Panasonic

Inverter
VF100
Instruction Manual

http://www.mew.co.jp/ac/c/

Panasonic Electric Works Automation Controls (Shanghai) Co., Ltd.

Foreword

Thank you for purchasing the general-purpose VF100 series inverter produced by Panasonic Electric Works Automation Controls (Shanghai) Co., Ltd.

Usage methods and precautions are described in this instruction manual. Read this manual carefully before attempting to operate the inverter and store it for future reference.

⚠ ATTENTION

- This general-purpose inverter produced by our company is not designed or manufactured to be used in equipment or system in situations that can affect or endanger human life.
  When considering this product for operation in special applications such as machinery or systems used in movable body, medical, aerospace, nuclear energy control, or submarine relay applications, please contract us.
- Although this product was manufactured under strict quality control conditions, it is strongly advised to install safety devices to forestall serious accidents when used in facilities where a breakdown of this product is likely to cause a serious human injury or generate major losses.
- Do not use this product for loads other than a 3-phase induction motor.

Safety Precautions

Read this manual and related documents before attempting to install, operate, service or inspect the inverter.

Make sure that you have an understanding of the device, the safety information and all precautions before starting use. Precautions described in this manual are divided into two grades: "Caution" and "Note".

⚠ Caution : indicates dangerous situations that could lead to personal injury or death by mishandling the equipment.

⚠ Note : indicates dangerous situations that could lead to moderate or slight personal injury or property damage by mishandling the equipment.

In addition, failure to follow the precautions described in ⚠ Note may lead to serious situations in different conditions.

Please follow the information and instructions as laid out in this manual carefully to avoid damage to equipment or risk to personal injury.

1. Installation

⚠ Note

- Install the unit on a non-combustible material such as metal.
  Installing it on other material could lead to fires.
- Do not place the unit near flammable materials.
  Doing so could lead to fires.
- Do not hold by terminal cover during transportation.
  Doing so could cause the unit to drop and lead to injuries.
- Do not allow foreign matter such as metal swarf enter the unit.
  Entry of this type of matter could lead to fires.
- Install the unit according to the instruction manual on a place where the weight can be withstood.
  Failure to do so could lead to dropping of the unit and to injuries.
- Do not install or operate an inverter that is damaged or missing parts.
  Doing so could lead to injuries.

2. Wiring

⚠ Caution

- Always confirm that the power is OFF before starting wiring.
  Failure to do so could lead to electric shocks or fires.
- Always connect the earth.
  Failure to do so could lead to electric shocks or fires.
- Wiring work must be carried out by a qualified technician.
  Failure to do so could lead to electric shocks or fires.
- Always install the unit before wiring.
  Failure to do so could lead to electric shocks or injuries.

⚠ Note

- Do not connect an AC power supply to the output terminals (U, V, W).
  Doing so could lead to injuries or fire.
- Confirm that the product's rated voltage and the AC power supply voltage match.
  Failure to do so could lead to injuries or fires.
- Tighten the terminal screws to the designated torque.
  Failure to do so could lead to fires.

3. Operation

⚠ Caution

- Always close the terminal cover before turning the input power ON. Do not open the terminal cover while the power is ON. Doing so could lead to electric shock or fires.
- Do not operate the switches or buttons with wet hands. Doing so could lead to electric shock.
- Do not touch the inverter terminals when the inverter power is ON or even when the inverter is stopped. Doing so could lead to electric shock.
- The STOP button is not designed for emergency stop purposes. Prepare a separate emergency stop button. Failure to do so could lead to injury.
- Depending on the start mode and ride-through function settings, if the run signal is ON or the power is restored after a power failure, the inverter may start (restart) suddenly. Keep out of the working part of motor and the machine.

  [Design the machine so that personal safety can be ensured even if the inverter starts suddenly.]

  Failure to do so could lead to injury.
- Depending on the start mode function setting, if the fault trip is reset with the run signal present, the inverter may restart suddenly. (Reset the trip after ensuring personal safety.) Failure to do so could lead to injury.
- When the retry function is used, the unit may automatically start (restart) suddenly, so do not approach the unit. (Secure personal safety before using this function.) Failure to do so could lead to injury.
- When the automatic tuning function is used, the inverter may automatically drive the motor in the stand-alone mode if the RUN button on the panel is pressed. (Secure personal safety before using this function.) Failure to do so could lead to injury.

⚠ Note

- The heat sink fins and brake resistor can reach high temperatures, so do not touch them.
  Doing so could lead to burns.
- The inverter can be easily set to run from low speeds to high speeds. Confirm the tolerable range of the motor and machine before starting operation.
  Failure to do so could lead to injury.
- Prepare holding brakes if required.
  Failure to do so could lead to injury.

4. Maintenance, Inspection and Part Replacement

⚠ Caution

- Wait at least five minutes after turning the input power OFF before starting inspections.
  Failure to do so could lead to electric shock.
- Maintenance, inspection and part replacement must be done by qualified persons. [Remove all metal personal belongings (watches, bracelets, etc.) before starting the work.] (Use tools treated with insulation.)
  Failure to do so could lead to electric shocks or injury.

⚠ Note

- Have an electrician periodically tighten the terminal screws.
  Loosening of the terminal screws could lead to overheating or fire.

5. Others

Caution

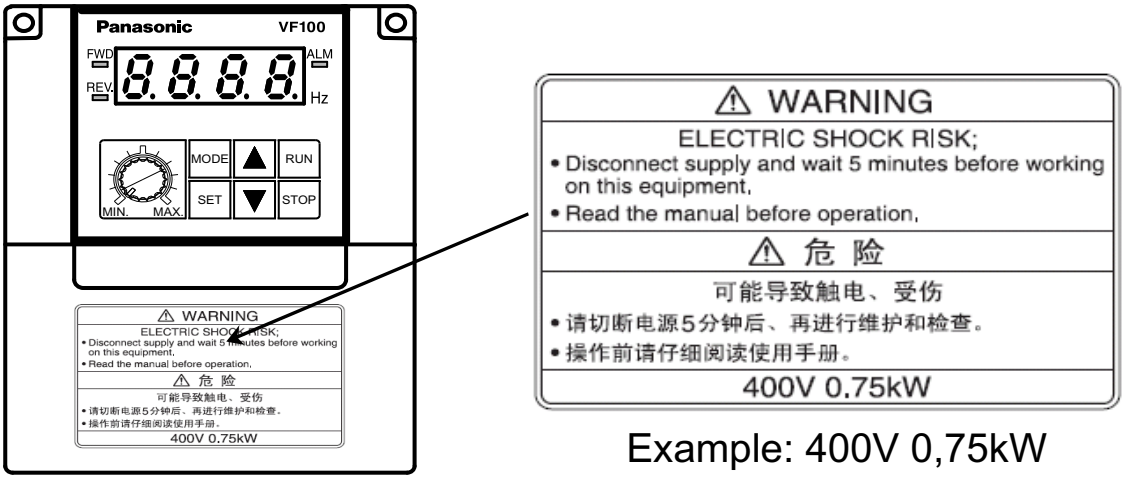
- Never modify the unit. Doing so could lead to electric shock or injury.

6. General Precautions

All diagrams in this instruction manual show the state with the cover or safety partitions removed to explain the details. Before operating the product, replace the covers and partitions to the positions specified, and operate the unit according to the instruction manual.

7. Warning Label on Inverter

[Inverter Surface]



Example: 400V 0,75kW

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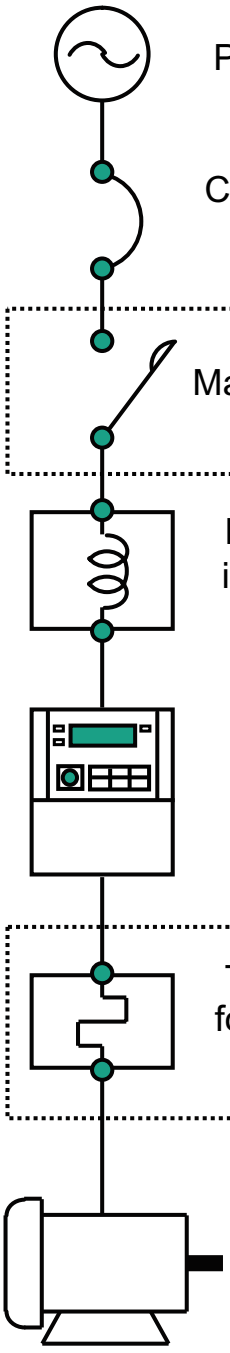
1. Points for Handling

Follow this manual and precautions when handling the inverter. Incorrect handling could lead to inhibited operation or a drop operating life. In the worst case, the inverter could be damaged.



Power supply	Use within + 10%, -15% of the tolerable input voltage range, and with in±5% of the tolerable input frequency range.
Circuit breaker (MCCB)	Size a breaker from the selection table on page 21.
Magnet contactor (MC)	A magnetic contactor is not required in normal use. If installed, do not start or stop the inverter with the magnet contactor.
Power factor improvement reactor	Connect this when the power factor must be improved.
Inverter	The ambient temperature is the most important factor for the installation site. Make sure that the tolerable value is not exceeded. (See page 12)
Thermal relay for open phase protection	The thermal relay built into the inverter is used to protect against overloads. Use an open phase protection thermal relay for open phase protection.
Motor	3-phase induction motor

2. Special Precautions

◆Use the inverter only within tolerable ambient temperature range.(-10 to +50°C)

Because the life of the inverter is greatly affected by ambient temperature, use it within tolerable temperature range.
Also, pay attention to the installation directions and conditions. (See page 12)

◆The inverter will be damaged if the power voltage is applied to its output terminal.

Applying power voltage to the output terminal U, V or W will damage the inverter.
Check carefully for fault wiring and operation sequence (commercial changeover circuit, etc.).
Never apply a voltage that exceeds the tolerable voltage of the inverter.

◆Never touch the inside of the inverter during operation.

This is extremely dangerous the inverter contains high-voltage circuit. Be sure to wait at least 5 minutes after the inverter power has been turned OFF, before making an internal check. Do not touch the heat sink fins or brake resistor during operation as these parts will become hot during operation.

◆Radio interference

The main circuit of the inverter contains a higher harmonic component and may interfere with communications equipment such as AM radios if these are used nearby. The amount of radio interference depends on the field strength in the area where the inverter is used. While it is difficult to completely eliminate radio interference, it may be reduced by changing the angle of your radio antenna, using a noise filter with the inverter, housing the inverter in a metallic shield box, or routing inverter cables in metal conduit. (Please inquire separately.)

◆Do not attempt insulation testing between the inverter cables.

To measure the insulation resistance of the power supply cables or the motor cables, them from the inverter. Never conduct insulation testing on the control circuits. However, insulation testing can be performed between the charging unit and the ground.

◆If a magnetic contactor is connected to the power supply side or the load side of the inverter, never use it to start or stop the motor (inverter).

Switching the inverter on the power supply side ON and OFF frequently by a magnetic contactor, can cause the inverter to malfunction. Do not turn the inverter on the load side ON and OFF during operation as this causes inverter fault trips. Start or stop the motor only by means of inverter run signals.

◆Do not connect a power factor capacitor or suppressor to the output terminal of the inverter.

Such devices can damage the inverter, its capacitors and other parts. Remove the device if one is connected.

◆Do not use the inverter for loads other than a motor or for single-phase motors.

◆If parameters are frequently written in, lifetime of non-volatile memory (EEPROM) will be shorten.

The maximum writing times of non-volatile memory (EEPROM) used in VF100 is 100,000 times. Therefore, do not write the parameters frequently.

◆Precautions regarding inverter's protection function

Various protection functions such as stall prevention, current limiting and overcurrent shut-off are built in the inverter.
These protection functions are used to protect the inverter from the sudden abnormal conditions in use, so they are not the control functions to be always used.

Therefore, do not use the applications in which those protection functions activate in the normal operating conditions.

In some cases, the inverter's life may be shorten, or the inverter may be damaged.

Always measure the output current, etc. with a measuring instrument, and check the details of the fault trip memory, and confirm that there is no problem in the conditions for all the precautions and specifications described in the manual when using the inverter.

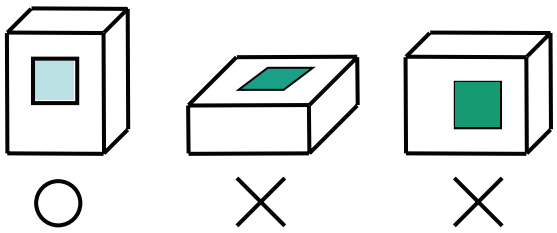
3. Installation

⚠ Note

- Install the inverter on a non-combustible material such as metal.
  Installing it on other material could lead to fire.
- Do not place the inverter near flammable materials.
  Failure to do so could lead to fire.
- Do not hold the terminal cover during transportation.
  Failure to do so could cause the inverter to drop and lead to injuries.
- Do not allow foreign matter such as metal swarf enter the unit.
  Entry of this type of matter could lead to fire.
- Mount the inverter according to the instruction manual in a place where the weight can be withstood.
  Failure to do so could lead to dropping of the inverter and to injuries.
- Do not install or operate an inverter that is damaged or with parts missing.
  Failure to do so could lead to injury.

[Install the inverter vertically]

Installing the inverter in any other way decreases its heat dissipation effect and results in malfunction.



Vertical Horizontal Sideways

[Make sure the ambient temperature stays within the specifications]

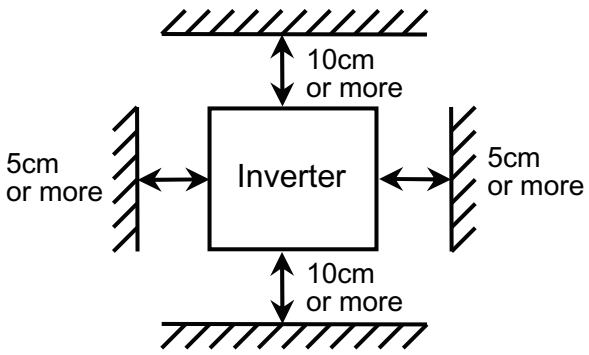
The ambient temperature surrounding the inverter will increase when it is installed near a heating unit or housed inside a panel. This may reduce the lift of the inverter. If you want to house the inverter inside a panel, give careful consideration to the cooling method and panel size.

- Tolerable ambient temperature: -10 to 50℃
  (Ambient temperatures should be measured at a point 5cm from the inverter.)
- If more than one inverters are tightly installed in horizontal direction, tolerable ambient temperature should be -10 to + 40℃.

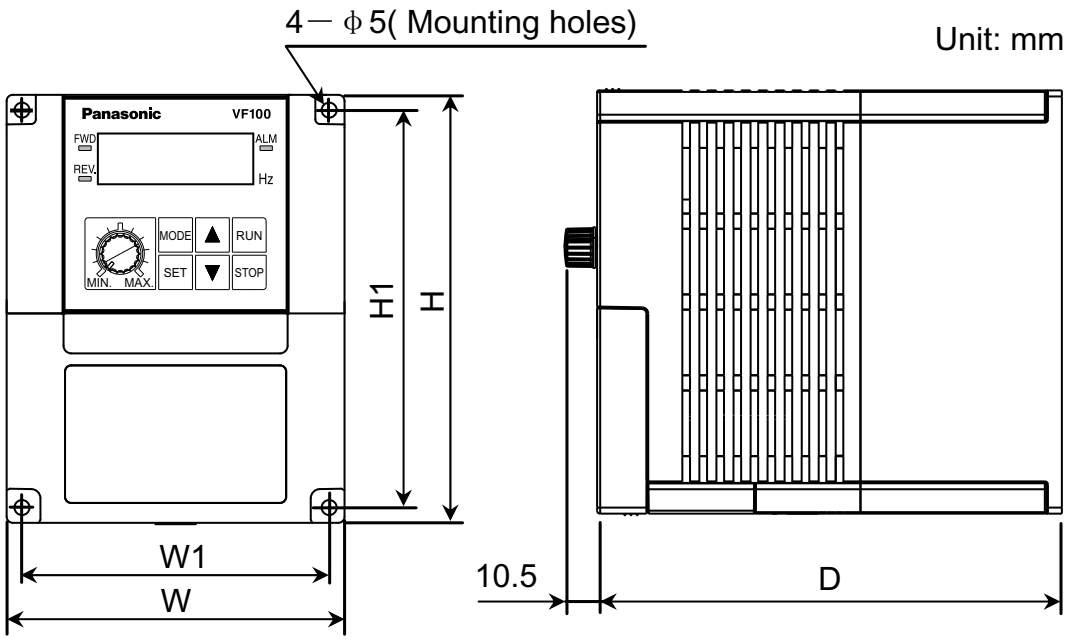
[Avoid installing the inverter in the following locations]

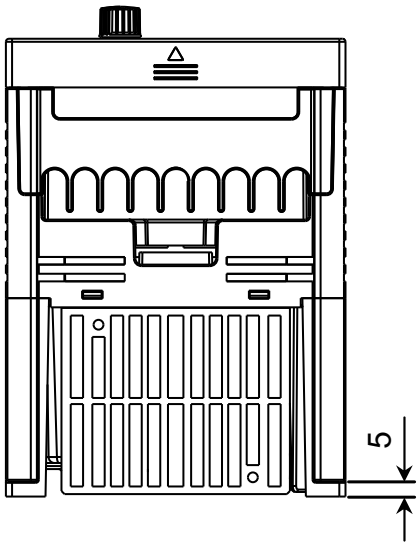
- Areas subject to direct sunlight
- Areas subject to water or high levels of humidity.
- Areas with large amounts of oil mist, dust or fiber dust.
- Areas where rain water, water drops or oil drops may come in contact.
- Areas where corrosive gases, explosive gases or flammable gases are present.
- Installation onto flammable materials such as wood, or near flammable materials.
- Areas subject to vibration.

- Space around the inverter



4. Outline Dimensions





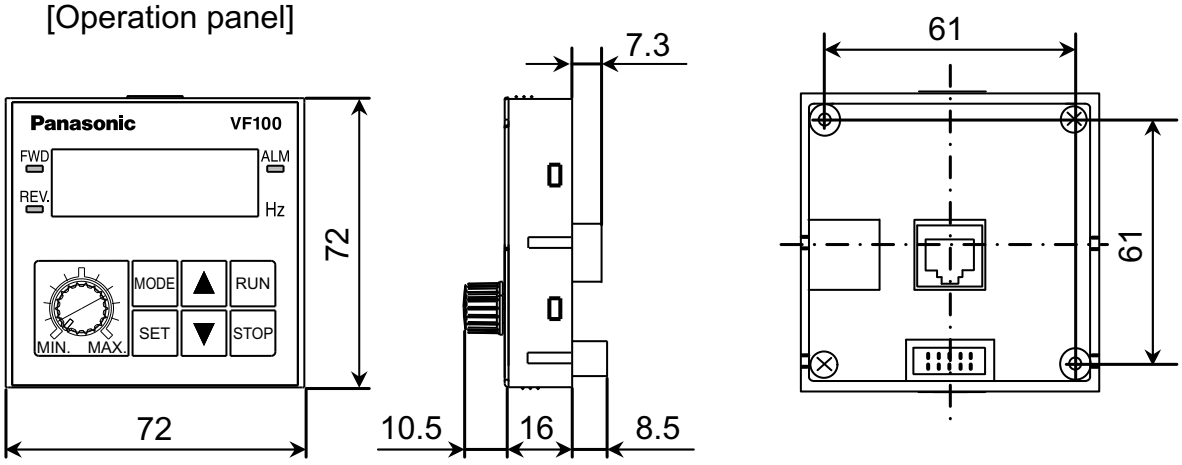
● 3-phase 400V input type

Unit: mm

Inverter capacity	W1	W	H1	H	D
0.75, 1.5kW	100	112	130	143	150
2.2, 3.7kW	130	143	130	143	160

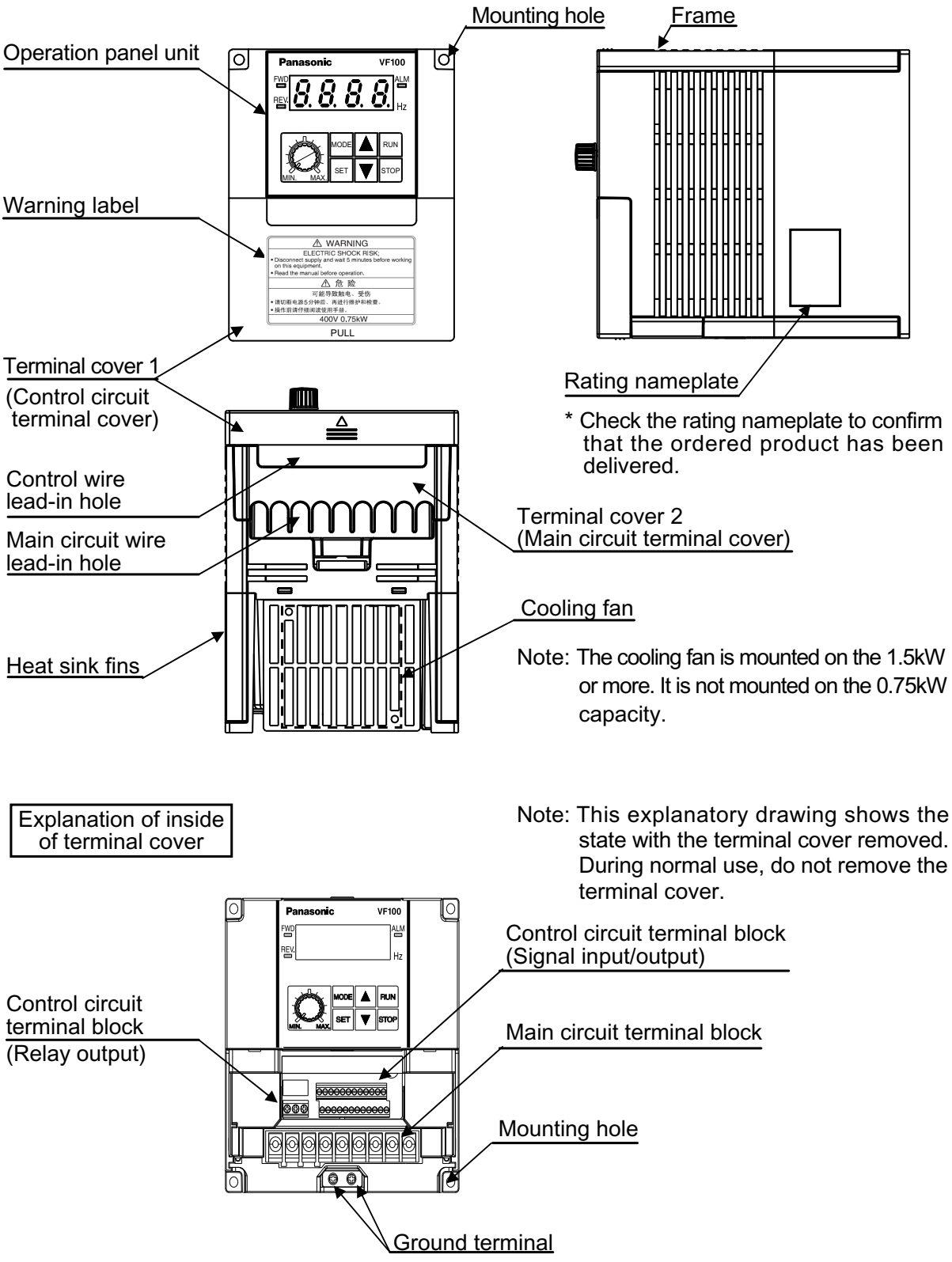
Note: The cooling fan is mounted on the 1.5kW, 2.2kW or 3.7kW capacities.

[Operation panel]



5. Parts Identification

5-1. Part Names



5-2. Details on Part Number

A VF100 – 007 4

Series name

Voltage class
4 : 3-phase 400V

Applicable motor capacity (kW)
007 : 0.75kW
015 : 1.5kW
022 : 2.2kW
037 : 3.7kW

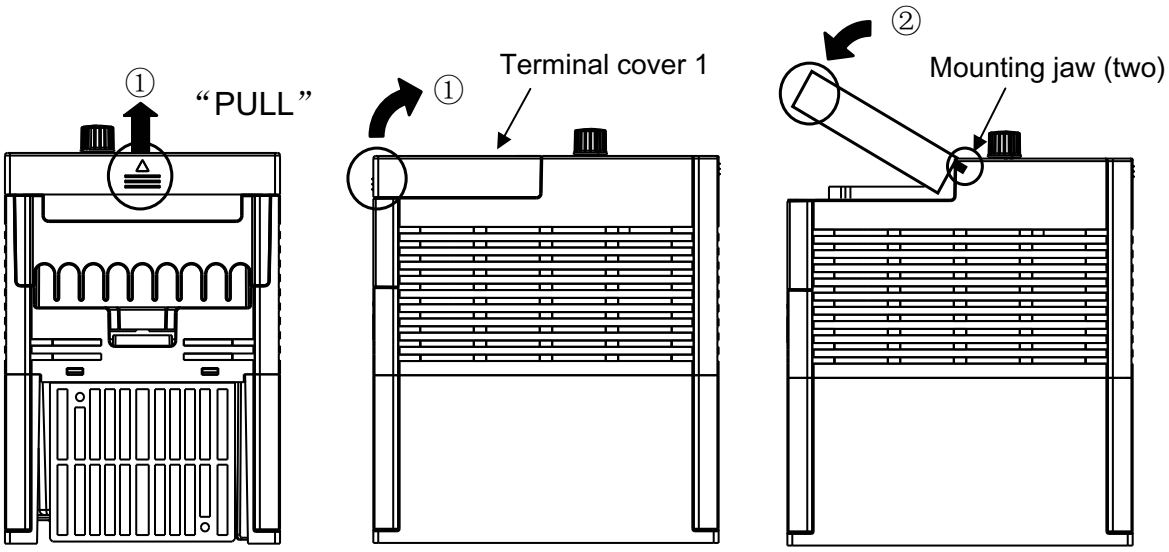
Input power supply	Applicable motor capacity (kW)	Part Number
3-phase 400V	0.75	AVF100－0074
	1.5	AVF100－0154
	2.2	AVF100－0224
	3.7	AVF100－0374

5-3. Removal and Installation of Terminal Cover

● Removal and installation of terminal cover 1 (Control circuit terminal cover)

[Removal] ① Lightly press up the center bottom edge of the terminal cover 1.

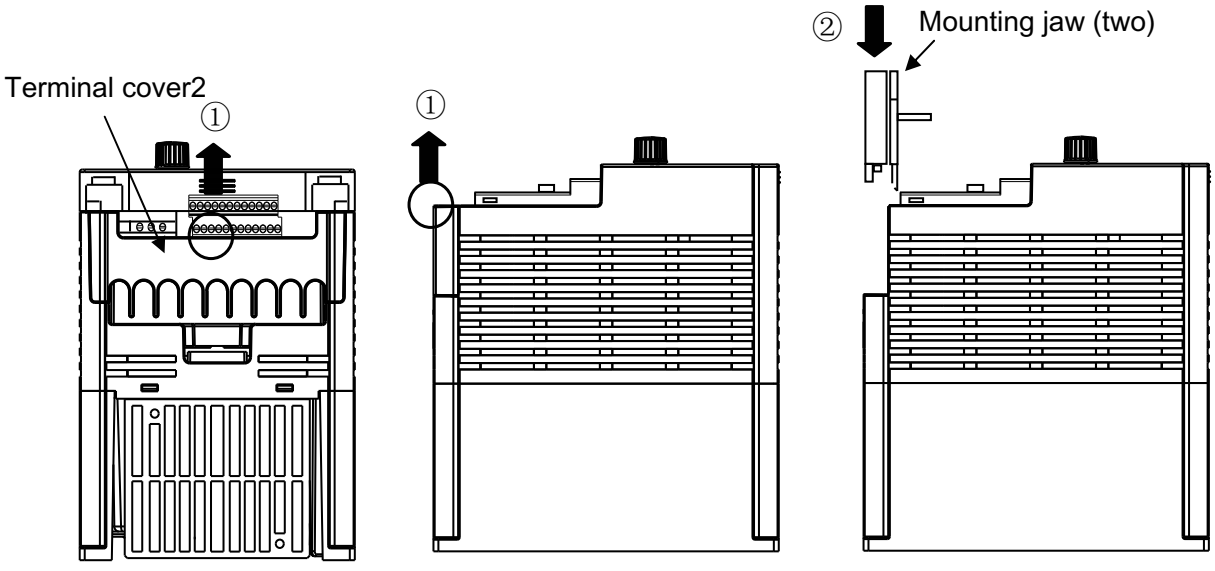
[Installation] ② Insert the mounting jaw of terminal cover 1 into the slot on the frame. Lightly press down the center top edge of the terminal cover 1.



● Removal and installation of terminal cover 2 (Main circuit terminal cover)

[Removal] ① Lightly press up the center part of the terminal cover 2 till the mounting jaw comes loose.

[Installation] ② Insert the mounting jaw of terminal cover 2 into the slot on the frame. Lightly press down the terminal cover 2.



Note) After installation, confirm that the terminal cover 1 and 2 are fitted.

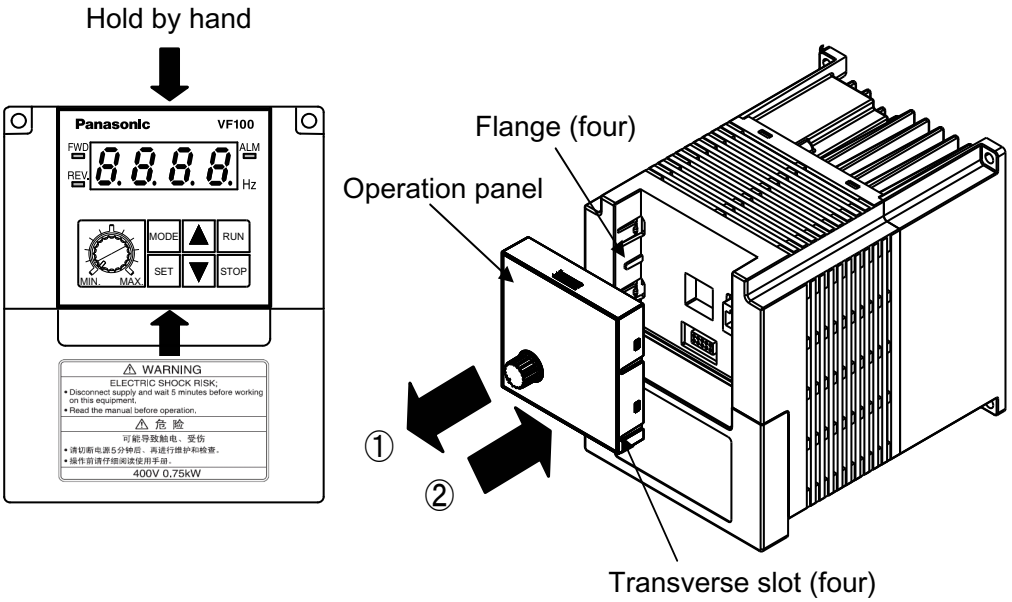
5-4. Removal and Installation of Operation Panel

Note Turn off the power supply before removing the operation panel. Removing the operation panel during operation can cause the operation to stop.

[Removal] ① Press up the center top and bottom part of the operation panel vertically to remove it.

[Installation] ② Aim at the mounting position (Align transverse slot on operation panel with flange on the frame.) and press down the center top and bottom part of the operation panel vertically to install it.

Note) After installation, confirm that the operation panel is fitted.



Use with the removed operation panel

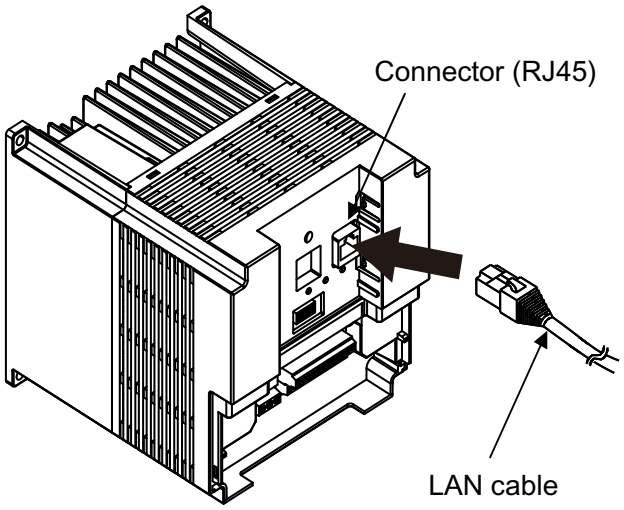
LAN cable on the market can be used to connect the unit of the inverter and the operation panel.
Use LAN cable only for the purpose of connecting the unit of the inverter and operation panel.
The inverter could be damaged if LAN cable is used to connect other machines.

LAN cable specifications: Max. length of connecting wire of 8Pin straight cable that is CAT5 or more is 5m.

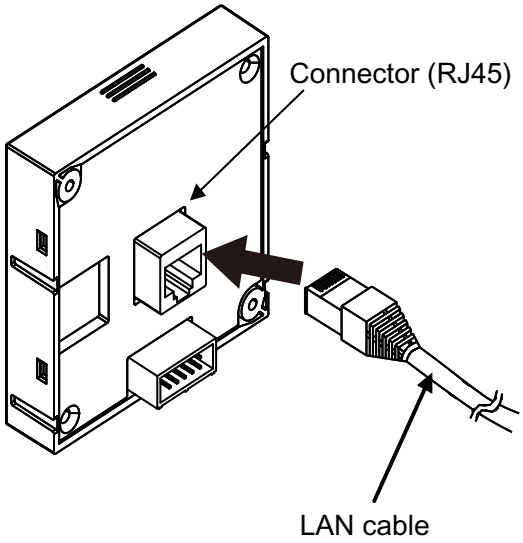
① Turn off the power supply and remove the panel according to above descriptions.

② Insert one end of LAN cable to the unit of the inverter and the other end to connector (RJ45) on the panel till click is heard.

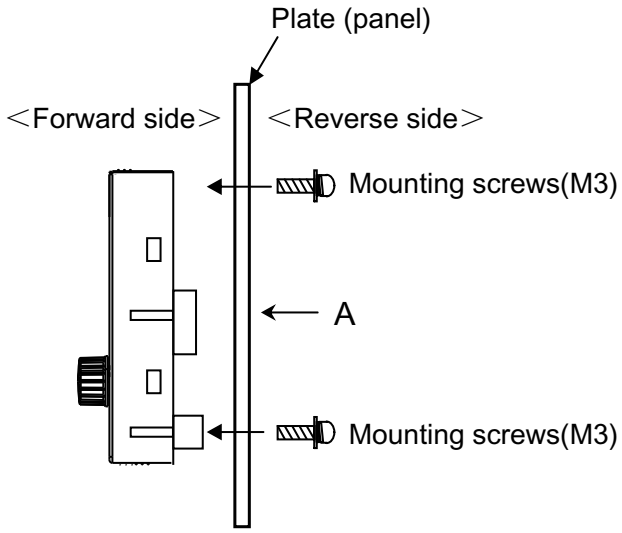
Inverter side

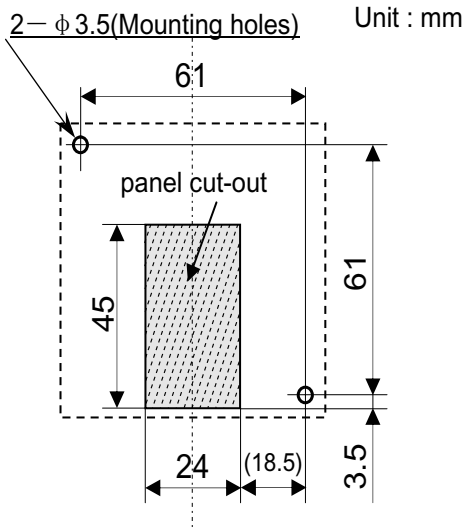


Operation panel side



Installed on the plate (panel)



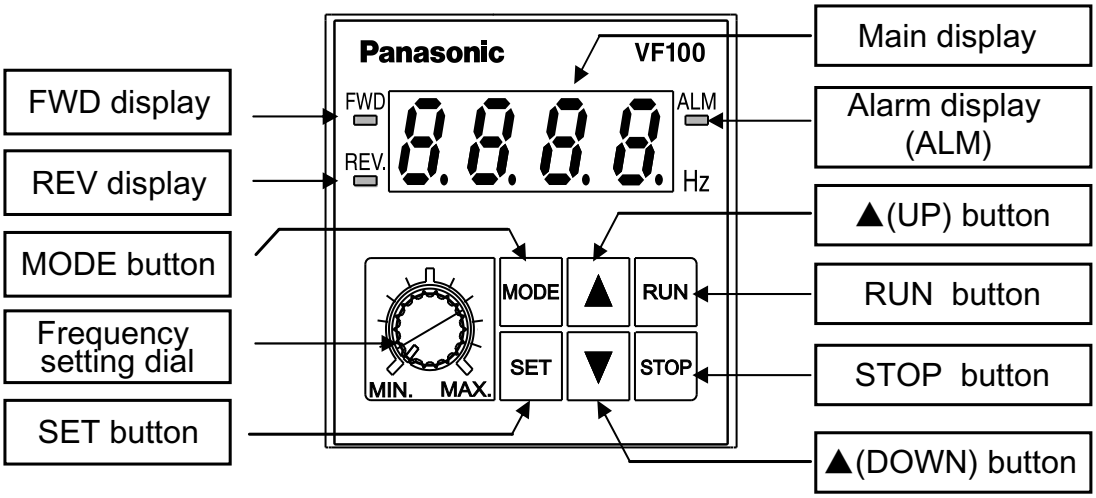


Dimensions of panel cut-out (A view)

[Mounting Procedure]

1. Manufacture the mounting plate according to dimensions of panel cut-out. The suitable thickness is 1.0mm~3.5mm.
2. Mount the operation panel on the forward side of plate (panel), and mount the attached mounting screws on the reverse side. (Tightening torque: 0.6N・m)
3. Mount LAN cable after the operation panel is installed.

5-5. Explanation of Operation Panel



Name of Each Part	Description of Functions
Main display	The output frequency, current, line speed, setting frequency, communication station No., error details, each mode display and data for function setting are displayed.
FWD display (green)	Forward run is displayed (During operation at constant speed: Lamp will turn ON; During acceleration/deceleration operation: flicker).
REV display (green)	Reverse run is displayed (During operation at constant speed: Lamp will turn ON; During acceleration/deceleration operation: flicker).
Alarm display (red)	Errors and alarm are displayed. (Refer to P147: Alarm LED operation selection)
RUN button	The switch is used to start the inverter.
STOP button	The switch is used to stop the inverter.
MODE button	This switch is used to change to each "operation status display", "frequency setting, monitor", "rotation direction setting", "control status monitor", "custom", "function setting", and "built-in memory setting" mode, and to switch the display from the data to mode display.
SET button	The switch is used to change the display between the mode and data display, and to save the data. In the "operation status display mode", this switch changes the display between the frequency and current.
▲(UP) button	This switch is used to change the data and output frequency, and to set forward run direction when carrying out forward rotation with the operation panel.
▼(DOWN) button	This switch is used to change the data and output frequency, and to set reverse run direction when carrying out reverse rotation with the operation panel.
Frequency setting dial	This is the dial for the potentiometer used to set the operating frequency with operation panel.

6. Wiring

6-1. Wiring (Main Circuit)

⚠ Caution

- Always confirm that the input power is OFF before starting wiring.
  Failure to do so could lead to electric shocks or fires.
- Always connect the earth.
  Failure to do so could lead to electric shocks or fires.
- Wiring work must be carried out by a qualified technician.
  Failure to do so could lead to electric shocks or fires.
- Always install the inverter before wiring.
  Failure to do so could lead to electric shocks or injuries.

⚠ Note

- Do not connect an AC power supply to the output terminals (U, V, W).
  Failure to do so could lead to injuries or fire.
- Confirm that the product's rated voltage and the AC power supply voltage match.
  Failure to do so could lead to injuries or fire.
- Tighten the terminal screws to the designated tightening torque.
  Failure to do so could lead to fire.

■ Precautions on Wiring

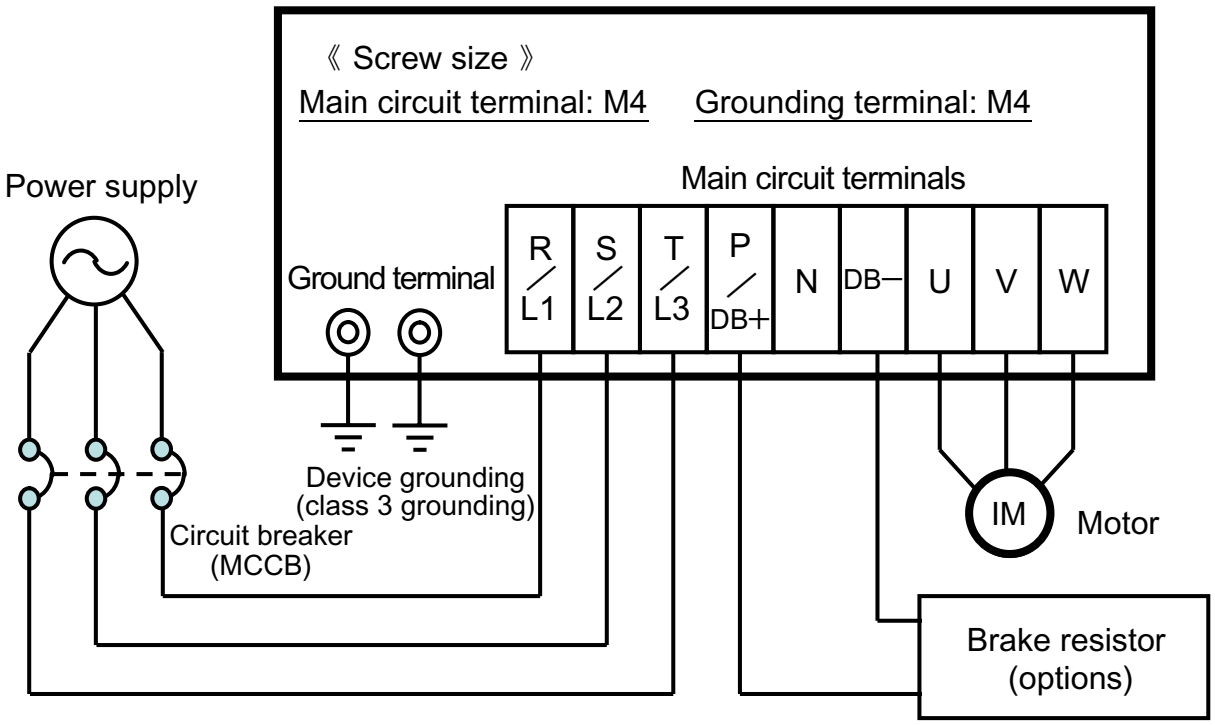
Note the following points carefully to prevent miswiring and misuse of the inverter. (Devices may be broken.)

1. Connect the power supply to input terminals (R/L1, S/L2, T/L3) and the motor to output terminals (U,V,W).
2. Use sleeved round crimp terminals for power supply and motor connections.
3. After wiring the main circuit, double check for tightness as access will be limited once control circuit wiring is in place.
4. When connecting directly to a large capacity power transformer (500kVA or more), always install a power factor improvement reactor on the inverter's input side.
5. Select connected devices and wire size, according to P21.

■ Wiring (Main Circuit Terminal)

Ground marking

Three-phase 400V 0.75～3.7kW



≪Precautions for Using Regenerative Brakes≫

1. When using regenerative brakes, set the parameter P019 setting data to "0". The brakes will not activate when the factory setting "1" is set.
2. Always use the Panasonic-dedicated option for the brake resistor.
3. The regenerative brake specifications are shown below. Carefully consider the working conditions before using these brakes.

   Note that the inverter could be damaged if the specifications are exceeded.

   ・Maximum duty factor (%ED): 5%　・Maximum working time: 5s
   ・Maximum torque: 100%

■ Connected Device, Wire Size and Main Circuit Terminal Tightening Torque

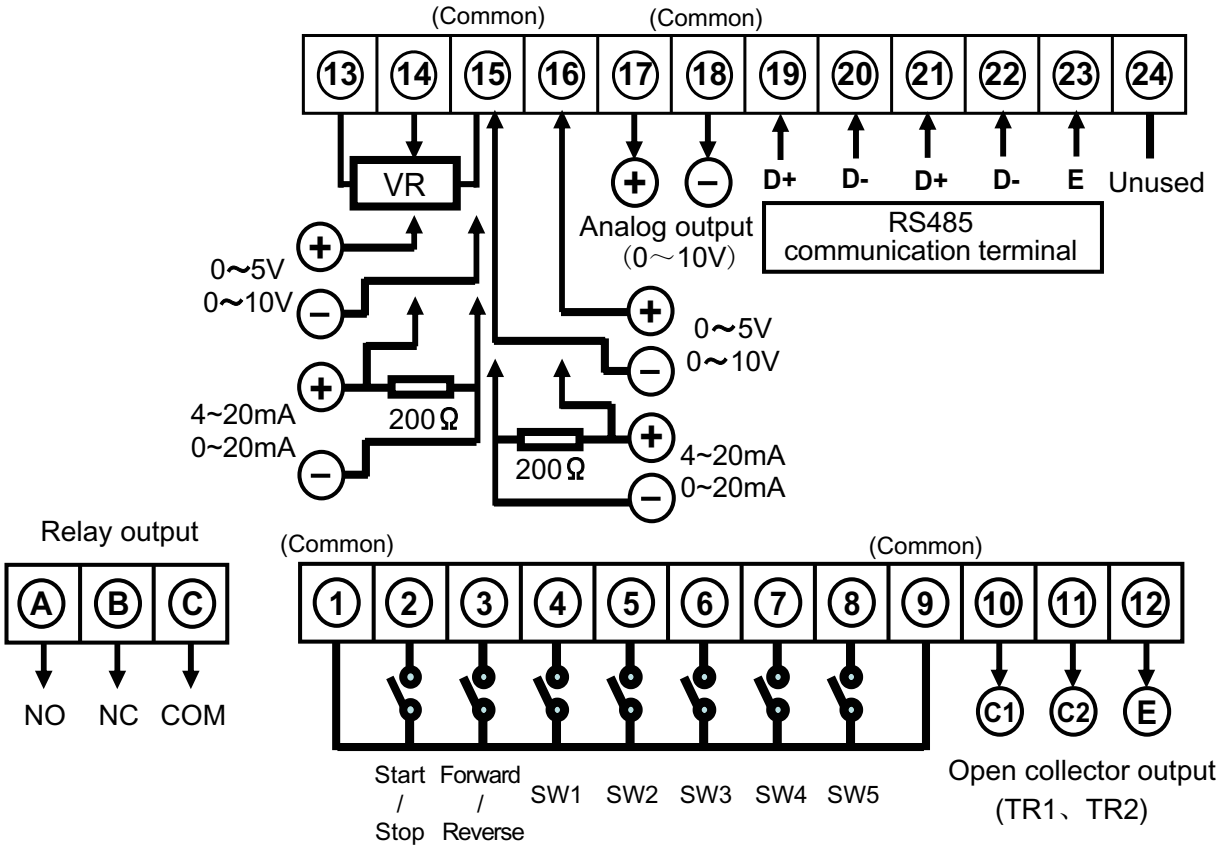
● Three-phase 400V input type

Inverter capacity	Circuit breaker	Screw size	Tightening torque	Wire size
0.75 kW	BC−30N 5A	M4	1.2 N・m	2mm^2 {14AWG}
1.5 kW	BC−30N 10A			
2.2 kW	BC−30N 15A			
3.7 kW	BC−30N 20A			

Note 1) If the breaker's overcurrent trip is a magnetic type, the device could overheat due to higher harmonics. Use a load rate of 50% or less in this case.
Note 2) When using an installed circuit breaker with motor protection, remove it.
Note 3) Always connect protective devices such as fuse for overcurrent, short circuits and leakage protection to the input.

6-2. Wiring (Control circuit)

■ Wiring(Control Circuit Terminal)



◆Frequency setting potentiometer(VR) specifications: 10 kΩ, 1/4W or more

◆Relay output contact specifications: 1c no-voltage contact,
230V AC 0.3 A and 30V DC 0.3A (Resistance load)

◆Open collector output specifications: Maximum rating 50V DC，50mA

【Wiring Method】

- For the wiring of the control circuit terminals, use the electric wires after removing the specific size of wire's insulation.
- Loosening the terminal screws and insert the wires from under the terminal block, and tighten the screws to the designated tightening torque.

Note 1) Twist the strands of the uncovered electric wires.
Do not solder them.

Note 2) Tightening loosely causes the wires to be come away or malfunctions.
Tightening too hard causes the short-circuit due to the damage of the screw or the inverter.

Note 3) When using 4~20mA or 0~20mA signal in frequency setting, always connect the resistor(200Ω, 1/4W). (Otherwise, the inverter may be broken.)

Note 4) Please read carefully the specific functions of relevant parameters of each terminal before attempting to operate the inverter.

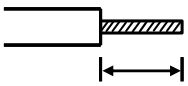
Note 5) Common terminals(①,⑨, ⑮, ⑱) are connected within the inverter.
Do not ground the common terminal.

■ Electric Cable Size and Control Circuit Terminal Tightening Torque

Terminal mark	Screw size	Tightening torque N・m	Cable size	Wire's insulation removing size
A，B，C	M3	0.5～0.6	0.25～0.75mm^2 (AWG24～AWG18)	6mm
① ～ ㉔	M2	0.22～0.25	0.25～0.75mm^2 (AWG24～AWG18)	5mm

・Screwdriver: Small-size ⊖ screwdriver
(Depth of the edge: 0.4mm/ Width of the edge: 2.5mm)

・Wire's insulation removing size



■ Explanation of Control Circuit Terminals

Terminal No.	Terminal Function	Related Parameter No.
①	Common terminal of input signals (②～⑧)	—
②	Start /stop, forward run signal input terminal	P003
③	Forward /reverse, reverse run signal input terminal	P003
④	Multi-function control signal SW1 input	P036, P041
⑤	Multi-function control signal SW2 input terminal	P037, P041
⑥	Multi-function control signal SW3 input terminal	P038, P041
⑦	Multi-function control signal SW4 input terminal	P039, P041
⑧	Multi-function control signal SW5 input terminal	P040, P041
⑨	Common terminal of input signals (②～⑧)	—
⑩	Open-collector (TR1) output terminal (C1: Collector)	P090
⑪	Open-collector (TR2) output terminal (C2: Collector)	P091
⑫	Open-collector output terminal (E: Emitter)	P090, P091
⑬	Frequency setting potentiometer connection terminal (+ 5V)	P004
⑭	Frequency setting analog signal input terminal	P004
⑮	Common terminal of analog signals (⑬,⑭,⑯,⑰)	—
⑯	Second analog signal input terminal Feedback signal input terminal controlled by PID	P124,125 P106－111
⑰	Multi-function analog signal output terminal (0～10V/PWM)	P097, 098
⑱	Common terminal of analog signals (⑬,⑭,⑯,⑰)	—

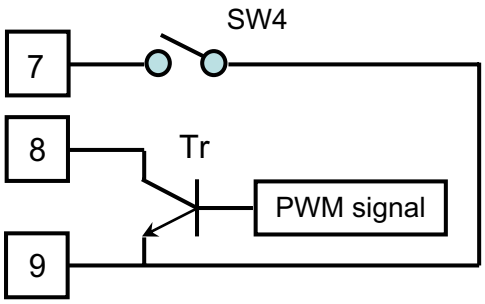
■ Explanation of Control Circuit Terminals

Terminal No.	Terminal Function	Related Parameter No.
⑲	RS485 communication transmission line + terminal (D+)	P135－142
⑳	RS485 communication transmission line - terminal (D-)	P135－142
㉑	RS485 communication transmission line + terminal (D+)	P135－142
㉒	RS485 communication transmission line - terminal (D-)	P135－142
㉓	RS485 communication terminator terminal (E)	P135－142
㉔	Unused terminal	－
A	Relay contact output terminal (NO: at factory setting)	P092
B	Relay contact output terminal (NC: at factory setting)	P092
C	Relay contact output terminal (COM)	P092

◆PWM signal can be used to control the operating frequency with terminals 7 and 8.

・No.7: Frequency setting signal changeover input terminal (SW4)
(OFF: PWM signal, ON: Controlled with signal set in parameter P004)

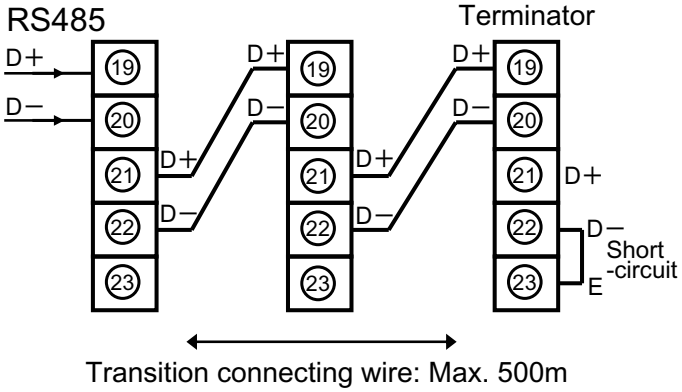
・No.8: PWM signal input terminal



Note 1) When using PWM signal to control output frequency, P087 to P089 must be set.

Note 2) Use a PWM signal transistor (Tr) that has the following capabilities:
・Max. rated voltage: 50VDC or more
・Rated current: 50mA or more

◆Terminals to connect personal computers and PLCs by the RS485 communication.



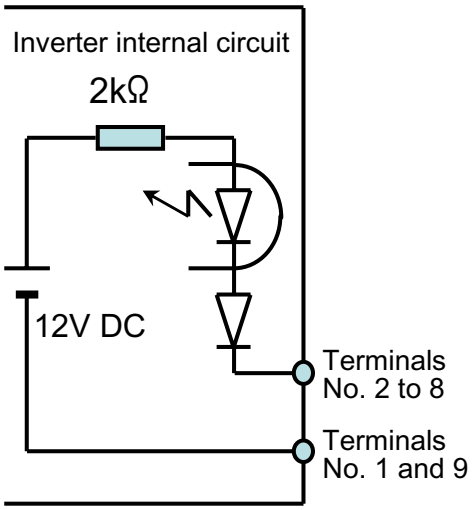
D+ : Transmission line + terminal (RS485 communication)
D- : Transmission line - terminal (RS485 communication)
E : Terminator terminal (RS485 communication)

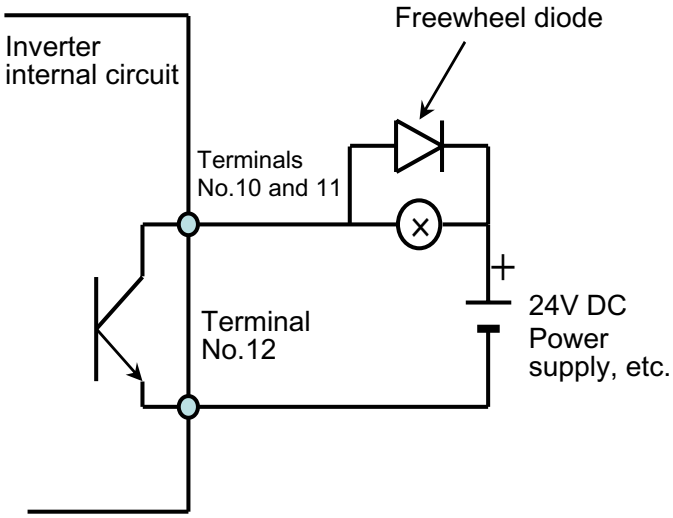
* Connect the D+ side and D+ side, D- side and D- side of the communication terminals.

* The D- side and E side of the inverter to be a terminator should be shorted. Do not short the units other than the terminator.

■ Precautions on Wiring

1. Use shielded wires for all control signal wires and keep them away more than 20cm from power lines and strong electric circuits.
2. Maximum control signal wire length is 30m or less.
3. The control circuit's input signal is a minute signal, so use two minute signal contacts in parallel or use a twin contact to prevent contact faults when inputting the contact.
4. No-voltage contact signal or open-collector signal should be used with control terminals No. 2 to 8. (If a voltage is applied across these terminals, the inverter may be damaged.)
   * Input circuit specifications are shown below. Take special care to avoid loop or leakage current.
5. When an inductive load is to be driven by an open-collector output, be sure to use a freewheel diode.





6. For the communication cable, use a double-core cable (VCTF) or twisted pair cable (with shield). Keep the cable away more than 20cm from power lines and strong electric circuits.
7. The total length of the communication cable must be 500m or less.

7. Operation (Basic Operation)

Caution

- Always close the terminal cover before turning the input power ON.
  Do not open the terminal cover while the power is ON.
  Failure to do so could lead to electric shock or fires.
- Do not operate the switches or dials with wet hands.
  Failure to do so could lead to electric shock.
- Do not touch the inverter terminals when the inverter power is ON or even when the inverter is stopped.
  Failure to do so could lead to electric shock.
- The STOP button is not designed for emergency stop purposes.
  Prepare a separate emergency stop button.
  Failure to do so could lead to injury.

Note

- The heat sink fins and brake resistor can reach high temperatures, so do not touch them.
  Failure to do so could lead to burns.
- The inverter can be easily set to run from low speeds to high speeds. Confirm the tolerable range of the motor and machine before starting operation.
  Failure to do so could lead to injury.
- Prepare holding brakes if required.
  Failure to do so could lead to injury.
- Before turning power ON, check the following points again.

  ① Check that all wiring is correct.
  Reversed wiring between the power supply and the load, in particular, can result in damage to the inverter.

  ② Make sure the inverter rating and power supply voltages match each other.

  ③ Make sure no power factor capacitor is connected to the motor, as it can damage the inverter and the capacitor.

  ④ Before starting a trial run, check the set frequency.

For VF100, the Following Three Operating Methods Are Available.

1. Operation panel
   Use buttons and potentiometer on operation panel to operate the inverter.

2. External control operation
   Use control circuit terminal to operate the inverter (Refer to page 63).

3. Communication (RS485)
   Use communication command sent by external machine through RS485 to operate the inverter.
   (Refer to page 63, page 134, and pages154 to 195)

7-1. Setting the Frequency with the Operation Panel

There are following two methods for setting the frequency with the operation panel.

① Potentiometer setting method (Parameter P004 set to "0": factory setting)

Set with the rotation angle of the frequency setting dial on the panel. The operation will stop at the Min. position (OV stop: refer to page111), and the maximum frequency will be attained at the Max. position.

② Digital setting method (Parameter P004 set to "1")

Press the MODE button on the panel to enter the frequency setting mode (display: Fr). Press the SET button, display the frequency to be set with the UP button and DOWN button, and then press the SET button to enter the data.
The following MOP function can also be used to set frequency during operation.

「MOP function」

The frequency can be changed by holding down the UP button or DOWN button during operation. This MOP function cannot be used when parameter P003 is set to "1".

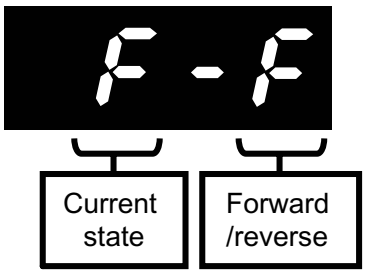
7-2. Setting Forward/Reverse Run Operation with the Operation Panel

There are following two methods for setting forward/reverse run operation with the operation panel.

① Forward run/reverse run method (Parameter P003 set to "1")

Press the UP (forward run) button or DOWN (reverse run) button on the panel to select the rotation direction. Operation will start when the RUN button is pressed.

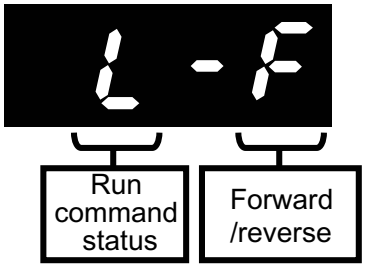
* The inverter will not start running just by pressing the RUN button.
* The MOP function cannot be used if the frequency is set with the digital method.



Current state	Display	Rotation direction	Display
During stop	0	Forward run	F
During forward run operation	F	Reverse run	r
During reverse run operation	r		

② Rotation direction setting mode method (Parameter P003 set to "0")

In "operation status display mode", press the MODE button twice to enter the "rotation direction setting mode". Press the SET button to display the rotation direction data, change the rotation direction with the UP button and DOWN button, and then press the SET button to enter the data. (Forward run is set as the factory setting.)
Operation will start when the RUN button is pressed.



