ES600 Model Owner's Manual

voltage vector control universal inverter

Version No. 1.02.00

200V Series 0.4KW～110KW(0.5HP～150 HP)

400V Series 0.75KW～450KW(1HP～600HP)

Precautions before use

Before operating this product, please read and pay attention to the relevant safety information to ensure your own safety and product safety.

DANGER	☑ When handling wiring and installing the inverter, be sure to confirm whether the power supply is off. ☑ After the AC power supply is cut off, before the POWER indicator of the inverter is extinguished, it indicates that there is still high voltage inside the inverter. Please do not touch the internal circuits and components. ☑ Various circuit elements on the internal circuit board of the inverter are easily damaged by static electricity. Please do not touch the circuit board with your hands before taking anti-static measures. ☑ It is prohibited to modify the internal parts or circuits of the inverter by yourself. ☑ The inverter terminals ⏚ must be properly grounded in accordance with local regulations. ☑ The inverter and accessories should be installed far away from fire sources, heating elements and flammable materials.
WARNING	☑ Please do not connect input AC power to the inverter output terminals U/T1, V/T2, W/T3. ☑ The rated voltage of the power supply system installed by the inverter cannot be higher than 115V for 110 series models, 240V for 230 series models, and 480V for 460 series models. ☑ Only qualified electrical engineer professionals can install, wire and repair the inverter. ☑ Even if the three-phase AC motor is stopped, the main circuit terminals of the inverter may still carry dangerous high voltage. ☑ The motor is stopped, and dangerous high voltage may still be attached to the main circuit terminals of the inverter. ☑ Disinfection of the outer box packaging (including wooden boxes, wooden strips, cartons, etc.) during transportation and installation, and precautions for disinfestation : 1. If packaging materials such as wood or cartons need to be disinfected, dewormed, etc., steam fumigation is prohibited. If the machine is damaged due to the above, it will not be included in the warranty. 2. Please use other methods for disinfection, deworming and other environmental cleaning methods. 3. The high temperature mode may be used: As packing material may be a temperature above 56 ℃, allowed to stand for about 30 minutes or more.

■ When there are updates or modifications to the product files, you can download the latest version from website of Long Shenq Electronics Co., Ltd.

http://www.acinverter.com.tw

TABLE OF CONTENTS

Chapter 1 Safety Precautions

1.1 Marking instructions related to safety

- Please read this instruction manual carefully before installing, wiring, operating and checking the inverter. Please follow this instruction manual and install the drive according to the local standards.

- The following marks are used in this instruction manual to indicate that the site is an important element of safety. Failure to comply with these precautions may result in death or serious injury and damage to the product, related machines and systems.

WARNING	If operated incorrectly, it may result in death or serious injury.
DANGER	If the operation is wrong, it is very likely to cause death or serious injury.
INHIBIT	Prohibited actions during product use. Such as the forced operation is likely to result in death or serious injury.
HOT	The heat sink is a thermal element, please do not touch it.

1.2 Safety precautions

DANGER	**Please pay attention to all information about safety in this manual.** If you do not follow the warnings, it may result in death or serious injury. Injuries and equipment damage caused by your company or your company's customers failing to comply with the contents of this manual, our company will not take any responsibility. **To prevent electric shock, do not perform wiring work while the power is on.** Please cut off the power to all equipment before checking. Even if the power supply is cut off, there is residual voltage in the internal capacitor. The waiting time after the power is cut off should not be shorter than the time marked on the inverter.

WARNING	**Regarding safety measures when the machine is restarted, some systems may suddenly move when the machine is energized, which may cause death or serious injury.** Before powering on the inverter, make sure that there are no people around the inverter, motor, or machinery. In addition, please make sure that the cover, coupling, shaft key and machinery of the inverter are properly protected. **It is strictly prohibited to modify the inverter.** Otherwise, there is a danger of electric shock.If your company or your company's customers modify the product, our company will not take any responsibility. **Non-electrical professionals are not allowed to perform maintenance, inspection or component replacement.** Installation, wiring, repair, inspection and component replacement should be carried out by a person who is familiar with the installation, adjustment and repair of the inverter. **Do not remove the cover of the inverter or touch the printed circuit board when the power is on.** Otherwise, there is a danger of electric shock. **In order to prevent fire, please confirm whether the rated voltage of the inverter is consistent with the power supply voltage before powering on.** If the main circuit power supply voltage is used incorrectly, there is a danger of fire. **Making sure to hold the case during transporting the inverter.** If you carry the inverter by grasping the front cover or terminal cover, the inverter body will fall, which may cause injury.

Important	**When operating the inverter, please follow the steps specified in ESD prevention measures .**Otherwise, the internal circuit of the inverter will be damaged due to static electricity. **No withstand voltage test can be carried out on any part of frequency inverter.** This device uses precision semiconductor components, which may cause damage to the inverter due to high voltage. **Do not operate the damaged machine.**Ohterwise,it will aggravate the damage to the machine.If the machine is obviously damaged or parts are missing , do not connect or operate it. ◦ **Please follow the local electrical codes and regulations to protect the shunt and short circuit.** If the protection measures for shunting or short circuiting are not proper, the inverter may be damaged.

1.3 Before power on

DANGER	☑ The main circuit terminals must be wired correctly. Single-phase (R/L1, S/L2)/three-phase (R/L1, S/L2, T/L3) are power input terminals, and they must not be connected to U/T1, V/T2 , W/T3 mixed use; when mixed use, power transmission will cause damage to the inverter. ☑ When this product is used in some environments, electromagnetic interference may be caused, so please conduct proper tests before use, and be sure to do grounding works. ☑ Provide motor over temperature protection function.

WARNING	☑ The selected power supply voltage must be the same as the input voltage specification of the inverter. ☑ When moving the inverter, please do not take the front cover directly. It should be carried by the inverter body to prevent the front cover from falling off and avoid the falling of the inverter and causing personal injury or damage to the inverter. ☑ Please install the inverter on non-combustible materials such as metals. Do not install on or near flammable materials to prevent fire. ☑ If multiple inverters are placed in the same control panel, please add a cooling fan to keep the temperature in the panel below 40℃ (without dust cover below 50℃) to prevent overheating or fire. ☑ Please turn off the power, and then disassemble or install the keypad operator, and operate the fixed operator according to the figure, so as to avoid poor contact and cause the operator to malfunction or not display. ☑ The installation and use of the product must be carried out by qualified professional electricians. ☑ The installation of the product must be done by fixed wiring.

1.4 Wire

DANGER

- ☑ Installing or wiring any inverter, be sure to turn off the main power supply to avoid electric shock and fire.
- ☑ Engineers must have relevant professional knowledge to avoid electric shock and fire.
- ☑ Confirm that the ground wire is connected to the earth. (220V class : the ground impedance must be lower than 100 ohms ; 440V class : the ground impedance must be lower than 10 ohms) .
- ☑ Ground the inverter according to EN61800-5-1 . The wire size may have to be at least 10mm ^{2} (6AWG) to meet the standard for limiting leakage current.
- ☑ The ground terminal of the inverter must be properly grounded; if it is not properly grounded, be sure to unplug the ground wire of the control board to avoid damage to the electronic parts by the surge.
- ☑ RCD must meet the B -type leakage current protection standard.
- ☑ After the wiring is completed, please confirm that the emergency stop (function parameter control terminal) setting is valid. (The wiring responsibility belongs to the user).
- ☑ Do not directly touch the input/output power cord, and avoid all wiring contact with the inverter shell and short circuit.
- ☑ Do not perform withstand voltage test on the inverter, which may damage the semiconductor components.

WARNING

- ☑ Confirm that the input main power supply matches the inverter to avoid injury or fire.
- ☑ Please connect the braking resistor and the braking module according to the relevant wiring diagram, otherwise there is a risk of fire
- ☑ Please tighten the terminal screws with the specified torque to avoid the risk of fire.
- ☑ Do not connect the input power supply to the inverter output terminals.
- ☑ Do not connect electromagnetic contactor or electromagnetic switch contacts to output terminals.
- ☑ Do not connect the phase-in capacitor or LC/RC filter to the output circuit.
- ☑ Ensure that the interference generated by the inverter and motor will not affect the surrounding sensors or equipment.

1.5 Precautions before operation

WARNING

- ☑ Please confirm that the model capacity of the inverter is the same as the model capacity set by the function parameters of the inverter before power on.
- ☑ If the cable length between the inverter and the motor exceeds 25 meters, it is necessary to reduce the carrier frequency or install an output filter to reduce the overvoltage or oscillation at the load end and avoid damage to the motor.

1.6 Parameter setting

WARNING

- ☑ When setting the dynamic operation of the motor for automatic adjustment, do not connect the motor to the load (mechanical equipment).
- ☑ When the motor is set to run dynamically for automatic adjustment, the motor will rotate. confirm the space around the motor to avoid danger.

1.7 Operation

DANGER

- ☑ Please confirm that the front cover is installed before turning on the power.
- ☑ Do not switch in or disconnect the motor unit during operation, otherwise it will cause the inverter to trip over current, or damage the main circuit of the inverter in severe cases.
- ☑ When performing the reset function, do not approach the machine. After the fault is cleared, the machine will restart.
- ☑ Do not operate the machine when your hands are wet.
- ☑ Provide an independent emergency stop switch, this switch is used when the function parameters are set to enable.
- ☑ Provide an independent external hardware emergency switch, which can turn off the output of the inverter in a hazard.
- ☑ Please confirm that the operation command is off before returning to the warning.
- ☑ If you choose to restart automatically after power recovery, the inverter will start automatically after power is restored.
- ☑ Before executing the automatic adjustment, please ensure the status of the peripheral systems and mechanical equipment to ensure the safety of personnel.
- ☑ Regardless of whether the inverter is running or stopped, avoid touching the relevant terminals to prevent danger.
- ☑ After the power is cut off, the fan may continue to rotate for a while.
- ☑ Avoid electric shock! The internal DC capacitor of the inverter will not be discharged until 5 minutes after the power is removed. Please disassemble or inspect it 5 minutes after the power is removed. Wait 15 minutes for 15Hp or more.

WARNING	☑ The inverter can easily make the motor run from low speed to high speed. Please confirm the allowable range of the motor and machine. ☑ When using products such as brake modules, please pay attention to the relevant settings for their use. ☑ When the inverter is running, do not check the signal on the circuit board.

HOT	☑ Do not touch heating parts such as heat sinks and brake resistors.

1.8 During inspection,maintenance and replacement

DANGER	☑ Before performing maintenance and inspection, please make sure that the power has been turned off and the power LED indicator is off (please confirm DC voltage does not exceed 25 volts). ☑ There are high voltage terminals in the inverter terminals, please do not touch them randomly. ☑ When the power is on, be sure to install the protective cover, and after removing the cover, always disconnect the power through the circuit breaker. ☑ Except for the designated professionals, please do not perform maintenance inspections or replace parts.

WARNING	☑ The surrounding temperature of the inverter should be used in a non-condensing environment of 14℉～104(140)℉ (-10～+40(60)℃) and ambient humidity below 90%RH, but ensure that there is no dripping water and metal dust in the surrounding environment.

1.9 Precautions when the inverter is scrapped

WARNING	**When the inverter needs to be scrapped, please dispose of it as industrial waste and pay attention to the following :** ☑ The electrolytic capacitors on the main circuit of the inverter and the electrolytic capacitors on the printed circuit board may explode when burned. ☑ Poisonous gas is generated when the plastic parts such as the housing of the inverter are burned. ☑ Devices with electronic components cannot be disposed of together with domestic waste. They must be recycled separately with electrical and electronic waste in accordance with local regulations.

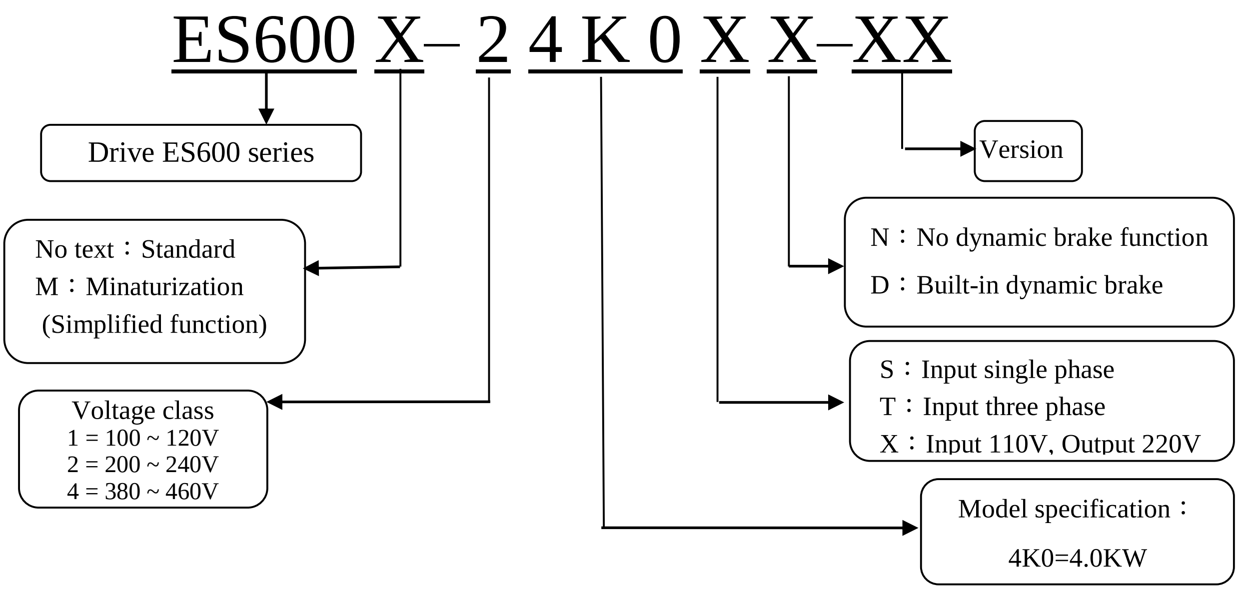
Chapter 2 Product Installation

2.1 Description of Nameplate

Found on one side of the ac drive,the nameplate bears model,specification,protection class and other information as described below.

Model No. →	MODEL : ES600-24K0-XX (VER X.XX.XX)
Input spec. →	INPUT : AC 3PH 200～240V 50/60Hz
Output spec. →	OUTPUT : AC 3PH 0 ～240V 6.0KVA
	16.0A cont 24.0A int
	4.0KW 5HP
Protection class →	PANEL. : IP20 NEMA 1
Series No. →	S/NO :

2.2 Model No. and power of ac drive

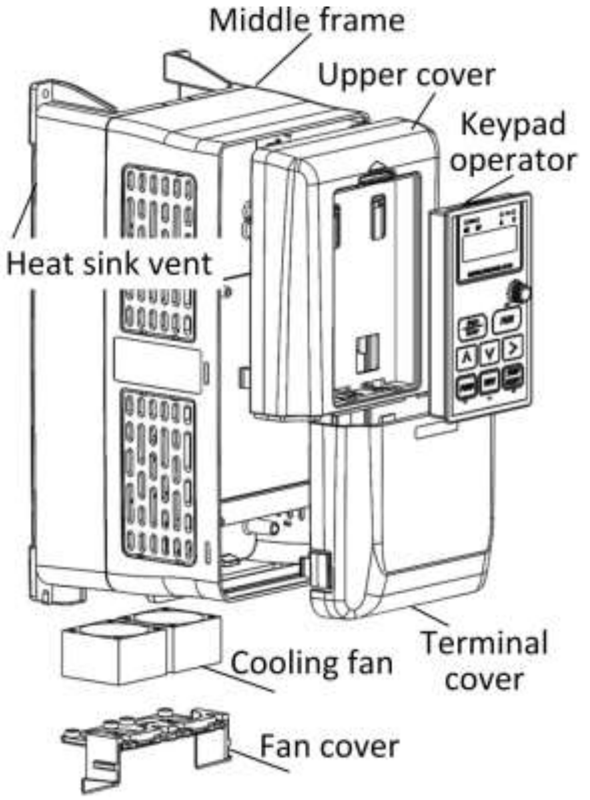


2.3 Comparison of inverter model specifications and motor power

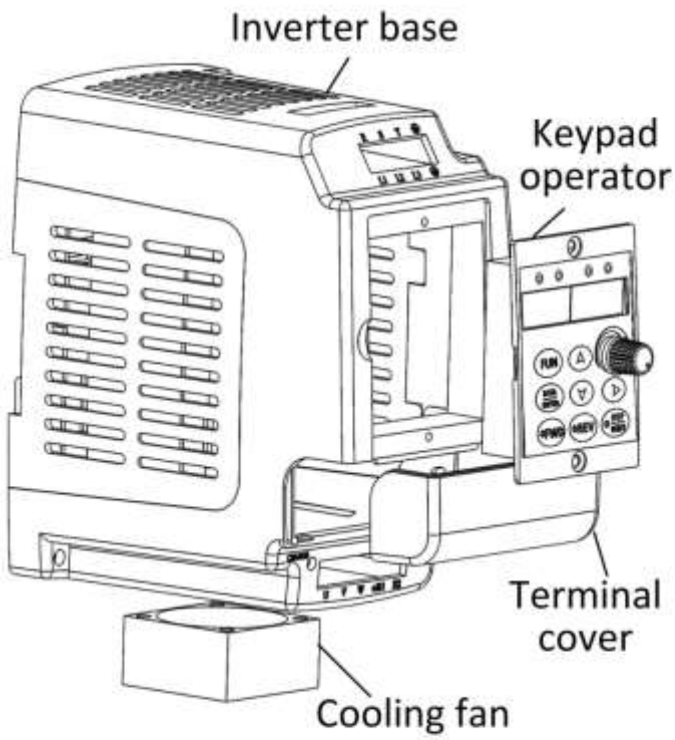
Model No.	Power(KW)	Model No.	Power(KW)	Model No.	Power(KW)
0K2	0.25KW	011	11KW	075	75KW
0K4	0.4KW	015	15KW	090	90KW
0K7	0.75KW	018	18.5KW	110	110KW
1K5	1.5KW	022	22KW	132	132KW
2K2	2.2KW	030	30KW	160	160KW
4K0	4.0KW	037	37KW	185	185KW
5K5	5.5KW	045	45KW	220	220KW
7K5	7.5KW	055	55KW		

2.4 Production Products means

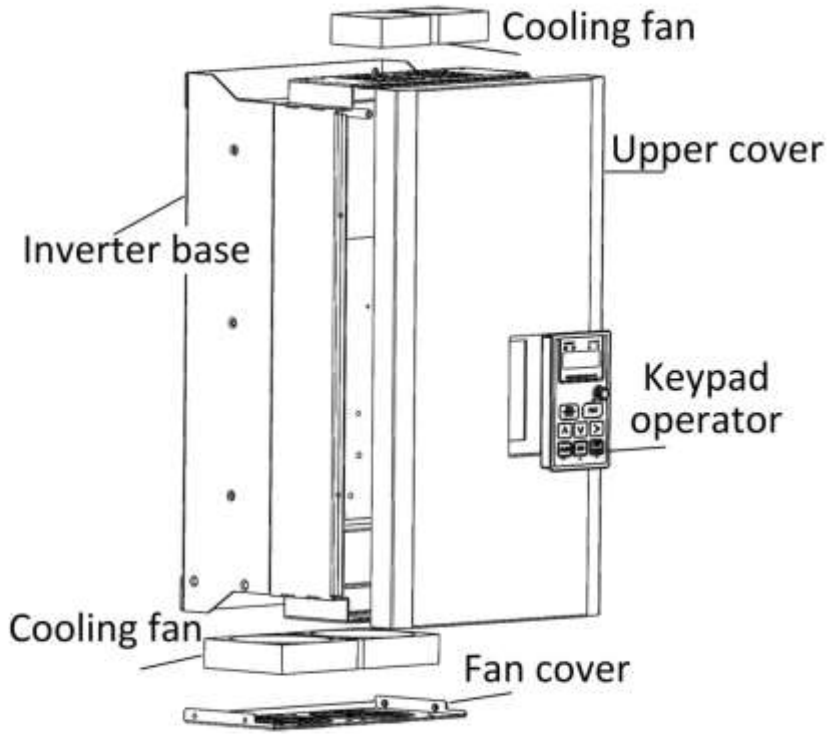
ES600-XXXXXX-A1



ES600M-XXXXXX-A1



ES600-XXXXXX-B1



Chapter 3 Surrounding Environment and Installation

3.1 Environmental requirements

The installation environment of the inverter has a direct impact on the normal functions of the inverter and its service life. Therefore, the installation environment of the inverter must meet the following conditions :

Surroundings	Condition
Installation site setup	Indoor
Ambient temperature	-10 ～+40 ℃ (closed wall mounting type) -10 ～+50 ℃ (In-panel mounting type) ◊ In order to improve the reliability of the machine, please use the inverter in a place where the temperature will not change rapidly. ◊ When using in a closed space such as a control panel, use a cooling fan or cooling air conditioner for cooling to prevent the internal temperature from exceeding the condition temperature. ◊ Please avoid freezing the inverter. 。
Humidity	◊Below 90%RH ◊Please avoid condensation of the inverter.
Environment	Please install the inverter in the following places : ◊ Places free of oil mist, corrosive gas, flammable gas, dust, etc. ◊ Metal powder, oil, water and other foreign objects will not enter the place inside the Inverter. ◊ Places free of radioactive materials and flammable materials. ◊ Places free of harmful gases and liquids. ◊ Places with little salt erosion. ◊ Places without direct sunlight.
Altitude	Altitude of 3000 meters or less, When the altitude is above 1000 meters, the rated capacity should be reduced by 2% for every 100 meters.
Vibration resistant	20Hz～50Hz 5.9m/s 2 (0.6G) or less, 20Hz or less 9.8m/s 2 (1G) or less
Installation direction	In order not to reduce the cooling effect of the inverter, be sure to install it vertically.
Storage temperature	-20 ～ +60℃

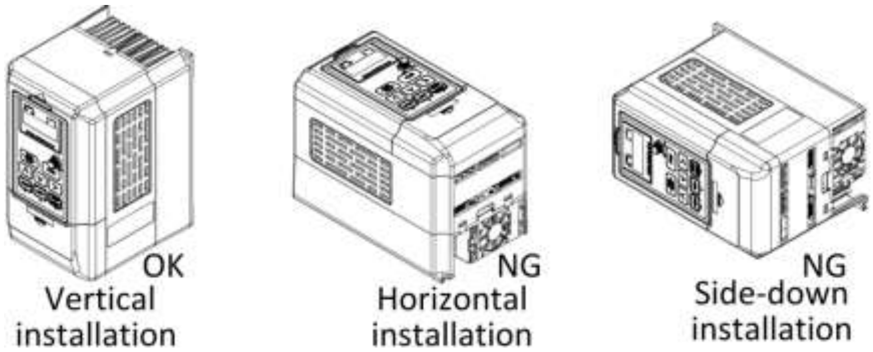
Important : Do not install equipment that generates electromagnetic waves or interference such as transformers around the inverter. Otherwise, it will cause the inverter to malfunction. If such equipment needs to be installed, a shield plate should be installed between it and the inverter.

Important : Regarding the prevention of foreign matter from entering during installation, please cover the upper part of the inverter with cloth or paper to prevent metal chips, oil, water, etc. from entering the inverter during drilling. After the job is over, be sure to remove the cloth or paper. If you continue to cover it, the ventilation will become poor and the inverter will generate abnormal heat.

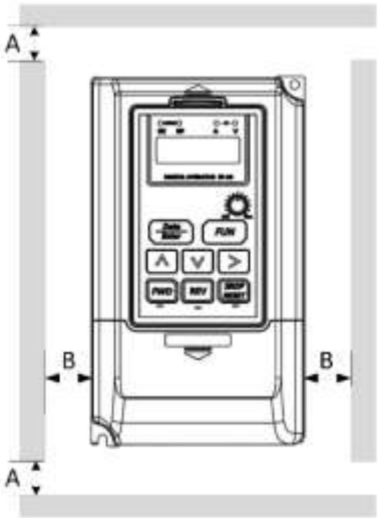
	In order to prevent fire, the drive disc is mounted in a closed box or cabinet, use a cooling fan or air conditioning to cool sufficiently to enable the cover mount (IP00) drive the intake air temperature is maintained at 50℃ or less , The air intake temperature of the enclosed wall-mounted inverter is kept below 40 ℃ . Otherwise it may cause overheating or fire.

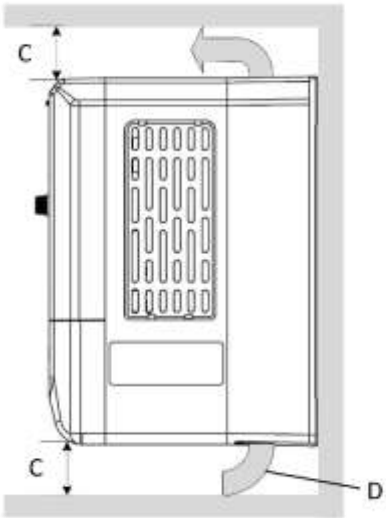
3.2 Installation direction and space

In order not to reduce the cooling effect of the inverter, be sure to install it vertically.



In order not to reduce the cooling effect of the inverter, appropriate space should be reserved during installation so that the air intake and exhaust of the cooling fan are not affected.



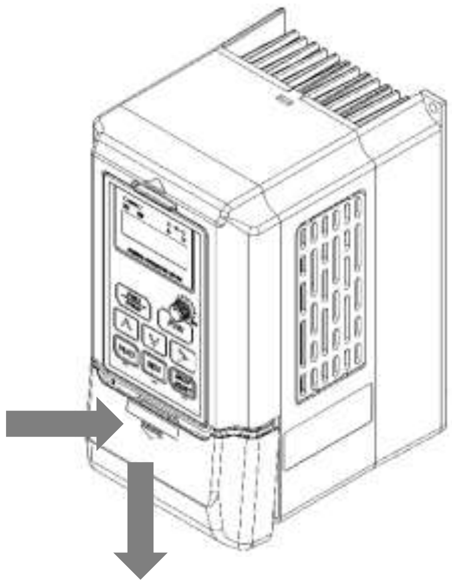


A = Above 50mm.
B = The inverter capacity is 18.5kw (Includes the following capacities), and the minimum recommended width is 30mm.
B = The inverter capacity is 22 kw (Including the above capacity), and the minimum recommended width is 50mm .
C = more than 120mm .
D = ventilation holes

- 🕮 The above A～C are the minimum required distances. If the distance is less than this distance, the cooling performance of the fan will be affected.
- 🕮 The inverter is equipped with a cooling fan. When the temperature rises to 45℃ after operation, the cooling fan will start to run. If the temperature rises to 88℃ (±3℃) under heavy load and full load or the ambient temperature is too high, Over temperature protection will be activated.
- 🕮 In poor places such as dust, grease, cotton lint, etc., regular cleaning and maintenance are required to ensure the cooling fan and heat dissipation function.

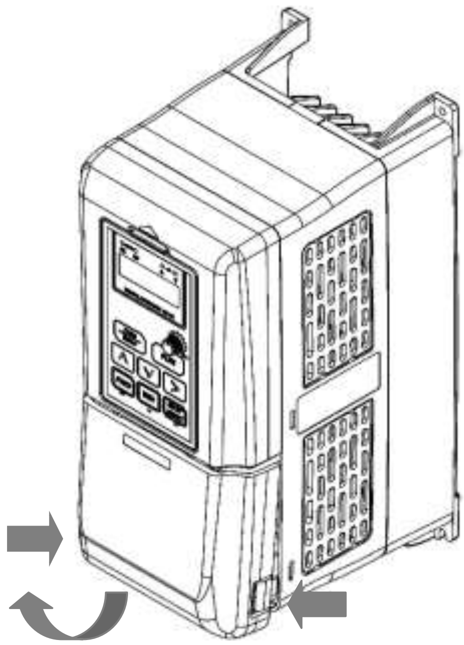
3.3 Disassembly and assembly of the product

ES600-XXXXXX-A1（FIG. A）



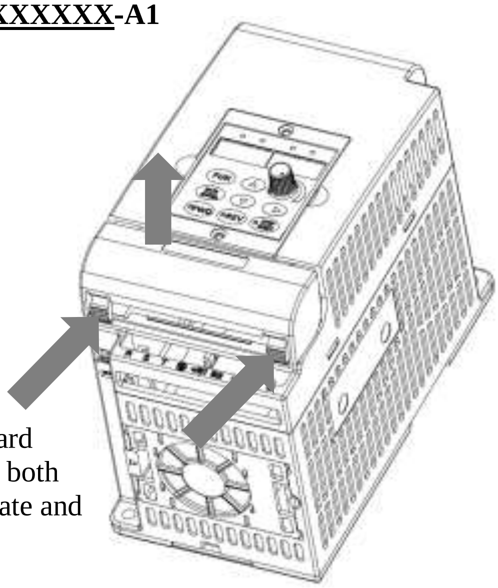
Press the arrow icon and pull it back out.

ES600-XXXXXX-A1（FIG. B）



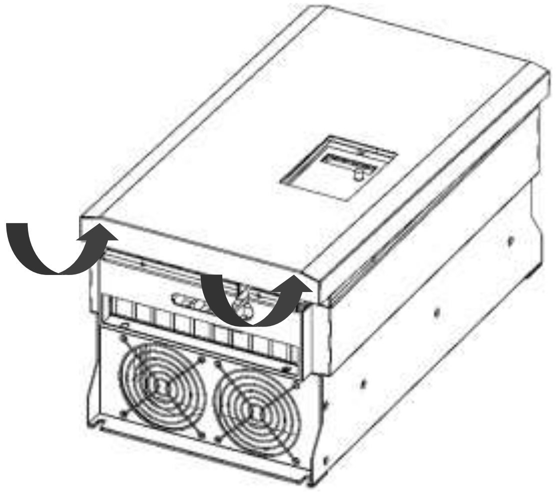
Press the card grooves on both sides to rotate and take out.

ES600M-XXXXXX-A1



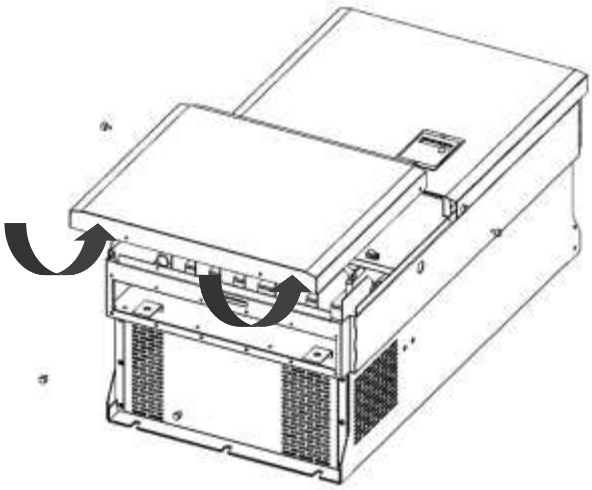
Press the card grooves on both sides to rotate and take out.

