbers are in Hertz.

MON lamp
While this is lit, the inverter is in monitor mode.
While blinking, the inverter is in "Past Trip History Details Monitor Display".

High voltage caution mark
The internal terminal in the upper right carries a high voltage. Never touch it.

STOP key
While the running lamp is blinking, pressing this button slows down and stops the inverter.

RUN key
Pressing this key while the run lamp is on starts operation.

MODE key
Switches between run, settings, and status monitor modes.

Setting dial
Turning the dial left and right changes the operation frequency, cycles parameters, and cycles among menus within parameters.

EASY key
Switches between easy and standard setting modes.

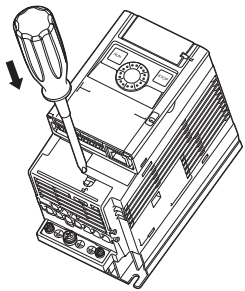
1.3.2 Opening the terminal cover

⚠ Caution	
Mandatory action	• When removing and installing the terminal cover with a screwdriver, be sure not to scratch your hand as this results in injury. • Pressing too hard on the screwdriver may scratch the inverter. • Always cut the power supply when removing the wiring cover. • After wiring is complete, be sure to replace the terminal cover.

Use the following procedure to remove both the outside and inside terminal block covers.

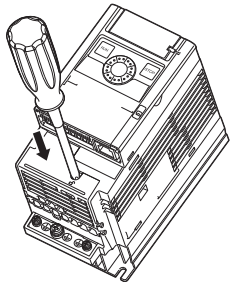
(1) Removing the outside terminal block cover (VFNC3M-2001 to 2007PY -A30)

1)



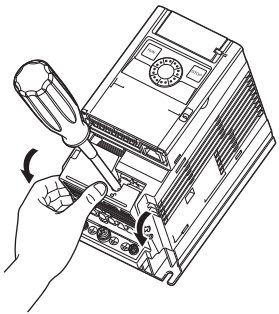
Insert a screwdriver or other thin object into the hole indicated with the ⏍ mark.

2)



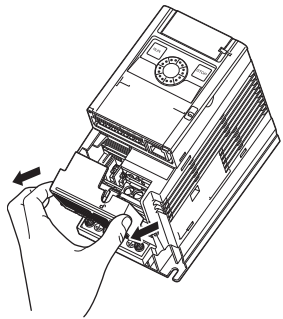
Press in on the screwdriver.

3)



While pressing on the screwdriver, rotate the terminal cover downward to remove it.

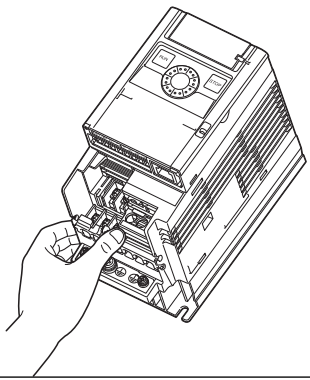
4)



Pull the terminal cover up at an angle.

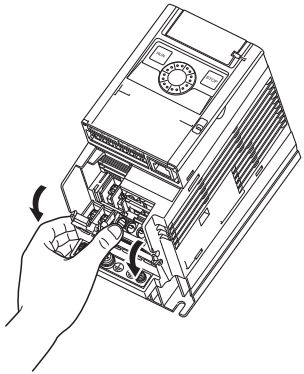
(2) Removing the inside terminal block cover (VFNC3M-2001 to 2007PY -A30)

1)



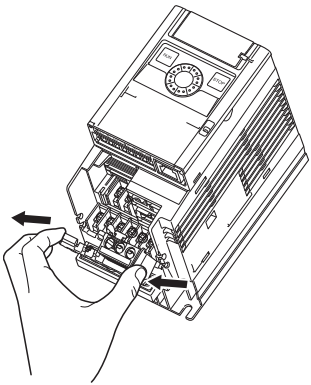
The finger is put on to the tab part of the terminal block cover.

2)



While pressing on the screwdriver, rotate the terminal cover downward to remove it.

3)

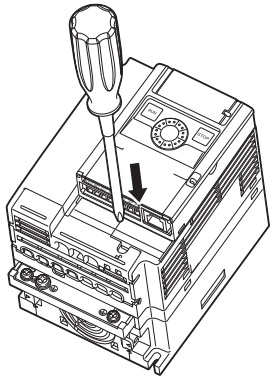


Pull the terminal cover up at an angle.

★ After wiring is complete, be sure to restore the terminal cover to its original position.

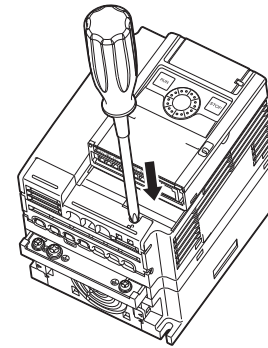
(3) Removing the outside terminal block cover (VFNC3M-2015, 2022PY -A30)

1)



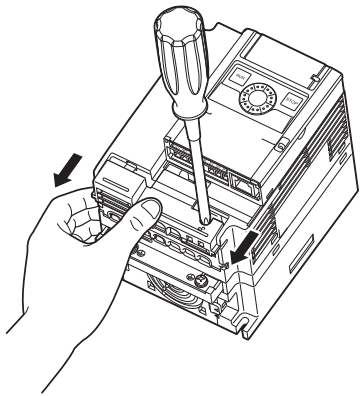
Insert a screwdriver or other thin object into the hole indicated with the ⏍ mark.

2)



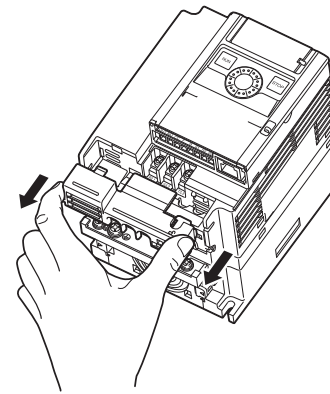
Press in on the screwdriver.

3)



While pressing on the screwdriver, sidles the terminal cover downward to remove it.

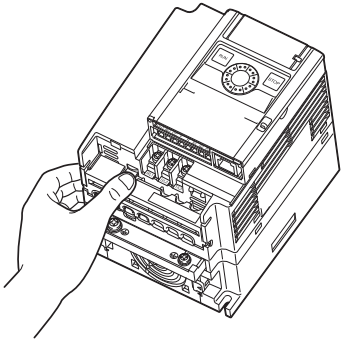
4)



Pull the terminal cover up.

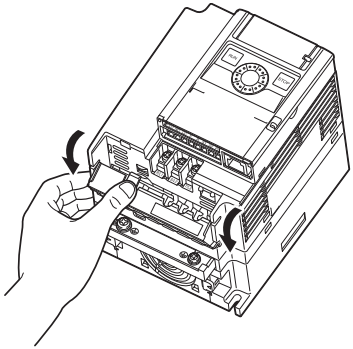
(4) Removing the inside terminal block cover (VFNC3M-2015, 2022PY -A30)

1)



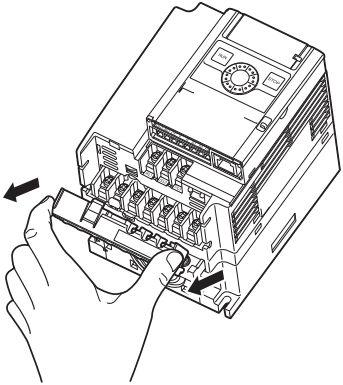
The finger is put on to the tab part of the terminal block cover.

2)



While pressing on the screwdriver, rotate the terminal cover downward to remove it.

3)



Pull the terminal cover up at an angle.

★ After wiring is complete, be sure to restore the terminal cover to its original position.

1.3.3 Power circuit and control circuit terminal boards

In case of the lug connector, cover the lug connector with insulated tube, or use the insulated lug connector.

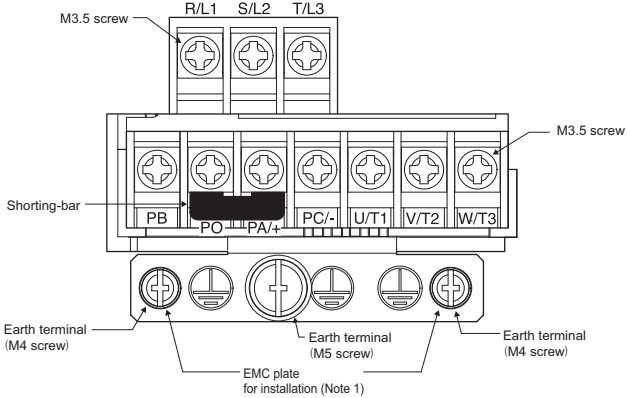
1) Power circuit terminal board

In case of the lug connector, cover the lug connector with insulated tube, or use the insulated lug connector.

Screw size	Tightening torque	
M3.5 screw	1.0Nm	8.9lb • in
M4 screw	1.4Nm	12.4lb • in
M5 screw	3.0Nm	26.6lb • in

Refer to section 2.3.1 for details about terminal functions.

VFNC3M-2001 to 2007PY -A30

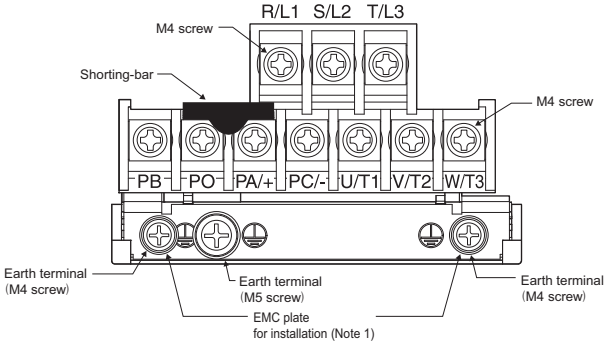


* Bend the clips on the wiring port of the terminal cover to connect the PB, PO, PA/+, and PC/- terminals.

When using a crimping terminal, be sure to cover the fastener with an insulating tube or use an insulated crimping terminal.

Note 1) The EMC plate is optional.

VFNC3M-2015, 2022PY -A30



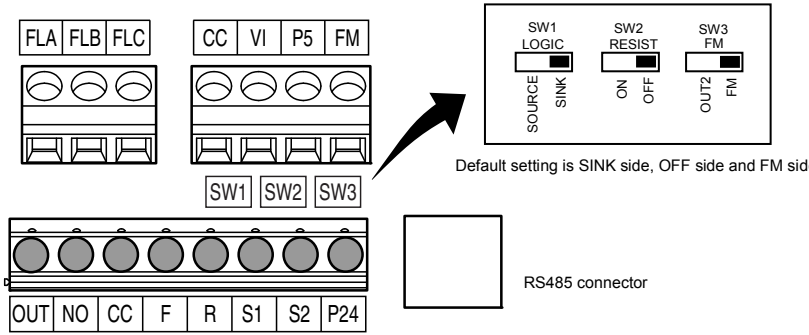
* Bend the clips on the wiring port of the terminal cover to connect the PB, PO, PA/+, and PC/- terminals.

When using a crimping terminal, be sure to cover the fastener with an insulating tube or use an insulated crimping terminal.

Note 1) The EMC plate is optional.

2) Control circuit terminal board

The control circuit terminal board is common to all equipment.



Default setting is SINK side, OFF side and FM side.

RS485 connector

Screw size	Recommended tightening torque
M2.5 screw	0.5 N·m
	4.4 lb·in

Stripping length: 6 (mm)
Screwdriver: Small-sized flat-blade screwdriver
(Blade thickness: 0.5 mm, blade width: 3.5 mm)

Refer to section 2.3.2 for details about all terminal functions.

Wire size

Conductor	1 wire	2 wires of same size
Solid	0.3-1.5mm^2 (AWG 22-16)	0.3-0.75mm^2 (AWG 22-18)
Stranded		

Recommended ferrule

Using ferrule to be improved efficiency and reliability of wiring is recommended.

	Wire size mm^2 (AWG)	Type	
		PHOENIX CONTACT	Dinkle International.,Ltd
	0.34 (22)	AI 0.34-6TQ	DN00306
	0.5 (20)	AI 0.5-6WH	DN00506
	0.75 (18)	AI 0.75-6GY	DN00706
	1 (18)	AI 1-6RD	DN01006
	1.5 (16)	AI 1.5-8BK	DN01508
*2	2 X 0.5 (-)	AI TWIN2 X 0.5-8WH	DTE00508
*2	2 X0.75 (-)	AI TWIN2 X 0.75-8GY	DTE00708

*1: Crimping pliers CRIMPFOX ZA3 (PHOENIX CONTACT)
CT1(Dinkle International.,Ltd)

*2: These ferrules enable practical crimping of two wires in a ferrule.

1.4 Notes on the application

1.4.1 Motors

When this inverter and our IPM Gear Motor are used in conjunction, pay attention to the following items.

⚠ Caution	
Mandatory action	Use an inverter that conforms to the IPM Gear Motor of our products “GTR-ECO series” being operated. If the inverter being used does not conform to those specifications, not only will the IPM Gear Motor not rotate correctly, but it may cause serious accidents through overheating and fire.

Comparisons with commercial power operation

This inverter employs the sinusoidal PWM system. However, the output voltage and output current are not perfect sine waves, they have a distorted wave that is close to sinusoidal waveform. This is why compared to operation with a commercial power there will be a slight increase in motor temperature, noise and vibration.

High speed operation exceeds 1800 rpm (0.1 to 0.4kW: 60Hz, 0.75 to 2.2kW: 90Hz)

The vibration and the noise are getting big when operating by the setting value with the frequency exceeds 1800rpm. In addition, please use it within the range of the frequency setting less than allowable highest rotational speed 2500rpm. Please note the output torque, because the frequency ambit that is 1800rpm or more is a constant power characteristic.

Low loads and low inertia loads

The motor may demonstrate instability such as abnormal vibrations or overcurrent trips at light loads of 50% or under of the load percentage, or when the load's inertia moment is extremely small. If that happens reduce the carrier frequency.

Occurrence of instability

Unstable phenomena may occur with the load and motor combinations.
In this case, to deal with the above lower the settings of inverter carrier frequency.

- Combined with couplings between load devices and motors with high backlash

When using the inverter in the above combination, use the S-pattern acceleration/deceleration function, or adjust the speed control response.

- Combined with loads that have sharp fluctuations in rotation such as piston movements

In this case, adjust the response time (inertial moment setting).

Braking a motor when cutting off power supply

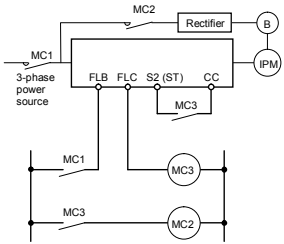
A motor with its power cut off goes into free-run, and does not stop immediately. To stop the motor quickly as soon as the power is cut off, select the IPM Gear Motors with a brake.

Load that produces regenerative torque

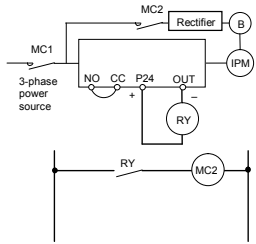
When combined with a load that produces regenerative torque, the overvoltage or overcurrent protection function may be activated to trip the inverter.

IPM Gear Motors with a brake

When the IPM Gear Motors with a brake are directly connected to the inverter's output, the brake cannot be released at startup because of low voltage. Wire the brake circuit separately from the main circuit.



Circuit diagram 1



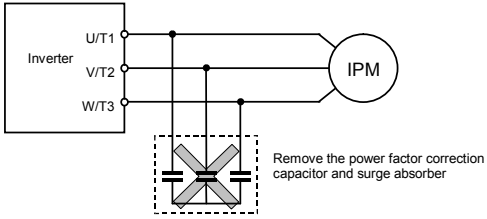
Circuit diagram 2

In circuit diagram 1, the brake is turned on and off through MC2 and MC3. If you do not wire it as shown in diagram 1, an over-current trip may occur because of a bound current during brake operation.
(Example of running preparation ST assigned to terminal S2.)
In circuit diagram 2, the brake is turned on and off by using low-speed signal OUT.

1.4.2 Inverters

Power factor correction capacitor

Power factor correction capacitors cannot be installed on the output side of the inverter. When a motor is run that has a power factor correction capacitor attached to it, remove the capacitors. This can cause inverter malfunction and capacitor destruction.

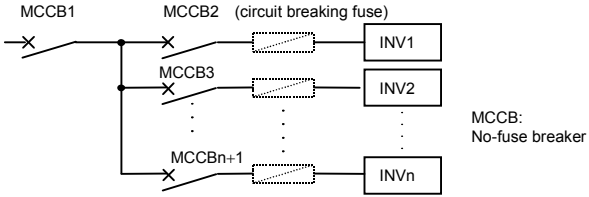


Power factor correction capacitor

Operating at other than rated voltage

Connections to voltages other than the rated voltage described in the rating label cannot be made. If a connection must be made to a power supply other than one with rated voltage, use a transformer to raise or lower the voltage to the rated voltage.

Circuit breaking when two or more inverters are used on the same power line



Breaking of selected inverter

There is no fuse in the inverter's main circuit. Thus, as the diagram above shows, when more than one inverter is used on the same power line, you must select interrupting characteristics so that only MCCB2 to MCCBn+1 will trip and the MCCB1 will not trip when a short occurs in the inverter (INV1). When you cannot select the proper characteristics install a circuit interrupting fuse behind MCCB2 to MCCBn+1.

If power supply distortion is not negligible

If the power supply distortion is not negligible because the inverter shares a power distribution line with other systems causing distorted waves, such as systems with thyristors or large-capacity inverters, install an input reactor to improve the input power factor, to reduce higher harmonics, or to suppress external surges.

■ Disposal

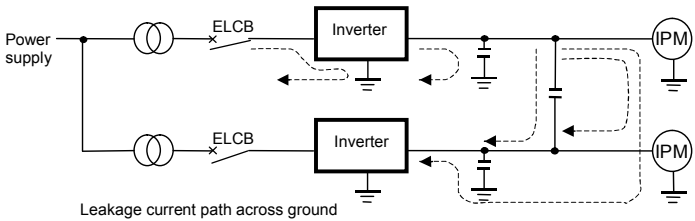
Refer to chapter 16.

1.4.3 What to do about the leakage current

⚠ Caution	
Mandatory action	Current may leak through the inverter's input/output wires because of insufficient electrostatic capacity on the motor with bad effects on peripheral equipment. The leakage current's value is affected by the carrier frequency and the length of the input/output wires. Test and adopt the following remedies against leak current.

(1) Influence of leakage current across ground

Leakage current may flow not just through the inverter system but also through ground wires to other systems. Leakage current will cause earth leakage breakers, leakage current relays, ground relays, fire alarms and sensors to operate improperly, and it will cause superimposed noise on the TV screen or display of incorrect current detection with the CT.



Leakage current path across ground

Remedies:

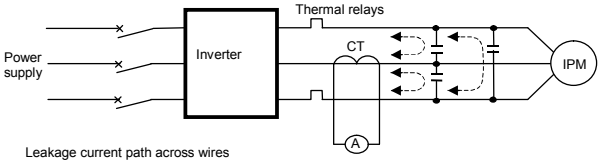
1.Reduce PWM carrier frequency.

The setting of PWM carrier frequency is done with the parameter F300.

Although the electromagnetic noise level is reduced, the motor acoustic noise is increased.

2. Use high frequency remedial products for earth leakage breakers

(2) Influence of leakage current across lines



(1) Thermal relays

The high frequency component of current leaking into electrostatic capacity between inverter output wires will increase the effective current values and make externally connected thermal relays operate improperly. If the wires are more than 50 meters long, it will be easy for the external thermal relay to operate improperly with models having motors of low rated current (several A(ampere) or less), because the leakage current will increase in proportion to the motor rating.

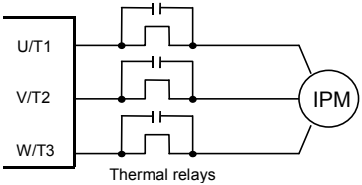
Remedies:

1.Use the electronic thermal built into the inverter. The setting of the electronic thermal is done using parameter $E\,Hr$. (Refer to section 3.4. Set to default setting by our company.)

2.Reduce the inverter's PWM carrier frequency. However, that will increase the motor's magnetic noise.

The setting of PWM carrier frequency is done with the parameter $F\,300$. (Refer to section 6.10)

3.This can be improved by installing 0.1μ~0.5μF - 1000V film capacitor to the input/output terminals of each phase in the thermal relay.



(2) CT and ammeter

If a CT and ammeter are connected externally to detect inverter output current, the leak current's high frequency component may destroy the ammeter. If the wires are long, it will be easy for the high frequency component to pass through the externally connected CT and be superimposed on and burn the ammeter with models having motors of low rated current (several A (ampere) or less), because the leakage current will increase in proportion to the motor's rated current.

Remedies:

1. Use a meter output terminal in the inverter control circuit.
   The load current can be output on the meter output terminal (FM). If the meter is connected, use an ammeter of 1mAdc full scale or a voltmeter of 10V full scale.
   0-20mAdc (4-20mAdc) can be also output. (Refer to section 3.3)
2. Use the monitor functions built into the inverter.
   Use the monitor functions on the panel built into the inverter to check current values. (Refer to section 8.2.1)

1.4.4 Installation

■ Installation environment

This inverter is an electronic control instrument. Take full consideration to installing it in the proper operating environment.

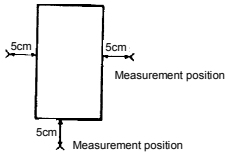
⚠ Warning	
Prohibited	• Do not place any inflammable substances near the VF-nC3M Inverter. If an accident occurs in which flame is emitted, this could lead to fire. • Do not install in any location where the inverter could come into contact with water or other fluids. This can result in electric shock or fire.
Mandatory action	• Operate under the environmental conditions prescribed in the instruction manual. Operations under any other conditions may result in malfunction. • Check to make sure that the input power voltage is +10%, -15% of the rated power voltage written on the rating label (±10% when the load is 100% in continuous operation) If the input power voltage is not +10%, -15% of the rated power voltage (±10% when the load is 100% in continuous operation) this may result in fire.

⚠ Caution	
Prohibited	• Do not install the VF-nC3M Inverter in any location subject to large amounts of vibration. This could cause the unit to fall, resulting in bodily injury.

- Do not install in any location of high temperature, high humidity, moisture condensation and freezing and avoid locations where there is exposure to water and/or where there may be large amounts of dust, metallic fragments and oil mist.
- Do not install in any location where corrosive gases or grinding fluids are present.

- Operate in areas where ambient temperature ranges from -10°C to 60°C.
  Operation over 40°C is allowed when the top label is peeled off. When installing the inverter where the ambient temperature will rise above 50°C, remove the label (seal) from the top and operate it at a current lower than the rated one. (Refer to section 6.10)

[Position for measuring ambient temperature]

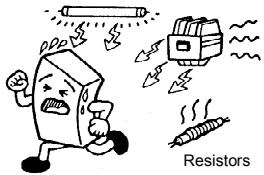


Note: The inverter is a heat-emitting body. Make sure proper space and ventilation is provided when installing in the cabinet. When installing inside a cabinet, we recommend the top seal peeled off although 40°C or less.

- Do not install in any location that is subject to large amounts of vibration.

Note: If the VF-nC3M Inverter is installed in a location that is subject to vibration, anti-vibration measures are required. Please consult with Toshiba about these measures.

- If the VF-nC3M Inverter is installed near any of the equipment listed below, provide measures to insure against errors in operation.



Solenoids:	Attach surge suppressor on coil.
Brakes:	Attach surge suppressor on coil.
Magnetic contactors:	Attach surge suppressor on coil.
Fluorescent lights:	Attach surge suppressor on coil.
Resistors:	Place far away from VF-nC3M Inverter.

■ How to install

Warning	
Prohibited	• Do not install or operate the inverter if it is damaged or any component is missing. This can result in electric shock or fire. Call our company for repairs.
Mandatory action	• Mount the inverter on a metal plate. The rear panel gets very hot. Do not install in an inflammable object, this can result in fire. • Do not operate with the front panel cover removed. This can result in electric shock. • An emergency stop device must be installed that fits with system specifications (e.g. shut off input power then engage mechanical brake). Operation cannot be stopped immediately by the inverter alone, thus risking an accident or injury. • All options used must be those specified by Toshiba. The use of any other option may result in an accident.

Caution	
Mandatory action	• The main unit must be installed on a base that can bear the unit's weight. If the unit is installed on a base that cannot withstand that weight, the unit may fall resulting in injury. • If braking is necessary (to hold motor shaft), install a mechanical brake. The brake on the inverter will not function as a mechanical hold, and if used for that purpose, injury may result.

(1) Normal installation

Select an indoor location with good ventilation, and then install it upright on a flat metal plate.

When installing multiple inverters, leave at least 5 cm of space between each inverter and install them aligned horizontally.

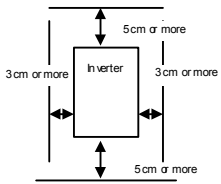
When using the inverter in locations with temperatures above 40°C, remove the caution plate (sticker) on top of the inverter before use. Current reduction is necessary in locations that exceed 50°C.

(2) Side-by-side installation

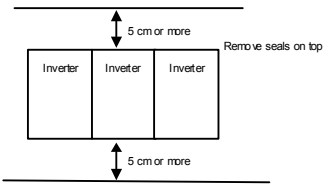
To align the inverters side-by-side horizontally, remove the caution plate (sticker) on top of the inverter before use. Current reduction is necessary in locations that exceed 40 °C.

If the door is opened 90° or more, please open the door with the left side inverter's door open when the same capacity inverters are installed with side-by-side.

Normal installation



Side-by-side installation



The space shown in the diagram is the minimum allowable space. Because air cooled equipment has cooling fans built in on the top or bottom surfaces, make the space on top and bottom as large as possible to allow for air passage.

Note: Do not install in any location where there is high humidity or high temperatures and where there are large amounts of dust, metallic fragments and oil mist.

■ Calorific values of the inverter and the required ventilation

About 5% of the rated power of the inverter will be lost as a result of conversion from AC to DC or from DC to AC. In order to suppress the rise in temperature inside the cabinet when this loss becomes heat loss, the interior of the cabinet must be ventilated and cooled.

The amount of forcible air-cooling ventilation required and the necessary heat discharge surface quantity when operating in a sealed cabinet according to motor capacity are as follows.

Notes

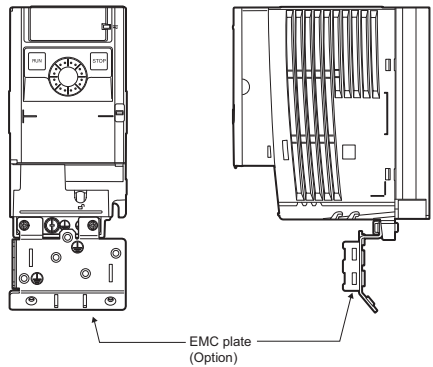
1) Case of 100% Load Continuation operation. The heat loss for the optional external devices (DC reactor) is not included in the calorific values in the table
2) It is power consumption when power is on but it is not operated and cooling fan is activated.

Voltage class	Capacity of applicable motor (kW)	Inverter type		Calorific values Note 1)		Amount of forcible air cooling ventilation required (m^3/min)		Heat discharge surface area required for sealed storage cabinet (m^3)		Standby power requirement (W) Note 2)
				4kHz	12kHz	4kHz	12kHz	4kHz	12kHz	
Three-phase 240V class	0.1	VFNC3M-	2001PY-A30	13	14	0.07	0.08	0.26	0.28	8
	0.2		2002PY-A30	16	18	0.09	0.10	0.32	0.36	8
	0.4		2004PY-A30	24	28	0.14	0.16	0.48	0.56	8
	0.75		2007PY-A30	41	45	0.23	0.26	0.82	0.90	8
	1.5		2015PY-A30	73	85	0.41	0.48	1.46	1.70	12
	2.2		2022PY-A30	85	90	0.48	0.51	1.70	1.80	12

■ Panel designing taking into consideration the effects of noise

The inverter generates high frequency noise. When designing the control panel setup, consideration must be given to that noise. Examples of measures are given below.

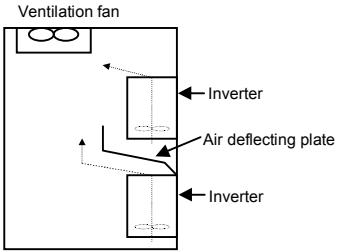
- Wire so that the main circuit wires and the control circuit wires are separated. Do not place them in the same conduit, do not run them parallel, and do not bundle them.
- Provide shielding and twisted wire for control circuit wiring.
- Separate the input (power) and output (motor) wires of the main circuit. Do not place them in the same conduit, do not run them parallel, and do not bundle them.
- Ground the inverter ground terminals (⏚).
- Install surge suppressor on any magnetic contactor and relay coils used around the inverter.
- Install noise filters if necessary.
- To comply with the EMC directives, install the optional EMC plate and fix the shield to it.
- Install EMC plate and use shielded wires.



■ Installing more than one unit in a cabinet

If you are installing two or more inverters in one cabinet, pay attention to the following.

- Inverters may be installed side by side with each other with no space left between them.
- When installing inverters side by side, detach the caution label on the top surface of each inverter and use them where the ambient temperature will not rise above 40°C.
- When using inverters where the ambient temperature will rise above 40°C, leave a space of 3 cm or more between them and remove the caution label from the top of each inverter, or operate each inverter at a current lower than the rated one.
- Ensure a space of at least 20 centimeters on the top and bottom of the inverters.
- Install an air deflecting plate so that the heat rising up from the inverter on the bottom does not affect the inverter on the top.



2. Connection

Warning	
Disassembly prohibited	• Never disassemble, modify or repair. This can result in electric shock, fire and injury. Call our company for repairs.
Prohibited	• Don't stick your fingers into openings such as cable wiring hole and cooling fan covers. This can result in electric shock or other injury. • Don't place or insert any kind of object into the inverter (electrical wire cuttings, rods, wires). This can result in electric shock or fire. • Do not allow water or any other fluid to come in contact with the inverter. That may result in electric shock or fire.

Caution	
Prohibited	• When transporting or carrying, do not hold by the front panel covers. The covers may come off and the unit will drop out resulting in injury.

2.1 Cautions on wiring

Warning	
Prohibited	• Never remove the terminal cover when power is on or open door if enclosed in a cabinet. The unit contains many high voltage parts and contact with them will result in electric shock.
Mandatory action	• Turn power on only after attaching the front cover or closing door if enclosed in a cabinet. If power is turned on without the terminal cover attached or closing door if enclosed in a cabinet. This can result in electric shock or other injury. • Electrical construction work must be done by a qualified expert. Connection of input power by someone who does not have that expert knowledge may result in fire or electric shock. • Connect output terminals (motor side) correctly. If the phase sequence is incorrect, the motor will operate in reverse and that may result in injury. • Wiring must be done after installation. If wiring is done prior to installation that may result in injury or electric shock. • The following steps must be performed before wiring. (1) Shut off all input power. (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. (3) Use a tester that can measure DC voltage (400VDC or more), and check to make sure that the voltage to the DC main circuits (across PA-PC) is 45V or less. If these steps are not properly performed, the wiring will cause electric shock. • Tighten the screws on the terminal board to specified torque. If the screws are not tightened to the specified torque, it may lead to fire. • The maximum wiring distance between the inverter and the motor is 50m

⚠ Warning	
Be Grounded	• Ground must be connected securely. If the ground is not securely connected, it could lead to electric shock or fire when a malfunction or current leak occurs.

⚠ Caution	
Prohibited	• Do not attach devices with built-in capacitors (such as noise filters or surge absorber) to the output (motor side) terminal. This could cause a fire.

■ Preventing radio noise

To prevent electrical interference such as radio noise, separately bundle wires to the main circuit's power terminals (R/L1, S/L2, T/L3) and wires to the motor terminals (U/T1, V/T2, W/T3).

■ Control and main power supply

The control power supply and the main circuit power supply for this inverter that is exclusively for IPM gear motor drive of our GTR-ECO series are the same.

If a malfunction or trip causes the main circuit to be shut off, control power will also be shut off. When checking the cause of the malfunction or the trip, use the trip holding retention selection parameter.

■ Wiring

- Because the space between the main circuit terminals is small use sleeved crimp-style terminals for the connections. Connect the terminals so that adjacent terminals do not touch each other.
- For ground terminal ⏚ use wires of the size that is equivalent to or larger than those given in table 10.1 and always ground the inverter (240V voltage class: D type ground).
  Use as large and short a ground wire as possible and wire it as close as possible to the inverter.
- Please connect the inverter grounding to an exclusive grounding terminal.
  (Please do not use the screws such as case or chassis)
- For the sizes of electric wires used in the main circuit, refer to the table in section 10.1.

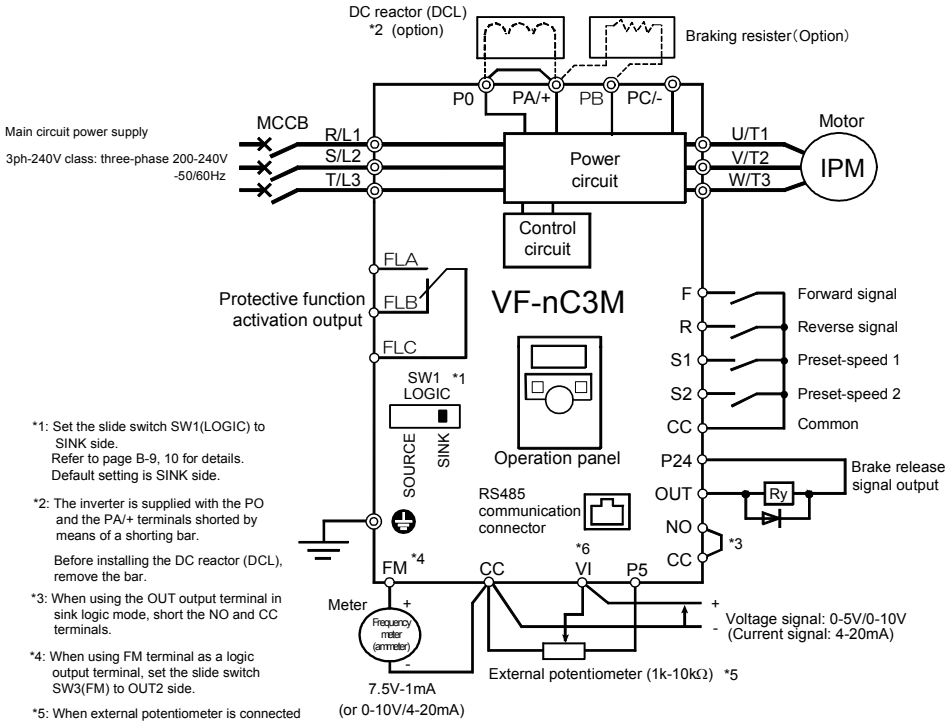
2.2 Standard connections

⚠ Warning	
 Prohibited	• Do not connect input power to the output (motor side) terminals (U/T1, V/T2, W/T3). Connecting input power to the output could destroy the inverter or cause a fire. • Do not insert a resistor between DC terminals (between PA/+ and PC/-, or between PO and PC/-). It could cause a fire. • First shut off input power and wait at least 15 minutes before touching wires on equipment (MCCB) that is connected to inverter power side. Touching the wires before that time could result in electric shock. • Do not shut down the external power supply on ahead when VI terminal is used as logic input terminal by external power supply (F127=0). It could result in malfunction as VI terminal is ON status.
 Mandatory action	• Confirm to logic setting of slide switch SW1 (LOGIC) and parameter F127 (sink/source switching) when F, R, S1, S2 terminals and VI terminal are used as logic input terminal. If it is not set, it could result in malfunction.
 Be Grounded	• Ground must be connected securely. If the ground is not securely connected, it could lead to electric shock or fire when a malfunction or current leak occurs.

2.2.1 Standard connection diagram 1

This diagram shows a standard wiring of the main circuit.

Standard connection diagram - SINK (Negative) (common:CC)



*1: Set the slide switch SW1(LOGIC) to SINK side.
Refer to page B-9, 10 for details.
Default setting is SINK side.

*2: The inverter is supplied with the PO and the PA/+ terminals shorted by means of a shorting bar.

Before installing the DC reactor (DCL), remove the bar.

*3: When using the OUT output terminal in sink logic mode, short the NO and CC terminals.

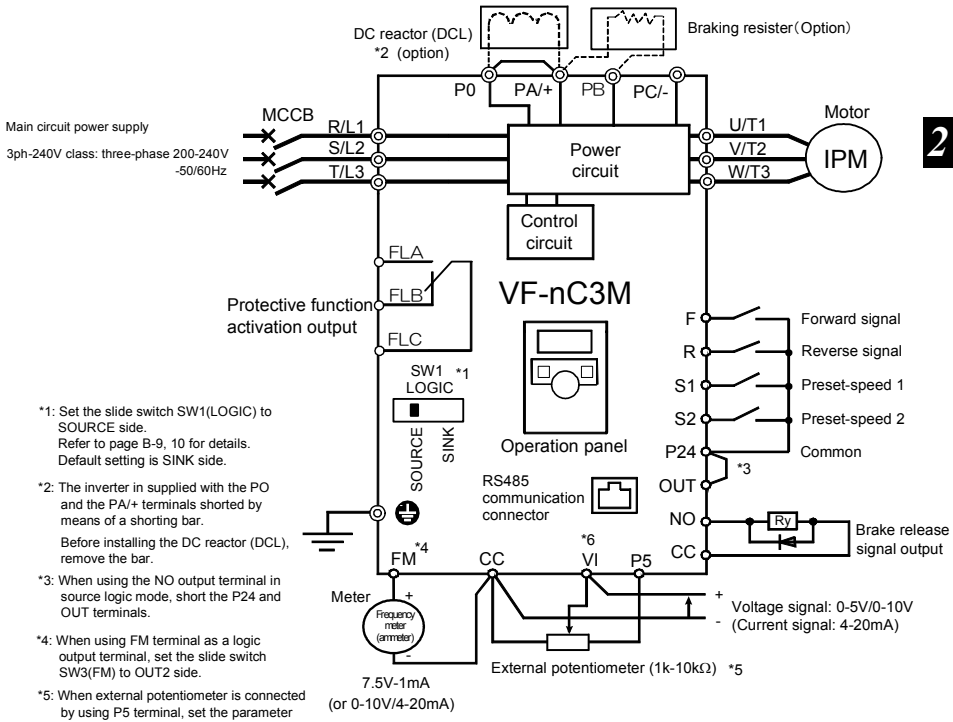
*4: When using FM terminal as a logic output terminal, set the slide switch SW3(FM) to OUT2 side.

*5: When external potentiometer is connected by using P5 terminal, set the parameter F109=3.

*6: When VI terminal is used as a logic input terminal, refer to page B-7,11.

2.2.2 Standard connection diagram 2

Standard connection diagram - SOURCE (Positive) (common:P24)



*1: Set the slide switch SW1(LOGIC) to SOURCE side.
Refer to page B-9, 10 for details.
Default setting is SINK side.

*2: The inverter in supplied with the PO and the PA/+ terminals shorted by means of a shorting bar.
Before installing the DC reactor (DCL), remove the bar.

*3: When using the NO output terminal in source logic mode, short the P24 and OUT terminals.

*4: When using FM terminal as a logic output terminal, set the slide switch SW3(FM) to OUT2 side.

*5: When external potentiometer is connected by using P5 terminal, set the parameter F109=3.

*6: When VI terminal is used as a contact input terminal, refer to page B-7,11.

2.3 Description of terminals

2.3.1 Power circuit terminals

■ Power circuit

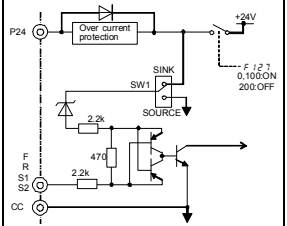
Terminal symbol	Terminal function
⏚	Grounding terminal for connecting inverter. There are 3 terminals in total.
R/L1,S/L2,T/L3	240V class: three-phase 200 to 240V-50/60Hz
U/T1,V/T2,W/T3	Connect to a motor (IPM Gear Motor).
PA/+, PB	Connect to braking resistors. Change parameters F304, F305, F308, F309 if necessary.
PC/-	This is a negative potential terminal in the internal DC main circuit. DC common power can be input across the PA terminals (positive potential).
PO, PA/+	Terminals for connecting a DC reactor (DCL: optional external device). Shorted by a short bar when shipped from the factory. Before installing DCL, remove the short bar.

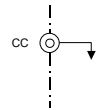
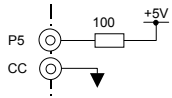
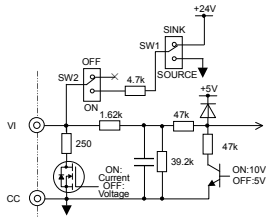
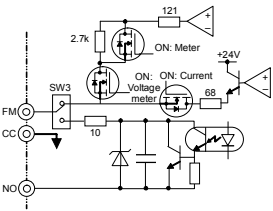
The arrangements of power circuit terminals are different from each range.
Refer to section 1.3.3.1) for details.

2.3.2 Control circuit terminals

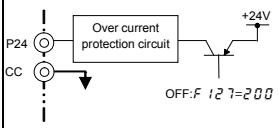
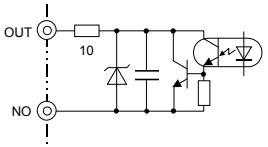
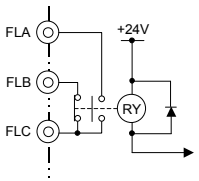
The control circuit terminal board is common to all equipment.
Regarding to the function and specification of each terminal, please refer to the following table.
Refer to section 1.3.3.2) about the arrangement of control circuit terminals.

■ Control circuit terminals

Terminal symbol	Input / output	Function		Electrical specifications	Inverter internal circuits
F	Input	Multifunction programmable logic input	Shorting across F-CC causes forward rotation; open causes slow-down and stop. (When Standby ST is always ON) 3 different functions can be assigned.	No voltage logic input 24Vdc-5mA or less *Sink/Source selectable using and slide switch SW1(LOGIC) (In case of sink logic is the left) (Default setting is SINK side)	
R	Input		Shorting across R-CC causes reverse rotation; open causes slow-down and stop. (When Standby ST is always ON) 3 different functions can be assigned.		
S1	Input		Shorting across S1-CC causes preset speed operation. 2 different functions can be assigned.		
S2	Input		Shorting across S2-CC causes preset speed operation. 2 different functions can be assigned.		

Terminal symbol	Input / output	Function	Electrical specifications	Inverter internal circuits
CC	Common to Input / output	Control circuit's equipotential terminal (2 terminals)		
P5	Output	Analog power supply output	5Vdc (permissible load current: 10mA)	
V I	Input	Multifunction programmable analog input. Factory default setting: 0-10Vdc (1/1000 resolution) and 0-60Hz (0-50Hz) frequency input. The function can be changed to 0-20mAdc (4-20mA) current input by parameter F109 = 1 setting. 0-5Vdc (1/1000 resolution) voltage input by parameter F109 =3 setting. Switch to this setting when external potentiometer is connected by using P5 terminal. By changing parameter F109=2 setting, this terminal can also be used as a multifunction programmable logic input terminal. Sink/source logic is switched by slide switch SW1(LOGIC) and parameter F127. In that case, set the slide switch SW2(RESIST) to ON side. Refer to page B-11 (2).	5V/10Vdc (internal impedance: 40kΩ) 4-20mA (internal impedance: 250Ω) Note 1)	
FM	Output	Multifunction programmable analog output. Standard default setting: output frequency. The function can be changed to 0-10Vdc voltage or 0-20mAdc (4-20mA) current output by parameter F681 setting. By setting the slide switch SW3(FM) to OUT side, these terminals can also be used as multifunction programmable open collector output terminals. (only sink logic)	1mAdc full-scale ammeter or QS60T(option) 0-20mA (4-20mA) DC ammeter Permissible load resistance: 750Ω or less 0-10V DC volt meter Permissible load resistance: 1kΩ or more Open collector output 25Vdc-50mA	

Note 1) Be careful, if 4-20mA is selected, when the inverter's power is ON, the internal impedance is 250Ω, but when the power is OFF, the internal impedance increases very much to approximately 40kΩ.

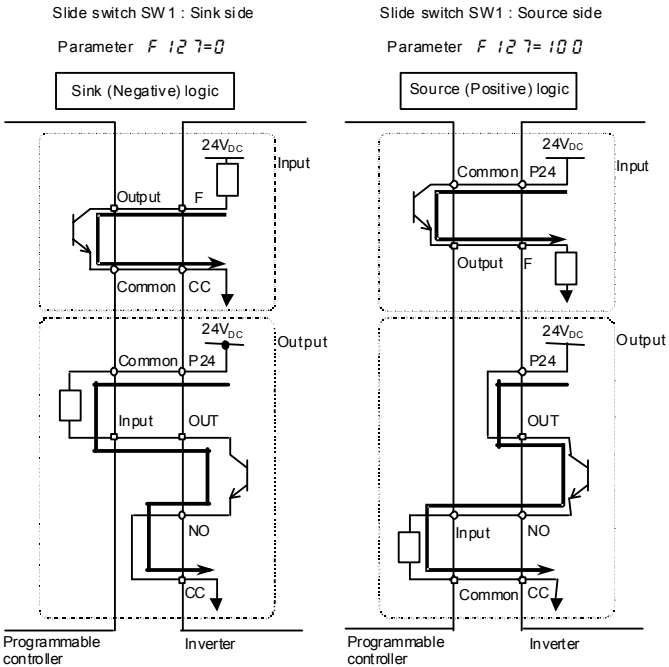
Terminal symbol	Input / output	Function	Electrical specifications	Inverter internal circuits
P24	Output	24Vdc power output This terminal is also input terminal of external 24Vdc power supply for logic input when external power supply is selected on sink logic. At this time, the setting of slide switch SW1 and parameter F127 are needed.	24Vdc-100mA	
OUT NO	Output	Multifunction programmable open collector output. Standard default setting detect and output Brake release signal "68". Multifunction output terminals to which two different functions can be assigned. The NO terminal is an isoelectric output terminal. It is insulated from the CC terminal. By changing parameter settings, these terminals can also be used as multifunction programmable pulse train output terminals.	Open collector output 24Vdc-100mA To output pulse trains, a current of 10mA or more needs to be passed. Pulse frequency range: 25～1600pps	
FLA FLB FLC Note 2)	Output	Multifunction programmable relay contact output. Detects the operation of the inverter's protection function. Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation.	Max. switching capacity 250Vac-2A 30Vdc-2A (cosϕ=1) : at resistive load 250Vac-1A (cosϕ=0.4) Min. permissible load 5Vdc-100mA	

Note 2) A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measures when connecting it directly with input unit terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected.

■ SINK (Negative) logic/SOURCE (Positive) logic (When the inverter's internal power supply is used)

Current flowing out turns control input terminals on. These are called sink logic terminals.
The general used method in Europe is source logic in which current flowing into the input terminal turns it on.
Sink logic is sometimes referred to as negative logic, and source logic is referred to as positive logic.
Each logic is supplied with electricity from either the inverter's internal power supply or an external power supply, and its connections vary depending on the power supply used.
Sink/source logic can be switched by slide switch SW1(LOGIC) and parameter F127.

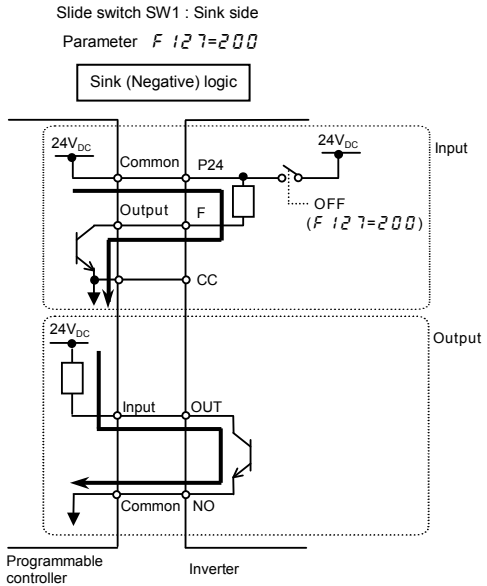
<Examples of connections when the inverter's internal power supply is used>



■ SINK (Negative) logic (When an external power supply is used)

The P24 terminal is used to connect to an external power supply or to separate a terminal from other input or output terminals.

<Examples of connections when an external power supply is used>



⚠ Warning	
Mandatory action	• Confirm to logic setting of slide switch SW1 (LOGIC) and parameter F127 (sink/source switching) when F, R, S1, S2 terminals and VI terminal are used as logic input terminal. If it is not set, it could result in malfunction.

■ Switching of slide switch

Refer to section 1.3.3 2) about location of slide switch.