Run command	Display	Rotation direction	Display
Operation panel	L	Forward run	F
External control operation	E	Reverse run	r
communication	C		

* Combination of "Operating method", "MOP function" and "rotation direction setting mode".

Operating method	MOP function	Details of rotation direction setting mode
Forward run/reverse run method	× (Cannot be used)	Only monitor function
Rotation direction setting mode method	○ (Can be used)	Monitor function and direction setting function

Note

- When operating method is set to "forward run/ reverse run method", even if the frequency is set with the "digital setting method", the MOP function cannot be used.

7-3. Operating With the Operation Panel

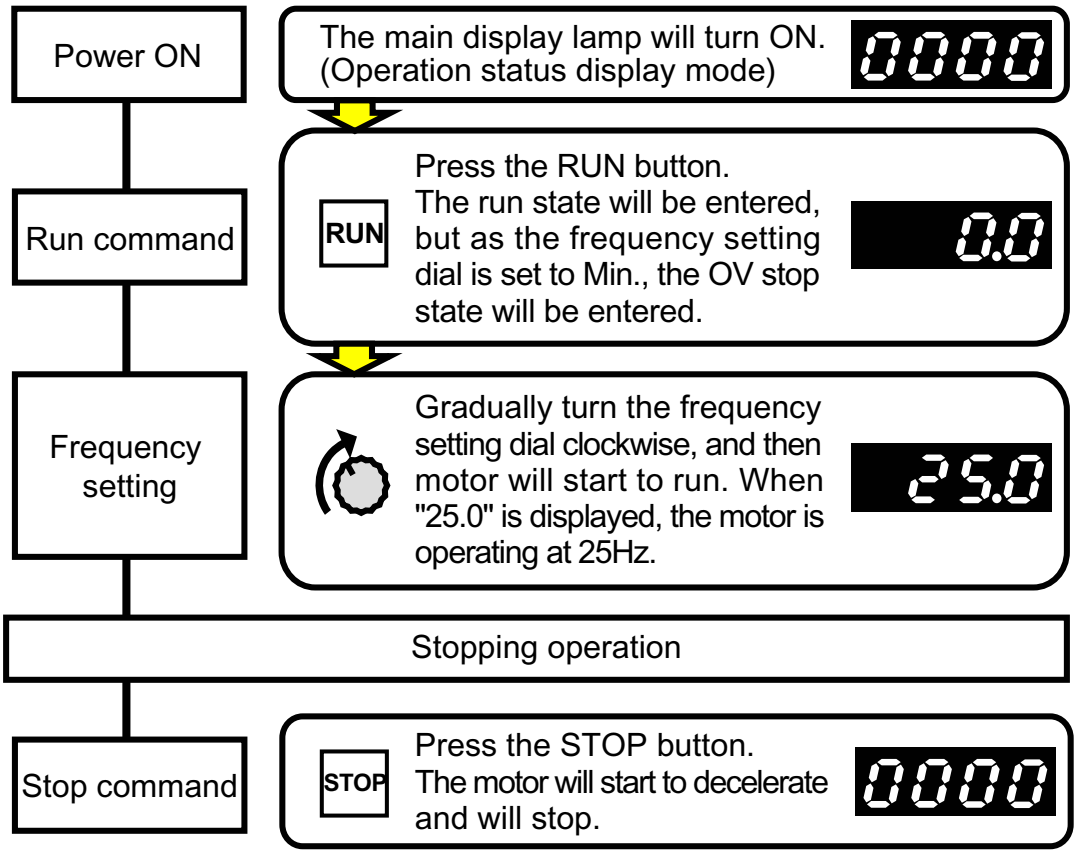
When operating with the operation panel, there are 4 modes constituted by the combination of parameter P003: run command select and parameter P004: frequency signal setting, as shown in 7-1 Setting the frequency with the operation panel and 7-2 Setting forward run/ reverse run operation with the operation panel.
The four operations will be taken as an example to make descriptions in this section.

		Parameter P004: Frequency signal setting	
		Setting value "0"	Setting value "1"
Parameter P003: Run command select	Setting value "0"	Operation 1	Operation 3
	Setting value "1"	Operation 2	Operation 4

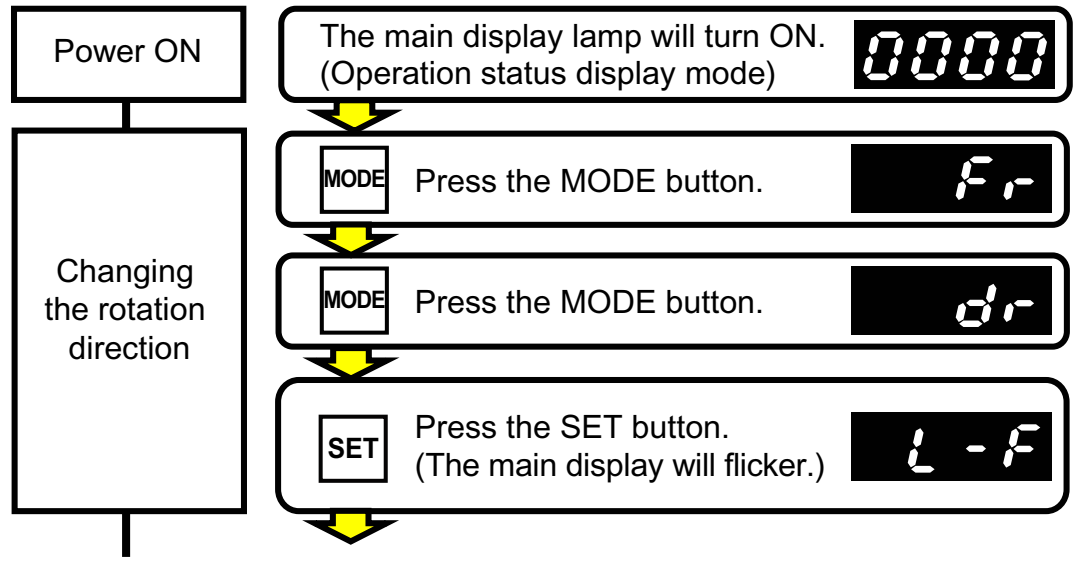
7-3.1 Operating with the Operation Panel -1 (Factory Setting State)

- Forward /reverse run function: Rotation direction setting mode method (Parameter P003=0)
- Frequency setting : Potentiometer setting (Parameter P004=0)

Example for rotating in forward direction at operating frequency 25Hz



Example for rotating in reverse direction at operating frequency 25Hz



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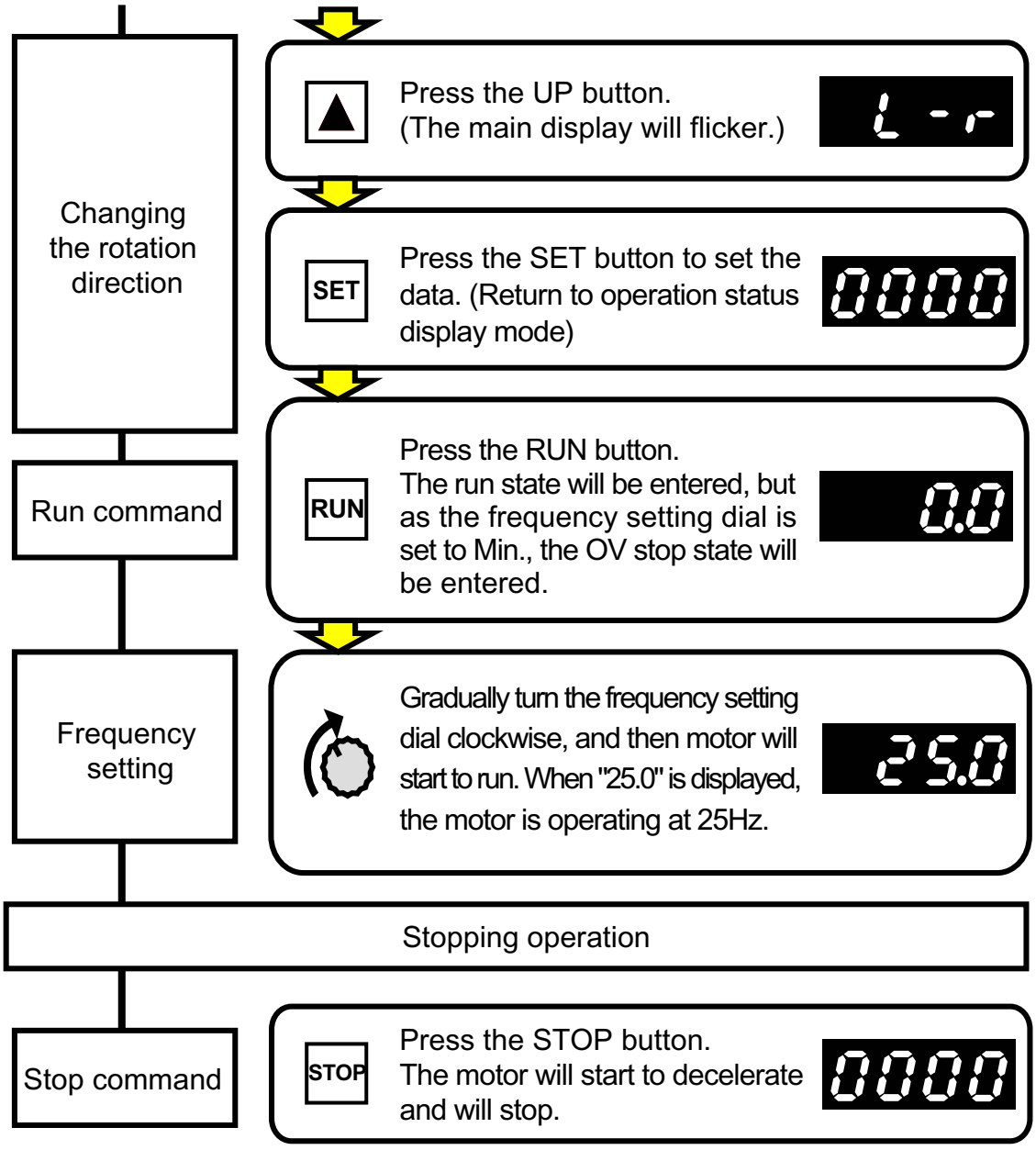


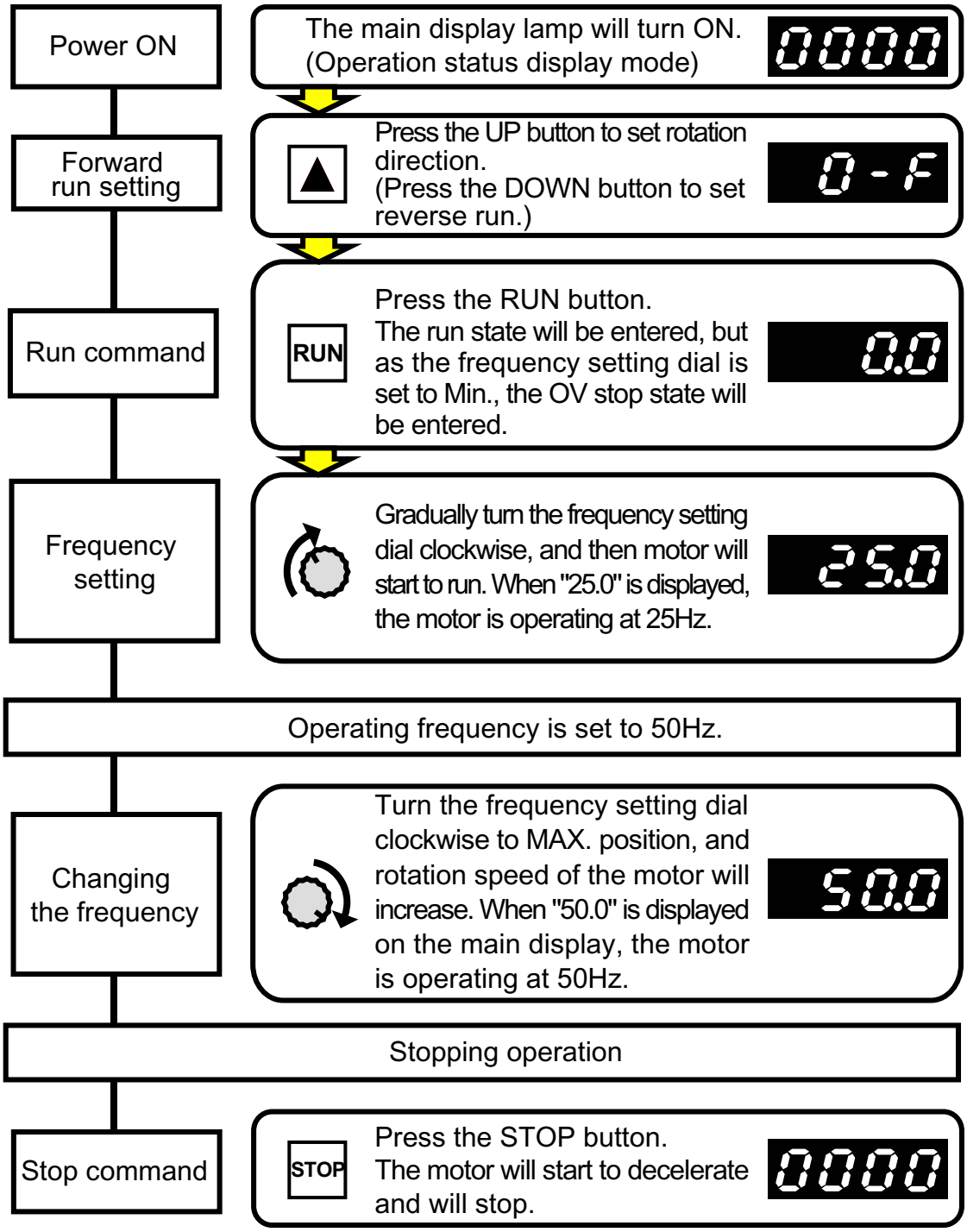
[Example for changing the rotation direction during operation]

Use the same procedures as "Changing the rotation direction" explained above. In this case, when the SET button is pressed last the display will change to the "operation state display mode", the motor will decelerate and then will start rotating in the reverse direction.

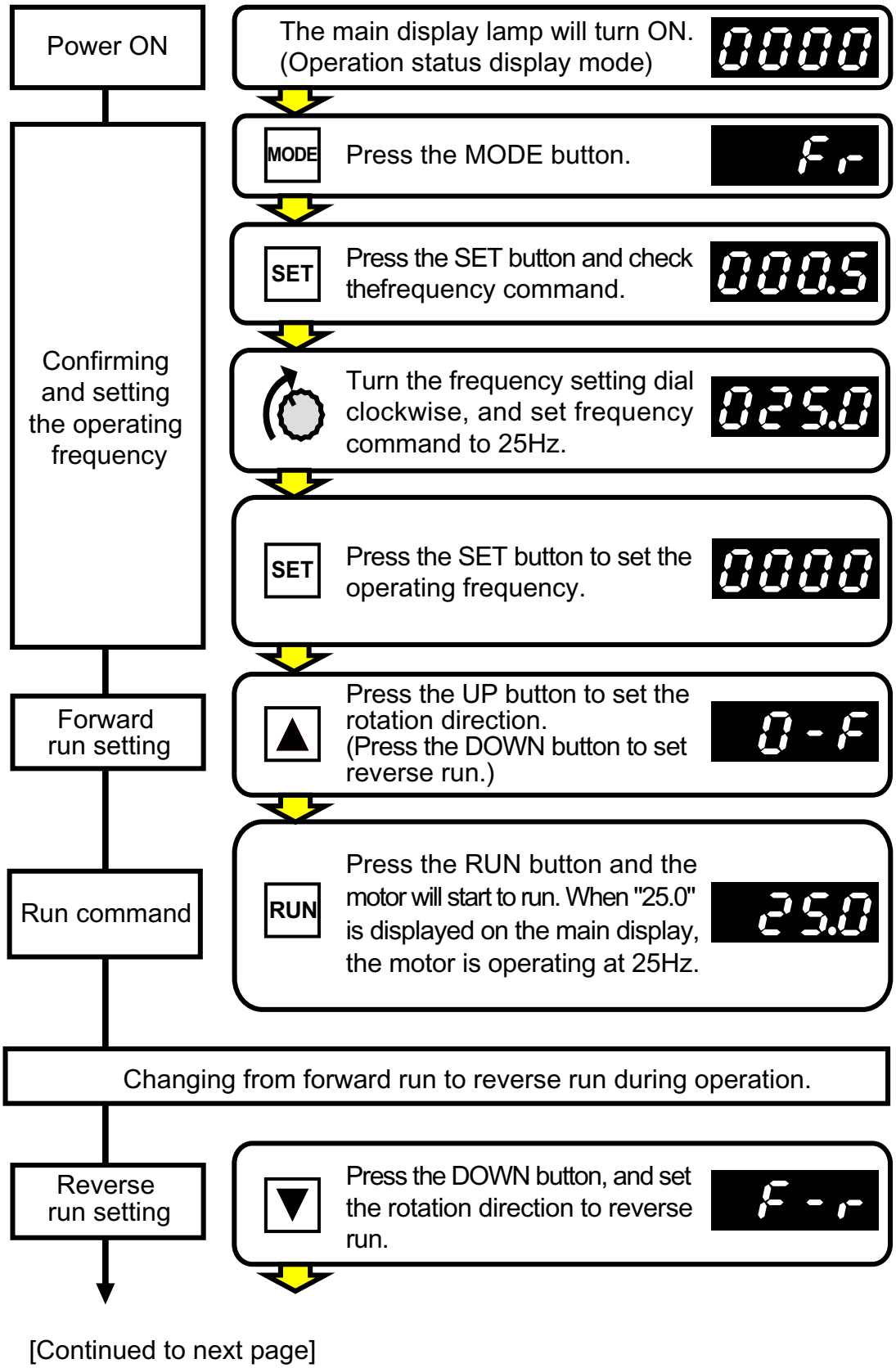
7-3.2 Operating with the Operation Panel - 2

- Forward /reverse run function: Forward / reverse run (Parameter P003=1)
- Frequency setting : Potentiometer setting (Parameter P004=0)

Example for rotating in forward direction at operating frequency 25Hz



[Example for monitoring and setting potentiometer frequency command before operation]



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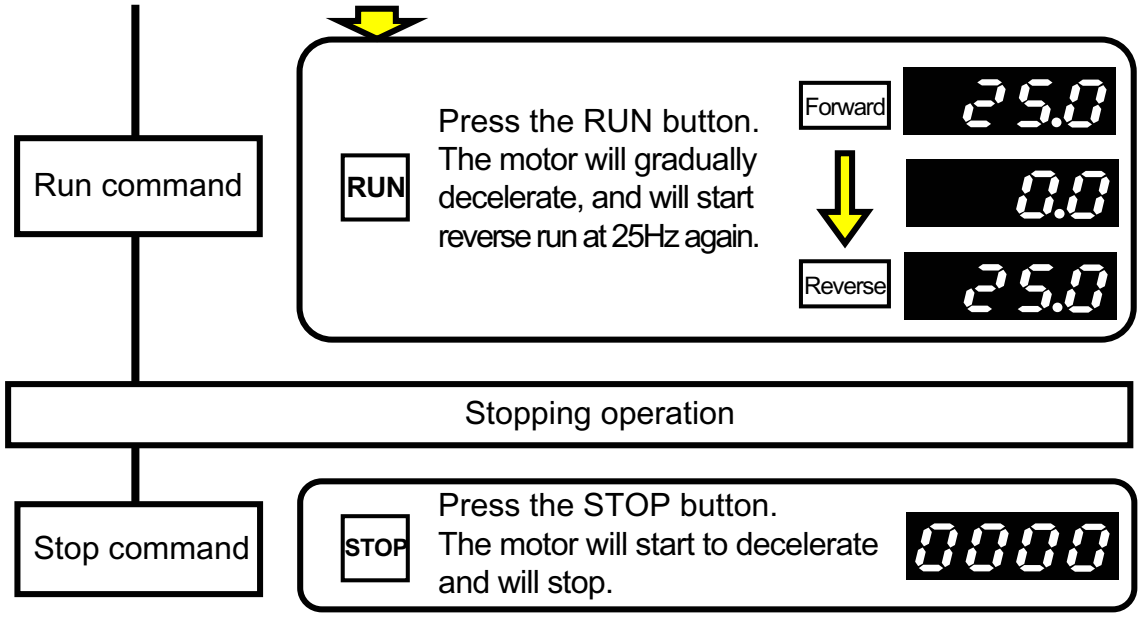
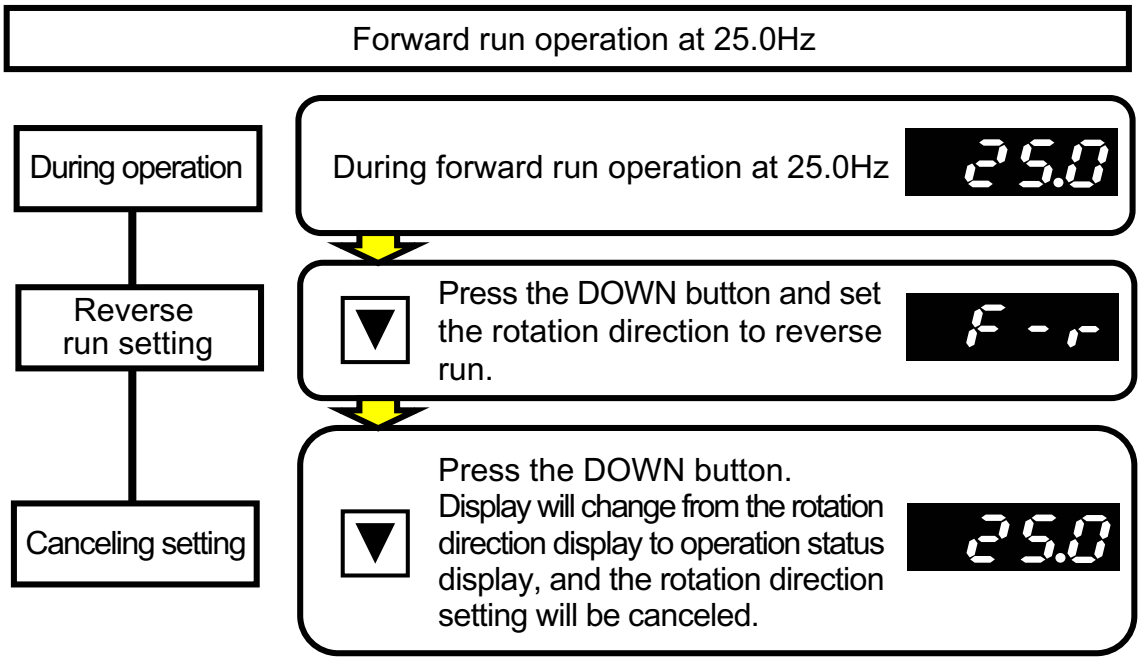


[Example for canceling the rotation direction setting]

After setting with the UP and DOWN buttons, the rotation direction can be canceled by pressing the same button again.



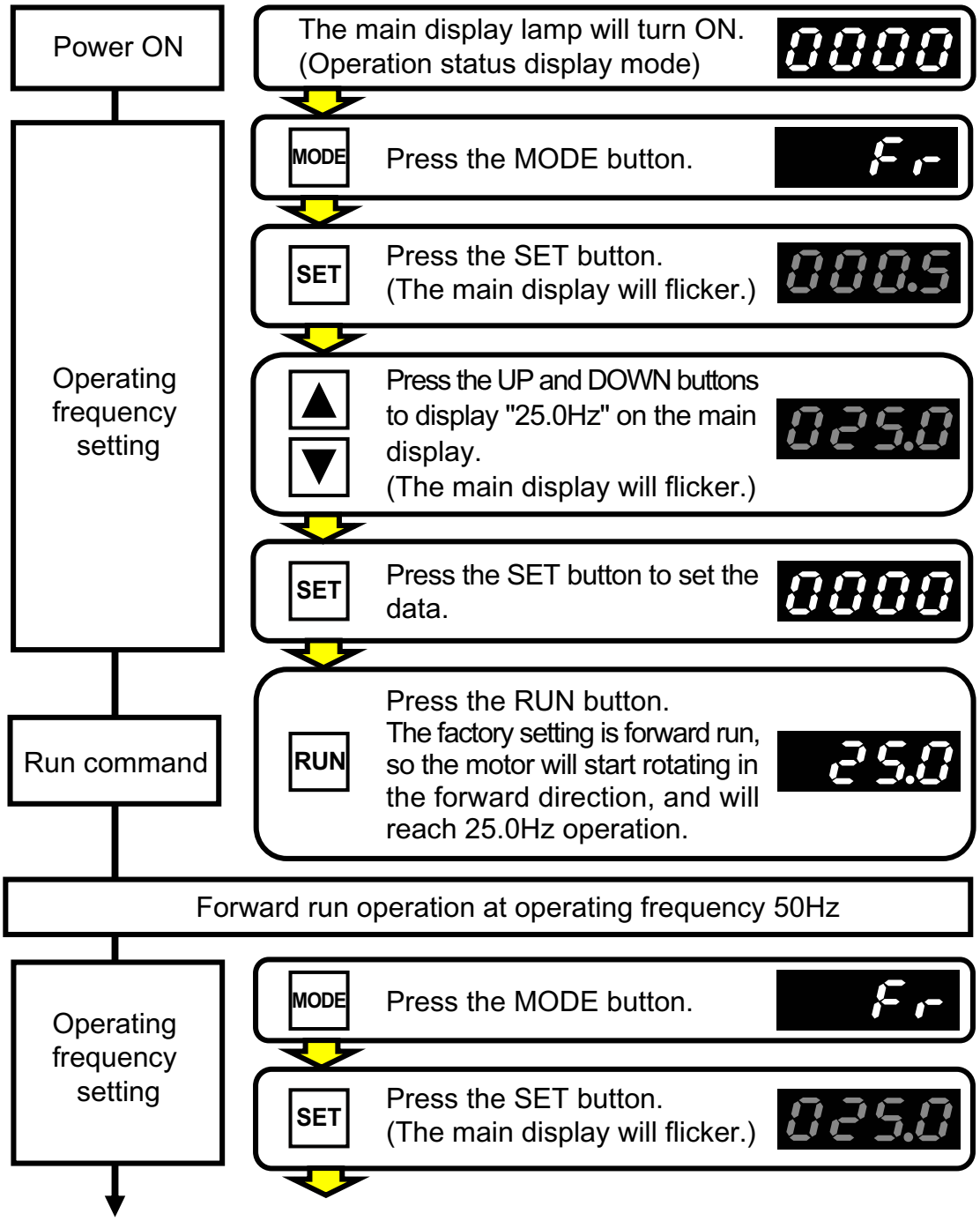
Note

- The setting can be canceled with the same procedure even when stopped.
- If the RUN button is not pressed after setting the rotation direction, the rotation direction will not change.

7-3.3 Operating with the Operation Panel - 3

- Forward /reverse run function: Rotation direction setting mode (Parameter P003=0)
- Frequency setting : Digital setting (Parameter P004=1)

Example for rotating in forward direction at operating frequency 25Hz



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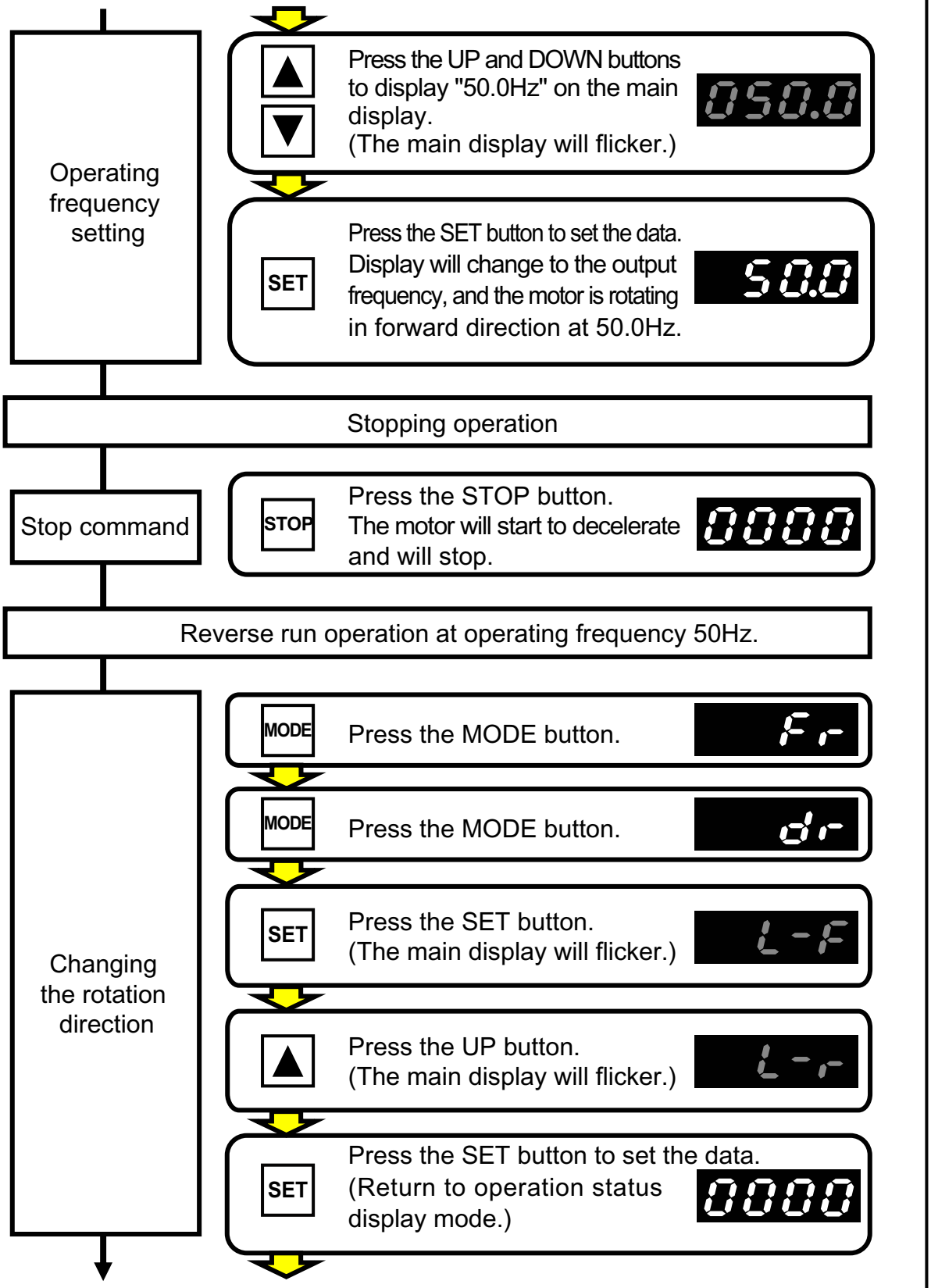

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Run command

RUN — Press the RUN button.
As the frequency is already set to 50Hz, the motor will start rotating in reverse direction at 50.0Hz.

Changing from reverse run to forward run during operation

Changing the rotation direction

MODE — Press the MODE button.

MODE — Press the MODE button.

SET — Press the SET button.
(The main display will flicker.)

▼ — Press the DOWN button.
(The main display will flicker.)

SET — Press the SET button.
The motor will gradually decelerate, and will start forward rotation at 50Hz again.

Reverse

Forward

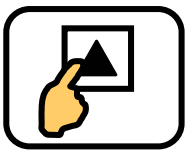
Stopping operation

Stop command

STOP — Press the STOP button.
The motor will start to decelerate and will stop.

Example for changing the frequency with the UP and DOWN buttons during operation (MOP function)

The operating frequency can be changed with the UP and DOWN buttons during operation.
The motor will accelerate or decelerate according to the operation.



If the UP button is held down, the operating frequency will increase.

If the DOWN button is held down, the operating frequency will decrease.

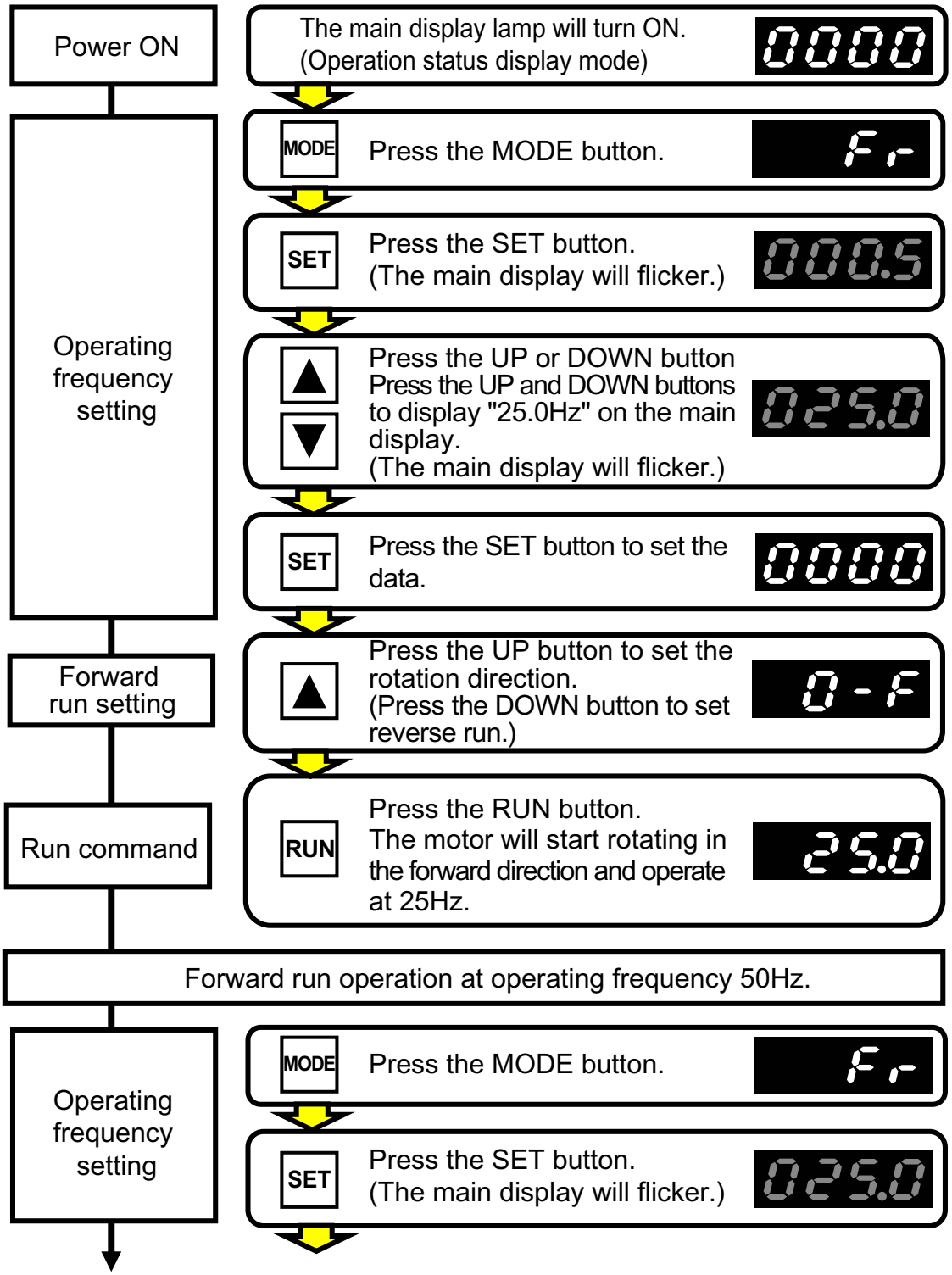
Note

- Once the operating frequency is determined, press the MODE button to display the frequency setting mode "Fr" and then press the SET button twice to set the operating frequency.
  If this is not carried out, this frequency will not be saved when the power is turned OFF.

7-3.4 Operating with the Operation Panel -4

- Forward / reverse run function: Forward run/reverse run (Parameter P003=1)
- Frequency setting : Digital setting (Parameter P004=1)

Example for rotating in forward direction at operating frequency 25Hz



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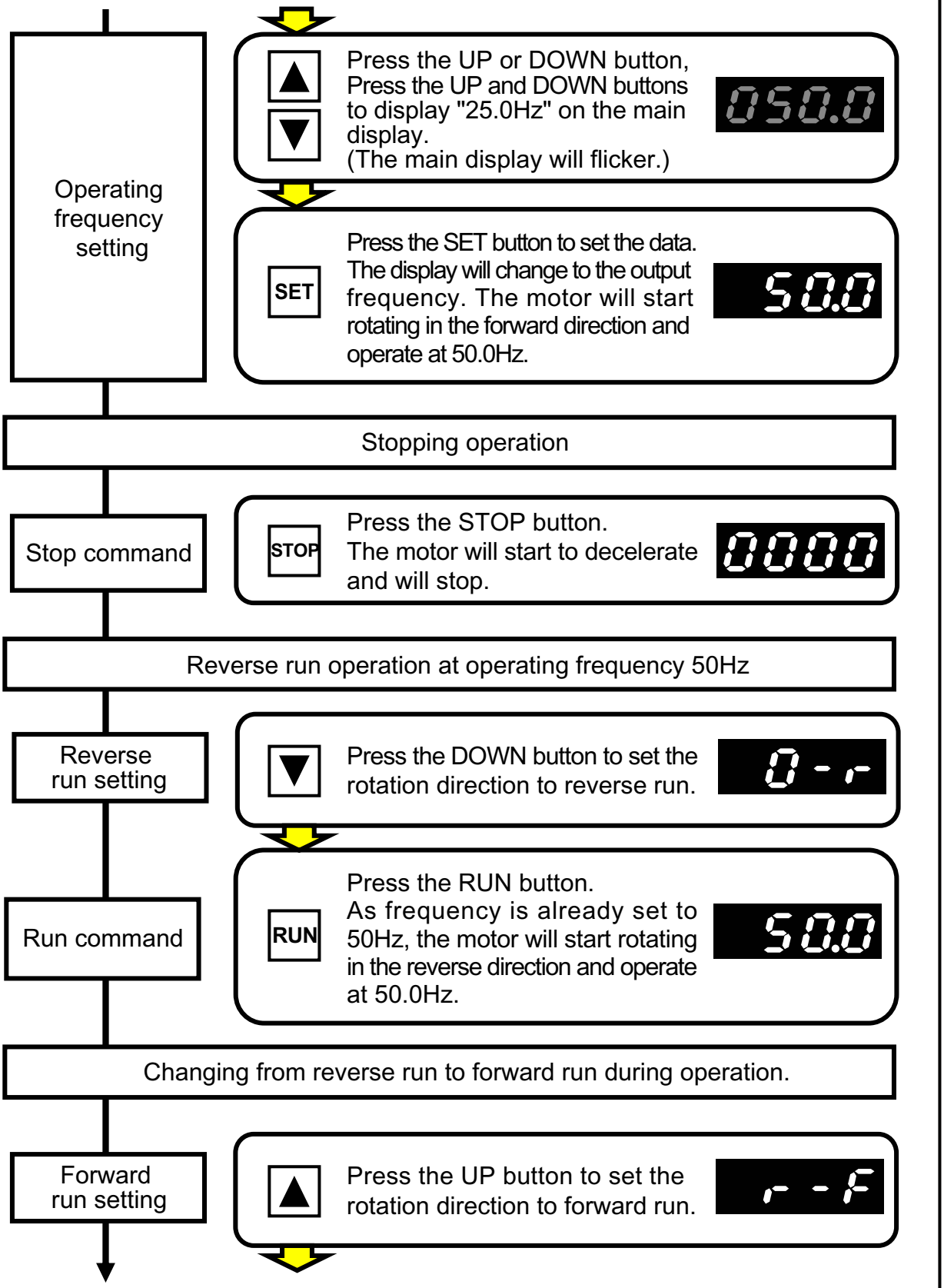

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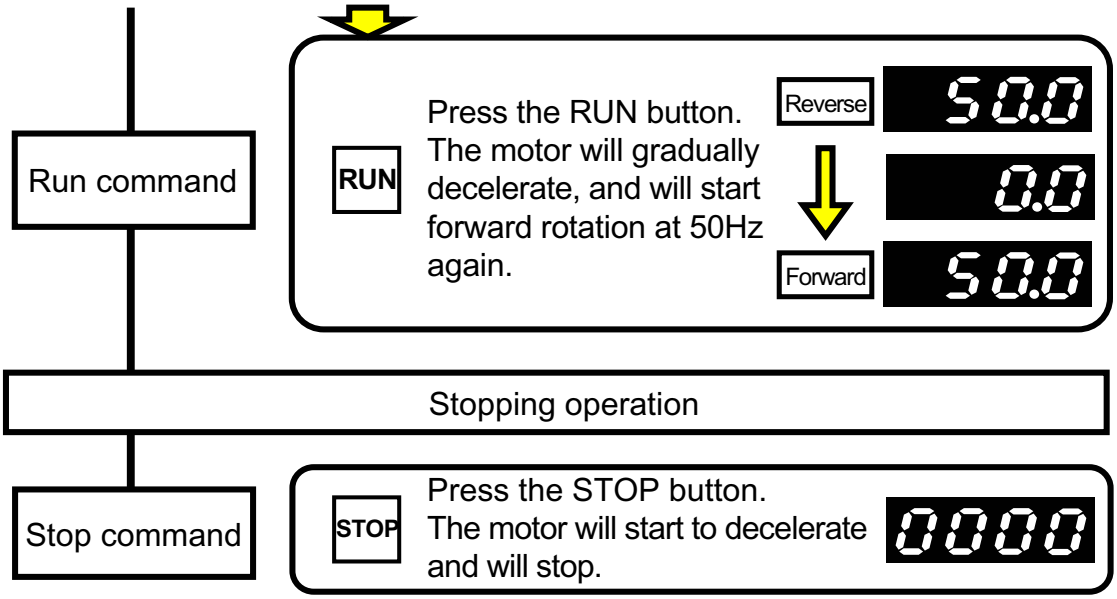


Note

- The rotation direction cannot be set with the "rotation direction setting mode (dr)". In this mode, only the rotation direction and local, external control or communication during operation can be monitored.
- The MOP function cannot be used.

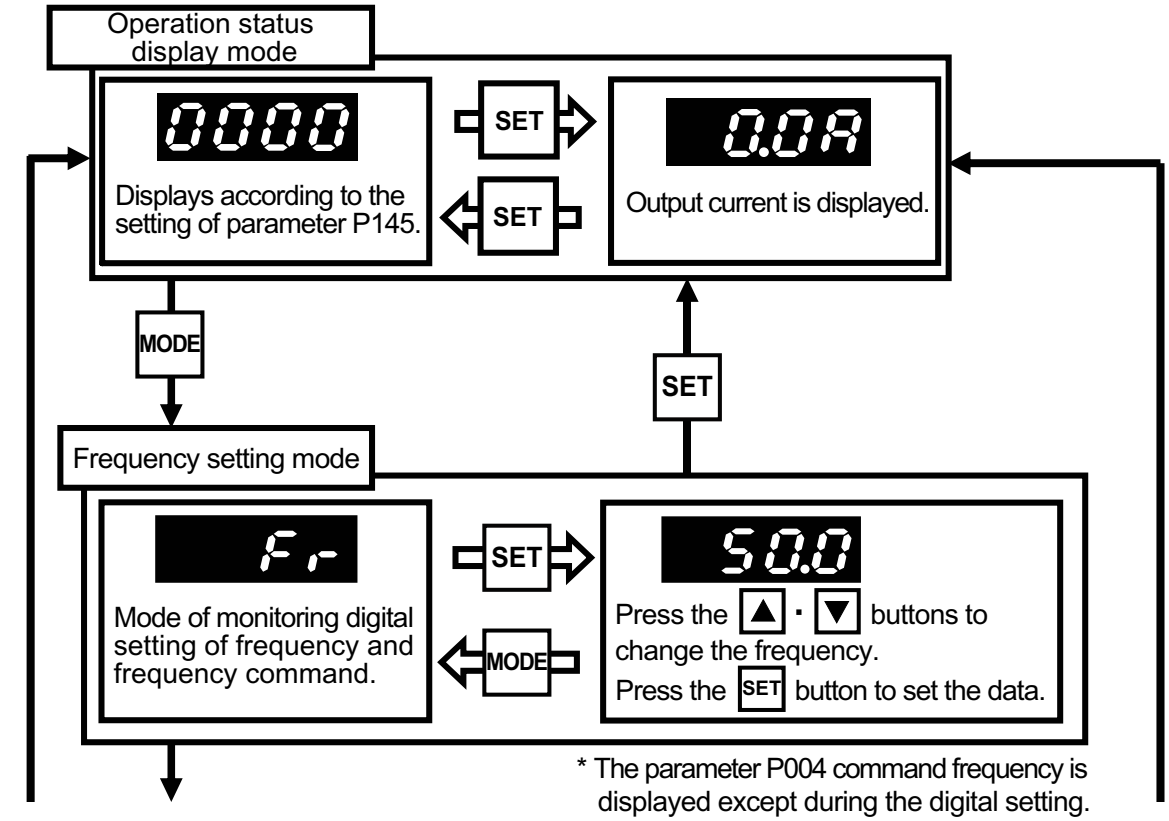
7-4 Operation Modes

VF100 has the following seven modes.

	Mode name	Details	Reference page
①	Operation status display mode	Output frequency and output current are displayed. (The display can be changed with parameter P145.)	136
②	Frequency setting mode	Digital setting of frequency and frequency command can be monitored.	41
③	Rotation direction setting mode	Rotation direction and control state (local/external control/ communication) set for panel operation can be monitored.	42
④	Control state monitor mode	Control state and details of errors can be monitored.	42
⑤	Custom mode	10 frequently-used parameters can be logged in and the data can be changed and monitored.	141
⑥	Function setting mode	Parameter data can be changed and monitored. In addition, copy function of the parameter data can be used.	53
⑦	Built-in memory setting mode	Set data in built-in memory on main display can be changed. (Display or undisplay can be selected.)	145

● Mode Operation Diagram

Normally, use in the operation status display mode. This mode is entered when the power is turned ON.



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MODE

Rotation direction setting mode

SET

L - F

Press the ▲ · ▼ buttons to change the rotation direction.

Press the SET button to set the data.

L - F

Run command status

Forward /reverse

Run command	Display	Rotation direction	Display
Local	L	Forward	F
External control operation	E	reverse	r
Communication	C		

dr

Mode of monitoring rotation direction setting and control state.

SET

MODE

MODE

Control state monitor mode

n001

Monitor No. is displayed.

Press the ▲ · ▼ buttons to set the required No..

SET

SET

MODE

Press the SET button to display the data.

The next monitor No. will be displayed after the SET button is pressed.

Press the MODE button, and the current monitor No. will be displayed.

[Continued to next page]

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MODE

Custom mode

Custom parameter No. is displayed.

Press the ▲ · ▼ buttons to set the required No..

SET

MODE

SET

Currently set parameter No. is displayed.

Holding down SET

* When displaying parameter No. in the custom mode, a dot is displayed after P.

SET

The parameter No. is changed.

Hold down the SET button to set the required parameter No..

As No. display is flickering, the ▲ · ▼ buttons can be used to set the required No.

Press the SET button to change the data and the next custom parameter No. will be displayed.

Press the MODE button to display the current custom parameter No. (The data is not changed.)

The data is changed.

Press the SET button to change the required data.

Press the ▲ · ▼ buttons to change the data.

Press the SET button to change the data and the next custom parameter No. will be displayed.

Press the MODE button to display the current custom parameter No. (The data is not changed.)

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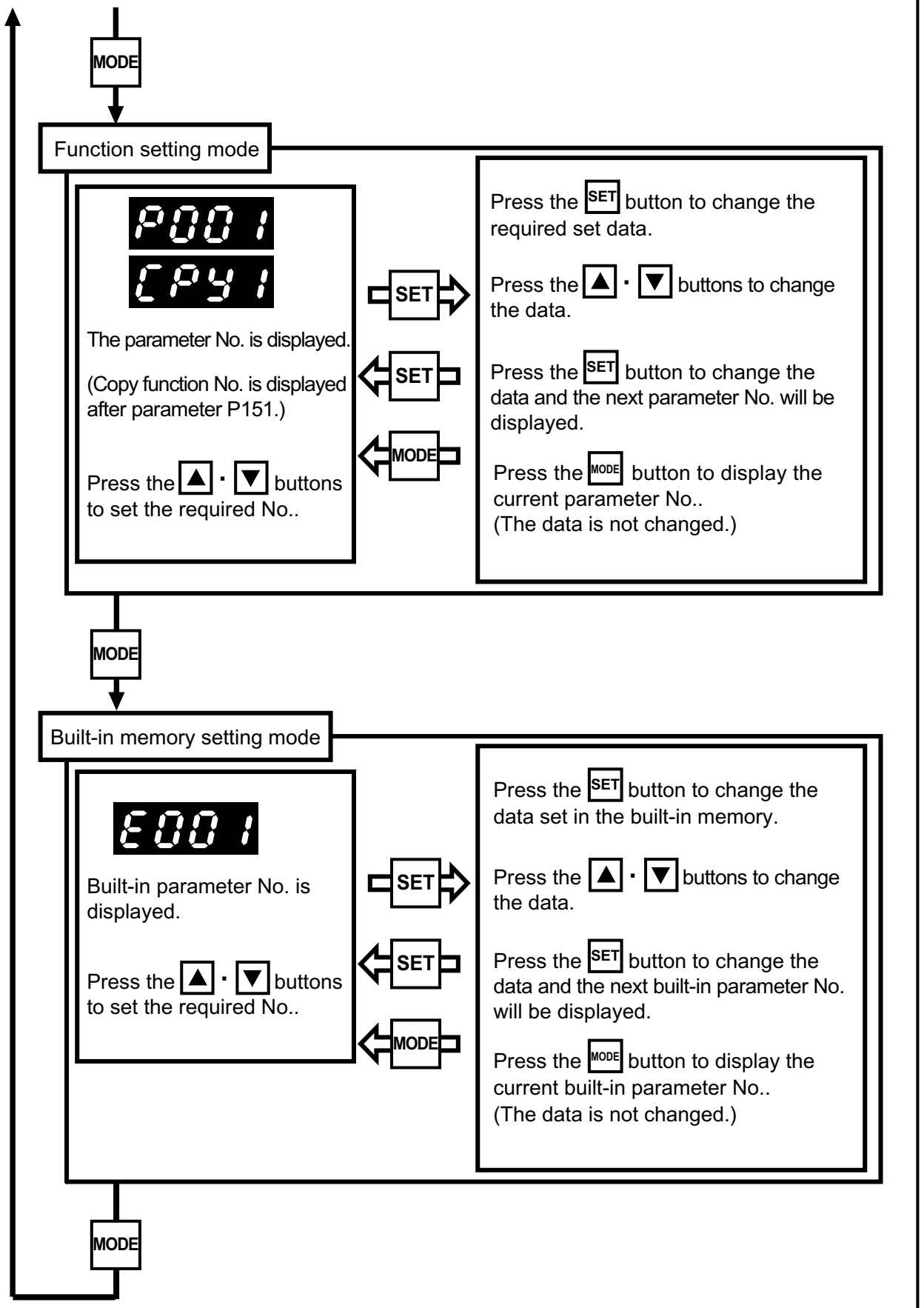


Note

- Except the digital setting in the frequency setting mode (P004: frequency signal setting = 1), command frequency of parameter P004 is displayed.
- Except operating method of the rotation direction setting mode in the rotation direction setting mode (P003: run command select =0), setting cannot be changed only through monitoring.
- When the password is to be set (parameter P150), "PS" will be displayed after the control state monitor mode. If the set password is not input, no custom mode, function setting mode and built-in memory setting mode will be displayed.(Refer to page139)
- Built-in memory setting mode can be set to display or undisplay. (Refer to page 152) When built-in memory setting mode is set to undisplay, it will change from function setting mode to operation status display mode.

8. Control State Monitor

The following 23 items can be monitored in the control state monitor mode.

Monitor No.	Monitor item	Unit	Indication	Reference page
n001	Output frequency	Hz	Output frequency	46
n002	Output current	A	Output current	46
n003	Output voltage	VAC	Output voltage	46
n004	Internal DC voltage	VDC	Internal DC voltage	46
n005	Setting frequency	Hz	Setting frequency	47
n006	Communication station No.	—	Communication station No. set currently	47
n007	Timer runtimes	times	Continuous times during a cycle when the timer is in operation.	47
n008	Alarm type	—	Indication of alarm LED	47
n009	Control terminal state (input signal)	—	Input signal state of control circuit terminals	48
n010	Control terminal state (output signal)	—	Output signal state of control circuit terminals	48
n011	Operation state monitor	—	Operation state of the inverter	49
n012	Operation control state monitor	—	Operation control state of the inverter	50
n013	Terminal function state monitor	—	Function state of control circuit terminals in the inverter	51
n014	PID setting value (SP)	%	Setting value under PID control (SP)	52
n015	PID target value (PV)	%	Setting value under PID control (PV)	52
n016	PID output value (MV)	%	Setting value under PID control (MV)	52
n017	Progress of automatic tuning	—	Progress of automatic tuning under PID control	52
n018	Accumulative operation time	—	Accumulative operation time of the inverter	52
n019	Accumulative fan operation time	—	Accumulative operation time of the inverter's fan	52
n020	Fault display (latest)	—	Latest details of errors	52
n021	Fault display (second to latest)	—	Second to latest details of errors	52
n022	Fault display (third to latest)	—	Third to latest details of errors	52
n023	Fault display (fourth to latest)	—	Fourth to latest details of errors	52

n001：Output frequency

Indicates the output frequency of the inverter. "0.0" is displayed when the inverter is stopped.

n002：Output current
n003：Output voltage
n004：Internal DC voltage

The indications of the output current, output voltage and internal DC voltage are not the accurate indications for measuring. Use those indications to get rough values.
(If you need the accurate values, use a measuring instrument.)

n005：Setting frequency

Indicates the setting frequency of the inverter.

n006：Communication station No.

Indicates the set communication station No..
Communication station No. can be set with P136: communication station No. setting.

n007：Timer runtimes

In timer's multi speed operation, timer's acceleration and deceleration linking operation, pulse input multi speed operation and pulse input acceleration and deceleration linking operation, runtimes in a cycle during each operation are displayed. When a cycle starts, runtimes will be counted up. When each operation ends, input the next run command, the counted numbers will be cleared.
Timer runtimes can be set with P068: timer runtimes.

n008：Alarm type

Indicates the lighting details of the alarm LED.

Alarm state	Display
Without error	nonE
Output voltage trouble alarm	AL OU
Overload alarm	AL OC
Temperature anomaly alarm	AL OH
Timer end-of-run signal	tEnd

* Alarm LED operation select (parameter P147) set to "1"

When various alarms occur simultaneously, the displayed order of priority is shown as follow. (If alarm in higher priority order is in operation, even an alarm in lower priority order enters, the alarm in higher priority order is still displayed.)

Temperature anomaly alarm > Overload alarm > Output voltage trouble alarm > Timer end-of-run signal

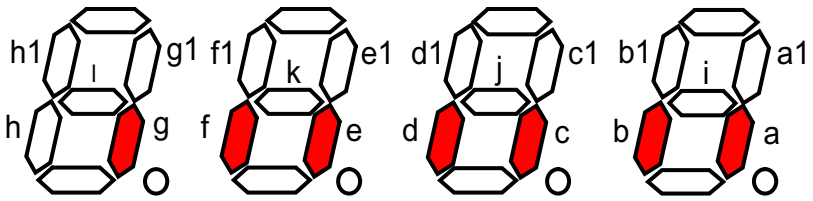
n009：Control terminal state (input signal)
n010：Control terminal state (output signal)

Monitor n009 and n010 indicate statuses of the input and output signals of the control circuit terminal.

Segment data a1~g1 light when input terminals (②～⑧)and common terminal (①or⑨) are ON, and light out when these terminals are OFF.
Segment data a1 and b1 of the monitor n010 light when output terminals are closed (ON) between ⑩-⑫, and ⑪-⑫, and light out when output terminals are opened (OFF) between ⑩-⑫, and ⑪-⑫.

Segment data c1 lights when the output terminal is ON (Energize in ON-state: short circuit across A - C ; Non energize in ON-state: short circuit across B - C), segment data c1 lights out when the output terminal is OFF (Energize in ON-state: opened across B- C; Non energize in ON-state: opened across A - C).

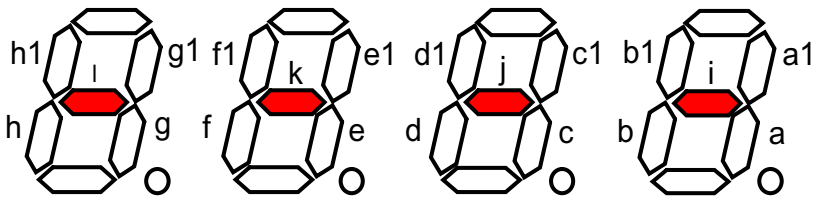
Monitor No.	Input and output signals	LED segment indication		
		Terminal indication	Signal ON	Signal OFF
n009	Start/stop	a lights	a1 lights	a1 lights out
	Forward/reverse	b lights	b1 lights	b1 lights out
	SW1	c lights	c1 lights	c1 lights out
	SW2	d lights	d1 lights	d1 lights out
	SW3	e lights	e1 lights	e1 lights out
	SW4	f lights	f1 lights	f1 lights out
	SW5	g lights	g1 lights	g1 lights out
n010	Open-collector 1	a lights	a1 lights	a1 lights out
	Open-collector 2	b lights	b1 lights	b1 lights out
	Relay	c lights	c1 lights	c1 lights out



n011：Operation state monitor

Indicates operation state of the inverter. Each LED segment lights and lights out according to the details of lighting and lighting out shown in the following table.
Normally, segment data i ~ I light.

Monitor No.	Operation state	LED segment indication	
		Details of lighting	Details of lighting out
n011	Operation state	Operation state	Stop state
		a lights	a lights out
	Reverse run operation state	Reverse run operation state	Stop state or forward run operation state
		b lights	b lights out
	Arrival signal	ON state	OFF state
		c lights	c lights out
	Overload signal	ON state	OFF state
		d lights	d lights out
	Frequency detect (parameter P093)	ON state	OFF state
		e lights	e lights out
	Frequency detect (parameter P094)	ON state	OFF state
		f lights	f lights out
	Detect current (or more) signal	ON state	OFF state
		g lights	g lights out
	Detect current (or less) signal	ON state	OFF state
		h lights	h lights out
	PID automatic tuning function	PID automatic tuning operation state	Normal operation state
		a1 lights	a1 lights out
	Timer operation function	Timer operation state	Normal operation state
		b1 lights	b1 lights out
	Automatic tuning function of motor constant	Automatic tuning function of motor constant	Normal operation state
		c1 lights	c1 lights out
	Error state	Error state	Normal state
		d1 lights	d1 lights out

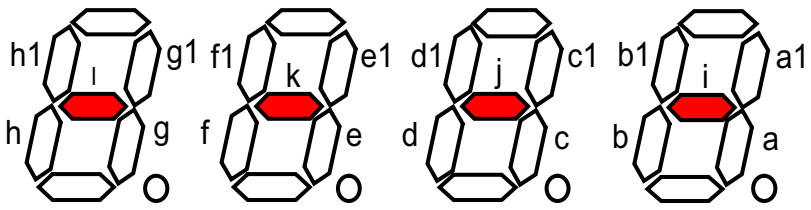


n012：Operation control status monitor

Indicates the operation control status of the inverter. Each LED segment lights and lights out according to the details of lighting and lighting out shown in the following table. Normally, segment data i ~ l light.

When command status is "in operation of timer" and parameter P45 (multi speed function setting) is set to "3" or "4", it lights if run command is input.
When command status is "in operation of pulse input" and parameter P45 (multi speed function setting) is set to "5" or "6", it lights if run command is input.