ES600-XXXXXX-B1（FIG. A）



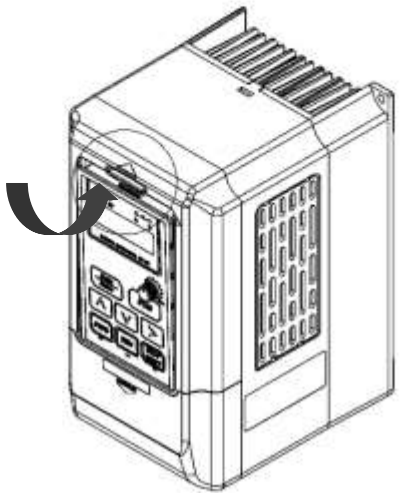
Resist PULL UP and push up.

ES600-XXXXXX-B1（FIG. B）

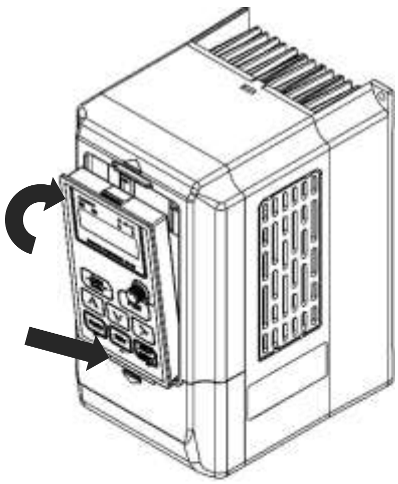


Remove the fixing screw and hold it against the
PULL UP and push it up.

Disassembly of the digital operator（Figure A）



Pull the card latch upward, and take out the digital operator after it pops out.



1. Clamp the two claws under the digital Manipulator Forward Cover and push the upper cover into the groove.
2. Press until you hear a "click" sound.

Chapter 4 WIRING

4.1 Safety precautions

DANGER	To prevent electric shock, do not perform wiring work while the power is on. Otherwise, there is a danger of electric shock.

WARNING	**To prevent electric shock :** ◊ Do not operate with the inverter cover removed, otherwise there will be a risk of electric shock. ◊ In order to illustrate the details of the product, the illustrations in this manual sometimes show the state of removing the outer cover or safety cover. ◊ Be sure to follow the instruction manual to operate the inverter with the specified cover or cover installed. ◊ Be sure to ground the ground terminal on the motor side, otherwise it may cause electric shock or fire due to contact with the motor casing. ◊ Don't perform work related to the inverter when you are wearing loose clothes or accessories on your body, and when you do not use goggles to protect your eyes. ◊ Do not remove the cover of the inverter or touch the printed circuit board when the power is on, otherwise there is a danger of electric shock. ◊ Only electric professionals are allowed to perform maintenance, inspection or component replacement, otherwise there is a danger of electric shock. ◊ Before wiring the inverter terminals, please cut off the power of all machines. Even if the power is cut off, there is still residual voltage in the capacitors inside the inverter. The waiting time after the power is cut off should not be shorter than the time marked on the inverter. **To prevent fire :** ◊ Please tighten the terminal screws according to the specified torque. If the connection of the main circuit wire is loose, it may cause a fire due to the overheating. ◊ Do not install the inverter on flammable materials, and avoid making flammable materials close to the inverter or attaching flammable materials to the inverter, otherwise there will be a risk of fire. ◊ Before power on, please confirm whether the rated voltage of the inverter is consistent with the power supply voltage. Please connect the brake resistor, the brake resistor unit and the brake unit according to the wiring diagram. Otherwise, there is a risk of fire. At the same time, it may damage the inverter, brake resistor, brake resistor unit and brake unit. **To prevent injuries:** ◊ Don't hold the front cover or terminal cover to carry the inverter. If you hold the front cover only, the main body will fall, which may cause risk of injury.

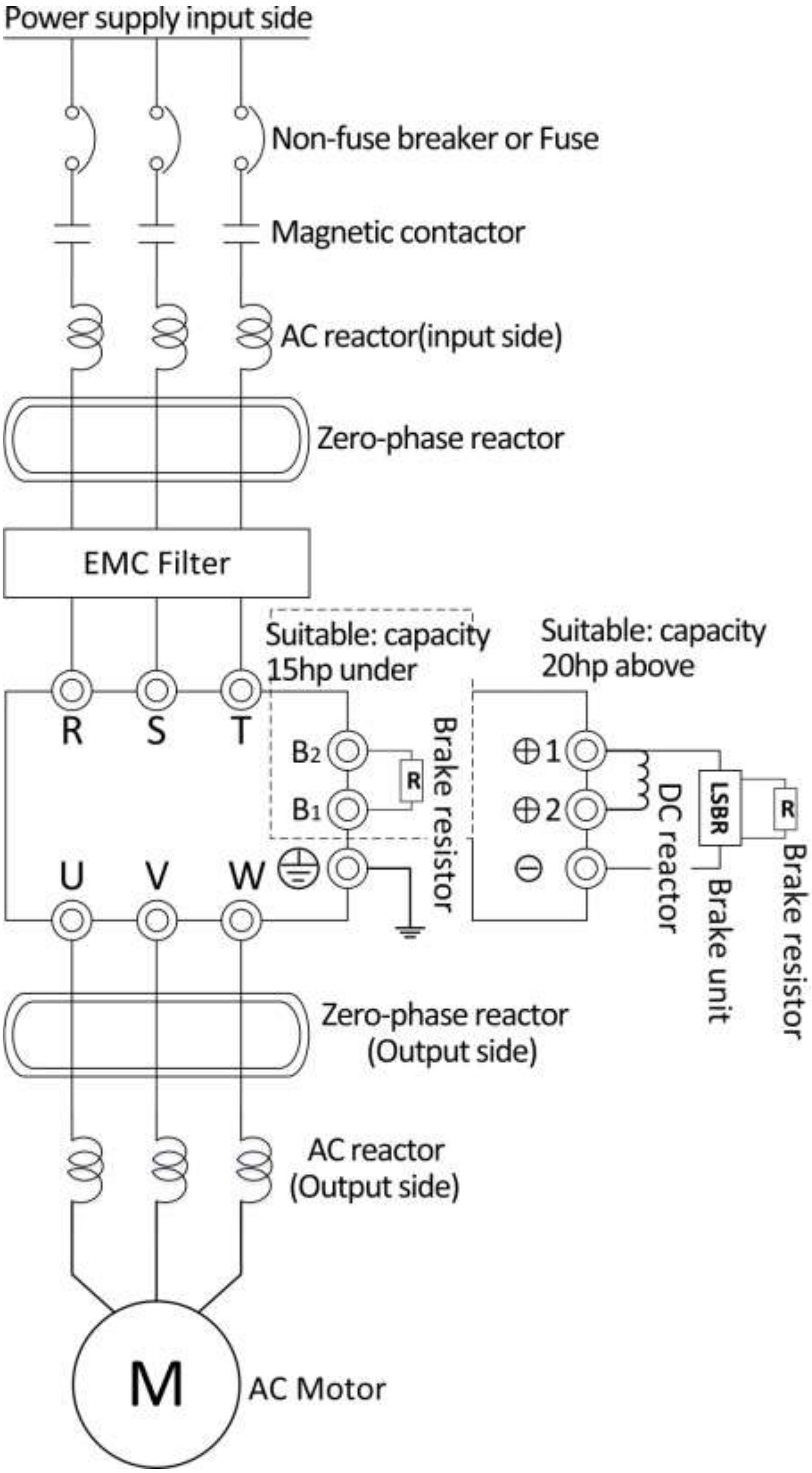
Important	◊ **When operating the inverter, please follow the steps specified in ESD prevention measures.** Otherwise, the internal circuit of the inverter will be damaged due to static electricity. ◊ **When the inverter is outputting voltage , do not unplug the motor wiring.** Otherwise, the inverter will be damaged. ◊ **When wiring the control circuit, do not use cables other than the shielded wire.** Otherwise it will cause the inverter to operate abnormally. Please use double-stranded shield wire and connect the shield layer to the ground terminal of the inverte. ◊ **Non -professionals do not wire.** Incorrect wiring may damage the circuit of the inverter or brake options. Please read the instructions carefully before connecting the brake option to the inverter。 ◊ **Do not change the circuit of the inverter.** Otherwise, the inverter will be damaged, and the repairs caused by this are not within the scope of our company's guarantee. Please never modify the inverter by yourself. If your company or your company's customers modify the product, the company will not be liable. ◊ **After the wiring of the inverter and other machines is completed, please make sure that all wiring is correct.** Otherwise,the inverter will be damaged.

4.2 System wiring diagram

System wiring diagram description

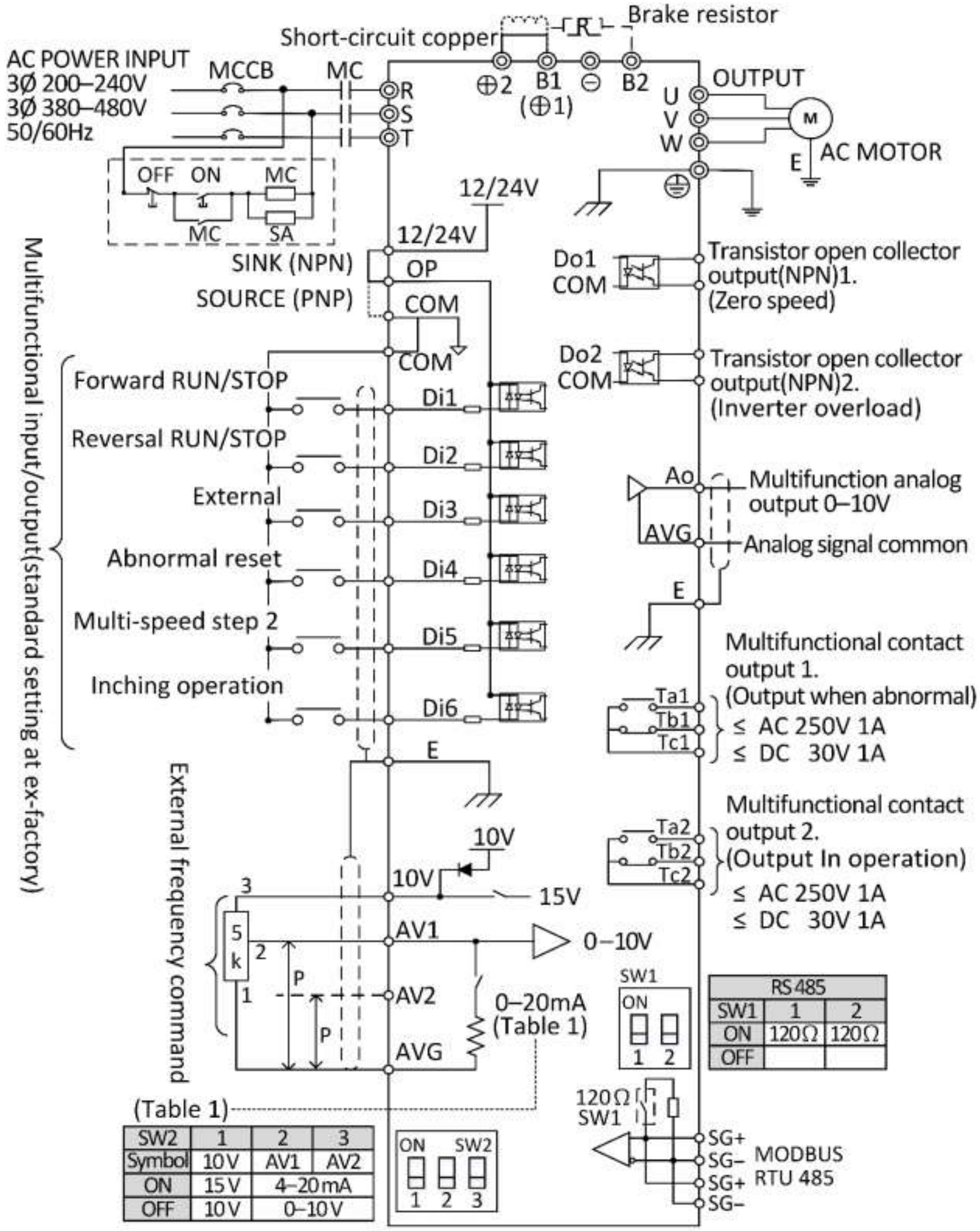
Power input
Please install the power supply according to the rated power specifications in the user manual.
NFB or fuse
There may be a large input current when the power is turned on. Please select an appropriate non-fused breaker or fuse.
Electromagnetic contactor
When installing an electromagnetic contactor (MC) on the power supply side, do not use this (MC) for frequent ON and OFF operations. To avoid causing inverter failure. The number of times when the MC is switched ON/OFF is limited to once every 30 minutes.
AC reactor (Input)
When connected to a large-capacity (above 600KVA) power transformer, or when the phase-in capacitor is switched, excessive peak current will flow to the input power circuit and damage the inverter. It is recommended to install an AC reactor to improve power factor. The wiring distance must be within 10m.
Zero-phase reactor
It is used to reduce frequency interference, especially in places with audio equipment, and at the same time reduce input and output side interference. The effective range is from AM band to 10MHz.
EMC filter
EMC filter can be used to reduce electromagnetic interference.
Braking resistor/ Module
It is used to shorten the motor deceleration time. Refer to test the contents of Chapter 10 shown. (Optional)
AC reactor (Output side)
When the output terminal is connected to the motor, the wiring length of the motor will affect the magnitude of the voltage reflected wave. When the wiring length of the motor is longer than 20 meters, it is recommended to install it (the closer to the inverter, the better the effect). (Optional)

System wiring diagram



4.3 Wiring of control circuit terminals

Control circuit wiring diagram(A) ⊙ ES600 Standardization



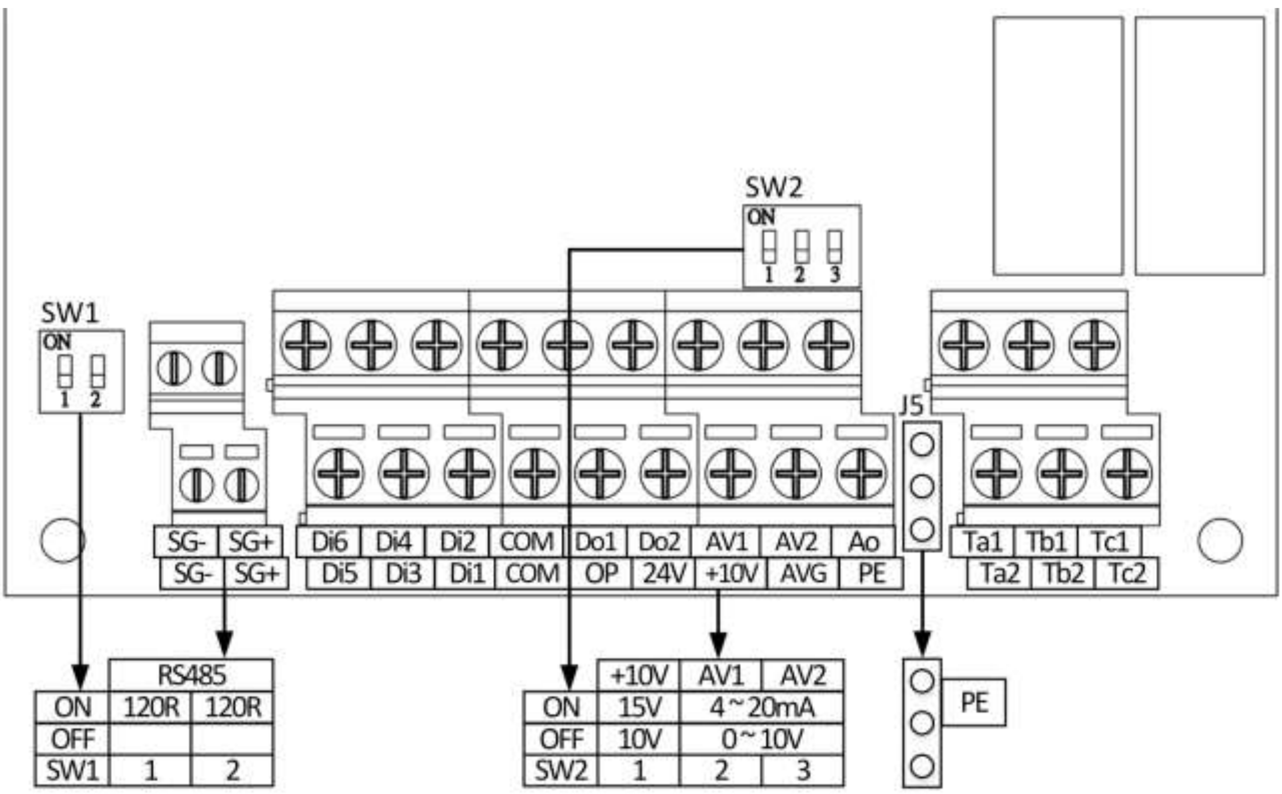
∗AV1 and AV2 need to configure P-046 and P-050.

∗The terminal symbol is +10V.When SW2 PIN1 switches to ON, the contact's output is 15V, and OFF is 10V.

Control circuit terminal configuration(A) ⊙ ES600 Standardization

SG-	SG+	Di6	Di4	Di2	COM	Do1	Do2	AV1	AV2	Ao	Ta1	Tb1	Tc1
SG-	SG+	Di5	Di3	Di1	COM	OP	24V	+10V	AVG	PE	Ta2	Tb2	Tc2

Mainboard, Jump configuration instructions（A）⊙ ES600 standardization



SW1 ： RS485, Terminal resistance 120 Ω.

SW2,PIN1 ： 10V terminal-power output 10V,15V selection.

SW2,PIN2 ： AV1 terminal-input voltage and current selection.

SW2,PIN3 ： AV2 terminal-input voltage and current selection.

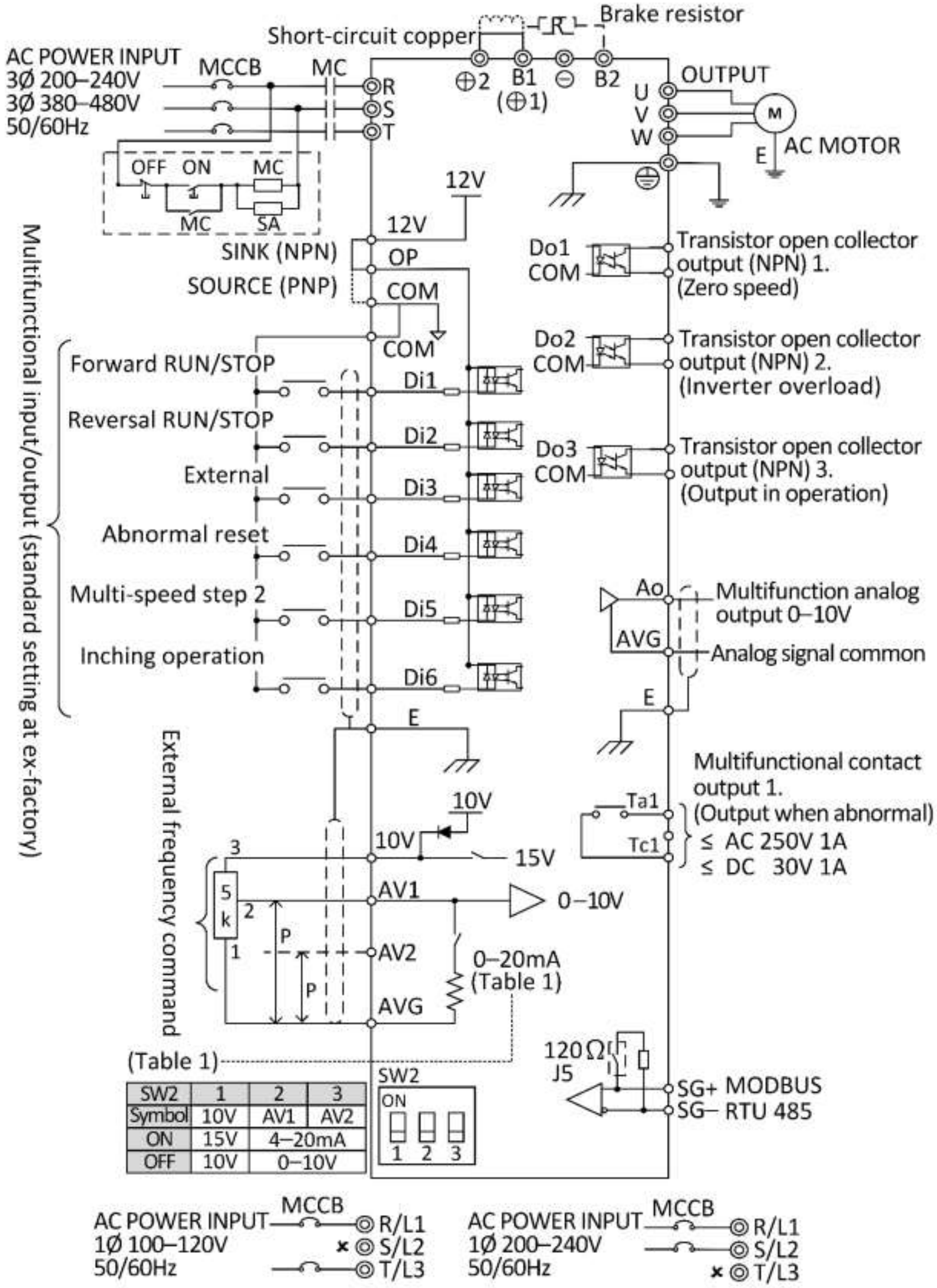
J5 ： PE terminal—When the inverter is not grounded or the grid is floating, the JUMP must be removed from the PE position.

Control circuit terminal function(A) ⊙ ES600 Standardization

Terminal mark		Terminals name	Content description
Multi-function Input Terminals	Di1	Forward command	When Di1-COM is connected (ON),it is forward rotation.On the other hand, Di1-COM is open(OFF),it is stopped.
	Di2	Reverse Command	When Di2-COM is connected (ON),it is reverse rotation.On the other hand, Di2-COM is open(OFF),it is stopped.
	Di3	Input when external fault input	When the external fault signal is ON,the inverter will trip off to stop.
	Di4	Fault reset	Use the control termainal ON (closed) to release the locked status when the fault protection circuit operates.
	Di5	Multistage speed command 2	Multi-stage speed command 2.The other Di is set to command 2,speed frequency can excute four-stage speed control with binary 2-bit when enabled.
	Di6	Inching(Jogging) operation	“ON” excute “Inching(Jogging) frequency”.
	COM	Common terminal for digital input	Reference ground for +24V output power supply.
PNP	COM	Common terminal for digital input	Reference ground for +24V output power supply.
	OP	Digital input signal	Common external power input.
NPN	24V	Input terminal voltage	Power supply +24V/200mA for input terminal working power supply.
Analog Frequency Setting	10V	Power supply for frequency setting	+10V/+15V power supply. (SW2 pin2 for optional setting)
	AVG	Analog output common terminal	The common terminal of analog power,input,output signals.
	AV1	Analog voltage frequency command	DC 0V～10V / 4mA～20mA input. (SW2 pin2 for optional setting)
	AV2	Analog voltage frequency command	DC 0V～10V / 4mA～20mA input. (SW2 pin3 for optional setting)
Multi-function Output Terminals	Do1	Detected in zero speed	This contact will be enabled “ON” status in stop status or below the zero speed level.
	Do2	Inverter Overload	It is ON when Inverter Overload (Er1).
	Ta1	Fault Output	When the fault protection function of the inveter is actived,it will output with 1a and 1b contact action.
	Tb1		*when fault output, Ta1-Tc1 is ON. Contact capacity: AC 250V 1A / DC 30V/1A
	Tc1		*when fault output, Tb1-Tc1 is OFF.

<table>
<tr><td rowspan="5">Multi-function Output Terminals</td><td>Ta2</td><td rowspan="3">In operation</td><td colspan="2">The inverter state is in the standby mode or in operation, and it outputs with 2a and 2b contact action.</td></tr>
<tr><td>Tb2</td><td>*During operation, Ta2-Tc2 is ON.</td><td rowspan="2">Contact capacity:
AC 250V 1A / DC 30V/ 1A</td></tr>
<tr><td>Tc2</td><td>*During operation, Tb2-Tc2 is OFF.</td></tr>
<tr><td>Ao</td><td>Reference output frequency</td><td colspan="2">Analog signal output 0V～10V.</td></tr>
<tr><td>AVG</td><td>Analog output common terminal</td><td colspan="2">The common terminal of analog power,input and output signals.</td></tr>
<tr><td rowspan="2">RS485 serial communication</td><td>SG＋</td><td>RS-485 series com interface</td><td colspan="2">RS485 serial communication port ‘Positive input’.</td></tr>
<tr><td>SG－</td><td>RS-485 series com interface</td><td colspan="2">RS485 serial communication port ‘Negative input’.</td></tr>
<tr><td></td><td>PE</td><td>Shield isolation ground terminal</td><td colspan="2">Covered isolation wire,connectuin selection ground wire dedicated</td></tr>
</table>

Control circuit wiring diagram(B) ⊙ ES600M miniaturization



SW2	1	2	3
Symbol	10V	AV1	AV2
ON	15V	4–20mA	
OFF	10V	0–10V	

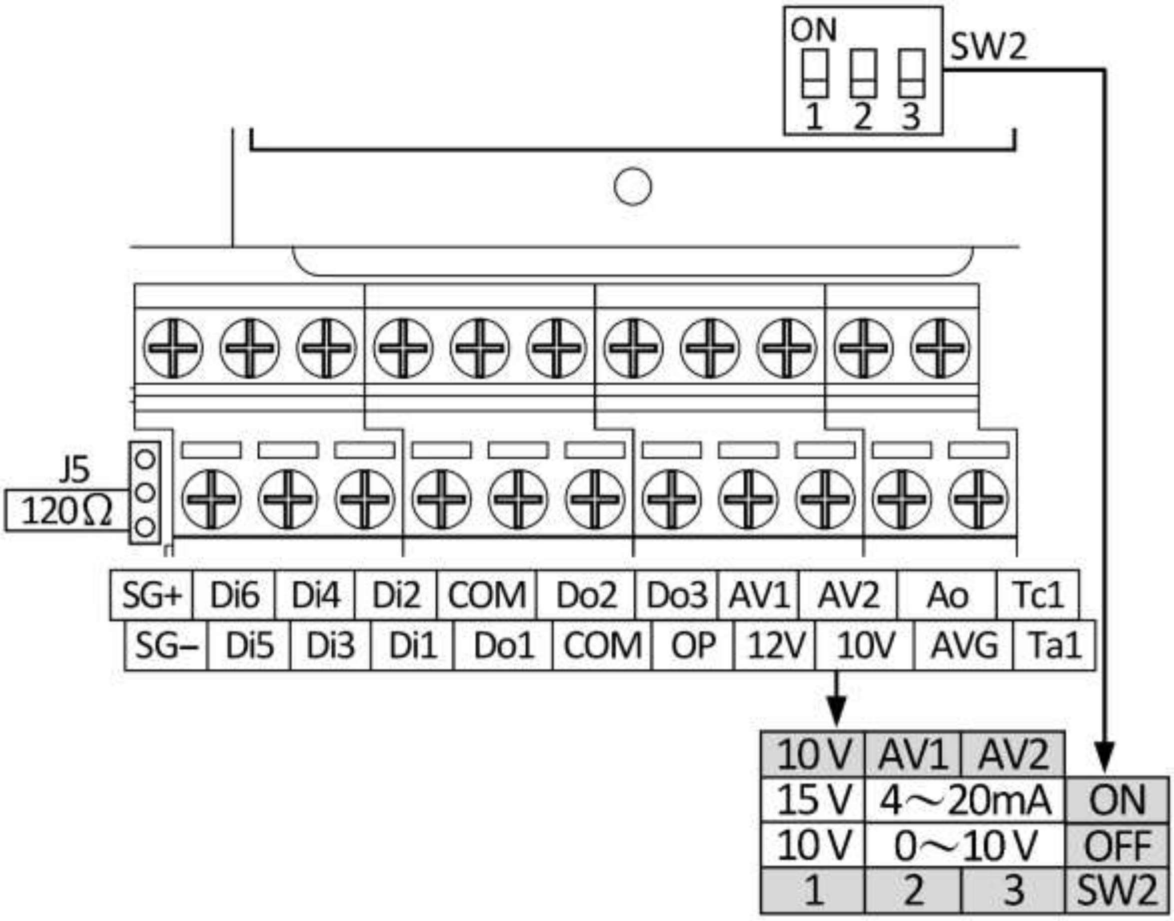
＊AV1 and AV2 need to configure P-046 and P-050.

＊The terminal symbol is +10V.When SW2 PIN1 switches to ON, the contact’s output is 15V, and OFF is 10V.

Control circuit terminal configuration(B) ⊙ ES600M miniaturization

SG+	Di6	Di4	Di2	COM	Do2	Do3	AV1	AV2	Ao	Tc1
SG-	Di5	Di3	Di1	Do1	COM	OP	12V	+10V	AVG	Ta1

Mainboard, Jump configuration instructions（B）⊙ES600M miniaturization



J5 ： RS485, Terminal resistance 120 Ω.

SW2,PIN1 ： 10V terminal-power output 10V,15V selection.

SW2,PIN2 ： AV1 terminal-input voltage and current selection.

SW2,PIN3 ： AV2 terminal-input voltage and current selection.

