Panasonic®

INVERTER
MK300
Instruction Manual

[Applicable models]
- Three phase 400V(0.75kW～3.7kW)

Read this manual carefully before attempting to operate the inverter and store it for future reference.

Foreward

Thank you for purchasing Panasonic products.

● For optimum performance and safety, please read this manual carefully before using this product.

● Please save this manual for future use.

Applicability of the Product

● This general-purpose inverter manufactured by us is not designed or manufactured to be used in machine or system in situations that can affect or endanger human life.

Before using this product in special applications such as machinery or systems in movable object, medical, aerospace, nuclear energy control, submarine relay equipments or systems, please contact us.

● Although this product was manufactured under strict quality control system, it is strongly recommended to install safety devices to prevent serious accidents when used in facilities where a breakdown of this product is likely to cause a serious injury or major losses.

● Do not use this product for loads other than a 3-phase induction motor.

● This product, if discarded, should be treated as industrial wastes.

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Safety Precautions

Safety Precautions

Please read this Manual and related documents carefully before attempting to install, operate, service or inspect the inverter.

Make sure that you have a full understanding of the device, the safety information and all precautions before starting the use.

Precautions described in this Manual are divided into two grades: "Danger" and "Caution".

⚠ Danger : Indicates dangerous situations that could lead to serious injury or death in case of any mishandling.

⚠ Caution : Indicates dangerous situations that could lead to moderate or minor injury or property damage in case of any mishandling.

In addition, failure to follow the precautions in ⚠ Caution may also

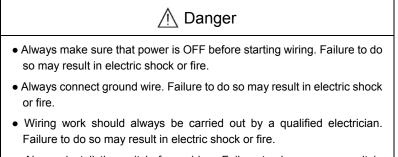lead to serious situations depending on conditions.

Since the precautions of the above two grades are of critical importance, please make sure to observe them strictly.

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1. Installation

⚠ Caution

● Install the unit on non-flammable material, such as metal, etc. Failure to do so may lead to fire.

● Do not place the unit near flammable materials. Failure to do so may lead to fire.

● Do not hold the unit by terminal cover while transporting it. Failure to do so may cause the unit to drop and result in injury.

● Do not let foreign matters such as metal sheet enter into the unit. Failure to do so may lead to fire.

● Install the unit on a place strong enough to support the weight of it according to the instruction manual. Failure to do so may lead to dropping of the unit and thus result in injury.

● Do not install or operate an inverter that is damaged or with part(s) missing. Failure to do so may result in injury.

2. Wiring

⚠ Danger

● Always make sure that power is OFF before starting wiring. Failure to do so may result in electric shock or fire.

● Always connect ground wire. Failure to do so may result in electric shock or fire.

● Wiring work should always be carried out by a qualified electrician. Failure to do so may result in electric shock or fire.
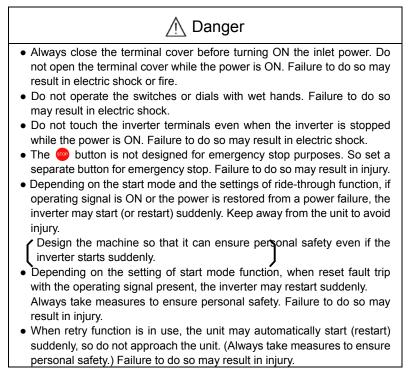
● Always install the unit before wiring. Failure to do so may result in electric shock or injury.

⚠ Caution

- Do not connect an AC power supply to output terminals (U·V·W). Failure to do so may result in injury or fire.
- Make sure that the voltage rating of the product matches with that of AC power supply. Or it may result in injury and fire.
- Tighten terminal screws to specified torque. Failure to do so may lead to fire.
- Do not connect any resistors to the DC terminals P/DB+ and N−. Failure to do so may lead to fire.

3. Operation

⚠ Danger

- Always close the terminal cover before turning ON the inlet power. Do not open the terminal cover while the power is ON. Failure to do so may result in electric shock or fire.
- Do not operate the switches or dials with wet hands. Failure to do so may result in electric shock.
- Do not touch the inverter terminals even when the inverter is stopped while the power is ON. Failure to do so may result in electric shock.
- The 🛑 button is not designed for emergency stop purposes. So set a separate button for emergency stop. Failure to do so may result in injury.
- Depending on the start mode and the settings of ride-through function, if operating signal is ON or the power is restored from a power failure, the inverter may start (or restart) suddenly. Keep away from the unit to avoid injury.

    ⎧ Design the machine so that it can ensure personal safety even if the ⎫
    ⎩ inverter starts suddenly. ⎭

- Depending on the setting of start mode function, when reset fault trip with the operating signal present, the inverter may restart suddenly. Always take measures to ensure personal safety. Failure to do so may result in injury.
- When retry function is in use, the unit may automatically start (restart) suddenly, so do not approach the unit. (Always take measures to ensure personal safety.) Failure to do so may result in injury.

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- While auto-tuning function is in use, the inverter will automatically drive the motor in the stand-along mode when the ⬤ button on the panel is pressed.
  Always take measures to ensure personal safety. Failure to do so may result in injury.
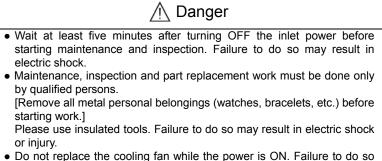- Please confirm and adjust parameters before operation.
  Some machines are likely to trigger unexpected operations.
  Always take measures to ensure personal safety. Failure to do so may result in injury.
- If data change during operation, variations of the motor and motor load may change drastically and sudden stop will occur.
  Always take measures to ensure personal safety. Failure to do so may result in injury.

⚠ Caution

- The heat sinks and braking resistors are at high temperature, so do not touch them. Doing so may result in burns.
- The inverter can be easily switched from low speed to high speed, so confirm carefully the allowable range of the motor and machine before making setting. Failure to do so may result in injury.
- Set separate holding brakes if required. Failure to do so may result in injury.

4. Maintenance, Inspection and Part Replacement

⚠ Danger

- Wait at least five minutes after turning OFF the inlet power before starting maintenance and inspection. Failure to do so may result in electric shock.
- Maintenance, inspection and part replacement work must be done only by qualified persons.
  [Remove all metal personal belongings (watches, bracelets, etc.) before starting work.]
  Please use insulated tools. Failure to do so may result in electric shock or injury.
- Do not replace the cooling fan while the power is ON. Failure to do so may result in electric shock or injury.

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⚠ Caution
● Employ an electrical engineering company to periodically tighten the terminal screws. Loosen screws may lead to overheating or fire.

5. Others
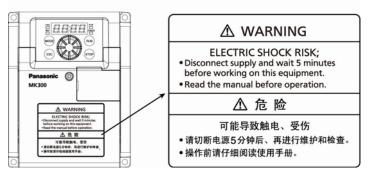
⚠ Danger
● Never modify the unit. 　Failure to do so may result in injury.

6. General Precautions

All diagrams in this instruction manual show the state with the cover or safety partitions removed to explain the details. Be sure to replace the covers and partitions in position, and then operate the unit according to the instruction manual.

7. Warning Label on Inverter

[Inverter Surface]

⚠ WARNING

ELECTRIC SHOCK RISK;
● Disconnect supply and wait 5 minutes before working on this equipment.
● Read the manual before operation.

⚠ 危 险

可能导致触电、受伤
● 请切断电源5分钟后、再进行维护和检查。
● 操作前请仔细阅读使用手册。

Points for Handling

Special Precautions

◆ Use the inverter only within the allow able ambient temperature range (-10∼ 50℃).

Since the service life of the inverter is greatly affected by the ambient temperature, use it within the allowable temperature range. Also, observe the installation directions and conditions. (Refer to P.17)

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

Applying power voltage to the output terminal U, V or W will damage the inverter. Check carefully for faulty wiring and operation sequence (commercial switching circuit, etc.). Never apply a voltage exceeding the allowable range.

◆ Never touch the inside of the inverter during operation.

It could be extremely dangerous since the inverter contains high-voltage circuit. Be sure to turn OFF the power of the inverter and wait at least 5 minutes before making an internal check. Do not touch the heat sink or the braking resistor during operation as these parts are at high temperature.

◆ Radio interference

The main circuit of the inverter contains a high-frequency harmonic component and may interfere with communicating equipment s (such as AM radio) near by. The severity of inte rference depends on the radio fi eld strength a nd is hard to be eliminated completely. While it ma y be reduced by relocating radio antenna, using noise filter, housing the inverter in a metal box, or routing cables in conduit. (Please inquire separately.)

◆ Do not conduct insulation resistance test between wires of the inverter.

To measure insulation resist ance between power cord and motor wires, please remove the cables connected to the invert er and conduct test w ith them. Do not conduct insulation test on the control circ uits. However, insulation test can b e performed between charging unit and the ground.

◆ Do not use a ma gnetic contactor which is connected to the po wer side or load side of the inverter to start or stop the motor (inverter).

Frequent ON/OFF switching on the power supply side can cause inverter malfunction. Also, do not conduct ON/OFF switching on the load side during inverter operation, or it can cause fault trip of the inverter. Start or stop the motor by operating signals of the inverter only.

◆ Do not connect a power capacitor or a surge absorber to the output side of the inverter.

Such device can damage the inverter, resulting in breakage of capacitors and other parts. Remove it if connected.

◆ Do not use the inverter for load other than a motor or for a 1-phase motor.

◆ Precautions for inverter's protection function

The inverter integrates various protection functions such as stall prevention, current limiting and over-current shut-off. These protection functions are designed to protect the inverter against the sudden abnormal conditions, instead of general control functions.

Therefore, avoid using them in applications where they will be activated under normal conditions.

Failure to do so may shorten the inverter's service life or damage the inverter.

Always measure the output current, etc. with a meter, check the details of the fault trip memory, and confirm that operation conditions conform to the precautions and specifications are correct.

In case the protection function is enabled, reset and restart the inverter only after all faults had been removed.

Besides, if the breaker on the input side of the inverter trips, it may be due to the wiring errors or the damaged parts in the inverter.

Find out the breaker tripping causes, and reconnect the breaker after all faults had been removed.

◆ Take the measure of suppressing higher order harmonics.

The higher order harmonics generated by the inverter may result in over-heating or damage of the intake phase capacitor or the electric generator.

◆ Precautions for motors of 400V series

If the inverter is used to drive the motors of 400V series, in this case, use the motors that had undergone a reinforced insulation treatment or adopt a method of suppressing the surge voltage.
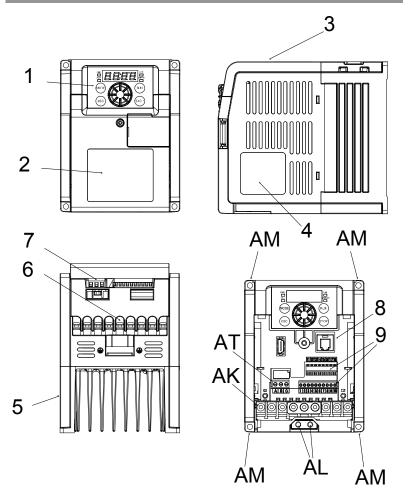
The surge voltage on the motor terminal produced due to the wiring parameters may lead to the aging of insulation of the motor for such reason.
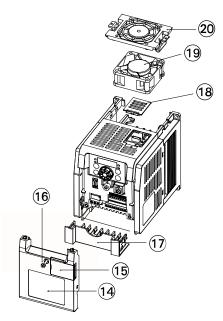
◆ The electronic thermal relay may be unable to provide an overheating protection for motors. It is therefore s uggested to also set an external thermal relay or a PTC thermistor to provide the overheating protection.

1

Part Names and Functions

1.1 Part Names and Functions

① Operation panel unit	⑪Terminal block for main circuit
② Warning label	⑫Ground terminal
③ Casing	⑬Mounting holes
④ Rating Indications(※1)	⑭Terminal cover
⑤ Heat sink	⑮Connection cover for optional units
⑥ Inlet hole for main circuit wire	⑯Fix screws for terminal covers
⑦ Inlet hole for control wire	⑰Terminal cover for main circuit
⑧ Connection terminals for optional units (RJ45)	⑱Cooling fan connector cover (※2)
⑨Terminal Block for control cir cuit (signal input/output)	⑲Cooling fan(※2)
⑩Terminal Block for control circuit (relay output)	⑳Cooling fan cover(※2)
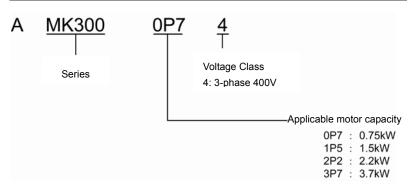
※1 Check that the rating nameplate confirms to your order.

※2 Cooling fans are not provided for models with a capacity of 0.75kW or lower.
    (⑱and ⑳ shall be equipped.)

1.2 List of models

A MK300   0P7 4

Series

Voltage Class
4: 3-phase 400V

Applicable motor capacity

0P7 : 0.75kW
1P5 : 1.5kW
2P2 : 2.2kW
3P7 : 3.7kW

Power supply	Applicable motor capacity (kW)	Model No.
3-phase 400V	0.75	AMK3000P74
	1.5	AMK3001P54
	2.2	AMK3002P24
	3.7	AMK3003P74

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Installation

2.1 Safety Precautions

⚠ Caution	Install the unit on non-flammable material, such as metal, etc.
	Failure to do so may lead to fire.
	Do not place the unit near flammable materials
	Failure to do so may lead to fire.
	Do not hold the unit by terminal cover while transporting it.
	Failure to do so may cause the unit to drop and result in injury.
	Do not let foreign matter such as metal sheet enter into the unit.
	Failure to do so may lead to fire.
	Install the unit on a place strong enough to support the weight of it according to the instruction manual.
	Failure to do so may lead to dropping of the unit and thus result in injury
	Do not install or operate an inverter that is damaged or with part(s) missing.
	Failure to do so may result in injury.

2.2 Installation Precautions

■ Do not install the inverter in the following locations.

・Locations subject to direct sunlight.
・Locations subject to water vapor or high humidity.
・Locations with large amount of oil mist, dust or fiber dust.
・Locations where rain water, water drops or oil drops may come in contact.
・Locations where there are corrosive gases, explosive gases or flammable gases.
・Installation onto flammable materials such as wood, or near flammable materials.
・Locations subject to vibration.

■ Make sure that the ambient temperature stays within the specified range.

If the inverter is installed near a heat generating device or housed in a panel, its surrounding temperature will increase. This may shorten the life of the inverter. When housing the inverter in a panel, give sufficient consideration to the cooling method and the panel size.

○ Allowable ambient temperature range: -10 to +50℃
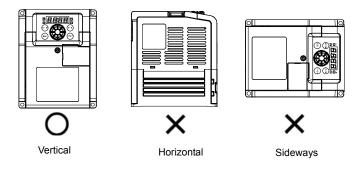(Ambient temperature should be measured at a point 5 cm from the inverter.)
○In case multiple inverters are installed
If multiple inverters are installed sideways, ambient temperature should be within the range of -10 to + 40 °C.

■ Install the inverter vertically

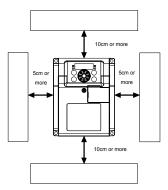Installing the inverter in any other way will decrease heat dissipation effect and result in malfunction.

Vertical   Horizontal   Sideways
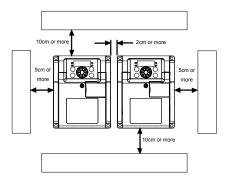
■ Space for Installation

When a single inverter is installed

To ensure that there are suf ficient spaces for the ventilatio n (cooling) and wiring of the in verter, always provide a clear ance as show n in the following figure.
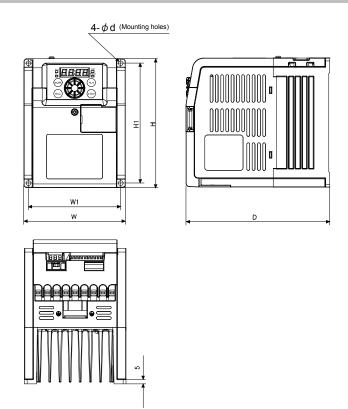

When multiple inverters are installed sideways

If multiple inverters are inst alled sideways inside the control panel, always provide a clearance as show in the following figure.

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2.3 Outline Dimensions

● 3-phase 400V input type   Unit: mm

Inverter capacity	W1	W	H1	H	D	Φd
0.75, 1.5 kW	100	110	130	140	156	5
2.2, 3.7 kW	130	140	130	140	156	5

Note 1): Install the M4 screws in the mounting holes.

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Wiring

3.1 Safety Precautions

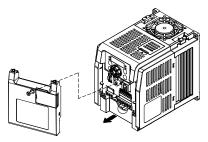|	
◇ Danger	Make sure that Power is turned OFF before starting wiring.
	Failure to do so may result in electric shock or fire.
	Always connect ground wire.
	Failure to do so may result in electric shock or fire.
	Wiring work should always be carried out by qualified electricians.
	Failure to do so may result in electric shock or fire.
	Always install the unit before wiring.
	Failure to do so may result in electric shock or injury.
⚠ Caution	Do not connect an AC power source to the output terminals (U·V·W).
	Failure to do so may result in injury or fire.
	Make sure that the voltage rating of the product matches with that of AC power source.
	Failure to do so may result in injury or fire.
	Tighten the terminal screws to the specified tightening torque.
	Failure to do so may lead to fire.
	Do not connect resistors to the DC terminals P/DB+ or N−. Failure to do so may lead to fire.

3.2 Removal and Installation of Terminal Cover

■Removal and Installation of Terminal Cover

〔Removal〕 ① Loosen the retaining screws in the terminal cover first, then pull it up lightly while holding the center button edge of the terminal cover.

〔Installation〕 ②Insert the mounting jaw of the terminal cover into the slot on the casing, then lightly press down the center bottom edge of the terminal cover.

Note: the screws are designed to be unable to detach from the cover for the purpose of preventing dust from entering.

■Removal and Installation of Terminal Cover of the Main Circuit

〔Removal〕 ① While holding the center part of the terminal cover of the main circuit, pull it up lightly until the mounting jaw releases.

〔Installation〕 ② Insert the mounting jaw of the terminal cover of the main circuit into the slot on the casing, then lightly press down the terminal cover.
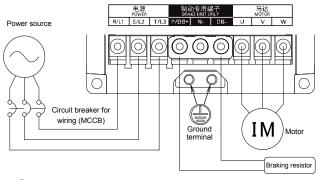
Note: after installation, make sure that the terminal cover and the main circuit terminal cover are fitted in position.

3.3 Wiring (Main Circuit)

3.3.1 Main Circuit Wiring Diagram

■ 3-phase 400V　0.75～3.7kW

To meet the CE marking requirements, protective devices against over-current, short-circuit and current leakage must be set up on the power supply side of the inverter.

⏚ ：Symbol for Grounding

■ Functions of Terminals for Main Circuit

Terminal No.	Terminal Name	Explanation of terminal function
R/L1, S/L2, T/L3	Power supply for main circuit	Connect to commercial power.
U, V, W	Inverter Output	Connect to 3-phase motor.
P/DB+, DB-	Braking resistor connection	Connect to breaking resistor.
N−	Internal DC voltage (negative)	Negative terminal of the internal DC voltage.
⏚ ×2	Ground	Ground terminal. 3-phase 400 V type: ground resistance 10 Ω or less. Ground the neutral of the power source.

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3.3.2 Precautions on Wiring Main Circuit

■ Precautions on Wiring

To avoid mistakes in wiring and operation, be sure to observe the following guides. (Failure to do so may damage the unit.)

・Always connect the power source to input terminals (R/L1, S/L2, T/L3), and connect the motor to output terminals (U, V, W). Please connect the output terminals (U, V, W) in the correct sequence. Failure to do so may cause the motor to run in the reverse direction.
・Use round crimp terminals with sleeve for power source and motor connections. Select crimp terminals according to wire sizes and screw sizes.
・After wiring main circuit, confirm the tightening condition of terminals.
・Main circuit must be wired prior to control circuit. Otherwise, re-tightening operation is not possible after control circuit wiring is completed.
・When connecting directly to a transformer of large capacity (500 kVA or more), always install an AC reactor on the input side of the inverter.

Note 1: It is recommended to use teflon insulated wire (600 V, Class 2, allowable operating temperature up to 75 °C) for main circuit wiring.
Note 2: Use wires with larger diameter if the wiring distance is long.
Note 3: If the over-current trip of the circuit breaker is a magnetic type, the device could become overheated due to higher harmonics. Use a load rate of 50% or lower in this case.
Note 4: Use a circuit breaker for the motor.
Note 5: Always connect protective devices against over-current, short-circuit and current leakage on the input side.

■ Precautions on Using Regenerative Brakes

・When using regenerative brakes, set the parameter P026 to "0". Since its factory setting is "1", the brakes will not be activated in that case.
・Specifications for regenerative brakes are shown as follows. Carefully consider the operation conditions before using them. Note that the inverter could be damaged if a brake outside specifications is used.

■ Connected Device, Wire Size and Tightening Torque (3-phase 400V)

Inverter capacity	Current rating of circuit breaker for wiring (MCCB)	Wire size		Screw size	Tightening torque	Braking resistor[1]		
		R/L1, S/L2, T/L3, U, V, W	Ground wire			Allowable braking utilization rate	Resistance value	Allowable continuous power rating
0.75 kW	10 A	2 mm² (AWG14)	2 mm² (AWG14)	M4	1.2N·m	5%	470Ω	80W
1.5 kW	15 A					5%	470Ω	80W
2.2 kW	20 A		3.5 mm² (AWG12)			5%	320Ω	120W
3.7 kW	30 A					5%	190Ω	220W

*1) The above specifications are reference data in such conditions where the braking torque is 100%, the max. operating time is 5s and the max. braking utilization rate is 5%.

Notes for Customers when selecting a braking resistor
1) Resistance Value (Ω)
When selecting a resistor by referring to the resistance value as shown in the above table, a larger resistance value can by chosen, however, the braking torque shall be decreased accordingly.
2) Allowable continuous power rating (W)
A larger power rating may be chosen when referring to the value as shown in the above table, yet in this case, it will cause the resistor to produce lots of heat (300℃). Please cooperate with the resistor manufacturer to take precautions during installation.
3) Allowable braking utilization rate (%)
The larger the continuous power rating of the braking resistor, the higher the utilization rate can be used in the theoretical calculation. Yet in this case, the resistor in the inverter shall be over-heated, therefore, it is suggested to use the utilization rate of 5% as specified.
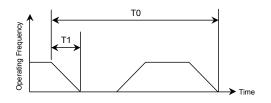
1) Braking torque: 100% or more
2) Max. Operating Time: T1max= 5s
3) Max. Utilization Rate: T1／T0 (%ED)　5％
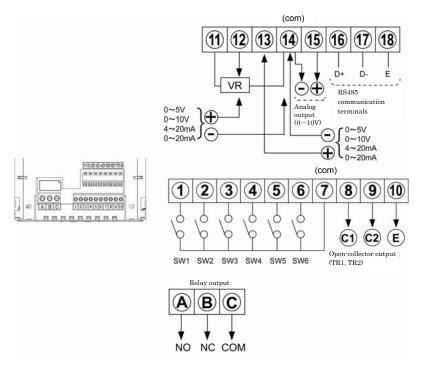
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3.4 Wiring (Control Circuit)

3.4.1 Terminal Arrangement and Functions

■ Terminal Arrangement

・Specification for frequency setting potentiometer (VR) : 10kΩ, 1/4W or higher

・Specification for relay output contact: 1c volt free contact

    230V AC 0.25 A (resistive load), 30V DC 1A (resistive load)

・Specification for open-collector output: Max. rating 50V DC, 50mA

■ Explanation of terminals for control circuit

Terminal No.	Terminal Function
①	Input terminal for multi-function control signal SW1
②	Input terminal for multi-function control signal SW2
③	Input terminal for multi-function control signal SW3
④	Input terminal for multi-function control signal SW4
⑤	Input terminal for multi-function control signal SW5
⑥	Input terminal for multi-function control signal SW6
⑦	Common terminals for input signals (①～⑥)
⑧	Output terminal for open-collector (TR1) (C1: Collector)
⑨	Output terminal for open-collector (TR2) (C2: Collector)
⑩	Common output terminal for open-collector (E: Emitter)
⑪	Connection terminal for frequency setting potentiometer (+5 V)
⑫	Input terminal for analog signal of frequency setting
⑬	Input terminal for the 2nd analog signal
⑭	Common terminals for analog signals (⑪, ⑫, ⑬, ⑮)
⑮	Output terminals for analog signals (0～10V)
⑯	＋terminal for RS485 communication transmission line (D＋)
⑰	－terminal for RS485 communication transmission line (D－)
⑱	Terminal for terminal station of RS485 communication (E)
A	Output terminal for relay contact (NO: factory setting)
B	Output terminal for relay contact (NC: factory setting)
C	Output terminal for relay contact (COM)

Note: common terminals (⑦, ⑩, ⑭) are connected internally. Do not ground the common terminal.

3.4.2 Common Precautions on Terminals for Control Circuit

■ Precautions on Wiring

・For wiring of terminals of control circuit, strip specified length of insulation coating before connecting.
・Loosen the terminal screws and insert the wires from the bottom of the terminal block, and tighten the screws to specified tightening torque.
・Any loose connection could cause wire to come off and lead to malfunction. Also, over-tightening could cause short-circuit due to the broken screws and unit, thus lead to malfunction
・Use shielded cables for all control signal lines and separate them from power lines or high-voltage circuits (20 cm or more).
・Wiring length of control signal lines should be within 30m.
・Since input signals of control circuit are feeble, use dedicated terminals for feeble signals to avoid poor contact during contact input.

■ Wire Size and Tightening Torque for Control Circuit Terminal

Terminal symbol	Screw size	Tightening torque N·m	Wire size	Stripping length of wire
A，B，C	M3	0.5～0.6	0.25～0.75mm^2 (AWG24～AWG18)	6mm
① to ⑱	M2	0.22～0.25	0.25～0.75mm^2 (AWG24～AWG18)	5mm

・Screwdriver: Small-size ⊖ screwdriver
 (Thickness of the edge: 0.4mm/Width of the edge: 2.5mm)
・Terminal block for main circuit：
 The maximum number of the conductors： 2*1
・Terminal block for control circuit (Relay output)
・Terminal block for control circuit (Signal input/output)：
 The maximum number of the conductors： 2 *1
*1 The maximum number of the conductors should be made in the reach of the suitable electric wire size.

・Stripping length of wire

■ Notes for wiring

To prevent wire disconnection, please observe the following points:
・Do not damage the core wire when peeling off its insulation layer.
・Connect the core wires at the same time.
・Do not lift the core wire to make a connection through welding. A disconnection is possible in this case due to vibration.
・After wiring, do not apply voltage to the cables.
・In respect of the terminal structure, if the wire is tightened in an anti-clockwise direction, it is an error connection.
 Unplug the wire and reconnect it after the correct terminal had been confirmed.

Insert the cable line here
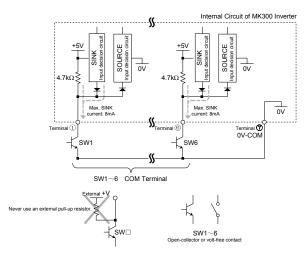
Clockwise   Anti-clockwise
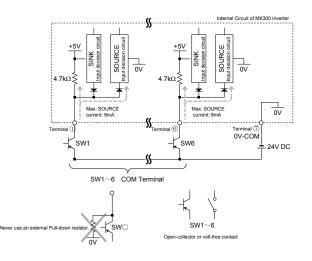
3.4.3 Specific Precautions on Each Terminal
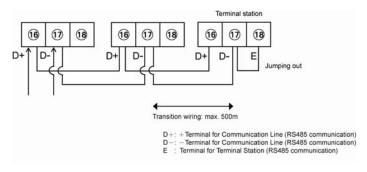
■ Input Terminal for Multi-function Control Signal (Terminals No. ① to ⑥)

• General SINK/SOURCE input type. The external input devices, SINK input or SOURCE input type, can be applicable. Please carry out the wiring as the wiring example given below.

■ Wiring Diagram and Precautions for SINK Input Setting

• Input open-collector signal or volt-free contact signal in between the input terminal (①~⑥) and the 0V-COM terminal ⑦.
• Never supply (＋) voltage from an external power source or use an external pull-up resistor. Otherwise, it will cause malfunction.
• Note that the 0V-COM terminal ⑦ is internally connected with the terminal (⑩, ⑭) and the internal circuit 0V. Moreover, never ground it.
• Each terminal has a max. SINK current of 8mA.

■ Wiring Diagram and Precautions for SOURCE Input Setting

・Input open-collector signal or volt-free contact signal to the input terminal (①～⑥) by supplying an external 24V power source. Connect the negative terminal (on the 0V side) of the external 24V power source to the 0V-COM terminal ⑦.

・Never use an external Pull-down resistor. Otherwise, it will cause malfunction.

・Note that the 0V-COM terminal ⑦ is internally connected to the terminal (⑩, ⑭) and the internal circuit 0V. Moreover, never ground it.

・Each terminal has a max. SOURCE current of 8mA.
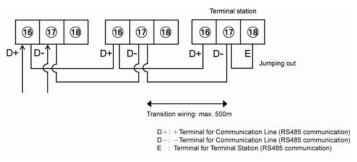
■ Wiring for Open-collector Output Terminals (Terminal No. ⑧ to ⑩)

　・When using open-collector output terminals to drive inductive loads, always connect a freewheel diode.

■ Wiring for RS485 Communication Terminals (Terminal No. ⑯ to ⑱)

The following figure shows the terminals used when connection is made between PC and PLC via RS485 communication lines.

　・As for communication cable, use a shielded twisted-pair cable and separate it from power lines or high-voltage circuits (20 cm or more).
　・The total wiring length of the communication cables must not exceed 500m.
　・Jump out the terminal "D-" and "E" of the inverter used as terminal station. Jumping is not allowed for any other device.

4

Operation Method
(Basic & Trial Operations)
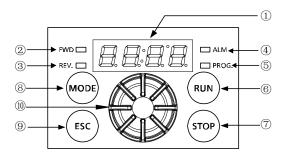
4.1 Safety Precautions

⚠ Danger	Always close the terminal cover before turning ON the inlet power. Do not open the terminal cover while the power is ON. Failure to do so may result in electric shock or fire. Do not operate the switches or dials with wet hands. Failure to do so may result in electric shock. Do not touch the inverter terminals even when the inverter is stopped while the power is ON. Failure to do so may result in electric shock. The ⬤ button is not designed for emergency stop purposes. Set a separate button for emergency stop. Failure to do so may result in injury.
⚠ Caution	The heat sinks and braking resistors are at high temperature, so do not touch them. Doing so may result in burns. The inverter can be easily switched from low speed to high speed, so confirm carefully the allowable range of the motor and machine before making settings. Failure to do so may result in injury. Set separate holding brakes if required. Failure to do so may result in injury. Before turning on the power, check the following points again. 1. Check again whether all wirings are correct. The reversed wirings between the power supply and the loads in particular could damage the inverter. 2. Check whether the voltage rating of the inverter matches with that of the power supply. 3. Check whether a phase-lead capacitor is connected to the motor. The connection of a phase-lead capacitor may result in faults to the inverter and capacitor. 4. Confirm the set frequency before starting a trial operation.