(1) Switching of sink/source logic: SW1 (Default setting : SINK side)
Setting of sink/source logic is switched by the slide switch SW1 (LOGIC) and parameter F127 when F, R, S1, S2 and VI terminals are used as logic input terminals.
Set the sink/source logic switching before wiring the control terminals.
Wire the control terminals after confirming the right for sink/source setting.

(2) Switching of analog/logic input: SW2 (Default setting : OFF side)
Setting of analog/ logic input for VI terminal is switched by parameter F109.
When using VI terminal as a logic input terminal (F109=2), set the slide switch SW2 (RESIST) to ON side surely. If it is not set, this could result in malfunction.
In this time, the connection of external resistance is not needed.
And when using VI terminal as logic input terminal, slide switch SW1 (LOGIC) and parameter F127 need the setting of sink/source logic. If it is set differently, this could result in malfunction.

(3) Switching of analog/open collector output: SW3 (Default setting : FM side)
Setting of analog/open collector output for FM terminal is switched by the slide switch SW3 (FM).
FM side is analog output and OUT2 side is open collector output.
The function is assigned for the analog output by parameter FmSL and for the open collector output by parameter F131 and F138.

3. Operations

⚠ Caution	
 Prohibited	• Do not touch inverter terminals when electrical power is going to the inverter even if the motor is stopped. Touching the inverter terminals while power is connected to it may result in electric shock. • Do not touch switches when the hands are wet and do not try to clean the inverter with a damp cloth. Such practices may result in electric shock. • Do not go near the motor in alarm-stop status when the retry function is selected. The motor may suddenly restart and that could result in injury. Take measures for safety, e.g. attaching a cover to the motor, against accidents when the motor unexpectedly restarts.
 Mandatory action	• If the inverter begins to emit smoke or an unusual odor, or unusual sounds, immediately turn power off. If the equipment is continued in operation in such a state, the result may be fire. Call our company for repairs. • Always turn power off if the inverter is not used for long periods of time. • Turn the input power on only after attaching the terminal block cover. When enclosed inside a cabinet and used with the terminal block cover removed, always close the cabinet doors first and then turn the power on. If the power is turned on with the terminal block cover or the cabinet doors open, this may result in electric shock. • Make sure that operation signals are off before resetting the inverter after malfunction. If the inverter is reset before turning off the operating signal, the motor may restart suddenly causing injury.

⚠ Caution	
 Contact prohibited	• Do not touch heat radiating fins or discharge resistors. These devices are hot, and you'll get burned if you touch them.
 Prohibited	• Observe all permissible operating ranges of motors and mechanical equipment. (Refer to the motor's instruction manual.) Not observing these ranges may result in injury.

3.1 Simplified Operation of the VF-nC3M

The procedures for setting operation frequency and the methods of operation can be selected from the following.

Run / Stop : (1) Run and stop using the panel keypad
(2) Run and stop using external signals to terminal board

Setting the frequency : (1) Setting using setting dial
(2) Setting using external signals to terminal board (0-5V/0-10Vdc, 4-20mAdc)

Use the basic parameters CMOd (command mode selection) FMOd and (frequency setting mode selection) for selection.

[Parameter setting]

Title	Function	Adjustment range	Default setting
CMOd	Command mode selection	0: Terminal board 1: Panel keypad (including extension panel) 2: RS485 communication	1
FMOd	Frequency setting mode selection	0: Terminal board VI 1: Setting dial 1 (press in center to save) 2: Setting dial 2 (save even if power is off) 3: RS485 communication 4: - 5: UP/DOWN form external logic input	2

☆ FMOd=2 (setting dial 2) is the mode where after the frequency is set by the setting dial, the frequency is saved even if the power is turned off.

☆ Refer to section 5.4 for details about FMOd=3 and 5.

3.1.1 How to run and stop

[Example of a CMOd setting procedure]

Panel operation	LED display	Operation
	0.0	Displays the operation frequency (operation stopped). (When standard monitor display selection F710=0 [Operation frequency])
MODE	AUH	Displays the first basic parameter [History (AUH)].
	CMOd	Turn the setting dial, and select "CMOd".
	1	Press the center of the setting dial to read the parameter value. (Standard default: 1).
	0	Turn the setting dial to change the parameter value to 0 (terminal block).
	0⇔CMOd	Press the center of the setting dial to save the changed parameter. CMOd and the parameter set value are displayed alternately.

(1) Run and stop using the panel keypad (CMOd= 1)

Use the RUN and STOP keys on the panel keypad to start and stop the motor.

RUN : Motor runs. STOP : Motor stops.

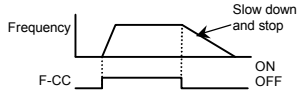
- ☆ The direction of rotation is determined by the setting of parameter Fr (forward run, reverse run selection). (0: forward run, 1: reverse run)
- ☆ To switch between forward run and reverse run from the extension panel (option), the parameter Fr (forward run, reverse run selection) needs to be set to 2 or 3. (Refer to section 5.6)

(2) RUN / STOP by means of an external signal to the terminal board (CMOd=0): Sink (Negative) logic

Use external signals to the inverter terminal board to start and stop the motor.

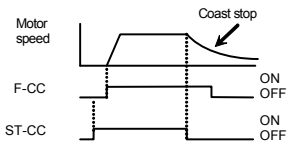
Short F and CC terminals: run forward

Open F and CC terminals: slow down and stop



(3) Coast stop

The standard default is slowdown stop. To make a coast stop, assign "6 (ST)" to an idle terminal.
Change to F110=0.
For coast stop, open the ST-CC when stopping the motor in the state described at right. The monitor on the inverter at this time will display OFF.
A coast stop can also be made by assigning "96 (FRR)" to an idle terminal.
When doing this, a coast stop is done by FRR and CC both turning on.



3.1.2 How to set the frequency

[Example of FMOd setting procedure]: Setting the frequency setting destination to the terminal block

Panel operation	LED display	Operation
	0.0	Displays the operation frequency (operation stopped). (When standard monitor display selection F710=0 [Operation frequency])
MODE	RUH	Displays the first basic parameter [History (RUH)].
	FMOd	Turn the setting dial, and select "FMOd".
	2	Press the center of the setting dial to read the parameter value. (Standard default: 2).
	0	Turn the setting dial to change the parameter value to 0 (terminal block VI).
	0⇔FMOd	The parameter value is written. FMOd and the parameter value are displayed alternately several times.

* Pressing the MODE key twice returns the display to standard monitor mode (displaying operation frequency).

(1) Setting using the keypad (FMOd= 1 or 2)

 : Moves the frequency up  : Moves the frequency down

■ Example of operating from the panel (FMOd= 1: press in center to save)

Panel operation	LED display	Operation
	0.0	Displays the operation frequency. (When standard monitor display selection F710=0 [Operation frequency])
	50.0	Set the operation frequency. (The frequency will not be saved if the power is turned off in this state.)
	50.0⇔FC	Save the operation frequency. FC and the frequency are displayed alternately.

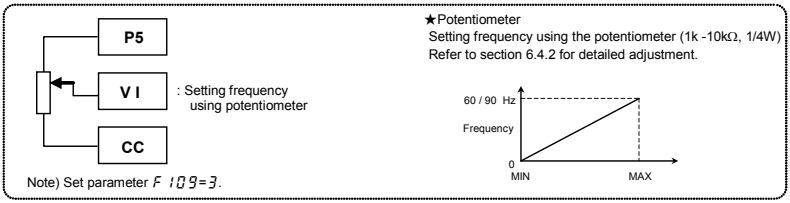
■ Example of operating from the panel (FMOd=2: save even if power is off)

Panel operation	LED display	Operation
	0.0	Display the operation frequency. (When standard monitor display selection is set as F710=0 [operation frequency])
	60.0	Set the operation frequency.
-	60.0	The frequency will be saved even if the power is turned off in this state.

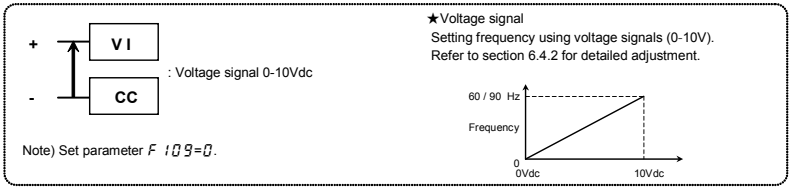
(2) Setting of frequency using external signals to terminal block (F00d=0)

■ Frequency setting

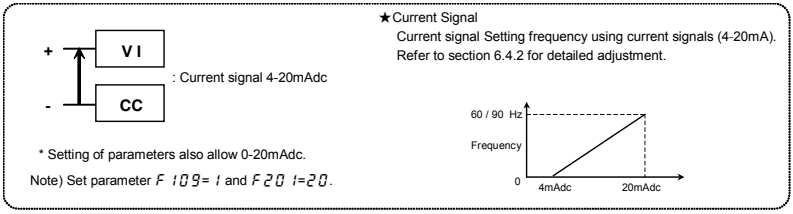
1) Setting the frequency using external potentiometer



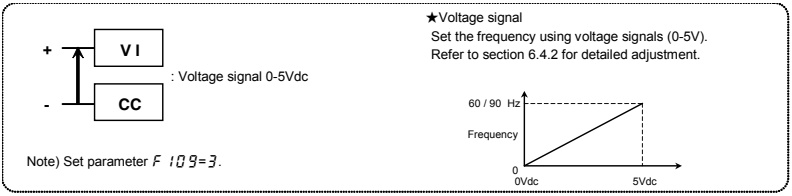
2) Setting the frequency using voltage input (0-10V)



3) Setting the frequency using current input (4-20mA)



4) Setting the frequency using voltage input (0-5V)

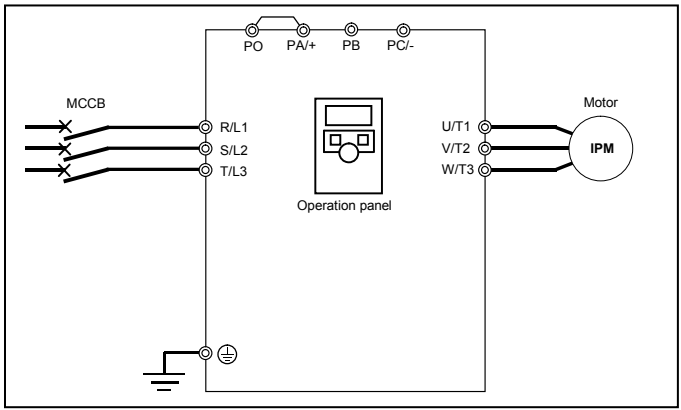


3.2 How to operate the VF-nC3M

Overview of how to operate the inverter with simple examples.

Ex.1 Setting the frequency using the setting dial, and run/stop using the panel keypad (1)

(1) Wiring



(2) Parameter setting (default setting)

Title	Function	Programmed value
CMOd	Command mode selection	1
FMOd	Frequency setting mode selection	2

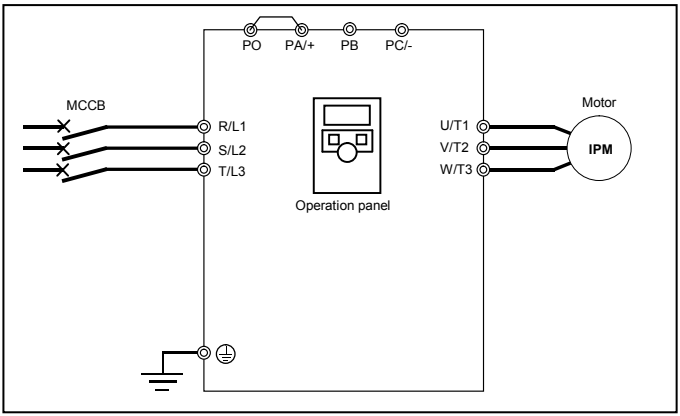
(3) Operation

Run/stop: Press the RUN and STOP keys on the panel.

Frequency setting: Turn the setting dial to set the frequency. The frequency setting is saved just by turning the setting dial.

Ex.2 Setting the frequency using the setting dial, and run/stop using the panel keypad (2)

(1) Wiring



(2) Parameter setting

Title	Function	Programmed value
CMOd	Command mode selection	1
FMOd	Frequency setting mode selection	1

(3) Operation

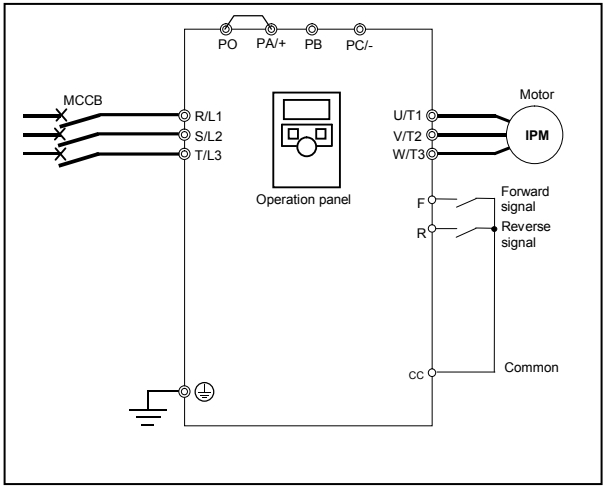
Run/stop: Press the RUN and STOP keys on the panel.

Frequency setting: Turn the setting dial to set the frequency.
To save the frequency setting, press the center of the setting dial.
FC and the set frequency will flash on and off alternately.

3

Ex.3 Setting the frequency using the setting dial, and run/stop using external signals

(1) Wiring



(2) Parameter setting

Title	Function	Programmed value
CMOd	Command mode selection	0
FMOd	Frequency setting mode selection	1 or 2

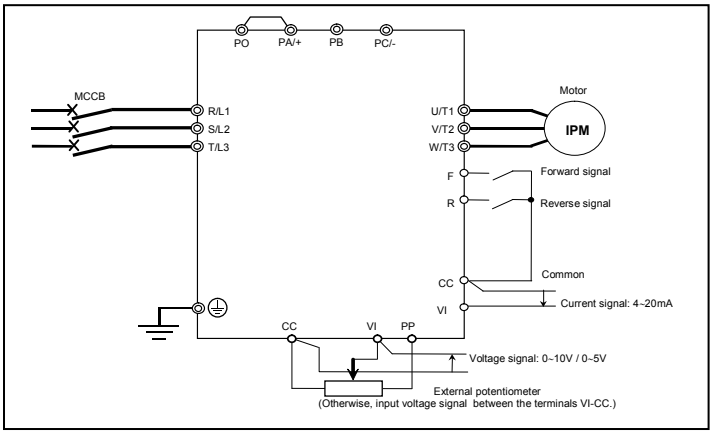
(3) Operation

Run/stop: ON/OFF input to F-CC, R-CC. (with sink logic)

Frequency setting: Turn the setting dial to set the frequency.

Ex.4 Setting the frequency using external signals, run/stop using external signals.

(1) Wiring



(2) Parameter setting

Title	Function	Programmed value
CMOd	Command mode selection	0
FMOd	Frequency setting mode selection	0

(3) Operation

Run/stop: ON/OFF input to F-CC, R-CC. (with sink logic)

Frequency setting: VI: Input 0-10Vdc (external potentiometer) or 4-20mAdc to set the frequency.

* Set the voltage/current input of VI in parameter F 109.

0: Voltage signal input (0-10V)

1: Current signal input (4-20mA)

3: Voltage signal input (0-5V), when the P5 terminal is connected and the external potentiometer is used

3.3 Meter setting and adjustment

FMSL: Meter selection

FM: Meter adjustment gain

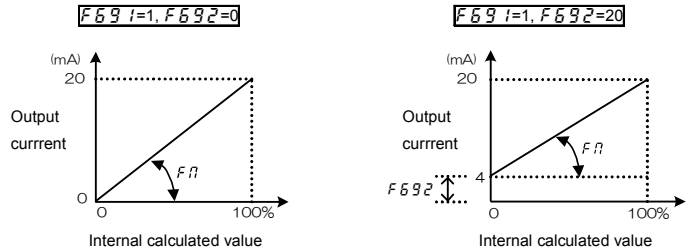
- Function
  Output of 0 - 1mAdc, 0 (4) - 20mAdc, 0 - 10vdc can be selected for the output signal from the FM terminal, depending no the F681 setting. Adjust the scale at FM.
  Use an ammeter with a full-scale 0 - 1mAdc meter.
  The F692 (analog output bias) needs to be adjusted if output is 4 - 20mAdc.

[Parameter setting]

Title	Function	Adjustment range	Supposition output at FMSL = 17	Default setting
FMSL	Meter selection	0: Output frequency 1: Output current 2: Frequency command value 3: Input voltage (DC detection) 4: Output voltage (command value) 5: Input power 6: Output power 7 to 10: - 11: PBR (Braking resistor) cumulative load factor 12: Actual output frequency 13: VI input value 14: - 15: Fixed output 1 (output current 100% equivalent) 16: Fixed output 2 (output current 50% equivalent) 17: Fixed output 3 (other than the output current) 18: RS485 communication data 19: For adjustments (FM set value is displayed) 20 to 22: -	Maximum frequency (FH) - Maximum frequency (FH) 1.5x rated voltage 1.5x rated voltage 1.85x rated power 1.85x rated power - Rated load factor Maximum frequency (FH) Maximum input value - - - - Maximum value (100.0%) - -	0
FM	Meter adjustment gain	-	-	-

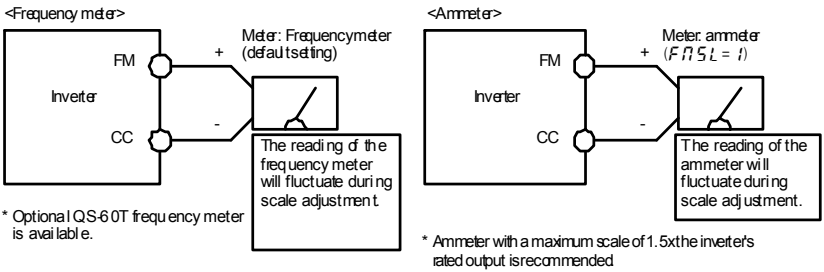
■ Resolution
All FM terminals have a maximum of 1/255.

■ Example of 4-20mA output adjustment (Refer to section 6.19.2 for details)



Note 1) When using the FM terminal for current output, be sure that the external load resistance is less than 750Ω. Use at over 1kΩ external load resistance, if used for voltage output.
Note 2) When using the FM terminal as a logic output terminal, set the slide switch SW3 (FM) to OUT2 side.

■ Adjustment scale with parameter FM (Meter adjustment)
Connect meters as shown below.



[Example of how to adjustment the FM terminal frequency meter]

* Use the meter's adjustment screw to pre-adjust zero-point.

Operation panel action	LED display	Operation
-	60.0	Displays the output frequency. (When standard monitor display selection F710 is set to 0)
MODE	AUH	The first basic parameter "AUH" (history function) is displayed.
	FM	Turn the setting dial to select FM.
	60.0	Operation frequency can be read by pressing the center of the setting dial.
	60.0	Turn the setting dial to adjust the meter. Note that the meter's indicator changes at this time, but the inverter's display (monitor) does not change. 
	60.0 ⇔ FM	Press the center of the setting dial to save the meter's calibrations. FM and the frequency are displayed alternately.
MODE + MODE	60.0	The display returns to its original indications. (When standard monitor display selection F710 is set to 0 [Operation frequency])

■ Adjusting the meter in inverter stop state

- Adjustment of output current (FM5L = 1)
  If, when adjusting the meter for output current, there are large fluctuations in data during adjustment, making adjustment difficult, the meter can be adjusted in inverter stop state.
  When setting FM5L to 15 for fixed output 1 (output current 100% equivalent), a signal of absolute values will be output (inverter's rated current = 100%). In this state, adjust the meter with the FM (Meter adjustment) parameter.
  Similarly, if you set FM5L to 16 for fixed output 2 (output current 50% equivalent), a signal that is sent out when half the inverter's rated current is flowing will be output through the FM terminal.
  After meter adjustment is ended, set FM5L to 1 (output current).

- Other adjustments (FM5L = 0, 2 - 4, 12, 13, 18)
  FM5L = 17: When fixed output 3 (other than the output current) is set, a signal of the the value for other monitors is fixed at the following values and output through the FM terminal.
  100% standard value for each item is the following:
  FM5L=0, 2, 12 : Maximum frequency (FH)
  FM5L=3, 4 : 1.5 times of rated voltage
  FM5L = 13 : Maximum input value (5V, 10V, or 20mA)
  FM5L = 18 : Maximum value (1000)

3.4 Setting the electronic thermal

tHr : Motor electronic-thermal protection level 1

F607 : Motor 150% overload detection time

F632 : Electronic-thermal memory

- Function
  This parameter allows selection of the appropriate electronic thermal protection characteristics according to the particular rating and characteristics of the motor.

[Parameter setting]

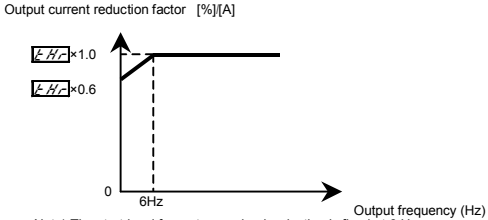
Title	Function	Adjustment range	Default setting
tHr	Motor electronic-thermal protection level 1	10 – 100 (%) / (A) *1	0.1kW model : 64 0.2kW model : 61 0.4kW model : 73 0.75kW model : 80 1.5kW model : 82 2.2kW model : 82
F607	Motor 150% overload detection time	10 – 2400 (s)	60
F632	Electronic-thermal memory	0: Disabled 1: Enabled *2	0

*1: The inverter's rated current is 100%. When F701 (current and voltage unit selection) = 1 (A (amps)/V (volts)) is selected, it can be set at A (amps).

*2: The thermal status (overload totaling level) of the inverter or motor is saved when the power is turned off, and is calculated when the power is turned on from the off status.

1) Setting of motor electronic-thermal protection level 1 [ETHr]

Adjust the electronic-thermal protection level 1 [ETHr] so that it fits the motor's rated current.
* If the indications are in percentages (%), then 100% equals the inverter's rated output current (A).



Note) The start level for motor overload reduction is fixed at 6 Hz.

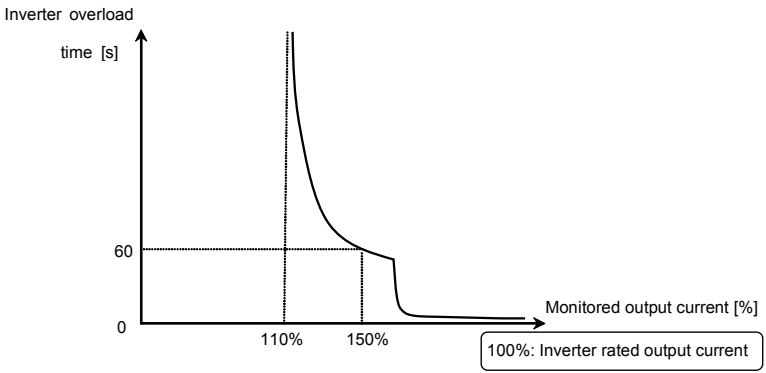
Note 1) Motor electronic-thermal protection level 1 is set to default setting every each motors.
Please contact to us surely when the protection level changes for controlling a motor trouble.

2) Motor 150%-overload detection time [F607]

Parameter [F607] is used to set the time elapsed before the motor trips under a load of 150% (overload trip [OL2]) within a range of 10 to 2400 seconds.

3) Inverter overload characteristics

Set to protect the inverter itself. The setting of this parameter cannot be turned to off.
When an inverter overload trip ([OL1]) operates, operation can be improved by lowering stall operating level [F601], or increasing acceleration time [ACC] and deceleration time [dEC].



Inverter overload protection characteristic

Note 1: At extremely low speeds of lower than 1 Hz or over 150%, an overload trip (OL 1) occurs in a short period of time to protect the inverter.

Note 2: If an inverter overload occurs with the factor default settings, the inverter is set to lower the carrier frequency automatically and overload tripping is (OL 1) controlled. Although noise from the motor increases when the carrier frequency is reduced, there is no effect on performance. When reducing the carrier frequency is undesirable, set parameter F316 = 0.

4) Electronic-thermal memory F632

When the power is OFF, it is possible to reset or maintain the overload totaling level.
This parameter's settings are applied both to the motor's electronic thermal memory and the electronic thermal memory for inverter protection.

[Parameters settings]

Title	Function	Adjustment range	Default setting
F632	Electronic-thermal memory	0: Disabled 1: Enabled	0

☆F632= 1 is a function for complying with the U.S. NEC standards.

3.5 Preset-speed operation (speeds in 15 steps)

Sr 1 - Sr 7: Preset-speed frequency 1-7

F287 - F294: Preset-speed frequency 8-15

- Function
  A maximum of 15 speed steps can be selected just by switching an external logic signal. Multi-speed frequencies can be programmed anywhere from the lower limit frequency LL to the upper limit frequency UL.

[Setting method]

1) Run/stop
   The starting and stopping control is done from the terminal board.

Title	Function	Adjustment range	Setting
CMOd	Command mode selection	0: Terminal board 1: Panel keypad (including extension panel) 2: RS485 communication	0

Note: When switching between preset-speed operation and other speed commands (analog signal, setting dial, communication, etc.), select the frequency setting mode at FMOd. ⇒ Refer to section 3.5-3) or 5.4.

2) Preset-speed frequency setting
   Set the speed (frequency) of the number of steps necessary.

[Parameter setting]

Setting from speed 1 to speed 7

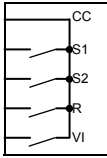
Title	Function	Adjustment range	Default setting
Sr 1- Sr 7	Preset-speed frequency 1-7	LL - UL (Hz)	0.0

Setting from speed 8 to speed 15

Title	Function	Adjustment range	Default setting
F287- F294	Preset-speed frequency 8-15	LL - UL (Hz)	0.0

Preset-speed logic input signal example: SW1(LOGIC) = SINK, F127 (sink/source switching) = 0: With sink settings

O: ON -: OFF (Speed commands other than preset-speed commands are valid when all are OFF)



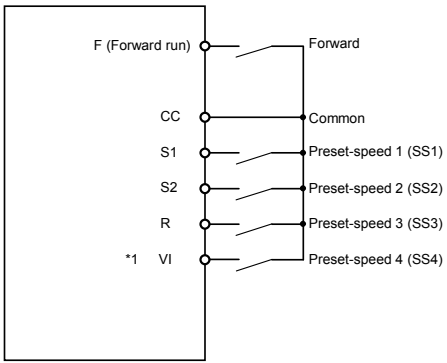
Terminal	Preset-speed														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S1-CC	O	-	O	-	O	-	O	-	O	-	O	-	O	-	O
S2-CC	-	O	O	-	-	O	O	-	-	O	O	-	-	O	O
R-CC	-	-	-	O	O	O	O	-	-	-	-	O	O	O	O
VI-CC	-	-	-	-	-	-	-	O	O	O	O	O	O	O	O

☆ Terminal functions are as follows.

Terminal S1..... Input terminal function selection 3A (S1)
F113= 10 (Preset-speed command 1: SS1)
Terminal S2..... Input terminal function selection 4A (S2)
F114= 12 (Preset-speed command 2: SS2)
Terminal R..... Input terminal function selection 2A (R)
F112= 14 (Preset-speed command 3: SS3)
Terminal VI ····· Analog/ logic input selection (VI)
F109=2 (logic input)
Input terminal function selection 5 (VI)
F115= 16 (preset-speed command 4: SS4)

☆ In the default settings, SS3 and SS4 are not assigned. Assign SS3 and SS4 to R and VI with input terminal function selection. VI terminal must also be set for switching to logic input.

[Example of a connection diagram]
(with sink settings)



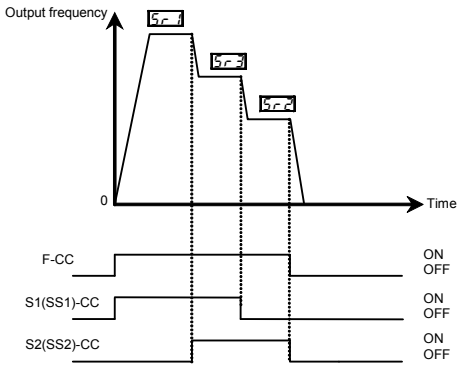
*1: When using VI terminal as a logic input terminal (F109=2), set the slide switch SW2 (RESIST) to ON side. Refer to section 2.3.2 (page B-7, 11) for details.

3) Using other speed commands with preset-speed command

Command mode selection CMOd		0: Terminal board			1: Panel keypad (including extension panel), 2: RS485 communication		
Frequency setting mode selection FMOd		0: Terminal board VI 5: UP/DOWN from external logic input	1: Setting dial 1 (press in center to save) 2: Setting dial 2 (save even if power is off)	3: RS485 communication	0: Terminal block VI 5: UP/DOWN from external logic input	1: Setting dial 1 (press in center to record) 2: Setting dial 2 (save even if power is off)	3: RS485 communication
Preset-speed command	Active	Preset-speed command valid Note)			Terminal command valid	Setting dial command valid	Communication command valid
	Inactive	Terminal command valid	Setting dial command valid	Communication command valid	(The inverter doesn't accept Preset-speed command.)		

Note) The preset-speed command is always given priority when other speed commands are input at the same time.

An example of three-speed operation with the default settings is shown below. (Frequency settings are required for Sr 1 to 3.)



Example of 3-speed operation

4. Setting parameters

4.1 Setting and Display Modes

This inverter has the following three display modes.

Standard monitor mode **The standard inverter mode. This mode is enabled when inverter power goes on.**

This mode is for monitoring the output frequency and setting the frequency reference value. If also displays information about status alarms during running and trips.

- Display of output frequency, etc.
  - F710 Initial panel display selection
  - (F720 Initial remote keypad display selection)
  - F702 Free unit display scale 1
- Setting frequency reference values.
- Status alarm

  If there is an error in the inverter, the alarm signal and the frequency will flash alternately in the LED display.
  - C: When a current flows at or higher than the overcurrent stall prevention level.
  - P: When a voltage is generated at or higher than the over voltage stall prevention level.
  - L: When the cumulative amount of overload reaches 50% or more of the overload trip value, or when the main circuit element temperature reaches the overload alarm level
  - H: When the overheat protection alarm level is reached

Setting monitor mode **The mode for setting inverter parameters.**

⇒ How to set parameters, refer to section 4. 2.

There are two parameter read modes. Refer to section 4. 2 for details about selection and switching of modes.

Easy setting mode : Only the seven most frequently used parameters are displayed.
Parameters can be registered as necessary. (max. 24 parameters)

Standard setting mode : Both basic and extended all parameters are displayed.

☆ Each press of the EASY key switches between the Easy setting mode and the Standard setting mode.

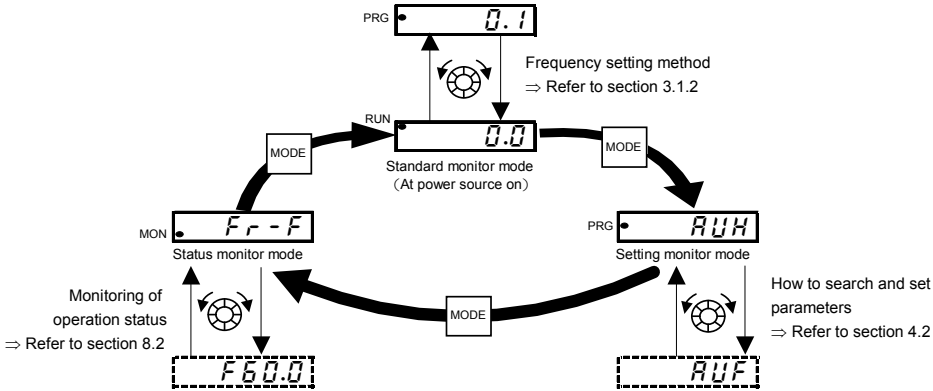
Status monitor mode

The mode for monitoring all inverter status.

Allows monitoring of set frequencies, output current/voltage and terminal information.

⇒ Refer to chapter 8.

The inverter can be moved through each of the modes by pressing the MODE key.



4.2 How to set parameters

There are two types of setting monitor modes: Easy mode and Standard setting mode. The mode active when power is turned on can be selected at PSEL (EASY key mode selection), and the mode can be switched by the EASY key. Note, however, that the switching method differs when only the Easy mode is selected. Refer to section 4.4 for details.

Setting dial and panel key operations are as follows:

Turning the setting dial
Used to select items and incrementing/ decrementing values. Note)

Pressing the center of the setting dial
Used for executing operations and determining values. Note)

MODE — Used to select the mode and return to the previous menu

EASY — Used to switch between the Easy and Standard setting modes.
Each press alternately switches between the two modes in the standard monitor mode.

4

Easy setting mode : The mode changes to the Easy setting mode when the EASY key is pressed and "EASY" is displayed. Only the most frequently used 7 basic parameters are displayed. (Standard default)

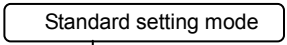
Easy setting mode

Title	Function
CMOd	Command mode selection
FMOd	Frequency setting mode selection
ACC	Acceleration time 1
dEC	Deceleration time 1
tHr	Motor electronic-thermal protection level 1
FM	Meter adjustment gain
PSEL	EASY key mode selection

☆ In the Easy setting mode, the PRG lamp blinks.

☆ If the EASY key is pressed while the setting dial is being turned, values continue to be incremented or decremented even if you release your finger from the setting dial.
This feature is handy when setting large values.

Note) Of the available parameters, number value parameters (ACC etc.) are reflected in actual operation when the setting dial is turned. Note, however, that the center of the setting dial must be pressed to save values even when the power is turned off.
Note, also, that item selection parameters (FMOd etc.) are not reflected in actual operation by just turning the setting dial. To reflect these parameters, press the center of the setting dial.



: The mode changes to the Standard setting mode when the EASY key is pressed and "SEtd" is displayed. Both basic and extended all parameters are displayed.

- Basic parameters : This parameter is a basic parameter for the operation of the inverter.
  - ⇒ Refer to chapter 5 for details.
  - ⇒ Refer to section 11.2 for parameter tables.
- Extended parameters : The parameters for detailed and special setting.
  - ⇒ Refer to chapter 6 for details.
  - ⇒ Refer to section 11.3 for parameter tables.

4

Note) Refer to section 11.6 for unchangeable parameters in running.
For reasons of safety, these parameters cannot be changed during inverter running.

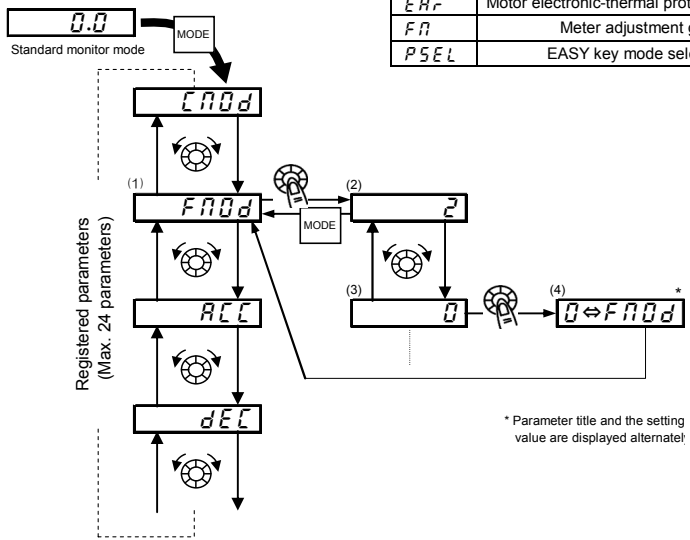
4.2.1 Settings in the Easy setting mode

The inverter enters this mode by pressing the MODE key when the Easy setting mode is selected

When you are unsure of something during operation:
You can return to the Standard monitor mode by pressing the MODE key several times.

Easy setting mode (Default registered parameters)

Title	Function
CMOd	Command mode selection
FMOd	Frequency setting mode selection
ACC	Acceleration time 1
dEC	Deceleration time 1
tHr	Motor electronic-thermal protection level 1
FM	Meter adjustment gain
PSEL	EASY key mode selection



■ Setting parameters in the Easy setting mode

(1) Selects parameter to be changed. (Turn the setting dial.)

(2) Reads the programmed parameter setting. (Press the center of the setting dial.)

(3) Change the parameter value. (Turn the setting dial.)

(4) Press this key to save the change. (Press the center of the setting dial.)

☆ To switch to the Standard setting mode, press the EASY key in the Standard monitor mode. "Std" is displayed, and the mode is switched.

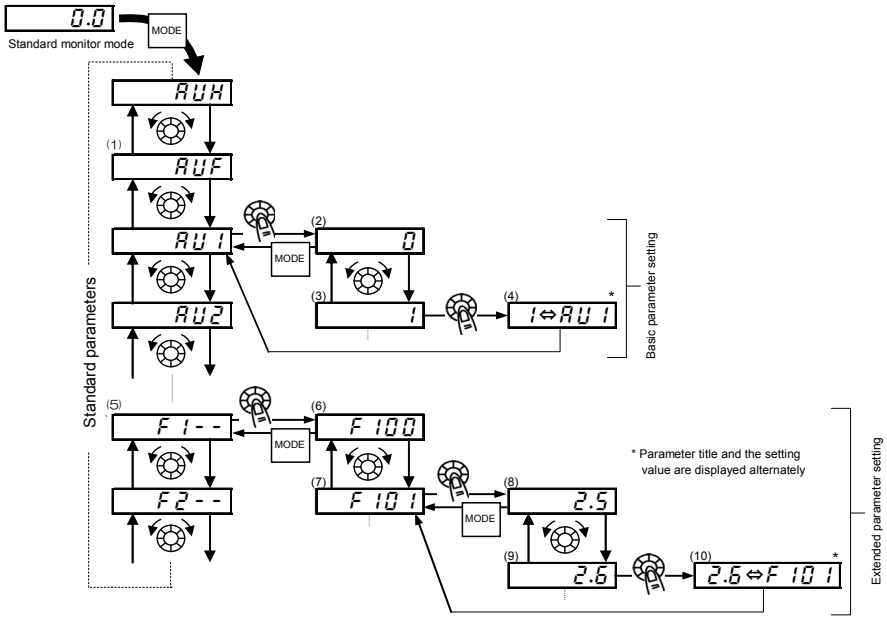
4.2.2 Settings in the Standard setting mode

The inverter enters this mode by pressing the MODE key when the Standard setting mode is selected.

When you are unsure of something during operation:
You can return to the Standard monitor mode by pressing the MODE key several times.

■ How to set basic parameters

(1) Selects parameter to be changed. (Turn the setting dial.)
(2) Reads the programmed parameter setting. (Press the center of the setting dial.)
(3) Change the parameter value. (Turn the setting dial.)
(4) Press this key to save the change. (Press the center of the setting dial.)



☆ To switch to the Easy setting mode, press the EASY key in the Standard monitor mode. EASY is displayed, and the mode is switched.

■ How to set extended parameters

Each extended parameter is composed of an "F"suffixed with a 3-digit figure, so first select and read out the heading of the parameter you want "F 1- -" to "F 9- -". ("F 1- -": Parameter starting point is 100, "F 9- -": Parameter starting point is 900.)

(5) Select the title of the parameter you want to change. (Turn the setting dial.)

(6) Press the Enter key to activate the selected parameter. (Press the center of the setting dial.)

(7) Selects parameter to be changed. (Turn the setting dial.)

(8) Reads the programmed parameter setting. (Press the center of the setting dial.)

(9) Change the parameter value. (Turn the setting dial.)

(10) Press this key to save the change. (Press the center of the setting dial.)

■ Adjustment range and display of parameters

H 1: An attempt has been made to assign a value that is higher than the programmable range. (Note that the setting of the currently selected parameter may exceed the upper limit as a result of changing other parameters.)

L 0: An attempt has been made to assign a value that is lower than the programmable range. (Note that the setting of the currently selected parameter may fall below the lower limit as a result of changing other parameters.)

If the above alarm is flashing on and off, values that exceed H 1 or are equal or lower than L 0 cannot be set.

4

4.3 Functions useful in searching for a parameter or changing a parameter setting

This section explains functions useful in searching for a parameter or changing a parameter setting. To use these functions, a parameter needs to be selected or set in advance.

Changed parameters history search (History function) AUH

This function automatically searches for the last five parameters whose settings have been changed. To use this function, select the AUH parameter. (Any changes are displayed regardless of whether or not they are the same as standard defaults)

⇒ Refer to section 5.1 for details.

Set parameters by purpose (Guidance function) AUF

Only parameters required for a special purpose can be called up and set.

To use this function, select parameter AUF.

⇒ Refer to section 5.2 for details.

Reset parameters to default settings tYP

Use the tYP parameter to reset all parameters back to their default settings.

To use this function, set parameter tYP=8.

Note) When once the customer settings saved with tYP=7, it cannot return to the default settings.

⇒ Refer to section 4.3.2 for details.

Call saved customer settings tYP

Customer settings can be batch-saved and batch-called.

These settings can be used as customer-exclusive default settings.

To use this function, set parameter tYP=7 or 8.

⇒ Refer to section 4.3.2 for details.

4.3.2 Return to default settings

tYP : Default setting

- Function
  It is possible to return groups of parameters to their defaults, clear run times, and record/recall set parameters.

[Parameter setting]

Title	Function	Adjustment range	Default setting
tYP	Default setting	0: - 1: - 2: - 3: - 4: Trip record clear 5: Cumulative operation time clear 6: Initialization of type information 7: Save user setting parameters 8. Initialization or load user setting parameters 9. Cumulative fan operation time record clears 10 to 13: -	7 Note 1

★ This function will be displayed as 7 during reading on the right. This previous setting is displayed.
Example: 8 7

Note 1: Do not change setting to 0 to 3 and 10 to 13, because our IPM gear motor drive becomes impossible.

★ tYP cannot be set during the inverter operating. Always stop the inverter first and then program.

Programmed value

Trip record clear (tYP = 4)

Setting tYP to 4 initializes the past four sets of recorded error history data.

☆ The parameter does not change.

Cumulative operation time clear (tYP = 5)

Setting tYP to 5 resets the cumulative operation time to the initial value (zero).

Initialization of type information (tYP = 6)

Setting tYP to 6 clears the trips when an EtYP format error occurs. But if the EtYP displayed, call our company.

Save user setting parameters (tYP = 7)

Setting tYP to 7 saves the current settings of all parameters.

Note1) After setting to tYP to 7, an initialization by tYP to 8 becomes impossible.
Please call us if you need an initialization (default setting).

Initialization or load user setting parameters (tYP = 8)

Note1) Never executed setting tYP to 7.
Set tYP to 8 to return all parameters to their default settings.
Note2) Setting tYP to 7 has ever executed.
Setting tYP to 8 returns the parameter set by tYP to 7. (called up)

Cumulative fan operation time record clear (tYP = 9)

Setting tYP to 9 resets the cumulative operation time to the initial value (zero).
Set this parameter when replacing the cooling fan, and so on

4.4 EASY key function

PSEL : EASY key mode selection

F751 - F774 : Easy setting mode parameter 1 to 24

• **Function**
It is possible to switch between standard mode and easy setting mode using the EASY key.
Up to 24 arbitrary parameters can be registered to easy setting mode.

[Parameter setting]

Title	Function	Adjustment range	Default setting
PSEL	EASY key mode selection	0: Standard setting mode at power on 1: Easy setting mode at power on 2: Easy setting mode only	0

It is possible to switch between standard mode and easy setting mode using the EASY key.
The way parameters are read out and displayed varies according to the mode selected.

Easy setting mode
Allows pre-registration (easy setting mode parameters) of frequently changed parameters and reading of only registered parameters (maximum of 24 types).

Standard setting mode
Standard setting mode in which all parameters are read out.

[How to read out parameters]
To enter the setting monitor mode, switch to the setting monitor mode using the EASY key, and then press the MODE key.
Turn the setting dial to read the parameter.
The relation between the parameter and the mode selected is shown below.

PSEL=0

* When the power is turned on, the inverter is in standard mode. Press the EASY key to switch to easy setting mode.

PSEL=1

* When the power is turned on, the inverter is in easy setting mode. Press the EASY key to switch to standard mode.

PSEL=2

* Always in easy setting mode. However, it can be switched to standard setting mode by EASY key if it is set to PSEL=0, 1. When PSEL is not displayed in Easy setting mode, Und0 is displayed and it can be temporarily switched to standard setting mode by EASY key after center of the setting dial is pushed for five seconds or more.

[How to select parameters]
Select the desired parameters as easy setting mode parameters 1 to 24 (F751 to F774). Note that parameters should be specified by communication number. For communication numbers, refer to Table of parameters.
In easy setting mode, only parameters registered to parameters 1 to 24 are displayed in order of registration.
The values of the default settings are shown in the table below.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F751	Easy setting mode parameter 1	0-999	3 (CMOd)
F752	Easy setting mode parameter 2	0-999	4 (FMOd)
F753	Easy setting mode parameter 3	0-999	9 (ACC)
F754	Easy setting mode parameter 4	0-999	10 (dEC)
F755	Easy setting mode parameter 5	0-999	600 (tHr)
F756	Easy setting mode parameter 6	0-999	6 (FM)
F757	Easy setting mode parameter 7	0-999	999 (No function)
F758	Easy setting mode parameter 8		
F759	Easy setting mode parameter 9		
F760	Easy setting mode parameter 10		
F761	Easy setting mode parameter 11		
F762	Easy setting mode parameter 12		
F763	Easy setting mode parameter 13		
F764	Easy setting mode parameter 14		
F765	Easy setting mode parameter 15		
F766	Easy setting mode parameter 16		
F767	Easy setting mode parameter 17		
F768	Easy setting mode parameter 18		
F769	Easy setting mode parameter 19		
F770	Easy setting mode parameter 20		
F771	Easy setting mode parameter 21		
F772	Easy setting mode parameter 22		
F773	Easy setting mode parameter 23		
F774	Easy setting mode parameter 24	0-999	50 (PSEL)

Note: If any number other than communication numbers is specified, it is regarded as 999 (no function assigned).

5. Main parameters

Before you operate the inverter, the parameters that you must first program are the basic parameters.
Refer to section 11 tables of basic parameters.

5.1 Searching for changes using the history function (AUH)

AUH : History function

History function (AUH):
Automatically searches for 5 latest parameters that are programmed with values different from the standard default setting and displays them in the AUH. Parameter setting can also be changed within this group AUH.

Notes on operation
- If no history information is stored, this parameter is skipped and the next parameter "AUF" is displayed.
- HERd and End are added respectively to the first and last parameters in a history of changes.

■ How to use the history function

Operation panel action	LED display	Operation
	0.0	Displays the output frequency (operation stopped). (When standard monitor display selection F710=0 [Output frequency])
MODE	AUH	The first basic parameter "AUH" (history function) is displayed.
	ACC	The parameter that was set or changed last is displayed.
	8.0	Press the center of the setting dial to display the set value.
	5.0	Turn the setting dial to change the set value.
	5.0⇔ACC	Press the center of the setting dial to save the changed value. The parameter name and the programmed value will flash on and off alternately.
	****	Turn the dial as described above to search for and display changed parameters to check and change the settings.
	HERd (End)	HERd: First historic record End: Last historic record

MODE MODE MODE	Parameter display ↓ AUH ↓ Fr-F ↓ 0.0	Press the MODE key to return to the parameter setting mode "AUH." After that you can press the MODE key to return to the status monitor mode or the standard monitor mode (display of output frequency).

Note: The following parameters are not displayed in this AUH, even if they are the most recent changes. FC (Operation frequency of operation panel), AUF (Guidance function), AU1 (Automatic acceleration/deceleration), tYP (Default setting), F700 (Prohibition of change of parameter settings)

5.2 Setting a parameter using the guidance function (AUF)

5

AUF : Guidance function

Guidance function (AUF):
The guidance function refers to call up only functions necessary in response to the user's needs. When two purpose specific guidances are selected, a group of parameters needed for the specified application (function) is formed and the inverter is switched automatically to the mode of setting the group of parameters selected. You can set up the inverter easily by simply setting the parameters in the group one after another.

[Parameter setting]

Title	Function	Adjustment range	Default setting
AUF	Guidance function	0:- 1: - Note 2: Preset speed guidance 3: Analog signal operation guidance 4: - Note 5: - Note	0

Note: 1, 4, 5 are for manufacturer's settings. Do not change the settings.