Control circuit terminal function(B) ⊙ ES600M miniaturization

Terminal mark		Terminals name	Content description
Multi-function Input Terminals	Di1	Forward command	When Di1-COM is connected (ON),it is forward rotation.On the other hand, Di1-COM is open(OFF),it is stopped.
	Di2	Reverse Command	When Di2-COM is connected (ON),it is reverse rotation.On the other hand, Di2-COM is open(OFF),it is stopped.
	Di3	Input when external fault	When the external fault signal is ON,the inverter will trip off to stop.
	Di4	Fault reset	Using the control termainal ON (closed) to release the locked status when the fault protection circuit operates.
	Di5	Multistage speed command 2	Multi-stage speed command 2.The other Di is set command 2,speed frequency can excute four-stage speed control with binary 2-bit when enabled.
	Di6	Inching(Jogging) operation	“ON” excute “Inching(Jogging) frequency”.
	COM	Common terminal for digital input	Reference ground for +12V output power supply.
PNP	COM	Common terminal for digital input	Reference ground for +12V output power supply.
	OP	Digital input signal	Digital input common terminal.
NPN	12V	Input terminal voltage	Power supply +12V for input terminal working power supply.
Analog Frequency Setting	10V	Power supply for frequency setting	+10V/+15V power supply.
	AVG	Analog output common terminal	The common terminal of analog power,input,output signals.
	AV1	Analog voltage frequency command	DC 0V～10V / 4mA～20mA input.(SW2 pin2 for optional setting)
	AV2	Analog voltage frequency command	DC 0V～10V / 4mA～20mA input.(SW2 pin3 for optional setting)

Multi-function Output Terminals	Do1	Detected in zero speed	This contact will be enabled "ON" status in stop status or below the zero speed level.
	Do2	Forward command	It is ON when the speed is in forward rotation.
	Do3	In operation	It is ON when the inverter state is in standby mode or in operation.
	Ta1	Fault Output	When the fault protection function of the inveter is actived,it will output with 1a and 1c contact action.
	Tc1		Contact capacity: AC 250V 1A / DC 30V/1A
	Ao	Reference output frequency	Analog signal output 0V～10V.
	AVG	Analog output common terminal	The common terminal of analog power,input,output signals.
RS485 serial communication	SG＋	RS-485 series com interface	RS485 serial communication port 'Positive input'.
	SG－	RS-485 series com interface	RS485 serial communication port ' Negative input'.

Power line connection notes :

- 🕮 Multi-function input terminals are dry contact characteristics. Any signal source with voltage should not be input. If contact input control is required, a contact with high reliability for low voltage signals should be used.

- 🕮 Control circuit wiring : After the main circuit wiring is separated from other cables or power lines, perform the control circuit wiring. Please make a 90-degree cross if you need to cross-connect.

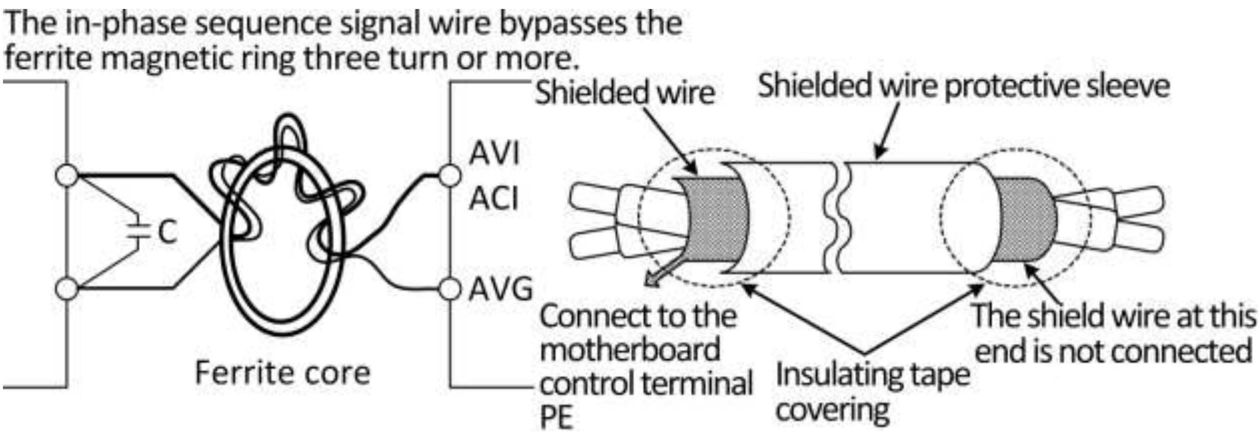
- 🕮 All input/output control signals, or the communication lines of the remote digital operation setting device, must be separated as far as possible from the high-current power lines (power, motor, brake). It is absolutely prohibited to be placed in the same trunking.

- 🕮 When the display light of the digital operator is on or the [CHARGE] light is on, do not connect or remove any wiring.

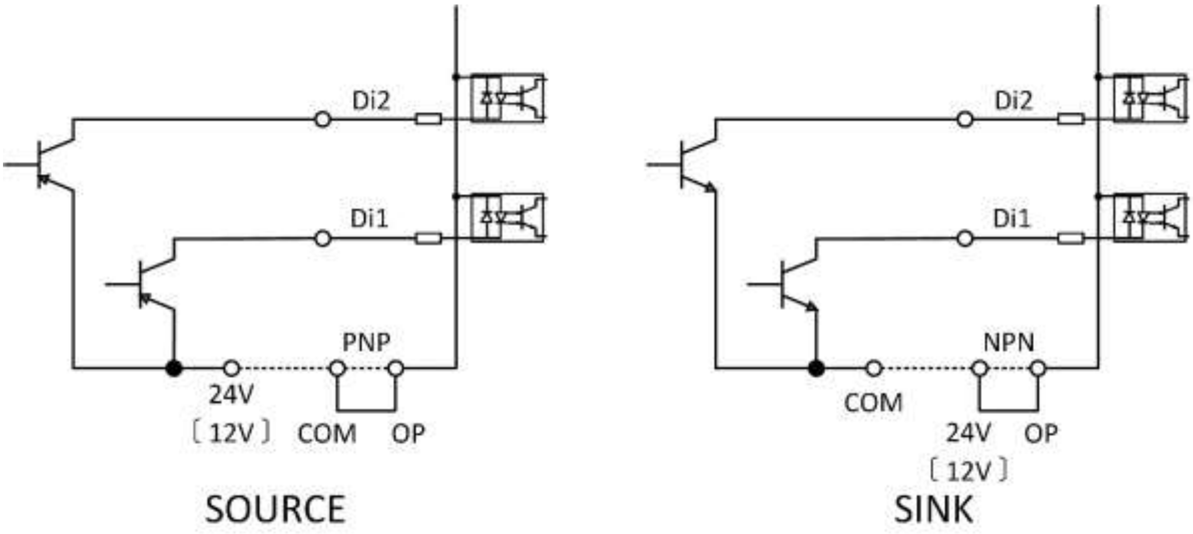
- 🕮 The analog input terminals (AVI, ACI, AVG) are connected to weak analog signals, which are more susceptible to external noise interference, so the wiring should not be too long (recommended to be less than 20m), and shielded wires should be used. In addition, the outer network the shielded cable must be well grounded. If the induced noise is large, the effect of connecting to the AVG terminal will be better.

- 🕮 When connecting the external analog signal,the interference caused by the analog signal and the AC motor driver may cause malfunction.When this happens,connect a capacitor and ferrite core on the external analog output side to suppress noise.As shown below.

- 🕮 In order to prevent noise interference, the control circuit wiring must use shielded isolation twisted wires, and the wiring distance should not exceed 20m. Please refer to the figure below.



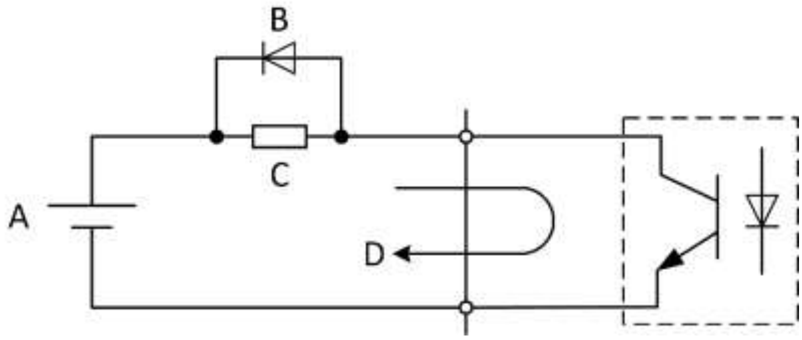
Sink mode (OP/24V〔12V〕) and Source mode (COM/OP) instructions



🕮 Do not assign the functions of frequent ON/OFF operations to the terminals Ta1, Tb1, Tc1, Ta2, Tb2, and Tc2. Otherwise, the life of the relay contacts will be shortened.

🕮 Multi-function contact output terminals Ta1, Tb1, Tc1 and Ta2, Tb2, Tc2, please separate wiring from other control circuits. Otherwise, it will cause the inverter and the machine to malfunction or trip.

🕮 Do output, when driving the control relay, a surge absorber or flywheel diode should be connected in parallel at both ends of the excitation coil, and pay attention to the correct polarity when connecting.



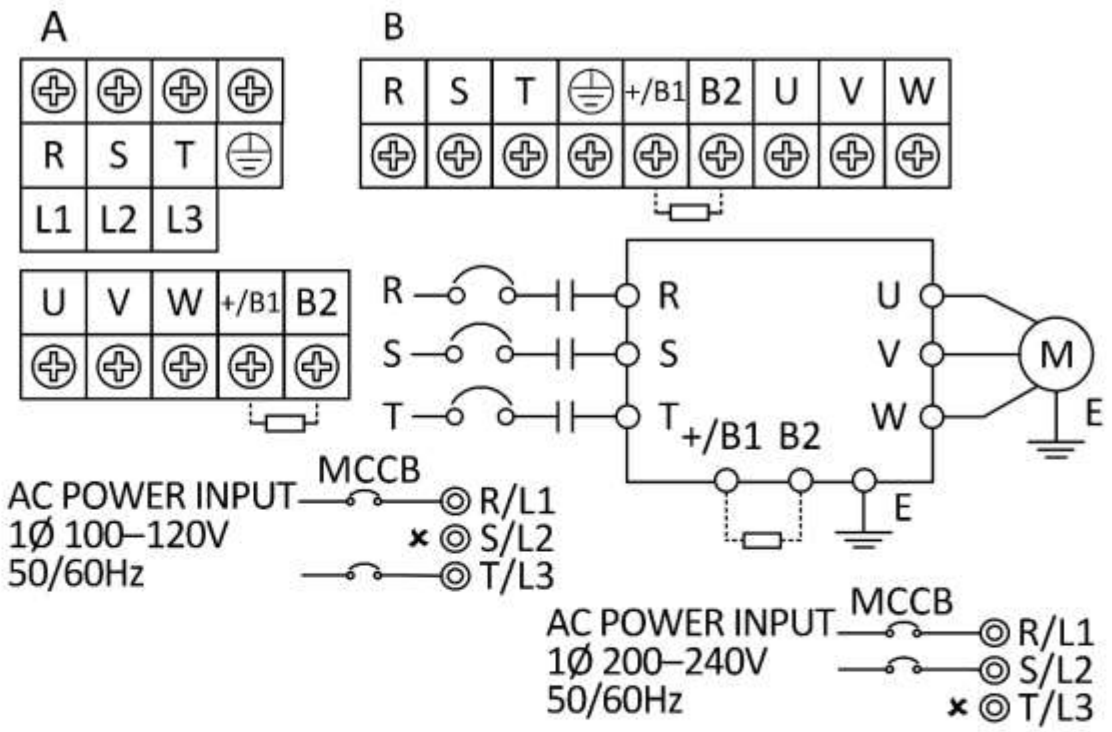
4.4 Main circuit terminals wiring

Main circuit terminal configuration description table

Terminal mark	Content description
R/L1, S/L2, T/L3	Power input terminal (Single- phase /3-phase) .
U/T1, V/T2, W/T3	AC motor driver output, connected to 3-phase induction motor or synchronous motor.
+1 、+2	For the connection end of the power improvement DC reactor, please remove the short-circuit piece when installing.
B1 、B2	Please purchase the braking resistor connection terminal according to the selection table .
-N 、 ⊖ 、P 、N	DC Busbar wiring.
⏚	Please use the third type of grounding for 200V series and special grounding for 400V series according to electrical engineering regulations.

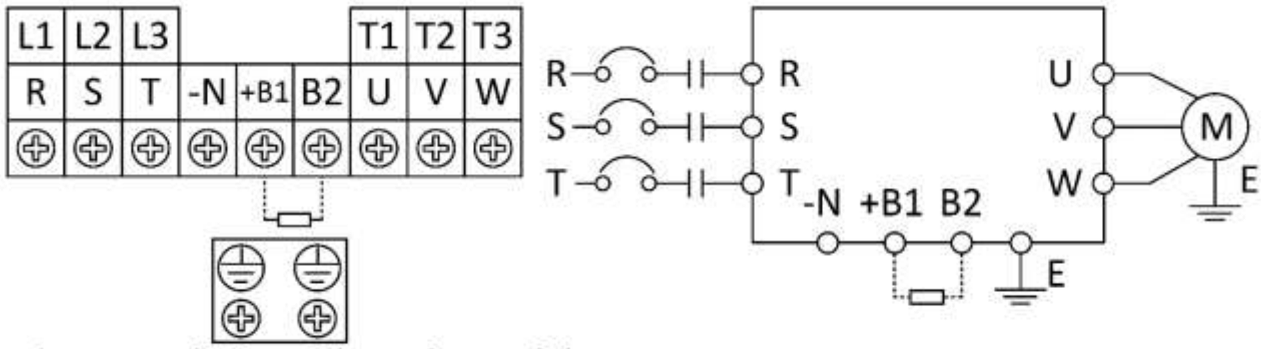
Main circuit terminal block configuration : ES600M miniaturization

220V	0.4 KW～2.2 KW（0.5～3 HP）	European standard terminal
440V	0.75 KW～4.0 KW（1～5 HP）	



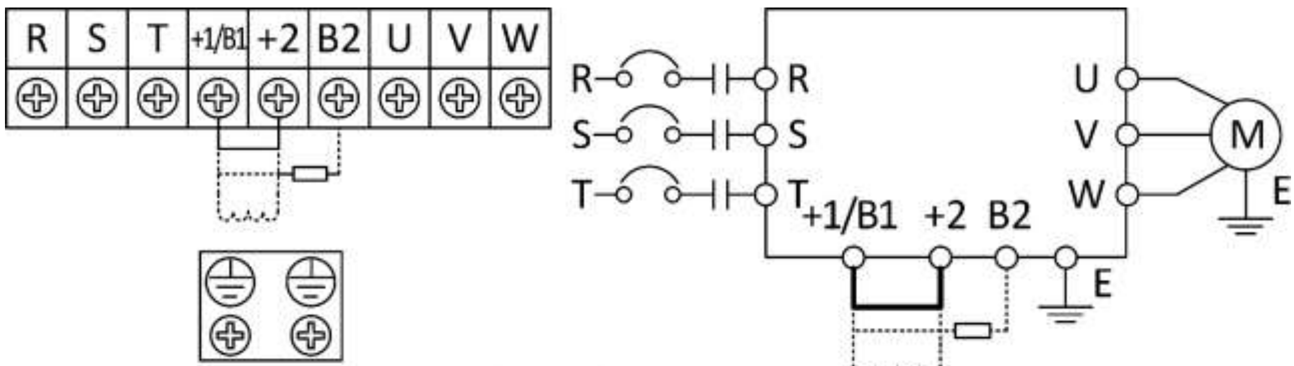
Main circuit terminal block configuration : ES600 standardization

220V	0.75 KW～5.5 KW（1～7 HP）	M4
440V	0.75 KW～7.5 KW（1～10 HP）	



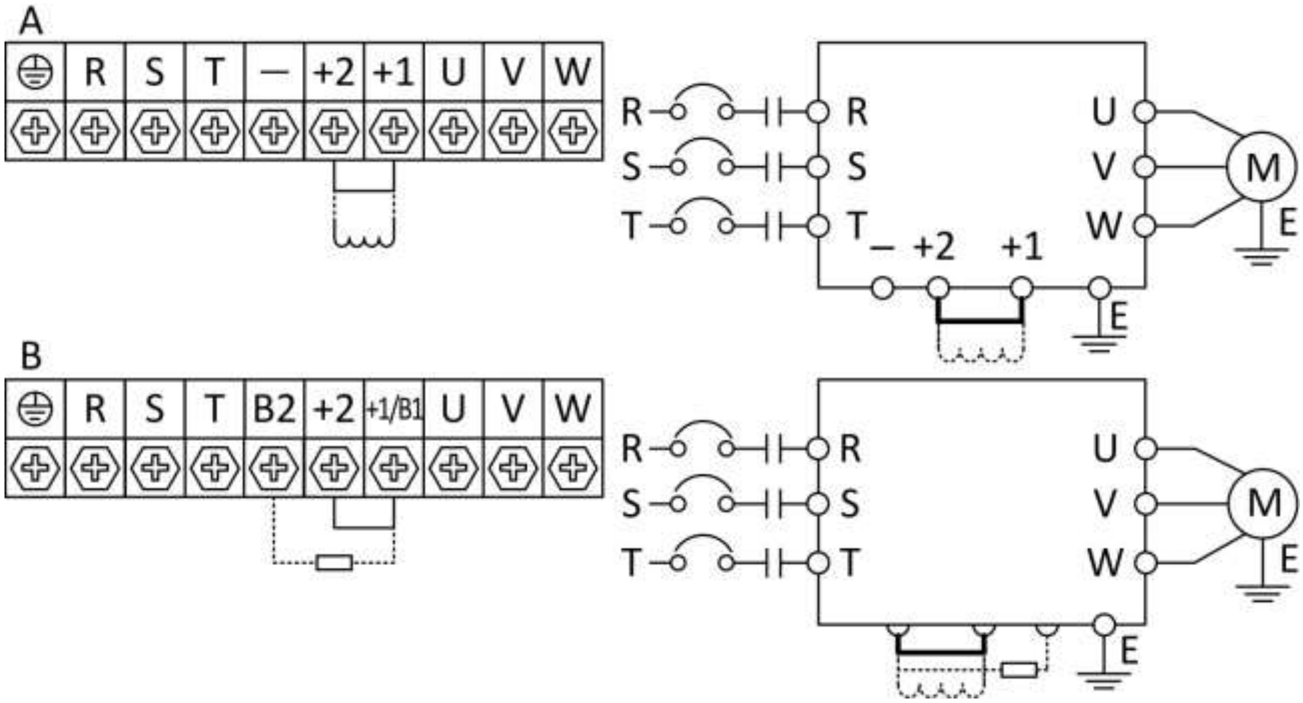
The ground terminal is in front of the power terminal block, M4 screw

220V	7.5 KW～15 KW（10～20 HP）	M6
440V	11 KW～18 KW（15～25 HP）	

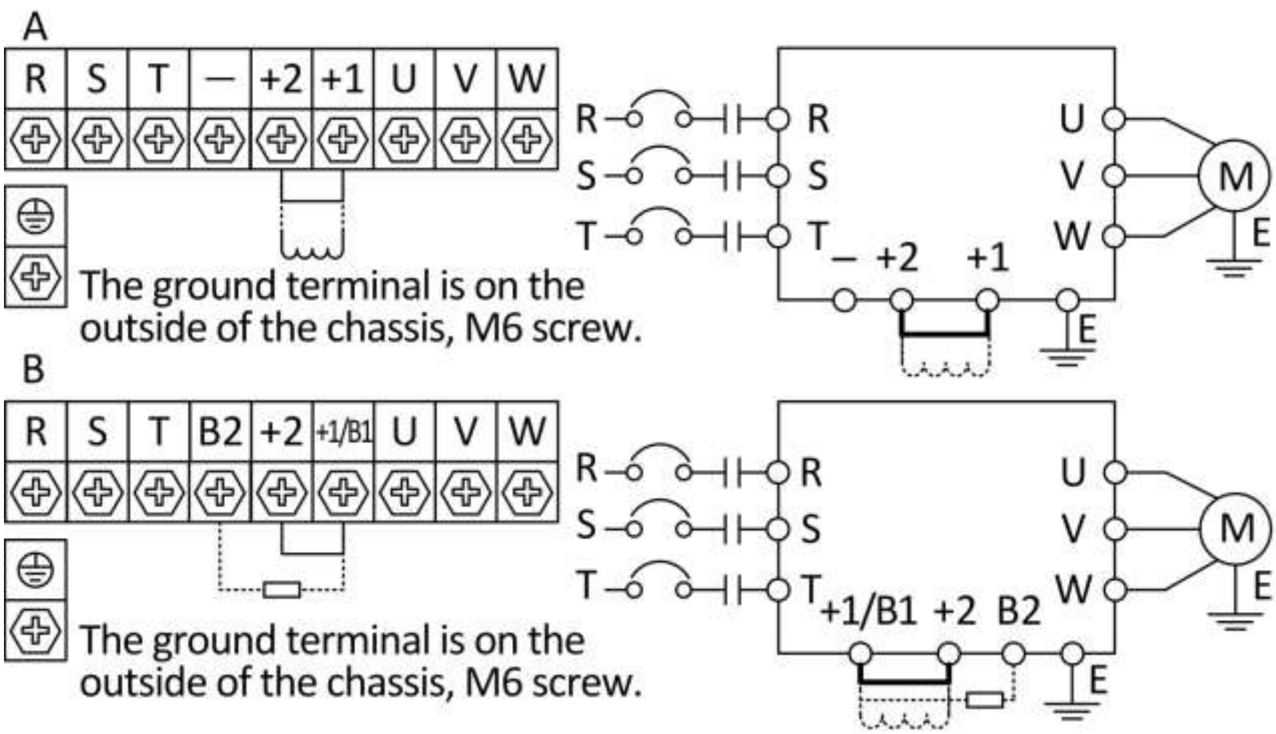


The ground terminal is in front of the power terminal block, M5 screw

220V	18 KW～30 KW（25～40 HP）	M6	A：Without BRAKE
440V	22 KW～37 KW（30～50 HP）		B：With BRAKE

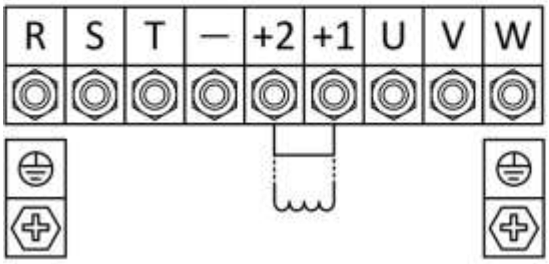


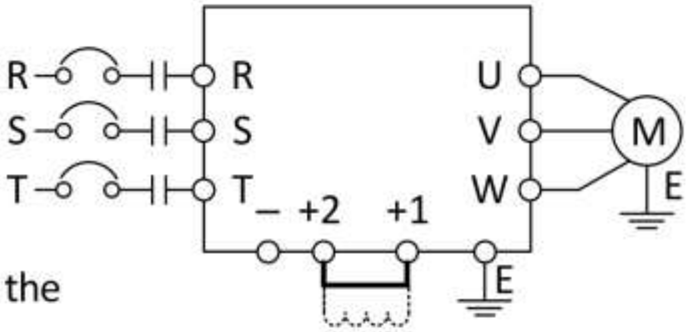
220V	37 KW～55 KW（50～75HP）	M8	A：Without BRAKE
440V	45 KW～75 KW（60～100 HP）		B：With BRAKE



220V	75 KW（100 HP）	M10 screw cap	A：Without BRAKE
440V	90 KW～132 KW（125～175 HP）		B：With BRAKE

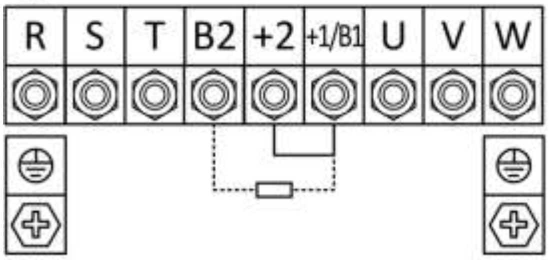
A

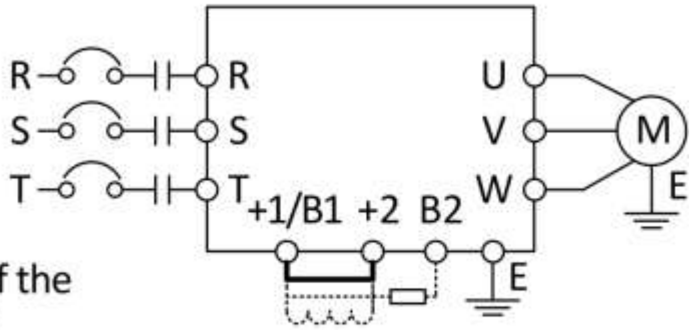




The ground terminal is in front of the power terminal block, M8 screw

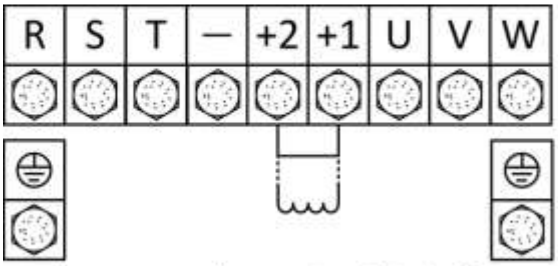
B

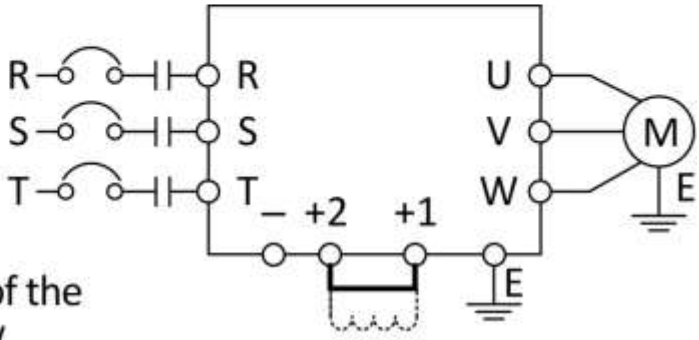




The ground terminal is in front of the power terminal block, M8 screw

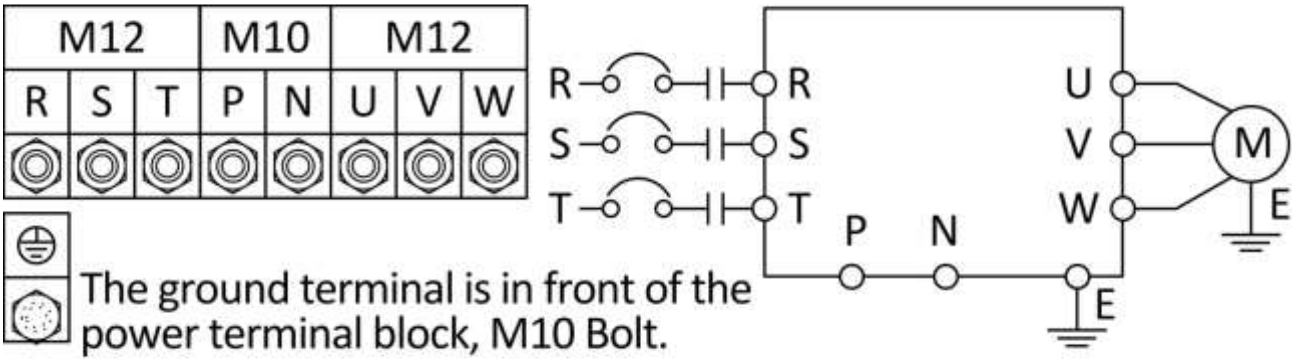
220V	90 KW～110 KW（125～150 HP）	M10 Bolt
440V	160 KW～220 KW（200～300 HP）	





The ground terminal is in front of the power terminal block, M8 screw

440V	260 KW～317 KW（350～425 HP）	M12、M10 screw cap



WARNING

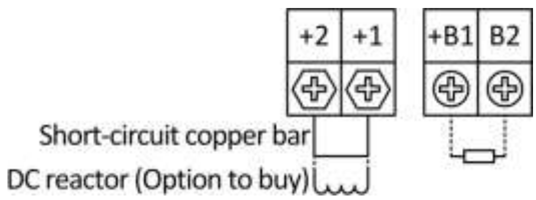
DC reactor connection terminals, external braking resistor connection terminals and DC test circuit terminals :

◊ The connection terminal of DC reactor improves the power factor. When leaving the factory, a short-circuit strip is connected to it. When connecting the DC reactor, take out this short-circuit piece first.

◊ When the reactor is not installed, be sure to lock the short-circuit piece to prevent the inverter from losing power or terminal damage. If the connection is loose, it may cause a fire due to overheating of the wire connection.

◊ If inverter is used with frequent deceleration and braking or short deceleration time (high-frequency operation and heavy load operation, etc.), please refer to below wire figure. When the braking capacity of the inverter is insufficient or in order to increase the braking torque, an external braking resistor also is needed.

◊ The braking resistor is connected to B1 and B2 of the inverter, and must not be connected to the other side terminals, otherwise the inverter and braking resistor will be damaged.



Please refer to the following table for the distance and specifications of the inverter's power input and output.

	Standard length of wiring	Wiring length limit
Power System → distance to the power terminal of the inverter	Within 2～ 30 meters	Within 30～ 300 meters
Inverter output terminal → to AC motor terminal	Within 2～ 25 meters	Within 25～ 200 meters
The solution to excessive wiring is as described on the right	It is recommended to install input and output reactors.	Mandatory installation of input and output reactors.

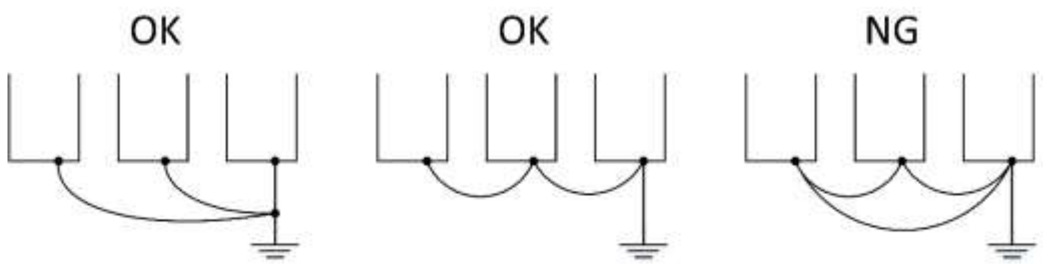
For surge absorbers and coils of inverter peripheral equipment such as electromagnetic contactors, relays, solenoid valves, etc., please connect surge absorbers in parallel to prevent noise interference. Please refer to the table on the next page for the use of surge absorbers

Voltage	User target audience	Surge absorber specifications
200V	Large capacity coils other than relays.	AC250V 0.5uf/200Ω
	Control relay	AC250V 0.1uf/100Ω
400V	Same as above	AC500V 0.5uf/220Ω

WARNING	If the length of the power line is too long, the motor and the power line will generate parasitic capacitance to the ground (low potential end), which will generate high voltage surges and directly damage the insulation withstand voltage of the inverter and the motor.