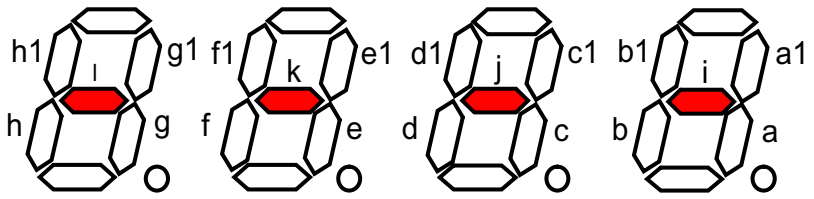
Monitor No.	Command status	LED segment indication	
		1: with command	0: without command
n012	Run command status	a lights	a lights out
	Reverse run command status	b lights	b lights out
	SW1 command status	c lights	c lights out
	SW2 command status	d lights	d lights out
	SW3 command status	e lights	e lights out
	SW4 command status	f lights	f lights out
	SW5 command status	g lights	g lights out
	In operation of timer	h lights	h lights out
	In operation of pulse input	a1 lights	a1 lights out



n013：Terminal function status monitor

Indicates function status of the inverter's control terminal circuit. Each LED segment lights and lights out according to the details of lighting and lighting out shown in the following table. Normally, segment data i ~ I light.

Monitor No.	Command status	LED segment indication	
		1: with command	0: without command
n013	Multi speed function	a lights	a lights out
	Parameter setting disable function	b lights	b lights out
	Reset input function	c lights	c lights out
	Reset lock function	d lights	d lights out
	JOG function	e lights	e lights out
	External fault stop function	f lights	f lights out
	Coast-to-stop function	g lights	g lights out
	Frequency signal switching function	h lights	h lights out
	2nd characteristic select function	a1 lights	a1 lights out
	PID function switching function	b1 lights	b1 lights out
	3 line stop command function	c1 lights	c1 lights out
	Frequency ▲(UP) setting function	d1 lights	d1 lights out
	Frequency ▼(DOWN) setting function	e1 lights	e1 lights out
	PWM frequency signal select function	h1 lights	h1 lights out



n014：PID setting value (SP)
n015：PID measured value (PV)
n016：PID output value (MV)

Indicates setting value(SP), measured value(PV) and output value(MV) under PID control. The unit is "%".

n017：Progress of automatic tuning

When automatic tuning is set with P106: PID control mode, the progress of the automatic tuning is displayed. The initial value is "0" and "1" to "5" is displayed according to progress. When the automatic tuning ends, the display will return to initial value "0".

"0" to "5" : during measure; "6": measure ends (End) ; "7": measure stops (Err)

n018：Accumulative operation time
n019：Accumulative fan operation time

Monitor n018 indicates the accumulative time of the inverter when the power supply is turned ON. Monitor n019 indicates the accumulative time of the cooling fan in the inverter to operate. P143: cooling fan ON-OFF control is set to"1": In association operation, no counting will be carried out when the cooling fan is stopped. Display unit is one hour ="0.001". Displays in 10 hours after "10.00" according to "0.01", in 100 hours after "100.0" according to "0.1" and in 1000 hours after "1000" according to "1".
As a certain number of errors are available in the details of display, the display can only be used as reference value.

n020：Fault display 1 (latest)
n021：Fault display 2 (second to latest)
n022：Fault display 3 (third to latest)
n023：Fault display 4 (fourth to latest)

Indicates the latest, second to latest, third to latest and fourth to latest errors of the inverter.

9. Function Parameters

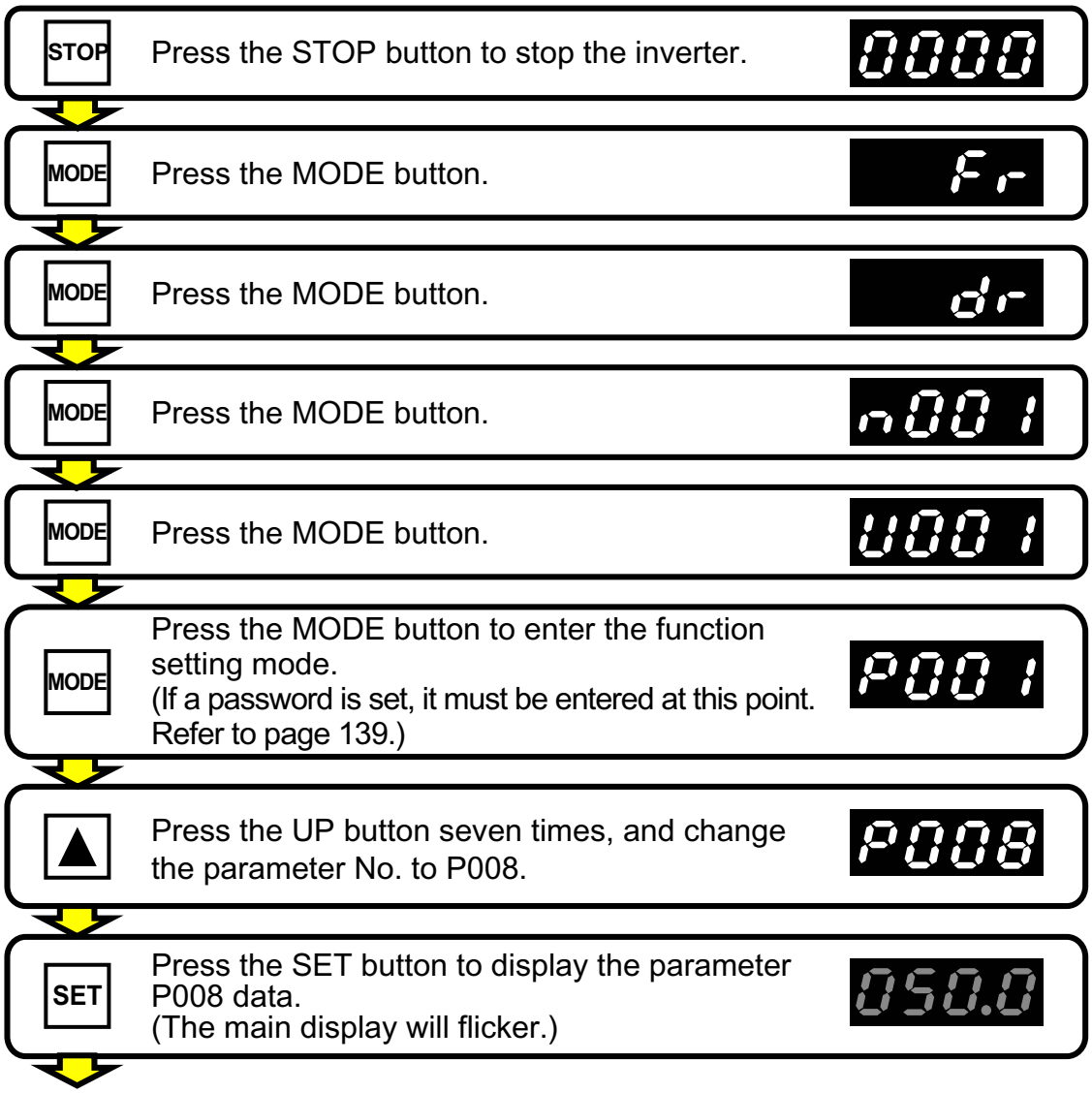
The inverter VF100 has 151 function parameters. Please set the necessary parameters according to load and operation specifications. Parameters can be set and monitored in "custom mode" and "function setting mode".

9-1. Setting and Changing Function Parameters

Various functions data can be changed and set when the operation is stopped. Note that some function parameters can be changed during operation.

9-1.1 Setting and changing function parameters when operation is stopped.

Setting example: Change the maximum output frequency from 50.0Hz to 60.0Hz. (Changing the parameter P008 data from "50.0" to "60.0".)



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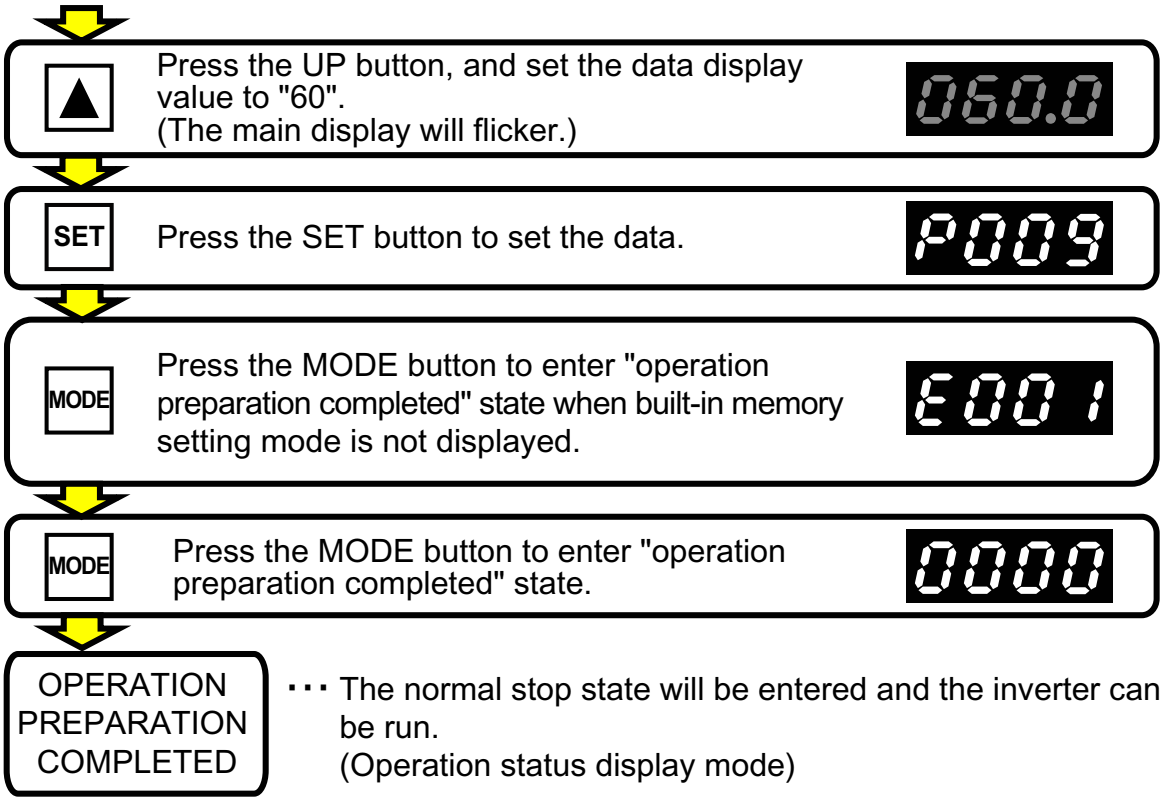


Note

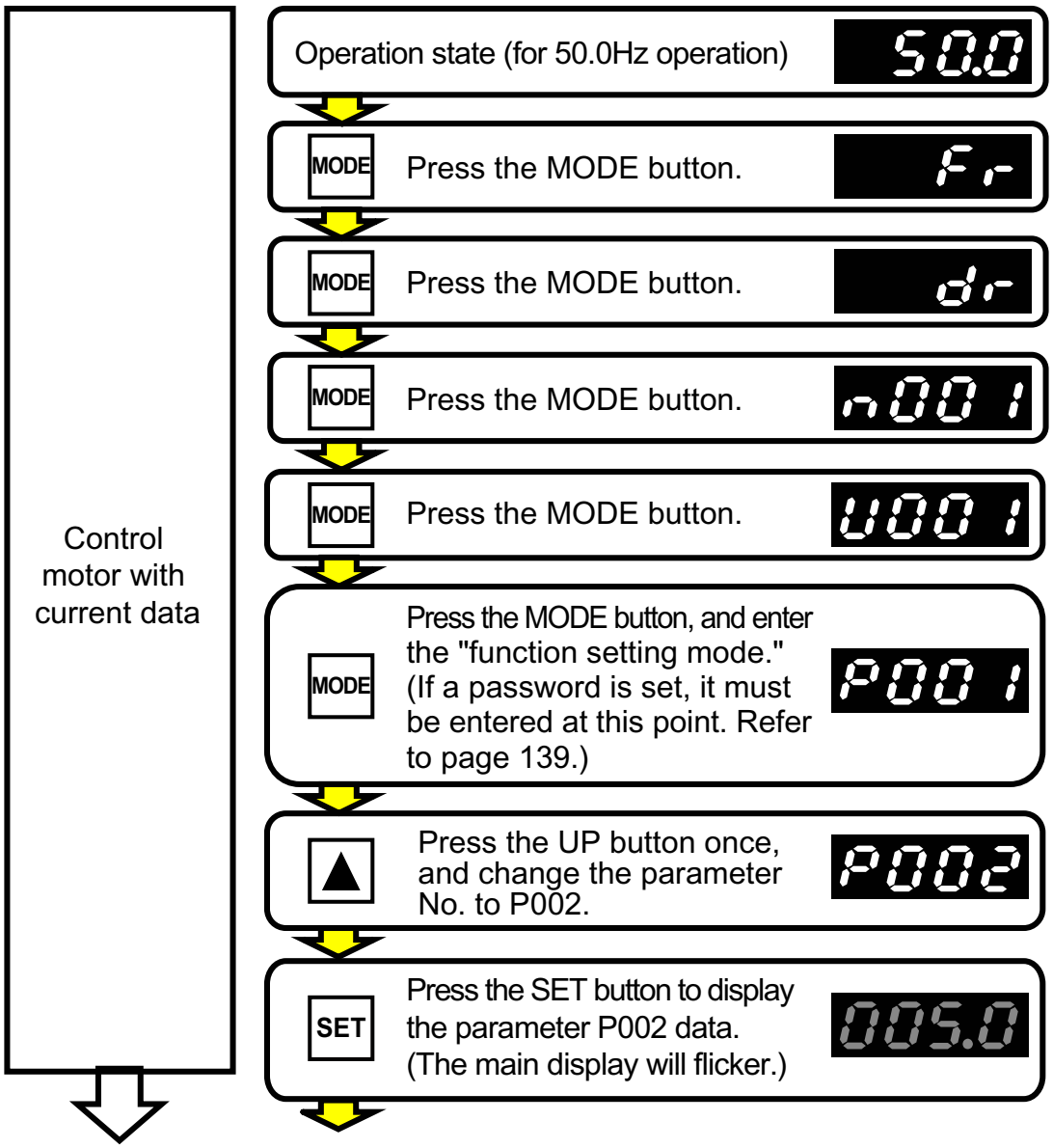
- After the function parameter is set, the inverter will not run unless the MODE button is pressed and the "operation status display mode" is set to.
- If the function setting returns to the "operation preparation completed" state during data changing, while a start input signal is being applied through external control, an "OP" error will be displayed, causing the inverter to remain inoperative.
  Reset the fault indication using the instructions under "Resetting Fault Trips" (page 197).
- If writing the set data in the non-volatile memory inside the inverter while the data is being set and changed, the set data will be stored in the memory even after the power supply has been turned OFF. The maximum writing times of the non-volatile memory inside the inverter is 100,000 times. Therefore, note that the setting of parameters cannot be changed frequently.

9-1.2 Setting and Changing Function Parameters during Operation

Caution: The motor and motor load fluctuation could change significantly and the motor may suddenly start or stop when data is being changed during operation.
(Before making changes, ensure personal safety at all times.)
Failure to do so could lead to injury.

Under item "Changeable in Operation" in "9-2 Function Parameter Table", the ○ mark indicates parameters that can be changed during operation.

[Setting example: Change change 1st deceleration time from 5.0s to 10.0s.]
(Changing the parameter P002 data from "5.0" to "10.0")



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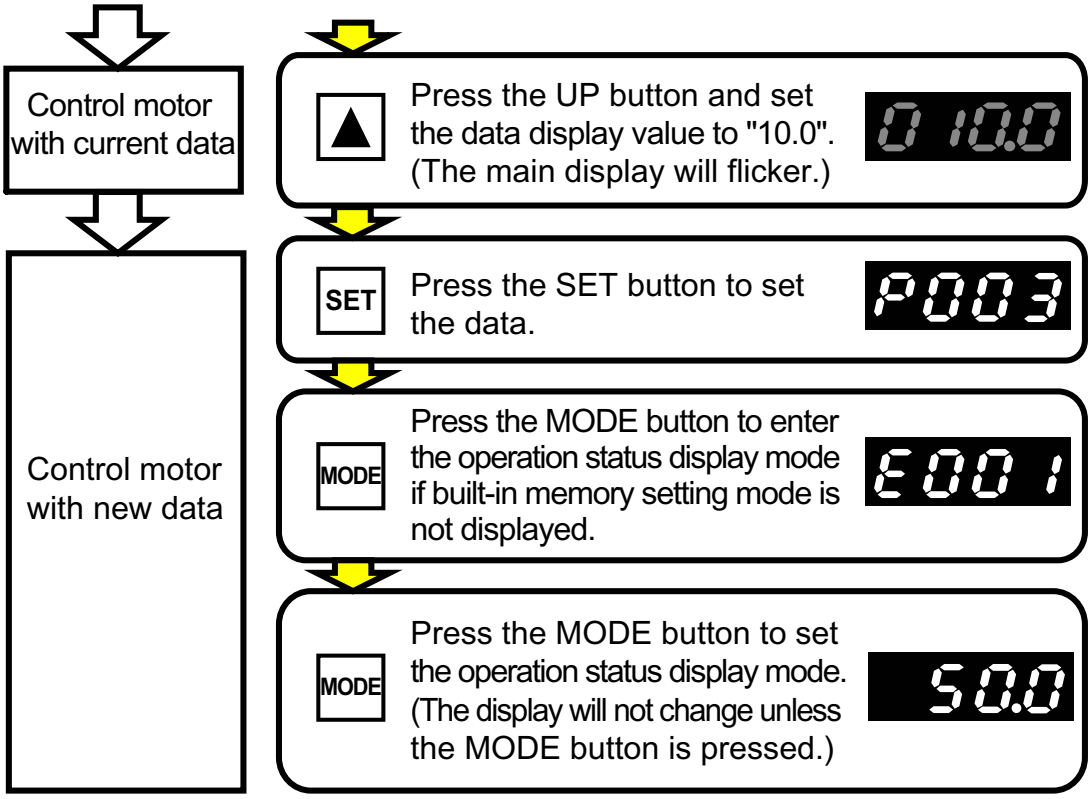


Note

- During operation, the function parameters other than those that can be changed will only be monitored.
  (The function parameters can only be displayed, but cannot be changed.)
- If a stop signal is input while changing the data and the inverter stops, the mode will return to the " operation preparation completed" state.
- If the inverter occurs 0V stop while changing the data, it will return to the "0V stop state".
- While changing the data in the "0V stop" state, the inverter will return to the "operation status display mode" after entering operation state.
- When the speed frequency 2 ~ 16 of parameters P046 ~ P060 are set to "0000", the inverter will carry out 0V stop.

If "bias frequency setting" and "bias frequency setting 2" of parameters P103 and P126 are set to "0" or less, the inverter will carry out 0V stop.

If "gain frequency setting" and "gain frequency setting 2" of parameters P104 and P127 are set to "0000", the inverter will carry out 0V stop.
(The motor will start or stop while the data is being changed and set to "0000", So ensure personal safety before operation.)

9-2 Functional Descriptions (Parameters Table)

Function parameters of inverter VF100 are shown in the following table.

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Remarks	Reference page
P001	1st acceleration time	○	0000, 0.1～3600	S	5.0		62
P002	1st deceleration time	○	0000, 0.1～3600	S	5.0		62
P003	Operation command select		0～7	—	0		63
P004	Frequency setting signal		0～7	—	0		64
P005	V/F pattern		50・60・FF・3C	—	50		65
P006	V/F curve		0・1	—	0		67
P007	Torque boost level	○	0～40	%	4		68
P008	Max. output frequency		50.0～400.0	Hz	50.0		69
P009	Base frequency		45.0～400.0	Hz	50.0		69
P010	Change point frequency 1		0.5～400.0	Hz	0.5		70
P011	Change point voltage 1		0～100	%	00		70
P012	Change point frequency 2		5～400.0	Hz	0.5		70
P013	Change point voltage 2		0～100	%	0		70
P014	Max. output voltage		0～500	V	0		71
P015	S-shaped acceleration/ deceleration mode		0～2	—	0		71
P016	Electronic thermal select		0～3	—	2		72
P017	Thermal current setting		0.1～100.0	A	*		72
P018	Overcurrent stall prevention function		0・1	—	1		73
P019	Overvoltage stall prevention Function		0・1	—	1		73
P020	Current limit function		0～9.9	S	0		74
P021	OCS level		1～200	%	140		74
P022	Retry function		0～3	—	0		75
P023	Retry times		1～10	times	1		75
P024	Start mode		0～3	—	1		76
P025	Ride-through restart select		0～2	—	0		77
P026	Wait time		0.1～100.0	S	0.1		78
P027	Reverse run lock		0・1	—	0		79
P028	Stop mode		0・1	—	0		79
P029	Start frequency		0.5～60.0	Hz	0.5		79
P030	Stop frequency		0.5～60.0	Hz	0.5		79
P031	DC brake time		0～120.0	S	0		80
P032	DC brake level		0～100	%	0		80
P033	Stop frequency during forward /reverse operation		0.5～60.0	Hz	0.5		80
P034	DC brake time during forward /reverse run operation		0～120.0	S	0		80

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Remarks	Reference page
P035	DC brake level during forward /reverse run operation		0～100	%	0		80
P036	SW1 function select		0～10	—	0		82
P037	SW2 function select		0～11	—	0		82
P038	SW3 function select		0～10	—	0		82
P039	SW4 function select		0～10	—	0		82
P040	SW5 function select		0～11	—	0		82
P041	Input terminal logic setting		0～31	—	0		89
P042	JOG frequency	○	0.5～400.0	Hz	10.0		90
P043	JOG acceleration time	○	0.0～3600	S	5.0		90
P044	JOG deceleration time	○	0.0～3600	S	5.0		90
P045	Multi speed function select		0～6	—	0		91
P046	2nd speed frequency	○	0000, 0.5～400.0	Hz	5.0		99
P047	3rd speed frequency	○	0000, 0.5～400.0	Hz	10.0		99
P048	4th speed frequency	○	0000, 0.5～400.0	Hz	12.5		99
P049	5th speed frequency	○	0000, 0.5～400.0	Hz	15.0		99
P050	6th speed frequency	○	0000, 0.5～400.0	Hz	17.5		99
P051	7th speed frequency	○	0000, 0.5～400.0	Hz	20.0		99
P052	8th speed frequency	○	0000, 0.5～400.0	Hz	22.5		99
P053	9th speed frequency	○	0000, 0.5～400.0	Hz	25.0		99
P054	10th speed frequency	○	0000, 0.5～400.0	Hz	27.5		99
P055	11th speed frequency	○	0000, 0.5～400.0	Hz	30.0		99
P056	12th speed frequency	○	0000, 0.5～400.0	Hz	32.5		99
P057	13th speed frequency	○	0000, 0.5～400.0	Hz	35.0		99
P058	14th speed frequency	○	0000, 0.5～400.0	Hz	40.0		99
P059	15th speed frequency	○	0000, 0.5～400.0	Hz	45.0		99
P060	16th speed frequency	○	0000, 0.5～400.0	Hz	50.0		99
P061	2nd acceleration time	○	0.1～3600	S	5.0		100
P062	2nd deceleration time	○	0.1～3600	S	5.0		100
P063	3rd acceleration time	○	0.1～3600	S	5.0		100
P064	3rd deceleration time	○	0.1～3600	S	5.0		100
P065	4th acceleration time	○	0.1～3600	S	5.0		100
P066	4th deceleration time	○	0.1～3600	S	5.0		100
P067	Rotation direction of timer's operation		0～255	—	0		100
P068	Continuous times of timer's operation		0000・1～9999	times	1		101
P069	Continuous mode of timer's operation		0・1	—	0		101
P070	Continuous wait time of timer's operation		0000・0.1～6553	S	0000		101
P071	1st speed runtime		0000・0.1～6553	S	0000		102

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Remarks	Reference page
P072	2nd speed runtime		0000・0.1～6553	S	0000		102
P073	3rd speed runtime		0000・0.1～6553	S	0000		102
P074	4th speed runtime		0000・0.1～6553	S	0000		102
P075	5th speed runtime		0000・0.1～6553	S	0000		102
P076	6th speed runtime		0000・0.1～6553	S	0000		102
P077	7th speed runtime		0000・0.1～6553	S	0000		102
P078	8th speed runtime		0000・0.1～6553	S	0000		102
P079	1st speed pulse input times		0000・1～65530	times	0000		102
P080	2nd speed pulse input times		0000・1～65530	times	0000		102
P081	3rd speed pulse input times		0000・1～65530	times	0000		102
P082	4th speed pulse input times		0000・1～65530	times	0000		102
P083	5th speed pulse input times		0000・1～65530	times	0000		102
P084	6th speed pulse input times		0000・1～65530	times	0000		102
P085	7th speed pulse input times		0000・1～65530	times	0000		102
P086	8th speed pulse input times		0000・1～65530	times	0000		102
P087	PWM frequency signal select		0・1	—	0		103
P088	PWM signal average time		1～100	times	1		104
P089	PWM signal cycle		1.0 ～2000	ms	1.0		104
P090	Output TR1 function select		0～11	—	0		105
P091	Output TR2 function select		0～10	—	0		105
P092	Output RY function select		0～10、r0～r10	—	7		106
P093	Detect frequency (output TR)		0000, 0.5～400.0	Hz	0.5		107
P094	Detect frequency (output RY)		0000, 0.5～400.0	Hz	0.5		107
P095	Level of current detect		0.1～100.0	A	*		108
P096	Retardation time of current detect		1～10.0	S	0.1		108
P097	Analog and PWM output function select		0・1	—	0		109
P098	Analog and PWM output voltage compensation	○	25～100	%	100		110
P099	Lower frequency clamp		0.5～400.0	Hz	0.5		110
P100	Upper frequency clamp		0.5～400.0	Hz	400.0		110
P101	0V stop function select		0000, 0.5～400.0	Hz	0.5		111
P102	Bias/gain function select		0・1	—	0		112
P103	Bias frequency setting	○	-99.0～250.0	%	0		112
P104	Gain frequency setting	○	0.0～500.0	%	100		112
P105	Analog input filter	○	5～200	times	10		113
P106	PID control mode	○	0～3、A0～A3	—	0		114
P107	Proportional gain (kp)	○	0.1～1000	—	1		115
P108	Integral time (Ti)	○	0000・0.1～3600	S	0		115

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Remarks	Reference page
P109	Derivative time (Td)	○	0000・0.1～3600	S	0		115
P110	Control cycle (Ts)	○	0.01～60.00	S	0.01		115
P111	PID target value	○	0.0～100.0	%	100.0		115
P112	Skip frequency 1		0000, 0.5～400.0	Hz	0000		118
P113	Skip frequency 2		0000, 0.5～400.0	Hz	0000		118
P114	Skip frequency 3		0000, 0.5～400.0	Hz	0000		118
P115	Skip frequency band width		0～10	Hz	0		118
P116	2nd Base frequency		45.0～400.0	Hz	50.0		119
P117	2nd Torque boost level	○	0～40	%	4		120
P118	2nd Electronic thermal select		0～3	—	2		121
P119	2nd Thermal current setting		0.1～100.0	A	*		121
P120	2nd change point frequency 1		0.5～400.0	Hz	0.5		122
P121	2nd change point voltage 1		0～100	%	0		122
P122	2nd change point frequency 2		0.5～400.0	Hz	0.5		122
P123	2nd change point voltage 2		0～100	%	0		122
P124	2nd Analog input function select		0・1	—	0		123
P125	2nd Analog input signal select		3～6	—	3		124
P126	2nd Bias frequency setting	○	-99.0～250.0	%	0		125
P127	2nd Gain frequency setting	○	0.0～500.0	%	100		125
P128	Carrier frequency	○	0.8～10.0	kHz	2.5		127
P129	Vector control select		0・1	—	0		128
P130	Motor capacity		0.4～3.7	—	*		129
P131	No. of motor poles		2・4・6	—	4		129
P132	Measurement function for motor constant		0・1～3	—	0		130
P133	Voltage compensation constant		0.01～99.99	V	*		133
P134	Slip compensation frequency		-5.00～5.00	Hz	*		133
P135	Communication protocol select		0・1	—	0		134
P136	Communication station No. setting		01～31	—	01		134
P137	Communication speed setting		4800・9600・19200・38400	bps	96		134
P138	Stop bit length		1・2	—	1		134
P139	Parity check		0～2	—	0		134
P140	Timeover detect		0000・0.1～60.0	S	0000		134
P141	Send wait time		1～1000	ms	1		134
P142	TEXT completion judgment time		3～200	ms	3		134
P143	Cooling fan ON-OFF control select		0・1	—	0		135
P144	Input terminal filter		5～100	times	20		135

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Remarks	Reference page
P145	Operation status monitor	○	0～7	—	0		136
P146	Line speed multiplier	○	0.1～100.0	—	3		137
P147	Alarm LED operation select	○	0～5	—	0		138
P148	Alarm LED upper voltage clamp	○	0.1～600.0	V	550.0		138
P149	Alarm LED upper current clamp	○	0.1～100.0	A	*		138
P150	Password		0000・1～9999	—	0000		139
P151	Setting data clear		0・1・2・3	—	0		140

Note

- The ○ mark indicates parameters that can be changed during operation.
- The * mark indicates rated output current of the inverter. The value may vary depending on each rated value.

9-3 Functional Descriptions (By Parameters)

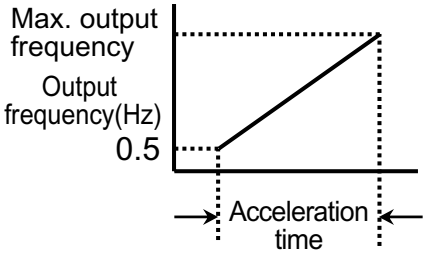
Function parameters in the above table will be described in detail as bellow. Depending on the load in use and operation state of the motor to set these parameters.

P001：1st acceleration time

Used to set the time to accelerate to the maximum output frequency from 0.5Hz.

Data setting range (s)	0.04・0.1～3600
Setting unit (s)	0.1(0.1～999.9), 1(1000～3600)

- The display code for 0.04s is "000".
- The maximum output frequency is set with parameters P005 and P008.



Note

- Take note that if acceleration time is set to a too short value, overcurrent may flow due to different load states.

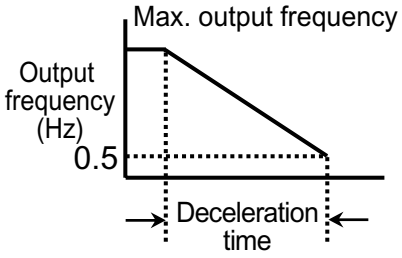
Related parameters	P005, P008

P002：1st deceleration time

Used to set the time to decelerate to the maximum output frequency from 0.5Hz.

Data setting range (s)	0.04・0.1～3600
Setting unit (s)	0.1(0.1～999.9), 1(1000～3600)

- The display code for 0.04s is "000".
- The maximum output frequency is set with parameters P005 and P008.



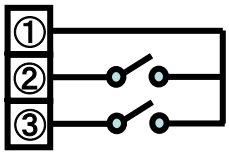
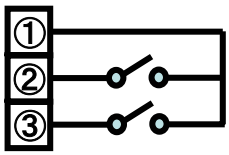
Note

- Take note that if deceleration time is set to a too short value, overcurrent may flow due to different load states.

Related parameters	P005, P008

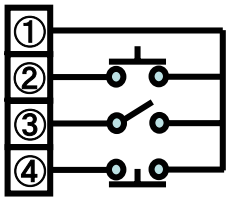
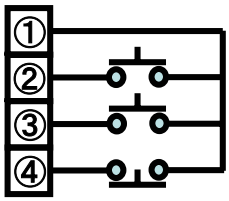
P003：Operation Command Select

Used to select whether to carry out start/stop and forward/reverse run with the operation panel, with signals input from external devices or with communication command.

Data setting value	Command state	Panel reset function	Operation method and control terminal connection diagram
0	Panel	Provided	Start: RUN, Stop: STOP Forward/reverse run: Set in rotation direction setting mode (dr mode)
1	Panel	Provided	Forward run: UP+RUN, Reverse run: DOWN +RUN, Stop: STOP
2	External control	Unprovided	 Common terminal (Terminal No.1 or No.8) ON: Start / OFF: Stop ON: Reverse run / OFF: Forward run
4	External control	Provided	
3	External control	Unprovided	 Common terminal (Terminal No.1 or No.8) ON: Forward run / OFF: Stop ON: Reverse run / OFF: Stop
5	External control	Provided	
6	Communication	Unprovided	Make the operation command input by communication valid.
7	Communication	Provided	

[3-wire start/stop command]

Distribute" 3-wire stop command" to any input terminal SW1 to SW5.
The following connecting example indicates the situation that "3-wire stop command" is distributed to input terminal SW1.

Data setting value	Command state	Panel reset function	Operation method and control terminal connection diagram
2	External control	Unprovided	 Common terminal (Terminal No.1 or No.8) ON: Start ON: Reverse run / OFF: Forward run ON: Stop (*1)
4	External control	Provided	
3	External control	Unprovided	 Common terminal (Terminal No.1 or No.8) ON: Forward run ON: Reverse run ON: Stop (*1)
5	External control	Provided	

(*1) If any terminal SW1 to SW5(control terminals No.4~No.8) is used as "3-wire stop command", "P036~P040: SW1~SW5 function select" is set to "10" (3-wire stop command). In addition, take note that even if "P041: input logic setting" is set to A contact input, B contact input always applies.

[Panel reset function]

When a fault trip occurs, the state cannot be reset with the stop signal input from external devices. Use STOP SW on the panel to reset the fault trip. If reset lock function is used, it will have the priority. In addition, reset function is still valid.

Note

- If forward run and reverse run signals are turned ON simultaneously, operation state will not change. If the inverter is stopped and both signals are turned ON simultaneously, the operation will not start.

Related parameters	P036~P040

P004：Frequency setting signal

Used to select frequency setting signal with the operation panel, with signals input from external devices or with communication command.

Data setting value	Command state	signa setting content	Operation method and control terminal connection diagram
0	Panel	Potentiometer setting	Potentiometer on the panel MAX: maximum frequency (Refer to P005 and P008) MIN: minimum frequency (or OV stop)
1		Digital setting	Setting in "frequency setting mode (Fr)".
2	External control	Potentiometer	Terminals No.13, 14, and 15 (Center of potentiometer is connected to No.14)
3		0~5V (voltage signal)	Terminals No.14 and 15(14: +, 15: -)
4		0~10V (voltage signal)	Terminals No.14 and 15(14: +, 15: -)
5		4~20mA(Current signal)	Terminals No.14 and 15(14: +, 15: -) 200Ω is connected between 14 and 15.
6		0~20mA(Current signal)	Terminals No.14 and 15(14: +, 15: -) 200Ω is connected between 14 and 15.
7	commu-nication	RS485 communication	Make the frequency command input by communication valid.

Note

- If 4~20mA or 0~20mA signals are used, always connect a "200Ω resistance" between terminals No.14 and 15. (If the 200Ω resistance is not connected, the inverter could be damaged.)
- When frequency setting signal is set to the data other than "1" and "7", the inverter will start or stop divided by setting value of "P101: OV stop function select.
  If OV stop function is set to be invalid, parameter P101 should be set to "0000"
  (OV stop function select: Refer to page 111)

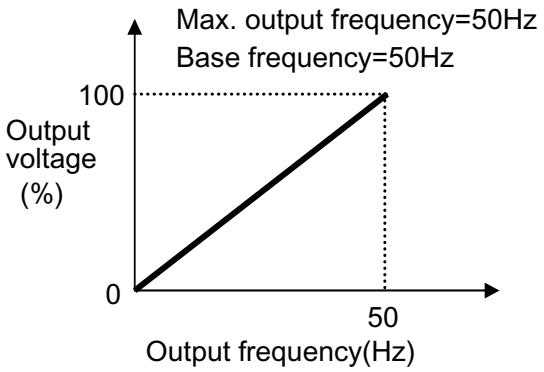
Related parameters	P005, P008 P101～P104

P005：V/F pattern

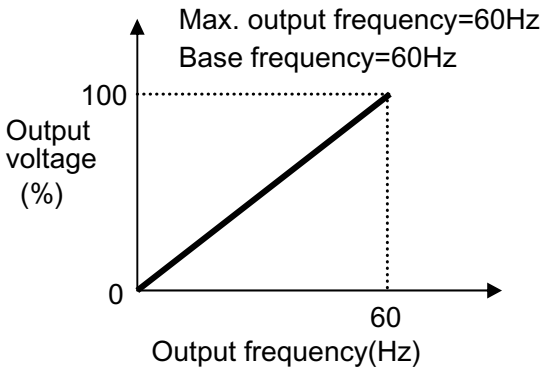
V/F pattern of 50 · 60 or 0.5 to 400Hz can be set independently from the maximum output frequency (50 to 400 Hz).

Data setting value	Name	Remarks
50	50Hz mode	The V/F pattern of 50Hz is set regardless of parameter P008 and P009 settings.
60	60Hz mode	The V/F pattern of 60Hz is set regardless of parameter P008 and P009 settings.
FF	Free mode	The V/F pattern can be set according to the parameter P008 and P009 settings. The maximum output frequency is set with parameter P008 and base frequency is set with parameter P009.
3C	3 points mode	The 3C V/F pattern can be set according to the parameter P008~P013 settings. The maximum output frequency is set with parameter P008 and base frequency is set with parameter P009. The change point frequency 1 is set with parameter P010 and change point voltage 1 is set with parameter P011. The change point frequency 2 is set with parameter P012 and change point voltage 2 is set with parameter P013.

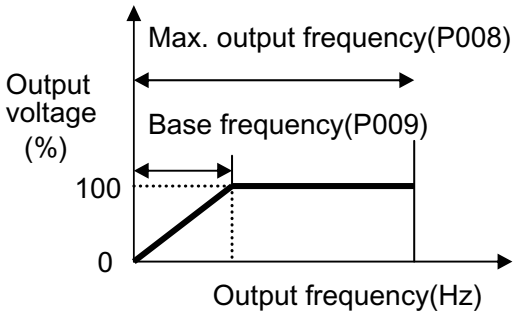
[50Hz mode]



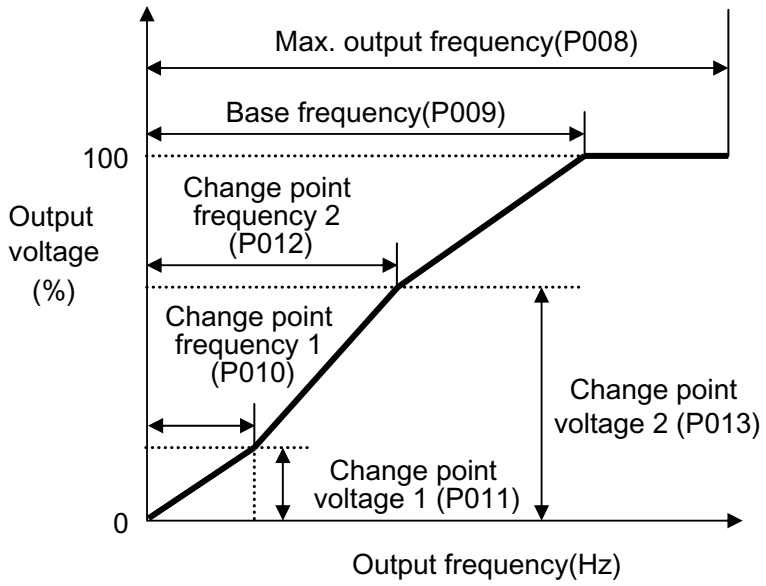
[60Hz mode]



[Free mode]



[3C mode]



If 3C mode in V/F pattern is used, setting parameters according to the relationship graph as follow. (Same in 2nd characteristics)

Max. output frequency(P008) > Base frequency (P009) > Change point frequency 2 (P012) > Change point frequency 1 (P010)

Change point voltage 2 (P013) > Change point voltage 1 (P011) > Torque boost level (P007)

Note

- Both the maximum output frequency and base frequency are set to 50Hz as the factory setting data.
- Take note of the upper frequency clamp (parameter P100) when changing the maximum output frequency setting.
- In free mode or 3C mode, take note that overcurrent may flow due to different setting value and load state.
- When change point frequency 1 and 2 are set above base frequency, change point frequency 1 and 2 will operate according to the setting value of base frequency.
- When change point frequency 2 is set below change point frequency 1, change point frequency 2 will operate according to the setting value of change point frequency 1.

- When setting "P007: torque boost level", if change point voltage 1 and 2 are set below torque boost level, change point voltage 1 and 2 will operate according to setting value of torque boost level.
- If change point voltage 2 is set below change point voltage 1, change point voltage 2 will operate according to setting value of change point voltage 1.
- In 3C mode, V/F curve (P006) is constant torque mode. Even if V/F curve is set to square torque mode, operation will start according to constant torque mode.
- Under control of vector (P129= "1"), V/F pattern is invalid.

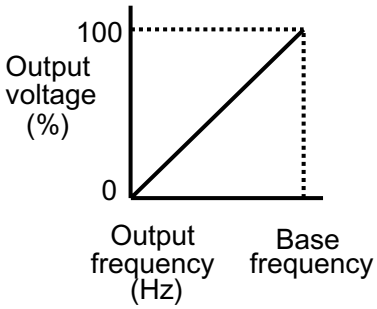
Related parameters	P007～P013 P100

P006：V/F curve

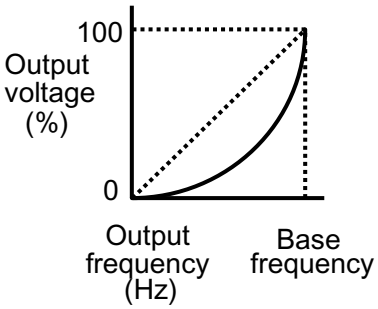
Used to select either the constant or square torque mode.

Data setting value	Name	Remarks
0	Constant torque mode	For machine applications.
1	Square torque mode	For fan and pump applications.

[Constant torque mode]



[Square torque mode]



Note

- If "P005:V/F pattern" is set to 3C mode, V/F curve is constant torque mode. Even if V/F curve is set to square torque mode, operation will start according to constant torque mode.
- Under control of vector (P129= "1"), V/F curve is invalid.

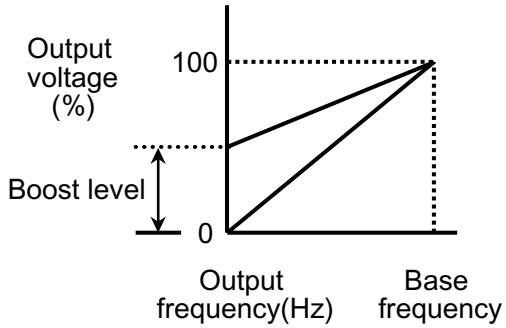
Related parameters	P005, P009

P007：torque boost level

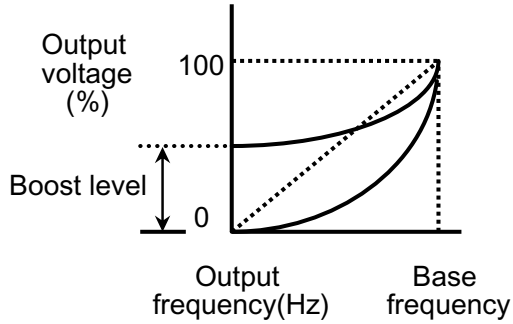
Used to set a torque boost level that best fits the load characteristics. A larger value causes a higher output voltage and stronger boost.

Data setting range (%)	0 to 40

[Constant torque mode]



[Square torque mode]



＜Method to boost torque at low speed＞

If larger torque is required at low speed, value of torque boost level can be set to larger data. Increasing output voltage to boost torque.

Note

- If the boost level is too high, an overcurrent fault, overload fault or motor overheating could occur or the noise could increase.
- The motor current will increase when the value of boost level is increased. Carefully consider the settings for "P016: electronic thermal select "and "P017: thermal current setting".
- Under control of vector (P129= "1"), torque boost level is invalid.

Related parameters	P005～P013 P016, P017

P008：Max. output frequency
P009：Base frequency

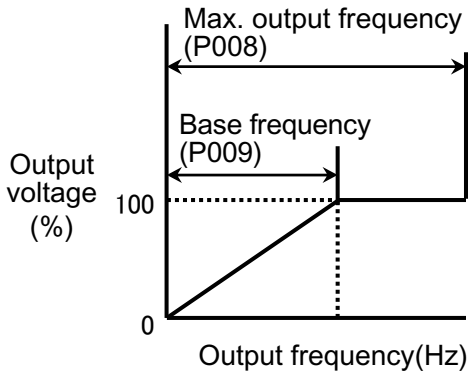
Used to set the maximum output frequency and base frequency.
(Parameter P005 is valid only when "FF" or "3C" is set.)

[Parameter P008: Max. output frequency]

Data setting range (Hz)	50.0 to 400.0

[Parameter P009: Base frequency]

Data setting range (Hz)	45.0 to 400.0



Note

- If "P005: V/F pattern" is set to "50" or "60", the max. output frequency and base frequency are fixed value.
- A frequency higher than "P100: upper frequency clamp" cannot be output.
- If a general-purpose motor with a rated frequency of 50 or 60Hz is run at a frequency exceeding the rated frequency, the motor may be damaged. Always set the frequency to match the motor characteristics.
- If the base frequency is required to be changed together with the max. output frequency for a high-speed exclusive motor, etc., such change is done with this parameter.
- When running a general-purpose motor with a frequency higher than the universal frequency, the base frequency will be set to the normal motor's rated output frequency(50 or 60Hz).
- When using the general-purpose motor at a level higher than the base frequency (normally 50 or 60Hz), the motor will enter the constant output characteristics, and the generated torque will drop in inverse proportion to the frequency.

Related parameters	P005, P100

P010：change point frequency 1
P011：change point voltage 1
P012：change point frequency 2
P013：change point voltage 2

Used to set change points 1 and 2 set with 3C mode in "P005: V/F pattern".
(These parameters are valid only when parameter P005 is set to "3C".)

[Parameter P010: change point frequency 1]

Data setting range (Hz)	0.5 to 400.0

[Parameter P011: change point voltage 1]

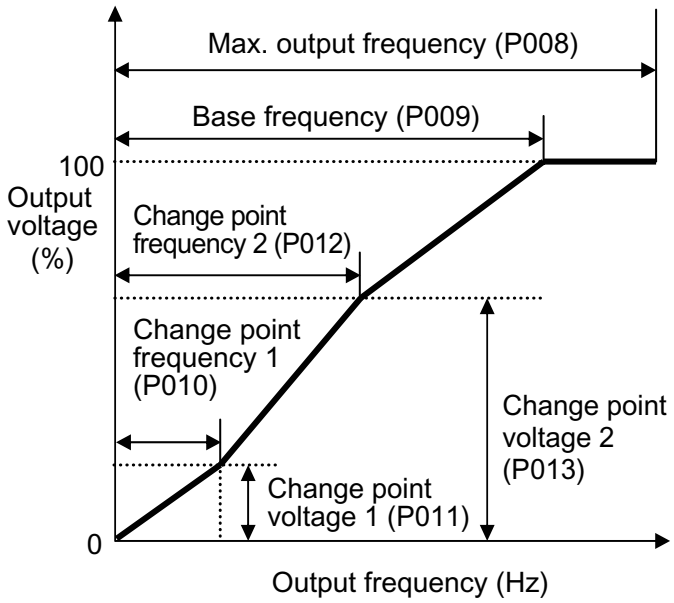
Data setting range (%)	0 to 100

[Parameter P012: change point frequency 2]

Data setting range (Hz)	0.5 to 400.0

[Parameter P013: change point voltage 2]

Data setting range (%)	0 to 100



Note

- Read carefully details on "P005: V/F pattern" before setting.
- If change point frequencies1 and 2 are set to be higher than base frequency, change point frequencies 1 and 2 will operate according to setting value of base frequency.
- If change point frequency 2 is set to be lower than change point frequency 1, change point frequency 2 will operate according to setting value of change point frequency 1.
- When setting "P007: torque boost level", if change point voltage 1 and 2 is set to be lower than torque boost level, change point voltage 1 and 2 will operate according to setting value of torque boost level.
- If change point voltage 2 is set to be lower than change point voltage 1, change point voltage 2 will operate according to setting value of change point voltage 1.

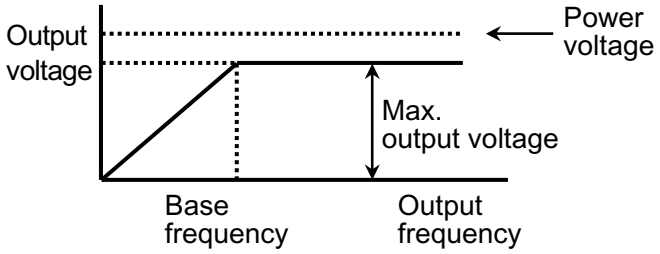
Related parameters	P005, P100 P007～P009

P014：Max. output voltage

Used to set the max. output voltage.

Data setting range(V)	1 to 500

* When "0" is set, the power voltage value will be output.



Note

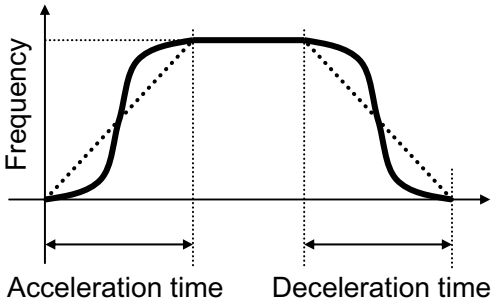
- A voltage exceeding the power voltage cannot be output.
- This setting does not affect the DC brake level.

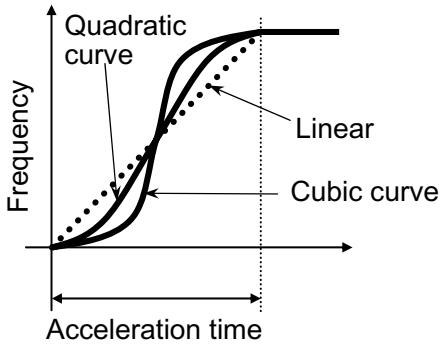
Related parameters	P005, P008

P015：S-shaped acceleration/deceleration mode

The acceleration/deceleration mode can be selected between linear and S-shaped (quadratic and cubic) mode.

Data setting value	Details
0	Linear acceleration/deceleration (Factory setting data)
1	S-shaped acceleration/deceleration (Quadratic curve)
2	S-shaped acceleration/deceleration (Cubic curve)





Note

- The acceleration/deceleration time is always the same regardless of the acceleration/ deceleration mode (Linear or S-shaped acceleration/deceleration).

Related parameters	P001, P002 P061～P066

P016：Electronic thermal select
P017：Thermal current setting

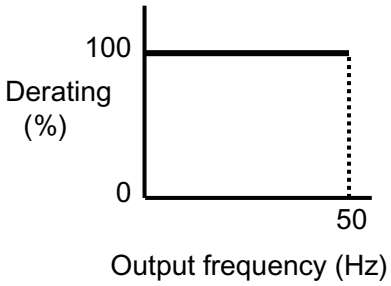
Used to set the operation level of the electronic thermal when the motor overload is detected and the inverter output is to be stopped.
Operation coasts to stop when OL is displayed.

[Parameter P016: Electronic thermal select]

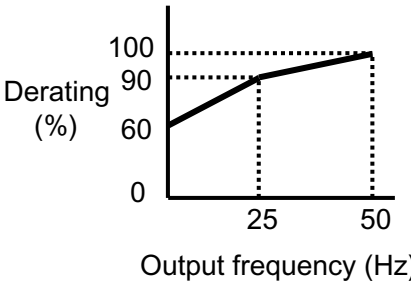
Data setting value	Validity of function	Details of function
0	invalid	OL trip will occur if a current that is 140% of the inverter's rated current flows for one minute.
1	valid	Without output frequency derating
2	valid	With output frequency derating
3	valid	Forced ventilation motor specifications

* About derating
Function to automatically compensate operation level when motor cooling performance drops during low-speed operation.

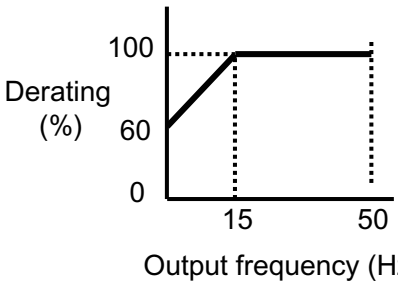
[Parameter P016 = 1]



[Parameter P016 = 2]



[Parameter P016 = 3]



[Parameter P017: Thermal current setting]

Data setting range (A)	0.1 to 100.0

* Set these parameters according to the rated current of applicable motor.

■Example for setting current and thermal operation (P016 = 1)

- Set current X 100% ⇒ Does not operate
- Set current X 125% ⇒ operate (OL trip)

P018：Overcurrent stall prevention function

When the set acceleration time is too short for the inertial load, this parameter can be used to temporarily reduce the acceleration rate to prevent an overcurrent trip.

Data setting value	Detail
0	Stall prevention function disabled
1	Stall prevention function enabled

[Overcurrent trip prevention function]

When value is set to "1" and heavy current flows in the inverter during the low-speed operation, this function may temporarily stop output. When current decreases, output will be restarted. But in 3.7kW inverter, if carrier frequency is set to "10kHz", overcurrent trip prevention function is invalid.When the load is changed suddenly or the inverter is accelerated or decelerated rapidly, instantaneous flow of heavy current may lead to trip sometimes.

Note

- The level that the stall prevention functions at can be set with parameter "P021: OSC level ".
- When "P020: Current limit function" is already set, overcurrent trip prevention function still applies.

Related parameters	P021

P019：Overvoltage stall prevention function

When the set deceleration time is too short for the inertial load, this parameter can be used to temporarily reduce the deceleration rate to prevent an overvoltage trip.

Data setting value	Detail
0	Stall prevention function disabled
1	Stall prevention function enabled

Note

- When using the regenerative brakes with the inverter with brakes, set the setting data to "0". (The regenerative brake function will not activate with the factory setting "1".)
- When using regenerative brakes, make sure to use the dedicated brake resistor of our company.
- The specifications of the inverter built-in brakes are as follow. Consider these carefully before starting use. Note that the brake resistor and inverter could be damaged if the specifications are exceeded.

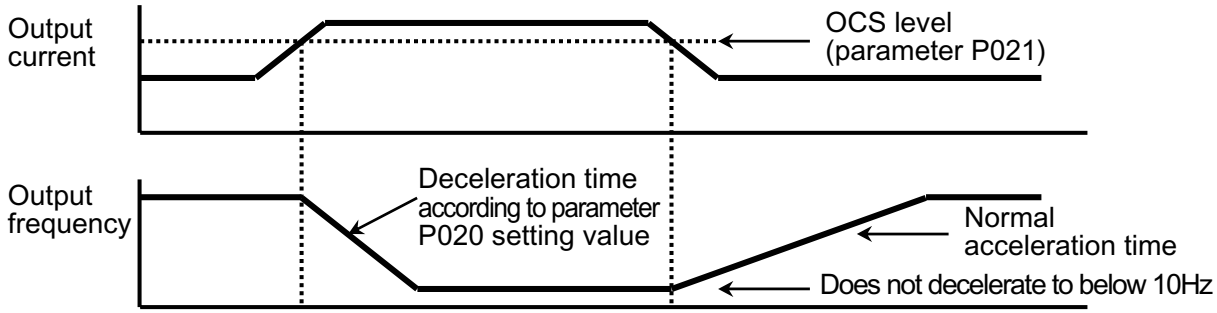
  (1) Braking torque: 100% (2) Maximum duty factor(%ED): 5% (3) Maximum working time: 5s
- Only brake circuit is built in 3-phase 400V input type. Always use the dedicated options of our company for brake resistor.

P020：Current limit function

If the output current reaches the overcurrent stall level (OCS level) due to an overload operation, the frequency is automatically reduced.
When the load returns to the correct level, the frequency is automatically returned to the original setting, and the operation is continued. This function is effective for preventing overcurrent trips in machines that knead glutinous materials, etc.
The function's validity and the deceleration time for automatically lowering the frequency when the output current reaches the overcurrent stall level are set with this parameter.
The operation level (overcurrent stall level) can be set with parameter "P021: OSC level".

Data setting range(s)	00 ・0.1 to 9.9

* "00" is set when the current limit function is disabled.



Note

・When "P020: Current limit function" is already set, overcurrent trip prevention function still applies.

Related parameters	P018, P021

P021：OCS level

The OCS level (overcurrent stall prevention operation level) and current limit function level can be set with a percent (%) to the inverter's rated current.

Data setting range (%)	1 to 200

Note

・The OCS level and current limit levels are the same.
・This setting is not related to the electronic thermal level and overload detection level.

Related parameters	P018, P020

P022：Retry function
P023：Retry times

If an inverter fault trip occurs, the retry function will automatically reset the fault and will restart (run) operation after the wait time has elapsed. Use this function to continue operation.

Caution

When the retry function is used, the inverter may automatically start (restart).
Keep out of the machine.
(Secure personal safety before using this function.)
Failure to do so could lead to injury.

- Select the "retry function validity" and the details of the fault for carrying out retry with parameter P022.
- Set the "retry times" with parameter P023.
- The time interval for retrying is set with parameter "P026: Wait time".
- The fault warning signal will not be output during retry. If a fault occurs even when the set number of retries has been carried out, a fault warning signal will be issued.
- If a fault not selected occurs during retry, a fault warning signal will be output, and the counted retry times will be cleared.
- The counted retry times will be cleared when the power is turned OFF.
- If a fault dose not occur for 5 or more minutes, the counted retry times will be cleared.

[Parameter P022: Retry function]

Data setting value	Details
0	Retry function disabled (Retry is not carried out.)
1	Execute retry only for overcurrent fault and heat sink fin abnormal overheating (SC1/SC2/SC3/SC4/OC1/OC2/ OC3)
2	Execute retry only for overvoltage fault (OU1/OU2/OU3)
3	Execute retry for overcurrent fault and heat sink fin abnormal heating (SC1/ SC2/SC3/SC4/OC1 /OC2/OC3)and overvoltage fault (OU1/OU2/OU3)

[Parameter P023: Retry times]

Data setting range(times)	1 to 10

Related parameters	P026

P024：Start mode

This parameter sets the starting operation for the case that an externally set run signal is input when the power is turned ON.

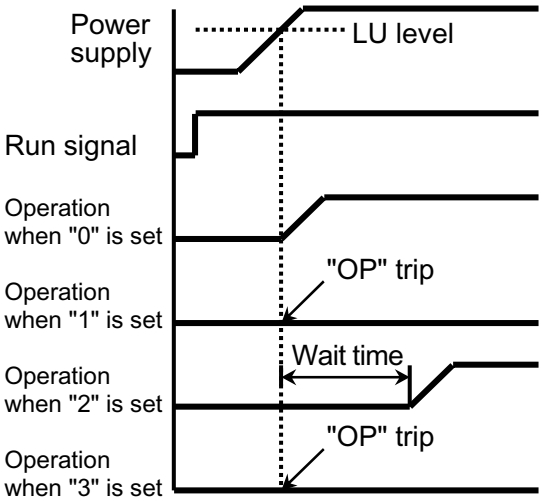
Caution

Depending on the start mode setting, when the run signal is ON, the inverter may start (restart) suddenly if the power is turned ON or the power is restored after a power failure. Keep out of the machine.
Design the machine so that personal safety can be ensured even if the inverter starts suddenly.
Failure to do so could lead to injury.
Depending on the start mode function setting, if the fault trip is reset with the run signal being ON, the inverter may restart suddenly.
(Reset the trip after ensuring personal safety.)
Failure to do so could lead to injury.

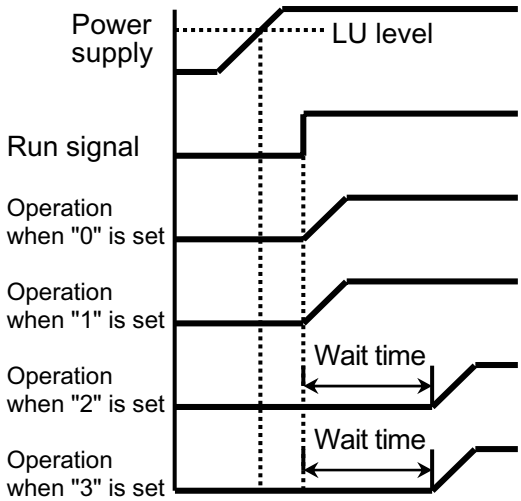
- The factory setting is "1" (OP stop).
- If the value is set to "0", operation starts immediately when the power is turned ON.
- If the value is set to "2", operation starts after the wait time has elapsed after the power is turned ON.