■ How to use the guidance function

Here are the steps to follow to set parameters, using the guidance function. (When the basic setting guidance (AUF) is set to 1)

Operation panel action	LED display	Operation
	0.0	Displays the output frequency (operation stopped). (When standard monitor display selection F710=0 is set to 0 [Output frequency]).
MODE	AUH	The first basic parameter "History (AUH)" is displayed.
	AUF	Turn the setting dial to select the guidance function (AUF).
	0	Press the center of the setting dial to display 0.
	2	Turn the setting dial to change to the purpose-specific guidance setting value "2".
	CMOd	Press the center of the setting dial to display the purpose-specific guidance parameter group (refer to table below).
	****	After moving to the purpose-specific guidance parameter group, use the setting dial to change the parameters.
	End	End is dialyzed on completion of the setting of the guidance parameter group.
MODE MODE MODE	Display of parameter ↓ AUF ↓ Fr-F ↓ 0.0	Press the MODE key to exit the guidance parameter group. By pressing the MODE key, you can return to the default monitoring mode (display of output frequency).

If there is anything you do not understand during this operation, press the MODE key several times to start over from the step of AUH display.
HEAd or End is affixed respectively to the first or last parameter in each guidance wizard parameter group.

5

Table of parameters that can be changed using the guidance function

Preset-speed setting guidance AUF=2	Analog input operation guidance AUF=3
CNOd	CNOd
FNOd	FNOd
ACC	ACC
dEC	dEC
FH	FH
UL	UL
F109	LL
F111	F109
F112	F201
F113	F202
F114	F203
F115	F204
Sr1	
Sr2	
Sr3	
Sr4	
Sr5	
Sr6	
Sr7	
F287	
F288	
F289	
F290	
F291	
F292	
F293	
F294	

5.3 Setting acceleration/deceleration time

AU 1 : Automatic acceleration/deceleration

ACC : Acceleration time 1

dEC : Deceleration time 1

- Function
  1) For acceleration time 1 ACC programs the time that it takes for the inverter output frequency to go from 0Hz to maximum frequency FH.
  2) For deceleration time 1 dEC programs the time that it takes for the inverter output frequency to go from maximum frequency FH to 0Hz.

5.3.1 Automatic acceleration/deceleration

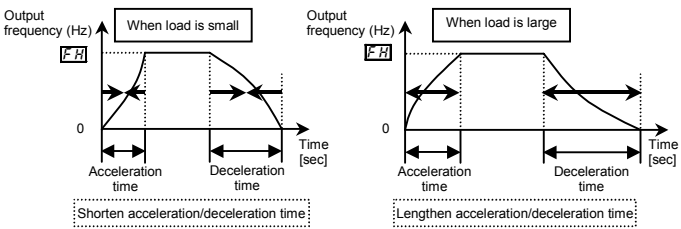
This automatically adjusts acceleration and deceleration time in line with load size.

AU 1 = 1

* Adjusts the acceleration/deceleration time automatically within the range of 1/8 to 8 times as long as the time set with the ACC or dEC, depending on the current rating of the inverter.

AU 1 =2

* Automatically adjusts speed during acceleration only. During deceleration, speed is not adjusted automatically but reduced at the rate set with dEC.



Set AU 1 (automatic acceleration/deceleration) to 1 or 2.

[Parameter setting]

Title	Function	Adjustment range	Default setting
AU 1	Automatic acceleration/deceleration	0: Disabled (manual setting) 1: Automatic 2: Automatic (only at acceleration)	0

☆ When automatically setting acceleration/deceleration time, always change the acceleration/deceleration time so that it conforms to the load. The acceleration/deceleration time changes constantly with load fluctuations. For inverters that require a fixed acceleration/deceleration time, use the manual settings (ACC, dEC).

☆ Setting acceleration/deceleration time (ACC,dEC) in conformance with mean load allows optimum setting that conforms to further changes in load.
☆ Use this parameter after actually connecting the motor.
☆ When the inverter is used with a load that fluctuates considerably, it may fail to adjust the acceleration or deceleration time in time, and therefore may be tripped.
☆ Please note when using the function of hit and stop because the deceleration completion position changes depending on load.

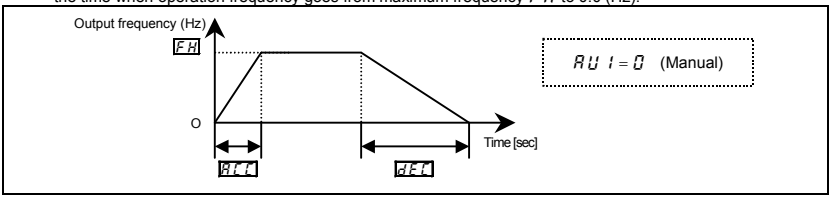
[Methods of setting automatic acceleration/deceleration]

Operation panel action	LED display	Operation
	0.0	Displays the output frequency. (When standard monitor display selection F710 is set to 0 [Output frequency])
MODE	AUH	The first basic parameter "AUH" (history function) is displayed.
	AU1	Turn the setting dial to the right to change the parameter to AU1.
	0	Parameter values can be read by pressing the center of the setting dial.
	1	Turn the setting dial to the right to change the parameter to 1 or 2.
	1⇔AU1	Press the center of the setting dial to save the changed parameter. AU1 and the parameter are displayed alternately.

☆ Assigning the forced deceleration command (function number 122, 123) to any logic input terminal, it can be changed automatic deceleration by compulsion.

5.3.2 Manually setting acceleration/deceleration time

Set acceleration time from 0.0 (Hz) operation frequency to maximum frequency FH and deceleration time as the time when operation frequency goes from maximum frequency FH to 0.0 (Hz).



[Parameter setting]

Title	Function	Adjustment range	Default setting
ACC	Acceleration time 1	0.0-3000 s	1.5
dEC	Deceleration time 1	0.0-3000 s	5.0

Note: When the acceleration/deceleration time is set to 0.0 seconds, the inverter accelerates and decelerates 0.05 seconds.
Please note after driving signal input initial position estimation time (about 150 ms) occurs by a movement start.

☆ If the programmed value is shorter than the optimum acceleration/deceleration time determined by load conditions, overcurrent stall or overvoltage stall function may make the acceleration/deceleration time longer than the programmed time. If an even shorter acceleration/deceleration time is programmed, there may be an overcurrent trip or overvoltage trip for inverter protection. (Refer to section 13.1 for details)

5.4 Selection of operation mode

CMOd: Command mode selection

FMOd: Frequency setting mode selection

- Function
  These parameters are used to specify which input device (operation panel, terminal board, or RS485 communication) takes priority in entering an operation stop command or frequency setting command (terminal block VI, setting dial 1 (storing by pressing center of setting dial), RS485 communication, or UP/DOWN from external logic).

<Command mode selection>
[Parameter setting]

Title	Function	Adjustment range	Default setting
CMOd	Command mode selection	0: Terminal board 1: Panel keypad (including extension panel) 2: RS485 communications	1

Programmed value

0: Terminal board operation — ON and OFF of an external signal run and stop operation.

1: Panel keypad operation — Press the RUN and STOP keys on the panel keypad to run and stop. Operation can also be done from the extension panel.

2: RS485 communication — Run/stop operations from an external device.

* There are two types of function: the function that conforms to commands selected by CMOd, and the function that conforms only to commands from the terminal board. (function number 108, 109) See the table of input terminal function selection in section 11.4.

* When priority is given to commands from a linked computer or terminal board, they have priority over the setting of CMOd.

<Frequency setting mode selection>
[Parameter setting]

Title	Function	Adjustment range	Default setting
FMOd	Frequency setting mode selection	0: Terminal board VI 1: Setting dial 1 (press in center to save) 2: Setting dial 2 (saved even if power is off) 3: RS485 communication 4: - 5: UP/DOWN from external logic input	2

[Programmed value]

0: Terminal board VI — A frequency command is set by means of external signals (VI terminal: 0 - 5/ 0 - 10 Vdc, or 0 (4) - 20 mAdc).

1: Setting dial 1 — Frequencies are set by rotating the setting dial on the inverter. Press the center of the setting dial to save the frequency setting value.

2: Setting dial 2 — Frequencies are set by rotating the setting dial on the inverter. Like the position of notches in a volume knob, the frequency setting value at the position of the notch is saved.

3: RS485 communication — Frequencies are set by commands from an external control unit. (Refer to section 6.21)

5: UP/DOWN frequency — Frequencies are set by up/down commands from a terminal. (Refer to section 6.4.3)

5

☆ No matter what value the command mode selection CMOd and the frequency setting mode selection FMOd are set to the control input terminal functions described below are always in operative state.
- Reset terminal (valid only for tripping if set for programmable input terminal function)
- Standby terminal (when programmed by programmable input terminal functions).
- External input tripping stop terminal command (when so set using the programmable input terminal function)
- Coast stop command terminal (if set for programmable input terminal function)

☆ To make changes in the command mode selection CMOd and the frequency setting mode selection 1 FMOd, first stop the inverter temporarily.
(Can be changed while in operation when F736 is set to 0.)

☆ Priority commands from communications or terminal blocks are given priority over FMOd.

■ Preset-speed operation

CMOd: Set to 0 (Terminal board).
FMOd: Valid in all setting values.

■ Input terminal settings

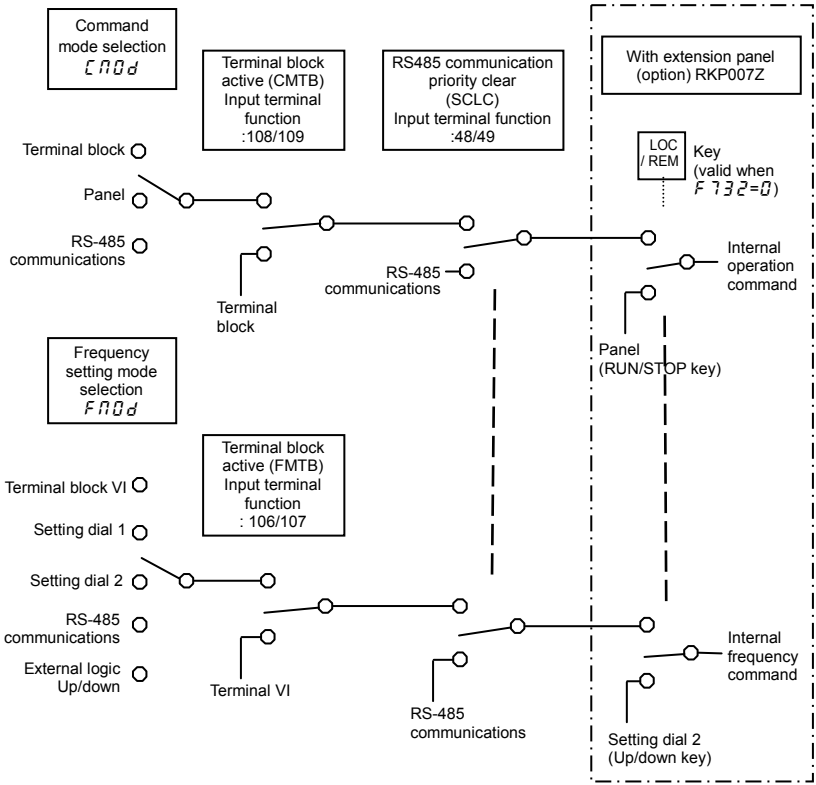
Assign the following functions to the input terminal to allow switching of the frequency command by turning the terminal ON/OFF.

Input terminal function		ON	OFF
48	Forced local from communication	Enabled during communication Local (Setting of CMOd, FMOd)	Communication
106	Frequency setting mode terminal board VI	Terminal board (VI) enabled	setting of FMOd

Each of the following numbers (49, 107) are reverse signals.

■ Example of run and frequency command switching

Command mode and frequency setting mode switching



5.5 Meter setting and adjustment

FMSL: Meter selection

FM: Meter adjustment gain

Refer to section 3.3 for details.

5.6 Forward/reverse run selection (Panel keypad)

Fr: Forward/reverse run selection (Panel keypad)

- Function
  Program the direction of rotation of the motor when the running and stopping are made using the RUN key and STOP key on the operation panel.
  Valid when CMOd (command mode) is set to 1 (operation panel).

[Parameter setting]

Title	Function	Adjustment range	Default setting
Fr	Forward/reverse run selection (Panel keypad)	0: Forward run 1: Reverse run 2: Forward run (F/R switching on extension panel) 3: Reverse run (F/R switching on extension panel)	0

★ Using extension panel RKP007Z (option) :
When Fr is set to 2 and the standard monitor is displayed, pressing the FWD/REV key changes the direction of rotation from forward to reverse after displaying the message Fr-r.
Pressing the FWD/REV key again changes the direction of rotation from reverse to forward after displaying the message Fr-F.

★ Check the direction of rotation on the status monitor. Refer to section 8.1 for details about monitor.
Fr-F: Forward run
Fr-r: Reverse run

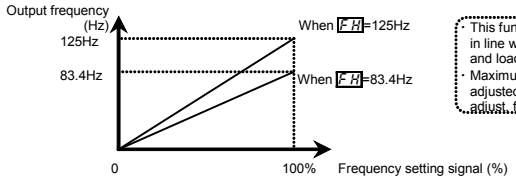
★ When the F and R terminals are used for switching between forward and reverse rotation from the terminal board, the Fr forward/reverse run selection parameter is rendered invalid.
Short across the F-CC terminals: forward rotation
Short across the R-CC terminals: reverse rotation.

★ The inverter was factory-configured by default so that shorting terminals F-CC and terminals R-CC simultaneously would cause the motor to slow down to a stop.
Using the parameter F105, however, you can select between forward run and reverse run.

5.7 Maximum frequency

FH : Maximum frequency

- Function
  1) Programs the range of frequencies output by the inverter (maximum output values).
  2) This frequency is used as the reference for acceleration/deceleration time.



- This function determines the value in line with the ratings of the motor and load.
- Maximum frequency cannot be adjusted during operation.To adjust, first stop the inverter.

★ If FH is increased, adjust the upper limit frequency UL as necessary.

[Parameter setting]

Title	Function	Adjustment range	Default setting
FH	Maximum frequency	30.0-400.0 (Hz)	0.1k to 0.4kW model : 83.4 0.75k to 2.2kW model : 125

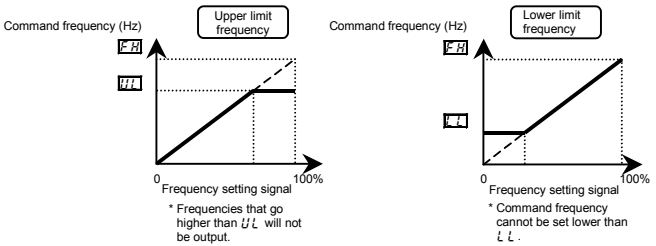
Note) The permission maximum rotary speed of our IPM gear motor is to 2500 rpm.
Set the frequency 2500 rpm or less.
(Inverter maximum frequency: 0.1k to 0.4kW model: 83.4Hz or less, 0.75 to 2.2kW model: 125Hz or less)

5.8 Upper limit and lower limit frequencies

UL : Upper limit frequency

LL : Lower limit frequency

- Function
  Programs the lower limit frequency that determines the lower limit of the output frequency and the upper limit frequency that determines the upper limit of that frequency.



[Parameter setting]

Title	Function	Adjustment range	Default setting
UL	Upper limit frequency	0.5 - FH (Hz)	0.1k to 0.4kW model : 60 0.75k to 2.2kW model : 90
LL	Lower limit frequency	0.0 - UL (Hz)	0.0

Note 1: Output frequency lower than parameter F240 (Starting frequency setting) is not output.

5.9 Setting the electronic thermal

[tHr] : Motor electronic-thermal protection level 1

Refer to section 3.4 for details.

5.10 Preset-speed operation

[Sr1] - [Sr7]: Preset-speed frequency 1-7

Refer to section 3.5 for details.

5.11 Default setting

[tYP]: Default setting

Refer to section 4.3.2 for details.

5.12 EASY key mode selection

[PSEL]: EASY key mode selection

Refer to section 4.4 for details.

6. Other parameters

Extended parameters are provided for sophisticated operation, fine adjustment and other special purposes. Modify parameter settings as required. Refer to section 11 tables of extended parameters.

6.1 Input/output parameters

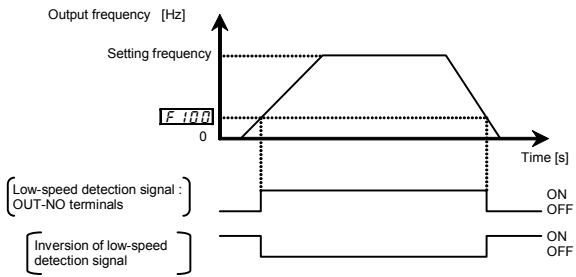
6.1.1 Low-speed signal

F 100: Low-speed signal output frequency

- Function
  When the output frequency exceeds the setting of F 100 an ON signal will be generated.
  This signal can also be used as an operation signal when F 100 is set to 0.0Hz, because an ON signal is put out if the output frequency exceeds 0.0Hz.
  ★ Output from the open collector output terminal OUT.
  Output from relay output FLA-FLB-FLC is possible depending on the parameter settings.

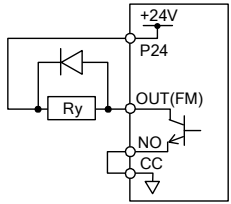
[Parameter setting]

Title	Function	Adjustment range	Default setting
F 100	Low-speed signal output frequency	0.0 - FH (Hz)	0.0

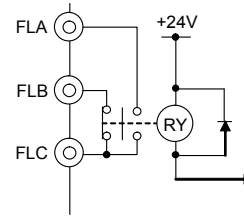


☆ When FM terminal is used as the open collector terminal, it needs to switch to the slide switch SW3 (OUT2).

An example of the connection of the open collector OUT or FM terminal (sink logic)



An example of the connection of the relay output terminals



- Output terminal setting

[Parameter setting]

Title	Function	Adjustment range	Default setting
F130	Output terminal selection 1A (OUT)	0-255 (Refer to section 11.5)	4: LOW (Low-speed detection signal)

Setting value 5 is reverse signal.
Note 1: Set F132 to output to FLA-FLC-FLB terminals and F131 to FM terminal.
Note 2: Braking release signal "68" is set to the output terminal OUT in default setting.

6

6.1.2 Output of designated frequency reach signal

F102: Speed reach detection band

- Function
  When the output frequency becomes equal to the setting by designated frequency ±F102, an ON or OFF signal is generated.

[Parameter setting]

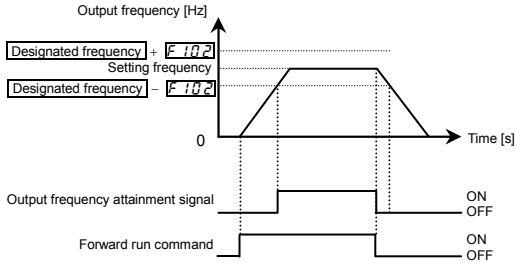
■Parameter setting of designated frequency and detection band

Title	Function	Adjustment range	Default setting
F102	Speed reach detection band	0.0 - FH (Hz)	2.5

■Parameter setting of output terminal selection

Title	Function	Adjustment range	Setting
F130	Output terminal selection 1A (OUT)	0-255 (Refer to section 11.5)	6: RCH (Output frequency attainment signal (acceleration/deceleration completed))

Setting value 7 is reverse signal.
Note 1: Set F132 to output to FLA-FLC-FLB terminals and F131 to FM terminal.
Note 2: Braking release signal "68" is set to the output terminal OUT in default setting.



Note 3: When the operation signal (forward run command or reverse run command) is OFF, the output frequency signal (RCH) is OFF.

6.1.3 Output of set frequency speed reach signal

F101: Speed reach setting frequency

F102: Speed reach detection band

- Function
  When the output frequency becomes equal to the frequency set by F101±F102, an ON or OFF signal is generated.

[Parameter setting]

■Parameter setting of frequency and detection band

Title	Function	Adjustment range	Default setting
F101	Speed reach setting frequency	0.0 - FH (Hz)	0.0
F102	Speed reach detection band	0.0 - FH (Hz)	2.5

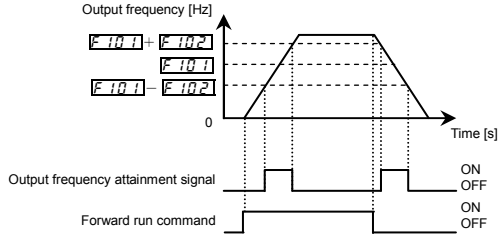
■Parameter setting of output terminal selection

Title	Function	Adjustment range	Setting
F130	Output terminal selection 1A (OUT)	0-255 (Refer to section 11.5)	8: RCHF (Set frequency attainment signal)

Setting value 9 is reverse signal.

Note 1: Set F132 to assign to FLA-FLC-FLB terminals and F131 to FM terminal.

Note 2: Braking release signal “68” is set to the output terminal OUT in default setting.



6.2 Input signal selection

6.2.1 Priority selection (Both F and R are ON)

6

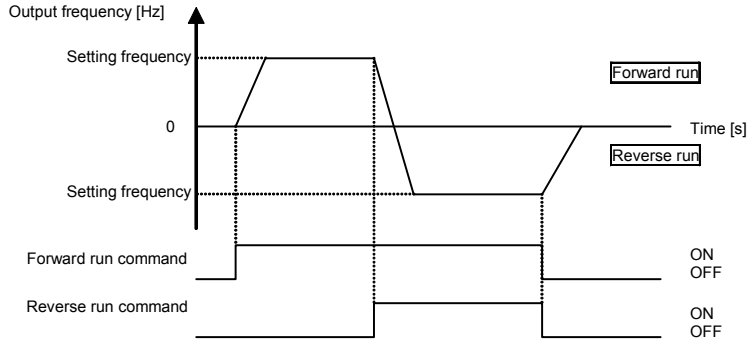
F105: Priority selection (Both F and R are ON)

- Function
  This parameter allows you to select the direction in which the motor runs when a forward run (F) command and a reverse run (R) command are entered simultaneously.
  1) Reverse
  2) Slowdown stop

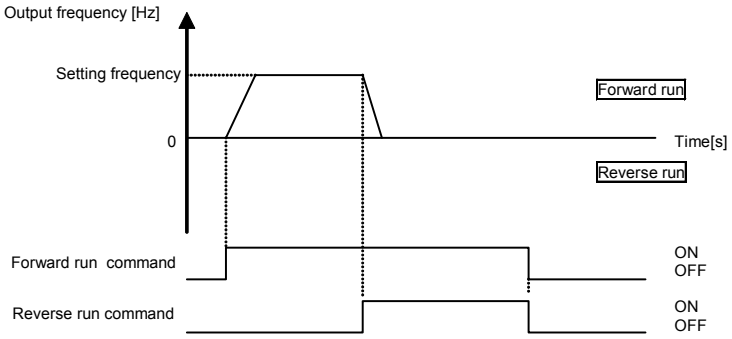
[Parameter setting]

Title	Function	Adjustment range	Default setting
F105	Priority selection (Both F and R are ON)	0: Reverse 1: Slowdown stop	1

(1) [F 105 = 0 (Reverse)]: If an F command and an R command are entered simultaneously, **the motor will run in the reverse direction.**



(2) [F 105 = 1 (Stop)]: If an F command and an R command are entered simultaneously, **the motor will slow down to a stop.**



6.2.2 Changing the functions of VI terminal

F 109: Analog/logic input selection (VI terminal)

- Function
  This parameter allows you to choose between analog input and logic input for the VI terminal.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F 109	Analog/logic input selection (VI terminal)	0: Voltage signal input (0 - 10V) 1: Current signal input (4 - 20mA) 2: Logic input 3: Voltage signal input (0 - 5V)	0

☆ Resolution is maximum 1/1000 when VI terminal is used as analog input terminal (F 109=0 .1 .3).

* When using VI terminal as the logic input terminal, set the slide switch SW2(RESIST) to ON.
Refer to section 2.3.2 for details (page B-7, 11).

* For information about the interface with the programmable controller, refer to section 7.2.1 (page G-3).

6.3 Terminal function selection

6.3.1 Changing control logic switching

F127: Sink/source switching

⚠ Warning	
Prohibited	• Do not shut down the external power supply on ahead when VI terminal is used as logic input terminal by external power supply (F127=200). It could cause unexpected result as VI terminal is ON status.
Mandatory action	• Confirm to logic setting of slide switch SW1 (LOGIC) and parameter F127 (sink/source switching) when F, R, S1, S2 terminals and VI terminal are used as logic input terminal. If it is not set, it could result in malfunction.

• Function
When the VI terminal is used for the logic input terminal, control input/output terminal sink logic (minus common)/source logic (plus common) is switched.

6

[Parameter setting]

Title	Function	Adjustment range	Default setting
F127	Sink/source switching	0: Sink(Internal power supply), 100: Source, 200: Sink(External power supply) 1-99, 101-199, 201-255: invalid	0

☆ Setting of sink/source logic for F, R, S1 and S2 terminals are switched by slide switch SW1 (LOGIC). Refer to section 2.3.2 for details (page B-11).

☆ The parameters are used for switching sink/source. However, disconnect the control circuit terminals of the inverter. Otherwise, the equipment may malfunction.
After setting F127 switching, the check alarms (E-49, E-50, E-51) are displayed, reset panel, external signal, or power.
Refer to section 2.3.2 (page B-9 and B-10) regarding sink/source logic connections.

☆ Do not shut down the external power supply on ahead when VI terminal is used as logic input terminal by external power supply (F127=200). It could cause unexpected result as VI terminal is ON status.

☆ Confirm to logic setting of slide switch SW1 (LOGIC) and parameter F127 (sink/source switching). If it is not set, it could result in malfunction.

☆ When 0 (internal power supply) and 200 (external power supply) are selected by F127 sink logic setting, the LED display of logic input terminals setting section in Chapter 8 Status monitor mode is different.
Logic input terminals setting F127=0 : L-51, F127=200 : L-49

6.3.2 Keeping an input terminal function always active (ON)

F 104 : Always active function selection 1

F 108 : Always active function selection 2

F 110 : Always active function selection 3

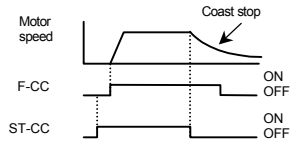
- Function
  This parameter specifies an input terminal function that is always to be kept active (ON).

[Parameter setting]

Title	Function	Adjustment range	Default setting
F 104	Always active function selection 1	0-153 (Refer to section 11.4)	0 (No function)
F 108	Always active function selection 2	0-153 (Refer to section 11.4)	70 (Servo lock)
F 110	Always active function selection 3	0-153 (Refer to section 11.4)	6 (Standby)

☆ Function No. 70 (Servo lock) is assigned to F 108 (Always active function selection 2) by default setting. Therefore if set F257 to 1 while stopping operation, the servo lock function always operates. Assign function No. 70 or 71 (reverse signal) to an available input function and other function such as 0 (No function) to F 108 when the servo lock function is switched ON/OFF by input terminal.

★ Explanation of the coast stop function
When ST (Standby) is OFF, coast stops.
The default setting for ST (Standby) is ON, change the following settings.
・ F 110=0 (no function)
・ Assign open input terminal 6: ST (Standby).
Coast stops if terminal set for ST (Standby) is set to OFF. The monitor on the inverter at this time displays OFF



6.3.3 Modifying input terminal functions

F111: Input terminal selection 1A (F)
F112: Input terminal selection 2A (R)
F113: Input terminal selection 3A (S1)
F114: Input terminal selection 4A (S2)
F109: Analog/logic input selection (VI Terminal)
F115: Input terminal selection 5 (VI)
F151: Input terminal selection 1B (F)
F152: Input terminal selection 2B (R)
F153: Input terminal selection 3B (S1)
F154: Input terminal selection 4B (S2)
F155: Input terminal selection 1C (F)
F156: Input terminal selection 2C (R)

⇒ Refer to section 7.2.1 for details about input terminal functions.

6.3.4 Modifying output terminal functions

F130: Output terminal selection 1A (OUT)
F131: Output terminal selection 2A (FM)
F132: Output terminal selection 3 (FL)
F137: Output terminal selection 1B (OUT)
F138: Output terminal selection 2B (FM)
F139: Output terminal logic selection (OUT, FM)

⇒ Refer to section 7.2.2 for details about output terminal functions.

6.4 Setting frequency command

6.4.1 Switching frequency command

F00d : Frequency setting mode selection

F 1 1 1 - F 1 1 5 : Input terminal selection 1A, 2A, 3A, 4A, 5

F 1 5 1 - F 1 5 6 : Input terminal selection 1B, 2B, 3B, 4B, 1C, 2C

- Function
  Frequency command can be changed according to the terminal block input.

Refer to section 7.2.1 for details.

6.4.2 Setting frequency command characteristics

F109: Analog/logic input selection (VI terminal)

F201: Setting of VI input point 1

F202: Frequency of VI input point 1

F203: Setting of VI input point 2

F204: Frequency of VI input point 2

F209: Analog input filter

- Function
  Output frequency is adjusted in relation to frequency command according to external analog signals.
  Analog signal is F109 set to 0: 0 to 10Vdc, 1: 4 to 20mAdc, 3: 0 to 5Vdc.
  F209 analog input filter is effective for eliminating noise from frequency setting circuit. Increase if operation cannot be done because noise effects stability.

☆ To fine adjust the frequency command characteristics for VI input, use the parameters F470 and F471. (Refer to section 6.4.4)

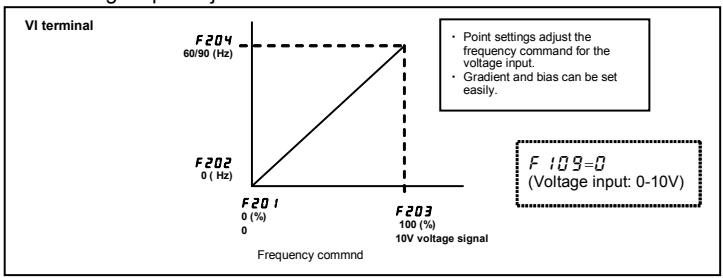
[Parameter setting]

Title	Function	Adjustment range	Default setting
F109	Analog/logic input selection (VI terminal)	0: Voltage signal input (0 - 10V) 1: Current signal input (4 - 20mA) 2: Logic input 3: Voltage signal input (0 - 5V)	0
F201	Setting of VI input point 1	0 - 100(%)	0
F202	Frequency of VI input point 1	0.0 - 400.0 (Hz) Note 2	0.0
F203	Setting of VI input point 2	0 - 100(%)	100
F204	Frequency of VI input point 2	0.0 - 400.0 (Hz) Note 2	0.1 to 0.4kW model : 60.0 0.75 to 2.2kW model : 90.0
F209	Analog input filter	4 - 1000 (ms)	64

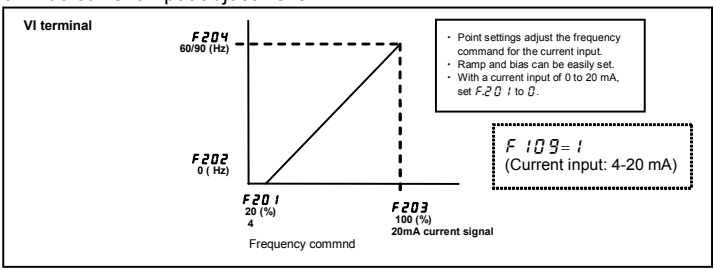
Note 1: Do not set point 1 and 2 (F201 and F203) to the same value. If they are set to the same value, Err1 is displayed.

Note 2: The permission maximum rotary speed of our IPM gear motor is to 2500 rpm.
Set the frequency 2500 rpm or less.
(Inverter maximum frequency: 0.1k to 0.4kW model: 83.4Hz or less, 0.75 to 2.2kW model: 125Hz or less)

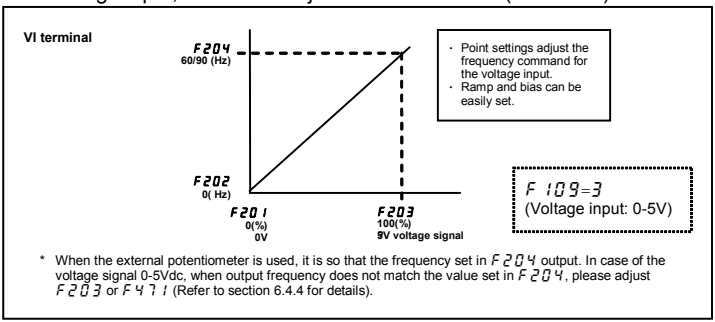
1) 0-10Vdc voltage input adjustment



2) 4-20mAdc current input adjustment



3) 0-5 Vdc voltage input, or used to adjust external volume (P5-VI-CC)



* When the external potentiometer is used, it is so that the frequency set in F204 output. In case of the voltage signal 0-5Vdc, when output frequency does not match the value set in F204, please adjust F203 or F711 (Refer to section 6.4.4 for details).

6.4.3 Setting of frequency with the input from an external logic

F264: External logic input - UP response time

F265: External logic input - UP frequency steps

F266: External logic input - DOWN response time

F267: External logic input - DOWN frequency steps

F268: Initial value of UP/DOWN frequency

F269: Change of the initial value of UP/DOWN frequency

- Function
  These parameters are used to set an output frequency by means of a signal from an external device.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F264	External logic input - UP response time	0.0 - 10.0 (S)	0.1
F265	External logic input - UP frequency steps	0.0 - FH (Hz)	0.1
F266	External logic input - DOWN response time	0.0 - 10.0 (S)	0.1
F267	External logic input - DOWN frequency steps	0.0 - FH (Hz)	0.1
F268	Initial value of UP/DOWN frequency	LL - UL (Hz)	0.0
F269	Change of the initial value of UP/DOWN frequency	0: Not changed 1: Setting of F268 changed when power is turned off	1

☆ This function is valid when the parameter FMOd (frequency setting mode selection) = 5 is set.

■ Input terminal settings

Assign the following functions to the input terminal, you can change (up/down) or clear the output frequency by using the terminal's ON/OFF.

Input terminal function		ON	OFF
88	Frequency UP	Frequency setting increase	Clear
90	Frequency DOWN	Frequency setting decrease	Clear
92	Clear frequency UP/DOWN	OFF → ON: External logic up/down frequency Clear settings	FMOd settings

Each of the following numbers (89, 91, 93) are reverse signals.

■ Adjustment with continuous signals (Operation example 1)

Set parameters as follows to adjust the output frequency up or down in proportion to the frequency adjustment signal input time:

Panel frequency incremental gradient = F265/F264 setting time

Panel frequency decremental gradient = F267/F266 setting time

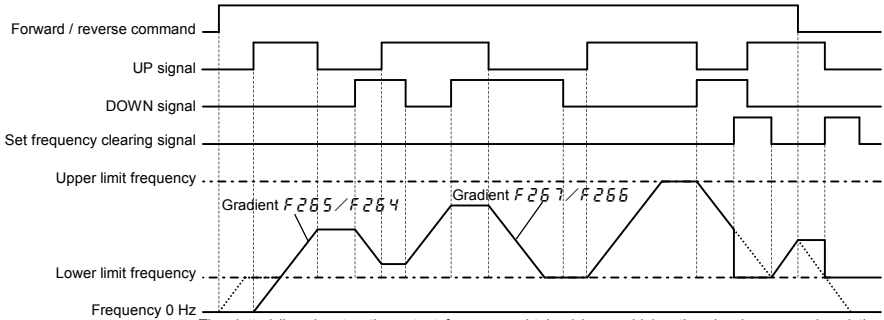
Set parameters as follows to adjust the output frequency up or down almost in synchronization with the adjustment by the panel frequency command:

F264 = F266 = 1

(FH/RCC) ≥ (F265/F264 setting time)

(FH/dEC) ≥ (F267/F266 setting time)

<<Sample sequence diagram 1: Adjustment with continuous signals>>



The dotted line denotes the output frequency obtained by combining the slowdown speed and the panel frequency adjustment speed.

Note: If the operation frequency is set to the lower limit frequency, it will increase from 0Hz when power is turned on for the first time after the setting, and therefore the output frequency will not rise until the operation frequency reaches the lower limit frequency. (Operation at the lower limit frequency)
In this case, the time required for the operation frequency to reach the lower limit frequency can be shortened by setting FC to the lower limit frequency.

■ Adjustment with pulse signals (Operation example 2)

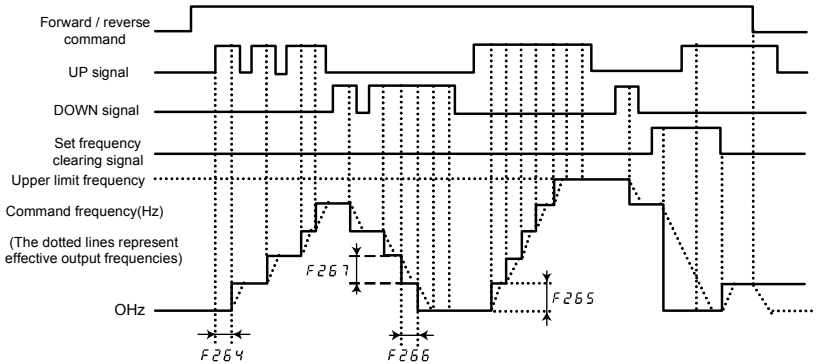
Set parameters as follows to adjust the frequency in steps of one pulse:

F264, F266 ≤ Pulse On time

F265, F267 = Frequency obtained with each pulse

* The inverter does not respond to any pulses with an ON time shorter than that set with F264 or F266. 12ms or more of clearing signal is allowed.

<<Sample sequence diagram 2: Adjustment with pulse signals>>



■ If two signals are impressed simultaneously

- If a clear single and an up or down signal are impressed simultaneously, priority will be given to the clear signal.
- If up and down signals are impressed simultaneously, The frequency will change at the specified up or down rate.

■ About the setting of the initial up/down frequency

To adjust the frequency starting at a specified frequency other than 0.0 Hz (default initial frequency) after turning on the inverter, specify the desired frequency using F268 (initial up/down frequency).

■ About the change of the initial up/down frequency

To make the inverter automatically save the frequency immediately before it is turned off and start operation at that frequency next time power is turned on, set F269 (change of initial up/down frequency) to 1 (which changes the setting of F268 when power is turned off).
Keep in mind that the setting of F268 is changed each time power is turned off.

■ Frequency adjustment range

The frequency can be set from 0.0Hz to FH (Maximum frequency). The lower-limit frequency will be set as soon as the set frequency clearing function (function number 92, 93) is entered from the input terminal.

■ Minimum unit of frequency adjustment

If F702 (Frequency free unit magnification) is set to 1.00, the output frequency can be adjusted in steps of 0.01Hz.

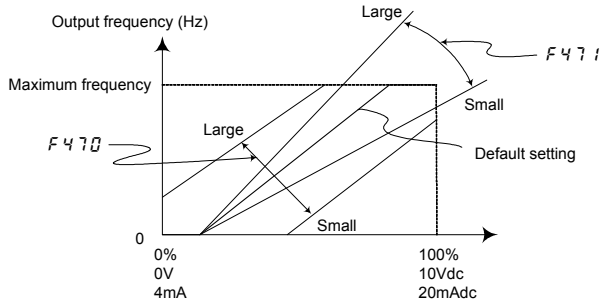
6.4.4 Fine adjustment of frequency setting signal

F470: VI input bias

F471: VI input gain

- Function
  These parameters are used to fine adjust the relation between the frequency setting signal input through the analog input terminal VI and the output frequency.
  Use these parameters to make fine adjustments after making rough adjustments using the parameters F201 to F204.

The figure below shows the characteristic of the frequency setting signal input through the VI terminal and that of the output frequency.



Frequency setting signal（VI input value）

* Bias adjustment of VI input terminal (F470)
To give leeway, the inverter is factory-adjusted by default so that it will not produce an output until a certain amount of voltage is applied to the VI input terminal. If you want to reduce the leeway, set F470 to a larger value. Note that specifying a too large value may cause an output frequency to be output, even though the operation frequency is 0 (zero) Hz.

* Gain adjustment of VI input terminal (F471)
The inverter is factory-adjusted by default so that the operation frequency can reach the maximum frequency, even though the voltage and current to the VI input terminal are below the maximum levels. If you want to adjust the inverter so that it will output the maximum frequency at the maximum voltage and current, set F471 to a smaller value. Note that specifying a too small value may cause the operation frequency not to reach the maximum frequency, even though the maximum voltage and current are applied.

6.5 Operation frequency

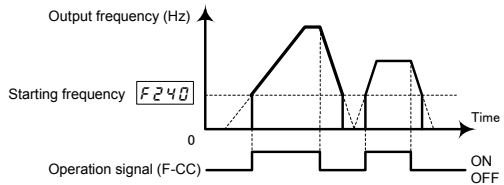
6.5.1 Starting frequency

F240: Starting frequency

- Function
  The frequency set with F240 is put out as soon as operation is started.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F240	Starting frequency	0.1-10.0 (Hz)	0.1



6.5.2 Run/stop control with frequency setting signals

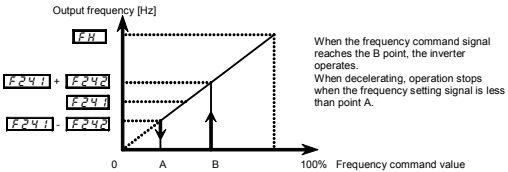
F241: Operation starting frequency

F242: Operation starting frequency hysteresis

- Function
  The Run/stop of operation can be controlled simply with frequency setting signals.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F241	Operation starting frequency	0.0-FH (Hz)	0.0
F242	Operation starting frequency hysteresis	0.0-FH (Hz)	0.0



6.6 Time limit for lower-limit frequency operation

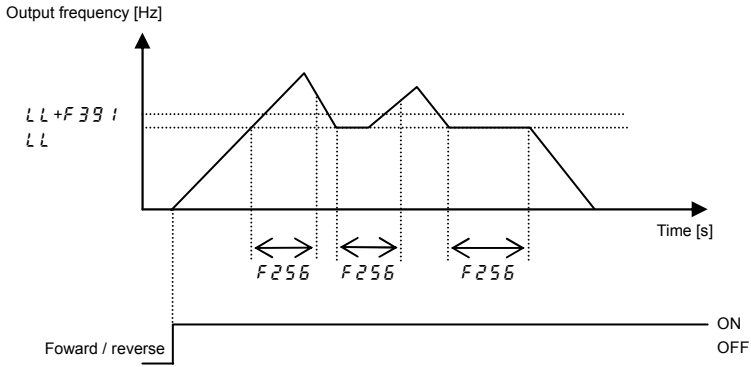
F256: Time limit for lower-limit frequency operation

F391: Auto-stop hysteresis in case of lower-limit frequency continuous operation

- Function
  If operation is carried out continuously at a frequency below the lower-limit frequency (LL) for the period of time set with F256, the inverter will automatically slow down the motor to a stop. At that time, "LStP" is displayed (alternately) on the operation panel.
  This function will be canceled if a frequency command above the lower-limit frequency (LL) +F391 (Hz).

[Parameter setting]

Title	Function	Adjustment range	Default setting
F256	Time limit for lower-limit frequency operation	0.0: Disabled 0.1 - 600.0 (s)	0.0
F391	Auto-stop hysteresis in case of lower-limit frequency continuous operation	0.0-UL (Hz)	0.2



Note: This function is valid when doing forward/reverse switching.
When starting operation, does not operate until operation frequency reaches LL.

6.7 Simple servo lock function settings

6.7.1 Enabling the simple servo lock function

F108: Always active function selection 2
F257: Servo lock function
F930: Position loop gain

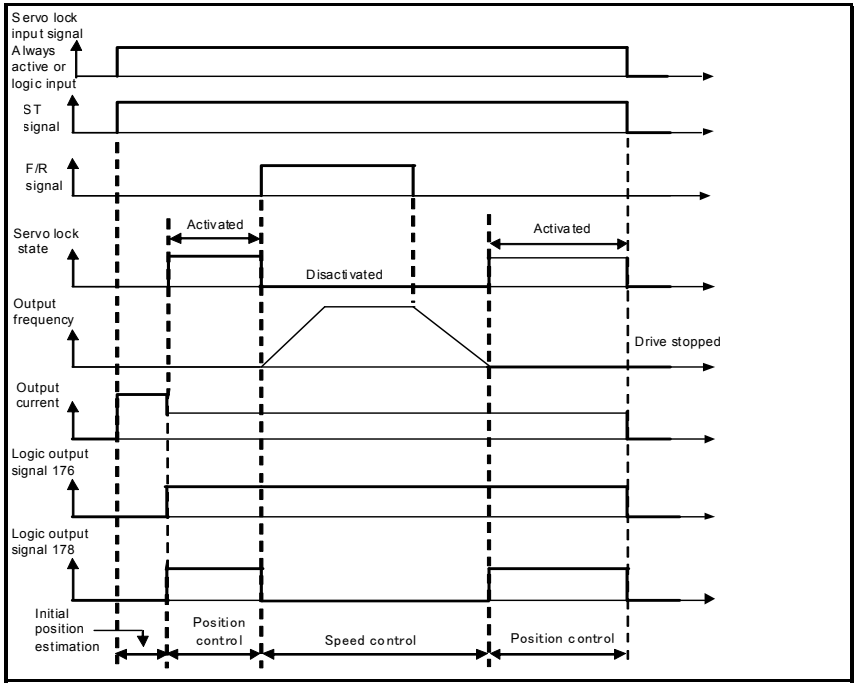
Function
・While operation is in standby (operation stopped), performs control that maintains the position in order to stop the IPM gear motor.

[Parameter Settings]

Title	Function	Adjustment range	Default setting
F108	Always active function selection 2	0-153	70 (SVLOCK)
F257	Servo lock function	0: Prohibited 1: Permitted	0
F930	Position loop gain	1-250	100

☆To operate the simple servo lock function, set servo lock function F257 to 1 (Permitted).
☆You can use F930 to adjust the response to load fluctuation during servo lock. Refer to page 6.16 for details.
Note 1: Parameter F257 can be switched during operation. When switching, take care concerning IPM gear motor operation.
☆With the default setting, function number 70 (servo lock) is assigned to F108 (Always active function selection 2), setting F257= 1 causes the servo lock function always to operate whenever operation is stopped. If you want to turn the servo lock function on or off using an input terminal, assign function number 70 or 71 (reverse signal of 70) to an open input terminal, and assign 0 (No function) or some other function to F108.
☆Approximately 150 ms of initial position estimation time (phase detection time) is required until the servo lock input signal turns ON and operation starts. After that servo lock operation is implemented.
☆The servo lock function is canceled by operation signal ON input. An operation command takes priority.
☆"Sr vo" is displayed during servo lock operation.
☆Assigning "Servo lock braking signal 176, 177 (reverse signal of 176)" or "servo lock signal 178, 179 (reverse signal of 178)" for output terminal selection can be used to check servo lock operation, etc.

Note 2: The motor does not run during servo lock operation, but the inverter operates to stop the IPM gear motor, so care should be taken to avoid touching the main circuit terminal strip and other parts that can cause electric shock.
Note 3: The simple servo lock function does not operate when braking mode selection F341 is set to 3 (Enabled). Braking mode selection takes priority. Keep this in mind when performing operations.
Note 4: When using the simple servo lock function with an IPM gear motor with brake, use " Servo lock braking signal 176 and 177 (reverse signal of 176)" for the brake on/off timing signals.
Note 5: When using an IPM gear motor with brake, do not leave the servo lock engaged for a long period when the brake circuit is open (brake closed). This can cause motor current to increase and tripping of overload.



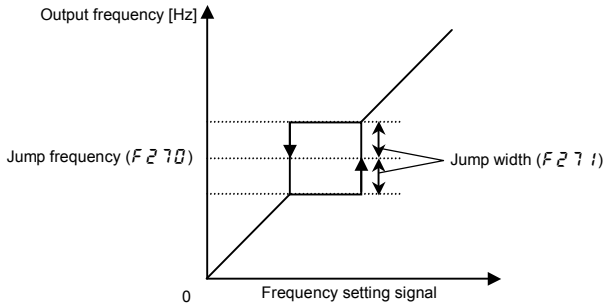
☆ Though the servo lock function does not operate unless both "input terminal function signal 6: ST signal (Standby)" and "input terminal function number 70: servo lock" are operational (ON), the ST signal (Standby) is assigned to F110 (Always active function selection 3) at the default setting, so servo lock function operation can be performed simply by turning "input terminal function signal 70: Servo lock" ON and OFF.

6.8 Jump frequency - Avoiding frequency resonance

F270: Jump frequency

F271: Jumping width

- Function
  Resonance due to the natural frequency of the mechanical system can be avoided by jumping the resonant frequency during operation. During jumping, hysteresis characteristics with respect to the jump frequency are given to the motor.



[Parameter setting]

Title	Function	Adjustment range	Default setting
F270	Jump frequency	0.0-FH (Hz)	0.0
F271	Jump width	0.0-30.0 (Hz)	0.0

Note 1: During acceleration and deceleration, the operation frequency jumps do not occur.

6.9 Preset-speed frequencies

F287 - F294: Preset-speed frequency 8 to 15

Refer to section 3.5 for details.