Ground wire :

1. For safety and noise reduction, the 200V series adopts the third grounding, and the 400V series adopts special grounding.
   📖 Ground impedance will be less than 10Ω.
2. Absolutely avoid sharing the grounding wire with large power equipment such as fusion splicer and power machinery, and keep it away from the power line of large power equipment as much as possible.
3. The size of the grounding wire is in accordance with the technical standards of electrical equipment. The shorter the grounding wire, the better.
4. When multiple inverters are grounded together, please refer to the figure below and do not form a ground loop.



About the wiring distance between the inverter and the motor :

1. When the system configuration requires that the wiring distance exceeds 100m, please take measures to reduce distributed capacitance (do not use metal sleeves outside the cables, separate the cables of each phase for wiring, etc.).

Wiring distance between inverter and motor	Below 50m	Below 100m	Over 100m
Carrier frequency	Below 15kHz	Below 5kHz	Below 2kHz

📖 When one inverter is connected to multiple motors, the wiring distance is the total wiring length.

WARNING

Wiring precautions：

◊ The power line input are terminal R.S.T and output terminal U.V.W are connected to the motor. They must not be connected by mistake, otherwise the inverter will be seriously damaged.

◊ Do not use phase-in capacitors, LC, RC noise filters and other components at the output of the inverter.

◊ The main circuit wiring of the inverter must be far away from the signal lines of other control equipment (such as PLC, weak current system) to avoid harmful interference.

◊ Between the AC main circuit power supply and the power supply side of the input terminal R.S.T, at least a non-fuse breaker must be installed or Install an electromagnetic contactor for overload to protect the circuit.

◊ The special leakage circuit breaker for the inverter, please select a sensitivity current above 30mA for each inverter.

◊ When using a general leakage circuit breaker, please select a sensitivity current of 200mA or more for each inverter, and the action time is 0.1 second or more.

◊ In order to reduce noise interference, please remember to install R—C surge absorbers at both ends of the coil of the electromagnetic contactor.

220V Series wiring table

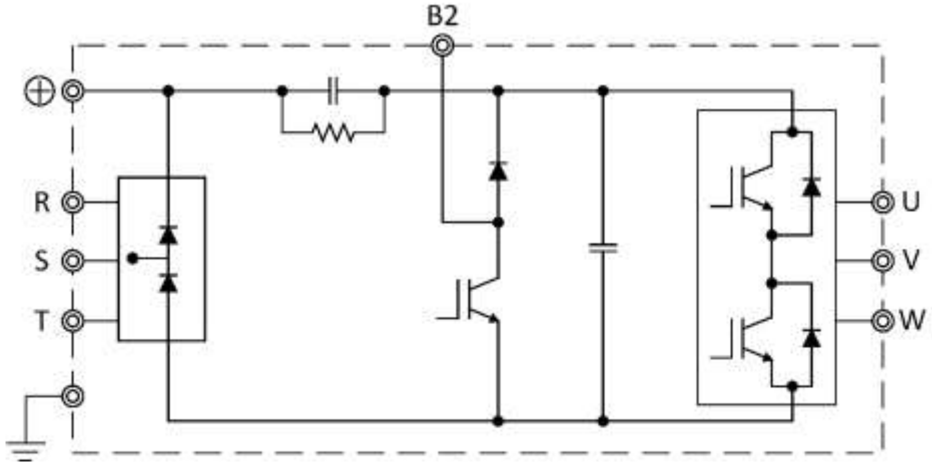
model	Rated KW	Horsepower	Wire diameter mm ^{2}	Screw specification	MCCB rated Current (A)	Control line mm ^{2}
20K4	0.4	0.5	2	M4	5	0.5 | 1.25
20K7	0.75	1	2	M4	10	
21K5	1.5	2	2	M4	15	
22K2	2.2	3	2	M4	30	
24K0	4.0	5	3.5	M4	40	
25K5	5.5	7.5	8	M4	50	
27K5	7.5	10	14	M6	60	
2011	11	15	14	M6	100	
2015	15	20	22	M6	125	
2018	18.5	25	30	M6	150	
2022	22	30	38	M6	175	
2030	30	40	60	M6	225	
2037	37	50	80	M8	250	
2045	45	60	100	M8	300	
2055	55	75	80 X 2	M8	400	
2075	75	100	80 X 2	M10	450	
2090	90	125	100 X 2	M10	500	
2110	110	150	125 X 2	M10	550	

400V Series wiring table

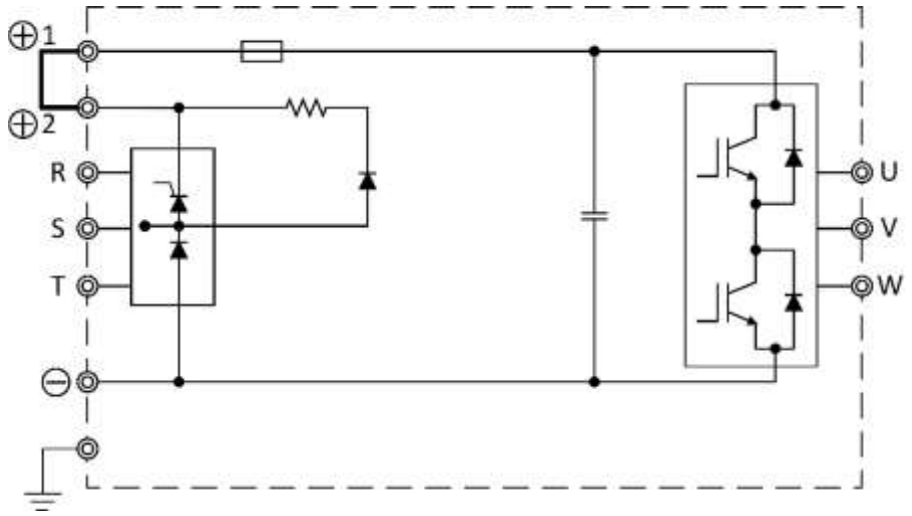
model	Rated KW	Horsepower	Wire diameter mm ^{2}	Screw specification	MCCB rated Current (A)	Control line mm ^{2}
40K7	0.75	1	2	M4	5	0.5 | 1.25
41K5	1.5	2	2	M4	10	
42K2	2.2	3	2	M4	15	
44K0	4.0	5	3.5	M4	20	
45K5	5.5	7.5	3.5	M4	30	
47K5	7.5	10	5.5	M4	40	
4011	11	15	8	M6	50	
4015	15	20	14	M6	60	
4018	18.5	25	14	M6	75	
4022	22	30	14	M6	100	
4030	30	40	22	M6	125	
4037	37	50	30	M6	150	
4045	45	60	38	M8	175	
4055	55	75	60	M8	200	
4075	75	100	80	M8	225	
4090	90	125	150	M10	250	
4110	110	150	150	M10	275	
4132	132	175	200	M10	300	
4160	160	200	250	M10	350	
4185	185	250	125 X 2	M10	400	
4220	220	300	150 X 2	M10	450	
4260	260	350	80 X 4	M12		
4280	280	375	80 X 4	M12		
4315	315	425	80 X 4	M12		

4.5 Internal wiring diagram of the main circuit

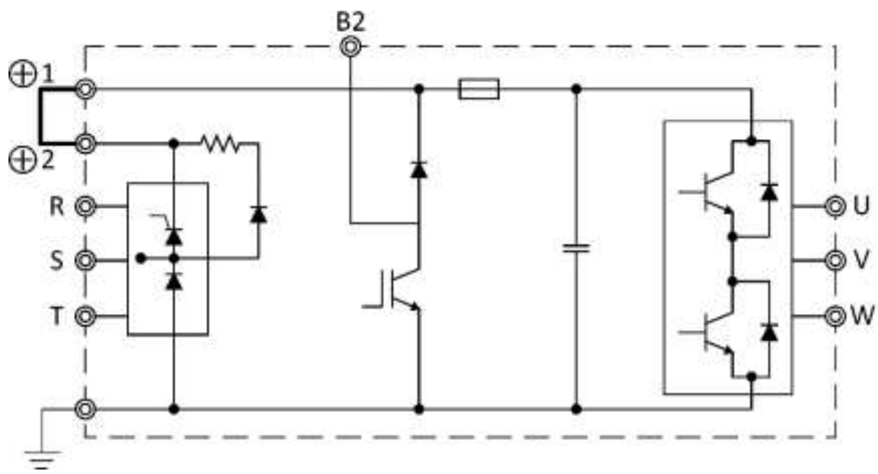
200V Series ES600-20K4～2011	400V Series ES600-40K7～4011



200V Series ES600-2015～2055	400V Series ES600-4015～4075

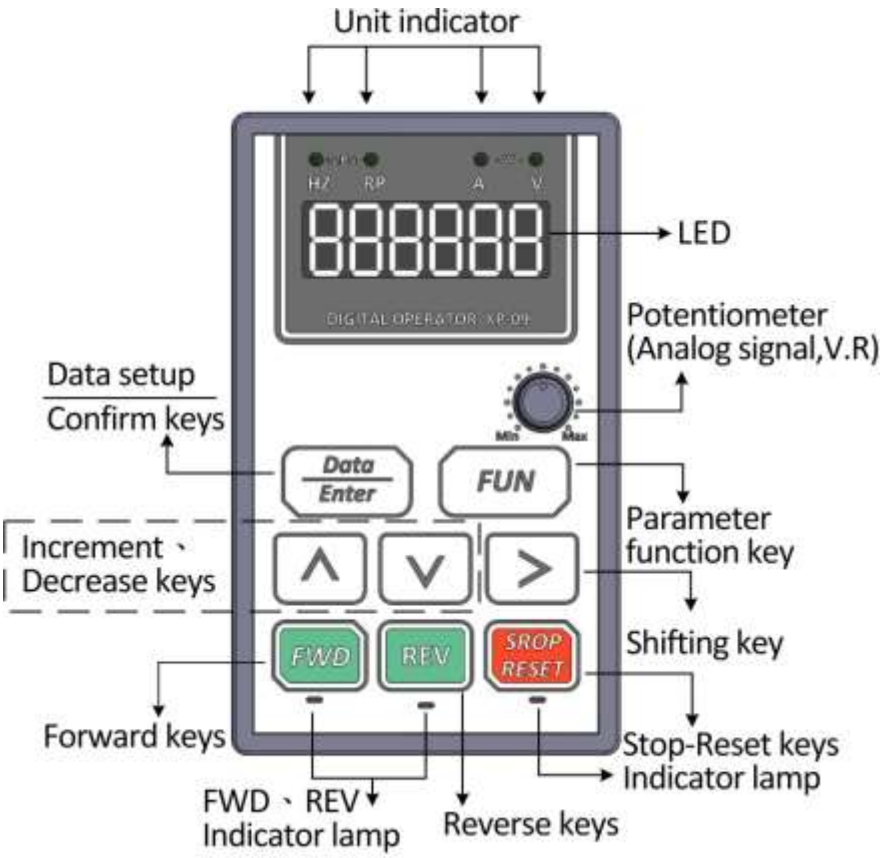


200V Series ES600-2015～2055（With Brake circuit）	400V Series ES600-4015～4075（With Brake circuit）



Chapter 5 Digital Keypad

5.1 Position name of digital keypad operator



The function of digital keypad operator

It can perform functions such as operation, frequency setting, operation status monitoring, parameter setting, fault codes display, parameter storage and parameter reading.

Parameter storage

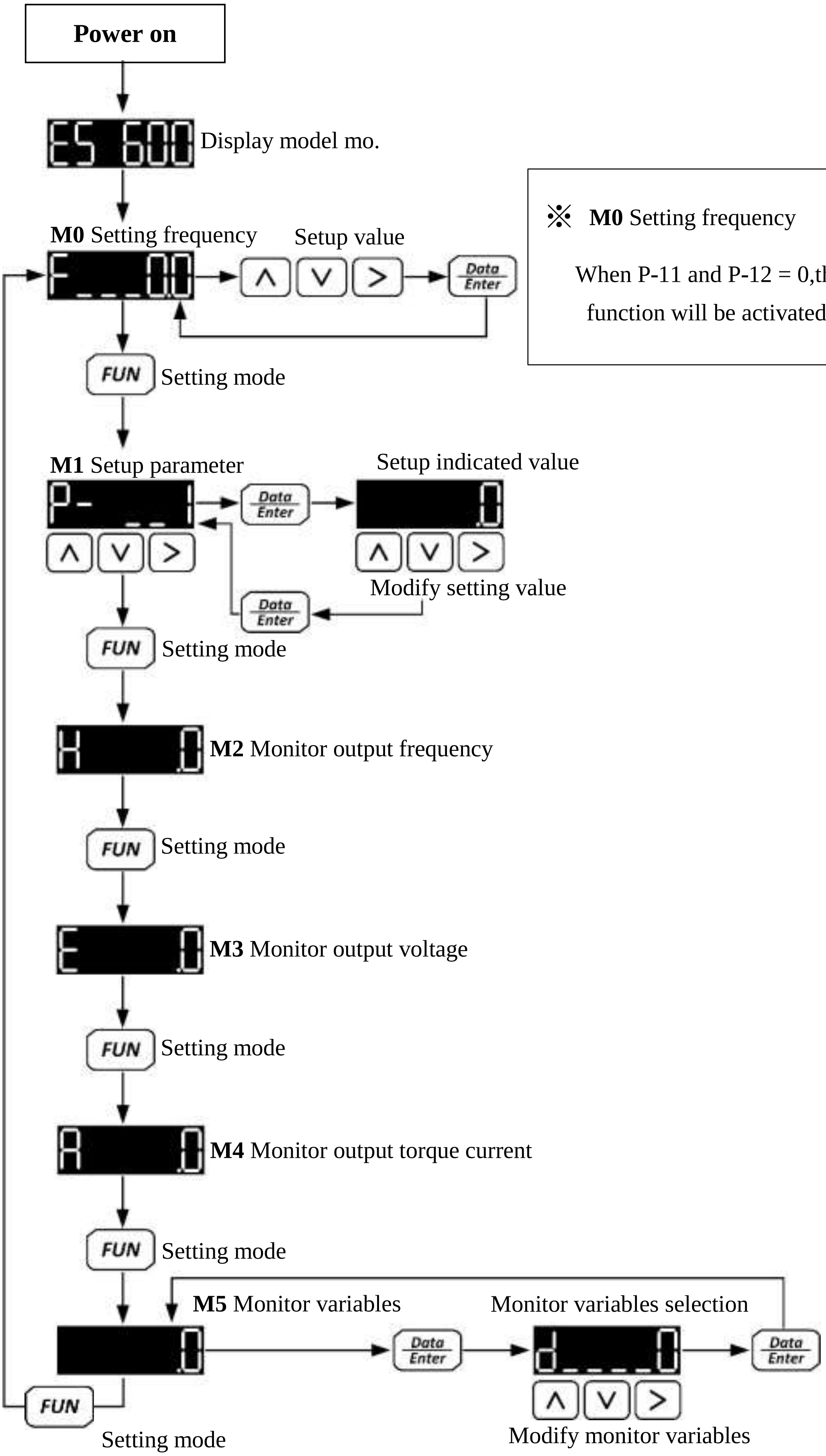
When all the parameter values have been confirmed and the test run has reached the required purpose, the content value will be automatically stored in the EEPROM of the DSP.

If all the confirmed parameter values need to be retained and can be read back by the user at any time, they can set P122 (save/read parameter page number), and with the operation process of "parameter EEPROM storage/read".The parameter will be stored in the EEPROM specified by the user.

5.2 Overview of Digital Keypad Operator

Classific-ation	Button	Function summary
Parameter／Data keys	FUN	Enter the mode to cycle the display key.
	Data Enter	To read, and write parameter settings.
		To confirm and enter data, and save the data at DSP (interior of RAM) automatically.
Shift／increase, decrease	>	To move the position of flashing cursor rightward to select the place for data entry.
	∧	Parameter code, setting value, etc., increase the value.
	∨	Parameter code, setting value, etc., decrease the value.
Operation command keys	FWD	To use the keypad operator to execute the forward rotation command and illuminate the LED light to indicate.
		When the steering limit does not execute the forward rotation command, it is the function key for the stop operation command.
	REV	To use the keypad operator to execute the reverse rotation command and illuminate the LED light to indicate.
		When the steering limit does not execute the reverse rotation command, it is the function key for the stop operation command.
	STOP RESET	To excute the stop operation command, and light up the LED indicator.
		When an fault occurs, it is used as an failure reset key.
Speed command		Keypad operator the AV (VR, Potentiometer) of the speed control.

5.3 Operation process of digital keypad operator



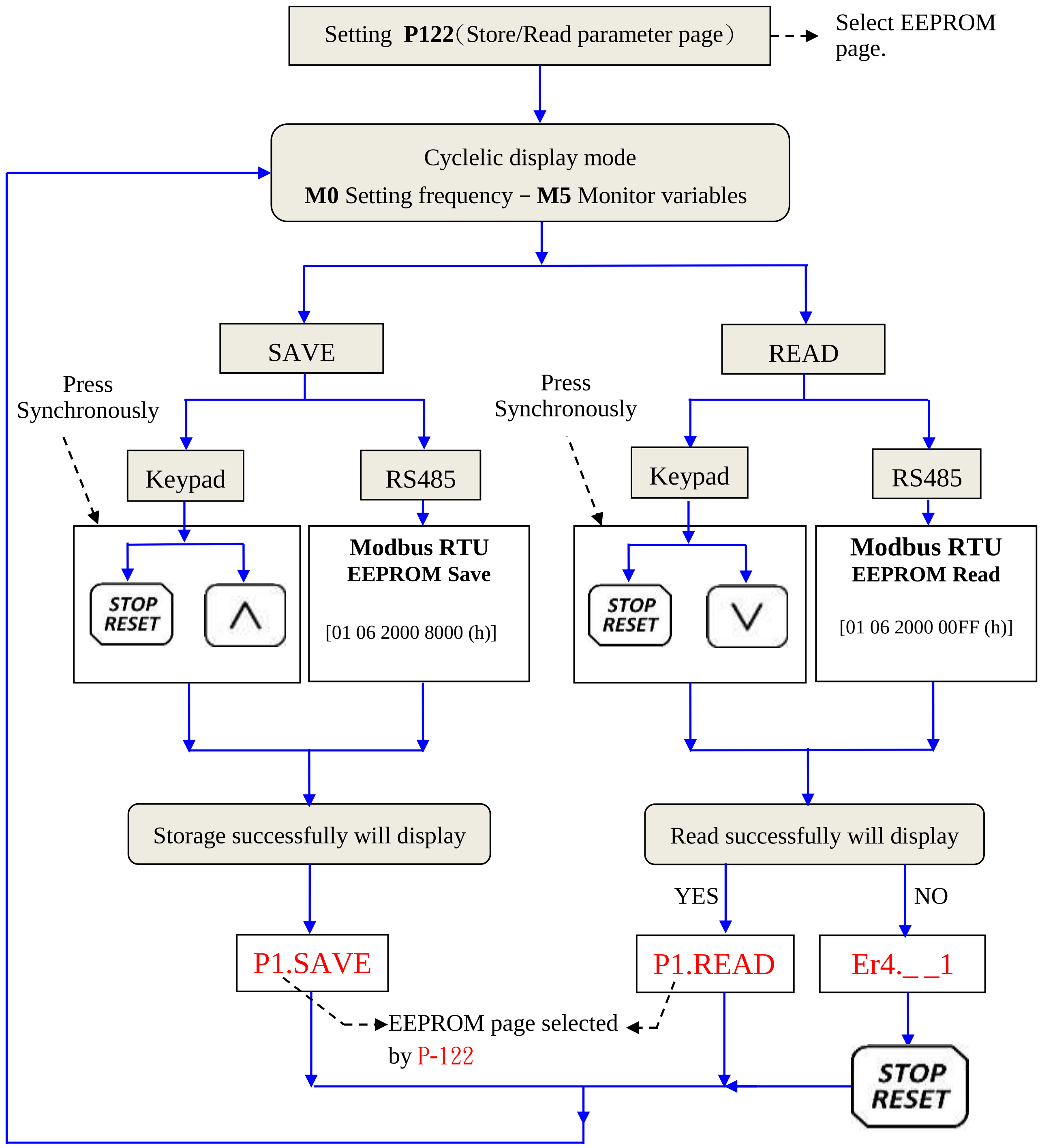
※ **M0** Setting frequency

When P-11 and P-12 = 0,the function will be activated.

5.4 Process of Parameter (EEPROM) Storage/Read

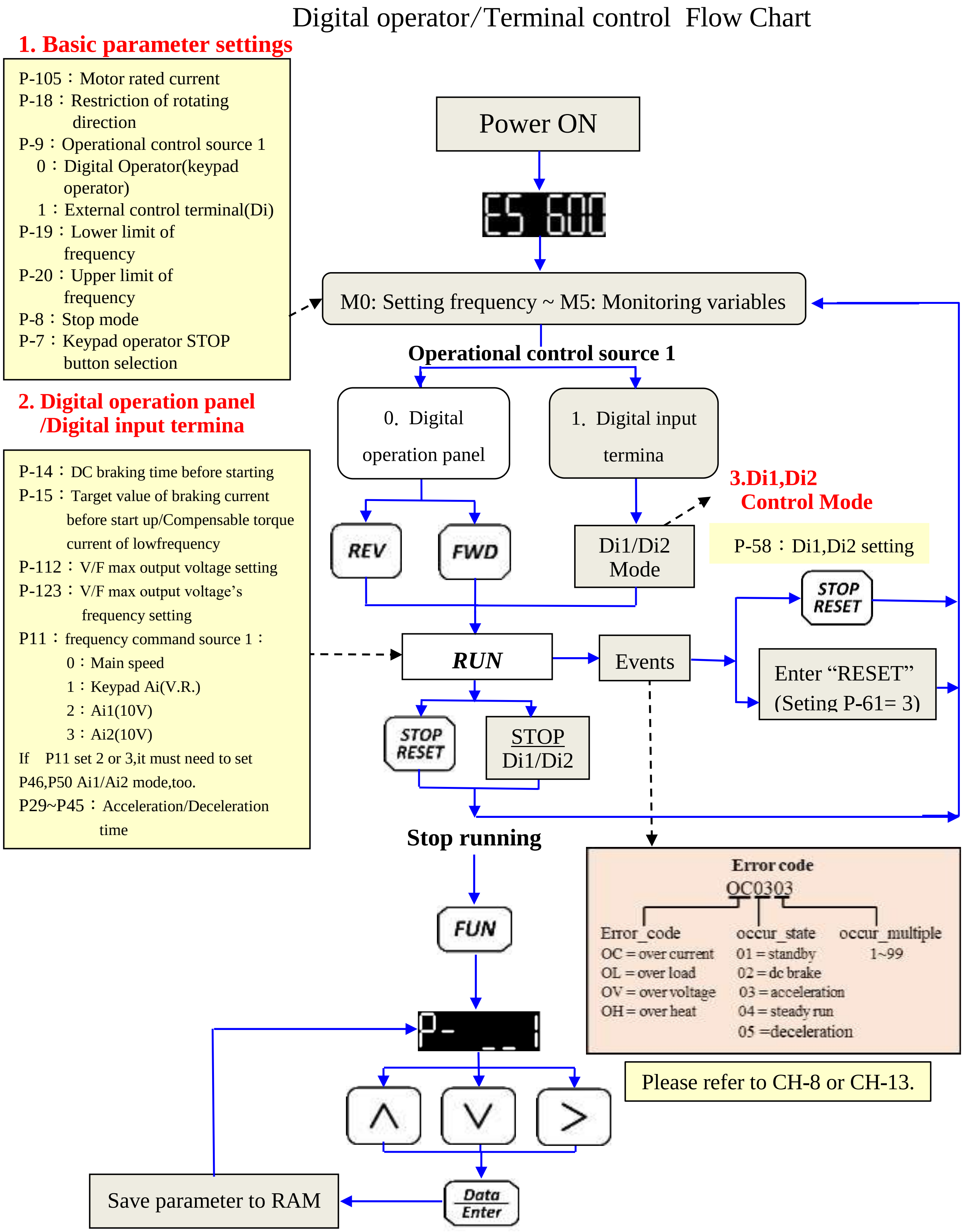
If all the confirmed parameter settings need to be saved and can be read back at anytime, please set **P-122** (store/read parameter page number) to select the EEPROM page. To execute the following procedure storage in EEPROM.

Parameter (EEPROM) Storage/Read Flow Chart



5.5 Digital operator/Terminal control mode

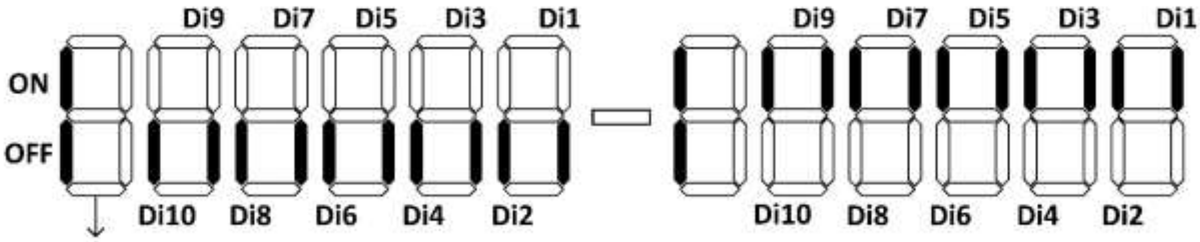
The following flow chart is the operating flow of the digital operator/terminal control mode.



Note: If the source of the speed signal is not at main speed (P-11, P-12＝0), (frequency command source 1/2): in modes of the main speed increment (P-69~P-70=11) and decrement (P-69~P-70 = 12) the digital terminal, the digital speed command input is invalid.

5.6 Digital input terminal status display value check

◆ P-005 = 2 : State of digital terminal input state (DI).



I : DI symbol

※ Note: Modbus read 2107(h) ; please refer to the table.

Ex.	Digital terminal	Di10	Di9	Di8	Di7	Di6	Di5	Di4	Di3	Di2	Di1	Sum (P-005 = 2)
	Conducting value	**512**	**256**	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**	
1	**Terminal state**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**0**
	Conducting value	×	×	×	×	×	×	×	×	×	×	
2	**Terminal state**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	**1**
	Conducting value	×	×	×	×	×	×	×	×	×	1	
3	**Terminal state**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	4+2+1=**7**
	Conducting value	×	×	×	×	×	×	×	4	2	1	
4	**Terminal state**	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	16+8+4=**28**
	Conducting value	×	×	×	×	×	16	8	4	×	×	
5	**Terminal state**	OFF	ON	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	256+32+16+4 = **308**
	Conducting value	×	256	×	×	32	16	×	4	×	×	
6	**Terminal state**	ON	OFF	ON	OFF	ON	ON	ON	OFF	OFF	ON	512+128+32 +16+8+1 = **697**
	Conducting value	512	×	128	×	32	16	8	×	×	1	
7	**Terminal state**	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	OFF	512+256+32 +16+8+4 +2 = **830**
	Conducting value	512	256	×	×	32	16	8	4	2	×	
8	**Terminal state**	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	**1023**
	Conducting value	512	256	128	64	32	16	8	4	2	1	

∗ ON(Conducting state),OFF(Non-conducting state).

The value corresponding to the conduction is the result of converting binary to decimal. In order to check whether the digital terminals Di1~Di10 are in a conductive state, we can directly convert the sum from decimal to binary. You can know the individual status of the terminal. Assuming that only Di1 is turned on, the value will be 1. The corresponding values of the remaining Di1~ Di10 that are individually turned on are 2 (Di2), 4 (Di3), 8 (Di4), 16 (Di5) , 32 (Di6) and the virtual digital output (Di7-Di10) are 64 (Di7), 128 (Di8), and 256 (Di9), 512 (Di10). If it is a composite conduction, add the individual values, as shown in the following example.

Example 1 : Sum is **0**. Di1~Di10 are all OFF, that is, they are all non-conducting state.

Example 2 : Sum is **1**. Di1 is ON.Di2~Di10 are all OFF, that is, they are all non-conducting state.

Example 3 : Sum is **7**. Di1~Di3 are ON, Di4~Di10 are OFF(non-conducting state).

Example 4 : Sum is **28**. Di3, Di4, Di5 are ON. Di1, Di2, Di6, Di7, Di8, Di9, Di10 are OFF.

Example 5 : Sum is **308**. Di3, Di5, Di6, Di9 are ON. Di1, Di2, Di4, Di7, Di8, Di10 are OFF.

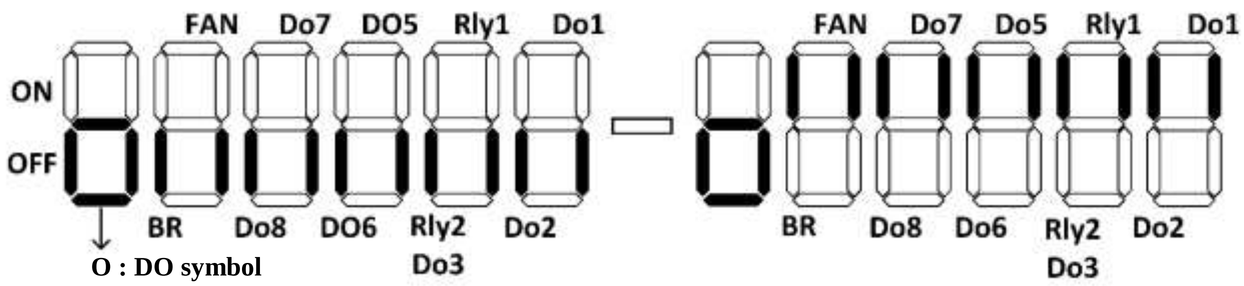
Example 6 : Sum is **697**. Di1, Di4, Di5, Di6, Di8, Di10 are ON. Di2, Di3, Di7, Di9 are OFF.

Example 7 : Sum is **830**. Di2, Di3, Di4, Di5, Di6, Di9, Di10 are ON. Di1, Di7, Di8 are OFF.

Example 8 : Sum is **1023**, and terminals Di1~Di10 are all ON(Conducting state).