Data setting value	Operation	Details of operation
0	Run	Operation starts immediately when the power is turned ON and the low voltage level (LU level) is exceeded.
1	"OP" stop	The inverter OP trips when the power is turned ON and the low voltage level (LU level) is exceeded. Turn the start input signal OFF once, reset the inverter and then turn the run signal ON again to resume operation.
2	Operate after wait time	The inverter starts when the power is turned ON, the low voltage level (LU level) is exceeded and the wait time is passed. (The wait time is set with parameter P026.)
3	"OP" stop	The inverter OP trips when the power is turned ON and the low voltage level (LU level) is exceeded. Turn the start input signal OFF once, reset the inverter and then turn the run signal ON again to resume operation. (This setting will function in the same manner as data "1" if the run signal is ON when the power is turned ON. However, starting after the wait time has elapsed is possible during normal startup.)

[When power is turned ON with run signal ON]



[When run signal is turned ON after power is turned ON]



Note

・Wait time can be set with parameter P026.

Related parameters	P026

P025：Ride-through restart select

Used to select the restart mode after an instantaneous power failure occurs, according to the load conditions and system.
A wait timer function is built-in.

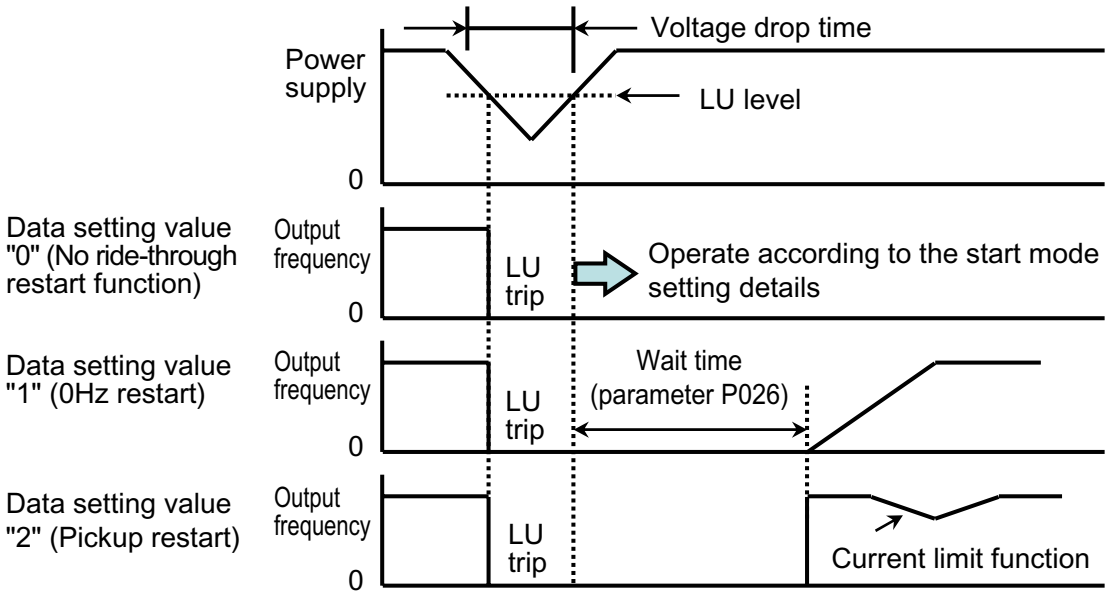
Caution Depending on the ride-through restart setting, the inverter may automatically start (restart) if the power is restored after a power failure. Keep out of the machine. (Secure personal safety before using this function.)
Failure to do so could lead to injury.

<table>
<tr><th rowspan="2">Data setting value</th><th colspan="4">Inverter operation in regard to instantaneous power failure time</th></tr>
<tr><th>Min. 15ms or more (Note 1)</th><th>Exceeding min.15ms (Note 1)</th><th>Min. 100ms or less (Note 2)</th><th>Exceeding min.100ms (Note 2)</th></tr>
<tr><td>0</td><td rowspan="3">Operation continues</td><td colspan="3">・The LU trips, and the inverter operates according to the start mode setting.
・"LU" will be displayed, and a fault warning signal will be output.</td></tr>
<tr><td>1</td><td colspan="2">・Restarts from 0Hz after the wait time has elapsed.
・"LU" will be displayed, but a fault warning signal will not be output.</td><td rowspan="2">Operation takes place according to the details set in the start mode.</td></tr>
<tr><td>2</td><td colspan="2">・After the wait time has elapsed, the inverter restarts at the frequency applied before the ride-through occurred
・"LU" will be displayed, but a fault warning signal will not be output.</td></tr>
</table>

(Note1) This is the min. time for operation at the rated output current.
(This time may be longer depending on different types.)

(Note 2) This is the min. time. (The time may be longer with the increase of rated capacity.)
Even if the power failure time is relatively long (approx. 1 min), the inverter may restart after the power is restored. So inverter, motor and loading equipments should be restarted after the power is restored more than 4 minutes (wait time + 2 minutes).

[When voltage drop time is more than 15ms but less than 100ms]



Note

・Wait time can be set with parameter P026.

Related parameters	P026

P026：Wait time

Used to set the wait time for the start mode, the ride-through restart and retry functions.

Data setting range(s)	0.1 to 100.0

Related parameters	P022～P025

P027：Reverse run lock

If only forward run operation is enabled, reverse run can be disabled to avoid the mishandling of "reverse run operation".

Data setting value	Details
0	Reverse run operation enabled (Both forward run and reverse run operation enabled)
1	Reverse run operation disabled (Only forward run operation enabled)

Note

- If reverse run operation is set to be disabled, reverse run cannot be carried out during the operation of panel, external control and communication.

Related parameters	P004

P028：Stop mode

Used to select whether to ramp-to-stop or coast-to-stop when stopping the inverter.

Data setting value	Details	Descriptions
0	ramp-to-stop	The frequency is decelerated by the stop signal according to the deceleration time, and then the motor stops.
1	coast-to-stop	The inverter output is shut off immediately by the stop signal.

P029：Start frequency

Used to set the frequency which the inverter output starts when starting the inverter.

Data setting range (Hz)	0.5 to 60.0

P030：Stop frequency

Used to set the frequency which the inverter output stops when the inverter deceleration to a stop.

Data setting range (Hz)	0.5 to 60.0

Related parameters	P031～P032

P031：DC brake time
P032：DC brake level

The DC brake can be applied when the inverter output frequency drops below "P030: Stop frequency "during ramp-to-stop.
In addition, together with JOG, positioning control can be carried out.

[Parameter P031: DC brake time]

Data setting range(s)	0000・0.1 to 120.0

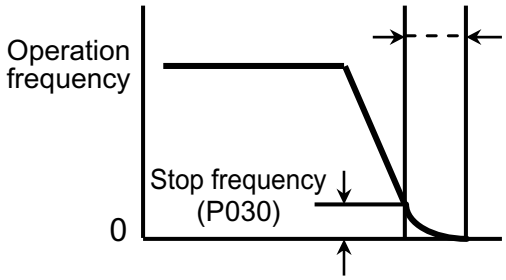
* The DC brake is not applied when "0000" is set.

[Parameter P032: DC brake level]

Data setting range(s)	0 to 100

* Set in increments of 5. The braking force will increase when a larger value is set.

[ramp-to-stop] DC brake time(P031)



Note

- The frequency for applying the DC brake is set by parameter P030 stop frequency.
- The DC brake when switching between forward run and reverse run is set with parameters "P033: Stop frequency during forward run/reverse run operation", "P034: DC brake time during forward run/reverse run operation" and "P035: DC brake level during forward run/reverse run operation".

Related parameters	P030

P033：Stop frequency during forward run/reverse run operation
P034：DC brake time during forward run/reverse run operation
P035：DC brake level during forward run/reverse run operation

The DC brake can be applied when the inverter output frequency drops below "P033: Stop frequency during forward run/reverse run operation" during forward run/reverse run operation.

[Parameter P033: Stop frequency during forward run/reverse run operation]

Data setting range(Hz)	0.5 to 60.0

[Parameter P034: DC brake time during forward run/reverse run operation]

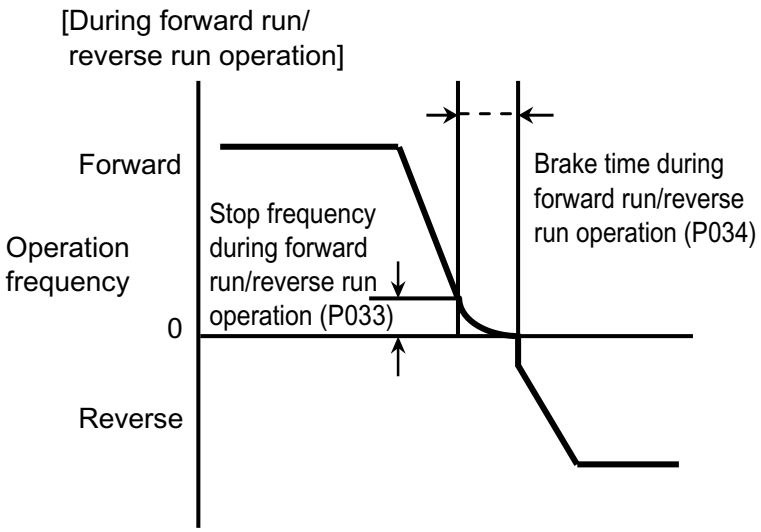
Data setting range(s)	0000・0.1 to 120.0

* The brakes are not applied when "0000" is set.

[Parameter P035: DC brake level during forward run/reverse run operation]

Data setting range(s)	0 to 100

* Set in increments of 5. The braking force will increase when a larger value is set.



Note

- The frequency for applying the DC brake is set with parameter P033 stop frequency during forward run/reverse run operation.
- "P033: Stop frequency during forward run/reverse run operation" is valid only when applying DC brake during forward run/reverse run operation.
  (It's valid when P034 is set to value other than 0000.)
- DC brake during stopping is set with parameters "P030: Stop frequency", "P031: DC brake time" and "P032: DC brake level".

P036：SW1 function select
P037：SW2 function select
P038：SW3 function select
P039：SW4 function select
P040：SW5 function select

Used to set the control function of SW1, 2, 3, 4, 5 (control circuit terminals No.4, 5, 6. 7, 8).

SW with set function	SW1 (terminal No.4)	SW2 (terminal No.5)	SW3 (terminal No.6)	SW4 (terminal No.7)	SW5 (terminal No.8)
Parameter No.	P036	P037	P038	P039	P040

Data setting value						
	0	Multi speed SW input	Multi speed SW input	Multi speed SW input	Multi speed SW input	Multi speed SW input
	1	Reset input	Reset input	Reset input	Reset input	Reset input
	2	Reset lock input	Reset lock input	Reset lock input	Reset lock input	Reset lock input
	3	JOG select input	JOG select input	JOG select input	JOG select input	JOG select input
	4	External fault stop input	External fault stop input	External fault stop input	External fault stop input	External fault stop input
	5	Parameter setting disable input	Parameter setting disable input	Parameter setting disable input	Parameter setting disable input	Parameter setting disable input
	6	Coast-to-stop input	Coast-to-stop input	Coast-to-stop input	Coast-to-stop input	Coast-to-stop input
	7	Frequency signal changeover input	Frequency signal changeover input	Frequency signal changeover input	Frequency signal changeover input	Frequency signal changeover input
	8	2nd characteristics select input	2nd characteristics select input	2nd characteristics select input	2nd characteristics select input	2nd characteristics select input
	9	PID control changeover input	PID control changeover input	PID control changeover input	PID control changeover input	PID control changeover input
	10	3-wire stop command	3-wire stop command	3-wire stop command	3-wire stop command	3-wire stop command
	11	————	Pulse counter input	————	————	Frequency ▲ or ▼ setting

Multi speed SW function

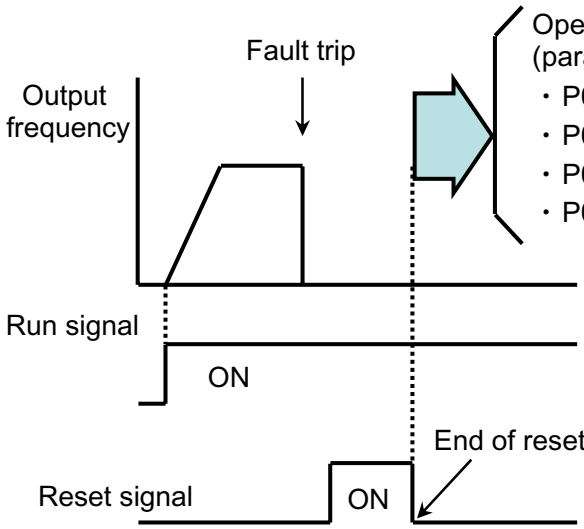
SW function is set for applying as multi speed function.
Multi speed function select is set with parameter P045.

- When all SW are set to multi speed function and 16 speed operation is applied, the four SW with smaller No. are valid as multi speed command SW.
  (SW1~SW5 are set to multi speed function → SW1, SW2, SW3 and SW4 are used as multi speed command.)
- P045: Read details on multi speed function select carefully before using this function.
  (Refer to page 91)

Related parameters P045～P086

Reset function

Used to reset the fault stop state through external control if an inverter fault trip (stop) occurs.
If a fault trip occurs, SW signal input enters ON state and the fault trip state will be relieved if the SW signal input is turned OFF.



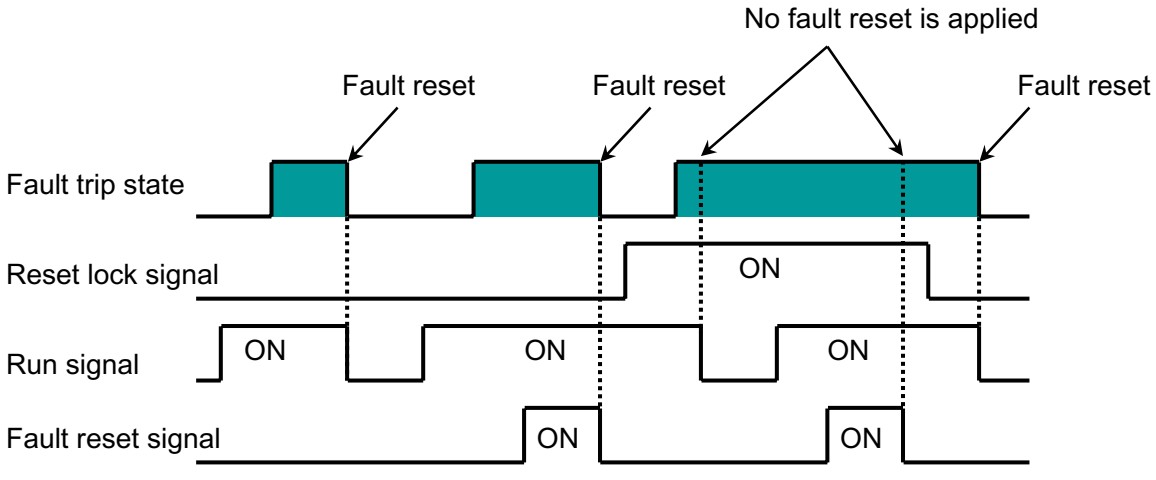
Operates according to the start mode (parameter P024) setting details
- P024＝0： Immediate start
- P024＝1： OP stop (at factory setting)
- P024＝2： Starts after the wait time has elapsed
- P024＝3： OP stop

* When the run/stop operation is applied with the operation panel, the inverter can be restarted with the panel after the trip is reset. Only depending on the reset, the inverter cannot be restarted.
* When run signal is turned OFF (stop), the fault trip can be reset.

Reset lock function

When a fault trip occurs, relief of the fault trip state with stop signal is disabled. The fault trip should be reset with this SW signal after confirming details on the trip and handling fault situations.

- Normally SW signal is input with ON.
- When a fault trip occurs, the inverter will maintain the trip state even if stop signal and reset signal are input.
- After details of errors are confirmed and handled, the fault trip will be reset if this SW is turned OFF.



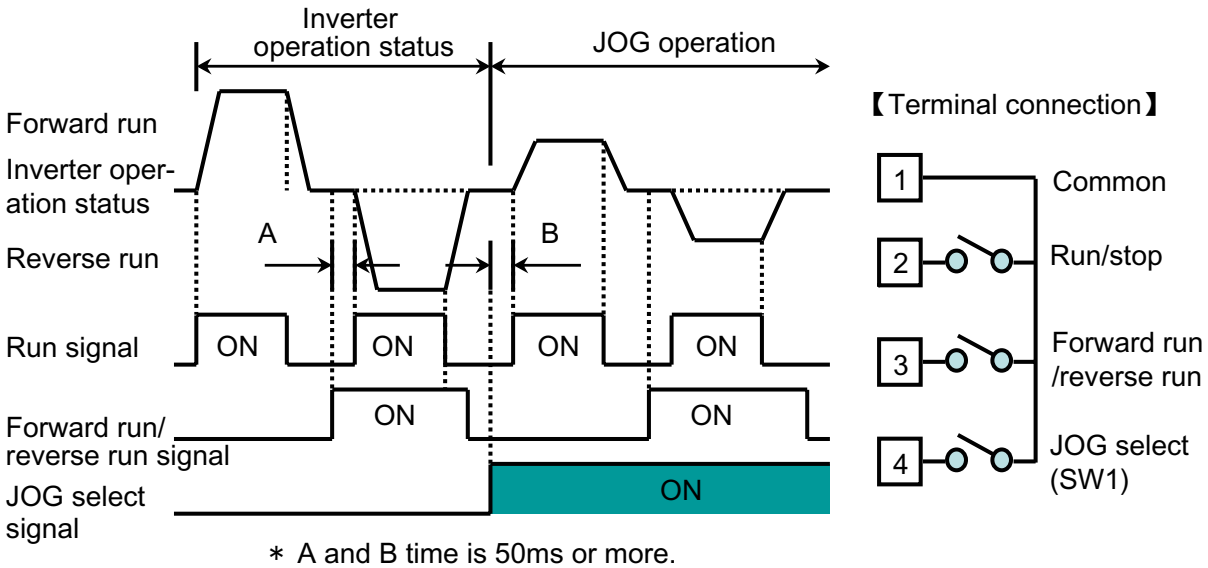
* Turn reset lock signal OFF and press the STOP button to reset the fault.
In addition, turn the fault reset signal OFF.

JOG function

Such micro operations as position adjustment can be applied with external control signals.
Used to set signal input terminal for controlling micro operation from external devices with parameters P036~P040.
But run command select (parameter P003) should be set through external control.

- Turn the signal input ON, and then enter the JOG operation mode.
- JOG operation is carried out according to "P042: JOG frequency", "P043: JOG acceleration time" and " P044: JOG deceleration time" settings, after run/stop and forward run/reverse run signals are input with terminals No.2 and No.3.

《Example:》 When SW1 (parameter P036=3) is set to JOG function and run command select (parameter P003 = 2),



＊ A and B time is 50ms or more.

Note 1) During JOG operation, turn the JOG select signal ON (B time) and then turn the run signal ON.

Note 2) During reverse run operation, turn the reverse run signal ON(A time) and then turn the run signal ON.

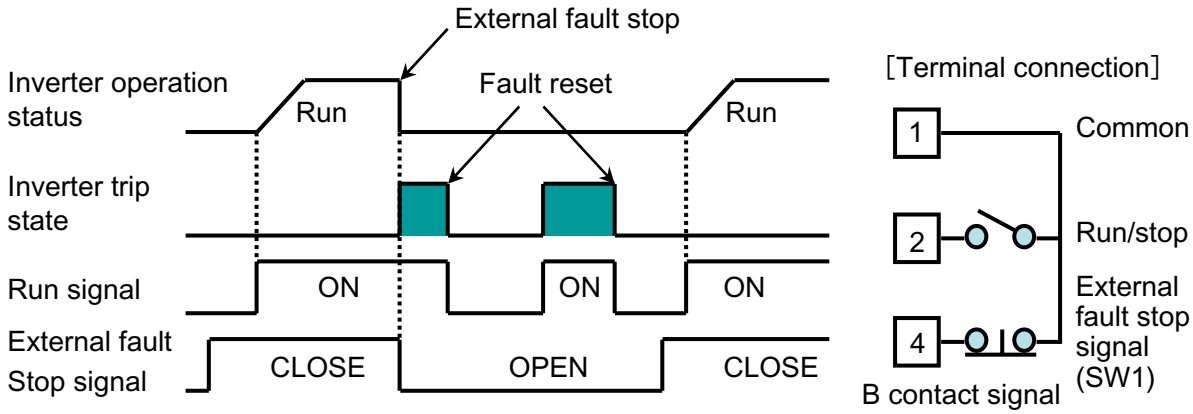
Related parameters	P042～P044

External fault stop function

Used to set the signal input terminal for applying fault stop (emergency stop) to the inverter from external devices.

- External fault stop input (setting data = 4) turns SW signal ON and then "AU" is displayed. The inverter will stop input immediately.
- Input signal logic setting (A and B contact input select) can be set with "P041: input logic setting".

《Example:》 When SW1 (parameter P036 = 4) is set to external fault stop, and logic setting (P041 =1) and run command select (parameter P003 =2) are input,



* When external fault stop signal is set to B contact input, fault reset can be applied after run signal is turn OFF, even if external stop signal is "OPEN". However, if turn the run signal ON again, a fault trip will occur.

Turn the external fault stop signal "CLOSE", and then turn the run signal ON to apply the normal operation.

Parameter setting disable function

Used to set the signal input terminal for disabling the parameter setting through external control.

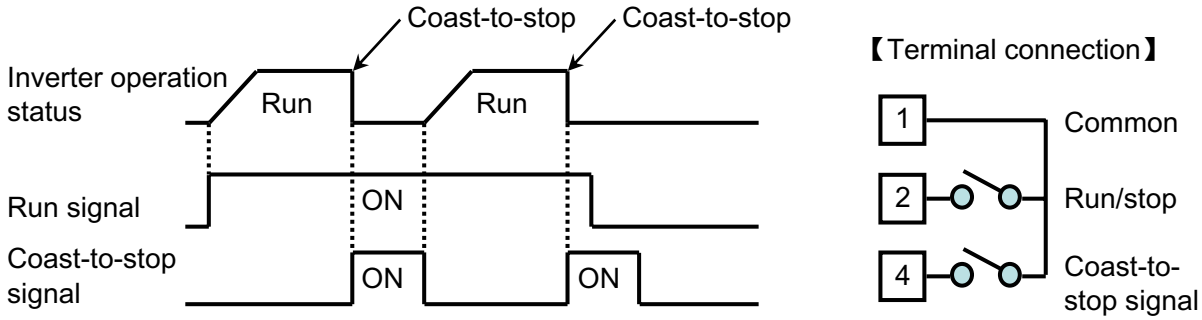
- After signal input is turned ON, setting parameters with the operation panel and communication is disabled.
- When the signal input is in ON state, function parameters and built-in memory parameters settings are all disabled. Only monitor can be applied.
- In the process of data setting, SW cannot change the data even if the SET button is pressed when the signal is ON.

Coast-to-stop function

Used to set the signal input terminal for applying coast-to-stop through external control.

- During operation, when the signal input is turned ON, "0.0" will be displayed and the inverter will stop output immediately.
  (NO fault indications and fault alarm output will be output.)
- When the signal input is turned OFF, the inverter will start operation immediately after run signal is turned ON.
  [Note] If signal is turned OFF, the inverter may start simultaneously. Ensure personal safety before operation.
- When signal input is turned OFF, the inverter is normally stopped after the run signal is turned OFF.

《Example:》 When SW1 (parameter P036=6) is set to coast-to-stop and run command select (parameter P003 =2),



Frequency signal changeover function

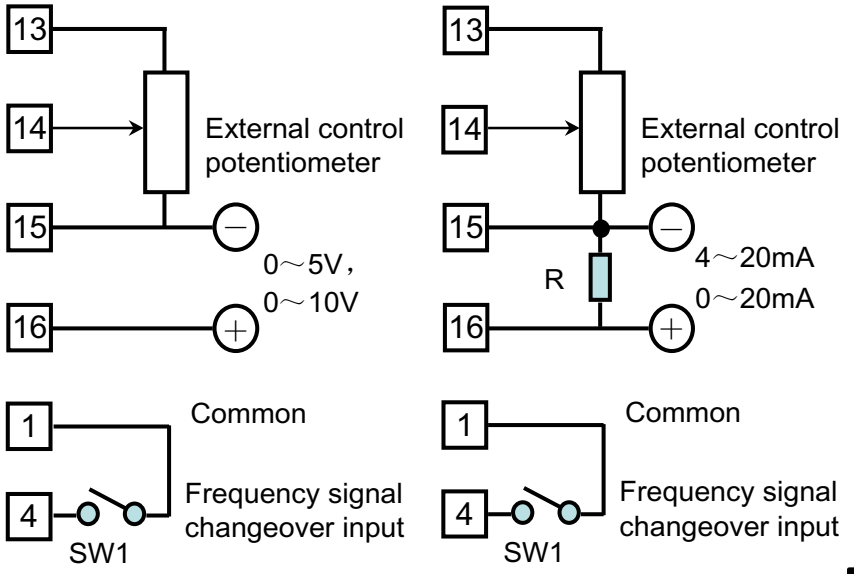
Used to set signal input terminal for switching frequency setting command from "1st frequency setting signal (command set with parameter P004) to "2nd frequency setting signal (command set with parameter P125)".

When 2nd analog input function select is 2nd frequency setting signal (parameter P124 =0), this function is valid.

(The function is invalid under PID control (parameter P124=1))

・When signal input is OFF: 1st frequency setting signal ・When signal input is ON: 2nd frequency setting signal

《Example:》When SW1 (parameter P036 =7) is set to frequency changeover,



Note 1) Always connect the resistor R (200Ω).

Note 2) Common terminals ① and ⑮ are connected internally.

Related parameters	P124～P127

2nd characteristics select function

When SW signal is ON, operate according to 2nd characteristics function parameter settings as follow.

Switch key OFF		Switch key ON
P001: 1st acceleration time	⇔	P061: 2nd acceleration time
P002: 1st deceleration time	⇔	P062: 2nd deceleration time
P009: Base frequency	⇔	P116: Base frequency 2
P007: Torque boost level	⇐	P117: Torque boost level 2
P016: Electronic thermal select	⇐	P118: Electronic thermal select 2
P017: Thermal current setting	⇐	P119: Thermal current setting 2
P010: Change point frequency 1	⇒	P120: 2nd change point frequency 1
P011: Change point voltage1	⇒	P121: 2nd change point voltage 1
P012: Change point frequency 2	⇒	P122: 2nd change point frequency 2
P013: Change point voltage 2	⇒	P123: 2nd change point voltage 2

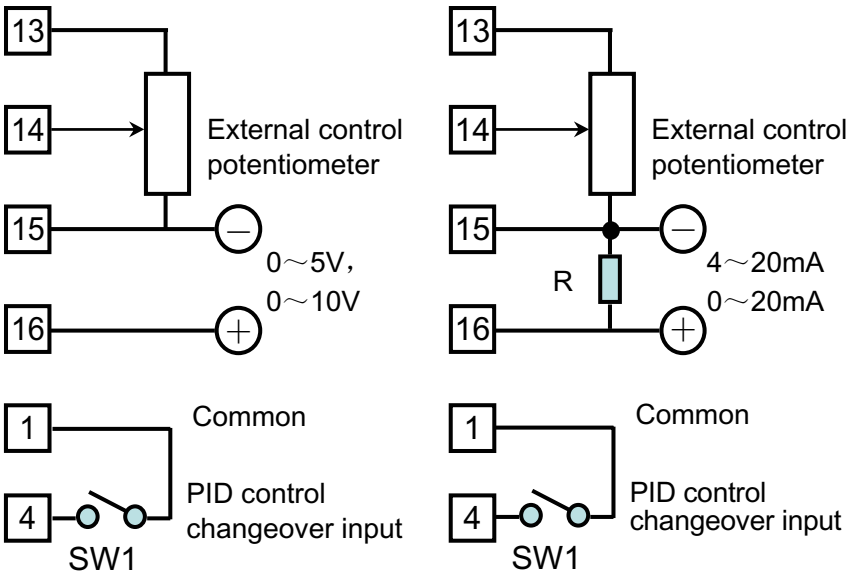
Note) Ensure personal safety before switching characteristics.

PID control changeover function

Used to set the signal input terminal for canceling PID control through external control.
When the signal input is turned ON, switching from "PID control" to the command set with parameter P004.
When 2nd analog input function select is PID control (parameter P124 =1), this function is valid.
(The function is invalid when 2nd analog input function (parameter P124) is equal to 0.)

・When the signal input is OFF: PID control ・When the signal input is ON: setting command of parameter P004

《Example:》 When SW1 (parameter P036 = 9) is set to frequency changeover,



Note 1) Always connect the resistor R (200Ω).

Note 2) Common terminals ① and ⑮ are connected internally.

Related parameters	P004, P124 P101～P104

3-wire stop command function

Used to set the signal input terminal for applying 3-wire stop command.
When "3-wire stop signal" is ON, "run signal" or "forward run and reverse run signal" is automatically held. Using OFF to delete such holding.

・Run command select is set with parameter P003.
・Input signal of 3-wire stop command is "B contact input".
(Without reference to the setting value of "P041: Input logic setting")

Related parameters	P003

Pulse counter input function

This function is set during pulse input multi speed operation (P045=5, 6). Input the pulse input signal into SW2 (terminal No.5) and count the pulse.
When "P045: Multi speed function select" is set to "5" or "6", this function is valid.
Take count of OFF→ON positive edge of pulse.

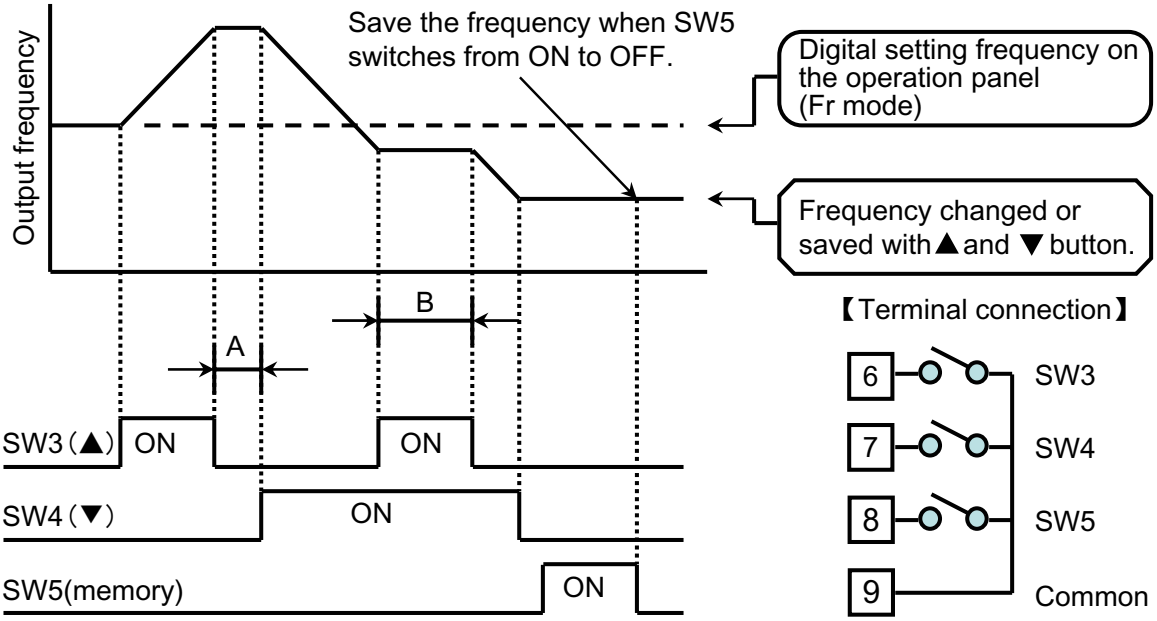
・In respect of pulse input multi speed operation, read "P045: Multi speed function select" carefully before using this function.

Related parameters	P001, P002, P045～P052 P061～P066, P079～P086

Frequency▲/▼setting function

When frequency is set to "digital setting with operation panel (P004=1)", and parameter P040 is set to "11", SW3 and SW4 can be used to change frequency and SW5 can be used to save this frequency.

- Frequency is forced to become function input terminal of "SW3: frequency increase SW", "SW4: frequency decrease SW" and "SW5: frequency memory SW" after parameter P040 is set to "11".
- SW3: During ON, frequency increases. (During OFF, existing frequency is held.)
- SW4: During ON, frequency decreases. (During OFF, existing frequency is held.)
- SW5: Turn ON once, then turn OFF to save the current frequency.
  (This frequency will be saved even if the power is turn OFF.)



Note1) Turn ▲button (SW3) and ▼button (SW4) "OFF" or "ON" simultaneously (A, B area, etc.), operation frequency will not be changed.

Note2) When "frequency memory operation of SW5" and "frequency setting in the frequency setting mode" on the operation panel are not applied, operation frequency will not be saved.

Note

- ON/OFF state of each SW can be set to A contact input or B contact input with parameter "P041: Input logic setting". When using each SW function, please take note of the setting value of parameter P041.

Related parameters	P004

P041: Input logic setting

It can be selected to detect the input signal by "A contact input" or "B contact input".

＜Setting value＞

- A contact input="0": When SW(switch) signal is closed (terminal level is "L"), ON is detected.
- B contact input="1": When SW(switch) signal is opened (terminal level is "H"), ON is detected.

＜Setting method＞

- Convert 0 to 4 bits to decimal numbers and input.
- Input the total value of the setting value × the additional value into the setting data.

［Example］ When SW1 and SW2 are B contact input, and other signals are A contact input

Setting data＝(0×16)＋(0×8)＋(0×4)＋(1×2)＋(1×1)＝3

Terminal name	Without setting	SW5	SW4	SW3	SW2	SW1
Terminal No.	-	⑧	⑦	⑥	⑤	④
bit	5-15	4	3	2	1	0
Setting value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1
Additional value	-	16	8	4	2	1

Note

- ON-OFF state of each SW changes according to the input logic setting. Completely confirm the setting value before using each terminal.
- Forward run/reverse run and run/stop are always A contact input.
- When each SW function is set to "3-wire stop command function", "B contact input" is always applied even if the input logic setting is set to "A contact input."

Related parameters P036～P040

P042：JOG frequency
P043：JOG acceleration time
P044：JOG deceleration time

Used to set operation frequency, acceleration time and deceleration time during JOG operation.

[Parameter P042: JOG frequency]

Data setting range (Hz)	0.5 to 400.0

[Parameter P043: JOG acceleration time]

Data setting range (s)	0.04・0.1 to 3600
Setting unit (s)	0.1(0.1 to 999.9)、1(1000 to 3600)

・The display code for 0.04 s. is "0000".

[Parameter P044: JOG deceleration time]

Data setting range (s)	0.04・0.1 to 3600
Setting unit (s)	0.1(0.1 to 999.9)、1(1000 to 3600)

・The display code for 0.04 s. is "0000".

Note

・Run command select should be set to external control. (Value of parameter P003 is "2 to 5".)

・ SW function select should be set to JOG function.

・When SW set to JOG function is turned ON, the JOG operation preparation state is entered.

・JOG run/stop and forward run/reverse run are applied with terminals No.2 and 3.

・Meanwhile, refer to function descriptions on page 84.

・JOG frequency under control of vector is 1Hz to 120Hz.

Related parameters	P003 P036～P040

P045：Multi speed function select

Used to set each control function when SW1~5 (control circuit terminals No.4~8) are set as multi speed function with parameters P036~P040, and SW2 (control circuit terminal No.5) is set as pulse counter input function with parameter P037.

Data setting value	Details
0	Set to multi speed frequency operation function
1	Set to 2nd, 3rd and 4th acceleration and deceleration operation function
2	Set to acceleration and deceleration link multi speed frequency operation function
3	Set to timer's multi speed frequency operation function
4	Set to timer's acceleration and deceleration link multi speed frequency operation function
5	Set to pulse input multi speed frequency operation function
6	Set to pulse input acceleration and deceleration link multi speed frequency operation function

When setting value is 0 to 2, use SW1~5(control circuit terminals No.4~8) after they are set to " multi speed function" (setting value "0") with parameter P036~P040.

When setting value is 3 to 4, SW1~5(control circuit terminals No.4~8) are invalid even if they are set to "multi speed function" with parameter P036~P040.

When setting value is 5 to 6, use SW2 (control circuit terminal No.5) after it is set to "pulse counter input function" (setting value "11") with parameter P037.

Multi speed frequency operation function (setting value "0")

2nd, 3rd and 4th acceleration and deceleration operation function (setting value"1")

Acceleration and deceleration link multi speed frequency operation function (setting value "2")

[Setting value "1": Multi speed frequency operation function]

Multi speed frequency operation of SW can reach 16 speed at most. Acceleration and deceleration time is fixed to 1st acceleration and deceleration time. (parameters P001 and P002).

When all setting values of SW function of SW1~5 are "0" (multi speed SW input function), four SW in order with smaller SW No. are valid as multi speed command SW.

2nd ~16th speed frequency is set with parameter P046~P060.

[Setting value "2" : 2nd , 3rd and 4th acceleration and deceleration operation function]

Frequency is fixed to 1st speed frequency. SW can be used to change at most four acceleration and deceleration time for operating the inverter.

2nd ~4th acceleration and deceleration time are set with parameters P061~P066.

[Setting value "3": Acceleration and deceleration link multi speed frequency operation function]

Using 4 SW to link at most 16 speed and 4 acceleration and deceleration time for applying multi speed frequency operation.

SW1 (Note1)	SW2 (Note1)	SW3 (Note1)	SW4 (Note1)	Multi speed frequency operation function		2nd, 3rd and 4th acceleration and deceleration operation function		Acceleration and deceleration link multi speed frequency operation function	
				P045=0		P045=1		P045=2	
				Frequency	Acceleration and deceleration time	Frequency	Acceleration and deceleration time	Frequency	Acceleration and deceleration time
OFF	OFF	OFF	OFF	1st speed	1st acceleration and deceleration	1st speed	1st acceleration and deceleration	1st speed	1st acceleration and deceleration
ON	OFF	OFF	OFF	2nd speed			2nd acceleration and deceleration	2nd speed	2nd acceleration and deceleration
OFF	ON	OFF	OFF	3rd speed			3rd acceleration and deceleration	3rd speed	3rd acceleration and deceleration
ON	ON	OFF	OFF	4th speed			4th acceleration and deceleration	4th speed	4th acceleration and deceleration
OFF	OFF	ON	OFF	5th speed			1st acceleration and deceleration	5th speed	1st acceleration and deceleration
ON	OFF	ON	OFF	6th speed				6th speed	
OFF	ON	ON	OFF	7th speed				7th speed	
ON	ON	ON	OFF	8th speed				8th speed	
OFF	OFF	OFF	ON	9th speed				9th speed	
ON	OFF	OFF	ON	10th speed				10th speed	
OFF	ON	OFF	ON	11th speed				11th speed	
ON	ON	OFF	ON	12th speed				12th speed	
OFF	OFF	ON	ON	13th speed				13th speed	
ON	OFF	ON	ON	14th speed				14th speed	
OFF	ON	ON	ON	15th speed				15th speed	
ON	ON	ON	ON	16th speed				16th speed	

(Note 1) Any four SW function among 1~5 are set to "0" (multi speed SW input function), 4 SW in order are valid as multi speed command SW from the smaller SW No.

＜Example＞ When SW1, SW2, SW4 and SW5 are set to multi speed SW input function, the position of SW3 in the above table will change to SW4 and the position of SW4 will change to SW5.

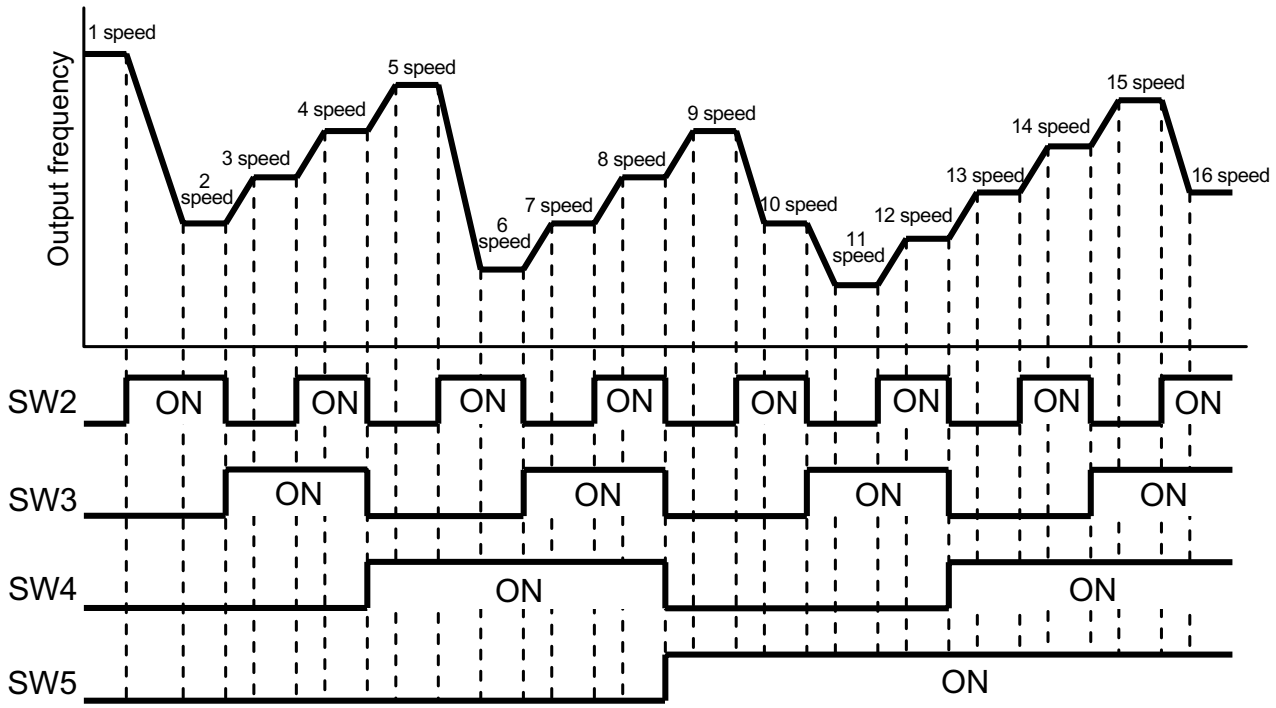
[Setting value "1": example for multi speed frequency operation function]

The 16 frequency can be selected, switched and controlled with the four button signals SW2~5. (1st speed: setting signal of P004, 2nd ~16th speed: setting frequency of P046~P060)

・Any four buttons among SW1~5 are set to multi speed function buttons. (Value of P036~P040 is set to "0".)

・In this function, using one button to input 2 speed, two buttons to input 4 speed and three buttons to input 8 speed.
・When 2nd ~16th speed frequency (P046~P060) is set to "0000" and this multi speed frequency is selected, the inverter stops (0V stop).

＜When SW2~5 are to multi speed SW input function＞



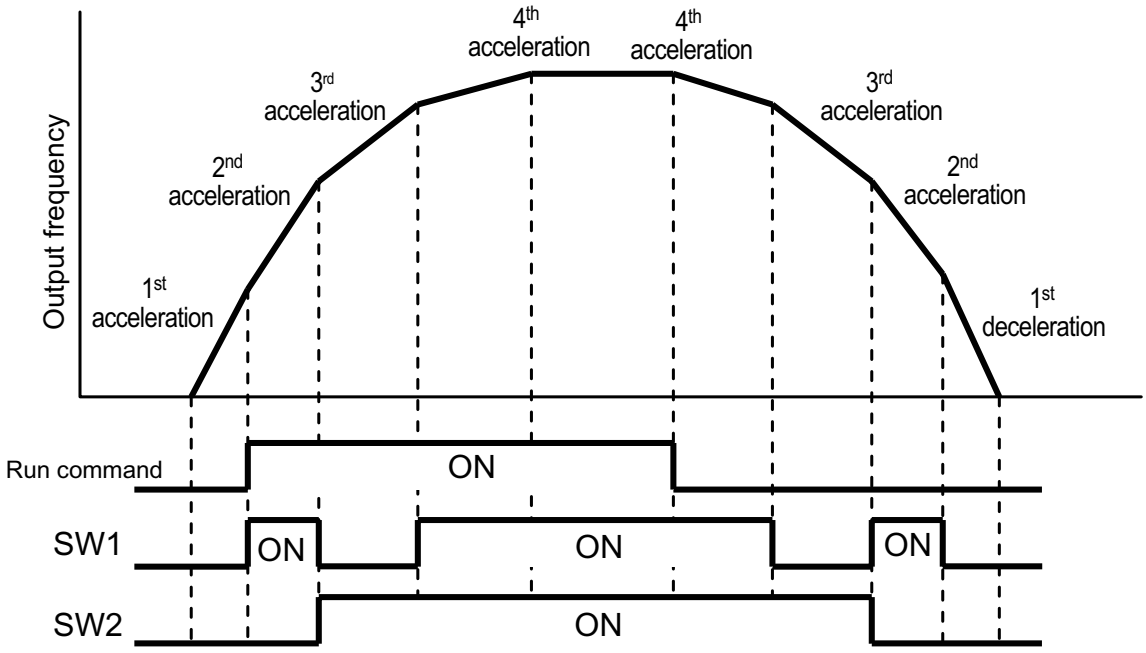
[Setting value "2": example for 2nd, 3rd and 4th acceleration and deceleration operation function]

The 4 acceleration and deceleration time can be selected, switched and controlled with the two SW button signals.

(1st acceleration and deceleration time :P001 and P002, 2nd ~4th acceleration and deceleration time : P061~P066)

・Any two buttons among SW1~5 are set to multi speed function buttons. (Value of P036~P040 is set to "0".)

＜When SW1 and SW 2 are set to multi speed SW input function＞

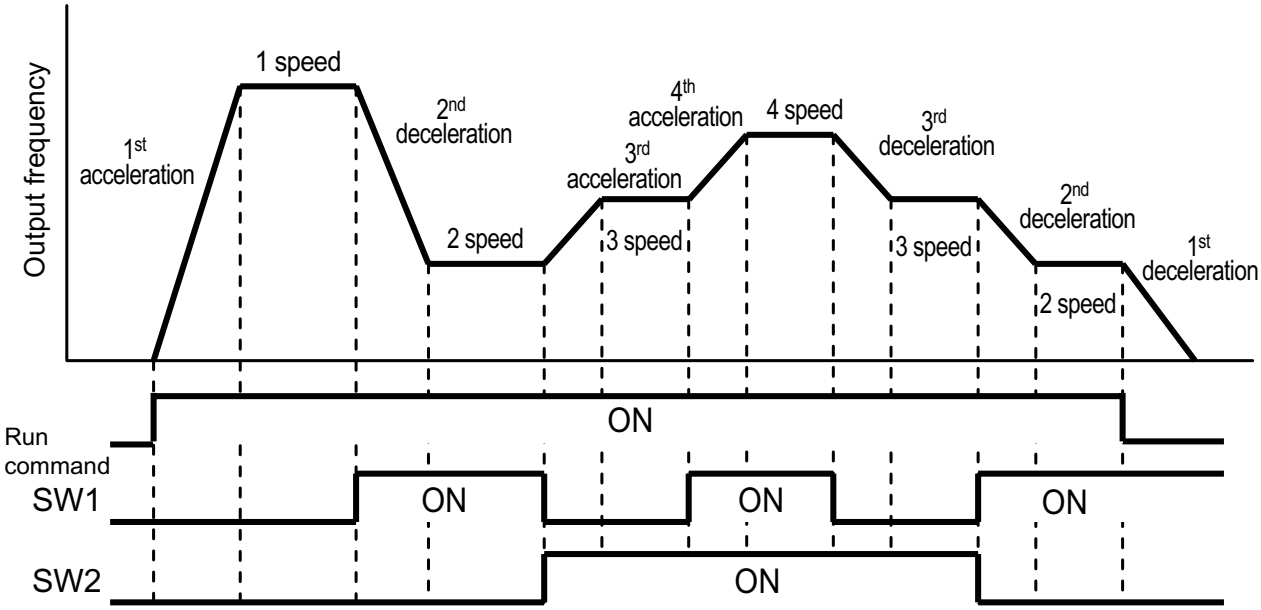


[Setting value "3": Example for acceleration and deceleration link multi speed frequency operation function]

Using two SW button signals among 2nd, 3rd and 4th speed to link 2nd, 3rd and 4th acceleration and deceleration.

・Any two buttons among SW1~5 are set to multi speed function buttons.(Value of P036~P040 is set to "0".)

＜When SW1 and Sw2 are set to multi speed SW input function,＞



Note

・1st speed is command value of frequency setting signal set with parameter P004.

・1st acceleration time is the acceleration time set with parameter P001.
1st deceleration time is the deceleration time set with parameter P002.

・2nd ~16th speed frequency are the frequency set with parameters P046~P060.
2nd ~4th acceleration and deceleration time are set with parameters P061~P066.

Related parameters	P036～P041 P046～P066

Timer's multi speed frequency operation (setting value "3")
Timer's acceleration and deceleration link multi speed frequency operation function (setting value "4")

[Setting value "3": timer's multi speed frequency operation]

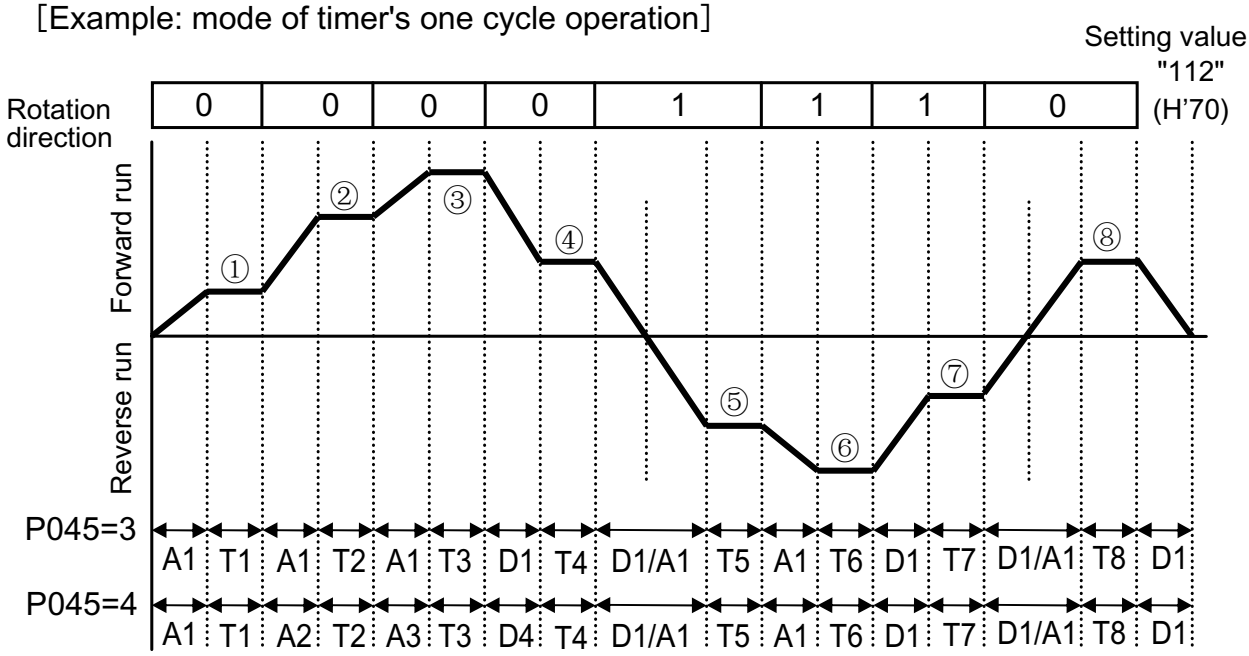
During timer's multi speed operation, acceleration and deceleration time can be fixed to 8 speed at most. Input run command, and then speed will automatically switch to the next speed after the inverter operates within set time.
In the state that SW1~5 are set to "multi speed SW input function" in timer's multi speed, even if signals are input during timer's multi speed operation, these signals are invalid and timer's multi speed operation will continue.
Rotation direction can be set with parameter "P067: Rotation direction of timer's operation". Continuous times of timer's one cycle operation can be set with parameter "P068: Continuous times of timer's operation". Operation mode and wait time for the timer operating from the end of one cycle to the next cycle can be set with parameters "P069: Continuous mode of timer's operation" and "P070: Continuous wait time of timer's operation". Each runtime for 1st speed to 8th speed can be set with parameters "P071 ~P078: 1st speed ~8th speed runtime".

[Setting value "4": timer's acceleration and deceleration link multi speed frequency operation function]

At most 8 speed and 4 acceleration and deceleration time can be linked for applying timer's multi speed operation.

Timer's multi speed frequency operation function				Timer's acceleration and deceleration link multi speed frequency operation function			
P045=3				P045=4			
Rotation direction (selected position)	Frequency	Runtime	Acceleration and deceleration time	Rotation direction (selected position)	Frequency	Runtime	Acceleration and deceleration time
Forward run /reverse run 0 / 1	1st speed ①	1st speed runtime T1	1st acceleration time A1 1st deceleration time D1	Forward run /reverse run 0 / 1	1st speed ①	1st speed runtime T1	1st acceleration and deceleration time A1/D1
Forward run /reverse run 0 / 1	2nd speed ②	2nd speed runtime T2		Forward run /reverse run 0 / 1	2nd speed ②	2nd speed runtime T2	2nd acceleration and deceleration time A2/D2
Forward run /reverse run 0 / 1	3rd speed ③	3rd speed runtime T3		Forward run /reverse run 0 / 1	3rd speed ③	3rd speed runtime T3	3rd acceleration and deceleration time A3/D3
Forward run /reverse run 0 / 1	4th speed ④	4th speed runtime T4		Forward run /reverse run 0 / 1	4th speed ④	4th speed runtime T4	4th acceleration and deceleration time A4/D4
Forward run /reverse run 0 / 1	5th speed ⑤	5th speed runtime T5		Forward run /reverse run 0 / 1	5th speed ⑤	5th speed runtime T5	1st acceleration and deceleration time A1/D1
Forward run /reverse run 0 / 1	6th speed ⑥	6th speed runtime T6		Forward run /reverse run 0 / 1	6th speed ⑥	6th speed runtime T6	
Forward run /reverse run 0 / 1	7th speed ⑦	7th speed runtime T7		Forward run /reverse run 0 / 1	7th speed ⑦	7th speed runtime T7	
Forward run /reverse run 0 / 1	8th speed ⑧	8th speed runtime T8		Forward run /reverse run 0 / 1	8th speed ⑧	8th speed runtime T8	

[Example: mode of timer's one cycle operation]



* Setting value of "P069: Continuous mode of timer's operation" is "0".
Setting value of "P067: Rotation direction of timer's operation" is "112".

After the timer runs one cycle for times set with parameter "P068: Continuous times of timer's operation" , "tEnd" will be displayed. Input stop command when "tEnd" is being displayed, "0000" will be returned to (operation state mode).

"P068: Continuous times of timer's operation"
Setting times
End of timer's operation

Panel: STOP SW
External control: stop command (terminal No.2 is turned OFF)
Communication: stop command

Note

- During timer's operation, forward run/reverse run command of the operation panel, external control and communication is invalid.
- During timer's operation, if stop command is input, the operation will be stopped immediately even in cycle operation.

Related parameters	P001, P002, P036～P041 P046～P052, P061～P078

Pulse input multi speed frequency operation (setting value "5") Pulse input acceleration and deceleration link multi speed frequency operation function (setting value "6")

[Setting value "5": pulse input multi speed frequency operation]

Input pulse into SW2, and the acceleration and deceleration time can be fixed to 8 speed at most for applying pulse input multi speed operation. Input run command and the set pulse, speed will automatically switch to the next one.

"P037: SW2 function select" is set to "11". Detect the times of OFF→ON positive edge. Rotation direction can be set with parameter "P067: Rotation direction of timer's operation". Continuous times of timer's one cycle operation can be set with parameter "P068: Continuous times of timer's operation". Operation mode and wait time for the timer operating from the end of one cycle to the next cycle can be set with parameters "P069: Continuous mode of timer's operation" and "P070: Continuous wait time of timer's operation". Each pulse input times of 1st speed to 8th speed can be set with parameters "P079 ~P086: 1st ~8th speed pulse input times".

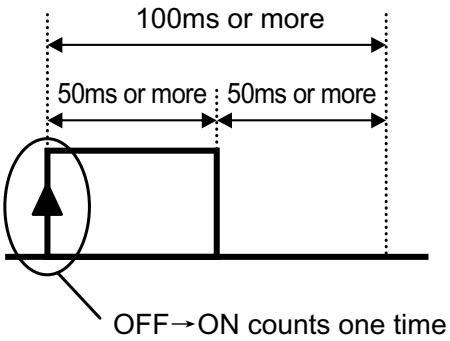
[Setting value "6": pulse input acceleration and deceleration link multi speed frequency operation function]

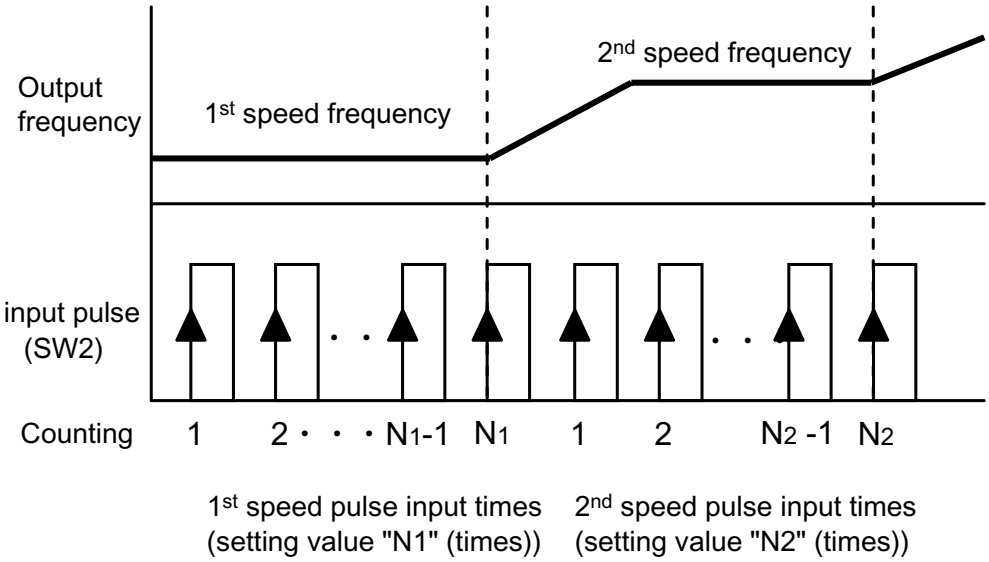
Input pulse into SW2 and at most 8 speed and 4 acceleration and deceleration time of pulse input multi speed operation can be applied. "P037: SW2 function select:" is set to "11". Detect the times of OFF→ON positive edge.