4.2 Description of Operation Panel

No	Component name	Symbols used in this Manual	Details of function
①	Display part		For displaying output frequency, current, linear speed, set frequency, communication station No., error details, each mode indication and function setting data.
②	FWD indicator (green)		For indicating forward run (ON during constant-speed running/Flickering during acceleration/deceleration running).
③	REV indicator (green)		For indicating reverse run (ON during constant-speed running/Flickering during acceleration/deceleration running).
④	ALM indicator (red)		For indicating abnormality and alarms.
⑤	PROG indicator (green)		ON when switching the parameter setting mode.
⑥	RUN button	RUN	A button for enabling the inverter to run.
⑦	STOP button	STOP	A button for disabling the inverter to run.
⑧	MODE button	MODE	A button used to switch modes of "operation status display" and "function setting", and from data display to mode display.
⑨	ESC button	ESC	Return to the previous action during parameters setting.
⑩	Knob	To the right	For adding the parameter No., increasing the set value and switching the direction setting.
		To the left	For reducing the parameter No., decreasing the set value and switching the direction setting.
		Press down	For pressing down when the mode, rotation direction, parameter No., or the set value had been confirmed. And for switching between the frequency and current display in the mode of "operation status display".

4.3 Operation Modes
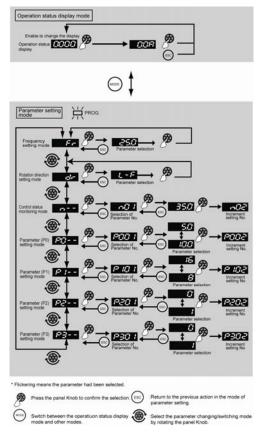
Mode	Description	Panel Display Content
Operation status display mode	For displaying the output frequency and the output current	`0000` `0.0A`
Frequency setting mode	For digital setting of frequency and frequency command monitoring	`Fr` `0.2`
Rotation direction setting mode	For rotation direction setting of panel operation and control status (operation panel/external control/communication) monitoring	`dr` `L - F`
Control status monitoring mode	For monitoring of control status and abnormality	`n01`
Parameter (P0) setting mode	For changing and monitoring the parameter data, and using the copy function of parameter data.	`P001`
Parameter (P1) setting mode	For changing and monitoring the parameter data, and using the copy function of parameter data.	`P101`
Parameter (P2) setting mode	For changing and monitoring the parameter data, and using the copy function of parameter data.	`P201`
Parameter (P3) setting mode	For changing and monitoring the parameter data, and using the copy function of parameter data.	`P301`

4.4 Switching between Operation Modes

・Press the (MODE) button to switch between the modes of "operation status display" and "parameter setting".

(The PROG LED will be turned ON in the parameter seeting mode.)
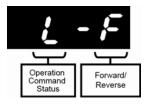
・In each mode, if the "Knob" button is pressed, the data monitoring or changing function will be enabled; and if the ESC button is pressed, it will return to the previous display status. Therefore, if the "Knob" button is pressed by mistake, just press the ESC button to return to the previous display status.

* Flickering means the parameter had been selected.

Press the panel Knob to confirm the selection. ESC: Return to the previous action in the mode of parameter setting.

MODE: Switch between the operatiuon status display mode and other modes. Select the parameter changing/switching mode by rotating the panel Knob.

4.5 Rotation Direction Setting Mode

In the Operation Status Display mode, press the ⓜⓞⓓⓔbutton once, the mode shall be changed to the Parameter Setting mode, then clockwisely rotate the panel Knob to select the Rotation Direction Setting mode and press the panel Knob to display the rotation direction data, next, change the rotation direction with the Knob and press the the Knob to apply the change. (The factory setting is "Forward Run".)

Finally, press the ⓡⓤⓝ button to start the operation.

Operation Command	Display	Rotation Direction	Display
Operation panel	L	Forward Run	F
External control	E	Reverse Run	r
Communication	C		

【Note】

・ The rotation direction setting in this mode is only enabled when P003 is set to 0.

The setting function is disabled and only the monitoring function is enabled when P003 is set to 1.

4.6 Monitoring Mode

The Monitoring mode in the Setting mode enables you to view the inverter information.

27 items can be viewed in the Monitoring mode.

4.6.1 List of Monitoring Parameters

No	Name	Unit	Content
n001	Output frequency	Hz	To display the output frequency (unit: 0.1Hz)
n002	Output current	A	To displaythe output current (unit: 0.1A)
n003	Output voltage	VAC	To display the output voltage (unit: 1VAC)
n004	Internal DC voltage	VDC	To display the internal DC voltage (unit: 1VDC)
n005	Set frequency	Hz	To display the set frequency (unit: 0.1Hz)
n006	Communication station No.	—	To display the current setting of the connmunication station No.
n007	Operation times of timer	Times	To display the continuous operation times of timer in one cycle
n008	Alarm type	—	To display the indication of the LED alarm
n009	Control circuit terminal status (input signal)	—	To display the input signal status of the control circuit terminal
n010	Control circuit terminal status (output signal)	—	To display the output signal status of the control circuit terminal
n011	PID setting value (SP)	%	To display the setting value (SP) of PID control
n012	PID measured value (PV)	%	To display the measured value (PV) of PID control
n013	PID output value (MV)	%	To display the output value (MV) of PID control
n014	Cumulative operation time	—	To show the cumulative operation time of the inverter
n015	Cumulative operation time of fan	—	To show the cumulative operation time of fan of the inverter
n016	Abnormality display 1 (latest)	—	To display the details of the latest abnormality
n017	Abnormality display 2 (second to latest)	—	To display the details of abnormality from second to latest
n018	Abnormality display 3 (third to latest)	—	To display the details of abnormality from third to latest
n019	Abnormality display 4 (fourth to latest)	—	To display the details of abnormality from fourth to latest
n020	Unit Version	—	To show the firmware version of the Unit
n021	Pulse input signal detection value	Hz	To display the detected frequency value based on the pulse input signal
n022	Winding length	m	To display the current winding length
n023	Used for manufacturer's confirmation	—	—
n024	Used for manufacturer's confirmation	—	—
n025	Analog input 1	%	To display the corresponding percentage of the analog quantity of the analog input terminal ⑫
n026	Analog input 2	%	To display the corresponding percentage of the analog quantity of the analog input terminal⑬
n027	Temperature of internal module	℃	To show the temperature of the internal module.

4.6.2 Explanation of the Monitored Items

n001 Output Frequency

To display the output frequency of the inverter; "0.0"shall be displayed if the inverter is in the stop status (unit: Hz).

n002 Output Current
n003 Output Voltage
n004 Internal DC Voltage

To display the output frequency, output voltage as well as the internal DC voltage of the inverter. These indicated data are not served as values from precision measurement, they are provided for reference only. (if you need accurate values, use other measuring instruments.)

n005 Set Frequency

To display the set frequency of the inverter (Unit: Hz).

n006 Communication Station No.

To display the communication station number that had been set.
The communication station number can be set with "P132: Communication Station No. Setting".

n007 Operation Times of Timer
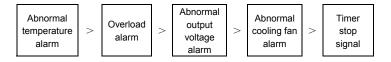
To disply the operation times of the timer in one cycle in the sate of multi-step speed operation or acceleration/deceleration linking operation. When a cycle starts, the operation times shall be counted up. Yet when each operation ends and the next operation command is input, the counted times shall be cleared. Operation times of timer can be set with "P324: Timer Operation Times".

n008 Alarm Type

To display different alarm LED contents.

Alarm Type	Indication
Normal	$nonE$
Abnormal output voltage alarm	$ALOU$
Overload alarm	$ALOC$
Abnormal temperature alarm	$ALOH$
Abnormal cooling fan alarm	$ALFn$
Timer stop signal	$tEnd$

Note: 1. When "Alarm LED Operation Selection"(Parameter P056) is set to "1"; If all alarms occur simultaneously, their display priortity shall be as follows. (If a higher-priority alarm is in an active state, it will be continuously displayed even if a lower-priority alarm enters.)

Abnormal temperature alarm	>	Overload alarm	>	Abnormal output voltage alarm	>	Abnormal cooling fan alarm	>	Timer stop signal
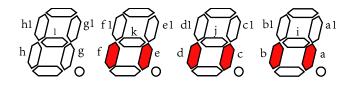
n009	Control Circuit Terminal Status (Input Signal)
n010	Control Circuit Terminal Status (Output Signal)

Monitoring Parameters n009 and n010 and displaying the statuses of the input and output signals of the control circuit terminal.

Segment a1 to f1 shall accordingly light up or light out when the input terminals (①～⑥) and the common terminal ⑦ are turned ON or turn OFF. When output terminals are closed (ON) between ⑧ to ⑩ and ⑨ to ⑩, segment a1 and b1 of n010 light up; when output terminals are opened (OFF) between ⑧ to ⑩ and ⑨ to ⑩, segment a1 and b1 light out.

Segment c1 lights up when the output terminals is ON (Excitation in ON status: short circuit across A-C; non-excitation in ON status: short circuit across B-C); segment c1 lights out when the output terminal is OFF (Excitation in ON status: open circuit across B-C; non-excitation in ON status: open circuit across A-C).)

Monitor No.	I/O signal	LED segment indication		
		Terminal indication	Signal ON	Signal OFF
n009	SW1	"a" lights up	"a1" lights up	"a1" lights out
	SW2	"b" lights up	"b1" lights up	"b1" lights out
	SW3	"c" lights up	"c1" lights up	"c1" lights out
	SW4	"d" lights up	"d1" lights up	"d1" lights out
	SW5	"e" lights up	"e1" lights up	"e1" lights out
	SW6	"f" lights up	"f1" lights up	"f1" lights out
n010	Open-collector 1	"a" lights up	"a1" lights up	"a1" lights out
	Open-collector 2	"b" lights up	"b1" lights up	"b1" lights out
	Relay	"c" lights up	"c1" lights up	"c1" lights out

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n011	PID Setting Value (SP)
n012	PID Measured Value (PV)
n013	PID Output Value (MV)

To display the setting value (SP), measured value (PV) as well as the output value (MV) of PID control (Unit: %).

n014	Cumulative Operation Time
n015	Cumulative Operation Time of Fan

"n014" shows the accumulative power-on time of inverter. "n015" shows the accumulative operation time of the inverter cooling fan. "P052: Cooling Fan ON-OFF Control" is set to "1": In synchronized operation, no counting will be executed when the cooling fan is stopped.

The basic display unit is "0.001" corresponding to 1 hour. The display increment is "0.01" corresponding to 10 hours for the time longer than 10.0; and "0.1" corresponding to 100 hours for the time longer than 100.0; and "1" corresponding to 1000 hours for the time longer than 1000.0.

Since there are errors in the displayed values, so just use them for reference only.

n016	Abnormality Display 1 (Latest)
n017	Abnormality Display 2 (Second to Latest)
n018	Abnormality Display 3 (Third to Latest)
n019	Abnormality Display 1 (Fourth to Latest)

To show the abnormality information of the inverter (latest, second to latest, third to latest and fourth to latest).

n020	Unit Version

· To show the firmware versions of the MK300 unit and the operation panel.
· The model code and version code are shown as follows.

Version Code
(Retain 2 decimals)

About the version of the MK300 unit
· Operation status display varies depending on the combination of the firmware versions of MK300 unit and the operation panel.

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n021 Pulse Input Signal Detection Value

・To show the detected frequency value based on the pulse input signal from the inverter (unit: Hz).

n022 Winding Length

・To show the calculated result of the winding length of the pulse input signal when any one of the set values of "P101: SW1 Function Selection " to"P106: SW6 Function Selection" is set to "14".
・The winding length is calculated as below.

$$\text{Winding Length} = \frac{\text{(Pulse value input to SW)} \times \text{(P343:Winding length ratio)}}{1000}$$

・The relationship between the winding length and the indication is as follows.
Display 1～9999 when the winding length is 1m～9,999m.
Display1.000～9.999 when the winding length is 10,000m～99,999m.
Display 10.00～60.00 when the winding length is 100,000m～600,000m.
・The calculated value shall be cleared when any one of the set values of "P101: SW1 Function Selection " to"P106: SW6 Function Selection" is set to "15"and SW is turned to be ON.

n025 Analog Input 1

To show the corresponding percentage (0～100%) of the analog quantity of the analog input terminal ⑫ (unit: %).

n026 Analog Input 2

To show the corresponding percentage (0～100%) of the analog quantity of the analog input terminal ⑬ (unit: %).

n027 Temperature of Internal Module

To show the temperature of the internal module (unit: ℃).

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4.7 Method for Changing Parameters

Be sure to change and set various function parameters in stop status. And note that some function parameters can be changed during operation.

4.7.1 Changing Function Parameters in Stop Status

Setting Example:

Change the base frequency from 50.0Hz to 45.0Hz (that is, change the setting value of parameter P013 from "50.0" to "45.0")

① Press [STOP] button to stop the inverter and show "0000".

② Press [MODE] button to show "Fr".

③ Rotate the encoder to "P0--".

④ Press the encoder to show "P001".

⑤ Rotate the encoder to "P013".

⑥ Press the encoder to show "50.0" and it flickers.

⑦ Rotate the encoder to "45.0", and it flickers.

⑧ Press the encoder to set the data. It shows "P014".

⑨ Press [MODE] button to show "0000".
By now, the inverter is in the normal stop status and can be operated.

4.7.2 Changing Function Parameters During Operation

⚠ Danger	Changing parameters during operation are likely to cause great changes to the motor and motor load, thus resulting in a sudden stop of them. (Please take measures to ensure personal safety.) Failure to do so may result in injury.

For the function parameters that can be changed during operation, please refer to items marked with "○" in "Changeable during Operation" of "4.8 List of Function Parameters".

Setting Example:
Change the first deceleration time from 5.0s to 10.0s (that is, change the setting value of parameter P002 from "5.0" to "10.0"). Confirm

Use the current data to control the motor

① Confirm the operation status (operating at 50.0Hz).

② Press (MODE) button to show "Fr".

③ Rotate the encoder to "P0--".

④ Press the encoder to show "P001".

⑤ Rotate the encoder to "P002".

⑥ Press the encoder to show "5.0" and it flickers.

⑦ Press the encoder to show "10.0" and it flickers.

Use new data to control the motor

① Press the encoder to set the data. It shows "P002".

② Press (MODE) button to show "50.0".

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【Note】

• The initial values of such parameters may vary with the different ratings of inverters.

• If you monitor parameters that cannot be set during operation when the operation signal is OFF, the setting values will flicker and then become changeable.

Operation Signal: ON — OFF

• The changed communication parameters will only be effective after the inverter is rebooted (namely, the power is changed from OFF to ON).

• During operation, it is impossible to change to auto torque boost from manual torque boost and vice versa.

4.8 List of Function Parameters

4.8.1 List of P0 Function Parameters

No.	Function name	Changeable during operation	Setting range				Unit	Initial value	Reference page
P001	The 1st Acceleration Time	○	0.0(0.04sec)•0.1～3600				0.1[sec]	5.0	100
P002	The 1st Deceleration Time	○	0.0(0.04sec)•0.1～3600				0.1[sec]	5.0	101
P003	Run Command Selection	—	**Setting value** / **Panel Reset**[*1] / **Control Type** / **Content**				—	0	102

Detail of P003 Setting range:

Setting value	Panel Reset[*1]	Control Type	Content
0	Yes	Panel	Run: RUN Stop: STOP Rotation direction: set in "dr" mode
1	Yes	Panel	Forward: ⊛+RUN Reverse: ⊛+RUN Stop: STOP
2	No	External control	Run: SW1 ON Stop: SW1 OFF Forward: SW2 OFF Reverse: SW2 ON
3	Yes	External control	Run: SW1 ON Stop: SW1 OFF Forward: SW2 OFF Reverse: SW2 ON
4	No	External control	Forward run: SW1 ON Stop: SW1 OFF Reverse run: SW2 ON Stop: SW2 OFF
5	Yes	External control	Forward run: SW1 ON Stop: SW1 OFF Reverse run: SW2 ON Stop: SW2 OFF
6	No	Communication	Communication command
7	Yes	Communication	Communication command

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P004	Frequency Setting Signal	—	0: Panel input 1: External Control: "VR" input 2: External Control:　0〜5V 3: External Control:　0〜10V 4: External Control:　4〜20mA 5: External Control:　0〜20mA 6: Communication: Communication command 7: External Control: PWM signal 8: External Control: pulse signal	—	0	104
P005	Operation Status Monitoring	—	0: Output frequency 1: Linear speed 2: Output current 3: Communication station No. 4: Set frequency 5: Communication station No./Output frequency 6: Communication station No./Linear speed 7: Communication station No./Output current 8: Winding length	—	0	105
P006	Vector Control Selection	—	0: V/F control 1: Sensorless vector control	—	0	106
P007	Carrier Frequency	○	In V/F control: 0.8〜15.0 (9 options) In sensorless vector control: 2.5〜15.0 (6 options)	[kHz]	2.5	106
P008	S-shape Acceleration/Deceleration mode	—	0: Linear acceleration/deceleration 1: S-shape acceleration/deceleration(quadratic curve) 2: S-shape acceleration/deceleration (cubic curve)	—	0	107
P009	V/F Mode	—	50: 50Hz mode 60: 60Hz mode FF: Free mode 3C: 3-point mode 3C1: 3-point fixed 1 3C2: 3-point fixed 2 3C3: 3-point fixed 3 3C4: 3-point fixed 4 3C5: 3-point fixed 5 3C6: 3-point fixed 6	—	50	108
P010	V/F Curve	—	0: Constant torque mode 1: Reduced torque mode	—	0	111
P011	Torque Boost *7	○	0〜40: Manual torque boost Auto: Auto torque boost	1[%]	5	112
P012	Max. Output Frequency	—	50.0〜400.0	0.1[Hz]	50.0	113
P013	Base Frequency	—	45.0〜400.0	0.1[Hz]	50.0	113
P014	Change Point Frequency 1	○	0.2〜400.0	0.1[Hz]	0.2	114

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P015	Change Point Voltage 1	○	0.0～100.0	0.1[%]	0.0	114
P016	Change Point Frequency 2	○	0.2～400.0	0.1[Hz]	0.2	114
P017	Change Point Voltage 2	○	0.0～100.0	0.1[%]	0.0	114
P018	Max. Output Voltage	─	0 (power source voltage value), 1～500	1[V]	0	115
P019	JOG Frequency	○	0.2～400.0	0.1[Hz]	10.0	116
P020	JOG Acceleration	○	0.0(0.04sec)•0.1～3600	0.1[sec]	5.0	116
P021	JOG Deceleration	○	0.0(0.04sec)•0.1～3600	0.1[sec]	5.0	116
P022	JOG Panel Operation	─	0: Do not use the panel JOG function. 1: Use the panel JOG function(external control JOG function is unavailable). 2: Use the panel JOG function(external control JOG function is unavailable).	─	0	116
P023	Electronic Thermal Selection	○	0: 140% of the rated current, 1min OL tripping 1: without reducing the output frequency 2: Reducing the output frequency 3: Specifications of forced air-cooled motor	─	2	118
P024	Thermal Current Setting	○	0.1～100.0	0.1[A]	*4	118
P025	Overcurrent Stall Prevention Function	○	0: Overcurrent Stall Prevention Function: OFF 　Overcurrent Tripping Prevention Function: OFF 1: Overcurrent Stall Prevention Function: ON 　Overcurrent Tripping Prevention Function: ON 2: Overcurrent Stall Prevention Function: OFF 　Overcurrent Tripping Prevention Function: ON 3: Overcurrent Stall Prevention Function: ON 　Overcurrent Tripping Prevention Function: OFF	─	1	119
P026	Overvoltage Stall Prevention Function	○	0: Stall Prevention Function: OFF 1: Stall Prevention Function: ON 　(the ON/OFF function of the regeneration resistor/brake resistor is disabled.)	─	1	120
P027	Current Limit Function	○	0.0•0.1～9.9	0.1[sec]	0.0	121
P028	OCS Level	○	1～200	1[%]	140	122

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P029	Retry Function Selection	○	0: Without retry function 1: Only for overcurrent abnormality 2: Only for overvoltage abnormality 3: Only for overcurrent abnormality/overvoltage abnormality	—	0	123
P030	Retry Count	○	1～10	1[Times]	1	123
P031	Start Mode	—	0: Run 1: OP Stop 2: Run after the waiting time 3: OP Stop (waiting time)	—	1	124
P032	Ride-through Restart Selection	—	0: Restart Mode 1 1: Restart Mode 2 2: Restart Mode 3 3: Restart Mode 4	—	0	126
P033	Waiting Time	○	0.1～100.0	0.1[sec]	0.1	128
P034	Reverse Run Lock	—	0: Enable forward/reverse run 1: Disable reverse run	—	0	128
P035	Start Frequency	○	0.2～60.0	0.1[Hz]	0.2	128
P036	Stop Mode	—	0: Slow down and stop 1: Coast-to-stop	—	0	129
P037	Stop Frequency	○	0.2～60.0	0.1[Hz]	0.2	129
P038	DC Brake Time	○	0.0～120.0	0.1[sec]	0.0	130
P039	DC Brake Level	○	0～100	1[%]	0	130
P040	Stop Frequency during Forward/Reverse Run Operation	○	0.2～60.0	0.1[Hz]	0.2	131
P041	DC Brake Time during Forward/Reverse Run Operation	○	0.0～120.0	0.1[sec]	0.0	131
P042	DC Brake Level during Forward/Reverse Run Operation	○	0～100	1[%]	0	131
P043	DC Brake Time at Start-up	○	0.0～120.0	0.1[sec]	0.0	132
P044	DC Brake Level at Start-up	○	0～100	1[%]	0	132
P045	Lower Limit Frequency	○	0.2～400.0	0.1[Hz]	0.2	133
P046	Upper Limit Frequency	○	0.2～400.0	0.1[Hz]	400.0	133
P047	Zero Stop Function Selection	—	0.0•0.2～400.0	0.1[Hz]	0.2	134
P048	The 1st Skip Frequency	○	0.0•0.2～400.0	0.1[Hz]	0.0	135
P049	The 2nd Skip Frequency	○	0.0•0.2～400.0	0.1[Hz]	0.0	135

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P050	The 3rd Skip Frequency	○	0.0•0.20.0～400.0	0.1[Hz]	0.0	135
P051	Skip Frequency Bandwidth	○	0～10	1[Hz]	0	135
P052	Cooling Fan ON-OFF Control Selection	○	0: ON when Power-on/ OFF when Power-off (With fan tripping) 1: ON when Power-on/ OFF when the temperature of the internal switch moule is below 100℃ (With fan tripping) 2: OFF ON when Power-on/ OFF when Power-off (Without fan tripping/giving alarm) 3: ON when Power-on/ OFF when the temperature of the internal switch moule is below 100℃ (Without fan tripping/giving alarm)	—	0	136
P053	Input Terminal Filter	○	5～100	1[Times]	20	137
P054	Linear Speed Multiplier	○	0.1～100.0	1[Times]	3.0	137
P055	Setting Data Clear		0: Normal status 1: All are set to the factory setting values except the motor constants. 2: Change all data to their factory setting values.	—	0	138
P056	Alarm LED Operation Selection	○	0: No settings 1: Full-range Monitoring and Alarming 2: Output voltage 3: Overload 4: Temperature ABNORMALITY 5: Timer stop 6: Cooling fan abnormality	—	0	139
P057	Upper Limit Voltage of Alarm LED	○	0.1～600.0	0.1[V]	550.0	139
P058	Upper Limit Current of Alarm LED	○	0.1～100.0	0.1[A]	*4	140
P059	Password	○	0000～9999	—	0000	140
P060	MOP Operation Selection	○	0: Linkage control of the acceleration/deceleration time for MOP Operation 1: Linkage control of the frequency setting 2: MOP function is closed	—	2	142
P061	Acceleration/deceleration Time for MOP Operation	○	0.0(0.04sec)•0.1～3600	0.1[sec]	5.0	142
P062	Torque Boost Gain	—	0～200	1[%]	75	144
P063	Torque Boost Response Gain	—	0～200	1[%]	100	144

4.8.2 List of P1 Function Parameters

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P101	SW1 Function Selection	–	0: No settings(*2) 1(r1): Multiple segments 2(r2): Reset 3(r3): Reset lock 4(r4): JOG Selection 5(r5): External fault stop 6(r6): Parameter setting disable 7(r7): Coast-to-stop 8(r8): Frequency signal switch 9(r9): The 2nd characteristic Selection 10(r10): PID control switch 11(r11): 3-wire stop command 12(r12): Speed search 13(r13): Temporary stopping of winding mode 14(r14): Input mode of winding length 15(r15): Clear winding length 16(r16): Run/stop 17(r17): Forward/reverse 18(r18): JOG forward run 19(r19): JOG reverse run 20(r20):　Invalid	–	16	145
P102	SW2 Function Selection	–	0: No settings(*2) 1(r1): Multiple segments 2(r2): Reset 3(r3): Reset lock 4(r4): JOG Selection 5(r5): External fault stop 6(r6): Parameter setting disable 7(r7): Coast-to-stop 8(r8): Frequency signal switch 9(r9): The 2nd characteristic Selection 10(r10): PID control switch 11(r11): 3-wire stop command 12(r12): Speed search 13(r13): Temporary stopping of winding mode 14(r14): Input mode of winding length 15(r15): Clear winding length 16(r16): Run/stop 17(r17): Forward/reverse 18(r18): JOG forward run 19(r19): JOG reverse run 20(r20):　Invalid	–	17	145

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P103	SW3 Function Selection	—	0: No settings(*2) 1(r1): Multiple segments 2(r2): Reset 3(r3): Reset lock 4(r4): JOG Selection 5(r5): External fault stop 6(r6): Parameter setting disable 7(r7): Coast-to-stop 8(r8): Frequency signal switch 9(r9): The 2nd characteristic selection 10(r10): PID control switch 11(r11): 3-wire stop command 12(r12): Speed search 13(r13): Temporary stopping of winding mode 14(r14): Input mode of winding length 15(r15): Clear winding length 16(r16): Run/stop 17(r17): Forward/reverse 18(r18): JOG forward run 19(r19): JOG reverse run 20(r20): Frequency ▲ setting	—	0	145
P104	SW4 Function Selection	—	0: No settings(*2) 1(r1): Multiple segments 2(r2): Reset 3(r3): Reset lock 4(r4): JOG selection 5(r5): External fault stop 6(r6): Parameter setting disable 7(r7): Coast-to-stop 8(r8): Frequency signal switch 9(r9): The 2nd characteristic selection 10(r10): PID control switch 11(r11): 3-wire stop command 12(r12): Speed search 13(r13): Temporary stopping of winding mode 14(r14): Input mode of winding length 15(r15): Clear winding length 16(r16): Run/stop 17(r17): Forward/reverse 18(r18): JOG forward run 19(r19): JOG reverse run 20(r20): Frequency ▲ setting	—	0	145

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P105	SW5 Function Selection	–	0: No settings(*2) 1(r1): Multiple segments 2(r2): Reset 3(r3): Reset lock 4(r4): JOG selection 5(r5): External fault stop 6(r6): Parameter setting disable 7(r7): Coast-to-stop 8(r8): Frequency signal switch 9(r9): The 2nd characteristic selection 10(r10): PID control switch 11(r11): 3-wire stop command 12(r12): Speed search 13(r13): Temporary stopping of winding mode 14(r14): Input mode of winding length 15(r15): Clear winding length 16(r16): Run/stop 17(r17): Forward/reverse 18(r18): JOG forward run 19(r19): JOG reverse run 20(r20): Frequency storage setting	–	0	145
P106	SW6 Function Selection	–	0: No settings(*2) 1(r1): Multiple segments 2(r2): Reset 3(r3): Reset lock 4(r4): JOG selection 5(r5): External fault stop 6(r6): Parameter setting disable 7(r7): Coast-to-stop 8(r8): Frequency signal switch 9(r9): The 2nd characteristic selection 10(r10): PID control switch 11(r11): 3-wire stop command 12(r12): Speed search 13(r13): Temporary stopping of winding mode 14(r14): Input mode of winding length 15(r15): Clear winding length 16(r16): Run/stop 17(r17): Forward/reverse 18(r18): JOG forward run 19(r19): JOG reverse run 20(r20): Winding length	–	0	145

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P107	Pulse Input Frequency	–	1.0～40.0	1[Hz]	1.0	159
P108	Pulse Input Filter	–	10～100	1[Times]	50	159
P109	PWM Signal Average Times	○	1～100	1[Times]	1	159
P110	PWM Signal Cycle	○	1.0～2000	0.1[msec]	1.0	160
P111	Analog Input Filter	○	5～200	1[Times]	10	161
P112	Bias Frequency Setting	○	−99.0～250.0	0.1[%]	0.0	162
P113	Gain Frequency Setting	○	0.0～500.0	0.1[%]	100.0	162
P114	Analog Direction Mode	○	0: No settings 1: Change the rotation direction based on the analog input signal (forward → reverse) 2: Change the rotation direction based on the analog input signal (reverse →forward)	–	0	163
P115	The 2nd Bias Frequency Setting	○	−99.0～250.0	0.1[%]	0.0	164
P116	The 2nd Gain Frequency Setting	○	0.0～500.0	0.1[%]	100.0	164
P117	The 2nd Analog Direction Mode	○	0: No settings 1: Reverse the rotation direction based on the analog input signal (forward → reverse) 2: Reverse the rotation direction based on the analog input signal (reverse →forward)	–	0	165
P118	The 2nd Analog Input Function Selection	–	0: The 2nd frequency setting signal 1: Setting value of PIDcontrol (PV) 2: Base frequency + PID adjusted value 3: Base frequency + complemented frequency setting signal	–	0	166
P119	The 2nd Analog Input SignalSelection	–	2: External control: 0～5V 3: External control: 0～10V 4: External control: 4～20mA 5: External control: 0～20mA	–	2	169
P120	Analog Output Function Selection	○	0: Output frequency 1: Output current	–	0	170
P121	PWM Output Duty-cycle Compensation	○	25～100	1[%]	100	170
P122	PWM Output Function Selection	○	0: Output frequency 1: Output current	–	0	171

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No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P123	PWM Output Cycle	○	1~2000	1[msec]	1	171
P124	Output TR1 Function Selection	○	0: Run signal 1: Reverse signal 2: Arrival signal 3: Overload alarm 4: Frequency detection 5: Current detection (1) 6: Current detection (2) 7: Abnormality alarm (1) 8: Abnormality alarm (2) 9: Timer stops running after a cycle 10: Timer stops running 11: Alarm 12: Speed search act 13: PWM output 14: Pulse output	—	0	172
P125	Output TR2 Function Selection	○	0: Run signal 1: Reverse signal 2: Arrival signal 3: Overload alarm 4: Frequency detection 5: Current detection (1) 6: Current detection (2) 7: Abnormality alarm (1) 8: Abnormality alarm (2) 9: Timer stops running after a cycle 10: Timer stops running 11: Alarm 12: Speed search act	—	0	172

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P126	Output RY Function Selection	○	0(r0): Run signal (*3) 1(r1): Reverse signal 2(r2): Arrival signal 3(r3): Overload alarm 4(r4): Frequency detection 5(r5): Current detection　(1) 6(r6): Current detection　(2) 7(r7): Abnormality alarm　(1) 8(r8): Abnormality alarm　(2) 9(r9): Timer stops running after a cycle 10(r10): Timer stops running 11(r11): Alarm 12(r12): Speed search act	―	0	173
P127	Detect Frequency (OutputTR)	○	0.0, 0.2～400.0	0.1[Hz]	0.2	174
P128	Detect Frequency (Output RY)	○	0.0, 0.2～400.0	0.1[Hz]	0.2	174
P129	Current Detection Level	○	0.1～100.0	0.1[A]	*4	175
P130	Current Detection Delay Time	○	0.1～10.0	0.1[sec]	0.1	175
P131	RS485 Communication Protocol *6	○	0: MEWTOCOL 1: Modbus－RTU 2: Modbus－ASCII	―	0	176
P132	RS485 Communication station No.*6	○	01～31	―	01	176
P133	RS485 Communication Speed *6	○	48: 4800 96: 9600 192: 19200 384: 38400 576: 57600 1152: 115200	bps	96	176
P134	RS485 Stop Bit Length *6	○	1: 1bit 2: 2bit	bit	1	176
P135	RS485 Parity Check *6	○	0: No check 1: Odd number 2: Even number	―	0	176
P136	RS485 Timeout Sensing *6	○	0.0•0.1～60.0	0.1[sec]	0.0	176
P137	RS485 Wait-to-send Time *6	○	1～1000	1[msec]	1	176