6.10 PWM carrier frequency

F300: PWM carrier frequency

F312: Random mode

F316: Carrier frequency control mode selection

- Function
  1) The F300 parameter allows the tone of the magnetic noise from the motor to be changed by switching the PWM carrier frequency. This parameter is also effective in preventing the motor from resonating with its load machine or its fan cover.
  2) In addition, the F300 parameter reduces the electromagnetic noise generated by the inverter. Reduce the carrier frequency to reduce electromagnetic noise. Note: Although the electromagnetic noise level is reduced, the acoustic noise of the motor is increased.
  3) The random mode reduces motor electromagnetic noise by changing the pattern of the reduced carrier frequency.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F300	PWM carrier frequency	2-16 (kHz) (*)	12
F312	Random mode	0: Disabled, 1: Automatic setting	0
F316	Carrier frequency control mode selection	0: Carrier frequency without reduction 1: Carrier frequency with automatic reduction	1

Note 1: Some models need reduced current ratings, depending on the PWM carrier frequency F300 settings. Refer to the table on the following page.

Note 2: When the PWM carrier frequency is set high, selecting “Carrier frequency not reduced automatically” causes the inverter to be tripped more easily than selecting “Carrier frequency reduced automatically.”

Reduction of rated current

[Three phase 200 V class]

VFNC3M	Ambient temperature	Carrier frequency		
		2 - 4 kHz	5 - 12 kHz	13 - 16 kHz
2001P	60°C or less	0.7A	0.7A	0.7A
2002P	50°C or less	1.4 A	1.4 A	1.4 A
	50 ~ 60°C	1.2 A	1.2 A	1.2 A
2004P	50°C or less	2.4 A	2.4 A	2.4 A
	50 ~ 60°C	2.1 A	2.1 A	2.1 A
2007P	40°C or less	4.2 A	3.6 A	3.0 A
	40 ~ 50°C	4.2 A	3.2 A	2.8 A
	50 ~ 60°C	3.7 A	3.2 A	2.8 A
2015P	40°C or less	7.5 A	7.5 A	7.1 A
	40 ~ 60°C	7.5 A	7.1 A	7.1 A
2022P	40°C or less	10.0 A	8.5 A	7.5 A
	40 ~ 60°C	10.0 A	7.5 A	7.5 A

* If ambient temperature exceeds 40°C, take the upper danger label off and reduce current according to table above.
* The table above is the value when the inverter is installed in general described in section 1.4.4.
* Default setting of PWM carrier frequency is 12kHz, but rated output current of rating label display at 4kHz. If F316 is set to 1 or 3, however, the carrier frequency will decrease automatically with increase in current in order to secure the rated current at frequencies of 4 kHz or less.
* If F316=0, and current is increased to the automatic reduction level, the OL alarm occurs, if current is increased further OL3 trips.
* Random mode is exercised when the motor is operated in a low-frequency range where it produces annoying acoustic noise.
  If the carrier frequency (F300) is set above 8 kHz, the random mode function will not be performed, because the level of motor magnetic noise is low at high frequencies.

6.11 Trip-less intensification

6.11.1 Auto-restart (Restart of coasting motor)

F301: Auto-restart control selection

Caution	
Mandatory action	• Stand clear of motors and mechanical equipment If the motor stops due to a momentary power failure, the equipment will start suddenly when power is restored. This could result in unexpected injury. • Attach warnings about sudden restart after a momentary power failure on inverters, motors and equipment for prevention of accidents in advance.

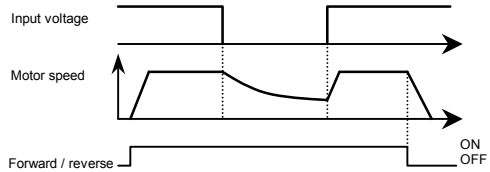
- Function
  The F301 parameter detects the rotating speed and rotational direction of the motor during coasting at the event of momentary power failure, and then after power has been restored, restarts the motor smoothly (motor speed search function). This parameter also allows commercial power operation to be switched to inverter operation without stopping the motor.
  During operation, "rtry" is displayed.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F301	Auto-restart control selection	0: Disabled 1: At auto-restart after momentary stop 2: At ST terminal off and on 3: 1 + 2 4: At start-up	0

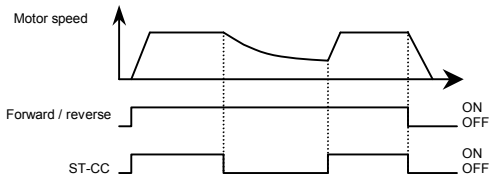
* If the motor is restarted in retry mode, this function will operate, regardless of the setting of this parameter.

1) Auto-restart after momentary power failure (Auto-restart function)



★ Setting F301 to 1 or 3: This function operates after power has been restored following detection of an undervoltage by the main circuits and control power.

2) Restarting motor during coasting (Motor speed search function)



★ Setting F301 to 2or 3: This function operates after the ST-CC terminal connection has been opened first and then connected again.

Note 1: The terminal function ST needs to be assigned to an input terminal, using the parameters F111 to F115.

3) Motor speed search at starting

When F301 is set to 4, a motor speed search is performed each time operation is started.
This function is useful especially when the motor is not operated by the inverter but it is running because of external force.

Warning!!

- At restart, it takes about 1 second for the inverter to check to see the number of revolutions of the motor.
  For this reason, the start-up takes more time than usual.
- Use this function when operating a system with one motor connected to one inverter.
  This function may not operate properly in a system configuration with multiple motors connected to one inverter.
- In case of using this function, do not set the output phase failure detection selection (F605= 1, 2).

Application to a crane or hoist

The crane or hoist may have its load moved downward during the above waiting time from input of the operation starting command to the restart of the motor. To apply the inverter to such machines, therefore, set the auto-restart control mode selection parameter to "F301=0" (Disabled), Do not use the retry function, either.

Note 2: It is not malfunction that abnormal noise might be heard from the motor during the motor speed search at the auto-restart.

6.11.2 Regenerative power ride-through control (Deceleration stop)

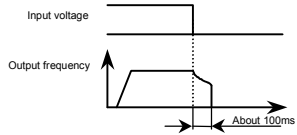
F302: Regenerative power ride-through control (Deceleration stop)

- Function
  1) Regenerative power ride-through control:
     This function continues the operation of the motor by utilizing motor regenerative energy in the event of momentary power failure.
  2) Slowdown stop in the event of momentary power failure:
     If a momentary power failure occurs during operation, the inverter stops forcibly. (Deceleration time varies with control.) When operation is stopped, the message "STOP" is displayed (alternately) on the operation panel.
     After the forced stop, the inverter remains static until you put off the operation command momentarily.

[Parameter setting]

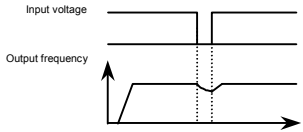
Title	Function	Adjustment range	Default setting
F302	Regenerative power ride-through control (Deceleration stop)	0: Disabled 1: Automatic setting 2: Slowdown stop	0

[When power is interrupted]



* The time for which the operation of the motor can be continued depends on the machine inertia and load conditions. Before using this function, therefore, perform verification tests.

[If momentary power failure occurs]



Note 1: Even when this parameter is set, the particular load conditions may cause the motor to coast. When keep running by regeneration energy becomes impossible and motor comes into coast deceleration, input the run command after checking the motor stop when power has been restored.

6

- Cause of coast stop during motor rotating -

1. At momentary power failure
2. Switch OFF the input terminal function ST (Standby) during motor rotating
3. Switch ON the input terminal function FRR (Coast stop command) during motor rotating
4. When the motor is rotating by external factor during not being operating the motor in the inverter

Please note that the above condition apply at momentary power failure, especially, when operating with short-circuit directly between input terminal that assigned the function of run command (forward/reverse) and CC terminal.

6.11.3 Retry function

F303: Retry selection (number of times)

Caution	
Mandatory action	• Do not go near the motor in alarm-stop status when the retry function is selected. The motor may suddenly restart, which could result in injury. • Take measures for safety, e.g. attach a cover to the motor, to prevent accidents if the motor suddenly restarts.

- Function
  This parameter resets the inverter automatically when the inverter gives an alarm. During the retry mode, the motor speed search function operated automatically as required and thus allows smooth motor restarting.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F303	Retry selection (number of times)	0: Disabled, 1-10 times	0

The likely causes of tripping and the corresponding retry processes are listed below.

Cause of tripping	Retry process	Canceling conditions
Overcurrent Overvoltage Overload Overheating Braking resistor overload trip SOUT trip	Up to 10 times in succession 1st retry: About 1 sec after tripping 2nd retry: About 2 sec after tripping 3rd retry: About 3 sec after tripping 10th retry: About 10 sec after tripping	The retry function will be canceled at once if tripping is caused by an unusual event other than: momentary power failure, overcurrent, overvoltage or overload. This function will also be canceled if retrying is not successful within the specified number of times.

★ Retry is only done when the following trips occur.
OC1, OC2, OC3, OP1, OP2, OP3, OL1, OL2, OL3, OH, SOUt

★ Protective operation detection relay signals (FLA, FLB, FLC terminal signals) are not sent during use of the retry function. (Default setting)

★ To allow a signal to be sent to the protective action detection relay (FLA, B and C terminals) even during the retry process, assign function numbers 146 or 147 to F132.

★ A virtual cooling time is provided for overload tripping (OL1,OL2).
In this case, the retry function operates after the virtual cooling time and retry time.

★ In the event of tripping caused by an overvoltage (OP1 to OP3), the retry function will not be activated until the voltage in the DC section comes down to a normal level.

★ In the event of tripping caused by overheating (OH), the retry function will not be activated until the temperature in the inverter comes down low enough for it to restart operation.

★ During retrying, the blinking display will alternate between rtry and the monitor display specified by status monitor display mode selection parameter F710.

★ The number of retries will be cleared if the inverter is not tripped for the specified period of time after a successful retry.
"A successful retry" means that the inverter output frequency reaches the command frequency without causing the inverter to re-trip.

6.11.4 Dynamic (regenerative) braking - For abrupt motor stop

F304: Dynamic braking selection

F308: Dynamic braking resistance

F309: Dynamic braking resister capacity

F626: Over-voltage stall protection level

- Function
  The inverter does not contain a braking resistor. Connect an external braking resistor in the following cases to enable dynamic braking function:
  1) when decelerating the motor abruptly or if overvoltage tripping (OP) occurs during deceleration stop
  2) when a continuous regenerative status occurs during downward movement of a lift or the winding-out operation of a tension control machine
  3) when the load fluctuates and a continuous regenerative status results even during constant speed operation of a machine such as a press

[Parameter setting]

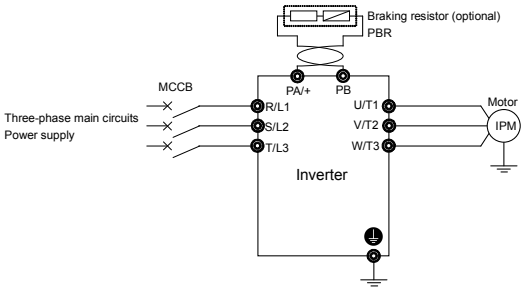
Title	Function	Adjustment range	Default setting
F304	Dynamic braking selection	0: Disabled 1: Enabled, Resistor overload protection enabled 2: Enabled 3: Enabled, Resistor overload protection enabled (At ST terminal on) 4: Enabled (At ST terminal on)	0
F308	Dynamic braking resistance	1.0-1000 (Ω)	0.1k to 0.75kW model : 200 1.5k to 2.2kW model : 75
F309	Dynamic braking resister capacity	0.01-10.00 (kW)	0.1k to 2.2kW model : 0.09
F626	Over-voltage stall protection level	100-150 (%)	136

Note 1) The operation level of dynamic braking is defined by parameter F626.

Note 2) If parameter F304= 1 to 4, the inverter will be set automatically so as to deal with the regenerative energy from the motor by means of a resistor, without taking any action to limit overvoltage.
(The same function as F305= 1)

1) Connecting an external braking resistor (optional)

Separate-optional resistor (with thermal fuse)



[Parameter setting]

Title	Function	Setting
F304	Dynamic braking selection	1-4
F308	Dynamic braking resistance	Proper value
F309	Dynamic braking resister capacity	Proper value
F626	Over-voltage stall protection level	136 (%)

☆ To use this inverter in applications that create a continuously regenerative status (such as downward movement of a lift, a press or a tension control machine), or in applications that require deceleration stopping of a machine with a significant load inertial moment, increase the dynamic braking resistor capacity according to the operation rate required.

☆ To connect an external dynamic braking resistor, select one with a resultant resistance value greater than the minimum allowable resistance value. Be sure to set the appropriate operation rate in F308 and F309 to ensure overload protection.

☆ When using a braking resistor with no thermal fuse, connect and use a thermal relay as a control circuit for cutting power off.

2) Optional dynamic braking resistors

Optional dynamic braking resistors are listed below. All these resistors are 3%ED in operation rate

Inverter type	Braking resistor		
	Type-form	Rating	Continuous regenerative braking allowable capacity
VFNC3M-2001 to 2007P	OP-PBR-2007	0.12kW-200Ω	0.09kW
VFNC3M-2015 to 2022P	OP-PBR-2022	0.12kW -75Ω	0.09kW

Note 1: The data in Rating above refer to the resultant resistance capacities (watts) and resultant resistance values (Ω).

Note 3: Optional dynamic braking resistors above are “with thermal fuse” type.

3) Minimum resistances of connectable braking resistors

The minimum allowable resistance values of the externally connectable braking resistors are listed in the table below.

Do not connect braking resistors with smaller resultant resistances than the listed minimum allowable resistance values.

Inverter rated output capacity (kW)	Resistance of standard option	Minimum allowable resistance
0.1	200Ω	91Ω
0.2	200Ω	91Ω
0.4	200Ω	91Ω
0.75	200Ω	91Ω
1.5	75Ω	44Ω
2.2	75Ω	33Ω

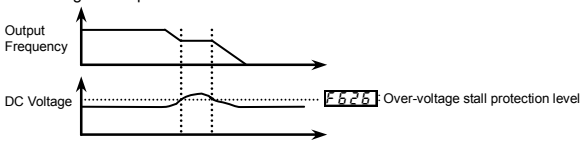
6.11.5 Avoiding overvoltage tripping

F305: Overvoltage limit operation (Slowdown stop mode selection)

F626: Overvoltage stall protection level

- Function
  These parameters are used to keep the output frequency constant or increase it to prevent overvoltage tripping in case the voltage in the DC section rises during deceleration or varying speed operation. The deceleration time during overvoltage limit operation may increase above the designated time.

Overvoltage limit operation level



[Parameter setting]

Title	Function	Adjustment range	Default setting
F305	Overvoltage limit operation (Slowdown stop mode selection)	0: Enabled 1: Disabled 2: Enabled (Quick deceleration control) 3: Enabled (Dynamic quick deceleration control)	2
F626	Overvoltage stall protection level	100-150%	136

☆ If F305 is set to 2 (quick deceleration control), the inverter will increase the voltage to the motor (over-excitation control) to increase the amount of energy consumed by the motor when the voltage reaches the overvoltage protection level, and therefore the motor can be decelerated more quickly than normal deceleration.

☆ If F305 is set to 3 (dynamic quick deceleration control), the inverter will increase the voltage to the motor (over-excitation control) to increase the amount of energy consumed by the motor as soon as the motor begins to slow down, and therefore the motor can be decelerated still more quickly than quick deceleration.

☆ During overvoltage limit operation, the overvoltage pre-alarm (P blinks) is displayed.

☆ Parameter F626 serves also as a parameter for setting the regenerative braking level.

6.11.6 Reverse-run prohibition

F311: Reverse-run prohibition

- Function
  This function prevents the motor from running in the forward or reverse direction when it receives the wrong operation signal.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F311	Reverse-run prohibition	0: Forward/reverse run permitted 1: Reverse run prohibited 2: Forward run prohibited	0

6.12 Brake sequence function

6.12.1 Enabling the brake sequence function

F341: Braking mode selection
F345: Braking release time
F340: Creeping time
F346: Creeping frequency
F347: Braking delay time

- Function
  - Configures motor operation settings during mechanical brake opening/closing.
  - A mechanical brake operation timing signal is output from the inverter for raising/lowering applications, etc.

[Parameter Settings]

Title	Function	Adjustment range	Default setting
F341	Braking mode selection	0: Disabled 1: - 2: - 3: Disabled	0
F345	Braking release time	0.00-10.00s	0.5s
F340	Creeping time	0.00-10.00s	0.00s
F346	Creeping frequency	F240 -20Hz	3Hz
F347	Braking delay time	0.00-10.00s	0.3s

[Output Terminal Parameter Settings]

Title	Function	Adjustment range	Default setting
F130	Output terminal selection 1A (OUT)	0-255 (Refer to section 11.5)	68 : Brake (Braking release signal)

Setting value 69 is reverse signal.

☆ To operate the brake function, change the setting of braking mode selection F341 to 3 (Disabled).

Note 1: This parameter can not be switched during operation. Implement the switched setting when the operation signal is OFF.

Note 2: The simple servo lock function does not operate when braking mode selection F341 is set to 3 (Disabled).

☆ Use " Braking release signal 68 (reverse signal 69)" for the timing signal of the mechanical brake open/close operation.
Braking release signal 68 is set to output terminal OUT at default setting.

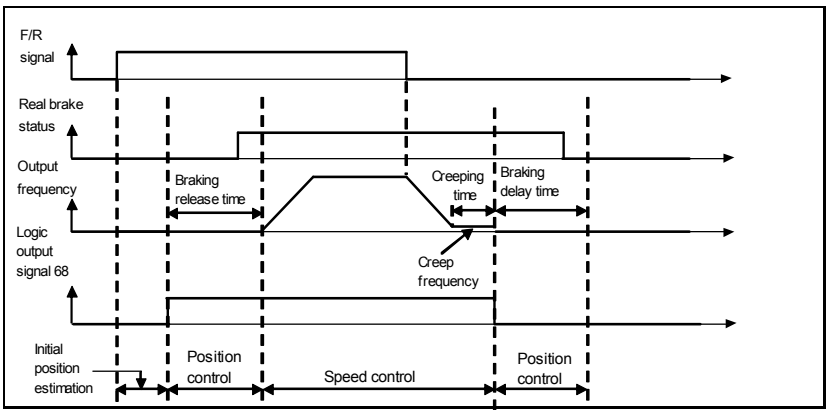
☆ Approximately 150 ms of initial position estimation time is required until the normal rotation/reverse rotation signal turns ON and operation starts.
After that, a servo lock operation is performed for the setting time by braking release time F345.

☆ After braking release time F345 elapses, there is a transition to speed control.

☆ After creeping frequency F346 and creeping time F340 progress, a servo lock operation is performed for the setting time by braking delay time F347.

☆ Configuring settings so braking release time F345 matches the actual brake operation release time and braking delay time F347 matches actual brake operation braking delay time makes it possible to maintain and transfer the servo lock and mechanical brake positions.

Note 3: The motor does not run during servo lock operation, but the inverter operates to stop the IPM gear motor, so take care to avoid electric shock by touching the main circuit terminal block and other parts.



☆ When cargo tends to momentarily drop down in a raising/lowering application (normal rotation/reverse rotation command), the settings described below can be configured in order to improve operation.

Improvement Method

Then gradually reduced from the default setting of F345 "Braking Release Time", adopt a value that is cargo down the behavior steps.

Response also can be further improved by raising the values of F460 "Speed loop proportional gain" and F930 "Position loop gain". Refer to "6.16 Control gain adjustment function" for details about these functions.

6.13 PID control

F359: PID control waiting time

F360: PID control

F362: Proportional gain

F363: Integral gain

F366: Differential gain

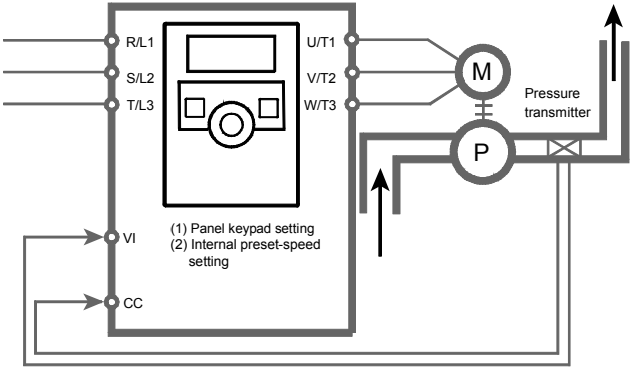
F380: PID forward/reverse characteristics selection

- Function
  Using feedback signals (4 to 20mA, 0 to 5 V, 0 to 10V) from a detector, process control can be exercised, for example, to keep the airflow, amount of flow or pressure constant.
  Or, it is also possible to always set 0 for integral and differential at terminal input.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F359	PID control waiting time	0-2400 [s]	0
F360	PID control	0: Disabled, 1: Enabled	0
F362	Proportional gain	0.01-100.0	0.30
F363	Integral gain	0.01-100.0	0.20
F366	Differential gain	0.00-2.55	0.00
F380	PID forward/reverse characteristics selection	0: Forward 1: Reverse	0

1) External connection



Feedback signals (1)DC : 4~20mA (2)DC : 0~10V (3)DC : 0~5V

6

2) Types of PID control interfaces

Set process amount input value (frequency setting) for when doing PID control.

Process amount input value (frequency setting)	Feedback signal
Frequency setup mode selection: FNOd 1: Setting dial 1 (press in center to save) 2: Setting dial 2 (save even if power is off) 3: RS485 communication 5: UP/DOWN from external logic input	External analog input VI (DC: 4 - 20mA/ DC: 0 - 10V/ DC: 0 - 5V)
Preset-speed operation (CNOd=0, FNOd are all possible)	

Note 1: Regarding setting value for FNOd: Terminal VI is used for a feed back signal, do not set FNOd=0 (terminal VI).

3) Setting PID control

Set "1" in the extended parameter F360 (PID control).

(1) Set parameters RCC (acceleration time), and dEC (deceleration time) to the system fitting values.

(2) To limit the output frequency, set parameters UL (upper limit frequency) and LL (lower limit frequency). If process quantities are set with the setting dial, however, the process quantity setting range will be limited by the settings of UL and LL.

☆ Assigning the PID control prohibition (input terminal function number: 36) to any logic input terminal, PID control function is stopped during the terminal ON.

4) Adjusting the PID control gain level

Adjust the PID control gain level according to the process quantities, the feedback signals and the object to be controlled.

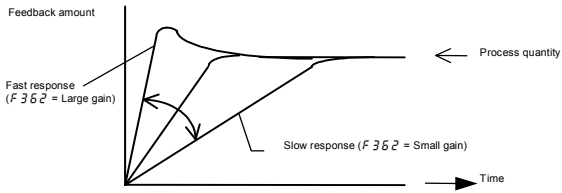
The following parameters are provided for gain adjustment:

Title	Function	Adjustment range	Default setting
F362	Proportional gain (P)	0.01 - 100.0	0.30
F363	Integral gain (I)	0.01 - 100.0	0.20
F366	Derivative gain (D)	0.00 - 2.55	0.00

F362 (P-gain adjustment parameter)

This parameter adjusts the proportional gain level during PID control. A correction value proportional to the particular deviation (the difference between the process quantity and the feedback value) is obtained by multiplying this deviation by the parameter setting.

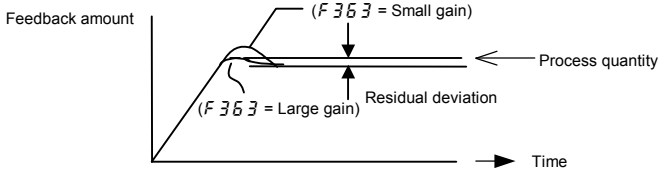
A larger P-gain adjustment value gives faster response. Too large an adjustment value, however, results in an unstable event such as hunting.



F363 (I-gain adjustment parameter)

This parameter adjusts the integral gain level during PID control. Any deviations remaining unremoved during proportional action are cleared to zero (residual deviation offset function).

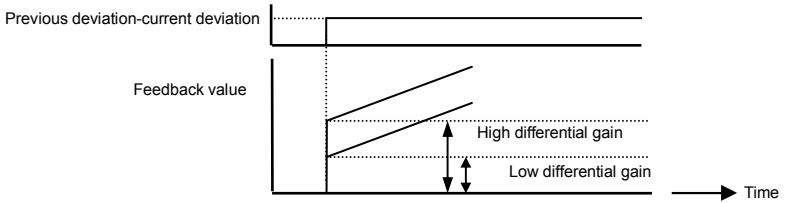
A larger I-gain adjustment value reduces residual deviations. Too large an adjustment value, however, results in an unstable event such as hunting.



☆ Assign an input terminal function 52 (PID integral/derivative) to an input terminal, when that input terminal is ON, it is possible to calculate integral/derivative amounts always as 0 (zero).

F366 (D-gain adjustment parameter)

This parameter adjusts the differential gain level during PID control. This gain increases the speed of response to a rapid change in deviation (difference between the process value and the feedback value). Note that setting the gain more than necessary may cause fluctuations in output frequency, and thus operation to become unstable.



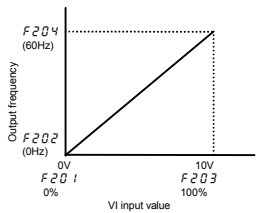
☆ Assign an input terminal function 52 (PID integral/derivative) to an input terminal, when that input terminal is ON, it is possible to calculate integral/derivative amounts always as 0 (zero).

5) Adjusting feedback input

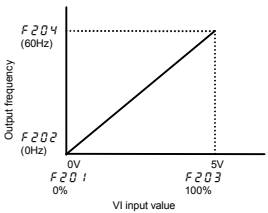
To use external feedback input (VI), perform voltage-scaling adjustments (input point setting) as required. Refer to section 6.4.2 for details.

If the feedback input data is too small, voltage-scaling adjustment data can also be used for gain adjustment.

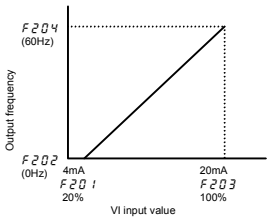
Example of 0 - 10 Vdc voltage input setting (F109=0)



Example of 0 - 5 Vdc voltage input setting (F109=3)



Example of 4 - 20 Adc voltage input setting (F109=1)



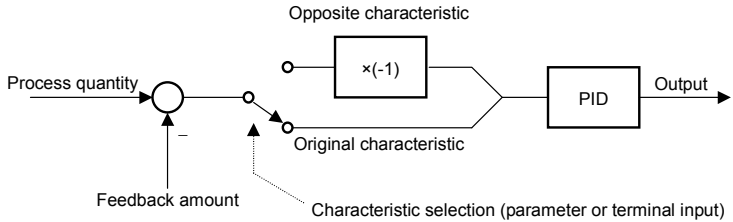
6) Setting the time elapsed before PID control starts

You can specify a waiting time for PID control to prevent the inverter from starting PID control before the control system becomes stable, for example, after start-up.

The inverter ignores feedback input signals, carries out operation at the frequency determined by the amount of processing for the period of time specified with F359 and enters the PID control mode after a lapse of the specified time.

7) PID control forward/reverse characteristic switch

PID input characteristics can be reversed.



- When characteristic is reversed according to parameters
  When PID calculation reverse selection parameter F380 is 1: Set reverse characteristics.

- When characteristic is reversed using logic input terminal
  Input terminal function 54/55: Assign to switch PID characteristics.

  (Caution) If reverse characteristics is selected for parameter F380 and terminal input at the same time, they become forward characteristic.

6.14 Impact stop sequence function

6.14.1 Enabling the impact stop sequence function

F382: Impact stop function
F383: Impact stop frequency
F384: Impact stop torque limit
F385: Impact stop detection time
F386: Impact stop continuous torque

Function
・Performs a series of deceleration, impact stop operations with a single input signal. A impact stop status signal is also output.

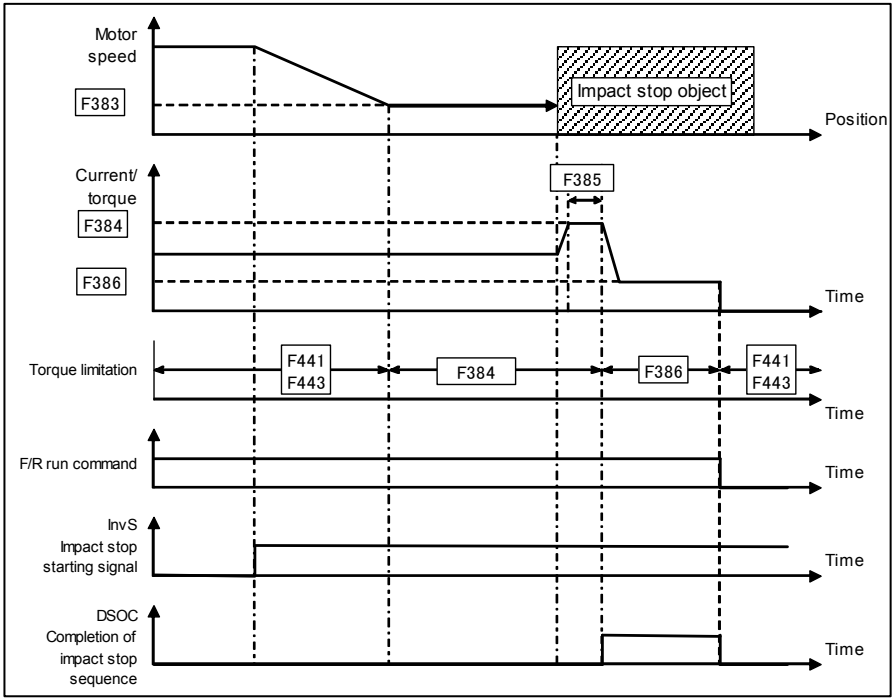
[Parameter Settings]

Title	Function	Adjustment range	Default setting
F382	Impact stop function	0: Disabled 1: - 2: Enabled	0
F383	Impact stop frequency	0.1-30.0Hz Note 1	0.1 to 0.4kW model : 5Hz 0.75 to 2.2kW model : 7.5Hz
F384	Impact stop torque limit	0.0-120%	100%
F385	Impact stop detection time	0.0-25.0s	0.3s
F386	Impact stop continuous torque	0.0-100%	10%

☆ Set impact stop function F382 to 2 (Enabled).
☆ Configure settings from F383 to F386 with values that are appropriate for the machinery of the IPM gear motor being used.
☆ Assign "Input Terminal Function Number 150: Inv S (Impact stop starting signal)" (reverse signal 151) as the input signal to start impact stop operation.
☆ Use "Output Terminal Function Number 174: D SOC (Completion of impact stop sequence)" (reverse signal 175) as the impact stop state end signal.
☆ Following input signal Inv S ON (maintain input signal), after the impact stop frequency decelerates to F383, the output torque upper limit value becomes impact stop torque limit F384.
☆ When IPM gear motor operation is locked by a impact stop object and impact stop detection time F385 elapses, output torque transitions to impact stop continuous torque F386 and the push and hit status is maintained.
☆ As the same time there is a transition to impact stop continuous torque F386, the output signal DSOC becomes ON.
☆ Output signal DSOC becomes OFF in accordance with the normal rotation/reverse rotation command OFF.

Note 1: Set the setting value of impact stop frequency F383 the default setting value or less. Performing impact stop operation with a value that is larger than the default setting value creates the risk of IPM gear motor gear damage.

Note 2: With this function, the conditions that completion of impact stop sequence DSOC outputs are the torque of F384 and the duration of F385. Note that because of this, if load torque that is above the setting value of F384 at the stage before the impact stop object is hit that has already continued for the duration of F385, will be judged at that point to have reached the impact stop state, and output signal DSOC will be output.

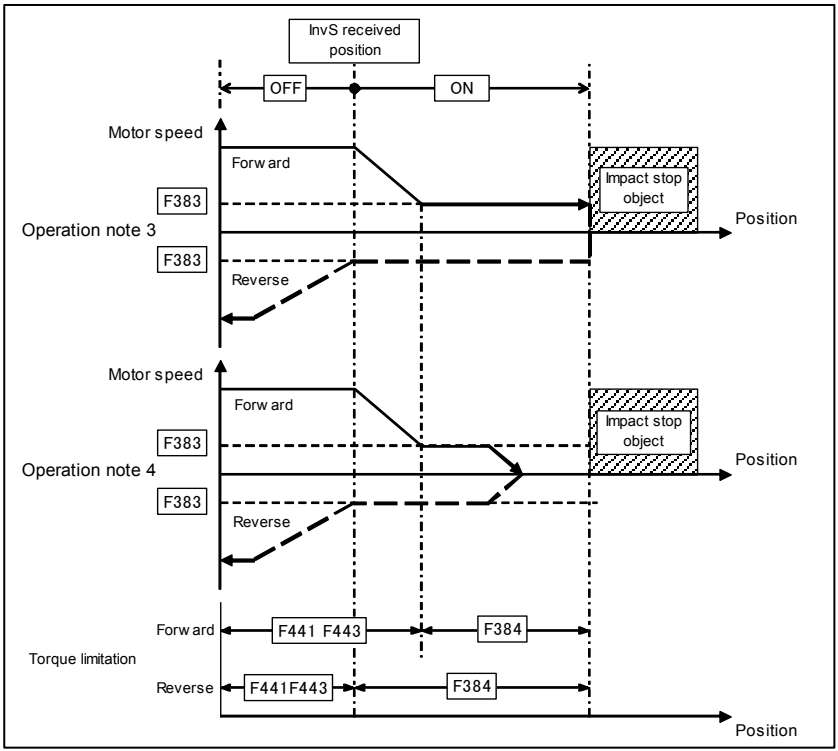


Note 3: After a reverse operation command is input during the impact stop state (after output signal DSOC is ON), output signal DSOC becomes OFF. However, note that this implements the reverse running operation described below.

- Reverse running operation at impact stop frequency F383 and impact stop torque limit F384 starts, and reverse running operation continues up to the input signal Inv S receive position.
- After the input signal Inv S receive position is passed, the rotating speed increases up to the input command frequency. Also, the torque limit values become the setting values of the power running torque limit F441 and regenerative braking torque limit F443.

Note 4: Note that the reverse rotation operation described below is implemented when a reverse rotation command occurs during the interval between input signal Inv S receipt and the impact stop object.

- The speed is temporarily decreased down to 0 Hz. After that, impact stop frequency reverse rotation running operation is started with an impact stop frequency F383 and an impact stop torque limit F384.
- After reverse rotation running operation is started, the operation is the same as that described in Note 3, above.



6.15 Torque limit

6.15.1 Torque limit switching

F441 : Power running torque limit 1 level

F443 : Regenerative braking torque limit 1 level

F444 : Power running torque limit 2 level

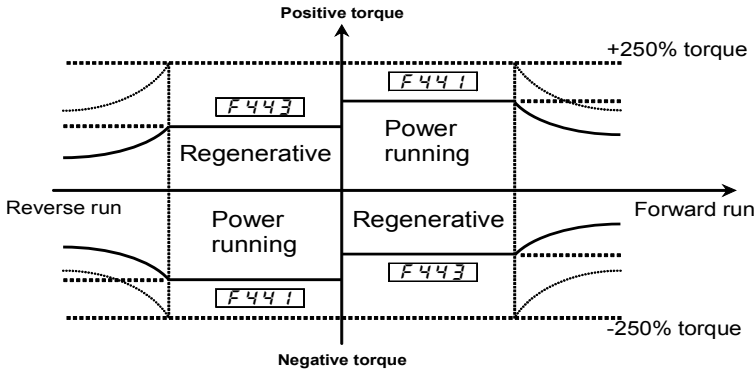
F445 : Regenerative braking torque limit 2 level

- **Function**

  This function is to decrease or increase the output frequency according to the loading condition when the motor torque reaches the limit level.

■ Setting methods

When setting limits to torque. (Torque limits can also be set with an external control device)



Note : Some what weak magnetic field is a constant motor output is limited.
Generation torque is reduced in accordance with the weak ratio of magnetic flux.

Torque limits can be set with the parameters F441, F443, F444 and F445.

[Setting of power running torque]

F441 (Power running torque limit 1) : Set a desirable torque limit level.

F444 (Power running torque limit 2) : Set a desirable torque limit level.

[Setting of regenerative torque]

F443 (Regenerative braking torque limit 1) : Set a desirable torque limit level.

F445 (Regenerative braking torque limit 2) : Set a desirable torque limit level.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F441	Power running torque limit 1 level	0.0-250.0 (%)	150.0%
F443	Regenerative braking torque limit 1 level	0.0-250.0 (%)	150.0%
F444	Power running torque limit 2 level	0.0-250.0 (%)	150.0%
F445	Regenerative braking torque limit 2 level	0.0-250.0 (%)	150.0%
F454	Factory specific coefficient	-	0

☆ The torque limit 1 and 2 can be switched by input terminal function "Torque limit switching signal 32 (reverse signal is 33).

Note 1: Be sure to set the torque limit level default setting value or less. Using with above default setting cause gear damage.

Note 2: If the value set with F601 (stall prevention level) is smaller than the torque limit, then the value set with F601 acts as the torque limit.

6.16 Control gain adjustment function

6.16.1 Speed control gain adjustment

F458 : Current control proportional gain
F459 : Load inertia moment coefficient
F460 : Speed loop proportional gain
F461 : Speed loop stabilization coefficient
F462 : Speed control filter rate
F930 : Position loop gain

・**Function**
This function can suppress vibration and adjust speed response optimally for the inertia of the load.

[Parameter Settings]

Title	Function	Adjustment range	Default setting
F458	Current control proportional gain	0.0-100	80
F459	Load inertia moment coefficient	0.1-100	0.1kW model : 1.8 0.2kW model : 1.2 0.4kW model : 1.4 0.75kW model : 1.1 1.5kW model : 2.0 2.2kW model : 1.9
F460	Speed loop proportional gain	0.0-25.0	0.1kW model : 3.0 0.2k to 2.2kW model : 3.5
F461	Speed loop stabilization coefficient	0.5-2.50	1.00
F462	Speed control filter rate	0.0-100	75
F930	Position loop gain	1-250	100

☆ The default setting values of these parameters are optimized for our IPM gear motors. Because of this, it is recommended that they basically be used as they are without modification.
However, if the motor exhibits such symptoms as hunting, when performing actual no-load and load running, buzzing, gear rattling or other abnormalities, adjusting these gains can result in improvement.

1. Adjust load inertia moment coefficient F459
If the correct value for a machine's inertia moment is unknown, adjust as described below.
If the machine inertia moment arrived at by motor axis calculation is extremely small, lower the setting, using a value that is one half the F459 default setting as the lower limit. If that does not improve conditions, try increasing F461.
If the machine inertia moment arrived at by motor axis calculation is extremely large, increasing F459 can produce stable response without overshooting the speed.

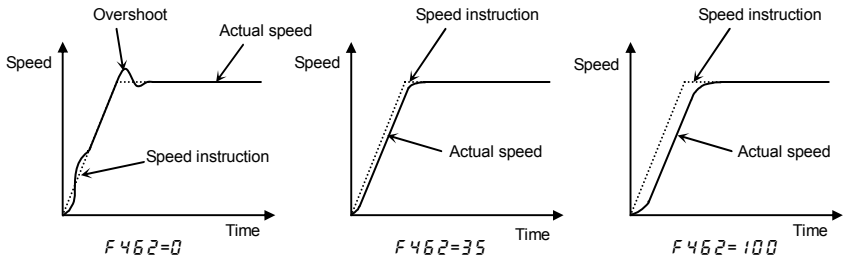
If the correct value for a machine's inertia moment is unknown, adjust as described below.
If the machine inertia moment arrived at by motor axis calculation is α times that of inertia moment A of the IPM gear motor itself, set F459 to the value produced by the calculation below.
F459 = (A + A × α) / B

Refer to the table on the next page for the values of A and B.
If the hunting and other symptoms are not improved after performing the above adjustments, try increasing F461 or decreasing F460.

Motor Capacity	Value of A (Inertia moment of IPM gear motor itself)	Value of B (kgm^2)
0.1 kW	Values depend on the motor type (with or without brake, etc.) For details, refer to the GTR-ECO Series catalog.	4.32×10^{-4}
0.2 kW		7.90×10^{-4}
0.4 kW		11.9×10^{-4}
0.75 kW		27.3×10^{-4}
1.5 kW		40.0×10^{-4}
2.2 kW		60.0×10^{-4}

2. Adjust F460 (speed loop proportional gain)
When a stable state without hunting or other symptoms is attained by adjusting load inertia moment coefficient F459, you can increase the size of F460 (speed loop proportional gain) when you need to improve speed response. Note that too much of an increase may cause vibration. When making adjustments, use 8.5 as an upper limit.

3. Adjust speed Control Filter Rate (F462)
The speed control filter rate parameter has the effect of limiting sudden acceleration when accelerating or decelerating.
In the case of accelerating or decelerating machines with large load inertia in particular, a change in acceleration at the point that acceleration is complete or at the point of stopping when deceleration can generate speed overshooting.
The figures shown below illustrated the relationship between speed instructions when accelerating and F462.
The F462 is set to 75 at the default setting. If you feel that acceleration is too sluggish, lower the setting, using a lower limit of around 35.



If the above method does not produce the desired results, you will need to adjust F458 (current control proportional gain). Though F458 is a parameter that adjusts torque response, response can be improved by increasing its value.
This parameter is effective for suppressing hunting and other phenomena that occur when response is fast. Use a setting of 80 (the default setting) as a reference and check for the occurrence of unwanted phenomena.
If this does not produce the desired result, it means that another factor is the problem. Contact us for more information.

4. Adjust F930 (Position loop gain)
You can adjust F930 upwards when you want to increase response verses load change during servo lock (axis lock control). Though you can also increase response by raising F460, doing so can cause vibration, so F460 should be adjusted using an upper limit of around 5.

6.17 2nd acceleration/deceleration

6.17.1 Switching acceleration/deceleration time 1 & 2

F500 :Acceleration time 2

F501 :Deceleration time 2

F505 : Acceleration/deceleration 1 and 2 switching frequency

- Function
  Acceleration and deceleration times can be set individually. Select from the following two methods for selecting and switching.
  1) Switching by frequency
  2) Switching by terminal

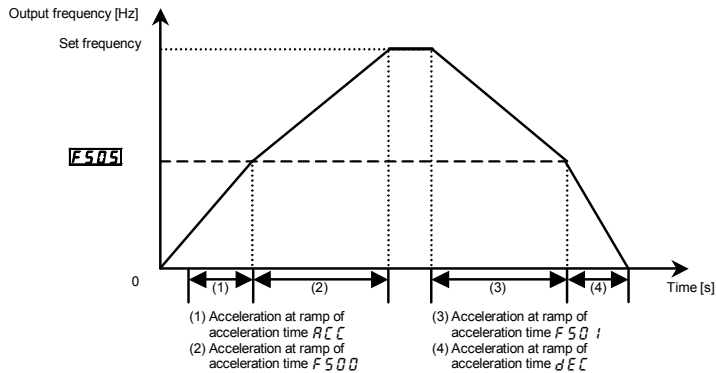
[Parameter setting]

Title	Function	Adjustment range	Default setting
F500	Acceleration time 2	0.0 - 3000 (s)	10.0
F501	Deceleration time 2	0.0 - 3000 (s)	10.0

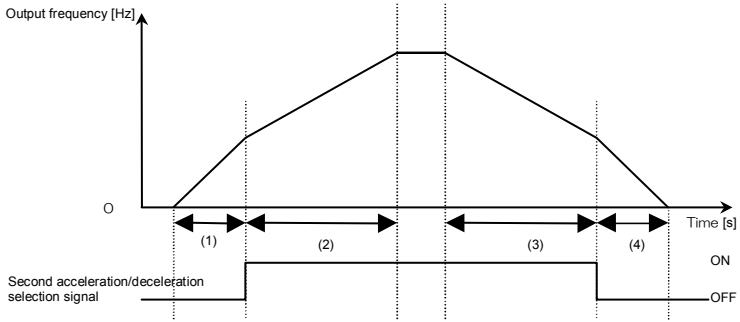
1) Switching according to frequency (automatically switching from the set frequency to the acceleration/deceleration time)

[Parameter setting]

Title	Function	Adjustment range	Default setting
F505	Acceleration/deceleration 1 and 2 switching frequency	0.0 (disabled), 0.1-UL	0.0



2) Switching according to terminal (switching acceleration/deceleration time by external terminal)



6

■ Parameter configuration method

a) Method of operation from terminal input
Set run operation selection CMOd to 0 (terminal block).

b) Set the second acceleration/deceleration switching to any input terminal.
The following shows an example of setting to input terminal S2.

Title	Function	Adjustment range	Setting
F114	Input terminal selection 4A (S2)	0 - 201	24: AD2 (2nd acceleration/deceleration)

Setting value 25 is reverse signal.

Note : When the switching by the frequency is selected, the switching by the terminal does not work.
When using the switching by the terminal, set to F505=0.0.

6.17.2 Acceleration/deceleration pattern setting

F502 :Acceleration/deceleration 1 pattern

F503 :Acceleration/deceleration 2 pattern

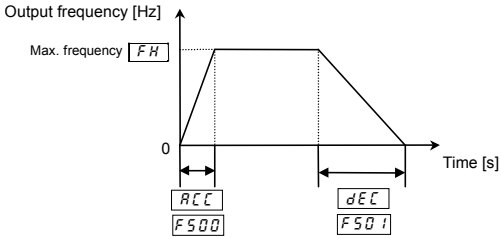
- Function
  Select a acceleration and deceleration pattern appropriate for the application.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F502	Acceleration/deceleration 1 pattern	0: Linear 1: S-pattern 1 2: S-pattern 2	0
F503	Acceleration/deceleration 2 pattern		0

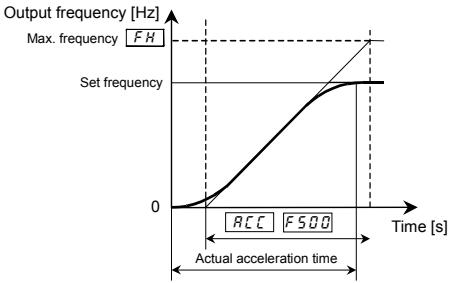
1) Linear acceleration/deceleration

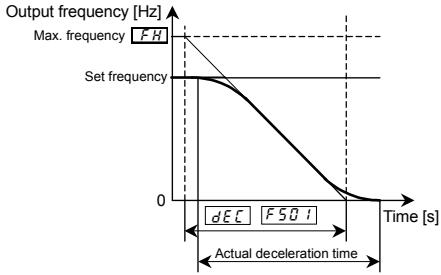
Normal acceleration/deceleration pattern.
Normally, this setting can be used.



2) S-pattern acceleration/deceleration 1

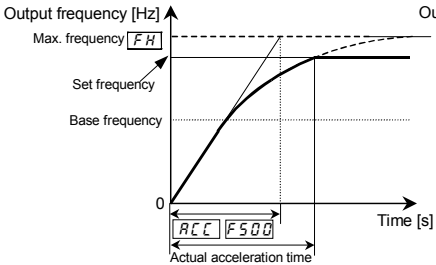
Used when necessary to accelerate or decelerate in a short period of time up to a high-speed area over 60 Hz, and to moderate shock at acceleration. Perfect for conveyance machinery.

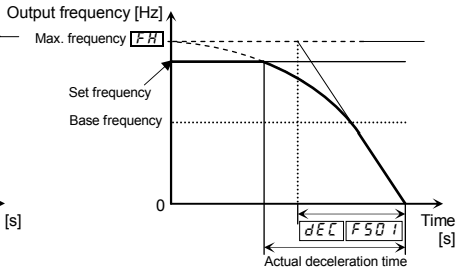




3) S-pattern acceleration/deceleration 2

Motor acceleration torque increases slowly in areas with a small weak magnetic field.





6.18 Protection functions

6.18.1 Setting motor electronic thermal protection

[tHr]: Motor electronic-thermal protection level 1

[F607]: Motor 150% overload detection time

[F632]: Electronic-thermal memory

- Function
  This parameter allows selection of the appropriate electronic thermal protection characteristics according to the particular rating and characteristics of the motor.

[Parameter setting]

Title	Function	Adjustment range	Default setting
tHr	Motor electronic-thermal protection level 1	10-100 (%) / (A)	0.1kW model : 64 0.2kW model : 61 0.4kW model : 73 0.75kW model : 80 1.5kW model : 82 2.2kW model : 82
F607	Motor 150% overload detection time	10-2400 (s)	60
F632	Electrical-thermal memory	0: Disabled, 1: Enabled	0

Refer to section 3.4 for details.

Note 1: Motor electronic-thermal protection level 1 is set to the default setting by each motor. Please consult us if the protection level changes to suppress motor trouble.