＜About pulse input into SW2＞

Input the following pulses into SW2

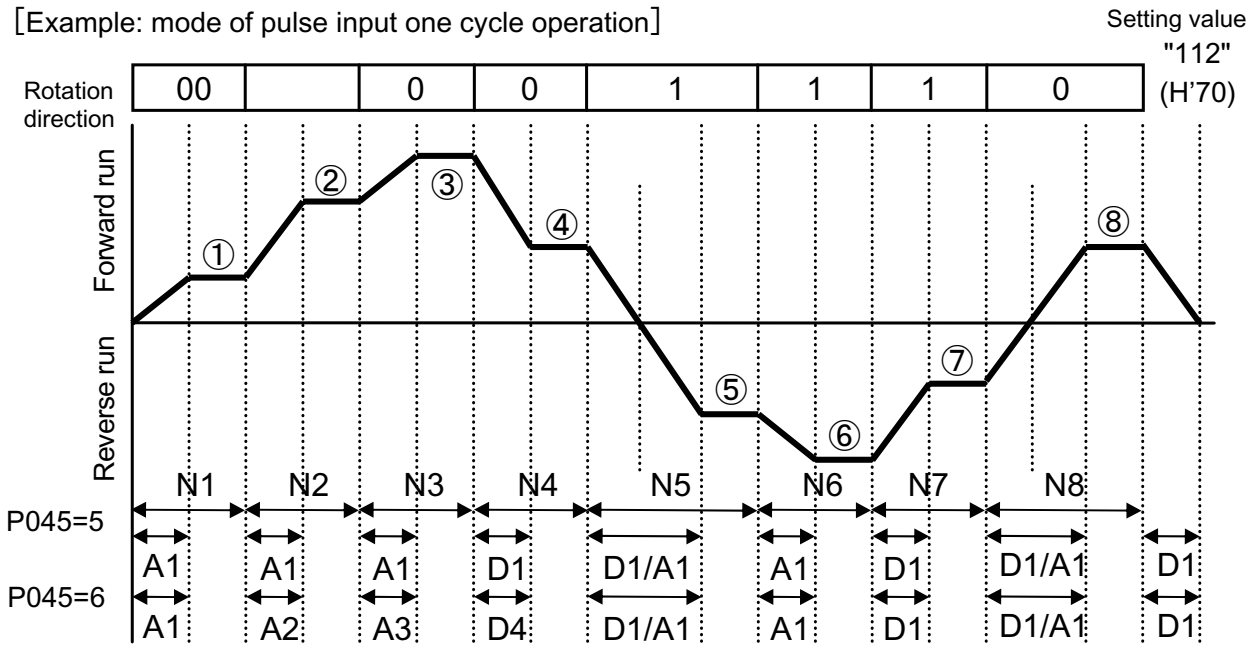
- Min. cycle: 100msec
- Min. ON width: 50msec
- Min. OFF width: 50msec。





Pulse input multi speed frequency operation function				Pulse input acceleration and deceleration link multi speed frequency operation function			
P045=5				P045=6			
Rotation direction (selected position)	Frequency	Runtime	Acceleration and deceleration time	Rotation direction (selected position)	Frequency	Runtime	Acceleration and deceleration time
Forward run/ reverse run 0 / 1	1st speed ①	1st speed pulse input times N1	1st acceleration time A1 1st deceleration time D1	Forward run/ reverse run 0 / 1	1st speed ①	1st speed pulse input times N1	1st acceleration and deceleration time A1/D1
Forward run/ reverse run 0 / 1	2nd speed ②	2nd speed pulse input times N2		Forward run/ reverse run 0 / 1	2nd speed ②	2nd speed pulse input times N2	2nd acceleration and deceleration time A2/D2
Forward run/ reverse run 0 / 1	3rd speed ③	3rd speed pulse input times N3		Forward run/ reverse run 0 / 1	3rd speed ③	3rd speed pulse input times N3	3rd acceleration and deceleration time A3/D3
Forward run/ reverse run 0 / 1	4th speed ④	4th speed pulse input times N4		Forward run/ reverse run 0 / 1	4th speed ④	4th speed pulse input times N4	4th acceleration and deceleration time A4/D4
Forward run/ reverse run 0 / 1	5th speed ⑤	5th speed pulse input times N5		Forward run/ reverse run 0 / 1	5th speed ⑤	5th speed pulse input times N5	1st acceleration and deceleration time A1/D1
Forward run/ reverse run 0 / 1	6th speed ⑥	6th speed pulse input times N6		Forward run/ reverse run 0 / 1	6th speed ⑥	6th speed pulse input times N6	
Forward run/ reverse run 0 / 1	7th speed ⑦	7th speed pulse input times N7		Forward run/ reverse run 0 / 1	7th speed ⑦	7th speed pulse input times N7	
Forward run/ reverse run 0 / 1	8h speed ⑧	8th speed pulse input times N8		Forward run/ reverse run 0 / 1	8h speed ⑧	8th speed pulse input times N8	

[Example: mode of pulse input one cycle operation]



* Setting value of "P069: Continuous mode of timer's operation" is "0".
Setting value of "P067: Rotation direction of timer's operation" is "112".

After the timer operates one cycle for times set with parameter "P068: Continuous times of timer's operation" , "tEnd" will be displayed. Input stop command when "tEnd" is being displayed, "0000" will be returned to (operation state mode).

Times set with "P068: Continuous times of timer's operation"
End of timer's operation

Panel: STOP SW
External control: stop command (terminal No.2 is turned OFF)
Communication: stop command

Note

- During pulse input operation, forward run/reverse run command of the operation panel, external control and communication is invalid.
- During pulse input operation, if stop command is input, the operation will be stopped immediately even in one cycle operation.

Related parameters	P001, P002, P036～P041 P046～P052, P061～P070 P079～P086

P046: 2nd speed frequency	P051: 7th speed frequency	P056: 12th speed frequency
P047: 3rd speed frequency	P052: 8th speed frequency	P057: 13th speed frequency
P048: 4th speed frequency	P053: 9th speed frequency	P058: 14th speed frequency
P049: 5th speed frequency	P054: 10th speed frequency	P059: 15th speed frequency
P050: 6th speed frequency	P055: 11th speed frequency	P060: 16th speed frequency

2nd ~16th speed frequency can be set for applying multi speed operation.

Data setting range (Hz)	0000・0.5 to 400.0

- "0000" indicates 0V stop.
- Under control of vector, frequency is1Hz~120Hz.

Related parameters	P036～P041, P045 P061～P086

P061: 2nd acceleration time P063: 3rd acceleration time P065: 4th acceleration time
P062: 2nd deceleration time P064: 3rd deceleration time P066: 4th deceleration time

Used to set 2nd~4th acceleration time and 2nd~4th deceleration time for applying 4 step acceleration and deceleration control operation. 2nd~4th acceleration and deceleration time is that from 0.5Hz to max. output frequency.

Data setting range (s)	0.1 to 3600
Setting unit (s)	0.1（0.1 to 999.9）、1（1000 to 3600）

Related parameters	P036～P041, P045～P048 P067～P086

P067: Rotation direction of timer's operation

In "P045: Multi speed function select", if setting value is 3~6, set the rotation direction at each speed from 1st to 8th speed.

Forward run is "0" and reverse run is "1". Using 1~8 speed as bit to determine 0 (forward run) or 1 (reverse run). The sum of 0 or 1 multiplied by 8 bits of additional value responding to each bit is setting value.

(Refer to details in the table as follow. The total value of setting value × additional value of each speed is setting value.)

[Setting example] 1st speed = forward run , 2nd speed = forward run , 3rd speed = forward run
4th speed = forward run , 5th speed = reverse run , 6th speed = reverse run
7th speed = reverse run , 8th speed = forward run

Speed	1st speed	2nd speed	3rd speed	4th speed	5th speed	6th speed	7th speed	8th speed
Rotation direction	Forward run	Forward run	Forward run	Forward run	Reverse run	Reverse run	Reverse run	Forward run
Setting value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Additional value	1	2	4	8	16	32	64	128

$$(0\times1)+(0\times2)+(0\times4)+(0\times8)+(1\times16)+(1\times32)+(1\times64)+(0\times128)=112$$

Set 112 in setting value.

Note

- This function is valid only when setting value is 3~6 in "P045: Multi speed function select".
- Note that rotation direction changes according to settings.

Related parameters	P001, P002, P045～P052 P061～P066

P068：Continuous times of timer's operation

In "P045: Multi speed function select", if the setting value is 3~6, using 1st to 8th speed operation as "timer's operation cycle" to set continuous times of one cycle.

Data setting range (times)	0000・1 to 9999

* "0000" is setting without limit on times. Keep on operating after run command is input till stop command is input.

Note

・This function is valid only when setting value is 3~6 in "P045: Multi speed function select".

Related parameters	P045 P068～P070

P069：Continuous mode of timer's operation
P070：Continuous wait time of timer's operation

In "P045: Multi speed function select", if setting value is 3~6, used to set operation method and continuous operation wait time when the timer runs one cycle and enters the 2nd cycle.

When continuous mode of timer's operation is set to "1", continuous wait time of timer's operation is invalid.

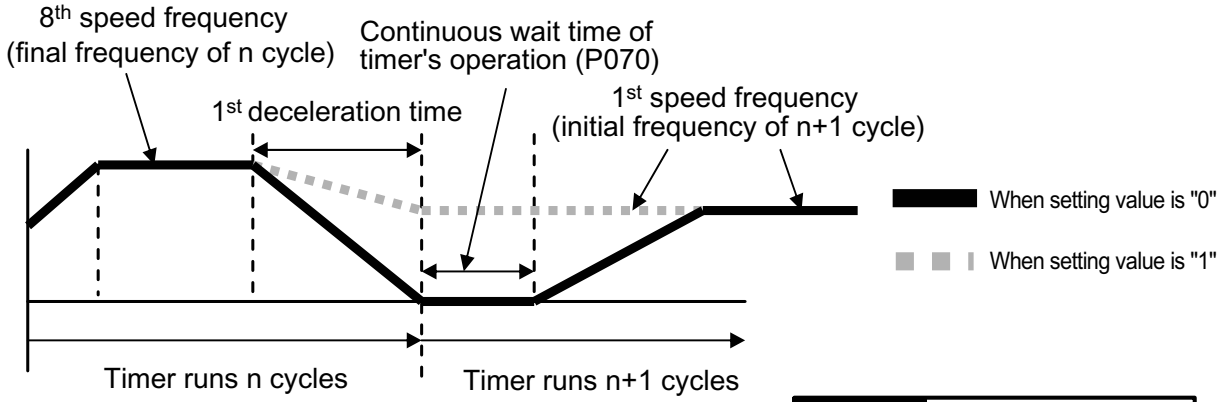
[Parameter P069: Continuous mode of timer's operation]

Data setting value	Details
0	Once one cycle operation ends, returns to the 0V stop state from 1st deceleration time and enters the next cycle.
1	Once one cycle operation ends, changes to 1st speed frequency in the next cycle from 1st deceleration time.

[Parameter P070: Continuous wait time of timer's operation]

Data setting range (s)	0000・0.1 to 6553
Setting unit (s)	0.1(0.1 to 999.9)、1(1000 to 6553)

* "0000" is setting without wait time.



Related parameters	P002, P045～P052 P061～P068

P071：1st speed runtime P075：5th speed runtime
P072：2nd speed runtime P076：6th speed runtime
P073：3rd speed runtime P077：7th speed runtime
P074：4th speed runtime P078：8th speed runtime

In "P045: Multi speed function select", if setting value is 3 or 4, used to set 1st to 8th speed frequency runtime.

Data setting range (s)	0000・0.1 to 6553
Setting unit (s)	0.1(0.1 to 999.9)、1(1000 to 3600)

* "0000" is set to operate at the speed other than this speed.

Note

- Each function is valid only when setting value is 3 or 4 in "P45: Multi speed function select".
- When set to "0000", the inverter will not operate at the set speed. Timer's multi speed operation will be applied only at speed whose time is set with P071~P072.

Related parameters	P045～P052 P061～P070

P079：1st pulse input times P083：5th pulse input times
P080：2nd pulse input times P084：6th pulse input times
P081：3rd pulse input times P085：7th pulse input times
P082：4th pulse input times P086：8th pulse input times

In "P045: multi speed function select", if setting value is 5 or 6, used to set pulse input times of 1st to 8th speed frequency.

Data setting range (s)	0000・0.1 to 65530
Setting unit (s)	Indication "0.1" = "one time" (Indication: 0.1 to 999.9) Indication "1" = "ten times" (Indication: 1000 to 6553)

* "0000" is set to operate at the speed other than this speed.

Note

- Each function is valid only when setting value is 5 or 6 in "P45: Multi speed function select".
- When set to "0000", the inverter will not operate at the set speed. Pulse input multi speed operation will be applied only at speed whose time is set with P079~P086.

Related parameters	P045～P052 P061～P070

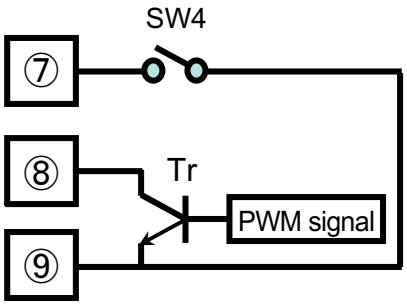
P087： PWM frequency signal select

Using PWM signal from PLC etc. to control operation frequency.
(But allowable PWM signal cycle is within 0.9ms~1100ms)

Data setting value	Details
0	With PWM frequency signal select
1	Without PWM frequency signal select

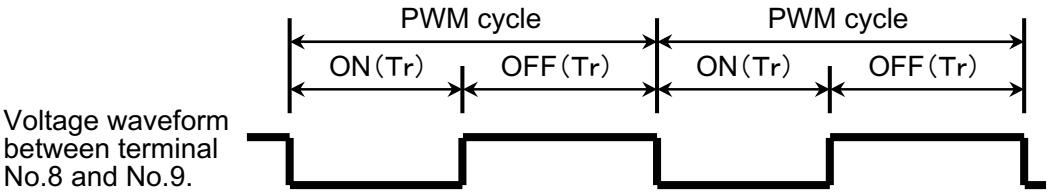
＊When selecting PWM frequency signal, function of SW4 (terminal No.7) and SW5 (terminal No.8) are forced to be used by PWM control exclusively.

[Connection and function descriptions of control circuit terminals]



- Terminal No.7: frequency signal changeover input terminal
  ON: signal set with parameter P004
  OFF: PWM frequency signal
- Terminal No.8: PWM frequency signal input terminal
  Input open-collector signal that meets the specifications below.
  Max. rated voltage: 50V DC
  Current: 50mA or more

[Relationship between PWM signal and frequency command]



$$\text{Frequency command value (Hz)} = \frac{\text{ON time}}{\text{PWM cycle}} \times \text{Max. output frequency (Hz)}$$

- When parameter P005 is set to "50", the max. output frequency is "50Hz". When set to "60", the max. output frequency is "60Hz". When set to "FF" or "3C", the max. output frequency is "value of parameter P008".

Note

- Allowable PWM signal cycle is within 0.9ms~1100ms.
- When P087=1, setting value of "P039: SW4 function select" and "P040: SW5 function select" are invalid.

Related parameters	P005, P008 P088, P089

P088：PWM signal average time

The inverter measures and calculates the ON time and OFF time of each PWM cycle as frequency command.
When using this parameter for setting, the times of each above-mentioned PWM cycle command should be averaged, and then the average operation times are set as final output frequency.

Data setting range (times)	1 to 100

* If average times are increased, frequency command will be stable, but response speed will decrease.

Related parameters	P087, P089

P089：PWM signal cycle

Input PWM signal cycle into this parameter.
Data is set within ±12.5% of the input PWM signal cycle.

Data setting range (msec)	1 to 2000

Note

- PWM signal of output frequency is "0V stop or min. frequency in the state that no ON is available" and "max. frequency in the state that no OFF is available".
- Nearby min. frequency and max. frequency, accuracy rating of output frequency related to input signal will decrease. Don't use it for the purpose of precise frequency control.
- When 2nd frequency setting signal (ON) is selected, 2nd frequency setting signal take precedence over PWM frequency signal.
- When PWM frequency signal is selected, PID control function is invalid.
  PWM frequency signal cannot be used as PID setting value (SP).

Related parameters	P087, P088

P090：Output TR1 function select
P091：Output TR2 function select

Used to set functions of open-collector output 1 (control terminals No.10-12) and open-collector output 2 (control terminals No.11-12).

	TR1 P090	TR2 P091	Function	Conditions for open-collector output to turn ON
Setting data	0	0	Run signal	ON when run signal is ON or during inverter output
	1	1	Reverse run signal	ON when the inverter is running in reverse
	2	2	Arrival signal	ON when the output frequency is within the setting frequency±2Hz
	3	3	Overload alarm	ON when the output current is 140% of the rated current or higher or when the electronic thermal level is reached.
	4	4	Frequency detect	ON when output frequency is higher than detect frequency (parameter P093 setting)
	5	5	Current detect (1)	ON when output current is higher than detect current level (parameter P095 setting)
	6	6	Current detect (2)	ON when output current is lower than detect current level (parameter P095 setting)
	7	7	Fault alarm (1)	ON when the inverter is in the fault trip state
	8	8	Fault alarm (2)	ON when the inverter is in the normal state (OFF when the inverter is in the fault trip state)
	9	9	End of timer's one cycle operation	ON when timer operates one cycle (only output during wait time)
	10	10	End of timer's operation	ON when timer's operation ends (when "tEnd" is displayed)
	11	-	Output state signal	Usually output PWM signal that is in direct proportion to output frequency or output current

Note

- Retardation time of current detect signal set to "5" and "6" can be set with "P096: Retardation time of current detect".
- Setting data "10" is used to output the time set with "P070: Continuous wait time of timer's operation".
- Output frequency ratio or output current ratio of setting data "11" is set with parameter P097.
- Setting data "11" can only be used to set open-collector output 1 (TR1).

Related parameters	P070, P093 P095～P097

P092：Output RY function select

Used to set the functions of the relay output (control terminals A, B and C).

- Energize in ON-state: The relay is turned ON when the coil is excited.
  (The signal ON-state= Across terminals A-C: ON, across terminals B-C: OFF)
- Non energize in ON-state: The relay is turned ON when the coil is not excited.
  (The signal ON-state= Across terminals A-C: OFF, across terminals B-C: ON)

Setting data		Function	Conditions for relay to turn ON
Energize in on-state	Non energize in on-state		
0	r0	Run signal	ON when run signal is ON or during inverter output
1	r1	Reverse run signal	ON when the inverter is running in reverse
2	r2	Arrival signal	ON when the output frequency is within the setting frequency ±2Hz
3	r3	Overload alarm	ON when the output current is 140% of the rated current or higher or when the electronic thermal level is reached.
4	r4	Frequency detect	ON when output frequency is higher than detect frequency (parameter P094 setting)
5	r5	Current detect (1)	ON when output current is higher than detect current level (parameter P095 setting)
6	r6	Current detect (2)	ON when output current is lower than detect current level (parameter P095 setting)
7	r7	Fault alarm (1)	ON when the inverter is in the fault trip state
8	r8	Fault alarm (2)	ON when the inverter is in the normal state (OFF when the inverter is in the fault trip state)
9	r9	End of timer's one cycle operation	ON when timer operates one cycle (only output during wait time)
10	r10	End of timer's operation	ON when timer's operation ends (when "tEnd" is displayed)

Note

- Retardation time of current detect signal set to "5" and "6" can be set with "P096: Retardation time of current detect".
- Setting data "10" is used to output the time set with "P070: Continuous wait time of timer's operation".

Related parameters	P070 P094～P096

P093：Detect frequency [output TR]
P094：Detect frequency [output RY]

Using open-collector output 1, 2 and relay output to set the detected frequency when frequency detect signal is output.

[Parameter P093: Detect frequency (output TR)]

Data setting range (Hz)	0000・0.5 to 400.0

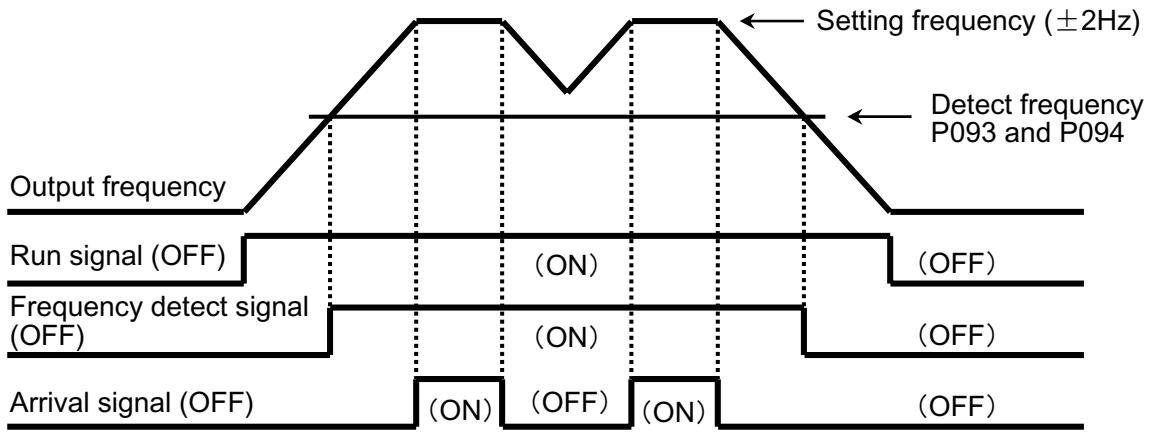
- The frequency is valid in open-collector output 1 and 2.
- "0000" is 0V stop (0.0).

[Parameter P094: Detect frequency (output RY)]

Data setting range (Hz)	0000・0.5 to 400.0

- "0000" is 0V stop (0.0).

[Relationship between output frequency and each output signal]



Related parameters	P090～P092

P095：Level of current detect
P096：Retardation time of current detect

Using open-collector output 1, 2 and relay output to set current detect level and retardation time when current detect signal is output.

[Parameter P095: Level of current detect]

Data setting range (A)	0.1 to 100.0

[Parameter P095: Retardation time of current detect]

Data setting range (s)	0.1 to 10.0

- Retardation time of current detect signal is used to set retardation time of signal from OFF to ON.
  Retardation time of signal from OFF to ON is about 100ms (fixed).

Related parameters	P090～P092

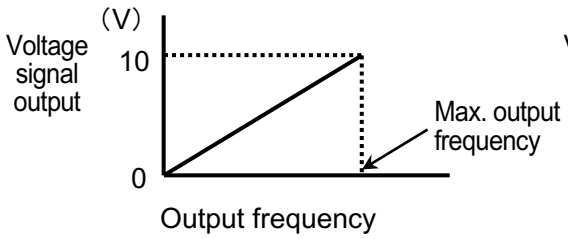
P097：Analog and PWM output function select

Used to set function of "0~10V voltage signal" output with control circuit terminal No.17 and "output state signal (PWM)" output with terminals No.10-12.

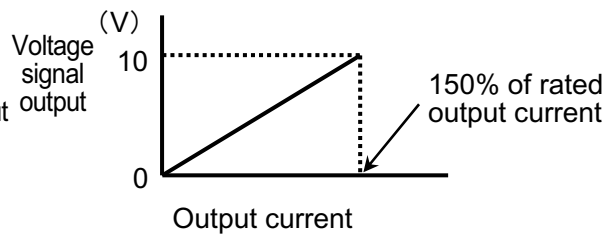
Data setting value	Details
0	Output signals in proportion to output frequency
1	Output signals in proportion to output current

[Relationship between 0~10V voltage signal and output frequency and output current]

＜In proportion to output frequency ＞

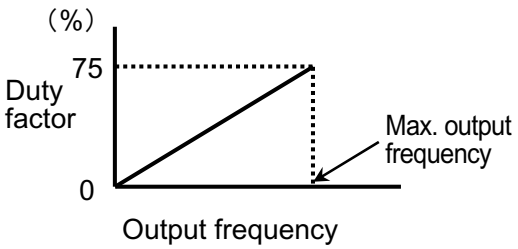


＜n proportion to output current＞

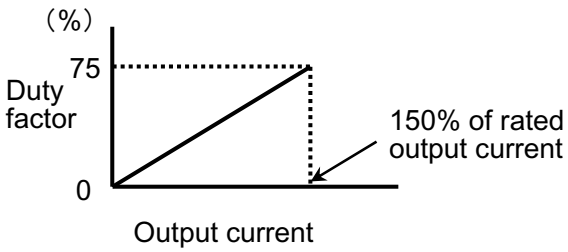


[Relationship between output signal and output frequency and output current]

＜In proportion to output frequency＞



＜In proportion to output current＞



- Cycle of PWM output signal is "1ms".

[Precautions on 0~10V voltage output and output state signal (PWM)]

- The indications of the output signal are not the accurate indications for measuring. Use those indications to get rough values.
  (If you need the accurate values, use a separate measuring instrument.)
- Note that the signal in proportion to output current may output large signal value under 40% of rated current.
  (For example, signal level will be output to a certain extent even if no output current is available. But if the inverter is in the stopping state, "0 level" is output.

Note

- For the purpose of acquiring "PWM output" with terminals No.10-12, parameter P090 (output TR1 function select) is required to be set to "11".

Related parameters	P090, P098

P098：Analog and PWM output voltage compensation

Used to compensate the output of "0~10V voltage signal" and "output state signal (PWM)".

Data setting range (%)	25 to 100 (1% unit)

[Adjustment range (full scale value)]

- Analog output voltage signal: 3.75~10(V)
- PWM signal: 56.3~75(%)

Related parameters	P090, P097

P099：Lower frequency clamp
P100：Upper frequency clamp

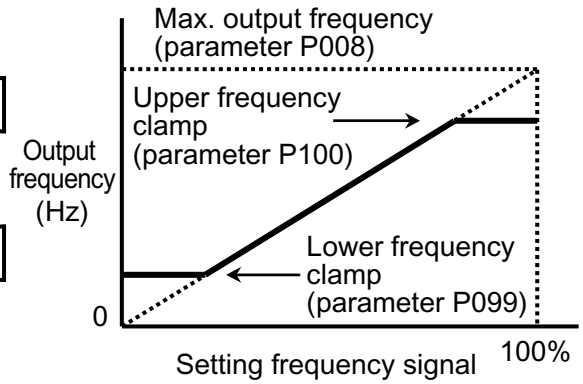
Used to set the upper and lower limits of the output frequency.

[Parameter P099: Lower frequency clamp]

Data setting range (Hz)	0.5 to 400.0

[Parameter P100: Upper frequency clamp]

Data setting range (Hz)	0.5 to 400.0



Note

- If the upper frequency clamp is lower than the maximum output frequency (parameter P008), the upper frequency clamp will have the priority.
- If the lower frequency clamp is higher than the upper frequency clamp (reverse run setting), the upper frequency clamp will have the priority.

Related parameters	P005, P008

P101：OV stop function select

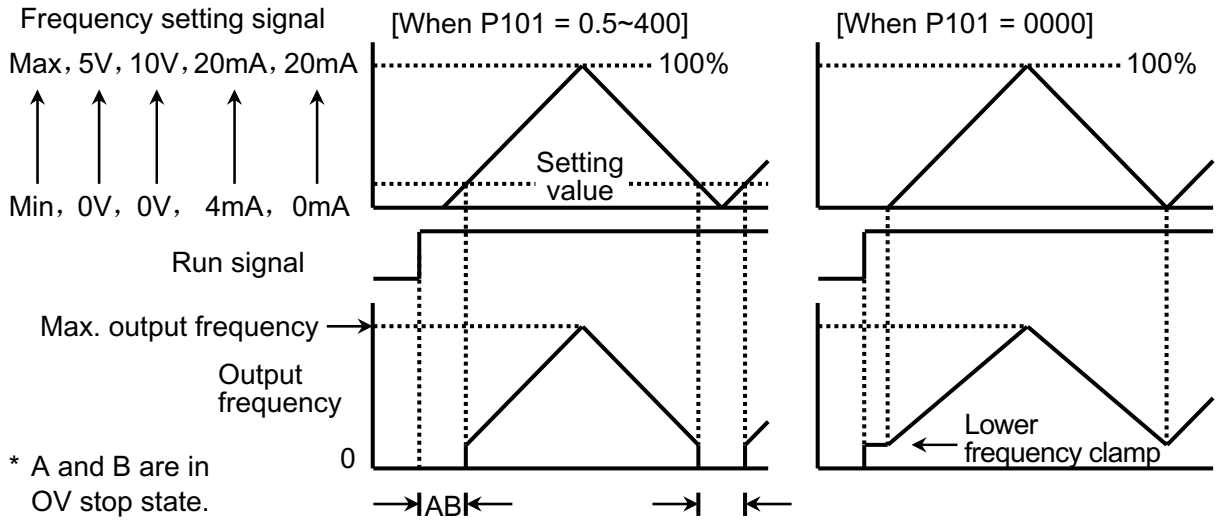
When frequency setting signal is lower than data setting value, the inverter's output can be stopped if the OV stop function is used effectively.

Data setting range (Hz)	0000・0.5 to 400.0

- Setting data value "0000": OV stop function is not provided.
- Setting data "0.5~400.0": OV stop function is provided. (OV stop frequency setting)

[OV stop function]

- If frequency setting signal is " analog setting (parameter P004 = "0","2","3","4","5","6") ", and frequency setting value is below setting value of the OV stop function select, the inverter's output will be stopped.
- If the OV stop function select is set to "0000", the inverter wil not carry out OV stop. When frequency setting signal is less than 1/100 (1%) full scale, the inverter will continuously run at the lower frequency limit.



Note

- When frequency setting signal is set with digits or communication, the inverter will not carry out OV stop.
- When frequency setting signal is less than 1/100 (1%) full scale, command value will change to 0Hz.

Related parameters	P004, P099 P125

P102：Bias/Gain function select
P103：Bias frequency setting
P104：Gain frequency setting

Used to change relationship between output frequency and frequency setting signal (frequency setting analog signal of control terminal No.14 or potentiometer). Use this function according to applications.

[Parameter P102: Bias/Gain function select]

Data setting value	Details
0	With bias/Gain function
1	Without bias/Gain function

[Parameter P103: Bias frequency setting]

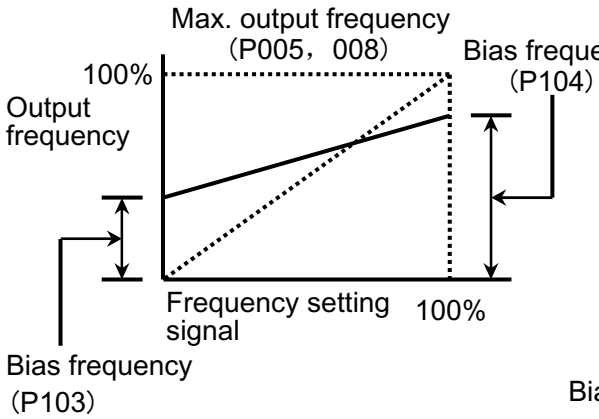
Data setting range (%)	-99.0 to 250.0

[Parameter P104: Gain frequency setting]

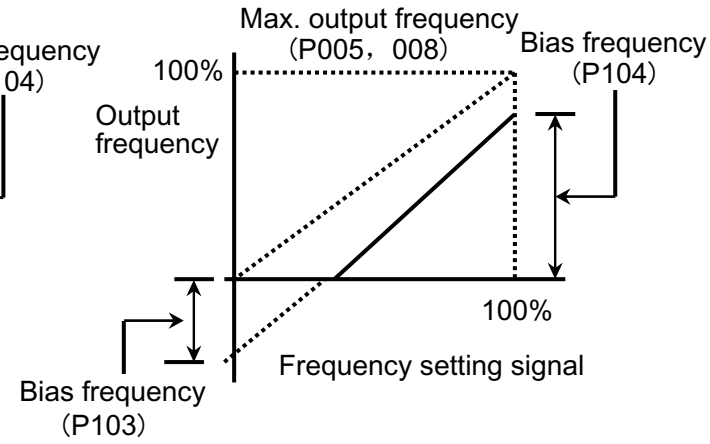
Data setting range (%)	0.0 to 500.0

- Bias frequency and gain frequency are set with ratio (%) of 100% max. output frequency (parameter P008).
- No frequency exceeding max. output frequency or upper frequency clamp will be output. No frequency will decrease less than lower frequency clamp.
- The inverter will not run in reverse direction even if negative frequency setting signal is input.

[When bias frequency setting is positive]



[When bias frequency setting is negative]



Related parameters	P004, P005 P008

P105：Analog input filter

Used to set filter constant of analog input terminal (control circuit terminals No.14 and No.17).
It's effective to remove external voltage or external interference of current frequency setting signal.

Data setting range (times)	5 to 200 (setting unit :1)

- Filter constant of analog input signal of control circuit terminals No.14 and No.17 is the same setting value.
- After setting value (average times) is increased, frequency command is stable, but the response speed decreases.

Related parameters	P004, P125

P106：PID control mode

The inverter can be used to control processes such as flow, air volume or pressure.

Caution

When the automatic tuning through PID control is started, the inverter may automatically drive the motor in the range of upper/lower frequency clamp. Keep out of the machine.
Failure to do so could lead to injury.

"PID operation mode select" and "changeover setting for automatic tuning function" can be applied.

Data setting value	PID operation mode		Automatic tuning function
0	Derivative look-ahead type	Negative operation	Unprovided
1		Positive operation	
2	Proportional-derivative look-ahead type	Negative operation	
3		Positive operation	
A0	Derivative look-ahead type	Negative operation	Provided
A1		Positive operation	
A2	Proportional-derivative look-ahead type	Negative operation	
A3		Positive operation	

[PID operation mode select]

- "Derivative look-ahead PID control" and "Proportional-derivative look-ahead PID control" can be selected.
  Derivative look-ahead PID control : In general, when changing the setting value (SP), output change will increase and convergence will speed up.
  Proportional-derivative look-ahead PID control: In general, when changing the setting value (SP), output change will decrease and convergence will slow down.
- Upward-downward direction of the output when the process changes (positive/negative operation) can be selected.
  Negative operation: When measured value (PV) decreases, the output is increased. (Example: hot air)
  Positive operation: When measured value (PV) increases, the output is increased. (Example: cooling air)

[Automatic tuning function]

- Applying automatic tuning, calculate the optimum value of proportional gain (Kp), integral time (Ti) and derivative time (Td) required by PID control, and set the speculated results to parameters automatically.
  Setting data "A0"~"A3" can be used to apply changeover setting for automatic tuning function.
  Refer to operating procedure of automatic tuning on page 131.

Note

- When applying automatic tuning, ensure allowable range of the motor and machine before application.

Related parameters P107～P111

P107：Proportional gain [Kp]
P108：Integral time [Ti]
P109：Derivative time [Td]
P110：Control cycle [Ts]
P111：PID target value

Used to set proportional gain, integral time, derivative time, control cycle and PID target value required in PID control.

- Parameter P107~109 settings are used as parameter of PID control.
- Parameter P110 setting performs cycle under PID control.
- When Parameter P004 = "1" or "7", setting value (SP) is set with parameter P111.

[Parameter P107: Proportional gain (Kp)]

Data setting range	0.1 to 1000

[Parameter P108: Integral time (Ti)]

Data setting range (s)	0000・0.1 to 3600

* "0000" is setting that the integral control is to be disabled.

[Parameter P109: Derivative time (Td)]

Data setting range (s)	0000・0.1 to 3600

* "0000" is setting that the derivative control is to be disabled.

[Parameter P110: Control cycle (Ts)]

Data setting range (s)	0.01 to 60.0

[Parameter P111: PID target value]

Data setting range (%)	0.0・0.1 to 100.0

Related parameters

- ・PID control select ⇒ " P124: Analog input function select 2"
- ・Input signal select of measured value (PV) ⇒ "P125: Analog input signal select 2"
- ・Bias/gain setting for measured value (PV) ⇒ "P126: Bias frequency setting 2"
  "P127: Gain frequency setting 2"
- ・Setting signal select of setting value (SP) ⇒ "P004: Frequency setting signal"
- ・Bias/gain setting for setting value (SP) ⇒ "P102: Bias/gain function select"
  "P103: Bias frequency setting"
  "P104: Gain frequency setting"
- ・Upper/lower clamp setting for output frequency ⇒ "P099: Lower/upper frequency clamp",
  "P100: Lower/upper frequency clamp"
- ・PID control changeover input setting ⇒ "P036~040: SW1~5 function select"

[Setting procedure of PID control]

1. PID control select

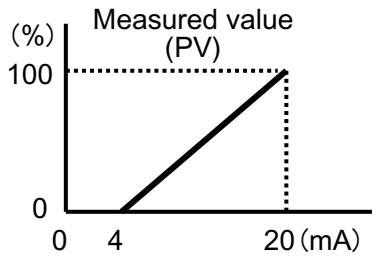
   • "P124: Analog input function select 2" is set to "1".
   (When parameter P124 ="0", PID control will not be selected.)

2. Measured value (PV) setting

   • "P125: Analog input signal select 2" is set to signal specifications of detector.

   • Relationship between detector signal and measured value (PV) is set with "P126: Bias frequency setting 2" and "P127: Gain frequency 2" .

   Example: 4m＝0%, 20mA＝100%



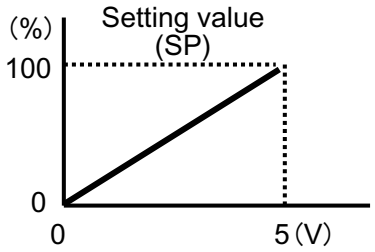
3. Setting value (SP) setting

   • Setting signal of setting value (SP) is set with parameter P004 (frequency setting signal).

   (Note) When parameter P004 ="1" or "7", setting value (SP) is set with parameter P111 (PID target value).

   • Relationship between setting signal and setting value (SP) is set with parameters P102 -104 (Bias/gain function select, Bias frequency setting and Gain frequency setting).

   Example: 0V＝0%, 5V＝100%



4. PID operation mode select

   • PID operation mode is selected with parameter P106 (PID control mode)

5. Proportional gain (Kp), integral time (Ti), derivative time (Td) and control cycle (Ts) settings

   • Parameters (Kp, Ti, Td) used in PID control are set to parameters P107~109.

   * Automatic tuning function can be used to adjust parameters (Kp, Ti, Td) automatically and change the setting value.

   • Cycle (Ts) applying PID control is set to parameter P110.

   * Lower/upper frequency clamp of output frequency are set with parameters P099 and P100.

[Operating procedure of automatic tuning]

① Switch to automatic tuning function setting

Use "P106: PID control mode" to select "A0~A3" and press the SET button to set the data.

② Enter the measurement preparation completed state

Press the MODE SW button to enter the measurement preparation completed state.

③ Start of automatic tuning

Turn the run command ON and automatic tuning will start. (Main display will flicker.)

* Inverter will drive the motor automatically.

④ End of automatic tuning

When automatic tuning ends, measured data will be written into parameters P107~109. When "End" is displayed, it indicates the end of automatic tuning.

After automatic tuning ends, parameter P106 data will automatically change to PID operation mode without automatic tuning function. (When applying with "A0", "0" is changed to. "A1"→"1"、"A2"→"2")

⑤ Enter run preparation completed state (normal stopped state)

Turn stop command ON and enter run preparation completed state.
After this operation, normal operation can be carried out.

* In control status monitor (n14~n17), PID control state can be monitored.

Note

- Automatic tuning cannot be applied in some different processes.
  In this case, "Err" is displayed. Data setting value of each parameter will not change even if automatic tuning ends.
  "Err" may reset when stop command is turned ON and become normal stopped state.
- After multi speed signal is input, PID control will be stopped and the multi speed operation will be applied.
- PID control will not be applied even if JOG signal is input.
- PID control will not be applied after PWM frequency signal is selected.

P112：Skip frequency 1
P113：Skip frequency 2
P114：Skip frequency 3
P115：Skip frequency band width

If the load mechanism resonates at a specific inverter output frequency, a continuous operation in that frequency band can be avoided by setting the skip frequency and the skip frequency band.

- Up to three skip frequencies can be set, and the skip frequency band can be set between 1 and 10Hz.

[Parameter P112: Skip frequency 1]

[Parameter P113: Skip frequency 2]

[Parameter P114: Skip frequency 3]

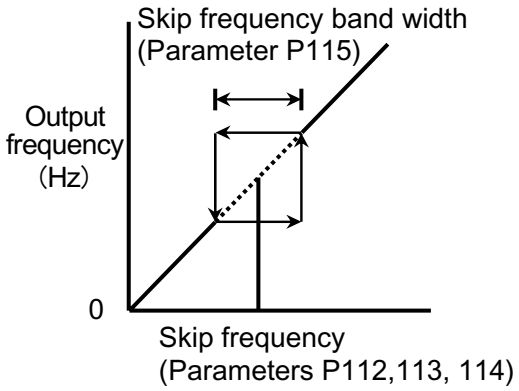
Data setting range(Hz)	0000・0.5 to 400.0

* "0000" is setting that the skip frequency is to be disabled.

[Parameter P115: Skip frequency band width]

Data setting range(Hz)	0・1 to 10

* "000" is setting that the skip function is to be disabled.



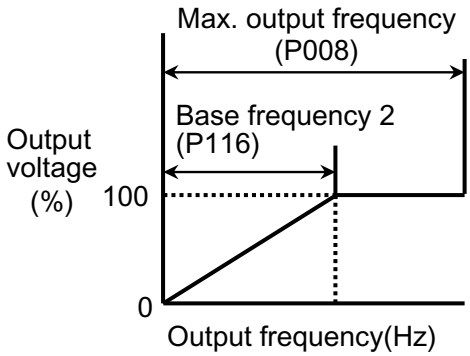
P116：Base frequency 2

2nd characteristics select button can be used to select and set base frequency 2.
(It is valid when Parameter P005 is set to "FF" or "3C".)

[Parameter P116: Base frequency 2]

Data setting range (Hz)	45.0 to 400.0

・Max. output frequency is the setting value of parameter P005 (V/F mode) or parameter P008 (Max. output frequency).



Note

- If "P005: V/F mode" is set to "50" or "60", the max. output frequency and base frequency are fixed value.
- A frequency higher than "P100: upper frequency clamp" cannot be output.
- If a general-purpose motor with a rated frequency of 50 or 60Hz is run at a frequency exceeding the rated frequency, the motor may be damaged. Always set the frequency to match the motor characteristics.
- If the base frequency is required to be changed together with the max. output frequency for a high-speed exclusive motor, etc., such change is done with this parameter.
- When running a general-purpose motor with a frequency higher than the universal frequency, the base frequency will be set to the normal motor's rated output frequency(50 or 60Hz).
- When using the general-purpose motor at a level higher than the base frequency (normally 50 or 60Hz), the motor will enter the constant output characteristics, and the generated torque will drop in inverse proportion to the frequency.

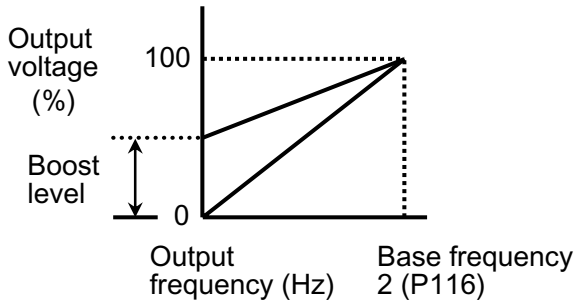
Related parameters	P005, P008, P036～P040 P100, P117, P120～P123

P117：Torque boost level 2

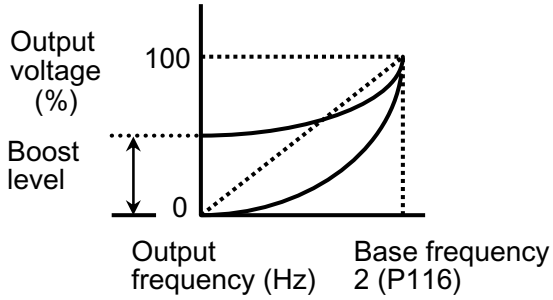
2nd characteristics select button can be used to select and set the torque boost level 2.
A larger value causes a higher the output voltage and stronger boost.

Data setting range (%)	0 to 40

[Constant torque mode]



[Square torque mode]



Note

- If the boost level is too high, an overcurrent fault, overload fault or motor overheating could occur or the noise could increase.
- The motor current will increase when the value of boost level is increased. Carefully consider the settings for "P118: Electronic thermal select 2"and "P119: Thermal current setting 2".
- Under control of vector (P129= "1"), torque boost level 2 is invalid.

Related parameters	P005, P008, P036～P040 P116, P118～P123

P118：Electronic thermal select 2
P119：Thermal current setting 2

2nd characteristics button can be used to select and set the operation level of the electronic thermal when the inverter output is to be stopped. Operation coasts to stop when OL is displayed.

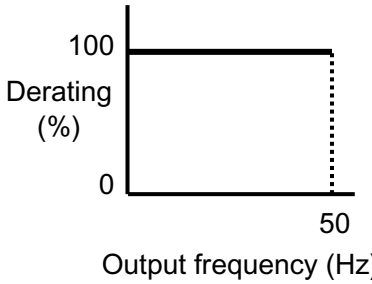
■ Example for setting current and thermal operation (P016 = 1)
- Set current X 100% ⇒ Does not trip
- Set current X 125% ⇒ Trips (OL trip)

[Parameter P118: Electronic thermal select 2]

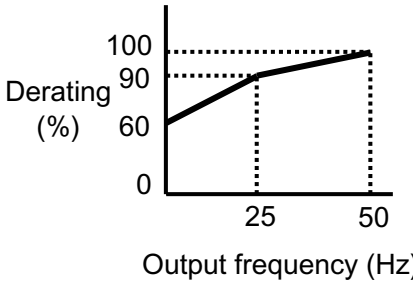
Data setting value	Validity of function	Details of function
0	invalid	OL trip will occur if a current that is 140% of the inverter's rated current flows for one minute.
1	valid	Without output frequency derating
2	valid	With output frequency derating
3	valid	Forced ventilation motor specifications

* About derating
Function to automatically compensate operation level when motor cooling performance drops during low-speed operation.

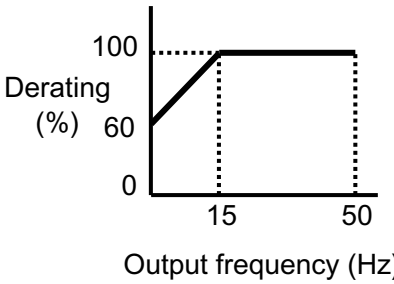
[Parameter P119 = 1]



[Parameter P119 = 2]



[Parameter P119 = 3]



[Parameter P119: Thermal current setting 2]

Data setting range (A)	0.1 to 100.0

* Set these parameters according to the rated current of applicable motor.

Related parameters	P036～P040

P120：2nd change point frequency 1
P121：2nd change point voltage 1
P122：2nd change point frequency 2
P123：2nd change point voltage 2

Used to set change points 1 and 2 set with 3C mode in "P005: V/F mode".
(These parameters are valid only when parameter P005 is set to "3C".)

[Parameter P120: 2nd change point frequency 1]

Data setting range (Hz)	0.5 to 400.0

[Parameter P121: 2nd change point voltage 1]

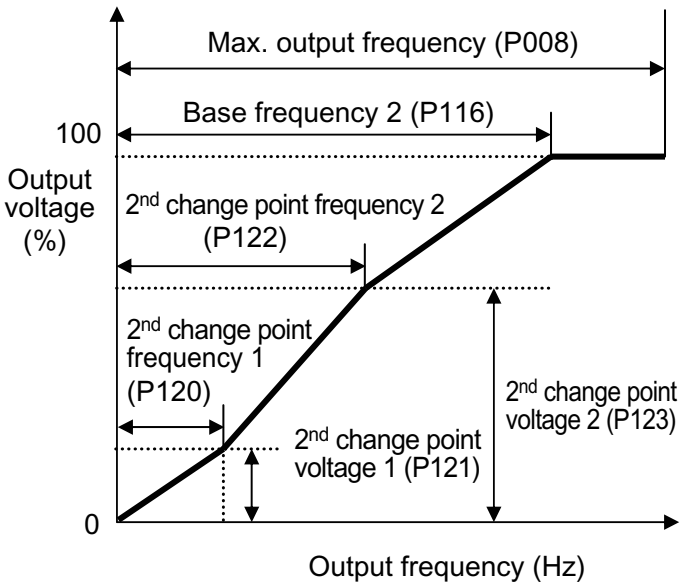
Data setting range (%)	0 to 100

[Parameter P122: 2nd change point frequency 2]

Data setting range (Hz)	0.5 to 400.0

[Parameter P123: 2nd change point voltage 2]

Data setting range (%)	0 to 100



Note

- Read carefully details on "P005: V/F mode" before setting.
- If 2nd change point frequencies 1 and 2 are set to be higher than base frequency, 2nd change point frequencies 1 and 2 will operate according to setting value of base frequency.
- If 2nd change point frequency 2 is set to be lower than 2nd change point frequency 1, 2nd change point frequency 2 will operate according to setting value of 2nd change point frequency 1.
- When setting "P117: Torque boost level 2", if 2nd change point voltage 1 and 2 is set to be lower than torque boost level 2, 2nd change point voltage1 and 2 will operate according to setting value of torque boost level 2.
- If 2nd change point voltage 2 is set to be lower than 2nd change point voltage 1, 2nd change point voltage 2 will operate according to setting value of 2nd change point voltage 1.

Related parameters	P005, P008, P036～P040 P116, P117

P124：Analog input function select 2

Control function of analog input terminal 2 (control circuit terminal No.16) can be selected.

Data setting value	Details
0	Frequency setting signal 2
1	Feedback signal under PID control (Measured value PV)

[Frequency setting signal 2]

- Analog input terminal 2 can be used as frequency setting signal 2.
- SW function select is set to frequency signal changeover input. Turn the set SW ON/OFF for switching frequency setting command to frequency setting signal 1 or 2.
  (SW function select : parameter P036~P040)
- Input OFF into SW : frequency setting signal 1,
  Input ON into SW: frequency setting signal 2

[Feedback signal under PID control]

- Analog input terminal 2 can be used as feedback signal under PID control (Measured value PV).
- For using PID control effectively, parameter (P124) is required to be set to "1".
- When applying PID control, refer to details on parameters P106~P111.

Related parameters	P004, P036～P040 P106～P111, P125～P127

P125：Analog input signal select 2

Setting signal of analog input terminal 2 (control circuit terminal No.16) can be selected.

Data setting value	Details on setting signal	Operation method and control terminal connection diagram
3	0~5V(voltage signal)	Terminals No.16 and 15 (16 : + , 15 : -)
4	0~10V(voltage signal)	Terminals No.16 and 15 (16 : + , 15 : -)
5	4~20mA(Current signal)	Terminals No.16 and 15 (16 : + , 15 : -) 200Ω, is connected between 16 and 15.
6	0~20mA(Current signal)	Terminals No.16 and 15 (16 : + , 15 : -) 200Ω, is connected between 16 and 15.

Note

- If 4~20mA or 0~20mA signals are used, always connect a "200Ω, resistance" between terminals No.16 and 15.
  (If the 200Ω, resistance is not connected, the inverter could be damaged.)
- Start or stop of operation is divided by setting value of "P101: 0V Stop function select".
  If 0V stop function is set to be invalid, parameter P101 should be set to "0000"
  (0V stop function select: Refer to page 111)

Related parameters	P101, P124 P126, P127

P126：Bias frequency setting 2
P127：Gain frequency setting 2

Relationship between output frequency and frequency setting signal 2 (control circuit terminal No.16) can be changed at random. Use this function according to applications.

[Parameter P126: Bias frequency setting 2]

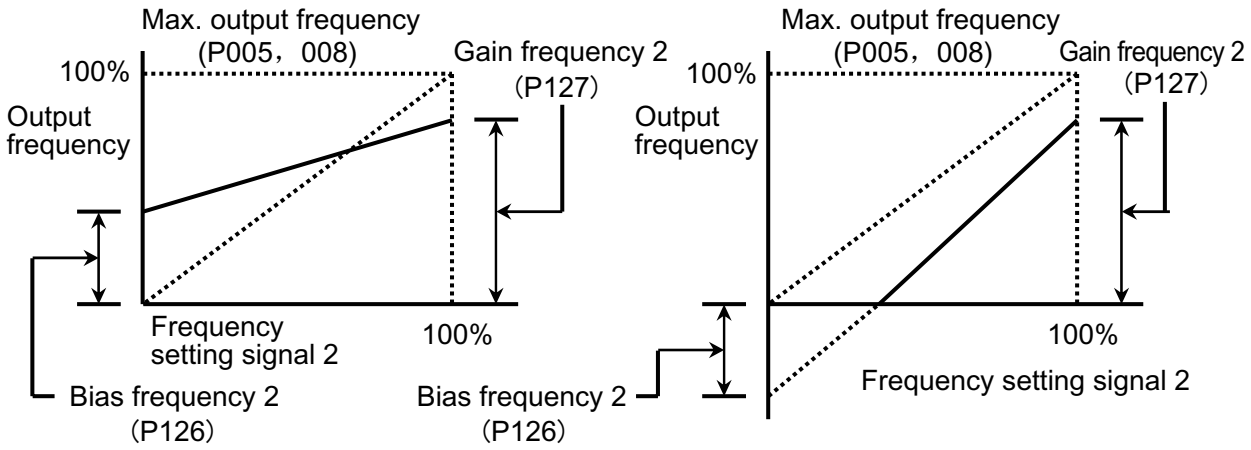
Data setting range (%)	-99.0 to 250.0

[Parameter P127: Gain frequency setting 2]

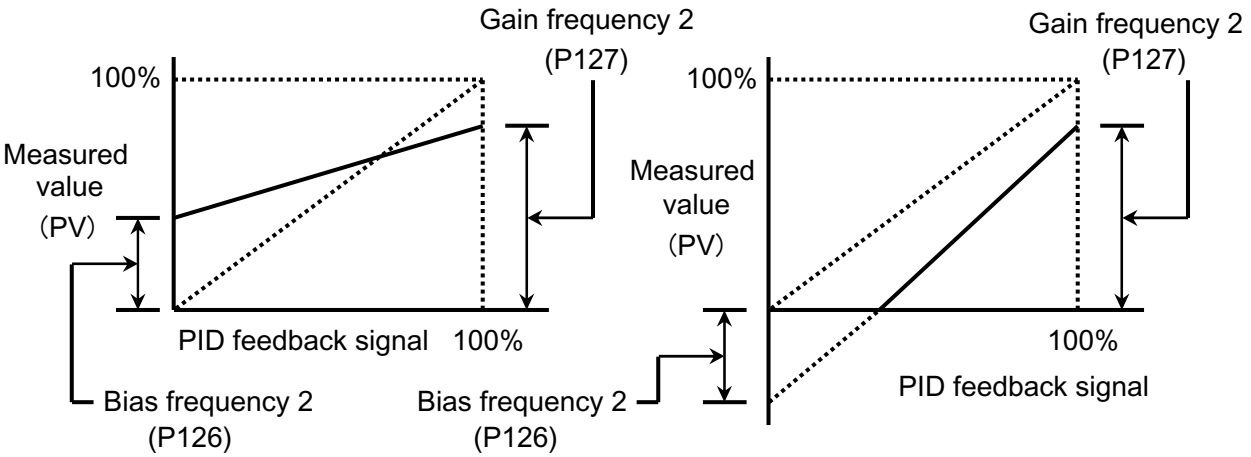
Data setting range (%)	0.0 to 500.0

- Bias frequency 2 and gain frequency 2 are set with a percent (%) to100% max. output frequency (parameter P008).
- No frequency exceeding max. output frequency or upper frequency clamp will be output. No frequency will decrease less than the lower frequency clamp.
- The inverter will not run in reverse direction even if negative frequency setting signal is input.

[Relationship between frequency setting signal 2 and output frequency]



[Relationship between feedback signal under PID control and measured value (PV)]



Note

- No frequency exceeding max. output frequency or upper frequency clamp will be output. No frequency will decrease less than the lower frequency clamp.
- The inverter will not run in reverse direction even if negative frequency setting signal 2 is input. Negative PID feedback signal is 0%.
- Setting value of bias/gain function select (parameter P102) does not affect bias frequency 2 and gain frequency 2.

Related parameters	P005, P008, P036～P040 P124, P125, P106～P111

P128：Carrier frequency

This carrier frequency can be changed to "reduce motor noise" and to" avoid mechanical resonance".

■ Setting value of parameter "P129: Vector control select" is "0". (When V/F control is selected.)

Data setting value (kHz)	0.8, 1.1, 1.6, 2.5, 5.0, 7.5, 10.0 (Seven types of settings are possible.)

■ Setting value of parameter "P129: Vector control select" is "1". (When vector control is selected.)

Data setting value (kHz)	2.5, 5.0, 7.5, 10.0 (Four types of settings are possible.)

Note

- This setting can be changed during operation, but the following groups [Low frequency group] and [High frequency group] can be set only when the operation is stopped.

  [Low frequency group] 0.8~1.6 kHz
  [High frequency group] 2.5~10.0 kHz

- When data value is set to "10.0", the carrier frequency can be used only in the case that the rated output current of the 3.7kW inverter is decreased. Always refer to precautions on the usage on page 202.

- When the carrier frequency is set to 7.5 kHz or 10.0 kHz, the carrier frequency will change depending on the output frequency.
  1) When it is set to 7.5 kHz, the carrier frequency will be output at 5.0 kHz for the output frequency in the range of 0.5 to 10Hz.
  2) When it is set to 10.0 kHz, the carrier frequency will be output at 5.0 kHz for the output frequency in the range of 0.5 to 10Hz, and at 7.5 kHz for the one in the range of 10 to 15Hz.

- When data value is set to "10.0", the carrier frequency can be used only in the case that the rated output current of the 3.7kW inverter is decreased.
  Overcurrent trip prevention function (page 73) is invalid.

Related parameters	P129

P129： Vector control select

When large starting torque or sufficient torque is required at low speed, this function is valid in the case that the load changes sharply.
It's not applicable to the load that minor rotation may lead to problems at low speed.

Data setting value	Details
0	V/F control
1	Vector control

■ When using vector control mode, the specifications below should be met.

- The motor is general-purpose cage type or induction motor.
- The motor capacity is "the same as" or "one level lower than" the inverter capacity, and it is 0.4kW or more.
- One level lower refers to the motor with the same rated value as that of the inverter capacity. Other motor capacity accords to the rated value that is close to host one.
- Motor polarity is 2, 4, or 6 poles.
- Signal-unit operation. (One motor is applied in one inverter.)
- Max. wiring length between inverter and motor is 30m or less.
- Carrier frequency is 2.5 kHz or more.

Under other conditions, good operating characteristics may not be achieved.

■ In the vector control mode, carrier frequency may automatically change in the area where output frequency is relatively low.

[Setting procedure when vector control is selected]

1) Control method select : Vector control is selected. (P129 is set to "1".)

2) Motor capacity setting : Motor capacity in use is set to "P130: Motor capacity". (0.2~3.7kW)
Motor capacity and inverter capacity are the same at factory setting.
If motor capacity and inverter capacity are the same, setting is not required.

3) Motor polarity setting : Motor polarity in use is set to "P130: No. of motor poles". (2, 4, 6 poles)
Motor polarity is set to 4 poles at factory setting.
If motor polarity is set to 4 poles, setting is not required.

4) Operation on trial : If the required motor characteristics are achieved, setting is completed till now.
(Operation under motor constant recommended by our company.)
If the required motor characteristics are not achieved, the setting below will be applied.

5) Motor constant setting : When motor constant is known beforehand,
"P133: Voltage compensation constant" setting
"P134: Slip compensation frequency" setting
When motor constant is unknown beforehand, automatic tuning is applied.
"P132: Measurement function of motor constant" is set to "1",
and measure voltage compensation constant.
"P132: Measurement function of motor constant" is set to "2",
and measure the slip compensation frequency.

6) Operation on trial : If the required motor characteristics are achieved, the setting is completed till now.
After motor constant is set with P133 and P134, the required motor characteristics are still not achieved, automatic tuning will be applied.

Note

- When vector control is selected, output frequency is in the range of 1Hz~120Hz.
- Vector control is valid only when "P128: Carrier frequency" is in the range of 2.5kHz~10.0kH. When carrier frequency is set to 0.8kHz~1.6kHz and "P129: Vector control select" is set to "1" (vector control), setting value of carrier frequency will change to 2.5kHz automatically.

Related parameters	P128 P130～P134

P130：Motor capacity

Used to set the capacity required to drive the motor when vector control is used.

Data setting value	Motor capacity
0.4	0.4kW
0.7	0.75kW
1.5	1.5kW
2.2	2.2kW
3.7	3.7kW

Note

- After setting data is changed, data of "P133: Voltage compensation constant" and "P134: Slip compensation frequency" will automatically change to the motor constant recommended by our company.

Related parameters	P129 P131～P134

P131：No. of motor poles

Used to set No. of poles required to drive the motor when vector control is used.

Data setting value	No. of motor poles
2	2 poles
4	4 poles
6	6 poles

Note

- After setting data is changed, data of "P133: Voltage compensation constant" and "P134: Slip compensation frequency" will automatically change to motor constant recommended by our company.

Related parameters	P129～P130 P131～P134

P132：Measurement function of motor constant

Used to set "changeover setting of automatic tuning mode" for the motor constant required by vector control and the motor constant recommended by our company.

⚠ Caution

- When automatic tuning of voltage compensation constant is started, inverter will automatically apply DC high-voltage to the motor. Keep out of the devices.
  Failure to do so could lead to electric shocks.
- When automatic tuning of slip compensation frequency is started, inverter will automatically drive the motor at 60Hz. Keep out of the devices.
  Failure to do could lead to injuries.

Data setting value	Details
0	Indicates the data value in normal state. * Used to set when canceling setting state after the automatic tuning mode of setting value "1 "and "2".
1	After voltage compensation constant is set to automatic tuning mode After the data is set, return to the operation status display mode. Enter measurement state, and press the RUN SW to measure constant.
2	After slip compensation constant is set to automatic tuning mode After the data is set, return to the operation status display mode. Enter measurement state, and press the RUN SW to measure constant.
3	According to setting data of "P130: Motor capacity" and "P131: No. of motor poles", details on "P133: Voltage compensation constant" and "P134: Slip compensation constant" are changed to the constant recommended by our company. (After the data is set, if the constant of P133 and P134 is changed, setting value will return to 0 automatically.)