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P138	RS485 Judging Time for TEXT Completion *6	○	3～200	1[msec]	3	176
P139	The 2nd Base Frequency		45.0～400.0	0.1[Hz]	50.0	178
P140	The 2nd Torque Boost *7	○	0～40: manual torque boost Auto: auto torque boost	1[%]	5	179
P141	The 2nd Electronic Thermal Selection	○	0: 140% of the rated current, 1min OL tripping 1: without reducing the output frequency 2: Reducing the output frequency 3: Specifications of forced air-cooled motor	—	2	180
P142	The 2nd Thermal Current Setting	○	0.1～100.0	0.1[A]	*4	180
P143	The 2nd Change Point Frequency 1	○	0.2～400.0	0.1[Hz]	0.2	181
P144	The 2nd Change Point Voltage 1	○	0.0～100.0	0.1[%]	0	181
P145	The 2nd Change Point Frequency 2	○	0.2～400.0	0.1[Hz]	0.2	181
P146	The 2nd Change Point Voltage 2	○	0.0～100.0	0.1[%]	0	181
P147	Pulse Output Frequency	○	1.0～10.0	0.1[kHz]	1.0	182
P148	Pulse Output Duty-cycle	○	25～75	1[%]	50	182
P149	Analog Output Voltage Compensation	○	25～100	1[%]	100	182

4.8.3 List of P2 Function Parameters

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P201	Load Rating	—	0: Heavy load rating 1: Light load rating	—	0	183
P202	Auto-tuning	—	0: Without tuning 1: Full band tuning	—	0	184
P203	Motor Capacity	—	0.2: 0.2kW 0.4: 0.4kW 0.7: 0.75kW 1.5: 1.5kW 2.2: 2.2kW 3.7: 3.7kW 5.5: 5.5kW 7.5: 7.5kW 11.: 11kW 15.: 15kW	—	*4	185
P204	Motor Pole Number	—	2: 2 poles 4: 4 poles 6: 6poles	Poles	4	185
P205	Rated Voltage of Motor	—	0〜500	1[V]	*5	185
P206	Rated Frequency of Motor	—	10.0〜120.0	0.1[Hz]	50.0	185
P207	Rated Current of Motor	—	0.01〜99.99	0.01[A]	*4	185
P208	Primary Resistance	—	0.00〜99.99	0.01[Ω]	*4	186
P209	Secondary Resistance	—	0.00〜99.99	0.01[Ω]	*4	186
P210	Energizing Inductance	—	0.0〜999.9, 1000〜5000 (Unit: 1mH)	0.1[mH]	*4	186
P211	Leakage Inductance	—	0.0〜999.9	0.1[mH]	*4	186
P212	Energizing Current	—	0.01〜99.99	0.01[A]	*4	186
P213	Speed Control Percentage Increment	—	0.01〜10.00	0.01	*4	187
P214	Speed Control Integral Increment	—	0.01〜10.00	0.01	*4	187
P215	Torque Limit Level	—	50〜400	1[%]	220	188

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P216	The 2nd Motor Capacity		0.2: 0.2kW 0.4: 0.4kW 0.7: 0.75kW 1.5: 1.5kW 2.2: 2.2kW 3.7: 3.7kW 5.5: 5.5kW 7.5: 7.5kW 11.: 11kW 15.: 15kW	—	*4	189
P217	Poles Number of the 2nd Motor		2: 2 极 4: 4 极 6: 6 极	极	4	189
P218	Rated Voltage of the 2nd Motor		0～500	1[V]	*5	189
P219	Rated Frequency of the 2nd Motor		10.0～120.0	0.1[Hz]	*4	189
P220	Rated Current of the 2nd Motor		0.01～99.99	0.01[A]	*4	189
P221	Primary Resistance of the 2nd Motor		0.00～99.99	0.01[Ω]	*4	190
P222	Secondary Resistance of the 2nd Motor		0.00～99.99	0.01[Ω]	*4	190
P223	Energizing Inductance of the 2nd Motor		0.0～999.9, 1000～5000 (Unit: 1mH)	0.1[mH]	*4	190
P224	Leakage Inductance of the 2nd Motor		0.0～999.9	0.1[mH]	*4	190
P225	Energizing Current of the 2nd Motor		0.01～99.99	0.01[A]	*4	190
P226	Speed Control Percentage Increment of the 2nd Motor		0.01～10.00	0.01	*4	191
P227	Speed Control Integral Increment of the 2nd Motor		0.01～10.00	0.01	*4	191
P228	Torque Limit Level of the 2nd Motor		50～400	1[%]	220	192

4.8.4 List of P3 Function Parameters

No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P301	Multi-step speed Function Selection	—	0: Multi-step speed frequency operation function 1: The 2nd/3rd/4th acceleration/deceleration operation function 2: Acceleration/deceleration linked with multi-step speed frequency operation function 3: Timer controlled multi-step speed frequency operation 4: Timer controlled acceleration/deceleration linked with multi-step speed frequency operation	—	0	193
P302	The 2nd Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	5.0	200
P303	The 3rd Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	10.0	200
P304	The 4th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	12.5	200
P305	The 5th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	15.0	200
P306	The 6th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	17.5	200
P307	The 7th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	20.0	200
P308	The 8th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	22.5	200
P309	The 9th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	25.0	200
P310	The 10th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	27.5	200
P311	The 11th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	30.0	200
P312	The 12th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	32.5	200
P313	The 13th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	35.0	200
P314	The 14th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	40.0	200
P315	The 15th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	45.0	200
P316	The 16th Speed Frequency	○	0.0, 0.2～400.0	0.1[Hz]	50.0	200
P317	The 2nd Acceleration Time	○	0.1～3600	0.1[sec]	5.0	200
P318	The 2nd Deceleration Time	○	0.1～3600	0.1[sec]	5.0	200
P319	The 3rd Acceleration Time	○	0.1～3600	0.1[sec]	5.0	200
P320	The 3rd Deceleration Time	○	0.1～3600	0.1[sec]	5.0	200
P321	The 4th Acceleration Time	○	0.1～3600	0.1[sec]	5.0	200
P322	The 4th Deceleration Time	○	0.1～3600	0.1[sec]	5.0	200
P323	Rotation Direction of Timer Operation	—	0～255	—	0	201
P324	Continuous Operation Times of Timer	○	0•1～9999	1[Times]	1	202

| No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P325	Continuous Operation Mode of Timer	○	0: Return to zero position/stop status, and change to the next cycle. 1: Change to the 1st Speed Frequency of the next cycle.	—	0	203
P326	Continuous Waiting Time of Timer	○	0.0•0.1～6553	0.1[sec]	0.0	203
P327	The 1st Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P328	The 2nd Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P329	The 3rd Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P330	The 4th Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P331	The 5th Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P332	The 6th Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P333	The 7th Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P334	The 8th Speed Runtime	○	0.0•0.1～6553	0.1[sec]	0.0	204
P335	Winding Mode Control Selection	○	0: Winding mode control: OFF 1: Set frequency standard 2: Max. frequency standard	—	0	205
P336	Amplitude in Winding Mode	○	0.0～100.0	0.1[%]	50.0	205
P337	Recoil Frequency Band in Winding Mode	○	0.0～100.0	0.1[%]	10.0	205
P338	Winding Mode Cycle	○	0.0～3600	0.1[sec]	10.0	205
P339	Rise Time Coefficient in Winding Mode	○	0.0～100.0	0.1[%]	50.0	205
P340	Winding Mode Operation Selection	—	0: Normal Mode 1: 2-point normal mode 2: Random Swinging Mode 3: 2-point Random Swinging Mode	—	0	206
P341	Max. Random Rise Time Coefficient	—	0.0～100.0	0.1[%]	50.0	207
P342	Min. Random Rise Time Coefficient	—	0.0～100.0	0.1[%]	50.0	207
P343	Winding Length Multiplier	—	0～9999	—	1	207
P344	Winding Stop Length	—	0•1～9999，1.000～60.00	1[m]	0	207
P345	PID Target Value	○	0.0～100.0	0.1[%]	0.0	208
P346	PID Upper Limit Value	○	0.0～100.0	0.1[%]	100.0	208
P347	PID Lower Limit Value	○	0.0～100.0	0.1[%]	0.0	209
P348	PID Bias Value	○	－100～100.0	0.1[%]	100.0	209
P349	Proportional Gain [Kp]	○	0.1～1000	—	1.0	209
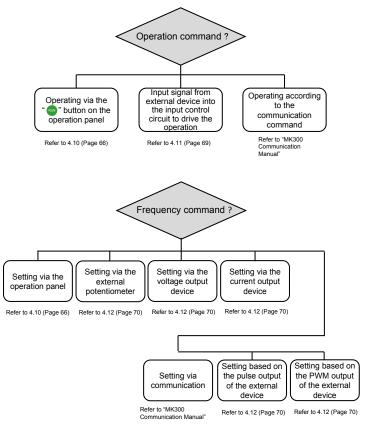
No.	Function name	Changeable during operation	Setting range	Unit	Initial value	Reference page
P350	Integral Time[Ti]	○	0.00〜360.0	0.01[sec]	0.00	209
P351	Derivative Time [Td]	○	0.00〜10.00	0.01[sec]	0.00	209
P352	Control Cycle [Ts]	○	0.00〜60.00	0.01[sec]	0.00	210
P353	PID Output Characteristics	—	0: Inverse Operation 1: Forward operation	—	0	210
P354	PIDOutput Reverse Selection	—	0: Reverse operation is invalid. 1: Reverse operation is valid.	—	0	210
P355	Frequency of Sleep Operation	○	0.0•0.2〜400.0	0.1[Hz]	0.0	211
P356	Delay Time of Sleep Operation	○	0.0〜25.0	0.1[sec]	0.0	211
P357	Speed Search Selection at Startup	○	0: Valid 1: Invalid	—	0	211
P359	Speed Search Waiting Time	○	0.0〜100.0	0.1[sec]	0.5	212
P360	Speed Search Voltage Recovery Time	○	0.0〜10.0	0.1[sec]	0.5	212
P361	Speed Search Selection at Retry	○	0: Invalid 1: Valid	—	0	212
P362	Speed Search Retry Selection	○	0: Error reporting stops 1: Start the frequency operation	—	0	212
P363	Speed Search Retry Times	○	0〜10	1[Times]	0	213
P364	Speed Search Upper Limit Frequency Selection	○	0: Below Max. frequency 1: Below the previous frequency value before the coast-to-stop operation.	—	0	213

【Note】

*1: After an abnormal tripping, if the stop signal from external operation cannot reset it, use the ⬤stop button on the operation panel to make a reset.
However, if the reset lock function is enabled, the reset lock function shall take precedence, yet the reset function is also valid.
*2: If the setting value displays "r", it is a "b" contact operation. (If no "r" is displayed, then it is an "a" contact operation.)
*3: If the setting value displays "r", then it is a non-exciting operation when it is ON. (If no "r" is displayed, then it is an exciting operation when it is ON.)
*4: The initial values vary with the different capacities of inverters.
*5: The initial values vary with the different applicable input voltages of inverters.
The initial value is 200 at 200V, 380 at 400V.
*6: It is effective when the power is OFF. (All changed parameters will apply after the power is turned from OFF to ON.)
*7: During operation, it is impossible to change to auto torque boost from manual torque boost and vice versa.

4.9 Operation Method
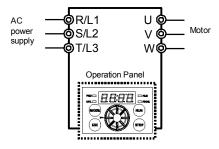
There needs operation command and frequency command for the inverter. The motor will rotate when the operation command is set to ON, in this case, the rotating speed of the motor shall be determined by the frequency command (set frequency).

Please make a setting according to the following flow chart.

Operation command ?

| Operating via the " RUN " button on the operation panel | Input signal from external device into the input control circuit to drive the operation | Operating according to the communication command |

Refer to 4.10 (Page 66)   Refer to 4.11 (Page 69)   Refer to "MK300 Communication Manual"

Frequency command ?

| Setting via the operation panel | Setting via the external potentiometer | Setting via the voltage output device | Setting via the current output device |

Refer to 4.10 (Page 66)   Refer to 4.12 (Page 70)   Refer to 4.12 (Page 70)   Refer to 4.12 (Page 70)

| Setting via communication | Setting based on the pulse output of the external device | Setting based on the PWM output of the external device |

Refer to "MK300 Communication Manual"   Refer to 4.12 (Page 70)   Refer to 4.12 (Page 70)

4.10 Operating via Operation Panel

【Wiring Example】

AC power supply

R/L1   U
S/L2   V   Motor
T/L3   W

Operation Panel

Please set parameter P003 to "0" or "1" when operating via operation panel.

Note that the setting of rotation direction varies with different setting values.

4.10.1   Operating via Operation Panel and Changing of the Set Frequency - 1(when P003=0)

During operation, please pay full attention to the safety of the surrounding of the motor and other machines.
Make sure that the wiring of the motor is correct.

【Factory Setting】

① Turn on the power.
   The display part with be ON immediately after power on. (Operation Status Display Mode)

   0000

② Press.
   The motor rotate at the frequency of 0.2Hz. Confirm the rotation direction of the motor.

   RUN   **0.2**

【Changing Frequency】

Method 1: change the setting of "Fr"

③ Press (MODE) to show "Fr".

   (MODE)   **Fr**

④ Press the panel knob.

   0.2

⑤ Rotate the panel knob to set the frequency to "50.0Hz".

   50.0

⑥ Press the panel knob to cause the motor to accelerate to "50.0Hz".

`Fr`

⑦ Press (MODE) to show the operation frequency.

`50.0`

⑧ Press (STOP) to cause the motor to start decelerating and stop when it displays "0000".

`0000`
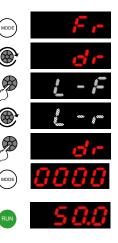
【Changing the rotation direction】

① Press (MODE) to show "Fr".

`Fr`

② Rotate the panel knob to show "dr" (Direction Setting Mode).

`dr`

③ Press the panel knob.

`L-F`

④ Rotate the panel knob to select "L-r".

`L-r`

⑤ Press the panel knob.

`dr`

⑥ Press(MODE).

`0000`

⑦ Press (RUN) to cause the motor to start running in a reverse direction until the frequency becomes "50Hz".

`50.0`

⑧ Press (STOP) to cause the motor to start decelerating and stop when it displays "0000".

`0000`

• During operation, you can also make this change through these procedures.

4.10.2 Operating via Operation Panel and Changing of the Set Frequency - 2(when P003=1)

① Turn on the power.
The display part with be ON immediately after power on. (Operation Status Display Mode)

<div style="text-align:right">**0000**</div>

② Counterclockwisely rotate the panel knob to show "L-F". (Clockwaisely rotate the encoder to show "L-r")

<div style="text-align:right">**L - F**</div>

③ Press ⦿.
The motor rotate forward at the frequency of

<div style="text-align:right">**0.2**</div>

Confirm the rotation direction of the motor.

④ Press ⦿ to show "Fr".

<div style="text-align:right">**Fr**</div>

⑤ Press the panel knob.

<div style="text-align:right">**0.2**</div>

⑥ Rotate the panel knob to set the frequency to "50.0Hz".

<div style="text-align:right">**50.0**</div>

⑦ Press the panel knob.
The motor accelerates to "50.0Hz".

<div style="text-align:right">**Fr**</div>

⑧ Press ⦿.

<div style="text-align:right">**50.0**</div>

⑨ Counterclockwisely rotate the panel knob to show "L-r";
(Clockwaisely rotate the encoder to show "L-F")

<div style="text-align:right">**L - r**</div>

⑩ Press ⦿ to cause the motor to decelerate to "0Hz", then the motor will reversely run at the frequency of "50.0Hz".

<div style="text-align:right">**50.0**</div>

⑪ Press ⦿ to cause the motor to start decelerating and stop when it displays "0000".

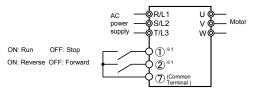<div style="text-align:right">**0000**</div>

4.11 Operating based on External Input Signal

It can be operated based on the external input signals when the parameter P003 is set to "2" to "5".
Note that the changing of the rotatation direction for the setting value of "2", "3", "4" and "5" is different.Wiring
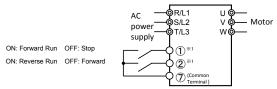
【Wiring Example: when P003 = 2 or 3】

```
                              R/L1      U        
                    AC        S/L2      V   — Motor
                    power     T/L3      W        
                    supply                       
ON: Run    OFF: Stop          ①※1                
ON: Reverse OFF: Forward      ②※1                
                              ⑦ (Common          
                                 Terminal )      
```

※1 In the input terminal function mode, non-terminals No. ① and ② can also be set.

※2 No example of wiring for frequency setting signal is provided.
For the setting of frequency, please refer to "4.11 Operating based on External Input Signal", it is set at the same time as the wiring.

【Wiring Example: when P003 = 4 or 5】

```
                              R/L1      U        
                    AC        S/L2      V   — Motor
                    power     T/L3      W        
                    supply                       
ON: Forward Run  OFF: Stop    ①※1                
ON: Reverse Run  OFF: Forward ②※1                
                              ⑦ (Common          
                                 Terminal )      
```
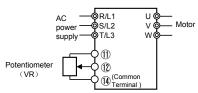
※1 In the input terminal function mode, non-terminals No. ① and ② can also be set.

※2 No example of wiring for frequency setting signal is provided.
For the setting of frequency, please refer to "4.11 Operating based on External Input Signal", it is set at the same time as the wiring.
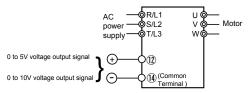
4.12 Setting Frequency via External Device

The frequency can also be set according to the output signal from the external device in addition to methods of setting via the operation panel and communication. Frequencies corresponding to various output signals can be set by changing the parameter P004.

【Wiring Example: when setting via the potentiometer input (P004 = 1)】

AC power supply — R/L1, S/L2, T/L3
U, V, W — Motor
⑪
Potentiometer（VR） — ⑫
⑭ (Common Terminal)

※1   No example of wiring for operation command signal is provided.
For the operation command signal, please refer to "4.11 Operating based on External Input Signal", it is set at the same time as the wiring.

• Please choose a potentiometer with the specifications higher than 10kΩ and 1/4W.

【Wiring Example: when setting via the voltage output device (P004 = 2 or 3)】

AC power supply — R/L1, S/L2, T/L3
U, V, W — Motor
0 to 5V voltage output signal (＋) — ⑫
0 to 10V voltage output signal (－) — ⑭ (Common Terminal)

※1   No example of wiring for operation command signal is provided.
For the operation command signal, please refer to "4.11 Operating based on External Input Signal", it is set at the same time as the wiring.

• Set parameter P004 to "2" when the output signal from the external device is in the range of 0 to 5V.
• Set parameter P004 to "3" when the output signal from the external device is in the range of 0 to 10V.

Related Parameters P047, P111～P114

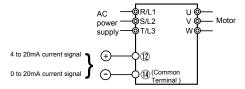【Wiring Example: when setting via the current output decvice (P004 = 4 or 5)】

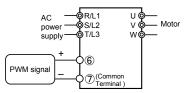※1 No example of wiring for operation command signal is provided.
For the operation command signal, please refer to "4.11 Operating based on External Input Signal", it is set at the same time as the wiring.

• Set parameter P004 to "4" when the output signal from the external device is in the range of 4 to 20mA.
• Set parameter P004 to "5" when the output signal from the external device is in the range of 0 to 20mA.

Related ParametersP047, P111～P114

【Wiring Example: When setting based on the PWM signal (P004 = 7)】
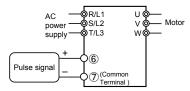
※1 No example of wiring for operation command signal is provided.
For the operation command signal, please refer to "4.11 Operating based on External Input Signal", it is set at the same time as the wiring.

Be sure to set the following parameters when setting the frequency based on the PWM signal. Moreover, they should only be used after the notes for every parameter had been carefully read.

Parameter No.	Function name	Unit	Setting range	Initial Value
P109	PWM Signal Average Times	1[Times]	1～100	1
P110	PWM Signal Cycle	0.1[msec]	1.0～2000	1.0

【Wiring Example: When setting based on the pulse signal (P004 = 8)】


```
           ┌──── R/L1      U ────┐
AC  ───────│──── S/L2      V ────│── Motor
power ─────│──── T/L3      W ────│
supply ────┘                     
        ┌──────────┐  +
        │          │───○ ⑥
        │Pulse     │
        │signal    │  −    (Common
        │          │───○ ⑦  Terminal)
        └──────────┘
```

※1 No example of wiring for operation command signal is provided.
For the operation command signal, please refer to "4.11 Operating based on External Input Signal", it is set at the same time as the wiring.

Be sure to set the following parameters when setting the frequency based on the pulse signal. Moreover, they should only be used after the notes for every parameter had been carefully read.

Parameter No.	Function name	Unit	Setting range	Initial Value
P107	Pulse Input frequency	1[kHz]	1.0~40.0	1.0
P108	Pulse Input Filter	1[msec]	10~100	50

4.13 V/F Control Setting

MK300 supports the V/F control and the sensorless vector control.
In the V/F control mode, the output voltage of the inverter is proportional to its output frequency.

■ Steps for Setting the V/F Control:
 • Setting Example: change the max. output frequency from 50.0Hz to 60.0Hz (that is, change the value of parameter   P012 fro "50.0" to "60.0")

① It displays "0000" when the inverter is powered ON.

0000

② Set P006 to "0".
   •Refer to "4.8 Parameter Setting" for the setting of
   parameters.

P006

③ Set P009 to "50".
   •Refer to "4.8 Parameter Setting" for the setting of
   parameters.
   •Different V/F modes are available for the function parameter
   P009.

P009

P009 Setting value	Corresponding VF mode	P009 Setting value	Corresponding VF mode
50	50Hz mode	3C2	3-point fix mode 2
60	60Hz mode	3C3	3-point fix mode 3
FF	Free mode	3C4	3-point fix mode 4
3C	3-point mode	3C5	3-point fix mode 5
3C1	3-point fix mode 1	3C6	3-point fix mode 6

Refer to the detailed explanation about the function parameter P009 for the details of various modes.

④ Set P012 to "50.0".
   •In the 50Hz mode, P012 will be automatically set to "50.0"
   and cannot be modified.
   •In the 60Hz mode, P012 will be automatically set to "60.0"
   and cannot be modified.
   •In other modes, P012 needs to be set manually.
   •Refer to "4.8 Parameter Setting" for the setting of
   parameters.

P012

⑤ Set P013 to "50.0".
   •In the 50Hz mode, P013 will be automatically set to "50.0"
   and cannot be modified.
   •In the 60Hz mode, P013 will be automatically set to "60.0"
   and cannot be modified.
   •In other modes, P013 needs to be set manually.
   •Refer to "4.8 Parameter Setting" for the setting of
   parameters.

P013

⑥ After the above steps had been completed, the control mode
   will be changed to V/F control. By now, the inverter may be
   operated through the V/F control.

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4.14 Auto-tuning

When operating in the sensorless vector control mode, or operating the auto torque boost in the V/F control mode, be sure to perform the auto-tuning for all motores before their first operation. Otherwise, they cannot be controlled normally. Measure the motor constants for control use and automatically save them to parameter P208 to P212 (for the 2nd motor: P216 to P220)

⚠ Danger	The inverter will automatically drive the motor within the range of uppter/lower frequency limit after the auto-tuning starts.
	Do not start an auto-tuning if there is a danger with the motor that is being driven.
	Do not approach the unit and the conductive parts during auto-tuning.
	Failure to do so may result in injury and accidents.

・Do not connect loads and other objects to the motor shaft during auto-tuning. It is suggested that it should be done in the standalone status.

The auto-tuning cannot be normally performed if loads and objects with greater inertia are connected.

Perform the auto-tuning in a free rotation state without loads as far as possible.
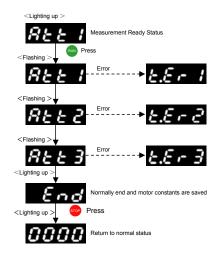
・Start the auto-tuning only after the motor had come to a complete stop.

■ Auto-tuning Procedure:

・Perform it in the following order (1 to 4).

1．Set motor specifications with the parameters P203 to P207 (for the 2nd motor: P216 to P220).
   • Be sure to set them before the start of the auto-tuning.
2．For the 2nd motor only: switch to the 2nd Characteristics Selection status.
   • Switch the selection status by inputing control signals.
     (Refer to parameters P101 to P106.)
3．After setting P202 to "1", swich to the Operation Status Display mode by pressing the (MODE) button.
   • It will enter the measurement ready status after the panel displays "Att1".
     (Reset P202 to "0" to exit the ready status if needed.)

＜Lighting up ＞

4. Press ⓇⓊⓃ button to perform the auto-tuning.
- In the "Att1" lighting-up status, press ⓇⓊⓃ button to automatically start the measurement. The displaying parts show as follows with the progress of the measurement.
- Press ⓇⓊⓃ button only after it is confirmed that the motor had completely stopped.
- It takes about 2 minutes for the measurement to end.
- If the measurement needs to be stopped halfway, press ⓈⓉⓄⓅ button. The motor constants will not be saved if it is stopped before it displays "End" ("Att1" to "Att3" flashing) and it will return to the measurement ready status (3.). (Reset P202 to "0" to exit the ready status if needed.)
- It will display "End" if the measurement ends normally, and the motor constants will be saved.
  Press ⓈⓉⓄⓅ button in the "End" displaying status to return to the normal status. (P202 will automatically return to "0".)

\<Lighting up\>

Att 1   Measurement Ready Status

ⓇⓊⓃ Press

\<Flashing\>

Att 1 ----Error----> t.Er 1

\<Flashing\>

Att 2 ----Error----> t.Er 2

\<Flashing\>

Att 3 ----Error----> t.Er 3

\<Lighting up\>

End   Normally end and motor constants are saved

\<Lighting up\>   ⓈⓉⓄⓅ Press

0000   Return to normal status

- During measurement, if errors occur and it displays "t.Er1～3", press ⓈⓉⓄⓅ button to return to the measurement ready status (3.). Check the configuration and wiring, and restart the automatic measurement after it is confirmed that the motor had completely stopped.
- If errors still occur in the new measurement after the configuration and wiring status had been ensured, please temperately reset P202 to "0" to exit the ready status and confirm again the specifications of the motor.

4.15 Vector Control

In sensorless vector control mode, the output current of inverter can be divided into the energizing current and the torpque current in the vector operation and make a compensation for the frequency and voltage to ensure that the current flowing into the motor matches up with the load torque.
This function is effective for the case that the load fluctuates sharply when high start-up torque or sufficient torque at lower speed is required.

In sensorless vector control mode, please use the inverter in the following conditions.

- A squirrel-cage induction motor should be selected.
- Please select the inverter with the capacity equivalent to or 1 level higher than the motor capacity.
- The motor must be a 2-pole, 4-pole or 6-pole one.
- It must operate in standalone mode (i.e. one motor is driven by one inverter).
- The maximum wiring length between the inverter and the motor must not exceed 30m.
- The carrier frequency should be higher than 2.5kHz.

If the above conditions are not satisfied, sound operation performance cannot be achieved.

【Note】

- Uneven rotations occur more often than in the V/F control mode. It is not applicable to the load whose minor rotation may cause problems at lower speed. In this case, V/F control should be selected.
- The output frequency ranges from 0.5Hz to 120Hz when the sensorless vector control is selected.
- The "P007: carrier frequency" is only effective in the frequency range of 2.5kHz to15.0kHz when the sensorless vector control is selected.
  The setting value of carrier frequency shall be automatically changed to 2.5kHz if the "P007: Vector Control Selection" is set to "1" (sensorless vector control) in the condition that the carrier frequency is set to "0.8kHz to 1.6kHz".
- In sensorless vector control mode, carrier frequency in area where output frequency is relatively lower may vary accordingly.

【Setting Procedure for Sensorless Vector Control】

Make a setting and carry out the trial operation in the following order (1 to 4).

1. Selecting the inverter control mode
   ・In "P006: Vector Control Selection" mode, you may select the V/F control mode or the sensorless vector control mode.
   It had been initially set to V/F control mode, therefore, it is necessary to change it to sensorless vector control mode (P006 = "1").

2. Setting based on various specifications of the motor
   The following setting values shall be taken as the benchmark for the auto-tuning, so be sure to set them before the start of the auto-tuning (parameter P202).

   1) Setting of Motor Capacity:
      ・Set the applied motor capacity to "P203: Motor Capacity".
      The initial value of the "Motor Capacity" had been set equivalent to the "Inverter Capacity".

   2) Setting of Motor Polarity:
      ・Set the applied motor polarity to "P204: Motor Pole Number".
      The initial value of the "Motor Polarity" had been set to "4 poles".

   3) Setting of Motor Rated Voltage
      ・Set the applied motor rated voltage to "P205: Motor Rated Voltage".
      The initial value of the "Motor Rated Voltage" had been set to "380V" (in the 400V mode)".

   4)Setting of Motor Rated Frequency
      ・Set the applied motor rated frequency to "P206: Motor Rated Frequency".
      The initial value of the "Motor Rated Frequency" had been set to "50Hz".

   5) Setting of Motor Rated Current
      ・Set the applied motor rated current to "P207: Motor Rated Current".

【Note】

 ・The specifications of the motor are generally specified according to the combinations of the rated voltage, rated frequency and rated current.
   【For example】380V／50Hz／1.0A，400V／60Hz／1.5A
   The rated voltage should be set only after the power voltage in practical use input to the inverter MK300 had been selected.
   Moreover, the rated current varies with the rated voltage and the rated frequency, be sure to set them after the combination had been confirmed.

3. Setting of Motor Constants
   Be sure to perform the auto-tuning after the specifications of motor had been set.

・Do not connect loads to the motor shaft during auto-tuning. It is suggested that it should be done in the standalone status. The auto-tuning cannot be normally performed if loads and objects with greater inertia are connected. Perform the auto-tuning in a free rotation state without load as far as possible.
・Start the auto-tuning only after the motor had completely stopped.

   Refer to "4.14 Auto-tuning" for the auto-tuning procedure.

4. Trial Operation
   Perform the trial operation only after the operation command and the speed command had been set.
   Please set various functions (acceleration time, deceleration time, max. output frequency) according to the need.
   The settings shall be finished if the required motor characteristics had been achieved.

Related Parameters: P006, P201～P228

5

Troubleshooting

5.1 Safety Precautions

	Wait at least fiv e minutes after turning off the input power before starting the maintenance and inspection work. Failure to do so may result in electric shock. Maintenance, inspection and part replacement work must be done only by qualified persons. (Remove metal articles such as watch, bracelet(s) etc. before operation.) (Please use insulated tools.) Failure to do so may result in electric shock or injury.
⚠ Danger	

5.2 Abnormality Diagnostic Function and Reset Method

5.2.1 Details and Remedies for Various Fault Trips

The fault trip memory stores the causes of trip in monitor modes n16 to n19.
Even if the power is cut off, the fourth to the latest causes of trip will still be held.
(Details of factory inspection are stored in the memory before delivery.)