6.18.2 Setting of stall prevention level

[F601]: Stall prevention level 1

Caution	
Prohibited	• Do not set the stall prevention level (F601) extremely low. If the stall prevention level parameter (F601) is set at or below the no-load current of the motor, the stall preventive function will be always active and increase the frequency when it judges that regenerative braking is taking place. Do not set the stall prevention level parameter (F601) below 30% under normal use conditions.

- Function
  This parameter adjusts the output frequency by activating a current stall prevention function against a current exceeding the F601-specified level.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F601	Stall prevention level 1	10-199 (%) / (A), 200: Disabled	150

☆ The unit of monitor display can changed by F701. (Refer to section 6.20.2)

[Display during operation of the stall prevention]

During an OC alarm status, (that is , when there is a current flow in excess of the stall prevention level), the output frequency changes. At the same time, to the left of this value, "C" is displayed flashing on and off.

Example of display

C 50

Note 2: The 100% standard value is the rated output current indicated on the nameplate.

6.18.3 Inverter trip retention

F602: Inverter trip retention selection

- Function
  If the inverter trips, this parameter will retain the corresponding trip information. Trip information that has thus been stored into memory can be displayed, even after power has been reset.

[Parameter setting]

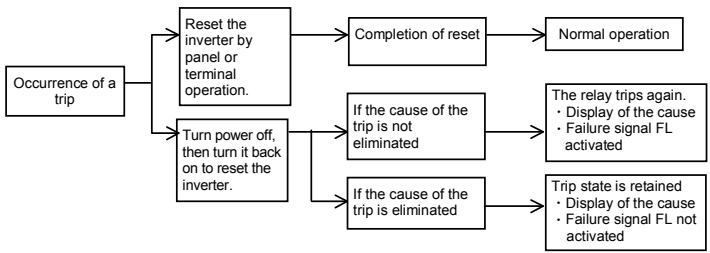
Title	Function	Adjustment range	Default setting
F602	Inverter trip retention selection	0: Cleared with power off 1: Retained with power off	0

★ The causes of up to four trips that occurred in the past can be displayed in status monitor mode. (Refer to section 8.3)

★ Data displayed in status monitor mode when the inverter is tripped is cleared when power is turned off. Check the details monitor for the history of past trips. (Refer to section 8.2.2)

★ Trip records are retained even if power is turned off and turned back on during retry operation.

■ Flow of operation when F602=1



6.18.4 Emergency stop

F603: Emergency stop selection

- Function
  Set the stop method for an emergency. When operation stops, a trip occurs (E displays) and failure signal FL operates.

1) Emergency stop from terminal

Emergency stop occurs at contact a or b. Follow the procedure below to assign a function to an input terminal and select a stop method.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F603	Emergency stop selection	0: Coast stop 1: Slowdown stop 2: -	0

Setting example) When assigning the emergency stop function to S2 terminal

Title	Function	Adjustment range	Setting
F114	Input terminal selection 4A (S2)	0 - 201	20: EXT (Emergency stop by external signal)

Setting value 21 is reverse signal.

Note 1) Emergency stopping via the specified terminal is possible, even during panel operation.

2) Emergency stopping from the operation panel

Emergency stopping from the operation panel is possible
by pressing the STOP key on the panel twice while the inverter is not in the panel control mode.

(1) Press the STOP key ..... "EOFF" will blink.

(2) Press the STOP key once again..... Operation will come to a trip stop in accordance with the setting of the F603 parameter.
After this, "E" will be displayed and a failure detection signal generated (FL relay deactivated).

Note: While an emergency stop signal is input at a terminal, the trip cannot be reset. Clear the signal and then reset the trip.

6.18.5 Output phase failure detection

F605: Output phase failure detection selection

- Function
  This parameter detects inverter output phase failure. If the phase failure status persists for one second or more, the tripping function and the FL relay will be activated. At the same time, a trip information EPH0 will also be displayed.

F605=0: No tripping (FL relay deactivated).
F605=1: With the power on, the phase failure detection is enabled only at the start of the first operation. The inverter will trip if the Phase failure status persists for one second or more.
F605=2: The inverter checks for output phase failures each time it starts operation. The inverter will trip if the Phase failure status persists for one second or more.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F605	Output phase failure detection selection	0: Disabled 1: At start-up (only one time after power on) 2: At start-up (each time)	0

Note 1: The rotor may move when the inverter output phase failure detection, if set this detect parameter 1 or 2. Please note the rotor does not move when the inverter is started.

6.18.6 Input phase failure detection

F608: Input phase failure detection selection

- Function
  This parameter detects inverter input Phase failure. If the abnormal voltage status of main circuit capacitor persists for few minutes or more, the tripping function and the FL relay will be activated. Trip display is EPH1. Detection may not be possible when operating with a light load, or when the motor capacity is smaller than the inverter capacity.
  If the power capacity is larger than the inverter capacity (more than 200kVA or more than 10 times), detection errors may occur. If this actually happens, install an AC or DC reactor .

F608=0: No tripping (Failure signal FL not activated)
F608=1: Phase failure detection is enabled during operation. The inverter will trip if the abnormal voltage status of main circuit capacitor persists for few minutes or more. (Failure signal FL activated)

[Parameter setting]

Title	Function	Adjustment range	Default setting
F608	Input phase failure detection selection	0: Disabled, 1: Enabled	1

6

Note1: Setting F608 to 0 (input phase failure detection: disabled) may result in a breakage of the capacitor in the inverter main circuit if operation is continued under a heavy load in spite of the occurrence of an input phase failure.
Note2: When operating the inverter with DC input, set F608=0: (none).

6.18.7 Control mode for small current

F609: Small current detection hysteresis
F610: Small current trip/alarm selection
F611: Small current detection current
F612: Small current detection time

- Function
  If the output current falls below the value set at F611 and doesn't return above F611+F609 for a time that exceeds the value set at F612, tripping or output alarm will be activated.
  UC is displayed in the event of a trip.

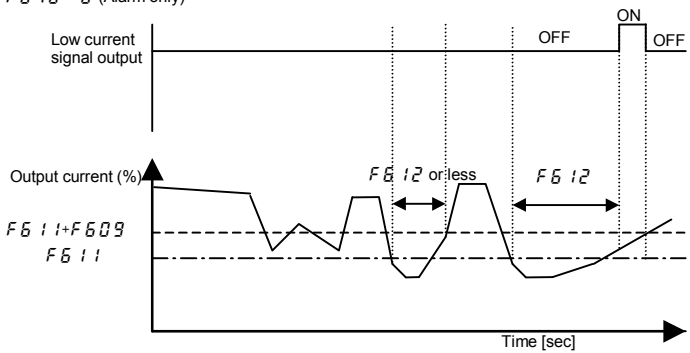
F610=0: No tripping (Failure signal FL not activated).
A small current alarm can be put out by setting the output terminal function selection parameter.
F610=1: The inverter will trip (Failure signal FL activated) if a current below the current set with F611 flows for the period of time specified with F612.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F609	Small current detection hysteresis	1-20 (%)	10
F610	Small current trip/alarm selection	0: Alarm only 1: Tripping	0
F611	Small current detection current	0-150 (%) / (A)	0
F612	Small current detection time	0-255 (s)	0

<Example of operation>
Output terminal function: 26 (UC) Low current detection

F610 = 0 (Alarm only)



* When setting F610 to 1 (Trip), trip after low current detection time setting of F612. After tripping, the low current signal remains ON.

6.18.8 Detection of output short-circuit

F613: Detection of output short-circuit at start-up

- Function
  This parameter detects inverter output short-circuit. It can be usually detected in the length of the standard pulse. When operating low-impedance motor such as high-speed motor, however, select the short-time pulse.

F613=0: Detection is executed in the length of the standard pulse every time you start up the inverter.
F613=1: Detection is executed in the length of standard pulse only during the first start-up after putting on the power or after resetting.
F613=2: Detection is executed with the short-time pulse every time you start up the inverter.

F613=3: Detection is executed with the short-time pulse only for the first time after putting power on or after resetting.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F613	Detection of output short-circuit at start-up	0: Each time (standard pulse) 1: Only one time after power on (standard pulse) 2: Each time (short pulse) 3: Only one time after power on (short pulse)	0

6.18.9 Over-torque trip

F615: Over-torque trip/alarm selection

F616: Over-torque detection level

F618: Over-torque detection time

F619: Over-torque detection hysteresis

- Function
  If the torque value exceeds the value set at F616 and doesn't return below F616-F619 for a time that exceeds the value set at F618, tripping or output alarm will be activated.
  0L is displayed in the event of a trip.

F615=0: ..... No tripping (FL deactivated).
An over-torque alarm can be put out by setting the output terminal function selection parameter.

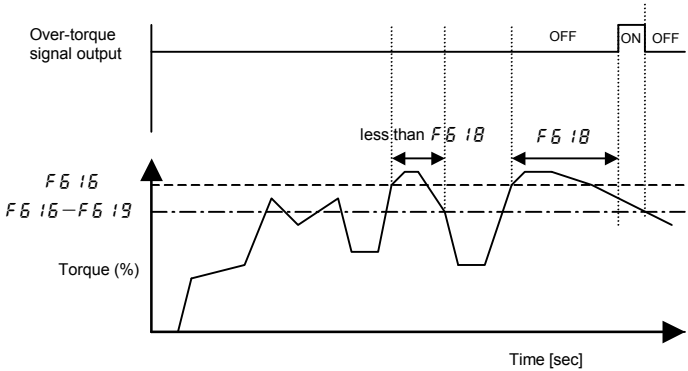
F615=1: ..... The inverter is tripped (FL activated) only after a torque exceeding the F616-specified level has been detected for more than the F618-specified time.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F615	Over-torque trip/alarm selection	0: Alarm only 1: Tripping	0
F616	Over-torque detection level	0 (disabled), 1-200(%)	200
F618	Over-torque detection time	0.0-10.0 (s) Note 1	0.5
F619	Over-torque detection hysteresis	0-100 (%) Note 2	10

Note 1: The 100% standard value is the rated torque of the motor indicated on the nameplate.
Note 2: F618 = 0.0 seconds is the shortest time detected on control.

<Example of operation>
1) Output terminal function: 28 (OT) Over-torque detection
F615=0 (Alarm only)



6

When F615 = 1 (tripping), the inverter will trip if over-torque lasts for the period of time set with F618. In such a case, the over-torque signal remains ON.

6.18.10 Cooling fan control selection

F620: Cooling fan ON/OFF control

- Function
  Set to operate the fan only when the ambient temperature is high during operation. When the inverter is on, the service life of the cooling fan is longer than if it is always running.

F620=0: Cooling fan automatically controlled. Cooling fan operates only when the ambient temperature is high during operation.
F620=1: Cooling fan not automatically controlled. Fan is always running when the inverter is on.

★ If the ambient temperature is high, even when the inverter is stopped, the cooling fan automatically operates.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F620	Cooling fan ON/OFF control	0: ON/OFF control 1: Always ON	0

6.18.11 Cumulative operation time alarm setting

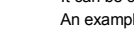
F621: Cumulative operation time alarm setting

- Function
  This parameter allows you to set the inverter so that it will put out an alarm signal after a lapse of the cumulative operation time set with F621.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F621	Cumulative operation time alarm setting	0.0-999.0	610.0

★ "0.1" displayed on the monitor refers to 10 hours, and therefore "1" denotes 100 hours.
Ex.: 38.5 displayed on the monitor = 3850 (hours)

★ Monitor display of cumulative operation time alarm.
It can be confirmed in parts replacement alarm information of status monitor mode.
An example of display: 

★ Signal output of cumulative operation time alarm
Assign the cumulative operation time alarm function to any output terminal.

Setup example) When assigning the cumulative operation alarm signal output function to the OUT terminal

Title	Function	Adjustment range	Setting
F130	Output terminal selection 1A (OUT)	0-255	56: COT (Cumulative operation time alarm)

Setting value 57 is reverse signal.
Note: Braking release signal "68" is set to the output terminal OUT in default setting.

6.18.12 Undervoltage trip

F627: Undervoltage trip/alarm selection

- Function
  This parameter is used for selecting the control mode when an undervoltage is detected. Trip information is displayed as "UP 1".

F627=0: The inverter is stopped. However, it is not tripped (Failure signal FL not activated).
The inverter is stopped when the voltage does not exceed 64 % or less of its rating.

F627= 1: Inverter is stopped. It is also tripped (Failure signal FL activated), only after detection of a voltage not exceeding 64% or less of its rating.

F627=2: Inverter is stopped. However, it is not tripped (Failure signal FL not activated). The inverter stop (Failure signal FL not activated.), only after detection of a voltage not exceeding 50% of its rating. Be sure to connect the input AC reactor.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F627	Undervoltage trip/alarm selection	0: Alarm only (detection level 64% or less) 1: Tripping (detection level 64% or less) 2: Alarm only (detection level 50% or less, input AC reactor required)	0

6.18.13 VI analog input break detection

F633: VI analog input break detection level

- Function
  The inverter will trip if the VI value remains below the specified value for about 0.3 seconds. In such a case, "E-18" is displayed.

F633=0: Disabled....Not detected.
F633=1-100....The inverter will trip if the VI input remains below the specified value for about 0.3 seconds.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F633	VI analog input break detection level	0: Disabled 1-100%	0

Note : The VI input value may be judged earlier to be abnormal, depending on the degree of deviation of the analog data detected.

6.18.14 Parts replacement alarms

F634: Annual average ambient temperature (parts replacement alarms)

- Function
  You can set the inverter so that it will calculate the remaining useful lives of the cooling fan, main circuit capacitor and on-board capacitor from the ON time of the inverter, the operating time of the motor, the output current (load factor) and the setting of F634, and that it will display and send out an alarm through output terminals when each component is approaching the time of replacement.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F634	Annual average ambient temperature (parts replacement alarms)	1: -10 to +10°C 2: 11-20°C 3: 21-30°C 4: 31-40°C 5: 41-50°C 6: 51-60°C	3

★ Display of part replacement alarm information

Part replacement alarm information (Refer to chapter 8) in the Status monitor mode allows you to check on the time of replacement.

An example of display: 0.0.1.1.1

★ Output of part replacement alarm signal

The parts replacement alarm is assigned to the output terminal.

Setup example) When the parts replacement alarm is assigned to the OUT terminal

Title	Function	Adjustment range	Setting
F130	Output terminal selection 1A (OUT)	0 - 255	128: LTA (Parts replacement alarm)

Setting value 129 is reverse signal.

Note 1: Using F634 enter the annual average temperature around the inverter. Be careful not to enter the annual highest temperature.

Note 2: Set F634 at the time of installation of the inverter, and do not change its setting after the start of use. Changing the setting may cause parts replacement alarm calculation error.

6.18.15 Number of starting alarm

F648: Numbers of starting alarm

- Function
  Counting the number of starting, when it will reach the value of parameter F648 setting, it will be displayed and alarm signal is output.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F648	Numbers of starting alarm	0.0-999.9	100.0

★ This parameter's unit is 10000 (ten thousand) times, thus 1000000 (million) times at the default setting.

★ Display of number of starting alarm information
Number of starting alarm information (Refer to chapter 8) in the Status monitor mode allows you to check on the time of replacement.
An example of display: n1 1,,,,

★ Output of number of starting alarm signal
The number of starting alarm is assigned to the output terminal.

Setup example) When the number of starting alarm is assigned to the OUT terminal

Title	Function	Adjustment range	Setting
F130	Output terminal selection 1A (OUT)	0-255	162: NSA (Number of starting alarm)

Setting value 163 is reverse signal.

6.19 Adjustment parameters

6.19.1 Pulse train output for meters

F669: Logic output/pulse train output selection (OUT)

F676: Pulse train output function selection (OUT)

F677: Maximum numbers of pulse train

- Function
  Pulse trains can be sent out through the OUT output terminals.
  To do so, it is necessary to select a pulse output mode and specify the number of pulses.

Ex.: When operations frequencies (0 to 60Hz) are put out by means of 0 to 600 pulses
FH=60.0, F669=1, F676=0, F677=0.60

[Parameter setting]

Title	Function	Adjustment range	Reference of maximum value of F677	Default setting
F669	Logic output/pulse train output selection (OUT)	0: Logic output 1: Pulse train output	–	0
F676	Pulse train output function selection (OUT)	0: Output frequency 1: Output current 2: Frequency command value 3: Input voltage (DC detection) 4: Output voltage (command value) 5 to11: - 12: Actual output frequency 13: VI input value 14: - 15: Fixed output 1 (Output current: 100% equivalent) 16: Fixed output 2 (Output current: 50% equivalent) 17: Fixed output 3 (Other than the output current) 18: RS485 communication data 19-22: -	FH 185% FH 150% 150% - FH 10 V/20 mA - 185% 185% 100% 100.0% -	0
F677	Maximum numbers of pulse train	0.50-1.60 (kpps)	–	0.80

☆ Digital panel meter for reference
Type: K3MA-F (OMRON)
Connection terminal: OUT-E4, NO-E5

Note 1: When item of F676 reaches "Reference of max. value", the number of pulse train set by F677 are sent to output terminals (OUT)

Note 2: The pulse ON/OFF duty ratio is fixed at 50%.

Note 3: The minimum pulse output rate is 25pps. Keep in mind that no pulses can be put out at any rate smaller than 25pps.

6.19.2 Calibration of analog output

F681: Analog output signal selection

F691: Inclination characteristic of analog output

F692: Analog output bias

- Function
  Output signal from the FM terminal can be switched between 0 to 1mAdc output, 0 to 20mAdc output, and 0 to 10Vdc output with the F681 setting. The standard setting is 0 to 1mAdc output.

* Recommended frequency meter: When using QS-60T (Toshiba Schneider Inverter product), set F681=0 (meter option (0 to 1mA) output).

[Parameter setting]

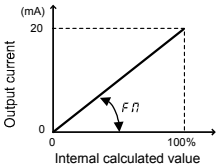
Title	Function	Adjustment range	Default setting
F681	Analog output signal selection	0: Meter option (0 to 1mA) 1: Current (0 to 20mA) output 2: Voltage (0 to 10V) output	0
F691	Inclination characteristic of analog output	0: Negative inclination (downward slope) 1: Positive inclination (upward slope)	1
F692	Analog output bias	-1.0 - +100.0%	0

Note 1: With 0 to 20mAdc (4 to 20mAdc) output, or 0 to 10Vdc output, set F681 to 1 or 2.

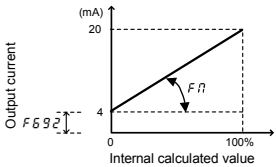
Note 2: When the FM terminal is used for analog output, set the slide switch SW3(FM) to FM side.

■ Example of setting

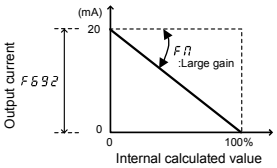
F681=1, F691=1, F692=0(%)



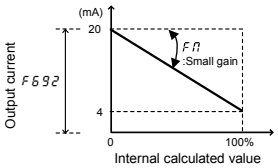
F681=1, F691=1, F692=20(%)



F681=1, F691=0, F692=100(%)



F681=1, 691=0, F692=100(%)



☆ The analog output inclination can be adjusted using the parameter FM.

6.20 Operation panel parameter

6.20.1 Prohibition of key operations and parameter settings

F700: Parameter write protection selection

F730: Panel frequency setting prohibition (FC)

F732: Local/remote operation prohibition for remote keypad

F733: Panel operation prohibition (RUN key)

F734: Prohibition of panel emergency stop operation

F735: Prohibition of panel reset operation

F736: CMOd/FMOd change prohibition during operation

F738: Password setting (F700)

F739: Password examination

- Function
  These parameters allow you to prohibit or allow operation of the RUN and STOP keys on the operation panel and the change of parameters. Using these parameters, you can also prohibit various key operations. Lock parameters with a password to prevent configuration.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F700	Parameter write protection selection	0: Permitted 1: Prohibited (Panel and extension panel) 2: Prohibited (1 + RS485 communication)	0
F730	Panel frequency setting prohibition (FC)	0: Permitted, 1: Prohibited	0
F732	Local/remote operation prohibition for remote keypad	0: Permitted, 1: Prohibited	1
F733	Panel operation prohibition (RUN key)	0: Permitted, 1: Prohibited	0
F734	Prohibition of panel emergency stop operation	0: Permitted, 1: Prohibited	0
F735	Prohibition of panel reset operation	0: Permitted, 1: Prohibited	0
F736	CMOd/FMOd change prohibition during operation	0: Permitted, 1: Prohibited	1
F738	Password setting (F700)	0: Password unset 1-9998 9999: Password set	0
F739	Password examination	0: Password unset 1-9998 9999: Password set	0

☆ Assigning the parameter editing permission (function number 110, 111) to any logic input terminal, parameters can be written regardless of the setting of F700.

Note1: F700=2 will be available after reset operation.

When protection using a password is necessary, set and remove with the following method.

■ Password setup method

Preparation: Parameters other than F700, F738, and F739 cannot be changed when F700 is set to 1 or 2.

(1) When F738 or F739 are read out and the value is 0, a password is not set. A password can be set.
(2) When F738 or F739 are read out and the value is 9999, a password is already set.
(3) If a password is not set, one can be set. Select and register a value between 1 and 9998 for F738. The number becomes the password. It must be entered to remove the password, so do not forget it.
(4) The settings for parameter F700 cannot be changed.

Note2: If you forget the password, it cannot be removed. Do not forget this password as we cannot retrieve it.

Note3: Password cannot be set when parameter F700=0 setting.
Set the password after parameter F700= 1 or 2 setting.

Note4: Reading out password to parameter writer (option) is possible in 5 minutes after setting F738.
Please note that reading out is impossible after elapse of 5 minutes or power off because of protection of password.

■Password examination method

(1) When F738 or F739 are read out and the value is 9999, a password is set. Changing the parameter requires removing the password.
(2) Enter a the number (1 to 9998) registered to F738 when the password was set for F739.
(3) If the password matches, PASS blinks on the display and the password is removed.
(4) If the password is incorrect, FAIL blinks on the display and F739 is displayed again.
(5) When the password is removed, the setting for parameter F700 can be changed.
(6) By setting parameter F700=0, the settings of all parameters can be changed.

Note5: Entry of F739 setting is possible up to 3 times. Please note it is impossible to set, if you set the wrong number over 3 times. Number of times is reset after power off.

When protecting a parameter is necessary with the external logic input terminal, set with the following method.

■Prohibit changing parameter settings with logic input

Set "Parameter editing prohibited" for any input terminal.
Activating the "Parameter editing prohibited" function prevents changes to all parameters.
The following table shows an example of setting input terminal S2.

Title	Function	Adjustment range	Setting
F114	Input terminal selection 4A (S2)	0-201	200: PWP(Parameter editing prohibited)

Setting value 201 is reverse signal.

6.20.2 Changing the unit (A/V) from a percentage of current and voltage

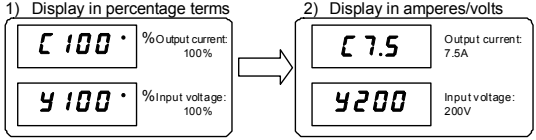
F701 :Current/voltage unit selection

- Function
  These parameters are used to change the unit of monitor display.
  % ⇔ A (ampere)/V (volt)

Current 100% = Rated current of inverter
Input/output voltage 100% = 200Vac

■ Example of setting

During the operation of the VFNC3M-2015P (rated current: 7.5A) at the rated load (100% load), units are displayed as follows:



[Parameter setting]

Title	Function	Adjustment range	Default setting
F701	Current/voltage unit selection	0: % 1: A (ampere) / V (volt)	0

* The F701 converts the following parameter settings:
- A display Current monitor display: Load current, torque current
  Motor electronic-thermal protection level 1 EHr
  Stall prevention level 1 F601
  Small current detection current F611
- V display: Input voltage, output voltage

6.20.3 Displaying the motor or the line speed

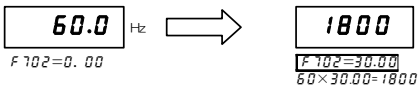
F702: Free unit display scale 1

- Function
  The frequency or any other item displayed on the monitor can be converted freely into the rotational speed of the motor, the operating speed of the load, and so on.

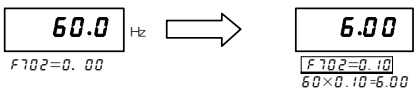
The value obtained by multiplying the displayed frequency by the F702-set value will be displayed as follows:

Value displayed = Monitor-displayed or parameter-set frequency × F702

1) Displaying the motor speed
   To switch the display mode from 60Hz (default setting) to 1800min^{-1} (the rotating speed of the 4P motor)



2) Displaying the speed of the loading unit
   To switch the display mode from 60Hz (default setting) to 6m/min^{-1} (the speed of the conveyer)



Note: This parameter displays the inverter output frequency as the value obtained by multiplying it by a positive number. This does not mean that the actual motor speed or line speed are indicated with accuracy.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F702	Free unit display scale 1	0.00: Disabled (display of frequency) 0.01-200.0	0.00

* The F702 converts the following parameter settings:
  - Free unit Frequency monitor display: Operation frequency command, Operation frequency, PID feedback, Actual output frequency, Operation frequency command at trip
  - Frequency-related parameters: FC, FH, UL, LL, Sr1 to Sr7, F100, F101, F102, F202, F204, F240, F241, F242, F250, F265, F267, F268, F270, F271, F287 to F294, F391, F505, F707

  Note) The unit of the Base frequency 1 (uL) are always Hz.

6.20.4 Changing the steps in which the value increment

F707: Free step (1-step rotation of setting dial)

- Function
  It is possible to change the step width changed at panel frequency setting.
  This function is useful when only running with frequencies of intervals of 1 Hz, 5 Hz, and 10 Hz units.

6

Note 1: The settings of these parameters have no effect when the free unit selection 1 (F702) is enabled.
Note 2: Set F707 to other than 0. When increasing the frequency by rotating the setting dial and if UL (Upper limit frequency) is exceeded by rotating 1 step more, be careful as the H1 alarm displays before this happens and the frequency cannot be increased beyond this point.
Similarly, when rating the settings dial to lower the frequency, if the rotating 1 step more lowers it below LL (lower limit frequency), the L0 alarm displays before this happens and the frequency cannot be lowered beyond this point.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F707	Free step (1-step rotation of setting dial)	0.00: Disabled 0.01-FH (Hz)	0.00

■ Operation example

F707 = 0.00 (disabled)
By rotating the setting dial 1 step, the panel frequency command value changes only 0.1 Hz.
When F707 = 10.00 (Hz) is set
Rotating the setting dial 1 step changes the panel frequency command value in 10.00 Hz increments, from 0.00 up to 60.00 (Hz).

6.20.5 Changing the initial display of the panel

F710: Initial panel display selection

F720: Initial remote keypad display selection

- Function
  This parameter specifies display format while power is ON.

■ Changing the display format while power is ON

When the power is ON, the standard monitor mode displays the operation frequency (default setting) in the format of "0.0" or "OFF". This format can be changed to any other monitor display format by setting F710. This new format, however, will not display an assigned prefix such as b or C. When the power is ON, the display of the extension panel is set at F720.

☆ When the power is ON, the main panel and the extension panel can be set to display differently.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F710	Initial panel display selection	0: Output frequency (Hz/free unit) 1: Output current (%/A) 2: Frequency command value (Hz/free unit) 3 to 17: - 18: Arbitrary code from communication 19 to 33: - 34: Number of starting (10000 times) 35 to 49: - 50: Free unit display scale 2 monitor display 51: Free unit display scale 2 decimal point position 52: Frequency command value / output frequency (Hz/free unit)	0
F720	Initial remote keypad display selection		0

☆ For details on F710 / F720= 18, see the Communications Function Instruction Manual.
Note : If set to F720= 18. The value that changed real time is not displayed.

6.20.6 Changing display of the status monitor

F711 - F716: Status monitor 1 to 6

Change monitor display items in the status monitor mode.
⇒ Refer to chapter 8 for details.

6.20.7 Parameter registration to easy setting mode

F751 - F774: Easy setting mode parameter 1 to 24

Up to 24 arbitrary parameters can be registered to easy setting mode.
⇒ Refer to section 4.4 for details.

6.21 Communication function (RS485)

F800: Baud rate
F801: Parity
F802: Inverter number
F803: Communication time-out time
F804: Communication time-out action
F805: Communication waiting time
F808: Communication time-out detection condition
F829: Selection of communication protocol

F870: Block write data 1
F871: Block write data 2
F875: Block read data 1
F876: Block read data 2
F877: Block read data 3
F878: Block read data 4
F879: Block read data 5

Warning	
Mandatory action	• Set the parameter Communication time-out time (F803) and Communication time-out action (F804). If these are not properly set, the inverter cannot be stopped immediately in breaking communication and this could result in injury and accidents. • An emergency stop device and the interlock that fit with system specifications must be installed. If these are not properly installed, the inverter cannot be stopped immediately and this could result in injury and accidents.

Refer to the Communications Function Instruction Manual (E6581657) for details.

- Function
  2-wire RS485 communication is built-in as standard.
  Connect with the host to create a network for transmitting data between multiple inverters. A computer link function is available.
  <Computer-linking functions>
  The following functions are enabled by data communication between the computer and inverter
  (1) Monitoring inverter status (such as the output frequency, current, and voltage)
  (2) Sending RUN, STOP and other control commands to the inverter
  (3) Reading, editing and writing inverter parameter settings

★ Timer function …Function used to detect cable interruptions during communication. When data is not sent even once to the inverter during a user-defined period of time, an inverter trip (Err5 is displayed on the panel) or an output terminal alarm can be output.

★ Broadcast communication function …Function used to send a command (data write) to multiple inverters with a single communication.

★ Communication protocol …Toshiba inverter protocol and Modbus RTU protocol are supported

☆ 2-wire RS485 communication option is as follows.

(1) USB communication exchange unit (Type: OP-USB001Z)
Cable for communication between the inverter and the unit (Type: OP-CAB0011 (1m), OP-CAB0013 (3m), OP-CAB0015 (5m))
Cable for communication between the unit and computer: Use a commercially available USB 1.1 or 2.0 cables. (Type: A-B, Cable length: 0.25 to 1.5m)

(2) Parameter writer (Type: OP-RKP002Z)
Communication cable (Type: OP-CAB0011 (1m), OP-CAB0013 (3m), OP-CAB0015 (5m))

(3) Extension panel (Type: OP-RKP007Z)
Communication cable (Type: OP-CAB0071 (1m), OP-CAB0073 (3m), OP-CAB0075 (5m))

■ Settings for run/stop via communication

Title	Function	Adjustment range	Standard defaults	Setting example
CMOd	Command mode selection	0 - 2	1 (panel)	2 (RS485 communications)

■ Settings for speed command via communication

Title	Function	Adjustment range	Standard defaults	Setting example
FMOd	Frequency setting mode selection	0 - 5	2 (Setting dial 2)	3 (RS485 communications)

6

■ Communication function parameters (2-wire RS485 communication)
Communication speed, parity, inverter number, and communication error trip time settings can be changed via panel operations or communication.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F800	Baud rate	3: 9600bps 4: 19200bps 5: 38400bps	4
F801	Parity	0: NON (No parity) 1: EVEN (Even parity) 2: ODD (Odd parity)	1
F802	Inverter number	0-247	0
F803	Communication time-out time	0: Disabled (*) 0.1-100.0 (s)	0.0
F804	Communication time-out action	0: Alarm only 1: Trip (Coast stop) 2: Trip (Deceleration stop)	0
F805	Communication waiting time	0.00-2.00	0.00
F808	Communication time-out detection condition	0: Valid at any time 1: Communication selection of FMOd or CMOd 2: 1 + during operation	1
F829	Selection of communication protocol	0: Toshiba inverter protocol 1: ModbusRTU protocol	0

Title	Function	Adjustment range	Default setting
F870	Block write data 1	0: No selection 1: Command information 2: - 3: Frequency command value 4: Output data on the terminal board 5: Analog output for communication	0
F871	Block write data 2		0
F875	Block read data 1	0: No selection 1: Status information 2: Output frequency 3: Output current 4: Output voltage 5: Alarm information 6: PID feedback value 7: Input terminal board monitor 8: Output terminal board monitor 9: VI terminal board monitor	0
F876	Block read data 2		0
F877	Block read data 3		0
F878	Block read data 4		0
F879	Block read data 5		0

* : Disabled..... Indicates that the inverter will not be tripped even if a communication error occurs.
Trip..... The inverter trips when a communication time-over occurs.
In this case a trip information Err5 flashes on and off on the operation panel.
Alarm ..... When a communication time-over occurs, an alarm can be output from the output terminal.
Output terminal function: 78 (RS485 communication error) or 79 (RS485 communication error reverse)

■ Communication function settings

Commands and frequency settings are given priority by communication. (Prioritized by commands from the panel or terminal block.) Thus, command and frequency settings from communication are activated, regardless of the command mode selection (CMOd) or frequency settings mode selection settings (FMOd).

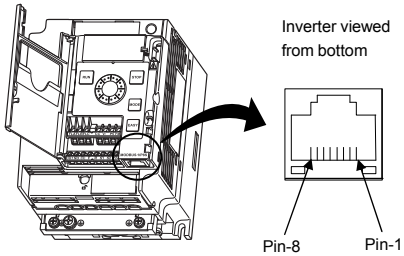
However, setting 48: SCLC (switching from communication to local) with input terminal function selection and when inputting from an external device, it is possible to operate at command mode selection (CMOd) and frequency setting mode selection (FMOd) settings.

Moreover, connecting the optional extension panel and selecting local mode with the LOC/REM key changes to panel frequency/panel operation mode.

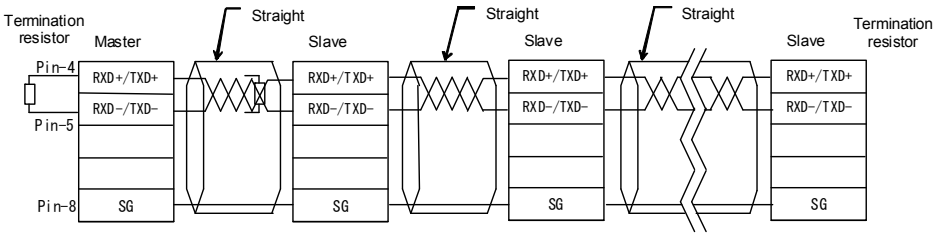
■ Transmission specifications

Item	Specifications
Interface	RS485 compliant
Transmission path configuration	Half duplex [path type (end terminal resistance necessary at both ends of system)]
Wiring	2-wire
Transmission distance	500 m max. (total length)
Connection terminals	32max. (including upper host computer) Inverters connected in the system: 32max.
Synchronization	Asynchronous
Transmission speed	Default: 19200 bps (parameter setting) 9600/19200/38400 bps selectable
Transmission character	ASCII mode … JIS X 0201 8-bit (ASCII) Binary code … Binary code, 8-bit fixed
Stop bit length	INV reception: 1-bit, INV sending: 2-bit
Error detection	Battery Even number/odd number/non Selection (parameter setting), checksum
Error correction	None
Response monitoring	None
Transmission character type	Reception: 11-bit, Sending: 12-bit (when there is parity)
Other	Inverter operation at communication time-over: Select from trip/alarm/none → When alarm is selected, an alarm is output from the output terminal. When trip is selected, Err5 blinks on the panel.

■ Configuration of RS485 connector and wiring



Pin number	Name	Description	RS485 communication
1	-	For factory	Do not connect
2	-		
3	(SG)	Ground	
4	RXD+/TXD+	Same phase reception data	Using
5	RXD-/TXD-	Anti-phase reception data	
6	-	Open	Do not connect
7	P8	Power supply for option	
8	SG	Ground	Using



Termination resistor : 100 to 120Ω-1/4W or more

☆ Connect only Pin-4, 5, 8 when manufacturing on the communication cable on the user side.
Never use pin-7. Note 1)

In case branch cables, use the terminal board or refer to following table.
Full length must be within 500m and stab length of branches must be within 1m each.
Examples of products available on the market (as of October 2010) Note 2)

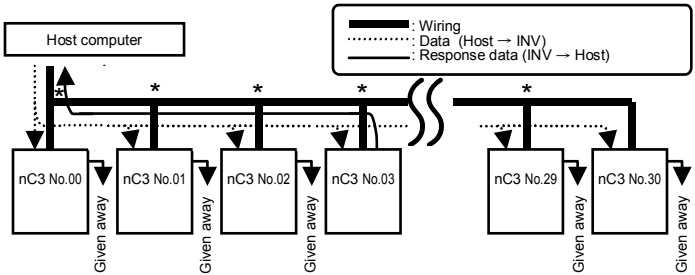
Product	Type	Maker
Jack / jack type branch adaptor	BJ8888W	SANWA DENKI KOGYO CO.,LTD.
Branch connector	BMJ-8	HACHIKO ELECTRIC CO.,LTD.
Branch connector with termination resistor	BMJ-8P	
Rosette (additional 8 units)	OMJ-88R	

Note 1) Pin-7 provides power to the extension panel for option. Do not use this pin for RS485 communication.
Incorrect connect may result in the inverter malfunction or failure.
Note 2) All pins of these connectors are connected. Pull out pins except pin-4, 5, 8 by cable side.

■ Connection example when using the computer link function

<Independent communication>

Perform computer-inverter connection as follows to send operation frequency commands from the host computer to inverter No. 3:



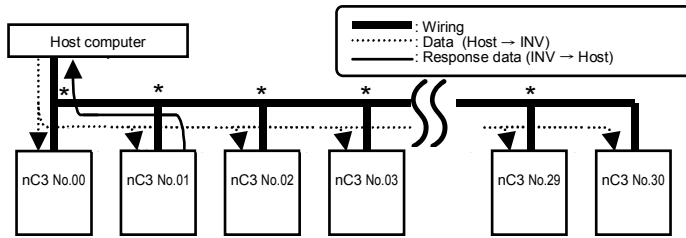
"Given away": Only the inverter with the selected inverter number conducts data processing. All other inverters, even if they have received the data, give it away and stand by to receive the next data.

* : Use the terminal board to branch the cable.

(1) Data is sent from the host computer.
(2) Data from the computer is received at each inverter and the inverter numbers are checked.
(3) The command is decoded and processed only by the inverter with the selected inverter number.
(4) The selected inverter responds by sending the processing results, together with its own inverter number, to the host computer.
(5) As a result, only the selected inverter starts operating in accordance with the operation frequency command by communicating independently.

<Broadcast communication>

When sending an operation frequency command via a broadcast from the host computer



★ : Split the cable among terminal blocks.

(1) Send data from the host computer.
(2) The inverters receive data from the host computer and the inverter number is checked.
(3) When * is next to the position of an inverter number, it is judged a broadcast. The command is decoded and processed.
(4) To prevent data conflicts, only inverters where * is overwritten to 0 can reply with data to the host computer.
(5) As a result, all inverters are operating with the broadcast operation frequency command.

Note: Specify inverter numbers by group for group broadcasts.
(Function only for ASCII mode. For parity mode, see the Communications Function Instruction Manual.)
(Ex) When *1 is set, inverters 01, 11, 21, 31 to 91 can be broadcast to.
In this case, the inverter specified in 01 can reply.

6.22 Free unit display scale 2

6.22.1 Enabling the free unit display scale 2 function

F710: Initial panel display selection

F900: Monitor digit of free unit display scale 2

F901: Machine ratio 1 (denominator)

F902: Machine ratio 2 (denominator)

- Function
  The system movement speed is displayed as a value.

[Parameter setting]

Title	Function	Adjustment range	Default setting
F710	Initial panel display selection	0-52 50: Free unit display scale 2 monitor display 51: Free unit display scale 2 decimal point position	0
F900	Monitor digit of free unit display scale 2	1: Display upper 1 digit 2: Display upper 2 digit 3: Display upper 3 digit 4: Display upper 4 digit	4
F901	Machine ratio 1 (denominator)	1-9999	1
F902	Machine ratio 2 (denominator)	0.1-1800	1.0

☆ The inverter output frequency is converted in accordance with the formula shown below, and the most significant four digits of the result are automatically displayed on the 7-segment LED. Under default settings, the output frequency is calculated using an upper limit frequency (60 Hz for 0.1 K to 0.4 kW models, 90 Hz for 0.75 to 2.2 kW models).

・Monitor calculation formula = (120 * Output Frequency/Number of Motor Pole Pairs) * Machine Ratio 1 (1/F901) * Machine Ratio 2 (1/F902)
・The monitor display range is 0 to 9999.
・Default settings are status monitor 5 (F715) for the monitor display (monitor display function 50), and monitor 6 (F716) for the decimal place position display (monitor display function 51).
☆Since the number of display significant digits is calculated to become the number of digits specified by F900 based on the upper limit frequency, the number of digits specified by F900 may not be displayed at a frequency that is lower than the upper limit frequency. Adjustment can be performed by setting the upper limit frequency to the frequency actually being used + α.
☆"9999" will blink on the display if the output frequency temporarily exceeds the UL frequency and overflows the calculation result.
☆Use Monitor digit of free unit display scale "F900" to limit the number of LED display digits.
Use this setting when you want to avoid flickering of values at the bottom of the display, etc.

Note: The value for Machine ratio 2 (F902) can be input in units of 0.1 within the range of 1 to 999.9. Input is in units of 1.0 within the range of 1000 to 1800.

■Free unit display scale 2 function: reference example
Monitor calculated value: (120 * 60 Hz/4P) * (1/1800) * (1/1000) = 0.001
Monitor display (monitor display function number: 50) setting status monitor: 1000
Decimal point position (monitor display function number: 51) setting status monitor: -6
*Changing the F900 default value from 4 to 3 causes the monitor display to become "100" and the decimal place position display to become "-5".

Monitor calculated value: (120 * 60 Hz/4P) * (1/1) * (1/1.0) = 1800
Monitor display (monitor display function number: 50) setting status monitor: 1800
Decimal point position (monitor display function number: 51) setting status monitor: 0
*Changing the F900 default value from 4 to 3 causes the monitor display to become "180" and the decimal place position display to become "1".

6.23 Free notes

F880: Free notes

- Function
  To enable easier management and maintenance of the inverter, it is possible to enter the identification number.

[Parameter setting]

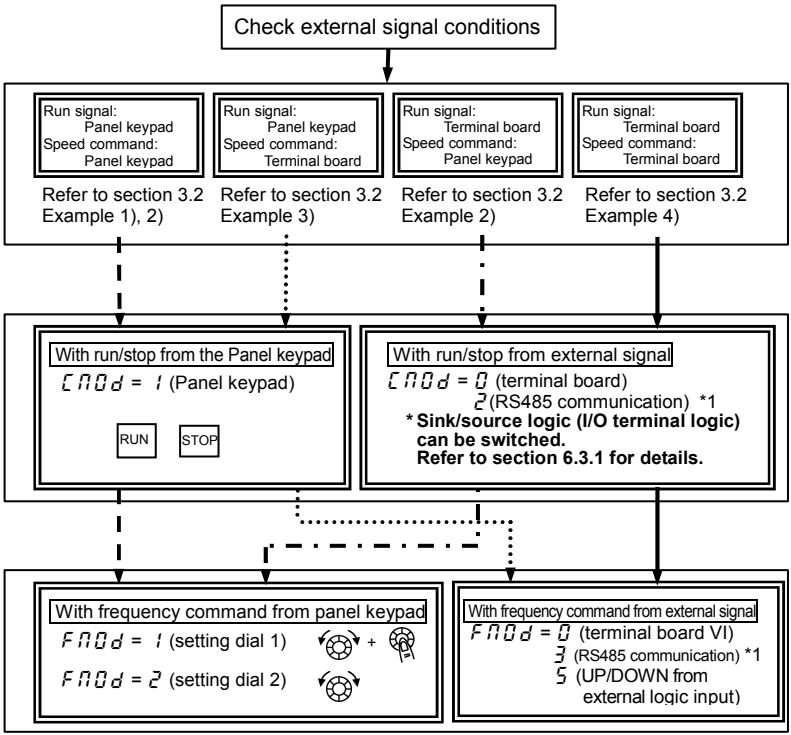
Title	Function	Adjustment range	Default setting
F880	Free notes	0 - 65535	0

7. Operations with external signal

7.1 Operating external signals

You can control the inverter externally.
The parameter settings differ depending upon your method of operation. Determine your method of operation (the operational signal input method, speed command input method) before using the procedure below to set the parameters.

[Procedure for setting parameters]



*1: For settings based on communication, refer to the Communication Manual (E6581657) or section 6.21.

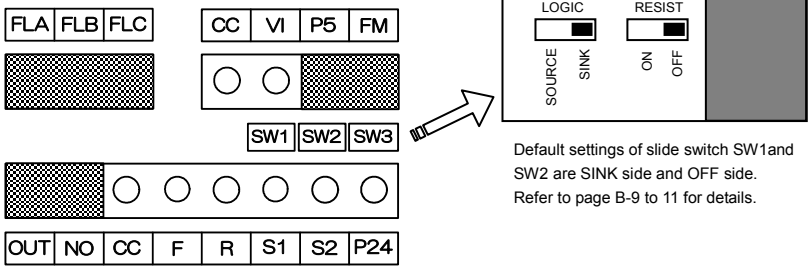
7.2 Applied operations by an I/O signal (operation from the terminal block)

Input terminal sink and source logic are set by slide switch SW1 (LOGIC) and parameter F127 with default setting.

7.2.1 Input terminal function

This function is used to send a signal to the input terminal from an external programmable controller to operate or configure the inverter.
The ability to select from a variety of functions allows for flexible system design.

[Control terminal board]



Default settings of slide switch SW1and SW2 are SINK side and OFF side.
Refer to page B-9 to 11 for details.

7

■ Settings for the logic input terminal function

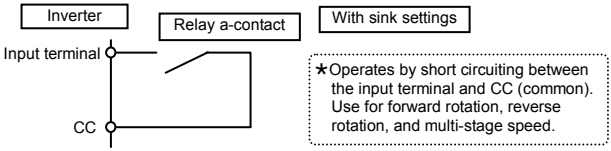
Terminal symbol	Title	Function	Adjustment range	Default setting
F	F111	Input terminal selection 1A (F)	0-201 Note 1)	2 (F)
	F151	Input terminal selection 1B (F)		0 (No function)
	F155	Input terminal selection 1C (F)		0 (No function)
R	F112	Input terminal selection 2A (R)	0-201 Note 1)	4 (R)
	F152	Input terminal selection 2B (R)		0 (No function)
	F156	Input terminal selection 2C (R)		0 (No function)
S1	F113	Input terminal selection 3A (S1)	0-201 Note 1)	10 (SS1)
	F153	Input terminal selection 3B (S1)		0 (No function)
S2	F114	Input terminal selection 4A (S2)	0-201 Note 1)	12 (SS2)
	F154	Input terminal selection 4B (S2)		0 (No function)
VI	F109	Analog/logic input Selection (VI terminal)	0: Voltage signal input (0 - 10 V) 1: Current signal input (4 - 20 mA) 2: Logic input 3: Voltage signal input (0 - 5 V)	0
	F115	Input terminal selection 5 (VI)	8-55 Note 3)	14 (SS3)

Note 1) Multiple functions assigned to a single terminal operate simultaneously.
Note 2) In case of setting always active function, assign the menu number to F104, F108 and F110 (always active function selection).

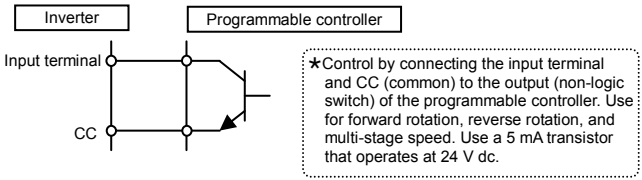
Note 3) When using VI terminal as a logic input terminal, set parameter F 109=2 and set the slide switch SW2 (RESIST) to ON side. Refer to section 2.3.2 (page B-7) and section 11.4 (page K-19, 20) for details.

■ Connecting

1) For logic input a

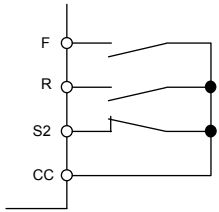


2) For connection (sink logic) via transistor output



■ Usage example 1 ··· 3-wire operation (one-push operation)

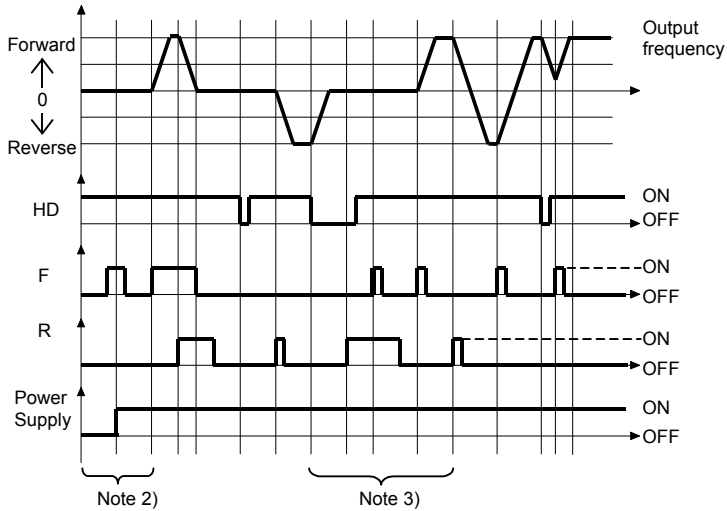
Use the 3-wire operation function to operate the inverter, maintaining operation without using the sequence circuit by inputting an external signal (reset logic signal).