Note

- Apply automatic tuning only when vector control is selected (P129 ="1")
- Apply automatic tuning in the state that the motor is stopped completely.
- Apply automatic tuning of slip compensation frequency in the state that no load on the motor shafts.
- Acceleration time when slip compensation frequency is tuned automatically is the setting value of P001. When acceleration time is too short, overcurrent trip may occur. In this case, tuning cannot be applied correctly.
- If automatic tuning of motor constant and PID are set simultaneously, automatic tuning of PID will have the priority.

Related parameters	P129～P131 P133, P134

[Operating procedure of automatic tuning]

① Switch to automatic tuning mode setting

- When voltage compensation constant is measured : P132 is set to "1"
- When slip compensation frequency is measured : P132 is set to "2"

② Enter measurement preparation completed state

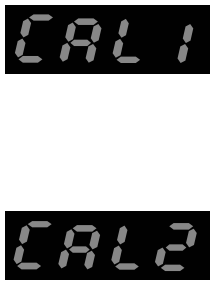
Press the MODE SW and enter operation status display mode.

- When voltage compensation constant is measured, P132 = "1" is displayed.
- When slip compensation frequency is measured, P132 = "2" is displayed.

③ Start of automatic tuning

Press the RUN SW and automatic tuning is started.

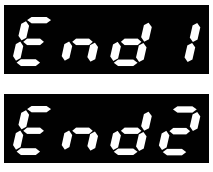
- When voltage compensation constant is measured,
  - Inverter will automatically apply DC high-voltage to the motor and such operation will last about 2 seconds.
    P132 = "1" is displayed in measurement. (flicker)
- When slip compensation frequency is measured,
  - Inverter will drive the motor at 60Hz.
    Such operation will last normal 1st acceleration time plus about 5 seconds.
    P132 = "2" is displayed in measurement. (flicker)



④ End of automatic tuning

When automatic tuning ends, data will be automatically written in P133 or P134 and it indicates the end of automatic tuning.

- When voltage compensation constant is measured, it indicates the end of measurement.
- When slip compensation frequency is measured, it indicates the end of measurement.



⑤ Enter operation preparation completed state (normal stopped state)

Press the STOP SW and enter the operation preparation completed state.
After such operation, normal operation can be applied.

■ Tuning results out of specific range

Special motors such as high-speed motor and high slip motor occasionally cannot perform tuning correctly.
"tEr1" or "tEr2" will be displayed in case of fault tuning, and trip will occur.
Press the STOP SW and the trip will be reset.

P133：Voltage compensation constant

Data value is used to set voltage compensation constant required by vector control.

Data setting value (V)	0.01 to 99.99 (0.01 unit)

Calculate the setting data value of voltage compensation constant according to method as below.

Setting value = R×I R : Includes one-phase resistance value of wiring resistance (1/2 of measured resistance value among motor terminals)

I : Equivalent current (Equivalent to inverter rated current of motor capacity)

Motor capacity	Equivalent current (A)
0.4kW	1.6
0.75kW	2.1
1.5kW	4.0
2.2kW	6.0
3.7kW	9.4

Note

- When the setting value is relatively large, current trip may occur.
- When the setting value is relatively small, torque may be inadequate at low speed.

Related parameters	P129～P132 P134

P134：Slip compensation frequency

Data value is used to set slip compensation frequency required by vector control.

Data setting value (Hz)	-5.00 to 5.00 (0.01 unit)

Converting slip at 60Hz to frequency value for setting slip compensation frequency.
Calculate the data according to the method as follow.

$$\text{Setting value} = \frac{N0 - N1}{N0} \times 60(\text{Hz}) \qquad N0 : \frac{120 \times 60}{\text{No. of motor poles}}$$

N1: Rated rotation number of motor (at 60Hz)

Note

- When the setting value is relatively large, rotation number of motor may be larger than the target.
- When the setting value is relatively small, rotation number of motor may be smaller than the target.

Related parameters	P129～P133

P135：Communication protocol select
P136：Communication station No. setting
P137：Communication speed setting
P138：Stop bit length
P139：Parity check
P140：Timeover detect
P141：Send wait time
P142：TEXT completion judgment time

Used to set the parameters necessary for communication when sending command to the inverter.

[P135: Communication protocol select]

For VF100, two protocols MEWTOCOL-COM and MOD-BUS (RTU) are available. Either protocol can be set for using.

Data setting value	Details of function
0	MEWTOCOL-COM
1	MOD-BUS(RTU)

[P136: Communication station No. setting]

Data setting range	1 to 31

[P137: Communication speed setting]

Data setting value	Details of function
48	4800 bps
96	9600 bps
192	19200 bps
384	38400 bps

[P138: Stop bit length]

Data setting value	Details of function
1	1 bit
2	2 bit

[P139: Parity check]

Data setting value	Details of function
0	No parity check
1	Odd
2	Even

[P140: Timeover detect]

Data setting range (sec)	0000・0.1 to 60.0

* "0000" is setting not to perform the time-over detect.

[P141: Send wait time]

Data setting range (msec)	1 to 1000

[P142: TEXT completion judgment time]

Data setting range (msec)	3 to 200

* The function is valid only protocol MOD-BUS (RTU) is used.

Note

- In respect of each protocol, read descriptions of "12. Supplementary explanation of communication function" (page 154) carefully.
- The power supply is turned off once after setting the data for the communication parameters P135 to P142.
  The data setting value will be displayed in the inverter after the power supply is turned on again.

P143：Cooling fan ON-OFF control select

Used to select operation of cooling fan in the inverter.

Data setting value	Details of function
0	ON : Power supply is turned ON OFF: Power supply is turned OFF
1	ON : When operation starts OFF: Temperature of heat sink fins in the inverter is 100℃ or less

Note

- This parameter is invalid in the model (0.75kW) that is not equipped with cooling fan.

P144：Input terminal filter

Used to set filter constant of control terminals (No.2~8) in the inverter.
Used to eliminate interference of external signal input effectively.

Setting times (times)	5 to 100 (setting unit: 1)

Note

- If the setting value is too large, interference resistance capability is strong, but response speed of control input terminal will become low.
- If the setting value is too small, interference resistance capability is weak, but response speed of control input terminal will become high.
- Using start/stop, forward run signal and reverse run signal (terminals 2 and 3) to operate the inverter, internal processing time of the inverter will be relatively long, even if the setting value is relatively small. So response speed is lower than that of other terminals.

P145：Operation status monitor

Used to change display on the panel according to applications.

Data setting value	Function name	LED indication	
		Operation preparation completed state (in stopped state)	Operation status
0	Output frequency		
1	Line speed		
2	Output current		
3	Communication station No.		
4	Setting frequency		
5	Communication station No. / output frequency		
6	Communication station No. / line speed		
7	Communication station No./ output current		

* The values shown in the above table are displaying examples for operating frequency "50.0", output current "1.0 A", setting frequency "50.0", communication station No. "01" and line speed multiplier "0.5".

Note

- In the "operation status display mode", press the SET button and switch to current display.
- Operation preparation completed state is recorded as "0000" in this manual. When changing this parameter, indication will change depending on data setting value.

Related parameters	P146

P146：Line speed multiplier

Used to set the multiplier in relation to output frequency when setting data value is displayed as "1" line speed in "P145: Operation status monitor".

[Parameter P146: Line speed multiplier]

Data setting range	0.1 to 100.0

[Setting example] Display line speed

Line speed (m/min) ＝ F (Hz) ×K (multiplier)

- To display the line speed 25 (m/min) for 50Hz, set the multiplier (K) to "0.5".

Note

- A line speed exceeding "9999" is displayed as "9.9.9.9".

Related parameters	P145

P147：Alarm LED operation select

Used to select alarm LED operation of the panel.

Data setting value	Function name	Details of function
0	No setting	No setting (but when fault trip occurs, the alarm LED will light.)
1	Full monitor alarm	Any one among output voltage fault, overload, temperature anomaly and timer end-of-run conforms to the designated conditions, the alarm LED will flicker.
2	Output voltage fault alarm	When the setting value (P148) or more is reached, the alarm LED will flicker.
3	Overload alarm	When the setting value (P149) or more is reached, the alarm LED will flicker.
4	Temperature anomaly alarm	When temperature of heat sink fins reaches 80℃ or more, the alarm LED will flicker.
5	Timer end-of-run signal	When the timer's operation ends, the alarm LED will flicker. (Associated with timer operation function, when ∞ is displayed, the alarm LED will not flicker.)

- If fault trip occurs, alarm LED will light.
- Determine which type the current alarm belongs to with monitor function "n008: Alarm type".
- When alarm LED operation select (parameter P147) is set to "1" and various alarms occur simultaneously, the displayed order of priority is shown as follow.
  (If alarm in higher priority order is in operation, the alarm in higher priority order is still displayed even if an alarm in lower priority order enters.)

Temperature anomaly alarm > Overload alarm > Output voltage fault alarm > Timer end-of-run signal

Related parameters	P148, P149

P148：Alarm LED upper voltage clamp

When alarm LED operation select is set to "1" or "2", the upper voltage clamp for judging output voltage fault alarm can be set.
When output voltage of inverter is larger than setting value, alarm LED will flicker as output voltage fault alarm.

Data setting range (V)	0.1 to 600.0

Related parameters	P147

P149：Alarm LED upper current clamp

When alarm LED operation select is set to "1" or "3", the upper current clamp for judging output voltage fault alarm can be set.
When output current of inverter is larger than setting value, alarm LED will flicker as overload alarm.

Data setting range (A)	0.1 to 100.0

Related parameters	P147

P150：Password

A password can be set to prevent unintentional changes to the parameter data after they have been set.

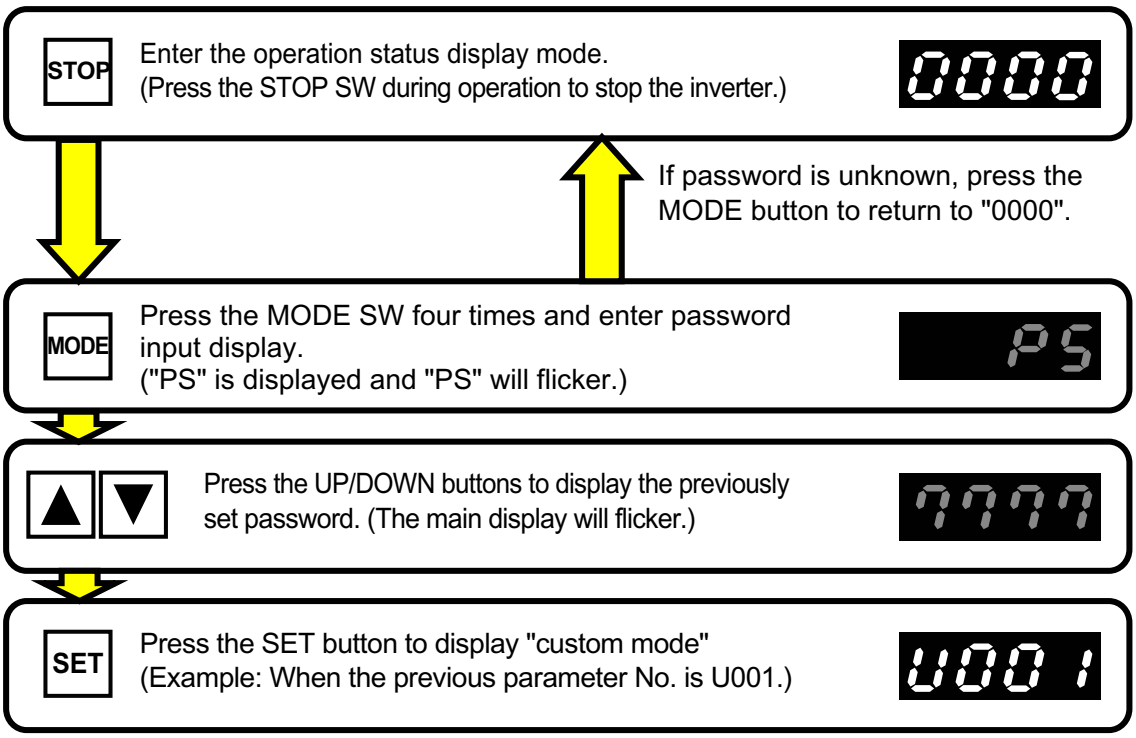
Data setting range	0000 ・1 to 9999

* "0000" indicates that there is no password.

When setting password, press the MODE SW in the "control status monitor mode" and password indication changes to "PS". After the password is input and the MODE SW is pressed, "custom mode", "function setting mode" and "built-in memory setting mode" can be called.
No password is displayed in password input indication "PS". Press the MODE SW and enter to "operation status display mode".

[Procedures for changing parameter data after setting password]

・When password is set to "7777"



After this step, the data is changed with the normal changing procedures.

・After the parameter is set, the "custom mode", "function setting mode" and "built-in memory setting mode" cannot be called without inputting the password.
(Write down the password so that you do not forget it.)

P151：Setting data clear

The set data can be changed to the factory setting data in a batch.

Data setting value	Details
0	Data value that indicates normal state.
1	Changes all data regardless of vector control to the factory settings. *
2	Changes all data to the factory settings.
3	Changes function distribution in the custom mode to the distribution at factory setting.

* Data related to vector control

"P130: Motor capacity"	"P133: Voltage compensation constant"
"P131: No. of motor poles"	"P134: Slip compensation frequency"

Note

- Setting value is changed to the value other than "0". Press the SET button and when the displayed value automatically changes to "0" after data changing, the change is completed.

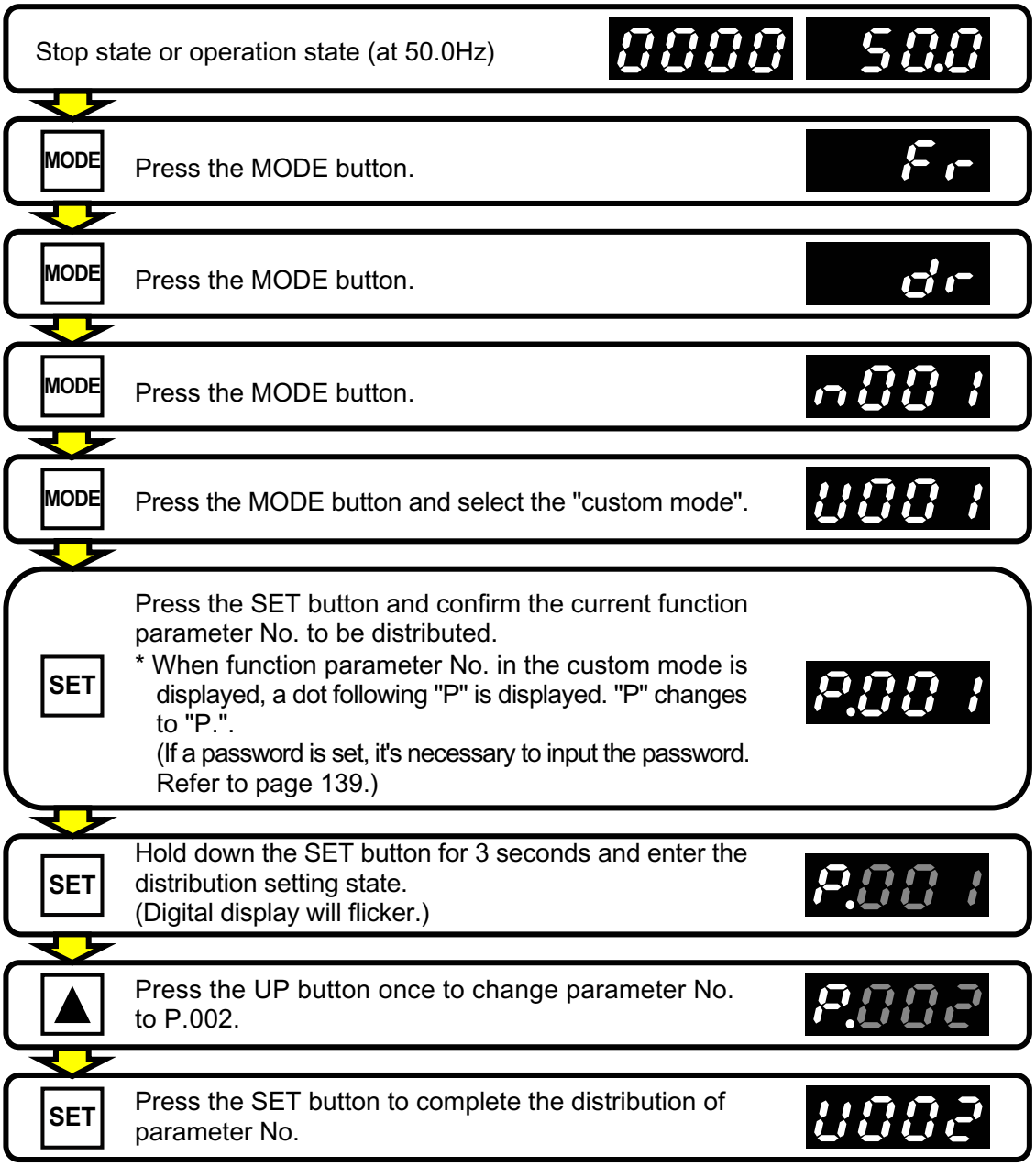
10. Custom mode

"Custom mode" can be used to freely select 10 function parameters frequently changed by the customer among the 151 function parameters to make the data changing easier.

10-1. Method of distributing function parameter No. to custom parameter No.

1~10 can be distributed to custom parameter No.. The distributed data will be written in non-volatile memory inside the inverter and the data will be stored even if the power is turned off. (Max. writing times of the non-volatile memory inside the inverter is 100,000 times. Note that function parameter No. cannot be distributed too frequently.)

[Setting example] Function parameter "P002" (1st deceleration time) is distributed to custom parameter "U001".



Initial settings for custom parameter No.1~10 are shown in the table as below.

Custom parameter No.	Function parameter No.	Function name	Initial value	Related page
U001	P001	1st acceleration time	5.0	62
U002	P002	1st deceleration time	5.0	62
U003	P007	Torque boost level	05	68
U004	P003	Operation command select	0	63
U005	P004	Frequency setting signal	0	64
U006	P008	Max. output frequency	50.0	69
U007	P009	Base frequency	50.0	69
U008	P145	Operation status monitor	0	136
U009	P147	Alarm LED operation select	0	138
U010	P150	Password	0000	139

For making the distribution setting of custom parameter No.1~10 return to initial state, value of function parameter "P151: Setting data clear" is set to "3". (The data value is not changed.) (Refer to page 140.)

Note

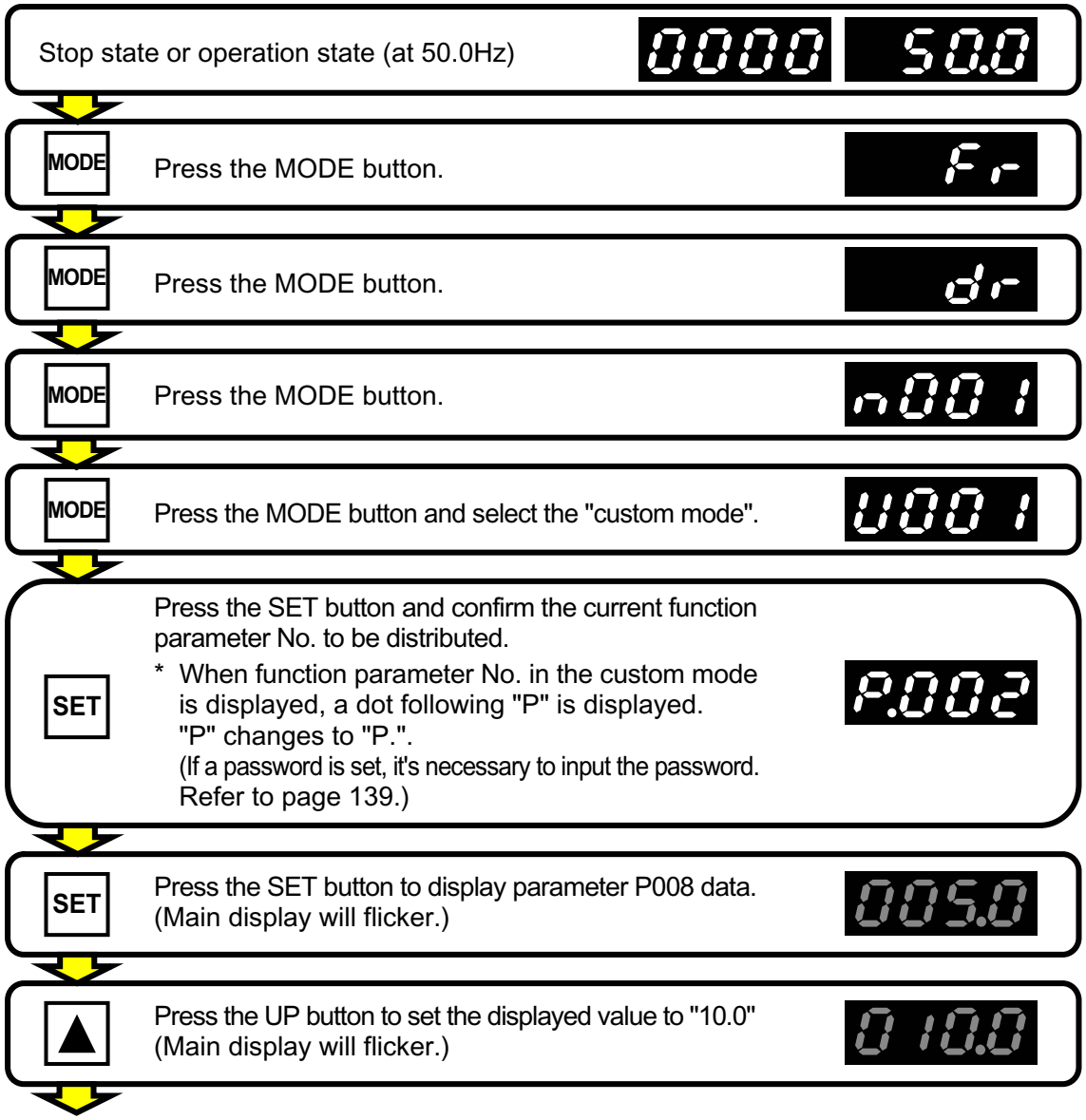
- After the distribution is completed, the inverter will not run unless the MODE button is pressed and the "operation status display mode" is set to.
- While changing the data, the mode will return to the "operation status display mode" if a stop signal is input and the inverter stops.
- During data changing, the "0V stop state" will be returned to if the inverter 0V stops.
- While changing the data in the "0V stop state", the mode will return to the "operation status display mode" if the inverter enters operation state.
- The distribution of custom parameters is stored in the panel, so such distribution is still valid even if the panel is removed from this inverter and then installed on other inverters.

10-2. Method of setting and changing function parameter data in custom mode

Used to set, change and confirm function parameter data distributed to custom parameter No. In respect of changeable function parameters during operation, refer to "changeable during operation " item in "9-2 Function parameters table".
(See page 57)

Caution When changing the data during operation, the inverter may starts or stops suddenly if the motor and motor load changes greatly.
(Ensure personal safety before using this function.)
Failure to do so could lead to injury.

[Setting example] Change "P002" (1st deceleration time) data distributed to custom parameter "U001" from "5.0" to "10.0"



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SET

Press the SET button to set the data.
If data is changed during operation, new data is applied hence.

Note

- After the data is set, the inverter will not run unless the MODE button is pressed and the "operation status display mode" is set to.
- While changing the data, the mode will return to the "operation status display mode" if a stop signal is input and the inverter stops.
- During data changing, the "0V stop" will be returned to if the inverter 0V stops.
- While changing the data in the "0V stop state", the mode will return to the "operation status display mode" if the inverter enters operation state.
- During operation, the parameters other than those that can be changed will be monitored only. (The data can only be displayed, but cannot be changed.)

11. Setting mode and copy function of built-in memory

In VF100 inverter, main unit and operation panel both have built-in memory and "parameter copy function". Remove the panel and copy the data inside the panel to main unit in other VF100 inverter. Four parameter copy functions are available. In the "function setting mode", "CPY1~CPY4" are displayed after P151. Parameter copy function can be used depending on using the setting data. In addition, the data of memory built into the panel can be confirmed in "built-in memory setting mode".

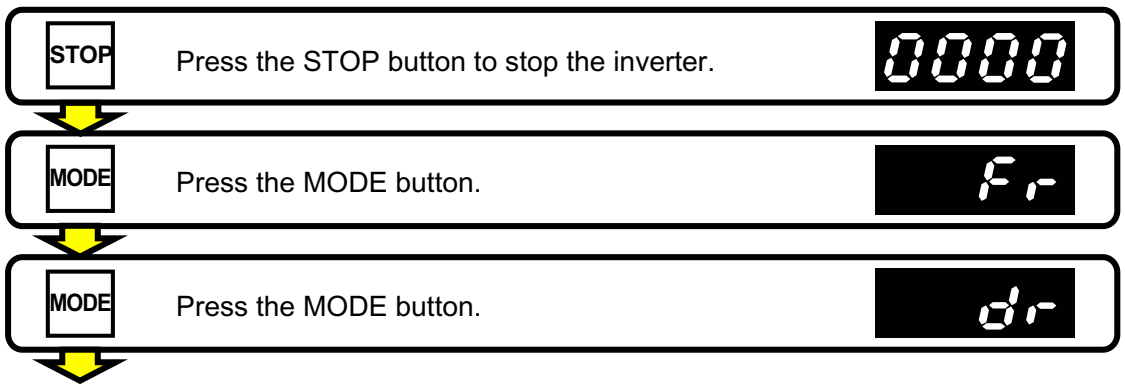
Copy parameter No.	Function name	Details	Related page
CPY1	Upload function	Upload the parameter setting of the main unit to built-in memory parameters of the operation panel.	147
CPY2	Down function	Download the built-in memory parameters of the operation panel to the parameter setting of the main unit.	149
CPY3	Check function	Confirm whether function parameter of the main unit is in conformity with details on built-in memory parameters of the operation panel.	150
CPY4	built-in memory setting mode select	Display or undisplay of built-in memory setting mode can be selected in setting mode display select.	152

11-1. Setting method of built-in memory parameters

Built-in memory parameters are E001~E151 in conformity with details of each function parameter P001~P151. Built-in memory parameter data can be changed in "built-in memory setting mode".

■ Setting and changing built-in memory parameters

[Setting example] Change the maximum output frequency from 50.0Hz to 60.0Hz.
(Changing the built-in memory parameter E008 data from "50.0" to "60.0")



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MODE — Press the MODE button.

MODE — Press the MODE button.
(If a password is set, it's necessary to input the password. Refer to page 139.)

MODE — Press the MODE button.

MODE — Press the MODE button to select built-in memory setting mode.
(If the mode is not displayed, set the copy function 4 to "E2P")

▲ — Press the UP button seven times and change built-in memory parameter No. to E008.

SET — Press the SET button to display built-in memory parameter E008 data.
(Main display will flicker.)

▲ — Press the UP button to set the displayed value to "60.0".
(Main display will flicker.)

SET — Press the SET button to set the data.

MODE — Press the MODE button and enter the operation preparation completed state.

Operation preparation completed state

・・・ The normal stop state will be entered and the inverter can be run.
(Operation status display mode)

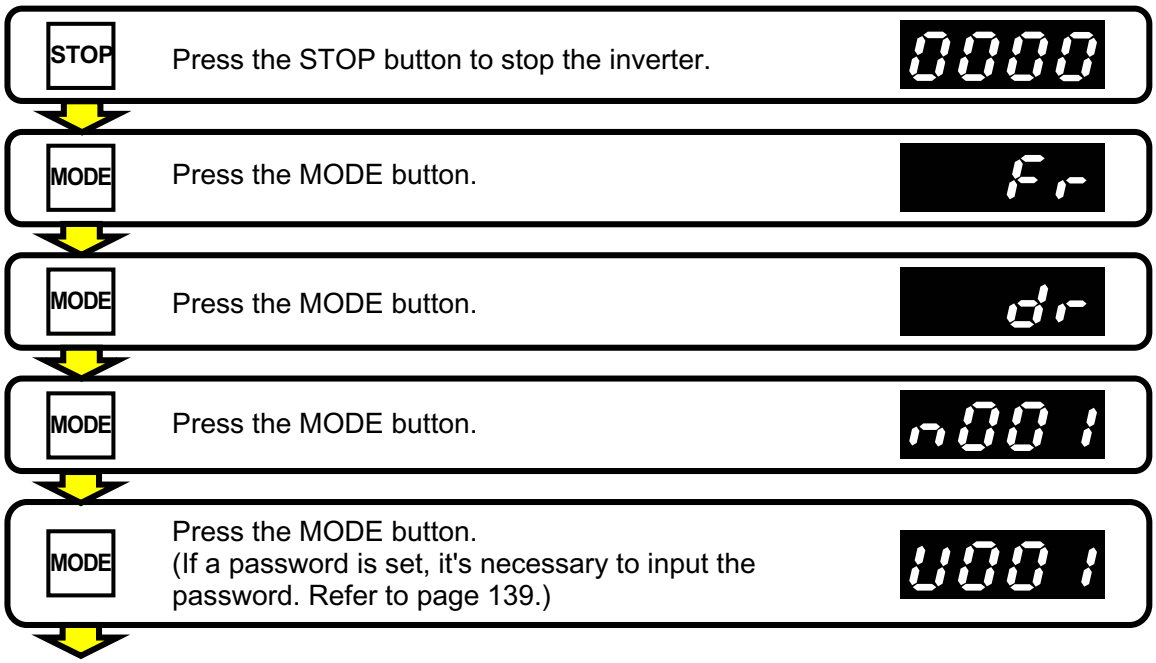
Note

- Function parameter data of the main unit connected with the operation panel will not change even if built-in memory parameter data is changed.
- While changing the data, the mode will return to the "operation status display mode" if a stop signal is input and the inverter stops.
- During data changing, the "0V stop state" will be returned to if the inverter stops at zero.
- While changing the data in the "0V stop", the mode will return to the "operation status display mode" if the inverter enters operation state.
- During operation, the parameters other than those that can be changed will be monitored only. (The data can only be displayed, but cannot be changed.)
- While setting and changing the data, the set data will be written in non-volatile memory inside the inverter and the data will be stored even if the power is turned off. Max. writing times of the non-volatile memory inside the inverter is 100,000 times. Note that function parameter No. cannot be changed too frequently.

11-2 Upload function of parameters (CPY1)

Upload all function parameters of the main unit connected with the operation panel to built-in memory inside the operation panel. After data value is set to "UPL", all upload will start.

■ Upload method of function parameters



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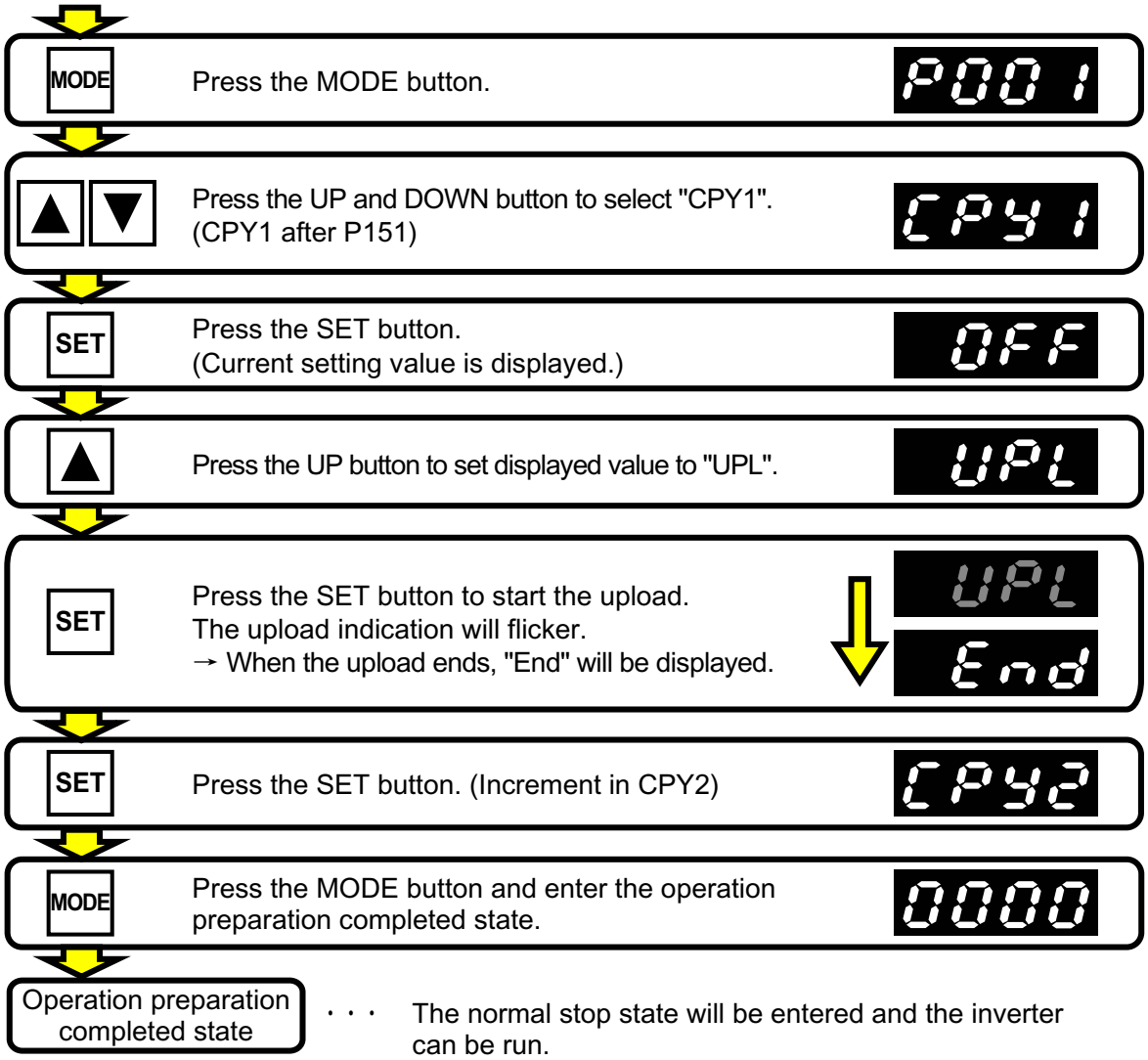


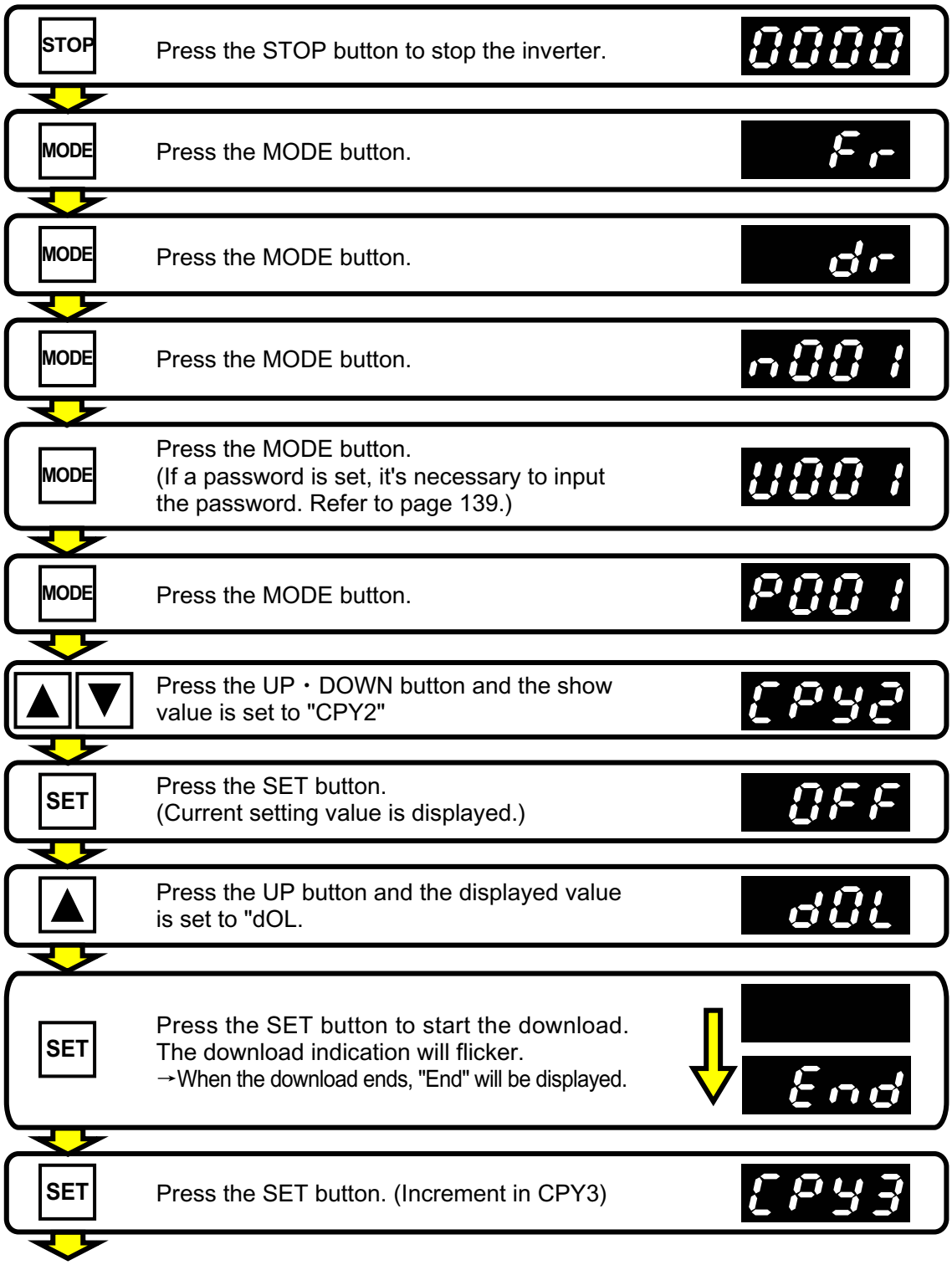
Note

- The function cannot be used during operation. Always use this function in the stopped state.
- When the upload ends, built-in memory parameter data and parameters of the main unit are the same.
- If a run signal enters during uploading, the operation will not be activated. After the operation preparation completed state is returned to, OP trip will occur.
- While uploading the data, the set data will be written in non-volatile memory inside the inverter and the data will be stored even if the power is turned off. Max. writing times of the non-volatile memory inside the inverter is 100,000 times. Take note of the uploading times.

11-3. Download function of parameters (CPY2)

All setting values of function parameters of the main unit are changed to the setting values of built-in memory parameters inside the connected operation panel. After data value is set to "dOL", all download will be activated.

■ Download method of built-in memory parameters



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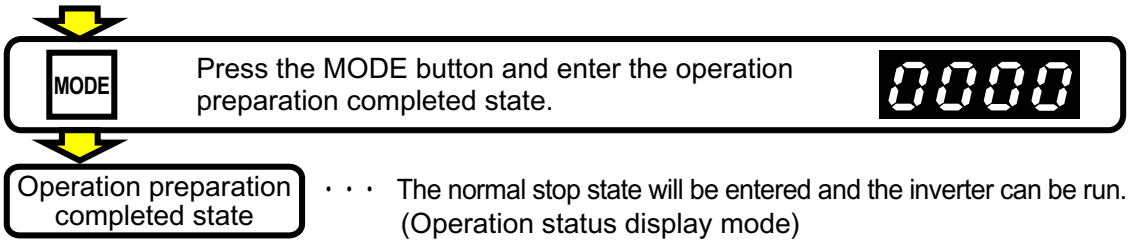


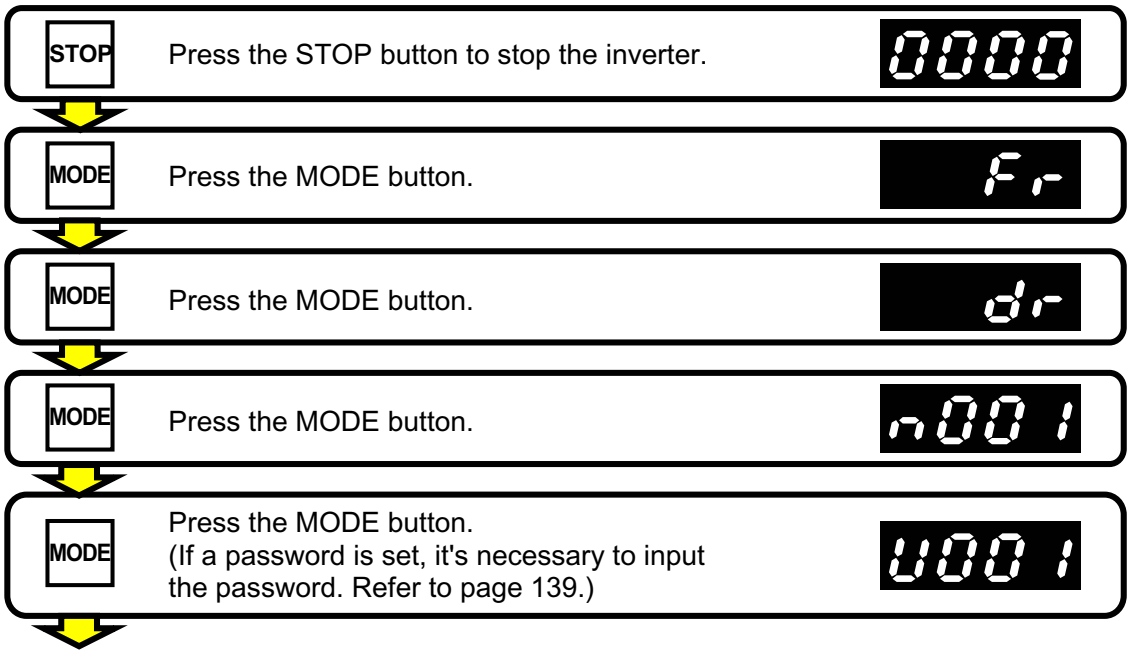
Note

- The function cannot be used during operation. Always use this function in the stopped state.
- When the download ends, built-in memory parameter data and parameters of the main unit are the same.
- If a run signal enters during downloading, the operation will not be activated. After the operation preparation completed state is returned to, OP trip will occur.
- While downloading the data, the set data will be written in non-volatile memory inside the inverter and the data will be stored even if the power is turned off. Max. writing times of the non-volatile inside the inverter is 100,000 times. Take note of the downloading times.

11-4. Check function of parameters

Used to compare and verify the setting values of function parameters of the main unit and the setting values of built-in memory parameters inside the connected operation panel. After data value is set to "VEr", comparison and verification will be activated.

■ Check method of parameters



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MODE — Press the MODE button. — P001

▲ ▼ — Press the UP・DOWN button and the show value is set to "CPY3". — CPY3

SET — Press the SET button. (Current setting value is displayed.) — OFF

▲ — Press the UP button and the displayed value is set to "VEr". — VEr

SET — Press the SET button to start the check. Check indication will flicker. — VEr

● Compare the data in various cases
- Compare the data in various cases and the displayed parameter No. will flicker.
- In this case, while the UP button is held down, the main unit data will be displayed. While the DOWN button is held down, built-in memory data inside the operation panel will be displayed.
- Press the SET button and the next data will start the verification again.
- Press the MODE button to stop the verification and "CPY3" will be displayed.

When all check ends, "End" will be displayed. — End

SET — Press the SET button. (Increment in CPY4) — CPY4

MODE — Press the MODE button and enter the operation preparation completed state. — 0000

Operation preparation completed state ・・・ The normal stop state will be entered and the inverter can be run. (Operation status display mode)

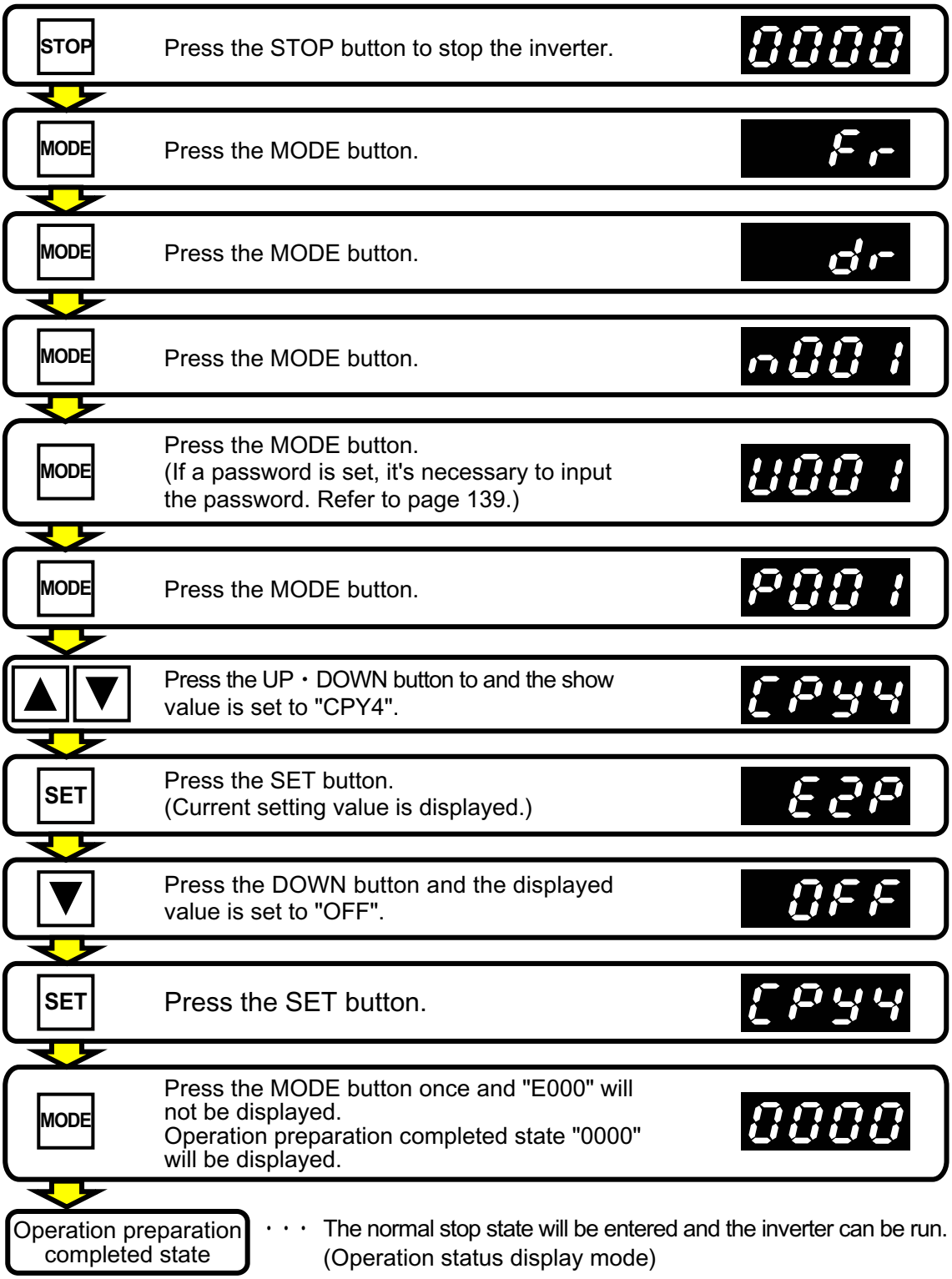
Note

- The function cannot be used during operation. Always use this function in the stopped state.
- If a run signal enters during checking, the operation will not be activated. After the operation preparation completed state is returned to, OP trip will occur.

11-5. Display or undisplay of built-in memory setting mode

Used to select whether to display the built-in memory setting mode or not. If copy function is not used, undisplay can be set to simplify the operation. If value is set to "E2P", built-in memory setting mode will be displayed. If value is set to "OFF", this mode will not be displayed.

■ Built-in memory setting mode is set to undisplay.



Note

- The function cannot be used during operation. Always use this function in the stopped state.
- If a run signal enters during data selecting, the operation will not be activated. After the operation preparation completed state is returned to, OP trip will occur.

12. Supplementary Explanation of Communication Function

12-1. About communication protocol

VF100 conforms to two protocols that are "MEWTOCOL-COM" and "MOD-BUS (RTU)".
In any event, 1: N communication is always applied.

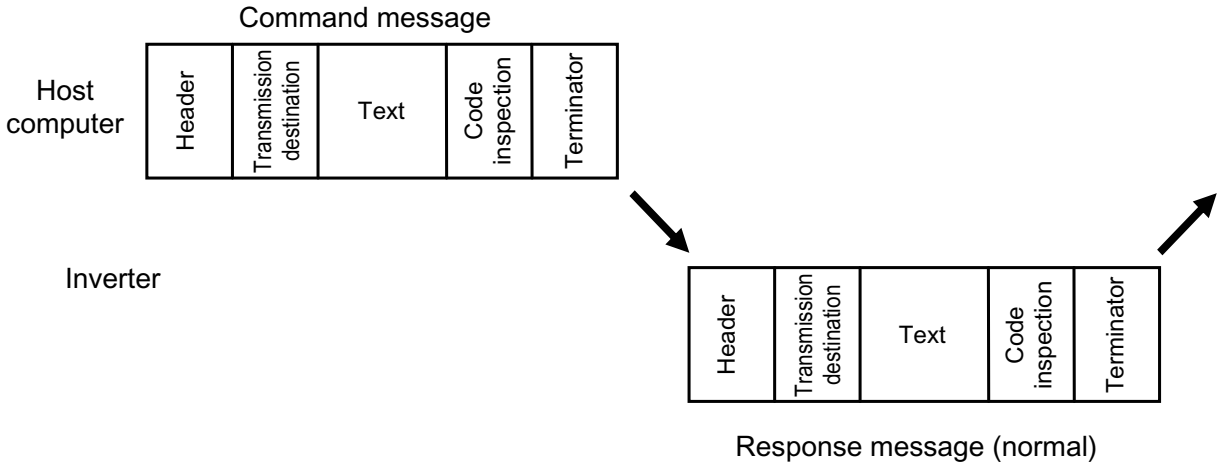
- "MEWTOCOL-COM"
  Communication protocol used for programmable logic controller (PLC) in our company.

- "MOD-BUS (RTU)"
  Communication protocol applicable to programmable logic controller (PLC) developed by the U. S.

12-2. General remarks on MEWTOCOL-COM in inverter

Host computer transmits command (order) to the inverter, and receives response (answer) from the inverter.
According to this step, by means of session between host computer and inverter, the host computer can receive or transmit various messages.

- ASCII code transmission.
- Original transmission right belongs to the host computer.
- Each time a command message is transmitted, the transmission right will be transferred.



12-3. Precautions on MEWTOCOL-COM in inverter

The inverter conforms to MEWTOCOL-COM, however, note that there are some differences as below.

(1) It does not support multiple frames, but only support single frame.

(2) The usable commands are the following 11 types:
RCS, RCP, WCS, WCP, RCC, WCC, RD, WD, MC, MD, MG

(3) The data code when using WD and RD commands is "D" (data register)

(4) The constant code when using WCS, WCP, RCS and RCP commands is "R" (internal relay)

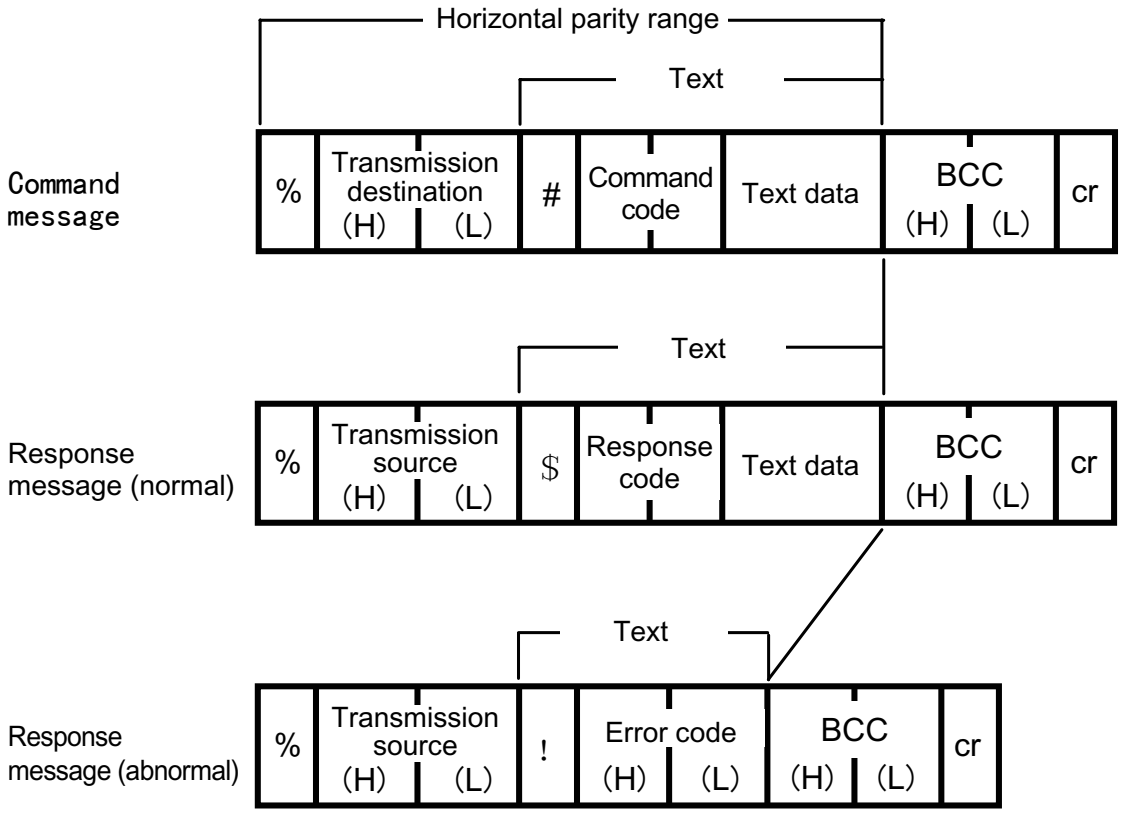
(5) A maximum of 40 contacts can be registered for the MC command.

(6) Header supports "%" only.

(7) There is no distinction between data and setting areas in the internal memory of the inverter. It can be treated as word data (16 bits) and contact data (1 bit) for the same address (region).

12-3.1 About message format

[Basic format (single frame)]



12-3.2 Message formation

Various factors used for constituting the message are specified as below.

[Control code]

Name	character	ASCII code (HEX)	Description
Header	%	25	Indicates the start of message.
Command	#	23	Indicates command message.
Response(normal)	$	24	Indicates normal response message.
Response(abnormal)	!	21	Indicates abnormal response message.
Terminator	cr	0D	Indicates the end of message.

[Transmission destination and transmission source]

Indicated with 2 bits decimal number. (H) indicates 10 bits and (L) indicates 1 bit. 01~31(ASCII code) is valid.

To display communication station No. (transmission destination) used for receiving command message in command message.

To display communication station No. (transmission source) used for transmitting response message in response message.

Namely, transmission destination and transmission source are the same communication station No.

When full station transmission (Command message is transmitted to all communication stations simultaneously.) is applied, transmission destination of command message is "FF", and response message in relation to this command message will not be sent back.

[Block Check Character (BCC)]

Indicated with 2 bits hexadecimal number (00~FF, ASCII code). Horizontal parity is used for checking the error code in transmitted data.

However, when * * instead of BCC is input, transmission can be performed without BCC. In this case, there is still BCC in response.

Refer to "Compiling method of BCC code" on the next page.

[Error code]

Indicated with 2 bits decimal number. The details will be displayed if error occurs.

Refer to " Error codes table" on page 195.

12-3.3 Compiling method of BCC (Block Check Character)

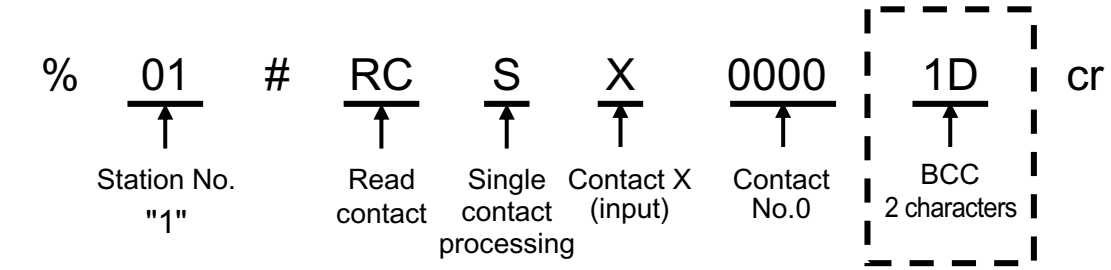
In order to improve reliability of data transmission, horizontal parity is used for error inspection.

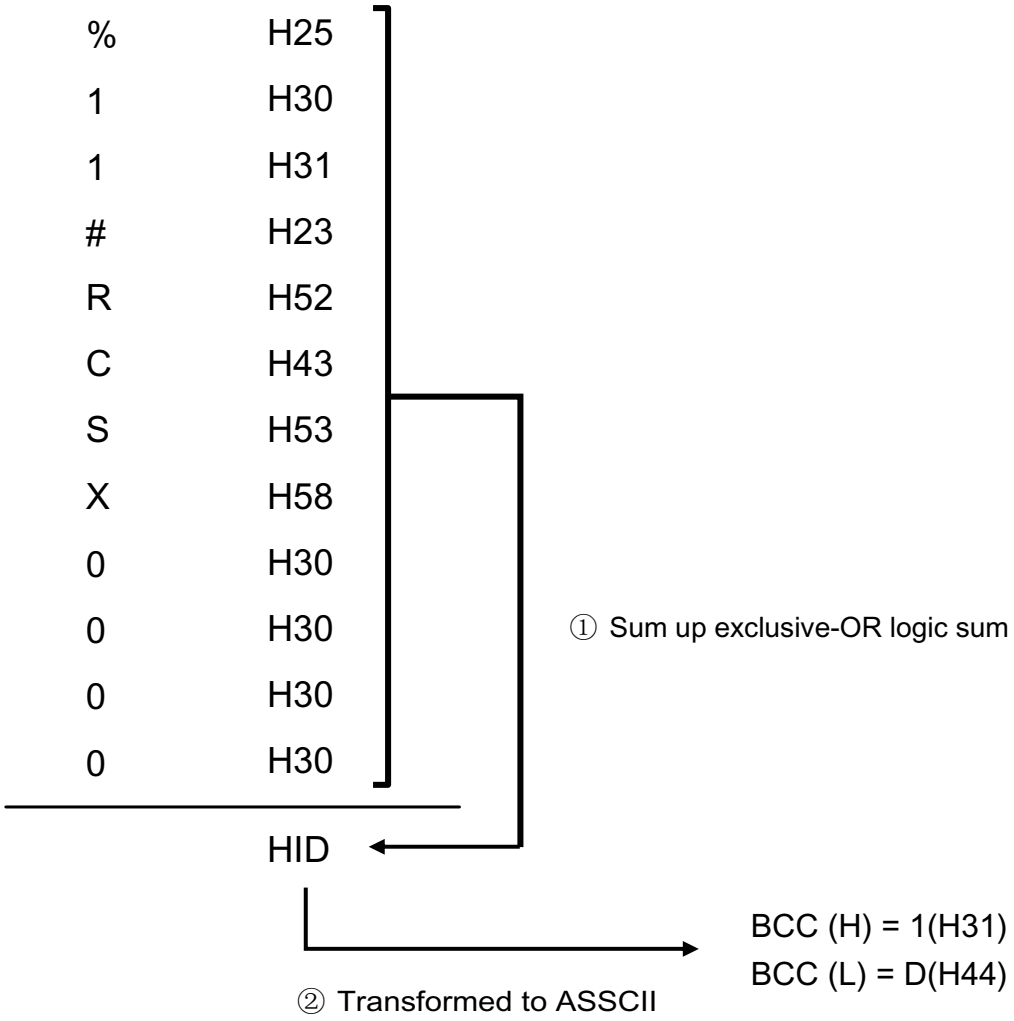
BCC is code applicable to horizontal parity check.