Indication	Details and causes of abnormality	Remedies
SC1	• Instantaneous overcurrent during acceleration	• Check if there is any output short-circuit or ground short-circuit. ·Remove sharp variations at load side. • Extend acceleration/deceleration time (parameters P001, P002, P317 to P322). • Stop open and close operation of magnetic contactor at load side.
SC2	• Instantaneous overcurrent at constant speed	
SC3	• Instantaneous overcurrent during deceleration	
SC4	• Instantaneous overcurrent during acceleration/deceleration or at constant speed	
SC5	• Short circuit & overcurrent at the output side at start-up	• Check if there is any output short-circuit or ground short-circuit.
SC6	• Faults detected at startup	• Check the power module faults (out-source repair services).
OC1	• Overcurrent during acceleration	• Check output for open phase and remove sharp variations at load side. • Extend acceleration/deceleration time (parameters P001, P002, P317 to P322).
OC2	• Overcurrent at constant speed	
OC3	• Overcurrent during deceleration	• Adjust torque boost level (parameter P011). • Check for restart operation during normal operation. • Stop open and close operation of magnetic contactor at load side.
OU1	• Internal DC over-voltage during acceleration	• Extend acceleration time (parameters P001, P317, P319, P321).

Indication	Details and causes of abnormality	Remedies
OU2	• Internal DC over-voltage at constant speed	• Remove sharp variations at load side.
OU3	• Internal DC over-voltage during deceleration	• Extend deceleration time (parameters P002, P318, P320, P322).
LU	• Power supply voltage below 85% of its rating	• Measure the power supply voltage and che ck input for open phase; • Check ride-through restart function.
OL	• The output current exceeds 125% o f electronic thermal setting current or 140% of rated current of inverter for more than 1 minute.	• Check the setting current of electronic thermal; • Check and adjust the torque boost lev el (parameter P011) • Reduce load
OH	• Heat sink overheating	• Check ambient temperature
AU	• External fault stop input signal is input from control circuit terminals.	• Check if the external signal is p roper and i f timing circuit is correct.
OP	• The power is turned ON with run signal ON. • Timeout detected • The communication cable comes off.	• Check start mode (parameter P031) • Check communication setting and wiring. • Reduce the interference around the inverter.
FAN	• Cooling fan abnormality	• Check if the cooling fan is locked.
SEr	• Speed search failed • Incorrect motor rotation direction • The rating of the motor is too small compared with that of inverter. • Motor rotates slowly during normal operation.	• Reduce the noise around the inverter. • Check the rotation direction of motor.
CPU	• Too much interference is applied to the inverter	• Reduce the interference around the inverter.
ErrC	• Too much interference is applied to the inverter	• Reduce the interference around the inverter.

【Note】

• Error information "SC6" refers to the error of power module fault detected in the inverter.

Please inquire the distributor from whom you purchased this product or the maintenance department of our Company about the product repair.

5.2.2 Resetting Fault Trips

If the abnormality indicator in the display part of operation panel lights up and operation is stopped, please handle the ab normality before resetting the operation.
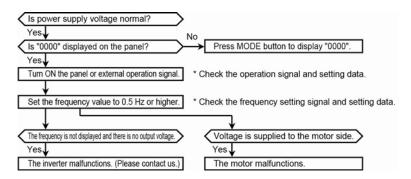
Reset by power	The reset can be made by cutting off the power once. (The inverter can operate when powered on again.)
Reset by stop signal	①For the operation in panel setting mode (parameter P003 is set to "0" or"1"), press 🔴 button on the operation panel to reset, and then restart the inverter. ②For the operation in external control mode (parameter P003 is set to "2" or"4"), turn off the OPERATION COMMAND button designed for external control once to reset, and then restart the inverter. Note: Reset by stop signal cannot be made through communication.
Reset by panel	For the operation in external control or communication setting mode (parameter P003 is set to "3", "5", or "7") , the reset cannot be made even if OPERATION COMMAND button designed for external control or communication is turned OFF once. Press 🔴 button on the operation panel to reset, and then restart the inverter.
Reset by multi-function terminal	Set parameters P101 to P106 to "2" "r2"; Then turn the function setting switch ON once and OFF again to perform the reset. Then restart the unit again.
Reset by communication command	Write 0x9696 into register No. 505 (DT505) to reset the inverter.

【Note】

・If the error information "SC6" or "CPU" is indicated, the mod es of "reset by stop signal", "reset b y panel", "reset b y multi-function termina l" or "reset b y communication" are disabled, in this case, only the mode of "reset by power" is enabled.

5.3 Handling Abnormalities

5.3.1 The motor does not rotate. (When abnormality indicator lights out.)
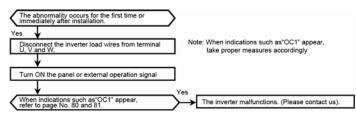

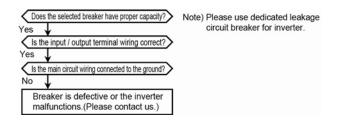### 5.3.2 The motor does not rotate. (When abnormality indicator lights up)

When abnormality indicators light up but the motor does not rotate, please check out the following two items.

1. Check whether the abnormality occurs for the first time or immediately after the initial installation or during operation.
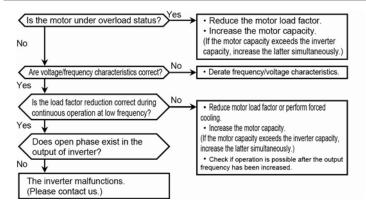
2. Check w hether the abnormality is caus ed by inverter failur e (defect) or incorrect wiring and motor failure.
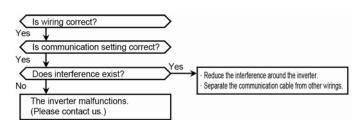
5.3.3 Breaker Trip

Does the selected breaker have proper capacity?
Yes ↓
Is the input / output terminal wiring correct?
Yes ↓
Is the main circuit wiring connected to the ground?
No ↓
Breaker is defective or the inverter malfunctions.(Please contact us.)

Note) Please use dedicated leakage circuit breaker for inverter.

5.3.4 Motor Overheating

Is the motor under overload status? —Yes→
· Reduce the motor load factor.
· Increase the motor capacity.
(If the motor capacity exceeds the inverter capacity, increase the latter simultaneously.)

No ↓

Are voltage/frequency characteristics correct? —No→ · Derate frequency/voltage characteristics.

Yes ↓

Is the load factor reduction correct during continuous operation at low frequency? —No→
· Reduce motor load factor or perform forced cooling.
· Increase the motor capacity.
(If the motor capacity exceeds the inverter capacity, increase the latter simultaneously.)
· Check if operation is possible after the output frequency has been increased.

Yes ↓

Does open phase exist in the output of inverter?

No ↓

The inverter malfunctions.
(Please contact us.)

5.3.5 Communication Failed

Is wiring correct?
Yes ↓
Is communication setting correct?
Yes ↓
Does interference exist? —Yes→ · Reduce the interference around the inverter.
· Separate the communication cable from other wirings.
No ↓
The inverter malfunctions.
(Please contact us.)

6

Maintenance and Inspection

6.1 Safety Precautions

⚠ Danger	Wait at least five minutes after turning off the input power before starting the maintenance and inspection work. Failure to do so may result in electric shock. Maintenance, inspection and part replacement work must be done only by qualified persons. (Remove metal articles such as watch, bracelet(s) etc. before operation.) (Please use insulated tools.) Failure to do so may result in electric shock or injury. Do not replace the cooling fan when power is ON. Failure to do so may result in electric shock
⚠ Caution	Employ an electrical engineering company to periodically tighten the terminal screws. Loose terminal screws could lead to overheating or fire.

6.2 Precautions on Inspection

 ・To measure the insulation resistance between the power supply cable and the motor cable with a megger, always disconnect the wires connected to the inverter first before measuring. Do not make such measurement on the control circuit.
 ・The inverter is mainly consisted of semiconductor elements. To prevent the negative effects arising from the temperature, humidity, dust and vibration etc. in working environment and the malfunctions caused by components' aging and service life, please perform daily inspection.
The following table shows the standard replacement interval (years) under normal working conditions (average annual ambient temperature = 30°C, load factor < 80% and average daily operation period < 12 h).

6.3 Inspection Items

1. Daily inspection: Basically check if abnormality occurs during operation.
                        A multimeter is normally used to check the input and output voltages of the inverter during operation.
2. Periodic inspection: To check all locations where inspection can be performed only
                        when the inverter is stopped and where periodic inspection is required.

6.4 Component Replacement

Wear-out faults are related to endurance period and service life. The endurance period largely depends on the working conditions.

1. For example, service life of relay is determined by the roughness of the contact surface.

   Contact current and load inductance are the major factors affecting its service life.

2. Capacitor inside the inverter is used mainly as a smoothing filter. Due to the chemical reaction that takes place internally, its service life is greatly affected by the temperature. Generally speaking, rising of 10°C in temperature reduces the service life of an aluminum electrolytic capacitor by half, which also affects the service life of inverter.

   When the inverter is used under high temperature, the aluminum electrolytic capacitor may suffer from wear-out faults prior to other components in normal status and must be replaced to extend the service life of inverter.

Component Name	Standard replacement interval (year)	Method of replacement/Others
Cooling fan	5 years	Replace with a new one
Smoothing capacitor	5 years	Investigate and replace with a new one if necessary.
Relays	—	Investigate and replace with a new one if necessary.

◆Contact us for replacing or repairing the components.

6.5 Maintenance and Inspection Table

Note: Symbols used in "Inspection interval" are with different meanings: ☆ for "daily", ○ for "yearly" and ◎ for "every two years".

Location	Inspection item	Inspection details	Inspection interval			Inspection method	Judgment criteria	Instrument
Whole unit	Ambient environment	Check the ambient temperature, humidity, dust level and etc.	☆			Refer to the "Precautions on installation"	Ambient temperature & humidity: -10 ～ 50℃, 90％	Thermometer Hygrometer
	Whole unit	Check for abnormal vibration and noise.	☆			Check visually and listen	In normal state	
	Power supply voltage	Check the main circuit voltage for correct.	☆			Measure input voltage	400V type: 323 to 506 VAC	Multimeter
Main Circuit	The whole part	1) Check if fasteners are loose; 2) Check if there is any sign of component overheating; 3) Cleaning	○ ○ ○			1) Strengthen the fasteners; 2) Check visually.	1), 2): In normal state	
	Connected conductors and wires	1) Check if conductors are crooked; 2) Check if the wire insulation is broken	○ ○			1), 2): Check visually.	1), 2): In normal state	
	Transformer	Check if there is burning smell.	☆			Just smell	In normal state	
	Terminal block	Check if there is sign of damage.	○			Check visually.	In normal state	
	Transistors and diodes	Check the resistance between the terminals.			◎	Disconnect the main circuit wires and measure at the terminals.		Multimeter
	Smoothing capacitor	1) Check for liquid leakage; 2) Check if the safety valve is working correctly; 3) Measure electrostatic capacity.	☆ ☆ ○			1), 2): Check visually. 3): Measure with a capacitance meter	1), 2): In normal state 3): Minimum 85% of rated capacity	Capacitance meter
	Relay	1) Check if the operation sound is normal; 2) Check the contact roughness.	○ ○			1) Just listen 2) Check visually.	1), 2): In normal state	

Location	Inspection item	Inspection details	Inspection interval			Inspection method	Judgment criteria	Instrument
	Resistor	1) Check if there is cracking on the insulation; 2) Check if open circuit exists.		○ ○		1), 2): Check visually.	1), 2): In normal state	
Control circuit and protection circuit	Operation Check	1) Check the balance condition of the output voltage between each phase during operation of single unit; 2) Inspect the protection and display circuit with timing protection operation test.		○ ○		1) Measure the voltage between output terminals 2) Simulate a short circuit condition between the inverter alarm outputs.	1) Line output balance is 8V max. 2) Timing protection circuit must function properly.	Rectifier voltmeter
	Whole unit	1) Check if there is burning smell and discoloration. 2) Check if there is heavy rustling.		○ ○		1), 2): Smell and check visually.	1), 2): In normal state	
	Capacitor	Check for liquid leakage and deformation.	☆			Check visually.	In normal state	
Cooling system	Cooling fan	1) Check for abnormal vibration and noise; 2) Check if connected parts are loose.	☆	○		1) Just listen; 2) Strengthen the fasteners.	1), 2): In normal state	
Display	Display unit	Check if the indicator malfunctions.	☆			Check visually.	In normal state	
	Meter	Check if the indication is correct.	☆			Check the indication.	Within specifications or control values.	Voltmeter Ammeter
Motor	Whole unit	1) Check for abnormal vibration and noise; 2) Check if there is burning smell.	☆ ☆			Check visually, listen and smell	1), 2): In normal state	

7

Specifications

7.1 Rated Specifications

■3-phase 400V Input Type

| Model AMK300□□□4		0P7	1P5	2P2	3P7
Standard specifications	Applicable motor output (kW) *1	0.75	1.5	2.2	3.7
	Rated output current (A) *2	2.6	4.0	6.0	9.5
	Rated output capacity (kVA) *3	2.1	3.2	4.8	7.6
	Rated input current (A) *4	3.9	6.0	9.0	14.3
	Power supply capacity (kVA) *4	3.1	4.8	7.2	11.4
Light load specifications	Applicable motor output(kW) *1	1.5	2.2	3.7	5.5
	Rated output current(A) *2	3.6	5.4	6.9	11.1
	Rated output capacity(kVA) *3	2.9	4.3	5.5	8.8
	Rated input current (A) *4	5.4	8.1	10.4	16.7
	Power supply capacity(kVA) *4	4.3	6.5	8.2	13.3
Mass (kg)		1.5	1.6	1.9	2.0
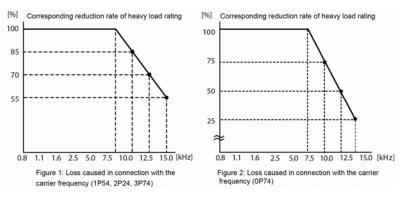
*1 The applicable motor here means the 4-pole standard motor at its maximum applicable capacity.
    Make sure that the rated output current of the inverter is higher than the rated current of the motor at the time when selecting a model.

*2 The rated output current varies depending on the set carrier frequency. Note to reduce the output current before its use.

*3 The rated output capacity here means the capacity when using the 3-phase 400V input type with a output voltage of 460 VAC.

*4 The input current and the power supply capacity varies with the impedance at its side. Prepare the power supply source with specifications higher than the listed values.

■ Table 1: Relationship between Carrier Frequency and Rated Current

Unit: A

Model	5.0kHz 以下		7.5kHz		10.0kHz		12.5kHz		15kHz	
	Light load	Heavy load	Light load	Heavy load	Light load	Heavy load	Light load	Heavy load	Light load	Heavy load
AMK3000P74	3.6	2.6	2.6	2.6	2.0	2.0	1.3	1.3	0.7	0.7
AMK3001P54	5.4	4.0	4.0	4.0	3.4	3.4	2.8	2.8	2.2	2.2
AMK3002P24	6.9	6.0	6.0	6.0	5.1	5.1	4.2	4.2	3.3	3.3
AMK3003P74	11.1	9.5	9.5	9.5	8.1	8.1	6.7	6.7	5.2	5.2

Figure 1: Loss caused in connection with the carrier frequency (1P54, 2P24, 3P74)

Figure 2: Loss caused in connection with the carrier frequency (0P74)

The rated output current varies depending on the set carrier frequency. Reduce the output current according to Table 1, Figure 1 and Figure 2 before its use.

7.2 Standard Specifications

■3-phase 400V Input Type

Items		Specifications
Standard output of applicable motor (kW)		0.75～3.7 kW
Rated output	Rated voltage	3-phase, 380 to 460V AC (proportional to power supply voltage)
	Overload current rating	Heavy load specifications: 150% of rated output current for 1 minute Light load specifications: 120% of rated output current for 1 minute
Input power supply	Number of phases, voltage and frequency	3-phase, 380 to 460VAC, 50/60Hz
	Allowable voltage fluctuation	＋10％ and －15％ of ratted input AC voltage
	Allowable frequency fluctuation	±5％ of rated input frequency
	Instantaneous voltage drop ride-through capability	·Operation continues when voltage is above 323VAC. ·Operation continues for 15ms when voltage drops below 323VAC.

7.3 Common Specifications

Input Power Supply	Applicable motor capacity (kW)	Model
3-phase 400V	0.75	AMK3000P74
	1.5	AMK3001P54
	2.2	AMK3002P24
	3.7	AMK3003P74

Items		Specifications
Output frequency	Frequency range	VF control: 0.2 to 400Hz Sensorless vector control: 0.5 to 120 Hz
	Frequency display	Digital display
	Frequency accuracy	Analog setting: within ±0.5% of maximum setting frequency (25°C±10°C) Digital setting: within ±0.01% of maximum setting frequency (-10°C to +50°C)
	Frequency resolution	Analog setting: 0.1Hz (in 50/60Hz mode) Digital setting: 0.1Hz
Inverter control mode		High carrier frequency sinusoidal PWM control (V/F control or sensorless vector control is available.)
Carrier frequency		·V/F control setting: 9 options can be selected (adjustable from 0.8 to 15 kHz). ·Sensorless vector control: 6 options can be selected (adjustable from 2.5 to 15 kHz) (0.8, 1.1, 1.6, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0kHz)
Operation	Run/Stop	• Operation panel buttons • 1a contact signal and 3-wire input (1a and 1b contact signals) can be selected. • RS485 communication • Wait time (0.1 to 100 s) can be set.
	Forward/Reverse run	• Operation panel buttons • 1a contact signal (reverse run can be disabled.) • RS485 communication
	JOG operation	Operation frequency: adjustable from 0.2 to 400 Hz Acceleration/deceleration time: adjustable from 0.04 to 3600s
	Stop mode	Ramp-to-stop / coast-to-stop (switchable)
	Reset function	Stop signal reset/external reset/panel reset (optional) /power supply reset

Items		Specifications
Operation	Start frequency	Adjustable from 0.2 to 60Hz
	Stop frequency	Adjustable from 0.2 to 60Hz
	Ride-through restart select	0 Hz restart/operation frequency restart/speed search restart (switchable)
	Speed search	Speed search during startup (optional)
	Retry function	Retry select: validity of function, details of retry faults Retry times: adjustable from 1 to 10 times
Control	Frequency setting signal	Panel setting (operation panel): digital setting Analog setting signal input from external control： • Potentiometer (10 kΩ, 1/4 W or higher) • 0 to 5 VDC, 0 to 10 VDC • 4 to 20 mA, 0 to 20 mA Digital setting signal input from external control: • PWM signal (cycle: 1 to 2000 ms) or Pulse input signal • Frequency rise SW/drop SW/storage SW signal Communication setting: RS485
	Voltage/frequency characteristics	Base frequency: fixed at 50/60 Hz, adjustable from 45 to 400Hz In 3-point V/F mode: adjustable voltage and frequency V/F curve: constant/square torque mode (switchable)
	Torque boost	Adjustable from 0 to 40%/auto torque boost (switchable)
	Acceleration/deceleration time	0.04 to 3600s (independent acceleration/deceleration setting)
	Acceleration/deceleration characteristics	Linear and S-shaped acceleration/deceleration (switchable)
	The 2nd function select	The 2nd function select (acceleration/deceleration time, torque boost, voltage/frequency characteristics (base frequency, 3-point V/F mode, electronic thermal and analog frequency setting)
	Multi-speed frequency setting	•Multi-speed operation: up to 16 speed settings (No limitation to frequency setting) •Timer operation: up to 8 speed settings (No limitation to frequency setting) It can be linked with acceleration/ deceleration time.
	Skip frequency setting	Up to 3 settings (skip frequency band adjustable from 1 to 10 Hz)
	Upper frequency limit setting	Adjustable from 0.2 to 400Hz
	Lower frequency limit setting	Adjustable from 0.2 to 400Hz
Control	Bias/gain frequency setting	Bias frequency: adjustable from −99.0 to 250.0% Gain frequency: adjustable from 0.0 to 500.0%

Items		Specifications
	External stop function	External fault stop/coast-to-stop (switchable)
	PID function	PID control mode (optional)
	Offline auto-tuning function	Auto-tuning of motor constant
	Cooling fan ON/OFF control	Optional
	Communication function	·Interface: RS485 serial communication ·Communication speed: 4800/9600/19200/38400/57600/ 115200 bps (switchable) ·Protocols: MEWTOCOL-COM/Modbus-RTU/ Modbus-ASCII (switchable) ·Communication pattern: Half duplex ·Maximum number of connected units: 31 ·Maximum transmission distance: 500m (in total)
Braking	Regenerative braking torque	·400V, 0.75 to 3.7kW: 20％ or higher
	DC braking	Operate at the frequency below stop frequency •Braking torque level: 0 to 100 •Braking time: adjustable from 0.1 to 120 s
Output signal	Analog output	Output specifications: 0 to 10 VDC(max. 1mA) Output function: output frequency and output current proportion (switchable)
	Open-collector output	Output specification: max. rating 50 VDC/50 mA Output functions: operation signal, arrival signal, overload alarm, frequency detection, abnormal reverse run signal alarm, current detection, timer OFF signal, output frequency/current proportion PWM signal and output frequency/current proportion pulse signal (switchable)
	Relay output	Output Specifications: 1c contact (contact capacity 230VAC, 0.3A; 30VDC, 0.3A resistive load) Output functions: operation signal, arrival signal, overload alarm, frequency detection, abnormal reverse run signal alarm, current detection, timer OFF signal (switchable)
Display	Operation/control status	Output frequency, linear speed display (switchable) and rotation direction Output voltage, internal DC voltage, setting frequency, communication station No., operation times of timer, alarm type, control circuit terminal status (I/O signal), operation status, PID (setting value, measured value and output value), progress of automatic tuning, accumulative operation time and accumulative operation time of fan
	Details of abnormality	Specific symbol is indicated when the protection function is activated (the latest four abnormalities are stored.)

Items		Specifications
Protection	Current limit	Current limit can be set within 1 to 200% of rated output current.
	Trip (stop)	Instantaneous overcurrent (SC1-6) and abnormal temperature (OH) Overcurrent (OC1-3), overload and electronic thermal relay (OL), undervoltage (LU), overvoltage (OU1-3), cooling fan fault (FAn), external fault (AU), operation fault (OP) and CPU fault (CPU, ErrC)
	Stall prevention function	Overcurrent and overvoltage stall prevention
Environment	Ambient temperature and humidity	-10 to +50°C (Note 1) (without freezing) and below 90%RH (without condensation)
	Storage temperature and humidity	-25 to +65°C and below 95%RH
	vibration	5.9m/s2(0.6G) or below
	Altitude	1000m or below
	Location	Indoor areas free of corrosive gases, flammable gases, oil mist or dust
Enclosure		IP20 cabinet-mounted
Cooling method		0.75kW: self-cooling; 1.5to 3.7kW: air-cooling

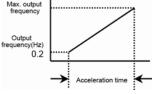Note 1: It is -10 to +40°C when multiple inverters are installed side-by-side.

Appendix

Function Parameter List

P001   The 1st Acceleration Time

The time to accelerate from 0.2 Hz to the maximum output frequency can be set.

Data setting range (s)	0.04·0.1～3600
Increment (s)	0.1(0.1～999.9)、1(1000～3600)

・ The display code for "0.04 s" is "0.0".

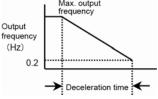・ The maximum output frequency can be set with parameter P009 and P012.

【Note】

・ Please note that if the acceleration time setting is too small, overcurrent may occur depending on the load.

Related parameters: P009, P012

| P002 | The 1st Deceleration Time |

The time to decelerate from the maximum to 0.2 Hz output frequency can be set.

Data setting range (s)	0.04·0.1 ～ 3600
Increment (s)	0.1(0.1 ～ 999.9)、1(1000 ～ 3600)

・ The display code for "0.04 s" is "0.0".

・ The maximum output frequency can be set with parameter P009 and P012.

【Note】

・ Please note that if the deceleration time setting is too small, overcurrent may occur depending on the load.

Related parameters: P009, P012

P003   Run Command Selection

Run/stop and forward/reverse run can be selected via the operation panel, the signal input from external control device or the communication commands.

Setting value	Command status	Panel reset function	Operation method and control circuit terminal connection diagram	
0	Panel	Enabled	RUN: RUN, STOP: STOP / (Forward/reverse): can be set in the Rotation Direction Setting mode (dr mode)	
1	Panel	Enabled	+RUN: Forward Run, +RUN: Reverse Run, STOP: STOP	
2	External control	Disabled		Commom terminal (Terminal No.⑦) ON: Run /OFF: Stop ON: Reverse /OFF: Forward
3	External control	Enabled		
4	External control	Disabled		Commom terminal (Terminal No.⑦) ON: Forward run/OFF: Stop ON: Reverse run/OFF: Stop
5	External control	Enabled		
6	Communication	Disabled	Make run command transmitted through communication valid.	
7	Communication	Enabled		

(*1): Set the "SW1～6"Function Selection of parameters P101～P106 to the setting values of "16(r16): Run/Stop" and "17(r17): Forward/Reverse".
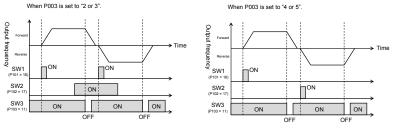
■Panel Reset Function
After an abnormal tripping, if the stop signal from external operation cannot reset it, use the STOP button on the operation panel to make a reset. However, if the reset lock function is enabled, the reset lock function shall take precedence, yet the reset function is also valid.

■ 3-wire run/stop command

Please assign the "3-wire stop command" to any one of the input terminals of SW1 to SW6.

Setting value	Command status	Panel reset function	Operation method and control circuit terminal connection diagram	
2	External control	Disabled		Commom terminal (Terminal No.⑦) ON: Run ON: Reverse/OFF: Forward ON: Stop (*1)
3	External control	Enabled		
4	External control	Disabled		Commom terminal (Terminal No.⑦) ON: Forward run ON: Reverse run ON: Stop (*1)
5	External control	Enabled		

(*1)　Set the "SW1～6"Function Selection of parameters P101 to P106 to the setting values of "16(r16): Run/Stop" and "17(r17): Forward/Reverse".

(*2)　If any terminal of SW1 to SW6 is used as "3-wire stop command", please set their corresponding parameters P101 to P106 to "11 or r11"

(*3)　When 3-wire mode is used, "a" contact input shall apply.

(*4)　When 3-wire mode is used, "b" contact input shall apply.

When P003 is set to "2 or 3".

When P003 is set to "4 or 5".

【Note】

・The operation status will not change if the forward run and reverse run signals are both "ON". But if it is in a stop mode, it will not operate even if the signals are both ON.

Related parameters: P101 to P106

P004   Frequency Setting Signal

The frequency setting signal can be set via the operation panel, the signal input from external devices or the communication command.

Setting value	Command status	Panel reset function	Operation method and control circuit terminal connection diagram
0	Panel	Digital setting	Can be set in the "Frequency Setting Mode (Fr)"
1	External control	Potentiometer VR input	Terminal AK, AL and AN, (center of potentiometer is connected to Terminal AL).
2		0～5V (Voltage signal)	Terminals AL and AN (12: ＋, 14: －)
3		0 ～10V (Voltage signal)	Terminals AL and AN (12: ＋, 14: －)
4		4～20mA (Current signal)	Terminals AL and AN (12: ＋, 14: －)
5		0～20mA (Current signal)	Terminals AL and AN (12：＋, 14：－)
6	Communication	RS485 communication	Enable the frequency command transmitted via communication.
7	External control	PWM signal input	Terminal No. 6 and No. 7 (6: ＋, 7: －)
8		Pulse input	Terminal No. 6 and No. 7 (6: ＋, 7: －)

【Note】

・When the setting value is set to "1" to "5", the inverter will run or stop as defined by the setting value of "P047: 0V Stop Function Selection". If 0V Stop Function is set to invalid, parameter P047 should be set to "0.0".

Related parameters: P009, P012, P047, P109 to P113

P005 Operation Status Monitoring

The display on the panel can be changed according to its purpose.

Setting value	Function Name	LED display	
		Operation Preparation Status (in Stop mode)	Operation Status
0	Output frequency	`0000`	`50.0`
1	Linear speed	`00.00`	`25.0`
2	Output current	`0.0A`	`1.0A`
3	Communication station No.	`01`	`01`
4	Setting frequency	`50.0`	`50.0`
5	Communication station No./Output frequency	`01`	`50.0`
6	Communication station No./Linear speed	`01`	`25.0`
7	Communication station No./Output current	`01`	`1.0A`
8	Winding length (the same as n022)	`10.00`	`10.00`

* The display example shown in the above Table, where the operation frequency is "50.0" , the output current is "1.0A", the setting frequency is "50.0", the communication station No. is "01", the linear speed multiplier is "0.5", and the winding length is "10.00".

【Note】

・When in the Operation Status Display mode, press 🖱 button to switch to the current display.

・The operation preparation status recorded in this Manual is "0000", the display will change based on the setting value when this parameter is changed.

Related parameters: P054

105

P006   Vector Control Selection

This function is effective for the case that the load fluctuates sharply when high start-up torque or sufficient torque at lower speed is required. But it is not applicable to the load whose minor rotation may cause problems at lower speed.

Setting value	Details
0	V/F control
1	Sensorless vector control

If it is set to the vector control mode, please carefully read "4.15: Vector Control" and follow the precautions to set various parameters.

P007   Carrier Frequency

To reduce the motor noise and avoid the machine resonance, you may change the carrier frequency.

■ "P006: Vector Control Selection" is set to "0" (when V/F control is selected)

Setting value (kHz)	0.8, 1.1, 1.6, 2.5, 5.0, 7.5, 10.0, 12.5, 15.0 (9 values are optional)

■ "P006: Vector Control Selection" is set to "1" (when sensorless V/F control is selected)

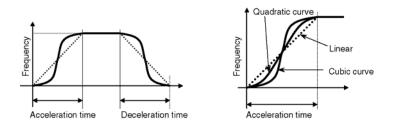| Setting value (kHz)	2.5, 5.0, 7.5, 10.0, 12.5, 15.0 (6 values are optional)

【Note】

 • Please carefully read "Chapter 7: Relationship between Carrier Frequency and Rated Current" before you change the carrier frequency.

P008	S-shape Acceleration/Deceleration Mode

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

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

【Note】

・The acceleration/deceleration time remains the same regardless of the acceleration/deceleration mode (linear or s-shaped acceleration/deceleration).
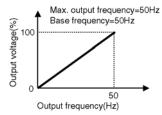
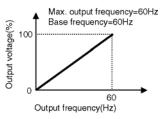Related parameters: P001, P002, P317 to P322

P009   V/F Control

V/F mode of "50· 60 Hz" and "0.2 to 400 Hz" can be set separately within the maximum output frequency band (50~400 Hz).
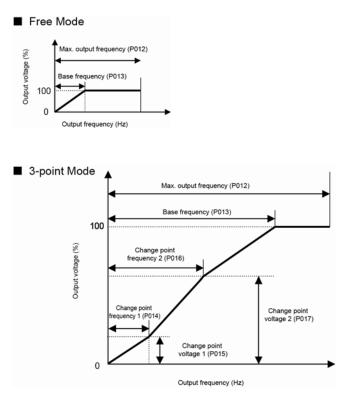
Setting value	Name	Details
50	50Hz mode	V/F mode of 50 Hz is set regardless of parameter P012 and P013 setting.
60	60Hz mode	V/F mode of 60 Hz is set regardless of parameter P012 and P013 setting.
FF	Free mode	V/F mode can be set via parameter P012 and P013. Set the maximum output frequency via parameter P012 and the base frequency via parameter P013.
3C	3-point mode	3-point V/F mode can be set via parameter P012 to P017. Set the maximum output frequency via parameter P012 and the base frequency via parameter P013. Set the change point frequency 1 via parameter P014 and the change point voltage 1 via parameter P015. Set the change point frequency 2 via parameter P016 and the change point voltage 2 via parameter P017.
3C1	3-point fixed mode 1	Set value for the fixed mode via parameter P013 to P017.
3C2	3-point fixed mode 2	Set value for the fixed mode via parameter P013 to P017.
3C3	3-point fixed mode 3	Set value for the fixed mode via parameter P013 to P017.
3C4	3-point fixed mode 4	Set value for the fixed mode via parameter P013 to P017.
3C5	3-point fixed mode 5	Set value for the fixed mode via parameter P013 to P017.
3C6	3-point fixed mode 6	Set value for the fixed mode via parameter P013 to P017.