5.7 Digital output terminal status display value check

◆ P-005 = 3 State of digital terminal output (DO).



※ Standardization type (ES600) terminals have hardware of DO1,DO2,Relay 1,Relay 2 .

Miniaturiztion type (ES600M) terminals have hardware of DO1,DO2,Relay 1,DO3 .

※ Modbus read 2108(h) ; please refer to the table.

Ex.	Digital terminal	Br	Fan	Do8	Do7	Do6	Do5	Do3/Rly2	Rly1	Do2	Do1	Sum
	Conducting value	**512**	**256**	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**	(P-005 = 3)
1	Terminal state	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**0**
	Conducting value	×	×	×	×	×	×	×	×	×	×	
2	Terminal state	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	**1**
	Conducting value	×	×	×	×	×	×	×	×	×	1	
3	Terminal state	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	4+2+1 = **7**
	Conducting value	×	×	×	×	×	×	×	4	2	1	
4	Terminal state	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	16+8+4= **28**
	Conducting value	×	×	×	×	×	16	8	4	×	×	
5	Terminal state	OFF	ON	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	256+32+16+4 = **564**
	Conducting value	512	×	×	×	32	16	×	4	×	×	
6	Terminal state	OFF	OFF	ON	OFF	ON	ON	ON	OFF	OFF	ON	128+32+16 +8+1=**185**
	Conducting value	×	×	128	×	32	16	8	×	×	1	
7	Terminal state	OFF	ON	OFF	OFF	ON	ON	ON	ON	ON	OFF	256+32 +16+8+4 +2 = **318**
	Conducting value	×	256	×	×	32	16	8	4	2	×	
8	Terminal state	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	**1023**
	Conducting value	512	256	128	64	32	16	8	4	2	1	

＊ **ON(Conducting state),OFF(Non-conducting state).**

In the same way as described by Di, in order to check whether the digital terminals Do1~Do8, Fan, and Brake are in a conductive state, we can directly convert the sum of decimal digits from decimal digits to binary digits to know the individual status of the terminals. Synchronization description, assuming that only Do1 is turned on, the value will be 1, and the corresponding values of the remaining Do2~Brake are individually turned on are 2 (Do2), 4 (Rly1), 8 (Rly2/Do3), virtual digital output (Do5-Do8) are 16(Do5), 32(Do6), 64(Do7), 128(Do8), and 256(Fan), 512(Br). If it is a composite conduction, add the individual values, as shown in the following example.

Example 1 : Sum is **0**. All OFF(non-conducting state).

Example 2 : Sum is **1**.Do1 is ON. Do2-Br are all OFF(non-conducting state).

Example 3 : Sum is **7**. Do1~ Rly1 are ON. Do3/Rly2-Br are OFF.

Example 4 : Sum is **28**. Rly1, Do3/Rly2,Do5 are ON. Do1, Do2, Do6, Do7, Do8,Br,Fan are OFF.

Example 5 : Sum is **564**. Rly1, Do5, Do6, Br are ON. Do1, Do2, Rly2/Do3, Do7, Do8, Fan are OFF.

Example 6 : Sum is **185**. Do1, Rly2/ Do3, Do5, Do6, Do8 are ON. Do2, Rly1, Do7, Fan, Br are OFF.

Example 7 : Sum is **318**. Do2, Rly1, Rly2/Do3, Do5, Do6, Fan are ON. Do1, Do7, Do8, Br are OFF.

Example 8 : Sum is **1023**. Do1～Do8, Fan, Brake are all ON(Conducting state).

Chapter 6 Test Run

6.1 Safety precautions

DANGER	**To prevent electric shock ,** do not perform wiring work while the power is on. Otherwise, there is a danger of electric shock.

WARNING	◊ Do not operate with the inverter cover removed, otherwise there is a danger of electric shock. ◊ To illustrate the details of the product, the illustrations in this manual are sometimes the status of removing the cover or safety cover. Always carry the inverter in accordance with the instruction manual while the specified cover or cover is installed. ◊ Do not remove the cover of the inverter or touch the printed circuit board when the power is on. Otherwise, there is a danger of electric shock. ◊ If you need to use the brake, please prepare separately. ◊ In an emergency, when the power is off , or when the inverter fails, please use the external sequence controller to ensure the brake is tightened. Otherwise, there is a risk of injury. ◊ When using the elevator, please take safety measures to prevent falling on the machine side. Otherwise, there is a risk of injury. ◊ Avoid electric shock! The internal DC capacitor of the inverter will not be discharged until 5 minutes after the power is removed. Please disassemble or inspect it 5 minutes after the power is removed. Wait 15 minutes for 15Hp or more.

6.2 Test run operation

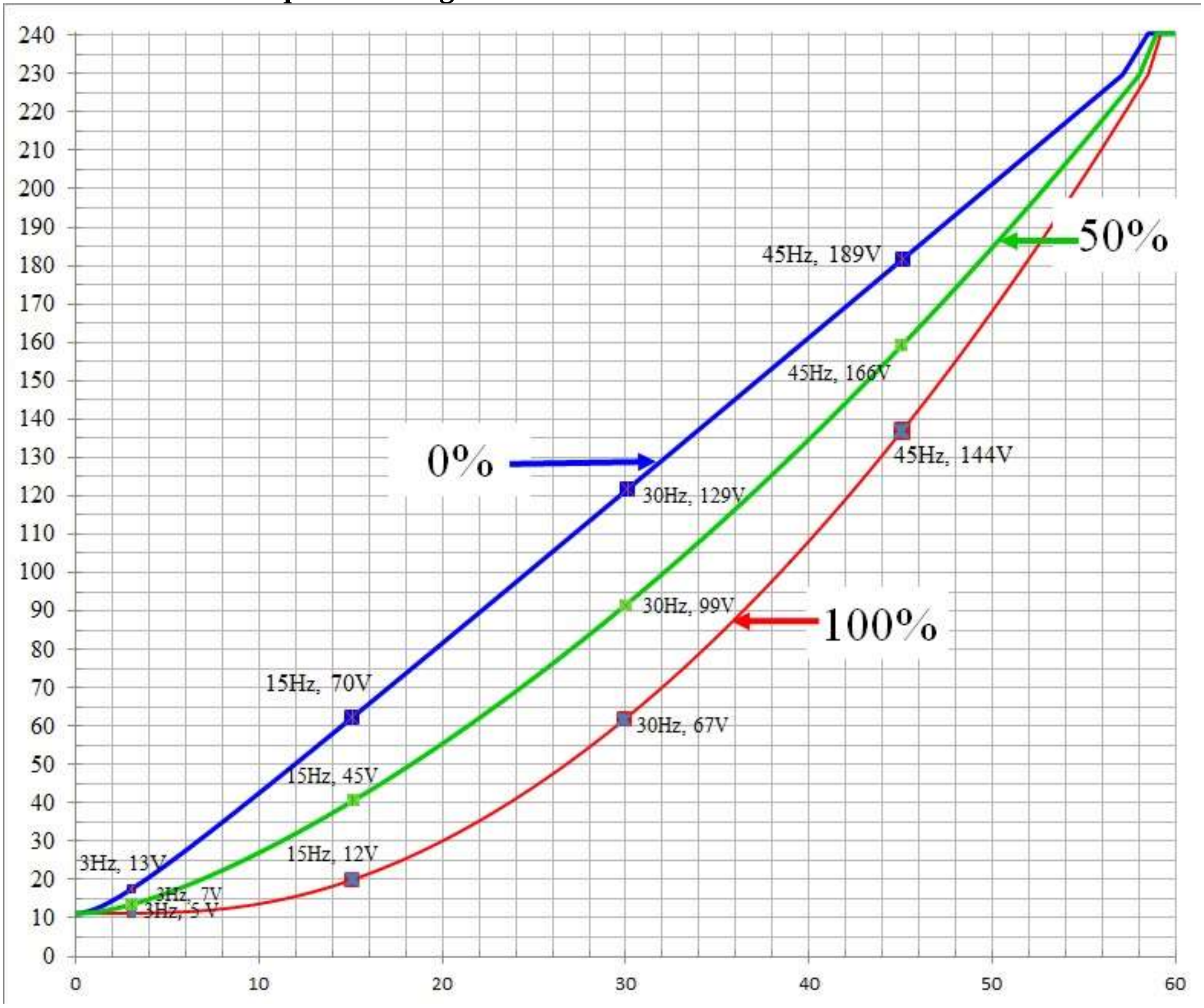
Verification of application：

📖 Before using the ac drive, please verify the user's machine and thereof applications.For example：
Cooling fan, air blower,water pump、Extruder,conveyor and general machines, etc.

Parameters and applications indirect impact against the performance control.

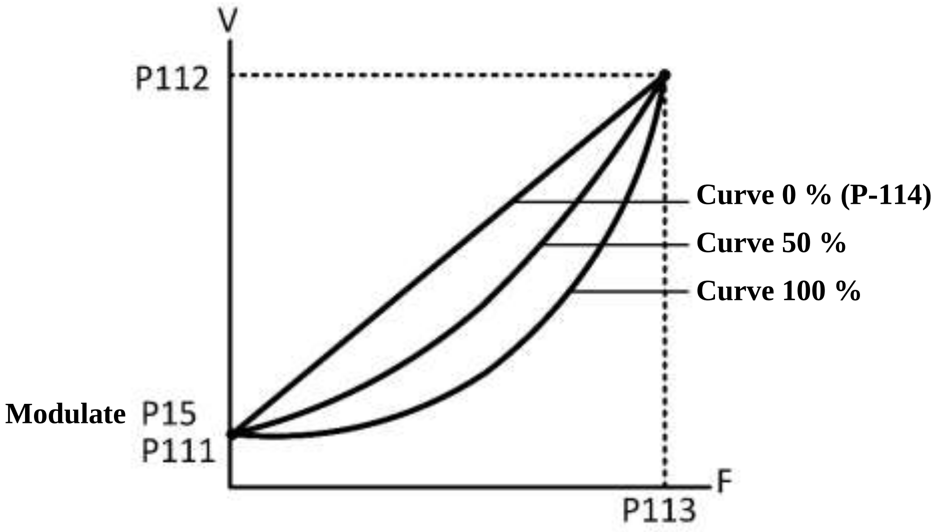
Parameter (code)	Applications
Acceleration / dec time (P29~P45)	To adjust the acceleration / deceleration time
N-square curve gain(P114)	The torque load is lessened along with the reduction of rpm.
Stall protection (P97、P98、P103)	To protect the motor from stall or OV (faulty overvoltage) when carrying a heavy load or performing a sharp acceleration / deceleration; generally, no change is needed when the initial values are effective.

Characteristic of N-square curve gain:



VF-N square curve

Note: The voltage in the figure is for reference only



VF-N square curve

Setup notes :

◎ V/F minimum voltage display (P-111)" will change with setting "Target value of braking current before starting /Compensable torque current of low frequency (P15)" level.

Inspection before Operation :

Be sure to confirm the following items before turning on the power.

Item	Content
Confirmation of power supply voltage	Please confirm that the power supply voltage is correct. 200V class : three-phase AC 200V ～240V, 50/60Hz 400V class : three-phase AC 380V ～480V, 50/60Hz
	Please connect the power input to terminals R, S, T.
	Confirm that the inverter and motor are properly grounded.
Environmental confirmation	If any residual conductor cutting left inside the ac drive and where around the area of the wiring terminal block.If any,clean it up.
Confirm the connection between the inverter output terminal and the motor terminal	Make sure that the inverter output terminals (the U. V. W)motor terminal (the U. V . W) is the connection secure.
	Reverse wiring between input and output is prohibited.
Confirm the connection with the inverter control circuit terminal	Please confirm whether the connection between the control circuit terminals of the inverter and other control devices is firm.
	Check if there is any short-circuit or grounding found among the terminals。
Confirmation of inverter control terminal status	Please confirm whether all the inverter control circuit terminals are in the OFF state (the inverter is not running).
Confirmation of load status	Please confirm whether the motor is in no-load state (the state is not connected to the mechanical system).

Commissioning：

◎ At the factory, the drive is set to open circuit V/F control mode, the operation control method is a digital operator P9 = 0 and P11 = 1 that take the frequency command source to control Potentiometer (V.R.) in operation panel. Before supplying power to perform the test run, please turn the knob of Potentiometer (V.R.) counter-clockwise to the end position and then input the power supply.

Please follow the steps below for trial operation :

1. Turn on the power.
2. Confirmation display state display target frequency value.
3. Enter operation control mode (press FWD key, enter into forward operation control).
4. Input speed command. (The operator of the increment、 decrement key to set the frequency values controlled to 20Hz within test run).
5. Press the STOP button, the motor deceleration to stop.

Inspection items during operation :

Whether the motor is running in the correct direction. (For example, when the direction of the motor is wrong, turn off the power, and after the display subtitle disappears, adjust any two of the motor cables to change the direction of motor rotation. Or set the P-107 UVW phase sequence to change the motor direction).

◎ Is the motor running smoothly ?

◎ Does the motor vibrate abnormally ?

◎ Are acceleration and deceleration smooth ?

◎ Is the three-phase load current normal?（During operation,it can be displayed in cycles to monitor voltage,current…and other data.）

Basic parameters setup

Parameter	Description	Range	Unit	Ex-factory setting
P-007	Keypad operator STOP button selection			1
	0：The keyboard STOP key is invalid　1：The keyboard STOP key is valid When the operational control command input by terminal or RS485,P7 can enable or disable the keypad's STOP button.			
P-008	Stop mode	0～2		1
	0：Free running stop　1：Dynamic stop　2：Dynamic + DC braking			
P-009	Operational control source 1	0～1		0
	0：Digital Operator (keypad operator)　1：External control terminal (Di)　2：RS-485 communication			
P-011	Frequency command source 1	0～4		1
	0：Main speed　1：Keypad operator Ai input (5V)　2：Ai1 input (0~10V/4~20mA) 3：Ai2(0~10V/4~20mA)			
P-018	Restriction of rotating direction	0～3		1
	0：Either Forward or Reversed　1：Forward only　2：Reversed only 3：Backward rotation available for negative bias			
P-019	Lower limit of frequency	0.0～480.0	Hz	0.0
P-020	Upper limit of frequency	0.0～480.0	Hz	60.0 / 50.0
P-021	Main speed	0.0～480.0	Hz	25.0
P-030	Main speed acceleration time	0.01～3000.0	sec	10.0
P-031	Main speed deceleration time	0.01～3000.0	sec	10.0
P-058	Di1,Di2 settings	0～4		0
	0：Di1(FWD/STOP)、Di2(REV/STOP)　3：Di1(FWD/STOP) , Di2 (according to P60) 1：Di1(RUN/STOP)，Di2(FWD/REV)　4：Di1 (according to P59) , Di2 (according to P60) 2：Three-wire stop:Di1(RUN)，Di2(STOP)，Di3(FWD/REV) (Note:any input terminal Di3~Di6 can define this function.)			
P-095	Stall current protection switch during running	0～1		0
	0：Disable　1：Protection start			

P-096	Fan start mode	0～1		1
	0：Fan constantly rotate 1：The fan is started by temperature(Reach the setting temperature of P100)			
P-097	Motor overload protection switch	0～1		0
	0：Disable 1：Enable Motor OL protection			
P-098	Stall prevention voltage switch during deceleration	0～1		1
	0：Disable 1：Enable			
P-099	Output current limit	0～220	%	185
P-100	Fan start temperature setting	40.0～60.0	℃	45.0
P-101	Over temperature protection setting	60.0～90.0	℃	88.0
P-102	Decelerating-Stall prevention voltage level	330.0~400.0 660.0~800.0	Vdc	370.0 740.0
P-103	Regenerative braking voltage level	350.0~400.0 700.0~800.0	Vdc	365.0 730.0
P-104	RST input voltage (rms)	150.0～255.0 300.0～510.0	Vac	220.0 | 200.0 440.0 | 380.0
P-105	Motor rated current	0.0～1400.0	A	P105
P-106	SVPWM carrier frequency	2～16K	Hz	8
	Note : PWM carrier frequency update after resarting to run. 0.5HP~30HP：8K 40HP~60HP：6K 75HP~125HP：5K 150HP~300HP：3K			
P-107	UVW output phase sequence setting	0～1		0
	0：UVW 1：UWV			

Fast operation control mode

🕮 Many operation control methods may be applied for the ac drive to activate it to operate.Here is a summary operation method to activate the ac drive.

🕮 Two primary operation control parameters involved in the activation of the ac drive; one is **P-009 : Operational control source 1**;and the other is **P-011 : Frequency command source 1**.
Refer to the table given below for the operation.

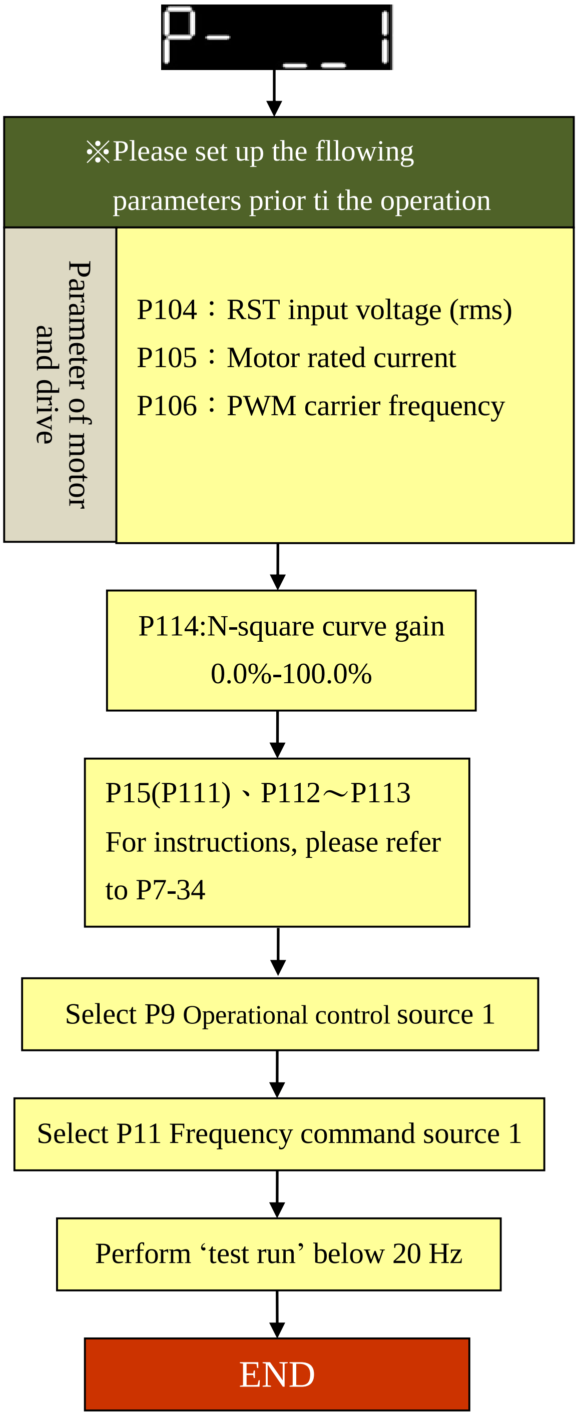
P-009：Operational control source 1 / P-010：Operational control source 2		
Parameter functionss	Description of Operate procedure	Ex-factory setting
0：Digital Operator (keypad operator)	Press the “FWD” key → Forward running mode (Note: Please pay attention to the forward and reverse direction of the motor during test run.)	0
1：External control terminal (Di)	P58 = 0~3,Di1 (ON) RUN → (OFF) STOP.	
2：RS-485 communication	Please refer to the function code of modbus rs485 communication 【06H】: Write the inverter operating parameters.	

P-011：Frequency command source 1 / P-012：Frequency command source 2		
Parameter functionss	Description of Operate procedure	Ex-factory setting
0：Main speed	1. During operation, change the frequency directly on the "Frequency Setting (F)" screen. 2. To set P9 = 1 (digital input terminal), P11 = 0 (main speed), P69 = 11 (main speed increasing), P70 = 12 (main speed decreasing) can increased and decreased the frequency by the function terminal.	1
1：Keypad operator Ai input (5V)	The speed is controlled by the potentiometer (V.R) on the keypad.	
2： Ai1 input (0~10V/4~20mA)	From the analog Ai1 terminal, input 0~+10V/0~20mA for speed control.	
3： Ai2 input (0~10V/4~20mA)	From the analog Ai2 terminal, input 0~+10V/0~20mA for speed control.	

P-013： Multi-speed control is specified by RS485 communication		
Parameter functionss	Description of Operate procedure	Ex-factory setting
0：Disable	When the multi-speed control is specified as 1 by RS485 communication, the multi-speed command can only be controlled from RS485 and cannot be started from the terminal.	0
1：Enable		

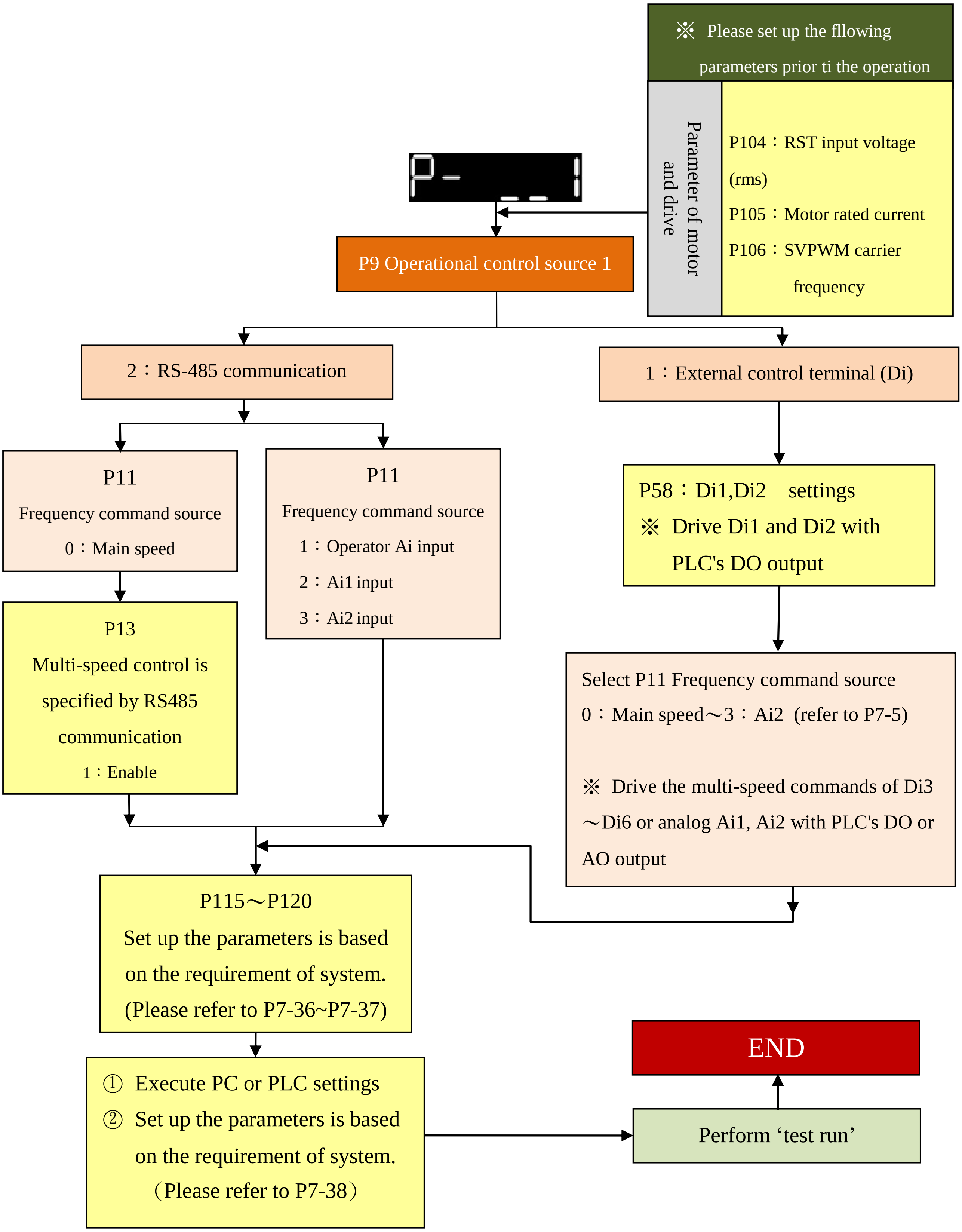
6.3 Control mode setup

◆ ES600 is categorized to a simple V/F voltage vector control in possession of including slip-offsetting function and V/F curve setting.



6.4 MODBUS Communication setting

- Ac drive and PC or PLC is serially connected for communication so that remote monitoring is accessible to the user.



Chapter 7 Parameter Description

7.1 OPERATION DISPLAY SETUP

Hex: MODBUS communication code/★:Read/write allowed during operation

NO./Hex	Description	Range	Default
P-001 001 (h)	Reserved	0～32768	0
P-002 002 (h)	Reserved	0～32768	0
P-003 003 (h)	Lock the functional parameters ★	-32767～32768	99

◆ **<u>99：Unlock parameters</u>** - Parameter settings can be modified.

◆ **<u>All values can be locked except 99</u>** - This function can lock most of the parameter content, it can only be displayed and cannot be changed.

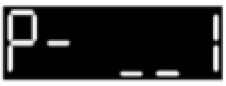
NO./Hex	Description	Range	Default
P-004 004 (h)	Boot display screen selection ★	0～5	0
0：Enter frequency setting (F) 1：Enter the parameter setting mode (P) 2：Display operating frequency (H) 3：Display output voltage (E) 4：Display operating torque current (A) 5：Display monitoring content (P-005) 6：Reserved			
● The set value is used as the initial item display when starting up. Use the **FUN** key of the digital operator to make a cycle selection display of 0 to 5.			

◎ Refer to <u>5.3 operation process of digital keypad operator</u>.

◆ **0：Enter frequency setting (F)**

Use the digital operator keys to set the frequency. ※P-11 and P-12 are equal to 0 (frequency command 0)

◆ **1：Enter the parameter setting mode (P)**

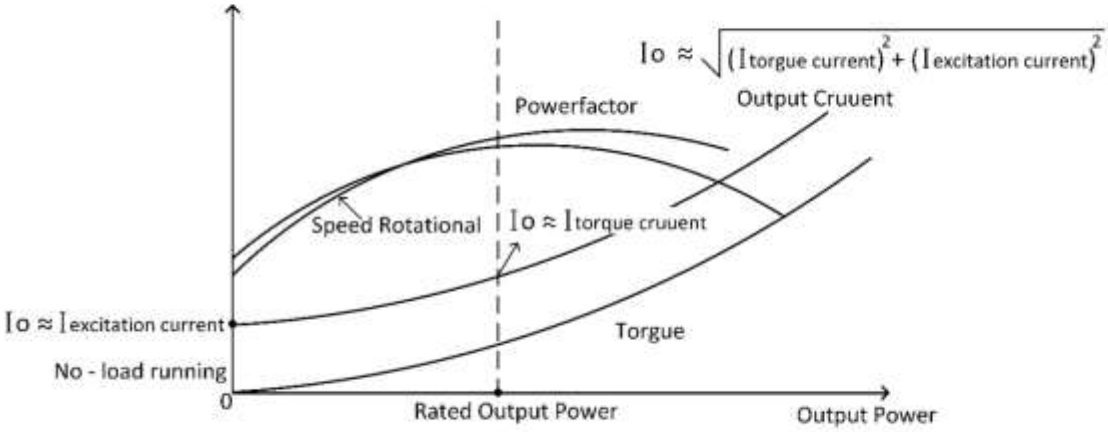


◆ **2：Display operating frequency (H)**

◆ **3：Display output voltage (E)**

Display the operating voltage output to the motor.

◆ 4 : Display operating torque current (A)



Torque current Load Charateristic Curve.

◎ When the motor is running without load, the excitation current accounts for the majority of the output current component and the torque current accounts for a small portion. The proportion of the torque current will not increase until the negative current is gradually added. The power factor will increase simultaneously until full load. When the torque current is loaded to 30% of the motor's rated current, it is approximately the output current Io.

◆ 5 : Display monitoring content(P-5)

Press the **DATA** key to change P-005 (monitoring operation content selection) for display.

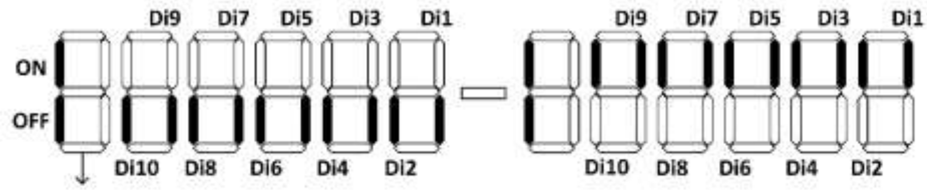
NO./Hex	Description	Range	Default
P-005 005 (h)	Monitoring operation content selection ★	0～15	0

P-005	Hex	Description	P-005	Hex	Description
00	2105	DC-BUS voltage (V)	**08**	210D	Ai2 Analog input signal (V)
01	2106	Output Power (%)	**09**	210E	Ai2 Analog input instructions (%)
02	2107	Number of digital terminal input segments	**10**	210F	Ai2 frequency command (%)
03	2108	Number of digital terminal output segments	**11**	2110	Ao output calculation result (%)
04	2109	The knob on the AV digital operator (VR)	**12**	2111	Temperature display (℃)
05	210A	Ai1 Analog input signal (V)	**13**	2112	Estimated speed (rpm)
06	210B	Ai1 Analog input instructions (%)	**14**	2100	Fault record
07	210C	Ai1 frequency command (%)	**15**	2113	Software version

◎ Refer to 5.3 operation process of digital keypad operator.

The contents of the above table are arranged in P-005 order, and the following contents are arranged in Hex order to facilitate MODBUS use.