BCC sums up the exclusive-OR logic from header (%) to text final character. Compiling is carried out after this 8 bits data is transformed to 2 characters of ASCII code.

In respect of exclusive-OR logic sum from header (%) of the received message to text final character, verify the consistence of the data after transmission. If the conditions before and after the transmission are different, it indicates some errors occur in communication.

[Example]





12-4. MEWTOCOL-COM command in inverter

The usable commands are the following 11 types.

Code command	Details
RCS	Read Contact Message in 1 Contact Unit
RCP	Read Multiple Contacts Message
RCC	Read Contact Message in Word Unit
WCS	Write Contact Message in 1 Contact Unit
WCP	Write Multiple Contacts Message
WC C	Write Contact Message in Word Unit
RD	Read Data Area
WD	Write Data Area
MC	Registration of Monitor Contact and Canceling of Registration
MD	Registration of Monitor Data and Canceling of Registration
MG	Performance of Monitor

- The data code when using WD and RD commands is "D" (data register).
- The contact code when using WCS, WCP, WCC, RCS, RCP, and RCC commands is "R". (internal relay)
- A maximum of 40 contacts can be registered for the MC command.
- A maximum of 16 data can be registered for the MD command.

RCS : RCS: Read Single Contact Area

[Command]

%	Transmis-sion destination (H)	Transmis-sion destination (L)	#	R	C	S	Contact code (1 character)	Contact No. (4 characters)	BCC (H)	BCC (L)	cr

Decimal address (3 bits)

Hexadecimal BIT specification (1 bit)

[Response]

・Normal response (read OK)

%	Transmis-sion source (H)	Transmis-sion source (L)	$	R	C	Contact data (1 character)	BCC (H)	BCC (L)	cr

・Error response (read error)

%	Transmis-sion source (H)	Transmis-sion source (L)	!			BCC (H)	BCC (L)	cr

Error code

[Contact code]

Contact	Data
R	"R"

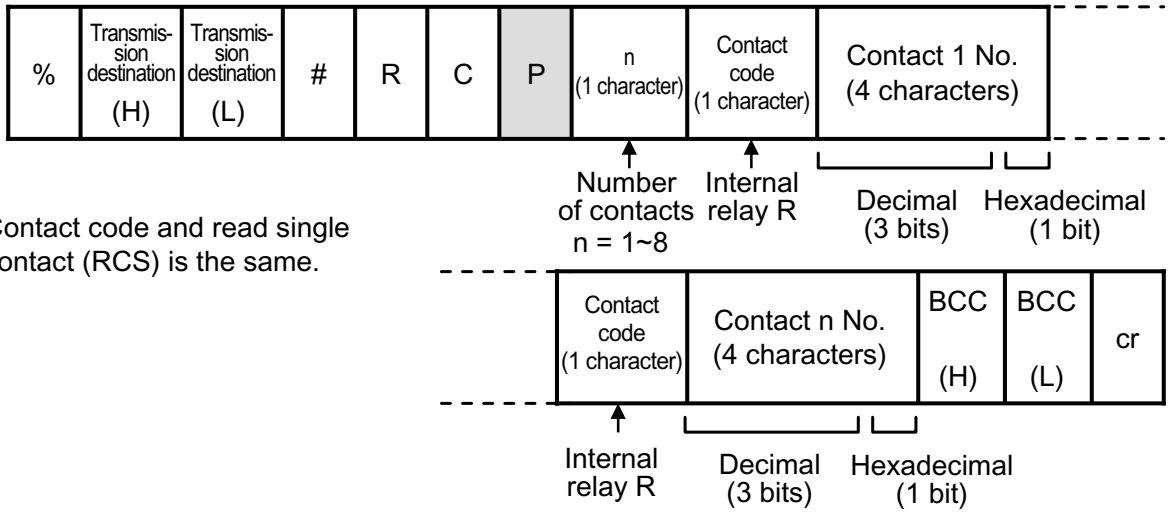
Internal relay

[Contact data]

Contact state	Data
OFF	0
ON	1

RCP : Read Multiple Contacts Area

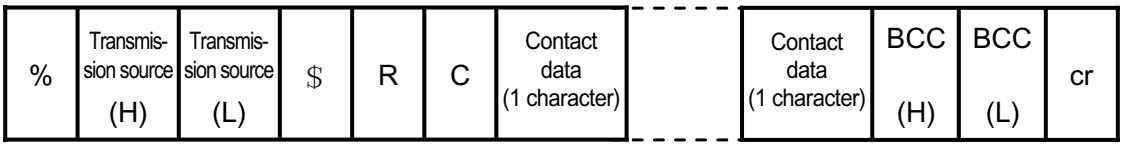
[Command]



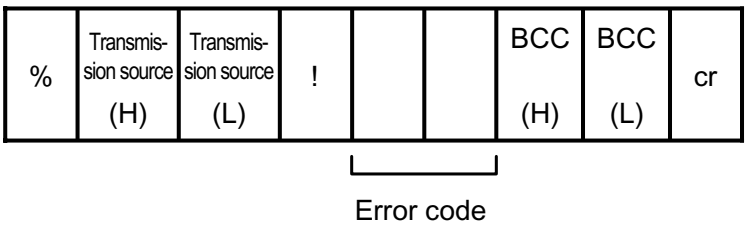
Contact code and read single contact (RCS) is the same.

[Response]

- Normal response (read OK)

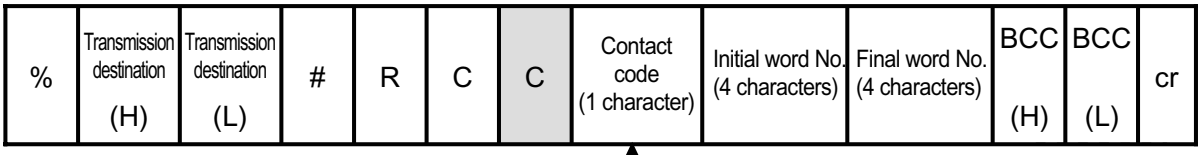


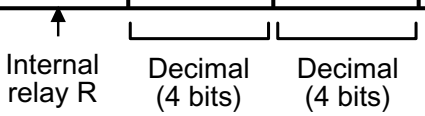
- Error response (read error)



RCC：Read Contact Area (block in word unit)

[Command]

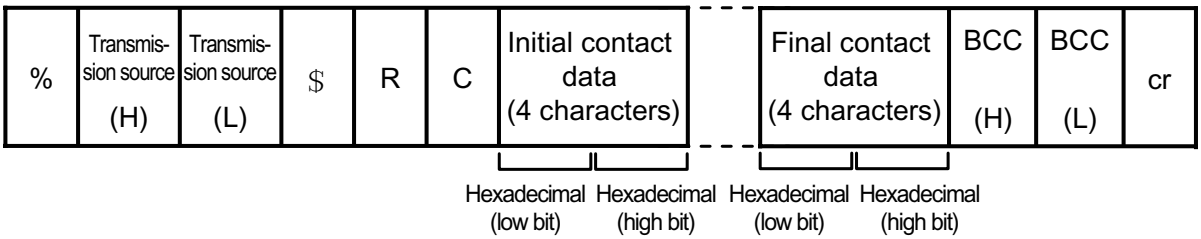




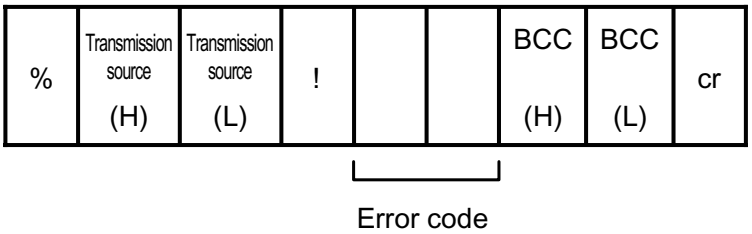
Contact code and read single contact (RCS) is the same.

[Response]

・ Normal response (read OK)



・ Error response (read error)



WCS : Write Single Contact Area

[Command]

%	Transmis-sion destination (H)	Transmis-sion destination (L)	#	W	C	S	Contact code (1 character)	Contact No. (4 characters)	Data (1 character)	BCC (H)	BCC (L)	cr

Decimal address (3 bits)

Hexadecimal BIT specification (1 bit)

[Response]

・ Normal response (write OK)

%	Transmis-sion source (H)	Transmis-sion source (L)	$	W	C	BCC (H)	BCC (L)	cr

・ Error response (write error)

%	Transmis-sion source (H)	Transmis-sion source (L)	!			BCC (H)	BCC (L)	cr

Error code

[Contact code]

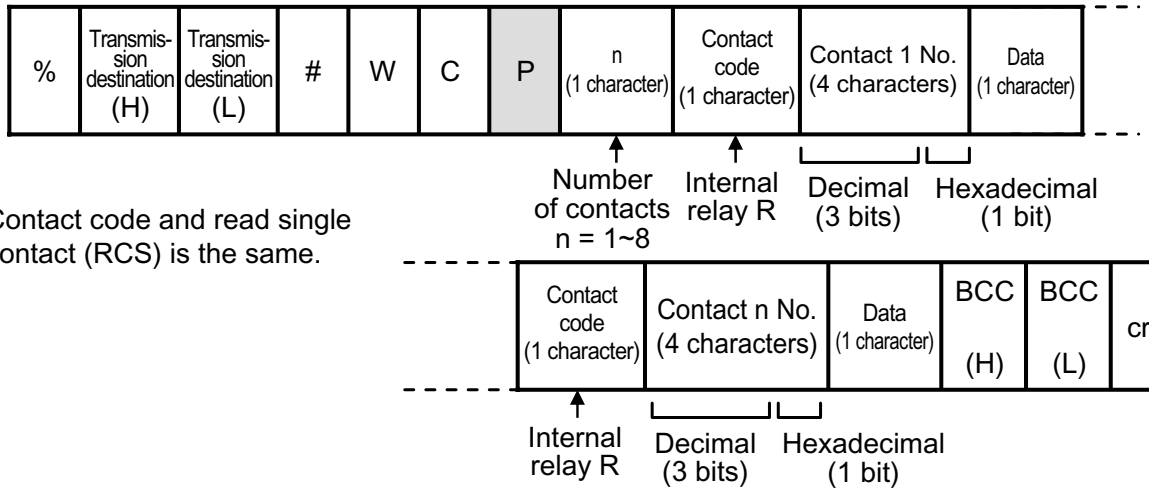
Contact	data	
R	"R"	Internal relay

[data]

Contact state	data
OFF	0
ON	1

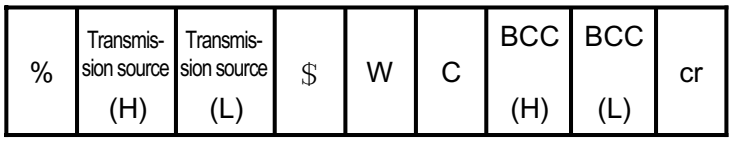
WCP : Write Multiple Contacts Area

[Command]

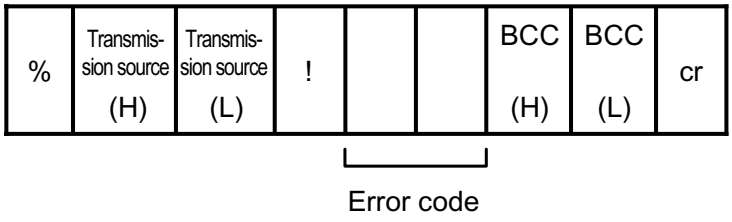


[Response]

- Normal response (write OK)



- Error response (write error)

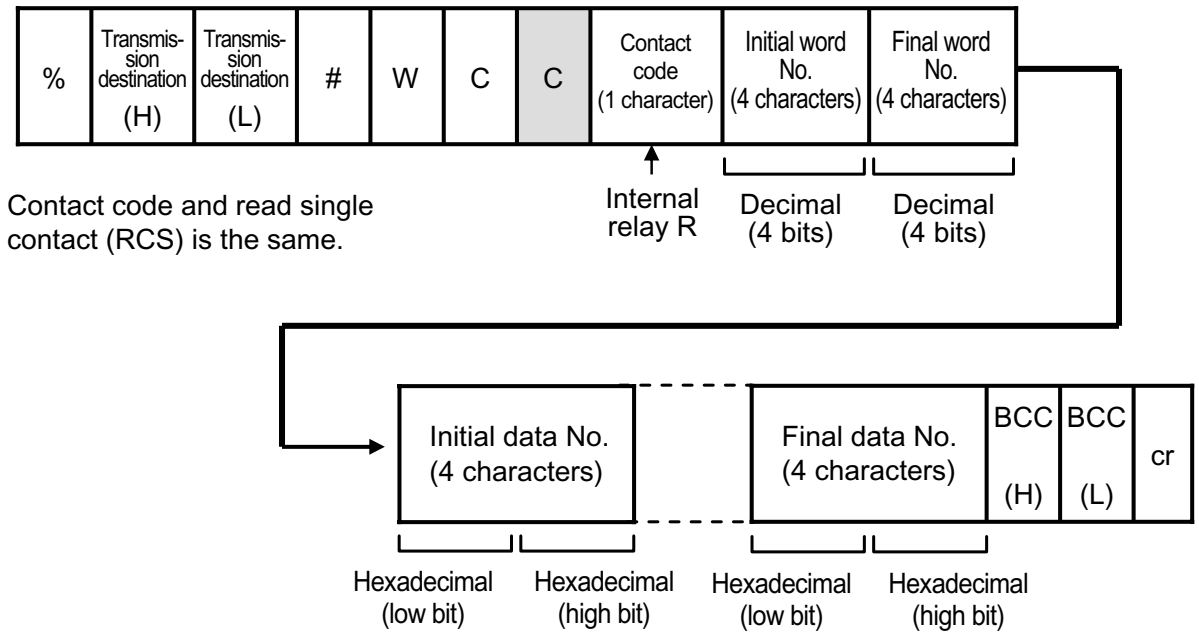


[Data]

Contact state	Data
OFF	0
ON	1

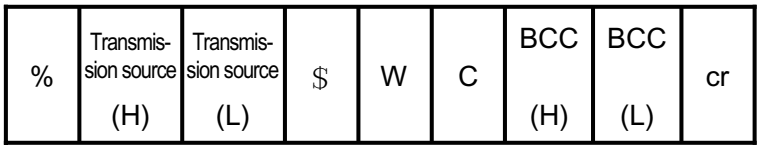
WCC : Write Contact Area (block in word unit)

[Command]

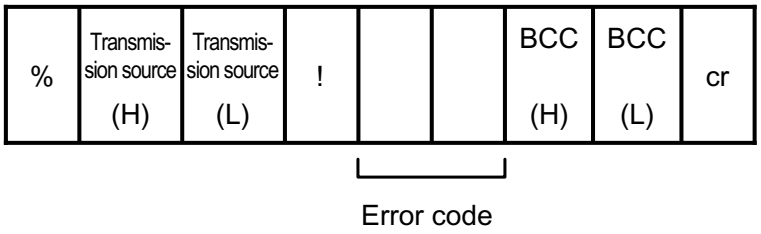


[Response]

- Normal response (write OK)

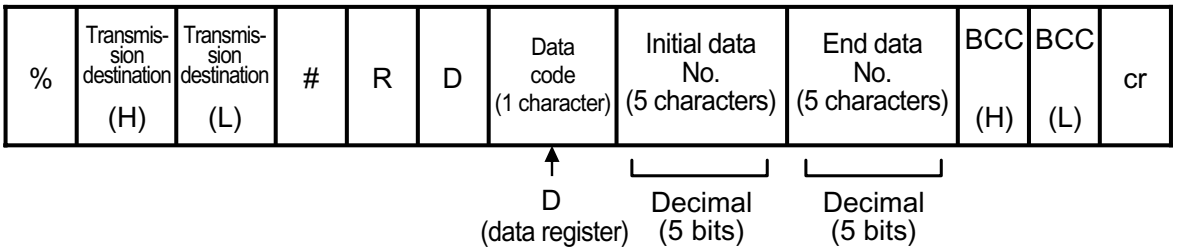


- Error response (write error)



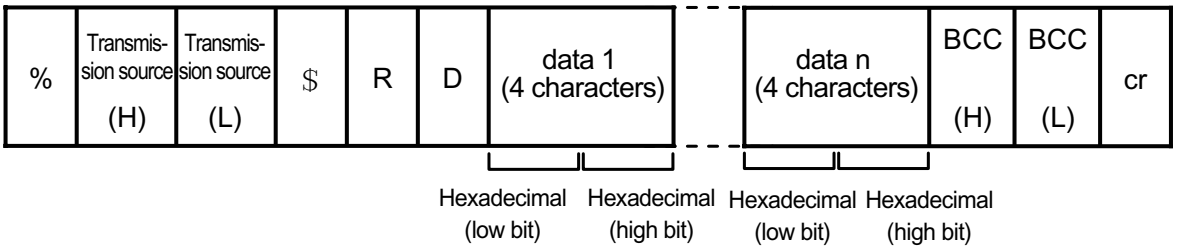
RD：Read Data Area

[Command]

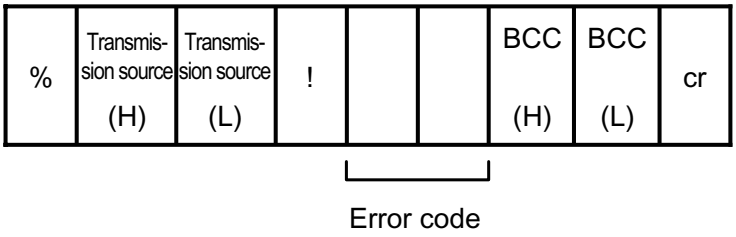


[Response]

・ Normal response (write OK)



・ Error response (write error)

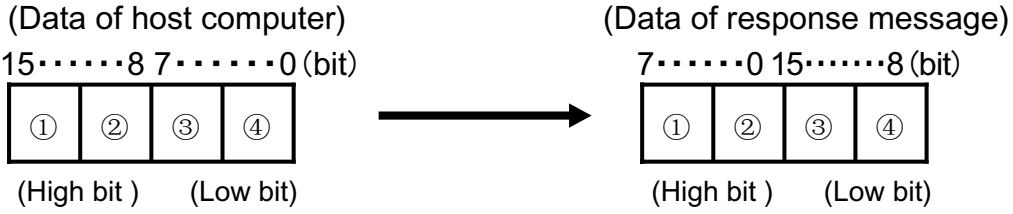


[Data code]

Data register	Data
DT	"D"

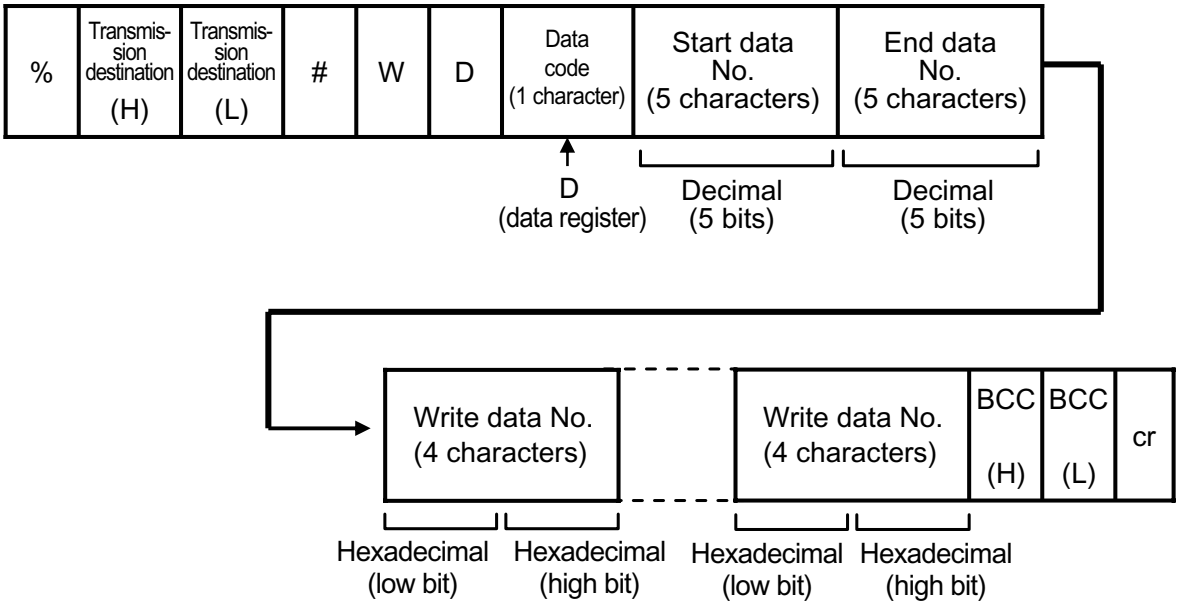
・ Read method of the data

Note that high byte and low byte switch and they are stored in the message.



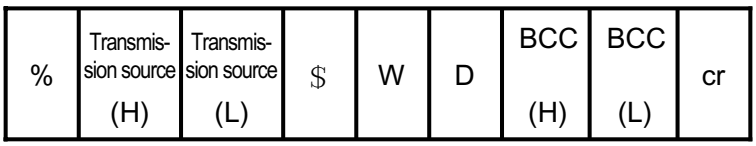
WD：Write Data Area

[Command]

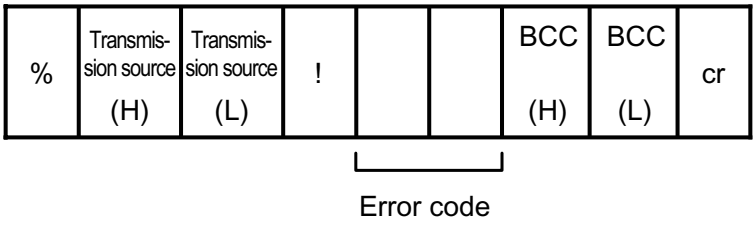


[Response]

- Normal response (write OK)



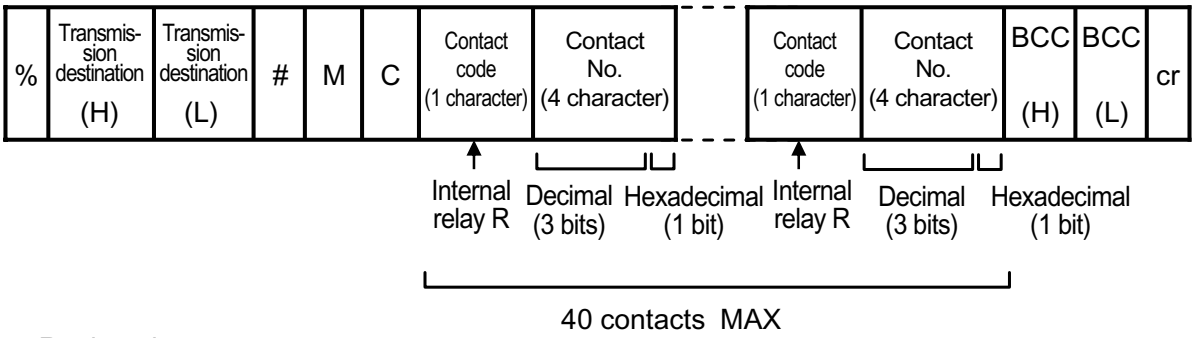
- Error response (write error)



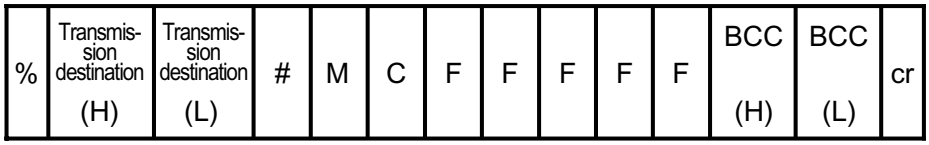
MC：Registration of Monitor Contact and Registration Reset

[Command]

・ Registration

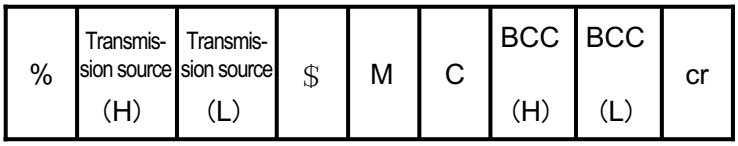


・ Registration reset

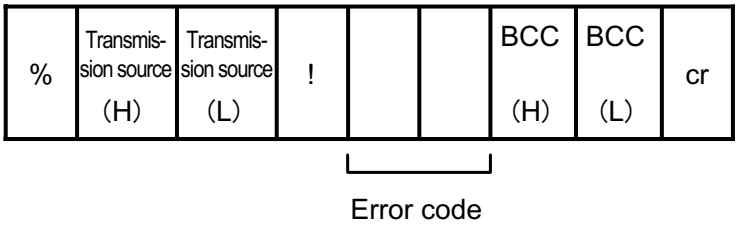


[Response]

・ Registration OK



・ Registration error

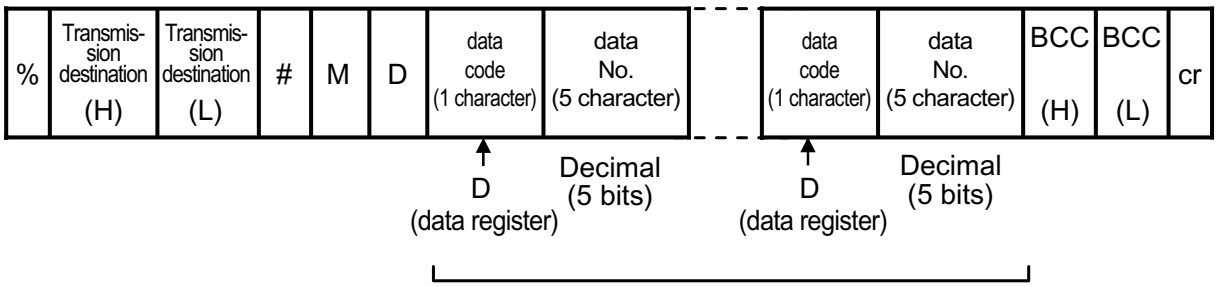


・ A maximum of 40 contacts can be registered.

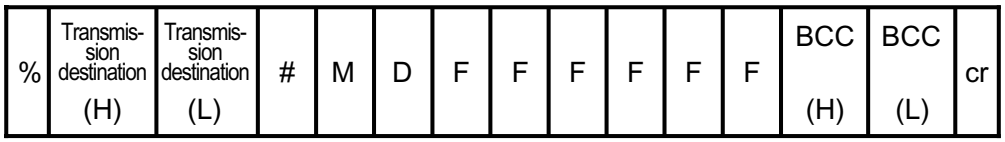
MD：Registration of Monitor Data and Registration Reset

[Command]

・ Registration

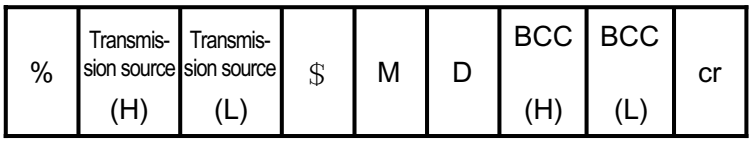


・ Registration reset

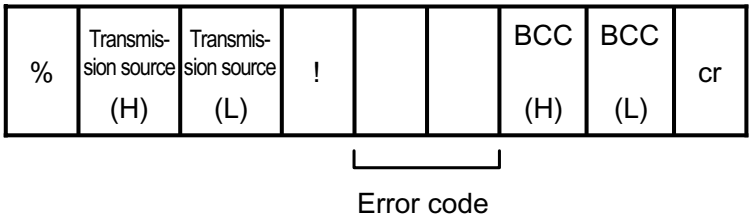


[Response]

・ Registration OK



・ Registration error



・ A maximum of 16 data can be registered.

MG : Performance of Monitor

Read contacts and state of data area registered for MC and MD commands.

[Command]

%	Transmis-sion destination (H)	Transmis-sion destination (L)	#	M	G	BCC (H)	BCC (L)	cr

[Response]

- Monitor OK

%	Transmis-sion source (H)	Transmis-sion source (L)	$	M	G	Basic counter (1 character)	Number of characters for contact (2 characters)	Contact data 1 (2 characters)	...	Contact data n (2 characters)

Hexadecimal Hexadecimal Hexadecimal

Number of characters for contact (2 characters)	data 1 (4 characters)	...	data n (4 characters)	BCC (H)	BCC (L)	cr

(low bit) (high bit) (low bit) (high bit)

Hexadecimal Hexadecimal Hexadecimal

Hexadecimal (number of data × 4)

- Registration error

%	Transmis-sion source (H)	Transmis-sion source (L)	!			BCC (H)	BCC (L)	cr

Error code

- Contact data is 2 characters and data of 8 contacts will be returned to.
- In respect of data, one out of every four data will be returned to.
- Number of characters transforms parity data to details of ASCII.
- If number of PLC scanning from last to next response reaches 10 or more in basic counter, "A" will be returned to.

12-5. Communication Summary of MOD-BUS (RTU) in Inverter

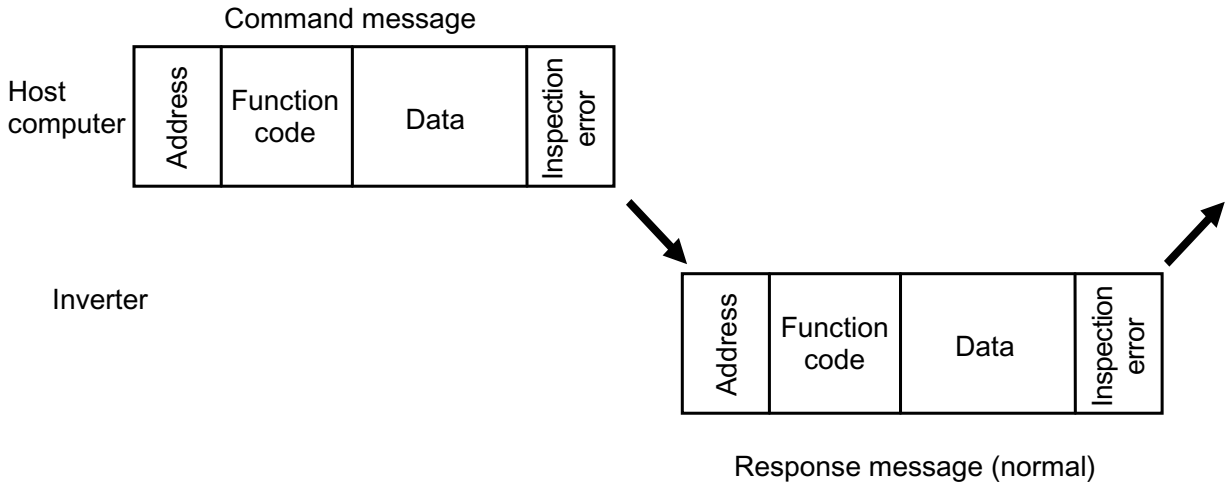
In MOD-BUS communication, host computer serves as master station and the inverter serves as slave station. The message is transmitted from master station to slave station. The slave station performs the specified function according to this command and sends back response message.

Transmission format of the command sent from the master station is composed of slave address, function code, data and error inspection field.

In addition, transmission format of response message consists of acknowledgement filed for details, response data and error inspection filed.

MOD-BUS communication in inverter only supports RTU mode.

- Original transmission right belongs to the host computer.
- Each time a command message is transmitted, the transmission right will be transferred.



12-6. Precautions on MOD-BUS (RTU) Communication in Inverter

The inverter conforms to MOD-BUS (RTU) communication, however, note that there are some differences as below.

1) The inverter has only one data block.

2) Each data can be accessed with 1 bit or 16 bits.

[Address calculation example] 9^{th} bit of address No. 123

Contact address = 123 ×16 + 9 = 1977(dec) = H07B9

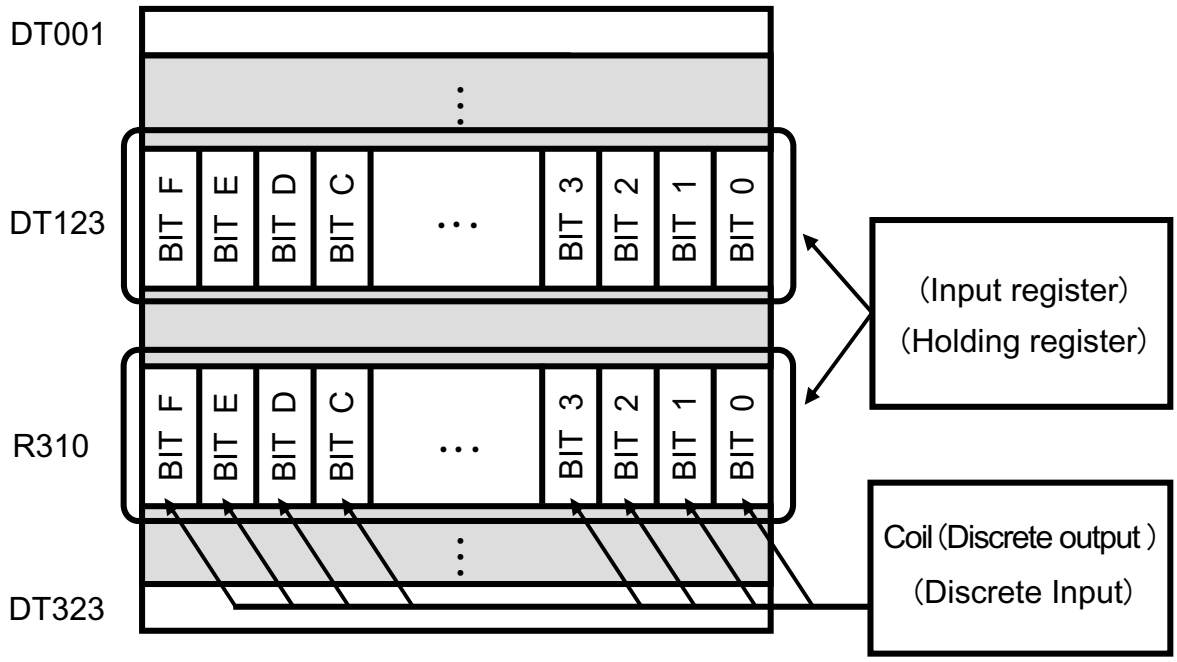
3) Function code is supported for the following eight codes.

"Read Coils",
"Read Discrete Inputs",
"Read Holding Registers",
"Read Input Registers)",
"Write Single Coil",
"Write Single Register",
"Write Multiple Coils",
"Write Multiple Registers"

4) There is no distinction between Coil (Discrete output) and Discrete input.
If the address is the same, it indicates the same contact No..

5) There is no distinction between Input register and Holding register.
If the address is the same, it indicates the same contact No..

Data address
Contact address

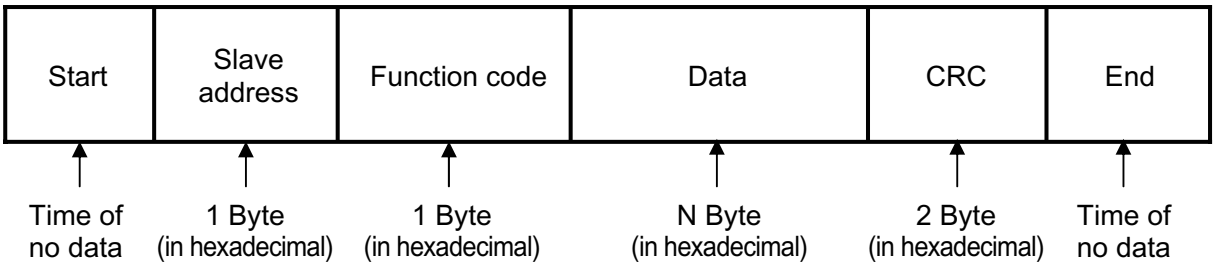


6) In MOD-BUS (RTU) communication, the start and end of the frame is normally set to 3.5 byte time with "P142: TEXT completion judgment time" in the inverter.
Setting value of parameter P142 changes depending on communication speed.

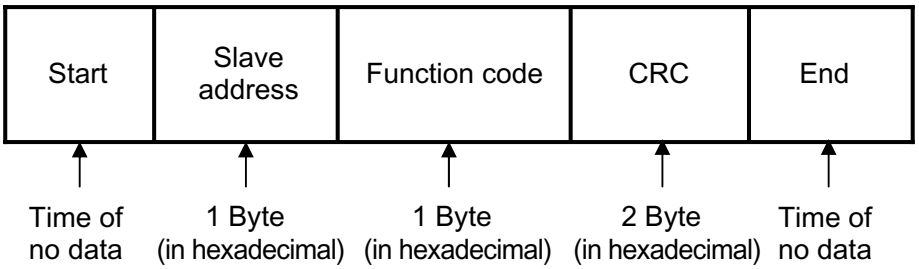
12-6.1 Message Frame

[Basic frame]

Command message/normal response message



Error response message



12-6.2 Message Formation

Various factors of the message are specified as below.

[Start / End]

In MOD-BUS (RTU) communication, the start and end of the frame is normally set to 3.5byte time with "P142: TEXT completion judgment time" in the inverter.
Setting value of parameter P142 changes depending on communication speed.

[Slave addresses]

The setting range is 1 to 31. ("P136: Communication station No.") "0" is broadcast (full station command). During broadcasting, no response message is sent back in relation to this command message.

[Function code]

Function code is supported for the following eight codes.

"(Read Coils)",
"Read Discrete Inputs",
"Read Holding Registers",
"Read Input Registers",
"Write Single Coil",
"Write Single Register",
"Write Multiple Coil",
"Write Multiple Registers"

[CRC code]

CRC code is used for checking the error in message frame during data transmission. Transmit side adds CRC code to message frame after calculation. Receive side also calculates CRC code of the received data. Then the two CRC codes are verified.
CRC code is CRC-16(CRC-ANSI). It is determined and calculated by the right feed of HA001.
($x^{16}+x^{15}+x^2+1$)

- When the CRC code of received data is not correct, no processing is carried out and no response data is sent.
- When the CRC code of received data is H00, no CRC check is performed.
  The response data is sent back with the calculated CRC code.

12-7. Function code for MOD-BUS (RTU) in inverter

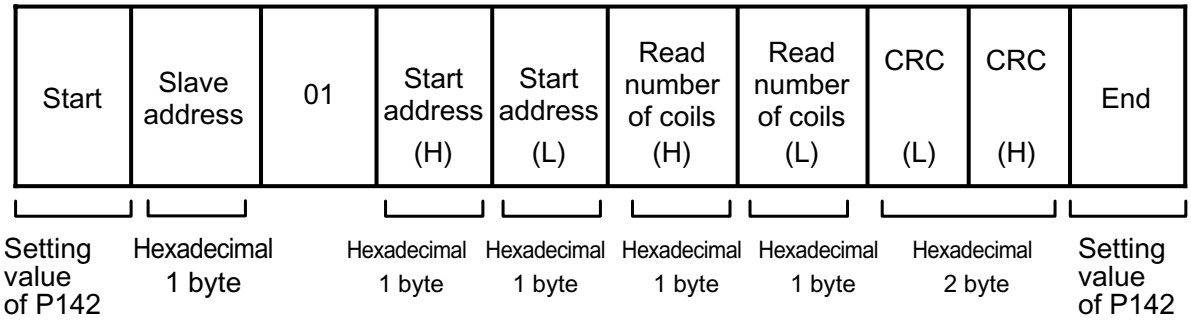
The inverter is supported for the following eight codes.

Function code		Name	Maximum number of read/write
DEC	HEX		
01	H01	Read Coils	32 coils
02	H02	Read Discrete Inputs	32 coils
03	H03	Read Holding Registers	32 registers
04	H04	Read Input Registers	32 registers
05	H05	Write Single Coil	1 coil
06	H06	Write Single Register	1 register
15	H0F	Write Multiple Coils	32 coils
16	H10	Write Multiple Registers	32 registers

- There is no distinction between Coil (Discrete output) and Discrete input, nor between Input register and Holding register.

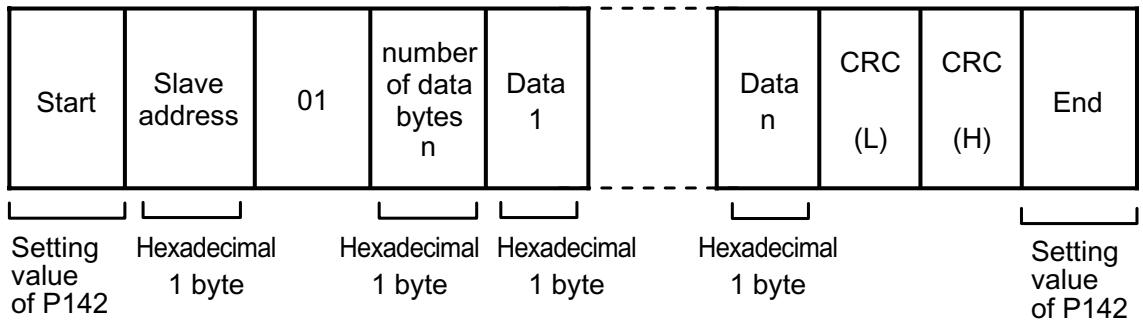
Read Coil : "H01"

[Command]



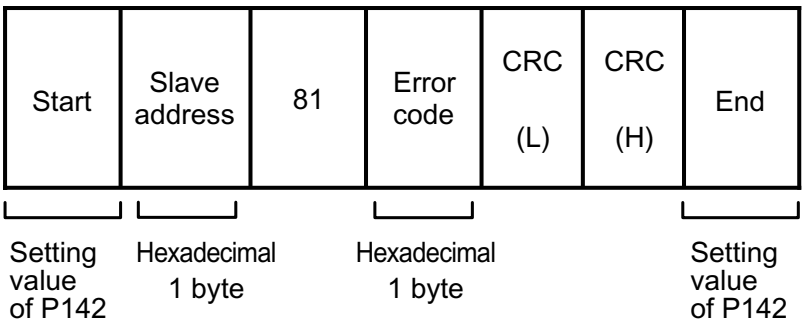
[Response]

- Normal response (read OK)



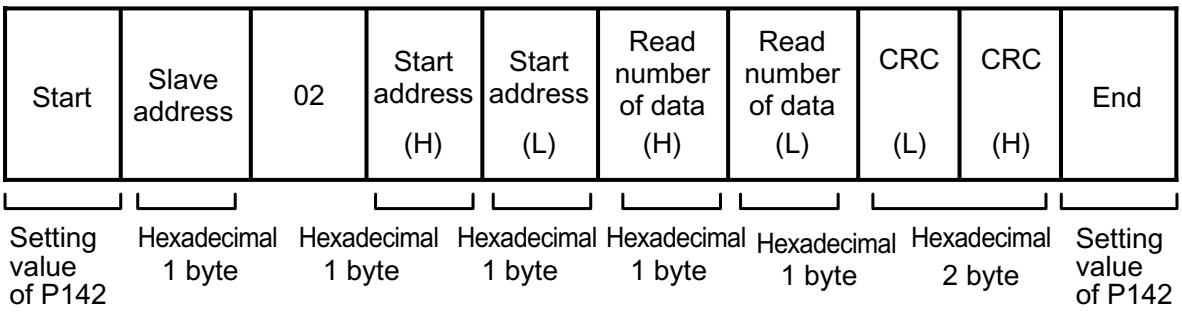
  - The lowest bit of data 1 is coil data of starting to read address.
  - If the last data coil is less than 8 bits, 0 is added.

- Error response (read error)



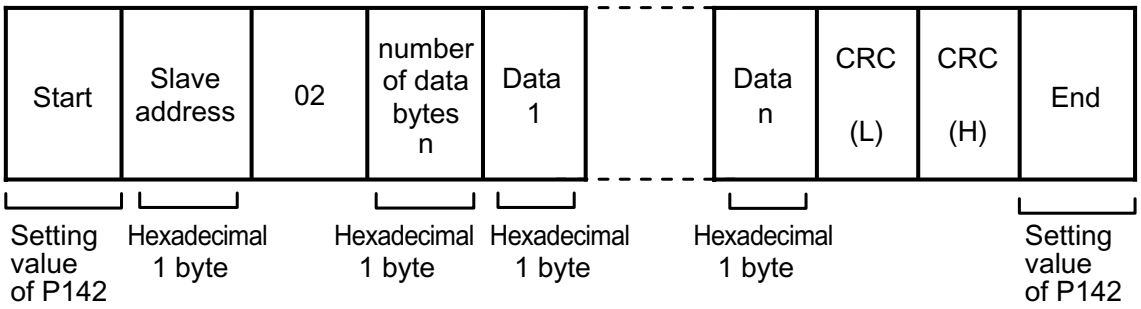
Read Discrete Input : "H02"

[Command]



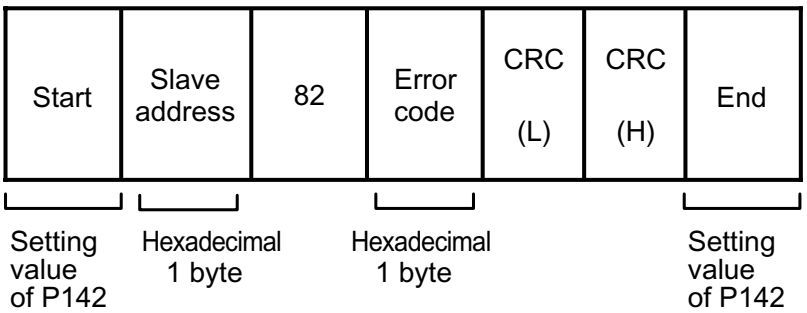
[Response]

- Normal response (read OK)



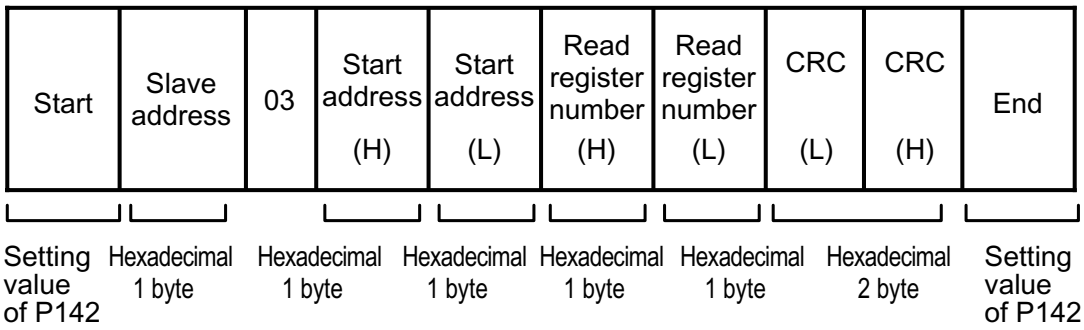
  - The lowest bit of data 1 is coil data of starting to read address.
  - If the last data coil is less than 8 bits, 0 is added.

- Error response (read error)



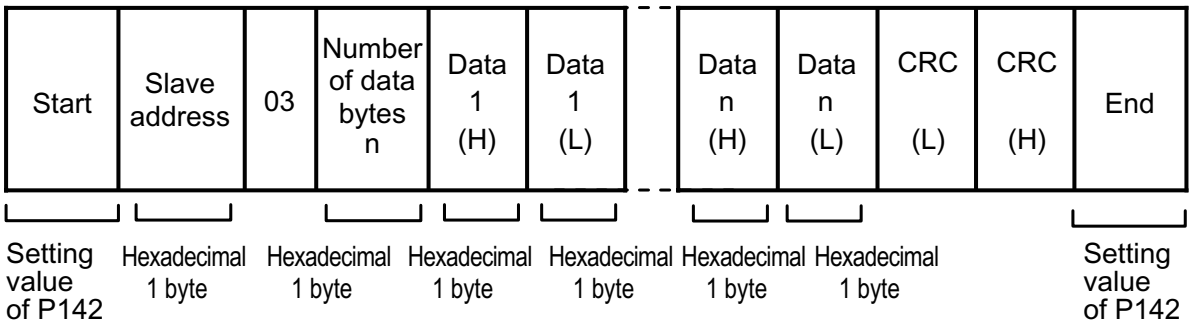
Read Holding Registers : "H03"

[Command]



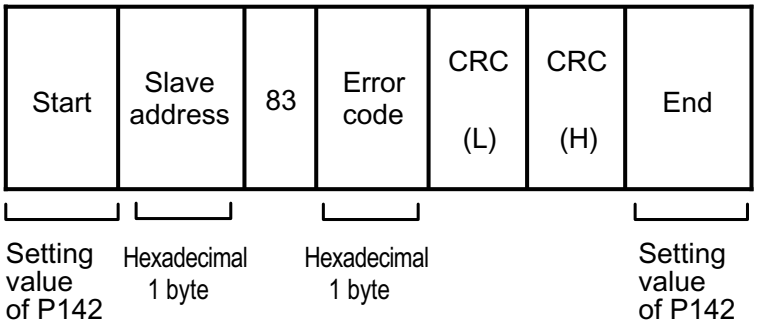
[Response]

・ Normal response (read OK)



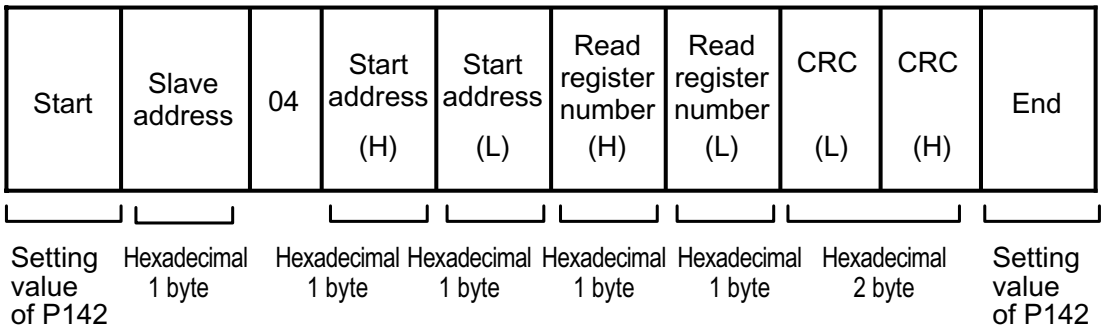
・ Register is 2 bytes, so number of data bytes is two times of read register number.

・ Error response (read error)



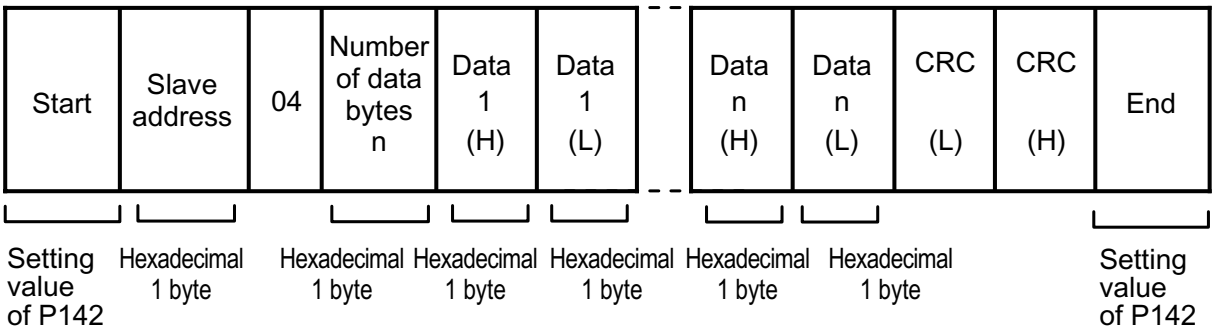
Read Input Registers : "H04"

[Command]



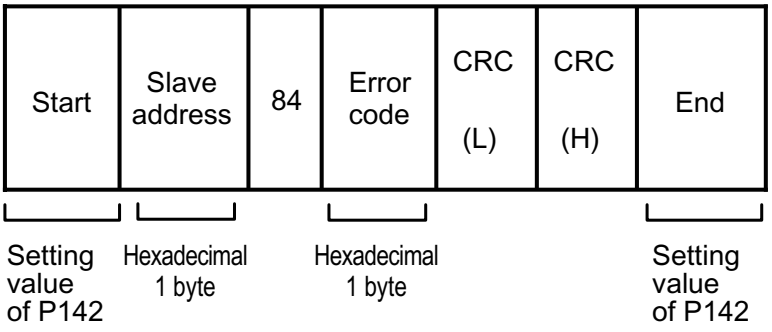
[Response]

・ Normal response (read OK)



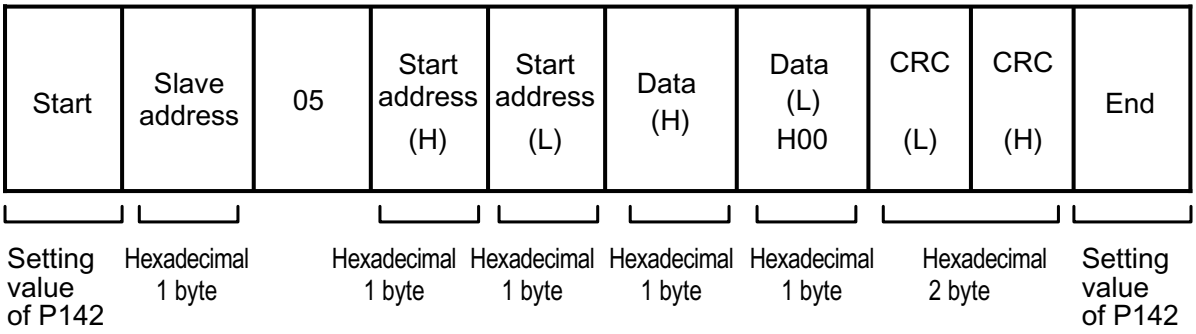
・ Register is 2 bytes, so number of data bytes is two times of read register number.

・ Error response (read error)



Write Single Coil : "H05"

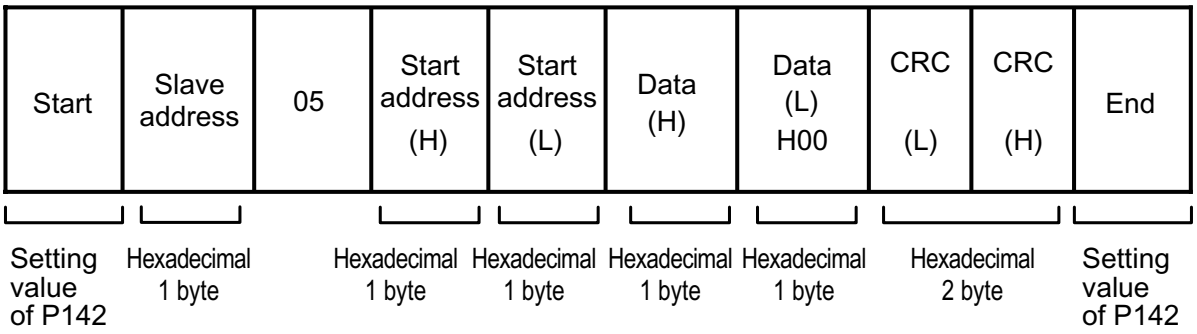
[Command]



- When data (H) is turned to ON, HFF is set to. When turned to OFF, H00 is set to.
- Data (L) is fixed to 00H.

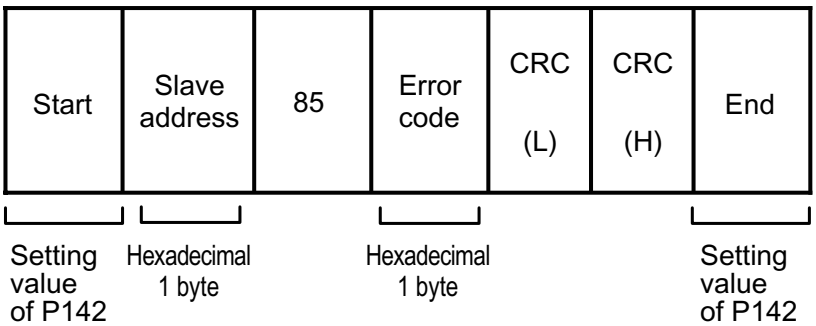
[Response]

- Normal response (write OK)



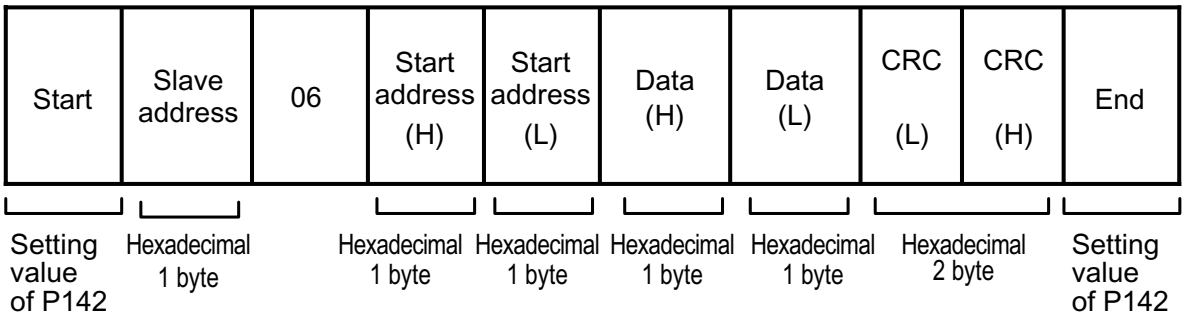
- Same as command.

- Error response (write error)



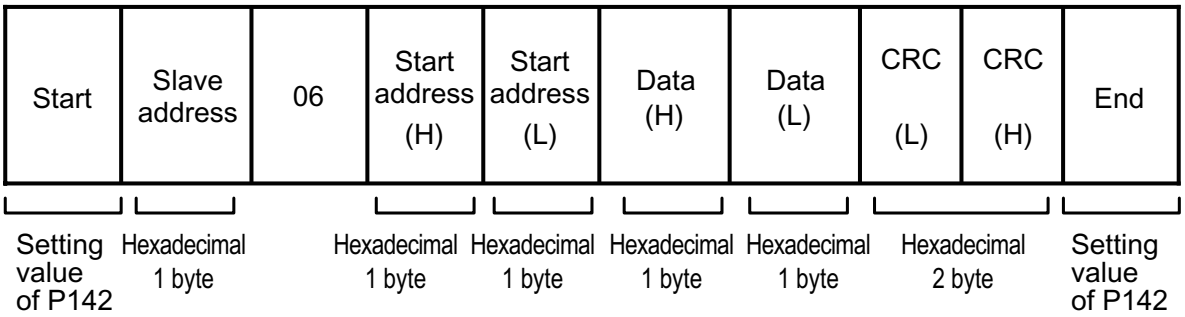
Write Single Register : "H06"

[Command]



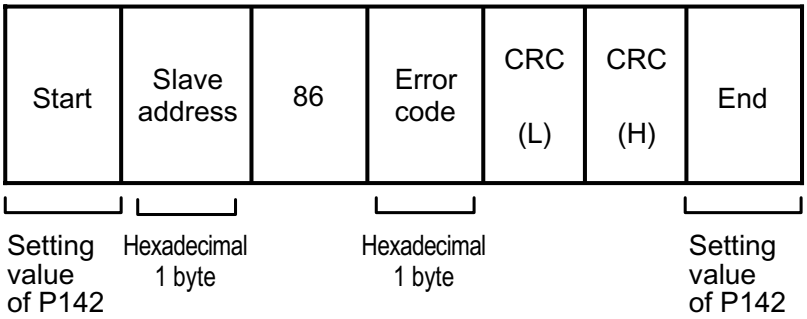
[Response]

- Normal response (write OK)



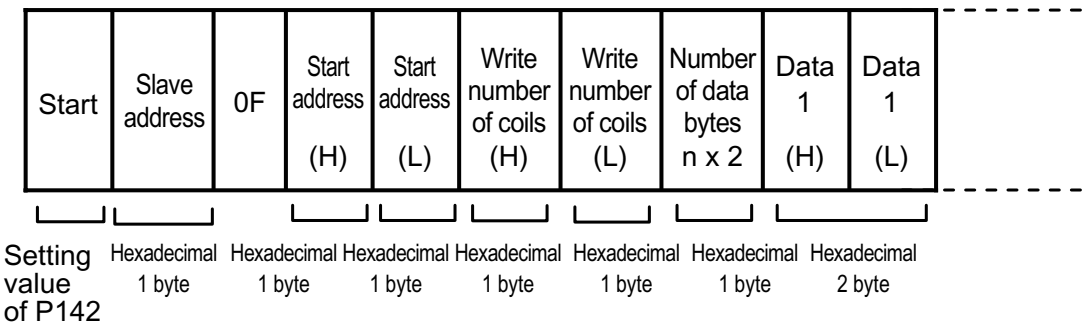
  - Same as command.