■ 50Hz mode

Max. output frequency=50Hz
Base frequency=50Hz
Output voltage(%)
100
0
50
Output frequency(Hz)

■ 60Hz mode

Max. output frequency=60Hz
Base frequency=60Hz
Output voltage(%)
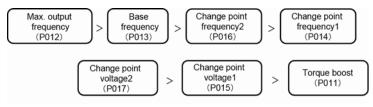100
0
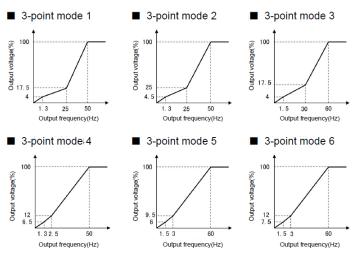60
Output frequency(Hz)

■ Free Mode

■ 3-point Mode

If 3-point V/F mode is used, please set each parameter according to the following diagram.
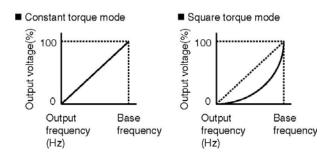(Also apply to the 2nd characteristic).

【Note】

- Settings for 3C1 to 3C6 will not affect the 2nd characteristics.
- Factory settings of maximum output frequency and base frequency are both 50Hz.
- Please consider the setting of Upper Frequency Limit (parameter P046) when changing the maximum output frequency.
- In free mode or 3-point mode, please note that sharp acceleration/deceleration or overcurrent may occur depending on setting values and load state if change point frequency and voltage are changed during operation.
- If change point frequency 1 or 2 is set to a value higher than the base frequency, the invert will still operate according to the base frequency setting.
- If change point frequency 2 is set to a value lower than change point frequency 1, it will operate according to the setting of the latter one.
- If change point voltage 1 or 2 is set below the torque boost value, it will operate according to the setting value of "P011: Torque Boost".
- If change point voltage 2 is set to a value lower than change point voltage 1, it will operate according to the setting of the latter one.
- In 3-point mode, V/F curve (P010) corresponds to constant torque mode. Even if the setting is square torque mode, constant torque mode still applies.
- It is invalid during vector control (P006 = "1").

Related parameters: P011 to P017, P046

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P010   V/F Curve

Constant or square torque mode can be selected.

Setting value	Name	Remarks
0	Constant torque mode	For machine applications, etc.
1	Square torque mode	For fan and pump applications, etc.

■ Constant torque mode   ■ Square torque mode

【Note】

• If "P009: V/F Mode" is set to "3C", "3C1 to 3C6", V/F curve will correspond to constant torque mode.
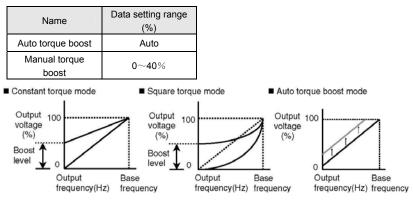 Even if the setting is square torque mode, constant torque mode will still apply.
• It is invalid during vector control (P006 = "1").

Related parameters: P009, P013

P011　Torque Boost

Torque boost level corresponding to load characteristics can be set. The larger the setting value is, the higher output voltage and torque boost will be.
・After the mode is set to "auto torque boost", the output voltage will change automatically according to the load fluctuation. To set "Auto torque boost", please clockwiswly rotate once when the operation panel displays "40".

Name	Data setting range (%)
Auto torque boost	Auto
Manual torque boost	0～40％

■ Constant torque mode　　　■ Square torque mode　　　■ Auto torque boost mode

Method of increasing torque at lower speed
・If higher torque is required at lower speed, the torque boost level can be set to a larger value, thus generating higher output voltage to increase the torque.
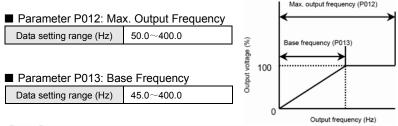
【Note】

・If the boost level setting is too high, it may cuase overcurrent fault, overload fault, motor overheating or excessive noise.
・The motor current will rise after the boost level increases. Please carefully consider the settings for "P023: Electronic Thermal Selection" and "P024: Thermal Current Setting".
・Once it is set to "vector control", the settings for parameter "P006: Vector Control Selection =1" and parameter "P011: Torque Boost" will become invalid.
・If auto torque boost mode is selected, be sure to conduct auto-tuning and use the inverter with correct setting of the motor constants.
 (Please carefully read "4.14: auto-tuning" for the details of auto-tuning.)

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| P012 | Max. Output Frequency |
| P013 | Base Frequency |

Maximum output frequency and base frequency can be set.

(Parameter P009 is only valid when "FF" or "3C" is set.)

■ Parameter P012: Max. Output Frequency

| Data setting range (Hz) | 50.0～400.0 |

■ Parameter P013: Base Frequency
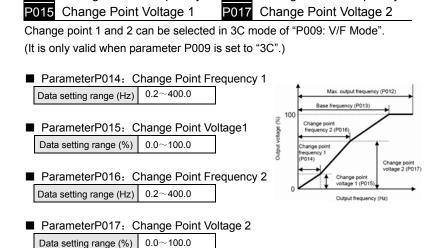
| Data setting range (Hz) | 45.0～400.0 |

【Note】

• If "P009: V/F Mode" is set to "50", "60" or "3C1 to 3C6", the maximum output frequency and base frequency will be fixed values.
• A frequency higher than "P046: Upper Frequency Limit" cannot be output.
• If a general-purpose motor with rated frequency of 50/60 Hz is running at a frequency exceeding the ratings, the motor may be damaged. Therefore, please set a frequency that matches with the motor characteristics.
• If base frequency is required to be changed simultaneously with maximum output frequency for a dedicated high-speed motor etc., such change should also be made via this parameter.
• When running a general-purpose motor at a frequency higher than universal frequency, the base frequency setting should not exceed the rated output frequency (50/60 Hz) of the motor.
• When a general-purpose motor reaches a level higher than the base frequency (normally 50/60 Hz), the motor will show constant output characteristics and the generated torque will drop in reverse proportion to the frequency.
• If "P006: Vector Control Selection" is set to "Sensorless Vector Control" mode, the maximum output frequency shall range from 50.0 to 120.0Hz.

Related parameters: P009, P046

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P014 Change Point Frequency 1 **P016** Change Point Frequency 2
P015 Change Point Voltage 1   **P017** Change Point Voltage 2

Change point 1 and 2 can be selected in 3C mode of "P009: V/F Mode".

(It is only valid when parameter P009 is set to "3C".)

■ ParameterP014：Change Point Frequency 1

| Data setting range (Hz) | 0.2～400.0 |

■ ParameterP015：Change Point Voltage1

| Data setting range (%) | 0.0～100.0 |

■ ParameterP016：Change Point Frequency 2

| Data setting range (Hz) | 0.2～400.0 |

■ ParameterP017：Change Point Voltage 2
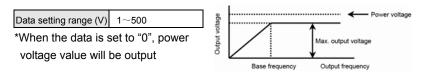
| Data setting range (%) | 0.0～100.0 |

【Note】

・Read "P009: V/F Mode" carefully before setting.
・Change point frequency 1 and 2 will operate according to the setting value of the base frequency when set to a value higher than the base frequency.
・Change point frequency 2 will operate according to the setting value of change point frequency 1 when set to a value lower than change point frequency 1.
・When setting "P011: Torque Boost", change point voltage 1 and 2 will operate according to the setting value of torque boost if set to a value lower than torque boost level.
・Change point voltage 2 will operate according to the setting value of change point voltage 1 when it is set to below change point voltage 1.
・Please note that sharp acceleration/deceleration or overcurrent may occur depending on setting values and load status if data is changed during operation.
・When "3C1" to "3C6" of "P009: V/F Mode" is set, P010 to P013 will change to fixed value automatically, and cannot be changed.

Related parameters: P009, P046, P011 to P013

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P018 Max. Output Voltage

The msximum output voltage can be set via this parameter.

| Data setting range (V) | 1～500 |

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

【Note】

・A voltage exceeding power supply rating cannot be output.
・This setting has no connection with the DC brake level.
・It is invalid when vector control mode is selected.

Related parameters: P009, P012

P019	JOG Frequency
P020	JOG Acceleration
P021	JOG Deceleration
P022	JOG Panel Operation

The operating frequency, acceleration/deceleration time during JOG operation can be respectively set via these parameters.

■ Parameter P019: JOG Frequency

| Data setting range (Hz) | 0.2～400.0 |

■ Parameter P020: JOG Acceleration

| Data setting range (s) | 0.04·0.1～600 |
| Increment (s) | 0.1(0.1～999.9), 1(1000～3600) |

・The display code for 0.04 is "0.0".

■ Parameter P021: JOG Deceleration

| Data setting range (s) | 0.04·0.1～3600 |
| Increment (s) | 0.1(0.1～999.9), 1(1000～3600) |

・The display code for 0.04 is "0.0".

■ Parameter P022: JOG Panel Operation

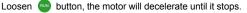| Name	Setting value	Details
Panel JOG Operation	0	Panel JOG function is invalid.
	1	Use Panel JOG function (JOG function of the external device is invalid)
	2	Panel JOG function (JOG function of the external device is invalid)

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Operation Method of Panel JOG Function

① Power on the inverter.
The inverter displays "0000" when the power is ON.

② Press (MODE) button to enter into the Parameter Setting mode.

③ Rotate the knob to "P0: Parameter Setting".

④ Press the knob to display parameter P001.

⑤ Rotate the knob to "P022: JOG Panel Operation".

⑥ Press the knob to proceed to the setting of value for P022.

⑦ Rotate the knob to adjust the value of P022 to "1".

⑧ Press the knob to apply the setting "1" for P022 and use the Panel JOG function. (adopt the same method to respectively set P019 to "10.0", P020 to "5.0" and P021 to "5.0").

⑨ Press (MODE) button to enter into Forward JOG operation and display "Jog.F".
(Counterclockwisely rotate the knob to switch to Reverse JOG operation to display "Jog.r")

⑩ Press (RUN) button to forward accelerate the motor to 10.0Hz and remain at this speed.Loosen
Loosen (RUN) button, the motor will decelerate until it stops.

【Note】

・ Where the external control JOG function is selected, the operation command must be set to External Control operation (Parameter P003 shall be set to "2" to "5").
・ Where the external control JOG function is selected, please refer to the related contents of parameters P101 to P106.
・ The JOG frequency used in vector control ranges from 0.5Hz to 120.0Hz.

Related parameters: P003, P101 to P106

P023	Electronic Thermal Selection
P024	Thermal Current Setting

Electronic thermal operation level can be set when motor overload is detected and the inverter output needs to be stopped.
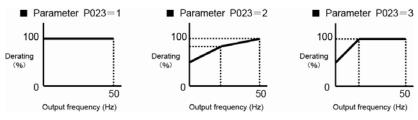Operation coasts to stop when OL is displayed.

■ Parameter P023: Electronic Thermal Selection

Setting value	Validity of function	Details of function
0	Disabled	OL trip will occur if the inverter current remains 140% of its rating for 1 minute.
1	Enabled	The output frequency is not derated.
2	Enabled	The output frequency is derated.
3	Enabled	Forced air-cooled motor specification

* About frequency derating

The function can automatically compensate operation level when motor cooling performance drops during low-speed operation.

■ Parameter P023＝1   ■ Parameter P023＝2   ■ Parameter P023＝3

■ Parameter P024：Thermal Current Setting

Data setting range (A)	0.1～100.0

* Please make settings according to the rated current of the applicable motor.

■Example of setting current and thermal operation (P023＝1)
・Setting current×100％　⇒Does not operate
・Setting current×125％　⇒Operate (OL trip)

P025   Overcurrent Stall Prevention Function

・Overcurrent Stall Prevention Function:

During acceleration/deceleration, if acceleration/deceleration time is too short for the inertial load and the output current exceeds OCS level, the parameter serves to extend acceleration/deceleration time.

・Overcurrent Trip Prevention Function:

If overcurrent occurs in the inverter during operation, output will be temporarily stopped and started again when the current drops to normal level.

Name	Setting value	Details
Overcurrent Stall Prevention Function	0	Overcurrent Stall Prevention Function: OFF Overcurrent Trip Prevention Function: OFF
	1	Overcurrent Stall Prevention Function: ON Overcurrent Trip Prevention Function: ON
	2	Overcurrent Stall Prevention Function: OFF Overcurrent Trip Prevention Function: ON
	3	Overcurrent Stall Prevention Function: ON Overcurrent Trip Prevention Function: OFF

【Note】

・When load fluctuates drastically or the inverter accelerates or decelerates sharply, instantaneous overcurrent may sometimes lead to a trip.

・The operation level of overcurrent stall prevention function can be set via parameter "P028: OCS Level". The factory setting is 140% of the rated current.

・Overcurrent trip prevention function is activated regardless of the setting of parameter "P025: Overcurrent Stall Prevention Function" after parameter "P027: Current Limit Function" is set.

・Overcurrent trip prevention function shall be disabled if the sensorless vector control function is selected.

Related parameters: P028

P026　Overvoltage Stall Prevention Function

During deceleration, when the deceleration time is too short for the inertial load, this parameter can be used to temporarily retard the deceleration, thus preventing overvoltage trip.

Setting value	Details
0	Stall prevention function disabled
1	Stall prevention function enabled

【Note】

・When regenerative brake is used in the inverter with braking function, please set the value to "0".

　(The regenerative brake function will be disabled if the factory setting is "1").

・The specifications of the built-in brake of the inverter are as follows. Please take them into full consideration before its use.

Please note that the braking resistor and inverter could be damaged if used beyond specifications.

　(1) Braking torque: 100%

　(2) Maximum duty factor (%ED): 5%

　(3) Maximum working time: 5s

・Only brake circuit is built in the inverter.
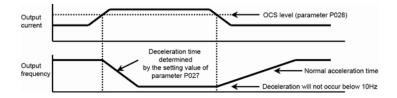
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P027   Current Limit Function

If the output current reaches the overcurrent stall level (OCS level) during overload operation, the frequency will be automatically reduced. When the load recovers to normal level, the frequency will be automatically restored to the original setting and the operation will continue. This function is effective for preventing overcurrent trips in sticky material crushing machines.

When the function becomes valid/invalid and the output current reaches the overcurrent stall level, deceleration time will be automatically set to lower the frequency.

The operation level (overcurrent stall level) can be set with the parameter "P028: OCS Level".

Data setting range (s)	0.0·0.1～9.9

* "0.0" corresponds to a setting without current limit.

【Note】

・Overcurrent trip prevention function is activated regardless of the setting of parameter "P025: Overcurrent Stall Prevention Function" after parameter "P027: Current Limit Function" is set.

Related parameters: P025, P028

P028   OCS Level

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

Data setting range (%)	1∼200

【Note】

・The factory setting of OCS level is 140％ of the rated current.

・The OCS level is equivalent to the current limit level.

・It has no connection with the electronic thermal level and the overload detection level.

Related parameters: P025, P027

P029	Retry Function Selection
P030	Retry Count

The retry function can automatically reset the fault and restart (run) operation after waiting time has elapsed when an inverter fault trip occurs. Please use this function to continue the operation.

⚠ Danger	When the retry function is used, the unit may automatically start (restart) suddenly, so do not approach the unit. (Please take measures to ensure personal safety.) Failure to do so may lead to injury.

■ Parameter P029: Retry Function Selection

Setting value	Details
0	Retry function disabled (retry is not performed.)
1	Perform retry operation only for overcurrent fault and heat sink abnormal overheating (OC1/OC2/OC3).
2	Perform retry operation only for overvoltage fault (OU1/OU2/OU3).
3	Perform retry operation only for overcurrent fault and heat sink abnormal overheating (OC1/OC2/OC3) and overvoltage fault (OU1/OU2/OU3)

■ Parameter P030: Retry Count

Data Setting Range (times)	1～10

【Note】

・The retry interval is set via the parameter "P033: Waiting Time".
・Fault alarm is not output during retry operation. But when the fault still occurs even if retry is performed for preset times, the fault alarm will be output.
・If an unselected fault occurs during retry, the fault alarm will be output and the retry count accumulated up to now will be cleared.
・Once the power is cut off, the retry count accumulated up to now will be cleared.
・If the fault does not occur for over 5 minutes, the retry times accumulated up to now will be cleared.
・When speed search is selected via parameter "P361: Speed Search Selection during Retry" and the time set via parameter "P033: Waiting Time" and "P359: Waiting Time to Speed Search" has elapsed, the speed search function will start to operate.
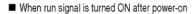
Related parameters: P033

P031　Start Mode

This parameter is used to set the start-up operation for the case that a run signal set externally is input when the power is turned ON.
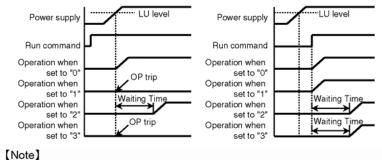
⚠ Danger	Depending on the start mode setting, when the run signal is ON, the inverter may start (restart) suddenly if the power is turned ON or restored after a power failure. Therefore, do not approach the unit. Design the machine so that personal safety can be ensured even if the inverter starts suddenly. Depending on the start mode function setting, if the fault trip is reset with the run signal ON, the inverter may sometimes restart suddenly. (Please take measures to ensure personal safety.) Failure to do so may lead to injury.

・The factory setting is "1" (OP stop).
・If the value is set to "0", operation will start immediately after the power is turned ON.
・If the value is set to "2", operation will start when the power is turned ON and after the waiting time has elapsed.

Setting value	Operation	Details of operation
0	Run	Operation starts immediately when the low voltage level (LU level) is exceeded after the power is turned ON.
1	"OP" stop	OP trip occurs when the low voltage level (LU level) is exceeded after the power is turned ON. Turn the run signal OFF once, perform reset operation and turn the run signal ON again to start operation.
2	Run after waiting time elapes	Operation starts when the low voltage level (LU level) is exceeded and the waiting time has elapsed after the power is turned ON.(The waiting time can be set via parameter P033.)
3	"OP" stop	OP trip occurs when the low voltage level (LU level) is exceeded after the power is turned ON. Turn the run signal OFF once, perform reset operation and turn the run signal ON again to start operation. (The setting will function in the same manner as data "1" with run signal ON when the power is turned ON. However, starting after the waiting 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-on

【Note】

• Waiting time can be set via parameter P033.

Related parameters: P033

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P032 Ride-through Restart Selection

The restart pattern after constant power failure or instantaneous power supply can be selected according to the load status and system configuration.
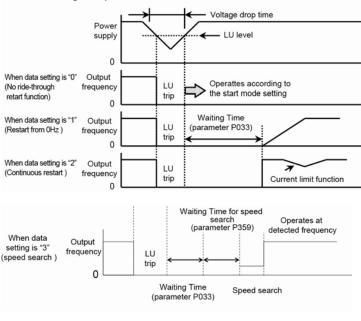A waiting timer function is built-in.

⚠ Danger	The inverter may suddenly start (restart) if the power is restored after a power failure with the setting of ride-through restart, so do not approach the unit. Please take measures to ensure personal safety. Failure to do so may result in injury.

Setting value	Function Name	Inverter operation in regard to instantaneous power failure time			
		≥ 15 ms (Note 1)	≥ 15 ms (Note 1)	≤ 100 ms (Note 2)	>100 ms (Note 2)
0	Restart Mode 1	Operation continues	·LU trip occurs and the inverter operates according to the start mode setting. ·"LU" will be displayed and the fault alarm signal will be output.		The inverter operates according to the start mode setting.
1	Restart Mode 2		·Restart from 0 Hz after the waiting time has elapsed. ·"LU" will be displayed and the fault alarm signal will not be output.		
2	Restart Mode 3		·After the waiting time has elapsed, the inverter restarts at the frequency applied before the ride-through occurrence. ·"LU" will be displayed and the fault alarm signal will be output.		
3	Restart Mode 4		·After the waiting time has elapsed, the inverter will sense the motor rotation through speed search function and restart at the corresponding frequency. (note 3) ·"LU" will be displayed and the fault alarm signal will be output.		

Note 1: This is the minimum time for operation at the rated output current.
(The time may be longer depending on different models.)

Note 2: This is the minimum time. (The time may be longer with higher rated capacity.)
Even if the power failure time is relatively long (approx. 1 min.), the inverter may sometimes restart after the power is restored. Therefore, inverter, motor and load equipments should be restarted after the power is restored for more than 4 minutes (waiting time + 2 minutes).

Note 3: In sensorless vector control, speed search will not be performed and the inverter will operate according to the start frequency setting (P036).

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■ When voltage drop time is between 15ms and 100ms

【Note】

• Waiting time can be set via parameter P033.

Related parameters: P033

P033　Waiting Time

Waiting time required by the start mode, the ride-through restart and retry function can be set.

Data setting range (s)	0.1～100.0

Related parameters: P029～P032

P034　Reverse Run Lock

When used only in forward run mode, reverse run can be disabled to avoid possible mishandling.

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

【Note】

- When disabled, reverse run cannot be performed during the operation of panel, external control and communication.

Related parameters: P004

P035　Start Frequency

The frequency at which the inverter output starts can be set during inverter start-up.

Data setting range (Hz)	0.2～60.0

【Note】

- Please note that overcurrent may occur depending on setting values and load status if the data is changed during operation.
- In vector control mode, the minimum value is changed to "0.5Hz".

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P036 Stop Mode

Ramp-to-stop or coast-to-stop mode can be selected when stopping the inverter.

Setting value	Details	Details
0	Ramp-to-stop	The inverter is stopped by the stop signal depending on the frequency decreased according to the deceleration time.
1	Coast-to-stop	The inverter output is shut off immediately by the stop signal.

P037 Stop Frequency

The frequency at which the inverter output stops can be set when the inverter ramps to stop.
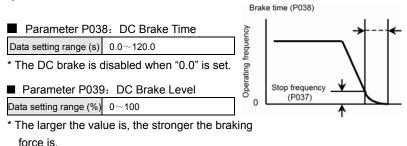
Data setting range (Hz)	0.2~60.0

Related parameters: P038 to P039

P038	DC Brake Time
P039	DC Brake Level

DC brake can be applied when the inverter output frequency drops below "P037: Stop Frequency" during ramp-to-stop.

In addition, positioning control can be performed combining with JOG operation.

■ Parameter P038：DC Brake Time

Data setting range (s)	0.0～120.0

* The DC brake is disabled when "0.0" is set.

■ Parameter P039：DC Brake Level

Data setting range (%)	0～100

* The larger the value is, the stronger the braking force is.

Brake time (P038)

【Note】

・DC brake starts at the frequency corresponding to the setting value of parameter "P037: Stop Frequency".

・DC brake during the switching between forward run and reverse run is set via parameter "P040: Stop Frequency during Forward/Reverse Run Operation", "P041: DC Brake Time during Forward/Reverse Run Operation" and "P042: DC Brake Level during Forward/Reverse Run Operation".

Related parameters: P037

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P040	Stop Frequency during Forward/Reverse Run Operation
P041	DC Brake Time during Forward/Reverse Run Operation
P042	DC Brake Level during Forward/Reverse Run Operation

DC brake can be applied when the inverter output frequency drops below "P040: Stop Frequency during Forward/Reverse Run Operation" during forward/reverse run operation.
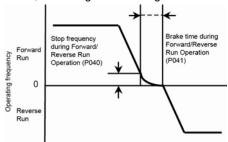
■ Parameter P040：Stop Frequency during Forward/Reverse Run Operation

| Data setting range (Hz) | 0.2～60.0 |

■ Parameter P041: DC Brake Time during Forward/Reverse Run Operation

| Data setting range (s) | 0.0～120.0 |

* The DC brake is disabled when "0.0" is set.

■ Parameter P042: DC Brake Level during Forward/Reverse Run Operation

| Data setting range (%) | 0～100 |

* The larger the value is, the stronger the braking force is.

【Note】

・ The frequency for applying the DC brake is set by parameter "P040: Stop Frequency during Forward/Reverse Run Operation".
・ "P040: Stop Frequency during Forward/Reverse Run Operation" is only valid when DC brake is applied during forward/reverse run operation. (It's valid when P041 is set to a value other than "0000")
・ To stop the inverter, DC brake can be set via parameter "P037: Stop Frequency", "P038: DC Brake Time" and "P039: DC Brake Level".

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P043	DC Brake Time at Start-up
P044	DC Brake Level at Start-up

・The coast-to-stop motor can be restarted via this parameter after a pause.

■ Parameter P043: DC Brake Time at Startup
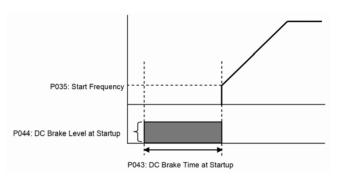
Data setting range (s)	0.0～120.0

■ Parameter P044: DC Brake Level at Startup

Data setting range (%)	0～100

*1: Set P043 to "0.0" to disable the DC brake function when not used.

*2：The larger the value is, the stronger the braking force is.

P035: Start Frequency

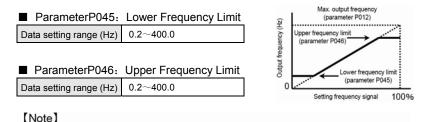P044: DC Brake Level at Startup

P043: DC Brake Time at Startup

【Note】

・The start frequency is specified by parameter "P035: Start Frequency".

・Please note that sharp acceleration/deceleration or overcurrent may occur depending on the setting values and load status if data is changed during operation.

・When parameter "P357: Speed Search at Startup" is set to "enabled", the setting value of DC brake set via this parameter is "disabled".

P045	Lower Frequency Limit
P046	Upper Frequency Limit

The upper limit and lower limit of the output frequency can be set.

■ ParameterP045：Lower Frequency Limit

Data setting range (Hz)	0.2～400.0

■ ParameterP046：Upper Frequency Limit

Data setting range (Hz)	0.2～400.0

【Note】

・ When the upper frequency limit is lower than the maximum output frequency (parameter P012), the upper frequency takes precedence.
・ When the lower frequency limit is higher than the upper frequency limit (reverse run setting), the latter takes precedence.
・ The inverter may accelerate/decelerate depending on the setting values when data is changed during operation.
・ In vector control mode, the minimum value and the maximum value shall be respectively changed to 0.5Hz and 120Hz.

Related parameters: P009, P012

P047   0V Stop Function Selection

When the frequency setting signal is lower than than setting value, the inverter output can be stopped by using 0V stop function.
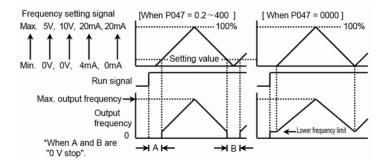
Data setting range (Hz)	0.0·0.2~400.0

- Setting value "0.0"   : 0V stop function disabled.
- Setting value "0.2~400.0"   : 0V stop function enabled(0V stop function setting)

■0V stop function
- When the frequency signal is set to "analog setting (parameter P004 = "1", "2", "3", "4" and "5"), the inverter will stop output after the frequency setting signal reaches a value below the setting value of 0 V stop function selection.
- 0 V stop will not be performed if 0 V stop function selection is set to "0.0". The inverter will continuously run at the lower frequency limit if the frequency setting signal is lower than 1/100 (1%) of full scale.

134

P048	The 1st Skip Frequency
P049	The 2nd Skip Frequency
P050	The 3rd Skip Frequency
P051	Skip Frequency Band Width

If mechanical parts of the load resonate at a specific output frequency of inverter, continuous operation within frequency band width should be avoided by setting the skip frequency and the skip frequency band width.

 ・Up to 3 skip frequency values can be set, and the skip frequency band width can be set between 1 and 10 Hz.

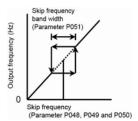■ Parameter P048: The 1st Skip Frequency
■ Parameter P049: The 2nd Skip Frequency
■ Parameter P050: The 3rd Skip Frequency

| Data setting range (Hz) | 0.0・0.2～400.0 |

* "0.0" indicates that there is no skip function setting.

■ Parameter P051: Skip Frequency Band Width

| Data setting range (Hz) | 0・1～10 |

* "0" indicates that there is no skip function setting.

135

P052　Cooling Fan ON-OFF Control Selection

• Operation modes of cooling fan in normal status and fault status can be set.

Setting value	Details	
	Operation of cooling fan	Operation when heat sink is faulty
0	Fan ON when the power supply is switched ON. Fan OFF when the power supply is switched OFF.	The inverter stops abnormally.
1	Fan ON at the start of the operation. Fan OFF when the operation stops. ※The status of the internal temperature of the inverter will be switched between ON and OFF when in the stop status (It shall be switched to OFF when the internal temperature of the inverter is below 100℃).	The inverter stops abnormally.
2	Fan ON when the power supply is switched ON. Fan OFF when the power supply is switched OFF.	The inverter does not stop but sends out alarm.
3	Fan ON at the start of the operation. Fan OFF when the operation stops. ※The status of the internal temperature of the inverter will be switched between ON and OFF when in the stop status (It shall be switched to OFF when the internal temperature of the inverter is below 100℃).	The inverter does not stop but sends out alarm.

【Note】

• The parameter is invalid to the models without cooling fans (3-phase 400 V/0.75 kW model).

·Please set the parameter "P056:—" to be "1" or "6" when the setting value "2" or "3" is used.

P053   Input Terminal Filter

Filter constants can be set to the control circuit terminals of the inverter to effectively remove the interference of the external signal input.

Setting value (times)	5～100

【Note】

- If the setting value is too large, the interference resistance capability will be enhanced, but the response speed of the control input terminals will decrease.
- If the setting value is too small, the interference resistance capability will be weakened, but the response speed of the control input terminals will increase.
- When start/stop, forward run and reverse run signals are used to operate the inverter, internal processing time of the inverter will become longer even if the setting value is small. In this case, the response speed of the control input terminals will be slower than other terminals.

P054   Linear Speed Multiplier

When the setting value shown in "P005: Operation Status Monitor" is "1" (linear speed), multiplier relative to the output frequency can be set.

■ Parameter P054：Linear Speed Multiplier

Data setting range (times)	0.1～100.0

<Setting example> When linear speed is displayed

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

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

【Note】

- Linear speed exceeding "9999" is displayed as "9.9.9.9".

Related parameters: P005

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P055   Setting Data Clear

All data can be restored to their factory settings via this parameter.

Setting value	Details
0	It indicates the value in normal status.
1	Except motor constants, all data will be restored to their factory settings.
2	All data will be restored to their factory settings.

■ Uninitialized motor constants when P055=2

Function Name	ParameterNo.	
	For the 1st motor	For the 2nd motor
Motor Capacity	P203	P216
Motor Pole Number	P204	P217
Rated Voltage of Motor	P205	P218
Rated Frequency of Motor	P206	P219
Rated Current of Motor	P207	P220
Primary Resistance	P208	P221
Secondary Resistance	P209	P222
Energizing Inductance	P210	P223
Leakage Inductance	P211	P224
Energizing Current	P212	P225
Speed Control Percentage Increment	P213	P226
Speed Control Integral Increment	P214	P227
Torque Limit Level	P215	P228

【Note】

• When the setting value is changed to a value other than "0" and ⊘ button is pressed, the display will automatically switch to "0" afterwards to apply the change.
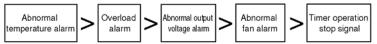
138

P056   Alarm LED Operation Selection

Alarm LED operation of the panel can be selected via this parameter.