Forward run (F) : Pressing forward run (F) rotates forward at the specified frequency command value.

Reverse run (R) : Pressing reverse run (R) rotates in reverse at the specified frequency command value.

HD (S2): Pressing HD (S2) decelerates and stops.



Note 1) Set F110 = 6 (ST: standby) and CNOd = 0 (terminal board) for 3 wire operation. Assign HD (operation hold) to any input terminal at input terminal selection. When assigning the S2 terminal as shown above, set F114 = 50 (HD: operation hold).

Note 2) If the terminals are ON before turning on the power, terminal input is ignored when the power is turned ON. (Prevents sudden movements.) After turning the power ON, turn terminal input ON again.

Note 3) When HD is OFF, F and R are ignored even when ON. R does not operate even if it's ON when HD is ON. Likewise in this state, F does not operate even if it's ON. Turn F and R OFF and then turn them ON.

Note 4) During 3 wire operation, sending the jog run mode command stops operation.

Note 5) Only F and R maintain HD (operation hold). When using F or R in combination with other functions, be aware that the other functions do not hold. For example, when F and SS1 are assigned, F holds, but SS1 does not.

[Parameter settings]

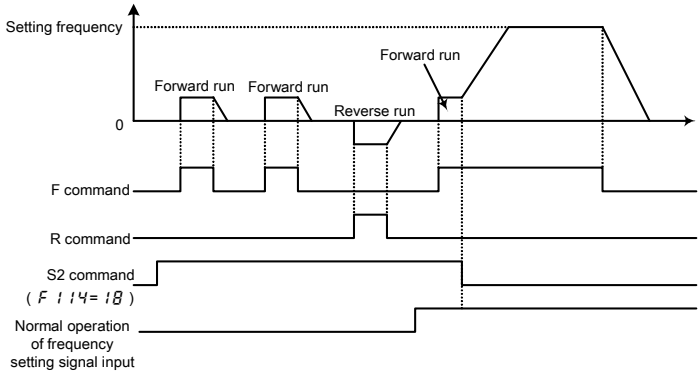
Terminal symbol	Title	Function	Adjustment range	Setting example
S2	F114	Input terminal selection 4A (S2)	0-201	50 (HD operation hold)

■ Usage example 2 ··· Jog run

Jog run is used for inching the motor. When a jog run signal is input, a jog run frequency is immediately output, regardless of the acceleration time set.

Assign the jog run function to any input terminal. For example, when assigned to the S2 terminal, set F114 = 18.

Jog run is done while the jog input terminal (S2 terminal) and either F or R are ON.



- The jog frequency is fixed at 5Hz.
- The stop pattern is slowdown stop.
- The jog run setting terminal is valid when the operation frequency is less than the jog frequency. Jog run does not function when the operation frequency is higher than the jog frequency.
- Even if an operation command is input midway, jog operation is prioritized.
- The jog frequency is not limited by the upper limit frequency (parameter UL).

Note) After the jog frequency decelerates, a coast stop is done. And then it occurs the time cannot be controlled for about 150 ms with initial position estimation time.
Please note the time cannot be this control.

■ List of logic input terminal function settings

Parameter programmed value		Function	Parameter programmed value		Function
Positive logic	Negative logic		Positive logic	Negative logic	
0	1	No function	48	49	Forced local from communication
2	3	Forward run command	50	51	Operation hold (hold of 3-wire operation)
4	5	Reverse run command	52	53	PID integral/differential clear
6	7	Standby	54	55	PID characteristics switching
8	9	Reset command	70	71	Servo lock
10	11	Preset-speed command 1	88	89	Frequency UP *1
12	13	Preset-speed command 2	90	91	Frequency DOWN *1
14	15	Preset-speed command 3	92	93	Clear frequency UP/DOWN *1
16	17	Preset-speed command 4	96	97	Coast stop command
18	19	Jog run mode	106	107	Frequency setting mode terminal board VI
20	21	Emergency stop by external signal	108	109	Command mode terminal board
22	23	Factory specific coefficient	110	111	Parameter editing permission
24	25	2nd acceleration/deceleration	122	123	Forced deceleration command
32	33	Torque limit 1, 2 switching	150	151	Hit and stop control starting signal
36	37	PID control prohibition	200	201	Parameter editing prohibition

*1: Active when FMOd (frequency setting mode selection) = 5 (UP/DOWN from external logic input) is set. The frequency setup range is from 0.0 to UL (upper limit frequency). The acceleration/deceleration time relative to the set frequency is ACCIdEC while the acceleration/deceleration speed is not switched.

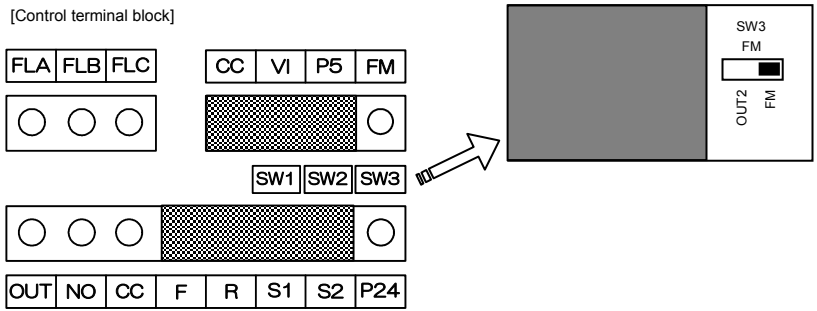
*2: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

☆ Refer to section 11.4 for details about the input terminal function.

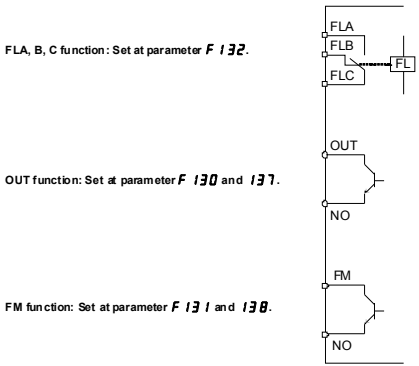
7.2.2 Output terminal function (sink logic)

This function is used to output a variety of signals to external devices from the inverter.
With the logic output terminal function, you can select from multiple output terminal functions. Set two types of functions for the OUT, FM terminal and then you can output when either one or both of them is ON.

[Control terminal block]



■ Usage



Note1) A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measures when connecting it directly with input unit terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected.

■ Assign one type of function to an output terminal

Terminal symbol	Title	Function	Adjustment range	Default setting
OUT	F130	Output terminal selection 1A	0 - 255	68 (Braking release signal)
FM	F131	Output terminal selection 2A		6 (Output frequency attainment signal)
FL (A, B, C)	F132	Output terminal selection 3		10 (Fault signal)

Note 2) When assigning 1 type of function to the OUT terminal, set only F130.
Leave parameter F137 as the standard setting (F137 = 255).
Note 3) When using FM terminal as a logic output terminal, set the slide switch SW3 (FM) to OUT2 side.
When assigning 1 type of function to the FM terminal, set only F131.
Leave parameter F138 as the standard setting (F138 = 255).

■ Assign two types of functions to the output terminal (OUT, FM)

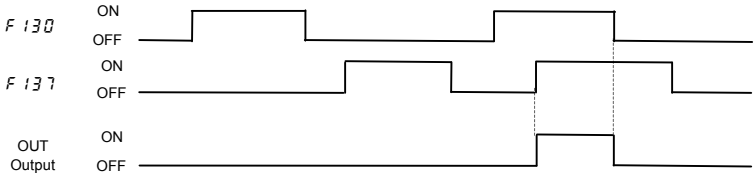
Terminal symbol	Title	Function	Adjustment range	Default setting
OUT	F130	Output terminal selection 1A	0 - 255	68 (Braking release signal)
FM	F131	Output terminal selection 2A		6(Output frequency attainment signal)
OUT	F137	Output terminal selection 1B		255 (Always ON)
FM	F138	Output terminal selection 2B		
OUT, FM	F139	Output terminal logic selection	0: F130 and F137 F131 and F138	0
			1: F130 or F137 F131 and F138	
			2: F130 and F137 F131 or F138	
			3: F130 or F137 F131 or F138	

Note 1) F130 and F137 are active only when F669 = 0: Logic output (default).
Function is inactive when F669 = 1: Pulse train output is set.
Note 2) F131 and F138 are active only when slide switch SW3(FM) is set to OUT2 side.
If it is set to FM side, it does not operate correctly.

(1) Output signals when two types of functions are simultaneously turned ON.

Signals are output when parameter F139 is the default (F139 = 0 or 2), and the functions set at parameters F130 and F137 are simultaneously turned ON.

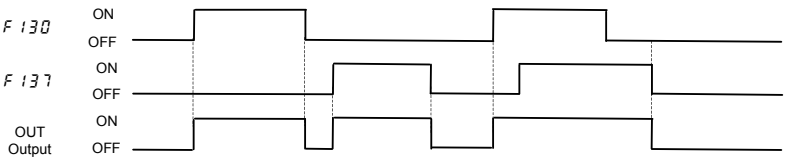
☆ Timing chart



(2) Output signals when either one of two types of functions are simultaneously turned ON.

Signals are output when parameter F139 = 1 or 3, and either of the functions set at parameters F130 and F137 are turned on.

☆ Timing chart



■ List of output terminal function settings

<Explanation of terminology>
• Alarm ..... Alarm output when a setting has been exceeded.
• Pre-alarm ..... Alarm output when the inverter may cause a trip during continued operation.

List of detection levels for output terminal selection

Parameter programmed value		Function	Parameter programmed value		Function
Positive logic	Negative logic		Positive logic	Negative logic	
0	1	Frequency lower limit	40	41	Run/Stop
2	3	Frequency upper limit	56	57	Cumulative operation time alarm
4	5	Low-speed detection signal	60	61	Forward/reverse run
6	7	Output frequency attainment signal (acceleration/deceleration completed)	68	69	Braking release signal
8	9	Set frequency attainment signal	78	79	RS485 communication error
10	11	Fault signal (trip output)	92	93	Designated data output
14	15	Over-current detection pre-alarm	128	129	Parts replacement alarm
16	17	Overload detection pre-alarm	146	147	Fault signal (output also at a ready)
20	21	Overheat detection pre-alarm	162	163	Number of starting alarm
22	23	Overvoltage detection pre-alarm	174	175	Completion of hit and stop control
24	25	Power circuit undervoltage detection	176	177	Servo lock braking signal
26	27	Small current detection	178	179	Servo lock signal
28	29	Over-torque detection	254		Always OFF
30	31	Braking resistor overload pre-alarm	255		Always ON

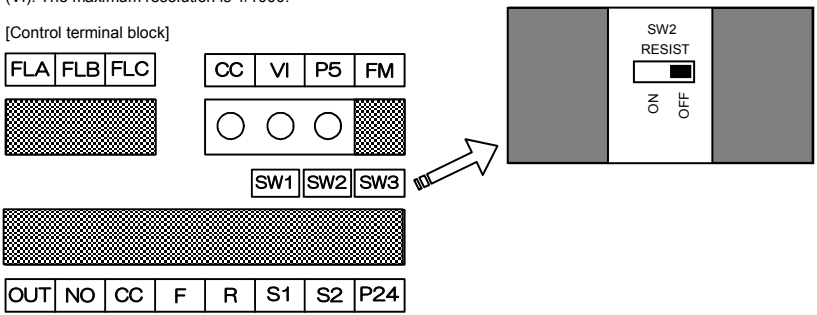
Note 1) ON with positive logic : Open collector output transistor or relay turned ON.
OFF with positive logic : Open collector output transistor or relay turned OFF.
ON with negative logic : Open collector output transistor or relay turned OFF.
OFF with negative logic: Open collector output transistor or relay turned ON.

☆ Refer to section 11.5 for details about the output terminal functions or levels.

7.3 Speed instruction (analog signal) settings from external devices

You can select from voltage input (0 to 10V, 0 to 5V), and current input (4 to 20mA) for an analog input terminal (VI). The maximum resolution is 1/1000.

[Control terminal block]



■ Analog input terminal (VI) function settings

Title	Function	Adjustment range	Default setting
F109	Analog/logic input selection (VI terminal)	0: Voltage signal input (0 - 10V) 1: Current signal input (4 - 20mA) 2: Logic input 3: Voltage signal input (0 - 5V)	0
F201	Setting of VI input point 1	0 - 100%	0
F202	Frequency of VI input point 1	0.0 - 400.0Hz Note3)	0.0
F203	Setting of VI input point 2	0 - 100%	100
F204	Frequency of VI input point 2	0.0 - 400.0Hz Note3)	0.1k to 0.4kW model : 60.0 0.75k to 2.2kW model : 90.0
F209	Analog input filter	4 - 1000 ms Note1)	64

Note1) When stable operation cannot be attained because of frequency setting circuit noise, increase F209.

Note2) Semiconductor switch is used to switch between current input and voltage input.
When power supply is off, it is high impedance between VI-CC terminals in spite of current input selecting.
The break detection might operate when current generator (4-20mA) with the break detection function is used.
Please correspond as following to prevent this problem.
1) Solution by sequence
Power supply is switched off inverter and current generator (PLC etc...) at same time with interlock sequence not to operate break detection function.
2) Solution by external resistor connection
Connect resistor 1/2W-500Ω or 470Ω between VI-CC terminals, and set the following parameter (voltage input setting). F109=0 (Voltage input : Default setting)

Note3) The permission maximum rotary speed of our IPM gear motor is to 2500 rpm.
Set the frequency 2500 rpm or less.
(Inverter maximum frequency: 0.1k to 0.4kW model: 83.4Hz or less, 0.75k to 2.2kW model: 125Hz or less)

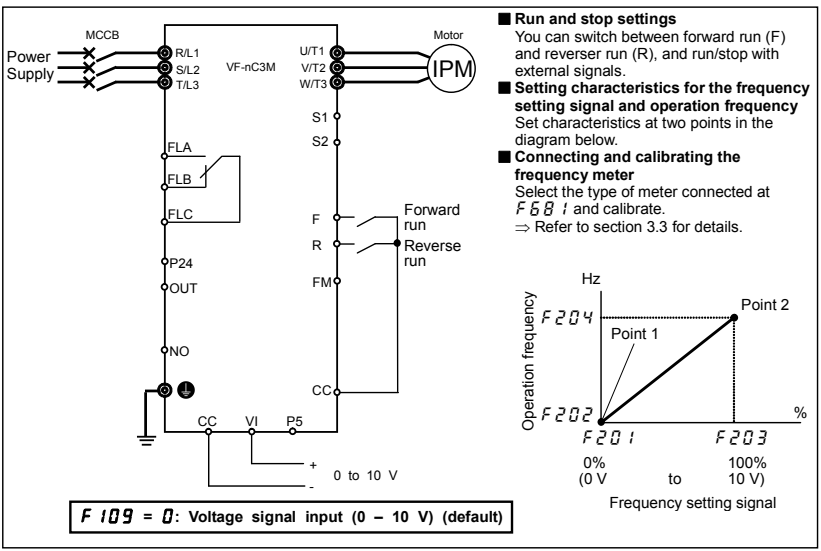
7.3.1 Settings depending on voltage (0 to 10 V) input

You can set the frequency settings by inputting an analog voltage signal of 0 to 10Vdc between the VI and CC terminals.

The following shows examples when the run command is input from the terminal.

Title	Function	Adjustment range	Default setting	Setting example
CMOd	Command mode selection	0 - 2	1 (panel keypad)	0 (terminal board)
FMOd	Frequency setting mode selection	0 - 5	2 (setting dial)	0 (terminal board VI)
F109	Analog/logic input selection (VI terminal)	0: Voltage signal input (0 - 10V) 1: Current signal input (4 - 20mA) 2: Logic input 3: Voltage signal input (0 - 5V)	0	0 (Voltage signal (0 – 10V))
F201	VI input point 1 setting	0 - 100%	0	0
F202	VI input point 1 frequency	0.0 - 400.0Hz	0.0	0.0
F203	VI input point 2 setting	0 - 100%	100	100
F204	VI input point 2 frequency	0.0 - 400.0Hz	0.1k to 0.4kW model : 60.0 0.75k to 2.2kW model : 90.0	0.1k to 0.4kW model : 60.0 0.75k to 2.2kW model : 90.0
F209	Analog input filter	4 - 1000 ms	64	64

7

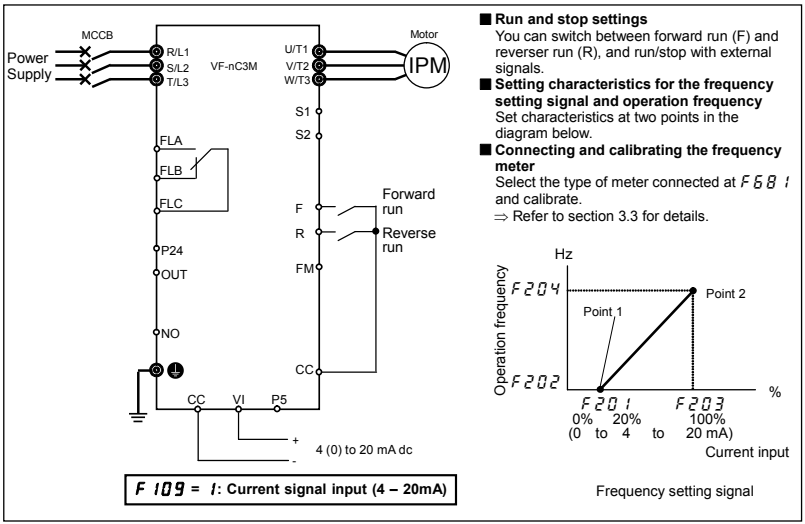


7.3.2 Settings depending on current (4 to 20 mA) input

You can set the frequency settings by inputting an analog current signal of 4 (0) to 20mA dc between the VI and CC terminals.

The following shows examples when the run command is input from the terminal.

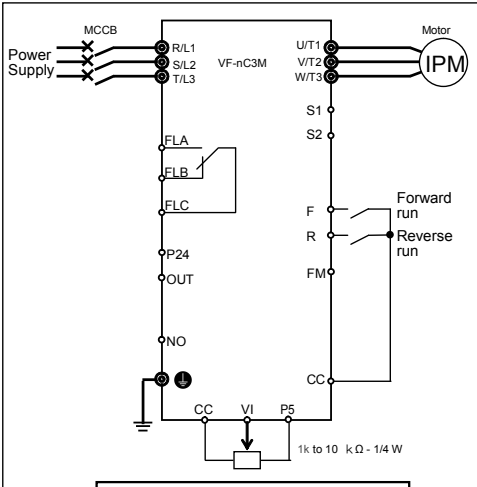
Title	Function	Adjustment range	Default setting	Setting example
CMOd	Command mode selection	0 - 2	1 (panel keypad)	0 (terminal board)
FMOd	Frequency setting mode selection	0 - 5	2 (setting dial)	0 (terminal board VI)
F109	Analog/logic input selection (VI terminal)	0: Voltage signal input (0 - 10V) 1: Current signal input (4 - 20mA) 2: Logic input 3: Voltage signal input (0 – 5V)	0	1 (Current signal (4 – 20mA))
F201	VI input point 1 setting	0 - 100%	0	20(0)
F202	VI input point 1 frequency	0.0 - 400.0Hz	0.0	0.0
F203	VI input point 2 setting	0 - 100%	100	100
F204	VI input point 2 frequency	0.0 - 400.0Hz	0.1k to 0.4kW model : 60.0 0.75k to 2.2kW model : 90.0	0.1k to 0.4kW model : 60.0 0.75k to 2.2kW model : 90.0
F209	Analog input filter	4 - 1000 ms	64	64



7.3.3 Settings depending on voltage (0 to 5 V) input <external potentiometer>

You can set the frequency by connecting a potentiometer (1k to 10kΩ – 1/4W) to the VI terminal.
Connect the potentiometer between the P5, VI, and CC terminals. The standard voltage for the P5 terminal is 5Vdc.
Instead of using the potentiometer, you can set the frequency settings by inputting an analog voltage signal of 0 to 5Vdc between the VI and CC terminals.
The following shows examples when the run command is input from the terminal.

Title	Function	Adjustment range	Default setting	Setting example
CMOd	Command mode selection	0 - 2	1 (panel keypad)	0 (terminal board)
FMOd	Frequency setting mode selection	0 - 5	2 (setting dial)	0 (terminal board VI)
F109	Analog/logic input selection (VI terminal)	0: Voltage signal input (0 - 10V) 1: Current signal input (4 - 20mA) 2: Logic input 3: Voltage signal input (0 - 5V)	0	3 (Voltage signal (0 - 5V))
F201	VI input point 1 setting	0 - 100%	0	0
F202	VI input point 1 frequency	0.0 - 400.0Hz	0.0	0.0
F203	VI input point 2 setting	0 - 100%	100	100
F204	VI input point 2 frequency	0.0 - 400.0Hz	0.1k to 0.4kW model : 60.0 0.75k to 2.2kW model : 90.0	0.1k to 0.4kW model : 60.0 0.75k to 2.2kW model : 90.0
F209	Analog input filter	4 - 1000 ms	64	64

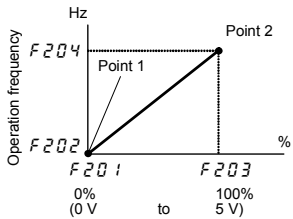


F109 = 3: Voltage signal input (0 – 5V)

■ **Run and stop settings**
You can switch between forward run (F) and reverser run (R), and run/stop with external signals.

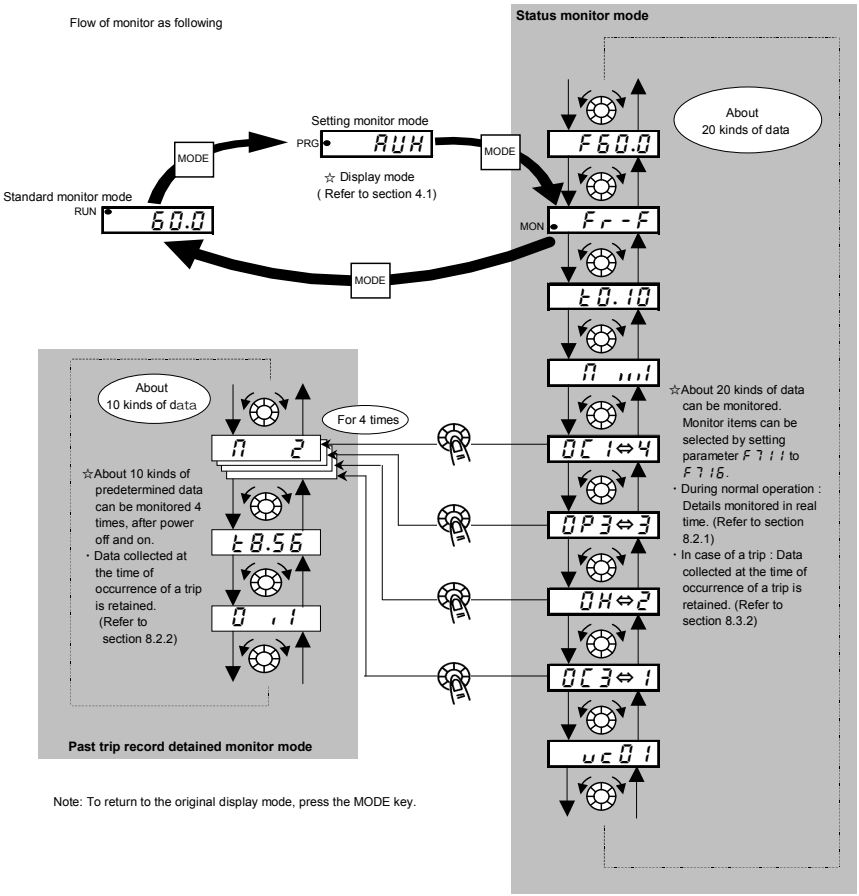
■ **Setting characteristics for the frequency setting signal and operation frequency**
Set characteristics at two points in the diagram below.

■ **Connecting and calibrating the frequency meter**
Select the type of meter connected at F681 and calibrate.
⇒ Refer to section 3.3 for details.



8. Monitoring the operation status

8.1 Flow of status monitor mode



Note: To return to the original display mode, press the MODE key.

8.2 Status monitor mode

8.2.1 Status monitor under normal conditions

In this mode, you can monitor the operation status of the inverter.

To display the operation status during normal operation:

Press the MODE key twice.

Setting procedure (eg. operation at 60Hz)

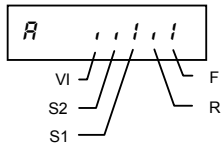
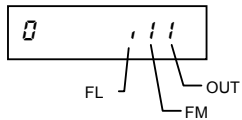
	Item displayed	Panel operated	LED display	Communication No.	Description
	Output frequency *		60.0		The output frequency is displayed (Operation at 60Hz). (When standard monitor display selection F710 is set at 0 [output frequency])
	Parameter setting mode	MODE	AUH		The first basic parameter "AUH" (history function) is displayed.
	Direction of rotation	MODE	Fr-F	FE01	The direction of rotation is displayed. (Fr-F: forward run, Fr-r: reverse run)
	Frequency command value *		F60.0	FE02	The frequency command value (Hz/free unit) is displayed. (In case of F711=2)
	Torque *		9 50	FE18	The inverter output torque (%) is displayed. (In case of F712=7)
Note 2	Output current *		C 80	FE03	The inverter output current (load current) (%/A) is displayed. (In case of F713=1)
Note 3	Input voltage *		Y100	FE04	The inverter input voltage (DC detection) (%/V) is displayed. (In case of F714=3)
	Free unit display scale 2 monitor display		1800	FD38	The calculated result of free unit display scale 2 monitor is displayed. (In case of F715=50)
	Free unit display scale 2 decimal point position		d001	FD39	The decimal point position of the calculated result of free unit display scale 2 monitor is displayed. (In case of F716=51)

(Continued overleaf)

* Monitor items can be selected by setting parameters F710 to F716, (F720). Refer to Note 11.

Refer to page H-8, 9 for Note 1 to 11.

(Continued)

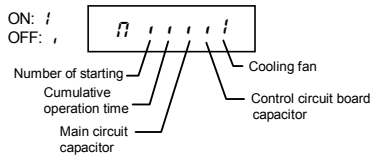
	Item displayed	Panel operated	LED display	Communication No.	Description
Note 4	Input terminal		A ,,1,1	FE06	The ON/OFF status of each of the control signal input terminals (F, R, S1, S2, VI) is displayed in bits. ON: 1 OFF: , 
Note 5	Output terminal		0 ,11	FE07	The ON/OFF status of each of the control signal output terminals (OUT, FM and FL) is displayed in bits. ON: 1 OFF: , 
	Logic input terminals setting		L-S1	FD31	Logic setting by F127 is displayed. L-S1: Sink logic (In case of F127=0) L-49: Sink logic (In case of F127=200) L-S0: Source logic
	CPU1 version		u101	FE08	The version of the CPU1 is displayed.
	CPU2 version		uc01	FE73	The version of the CPU2 is displayed.
Note 6	Past trip 1		OC3⇔1	FE10	Past trip 1 (displayed alternately)
Note 6	Past trip 2		OH⇔2	FE11	Past trip 2 (displayed alternately)
Note 6	Past trip 3		OP3⇔3	FE12	Past trip 3 (displayed alternately)
Note 6	Past trip 4		nErr⇔4	FE13	Past trip 4 (displayed alternately)

(Continued overleaf)

Refer to page H-8, 9 for Note 1 to 11.

8

(Continued)

	Item displayed	Panel operated	LED display	Communication No.	Description
Note 7	Parts replacement alarm information		n , , , , 1	FE79	The ON/OFF status of each of the cooling fan, circuit board capacitor, main circuit capacitor of parts replacement alarm, cumulative operation time or number of starting are displayed in bits. ON: 1 OFF: , 
Note 8	Cumulative operation time		t0.10	FE14	The cumulative operation time is displayed. (0.01=1 hour, 1.00=100 hours)
	Default display mode	MODE	60.0		The output frequency is displayed (Operation at 60Hz).

8.2.2 Display of detailed information on a past trip

Details on a past trip (of trips 1 to 4) can be displayed, as shown in the table below, by pressing the center of the setting dial when the trip record is selected in the status monitor mode.

Unlike the "Display of trip information at the occurrence of a trip" in 8.3.2, details on a past trip can be displayed, even after the inverter is turned off or reset.

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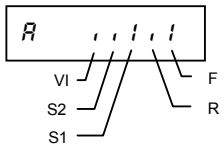
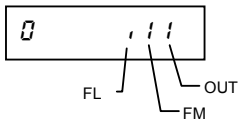
	Item displayed	Panel operated	LED display	Description
Note 9	Past trip 1		OC 1 ⇔ 1	Past trip 1 (displayed alternately)
	Continuous trips		n 2	For OCA, OCL, and Err5, the number of times (maximum of 31) the same trip occurred in succession is displayed (unit: times). Detailed information is recorded at the beginning and ending numbers.
	Output frequency		o60.0	The output frequency when the trip occurred is displayed.
	Direction of rotation		Fr-F	The direction of rotation when the trip occurred is displayed. (Fr-F: Forward run, Fr-r: Reverse run)
	Frequency command value		F80.0	The frequency command value when the trip occurred is displayed.
	Output current		C 150	The inverter output current when the trip occurred is displayed. (%/A)
	Input voltage		V 120	The inverter input voltage (DC detection) when the trip occurred is displayed. (%/V)

(Continued overleaf)

Refer to page H-8, 9 for Note 1 to 11.

(Continued)

	Item displayed	Panel operated	LED display	Description
	Output voltage		P100	The inverter output voltage when the trip occurred is displayed. (%/V)
Note 4	Input terminal		A ,,1,1	The ON/OFF statuses of the control input terminals (F, R, S1, S2, V I) are displayed in bits. ON: 1 OFF: , 
Note 5	Output terminal		0 ,11	The ON/OFF statuses of the control output terminals (OUT, FM and FL) are displayed in bits. ON: 1 OFF: , 
Note 8	Cumulative operation time		t8.56	The cumulative operation time when the trip occurred is displayed. (0.01=1 hour, 1.00=100 hours)
	Past trip 1	MODE	0C 1 ⇔ 1	Press this key to return to past trip 1.

* The monitor value of a trip is not always recorded as the maximum value because of the time required for detection.

Refer to page H-8, 9 for Note 1 to 11.

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8.3 Display of trip information

8.3.1 Trip code display

If the inverter trips, an error code is displayed to suggest the cause. Since trip records are retained, information on each trip can be displayed anytime in the status monitor mode.

Refer to section 13.1 for details about trip code display.

☆ The monitor value of a trip is not always recorded as the maximum value because of the time required for detection.

8.3.2 Display of trip information at the occurrence of a trip

At the occurrence of a trip, the same information as that displayed in the mode described in " 8.2.1 Status monitor under normal conditions ", can be displayed, as shown in the table below, if the inverter is not turned off or reset. To display trip information after turning off or resetting the inverter, follow the steps described in " 8.2.2 Display of detailed information on a past trip ".

■ Example of call-up of trip information

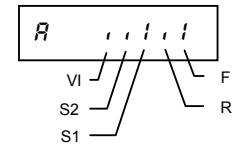
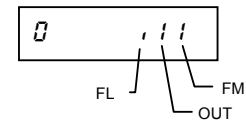
	Item displayed	Panel operated	LED display	Communication No.	Description
	Cause of trip		OP2		Status monitor mode (The code blinks if a trip occurs.) The motor coasts and comes to a stop (coast stop).
	Parameter setting mode	MODE	RUH		The first basic parameter "RUH" (history function) is displayed.
	Direction of rotation	MODE	Fr-F	FE01	The direction of rotation at the occurrence of a trip is displayed. (Fr-F: forward run, Fr-r: reverser run).
Note 1	Frequency command value *		F60.0	FE02	The frequency command value (Hz/free unit) at the occurrence of a trip is displayed. (In case of F711=2)
	Torque *		9 50	FE18	The inverter output torque (%) is displayed. (In case of F712=7)
Note 2	Output current *		C 80	FE03	The output power of the inverter at the occurrence of a trip (%/A) is displayed. (In case of F713=1)
Note 3	Input voltage *		U100	FE04	The inverter input voltage (DC detection) (%/V) at the occurrence of a trip is displayed. (In case of F714=3)
	Free unit display scale 2 monitor display		1800	FE38	The calculated result of free unit display scale 2 monitor is displayed. (In case of F715=50)
	Free unit display scale 2 decimal point position		d001	FE39	The decimal point position of the calculated result of free unit display scale 2 monitor is displayed. (In case of F716=51)

(Continued overleaf)

* Monitor items can be selected by settings parameters F710 to F716, (F720). Refer to Note 11.

Refer to page H-8, 9 for Note 1 to 11.

(Continued)

	Item displayed	Panel operated	LED display	Communication No.	Description
Note 4	Input terminal		A ,,1,1	FE06	The ON/OFF statuses of the control input terminals (F, R, S1, S2, VI) are displayed in bits. ON: 1 OFF: , 
Note 5	Output terminal		0 ,11	FE07	The ON/OFF status of each of the control signal output terminals (FM, OUT and FL) at the occurrence of a trip is displayed in bits. ON: 1 OFF: , 
	Logic input terminals setting		L-50	FD31	Logic setting by F127 is displayed. L-51: Sink logic (In case of F127=0) L-49: Sink logic (In case of F127=200) L-50: Source logic
	CPU1 version		u101	FE08	The version of the CPU1 is displayed.
	CPU2 version		uc01	FE73	The version of the CPU2 is displayed.
Note 6	Past trip 1		OP2⇔1	FE10	Past trip 1 (displayed alternately)
Note 6	Past trip 2		OH⇔2	FE11	Past trip 2 (displayed alternately)
Note 6	Past trip 3		OP3⇔3	FE12	Past trip 3 (displayed alternately)
Note 6	Past trip 4		nErr⇔4	FE13	Past trip 4 (displayed alternately)

(Continued overleaf)

Refer to page H-8, 9 for Note 1 to 11.

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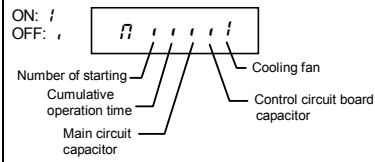
(Continued)

	Item displayed	Panel operated	LED display	Communication No.	Description
Note 7	Parts replacement alarm information		n , , , , , 1	FE79	The ON/OFF status of each of the cooling fan, circuit board capacitor, main circuit capacitor of parts replacement alarm, cumulative operation time or number of starting are displayed in bits. ON: 1 OFF: , 
Note 8	Cumulative operation time		t0.10	FE14	The cumulative operation time is displayed. (0.01=1 hour, 1.00=100 hours)
	Default display mode	MODE	OP2		The cause of the trip is displayed.

Note 1: The characters to the left disappear above 100 Hz. (Ex: 120 Hz is 120.0)

Note 2: You can switch between % and A (ampere)/V (volt), using the parameter F701 (current/voltage unit selection).

Note 3: The input (DC) voltage displayed is $1/\sqrt{2}$ times as large as the rectified d.c. input voltage. In case of

Note 4: If F109 = 2 (Logic input): VI bar is activated depend on VI terminal ON/OFF.
If F109 = 0, 1 or 3 (Voltage/current input): VI bar is always OFF.

Note 5: < OUT bar > F669 = 0 (Logic output): activated ON/OFF depend on OUT terminal output.
F669 = 1 (Pulse train output): always OFF.
< FM bar > When the slide switch SW3 (FM) is set to FM side (analog output), the bar is activated ON/OFF depending on the function setting by parameter F131 and F138. However, this result does not reflect to actual FM terminal output.

Note 6: Past trip records are displayed in the following sequence: 1 (latest trip record) ⇔2⇔3⇔4 (oldest trip record). If no trip occurred in the past, the message "nErr" will be displayed. Details on past trip record 1, 2, 3 or 4 can be displayed by pressing the center of the setting dial when past trip 1, 2, 3 or 4 is displayed. Refer to section 8.2.2 for details.

Note 7: Parts replacement alarm is displayed based on the value calculated from the annual average ambient temperature specified using F634, the ON time of the inverter, the operating time of the motor and the output current (load factor). Use this alarm as a guide only, since it is based on a rough estimation.

Note 8: The cumulative operation time increments only when the machine is in operation.

Note 9: If there is no trip record, nErr is displayed.

Note 10: Of the items displayed on the monitor, the reference values of items expressed in percent are listed below.

- Load current: The current monitored is displayed. The unit can be switched to A (amperes).
- Input voltage: The voltage displayed is the voltage determined by converting the voltage measured in the DC section into an AC voltage. The reference value (100% value) is 200 volts. The unit can be switched to V (volts).

- Output voltage: The voltage displayed is the output command voltage. 100% reference value is 200V. This unit can be switched to V (volts).
- Torque current: The current required to generate torque is calculated from the load current by vector operations. The value thus calculated is displayed. The reference value (100% value) is the value at the time when the load current is 100%.
- Load factor of inverter: Depending on the PWM carrier frequency (F300) setting and so on, the actual rated current may become smaller than the rated output current indicated on the nameplate. With the actual rated current at that time (after a reduction) as 100%, the proportion of the load current to the rated current is indicated in percent. The load factor is also used to calculate the conditions for overload trip (OL 1).
- Torque: The rated torque value of motor is 100%. (However, please use it as an indication value because it is estimation by the operation.)

Note 11: Status monitor of * mark is displayed by F710 to F716 and F720 setting.
The left side character is as following table by each parameter setting number.

Parameter	Setting No.	LED display	Function	Unit
F710 to F716, F720	0	o60.0	Output frequency	Hz / free unit
	1	C 16.5	Output current	% / A
	2	F50.0	Frequency command value	Hz / free unit
F711 to F716	3	U 100	Input voltage (DC detection)	% / V
	4	P 90	Output voltage (command value)	% / V
	5	h 3.0	Input power	kW
	6	H 2.8	Output power	kW
	7	q 80	Torque	%
	8	c 90	Torque current	% / A
	9, 10	-	-	-
	11	r 80	PBR (Braking resistor) cumulative load factor	%
	12	b51.0	Actual output frequency	Hz / free unit
	13-17	-	-	-
F710, F720	18	****	Arbitrary code from communication	-
F711 to F716	19-22	-	-	-
	23	d40.0	PID feedback value	Hz / free unit
	24-26	-	-	-
	27	L 70	Drive load factor	%
F710 to F716, F720	28-33	-	-	-
	34	n 89.0	Number of starting	10000 times
	35-49	-	-	-
	50	1800	Free unit display scale 2 monitor display	-
	51	d001	Free unit display scale 2 decimal point position	-
	52	c50.0	During stop : Frequency command value During operation : Output frequency	Hz / free unit

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9. Measures to satisfy the standards

9.1 How to cope with the CE directive

In Europe, the EMC directive and the low-voltage directive, which took effect in 1996 and 1997, respectively, made it obligatory to put the CE mark on every applicable product to prove that it complies with the directives. Inverters do not work alone but are designed to be installed in a control panel and always used in combination with other machines or systems which control them, so they themselves are not considered to be subject to the EMC directive. However, the CE mark must be put on all inverters because they are subject to the low-voltage directive.

The CE mark must be put on all machines and systems with built-in inverters because such machines and systems are subject to the above directives. It is the responsibility of the manufacturers of such final products to put the CE mark on each one. If they are "final" products, they might also be subject to machine-related directives. It is the responsibility of the manufacturers of such final products to put the CE mark on each one. In order to make machines and systems with built-in inverters compliant with the EMC directive and the low-voltage directive, this section explains how to install inverters and what measures should be taken to satisfy the EMC directive.

We have tested representative models with them installed as described later in this manual to check for conformity with the EMC directive. However, we cannot check all inverters for conformity because whether or not they conform to the EMC direction depends on how they are installed and connected. In other words, the application of the EMC directive varies depending on the composition of the control panel with a built-in inverter(s), the relationship with other built-in electrical components, the wiring condition, the layout condition, and so on. Therefore, please verify yourself whether your machine or system conforms to the EMC directive.

9.1.1 About the EMC directive

The CE mark must be put on every final product that includes an inverter(s) and a motor(s).

■ EMC directive
2004/108/EC

The EMC standards are broadly divided into two categories; immunity- and emission-related standards, each of which is further categorized according to the operating environment of each individual machine. Since inverters are intended for use with industrial systems under industrial environments, they fall within the EMC categories listed in Table 1 below. The tests required for machines and systems as final products are almost the same as those required for inverters.

Table 1 EMC standards

Category	Subcategory	Product standards	Test standard
Emission	Radiation noise	IEC 61800-3	CISPR11(EN55011)
	Transmission noise		CISPR11(EN55011)
Immunity	Static discharge		IEC61000-4-2
	Radioactive radio-frequency magnetic contactor field		IEC61000-4-3
	First transient burst		IEC61000-4-4
	Lightning surge		IEC61000-4-5
	Radio-frequency induction/transmission interference		IEC61000-4-6
	Voltage dip/Interruption of power		IEC61000-4-11

9.1.2 About the low-voltage directive

The low-voltage directive provides for the safety of machines and systems. Our inverters are CE-marked in accordance with the standard EN 50178 specified by the low-voltage directive, and can therefore be installed in machines or systems and imported without problem to European countries.

Applicable standard: IEC61800-5-1
Pollution level: 2
Overvoltage category: 3

9.1.3 Measures to satisfy the low-voltage directive

When incorporating our inverter into a machine or system, it is necessary to take the following measures so that the inverter satisfies the low-voltage directive.

(1) Install the inverter in a cabinet and ground the inverter enclosure. When doing maintenance, be extremely careful not to put your fingers into the inverter through a wiring hole and touch a charged part, which may occur depending on the model and capacity of the inverter used.
(2) Connect earth wiring to the earth terminal on the EMC plate. Or install the EMC plate (attached as standard) and another cable connect to earth terminal on the EMC plate. Refer to the table in 10.1 for details about earth cable sizes.
(3) Install a non-fuse circuit breaker or a fuse on the input side of the inverter. (Refer to section 10.1 and 9.2.3)

9.2 Compliance with UL Standard

This inverter, that conform to the UL Standard have the UL mark on the nameplate.

9.2.1 Compliance with Installation

A UL certificate was granted on the assumption that the inverter would be installed in a cabinet. Therefore, install the inverter in a cabinet and if necessary, take measures to maintain the ambient temperature (temperature in the cabinet) within the specified temperature range. (Refer to section 1.4.4)

9.2.2 Compliance with Connection

Use the UL conformed cables (Rating 75 °C or more, Use the copper conductors only.) to the main circuit terminals (R/L1, S/L2, T/L3) and output terminal (U/T1, V/T2, W/T3).
For instruction in the United States, Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
For instruction in the Canada, Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code and any additional local codes.

9.2.3 Compliance with Peripheral devices

Use the UL listed fuses at connecting to power supply.
Short circuit test is performed under the condition of the power supply short-circuit currents in below.
These interrupting capacities and fuse rating currents depend on the applicable motor capacities.

■ AIC, Fuse and Wire sizes

Inverter model	Maximum voltage (V)	Input withstand rating (kA) (1)	Output interrupt rating (kA) (2)	Branch circuit protection	Rating (A)	Wire sizes of power circuit	Earth Cable
	<Y>		<X>	<Z1>	<Z2>		
VFNC3M-2001P	240	5	5	Class CC FerrazATDR	3	AWG 14	AWG 14
VFNC3M-2002P	240	5	5	Class CC FerrazATDR	5	AWG 14	AWG 14
VFNC3M-2004P	240	5	5	Class CC FerrazATDR	7	AWG 14	AWG 14
VFNC3M-2007P	240	5	5	Ferraz HSJ	15	AWG 14	AWG 14
VFNC3M-2015P	240	5	5	Ferraz HSJ	25	AWG 14	AWG 14
VFNC3M-2022P	240	5	5	Ferraz HSJ	25	AWG 12	AWG 14

Suitable for use on a circuit capable of delivering not more than___X___rms symmetrical kilo Amperes,___Y___Volts maximum, when protected by___Z1___with a maximum rating of___Z2___.

(1) Input withstand rating is that for which the product has been designed thermally. Installation on a supply greater than this level will require additional inductance to satisfy this level.
(2) Output interrupt rating relies on Integral solid state short circuit protection. This does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes. This is dependant on the type of installation.

9.2.4 Motor thermal protection

Selects the electronic thermal protection characteristics that fit with the ratings and characteristics of the motor. (ETHr (Motor electronic-thermal protection level 1) is set corresponding to each IPM gear motors at default setting. Please consult our company when it is changed this setting value because there is a risk that a motor is burned out. Refer to section 3.4)

10. Peripheral devices

⚠ Warning	
Mandatory action	• When using switchgear for the inverter, it must be installed in a cabinet. Failure to do so can lead to risk of electric shock and can result in death or serious injury.
Be Grounded	• Connect grounding cables securely. Failure to do so can lead to risk of electric shock or fire in case of a failure or short-circuit or electric leak.

10.1 Selection of wiring materials and devices

Voltage class	Capacity of applicable motor (kW)	Inverter model	Wire size (See Note 4)					
			Power circuit (mm^2) (Note 1.)		DC reactor (optional) (mm^2)		Grounding cable (mm^2)	
			IEC compliant	For Japan (JEAC8001-2005)	IEC compliant	For Japan (JEAC8001-2005)	IEC compliant	For Japan (JEAC8001-2005)
Three-phase 240V class	0.1	VFNC3M-2001P	1.5(1.5)	2.0(2.0)	1.5	2.0	2.5	2.0
	0.2	VFNC3M-2002P	1.5(1.5)	2.0(2.0)	1.5	2.0	2.5	2.0
	0.4	VFNC3M-2004P	1.5(1.5)	2.0(2.0)	1.5	2.0	2.5	2.0
	0.75	VFNC3M-2007P	1.5(1.5)	2.0(2.0)	1.5	2.0	2.5	2.0
	1.5	VFNC3M-2015P	1.5(1.5)	2.0(2.0)	1.5	2.0	2.5	2.0
	2.2	VFNC3M-2022P	2.5(1.5)	2.0(2.0)	1.5	2.0	2.5	2.0

Note 1: Sizes of the wires connected to the input terminals R/L1, S/L2 and T/L3 and the output terminals U/T1, V/T2 and W/T3 when the length of each wire does not exceed 30m.
The numeric values in parentheses refer to the sizes of wires to be used when a DC reactor is connected.

Note 2: For the control circuit, use shielded wires 0.75 mm^2 or more in diameter.

Note 3: For grounding, use a cable with a size equal to or larger than the above.

Note 4: The wire sizes specified in the above table apply to HIV wires (cupper wires shielded with an insulator with a maximum allowable temperature of 75°C) used at an ambient temperature of 50°C or less.

Note 5: If there is a need to bring the inverter into UL compliance, use wires specified in chapter 9.

■ Selection of wiring devices

Voltage class	Applicable motor (kW)r	Input current (A)		Molded-case circuit breaker (MCCB) Earth leakage circuit breaker (ELCB)				Magnetic contactor (MC)			
				No reactor		with DCL		No reactor		with DCL	
		No reactor	With DCL	Rated current (A)	MCCB type (ELCB type)	Rated current (A)	MCCB type (ELCB type)	Rated current (A)	Model	Rated current (A)	Model
Three-phase 240V class	0.1	1.2	0.6	5	NJ30E (NJV30E)	5	NJ30E (NJV30E)	20	CA13	20	CA13
	0.2	2.0	0.9	5		5		20		20	
	0.4	3.6	1.8	5		5		20		20	
	0.75	6.3	3.5	10		5		20		20	
	1.5	11.1	6.6	15		10		20		20	
	2.2	14.9	9.3	20		15		20		20	

Note 1: Models made by Toshiba Industrial Products Sales Corporation are shown.

Note 2: Be sure to attach a surge killer to the exciting coil of the relay and the magnetic contactor.

Note 3: When using the auxiliary contacts 2a of the magnetic contactor MC for the control circuit, connect the contacts 2a in parallel to increase reliability.

Note 4: Select an MCCB with a current breaking rating appropriate to the capacity of the power supply, because short-circuit currents vary greatly depending on the capacity of the power supply and the condition of the wiring system. The MCCB, MC and ELCB in this table were selected, on the assumption that a power supply with a normal capacity would be used.