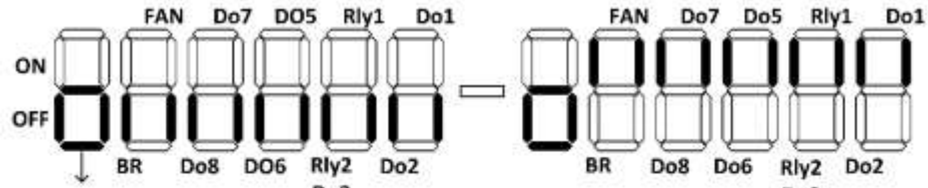
- **P-005 = 14： Fault record, (2100h)**
- Frequency setting (F), (2101h)
- Display operating frequency (H), (2102h)
- Display output voltage (E), (2103h)
- Display operating torque current (A), (2104h)
- **P-005 = 0：DC-BUS voltage (V)，(2105h)**
- **P-005 = 1：Output Power (%)，(2106h)**
- **P-005 = 2：Number of digital terminal input segments (I)，(2107h)** ◎ (Di)：Di10～Di1。



I : Digital Input

- **P-005 = 3：Number of digital terminal output segments (O)，(2108h)**

◎ (Do)：Br、Fan、Do8～Do5，Rly2/Do3、Rly1、Do2、Do1。



O : Digital Output

- **P-005 = 4：The knob on the AV digital operator (VR) (%)，(2109h)**

◎ 

Display analog input voltage value（0~5V/0~100%)

- **P-005 = 5：Ai1 Analog input signal (V)，(210ah)**

  Displays the Ai1 analog input terminal signal corresponding to the Ai1 analog input command (P-005 =5 : 0~Vmax, P-005 = 6: 0~100%).

- **P-005 = 6：Ai1 Analog input instructions (%)，(210bh)**

  According to the Ai1 mode and gain and bias settings, the speed command converted by Ai1 is displayed.

- **P-005 = 7：Ai1 frequency command (%)，(210ch)**

  According to the Ai1 mode, gain, bias voltage setting, and deadband setting, the frequency command percentage converted by Ai1 is displayed.

- **P-005 = 8：Ai2 Analog input signal (V)，(210dh)**

  Displays the Ai2 analog input terminal signal corresponding to the Ai2 analog input command (P-005 =8 : 0~Vmax, P-005 = 8: 0~100%).

- **P-005 = 9：Ai2 Analog input instructions (%)，(210eh)**

  According to the Ai2 mode and gain and bias settings, the speed command converted by Ai2 is displayed.

- **P-005 = 10：Ai2 frequency command (%)，(210fh)**

  According to the Ai2 mode, gain, bias voltage setting, and deadband setting, the frequency command percentage converted by Ai2 is displayed.

◆ **P-005 = 11：Ao output calculation result (%)，(2110h)**

Displays the analog output voltage value.

◆ **P-005 = 12：Temperature display (℃)，(2111h)**

Displays the temperature value of the heat sink inside the inverter.

◆ **P-005 = 13：Estimated speed (rpm)，(2112h)**

Displays the estimated motor speed (RPM) or mechanical (gear ratio output) speed (RPM).

◆ **P-005 = 15：Software version，(2113h)**

Display the inverter software version.

NO./Hex	Description	Range	Default
P-006 006 (h)	Unitless display ★	0.01～300.00	30.00

◎ This function can monitor motor speed (RPM) or mechanical (gear ratio output) speed (RPM).

◆ The display magnification is based on the set frequency × (P6), and the display value in P5 = 13 Estimated speed (rpm) is displayed.

7.2 OPERATION CONTROL PARAMETER

NO./Hex	Description	Range	Default
P-007 007 (h)	Keypad operator STOP button selection	0～1	1
0：The keyboard STOP button is invalid 1：The keyboard STOP button is valid			
◎ When the operation command is input from the terminal or RS485 communication, this parameter can turn on or off the STOP key of the digital operator.			

◆ P-007 : 1 is enabled. Whenever the motor drive from inverter's digital terminals or keypad or RS485 Communication, STOP button can stop the motor running.

NO./Hex	Description	Range	Default
P-008 008 (h)	Stop mode	0～2	1

◎ Select the appropriate shutdown mode according to the operation requirements of mechanical equipment.

◆ **0：Free running stop**

Free run (natural stop) function description: set parameter P8 = 0 or control board terminal (P59-P64) to set any digital terminal to 4: during natural stop, when the stop signal is started, the voltage and frequency output will be interrupted immediately, and the motor will follow the inertia idling to immediately, and the motor will follow the inertia idling to stops. At this time, stops. At this time, the displayed value of the keyboard will be zero Hz .

◆ **1：Dynamic stop**

According to the rate of deceleration time, the motor decelerates to stop.

◆ **2：Dynamic + DC braking**

Depending on the rate of deceleration of the deceleration ime,when the output frequency decelerate down to zero speed ,DC braking operation is started, thus the occurrence of idling phenomenon can be avoided after stopping the motor.

NO./Hex	Description	Range	Default
P-009 009 (h)	Operational control source 1 (Default)	0～2	0
P-010 00A (h)	Operational control source 2		1

◎ Select the operation command mode of the inverter to determine the source of the control start operation signal.

◆ **0：Digital Operator (keypad operator)**

Drive started running , Forward, Reverse, Stop running.The rotation is controlled by the keypad Operator.

◆ **1：External control terminal (Di)**

The start-up, forward, reverse, and stop operation of the drive are controlled by the digital input Di terminal.

◆ **2：RS-485 communication**

Input control commands through RS-485 communication control mode.

Dix switch	Content	
ON(OFF)	(P-009) Operational control source 1	(P-011) Frequency command source 1
Close(ON)	(P-010) Operational control source 2	(P-012) Frequency command source 2

◎ where one of the function settings of Dix (x = 1~6) = 13 (P-059~P-068) turn on operation command source 2 and frequency command source 2.

NO./Hex	Description	Range	Default
P-011 00B (h)	Frequency command source 1 (Default)	0～3	0
P-012 00A (h)	Frequency command source 2		1

◎ The Priority of speed command source: **Jog , Fwd jog , Rev jog> (Multi-stage speed command = Multi-stage speed control specified by RS485 communication) >P-011 frequency command source 1or P-012 frequency command source 2.**

◎ Dix is switched OFF: P-9, when switched ON: P-10.

Dix switch	Content
ON(OFF)	(P-011) Frequency command source 1
Close(ON)	(P-012) Frequency command source 2

◎ Where One of the function settings of Dix (x = 1~6) = 14 (turn on operation command source 2).

◆ **0：Main speed**

The main speed frequency is controlled by parameter P21 or the setting of P59~P64 is executed by the multi-function terminal to increase and decrease the control speed gradually.

◆ **1：Keypad operator Ai input (5V)**

It is controlled by the Voltage Regulator (V.R) signal DC 0～5V on the digital operator.

◆ **2：Ai1 input (0~10V/4~20mA)**

It is controlled by analog input terminal Ai1, input analog voltage_signal DC 0 ~ +10V (or 0~20mA). (This mode must be matched with the setting of **P46**.)

◆ **3：Ai2 input (0~10V/4 ~ 20mA)**

It is controlled by analog input terminal Ai2, input analog voltage signal DC 0～+10V (or 0～20mA) (This mode must be matched with the setting of **P50**.)

NO./Hex	Description	Range	Default
P-013 00D (h)	Multi-speed control is specified by RS485 communication	0～1	0

◎ When the multi-speed control is specified as 1 by RS485 communication, the multi- speed command can only be controlled from RS485 and cannot be started from the terminal.

◆ **0：Disable**

◆ **1：Enable**

This function is effective - use RTU pass information format, performs multi-stage speed control function.

NO./Hex	Description	Range	Default
P-014 00E (h)	DC braking time before starting	0.0～60.0 Sec	0.0

◎ This parameter sets the duration of the DC dynamic braking when the drive is started. After the time is completed, the inverter will start running and automatic torque compensation will be performed during operation.

◆ **0：Disabled**

The braking time before starting is set to **0**, and DC dynamic braking **is not started.**

※ If only automatic torque compensation is required, the time (P14) can be set to 0.2sec.

NO./Hex	Description	Range	Default
P-015 00F (h)	Target value of braking current before start up / Compensable torque current	0～100 %	20

◎ This percentage of braking current, and the rated current of the (P109) inverter, as a benchmark.

◎ This parameter enhances the torque current to smoothly start up when frequency is low on heavy loading.

◎ This parameter is to set the percentage of braking current output before the inverter running. If the braking current is set to the minimum 0%, it means that there is no braking energy output, and it will be regarded as a start delay time operation control. The time delay length is based on the setting value of P14.If high torque output is required at low frequency,the entire frequency output must have torque compensation after motor running time > P14,and this function can be activated.

◎ The output is 50% of the set value of P15 when P14 is above 0.1 sec. The output is 100% of the set value of P15 when P14 is above 0.2 sec.

※ P111 is the reference voltage of braking current before start up (P15).

◎ Restricted to the rated current of the motor to avoid motor damage.

WARNING	**Please avoid the DC braking of the drive as a mechanical hold, which may cause injury accidents.**

NO./Hex	Description	Range	Default
P-016 010 (h)	DC braking time after inverter stopping	0.0～60.0 Sec	2.5
P-017 011 (h)	Stop braking current target value	0～100 %	20

◎ This percentage of braking current, and the rated current of the (P109) inverter, as a benchmark.

◎ P111 is the reference voltage of P17.When the Stop braking current was triggered,P111 is also the reference voltage.

◆ 0：**Disabled**

The shutdown braking time and the shutdown brake current value cannot be set up minimum of 0%, as there is no time and brake energy to action when the 0 is set.

7.3 SPEED LIMIT

NO./Hex	Description	Range	Default
P-018 012 (h)	Restriction of rotating direction	0～3	0

◎ Due to the safety of the mechanical system, when it is necessary to limit the motor to only forward or reverse, please use this group of functions to restrict the direction of the motor's rotation.

◆ **0 : <u>Either Forward or Reversed</u>**

◆ **1 : <u>Forward only</u>**

◆ **2 : <u>Reversed only</u>**

◆ **3 : <u>Backward rotation available for negative bias</u>**

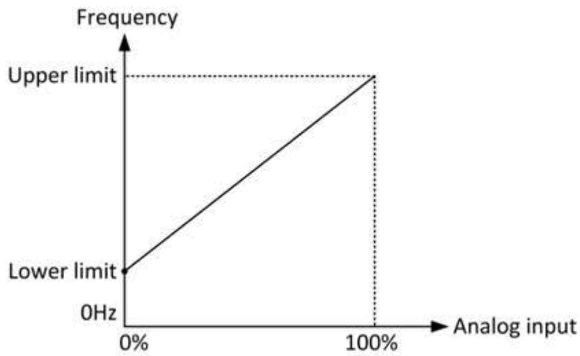
Negative bias voltage can be reversed, parameter P-009,010: There are 4 types of input signal states in the frequency command source, and the negative bias frequency value works in the negative bias frequency region, the motor runs in reverse rotation, and when it works in the positive frequency region, the motor runs forward.

WARNING	**The direction of rotation set to ac drive is not necessarily the same as the motor'sdirection of rotation.Each motor has different polarity,so please pay attention to the danger that may be resulted from the reversal rotation.**

<table>
<tr><th>NO./Hex</th><th>Description</th><th>Range</th><th colspan="2">Default</th></tr>
<tr><td>P-019
013 (h)</td><td>Lower limit of frequency</td><td>0.0～480.0 Hz</td><td colspan="2">0.0</td></tr>
<tr><td>P-020
014 (h)</td><td>Upper limit of frequency</td><td>0.0～480.0 Hz</td><td>60.0</td><td>50.0</td></tr>
</table>

◎ Appropriate upper and lower limit settings can ensure that your precious mechanical system, even if the operator gives the wrong command value, will not cause the system to be damaged due to overspeed or idling operation.

◎ According to the upper limit frequency value set by the user, the maximum value of the lower limit frequency will be automatically limited to the upper limit frequency P20≧P19.



7.4 MULTI-STAGE SPEED

NO./Hex	Description	Range	Default
P-021 015 (h)	Main speed ★	0.0～480.0 Hz	25.0
P-022 016 (h)	Stage 1 speed ★	0.0～480.0 Hz	10.0
P-023 017 (h)	Stage 2 speed ★	0.0～480.0 Hz	15.0
P-024 018 (h)	Stage 3 speed ★	0.0～480.0 Hz	20.0
P-025 019 (h)	Stage 4 speed ★	0.0～480.0 Hz	30.0
P-026 01A (h)	Stage 5 speed ★	0.0～480.0 Hz	40.0
P-027 01B (h)	Stage 6 speed ★	0.0～480.0 Hz	60.0
P-028 01C (h)	Stage 7 speed、Jog frequency command ★	0.0～480.0 Hz	5.0

◎ ON and OFF in the table indicate the use of external terminals for closing (ON) and opening (OFF) commands.

◎ In the multi-stage speed operation mode, the multi-function input terminal (P59～P64) must be used to select the stage speed operation editing (maximum 8 speeds), and edit with 3 bits in binary mode. (Please refer to the above table)

NO./Hex	Description	Range	Default
P-028 01C H	Stage 7 speed、Jog frequency command ★	0.0～480.0 Hz	5.0

◎ Jog motion is multi-speed (7th speed) method: Set any terminal Di1~Di6 as "multi-stage speed command" is closed (conducted) to com, that is to execute jogging (7th speed) control, the target speed will run according to P-028.

◎ Perform jog frequency operation separately: when either terminal Di1 to Di6 is set up **Inching (Jogging) operation** and com is closed (on), that is, the jog movement operation is performed. The target speed will operate according to P-028.

※ Please follow the P-011/ P-012 function description for priority order.

Speed	Di setting						NO.
	10	**9**	**8**	**7**	**6**	**5**	
	REV Inching (Jogging)	**FWD Inching (Jogging)**	**Inching (Jogging)**	**Multi-stage comm and 3**	**Multi-stage comm and 2**	**Multi-stage comm and 1**	
0	0	0	0	0	0	0	P-021
1	0	0	0	0	0	1	P-022
2	0	0	0	0	1	0	P-023
3	0	0	0	0	1	1	P-024
4	0	0	0	1	0	0	P-025
5	0	0	0	1	0	1	P-026
6	0	0	0	1	1	0	P-027
7	0	0	0	1	1	1	P-028
8	0	0	1	0	0	0	P-028
9	0	1	0	0	0	0	P-028
10	1	0	0	0	0	0	P-028

7.5 ACCELERATION/DECELERATION TIME

NO./Hex	Description	Range	Default
P-029 01D H	Acceleration and deceleration time unit	0～1	1

◎ Time unit decimal point setting, setting range 0.00～300.00 (0.0～3000.0)。

◆ 0：0.01 Sec

◆ 1：0.1 Sec

※ P-30~P-45 time unit decimal point setting is set by P-29, 0.1 or 0.01 seconds

NO./Hex	Description	Range	Default
P-030 01E (h)	Main speed acceleration time ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-031 01F (h)	Main speed deceleration time ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-032 020 (h)	Acceleration time of stage 1 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-033 021 (h)	Deceleration time of stage 1 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-034 022 (h)	Acceleration time of stage 2 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-035 023 (h)	Deceleration time of stage 2 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-036 024 (h)	Acceleration time of stage 3 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-037 025 (h)	Deceleration time of stage 3 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-038 026 (h)	Acceleration time of stage 4 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-039 027 (h)	Deceleration time of stage 4 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-040 028 (h)	Acceleration time of stage 5 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-041 029 (h)	Deceleration time of stage 5 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-042 02A (h)	Acceleration time of stage 6 speed ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-043 02B (h)	Deceleration time of stage 6 speed ★	0.01～300.00 Sec 0.01～3000.0 ※	10.0
P-044 02C (h)	Acceleration time of stage 7 speed(Jogging) ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0
P-045 02D (h)	Deceleration time of stage 7 speed(Jogging) ★	0.01～300.00 Sec 0.1～3000.0 ※	10.0

◎ Acceleration and deceleration are based on the set upper limit frequency and acceleration time as the conversion basis.

◎ Inching acceleration and deceleration start timing : When one of the functions of the Di terminal is set to "Inching", "Forward inching", "Reverse rotation inching", the acceleration and deceleration time of the inching control is triggered according to P-044, P- 045 decision.

WARNING	**If the acceleration or deceleration time is too short, it may cause the danger of instantaneous over-current or over-voltage. Improper adjustment will cause the inverter to trip, damage, or the motor may burn out.**

7.6 ANALOG (AI) INPUT

NO./Hex	Description	Range	Default
P-046 02E (h)	Ai1: Input signal mode	0～3	1
P-050 032 (h)	Ai2: Input signal mode	0～3	1

◆ **0：Disabled.**

Ai analog signal is not activated, and the speed command returns to 0.

◆ **1：0～10V。**

Ai input terminal, which can accept 0~10V analog signal.

◆ **2：4mA～20mA。**

Ai input terminal, which can accept 4~20mA analog signal.

◆ **3：0mA～20mA。**

Ai input terminal, which can accept 0~20mA analog signal.

※ The function must set main board "SW2" and refer to P4-5 (Control circuit wiring diagram(A) ⊙ ES600 Standardization),P4-8 (Control circuit terminal function(B) ⊙ ES600M miniaturization).

NO./Hex	Description	Range	Default
P-047 02F (h)	Ai1: 0V/4mA Input bias voltage	-200.0～200.0 %	0.0
P-048 030 (h)	Ai1: 10V/20mA Input gain	-400.0～400.0 %	100.0
P-049 031 (h)	Ai1: Input dead band	0.0～85.0 %	1.0
P-051 033 (h)	Ai2: 0V/4mA Input bias voltage	-200.0～200.0 %	0.0
P-052 034 (h)	Ai2: 10V/20mA Input gain %	-400.0～400.0 %	100.0
P-053 035 (h)	Ai2: Input dead band	0.0～85.0 %	1.0

◎ This parameter group function command defines the frequency value (gain frequency) corresponding to the maximum value of the analog signal (10V or 20mA). The output value of this gain frequency will be limited by the upper limit frequency.

◎ The operation methods of Ai1 and Ai2 are the same. The input signal mode of Ai1 and Ai2 can be selected from 0~10V/0~20mA.

◎ The non-inductive voltage setting of P49 and P53 can effectively prevent the operation from being interfered by noise at 0V, causing the driver to fail to stop correctly, causing the motor to swing forward and reverse. Input dead band voltage = 10Vdc × (P-049、P-053) .

◎ When using this function, the user can first determine the bias ratio (P47) and (P51) according to Formula 2, and then determine the gain ratio (P48) and (P52) according to Formula 1.

※ **Math：Y ＝ mX + b, (**m：Ai Input gain(%), X：Input signal ,b：Input bias voltage(%),Y：**P5=7,10)**
The following 9 formulas are based on this concept.

◎ Formula :

Y(Ai1/Ai2(%)) = **m**：((P48)、(P52)(%)) × (**X**：(0~10v)/10v + (**b**：(P47)、(P51)(%))

【Ai signal modes : **X** = (0~10v)/10v，(0~20mA)/20mA，(4~20mA)/20mA】

Formula 1 :

◆ **Ai maximum operating frequency = upper limit frequency × (gain ratio + bias ratio)**

upper limit frequency: (P20); gain ratio: (P48)、(F61); bias ratio: (P47)、(P51)

Formula 2 :

◆ **Frequency bias value = upper limit frequency × bias ratio**

upper limit frequency: (P20); bias ratio: (P47)、(P51)

Formula 3 :

◆ $$\text{Operating voltage(V)} = \frac{\text{The max voltage} \times (\text{Ai max operating freq} - \text{Freq bias value})}{\text{upper limit frequency} \times \text{gain ratio}}$$

Formula 4 :

◆ $$\text{Gain ratio} = \frac{\text{The max voltage} \times (\text{Ai max operating freq} - \text{Freq bias value})}{\text{upper limit frequency} \times \text{Operating voltage}}$$

Formula 5 :

◆ $$\text{Negative bias voltage} = \frac{10\text{V} \times \text{Negative bias ratio}}{\text{Gain ratio}}$$

◎ Please refer to the parameter descriptions in the table below according to Figures 1, 2 and 3:

Curve	①	②	③	④	⑤	⑥
P11/ P12 Frequency command source	2 : Ai1(0~10V / 4~20mA) / 3 : Ai2 (0~10V / 4~20mA)					
P46/ P50, Ai1/Ai2 Input signal mode	1 : 0~10V					
P20 Upper limit frequency	60HZ					
P47、P51 Ai :0V bias ratio	0%	100%	0%	0%	10%	-10%
P48、P52 Ai : 10V gain ratio	100%	-100%	120%	80%	100%	110%

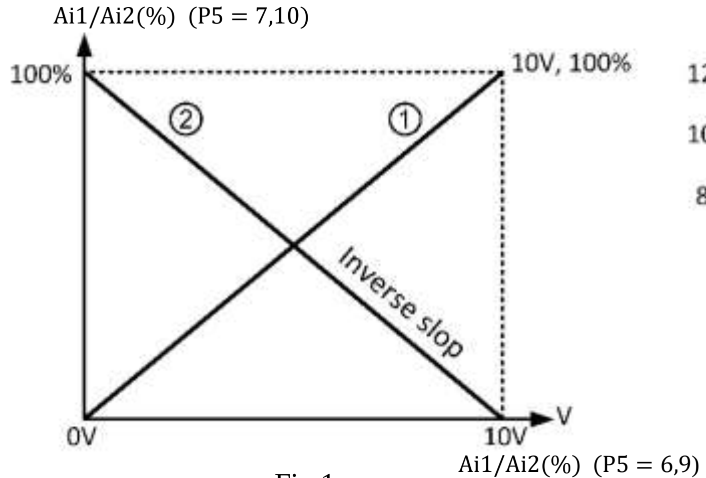


Fig.1

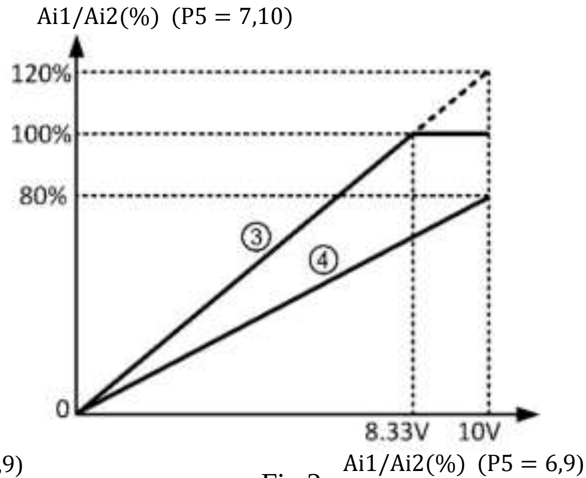


Fig.2

※ Note : The reverse slope can set **0V bias ratio (P47,P51)** and **10V gain ratio (P48,P52)** which refers to formula 1 and formula 2.

※ P-005 = 7,10. Ai1/Ai2 frequency command (%), 100 % means Upper limit frequency.

First of all, user determine the **bias ratio** (P47), (P51) with formla 2.The **gain ratio** (P48), (P52) was finally determined by formla 1.

Formula 1 :

◆ **Ai maximum operating frequency = upper limit frequency × (gain ratio + bias ratio)**

Ex. : Curve ② Ai maximum operating frequency = 60Hz × (−100% + 100%) = 0Hz

※ It means that 10V corresponds to 0Hz.On the contrary,when AV turn to 0V,the corresponding frequency is 60Hz.

Ex. : Curve ③ Ai maximum operating frequency = 60Hz × (120% + 0%) = 72Hz

restricted below the upper limit frequency 60Hz

※ P5 = 5,8 Ai1/Ai2 analog input signal (V). This monitoring parameter can correspond to 0~8.33V when the frequency command is 0~100%.

Ex. : Curve④ Ai maximum operating frequency = 60Hz × (80% + 0%) = 48Hz

Formula 2 :

◆ **Frequency bias value = upper limit frequency × bias ratio**

Ex. : Curve ② $= 60\text{Hz} \times 100\% = 60\text{Hz}$

Ex. : Curve ③④ Frequency Bias value $= 60\text{Hz} \times 0\% = 0\text{Hz}$

Ex. : Curve ⑤ $= 60\text{Hz} \times 10\% = 6\text{Hz}$

Ex. : Curve ⑥ $= 60\text{Hz} \times (-10\%) = -6\text{Hz}$

Formula 3 :

◆ $\textbf{Operating voltage(V)} = \dfrac{\textbf{The max voltage} \times (\textbf{Ai max operating freq} - \textbf{Freq bias value})}{\textbf{upper limit frequency} \times \textbf{gain ratio}}$

Ex. : Curve ③ Operating voltage $= \dfrac{10\text{V} \times 60\text{Hz}}{60\text{Hz} \times 120\%} = 8.33\text{V}$

Ex. : Curve ④ Operating voltage $= \dfrac{10\text{V} \times (48\text{Hz} - 0\text{Hz})}{60\text{Hz} \times 80\%} = 10\text{V}$

Formula 4 :

◆ $\textbf{Gain ratio} = \dfrac{\textbf{The max voltage} \times (\textbf{Ai max operating freq} - \textbf{Freq bias value})}{\textbf{upper limit frequency} \times \textbf{Operating voltage}}$

Ex. : Curve ③ Gain ratio $= \dfrac{10\text{V} \times 60\text{Hz}}{60\text{Hz} \times 8.33\text{V}} = 120\%$

Ex. : Curve ④ Gain ratio $= \dfrac{10\text{V} \times 48\text{Hz}}{60\text{Hz} \times 10\text{V}} = 80\%$

Fig. 3 Curve ⑤⑥

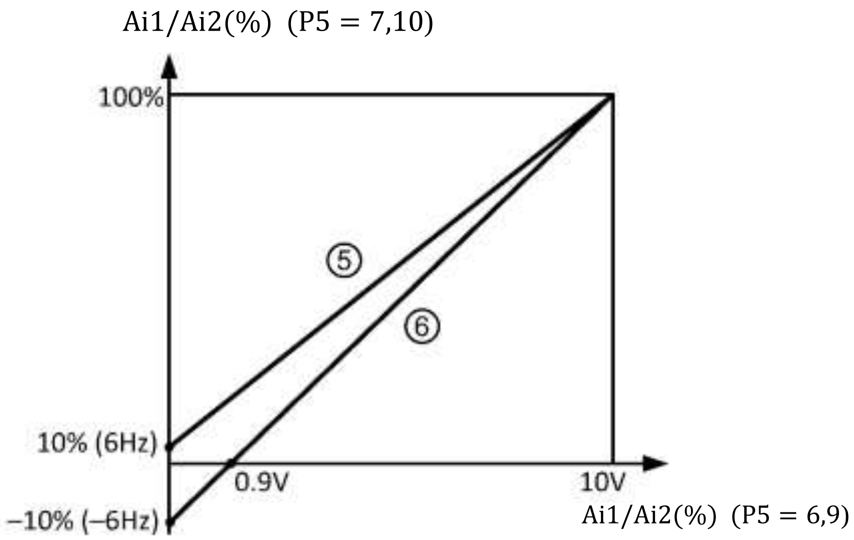


Fig.3

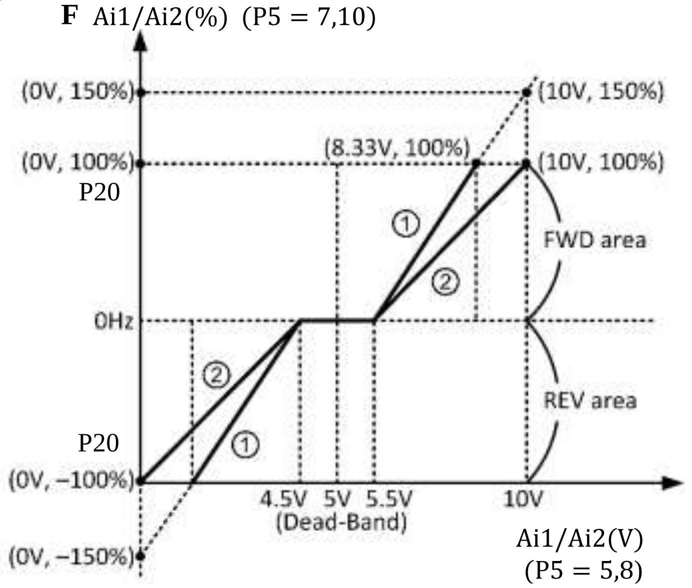
Formula 1 ：Ai maximum operating frequency $= 60\text{Hz} \times (110\% - 10\%) = 60\text{Hz}$

Formula 2 ：Frequency bias value $= 60\text{Hz} \times (-10\%) = -6\text{Hz}$

Formula 3 ：Curve ⑥ Operating voltage $= \dfrac{10\text{V} \times 60\text{Hz} - (-6\text{Hz})}{60\text{Hz} \times 110\%} = 10\text{V}$

Formula 4 ：Curve ⑥ Gain ratio $= \dfrac{10\text{V} \times 66\text{Hz}}{60\text{Hz} \times 10\text{V}} = 110\%$

Formula 5 ：Negative bias voltage $= [10\text{V} \div 110\%] \times 10\% = 0.9\text{V}$



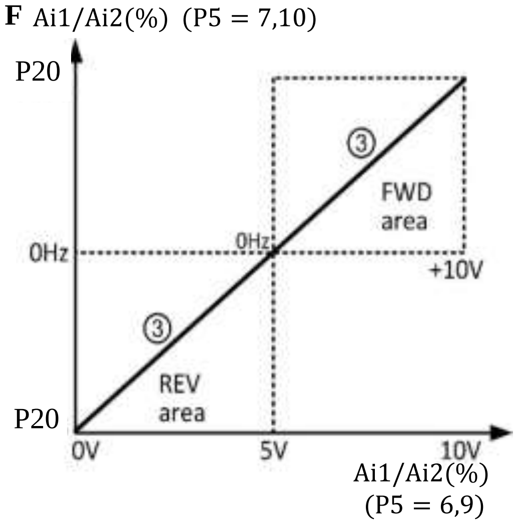


Fig.4 Fig.5

◎ Please refer to Figure 4 & 5 and see the description of parameters in the table below :

Curve	①	②	③
P11/ P12 Frequency command source	2 : Ai1 (0~10V / 4~20mA) 3 : Ai2 (0~10V / 4~20mA)		
P46/ P50, Ai1/Ai2 Input signal mode	1 : 0~10V / 3 : 0~20mA		
P18 Restriction of rotating direction	3：Backward rotation available for negative bias		
P20 Upper limit frequency	60HZ		
P47,P51 Ai:(0V/4mA)：Negative bias voltage	-150%	-100%	-100%
P48,P52 Ai:(10V/20mA)：Gain ratio	300%	200%	200%
Dead band(P49,P53)	10%	10%	0%

※ Curve ①,P5 = 7,10 (Ai1/Ai2 frequency command, 100% is the upper limit frequency).

※ The difference between curve ② and curve ③(P5 = 6,9 Ai1/ Ai2,100% = 10V) is 5V±0.5V (±5%),which is the starting frequency.