Setting Value	Function Name	Details of Function
0	N/A	N/A (The LED lights up when fault trip occurs)
1	Full monitor alarm	When any of the specified conditions (output voltage fault, overload, temperature abnormality, timer operation stop and cooling fan abnormality) is satisfied, the alarm LED will flicker.
2	Output voltage fault alarm	When the setting value (P057) is reached, the alarm LED will flicker.
3	Overload alarm	When the setting value (P058) is reached, the alarm LED will flicker.
4	Abnormal temperature alarm	When the heat sink temperature rises above 80 °C, the alarm LED will flicker.
5	Timer stop signal	When the timer operation is complete, the alarm LED will flicker. (The signal is linked with the timer operation function. When ∞ is displayed, the alarm LED will not flicker.)
6	Abnormal cooling fan alarm	When cooling fan abnormality occurs, the alarm LED will flicker.

• If fault trip occurs, the alarm LED will light up.
• Monitor function "n008: Alarm Type" can be used to identify the type of the current alarm.
• When alarm LED operation selection (parameter P056) is set to "1" and several alarms occur simultaneously, the alarm display order is as follows.
(If a higher-priority alarm is in operation, it will still be displayed even if a lower-priority alarm enters.)

Abnormal temperature alarm **>** Overload alarm **>** Abnormal output voltage alarm **>** Abnormal fan alarm **>** Timer operation stop signal

• When the settings of "P124 to P126: Output TR1, TR2 and Ry Function Selection" are set to "11(r11)", it can be output to the external devices as alarm signal.

Related parameters: P057, P058

P057   Upper Voltage Limit of Alarm LED

When alarm LED operation selection is set to "1" or "2", the upper voltage limit applied to judge the output voltage fault alarm can be set via this parameter.
If the output voltage of inverter is higher than the setting value, the alarm LED will flicker as output voltage fault alarm.

Data setting range (V)	0.1～600.0

Related parameters: P056

P058　Upper Current Limit of Alarm LED

When alarm LED operation selection is set to "1" or "3", the upper current limit applied to judge the overload fault alarm can be set via this parameter.

If the output current of inverter is higher than the setting value, the alarm LED will flicker as overload fault alarm.

Data setting range (A)	0.1～100.0

Related parameters: P056

P059　Password

To prevent accidental changes to the data after parameter setting is complete, password can be set via this parameter.

Data setting range	0000～9999

* "0000" indicates that there is no password.

To set a password, rotate the encoder to switch to the parameter setting mode to show "PS". You may proceed to parameter setting after you enter the password and press the encoder.

Input and Setting of Password

Password Input

① Power ON the inverter.
The inverter shows "0000" when it is powered ON.

`0000`

② Press ⓜⓞⓓⓔ to enter the Parameter Setting mode.   (MODE)

`Fr`

③ Rotate the knob to "P0: Parameter Setting".

`P0 - -`

④ Press the knob to display parameter P001.

`P001`

⑤ Rotate the knob to "P059: Password".

`P059`

⑥ Press the knob to proceed to the setting of P055.

`0000`

⑦ Rotate the knob to adjust the value of P055 to "1234".

`1234`

⑧ Press the knob to apply the setting of "1234".

`P060`

Password Setting

⑨ Press ⓜⓞⓓⓔ to proceed to "P0: Parameter Setting" to show"P0--".   (MODE)

`P0 - -`

⑩ Counterclockwisely rotate the knob to proceed to passwork lock mode to show"PS".   (ESC)

`PS`

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P060	MOP Function Selection
P061	Acceleration/Deceleration Time for MOP Operation

Operation of frequency change can be set via these parameters when MOP function is used.

When acceleration/deceleration time is relatively short, frequency change is much easier with this function.

■ Parameter P060：MOP Function Selection

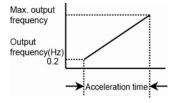| Setting Value	Function Name	Details
0	MOP operation linked with the acceleration/deceleration time	Press the Left/Right rotation knob, the inverter will accelerate/decelerate according to the acceleration/deceleration time set with the parameter P061.
1	Operation linked with frequency setting	Press the Left/Right rotation knob to switch to the frequency setting mode. But if operation linkage is not performed, press the knob after frequency is selected and acceleration/deceleration will be performed according to the acceleration/deceleration time set via parameter P001 and P002.
2	MOP function disabled	Disable the use of the MOP function.

■ Parameter P061: Acceleration/Deceleration Time for MOP Operation

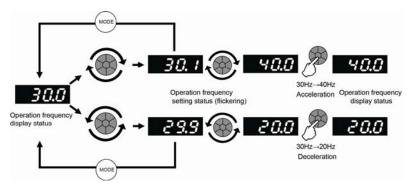| Data setting range (s)	0.04·0.1～3600
Increment (s)	0.1(0.1～999.9), 1(1000～3600)

• When parameter P060 is set to "1", applicable acceleration/deceleration time can be set via this parameter.
• When the data setting range is "0.04s", the display is "0.0".
• The maximum frequency is set via parameter P009 and P012.

【Note】

・ This function still applies even if parameter "P103 to P105: SW3 to SW5 Function Selection" is set to "20: Frequency ▲/▼ Setting".

■ Operation when parameter P060 is set to "1: Operation Linked with Frequency Setting"
・ Rotate the Left/Right Arrow button of the rotation knob while the setting frequency is being displayed, the displayed data will flicker and proceed to a status under which the frequency setting data can be changed.
・ Press the "knob" button to apply the frequency setting, the operation will start at the new frequency and implement the acceleration/deceleration operation.
・ Press "ESC" button to return to its previous status while the frequency display data is flickering.

Related parameters: P001, P002, P009, P012, P060, P103 to P105

| P062 | Torque Boost Increment |
| P063 | Torque Boost Response Increment |

The boost increment and response increment can be set via these parameters in the auto torque boost mode.

■ Parameter P062: Torque Boost Increment

| Data setting range (%) | 0～200 |

• With the increase of the setting value, the voltage will rise accordingly, in this case, overcurrent will occur depending on the loads.

■ Parameter P063: Torque Boost Response Increment

| Data setting range (%) | 0～200 |

• With the increase of the setting value, response to the load change will be quickened, in this case, the motor is likely to produce vibration.

【Note】

• Parameter P062 and P063 are valid only when parameter P011 and P140 are set to "Auto".

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P101	SW1 Function Selection
P102	SW2 Function Selection
P103	SW3 Function Selection
P104	SW4 Function Selection
P105	SW5 Function Selection
P106	SW6 Function Selection

Control function of SW1·2·3·4·5·6 (control circuit terminal No.1·2·3·4·5·6) can be set. Refer to the table below for the corresponding functions of the setting values of 1 to 18. If "b" contact input is applied, set the value with a letter "r".

- "A" contact input ＝"0": "ON" is detected when the SW signal is in a close state (the terminal level is "L").
- "B" contact input ＝ "1": "ON" is detected when the SW signal is in an oprn state (the terminal level is "H").

SW used to set the function		SW1	SW2	SW3	SW4	SW5	SW6
		Terminal No.1	Terminal No.2	Terminal No.3	Terminal No.4	Terminal No.5	Terminal No.6
Parameter		P101	P102	P103	P104	P105	P106

		0	No setting	No setting	No setting	No setting	No setting	No setting
Setting value	1	r1	Multi-step speed	Multi-step speed	Multi-step speed	Multi-step speed	Multi-step speed	Multi-step speed
	2	r2	Reset	Reset	Reset	Reset	Reset	Reset
	3	r3	Reset Lock	Reset Lock	Reset Lock	Reset Lock	Reset Lock	Reset Lock
	4	r4	JOG Selection	JOG Selection	JOG Selection	JOG Selection	JOG Selection	JOG Selection
	5	r5	External Fault Stop	External Fault Stop	External Fault Stop	External Fault Stop	External Fault Stop	External Fault Stop
	6	r6	Parameter Setting Disabled	Parameter Setting Disabled	Parameter Setting Disabled	Parameter Setting Disabled	Parameter Setting Disabled	Parameter Setting Disabled
	7	r7	Coast-to-stop	Coast-to-stop	Coast-to-stop	Coast-to-stop	Coast-to-stop	Coast-to-stop
	8	r8	Frequency Signal Switch	Frequency Signal Switch	Frequency Signal Switch	Frequency Signal Switch	Frequency Signal Switch	Frequency Signal Switch
	9	r9	The 2nd Characteristics Selection	The 2nd Characteristics Selection	The 2nd Characteristics Selection	The 2nd Characteristics Selection	The 2nd Characteristics Selection	The 2nd Characteristics Selection
	10	r10	PID Control Switch	PID Control Switch	PID Control Switch	PID Control Switch	PID Control Switch	PID Control Switch
	11	r11	3-wire Stop Command	3-wire Stop Command	3-wire Stop Command	3-wire Stop Command	3-wire Stop Command	3-wire Stop Command
	12	r12	Speed Search	Speed Search	Speed Search	Speed Search	Speed Search	Speed Search
	13	r13	Temporary Control Stop of Winding Mode	Temporary Control Stop of Winding Mode	Temporary Control Stop of Winding Mode	Temporary Control Stop of Winding Mode	Temporary Control Stop of Winding Mode	Temporary Control Stop of Winding Mode
	14	r14	Input Mode of Winding Length	Input Mode of Winding Length	Input Mode of Winding Length	Input Mode of Winding Length	Input Mode of Winding Length	Input Mode of Winding Length
	15	r15	Winding Length Zero Clearing	Winding Length Zero Clearing	Winding Length Zero Clearing	Winding Length Zero Clearing	Winding Length Zero Clearing	Winding Length Zero Clearing
	16	r16	Run/Stop	Run/Stop	Run/Stop	Run/Stop	Run/Stop	Run/Stop
	17	r17	Forward/Reverse	Forward/Reverse	Forward/Reverse	Forward/Reverse	Forward/Reverse	Forward/Reverse
	18	r18	JOG Forward Run	JOG Forward Run	JOG Forward Run	JOG Forward Run	JOG Forward Run	JOG Forward Run
	19	r19	JOG Reverse Run	JOG Reverse Run	JOG Reverse Run	JOG Reverse Run	JOG Reverse Run	JOG Reverse Run
	20	r20	──	──	Frequency▲Setting	Frequency▲Setting	Frequency Storage Setting	Winding Length

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■Multi-step speed SW Function

SW function is set so that it is used as multi-step speed function.

Multi-step speed function selection is set via parameter P301.

 ・When all SWs are set to multi-step speed function and 16-speed operation is performed, the four SWs with lower No. are valid as multi-step speed command SW.

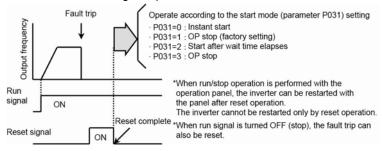(Set "SW1 to SW6" to multi-step speed function → Use SW1, SW2, SW3 and SW4 as multi-step speed command.)

 ・Read "P301: Multi Speed Function Selection" carefully before using this function.

Related parameters: P301 to P334

■Reset Function

Fault stop status can be reset through external control if an inverter fault trip (stop) occurs.
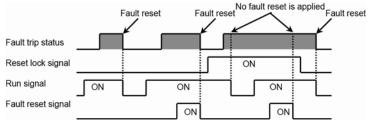
When a fault trip occurs and SW signal input is turned ON, the fault trip status will be cleared if the SW signal input is turned OFF.

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■Reset Lock Function

When a fault trip occurs, clearing of fault trip status with stop signal is disabled to perform reset operation with SW signal after identifying the details of fault trip and eliminating the abnormality.

・Normally, SW signal is input with ON status.

・When a fault trip occurs, the inverter will maintain the trip status even if stop signal and reset signal are input.

・After the abnormality is identified and eliminated, the fault trip will be reset when this SW is turned OFF.

* Turn reset lock signal OFF and press ⏹ button to reset the fault.

  In addition, turn the fault reset signal OFF.

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■JOG Function

Micro operations such as position adjustment can be performed with external control signals.
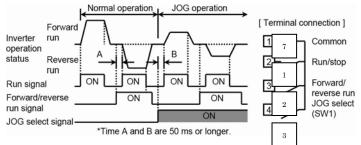
Signal input terminals for controlling micro operation from external devices can be set via parameter P101 to P106.

But Run Command Selection (parameter P003) should be set through external control.

・Turn the signal input ON, and it will enter JOG operation mode.

・JOG operation is performed according to "P019: JOG Frequency", "P020: JOG Acceleration Time" and "P021: JOG Deceleration Time" settings, after run/stop and forward/reverse run signals are input via terminals.

<Example> When SW1 (parameter P101) is set to "16 (Run/Stop)"; SW2 (parameter P102) is set to "17 (Forward/Reverse Run)"; SW3 (parameter P103) is set to "4 (JOG Selection)"; operations are performed as follows.

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

Note 2:　During reverse run operation, please turn the reverse run signal ON (time A) and then turn the run signal ON.
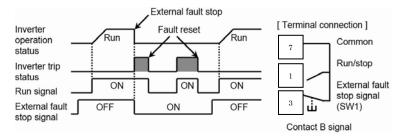
Related parameters: P019 to P021

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■External Fault Stop Function
Signal input terminal for applying fault stop (emergency stop) to the inverter through external devices can be set.
・The inverter will stop output immediately after the external fault stop input (setting value = 5) turns SW signal ON and "AU" is displayed.
・Input signal logic setting can be changed by setting the SW function parameter to "r5".

<Example> When SW1 (parameter P101) is set to "16 (Run/Stop)"; SW3 (parameter P103) is set to "r5" (fault stop input contrary to the logic) , operations are performed as follows.

* When external fault stop signal is set to contact B input, fault reset can be applied after run signal is turn OFF, even if external stop signal is "ON". But fault trip will occur after the run signal is turned "ON" again. So please turn the run signal "ON" after the external fault stop signal being turned "OFF" for normal operation.

■Parameter Setting Disabled Function
The signal input terminal for disabling the parameter setting through external control can be set.
・After signal input is turned ON, setting parameters with the operation panel and communication are disabled.
・When the signal input is turned ON, function parameters and built-in memory parameters cannot be set but be monitored.
・During data setting, data cannot be changed through the SW function even if
  button is pressed when the signal is ON.

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■Coast-to-stop Function

The signal input terminal for applying coast-to-stop through external control can be set.

・During operation, the inverter will stop output immediately after signal input is turned ON and "0.0" is displayed.
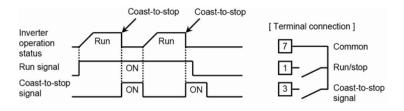
 (Without fault indication and fault alarm output)

・The inverter will run immediately after signal input is turned OFF and run signal is turned ON.

[Note] The inverter will start as the signal input is turned OFF, so please ensure personal safety before operation.

・The inverter will stop normally after the run signal is turned OFF together with signal input being turned OFF.

<Example> When SW1 (parameter P101) is set to "16 (Run/Stop)"; SW3 (parameter P103) is set to "7 (coast-to-stop)", and run command selection (parameter P003＝2) is used;

■Frequency Signal Switching Function

Signal input terminal for switching frequency setting command from "The 1st Frequency Setting Signal (command set via parameter P004)" to "The 2nd Frequency Setting Signal (command set via parameter P118)" can be set.

This function is valid when parameter "P119: The 2nd Analog Input Function Selection" is set to "0: The 2nd Frequency Setting Signal".

・When signal input is OFF: The 1st Frequency Setting Signal.
・When signal input is ON: The 2nd Frequency Setting Signal.

Related parameters: P118, P119

■The 2nd Characteristics Selection Function

When SW signal is ON, the inverter will run according to the 2nd Characteristics Function settings as follows.

Switching button OFF	Switching button ON
P001: The 1st Acceleration Time	P317: The 2nd Acceleration Time
P002: The 1st Deceleration Time	P318: The 2nd Deceleration Time
P013: Base Frequency	P139: The 2nd Base Frequency
P011: Torque Boost	P140: The 2nd Torque Boost
P023: Electronic Thermal Selection	P141: The 2nd Electronic Thermal Selection
P024: Thermal Current Setting	P142: The 2nd Thermal Current Setting
P014 Change Point Frequency1	P143: The 2nd Change Point Frequency 1
P015: Change Point Voltage 1	P144: The 2nd Change Point Voltage 1
P016: Change Point Frequency 2	P145: The 2nd Change Point Frequency 2
P017: Change Point Voltage 2	P146: The 2nd Change Point Voltage 2
P203: Motor Capacity	P216: The 2nd Motor Capacity
P204: Motor Pole Number	P217: Pole Number of the 2nd Motor
P205: Rated Voltage of Motor	P218: Rated Voltage of the 2nd Motor
P206: Rated Frequency of Motor	P219: Rated Frequency of the 2nd Motor
P207: Rated Current of Motor	P220: Rated Current of the 2nd Motor
P208:　Primary Resistance	P221: Primary Resistance of the 2nd Motor
P209:　Secondary Resistance	P222: Secondary Resistance of the 2nd Motor
P210: Energizing Inductance	P223: Energizing Inductance of the 2nd Motor
P211: Leakage Inductance	P224: Leakage Inductance of the 2nd Motor
P212: Energizing Current	P225: Energizing Current of the 2nd Motor
P213: Speed Control Percentage Increment	P226: Speed Control Percentage Increment of the 2nd Motor
P214: Speed Control Integral Increment	P227: Speed Control Integral Increment of the 2nd Motor
P215: Torque Limit Level 1	P228: Torque Limit Level 2 of the 2nd Motor

Note: Ensure personal safety before switching characteristics.

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■Control Switching Function

Signal input terminal for cancelling PID control through external control can be set. When the signal input is turned ON, the inverter switches from "PID control" to the command set via parameter P004.

The function is valid when parameter "P118: The 2nd Analog Input Function Selection" is set to "1 to 3".

·When the signal input is OFF: PID control or control based on auxiliary frequency signal.

·When the signal input is ON: command set via parameter P004.

■ 3-wire Stop Command Function

Signal input terminal for executing 3-wire stop command can be set.

When "3-wire stop signal" is ON, "run signal" or "forward/reverse run signal" can be held automatically. Also, switching to OFF will cancel the holding status.

 • Please set "Run Command Selection" via parameter P003.

 • Set the SW1 to SW6 terminals to be 3-wire stop command function (contact B input) (always be contact B input regardless of the setting value is 11 or r11).

Related parameters: P003

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■ Frequency ▲／▼ Setting Function
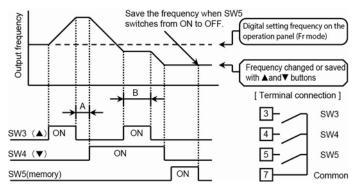
When frequency and parameter "P103 to P105" are set to "digital setting with operation panel (P004 = 1)" and "20" respectively, SW3 and SW4 can be used to change frequency while SW5 is used to save this frequency.

　• SW3: During ON, frequency increases. (During OFF, the existing frequency is held.)

　• SW4: During ON, frequency decreases. (During OFF, existing frequency is held.)

　• SW5: Turn ON once and OFF again to save the frequency at that time.

　　(The frequency can be saved even if the power is turned OFF.)

Note 1: The operating frequency will not be changed when both ▲button (SW3) and ▼button (SW4) are turned OFF or ON (i.e. in A or B area etc).

Note 2: The operating frequency will not be saved when "frequency memory operation of SW5" and "frequency setting in frequency setting mode" on the operation panel are not performed.

【Note】

　• When parameter "P060: MOP Function Selection" is set to "0", the acceleration/deceleration time set via parameter "P061: Acceleration/Deceleration Time for MOP Operation" will be used.

Please set P106 to be "0" or "1"when using this function.

Related parameters: P004, P060, P061

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■Speed Search Function
 ・The inverter will apply minor DC voltage to the motor, detect its rotation speed and restart it at this frequency when the motor rotates freely due to inertia, which is the so-called "speed search function".
 ・There are 3 methods to start the speed search.
1) Through input signal from control terminals (SW1 to SW6)
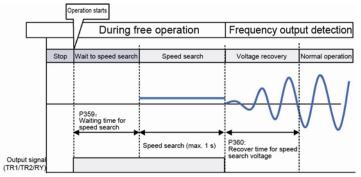Related parameters: P101 to P106 (SW1 to SW6 Function Selection)
2) At motor startup
Related parameters: P357 (Speed Search at Startup)
3) During retry operation of inverter after fault trip occurrence
Related parameters: P029 (Retry Function), P361 (Speed Search Selection during Retry)
 ・Perform speed search according to the following procedures.

When P124 to P126 are set to "12", the output signal is ON.

 ・Conditions of speed search can be set via parameter P359 to P364.

【Note】

 ・The start of speed search through control input is only valid during free operation. Therefore, even if the control input assigned to speed search is ON, the speed search will nevertheless be ignored.
 ・If the rotation speed is too low and the rotation direction does not match the rotation command, the rotation speed may not be sensed.
 ・The sensing function may fail if the speed search is performed for the motor with capacity smaller than the inverter.
 ・"CAL" will be displayed on the operation panel during speed search. During the displaying, there is minor DC voltage applied on the motor externally.

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■Winding Mode Control Function

・Winding mode control function will operate at the triangular-wave-shaped frequency as shown in the following graph.
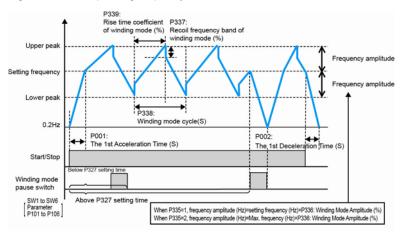
・When parameter "P335: Winding Mode Control Selection" is set to "1" or "2", winding mode control function will start after run command is turned ON. During startup, the inverter will keep on accelerating within the time set via parameter "P001: The 1st Acceleration Time" until the set frequency is reached.

・The conditions of winding mode control are set via parameter P335 to P339.

・The operational mode of winding mode is set via parameter "P340:Winding Mode Operation Selection". When parameter "P340" is set to "1" or "3", 2-point mode starts, in this case, set frequency of second point via parameter "P302: Second Frequency", set stop length via parameter "P344: Winding Stop Length", the basic frequency will change to the second frequency with the increase of the winding length, the change of linear and when the winding length reaches the stop length. When P340 is set to "2" or "3", random mode starts, in this case, set random change range via parameter "P341: Max Random Rise Time Coefficient" and "P342: Minimum Random Rise Time Coefficient", yet when P342<P341, random function doesn't start. Especially, when P340 is set to "3", it will be 2-point random mode, the basic frequency will change from fixed frequency to second frequency with the change of winding length. And, rise time coefficient change randomly in the random range.

・When parameter "P101 to P106: SW1 to SW6 Function Selection" is set to "13", and SW input of corresponding control input terminals (SW1 to SW6) are ON, the inverter will terminate winding mode control and continue to run at the frequency when SW input (SW1 to SW6) is turned ON.

・When stop command is turned ON, the deceleration will be performed to stop the inverter according to the value set via parameter "P002: The 1st Deceleration Time" regardless of the operating frequency.
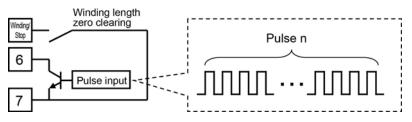
【Note】

If the following functions start together with winding mode control function, such function will take precedence. And what's more, winding mode control will not start when the following functions operate.

・Trial operation function
・Auto-tuning function
・Timer operation function
・PID function

■Winding Mode Input Length

When parameter "P335: Winding Mode Control Selection" is set to "1" or "2", parameter "P106: SW6 Function Selection" is set to "20" or "14", and pulse is input from SW6, length can be calculated based on "P343: Winding Length Multiplier".

・The calculated result will be displayed in n022.

$$\text{Winding length} = \frac{(\text{Pulse "n" input to SW6}) \times (\text{P343: Winding Length Multiplier})}{1000}$$

【Note】

When any multi-function SW is set to "14 (winding length input mode)", the response speed will be slower.

When the input pulse band width is shorter than 15ms, set P106 to "20" and input from SW6.
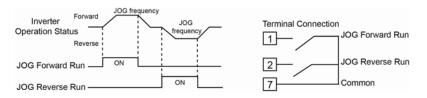
■JOG Forward Run/JOG Reverse Run

Micro operations such as position adjustment can be performed with external control signals.

Signal input terminals for controlling micro operation from external devices can be set via parameter P101 to P106.

JOG commands of all operations are valid, but the JOG command should take precedence.

・Turn the signal input ON, and it will enter JOG operation mode.
・JOG operation is performed according to "P019: JOG Frequency", "P020: JOG Acceleration Time" and "P021: JOG Deceleration Time" settings, after run/stop and forward/reverse run signals are input from terminals.
 <Example> When SW1 (parameter P101) and SW2 (parameter P102) are respectively set to "18 (JOG Forward Run)" and "19 (JOG Reverse Run)", operation are performed as follows.

Related parameters: P003, P019, P022

P107   Pulse Input Frequency

The number of pulses per second (pulse frequency) at the maximum output frequency can be set using this parameter.

Setting Range (kHz)	1.0～40.0

P108   Pulse Input Filter

The responsiveness to pulse input signal can be set using this parameter.
Please set at the time when diffirent frequency is sensed.

Setting Range (times)	10～100

P109   PWM Signal Average Times

The inverter measures and calculates ON time and OFF time of each PWM cycle used as frequency command.

When using this parameter, the times of each PWM cycle command should be averaged, and then the average operation times are set as final output frequency.

Data Setting Range (times)	1～100

* With the increase of the average times, the frequency command will become stable, while the response speed will decrease.

P110   PWM Signal Cycle

PWM signal cycle can be input via this parameter.

Data setting range(msec)	1.0〜2000

【Note】

・The output frequency controlled by PWM signal is "0 V stop or the minimum frequency (without ON status)" and "the maximum frequency (without OFF status)".
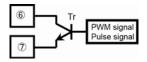
・Due to the fact that the output frequency accuracy relative to input signal will decrease around the minimum frequency and maximum frequency, do not use the inverter for precise frequency control.

・The 2nd frequency setting signal takes precedence over the PWM frequency signal if the 2nd frequency setting signal is selected (ON).
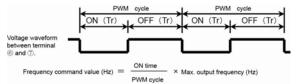
・PID control function is invalid when PWM frequency signal is selected. PWM frequency signal cannot be used as PID setting value (SP).

■Connection and Function Descriptions of Control Circuit Terminals

■Relationship between PWM Signal and Frequency Command Value

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

■Relationship between Pulse Signal and Frequency
Please set the number of pulse input per second (pulse frequency) at the maximum output frequency using parameter "P107: Pulse Input Signal Frequency".

・When parameter P009 is set to "50" and "60", the maximum output frequency shall be "50Hz" and "60Hz" accordingly; when it is set to "FF" or "3C", the maximum output frequency shall be the value of parameter P012.

Related parameters: P009, P012

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P111   Analog Input Filter

Filter constant of analog input terminal (control circuit terminal⑫and⑭) can be set to eliminate external interference caused by external voltage or current frequency setting signals.

Data Setting Range (times)	5~200

・Filter constant of analog input signals for control circuit terminal⑬and⑭ share the same setting value.

・Frequency command will become stable with the increase of the setting value (average times), while the response speed will decrease.

Related parameters: P004, P119

P112 Bias Frequency Setting
P113 Gain Frequency Setting

The relationship between output frequency and frequency setting signal can be adjusted freely. Please use this function according to the applications.

■Parameter P112: Bias Frequency Setting
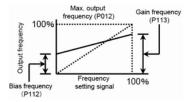
Data setting range (%)	$-99.0\sim250.0$

■Parameter P113: Gain Frequency Setting
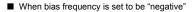
Data setting range (%)	$0.0\sim500.0$

・Bias frequency and gain frequency are set in terms of pencentage (%) of the maximum output frequency (100%) (parameter P012).
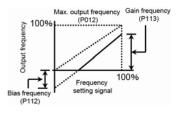・A frequency exceeding the maximum frequency or the upper frequency limit will not be output.
  Also, the frequency will not drop below the lower frequency limit.
・The inverter will not perform reverse run operation even if negative frequency setting signal is input.

■ When bias frequency is set to be "positive"   ■ When bias frequency is set to be "negative"

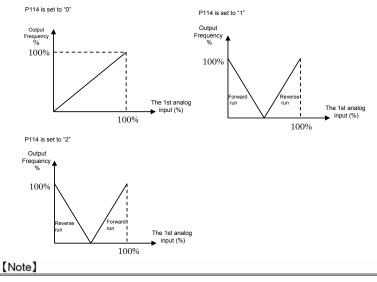Related parameters: P004, P009, P012

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P114 Analog Direction Mode

Used to set the direction after the frequency command had been set to analog signal.

■ Parameter P114: Analog Direction Mode

Setting	Details
0	Analog direction mode is disabled.
1	If frequency is controlled by the analog quantity, the forward run will switch to reverse run at the threshold value of 50% of the maximum analog quantity input.
2	If frequency is controlled by the analog quantity, the reverse run will switch to forward run at the threshold value of 50% of the maximum analog quantity input.

・Control the direction based on the analog quantity.

P114 is set to "0"

Output Frequency %

100%

The 1st analog input (%)

100%

P114 is set to "1"

Output Frequency %

100%

Forward run   Reverse run

The 1st analog input (%)

100%

P114 is set to "2"

Output Frequency %

100%

Reverse run   Forward run

The 1st analog input (%)

100%

【Note】

・The direction setting mode (dr) is invalid when the setting value is "1" or "2".

P115　The 2nd Bias Frequency Setting
P116　The 2nd Gain Frequency Setting

Output frequency and the 2nd analog input signal can be adjusted freely.

■　Parameter P115: The 2nd Bias Frequency Setting

Data setting range (%)	$-99.0 \sim 250.0$

■　Parameter P116: The 2nd Gain Frequency Setting

Data setting range (%)	$0.0 \sim 500.0$

・The 2nd bias frequency and the 2nd gain frequency are set in terms of pencentage (%) of the maximum output frequency (100%) (parameter P012).

・A frequency exceeding the maximum frequency or the upper frequency limit will not be output.

Also, the frequency will not drop below the lower frequency limit.

・The inverter will not perform reverse run operation even if negative frequency setting signal is input.

■　Relationship between the 2nd Frequency Setting Signal and the Output Frequency
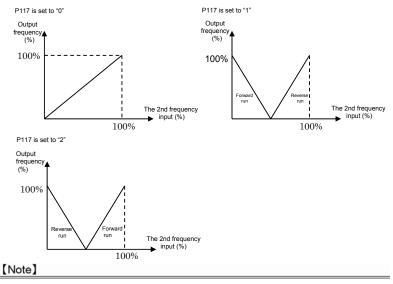
P117   The 2nd Analof Direction Mode

Used to set the direction after the frequency command had been set to analog signal.

■ Parameter P117: The 2nd Analog Direction Mode

Setting	Details
0	Analog direction mode is disabled.
1	If frequency is controlled by the 2nd analog quantity, the forward run will switch to reverse run at the threshold value of 50% of the maximum analog quantity input.
2	If frequency is controlled by the 2nd analog quantity, the reverse run will switch to forward run at the threshold value of 50% of the maximum analog quantity input.

· Control the direction based on the analog quantity.

P117 is set to "0"

P117 is set to "1"

P117 is set to "2"

【Note】

· The direction setting mode (dr) is invalid when the setting value is "1" or "2".

P118   The 2nd Analog Input Function Selection

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

Setting value	Details
0	The 2nd frequency setting signal
1	Measured value of PID control
2	Bias signal of PID control
3	Auxiliary frequency setting signal

■The 2nd frequency setting signal (setting value = "0")

 • The 2nd analog input terminal can be used as the 2nd frequency setting signal.

 • Frequency setting command can be switched between the 1st frequency setting signal and the 2nd frequency setting signal depending on the input status set via parameter "P101 to P106: SW1 to SW6 Function Selection".
SW with OFF input: the 1st frequency setting signal.
SW with ON input: the 2nd frequency setting signal.

■Measured Value of PID Control (setting value = "1")

 • The 2nd analog input terminal can be used as feedback signal of PID control (measured value PV).