10.2 Installation of a magnetic contactor

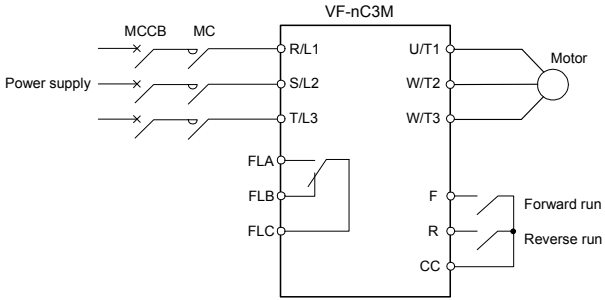
If using the inverter without installing a magnetic contactor (MC) in the primary circuit, use an MCCB (with a power cutoff device) to open the primary circuit when the inverter protective circuit is activated.
When using an optional braking resistor, install a magnetic contactor (MC) or non-fuse circuit breaker with a power cutoff device on the primary power supply of the inverter, so that the power circuit opens when the failure detection relay (FL) in the inverter or the externally installed overload relay is actuated.

■ Magnetic contactor in the primary circuit

To detach the inverter from the power supply in any of the following cases, insert a magnetic contactor (primary-side magnetic contactor) between the inverter and the power supply.

(1) If the motor overload relay is tripped
(2) If the protective detector (FL) built into the inverter is activated
(3) In the event of a power failure (for prevention of auto-restart)

When using the inverter with no magnetic contactor (MC) on the primary side, install a non-fuse circuit breaker with a voltage tripping coil instead of an MC and adjust the circuit breaker so that it will be tripped if the protective relay referred to above is activated. To detect a power failure, use an undervoltage relay or the like.



Example of connection of a magnetic contactor in the primary circuit

Notes on wiring

- When frequently switching between start and stop, do not use the magnetic contactor on the primary side as an on-off switch for the inverter.
  Instead, stop and start the inverter by using terminals F and CC (forward run) or R and CC (reverse run).
- Be sure to attach a surge killer to the exciting coil of the magnetic contactor (MC).

■ Magnetic contactor in the secondary circuit

If the motor is turned by 3000rpm (motor axis conversion) or more from the load side, the inverter may result in malfunction depending on the inductive voltage generated by the motor even if the inverter is stopped state. Please adopt the circuit which put a switch in the output side of the inverter by all means, when a motor may be turned by load.

Notes on wiring

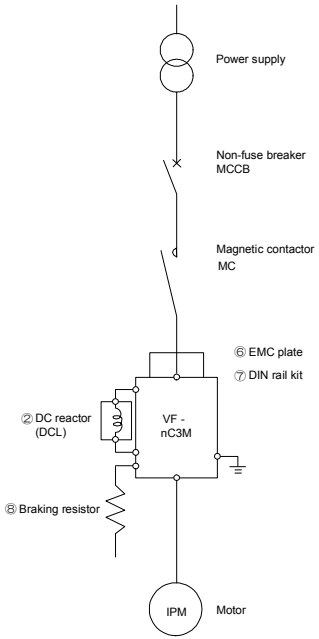
- Be sure to interlock to prevent the switch operates during driving the inverter.
- When installing a magnetic contactor (MC) between the inverter and the motor, avoid turning the magnetic contactor on or off during operation. Turning the magnetic contactor on or off during operation causes a current to rush into the inverter which could lead to malfunction.

10.3 Installation of an overload relay

1) This inverter has an electronic-thermal overload protective function.
   When shipped from our company, the motor electronic-thermal protection level is set to default setting for each IPM Gear Motor.

10.4 Optional external devices

The following external devices are optionally available for this inverter series.



(9) Parameter writer
(10) Extension panel
Cable for extension panel 1m, 3m, 5m

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11. Table of parameters and data

11.1 User parameters

Title	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
FC	Operation frequency of operation panel	Hz	0.1/0.01	LL-UL	0.0		3.1.2

11.2 Basic parameters

- Four navigation functions

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
AUH	-	History function	-	-	Displays parameters in groups of five in the reverse order to that in which their settings were changed. * (Possible to edit)	-		4.3 5.1
AUF	0093	Guidance function	-	-	0: - 1: - 2: Preset speed guidance 3: Analog signal operation guidance 4: - 5: -	0		4.3 5.2
AU1	0000	Automatic acceleration/ deceleration	-	-	0: Disabled (manual setting) 1: Automatic 2: Automatic (only at acceleration)	0		5.3
AU2	0001	Factory specific coefficient	-	-	-	0		-

*: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Basic parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
CMOD	0003	Command mode selection	-	-	0: Terminal board 1: Panel keypad (including extension panel) 2: RS485 communication	1		3 5.4 7.3
FMOD	0004	Frequency setting mode selection	-	-	0: Terminal board VI 1: Setting dial 1 (press in center to save) 2: Setting dial 2 (save even if power is off) 3: RS485 communication 4: - 5: UP/DOWN from external logic input	2		3 5.4 6.4.1 7.3

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
FMSL	0005	Meter selection	-	-	0: Output frequency 1: Output current 2: Frequency command value 3: Input voltage (DC detection) 4: Output voltage (command value) 5: Input power 6: Output power 7 to 10: - 11: PBR (Braking resistor) cumulative load factor 12: Actual output frequency 13: VI input value 14: - 15: Fixed output 1 (output current 100% equivalent) 16: Fixed output 2 (output current 50% equivalent) 17: Fixed output 3 (Other than the output current) 18: RS485 communication data 19: For adjustments (FM set value is displayed) 20 to 22: -	0		3.3
FM	0006	Meter adjustment gain	-	-	1-1280	512		
Fr	0008	Forward/reverse run selection (Panel keypad)	-	-	0: Forward run 1: Reverse run 2: Forward run (F/R switching on extension panel) 3: Reverse run (F/R switching on extension panel)	0		5.6
ACC	0009	Acceleration time 1	S	0.1/0.1	0.0-3000	1.5		5.3
dEC	0010	Deceleration time 1	S	0.1/0.1	0.0-3000	5.0		
FH	0011	Maximum frequency	Hz	0.1/0.01	< Adjustment range > 30.0-400.0 *1 <Default setting> 0.1k to 0.4kW model 0.75k to 2.2kW model	 83.4 125		5.7
UL	0012	Upper limit frequency	Hz	0.1/0.01	< Adjustment range > 0.5-FH <Default setting> 0.1k to 0.4kW model 0.75k to 2.2kW model	 60.0 90.0		5.8
LL	0013	Lower limit frequency	Hz	0.1/0.01	0.0- UL	0.0		
uL	0014	Factory specific coefficient	-	-	<Default setting> 0.1k to 0.4kW model 0.75k to 2.2kW model	 60.0 90.0		-
uLu	0409	Factory specific coefficient	-	-	<Default setting> 0.1kW, 0.2kW model 0.4kW model 0.75kW model 1.5kW model 2.2kW model	 146 140 137 148 163		-
PE	0015	Factory specific coefficient	-	-	-	6		-
ub	0016	Factory specific coefficient	-	-	<Default setting> 0.1k to 1.5kW model 2.2kW model	 6.0 5.0		-

*1: Do not set the frequency more than the default setting. (The permission maximum rotary speed of our IPM gear motor is to 2500 rpm)

*2: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
tHr	0600	Motor electronic-thermal protection level 1	% (A)	1/1	< Adjustment range > 10-100 *1 <Default setting> 0.1kW model 0.2kW model 0.4kW model 0.75kW model 1.5kW model 2.2kW model	 64 61 73 80 82 82		3.4 6.18.1
OLn	0017	Factory specific coefficient	-	-	-	4		-
Sr1	0018	Preset-speed frequency 1	Hz	0.1/0.01	LL-UL	0.0		3.5
Sr2	0019	Preset-speed frequency 2	Hz	0.1/0.01	LL-UL	0.0		
Sr3	0020	Preset-speed frequency 3	Hz	0.1/0.01	LL-UL	0.0		
Sr4	0021	Preset-speed frequency 4	Hz	0.1/0.01	LL-UL	0.0		
Sr5	0022	Preset-speed frequency 5	Hz	0.1/0.01	LL-UL	0.0		
Sr6	0023	Preset-speed frequency 6	Hz	0.1/0.01	LL-UL	0.0		
Sr7	0024	Preset-speed frequency 7	Hz	0.1/0.01	LL-UL	0.0		
tYP	0007	Default setting	-	-	0: - 1: - 2: - 3: - 4: Trip record clear 5: Cumulative operation time clear 6: Initialization of type information 7: Save user setting parameters 8. Initialization or load user setting parameters 9. Cumulative fan operation time record clears 10 to 13: -	7		4.3 4.3.2
SEt	0099	Factory specific coefficient	-	-	-	1		-
PSEL	0050	EASY key mode selection	-	-	0: Standard setting mode at power on 1: Easy setting mode at power on 2: Easy setting mode only	0		4.4
F1--	-	Extended parameter starting at 100	-	-	-	-		4.2.2
F2--	-	Extended parameter starting at 200	-	-	-	-		
F3--	-	Extended parameter starting at 300	-	-	-	-		
F4--	-	Extended parameter starting at 400	-	-	-	-		
F5--	-	Extended parameter starting at 500	-	-	-	-		
F6--	-	Extended parameter starting at 600	-	-	-	-		
F7--	-	Extended parameter starting at 700	-	-	-	-		
F8--	-	Extended parameter starting at 800	-	-	-	-		
F9--	-	Extended parameter starting at 900	-	-	-	-		
GrU	-	Factory specific coefficient	-	-	-	-		-

*1: Please contact to us surely when the protection level changes for controlling a motor trouble.

*2: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

II

11.3 Extended parameters

- Input/output parameters 1

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F100	0100	Low-speed signal output frequency	Hz	0.1/0.01	0.0-FH	0.0		6.1.1
F101	0101	Speed reach setting frequency	Hz	0.1/0.01	0.0-FH	0.0		6.1.3
F102	0102	Speed reach detection band	Hz	0.1/.01	0.0-FH	2.5		6.1.2 6.1.3
F104	0104	Always active function selection 1	-	-	0-153 *6	0		6.3.2
F105	0105	Priority selection (Both F and R are ON)	-	-	0: Reverse 1: Slowdown Stop	1		6.2.1
F108	0108	Always active function selection 2	-	-	0-153 *6	70 (SVLOCK)		6.3.2
F109	0109	Analog/logic input Selection (VI terminal)	-	-	0: Voltage signal input (0-10V) 1: Current signal input (4-20mA) 2: Logic input 3: Voltage signal input (0-5V)	0		6.2.2 6.3.3 6.4.2 7.2.1 7.3
F110	0110	Always active function selection 3	-	-	0-153 *6	6 (ST)		6.3.2
F111	0111	Input terminal selection 1A (F)	-	-	0-201 *6	2 (F)		6.3.3 6.4.1 7.2.1
F112	0112	Input terminal selection 2A (R)	-	-		4 (R)		
F113	0113	Input terminal selection 3A (S1)	-	-		10 (SS1)		
F114	0114	Input terminal selection 4A (S2)	-	-		12 (SS2)		
F115	0115	Input terminal selection 5 (VI)	-	-	8-55 *6	14 (SS3)		
F127	0127	Sink/source switching	-	-	0: Sink(Internal power supply), 100: Source, 200: Sink(External power supply) 1-99, 101-199, 201-255: invalid	0		6.3.1
F130	0130	Output terminal selection 1A (OUT)	-	-	0-255 *7	68 (Break)		6.3.4 7.2.2
F131	0131	Output terminal selection 2A (FM)	-	-		6 (RCH)		
F132	0132	Output terminal selection 3 (FL)	-	-		10 (FL)		
F137	0137	Output terminal selection 1B (OUT)	-	-		255 (always ON)		
F138	0138	Output terminal selection 2B (FM)	-	-		255 (always ON)		
F139	0139	Output terminal logic selection (OUT, FM)	-	-	0: F130 and F137 F131 and F138 1: F130 or F137 F131 and F138 2: F130 and F137 F131 or F138 3: F130 or F137 F131 or F138	0		

*6: Refer to section 11.4 for details about input terminal function.

*7: Refer to section 11.5 for details about output terminal function.

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F144	0144	Factory specific coefficient	-	-	-	0		-
F151	0151	Input terminal selection 1B (F)	-	-	0-201 *6	0		6.3.3 6.4.1 7.2.1
F152	0152	Input terminal selection 2B (R)	-	-		0		
F153	0153	Input terminal selection 3B (S1)	-	-		0		
F154	0154	Input terminal selection 4B (S2)	-	-		0		
F155	0155	Input terminal selection 1C (F)	-	-		0		
F156	0156	Input terminal selection 2C (R)	-	-		0		

- Basic parameter 2

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F170	0170	Factory specific coefficient	-	-	-	60.0		-
F171	0171	Factory specific coefficient	-	-	-	200		-
F172	0172	Factory specific coefficient	-	-	0.1k to 1.5kW model 2.2kW model	6.0 5.0		-
F173	0173	Factory specific coefficient	-	-	-	100		-
F185	0185	Factory specific coefficient	-	-	-	150		-

- Frequency parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F201	0201	Setting of VI input point 1	%	1/1	0-100	0		6.4.2 7.3
F202	0202	Frequency of VI input point 1	Hz	0.1/0.01	0.0-400.0 *1	0.0		
F203	0203	Setting of VI input point 2	%	1/1	0-100	100		
F204	0204	Frequency of VI input point 2	Hz	0.1/0.01	< Adjustment range > 0.0-400.0 *1			
					<Default setting> 0.1k to 0.4kW model 0.75k to 2.2kW model	60.0 90.0		
F209	0209	Analog input filter	ms	1/1	4-1000	64		
F240	0240	Starting frequency	Hz	0.1/0.01	0.1-10.0	0.1		6.5.1
F241	0241	Operation starting frequency	Hz	0.1/0.01	0.0-FH	0.0		6.5.2
F242	0242	Operation starting frequency hysteresis	Hz	0.1/0.01	0.0-FH	0.0		

*: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

*1: The permission maximum rotary speed of our IPM gear motor is to 2500 rpm. Set the frequency 2500 rpm or less.
(Inverter maximum frequency: 0.1k to 0.4kW model: 83.4Hz or less, 0.75k to 2.2kW model: 125Hz or less)

*6: Refer to section 11.4 for details about input terminal function.

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F249	0249	Factory specific coefficient	-	-	-	4		-
F250	0250	Factory specific coefficient	-	-	-	0.0		
F251	0251	Factory specific coefficient	-	-	-	50		
F252	0252	Factory specific coefficient	-	-	-	1.0		
F256	0256	Time limit for lower-limit frequency operation	s	0.1/0.1	0.0: Disabled 0.1-600.0	0.0		6.6
F257	0257	Servo lock function	-	-	0: Prohibited 1: Permitted	0		6.7
F258	0258	Factory specific coefficient	-	-	-	1		-
F264	0264	External logic input - UP response time	s	0.1/0.1	0.0-10.0	0.1		6.4.3
F265	0265	External logic input - UP frequency steps	Hz	0.1/0.01	0.0-FH	0.1		
F266	0266	External logic input - DOWN response time	s	0.1/0.1	0.0-10.0	0.1		
F267	0267	External logic input - DOWN frequency steps	Hz	0.1/0.01	0.0-FH	0.1		
F268	0268	Initial value of UP/DOWN frequency	Hz	0.1/0.01	LL-UL	0.0		
F269	0269	Change of the initial value of UP/DOWN frequency	-	-	0: Not changed 1: Setting of F268 changed when power is turned off	1		
F270	0270	Jump frequency	Hz	0.1/0.01	0.0-FH	0.0		6.8
F271	0271	Jumping width	Hz	0.1/0.01	0.0-30.0	0.0		
F287	0287	Preset-speed frequency 8	Hz	0.1/0.01	LL-UL	0.0		3.5 6.9
F288	0288	Preset-speed frequency 9	Hz	0.1/0.01	LL-UL	0.0		
F289	0289	Preset-speed frequency 10	Hz	0.1/0.01	LL-UL	0.0		
F290	0290	Preset-speed frequency 11	Hz	0.1/0.01	LL-UL	0.0		
F291	0291	Preset-speed frequency 12	Hz	0.1/0.01	LL-UL	0.0		
F292	0292	Preset-speed frequency 13	Hz	0.1/0.01	LL-UL	0.0		
F293	0293	Preset-speed frequency 14	Hz	0.1/0.01	LL-UL	0.0		
F294	0294	Preset-speed frequency 15	Hz	0.1/0.01	LL-UL	0.0		

*: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Operation mode parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F300	0300	PWM carrier frequency	kHz	1/0.1	2 -16	12		6.10
F301	0301	Auto-restart control selection	-	-	0: Disabled 1: At auto-restart after momentary stop 2: At ST terminal off and on 3: 1+2 4: At start-up	0		6.11.1
F302	0302	Regenerative power ride-through control (Deceleration stop)	-	-	0: Disabled 1: Automatic setting 2: Slowdown stop	0		6.11.2
F303	0303	Retry selection (number of times)	Times	1/1	0: Disabled 1-10	0		6.11.3
F304	0304	Dynamic braking selection	-	-	0: Disabled 1: Enabled, Resistor overload protection enabled 2: Enabled 3: Enabled, Resistor overload protection enabled (At ST terminal on) 4: Enabled (At ST terminal on)	0		6.11.4
F305	0305	Overvoltage limit operation (Slowdown stop mode selection)	-	-	0: Enabled 1: Disabled 2: Enabled (Quick deceleration control) 3: Enabled (Dynamic quick deceleration control)	2		6.11.5
F307	0307	Factory specific coefficient	-	-	-	3		-
F308	0308	Dynamic braking resistance	Ω	0.1/0.1	< Adjustment range > 1.0-1000			6.11.4
					<Default setting> 0.1k to 0.75kW model 1.5k to 2.2kW model	200 75		
F309	0309	Dynamic braking resister capacity	kW	0.01/0.01	< Adjustment range > 0.01-10.00			
					<Default setting> 0.1k to 2.2kW model	0.09		
F311	0311	Reverse-run prohibition	-	-	0: Forward/reverse run permitted 1: Reverse run prohibited 2: Forward run prohibited	0		6.11.5
F312	0312	Random mode	-	-	0: Disabled 1: Automatic setting	0		6.10
F316	0316	Carrier frequency control mode selection	-	-	0: Carrier frequency without reduction 1: Carrier frequency with automatic reduction	1		
F340	0340	Creeping time	s	0.01/0.01	0-10	0.00		6.12
F341	0341	Braking mode selection	-	1/1	0: Brake sequence disabled 1: - 2: - 3: Brake sequence enabled	0		
F343	0343	Factory specific coefficient	-	-	-	0		-

*: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F344	0344	Factory specific coefficient	-	-	-	100		-
F345	0345	Braking release time	s	0.01/0.01	0-10	0.50		6.12
F346	0346	Creeping frequency	Hz	0.1/0.01	F240 -20	3		
F347	0347	Braking delay time	s	0.01/0.01	0-10	0.30		
F348	0348	Factory specific coefficient	-	-	-	0		-
F359	0359	PID control waiting time	s	1/1	0-2400	0		6.13
F360	0360	PID control	-	-	0: Disabled 1: Enabled	0		
F362	0362	Proportional gain	-	0.01/0.01	0.01-100.0	0.30		
F363	0363	Integral gain	-	0.01/0.01	0.01-100.0	0.20		
F366	0366	Differential gain	-	0.01/0.01	0.00-2.55	0.00		
F380	0380	PID forward/reverse characteristics selection	-	-	0: Forward 1: Reverse	0		
F382	0382	Impact stop function	-	1/1	0: Disabled 1: - 2: Enabled	0		6.14
F383	0383	Impact stop frequency	Hz	0.1/0.01	< Adjustment range > 0.1-30.0 *1			
					<Default setting> 0.1k to 0.4kW model 0.75k to 2.2kW model	 5.0 7.5		
F384	0384	Impact stop torque limit	%	1/1	0.0-120	100		
F385	0385	Impact stop detection time	s	0.1/0.1	0.0-25.0	0.3		
F386	0386	Impact stop continueous torque	%	1/1	0.0-100	10		
F391	0391	Auto-stop hysteresis in case of lower-limit frequency continuous operation	Hz	0.1/0.01	0.0-UL	0.2		6.6

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- Torque boost parameters 1

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F400	0400	Factory specific coefficient	-	-	-	0		-
F401	0401	Factory specific coefficient	-	-	-	50		-

*: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

*1: Set the hit and stop control frequency to the default setting value or less.

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F402	0402	Factory specific coefficient	-	-	<Default setting> 0.1kW model 0.2kW model 0.4kW model 0.75kW model 1.5kW model 2.2kW model	 4.9 9.2 6.2 4.3 3.9 3.3		-
F405	0405	Factory specific coefficient	-	-	-	-		-
F412	0412	Factory specific coefficient	-	-	-	5.0		-
F415	0415	Factory specific coefficient	-	-	<Default setting> 0.1kW model 0.2kW model 0.4kW model 0.75kW model 1.5kW model 2.2kW model	 0.45 0.86 1.74 3.37 6.13 8.20		-
F416	0416	Factory specific coefficient	-	-	-	-		-
F417	0417	Factory specific coefficient	-	-	-	1800		-
F441	0441	Power running torque limit 1 level	%	1/1	0.0-250	150		6.15
F443	0443	Regenerative braking torque limit 1 level	%	1/1	0.0-250	150		
F444	0444	Power running torque limit 2 level	%	1/1	0.0-250	150		
F445	0445	Regenerative braking torque limit 2 level	%	1/1	0.0-250	150		
F451	0451	Factory specific coefficient	-	-	-	1		-
F454	0454	Factory specific coefficient	-	-	-	0		-
F458	0458	Current control proportional gain	Hz	1/1	0.0-100	80		6.16
F459	0459	Load inertia moment coefficient	Times	0.1/0.1	< Adjustment range > 0.1-100 <Default setting> 0.1kW model 0.2kW model 0.4kW model 0.75kW model 1.5kW model 2.2kW model	 1.8 1.2 1.4 1.1 2.0 1.9		
F460	0460	Speed loop proportional gain	Hz	0.1/0.1	< Adjustment range > 0.0-25.0 <Default setting> 0.1kW model 0.2k to 2.2kW model	 3.0 3.5		
F461	0461	Speed loop stabilization coefficient	-	0.01/0.01	0.5-2.50	1.00		
F462	0462	Speed control filter rate	-	1/1	0.0-100	75		
F467	0467	Factory specific coefficient	-	-	-	10		-

*: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Input/output parameters 2

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F470	0470	VI input bias	-	1/1	0-255	128		6.4.4
F471	0471	VI input gain	-	1/1	0-255	128		

- Torque boost parameters 2

Title	Communications No.	Function	Unit	Minimum setting unit Panel/Communications	Adjustment range	Default setting	User setting	Reference
F480	0480	Factory specific coefficient	-	-	-	120		-
F485	0485	Factory specific coefficient	-	-	-	100		
F490	0490	Factory specific coefficient	-	-	-	25		
F495	0495	Factory specific coefficient	-	-	-	104		

*: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Acceleration/deceleration time parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F500	0500	Acceleration time 2	s	0.1/0.1	0.0-3000	10.0		6.17
F501	0501	Deceleration time 2	s	0.1/0.1	0.0-3000	10.0		
F502	0502	Acceleration/deceleration 1 pattern	-	-	0: Linear 1: S-pattern 1 2: S-pattern 2	0		
F503	0503	Acceleration/deceleration 2 pattern	-	-		0		
F505	0505	Acceleration/deceleration 1 and 2 switching frequency	Hz	0.1/0.01	0.0 (disabled) 0.1-UL	0.0		

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- Protection parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F601	0601	Stall prevention level 1	% (A)	1/1	10-199, 200 (disabled)	150		6.18.2
F602	0602	Inverter trip retention selection	-	-	0: Cleared with power off 1: Retained with power off	0		6.18.3
F603	0603	Emergency stop selection	-	-	0: Coast stop 1: Slowdown stop 2: -	0		6.18.4
F605	0605	Output phase failure detection selection	-	-	0: Disabled 1: At start-up (only one time after power on) 2: At start-up (each time)	0		6.18.5

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F607	0607	Motor 150% overload detection time	s	1/1	10-2400	60		3.4 6.18.1
F608	0608	Input phase failure detection selection	-	-	0: Disabled 1: Enabled	1		6.18.6
F609	0609	Small current detection hysteresis	%	1/1	1-20	10		6.18.7
F610	0610	Small current trip/alarm selection	-	-	0: Alarm only 1: Tripping	0		
F611	0611	Small current detection current	% (A)	1/1	0-150	0		
F612	0612	Small current detection time	s	1/1	0-255	0		
F613	0613	Detection of output short-circuit at start-up	-	-	0: Each time (standard pulse) 1: Only one time after power on (standard pulse) 2: Each time (short pulse) 3: Only one time after power on (short pulse)	0		6.18.8
F615	0615	Over-torque trip/alarm selection	-	-	0: Alarm only 1: Tripping	0		6.18.9
F616	0616	Over-torque detection level	%	1/0.01	0 (disabled) 1-200	200		
F618	0618	Over-torque detection time	s	0.1/0.1	0.0-10.0	0.5		
F619	0619	Over-torque detection hysteresis	%	1/1	0-100	10		
F620	0620	Cooling fan ON/OFF control	-	-	0: ON/OFF control 1: Always ON	0		6.18.10
F621	0621	Cumulative operation time alarm setting	100 hours	0.1/0.1 (=10 hours)	0.0-999.0	610.0		6.18.11
F626	0626	Over-voltage stall protection level	%	1/1	100-150	136		6.11.4
F627	0627	Undervoltage trip/alarm selection	-	-	0: Alarm only (detection level 64% or less) 1: Tripping (detection level 64% or less) 2: Alarm only (detection level 50% or less, input AC reactor required)	0		6.18.12
F631	0631	Factory specific coefficient	-	-	-	0		-
F632	0632	Electronic-thermal memory	-	-	0: Disabled 1: Enabled	0		3.4 6.18.1
F633	0633	VI analog input break detection level	%	1/1	0: Disabled, 1-100	0		6.18.13
F634	0634	Annual average ambient temperature (parts replacement alarms)	-	-	1: -10 to +10°C 2: 11-20°C 3: 21-30°C 4: 31-40°C 5: 41-50°C 6: 51-60°C	3		6.18.14
F648	0648	Numbers of starting alarm	10000 times	0.1/0.1	0.0-999.9	100.0		6.18.15

*3: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Output parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F669	0669	Logic output/pulse train output selection (OUT)	-	-	0: Logic output 1: Pulse train output	0		6.19.1
F676	0676	Pulse train output function selection (OUT)	-	-	0: Output frequency 1: Output current 2: Frequency command value 3: Input voltage (DC detection) 4: Output voltage (command value) 5 to 11: - 12: Actual output frequency 13: VI input value 14: - 15: Fixed output 1 (output current 100% equivalent) 16: Fixed output 2 (output current 50% equivalent) 17: Fixed output 3 (Other than the output current) 18: RS485 Communication data 19 to 22: -	0		
F677	0677	Maximum numbers of pulse train	kpps	0.01/0.01	0.50-1.60	0.80		
F678	0678	Factory specific coefficient	-	-	-	64		-
F681	0681	Analog output signal selection	-	-	0: Meter option (0 to 1 mA) 1: Current (0 to 20 mA) output 2: Voltage (0 to 10 V) output	0		6.19.2
F684	0684	Factory specific coefficient	-	-	-	4		-
F691	0691	Inclination characteristic of analog output	-	-	0: Negative inclination (downward slope) 1: Positive inclination (upward slope)	1		6.19.2
F692	0692	Analog output bias	%	0.1/0.1	-1.0－+100.0	0		
F693	0693	Factory specific coefficient	-	-	-	100		-

*3: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Operation panel parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F700	0700	Parameter write protection selection	-	-	0: Permitted 1: Prohibited (Panel and extension panel) 2: Prohibited (1 + RS485 communication)	0		6.20.1
F701	0701	Current/voltage unit selection	-	-	0: % 1: A (ampere)/V (volt)	0		6.20.2
F702	0702	Free unit display scale 1	Times	0.01/0.01	0.00: Disabled (display of frequency) 0.01-200.0	0.00		6.20.3
F707	0707	Free step (1-step rotation of setting dial)	Hz	0.01/0.01	0.00: Disabled 0.01-FH	0.00		6.20.4

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F710	0710	Initial panel display selection	-	-	0: Output frequency (Hz/free unit) 1: Output current (%/A) 2: Frequency command value (Hz/free unit) 3 to 17: - 18: Arbitrary code from communication 19 to 33: - 34: Number of starting (10000 times) 35 to 49: - 50: Free unit display scale 2 monitor display 51: Free unit display scale 2 decimal point position 52: Frequency command value / output frequency (Hz/free unit)	0		6.20.5 6.22.1 8.2.1
F711	0711	Status monitor 1	-	-	0: Output frequency (Hz/free unit) 1: Output current (%/A) 2: Frequency command value (Hz/free unit) 3: Input voltage (DC detection) (%/V) 4: Output voltage (command value) (%/V) 5: Input power (kW) 6: Output power (kW) 7: Torque (%) 8: Torque current (%/A) 9, 10: - 11: PBR (Braking resistor) cumulative load factor 12: Actual output frequency 13 to 22: - 23: PID feedback value (Hz/free unit) 24 to 26: - 27: Drive load factor (%) 28 to 33: - 34: Number of starting (10000 times) 35 to 49: - 50: Free unit display scale 2 monitor display 51: Free unit display scale 2 decimal point position 52: Frequency command value / output frequency (Hz/free unit)	2		6.20.6 8.2.1 8.3.2
F712	0712	Status monitor 2	-	-		7		
F713	0713	Status monitor 3	-	-		1		
F714	0714	Status monitor 4	-	-		3		
F715	0715	Status monitor 5	-	-		50		
F716	0716	Status monitor 6	-	-		51		
F720	0720	Initial remote keypad display selection	-	-	0-52 (Same as F710)	0		6.20.5 8.2.1 8.3.2
F730	0730	Panel frequency setting prohibition (FC)	-	-	0: Permitted 1: Prohibited	0		6.20.1
F732	0732	Local/remote operation prohibition for remote keypad	-	-	0: Permitted 1: Prohibited	1		
F733	0733	Panel operation prohibition (RUN key)	-	-	0: Permitted 1: Prohibited	0		
F734	0734	Prohibition of panel emergency stop operation	-	-	0: Permitted 1: Prohibited	0		
F735	0735	Prohibition of panel reset operation	-	-	0: Permitted 1: Prohibited	0		
F736	0736	CMOd/FMOd change prohibition during operation	-	-	0: Permitted 1: Prohibited	1		

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Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F738	0738	Password setting (F700)	-	-	0: Password unset 1-9998 9999: Password set	0		6.20.1
F739	0739	Password examination	-	-	0: Password unset 1-9998 9999: Password set	0		
F746	0746	Factory specific coefficient	-	-	-	200		-
F751	0751	Easy setting mode parameter 1	-	-		3		4.4 6.20.7
F752	0752	Easy setting mode parameter 2	-	-		4		
F753	0753	Easy setting mode parameter 3	-	-		9		
F754	0754	Easy setting mode parameter 4	-	-		10		
F755	0755	Easy setting mode parameter 5	-	-		600		
F756	0756	Easy setting mode parameter 6	-	-		6		
F757	0757	Easy setting mode parameter 7	-	-		999		
F758	0758	Easy setting mode parameter 8	-	-		999		
F759	0759	Easy setting mode parameter 9	-	-		999		
F760	0760	Easy setting mode parameter 10	-	-		999		
F761	0761	Easy setting mode parameter 11	-	-		999		
F762	0762	Easy setting mode parameter 12	-	-	0-999 (Set by communication number)	999		
F763	0763	Easy setting mode parameter 13	-	-		999		
F764	0764	Easy setting mode parameter 14	-	-		999		
F765	0765	Easy setting mode parameter 15	-	-		999		
F766	0766	Easy setting mode parameter 16	-	-		999		
F767	0767	Easy setting mode parameter 17	-	-		999		
F768	0768	Easy setting mode parameter 18	-	-		999		
F769	0769	Easy setting mode parameter 19	-	-		999		
F770	0770	Easy setting mode parameter 20	-	-		999		
F771	0771	Easy setting mode parameter 21	-	-		999		
F772	0772	Easy setting mode parameter 22	-	-		999		
F773	0773	Easy setting mode parameter 23	-	-		999		
F774	0774	Easy setting mode parameter 24	-	-		50		
F799	0799	Factory specific coefficient	-	-	-	0		-

*3: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Communication parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F800	0800	Baud rate	-	-	3: 9600bps 4: 19200bps 5: 38400bps	4		6.21
F801	0801	Parity	-	-	0: NON (No parity) 1: EVEN (Even parity) 2: ODD (Odd parity)	1		
F802	0802	Inverter number	-	1/1	0-247	0		
F803	0803	Communication time-out time	s	0.1/0.1	0.0: Disabled, 0.1-100.0	0.0		
F804	0804	Communication time-out action	-	-	0: Alarm only 1: Trip (Coast stop) 2: Trip (Deceleration stop)	0		
F805	0805	Communication waiting time	s	0.01/0.01	0.00-2.00	0.00		
F808	0808	Communication time-out detection condition	-	-	0: Valid at any time 1: Communication selection of F002 or C002 2: 1 + during operation	1		
F829	0829	Selection of communication protocol	-	-	0: Toshiba inverter protocol 1: Modbus RTU protocol	0		
F856	0856	Factory specific coefficient	-	-	<Default setting> 0.1k to 0.4kW model 0.75k to 2.2kW model	 2 3		
F870	0870	Block write data 1	-	-	0: No selection 1: Command information 2: - 3: Frequency command value 4: Output data on the terminal board 5: Analog output for communication	0		
F871	0871	Block write data 2	-	-		0		
F875	0875	Block read data 1	-	-	0: No selection 1: Status information 2: Output frequency 3: Output current 4: Output voltage 5: Alarm information 6: PID feedback value 7: Input terminal board monitor 8: Output terminal board monitor 9: VI terminal board monitor	0		
F876	0876	Block read data 2	-	-		0		
F877	0877	Block read data 3	-	-		0		
F878	0878	Block read data 4	-	-		0		
F879	0879	Block read data 5	-	-		0		
F880	0880	Free notes	-	1/1	0-65535	0		6.23

*3: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

- Other parameters

Title	Communication No.	Function	Unit	Minimum setting unit Panel/Communication	Adjustment range	Default setting	User setting	Reference
F900	0900	Monitor digit of free unit display scale 2	-	1/1	1-4	4		6.22.1
F901	0901	Machine ratio 1 (denominator)	-	1/1	1-9999	1		
F902	0902	Machine ratio 2 (denominator)	-	0.1/0.1	0.1-1800	1.0		
F909	0909	Factory specific coefficient	-	-	-	20		-
F910	0910	Factory specific coefficient	-	-	-	35		
F911	0911	Factory specific coefficient	-	-	-	0.07		
F912	0912	Factory specific coefficient	-	-	<Default setting> 0.1kW model 0.2kW model 0.4kW model 0.75kW model 1.5kW model 2.2kW model	 138.7 138.7 67.80 11.72 9.83 7.55		
F913	0913	Factory specific coefficient	-	-	<Default setting> 0.1kW model 0.2kW model 0.4kW model 0.75kW model 1.5kW model 2.2kW model	 82.30 82.30 40.20 8.26 5.06 3.85		
F914	0914	Factory specific coefficient	-	-	-	0		
F915	0915	Factory specific coefficient	-	-	-	2		
F916	0916	Factory specific coefficient	-	-	-	25		
F917	0917	Factory specific coefficient	-	-	-	10		
F918	0918	Factory specific coefficient	-	-	-	10		
F919	0919	Factory specific coefficient	-	-	-	0		
F930	0930	Position loop gain	-	1/1	1-250	100		6.7 6.16

*3: Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

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11.4 Input Terminal Function

It can be assigned the function No. in the following table to parameter F 104, F 108, F 110~F 115, F 151~F 156.

- Table of input terminal functions 1

Function No.	Code	Function	Action	Reference
0,1	-	No function	Disabled	-
2	F	Forward run command	ON: Forward run, OFF: Slowdown stop	7.2.1
3	FN	Inversion of forward run command	Inversion of F	
4	R	Reverse run command	ON: Reverse run, OFF: Slowdown stop	
5	RN	Inversion of reverse run command	Inversion of R	
6	ST	Standby	ON: Ready for operation OFF: Coast stop (gate OFF)	6.3.2
7	STN	Inversion of standby	Inversion of ST	
8	RES	Reset command	ON: Acceptance of reset command ON → OFF: Trip reset	13.2
9	RESN	Inversion of reset command	Inversion of RES	
10	SS1	Preset-speed command 1	Selection of 15-speed SS1 to SS4 (SS1N to SS4N) (4 bits)	3.5 7.2.1
11	SS1N	Inversion of preset-speed command 1		
12	SS2	Preset-speed command 2		
13	SS2N	Inversion of preset-speed command 2		
14	SS3	Preset-speed command 3		
15	SS3N	Inversion of preset-speed command 3		
16	SS4	Preset-speed command 4		
17	SS4N	Inversion of preset-speed command 4		
18	JOG	Jog run mode	ON: Jogging mode (fixed at 5Hz) OFF: Jog run canceled	7.2.1
19	JOGN	Inversion of jog run mode	Inversion of JOG	
20	EXT	Emergency stop by external signal	ON: E trip stop OFF: After stopped by F603, E trip	6.18.4
21	EXTN	Inversion of emergency stop by external signal	Inversion of EXT	
24	AD2	2nd acceleration/deceleration	ON: Acceleration/deceleration 2 OFF: Acceleration/deceleration 1	6.17.1
25	AD2N	Inversion of 2nd acceleration/deceleration	Inversion of AD2	
32	OC stall	Torque limit switching	ON: Torque limit 2 limiting operation OFF: Torque limit 1 limiting operation	6.15.1
33	OC stall N	Inversion of torque limit switching	Inversion of OC stall	
36	PID	PID control prohibition	ON: PID control prohibited OFF: PID control enabled	6.13
37	PIDN	Inversion of PID control prohibition	Inversion of PID	
48	SCLC	Forced local from communication	Enabled during communication ON: Local (Setting of CMOd, FMOd) OFF: Communication	5.4
49	SCLCN	Inversion of forced local from communication	Inversion of SCLC	
50	HD	Operation hold (hold of 3-wire operation)	ON: F (forward run), R: (reverse run) held, 3-wire operation OFF: Slowdown stop	7.2.1
51	HDN	Inversion of operation hold (hold of 3-wire operation)	Inversion of HD	
52	IDC	PID integral/differential clear	ON: Integral/differential clear, OFF: Clear canceled	6.13
53	IDCN	Inversion of PID integral/differential clear	Inversion of IDC	
54	PIDSW	PID characteristics switching	ON: Inverted characteristics of F380 selection OFF: Characteristics of F380 selection	
55	PIDSWN	Inversion of PID characteristics switching	Inversion of PIDSW	

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- Table of input terminal functions 2

Function No.	Code	Function	Action	Reference
70	SVLOCK	Servo lock	ON: Servo lock operation OFF: Servo lock operation canceled	6.7
71	SVLOCKN	Inversion of servo lock	Inversion of SVLOCK	
88	UP	Frequency UP	ON: Frequency increased OFF: Frequency increase canceled	6.4.3
89	UPN	Inversion of frequency UP	Inversion of UP	
90	DWN	Frequency DOWN	ON: Frequency decreased OFF: Frequency decrease canceled	
91	DWNN	Inversion of frequency DOWN	Inversion of DWN	
92	CLR	Clear frequency UP/DOWN	OFF → ON: Clear frequency UP/DOWN	
93	CLRN	Inversion of clear frequency UP/DOWN	Inversion of CLR	
96	FRR	Coast stop command	ON: Coast stop (Gate OFF) OFF: Coast stop canceled	3.1.1
97	FRRN	Inversion of coast stop command	Inversion of FRR	
106	FMTB	Frequency setting mode terminal board VI	ON: Terminal board (VI) enabled OFF: Setting of F800	5.4
107	FMTBN	Inversion of frequency setting mode terminal board VI	Inversion of FMTB	
108	CMTB	Command mode terminal board	ON: Terminal board enabled OFF: Setting of C800	
109	CMTBN	Inversion of command mode terminal board	Inversion of CMTB	
110	PWE	Parameter editing permission	ON: Parameter editing permitted OFF: Setting of F700	6.20.1
111	PWEN	Inversion of parameter editing permission	Inversion of PWE	
122	FST	Forced deceleration command	ON: Forced deceleration command (Automatic deceleration) OFF: Forced deceleration canceled (Note that operation is resumed when forced deceleration is canceled)	5.3.1
123	FSTN	Inversion of forced deceleration command	Inversion of FST	
150	Inv S	Impact stop starting signal	ON: Hit and stop control function operation OFF: Canceled	6.14.1
151	Inv SN	Inversion of impact stop starting signal	Inversion of Inv S	
200	PWP	Parameter editing prohibition	ON: Parameter editing prohibited OFF: Setting of F700	6.20.1
201	PWPN	Inversion of parameter editing prohibition	Inversion of PWP	

* Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

Note 1: Function No. that are not appeared in the table above are assigned "No function".

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11.5 Output Terminal Function

It can be assigned the function No. in the following table to parameter F130~F138, F157, F158.

- Table of output terminal functions 1

Function No.	Code	Function	Action	Reference
0	LL	Frequency lower limit	ON: Output frequency is more than LL OFF: Output frequency is LL or less	-
1	LLN	Inversion of frequency lower limit	Inversion of LL	
2	UL	Frequency upper limit	ON: Output frequency is UL or more OFF: Output frequency is less than UL	
3	ULN	Inversion of frequency upper limit	Inversion of UL	
4	LOW	Low-speed detection signal	ON: Output frequency is F100 or more OFF: Output frequency is less than F100	6.1.1
5	LOWN	Inversion of low-speed detection signal	Inversion of LOW	
6	RCH	Output frequency attainment signal (acceleration/deceleration completed)	ON: Output frequency is within command frequency ± F102 OFF: Output frequency is more than command frequency ± F102	6.1.2
7	RCHN	Inversion of output frequency attainment signal (inversion of acceleration/deceleration completed)	Inversion of RCH	
8	RCHF	Set frequency attainment signal	ON: Output frequency is within F101±F102 OFF: Output frequency is more than F101 ±F102	6.1.3
9	RCHFN	Inversion of set frequency attainment signal	Inversion of RCHF	
10	FL	Fault signal (trip output)	ON: Inverter tripped OFF: Inverter not tripped	7.2.2
11	FLN	Inversion of fault signal (inversion of trip output)	Inversion of FL	
14	POC	Over-current detection pre-alarm	ON: Output current is F601 or more OFF: Output current is less than F601	6.18.2
15	POCN	Inversion of over-current detection pre-alarm	Inversion of POC	
16	POL	Overload detection pre-alarm	ON: 50% or more of calculated value of overload protection level OFF: Less than 50% of calculated value of overload protection level	-
17	POLN	Inversion of overload detection pre-alarm	Inversion of POL	
20	POH	Overheat detection pre-alarm	ON: Approx. 95°C or more of IGBT element OFF: Less than approx. 95°C of IGBT element (90°C or less after detection is turned on)	-
21	POHN	Inversion of overheat detection pre-alarm	Inversion of POH	
22	POP	Overvoltage detection pre-alarm	ON: Overvoltage limit in operation OFF: Overvoltage detection canceled	6.11.5
23	POPN	Inversion of overvoltage detection pre-alarm	Inversion of POP	
24	MOFF	Power circuit undervoltage detection	ON: Power circuit undervoltage (MOFF) detected OFF: Undervoltage detection canceled	-
25	MOFFN	Inversion of power circuit undervoltage detection	Inversion of MOFF	
26	UC	Small current detection	ON: After output current comes to F611 or less, value of less than F611+F609 for F612 set time OFF: Output current is more than F611 (F611+F609 or more after detection turns on)	6.18.7
27	UCN	Inversion of small current detection	Inversion of UC	
28	OT	Over-torque detection	ON: After torque comes to F616 or more, value of more than F616-F619 for F618 set time OFF: Torque is less than F616 (F616-F619 or less after detection turns on)	6.18.9
29	OTN	Inversion of over-torque detection	Inversion of OT	

- Table of output terminal functions 2

Function No.	Code	Function	Action	Reference
30	POHR	Braking resistor overload pre-alarm	ON: 50% or more of calculated value of F308 set overload protection level OFF: Less than 50% of calculated value of F308 set overload protection level	6.11.4
31	POHRN	Inversion of braking resistor overload pre-alarm	Inversion of POHR	
40	RUN	Run/stop	ON: While operation frequency is output or DC braking is in operation (db) OFF: Operation stopped	-
41	RUNN	Inversion of run/stop	Inversion of RUN	
56	COT	Cumulative operation time alarm	ON: Cumulative operation time is F621 or more OFF: The cumulative operation time is less than F621	6.18.11
57	COTN	Inversion of cumulative operation time alarm	Inversion of COT	
60	FR	Forward/reverse run	ON: Reverse run OFF: Forward run (The last status is held while motor operation is stopped)	-
61	FRN	Inversion of forward/reverse run	Inversion of FR	
68	Brake	Braking release signal	ON: Output the brake signal according to brake sequence OFF: Canceled	6.12.1
69	BrakeN	Inversion of braking release signal	Inversion of Brake	
78	COME	RS485 communication error	ON: Communication error occurred OFF: Communication works	6.21
79	COMEN	Inversion of RS485 communication error	Inversion of COME	
92	DATA	Designated data output	ON: bit0 of FA50 is ON OFF: bit0 of FA50 is OFF	-
93	DATAN	Inversion of designated data output	Inversion of DATA	
128	LTA	Parts replacement alarm	ON: Any one of cooling fan, control board capacitor, or main circuit capacitor reaches parts replacement time OFF: Any one of cooling fan, control board capacitor, or main circuit capacitor does not reach parts replacement time	6.18.14
129	LTAN	Inversion of parts replacement alarm	Inversion of LTA	
146	FLR	Fault signal (output also at a retry)	ON: While inverter is tripped or retried OFF: While inverter is not tripped and not retried	6.11.3
147	FLRN	Inversion of fault signal (output also at a retry)	Inversion of FLR	
162	NSA	Number of starting alarm	ON: Number of starting alarm is more than F648 OFF: Number of starting alarm is less than F648	6.18.15
163	NSAN	Inversion of number of starting alarm	Inversion of NSA	
174	D SOC	Completion of impact stop sequence	ON: Output signal of hit and stop control OFF: Canceled	6.14.1
175	D SOCN	Inversion of completion of impact stop sequence	Inversion of D SOC	
176	D SLR	Servo lock braking signal	ON: Output the brake signal during servo lock input signal ON OFF: Canceled	6.7.1
177	D SLRN	Inversion of servo lock braking signal	Inversion of D SLR	
178	D SL	Servo lock signal	ON: Output at servo lock operation OFF: Canceled	6.7.1
179	D SLN	Inversion of servo lock signal	Inversion of D SL	
254	AOFF	Always OFF	Always OFF	7.2.2
255	AON	Always ON	Always ON	

* Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

Note 1: As function No. that are not appeared in the table above are assigned "No function", output signal is always “OFF” at even number, output signal is always “ON” at odd number.

11.6 Unchangeable parameters in running

For reasons of safety, the following parameters cannot be changed during inverter running.
Change parameters while inverter stops.

［Basic parameters］

AUF (Guidance function)
AU1 (Automatic acceleration/deceleration)
AU2 (Factory specific coefficient)
CMOd* (Command mode selection)
FMOd* (Frequency setting mode selection)
FH (Maximum frequency)
Pt (Factory specific coefficient)
tYP (Default setting)
SEt (Factory specific coefficient)

［Basic parameters］

F105 (Priority selection (Both F and R are ON))
F104/F108/F110 (Always-active function selection 1 to 3)
F109 (Analog/logic input selection (VI terminal))
F111 to F115 (Input terminal selection 1A to 5)
F127 (Sink/source switching)
F130 to F138 (Output terminal selection 1A to 2B)
F139 (Output terminal logic selection(OUT, FM))
F151 to F156 (Input terminal selection 1B to 2C)
F301 (Auto-restart control selection)
F302 (Regenerative power ride-through control (Deceleration stop))
F304 (Dynamic braking selection)
F305 (Overvoltage limit operation (Slowdown stop mode selection))
F307 (Factory specific coefficient)
F311 (Reverse-run prohibition)
F316 (Carrier frequency control mode selection)
F340 (Creeping time)
F341 (Braking mode selection)
F346 (Creeping frequency)
F360 (PID control)
F382 (Hit and stop control)
F603 (Emergency stop selection)
F605 (Output phase failure detection selection)
F608 (Input phase failure detection selection)
F613 (Detection of output short-circuit at start-up)
F626 (Over-voltage stall protection level)
F627 (Undervoltage trip/alarm selection)
F631 (Factory specific coefficient)
F669 (Logic output/pulse train output selection (OUT))
F681 (Analog output signal selection)
F930 (Position loop gain)

*CMOd and FMOd can be changed during operation by setting F736=0.