- Error response (write error)

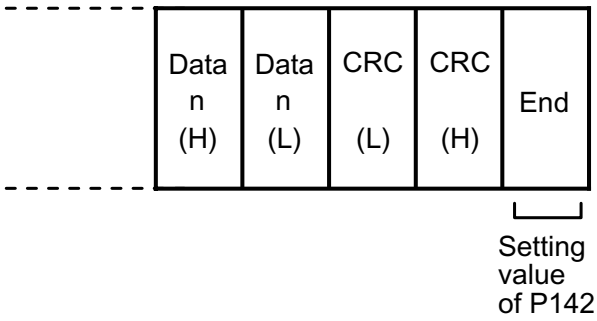


Write Multiple Coils : "H0F"

[Command]

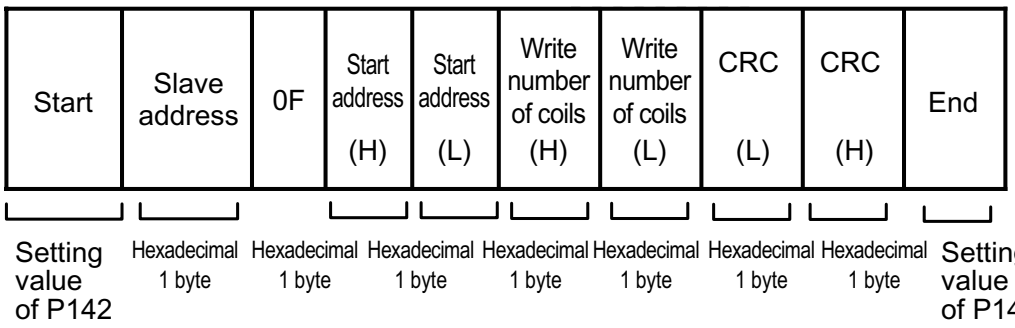


- Number of data bytes is 2 or 4, that is two times of number of data.

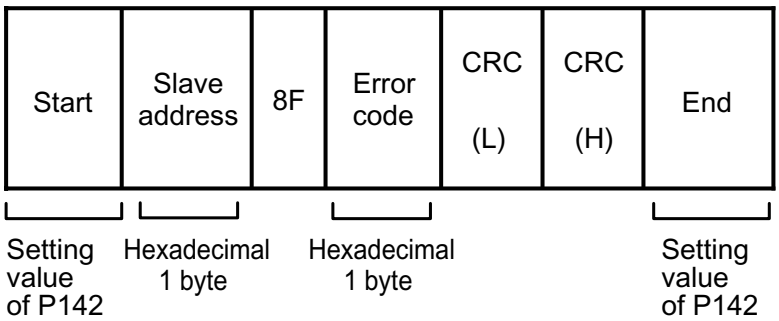


[Response]

- Normal response (write OK)

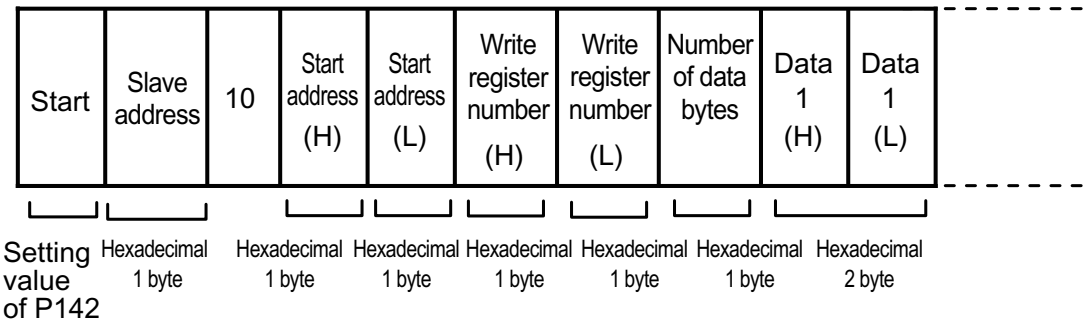


- Error response (read error)

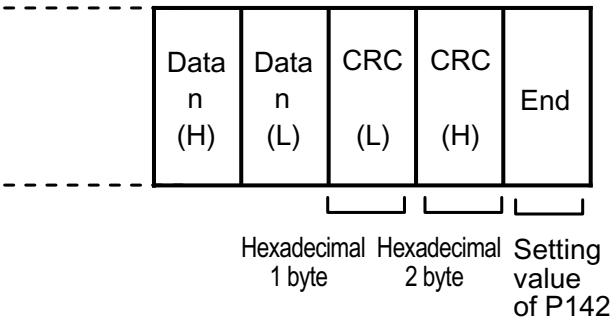


Write Multiple Registers : "H10"

[Command]

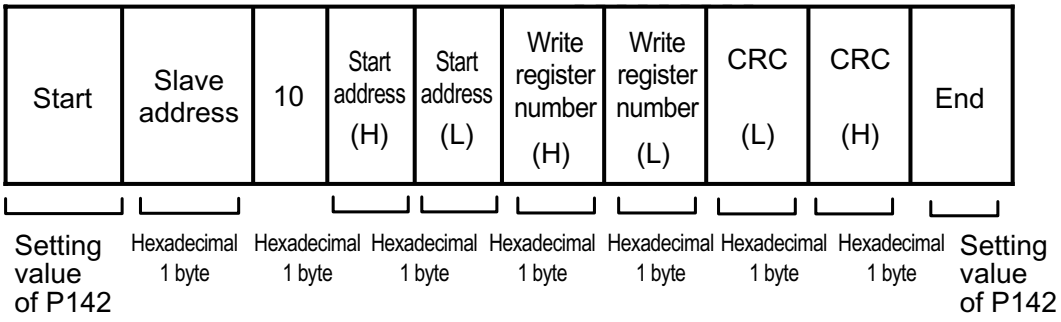


- For number of coils is 1 to 32, number of data bytes is 2 to 64, that is two times of number of data.

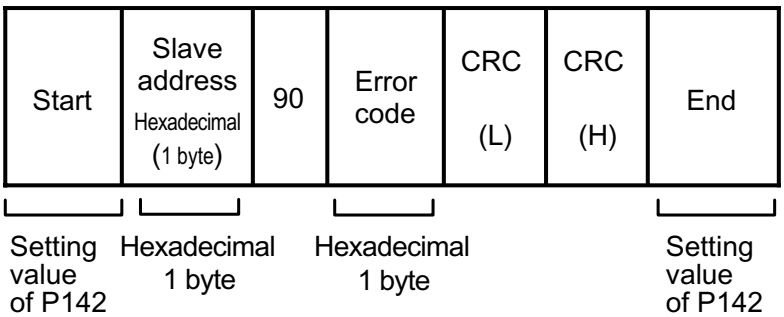


[Response]

- Normal response (write OK)



- Error response (read error)



12-8. Common Precautions on MEWTOCOL-COM and MOD-BUS(RTU)

In the event that inverter is used for communicating, common precautions on two protocols MEWTOCOL-COM and MOD-BUS (RTU) are the two points as follows.

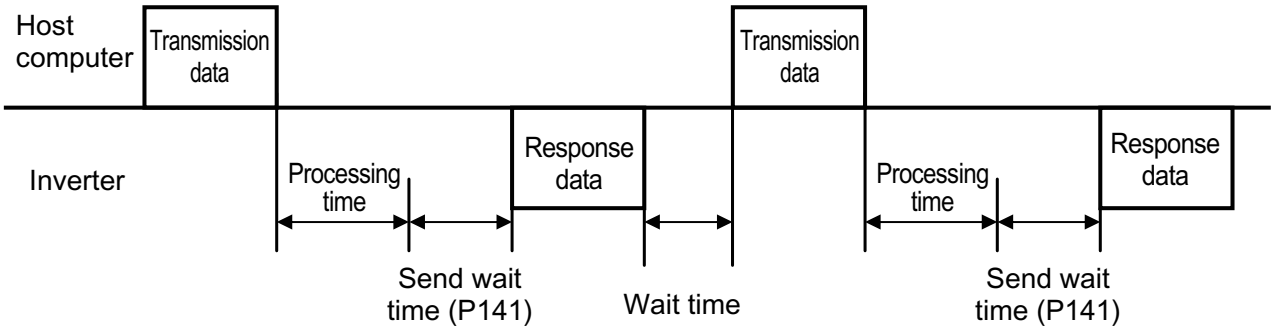
12-8.1 Send/Receive Changeover Wait Time

Set the wait time to the values larger than the values shown below after the inverter transmits the response message and before a host computer sends the next data.

Communication speed (bps)	Wait time (msec)
4800	2.0
9600	1.0
19200	0.5
38400	0.2

12-8. 2 Processing Time on Inverter

The internal processing time of the inverter differs depending on the operating conditions, however it is always below 50msec.
In case of setting the parameter "P150: Setting data clear", maximum 2.0sec processing time is necessary for writing data into the internal memory. When the timeout period is specified on the host computer, the value which does not give any effect on the system must be set.



12-8. 3 Precautions on Communicating with Host Computer

For inverter is not one party in communication, that internal memory of the inverter is ensured by host computer, set the connected machine in communication to use the internal memory of the connected machine.

[Example] When connected with programmable intelligent operation panels GT produced by Panasonic, basic communication area should be set to "GDT" (word area) and "WGR" (bit area).

12-9. Applicable Communication Function in Inverter

"Monitor", "Control/command" and "Setting" functions are available depending on communications.

Function	Register No. Relay No.	Function name	Remarks
Monitor	DT301	Output frequency	0.01 Hz unit (data type 3)
	DT302	Output current	0.1 A unit (data type 2)
	DT303	Output voltage	0.1V AC unit (data type 2)
	DT304	Internal DC voltage	0.1V DC unit (data type 2)
	DT305	Setting frequency	0.01 Hz unit (data type 3)
	DT306	Communication station No.	Indicates the communication station No. set currently.
	DT307	Timer runtimes	Indicates continuous times of timer's one cycle operation.
	DT308	Alarm type	Indicates details on alarm LED.
	R309□	Control terminal state (input signal)	Contact data
	R310□	Control terminal state (output signal)	Contact data
	R311□	Operation status monitor	Contact data
	R312□	Operation control status monitor	Contact data
	R313□	Terminal function status monitor	Contact data
	DT314	PID setting value (SP)	0.01 % unit (data type 3)
	DT315	PID target value (PV)	0.01 % unit (data type 3)
	DT316	PID output value (MV)	0.01 % unit (data type 3)
	DT317	Progress of automatic tuning progress	0-5: During measuring 6: Measurement ends 7: Measurement suspends
	DT320	Fault display (latest)	Fault trip data
	DT321	Fault display (second to latest)	
	DT322	Fault display (third to latest)	
	DT323	Fault display (fourth to latest)	
Control/Command	DT237	Frequency setting (without memory setting)	0.01 Hz unit (data type 3)
	DT238	Frequency setting (with memory setting)	
	R250□	Operation control	Contact data
	DT253	Fault reset	H9696
	DT255	Emergency stop command	H9696
Setting	DT1～DT151	Function parameter settings	Refer to page 189

- "□" suffixed to the relay number means the specified position for BIT (hexadecimal 0 to F). For the details on the functions of each BIT, refer to each functional descriptions.
- Refer to page 194 for the explanation of the data type mentioned in the above table.
- Accumulative operation time and accumulative fan operation time cannot be monitored by the medium of communication.

12-9.1 Supplementary Explanation of Communication Monitor Function

"R309□：Control terminal state monitor (input signal)"

It indicates the input states of the control terminals No.2~8.

Relay No.	Name	Details
R3090	Operation signal input state	1 : Terminal is ON (closed). 0 : Terminal is OFF (opened).
R3091	Reverse run signal input state	
R3092	SW1 signal input state	
R3093	SW2 signal input state	
R3094	SW3 signal input state	
R3095	SW4 signal input state	
R3096	SW5 signal input state	

"R310□：Control terminal state monitor (output signal)"

It indicates the output states of TR1, TR2 and RY output terminals.

Relay No.	Name	Details
R3100	TR1 output signal	1 : TR output signal is ON 0 : TR output signal is OFF
R3101	TR2 output signal	1 : TR output signal is ON 0 : TR output signal is OFF
R3102	RY output signal	1 : RY output signal is ON (energized). 0 : RY output signal is OFF (not energized).

"R311□: Operation status monitor"

It indicates the operation status of the inverter.

Relay No.	Name	Details
R3110	Operation status	1 : Runs 0 : Stops
R3111	Reverse operation status	1 : Runs 0 : Stops
R3112	Arrival signal	1 : ON 0 : OFF
R3113	Overload alarm	
R3114	Frequency detect (P93)	
R3115	Frequency detect (P94)	
R3116	Detect current (or more) signal	
R3117	Detect current (or less) signal	
R3118	PID automatic tuning	1 : PID automatic tuning operation state 0 : Normal operation state
R3119	Timer's operation function	1 : Timer's operation state 0 : Normal operation state
R311A	Automatic tuning function of motor constant	1 : Automatic tuning operation state of motor constant 0 : Normal operation state
R311B	Fault state	1 : Fault state 0 : Normal state

"R312□: Operation control status monitor"

It indicates the operation control status of the inverter.

Relay No.	Name	Details
R3120	Run command state	1 : With command 0 : No command
R3121	Reverse run command state	
R3122	SW1 command state	
R3123	SW2 command state	
R3124	SW3 command state	
R3125	SW4 command state	
R3126	SW5 command state	
R3127	During the operation of timer	
R3128	During the operation of pulse input	

"R313□: Terminal function status monitor"

It indicates function status of multifunction terminals. With function setting and command (SW input or communication command), "1" (ON) is set to.

Relay No.	Name	Details
R3130	Multi speed function	1 : Function is turned ON. 0 : Function is turned OFF.
R3131	Parameter setting disabled function	
R3132	Reset input function	
R3133	Reset lock function	
R3134	JOG function	
R3135	External fault stop function	
R3136	Coast-to-stop function	
R3137	Frequency signal changeover function	
R3138	2nd characteristics select function	
R3139	PID function changeover function	
R313A	3-wire stop command function	
R313B	Frequency▲(UP) setting function	
R313C	Frequency▼(DOWN) setting function	
R313D	PWM frequency signal select function	

"DT320: Fault display (latest)", "DT321: Fault display (second to latest)" "DT322: Fault display (third to latest)", "DT323: Fault display (fourth to latest)"

It indicates fault trip from latest to fourth to latest.
Refer to details of errors on page 198.

Data	Details of errors	Data	Details of errors	Data	Details of errors
0	SC1	6	OU1	15	OP
1	SC2	7	OU2	17	OH
2	SC3	8	OU3	18	SC4
3	OC1	9	LU	20	CPU
4	OC2	10	OL		
5	OC3	11	AU		

12-9.2 Supplementary Explanation of Communication Control/Command Function

"DT237: Storage without frequency setting memory"
"DT238: Storage with frequency setting memory"

- When communication control is used for setting frequency, value of P003 is set to "6" or "7".
- When a fault occurs in the inverter, no setting can be performed.
- When writing into DT237, it will not be stored in the memory inside the inverter.
- When storing with frequency setting memory (DT238), the set frequency is written in non-volatile memory inside the inverter. However, its maximum writing times is 100,000 times. If it is necessary to change frequency settings frequently, storage command without memory (DT237) should be set to.

"R250□: Operation control"

- When communication is used for controlling operation, value of P003 is set to "6" or "7".
- When a fault occurs in the inverter, the fault will not be reset even if the run command is turned to "OFF" ("0").
  Fault reset command (DT253) is used for fault reset.
- SW1 ~ SW5 functions differ depending on settings.

Relay No.	Name	Details
R2500	Run command state	1 : ON command 0 : OFF command
R2501	Reverse run command state	
R2502	SW1 command state	
R2503	SW2 command state	
R2504	SW3 command state	
R2505	SW4 command state	
R2506	SW5 command state	

"DT 253: Fault reset command"

- The fault reset activates by writing "H9696" in the register No. 253.
- The usable data is "H9696" only.
- This command is ignored when the inverter is operating properly.

"DT253: Emergency stop command"

- The emergency stop activates by writing "H9696" in the register No. 255.
- The coast-to-stop function is performed displaying "AU" in the same operation as the external fault input.
- The usable data is "H9696" only.

12-9.3 Terminal Input of Multifunction Terminals

- Command sent by the medium of communication cannot be performed occasionally according to function settings for multifunction terminals.

Relay No.	Name
Multi speed function	Terminal input and communication command can be used simultaneously. *1
Parameter setting disabled function	Terminal input and communication command can be used simultaneously.
Reset input function	Dedicated function of terminal input (Please use DT253.)
Reset lock function	Terminal input and communication command can be used simultaneously.
JOG function	Dedicated function of terminal input
External fault stop function	Dedicated function of terminal input (Please use DT255.)
Coast-to-stop function	Terminal input and communication command can be used simultaneously.
Frequency signal changeover function	Terminal input and communication command can be used simultaneously. *1
2nd characteristics select function	Terminal input and communication command can be used simultaneously. *1
PID function changeover function	Terminal input and communication command can be used simultaneously. *1
3-wire stop command function	Dedicated function of terminal input
Frequency▲(UP) setting function	Dedicated function of terminal input
Frequency▼(DOWN) setting function	Dedicated function of terminal input
pulse counter input function	Dedicated function of terminal input
PWM frequency signal select function	Dedicated function of terminal input

*1 indicates command and terminal input sent by the medium of communication are invalid during timer's operation.

12-9.4 Supplementary Explanation of Communication Setting Function

Function parameters P001~P151 can be set with communication.

Parameter No.	Register No.	Function name	Displayed data	Unit	Internal data	Data type
P001	DT1	1st acceleration time	0000, 0.1～3600	s	0～36000	2
P002	DT2	1st deceleration time	0000, 0.1～3600	s	0～36000	2
P003	DT3	Operation command select	0～7	—	0～7	1
P004	DT4	Frequency setting signal	0～7	—	0～7	1
P005	DT5	V/F mode	50・60・FF・3C	—	0・1・2・3	4
P006	DT6	V/F curve	0・1	—	0・1	1
P007	DT7	Torque boost level	0～40	%	0～40	1
P008	DT8	Max. output frequency	50.0～400.0	Hz	5000～40000	3
P009	DT9	Base frequency	45.0～400.0	Hz	4500～40000	3
P010	DT10	Change point frequency 1	0.5～400.0	Hz	50～40000	3
P011	DT11	Change point voltage 1	0～100	%	0～100	1
P012	DT12	Change point frequency 2	0.5～400.0	Hz	50～40000	3
P013	DT13	Change point voltage 2	0～100	%	0～100	1
P014	DT14	Max. output voltage	0～500	V	0～500	1
P015	DT15	S-shaped acceleration/ deceleration mode	0～2	—	0～2	1
P016	DT16	Electronic thermal select	0～3	—	0～3	1
P017	DT17	Thermal current setting	0.1～100.0	A	1～1000	2
P018	DT18	Overcurrent stall prevention function	0・1	—	0・1	1
P019	DT19	Overvoltage stall prevention Function	0・1	—	0・1	1
P020	DT20	Current limit function	0～9.9	s	0～99	2
P021	DT21	OCS level	1～200	%	1～200	1
P022	DT22	Retry function	0～3	—	0～3	1
P023	DT23	Retry times	1～10	time	1～10	1
P024	DT24	Start mode	0～3	—	0～3	1
P025	DT25	Ride-through restart select	0～2	—	0～2	1
P026	DT26	Wait time	0.1～100.0	s	1～1000	2
P027	DT27	Reverse run lock	0・1	—	0・1	1
P028	DT28	Stop mode	0・1	—	0・1	1
P029	DT29	Start frequency	0.5～60.0	Hz	50～6000	3
P030	DT30	Stop frequency	0.5～60.0	Hz	50～6000	3
P031	DT31	DC brake time	0000・0.1～120	s	0～1200	2
P032	DT32	DC brake level	0～100	%	0～20	5
P033	DT33	Stop frequency during forward run/reverse run operation	0.5～60.0	Hz	50 ～6000	3
P034	DT34	DC brake time during forward run/ reverse run operation	0000・0.1～120.0	s	0～1200	2

Parameter No.	Register No.	Function name	Displayed data	Unit	Internal data	Data type
P035	DT35	DC brake level during forward run/reverse run operation	0～100	%	0～20	5
P036	DT36	SW1 function select	0～10	—	0～10	1
P037	DT37	SW2 function select	0～11	—	0～11	1
P038	DT38	SW3 function select	0～10	—	0～10	1
P039	DT39	SW4 function select	0～10	—	0～10	1
P040	DT40	SW5 function select	0～11	—	0～12	1
P041	DT41	Input terminal logic setting	0～31	—	0～31	1
P042	DT42	JOG frequency	0.5～400.0	Hz	50～40000	3
P043	DT43	JOG acceleration time	0.0～3600	s	0～36000	2
P044	DT44	JOG deceleration time	0.0～3600	s	0～36000	2
P045	DT45	Multi speed function select	0～6	—	0～6	1
P046	DT46	2nd speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P047	DT47	3rd speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P048	DT48	4th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P049	DT49	5th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P050	DT50	6th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P051	DT51	7th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P052	DT52	8th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P053	DT53	9th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P054	DT54	10th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P055	DT55	11th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P056	DT56	12th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P057	DT57	13th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P058	DT58	14th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P059	DT59	15th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P060	DT60	16th speed frequency	0000, 0.5～400.0	Hz	0・50～40000	3
P061	DT61	2nd acceleration time	0.1～3600	s	1～36000	2
P062	DT62	2nd deceleration time	0.1～3600	s	1～36000	2
P063	DT63	3rd acceleration time	0.1～3600	s	1～36000	2
P064	DT64	3rd deceleration time	0.1～3600	s	1～36000	2
P065	DT65	4th acceleration time	0.1～3600	s	1～36000	2
P066	DT66	4th deceleration time	0.1～3600	s	1～36000	2
P067	DT67	Rotation direction of timer's operation	0～255	—	0～255	1
P068	DT68	Continuous times of timer's operation	0000・1～9999	times	0～9999	1
P069	DT69	Continuous mode of timer's operation	0・1	—	0・1	1
P070	DT70	Continuous wait time of timer's operation	0000・0.1～6553	s	0～65530	2
P071	DT71	1st speed runtime	0000・0.1～6553	s	0～65530	2

Parameter No.	Register No.	Function name	Displayed data	Unit	Internal data	Data type
P072	DT72	2nd speed runtime	0000・0.1～6553	s	0～65530	2
P073	DT73	3rd speed runtime	0000・0.1～6553	s	0～65530	2
P074	DT74	4th speed runtime	0000・0.1～6553	s	0～65530	2
P075	DT75	5th speed runtime	0000・0.1～6553	s	0～65530	2
P076	DT76	6th speed runtime	0000・0.1～6553	s	0～65530	2
P077	DT77	7th speed runtime	0000・0.1～6553	s	0～65530	2
P078	DT78	8th speed runtime	0000・0.1～6553	s	0～65530	2
P079	DT79	1st speed pulse input times	0000・1～65530	times	0 ～65530	2
P080	DT80	2nd speed pulse input times	0000・1～65530	times	0～65530	2
P081	DT81	3rd speed pulse input times	0000・1～65530	times	0～65530	2
P082	DT82	4th speed pulse input times	0000・1～65530	times	0～65530	2
P083	DT83	5th speed pulse input times	0000・1～65530	times	0～65530	2
P084	DT84	6th speed pulse input times	0000・1～65530	times	0～65530	2
P085	DT85	7th speed pulse input times	0000・1～65530	times	0～65530	2
P086	DT86	8th speed pulse input times	0000・1～65530	times	0～65530	2
P087	DT87	PWM frequency signal select	0・1	—	0・1	1
P088	DT88	PWM signal average time	1～100	times	1～100	1
P089	DT89	PWM signal cycle	1.0～2000	ms	1～20000	2
P090	DT90	Output TR1 function select	0～11	—	0～11	1
P091	DT91	Output TR2 function select	0～10	—	0～10	1
P092	DT92	Output RY function select	0～10、r0～r10	—	0～21	6
P093	DT93	Detect frequency (output TR)	0000, 0.5～400.0	Hz	0・50～40000	3
P094	DT94	Detect frequency (output RY)	0000, 0.5～400.0	Hz	0・50～40000	3
P095	DT95	Level of current detect	0.1～100.0	A	1～1000	2
P096	DT96	Retardation time of current detect	0.1～10.0	s	1～100	2
P097	DT97	Analog and PWM output function select	0・1	—	0・1	1
P098	DT98	Analog and PWM output voltage compensation	25～100	%	25～100	1
P099	DT99	Lower frequency clamp	0.5～400.0	Hz	50～40000	3
P100	DT100	Upper frequency clamp	0.5～400.0	Hz	50～40000	3
P101	DT101	0V stop function select	0000, 0.5～400.0	Hz	0・50～40000	3
P102	DT102	Bias/gain function select	0・1	—	0・1	1
P103	DT103	Bias frequency setting	-99.0～250.0	%	10～3500	7
P104	DT104	Gain frequency setting	0.0～500.0	%	0～50000	3
P105	DT105	Analog input filter	5～200	times	10～200	1
P106	DT106	PID control mode	0～3、A0～A3	—	0～7	8
P107	DT107	Proportional gain (kp)	0.1～1000	—	1～10000	2
P108	DT108	Integral time (Ti)	0000・0.1～3600	s	0～36000	2

Parameter No.	Register No.	Function name	Displayed data	Unit	Internal data	Data type
P109	DT109	Derivative time (Td)	0000・0.1～3600	s	0～36000	2
P110	DT110	Control cycle (Ts)	0.01～60.00	s	1～6000	3
P111	DT111	PID target value	0.0～100.0	%	0～10000	3
P112	DT112	Skip frequency 1	0000, 0.5～400.0	Hz	0・50～40000	3
P113	DT113	Skip frequency 2	0000, 0.5～400.0	Hz	0・50～40000	3
P114	DT114	Skip frequency 3	0000, 0.5～400.0	Hz	0・50～40000	3
P115	DT115	Skip frequency band width	0～10	Hz	0～10	1
P116	DT116	Base frequency 2	45.0～400.0	Hz	4500～40000	3
P117	DT117	Torque boost level 2	00～40	%	0～40	1
P118	DT118	Electronic thermal select 2	0～3	—	0～3	1
P119	DT119	Thermal current setting 2	0.1～100.0	A	1～1000	2
P120	DT120	2nd change point frequency 1	0.5～400.0	Hz	50～40000	3
P121	DT121	2nd change point voltage 1	0～100	%	0～100	1
P122	DT122	2nd change point frequency 2	0.5～400.0	Hz	50～40000	3
P123	DT123	2nd change point voltage 2	0～100	%	0～100	1
P124	DT124	Analog input function select 2	0・1	—	0・1	1
P125	DT125	Analog input signal select 2	3～6	—	3～6	1
P126	DT126	Bias frequency setting 2	-99.0～250.0	%	10～3500	7
P127	DT127	Gain frequency setting 2	0.0～500.0	%	0～50000	3
P128	DT128	Carrier frequency	0.8～10.0	kHz	0～6	9
P129	DT129	Vector control select	0・1	—	0・1	1
P130	DT130	Motor capacity	0.4～3.7	—	2～6	10
P131	DT131	No. of motor poles	2・4・6	—	0・1・2	11
P132	DT132	Measurement function for motor constant	0・1～3	—	0～3	1
P133	DT133	Voltage compensation constant	0.01～99.99	V	1～9999	3
P134	DT134	Slip compensation frequency	-5.00～5.00	Hz	500～1500	7
P135	DT135	Communication protocol select *	0・1	—	0・1	1
P136	DT136	Communication station No. setting *	01～31	—	1～31	1
P137	DT137	Communication speed setting *	48・96・192・384	bps	4～7	12
P138	DT138	Stop bit length *	1・2	—	1・2	1
P139	DT139	Parity check *	0～2	—	0～2	1
P140	DT140	Timeover detect *	0000・0.1～60.0	s	0～600	2
P141	DT141	Send wait time *	1～1000	ms	1～1000	1
P142	DT142	TEXT completion judgment time *	3～200	ms	3～200	1
P143	DT143	Cooling fan ON-OFF control select	0・1	—	0・1	1
P144	DT144	Input terminal filter	5～100	times	5～100	1
P145	DT145	Operation status monitor	0～7	—	～	1

Parameter No.	Register No.	Function name	Displayed data	Unit	Internal data	Data type
P146	DT146	Linear speed multiplier	0.1～100.0	—	1～1000	2
P147	DT147	Alarm LED operation select	0～5	—	0～5	1
P148	DT148	Alarm LED upper voltage clamp	0.1～600.0	V	1～6000	2
P149	DT149	Alarm LED upper current clamp	0.1～100.0	A	1～1000	2
P150	DT150	Password	0000・1～9999	—	0～9999	1
P151	DT151	Setting data clear	0・1・2・3	—	0～3	1

* Turn off the power supply once after the data has been set, otherwise the set value will not be displayed.

Note

- Refer to page 194 for the explanation of the data type mentioned in the above table.
- Refer to page 57 for determining whether to change parameter settings with communication or not during operation.
  When sending change command to parameters other than allowable ones during operation of the inverter, the command will return as response in MEWTOCOL-COM "mode error (code: 53)". Return to "H07: mode error" in MOD-BUS (RTU).

12-10. About Data Type

For the data for monitoring or setting, the displayed data of the inverter may differ from the transmission data, so transmission data should be used as the data to be used for communication. Calculate the transmission data using the following table of the data type.

Data type	Relationship between displayed data and transmission data
1	Displayed data and transmission data is the same.
2	Data in 0.1 unit (Transmission data) = (Displayed data) ×10
3	Data in 0.01 unit (Transmission data) = (Displayed data) ×100
4	"P005: V/F mode" data Displayed data: 50 60 FF 3C Transmission data: 0 1 2 3
5	"P032: DC brake level" and "P035: DC brake level during forward / reverse run operation" data (Transmission data) = (Displayed data) /5
6	"P092: Output RY function select" data Displayed data: 0 ～ 10 r0 ～ r10 Transmission data: 0 ～ 10 11 ～ 21
7	"P103: Bias frequency setting", "P126: 2nd bias frequency setting" and "P134: Slip compensation frequency" data (Transmission data) = (Displayed data) ×10 + 1000
8	"P106: PID control mode" data Displayed data: 0 1 2 3 A0 A1 A2 A3 Transmission data: 0 1 2 3 4 5 6 7
9	"P128: Carrier frequency" data Displayed data: 0.8 1.1 1.6 2.5 5.0 7.5 10.0 Transmission data: 0 1 2 3 4 5 6
10	"P130: Motor capacity" data Displayed data: 0.4 0.7 1.5 2.2 3.7 Transmission data: 2 3 4 5 6
11	"P131: No. of motor poles" data Displayed data: 2 4 6 Transmission data: 0 1 2
12	"P137: Communication speed setting" data Displayed data: 48 96 192 384 Transmission data: 4 5 6 7

12-11 Error Codes in Communication

Commands are ignored when an error occurred in communication.
Following error codes are returned to the host computer from the inverter in such cases.

[MEWTOCOL]

Code (ASCII)	Content	Description
21	NA CK error	A data error occurred during the communication. (e.g.) Parity error, framing error
27	Frame over error	A received data is 118 bytes or more.
40	BCC error	A transmission error occurred in the command data.
41	Format error	A command message does not match the transmission format. (e.g.) The No. of command data is insufficient. "#" or "transmission destination" is not contained in the message.
42	NOT support error	A command that is not supported was transmitted. A command was transmitted to a transmission destination that is not supported.
53	Busy error	The previous command is being processed when a message was received.
60	Parameter error	The function designated parameter has an incorrect code.
61	Data error	There is an error in the designation of the contact No., data No. or data code format. (e.g.) Set data is out of the designated range.
62	Registration error	Number of registration exceeded when monitoring data.
63	Mode error	When the command was transmitted, the operation mode of the inverter was one that could not process the command. ・ Parameter data setting during the inverter is operating. ・ Parameter data setting during the inverter has an error.

[MOD-BUS(RTU)]

Error code	Error name	Description
01	Function code error	An error in function code. A function code that is not corresponding was sent.
02	Address error	An address that is not available was specified.
03	Data error	Set data is out of the designated range.
07	Mode error	When a command was sent, the operation mode of the inverter is the one that cannot process the command. ・ Parameter data setting during the inverter is operating. ・ Parameter data setting during the inverter has an error.
08	Format error	A command message does not match the transmission format.

13. Individual Details and Resetting Fault Trips

13-1. Individual Details and Remedies for Fault Trips

● Fault trip memory ・・・ The cause of the trip in monitor mode n20 to n23 can be saved. The details on the latest trip and the three prior trips are saved even if the power is turned OFF. (The details of the shipment inspection are saved when the unit is shipped.)

Display	Details and cause of faults	Remedies
SC1	・Instantaneous overcurrent during acceleration or malfunction of cooling fan	・Check for an output short-circuit or ground fault ・Eliminate excessive changes in load ・Increase the acceleration and deceleration times ・Check operation of cooling fan
SC2	・Instantaneous overcurrent during constant speed or malfunction of cooling fan	
SC3	・Instantaneous overcurrent during deceleration or malfunction of cooling fan	
SC4	・Instantaneous overcurrent during deceleration	
OC1	・Overcurrent during acceleration	・Check for an open output phase Eliminate excessive changes in load ・Increase the acceleration and deceleration times ・Adjust the torque boost level ・Check the restart in inertia ・Do not switch the electromagnetic contactor at the load side
OC2	・Overcurrent during constant speed	
OC3	・Overcurrent during deceleration	
OU1	・Excessive internal DC voltage during acceleration	・Increase the acceleration time
OU2	・Excessive internal DC voltage during constant speed	・Eliminate excessive changes in load
OU3	・Excessive internal DC voltage during deceleration	・Increase the deceleration time
LU	・Power supply voltage drops to less than 85% of rating	・Measure the power supply voltage Check input open-phase ・Check the ride-through function
OL	・An output current exceeding 125% of the electronic thermal setting current or 140% or more of the inverter rated current occurs for more than 1 minute.	・Check the electronic thermal setting current ・Check and adjust the torque boost level ・Reduce the load
OH	・Abnormal heating of heat sink fins	・Check ambient temperatures
AU	・External fault stop signal is input at control circuit terminals.	・Check whether external signal is normal and whether sequence circuit is correct.

Display	Details and cause of faults	Remedies
OP	・The power was turned ON while the run signal was ON ・The run signal was turned ON while setting data in the stopped mode, and the mode was returned to the operation mode with the MODE button ・Timeover was detected ・The communication connector was removed during the operation	・Check the start mode (parameter P024) ・Check the run signal when the data is being set ・Check the communication settings and wirings ・Reduce the noise around the inverter
CPU	・Excessive nterference was applied on the inverter	・Reduce the nterference around the inverter
Er1 *	・Communication is not available between unit of the inverter and the operation panel	・Check whether the operation panel and the unit are connected correctly

* Details of errors of "Er1" are not displayed in monitor mode n020 to n023.

Note) Refer to "14. Troubleshooting" on page 198.

13-2. Resetting Fault Trips

● If a fault is displayed on the operation panel's display and the inverter is stopped, remedy the fault before resetting.

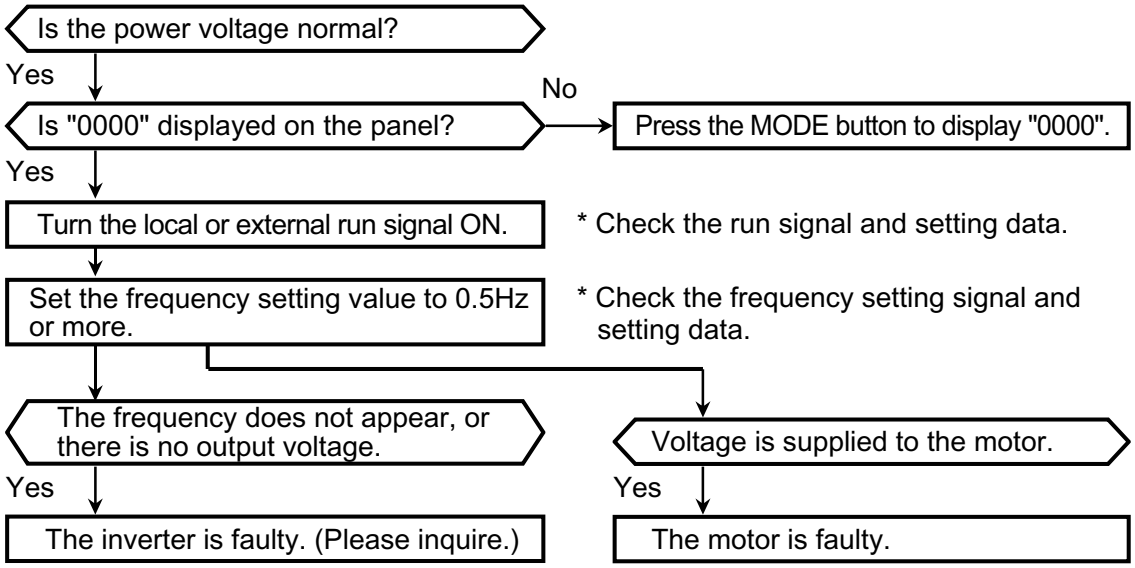
Power reset	Turn OFF the power once, then the fault will be reset. (Operation can be started when the power is turned ON again.)
Stop reset	① When operation is set to panel (Parameter P003 set to "0" or "1"), the fault will be reset when the "STOP button" on the operation panel is pressed and then the inverter can be restarted. ② When operation is set to external (Parameter P003 set to "2" or "3"), the fault will be reset when the "run command button" through external control is turned OFF once, and then the inverter can be restarted. Note) Stop reset cannot be performed by the medium of communication.
Resetting by panel	When operation is set to external or communication (Parameter P003 set to "4", "5" or "7"), the fault will not be reset even if the "run command button" through external control (communication) is turned OFF once. The fault will be reset when the "STOP button" on the operation panel is pressed and then the inverter can be restarted.
Multifunction terminal reset	The fault will be reset when setting data of parameters P036~P040 is set to "1" and function setting switch is turned "ON" once and then turned "OFF". In this case the inverter can be restarted. (Refer to page 82)
Communication command reset	The fault will be reset when H9696 is written in register No. 253 (DT253).

14. Troubleshooting

Caution

- Wait at least 5 minutes after turning the input power OFF before starting maintenance and inspection.
  Failure to do so could lead to electric shock.
- Maintenance, inspection and part replacement must be done by qualified persons.
  [Remove all metal personal belongings (watches, bracelets, etc.) before starting work.]
  (Use tools treated with insulation.)
  Failure to do so could lead to electric shock or injury.

1. The motor does not rotate (When fault display is not lit).

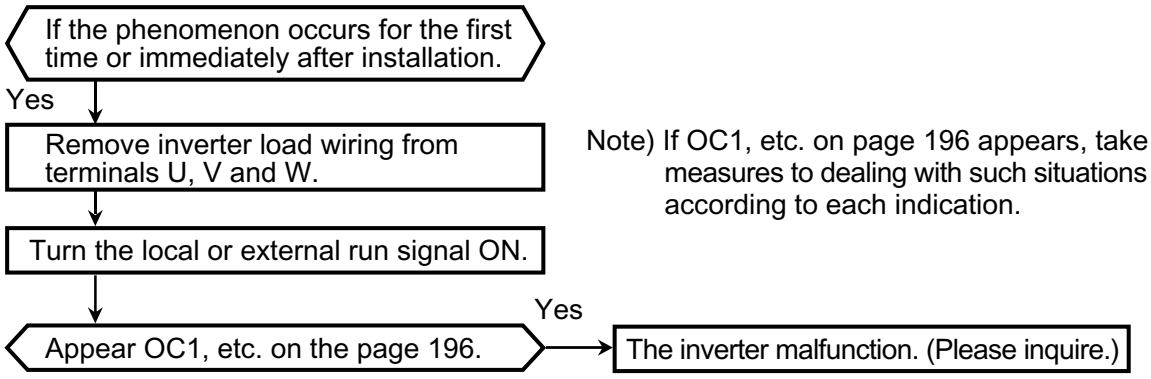


2. The motor does not rotate (When fault display is lit).

When one of faults on page 196 is displayed and the motor has not rotated, check the following two points:

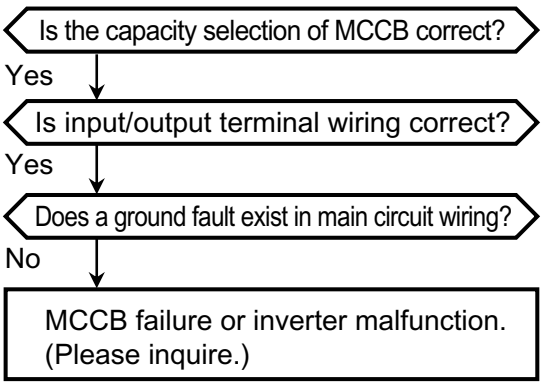
① Check whether this is the first time (or immediately after installation) power has been applied to the inverter, or it has been in use.

② Check if this is an inverter malfunction (failure), a wiring, or a motor malfunction.



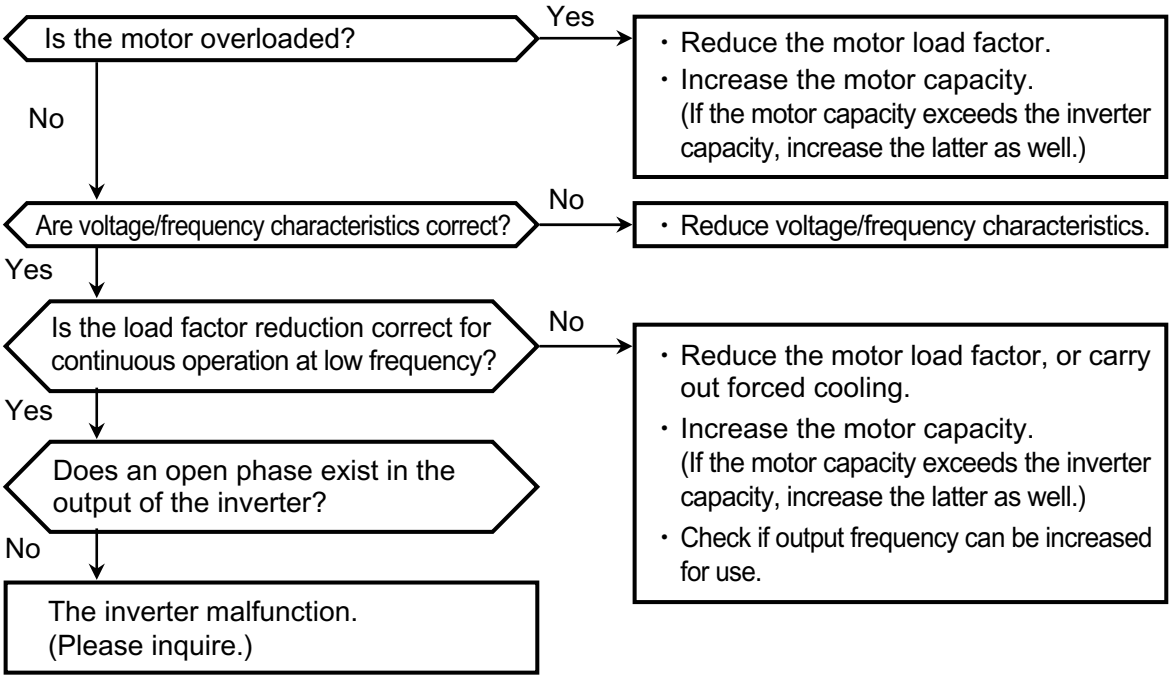
Note) If OC1, etc. on page 196 appears, take measures to dealing with such situations according to each indication.

3. MCCB trips.

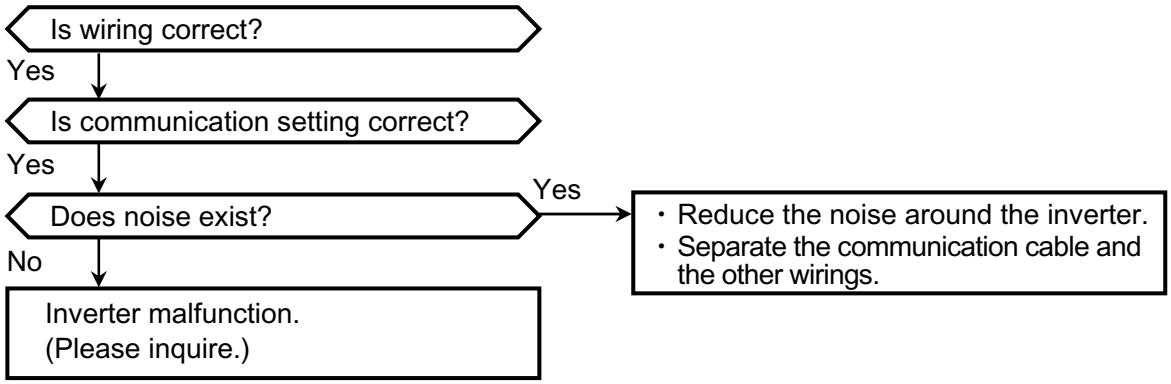


Note) Use a residual current circuit breaker that supports the inverter.

4. Motor has over temperature.



5. Communication is not available.



15. Maintenance and Inspection

Caution

- Wait at least 5 minutes after turning the input power OFF before starting maintenance and inspection.
  Failure to do so could lead to electric shock.
- Maintenance, inspection and part replacement must be done by qualified persons.
  [Remove all metal personal belongings (watches, bracelets, etc.) before starting work.]
  (Use tools treated with insulation.)
  Failure to do so could lead to electric shock or injury.

Note

- Have electric company periodically tighten the terminal screws.
  Loosening of the terminal screws could lead to overheating or fire.

1. Precautions for inspections

- When measuring the insulation between the power line and motor line, always disconnect the wires connected to the inverter first. Do not perform a megger test on the control circuit.
- The inverter is mainly configured of semiconductor elements. So, daily inspections must be carried out to prevent the effect of the working environment such as the temperature, humidity, dust and vibration, to prevent problems that occur due to the passage of part usage and part life. The standard replacement term that apply when the inverter is used in a general environment (ambient average annual temperature 30℃, load rate of 80% or less, and 12 working hours or less a day) are given in the following table.

2. Inspection Items

1) Daily inspection: Check that the inverter is operating as intended.
Check the input and output voltages of the inverter during operation using a multimeter.

2) Periodic inspection: Check all locations where inspection can only be performed when the inverter is stopped and where periodic inspection is required.

3. Parts Replacement

Wear fault (lifetime)…The lifetime is greatly dependent on the installation conditions.

1) For example: The lifetime of a relay depends on the wear condition of its contact surfaces. The contact current and load inductance are major factors.
2) The capacitor inside the inverter is used mainly as a smoothing filter and its lifetime varies greatly with temperature as internal chemical reactions take place. Generally, when the temperature of the aluminum electrolytic capacitor increases by 10℃, the life is halved. Thus, the temperature determines the inverter life span.
If the inverter is used at high temperatures, the aluminum electrolytic capacitor could wear out before the other parts. In this case, the capacitor must be replaced to extend the inverter's life.

Part name	Standard replacement	Replacement procedure
Cooling fan	2 or 3 years	Replace with a new part
Smoothing capacitor	5 years	Investigate and replace with new part if necessary.
Relays	———	Investigate and replace with new part if necessary.

◆ Contact us if you need part replacement or repairs.

4. Maintenance and Inspection Table

Note) Symbols in the check frequency field have the following meanings:
☆ means daily, ○ means yearly and, ◎ means every two years.

location	Inspection item	Inspection details	Inspection frequency			Inspection method	Test criteria	Instrument
Whole system	Ambient environment	Ambient temperature, humidity, dust,ect.	☆			See installation precautions	Ambient temperature: -10 to 50°C Humidity: 90% max.	Thermometer hygrometer
	Whole system	Is there any abnormal vibration or noise?	☆			Visual inspection and audible check	Normal	
	Power voltage	Is the main circuit voltage normal?	☆			Measure the input voltage	400V: 323~506 V AC	Multimeter
Main circuit	General	1) Check if all fastenings are tight 2) Any indication of overheating on any part? 3) Clean		○ ○ ○		1) Tighten fastenings 2) Visual inspection	1), 2) Normal	
	Connected electrical conductors and wires	1) Are electrical conductors crooked? 2) Is the cover broken?		○ ○		1), 2) Visual inspection	1), 2) Normal	
	Transformer	Strange smell?	☆			By smell	Normal	
	Terminal blocks	Is there any damage?		○		Visual inspection	Normal	
	Transistor and diode	Check the resistance between terminals			◎	Disconnect main circuit wires and measure at terminal		Multimeter
	Smoothing capacitor	1) Are there any liquid leaks? 2) Is the safety valve normal? 3) Measure electrostatic capacity.	☆ ☆	 ○		1), 2) Visual inspection 3) Using a capacitance meter	1), 2) Normal 3) Minimum 85% of rated capacity	Capacitance meter
	Relay	1) Is the operational noise normal? 2) Check the state of contact roughness.		○ ○		1) Audible check 2) Visual inspection	1), 2) Normal	
	Resistor	1) Are the insulators cracked? 2) Are any wires disconnected?		○ ○		1), 2) Visual inspection	1), 2) Normal	
Control and protection circuits	Operation checks	1) Check output line voltage balance between phases during inverter operation without application. 2) Check the protection and display circuits with the sequence protection operation test.		○ ○		1) Measure voltage between output terminals. 2) Simulate a short-circuit between the inverter warning outputs.	1) Line output balance is 4V max. (400V type is 8V maximum.) 2) The sequence protection circuit must function correctly.	Rectifier type voltmeter
	All parts	1) Any strange smells or discoloration? 2) Is there heavy rusting?		○ ○		1), 2) Visual inspection and smell	1), 2) Normal	
	Capacitor	Any trace of liquid leaks or deformation?	☆			Visual inspection	Normal	
Cooling system	Cooling fan	1) Is there any abnormal vibration or abnormal noise? 2) Are any of the connections loose?	☆	 ○		1) Audible check 2) Tighten fastenings	1), 2) Normal	
Display	Display unit	Are any LEDs not working?	☆			Visual inspection	Normal	
	Meter	Are all readings correct?	☆			Check indicated value	Must be within standard value and control value.	Voltmeter Ammeter
Motor	General	1) Is there any abnormal vibration or abnormal noise? 2) Strange smells?	☆ ☆			Visual, audible and smell test	1), 2) Normal	

16. Specifications

16-1. Rated Specifications

Three-phase 400V input type

Product No.	Applied motor output (kW)	Rated output current (A)	Rated output capacity (kVA) Note2)	Power supply capacity (kVA) Note3)	Mass (kg)
AVF100-0074	0.75	2.1	1.7	2.6	1.4
AVF100-0154	1.5	4.0	3.2	4.8	1.5
AVF100-0224	2.2	5.5	4.4	6.4	1.9
AVF100-0374	3.7	8.7 Note1)	6.9	10.4	2.0

Note1) Rated output current of 3.7kW is specified for carrier frequency of 7.5kHz or less. At 10.0 kHz, rated output current is used after it has been reduced by 10%.

・10.0 kHz: (rated output current) ×0.9 ＝ 7.83A

Note2) Rated output capacity is specified for output voltage of 460V AC.

Note3) Power supply capacity depends on power supply impedance. It should equal or exceed the capacity specified above.

16-2. Standard Specifications

Three-phase 400V input type

Applied standard motor output (kW)		0.75～3.7kW
Rated output	Rated voltage	Three-phase, 380 to 460V AC (proportional to power supply voltage)
	Overload current rating	150% of rated output current for 1 minute
Input power supply	Number of phases, voltage, frequency	Three -phase, 380 to 460V AC 50/60Hz
	Tolerable voltage variations	+10%, -15% of rated AC input voltage
	Tolerable frequency variations	±5% of rated input frequency
	Instantaneous voltage drop resistance capacity	Continuous operation at 323V AC or more. Continuous operation at less than 323V AC for 15ms

16-3. Common Specifications

Output frequency	Frequency range	0.5～400Hz
	Frequency display	Digital display
	Frequency accuracy	±0.5% of max. setting frequency (25 ℃±10 ℃: analog setting)
	Frequency setting resolution	Digital setting: 0.1Hz Analog setting: 0.1 Hz (50/60Hz mode)
Inverter control method		High carrier frequency sinusoidal PWM control (V/F control and simplified vector control are selectable.)
Carrier frequency		・ V/F control setting: Select from seven types (0.8 to 10kHz variable) ・ Simplified vector control setting: Select from four types (2.5 to 10kHz variable) （0.8，1.1，1.6，2.5，5.0，7.5，10.0kHz）
Operation	Start/Stop	・ Operation panel buttons ・ 1a contact signal and 3-wire input (1a, 1b contact signal) are selectable. ・ Wait time (0.1 to 100s) can be set with RS485 communication.
	Forward/Reverse run	・ Operation panel buttons ・ 1a contact signal (Disable reverse run can be set.) ・ RS485 communication.
	JOG operation	Setting frequency: Optional setting for 0.5 to 400Hz Acceleration/deceleration time: Optional setting from 0.04 to 3600s
	Stop mode	Select from ramp-to-stop or coast-to-stop (selection changeover)
	Reset function	Stop signal reset, external reset, panel reset (optional) and power supply reset.
	Start frequency	Optional setting from 0.5 to 60Hz.
	Stop frequency	Optional setting from 0.5 to 60Hz.
	Ride-through operation	Validity of function, 0Hz restart and operating frequency restart (selection changeover)
	Retry function	Retry selection: Select validity of function and details of retry fault Retry times: Optional setting for 1 to 10 times
Control	Frequency setting signal	Local setting (operation panel): Potentiometer and digital setting External analog setting signal: ・ Potentiometer: (10 kΩ, 1/4 W or more) ・ 0-5V DC、0-10 V DC ・ 4-20mA, 0-20mA (Connected with a 200Ω, 1/4 W or more external resistance) External digital setting signal: ・ PWM signal (signal cycle: 0.9 to 1100ms) ・ Frequency increasing SW, reduction SW and storage SW signal Communication setting: RS485 communication
	Voltage/frequency characteristics	Base frequency: 50, 60Hz fixed and optional setting between 45 and 400Hz. 3-point V/F mode: Optional setting for voltage and frequency V/F curve: Constant torque, torque reduction mode (selection changeover)
	Torque boost	Optional setting for 0 to 40%

Control	Acceleration/ deceleration time	0.04 to 3600s (individual acceleration and deceleration setting)
	Acceleration/ deceleration characteristics	Linear and S-shaped acceleration and deceleration (selectable)
	2nd function select	Select 2nd functions (acceleration and deceleration time, torque boost, voltage/frequency characteristics (base frequency and 3C V/F mode), electronic thermal and analog frequency setting)
	Multi speed frequency setting	・Multi speed operation: Up to 16 speed settings (Optional setting for frequency) ・Timer's operation: Up to 8 speed settings (Optional setting for frequency) ・Pulse input operation: Up to 8 speed settings (Optional setting for frequency) Used for linking acceleration and deceleration time.
	Skip frequency setting	Up to 3 place settings(skip frequency band setting from 1 to 10Hz)
	Upper frequency clamp setting	Optional setting from 0.5 to 400Hz.
	Lower frequency clamp setting	Optional setting from 0.5 to 400Hz.
	Bias and gain frequency setting	Bias frequency: Optional setting from -99 to 250% Gain frequency: Optional setting from 0 to 500%
	External stop function	external fault stop and coast-to-stop (optional)
	PID function	PID control mode (optional)
	Communication function	・Interface: RS485 serial communication ・Communication speed:4800/9600/19200/38400 bps (selectable) ・Protocol: MEWTOCOL-COM/MOD-BUS(RTU) (selection changeover) ・Communication method: Half duplex ・Max. No. of connected units: 31 units ・Max. transmission distance: 500m (total length)
Braking	Regenerative braking torque	20% or more
	DC braking	Operates when less than stop frequency ・Braking torque level: 0 to 100 (set between 20 levels) ・Braking time: Optional setting for 0.1 to 120s
Output signal	Analog output	Output specifications: 0 to 10 V DC (max. 1mA) Output function: output frequency and output current proportion (selection changeover)
	Open-collector output	Output specifications: Max. rating 50V DC and 50mA Output function: Run signal, arrival signal, overload alarm, frequency detect, reverse run signal fault alarm, current detect, timer's end signal, output frequency/current proportion, PWM signal (cycle 1ms) (selectable)
	Rely output	Output specifications: 1c contact (contact capacity 230V AC, 0.3A resistance load) Output function: Run signal, arrival signal, overload alarm, frequency detect, reverse run signal fault alarm, current detect and timer's end signal (selectable)
Display	Operating and control conditions	Output frequency, linear speed display (selection changeover), rotation direction output voltage, internal DC voltage, setting frequency, communication station No., timer's runtimes, alarm type, control terminal status (input signal, output signal), operation status, PID (setting value, measured value and output value), progress of automatic tuning, accumulative operation time and accumulative fan operation time
	Fault details	Symbol indicated when protective function activates (last 4 faults are stored.)

Protection	Current limit	Current limit can be set from 1 to 200% of rated output current.
	Trip (stop)	nstantaneous overcurrent and malfunction of fan (SC1 to 4) , temperature faults (OH), overcurrent (OC1 to3), overload and electronic thermal relay (OL), low voltage (LU), overvoltage (OU1 to 3), auxiliary faults (AU), operation error(OP) and CPU error (CPU)
	Stall prevention function	Overcurrent stall prevention and overvoltage stall prevention
Environment	Working ambient temperature and humidity	-10 to +50℃(Note1)(with no freezing) , 90% RH or less(with no dew condensation)
	Storage temperature and humidity	-25 to +65℃, 95% RH or less
	Vibration	5.9m/s^2 {0.6G} or less
	Altitude	Altitude 1000m or less
	Atmosphere	Indoors, with no corrosive gases, explosive gases, oil mist or dust present
Enclosure		IP20 defilade type
Cooling method		0.75kW: Self-cooling, 1.5~3.7kW: Air-cooling

Note 1) When inverters are tightly installed in horizontal direction, tolerable ambient temperature should be -10℃ to + 40℃.

17. Warranty

The specifications for this product are subject to change (including changes in the specifications or discontinuation of the production) without notice for production improvement. If you are about to place an order for this product, please consult with service center in our company to confirm whether information recorded in this manual is the latest edition.
In addition, when using this product in the conditions and environments that are out of the ranges specified in the instruction manual and specifications, or in the conditions and environments that are not recorded in this manual, or in the safety devices and control system of railway, aviation, medical services, etc. whose stability is strictly required, please consult with service center in our company.
This instruction manual is only applicable to specifications, environments and conditions specified by this article.

[Acceptance inspection]

Acceptance inspection shall be promptly performed for the product purchased or delivered. Please pay adequate attention to the safekeeping of the product before and during the acceptance inspection.

[Warranty period]

The warranty on this product are good for one year from the date of the purchase or the delivery to your designated place. However, warranty liabilities for expendable goods such as battery and electric light and auxiliary materials shall not be borne by our company.

[Coverage]

We will offer necessary parts, or promptly replace/repair the defective and/or faulty parts free of charge at the repairing sites designated by our company.

However, the following cases are the exceptions:

1. Failures caused by specifications or faulty handling methods adopted by you.
2. Failures caused by modifications to structure, performance or specifications without our prior approval.
3. When a damage is caused by the unpredictable phenomena with the technique that was practiced after the date of purchase.
4. Failures caused by the usage in the conditions and environments that are out of the ranges specified in the instruction manual and specifications.
5. Failures caused by incorporating in your equipment which is not provided with the generally accepted industrial functions and constructions.
6. Failures caused by natural disasters or force majeure.

Only the product purchased or delivered is covered under this warranty, and this warranty does not apply to damages induced by the physical defects of this product.
The above details are used in the transaction on China's mainland
(excluding Hong Kong, Macao and Taiwan)
With regard to any requirement or question on relative specifications, warranty and service of this production in the transaction and usage in other countries, please consult with our service center separately.

Record of changes

Manual No. is recorded on the back cover.

Date	Manual No.	Description of changes
2007.8	8A3 645 7000 1	First edition
2007.11	8A3 645 7000 1	Second edition (amendment) ・ Modification of hexadecimal indication ・ Appendix to "12-8.3 Precautions on Communicating with Host Computer" (Refer to page 182)

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