 • Input signals (0∼5 V, 0∼10 V, 4∼20 mA and 0∼20 mA) are fed back as measured values (PVs) of PID control (positive values: 0∼100%).

 • After parameter P118 is set to "1", set target value (SP) to the output frequency through parameter "P004: Frequency Setting Signal" to perform PID control so that measured value PV will approach the target value SP and the output frequency will be changed accordingly.
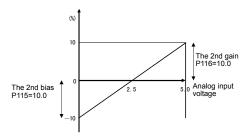
 • Parameters for PID control can be set via parameter P345 to P354.

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■Bias Signal of PID Control (setting value = "2")

　• The 2nd analog input terminal can be used as measured value of PID control (bias signal).

　• Input signals (0～5 V, 0～10 V, 4～20 mA and 0～20 mA) are fed back as bias signal of PID control (setting example: -10％～+10％).

　• Bias value can be converted inside the inverter via parameter "P115: The 2nd Bias Frequency Setting" and "P116: The 2nd Gain Frequency Setting".
<Example> When the analog input ranges from 0 to 5 V and both the 2nd bias value and the 2nd gain are set to "10"

　• After parameter P118 is set to "2", conduct the target value (SP) PID control based on the bias signal input to the analog input terminal, the output frequency will change accordingly. In this case, the bias signal (PV–SP) under PID control is the bias signal of the 2nd analog input terminal.

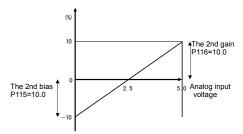　• Parameters for PID control can be set via parameter P345 to P354.

■Auxiliary Frequency Setting Signal (setting value = "3")

 ・The 2nd analog input terminal can be used as auxiliary frequency setting signal.

 ・Input signals (0～5 V, 0～10 V, 4～20 mA and 0～20 mA) are fed back as auxiliary frequency setting signal added to the 1st frequency setting signal (%) (setting example: -10%～+10%).

 ・The setting value of auxiliary frequency setting signal can be converted inside the inverter via parameter "P115: The 2nd Bias Frequency Setting" and "P116: The 2nd Gain Frequency Setting".
<Example> When the analog input ranges from 0 to 5 V and both the 2nd bias value and the 2nd gain are set to "10"

 ・It can be used when the result of PID calculation conducted by external devices such as PLC is added to the speed command value.
 ・The inverter's output frequency is determined by the following formula.

Output frequency＝Max. output frequency×(The 1st frequency setting signal (％) + auxiliary frequency setting signal (％))

Related parameters: P004, P101 to P106, P115 to P116, P345 to P354

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P119   The 2nd Analog Input Singal Selection

Setting signal of the 2nd analog input terminal (control circuit terminal⑬) can be selected.

Setting value	Details of setting signal	Operation method and control circuit terminal connection diagram
2	0~5V (voltage signal)	Terminal ⑬ and ⑭ (13: +, 14: -)
3	0~10V (voltage signal)	Terminal ⑬ and ⑭ (13: +, 14: -)
4	4~20mA (current signal)	Terminal ⑬ and ⑭ (13: +, 14: -)
5	0~20mA (current signal)	Terminal ⑬ and ⑭ (13: +, 14: -)

【Note】

・The inverter will run or stop as defined by the setting value of "P047: 0V Stop Function Selection".

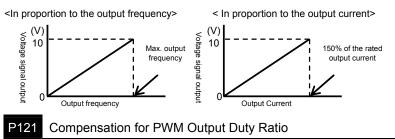To make the 0V stop function invalid, please set parameter P047 to "0.0".

Related parameters: P047, P115, P116

P120　Analog Output Function Selection

Functions of "0 to 10V voltage signal" from the control circuit terminal No. 15 can be set here.

Setting value	Details
0	Signals in proportion to output frequency are output.
1	Signals in proportion to output current are output.

■Relationship between 0 to 10V voltage signal and output frequency/output current
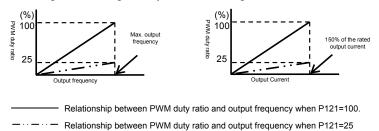
<In proportion to the output frequency>　　　< In proportion to the output current>

Voltage signal output (V) 10 / 0 — Output frequency — Max. output frequency

Voltage signal output (V) 10 / 0 — Output Current — 150% of the rated output current

P121　Compensation for PWM Output Duty Ratio

Compensation for output duty ratio of the "output status signal (PWM)" can be made here.

Data setting range (%)	25～100

■Adjustable Range (full scale value)

・PWM signal: PWM signal duty ratio×Percentage set with P121

PWM duty ratio (%) 100 / 25 — Output frequency — Max. output frequency

PWM duty ratio (%) 100 / 25 — Output Current — 150% of the rated output current

——— Relationship between PWM duty ratio and output frequency when P121=100.

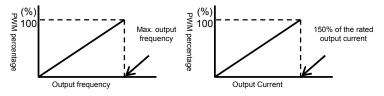— ‥ — ‥ — Relationship between PWM duty ratio and output frequency when P121=25

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P122　PWM/Pulse Output Function Selection
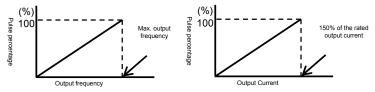
Functions of "output status signal (PWM)" from control circuit terminal ⑧ can be set here.

Setting value	Details
0	Signals in proportion to output frequency are output.
1	Signals in proportion to output current are output.

■Relationship between PWM signal output and output frequency/output current

■Relationship between pulse signal output and output frequency/output current

・The "pulse percentage" shown in the diagram refers to the percentage of the output pulse frequency in the setting value of "P147: Pulse Output Frequency".

P123　PWM Output Cycle

Set the output cycle for PWM when the Tr1 output function is set to be PWM output.

■ Parameter P123: PWM Output Cycle

Data setting range[msec]	1～2000

・Cycle of PWM wave output can be set.

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P124 Output TR1 Function Selection
P125 Output TR2 Function Selection

Functions of open-collector output 1 (control circuit terminal ⑧to⑩) and open-collector output 2 (control circuit terminal ⑨ to ⑩) can be set.

	P124 (TR1)	P125 (TR2)	Function	ON condtions for open-collector output
Setting value	0	0	Run signal	With run signal ON or during inverter output
	1	1	Reverse run signal	When inverter is in reverse run status
	2	2	Arrival signal	When output frequency is within ±2 Hz of setting frequency
	3	3	Overload alarm	When the output current is above 140% of the rated current or the electronic thermal level is reached.
	4	4	Frequency sensing	When the output frequency is above the sensing frequency (parameter P127 setting)
	5	5	Current sensing (1)	When the output current is above the sensing current level (parameter P129 setting)
	6	6	Current sensing (2)	When the output current is below the sensing current level (parameter P129 setting)
	7	7	Fault alarm (1)	When fault trip occurs in the inverter
	8	8	Fault alarm (2)	When the inverter is in normal status (OFF for fault trip status)
	9	9	After one cycle of timer operation	When one cycle of timer operation completes (output is available only during waiting time).
	10	10	Timer operation completed	When timer operation completes (with "t.End" displayed).
	11	11	Alarm	Output is available with alarm LED flickering.
	12	12	Speed search operation signal	When speed search starts, the open-collector output is ON; when the speed search completes, the open-collector output is OFF.
	13	–	Output status signal (PWM)	PWM signals in proportion to output frequency or output current will be output.
	14	–	Output status signal (pulse)	Pulse signals in proportion to output frequency or output current will be output.

【Note】

　• The setting value "5" and "6" are used to set the delay time of current detection signal with "P130: Current Sensing Delay Time".

　• The setting value "10" is used to output the time set with "P326: Continuous Waiting Time of Timer Operation".

　• Output frequency ratio or output current ratio of the setting value "13" and "14" can be set via parameter P121. Setting value "13" and "14" can only be used to set open-collector output 1 (TR1).

Related parameters: P326, P127, P129 to P131

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P126   Output RY Function Selection

Functions of relay output (control circuit terminal A, B and C) can be set.

・Energizing in ON status: The relay is turned ON when the coil is energized.

(Signal ON status = ON between terminals A and C, OFF between terminals B and C)

・Non-energizing in ON status: The relay is turned ON when the coil is not energized.

(Signal ON status = ON between terminals A and C, OFF between terminals B and C)

Setting value		Function	ON conditions for relay
Energizing in ON status	Non-energizing in ON status		
0	r0	Run signal	With run signal ON or during inverter output
1	r1	Reverse run signal	When inverter is in reverse run status
2	r2	Arrival signal	When output frequency is within ±2 Hz of setting frequency
3	r3	Overload alarm	When the output current is above 140% of the rated current or the electronic thermal level is reached.
4	r4	Frequency sensing	When the output frequency is above the sensing frequency (parameter P128 setting)
5	r5	Current sensing (1)	When the output current is above the sensing current level (parameter P129 setting)
6	r6	Current sensing (2)	When the output current is below the sensing current level (parameter P129 setting)
7	r7	Fault alarm (1)	When fault trip occurs in the inverter
8	r8	Fault alarm (2)	When the inverter is in normal status (OFF for fault trip status)
9	r9	After one cycle of timer operation	When one cycle of timer operation completes (output is available only during waiting time).
10	r10	Timer operation completed	When timer operation completes (with "t.End" displayed)
11	r11	Alarm	Output is available with alarm LED flickering.
12	r12	Speed search operation signal	When speed search starts, the open-collector output is ON; when the speed search completes, the open-collector output is OFF.

【Note】

・The setting value "5" and "6" are used to set the delay time of current detection signal with "P130: Current Sensing Delay Time".

・The setting value "10" is used to output the time set with "P326: Continuous Waiting Time of Timer Operation".

Related parameters: P326, P128 to P130

| P127 | Sensing Frequency［Output TR］ |
| P128 | Sensing Frequency［Output RY］ |

Open-collector 1, 2 and relay output can be used to set the frequency sensed when outputting frequency sensing signals.

■ Parameter P127: Sensing Frequency [Output TR]

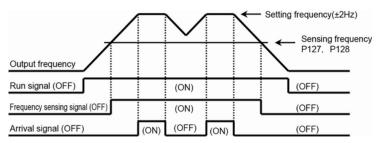| Data setting range (Hz) | 0.0·0.2〜400.0 |

・It is valid in open-collector output 1 and 2.

・"0.0" indicates 0V stop (0.0).

■Parameter P128: Sensing Frequency [Output RY]

| Data setting range (Hz) | 0.0·0.2〜400.0 |

・"0.0" indicates 0V stop (0.0).

■Relationship between output frequency and each output signal

Related parameters: P124 to P126

P129	Current Sensing Level
P130	Current Sensing Delay Time

Open-collector 1, 2 and relay output can be used to set current sensing level and delay time when current sensing signal is output.

■ Parameter P129: Current Sensing Level

Data setting range (A)	0.1～100.0

■ Parameter P130: Current Sensing Delay Time

Data setting range (s)	0.1～10.0

・Current sensing delay time refers to the delay time for a signal to switch from OFF to ON.

The delay time for a signal to switch from ON to OFF is about 100 ms (fixed value).

Related parameters: P124 to P126

P131	RS485 Communication Protocol Selection	P135	RS485 Parity Check
P132	RS485 Communication Station No. Setting	P136	RS485 Timeout Sensing
P133	RS485 Communication Speed Setting	P137	RS485 Wait-to-send Time
P134	RS485Stop Bit Length	P138	RS485 Judging Time for TEXT Completion

Important parameters necessary for sending commands to inverter through communication can be set.

■ P131: RS485 Communication Protocol Selection
MK300 is based on three protocols: MEWTOCOL-COM, Modbus(RTU) and Modbus (ASCII). Either protocol can be selected.

Setting value	Details of function
0	MEWTOCOL-COM
1	Modbus(RTU)
2	Modbus(ASCII)

■ P132: RS485 Communication Station No. Setting

Data setting range	1～31

■ P133: RS485 Communication Speed Setting

Setting value	Details of function
48	4800bps
96	9600bps
192	19200bps
384	38400bps
576	57600bps
1152	115200bps

■ P134: RS485 Stop Bit Length

Setting value	Details of function
1	1bit
2	2bit

■ P135: RS485 Parity Check

Setting value	Details of function
0	Without parity check
1	Odd parity
2	Even parity

■ P136: RS485 Timeout Sensing

If the status without communication continues for more than the allowable time when the Operation Command Selection (P003) and Frequency Setting Signal (P004) are in the communication setting mode, the inverter will abnormally stop (displaying "OP"). Such allowable time can be set here.

Data setting range(sec)	0.0·0.1～60.0

* "0.0" indicates a setting without timeout sensing.

■ P137: RS485 Wait-to-send Time

Data setting range(msec)	1～1000

■ P138: RS485 Judging Time for TEXT Completion

Data setting range(msec)	3～200

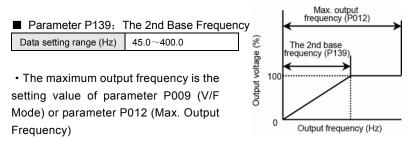* The setting is only valid when protocol Modbus (RTU) is used.

【Note】

・Please cut off the primary power supply after the values of conmmunication-related parameter P131 to P138 had all been set.

After the power supply reset, the setting values will be applied in the inverter.

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P139　The 2nd Base Frequency

The 2nd base frequency can be selected and set with the 2nd characteristics selection button.

(It is only valid when parameter P009 is set to "FF" or "3C".)

■ Parameter P139：The 2nd Base Frequency

Data setting range (Hz)	45.0～400.0

・The maximum output frequency is the setting value of parameter P009 (V/F Mode) or parameter P012 (Max. Output Frequency)

【Note】

・If "P009: V/F Mode" is set to "50" or "60", the maximum output frequency and base frequency will be fixed values.
・A frequency value exceeding "P046: Upper Frequency Limit" cannot be output.
・If a general-purpose motor with rated frequency of 50/60 Hz is running at a frequency value exceeding the ratings, the motor may be damaged. Therefore, please set the frequency to match motor characteristics.
・If the base frequency is required to be changed together with the maximum output frequency for a dedicated high-speed motor etc., such change can also be changed via this parameter.
・When running the general-purpose motor at a frequency value exceeding the universal frequency, please set the base frequency to the rated output frequency (50/60 Hz) of general-purpose motor.
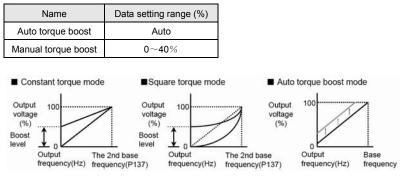・When the general-purpose motor reaches a level exceeding the base frequency (normally 50/60 Hz), the motor will have the constant output characteristics and the generated torque will drop in reverse proportion to the frequency.

Related parameters: P009, P012, P101～P106, P046, P140, P143～P146

P140 The 2nd Torque Boost

The 2nd torque boost can be selected and set with the 2nd characteristics selection button. The larger the setting value is, the higher output voltage and torque boost are.

·After the mode is set to "auto torque boost", the output voltage will be changed automatically according to the load fluctuation. To set "Auto torque boost", please rotate the knob once more when the operation panel displays "40".

Name	Data setting range (%)
Auto torque boost	Auto
Manual torque boost	0～40％

【Note】

 • If the boost level setting is too high, overcurrent fault, overload fault, motor overheating or excessive noise may occur.

 • The motor current will rise after the boost level is increased. Please carefully consider the settings of "P141: The 2nd Electronic Thermal Selection" and "P142: The 2nd Thermal Current Setting".

 • Auto-tuning is necessary when auto torque boost is selected. Please use it after the motor constants had been correctly set.

 (For the auto-tuning methods, please carefully read "4.14 Auto-tuning" .)

P141	The 2nd Electronic Thermal Selection
P142	The 2nd Thermal Current Setting

Electronic thermal operation level can be selected and set with the 2nd characteristics selection button when the inverter output is stopped. Operation coasts to stop when OL is displayed.

■ Example for setting current and thermal operation (P141＝1)
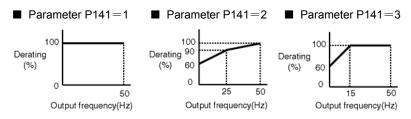
·Setting current ×100％　Does not operate

·Setting current ×125％　Operate (OL trip)

■ Parameter P141: The 2nd Electronic Thermal Selection

Setting value	Validity of function	Details of function
0	Disabled	OL trip will occur if current up to 140% of inverter's rating continues for 1 minute
1	Enabled	Without output frequency derating
2	Enabled	With output frequency derating
3	Enabled	Forced air-cooled motor specification

* About frequency derating

Cooling performance of the motor will be reduced at lower speed. To handle the problem, this function can automatically compensate operation level.

■ Parameter P141＝1　■ Parameter P141＝2　■ Parameter P141＝3

■ Parameter P142: The 2nd Thermal Current Setting

Data setting range (A)	0.1～100.0

* Please make settings according to the rated current of the applicable motor.
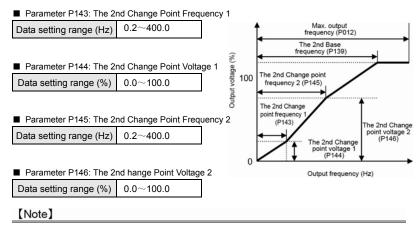
Related parameters: P101 to P106

P143	The 2nd Change Point Frequency 1	**P145**	The 2nd Change Point Frequency 2
P144	The 2nd Change Point Voltage 1	**P146**	The 2nd Change Point Voltage 2

Change point 1 and 2 can be selected in 3-point mode of "P009: V/F Mode".

(It is only valid when parameter P009 is set to "3C".)

■ Parameter P143: The 2nd Change Point Frequency 1

Data setting range (Hz)	0.2～400.0

■ Parameter P144: The 2nd Change Point Voltage 1

Data setting range (%)	0.0～100.0

■ Parameter P145: The 2nd Change Point Frequency 2

Data setting range (Hz)	0.2～400.0

■ Parameter P146: The 2nd hange Point Voltage 2

Data setting range (%)	0.0～100.0

【Note】

・Read "P009: V/F Mode" carefully before setting.
・The 2nd change point frequency 1 and 2 will operate according to the setting value of the base frequency when set to a value higher than the base frequency.
・The 2nd change point frequency 2 will operate according to the setting value of the 2nd change point frequency 1 when set to a value lower than the 2nd change point frequency 1.
・When setting "P140: The 2nd Torque Boost", the 2nd change point voltage 1 and 2 will operate according to the setting value of the 2nd torque boost if set to a value lower than the 2nd torque boost level.
・The 2nd change point voltage 2 will operate according to the setting value of the 2nd change point voltage 1 when it is set to below the 2nd change point voltage 1.
・Please note that sharp acceleration/deceleration or overcurrent may occur depending on setting values and load status if data is changed during operation.
・The auto torque boost mode will take precedence if the auto torque boost mode is selected via parameter "P140: The 2nd Torque Boost", in this case, settings related to 3-point mode (parameter P143 to P146: Change Point Voltage and Change Point Frequency) will become invalid.

Related parameters: P009, P012, P101 to P106, P139, P140

P147   Pulse Output Frequency

The number of pulses per second (pulse frequency) at the maximum output frequency or 150% of the rated output current can be set using this parameter.

Setting Range (kHz)	1.0~10.0

P148   Pulse Output Duty Ratio

The pulse output duty ratio can be adjusted within the range of 25% to 75%.

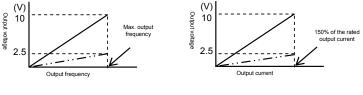| Setting Range (%)	25~75

P149   Analog Output Voltage Compensation

Output compensation for "0 to 10V voltage singal" can be made.

Setting Range (%)	25~100

■Adjustable Range (full scale value)

・Analog output voltage : Analog output voltage×Percentage set with P149

─────────   Relationship between analog output voltage and output frequency when P149=100.

─ ‥ ─ ‥ ─   Relationship between analog output voltage and output frequency when P149=25.

P201 Load Rating

Load rating types are set as the rated output current reference.

Setting value	Details
0	Heavy load specification
1	Light load specification

・For applications where requires a small variation in torque or small maximum torque and maximum speed, please select "1: Light Load Specification" to enable the motor to operate continuously at a high output level (however, the carrier frequency should be 5kHz or less).

・The light load specification can be used when the rated output current is larger than the heavy load specification, overload current ratings are listed as below.

【Overload Current Ratings】

Heavy load specification: 150% of the rated output current, lating for 1 minute

Light load specification: 120% of the rated output current, lating for 1 minute

・The heavy load specification has no difference with the light load specification when the carrier frequency is above 7.5kHz.

・Please carefully read Item 7 in this manual for the rated output currents of the heavy load specification and light load specification of various models and use them in their rating range.

【Note】

・For applications where there is a sharp variation in torque and an instantaneous sharp increase in torque, please select "0: heavy load specification".

If the light load specification is selected, the inverter will be forced to make a stop due to the protection function.

P202   Auto-tuning

Measure the motor constants used for control purpose and automatically save them to parameter P208 to P212 (the 2nd motor: P216 to P220)

⚠ Danger	The inverter will automatically drive the motor within the range of the upper frequency limit and the lower frequency limit after the auto-tuning starts. Do not start an auto-tuning if there is a danger with the motor that is being driven. Never approach the motor and the conductive parts during auto-tuning. Failure to do so may result in injury and accidents.

Setting value	Details
0	Normal status
1	Conduct auto-tuning

・ When operating in the sensorless vector control mode, or operating the auto torque boost in the V/F control mode, be sure to perform the auto-tuning for all motores before their first operation.
  Otherwise, they cannot be controlled normally.
・ Do not connect loads and other objects to the motor shaft during auto-tuning.
  It is suggested that it should be done in the standalone status.
  The auto-tuning cannot be normally performed if loads and objects with greater inertia are connected.
  Perform the auto-tuning in a free rotation state without loads as far as possible.
・ Start the auto-tuning only after the motor had come to a complete stop.
・ Refer to "4.14 Auto-tuning" for the auto-tuning procedures.

P203	Motor Capacity
P204	Motor Pole Number
P205	Rated Voltage of Motor
P206	Rated Frequency of Motor
P207	Rated Current of Motor

Motor specifications are set as the benchmarks for motor auto-tuning.

■ Parameter P203

Data setting range(kW)	0.2, 0.4, 0.7, 1.5, 2.2, 3.7, 5.5, 7.5, 11, 15

P203: The setting range of motor capacity is limited by the rated values of the inverter.

■ Parameter P204

Data setting range (poles)	2, 4, 6

■ Parameter P205

Data setting range (V)	0～500

■ Parameter P206

Data setting range (Hz)	10.0～120.0

■ Parameter P207

Data setting range (A)	0.01～99.99

・Set specifications for the motor used.
・These setting values shall be taken as benchmarks for auto-tuning, please make such setting before the start of auto-tuning (parameter P202).

【Note】

・The specifications of motor are defined by the combination of various rated voltages, rated frequencies amd rated currents.
　【For example】380V/50Hz/1.0A; 400V/60Hz/1.5A
　The rated voltage should be set after the AC power voltage actually used to input voltage to the MK300 inverter had been selected.
・In addition, be sure to set the rated current based on the combination due to that the rated current varies with the different rated voltage and rated frequency.
　Torque limitation (parameter P215) is conducted according to the internal arithmetic of the setting value of rated current of motor (P207). The limitation operation cannot be normally performed if the setting value of P207 is incorrect.

Related parameters: P202, P215

P208	Primary Resistance
P209	Secondary Resistance
P210	Energizing Inductance
P211	Leakage Inductance
P212	Energizing Current

Motor constants shall be saved after the auto-tuning is done.

■ Parameter P208

| Data setting range(Ω) | 0.00～99.99 |

■ Parameter P209

| Data setting range(Ω) | 0.00～99.99 |

■ Parameter P210

| Data setting range(mH) | 0.0～5000 |

■ Parameter P211

| Data setting range(mH) | 0.0～999.9 |

■ Parameter P212

| Data setting range (A) | 0.01～99.99 |

・Various motor constants shall be automatically saved after the auto-tuning (parameter P202) is done.
・In principle, the values saved after the auto-tuning can be used directly.

Related parameters: P202

P213	Speed Control Percentage Increment
P214	Speed Control Integral Increment

Set the speed control increment for the internal arithmetic of sensorless vector control.

■ Parameter P213

Data setting range	0.01～10.00

■ Parameter P214

Data setting range	0.01～10.00

・Applicable initial values of various motors had been set. Normally, such initial values can be used directly.

・In the actual operation in sensorless vector control mode, adjustment to such parameter can sometimes enhance the stability and responsiveness to the torque variation.

Adjust the values in small increments during parameter adjustment and verify their effectiveness through actual running test.

【Note】

・The adjustment of such parameter will cause the normal rotation control unable to be maintained when some values are applied.

When adjusting parameters, please conduct the test by taking into account the safety in case of abnormal rotation.

P215   Torque Limit Level

Set the limit value for torque current in the sensorless vector control mode.

Data setting range (%)	50~400

- The inverter will be forced to come to stop because of the protection function if the torque current increases due to that the torque is too large.
  Therefore, it is necessary to set a limit value for the torque current to prevent the force stop.
- The output frequency shall be automatically changed for the control when the torque current reaches the limit value.
- To disable the limitation, please set the upper limit value to "400".

【Note】

- If it is required to prevent a force stop to the utmost extent, it is suggested to set the limit value to 200 or less.
  The increase of the limit value are likely to cause it to reach the force stop level before the implementation of such limitation.
- Such torque limitation is conducted according to the internal arithmetic of the setting value of rated current of motor (P207). The limitation operation cannot be normally performed if the setting value of P207 is incorrect.

Related parameters: P207

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P216	Capacity of the 2nd Motor
P217	Pole Number of the 2nd Motor
P218	Rated Voltage of the 2nd Motor
P219	Rated Frequency of the 2nd Motor
P220	Rated Current of the 2nd Motor

Motor specifications used as benchmarks for the auto-tuning of the 2nd motor are set via these parameters.

■ Parameter P216

Data setting range(kW)	0.2, 0.4, 0.7, 1.5, 2.2, 3.7, 5.5, 7.5, 11, 15

■ Parameter P217

Data setting range (poles)	2, 4, 6

P216: The setting range of capacity of the 2nd motor is limited by the rated values of the inverter.

■ Parameter P218

Data setting range (V)	0~500

■ Parameter P219

Data setting range (Hz)	10.0~120.0

■ Parameter P220

Data setting range (A)	0.01~99.99

・ Set specifications for the 2nd motor used.
・ These setting values shall be taken as benchmarks for auto-tuning, please make such setting before the start of auto-tuning (parameter P202) of the 2nd motor.

【Note】

・ The specifications of motor are defined by the combination of various rated voltages, rated frequencies amd rated currents.
　　【For example】380V/50Hz/1.0A; 400V/60Hz/1.5A
The rated voltage should be set after the AC power voltage actually used to input voltage to the MK300 inverter had been selected.
In addition, be sure to set the rated current based on the combination due to that the rated current varies with the different rated voltage and rated frequency.
・ Torque limitation of the 2nd motor (parameter P228) is conducted according to the internal arithmetic of the setting value of rated current of the 2nd motor (P220). The limitation operation cannot be normally performed if the setting value of P220 is incorrect.

Related parameters: P202, P228

P221	Primary Resistance of the 2nd Motor
P222	Secondary Resistance of the 2nd Motor
P223	Energizing Inductance of the 2nd Motor
P224	Leakage Inductance of the 2nd Motor
P225	Energizing Current of the 2nd Motor

Motor constants of the 2nd motor shall be saved after the auto-tuning of the 2nd motor is done.

■ Parameter P221

Data setting range(Ω)	0.00～99.99

■ Parameter P222

Data setting range(Ω)	0.00～99.99

■ Parameter P223

Data setting range(mH)	0.0～5000

■ Parameter P224

Data setting range(mH)	0.0～999.9

■ Parameter P225

Data setting range (A)	0.01～99.99

・Various motor constants shall be automatically saved after the auto-tuning (parameter P202) of the 2nd motor is done.
・In principle, the values saved after the auto-tuning can be used directly.

Related parameters: P202

P226   Speed Control Percentage Increment of the 2nd Motor
P227   Speed Control Integral Increment of the 2nd Motor

Set the speed control increment of the 2nd motor for the internal arithmetic of sensorless vector control.

■ Parameter P226

Data setting range	0.01～10.00

■ Parameter P227

Data setting range	0.01～10.00

・Applicable initial values of various motors had been set. Normally, such initial values can be used directly.
・In the actual operation in sensorless vector control mode, adjustment to such parameter can sometimes enhance the stability and responsiveness to the torque variation.
  Adjust the values in small increments during parameter adjustment and verify their effectiveness through actual running test.

【Note】

・The adjustment of such parameter will cause the normal rotation control unable to be maintained when some values are applied.
  When adjusting parameters, please conduct the test by taking into account the safety in case of abnormal rotation.

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P228　Torque Limit Level of the 2nd Motor

Set the limit value for torque current of the 2nd motor in the sensorless vector control mode.

Data setting range (%)	50～400

- The inverter will be forced to come to stop because of the protection function if the torque current increases due to that the torque is too large.
  Therefore, it is necessary to set a limit value for the torque current to prevent the force stop.
- The output frequency shall be automatically changed for the control when the torque current reaches the limit value.
- To disable the limitation, please set the upper limit value to "400".

【Note】

- When it is required to prevent a force stop to the utmost extent, it is suggested to set the limit value to 200 or less.
  The increase of the limit value are likely to cause it to reach the force stop level before the implementation of such limitation.
- Such torque limitation is conducted according to the internal arithmetic of the setting value of rated current of the 2nd motor (P220).
  The limitation operation cannot be normally performed if the setting value of P220 is incorrect.

Related parameters: P220

P301 Multi-step speed Function Selection

Each control function can be set when using parameter P101 to P106 to set SW1 to SW6 to be used as multi-step speed functions.

Setting value	Details
0	Set to "multi-step speed frequency operation"
1	Set to "2nd/3rd/4th acceleration/deceleration operation"
2	Set to "acceleration/deceleration linked with multi-step speed frequency operation"
3	Set to "timer controlled multi-step speed frequency operation"
4	Set to "timer controlled acceleration/deceleration linked with multi-step speed frequency operation"

If the setting value is "0" to "2", SW1 to SW6 can only be used after they have been set to "multi-step speed function" via parameter P101 to P106.
If the setting value is "3" or "4", SW1 to SW6 are invalid even if they have been set to "multi-step speed function" via parameter P101 to P106.

Multi-step speed frequency operation (setting value = "0")
The 2nd/3rd/4th acceleration/deceleration operation (setting value = "1")
Acceleration/deceleration linked with multi-step speed frequency operation (setting value = "2")

■Setting value = "0": multi-step speed frequency operation
Up to 16 steps can be set by SW in multi-step speed frequency operation. Acceleration/deceleration time is fixed to "the 1st Acceleration/Deceleration Time" (parameter P001, P002).
When functions of SW1 to SW6 are all set to "1" and "r1" (multi-step speed SW input function), 4 SWs (starting from the one with the smallest No.) can be valid as multi-step speed command SW.
The 2nd to the 16th speed frequencies are set via parameter P302 to P316.
■Setting value = "1": The 2nd/3rd/4th acceleration/deceleration operation
When the frequency is fixed to the 1st speed, up to 4 acceleration/deceleration times can be changed through SW.
The 2nd to the 4th acceleration/deceleration times can be set via parameter P317 to P322.

■ Setting value = "2": Acceleration/deceleration linked with multi-step speed frequency operation

4 SWs can be used to link up to 16 speed steps and 4 acceleration/deceleration times to perform multi-step speed frequency operation.