Formula 1: **Ai maximum operating frequency = upper limit frequency × (gain ratio + bias ratio)**

① = 60Hz × (300% − 150%) = 90Hz, Upper limit frequency is 60Hz.

②,③ = 60Hz × (200% − 100%) = 60Hz

Formula 2: **Ai maximum operating frequency = upper limit frequency × bias ratio**

① = 60Hz × (− 150%) = −90Hz, Upper limit frequency is -60Hz.

②,③ = 60Hz × (− 100%) = −60Hz

Formula 3：Operating voltage. ※ P5 = 5,8 Ai1/Ai2 Analog input signal (V)，①Ai1/Ai2 Analog input instructions -100~100% corresponds to 1.66~8.33V.

$$\text{Curve③ operating voltage} = \frac{10V \times (60Hz - 60Hz \times (-100\%))}{60Hz \times 200\%} = \frac{10V \times (60Hz - (-60Hz))}{120Hz} = 10V$$

$$\text{Curve② operating voltage} = \frac{10V \times (60Hz - (-60Hz))}{60Hz \times 200\%} = 10V$$

$$\text{Curve① operating voltage} = \frac{10V \times \left(60Hz - (60Hz \times (-150\%))\right)}{60Hz \times 300\%} = \frac{10V \times (60Hz + 90Hz)}{180Hz} = 8.33V$$

Formula 5: Negative bias voltage = [10V ÷ 300%] × 150% = 5V

Input dead band voltage = 10V×(10%) = 1V.

Since the gain and bias parameter settings can cause inversion, 5V is the center of the insensitive band.

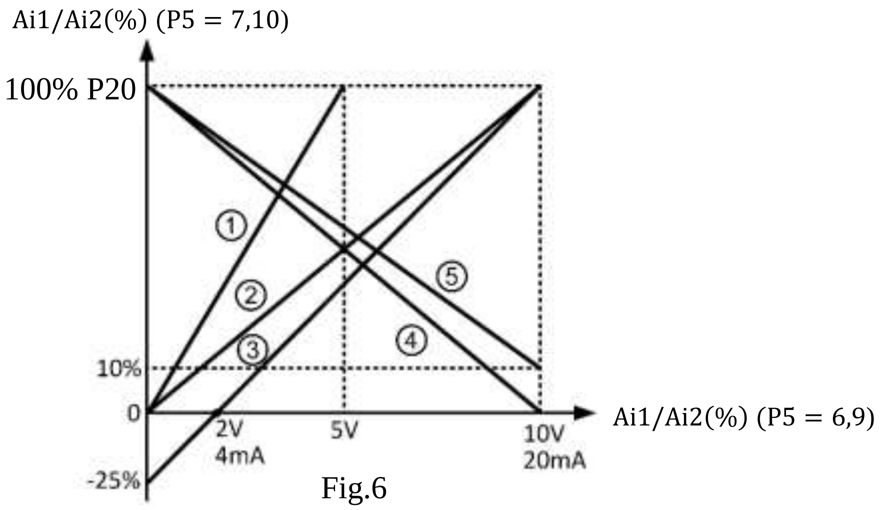


Fig.6

◎ Please refer to Figure 6 and see the description of parameters along different curves in the table below:

Curve		①	②	③	④	⑤	③
P11/ P12	Frequency command source	2 : Ai1 (0~10V / 4~20mA) 3 : Ai2 (0~10V / 4~20mA)					
P46/ P50	Ai1/Ai2 Input signal mode	1 : 0~10V / 3 : 0~20mA					2 : 4~20mA
P20	Upper limit frequency	60HZ					
P47,P51	0V(0mA) Negative bias voltage	0%	0%	-25%	100%	100%	0%
P48,P52	10V(20mA) Gain ratio	200%	100%	125%	-100%	-90%	100%
P18	Restriction of rotating direction	1:Only fwd					

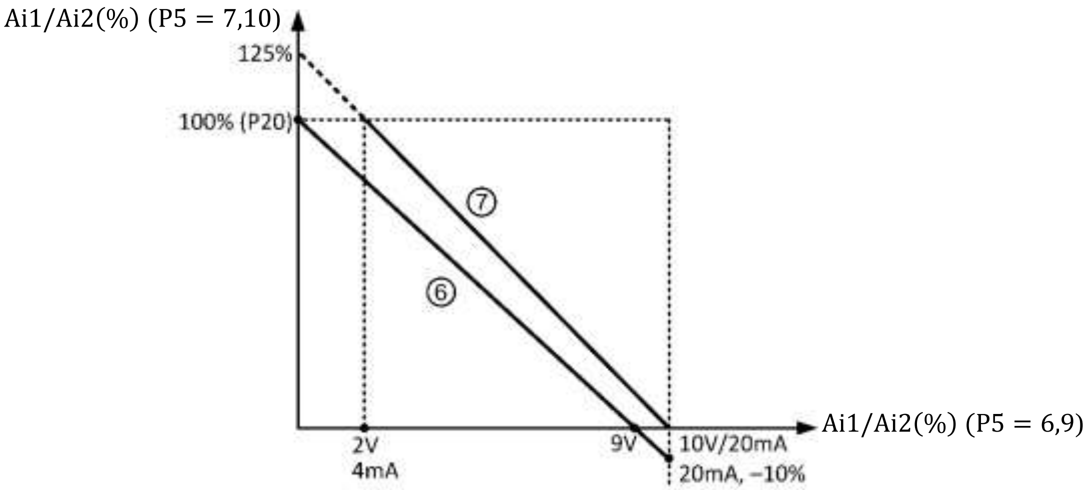


Fig.7

Curve		⑥	⑦
P11/ P12	Frequency command source	2 : Ai1 (0~10V / 4~20mA) 3 : Ai2 (0~10V / 4~20mA)	
P46/ P50	Ai1/Ai2 Input signal mode	3 : 0~20mA	2 : 0~10V 3 : 0~20mA
P19	Lower limit of frequency	0HZ	
P20	Upper limit frequency	60HZ	
P47, P51	0V(0mA) Negative bias voltage	100%	125%
P48, P52	10V(20mA) Gain ratio	-110%	-125%
P18	Restriction of rotating direction	3 :Backward rotation available for negative bias	1 :Only fwd

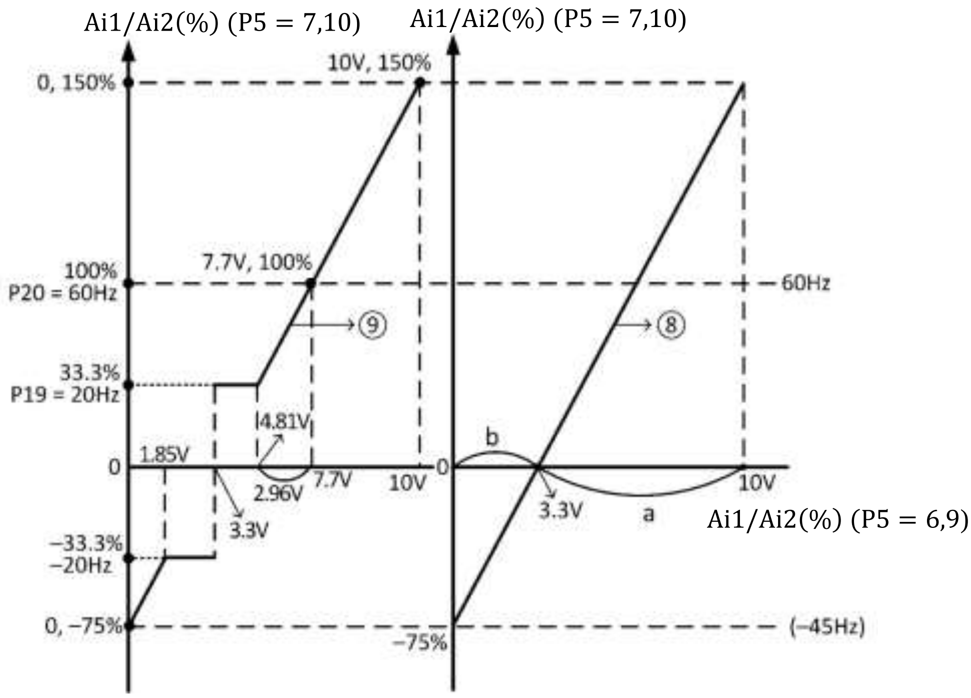


Fig.8

◎ Please refer to Figure 7,8 and see the description of parameters along different curves in the table below:

Curve	⑧	⑨
P11/ P12 Frequency command source	2 : Ai1 (0~10V / 4~20mA) 3 : Ai2 (0~10V / 4~20mA)	
P46/ P50 Ai1/Ai2 input signal mode	1 : 0~10V	
P19 Lower limit frequency	0HZ	20HZ
P20 Upper limit frequency	60HZ	
P47、P51 0V(0mA) Negative bias voltage	-75%	-75%
P48、P52 10V(20mA) Gain ratio	225%	225%
P18 Restriction of rotating direction	3 Backward rotation available for negative bias	

EX.The curve ⑧'s description of figure 8.

Assuming that the setting of curve ⑧ is based on the environment's application,it is known that the upper limit frequency is 60Hz, the frequency of negative bias voltage is 45Hz and the speed can accelerate to the upper limit frequency before the operating voltage of 10V. The following is calculation of curve ⑧'s **negative bias ratio**, **frequency voltage (resolution)**, **operating voltage** and **negative bias voltage value**.

Step 1. The frequency of negative bias is 45Hz and the negative bias ratio is calculated by formula 1.

Formula 6:

$$\blacklozenge\ \textbf{Negative bias ratio}(\%)\ =\frac{\textbf{Frequency of negative bias ratio}\times\ \textbf{100\%}}{\textbf{upper limit of frequency}}$$

$$\text{Negative bias ratio}(\%)\ =\frac{45\text{Hz}\times\ 100\%}{60\text{Hz}}=(-)75\%$$

Step 2. Considering that the speed can reach 60Hz before 10V, the gain ratio set up 225%, and the frequency voltage (resolution) of curve ⑧ is calculated by formula 2 and formula 3.

Formula 7 :

◆ **Slope of the curve** $= \dfrac{\textbf{Gain ratio}}{\textbf{10V}}$

Slope of the curve $= \dfrac{225\%}{10\text{V} - 0\text{V}} = 22.5(\%/V)$

Note: Gain ratio:150%-(-75%) = 225%.It means that 0 ~ 10V corresponds to -75% ~ 150% on fig.8.

Formula 8 :

◆ **Frequency voltage(Hz/V) = Upper limit of frequency × Slope of the curve**

Frequency voltage $= 60\text{Hz} \times 22.5(\%/V) = 13.5(Hz/V)$

Step 3. Calculate the operating voltage and negative bias voltage value of curve ⑧ by formula 4 and formula 5.

Formula 9 :

◆ **Operating voltage** $= \dfrac{\textbf{Upper limit of frequency}}{\textbf{Frequency voltage}}$

Operating voltage(a) $= 60(\text{Hz}) \div 13.5(\text{Hz/V}) = 4.44(\text{V}) \quad (0 \sim 60\text{Hz})$
Negative bias voltage(b) $= (10\text{V} \times 75\%) \div 225\% = 3.33(\text{V}) \quad (-45\text{Hz} \sim 0\text{Hz})$
[Other calculation: Negative bias voltage(b) $= (45 - 0)(\text{Hz}) \div 13.5(\text{Hz/V}) = 3.33(\text{V})$]
Total operating voltage(upper limit of frequency) $= 4.44\text{V} + 3.33\text{V} = 7.77(\text{V})$
Operating voltage(a) range：$3.33 \sim 7.77\text{V}$(the value corresponds to $0\text{Hz} \sim 60\text{Hz}$)
Negative bias voltage(b) range：$0 \sim 3.33\text{V}$(the value corresponds to $-45\text{Hz} \sim 0\text{Hz}$)

EX.The curve ⑨'s description of figure 8.
Continuing the setting of curve ⑧, the lower limit frequency is setup 20Hz.

Negative bias ratio(%) $= \dfrac{45\text{Hz} \times 100\%}{60\text{Hz}} = (-)75\%$

Frequency voltage(Hz/V) $= 60\text{Hz} \times \dfrac{225\%}{10\text{V}} = \dfrac{135\text{Hz}}{10\text{V}} = 13.5(Hz/V)$

Operating voltage(a) $= 60(\text{Hz}) \div 13.5(\text{Hz/V}) = 4.44(\text{V}) \quad (0 \sim 60\text{Hz})$
Negative bias voltage(b) $= (10\text{V} \times 75\%) \div 225\% = 3.33(\text{V}) \quad (-45\text{Hz} \sim 0\text{Hz})$

<u>Consider the lower limit frequency is 20Hz working range:</u>

Operating voltage range 1：$(60 - 20)(\text{Hz}) \div 13.5(\text{Hz/V}) = 2.96(\text{V}) \quad (20 \sim 60\text{Hz})$
(20 ～ 60Hz)：4.81 ～ 7.77 (V)

Operating voltage range 2：$(45 - 20)(\text{Hz}) \div 13.5(\text{Hz/V}) = 1.85(\text{V}) \quad (-20 \sim -45\text{Hz})$
(-45 ～ -20Hz)： 0 ～ 1.85 (V)

※ The operating voltage range can be observed from parameter P-005 = 5, 8.

NO./Hex	Description	Range	Default
P-054 036 (h)	(Ai1/Ai2：4~20mA mode) disconnection detection	0～3	0

◆ **0：No detection.**

No detect (Ai1/ Ai2：4~20mA mode) disconnection signal function.

◆ **1：Free run to stop.**

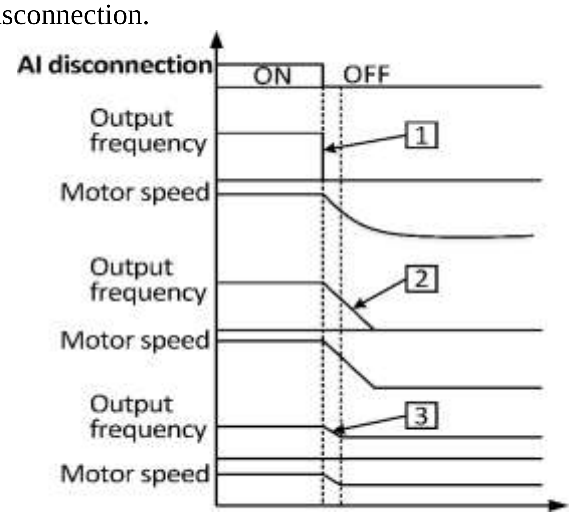
When (Ai1/Ai2：4~20mA mode) is disconnected, the inverter will immediately turn off the output signal, causing an open circuit between the inverter and the motor. The motor will naturally idle and then stop, and Er7 will be displayed.

◆ **2：Decelerate to stop.**

When (Ai1/Ai2：4~20mA mode) is disconnected, the output frequency decreases to 0.0Hz and then trips to stop, and Er7 is displayed.

◆ **3：Keep running at the Frequency before disconnection.**

After (Ai1/Ai2：4~20mA mode) detects a disconnection, the inverter will keep running at the frequency before the disconnection.



7.7 ANALOG (AO) OUTPUT

NO./Hex	Description	Range	Default
P-055 037 (h)	AO: Analog output function	0～4	0

◆ **0：Disabled**

◆ **1：Output frequency**

Displayed output frequency. (upper limit frequency：10V)

◆ **2：Output voltage**

Displayed output voltage. ((P104) output voltage：10V)

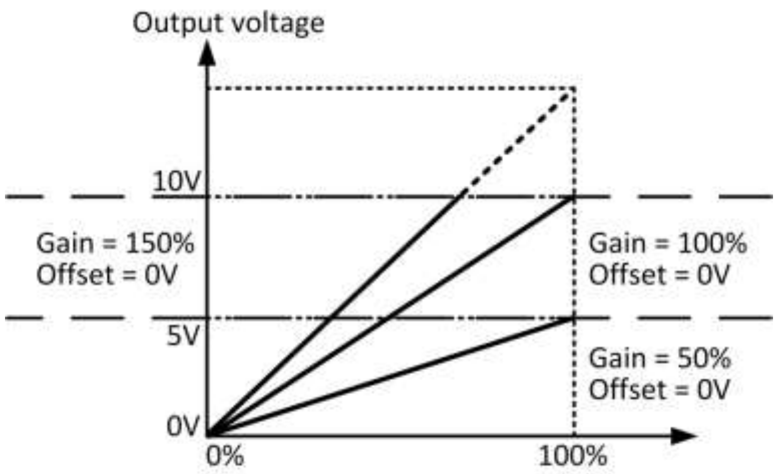
◆ **3：Output current**

Displayed torque current.
(This function is based on the setting of (P99). (P99) 200% is equivalent to 2 times the rated current of the inverter: 10V).

◆ **4：Output power**

Displayed output power. ((P110) Inverter rated power：10V)

NO./Hex	Description	Range	Default
P-056 038 (h)	AO：Output Offset	0.0～100.0 ％	0
P-057 039 (h)	AO：Output Gain	0.0～400 ％	100



7.8 DIGITAL (DI) INPUT

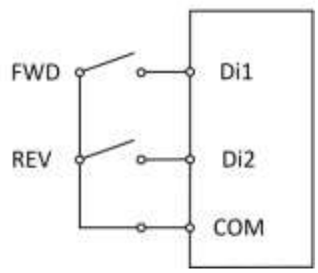
NO./Hex	Description	Range	Default
P-058 03A (h)	Di1,Di2 settings	0～4	0

◎ This function only sets Di1, Di2 two terminals, and only corresponding to the two-wire operation control, the rest of the multi-function is not in the Di1, Di2 operating range.

◆ **0：Di1(FWD/STOP)、Di2(REV/STOP)** . Two-wire control.

This mode is the most commonly used two-wire mode. The Di1 and Di2 terminal commands determine the forward and reverse of the motor.

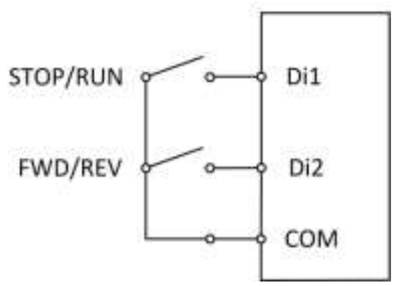
run command	Di1	Di2
STOP	0	0
FWD	1	0
REV	0	1
STOP	1	1



◆ **1：Di1(RUN/STOP)，Di2(FWD/REV)** .Two-wire control.

This mode is the most commonly used two-wire mode. The Di1 and Di2 terminal commands determine the forward and reverse of the motor.

run command	Di1	Di2
STOP	0	-
RUN	1	-
FWD	1	0
REV	1	1



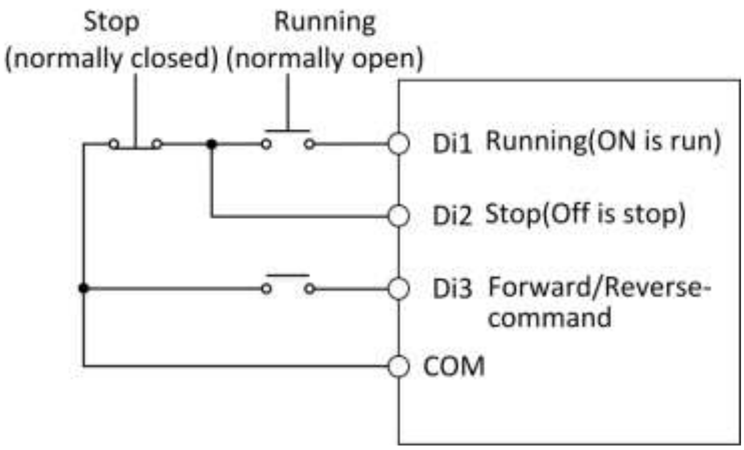
◆ **2：Three-wire stop:Di1(RUN)，Di2(STOP)，Di3(FWD/REV)，(any input terminal Di3~Di6 can define this function.**

When setting the three-wire sequence control, terminal Di3 becomes the input terminal for forward and reverse commands.

When terminal Di1 is set as the operation command, the inverter drives the motor to run when Di1 is closed. (Software self maintain).

When terminal Di1 is set as the operation command, the inverter drives the motor to run when Di1 is closed. (Software self maintain).

Terminal Di2 is (stop command), the input is disconnected for an instant, the inverter will decelerate and stop working immediately.
When the terminal Di3 is in the open state, the inverter always performs forward rotation; when it is in the closed state, it performs reverse rotation.



◆ **3：Di1(FWD RUN/STOP)，Di2(P59 : 0~14)**

Mode 3 : The Di1 terminal commands determine the forward run of the motor. The Di2 is Multi-function input terminal.

◆ **4：Di1(P59 : 0~14)，Di2(P60 : 0~14)**

Mode 4 : The Di1, Di2 are Multi-function input terminal

Di1,Di2 Settngs Mode	Di1	Di2	Di3
0	Fwd run/Stop	Rev run/Stop	–
1	Run/Stop	Fwd /Rev	–
2	Run	Stop	Fwd /Rev
3	Fwd run/Stop	P-60	–
4	P-59	P-60	–

NO./Hex	Description	Range	Default
P-059 03B (h)	Di1 settings	0～14	0
P-060 03C (h)	Di2 settings	0～14	0
P-061 03D (h)	Di3 settings	0～14	2
P-062 03E (h)	Di4 settings	0～14	3
P-063 03F (h)	Di5 settings	0～14	6
P-064 040 (h)	Di6 settings	0～14	8
P-065 041 (h)	Virtual Di7 settings(driven by virtual DO5) ★	0～14	0
P-066 042 (h)	Virtual Di8 settings(driven by virtual DO6) ★	0～14	0
P-067 043 (h)	Virtual Di9 settings(driven by virtual DO7) ★	0～14	0
P-068 044 (h)	Virtual Di10 settings(driven by virtual DO8) ★	0～14	0
P-069 045 (h)	Main speed increasing frequency	0.1～60.0 HZ	1.0
P-070 046 (h)	Main speed decreasing frequency	0.1～60.0 HZ	1.0

※ **Note : When virtual digital input(Di7-Di10) function set <u>3 : (RESET)</u> , it's invalid.**

◎ There is no certain sequence requirement for the setting of 6 terminal functions and 4 virtual digital input, but function cannot be set repeatedly; the only exception is function 0: disabled. <u>0 : Disalbe.</u>

◎ Multi-function input terminal, can be set and used arbitrarily, please read the function description to apply this function. It has priority control and related regulations.

◎ The combination of virtual Dix and DOx is not properly parameter setting,causing the inverter to fail to work normally.The solution refer to P7-30.

◆ **0：Disabled**

This function puts the functional input terminal in a non-functional state to avoid unexplained malfunctions.

◆ **1：Three-wire control**

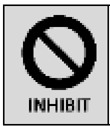
(Please refer to the three-wire control wiring diagram) The RUN terminal is an internal self-holding a contact terminal, and the STOP terminal is a b contact terminal that releases the RUN self-holding state. Forward and Reverse can be switched freely during operation.

◆ **2：External fault input**

When an external fault input occurs, the inverter immediately trips and stops output.

◆ **3：RESET**

When the inverter trips failure, the reset command can be used to release the failure holding state.



The reset command prohibits operation in a constant ON state.

◆ **4：Free run to stop**

When the function terminal signal is input, the inverter turns off the output and makes the motor idling to stop.

◆ **5：Multi-stage speed command 1**

◆ **6：Multi-stage speed command 2**

◆ **7：Multi-stage speed command 3**

Multi-speed commands 1, 2, 3, in binary 3bit mode, can edit eight-stage speed operation control, detailed table please refer to P7-8

◎ When the multi-speed control specified by (P13) RS485 communication is selected as 1, the multi-speed command can only be controlled from RS485 and cannot be started from the terminal.

Multi-speed frequency setting		Di switch		
Multi-step speed	Frequency command	Di1	Di2	Di3
Main speed	P–21	0	0	0
Stage 1 speed	P–22	0	0	1
Stage 2 speed	P–23	0	1	0
Stage 3 speed	P–24	0	1	1
Stage 4 speed	P–25	1	0	0
Stage 5 speed	P–26	1	0	1
Stage 6 speed	P–27	1	1	0
Stage 7 speed	P–28	1	1	1

※ 0 : OFF, 1 : ON

◆ **8 : Inching(Jogging) operation**

When an inching command is activated, its priority is over other frequency command.

◆ **9：FWD Inching(Jogging) operation**

◆ **10：REV Inching(Jogging) operation**

Forward jogging and reverse jogging are operation functions with (running direction command + jogging frequency).

◆ **11 : Main speed increment**

The main speed frequency signal is input from the multi-function terminal. When the switch of the terminal is turned on once, the main speed increases once according to the P69 frequency.

※ Note: P-011 or P-012 = 0 needs to be set as the main speed.

◆ **12 : Main speed decrement**

The main speed frequency signal is input from the multi-function terminal. When the terminal switch is turned on once, the main speed decreases once according to the P70 frequency. (Note: P-011 or P-012 = 0 needs to be set as the main speed).

※ These two sets of functions can be set through the functional terminals to perform external control of the main speed frequency, but the P11 or P12 frequency command source control rights must be set to 0: main speed.

◆ **13 : Turn on operation command source 2 (P10) and frequency command source 2 (P12)**

When the function is triggered, operation command source 1 and the frequency command source 1 Change to operation command source 2 and the frequency command source 2.

Di switch	Content	
On(OFF)	(P9) Operational control source 1	(P11) Frequency command source 1
Close(ON)	(P10) Operational control source 2	(P12) Frequency command source 2

◆ **14: Turn on frequency command source 2 (P12)**

When the function is triggered, the frequency command source change to the frequency command source 2.

Di switch	Frequency command source
ON(OFF)	(P11) Frequency command source 1
Close(ON)	(P12) Frequency command source 2

※ Priority : Inching(Jogging) operation = FWD Inching(Jogging) operation = REV Inching(Jogging) operation > (Multi-stage speed command = Multi-stage speed control specified by RS485 communication) > P11 or P12 frequency command source .

7.9 VIRTUAL DIGITAL (DI) INPUT EXAMPLE

NO./Hex	Description	Range	Default
P-065 041 (h)	Virtual Di7 settings(driven by virtual DO5)	0～14	0
P-083 053 (h)	Virtual DO5 settings (drive the virtual Di7 setting function)	0～45	0
P-084 054 (h)	Virtual Upper limit 5 (frequency/current/Ai1/Ai2)	0～100%	0
P-085 055 (h)	Virtual Lower limit 5 (frequency/current/Ai1/Ai2)	0～100%	0

◎ In order to explain specifically how virtual DO drives virtual Di, the following takes virtual DO5 driving Di7 as an Example.

For example : Assume that the system must use DO"Torque current comparison upper and lower limit" of the 3HP inverter as a judgment whether to drive the "**FWD Inching(Jogging) operation**" of Di7.

1. Setting parameter :

P83 = 40 (The percentage is based on 2 times of P109 "inverter rated current.), P84 = 10 "upper limit torque current comparison value",P85 = 5 "lower limit torque current comparison value", P65 = 9 "FWD Inching(Jogging) operation".

2. Calculation and Analyze :

P84=40, P83 = 10(%),P85 = 5(%),P65 = 9.
The upper limit torque current comparison value=20*10%=2(A) (P109=10A, 2 times current is 20A).
The lower limit torque current comparison value=20*5% = 1(A)

3. Conclusion :

When torque current is greater than 2A,Virtual DO5(P83 = 40) will trigger virtual Di7 (FWD Inching(Jogging) operation). When torque current is less than 1A,FWD Inching(Jogging) operation will disable.DO5(P83 = 41) is opposite logic

7.10 DIGITAL (DO) OUTPUT

NO./Hex	Description	Range	Default
P-071 047 (h)	DO1 settings	0～45	6
P-072 048 (h)	Upper limit 1(frequency/current/Ai1/Ai2)	0～100 ％	0
P-073 049 (h)	Lower limit 1(frequency/current/Ai1/Ai2)	0～100 ％	0
P-074 04A (h)	DO2 settings	0～45	16
P-075 04B (h)	Upper limit 2(frequency/current/Ai1/Ai2)	0～100 ％	0
P-076 04C (h)	Lower limit 2(frequency/current/Ai1/Ai2)	0～100 ％	0
P-077 04D (h)	Relay1 settings	0～45	2
P-078 04E (h)	Upper limit 3(frequency/current/Ai1/Ai2)	0～100 ％	0
P-079 04F (h)	Lower limit 3(frequency/current/Ai1/Ai2)	0～100 ％	0
P-080 050 (h)	Relay 2 settings / DO3 setting(M type)	0～45	4
P-081 051 (h)	Upper limit 4(frequency/current/Ai1/Ai2)	0～100 ％	0
P-082 052 (h)	Lower limit 4(frequency/current/Ai1/Ai2)	0～100 ％	0

※ **P-080 : Standardization type (ES600) terminals have hardware of DO1,DO2,Relay 1,Relay 2 .**
Miniaturiztion type (ES600M) terminals have hardware of DO1,DO2,Relay 1,DO3 .

◆ The Digital Output function is set to even 0, 2, 4, etc.. when the action occurs, Do will change to “On Output” (open collector output) and Relay will change to Action State. (a contact is closed, b contact is open).

◆ The "digital output" function is set to odd numbers 1, 3, 5, etc.. when an action occurs, Do will switch to "non-conducting output" (open collector no output), and Relay will switch to "non-operating state". (a contact = open , b contact = closed).

◆ Function setting odd and even are positive and opposite logic concepts.