* Factory specific coefficient parameters are manufacturer setting parameters. Do not change the value of these parameters.

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12. Specifications

12.1 Models and their standard specifications

■ Standard specifications

Item		Specification					
Input voltage class		3-phase 240V class					
Applicable motor (kW)		0.1	0.2	0.4	0.75	1.5	2.2
Rating	Type	VFNC3M					
	Form	2001PY-A30	2002PY-A30	2004PY-A30	2007PY-A30	2015PY-A30	2022PY-A30
	Capacity (kVA) Note 1)	0.3	0.6	1.0	1.6	2.9	3.9
	Output current (A) Note 2)	0.7 (0.7)	1.4 (1.4)	2.4 (2.4)	4.2 (3.6)	7.5 (7.5)	10.0 (8.5)
	Output voltage	Default setting Note 3)					
	Overload current rating	150%-60 seconds, 200%-0.5 second					
Power supply	Voltage-frequency	3-phase 200V to 240V - 50/60Hz Note 6)					
	Allowable fluctuation	Voltage 170 to 264V Note 4), frequency ±5%					
	Required Power supply capacity (kVA) Note 5)	0.5	0.8	1.4	2.5	4.3	5.7
Protective method (IEC60529)		IP20					
Cooling method		Self-cooling				Forced air-cooled	
Color		RAL 7016					
Built-in filter		-					

Note 1. Capacity is calculated at 220V for output voltage.

Note 2. Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4kHz or less. Between 5 kHz and 12 kHz, the rated output current is indicated in the ( ). Above 13 kHz, the output current must be reduced. (Refer to section 6.10) The default setting of the PWM carrier frequency is 12kHz.

Note 3. Output voltage is default setting.

Note 4. 180V-264V when the inverter is used continuously (load of 100%).

Note 5. Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).

Note 6. Rated power supply voltage of our IPM Gear Motor standards are 200 to 230V. Please call us for using at 240V.

■ Common specification

	Item	Specification
Principal control functions	Control system	Sinusoidal PWM control
	Output voltage range	Set to default setting for each capacity of IPM Gear Motor
	Output frequency range	Set to default setting for each capacity of IPM Gear Motor
	Minimum setting steps of frequency	0.1Hz: analog input (when the max. frequency is 100Hz), 0.01Hz: Operation panel setting and communication setting.
	Frequency accuracy	Digital setting: within ±0.1% of the max. frequency (-10 to +60°C) Analog setting: within ±1.0% of the max. frequency (25°C ±10°C)
	Voltage/frequency characteristics	Permanent magnet synchronous motor control
	Frequency setting signal	Setting dial on the front panel, external frequency potentiometer (connectable to a potentiometer with a rated impedance of 1k-10kΩ), 0-10Vdc / 0-5Vdc (input impedance: VI=40kΩ), 4-20mAdc (Input impedance: 250Ω). Note 1)
	Terminal board base frequency	The characteristic can be set arbitrarily by two-point setting. Possible to set: analog input (VI).
	Frequency jump	Setting of the jump frequency and the range.
	Upper- and lower-limit frequencies	Upper-limit frequency: 0 to max. frequency, lower-limit frequency: 0 to upper-limit frequency
	PWM carrier frequency	Adjustable range of 2k to 16kHz (default: 12kHz).
	PID control	Setting of proportional gain, integral gain, differential gain and control waiting time.
Operation specifications	Acceleration/deceleration time	Selectable from among acceleration/deceleration times 1 & 2 (0.0 to 3000 sec.). Automatic acceleration/deceleration function. S-pattern acceleration/deceleration 1 & 2. Control of forced rapid deceleration.
	Dynamic Braking Drive Circuit	Control and drive circuit is built in the inverter with the braking resistor outside (OP-PBR2007 or OP-PBR2022).
	Input terminal function (programmable)	Possible to select from among about 60 functions, such as forward/reverse run signal input, jog run signal input, operation base signal input and reset signal input, to assign to 5 input terminals. Logic selectable between sink and source.
	Output terminal functions (programmable)	Possible to select from among about 40 functions, such as upper/lower limit frequency signal output, low speed detection signal output, specified speed reach signal output and failure signal output, to assign to FL relay output, open collector output terminals.
	Forward/reverse run	The RUN and STOP keys on the operation panel are used to start and stop operation, respectively. Forward/reverse run possible through communication and logic inputs from the terminal block.
	Jog run	Jog mode, if selected, allows jog operation from the terminal board.
	Preset speed operation	Frequency references + 15-speed operation possible by changing the combination of 4 contacts on the terminal board.
	Retry operation	Capable of restarting automatically after a check of the main circuit elements in case the protective function is activated. 10 times (Max.) (selectable with a parameter)
	Various prohibition settings / Password setting	Possible to write-protect parameters and to prohibit the change of panel frequency settings and the use of operation panel for operation, emergency stop or resetting. Possible to write-protect parameters by setting 4 digits password and terminal input.
	Regenerative power ride-through control	Possible to keep the motor running using its regenerative energy in case of a momentary power failure (default: OFF).
	Auto-restart operation	In the event of a momentary power failure, the inverter reads the rotational speed of the coasting motor and outputs a frequency appropriate to the rotational speed in order to restart the motor smoothly. This function can also be used when switching to commercial power.
	Failure detection signal	1c- contact output Note 2) Maximum switching capacity : 250Vac-2A , 30Vdc-2A (At resistive load cosΦ=1), 250Vac-1A (cosΦ=0.4) , 30Vdc-1A (L/R=7ms) Minimum permissible load : 5Vdc-100mA, 24Vdc-5mA

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<Continued overleaf>

<Continued>

	Item	Specification
Protective function	Protective function	Stall prevention, current limitation, over-current, output short circuit, over-voltage, over-voltage limitation, undervoltage, ground fault detection, input phase failure, output phase failure, overload protection by electronic thermal function, armature over-current at start-up, load side over-current at start-up, over-torque, undercurrent, overheating, cumulative operation time, life alarm, emergency stop, various pre-alarms
	Electronic thermal characteristic	Setting of motor electronic-thermal protection level 1, setting of overload trip time, adjustment of stall prevention levels 1, selection of overload stall
	Reset function	Function of resetting by closing contact 1a or by turning off power or the operation panel. This function is also used to save and clear trip records.
Display function	Alarms	Stall prevention, overvoltage, overload, under-voltage, setting error, retry in process, upper/lower limits
	Causes of failures	Over-current, overvoltage, overheat, output short-circuit, ground fault, overload on inverter, arm overcurrent at start-up, overcurrent on the load side at start-up, CPU fault, EEPROM fault, RAM fault, ROM fault, communication error. (Selectable: emergency stop, under-voltage, small current, over-torque, motor overload, input phase failure, output phase failure)
	Monitoring function	Operation frequency, operation frequency command, forward/reverse run, output current, input voltage (DC detection), output voltage, torque, torque current, load factor of inverter, input power, output power, information on input terminals, information on output terminals, logic input terminals setting, version of CPU1, version of CPU2, PID feedback value, Actual output frequency, causes of past trips 1to 4, parts replacement alarm, cumulative operation time
	Past trip monitoring function	Stores data on the past four trips: number of trips that occurred in succession, operation frequency, forward/reverse run, output current, input voltage (DC detection), output voltage, information on input terminals, information on output terminals, and cumulative operation time when each trip occurred.
	Output for frequency meter	Analog output for meter: 1mA dc full-scale dc ammeter 0 - 20mA (4 to 20mA) output: DC ammeter (allowable load resistance: Less than 750Ω) 0 - 10V output: DC voltmeter (allowable load resistance: Over 1kΩ) Resolution: Maximum of 1/255
	4-digit 7-segments LED	Frequency: inverter output frequency. Alarm: stall alarm “C”, overvoltage alarm “P”, overload alarm “L”, overheat alarm “H”. Status: inverter status (frequency, cause of activation of protective function, input/output voltage, output current, etc.) and parameter settings. Free-unit display: arbitrary unit (e.g. rotating speed) corresponding to output frequency.
	Indicator	Lamps indicating the inverter status by lighting, such as RUN lamp, MON lamp, PRG lamp, % lamp, Hz lamp. The charge lamp indicates that the main circuit capacitors are electrically charged.
Environments	Location of use	Indoors; not exposed to direct sunlight, corrosive gas, explosive gas, flammable gas, oil mist, or dust; and vibration of less than 5.9m/s^2 (10 to 55Hz).
	Elevation	3000 m or less (current reduction required over 1000 m) Note 3)
	Ambient temperature	-10 to +60°C Note 4)
	Storage temperature	-25 to +70°C
	Relative humidity	5 to 95% (free from condensation and vapor).

Note 1. Be careful, if 4-20mA is selected, when the inverter's power is ON, the internal impedance is 250Ω, but when the power is OFF, the internal impedance increases very much to approximately 40kΩ.

Note 2. A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measures when connecting it directly with input unit terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected.

Note 3. Current must be reduced by 1% for each 100 m over 1000 m. For example, 90% at 2000m and 80% at 3000m.

Note 4. Above 40°C : Remove the protective seal from the top of inverter.
Above 50°C: Remove the seal from the top of the inverter and use the inverter with the output current reduced.
. Side by side installation (with no space between inverters): Remove the seal from the top of each inverter. When installing the inverter where the ambient temperature will rise above 40°C, remove the seal from the top of the inverter and use the inverter with the output current reduced.
(Refer to section 6.10 for details)

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12.2 Outside dimensions and mass

■ Outside dimensions and mass

Voltage class	Applicable motor (kW)	Inverter type	Dimensions (mm)						Drawing	Approx. weight (kg)
			W	H	D	W1	H1	H2		
3-phase 240V	0.1	VFNC3M-2001PY-A30	72	130	102	60	131	13	A	1.0
	0.2	VFNC3M-2002PY-A30								
	0.4	VFNC3M-2004PY-A30			121		118		B	
	0.75	VFNC3M-2007PY-A30			131					
	1.5	VFNC3M-2015PY-A30	105			93			C	1.5
	2.2	VFNC3M-2022PY-A30								

■ Outline drawing

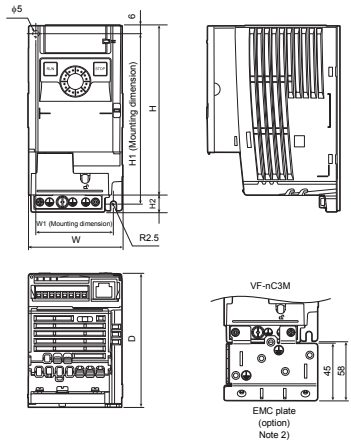

Fig.A

Note 1. Here are the meanings of the symbols used.
W: Width
H: Height
D: Depth
W1: Mounting dimension (horizontal)
H1: Mounting dimension (vertical)
H2: Height of EMC plate mounting area

Note 2. Here are the available EMC plate
Fig.A,B : OP-EMP007Z (Approx. weight : 0.3kg)
Fig.C : OP-EMP008Z (Approx. weight : 0.4kg)

Note 3. These models are fixed at two points: in the upper left and lower right corners.

Note 4. The models shown in Fig. A and Fig. B are not equipped with a cooling fan.

Note 5. “H” measurements in Fig. A is height measurements of cooling FIN installation surface. It is not include the protuberance for installation.

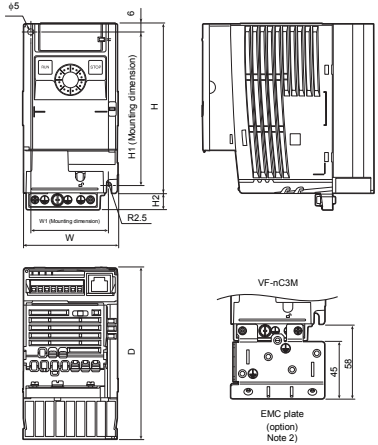
ϕ5
6
H1 (Mounting dimension)
H
H2
R2.5
W1 (Mounting dimension)
W
D
VF-nC3M
45
58
EMC plate
(option)
Note 2)

Fig.B

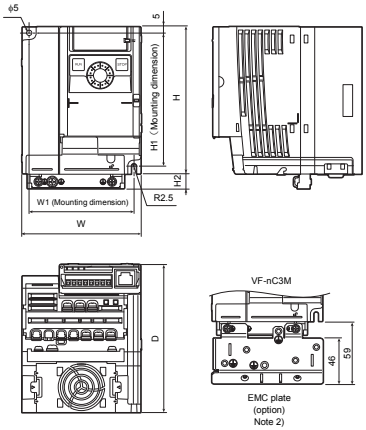
ϕ5
5
H1 (Mounting dimension)
H
H2
R2.5
W1 (Mounting dimension)
W
D
VF-nC3M
46
59
EMC plate
(option)
Note 2)

Fig.C

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13. Before making a service call - Trip information and remedies

13.1 Trip causes/warnings and remedies

When a problem arises, diagnose it in accordance with the following table.
If it is found that replacement of parts is required or the problem cannot be solved by any remedy described in the table, contact our company.

[Trip information]

Error code	Failure code	Problem	Possible causes	Remedies
OC 1	0001	Overcurrent during acceleration	• The acceleration time ACC is too short.	• Increase the acceleration time ACC.
			• A restart signal is input to the rotating motor after a momentary stop, etc.	• Use F301 (Auto-restart control selection) and F302 (Regenerative power ride-through control).
OC2	0002	Overcurrent during deceleration	• The deceleration time dEC is too short.	• Increase the deceleration time dEC.
OC3	0003	Overcurrent during constant speed operation	• The load fluctuates abruptly. • The load is in an abnormal condition.	• Reduce the load fluctuation. • Check the load (operated machine).
OCL	0004	Overcurrent (An overcurrent on the load side at start-up)	• The insulation of the output main circuit or motor is defective.	• Check the secondary wiring and insulation state.
OCA	0005	Arm overcurrent at start-up	• A main circuit elements is defective.	• Contact our company.
* EPH1	0008	Input phase failure	• A phase failure occured in the input line of the main circuit. • The capacitor in the main circuit lacks capacitance.	• Check the main circuit input line for phase failure. • Set input phase failure detection selection F608=0. • Check the capacitor in the main circuit for exhaustion.
* EPH0	0009	Output phase failure	• A phase failure occurred in the output line of the main circuit.	• Check the main circuit output line, motor, etc. for phase failure. • Set output phase failure detection selection F605=0.
OP1	000A	Overvoltage during acceleration	• The input voltage fluctuates abnormally. (1) The power supply has a capacity of 200kVA or more. (2) A power factor improvement capacitor is opened or closed. (3) A system using a thyrister is connected to the same power distribution line.	• Insert a suitable input reactor.
			• A restart signal is input to the rotating motor after a momentary stop, etc.	• Use F301 (Auto-restart control selection) and F302 (Regenerative power ride-through control).

* You can select a trip ON/OFF by parameters.
(Continued overleaf)

(Continued)

Error code	Failure code	Problem	Possible causes	Remedies
OP2	000B	Overvoltage during deceleration	• The deceleration time dEC is too short. (Regenerative energy is too large.)	• Increase the deceleration time dEC.
			• The input voltage fluctuates abnormally. (1) The power supply has a capacity of 200kVA or more. (2) A power factor improvement capacitor is opened and closed. (3) A system using a thyrister is connected to the same power distribution line.	• Insert a suitable input reactor.
OP3	000C	Overvoltage during constant-speed operation	• The input voltage fluctuates abnormally. (1) The power supply has a capacity of 200kVA or more. (2) A power factor improvement capacitor is opened or closed. (3) A system using a thyrister is connected to the same power distribution line.	• Insert a suitable input reactor.
			• The motor is in a regenerative state because the load causes the motor to run at a frequency higher than the inverter output frequency.	• Install an optional braking resistor.
OL1	000D	Inverter overload	• The acceleration time ACC is too short.	• Increase the acceleration time ACC.
			• A restart signal is input to the rotating motor after a momentary stop, etc.	• Use F301 (Auto-restart control selection) and F302 (Regenerative power ride-through control).
			• The load is too large.	• Use an inverter with a larger rating.
OL2	000E	Motor overload	• The motor is locked up.	• Check the load (operated machine).
OL3	003E	Main module overload	• The carrier frequency is high and load current has increased at low speeds (mainly at 15Hz or less).	• Raise the operation frequency. • Reduce the load. • Reduce the carrier frequency.
OLr	000F	Dynamic braking resistor overload trip	• The deceleration time is too short. • Dynamic braking is too large.	• Increase the deceleration time dEC.
* OL	0020	Over-torque trip	• Over-torque reaches to a detection level during operation.	• Enable F615 (over-torque trip selection). • Check system error.
OH	0010	Overheat	• The cooling fan does not rotate.	• The fan requires replacement if it does not rotate during operation.
			• The ambient temperature is too high.	• Decrease the temperature of inverter installation environment.
			• The vent is blocked up.	• Secure sufficient space around the inverter.
			• A heat generating device is installed close to the inverter.	• Do not place any heat generating device near the inverter.
E	0011	Emergency stop	• During automatic operation or remote operation, a stop command is entered from the operation panel or a remote input device.	• Reset the inverter. • If the emergency stop signal is input, reset after releasing this signal.

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* You can select a trip ON/OFF by parameters.

(Continued overleaf)

(Continued)

Error code	Failure code	Problem	Possible causes	Remedies
EEP1	0012	EEPROM fault 1	• A data writing error occurs.	• Turn off the inverter, then turn it again. If it does not recover from the error, contact our company.
EEP2	0013	EEPROM fault 2	• Power supply is cut off during EYP operation and data writing is aborted. • The error occurred when various data was written.	• Turn the power off temporarily and turn it back on, and then try EYP operation again. • Write the data again. Contact our company when it happening frequently.
EEP3	0014	EEPROM fault 3	• A data reading error occurred.	• Turn off the inverter, then turn it again. If it does not recover from the error, contact our company.
Err2	0015	Main unit RAM fault	• The control RAM is defective.	• Contact our company.
Err3	0016	Main unit ROM fault	• The control ROM is defective.	• Contact our company.
Err4	0017	CPU fault 1	• The control CPU is defective.	• Contact our company.
Err5	0018	Remote control error	• The communication was broken off.	• Check the remote control device, cables, etc.
Err7	001A	Current detector fault	• The current detector is defective.	• Contact our company.
* UC	001D	Low-current operation Trip	• The output current decreased to a low-current detection level during operation.	• Enable F610 (low-current detection). • Check the suitable detection level for the system (F609, F611, F612). • Contact our company if the setting is correct.
* UP1	001E	Undervoltage trip (main circuit)	• The input voltage (in the main circuit) is too low.	• Check the input voltage. • Enable F627 (undervoltage trip selection). • To take measures to momentary power failure, set F627=0 or 2, F301 (Auto-restart control selection) and F302 (Regenerative power ride-through control).
EF2	0022	Ground fault trip	• A ground fault occurs in the output cable or the motor.	• Check the cable and the motor for ground faults.
EEYP	0029	Inverter type error	• It may be a breakdown failure.	• Contact our company.
E-10	0042	Analog input terminal overvoltage	• The voltage more than ratings is impressed to an analog terminal.	• Impress the voltage within the ratings.
E-13	002D	Over speed fault	• The input voltage fluctuates abnormally. • Over speed fault due to the overvoltage limit operation.	• Check the input voltage. • Install a braking resistor. (OP-PBR-2007, OP-PBR-2022).
* E-18	0032	Brea in analog signal cable	• The input signal from VI is equal to or less than the F633 setting.	• Check the VI signal cable for breaks. Also, check the input signal value or setting of F633.
E-19	0033	CPU communications error	• A communications error occurs between control CPUs.	• Contact our company.
E-21	0035	CPU fault 2	• The control CPU is defective.	• Contact our company.
E-26	003A	CPU fault 3	• The control CPU is defective.	• Contact our company.
E-37	0045	Servo lock fault	• The motor shaft is not locked in servo lock operation.	• Reduce the load in servo lock operation. • Enforce a lock plan so that a motor axis is not turned in load more than electric corner 10 rounds.
SOUE	002F	Stepping-out	• The motor shaft is locked. • One output phase is open. • An impact load is applied. • The acceleration / deceleration time is too short. • It was turned to the opposite direction of the command. • The motor axis was turned during the initial position estimation (about 150 ms) at the time of the start.	• Unlock the motor shaft. • Check the interconnect cables between the inverter and the motor. • Increase F460. • Increase the acceleration ACC and deceleration time dEC. • Reduce the load. • Do not be turned the motor axis during the initial position estimation (about 150 ms).

* You can select a trip ON/OFF by parameters.

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[Alarm information] Each message in the table is displayed to give a warning but does not cause the inverter to trip.

Error code	Problem	Possible causes	Remedies
OFF	ST terminal OFF	• The ST-CC circuit is opened.	• Close the ST-CC circuit.
nOFF	Undervoltage in main circuit	• The supply voltage between R, S and T is under voltage.	• Measure the main circuit supply voltage. If the voltage is at a normal level, the inverter requires repairing.
Err 1	Frequency point setting error alarm	• The frequency setting signals at points 1 and 2 are set too close to each other.	• Set the frequency setting signals at points 1 and 2 apart from each other.
CLr	Clear command acceptable	• This message is displayed when pressing the STOP key while an error code is displayed.	• Press the STOP key again to clear the trip.
EOFF	Emergency stop command acceptable	• The operation panel is used to stop the operation in automatic control or remote control mode.	• Press the STOP key for an emergency stop. To cancel the emergency stop, press any other key.
H !! LO	Setting error alarm / An error code and data are displayed alternately twice each.	• An error is found in a setting when data is reading or writing.	• Check whether the setting is made correctly.
HEAd/ End	Display of first/last data items	• The first and last data item in the AUX data group is displayed.	• Press MODE key to exit the data group.
db	DC braking	• DC braking in process	• The message goes off in several tens of seconds if no problem occurs. Note)
E1 E2 E3	Flowing out of excess number of digits	• The number of digits such as frequencies is more than 4. (The upper digits have a priority.)	• Lower the frequency free unit magnification F702.
StOP	Momentary power failure slowdown stop prohibition function activated.	• The slowdown stop prohibition function set with F302 (momentary power failure ride-through operation) is activated.	• To restart operation, reset the inverter or input an operation signal again.
LStP	Auto-stop because of continuous operation at the lower-limit frequency	• The automatic stop function selected with F256 was activated.	• This function is cancelled, when frequency reference reaches LL+0.2Hz or operation command is OFF.
In It	Parameters in the process of initialization	• Parameters are being initialized to default values.	• Normal if the message disappears after a while (several seconds to several tens of seconds).
A-05	Output frequency upper limit	• An attempt was made to operate at a frequency higher than 10 times the base frequency (uL or F170).	• Operate at a frequency within 10 times the base frequency.
A-17	Operation panel key alarm	• The RUN or STOP key is held down for more than 20 seconds. • The RUN or STOP key is faulty.	• Check the operation panel.

(Continued overleaf)

(Continued)

Error code	Problem	Possible causes	Remedies
E-49	External power supply input logic switching check alarm	• The input terminal was switched to sink logic of external power supply input (+24V).	• Check the wiring, and set the appropriate logic. • Check to make sure that the wiring is normal, and reset or turn the power off and then back on again. This switches the logic.
E-50	Source logic switching check alarm	• The input terminal was switched to source logic.	
E-51	Sink logic switching check alarm	• The input terminal was switched to sink logic.	
PASS/ FAIL	Password verification result	• After the password setting (F738), the password was input to F739 (password verification).	• If the password is correct, PASS is displayed and if it is incorrect, FAIL is displayed.
EASY/ Std	Switching display of Easy setting mode / Standard setting mode	• The EASY key was pushed in the standard monitor mode.	• When EASY is displayed, setting mode becomes easy setting mode. When Std is displayed, it becomes standard setting mode.
nErr	No trip of past trip	• No new record of past trip, after past trips were clear.	• Normal operation.
n---	No detailed information of past trip	• The detailed information of past trip is read by pushing the center of setting dial during blinking nErr ⇔ number.	• Normal operation. To be returned by pressing MODE key.

[Prealarm display]

C	Overcurrent alarm	Same as OC (overcurrent)
P	Overvoltage alarm	Same as OP (overvoltage)
L	Overload alarm	Same as OL 1, OL 2 and OL 3 (overload)
H	Overheat alarm	Same as OH (overheat)
t	Communication alarm	Same as Err 5 (communication fault)

If two or more problems arise simultaneously, one of the following alarms appears and blinks.
CP, PL, CPL
The blinking alarms C, P, L, H, t are displayed in this order from left to right.

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13.2 Restoring the inverter from a trip

Do not reset the inverter when tripped because of a failure or error before eliminating the cause. Resetting the tripped inverter before eliminating the problem causes it to trip again.

The inverter can be restored from a trip by any of the following operations:

(1) By turning off the power (Keep the inverter off until the LED turns off.)
Note) See inverter trip hold selection F602 for details.
(2) By means of an external signal (Short circuit across RES and CC on control terminal block → Open): The reset function must be assigned to the input terminal block. (function number 8, 9)
(3) By panel keypad operation
(4) By inputting a trip clear signal from communication
(Refer to communication manual (E6581657) for details.)

To reset the inverter by panel keypad operation, follow these steps.

1. Press the STOP key and make sure that CLr is displayed.
2. Pressing the STOP key again will reset the inverter if the cause of the trip has already been eliminated.

☆ When any overload function [OL 1: inverter overload, OL2: motor overload, OLr: braking resistor overload] is active, the inverter cannot be reset by inputting a reset signal from an external device or by operation panel operation before the virtual cooling time has passed.

Virtual cooling time ... OL 1 : about 30 seconds after the occurrence of a trip
OL2 : about 120 seconds after a occurrence of a trip
OLr : about 20 seconds after a occurrence of a trip

☆ In case of a trip due to overheat (OH), the inverter checks the temperature within. Wait until the temperature in the inverter falls sufficiently before resetting the inverter.
☆ The inverter cannot be reset while the emergency stop signal is being input from the terminal.
☆ The inverter cannot be reset while the pre-alarm is occurred.

[Caution]
Turning the inverter off then turning it on again resets the inverter immediately. You can use this mode of resetting if there is a need to reset the inverter immediately. Note, however, that this operation may damage the system or the motor if it is repeated frequently.

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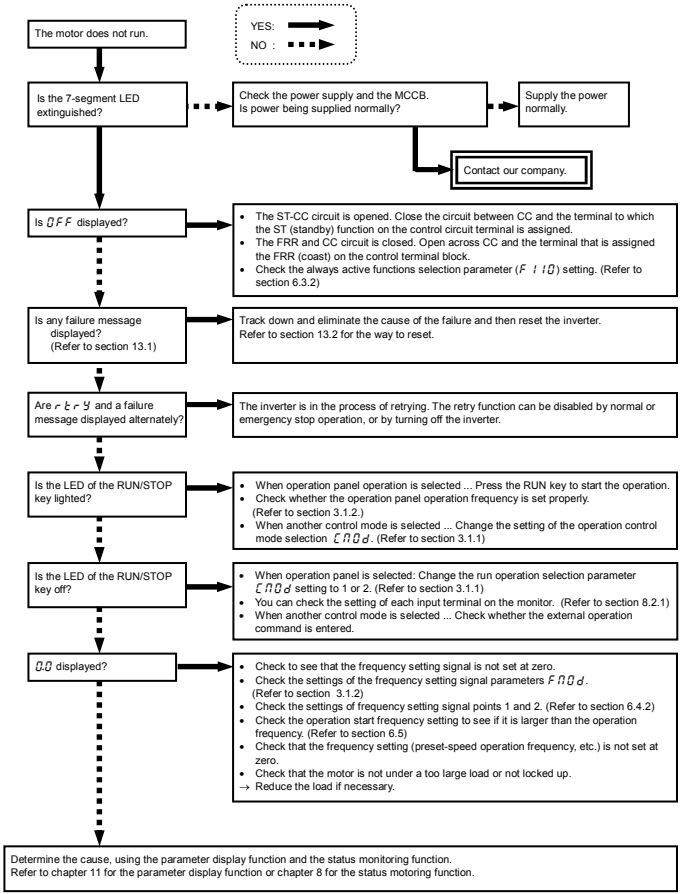
13.3 If the motor does not run while no trip message is displayed ...

If the motor does not run while no trip message is displayed, follow these steps to track down the cause.



13.4 How to determine the causes of other problems

The following table provides a listing of other problems, their possible causes and remedies.

Problems	Causes and remedies
The motor runs but its speed does not change normally.	• The soft stall function is activated. • The frequency setting signal is too low. Check the signal set value, circuit, cables, etc.
The motor does not accelerate or decelerate smoothly.	• The acceleration time (ACC) or the deceleration time (dEC) is set too short. Increase the acceleration time (ACC) or the deceleration time (dEC).
A too large current flows into the motor.	• The load is too heavy. Reduce the load.
The motor runs at a higher or lower speed than the specified one.	• The reduction gear ratio, etc., are not set properly. Adjust the reduction gear ratio, etc. • The output frequency is not set correctly. Check the output frequency range.
The motor speed fluctuates during operation.	• The load is too heavy or too light. Reduce the load fluctuation. • The inverter or motor used does not have a rating large enough to drive the load. Use an inverter or motor with a rating large enough. • Check whether the frequency setting signal changes.
Parameter settings cannot be changed.	Change the setting of the parameter setting selection prohibited parameter F700 to 0 (enabled) if it is set to 1 or 2 (prohibited). * For reasons of safety, some parameters cannot be reprogrammed while the inverter is running. (Refer to section 6.20.1)

How to cope with parameter setting-related problems

If you forget parameters which have been reset	Contact our company.

14. Inspection and maintenance

⚠ Warning	
Mandatory action	• The equipment must be inspected every day. If the equipment is not inspected and maintained, errors and malfunctions may not be discovered which could lead to accidents. • Before inspection, perform the following steps. (1) Shut off all input power to the inverter. (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. (3) Use a tester that can measure DC voltages (400V DC or more), and check that the voltage to the DC main circuits (across PA-PC) does not exceed 45V. Performing an inspection without carrying out these steps first could lead to electric shock.

Be sure to inspect the inverter regularly and periodically to prevent it from breaking down because of the environment of use, such as temperature, humidity, dust and vibration, or deterioration of its components with aging.

14.1 Regular inspection

Since electronic parts are susceptible to heat, install the inverter in a cool, well-ventilated and dust-free place. This is essential for increasing the service life.

The purpose of regular inspections is to maintain the correct environment of use and to find any sign of failure or malfunction by comparing current operation data with past operation records.

Subject of inspection	Inspection procedure			Criteria for judgment
	Inspection item	Inspection cycle	Inspection method	
1. Indoor environment	1) Dust, temperature and gas	Occasionally	1) Visual check, check by means of a thermometer, smell check	1) Improve the environment if it is found to be unfavorable.
	2) Drop of water or other liquid	Occasionally	2) Visual check	2) Check for any trace of water condensation.
	3) Room temperature	Occasionally	3) Check by means of a thermometer	3) Max. temperature: 60°C
2. Units and components	1) Vibration and noise	Occasionally	Tactile check of the cabinet	Is something unusual is found, open the door and check the transformer, reactors, contactors, relays, cooling fan, etc., inside. If necessary, stop the operation.
3. Operation data (output side)	1) Load current	Occasionally	Moving-iron type AC ammeter	To be within the rated current, voltage and temperature. No significant difference from data collected in a normal state.
	2) Voltage (*)	Occasionally	Rectifier type AC voltmeter	
	3) Temperature	Occasionally	Thermometer	

*) The voltage measured may slightly vary from voltmeter to voltmeter. When measuring the voltage, always take readings from the same circuit tester or voltmeter.

■ Check points

1. Something unusual in the installation environment
2. Something unusual in the cooling system
3. Unusual vibration or noise
4. Overheating or discoloration
5. Unusual odor
6. Unusual motor vibration, noise or overheating
7. Adhesion or accumulation of foreign substances (conductive substances)

14.2 Periodical inspection

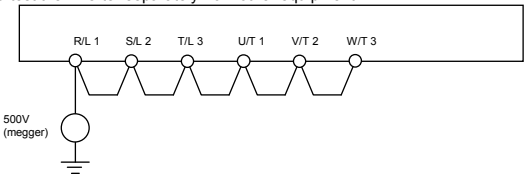
Make a periodical inspection at intervals of 3 or 6 months depending on the operating conditions.

⚠ Warning	
Mandatory action	•Before inspection, perform the following steps. (1) Shut off all input power to the inverter. (2) Wait at least 15 minutes and check to make sure that the charge lamp is no longer lit. (3) Use a tester that can measure DC voltages (400V DC or more), and check that the voltage to the DC main circuits (across PA-PC) does not exceed 45V. Performing an inspection without carrying out these steps first could lead to electric shock.
Prohibited	• Never replace any part. This could be a cause of electric shock, fire and bodily injury. To replace parts, call our company.

■ Check items

1. Check to see if all screwed terminals are tightened firmly. If any screw is found loose, tighten it again with a screwdriver.
2. Check to see if all caulked terminals are fixed properly. Check them visually to see that there is no trace of overheating around any of them.
3. Check all cables and wires for damage. Check them visually.
4. Remove dirt and dust. With a vacuum cleaner, remove dirt and dust. When cleaning, clean the vents and the printed circuit boards. Always keep them clean to prevent an accident due to dirt or dust.
5. If no power is supplied to the inverter for a long time, the performance of its large-capacity electrolytic capacitor declines.
   When leaving the inverter unused for a long time, supply it with electricity once every two years, for 5 hours or more each, to recover the performance of the large-capacity electrolytic capacitor. And also check the function of the inverter. It is advisable not to supply the commercial power directly to the inverter but to gradually increase the power supply voltage with a transformer, etc.
6. If the need arises, conduct an insulation test on the main circuit terminal board only, using a 500V insulation tester. Never conduct an insulation test on control terminals other than terminals on the printed circuit board or on control terminals. When testing the motor for insulation performance, separate it from the inverter in advance by disconnecting the cables from the inverter output terminals U/T1, V/T2 and W/T3. When conducting an insulation test on peripheral circuits other than the motor circuit, disconnect all cables from the inverter so that no voltage is applied to the inverter during the test.

(Note) Before an insulation test, always disconnect all cables from the main circuit terminal board and test the inverter separately from other equipment..



7. Never test the inverter for pressure. A pressure test may cause damage to its components.
8. Voltage and temperature check

Recommended voltmeter : Input side ... Moving-iron type voltmeter ()

Output side ... Rectifier type voltmeter ()

It will be very helpful for detecting a defect if you always measure and record the ambient temperature before, during and after the operation.

■ Replacement of expendable parts

The inverter is composed of a large number of electronic parts including semiconductor devices.
The following parts deteriorate with the passage of time because of their composition or physical properties. The use of aged or deteriorated parts leads to degradation in the performance or a breakdown of the inverter. To avoid such trouble, the inverter should be checked periodically.

Note) Generally, the life of a part depends on the ambient temperature and the conditions of use. The life spans listed below are applicable to parts when used under normal environmental conditions.

1) Cooling fan
The fan for cooling heat-generating parts has a service life of about ten years. The fan also needs to be replaced if it makes a noise or vibrates abnormally.

2) Smoothing capacitor
The smoothing aluminum electrolytic capacitor in the main circuit DC section degrades in performance because of ripple currents, etc. It becomes necessary to replace the capacitor after it is used for about 5 years under normal conditions. Since the smoothing capacitor is mounted on a printed circuit board, it must be replaced together with the circuit board.
<Criteria for appearance check>
- Absence of liquid leak
- Safety valve in the depressed position
- Measurement of electrostatic capacitance and insulation resistance

Note: Checking the life alarm function is useful for roughly determining the parts replacement time. To ensure customer safety, you should never replace parts on your own. (It is also possible to monitor the part replacement alarm and output a signal)

■ Standard replacement cycles of principal parts

As guides, the table below lists part replacement cycles that were estimated based on the assumption that the inverter would be used in a normal use environment under normal conditions (ambient temperature, ventilation conditions, and energizing time). The replacement cycle of each part does not mean its service life but the number of years over which its failure rate does not increase significantly.
Also, make use of the life alarm function.

Part name	Standard replacement cycle Note 1:	Replacement mode and others
Cooling fan	10 years	Replacement with a new one (To be determined after inspection)
Main circuit smoothing aluminum electrolytic capacitor	10 years Note 2	Replacement with a new one (To be determined after inspection)
Relays	-	Whether to replace or not depends on the check results
Aluminum electrolytic capacitor mounted on a printed circuit board	10 years Note 2	Replace with a new circuit board (To be determined after inspection)

Note 1: The replacement cycle is calculated on the assumption that the average ambient temperature over a year is 40°C. The environment must be free of corrosive gases, oil mist and dust.
Note 2: Figures are for when the inverter output current is 80% of the rated current of the inverter.
Note 3: The life of parts varies greatly depending on the operating environment.

14.3 Making a call for servicing

Please contact our nearest office or the factory. If defective conditions are encountered, please contact the Nissei service section in charge via your Nissei distributor.
When making a call for servicing, please inform us of the contents of the rating label on the right panel of the inverter, the presence or absence of optional devices, etc., in addition to the details of the failure.

14.4 Keeping the inverter in storage

Take the following precautions when keeping the inverter in storage temporarily or for a long period of time.

1. Store the inverter in a well-ventilated place away from heat, damp, dust and metal powder.

2. If no power is supplied to the inverter for a long time, the performance of its large-capacity electrolytic capacitor declines.
   When leaving the inverter unused for a long time, supply it with electricity once every two years, for 5 hours or more each, to recover the performance of the large-capacity electrolytic capacitor. And also check the function of the inverter. It is advisable not to supply the commercial power directly to the inverter but to gradually increase the power supply voltage with a transformer, etc.

15. Warranty

Any part of the inverter that proves defective will be repaired and adjusted free of charge under the following conditions:

1. This warranty applies only to the inverter main unit.
2. Any part of the inverter which fails or is damaged under normal use within twelve months from the date of delivery shall be repaired free of charge.
3. For the following kinds of failure or damage, the repair cost shall be borne by the customer even within the warranty period.
   - Failure or damage caused by improper or incorrect use or handling, or unauthorized repair or modification of the inverter
   - Failure or damage caused by the inverter falling or an accident during transportation after the purchase
   - Failure or damage caused by fire, salty water or wind, corrosive gas, earthquake, storm or flood, lightning, abnormal voltage supply, or other natural disasters
   - Failure or damage caused by the use of the inverter for any purpose or application other than the intended one
4. All expenses incurred by Toshiba for on-site services shall be charged to the customer, unless a service contract is signed beforehand between the customer and Toshiba, in which case the service contract has priority over this warranty.

16. Disposal of the inverter

⚠ Caution	
Mandatory action	• If you dispose of the inverter, have it done by a specialist in industry waste disposal(*). If you dispose of he inverter by yourself, this can result in explosion of capacitor or produce noxious gases, resulting in injury. (*) Persons who specialize in the processing of waste and known as "industrial waste product collectors and transporters" or "industrial waste disposal persons. "If the collection, transport and disposal of industrial waste is done by someone who is not licensed for that job, it is a punishable violation of the law. (Laws in regard to cleaning and processing of waste materials)

For safety's sake, do not dispose of the disused inverter yourself but ask an industrial waste disposal agent.
Disposing of the inverter improperly could cause its capacitor to explode and emit toxic gas, causing injury to persons.

If you have any trouble or concerns about the product, please contact your dealer or our nearest sales office or plant.

NISSEI CORPORATION

Sales, Overseas Division
1-1 Inoue, Izumi-cho, Anjo-shi, Aichi, 444-1297 JAPAN
TEL: +81-566-92-5312 FAX: +81-566-92-7002
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2011-10

Please refer to the following modifications on the instruction manual E6581815 for IPM gearmotor inverter VF-nC3M.

■ Error correction

Page	Wrong	Right
F－66 K－12	Adjustment range of parameter F707 0.00 : Invalid	Adjustment range of parameter F707 0.00 : Automatic
L－1	Overload current rating 150% – 60 seconds, 200% – 0.5 second (inverse-time characteristics)	Overload current rating 150% – 60 seconds (inverse-time characteristics)

■ Additional notes on torque limit parameter setting (F-43)

Title	Function	Adjustment range	Default setting	**Notes**
F441	Power running torque limit 1 level	0.0～250.0 %	150.0 %	**Caution !** **1. Please do not set to exceed the default setting value.** **2. Please set the same value for F441 and F443.** **3. Please se the same value for F444 and F445.**
F443	Regenerative braking torque limit 1 level	0.0～250.0 %	150.0 %	
F444	Power running torque limit 2 level	0.0～250.0 %	150.0 %	
F445	Regenerative braking torque limit 2 level	0.0～250.0 %	150.0 %	

■ Additional notes on installation of thermal relay (overload relay)(page A—17, 18／J－2, 3)

This inverter has an electronic-thermal overload protective function. However, when a thermal relay is installed on the secondary side (between this inverter and the motor), please do not install the electromagnetic contactor linked with the operation of this thermal relay on the secondary side. If installed on the secondary side, the secondary side will be turned ON/OFF during the operation, causing a large current to flow into the inverter and causing malfunction.

■ Addition of measures for OL 1 trip.

Trip information

Title	Error code	Description	Probable cause	**Measures**
OL 1	000D	Inverter overload	The acceleration time ACC is too short.	Increase the acceleration time ACC
			V/F is not appropriate.	Check the parameter V/F
			A restart signal is input to the rotating motor after a momentary stop.	Use F302 (Regenerative power ride-through control)
			The load is too large.	Reduce the load Set PWM carrier frequency F300 to 4kHz or less.

■ Additional sheet

Compliance with Low Voltage Directive 2014/35/EU

Since 21 June 2023, EN61800-5-1 2007 / A1 (2017) / A11 (2021) has been harmonized standard listed on the Directive 2014/35/EU (Low Voltage). This additional sheet is very important to use VF-nC3M inverter safely, prevent injury to yourself and other people around you as well as to prevent damage to property in the area. Thoroughly familiarize yourself with the symbols and indications shown in the VF-nC3M instruction manual (E6581815) and then continue to read this additional manual.

See web page https://www.nissei-gtr.co.jp/ for VF-nC3M instruction manual

See web page https://www.inverter.co.jp/ for EU Declaration of Conformity

⚠ WARNING

Mandatory action

- Install proper short-circuit protective device between the power supply and the inverter (primary side).
  If proper short-circuit protective device is not installed, short circuit current cannot be shut down by inverter alone and it will result in fire.
  Integral solid state short circuit protection in the inverter does not provide branch circuit protection.
  Branch circuit protection must be provided in accordance with any local codes
- Take into account the minimum required prospective short-circuit current of short-circuit protective device.
  If short circuit protective device does not work properly due to lower level short-circuit current, it will result in electric shock or fire.
- Install the inverter into enclosure based on this manual, and install short-circuit protective device or power distribution devices based on the manufacturer manual.
  When they are installed with improper coordination, this will result in electric shock or fire.
- The grounding wire must be connected securely.
  If the grounding wire is not securely connected, when the inverter has failure or earth leakage, this will result in electric shock or fire.

PKR86018-00

This additional manual includes the correction and additional information for [9.1.3] of E6581815 to comply with Low Voltage Directive 2014/35/EU under the condition below.

- Applicable standard: EN 61800-5-1 :2007 / A1:2017 / A11:2021 (IEC61800-5-1 Ed.2.1)
- Pollution degree: 2
- Overvoltage category: 3
- The electronic power output short-circuit protection circuitry meets the requirements of IEC 60364-4-41:2005/AMD1 — Clause 411

When incorporating the inverter into a power drive system, take the following measures to comply with IEC61800-5-1 Ed.2.1.

(1) Installation and upstream protection devices
- Install the inverter into the enclosure with proper short circuit protective device (SCPD) in accordance with the table of prospective short-circuit current (Isc) rating shown in following pages.
- Semiconductor fuses (gR) are mandatory in case of using DC bus and/or braking ports, to comply with IEC61800-5-1 Ed.2.1.

(2) Grounding
- Connect a dedicated wire to the grounding terminal on inverter.
- Ground each inverter directly when grounding multiple inverters.
- Refer to the table in [10. 1] of E6581815 to select a grounding wire size.

(3) Overload protection
- For overload protection of inverter, refer to [3.4] of E6581815.

(4) Motor overload protection
- For electronic motor thermal protection, refer to [3.4] of E6581815.

Prospective short-circuit current (Isc) rating table

The rating of the short circuit protection devices in the table are maximum values. Smaller sizes can be used.
Use the wire with the size described in [10.1] of E6581815.
Semiconductor fuses (gR) are mandatory in case of using DC output and/or braking ports to comply with IEC61800-5-1 Ed.2.1, refer to “Prospective short-circuit current rating table (Isc) with semiconductor fuse” in 2nd table.

Reference *1	Maximum input voltage (V)	Applicable motor (kW)	Max. Isc (kA)	SCPD rating		Minimum line reactor (mH)	Minimum enclosure volume (L)
				Fuse gG *2 (A)	Circuit breaker *3		
VFNC3M-2001P	240	0.1	5	4	GV2L07	-	15.7
VFNC3M-2002P		0.2	5	4	GV2L07	-	15.7
VFNC3M-2004P		0.4	5	8	GV2L08	-	15.7
VFNC3M-2007P		0.75	5	12	GV2L14	--	15.7
VFNC3M-2015P		1.5	5	20	GV2L16	-	15.7
VFNC3M-2022P		2.2	5	25	GV2L20	-	15.7

*1: Reference may be followed by any characters.
*2: Mersen is recommended supplier
*3: Tesys GV series from Schneider Electric are recommended.

Prospective short-circuit current rating (Isc) table with semiconductor fuse

The rating of the short circuit protection devices in the table are maximum values. Smaller sizes can be used.
Use the wire with the size described in [10.1] of E6581815.

Reference *1	Maximum input voltage (V)	Applicable motor (kW)	Max. Isc (kA)	SCPD rating (semiconductor fuse: IEC60269-4) gR *2 690V		Minimum line reactor (mH)	Minimum enclosure volume (L)
				Rating (A)	Min. Size		
VFNC3M-2001P	240	0.1	5	4	10x38	-	15.7
VFNC3M-2002P		0.2	5	4	10x38	-	15.7
VFNC3M-2004P		0.4	5	8	10x38	-	15.7
VFNC3M-2007P		0.75	5	12.5	10x38	-	15.7
VFNC3M-2015P		1.5	5	20	10x38	-	15.7
VFNC3M-2022P		2.2	5	25	10x38	-	15.7

*1: Reference may be followed by any characters.
*2: Mersen is recommended supplier

Compliance with EMC Directive 2014/30/EU

This additional manual includes the additional information for [9.1.1] of E6581815 to comply with EMC Directive 2014/30/EU.

These products cannot satisfy EMI requirement alone, but they can comply with the requirement by installing with the filter option shown in the table below

Reference *1	Career frequency (kHz)	EMC Filter	Conducted noise IEC61800-3 Category C1	Conducted noise IEC61800-3 Category C2
			Length of motor cable (m)	Length of motor cable (m)
VFNC3M-2001P	4 to 12	EMFS11-2007AZ	1	5
VFNC3M-2002P	4 to 12	EMFS11-2007AZ	1	5
VFNC3M-2004P	4 to 12	EMFS11-2007AZ	1	5
VFNC3M-2007P	4 to 12	EMFS11-2007AZ	1	5
VFNC3M-2015P	4 to 12	EMFS11-4015BZ	1	5
VFNC3M-2022P	4 to 12	EMFS11-4015BZ	1	5

*1: Reference may be followed by any characters.

(1) Insert a recommended EMC filter on the input side of the inverter to reduce conducted noise and radiation noise from input cables
(2) Use shielded power cables, such as inverter output cables, and shielded control cables. Route the cables and wires so as to minimize their lengths. Keep a distance between the power cable and the control cable and between the input and output wires of the power cable. Do not route them in parallel or bind them together, instead cross at right angle.
(3) It is more effective in limiting the radiation noise to install the inverter in a sealed steel cabinet. Using wires as thick and short as possible, earth the metal plate and the control panel securely with a distance kept between the earth cable and the power cable.
(4) Route the input and output wires apart from each other.
(5) To suppress radiation noise from cables, ground all shielded cables through a noise cut plate.
It is effective to earth shielded cables in the vicinity of the inverter and cabinet (within a radius of 10cm from each of them). Inserting a ferrite core in a shielded cable is even more effective in limiting the radiation noise.
(6) To further limit the radiation noise, insert a zero-phase reactor in the inverter output line and insert ferrite cores in the earth cables of the metal plate and cabinet.