SW1 (Note 1)	SW2 (Note 1)	SW3 (Note 1)	SW4 (Note 1)	multi-step speed frequency operation		2nd/3rd/4th acceleration/deceleration operation		Acceleration/deceleration linked with multi-step speed frequency operation	
				P301=0		P302=1		P303=2	
				Frequency	Acceleration /deceleration time	Frequency	Acceleration /deceleration time	Frequency	Acceleration /deceleration time
OFF	OFF	OFF	OFF	The 1st speed	The 1st acceleration /deceleration	The 1st speed	The 1st acceleration /deceleration	The 1st speed	The 1st acceleration /deceleration
ON	OFF	OFF	OFF	The 2nd speed			The 2nd acceleration /deceleration	The 2nd speed	The 2nd acceleration /deceleration
OFF	ON	OFF	OFF	The 3rd speed			The 3rd acceleration /deceleration	The 3rd speed	The 3rd acceleration /deceleration
ON	ON	OFF	OFF	The 4th speed			The 4th acceleration /deceleration	The 4th speed	The 4th acceleration /deceleration
OFF	OFF	ON	OFF	The 5th speed			The 1st acceleration /deceleration	The 5th speed	The 1st acceleration /deceleration
ON	OFF	ON	OFF	The 6th speed				The 6th speed	
OFF	ON	ON	OFF	The 7th speed				The 7th speed	
ON	ON	ON	OFF	The 8th speed				The 8th speed	
OFF	OFF	OFF	ON	The 9th speed				The 9th speed	
ON	OFF	OFF	ON	The 10th speed				The 10th speed	
OFF	ON	OFF	ON	The 11th speed				The 11th speed	
ON	ON	OFF	ON	The 12th speed				The 12th speed	
OFF	OFF	ON	ON	The 13th speed				The 13th speed	
ON	OFF	ON	ON	The 14th speed				The 14th speed	
OFF	ON	ON	ON	The 15th speed				The 15th speed	
ON	ON	ON	ON	The 16th speed				The 16th speed	

(Note 1) When the functions of any 4 SWs of SW1 to SW6 are set to "1" and "r1" (multi-step speed SW input function), the four SWs (starting from the one with the smallest No.) can be valid as multi-step speed command SW.
< Example > When SW1, SW2, SW4 and SW5 are set to multi-step speed SW input function, SW4 and SW5 will be allocated to the column (see Table above) previously occupied by SW3 and SW4.

■Example of multi-step speed frequency operation (setting value = "0")
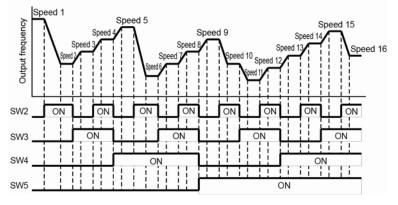Up to sixteen levels of frequency can be selected, switched and controlled by 4 button signals.
(The 1st speed: setting signal of P004, the 2nd to 16th speed: setting frequency of P302 toP316)
・Set any 4 buttons of SW1 to SW6 to multi-step speed function buttons.
(Set P101 to P106 to "1" or "r1".)
・With this function, 1 button, 2 buttons and 3 buttons are used to input 2-step speed, 4-step speed and 8-step speed respectively.
・The inverter will stop (0 V stop) when the 2nd to 16th speed frequency (P302 to P316) are set to "0" and this multi-step speed frequency is selected.

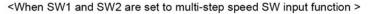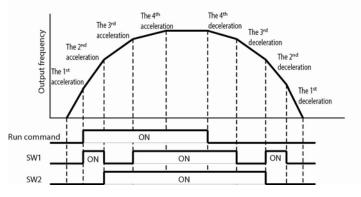\<When SW2 to SW5 are set to multi-step speed SW input function \>

■Example of the 2nd/3rd/4th acceleration/deceleration operation (setting value = "1")

Four groups of acceleration/deceleration times can be selected, switched and controlled with two SW signals.

(The 1st acceleration/deceleration time: P001 and P002, the 2nd to 4th acceleration/deceleration time: P317 to P322)

・Set any two buttons of SW1 to SW6 to multi-step speed function buttons. (Set P301 to P306 to "1" or "r1")

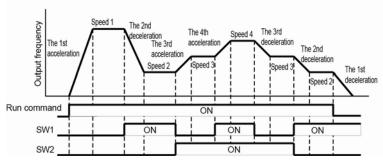<When SW1 and SW2 are set to multi-step speed SW input function >

■Example of Acceleration/deceleration linked with multi-step speed frequency operation (setting value = "2")

The 2nd, 3rd and 4th speed can be linked (combined) with the 2nd, 3rd and 4th acceleration/deceleration by using two SW signals.

・Set any two buttons of SW1 to SW6 to multi-step speed function buttons. (Set P101 to P106 to "1" or "r1")

<When SW1 and SW2 are set to multi-step speed SW input function >

【Note】

・The 1st speed is the command value of frequency setting signal set via parameter P004.
・The 1st acceleration time is set via parameter P001.
  The 1st deceleration time is set via parameter P002.
・The 2nd to 16th speed frequency are set via parameter P302 to P316.
  The 2nd to 4th acceleration/deceleration time are set via parameter P317 to P322.

Related parameters: P101 to P106, P302 to P322

Timer controlled multi-step speed frequency operation (setting value = "3")
Timer controlled acceleration/deceleration linked with multi-step speed frequency operation (setting value = "4")

■Setting Value = "3": Timer controlled multi-step speed frequency operation
During timer controlled multi-step speed frequency operation, the acceleration/deceleration time can be fixed to 8 steps. Upon the input of the run command, the inverter will automatically switch to the next speed after running for a period of the time set.
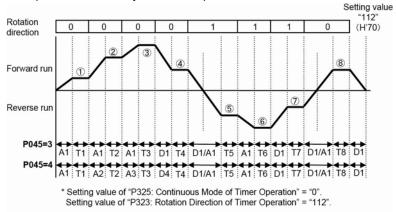When SW1 to SW6 are set to "multi-step speed SW input function", even if signals are input during the timer controlled multi-step speed operation, such signals will be invalid and the multi-step speed operation will continue.
Rotation direction and continuous operation times of timer during one cycle can be set via parameter "P323: Rotation Direction of Timer Operation" and "P324: Continuous Operation Times of Timer" respectively. Operation mode and waiting time for timer operation from the end of one cycle to the next one can be set via parameter "P325: Continuous Operation Mode of Timer" and "P326: Continuous Waiting Time of Timer Operation". Runtime for the 1st to 8th speed can be set via parameter "P327 to P334: The 1st to 8th Speed Runtime".

■Setting Value = "4": Timer controlled acceleration/deceleration linked with multi-step speed frequency operation
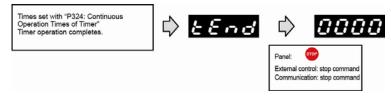Up to 8 steps of speeds and 4 acceleration/deceleration times can be linked to perform the timer controlled mullt-speed operation.

Timer controlled multi-step speed frequency operation				Timer controlled acceleration/deceleration linked with multi-step speed frequency operation			
P301=3				P301=4			
Rotation Direction (selected bit)	Frequency	Runtime	Acceleration/ deceleration time	Rotation Direction (selected bit)	Frequency	Runtime	Acceleration/ deceleration time
Forward run/ Reverse run 0 / 1	The 1st speed ①	The 1st speed runtime T1		Forward run/ Reverse run 0 / 1	The 1st speed ①	The 1st speed runtime T1	The 1st acceleration/ deceleration time A1 / D1
Forward run/ Reverse run 0 / 1	The 2nd speed ②	The 2nd speed runtime T2		Forward run/ Reverse run 0 / 1	The 2nd speed ②	The 2nd speed runtime T2	The 2nd acceleration/ deceleration time A2 / D2
Forward run/ Reverse run 0 / 1	The 3rd speed ③	The 3rd speed runtime T3		Forward run/ Reverse run 0 / 1	The 3rd speed ③	The 3rd speed runtime T3	The 3rd acceleration/ deceleration time A3 / D3
Forward run/ Reverse run 0 / 1	The 4th speed ④	The 4th speed runtime T4	The 1st acceleration time A1 The 1st deceleration time D1	Forward run/ Reverse run 0 / 1	The 4th speed ④	The 4th speed runtime T4	The 4th acceleration/ deceleration time A4 / D4
Forward run/ Reverse run 0 / 1	The 5th speed ⑤	The 5th speed runtime T5		Forward run/ Reverse run 0 / 1	The 5th speed ⑤	The 5th speed runtime T5	
Forward run/ Reverse run 0 / 1	The 6th speed ⑥	The 6th speed runtime T6		Forward run/ Reverse run 0 / 1	The 6th speed ⑥	The 6th speed runtime T6	The 1st acceleration/ deceleration time A1 / D1
Forward run/ Reverse run 0 / 1	The 7th speed ⑦	The 7th speed runtime T7		Forward run/ Reverse run 0 / 1	The 7th speed ⑦	The 7th speed runtime T7	
Forward run/ Reverse run 0 / 1	The 8th speed ⑧	The 8th speed runtime T8		Forward run/ Reverse run 0 / 1	The 8th speed ⑧	The 8th speed runtime T8	

■Example: Mode for one cycle of timer operation

After the timer runs one cycle for times set via parameter "P324: Continuous Operation Times of Timer", "tEnd" will be displayed. Then the timer will return to "0000" (operation status mode) after stop command is input with "tEnd" displayed.

【Note】

・During timer operation, forward/reverse run commands input from operation panel, external control and communication are invalid.
・During timer operation, operation will be stopped immediately even in cycle operation when the stop command is input.

Related parameters: P001, P002, P101 to P106, P317 to 334

P302	The 2nd Speed Frequency	P307	The 7th Speed Frequency	P312	The 12th Speed Frequency
P303	The 3rd Speed Frequency	P308	The 8th Speed Frequency	P313	The 13th Speed Frequency
P304	The 4th Speed Frequency	P309	The 9th Speed Frequency	P314	The 14th Speed Frequency
P305	The 5th Speed Frequency	P310	The 10th Speed Frequency	P315	The 15th Speed Frequency
P306	The 6th Speed Frequency	P311	The 11th Speed Frequency	P316	The 16th Speed Frequency

The 2nd to 16th speed frequency can be set to perform the multi-step speed operation.

Data setting range (Hz)	0.0·0.2～400.0

• "0.0" indicates 0V stop.

• When under vector control, the frequency is 0.5Hz to 120.0Hz.

Related parameters: P101 to P106, P301, , P317 to P334

P317	The 2nd Acceleration Time	P319	The 3rd Acceleration Time	P321	The 4th Acceleration Time
P318	The 2nd Deceleration Time	P320	The 3rd Deceleration Time	P322	The 4th Deceleration Time

The 2nd to 4th acceleration/deceleration time can be set to perform the 4-step acceleration/deceleration control operation.

The 2nd to 4th acceleration/deceleration time corresponds to the frequency band of 0.2 Hz to the max. output frequency.

Data setting range (s)	0.1～3600
Increment (s)	0.1(0.1～999.9)、1(1000～3600)

Related parameters: P101 to P106, P301 to 304, P323 to P334

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P323　Rotation Direction of Timer Operation

Rotation direction at each level from the 1st to 8th speed can be set in "P301: Multi-step Speed Function Selection" with the setting value of "3" or "4".

"0" and "1" indicate forward run and reverse run respectively, while the 1st to 8th speed indicate different levels. After rotation direction is determined ("0" (forward run) or "1" (reverse run)), the sum of 0 or 1 multiplied by addition value corresponding to each level can be acquired and used as the setting value. (Refer to the following table. The sum of rotation direction ("0" or "1") multiplied by addition value of each speed level is used as the setting value.)

■　Example of setting: The 1st speed＝forward run, the 2nd speed＝forward run, the 3rd speed＝forward run, the 4th speed＝forward run, the 5th speed＝reverse run, the 6th speed＝reverse run, the 7th speed＝reverse run, the 8th speed＝forward run

Speed	The 1st speed	The 2nd speed	The 3rd speed	The 4th speed	The 5th speed	The 6th speed	The 7th speed	The 8th speed
Rotation direction	forward run	forward run	forward run	forward run	reverse run	reverse run	reverse run	forward run
Set value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1
Addition value	1	2	4	8	16	32	64	128

(0×1)＋(0×2)＋(0×4)＋(0×8)＋(1×16)＋(1×32)＋
(1×64)＋(0×128)= 112
So the setting value is "112".

【Note】

・This function is only valid when "3" or "4" is set with "P301: Multi-step Speed Function Selection".
・Please note that rotation direction varies depending on the setting.

Related parameters: P001, P002, P301 to P308, P317 to P322

P324   Cntinuous Operation Times of Timer

Continuous operation times of timer in one cycle can be set by using the 1st to 8th speed operation as "timer operation cycle" when the setting is "3" or "4" in "P301: Multi-step Speed Function Selection".

Data Setting Range (times)	0·1～9999

* "0" indicates that there is no limit to operation times. After run command is input, the operation will keep on until stop command is input.

【Note】

- This function is only valid when "3" or "4" is set with "P301: Multi-step Speed Function Selection".
- If data is changed during operation, the changed data will become valid from the next cycle.

Related parameters: P301, P325 to P326

P325 Continuous Operation Mode of Timer
P326 Continuous Waiting Time of Timer Operation

Operation mode and continuous waiting time of timer operation from the end of the 1st cycle to the 2nd cycle can be set when "3" or "4" is set with "P301: Multi-step Speed Function Selection".
If the continuous operation mode of timer is set to "1", the continuous waiting time of timer operation will become invalid.
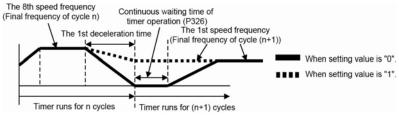
■ Parameter P325: Continuous Operation Mode of Timer

Setting value	Details
0	After one cycle of operation, the operation returns to the 0 V stop status within the 1st deceleration time and enters the next cycle.
1	After one cycle of operation, the operating frequency will change to the 1st speed frequency of the next cycle within the 1st deceleration time.

■ Parameter P326: Continuous Waiting Time of Timer Operation

Data setting range (s)	0.0·0.1～6553
Increment (s)	0.1(0.1～999.9)、 1(1000～6553)

* "0.0" indicates that there is no waiting time.

【Note】

・If mode is changed during operation, the changed mode will become valid from the next cycle.
・If data is changed during the waiting time, the changed data will become valid from the next cycle.

Related parameters: P002, P301 to P308, 317 to P324

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P327	The 1st Speed Runtime	P331	The 5th Speed Runtime
P328	The 2nd Speed Runtime	P332	The 6th Speed Runtime
P329	The 3rd Speed Runtime	P333	The 7th Speed Runtime
P330	The 4th Speed Runtime	P334	The 8th Speed Runtime

Runtime at the 1st to 8th speed frequency can be set when "3" or "4" is set with "P301: Multi-step Speed Function Selection".

Data setting range (s)	0.0·0.1～6553
Increment (s)	0.1(0.1～999.9)、1(1000～3600)

* "0.0" indicates that no operation will be performed at the set speed.

【Note】

・Each function is only valid when "3" or "4" is set with "P301: Multi-step Speed Function Selection".

・The inverter will not operate at the set speed when the setting is "0.0". Timer controlled multi-step speed operation will be performed only at the speed for which time is set with P327 to P334.

If data is changed during operation, the changed data will become valid from the next cycle.

Related parameters: P301 to P308, P317 to P326

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P335 Winding Mode Control Selection

Select ON status for the winding mode control operation and the amplitude during such control.

Setting	Details
0	Winding mode control is OFF.
1	Amplitude is set based on the setting frequency.
2	Amplitude is set based on the maximum frequency.

P336 Amplitude in Winding Mode

Frequency amplitude under winding mode control can be set via this parameter.

Setting Range (%)	$0.0 \sim 100.0$

When P335=1, frequency amplitude (Hz) = setting frequency (Hz) × amplitude in winding mode (%)
When P335=2, frequency amplitude (Hz) = maximum frequency (Hz) ×amplitude in winding mode (%)
For the details of the winding mode control function, please refer to P335.

P337 Recoil Frequency Band Width in Winding Mode

Percentage of the recoil frequency for frequency amplitude set via parameter P336 can be set via this parameter.

Setting Range (%)	$0.0 \sim 100.0$

P338 Winding Mode Cycle   P339 Rise Time Coefficient of Winding Mode

Time required for one cycle of winding mode control operation and the acceleration time in one cycle can be set via these parameters.

■Winding Mode Cycle

Setting range (sec)	$0.0 \sim 3600$

■Rise Time Coefficient of Winding Mode

Setting Range (%)	$0.0 \sim 100.0$

The formulas of acceleration/deceleration time below can be acquired via the setting of P338 and P339.
Rise time of triangular-wave frequency = winding mode cycle (s) × rise time coefficient of winding mode (%)
Drop time of triangular-wave frequency = winding mode cycle (s) × (100 - rise time coefficient of winding mode (%))
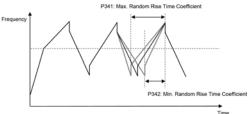
P340 Winding Mode Operation Selection

It is used for setting the winding mode operation selection.

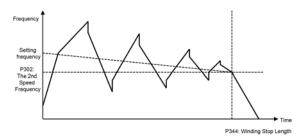| Setting value	Name
0	Normal mode
1	2-point normal mode
2	Random mode
3	2-point random mode

■Random Mode
When "P340: Winding Mode Operation Selection" is set to "2" or "3", the winding mode is a random mode. And the rise time shall swing between "P341: Max.Random Rise Time" and "P342: Min.Random Rise Time".

■2-point Mode
When "P340: Winding Mode Operation Selection" is set to "1" or "3", and "P344: Winding Stop Length" is not set to "0", the winding mode is a 2-point mode. In this case, the setting frequency will vary with the increase of the winding length and finally become "P302: The 2nd Speed Frequency"

Especially, when P340 is set to "3", namely the 2-point mode is selected, in this case, the base frequency will change from the setting frequency to the 2nd speed frequency (P344 is not set "0") with the change of the winding length, at the same time, the rise time coefficient will vary in a random range.

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P341	Max. Random Rise Time Coefficient	P342	Min. Random Rise Time Coefficient

Set the maximum and minimum values of rise time for random function.

Setting Range (%)	0.0~100.0(setting unit: 0.1%)

| P343 | Winding Length Multiplier |

When function of SW input pulse for winding length counts is set, the winding length can be calculated based on "P343: Winding Length Multiplier".

Setting range	1~9999

| P344 | Winding Stop Length |

The winding mode will stop when the winding length accumulates to the stop length.

Setting range (m)	0·1~600000(setting unit: 1m)

· The winding length stop function will be disabled when the setting value is "0".
· The relationship between the setting value and the display is as follows.
When the setting value is "1m~9,999m" , it will display "1~9999".
When the setting value is "10,000m~99,999m", it will display "1.000~9.999"
When the setting value is "100,000m~ 600,000m", it will display "10.00~60.00".

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PID control is a control method enabling the feedback value (measured value) to be consistent with the set target value. In MK300, PID control can be applied after the setting values of P118, P101 to P106 are changed to "10(r10)". Related parameters of PID control: P345 to P356.

■　P Control (Proportional Control)
Output the operation amount (output frequency) that is in direct proportion to the deviation.
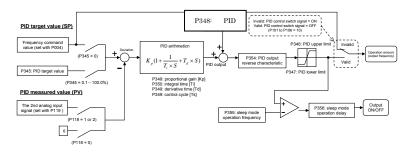
■　I Control (Integral Control)
Output the operation amount (output frequency) of the deviation integral. Which can be used to effectively control the consistence of the feedback value and the target value, however, a sharp change cannot be traced.

■　D Control (Derivative Control)
It is controlled via the value, which is obtained by derivative (slope deviation) multiplied by the time constant, to judge the deviation of the signal. Transient characteristics such as overshoot or vibration can be reduced through the derivative control.

■　PID Control Flow Chart

P345　PID Target Value

Target value used in PID control can be set via this parameter. When the setting value is "0.0", the frequency setting signal set with P004 shall be used as the target value.

Data setting range[%]	0.0, 0.1～100.0

P346　PID Upper Limit

Set the value obtained from the PID arithmetic not exceeding the setting value. Set "P012: Max. Output Frequency" to "100%".

Data setting range[%]	0.0～100.0

P347   PID Lower Limit

Set the value obtained from the PID arithmetic not lower than the setting value. Set "P012: Max. Output Frequency" to "100%".

Data setting range[%]	0.0, 0.1～100.0

P348   PID Bias

Bias corresponding to the PID output can be adjusted via this parameter. Set "P012: Max. Output Frequency" to "100%".

Data setting range[%]	-100～100.0

P349   PID Proportional Gain(Kp)

Proportional gain used in PID arithmetic can be set via this parameter.
The larger the setting value is, the smaller the deviation is, however, instability phenomenon such as vibration will be produced if it is too large.
The smaller the setting value is, the larger the deviation between the target value (SP) and the measured value (PV) is.

Data setting range	0.1～1000

P350   PID Integral Time (Ti)

Integral time (time constant for integral computation) used in PID arithmetic can be set via this parameter.
If the deviation cannot be reduced to zero through proportional control, then this parameter must be set to eliminate the deviation.
It can quickly reach a stable status by shortening the integral time, however, overshoot or vibration will occur if the setting time is too short.

Data setting range[sec]	0.00, 0.01～360.0

※ "0.00" indicates that there is no proportional control.

P351   PIDDerivative Time (Td)

Derivative time used in in PID arithmetic can be set
The larger the setting value is, the greater the responsiveness is, but vibration will be produced accordingly. The decrease of the setting value can inhibit the overshoot, but on the other hand, the responsiveness will be weakened.

Data setting range[sec]	0.00, 0.01～10.0

※ "0.00" indicates that there is no proportional control.

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P352　PID Control Cycle (Ts)

Execution cycle required in PID control can be set.

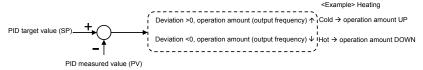| Data setting range[sec]	0.00, 0.01～60.0

P353　PID Output Characteristics

Forward or reverse operation output from PID arithmetic can be set via this parameter.

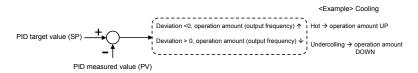| Setting value	Details
0	Reverse operation
1	Forward operation

■ Reverse Operation

Increase the operation amount (output frequency) if the deviation (SP-PV) is positive; decrease the operation amount if the deviation is negative.

<Example> Heating

PID target value (SP)　+　−

Deviation >0, operation amount (output frequency) ↑　Cold → operation amount UP

Deviation <0, operation amount (output frequency) ↓　Hot → operation amount DOWN

PID measured value (PV)

■ Forward Operation

Increase the operation amount (output frequency) if the deviation (SP-PV) is negative; decrease the operation amount if the deviation is positive.

<Example> Cooling

PID target value (SP)　+　−

Deviation <0, operation amount (output frequency) ↑　Hot → operation amount UP

Deviation > 0, operation amount (output frequency) ↓　Undercolling → operation amount DOWN

PID measured value (PV)

P354　PID Output Reverse Selection

Set whether the rotation direction can be reversed or not when the PID output is negative.

Setting range		Details
0	Reverse operation is disabled.	Set the output frequency to "0", when PID output <0.
1	Reverse operation is enabled.	Perform the reverse operation according to the output value when PID output <0.

【Note】

• It is invalid when P118=2.

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P355	Sleep Mode Operation Frequency
P356	Sleep Mode Operation Delay

■ Parameter P355: Sleep Mode Operation Frequency

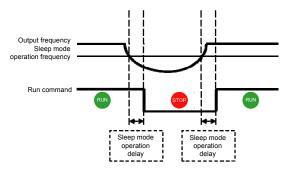| Data setting range (Hz)	0.0•0.2～400.0

■ Parameter P356: Sleep Mode Operation

Data setting range (s)	0.0～25.0

When output frequency < sleep mode operation frequency is set,
The inverter will stop the output after the elapse of the sleep mode operation delay.
When output frequency > sleep mode operation frequency is set,
The output will be resumed after the elapse of the sleep mode operation delay.

P357	Speed Search Selection at Startup

To set whether the speed search is enabled or disabled at the startup.

Setting	Details
0	Speed search at startup is disabled. When speed search is selected via parameter "P101 to P106: SW1 to SW6 Function Selection", speed search will be performed if relevant SWs are turned ON.
1	Speed search at startup is enabled.

【Note】

・ It is disabled in sensorless vector control mode.

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P359   Waiting Time for Speed Search

The time to start the speed search can be set via this parameter during speed search.

Setting range	0.0～100.0

【Note】

・If "P033: Waiting Time" is set and the waiting time has elapsed, the inverter will enter the waiting status according to the setting value of "Waiting Time for Speed Search" and then start the speed search.

P360   Voltage Recovery Time for Speed Search

The voltage can be applied gradually at the frequency detected during speed search.

Setting range	0.1～10.0

【Note】

・If the setting value is too low, overcurrent trip may occur.

P361   Speed Search Selection During Retry

When retry function is set to "enabled" via parameter "P029: Retry Function", whether speed search is performed or not during retry after fault occurrence can be set via this parameter.

Setting	Details
0	Disabled: speed search is not performed during retry after fault occurrence.
1	Enabled: speed search is performed during retry after fault occurrence.

【Note】

・It is disabled in sensorless vector control mode.

P362   Speed Search Retry Selection

Whether speed search is performed again after speed search selection failure can be set via this parameter.

Setting	Details
0	When speed search fails or the upper limit of retry times for speed search is exceeded, "SEr" will be displayed on the operation panel and operation will be stopped.
1	When speed search fails or upper limit of retry times for speed search is exceeded, operation will start at the start frequency.

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P363　Speed Search Retry Times

Speed search retry times can be set when "Speed Search Retry Selection" is selected.

Setting Range (times)	0～10

P364　Upper Limit Frequency Selection for Speed Search

Frequency range for speed search can be set via this parameter.

Setting	Details
0	Speed search is performed at a frequency below the maximum frequency.
1	Speed search is performed at a frequency lower than the previous frequency operating before the normal stop of the operation.

"Administrative Measures on the Control of Pollution Caused by Electronic Information Products" in China Names and Content Marks of Toxic and Hazardous Substances or Elements

Component name	Toxic and Hazardous Substances or Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr6+)	Polybrominated Biphenyl (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Base plate assembly	✕	○	○	○	○	○
Case	○	○	○	○	○	○
Other accessories	○	○	○	○	○	○
○： Indicates that the content of toxic or hazardous substances contained in all homogeneous materials for this component is below the standard specified in the "Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products".						
✕： Indicates that the content of toxic or hazardous substances contained in at least one homogeneous material for this component is above the standard specified in "Requirements for Concentration Limits for Certain Hazardous Substances in Electronic Information Products".						

Note: This product accords with the EU RoHS Directive.

Items that comply not with the EU RoHS Directive are listed in the above Table.

TYPE 1

Precautions on European Standard Directives

1. CE Marking labeled on the inverter is based on the following specifications directive.

   Council directive :
   2006/95/EC Low Voltage Directive
   2011/65/EU RoHS Directive

   $C \epsilon$

   Harmonized Standards :
   EN61800-5-1 : 2007 Second Edition
   EN50581 : 2012

2. Adaptability to EMC Directive shall be determined in a complete plant equipped with the inverter.

3. Inverter's control circuit terminals are only basically insulated (protection against electric shock I, overvoltage category II, pollution degree 2). To meet requirements of CE Marking, final product shall be subject to insulation.

4. Make sure to ground the supply neutral.

5. Power supply input end of the inverter shall be equipped with protection devices for over current, short circuit and leakage of electricity.

6. Main circuit wiring (L, N, U, V, W) shall be connected with ring-type compression terminals.

7. The inverter is only used for fixed installation, not for other occasions.

8. Adaptability to Low Voltage Directive for the inverter
   ① Protection against Electric Shock: I
   ② Overvoltage category: II
   ③ Pollution degree: 2

9. The capacity of relay output terminal mark A, B, C is 30V DC, 0.3A.

10. Use the 2.5 mm² wire with the allowable continuous operating temperature up to 70°C for the grounding.

11. Ambient Temperature: 40°C maximum.

Precautions on European Standard Directives

1. CE Marking labeled on the inverter is based on the specifications of the Low Voltage Directive.
2. Adaptability to EMC Directive shall be determined in a complete plant equipped with the inverter.
3. Inverter's control circuit terminals are only basically insulated (protection against electric shock I, overvoltage category II, pollution degree 2). To meet requirements of CE Marking, final product shall be subject to insulation.
4. Make sure to ground the supply neutral.
5. Power supply input end of the inverter shall be equipped with protection devices for over current, short circuit and leakage of electricity.
6. Main circuit wiring (R/L1, S/L2, T/L3, U, V, and W) shall be connected with ring-type compression terminals.
7. The inverter is only used for fixed installation, not for other occasions.
8. Adaptability to Low Voltage Directive for the inverter:
   ① Protection against Electric Shock: I
   ② Overvoltage category: II
   ③ Pollution degree: 2
9. The capacity of relay output terminal mark A, B, C is 30V DC, 0.3A (resistive load).
10. Use the wire of a specified size with the allowable continuous operating temperature up to 70°C for the grounding.
11. Ambient Temperature: 40°C maximum.

Warranty

The products and specifications listed in this document are subject to change without prior notice as occasioned by the improvements that we introduce into our products. Therefore, when you consider the use of the product and place orders for the product, you may contact our customer service representatives and check that the details listed in this document are commensurate with the most up-to-date information.

We spare no efforts to give utmost care and attention to the quality of this product. However, to ensure optimal performance, we recommend that:

1) When our product is used beyond the range of the specifications, environment or conditions listed herein, or it is used in any environment or conditions not listed herein, or when you are considering the use of product in any condition or environment that is not specified herein, or when you are considering the use of our product for particular purposes for which high reliability is required such as safety environment and control systems used for the railroad, aviation or medical care industries, you should contact our customer service representatives and obtain proper specification sheets.

2) Consult with us for the specifications of your own products, end users, environment and conditions of use, installation locations etc. to prevent accidents caused by the items not listed herein.

3) Take safety measures (such as double interlock, etc.) to the external circuit of the product to ensure the safety of the whole system in case of abnormities caused by product failure or external factors; and always use this product within its limits and capacity mentioned in this document.

4) For the product you have purchased from us or with the product delivered to your premises, promptly perform an acceptance inspection; for handling of our product both before and during the acceptance inspection, give full attention to the control and preservation of our product.

【Warranty Period】
• The warranty period of this product is 3 years from either the date of purchase or the date on which the product is delivered to the location specified by the Buyer.
However, the warranty period (the so-called "3 years") shall be valid only until 42 months from the date of manufacture which includes a maximum of 6-month distribution period.

【Warranty Scope】

- In the event of any failure or obvious defect in the product due to the reasons solely attributable to Panasonic Electric Works, Panasonic Electric Works shall remedy such malfunctioning or defective product at its own cost in one of the following ways: i) repair such product; ii) replace such product; iii) supply of replacement parts.

  However, the warranty shall not cover the failures or defects arising from any of the following reasons.

1. Specifications, standards and handling procedures specified by the Buyer.
2. Modifications to the structure, performance or specifications performed by a party other than the Seller after the date of purchase or the date on which the product is delivered.
3. Phenomena that could not have been foreseen with the technology that was put into practical use at or after the time of purchase.
4. Cases that the range of conditions, circumstances or environment described in the manual or specification sheet are exceeded.
5. Damages that could be avoided if Buyer's product provides the function and structure generally accepted in the industry when this product is incorporated into Buyer's product.
6. Natural disasters or force majeure.
7. Consumable goods such as capacitor, cooling fan and relay or optional accessories such as cables.

   In addition, the warranty described herein shall only cover the single unit purchased or delivered by Panasonic Electric Works. Damages arising from failures or defects of this product are excluded from this warranty.

Revision History

Issue Date	Manual No.	Descriptions of Revision
November 2014	MC-MK300SSC	The 1st edition