◆ **Do(P71、P74) :** Movement according to functional content Do will be switched to “**On output**” / Close. ◆ **Relay(P77、P80) :** Relay will be switched to “**Action state**”.		◆ **Do(P71、P74) :** Movement according to functional content Do will be switched to “ **NO On output**” / Open. ◆ **Relay(P77、P80) :** Relay will be switched to “**No action state**”.	
0	Disabled	1	Disabled
2	Fault output	3	Fault output
4	In operation	5	In operation
6	Zero speed	7	Zero speed
8	Forward	9	Forward
10	Reverse	11	Reverse
12	Accelerating	13	Accelerating
14	Decelerating	15	Decelerating
16	Consistent frequency (in constant speed)	17	Consistent frequency (in constant speed)
18	Inverter overload (Er1)	19	Inverter overload (Er1)
20	Heat sink temperature is too high (OHx)	21	Heat sink temperature is too high (OHx)
22	Overload alarm (OLx)	23	Overload alarm (OLx)
24	RS-485 communiction is failure	25	RS-485 communiction is failure
26	Digital input Di1 (High/Low) signal	27	Digital input Di1 (High/Low) signal
28	Digital input Di2 (High/Low) signal	29	Digital input Di2 (High/Low) signal
30	Digital input Di3 (High/Low) signal	31	Digital input Di3 (High/Low) signal
32	Digital input Di4 (High/Low) signal	33	Digital input Di4 (High/Low) signal
34	Digital input Di5 (High/Low) signal	35	Digital input Di5 (High/Low) signal
36	Digital input Di6 (High/Low) signal	37	Digital input Di6 (High/Low) signal
38	Frequency comparison upper and lower limit	39	Frequency comparison upper and lower limit
40	Torque current comparison upper and lower limit	41	Torque current comparison upper and lower limit
42	Ai1 compare upper and lower limits	43	Ai1 compare upper and lower limits
44	Ai2 compare upper and lower limits	45	Ai2 compare upper and lower limits

Table 1

◎ The following descriptions are all based on setting the "digital output" function to an even number. On the contrary, the output state of the odd number setting is opposite to the even number. The function settings are divided into odd and even numbers. See Table 1 for details.

◆ **0、1：Disabled**

Digital output is in an inactivated state.

◆ **2、3：Fault output**

The inverter detects that an failure condition has occurred.

◆ **4、5：In operation**

The inverter enters the standby mode or is in operation.

◆ **6、7：In zero speed**

When the inverter is stopped or the output frequency is equal to 0.

◆ **8、9：Forward rotation**

The inverter executes the forward rotation command and the output Frequency > 0Hz .

◆ **10、11：Reverse rotation**

when the inverter executes the reverse rotation command and the output frequency > 0Hz

◆ **12、13：Accelerating**

When the inverter is accelerating to the target command.

◆ **14、15：Decelerating**

when the inverter is decelerating to the target command.

◆ **16、17：Consistent frequency (constant speed)**

When the inverter output frequency, it is consistent with the frequency value of the speed command (Main speed ~ Stage 7 speed).

◆ **18、19：Inverter Overload (Er1)**

The output current of the inverter > P109 (the rated current display of the inverter) starts the Integral calculation, and when the current value reaches 150%, the load will be jumped for 1 minute.

◆ **20, 21：Overheating (OHx)**

The temperature of the heat sink reaches the value set by P101 Inverter over-temperature protection setting.

◆ **22, 23：Motor Overload (OLx)**

When the value of the electronic thermal relay of the motor overload protection function exceeds the detection value,the output terminal will be closed.

◆ **24, 25：RS-485 communiction is failure**

When the communication time exceeds the set detection transmission timeout, the signal cannot be received normally.

◆ **26、27 : Digital input Di1 (High/Low) signal**

◆ **28、29 : Digital input Di2 (High/Low) signal**

◆ **30、31 : Digital input Di3 (High/Low) signal**

◆ **32、33 : Digital input Di4 (High/Low) signal**

- **34、35 : Digital input Di5 (High/Low) signal**
- **36、37 : Digital input Di6 (High/Low) signal**
- **38、39：frequency comparison upper and lower limit**

When the drive output frequency (P4=2)≧the upper limit frequency (P72),(P75) ,(P78) and (P81), Do will change to an **"on state"** and Relay will change to an **" activation state"**; Until the drive output frequency≦the lower limit frequency (P73)、(P76)、(P79) and (P82), Do will change to an **"off state"** and Relay will turn to an **"inactive state".**

- **40、41：Torque current comparison upper and lower limit**

When the drive output torque Current (P4=4)≧the upper limit torque current (P72),(P75) ,(P78) and (P81), Do will change to an **"on state"** and Relay will change to an **" activation state"**; Until the drive output torque current≦the lower limit torque current (P73)、(P76)、(P79) and (P82), Do will change to an **"off state"** and Relay will turn to an **"inactive state".**

- **42、43：Ai1 comparison upper and lower limit :**

Please refer to P-071 ～ P-082 and (P-005=6)Ai1 Analog input instructions (%). The following instructions are disassembled into two parts: Do and Relay.

Do：(Function setting : P-071、P-074)

Ai1 Analog input instructions (%)≧ upper limit Ai1 (P72)、(P75), Do will change to an **"on state"**.

Ai1 Analog input instructions (%)≦ lower limit Ai1 (P73)、(P76), Do will change to an **"off state"**.

Relay：(Function setting : P-077、P-080)

Ai1 Analog input instructions (%)≧upper limit Ai1 (P78)、(P81), Relay will change to an **"activation state"**.

Ai1 Analog input instructions (%)≦ lower limit Ai1 (P79)、(P82),Relay will change to an**"inactive state"**.

- **44、45: Ai2 comparison upper and lower limit :**

Please refer to P-071 ~ P-082 and (P5=9) Ai2 Analog input instructions (%). The following instructions are disassembled into two parts: Do and Relay.

Do : (Function setting : P-071、P-074)

Ai2 Analog input instructions (%) ≥ upper limit Ai2 (P72)、(P75), Do will change to an **"on state"**.

Ai2 Analog input instructions (%) ≤ lower limit Ai2 (P73)、(P76), Do will change to an **"off state"**.

Relay：(Function setting : P-077、P-080)

Ai2 Analog input instructions (%)≧upper limit Ai2 (P78)、(P81) , Relay will change to an "**activation state**".

Ai2 Analog input instructions (%)≦ lower limit Ai2 (P79)、(P82),Relay will change to an"**inactive state**".

※ **For details, please refer to P7-31 and P7-32 for examples.**

7.11 VIRTUAL DIGITAL (DO) OUTPUT

NO./Hex	Description	Range	Default
P-083 053 (h)	Virtual DO5 settings ★ (drive the virtual Di7 setting function)	0～45	0
P-084 054 (h)	Virtual Upper limit 5 ★ (frequency/current/Ai1/Ai2)	0～100 %	0
P-085 055 (h)	Virtual Lower limit 5 ★ (frequency/current/Ai1/Ai2)	0～100 %	0
P-086 056 (h)	Virtual DO6 settings ★ (drive the virtual Di8 setting function)	0～45	0
P-087 057 (h)	Virtual Upper limit 6 ★ (frequency/current/Ai1/Ai2)	0～100 %	0
P-088 058 (h)	Virtual Lower limit 6 ★ (frequency/current/Ai1/Ai2)	0～100 %	0
P-089 059 (h)	Virtual DO7 settings ★ (drive the virtual Di9 setting function)	0～45	0
P-090 05A (h)	Virtual Upper limit 7 ★ (frequency/current/Ai1/Ai2)	0～100 %	0
P-091 05B (h)	Virtual Lower limit 7 ★ (frequency/current/Ai1/Ai2)	0～100 %	0
P-092 05C (h)	Virtual DO8 settings ★ (drive the virtual Di10 setting function)	0～45	0
P-093 05D (h)	Virtual Upper limit 8 ★ (frequency/current/Ai1/Ai2)	0～100 %	0
P-094 05E (h)	Virtual Lower limit 8 ★ (frequency/current/Ai1/Ai2)	0～100 %	0

◎ Virtual DOx（P83,P86,P89,P92）settings same as Do1,Do2.

◎ Virtual DO (P83,P86,P8,P92) and virtual upper/lower limit just drive virtual Dix(x=7-10) which have no signal output.
The combination of virtual Dix (x=7-10)and DOx (x=5-8) is not properly parameter setting,causing the inverter to fail to work normally.

◎ **Solution：**

Press and hold the "STOP+DATA" button for about 5 seconds, and then you can see the fault code "Stx."Finally, Press the "FUN" button to modify the parameters.It must reset parameters so that the virtual Dix function can recover.

DIGITAL (DO) OUTPUT EXAMPLE

NO./Hex	Description	Range	Default
P-071 047 (h)	DO1 settings	0～45	38-45
P-072 048 (h)	Upper limit 1(frequency/current/Ai1/Ai2)	0～100 ％	0
P-073 049 (h)	Lower limit 1(frequency/current/Ai1/Ai2)	0～100 ％	0

※ There are 4 parametric groups of "Upper limit" and "Lower limit" (frequency/current/Ai1/Ai2) in P-071-P-082. The first group is P-071-P-073.Terminal's DO1 is the signal output of the first group.The following are 4 examples.

※ P-072 and P-073 are the upper limit comparison value and lower limit comparison value of DO1 function setting 38-45. When DO1=38-45, the respective meanings of the upper and lower limit parameter settings are :

Upper/Lower limit of frequency

Example 1

When P-071=38, 39, P-072 is the "upper limit frequency comparison value", P-073 is the "lower limit frequency comparison value", and the percentage is based on the setting of P-020 "Inverter output upper limit frequency". Assume that according to project requirements, when the output frequency of the inverter is greater than 30HZ, Do is in the **"on state"**, and when it is less than 9HZ, it returns to the **"off state"**. What's value for converting 30HZ and 9HZ into P-072 and P-073 ?

Calculation and Analysis :

Assume that P20 "inverter output upper limit frequency" is 60 HZ (P20=60Hz).

The upper limit frequency comparison value is (30HZ/60 HZ)*100 % =50(%)

The lower limit frequency comparison value is (9HZ/60 HZ)*100 % = 15(%)

Then, P-072=50%, P-073=15%.

Conclusion : Output frequency is greater than 30 Hz(50%),Do outputs **"on state"**.Until output frequency is Less than 9 Hz,the Do output returns to the **"off state"**.

P-071=39 is oppisite logic. When the frequency is greater than 30 Hz, Do will turn into **"off state"**.When the frequency drops to less than 9 Hz, Do will turn into **"on state"**.

Upper/Lower limit of current

Example 2

When P-071 function value is 40 or 41,P-072 and P-073 are "upper limit torque current comparison value", and "lower limit torque current comparison value" respectively. The percentage is based on 2 times of P-109 "inverter rated current".Assume that the project equipment is 3HP inverter (rated current = 10A).

Inverter's torque current is greater than 8A,Digital output is **"on state"**, however,it is less than 2A, DO will return to **"off state"**. What's value for converting 8A and 2A into P-072 and P-073 ?

The upper limit torque current comparison value : (8 A/20 A)*100 % =40(%)

The lower limit torque current comparison value : (2A/20 A)*100 % = 10(%)

Then, P-072=40%, P-073=10%.

Conclusion : When the torque current is greater than 10A(40%),Do outputs **"on state"**.Until the torque current is less than 2A(10%),Do output returns to the **"off state"**. P-071=41 is oppisite logic.

Upper/Lower limit of Ai1/Ai2

Example 3

If P-071 function value is 42 or 43, P-072 is the "upper limit Ai1 comparison value" and P-073 is the "lower limit Ai1 comparison value". Assuming the Ai1 input signal mode is 0~10V,i.e. P-046 = 1. According to inverter engineering requirement is **"on state"** by Do signal when Ai1 command(Ai1 (V/mA) (%)(P5=5)) is greater than 8V. And Do signal returns to **"off state"** when Ai1 is less than 5V. How to convert P-072 and P-073 function value ?

Calculation and Analysis :

The upper limit frequency comparison value is (8V-0V)/(10V-0V)*100 % = 80(%)

The lower limit frequency comparison value is (5V-0V) /(10V-0V)*100 % = 50(%)

Then, P-072=80%, P-073=50%.

Conclusion :

When Ai1 is greater than 80%,Do outputs **"on state"**.Until the Ai1 is less than 80%,the Do output returns to the **"off state"**. P-071=43 is oppisite logic.

Example 4

If project of water pump equip a 4~20mA sensor for feedback. Inverter's engineering requirements **"on state"** occur in 16 mA,and **"off state"** occur in 5.6 mA.How to convert P-072 and P-073 function value?

Analysis :

1. The function P-071 value is setup 44 or 45. P-072 and P-073 are "upper limit Ai2 comparison value", and "lower limit Ai2 comparison value" respectively.
2. Ai2 input signal mode is 4~20 mA,i.e. P-050 = 2,the percentage range is based on 4~20mA corresponding to 0~100%.
3. When the inverter Ai2 speed command i.e. P-005=8 is greater than 16mA,Do output is in **"on state".** It is less than 5.6mA,Do output returns to **"off state".**

Calculation :

The upper limit Ai2 comparison value is (16mA-4mA)/(20mA-4mA)*100 % =75(%)

The lower limit Ai2 comparison value is (5.6mA-4mA)/ (20mA-4mA)*100 % = 10(%)

Conclusion : When Ai2 is greater than 75%,Do outputs is **"on state"**.Until the Ai2 is less than 10%,the Do output returns to the **"off state"**. P-071=45 is oppisite logic.

7.12 MOTOR PROTECTION SETTING

NO./Hex	Description	Range	Default
P-095 05F (h)	Stall current protection switch during running	0～1	0

◆ **0：Disable**

The protection function is closed and does not work .

◆ **1：Protection start**

To enable the protection function.

If the inverter current exceeds the P-099 settings, decelerate first and then continue to accelerate after the current decreases.

NO./Hex	Description	Range	Default
P-096 060 (h)	Fan start mode	0～1	1

◆ **0：Fan constantly rotate**

The fan continues to rotate without stopping.

◆ **1：The fan is started by temperature(P100 setting)**

The fan start to rotate when reach temperature of P100.

NO./Hex	Description	Range	Default
P-097 061 (h)	Motor overload protection switch	0～1	0

◆ **0：Disable**

◆ **1：Enable the mortor overload (OL) protection.**

In order to prevent self-cooling motors from overheating when running at low speeds, users can set motor overload protection to limit the allowable output power of the driver.

NO./Hex	Description	Range	Default
P-098 062 (h)	Stall prevention voltage switch during deceleration	0～1	1

◆ **0：Disable**

◆ **1：Enalbe Stall prevention voltage during deceleration protection.**

In decelerating, if the DC voltage exceeds the stall prevention level, deceleration will stop. When the DC voltage is lower than the detection level, deceleration will continue.The stall prevention function during deceleration automatically extends the deceleration time based on regenerative energy to prevent overvoltage during deceleration.

NO./Hex	Description	Range	Default
P-099 063 (h)	Output current limit ★	0～220 ％	185

◆ **0：Disable -**the protection function is closed and does not work .

◆ **1：Protection function is enable.**

When the output current exceeds the set value, the inverter will quickly reduce the output voltage value to prevent the inverter from tripping due to overcurrent.

※ Note: The rated current of the inverter is set at 100%, and the overcurrent is OC.200%.

Example : If this function is set at 150%, when the output current is greater than 150%, this function will quickly reduce the speed to make the current below 150%.

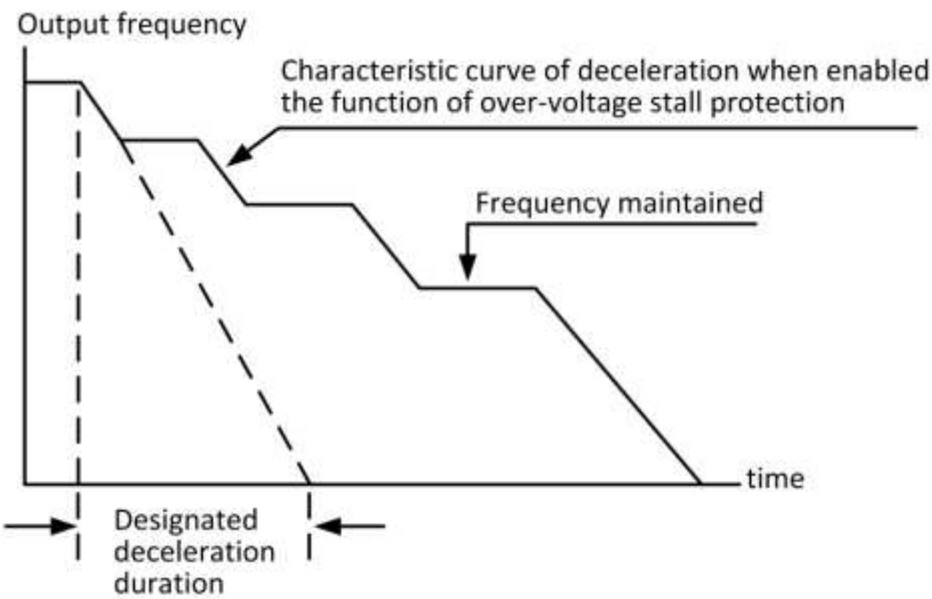
NO./Hex	Description	Range	Default
P-100 064 (h)	Fan start temperature setting	40.0～60.0 ℃	45.0
P-101 065 (h)	Over temperature protection setting	60.0～90.0 ℃	88.0

◆ The temperature of the heat sink rises to the starting temperature setting value to drive the fan to start. when the temperature drops (**P-100** setting value - 5.0℃), the fan stops running.

◆ If the temperature of the internal heat sink is greater than the set value of **P-101**, an fault is detected (OH2) and the motor stops freely.

NO./Hex	Description	Range	Default
P-102 066 (h)	Decelerating-Stall prevention voltage level	220V:330～400vdc	370
		440V:660～800vdc	740

◎ When the inverter is decelerating, due to the influence of the motor load inertia, the motor will generate rebound energy into the inverter, causing the DC bus voltage to increase. Therefore, when the inverter detects that the DC bus voltage is higher than the set value, the inverter will stop decelerating (The output frequency pauses and decreases), and the inverter will decelerate again when the DC bus voltage is lower than the set value.



7.13 MOTOR AND INVERTER PARAMETER SETTING

<table>
<tr><th>NO./Hex</th><th>Description</th><th>Range</th><th>Default</th></tr>
<tr><td rowspan="2">P-103
067 (h)</td><td rowspan="2">Regenerative braking voltage level</td><td>220Vdc:350～400</td><td>365</td></tr>
<tr><td>440Vdc:700～800</td><td>730</td></tr>
</table>

◎ Set the level of brake voltage action ON.

◎ Suppress overvoltage by braking resistor, and use external resistor to convert regenerative energy from motor into heat energy consumption.

◎ Please refer to the selection and wiring of regenerative braking resistor and the internal configuration of BRD models for the minimum resistance and BRD utilization rate that can be connected to each model.

<table>
<tr><th>NO./Hex</th><th>Description</th><th>Range</th><th colspan="2">Default</th></tr>
<tr><td rowspan="2">P-104
068 (h)</td><td rowspan="2">RST input voltage (rms)</td><td rowspan="2">150～255 V
300～510 V</td><td>220</td><td>200</td></tr>
<tr><td>440</td><td>380</td></tr>
<tr><td>P-105
069 (h)</td><td>Motor rated current</td><td>0.0～1400.0 A</td><td colspan="2">P105</td></tr>
</table>

◎ **P-104 and P-105** are motor nameplate rated value parameter groups. The set value must be set according to the rated value on the motor nameplate. According to this parameter group, the nverter will perform calculation control and protect motor overload... and other functions.

◎ **P-104 -** RST input voltage value setting, which is the actual input voltage value of the inverter.

NO./Hex	Description	Range	Default
P-106 06A (h)	SVPWM carrier frequency	2～16kHZ	8

◆ **P-106 = 2~16 (2K~16KHZ), the carrier frequency is updated after stopping and restarting.**

◎ This parameter can set the carrier frequency value of SVPWM output.

◎ The setting value of carrier frequency will affect the electromagnetic noise of motor, the switching loss of IGBT switch and the heat dissipation of switching loss. The relationship is as follows:

Carrier frequency	Motor noise	Switching loss	Heat dissipation	Torque	Harmonic rate
2KHz ↕ 16KHZ	Large ↕ Small	Small ↕ Large	Small ↕ Large	Large ↕ Small	Small ↕ Large

NO./Hex	Description	Range	Default
P-107 06B (h)	UVW output phase sequence setting	0～1	0

◎ This parameter setting can change the motor running direction without adjusting the forward/reverse signal or changing the UVW phase sequence of the output line-to-line voltage.

◆ **0 : UVW**

◆ **1 : VUW**

WARNING **In changing the direction of motor operation, please confirm the safety of equipment and personnel to avoid danger.**

NO./Hex	Description	Range	Default
P-108 06C (h)	Vdc gain (read only)	0～900 times	347

◎ This parameter is to adjust the gain value of the DC-BUS voltage at both ends of the capacitor, and the result of the gain value will be used as one of the important parameters for displaying P-005 = 0 : normal DC side voltage (DC-BUS) and internal control calculation.

NO./Hex	Description	Range	Default
P-109 06D (h)	Inverter rated current	0.0～1400.0 A	3.7

◎ This parameter can display the rated current value of the inverter. The rated current value of this unit has been defined at the factory.

NO./Hex	Description	Range	Default
P-110 06E (h)	Inverter rated power	0.0～500.0 HP	3.0

◎ This parameter can display the rated power value of the inverter. The rated power value of this unit has been defined at the factory.

7.14 V/F CURVE SETTING

NO./Hex	Description	Range	Default	
P-111 06F (h)	V/F minimum voltage display	0.0～10.0 ％	0.0	
P-112 070 (h)	V/F maximum output voltage setting	0.1～255 V	220	200
		0.2～510 V	440	380
P-113 071 (h)	V/F maximum voltage’s frequency setting	0.1～480.0 HZ	60.0	50.0

◎ P-111 minimum voltage display maximum value is 10% of inverter rated voltage.

◎ The voltage setting value and maximum output frequency of P-112 and P-113 should be set according to the voltage value on the motor nameplate.

◎ If the set value of P-113 is lower than the rated frequency of the motor, it may cause the inverter output current to be too large, causing damage to the motor or start the overcurrent protection of the inverter. If the setting value is higher than the rated frequency of the motor, the motor output torque may be insufficient.

NO./Hex	Description	Range	Default
P-114 072 (h)	N-square curve gain	0.0～100.0%	0.0

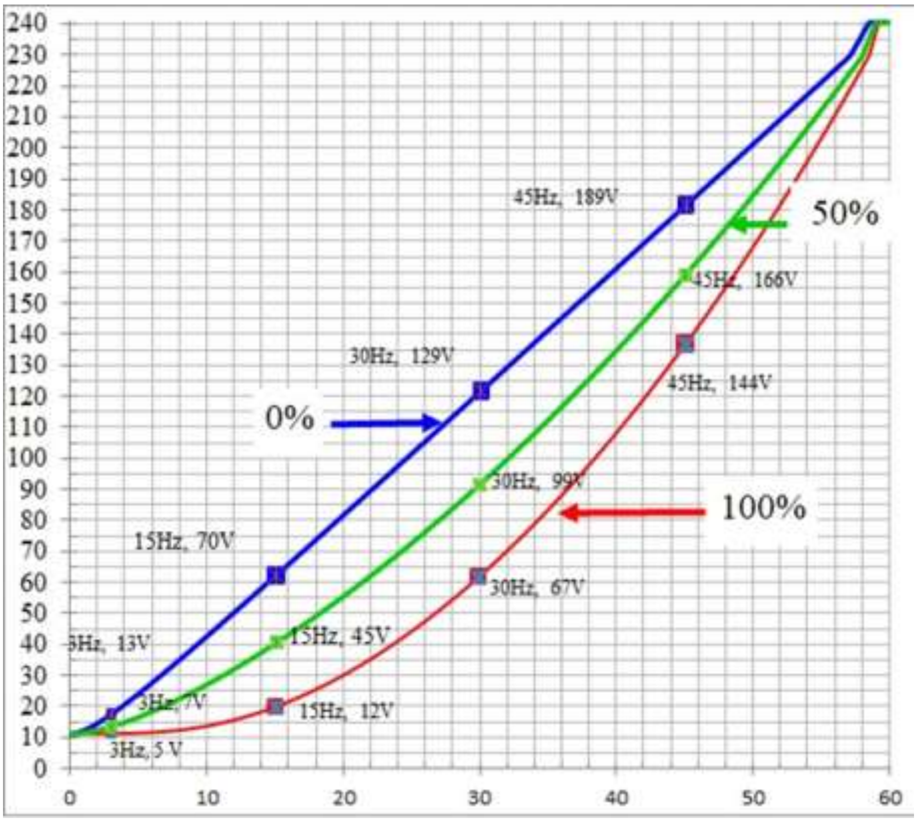
◎ The maximum output voltage setting value and maximum output frequency of P-112 and P-123 should be set according to the voltage value on the motor nameplate.

◎ If the set value of P-113 is lower than the rated frequency of the motor, it may cause the inverter output current to be too large, causing damage to the motor or triggering the inverter's overcurrent protection. If the setting value is higher than the rated frequency of the motor, the motor output torque may be insufficient.

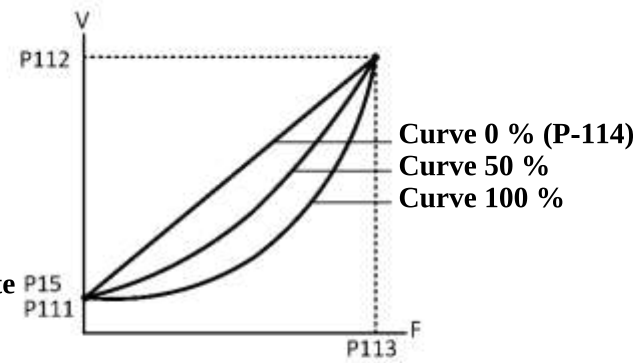
◎ Please adjust carefully and do not set too large.

◎ For V/F curve control, the gain value (P-114) is operated between 30% and 100%.

◎ When setting the V/F curve, please set the curve according to the purpose.



VF-N square curve (the values in the figure are for reference)



wind, hydraulic, fluid machinery

7.15 COMMUNICATION SETTING(RS485)

RS485 Communication parameter group			
NO./Hex	**Description**	**Range**	**Default**
P-115 073 (h)	Inverter communication address	1～254	1

◆ The legal communication address range of the inverter is between 1 and 254, which represents the communication address of the inverter in the communication network. The main device (PC or PLC is Master) can be remote based on the communication address set by each inverter monitor.

※ In the same communication network, there cannot be two (or more than two) inverters with the same communication address. 0 is broadcast.

※ If set to 0, the inverter will not respond to MEMOBUS communication.

NO./Hex	Description	Range	Default
P-116 074 (h)	PC transfer rate	0～6	2

- ◆ **0：2400 bps.**
- ◆ **1：4800 bps.**
- ◆ **2：9600 bps.**
- ◆ **3：19200 bps.**
- ◆ **4：38400 bps.**
- ◆ **5：57600 bps.**
- ◆ **6：115200 bps.**

◎ 2400 Bps transmission bits per second 2400/8 = 300 Bytes/Second Transfer rate is related to the quality and length of the transmission cable. If the transmission cable is longer, it is recommended to select a lower transfer rate so as to obtain higher transfer quality and stability. If you want to get a faster response speed of the inverter, in addition to adjust a higher transfer rate, it is advise to adjust the P116 communication response delay time as well.

NO./Hex	Description	Range	Default
P-117 075 (h)	Inverter communication data format	0～3	0

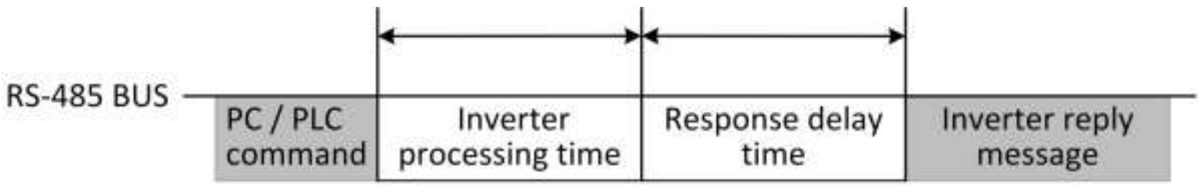
- ◆ **0：〈8,N,1〉 RTU (1 start bit ＋ 8 data bits ＋ 1 stop bit).**
- ◆ **1：〈8,E,1〉 RTU (1 start bit ＋ 8 data bits ＋ 1 Even bit＋1 stop bit).**
- ◆ **2：〈8,O,1〉 RTU (1 start bit ＋ 8 data bits ＋ 1 Odd bit ＋ 1 stop bit).**
- ◆ **3：〈8,N,2〉 RTU (1 start bit ＋ 8 data bits ＋ 2 stop bit).**

※ The Modbus protocol uses a dedicated information frame (Frame) to conduct "serial communication" between the master device and the slave device. The dedicated information frame (Frame) has the function of reading and writing data. Using this function, you can read and confirm the operating status from the inverter or write the input instructions of the inverter. The serial transmission mode of this machine is RTU (RemoteTerminal Unit) mode.

NO./Hex	Description	Range	Default
P-118 076(h)	Inverter communication response delay time	3～50 ms	5

◎ Set the time between the receipt of data and the start of transmission.

◎ The response time of the inverter is the delay time for the inverter to send the response signal after receiving the command signal from the master device (Master), due to the response time of each master device (Master), and the interval between one packet and the next packet The time is different. If the response time of the inverter is set too short and does not match the response time of the master device (Master), the response signal may overlap with the command signal in the communication network. Therefore, the inverter response time needs to be set according to the response time of different main devices.



NO./Hex	Description	Range	Default
P-119 077(h)	Detected transmission timeout	0.0～120.0 Sec	0.0

◆ 0：No detection of communication timeout, continue to run.

◎ The parameter is used to set the timeout time for the inverter to receive communication transmission from the master device (Master).

NO./Hex	Description	Range	Default
P-120 078(h)	Time-out detection processing method	0～2	2

◆ **0**：Free to stop.

◆ **1**：Decelerate to stop.

◆ **2**： Continue to run (only display Er7).

NO./Hex	Description	Range	Default
P-121 079(h)	Receive failure response code	0～7	0

NO.	Content	NO.	Content
0	Normal receiving	4	Packet receiving time exceeds P-119 seconds
1	Function code error	5	Write non-modifiable parameters
2	CRCL error	6	Parameter address error
3	CRCH error	7	The setting parameter value is out of range

MODBUS communication

◎ Character fomat

◎ **RTU mode**：Each 8-bit data consists of two 4-bit hexadecimal characters. For example: 64H

0: 8,N,1 RTU :11 bits(1 start bit +8 data bits +1 stop bit)

START BIT	0	1	2	3	4	5	6	7	STOP BIT

1: 8,E,1 RTU:11 bits (1 start bit +8 data bits +1 Even bit+1 stop bit)

START BIT	0	1	2	3	4	5	6	7	EVEN PARITY	STOP BIT

2: 8,O,1 RTU:11 bits (1 start bit +8 data bits+1 Odd bit +1 stop bit)

START BIT	0	1	2	3	4	5	6	7	ODD PARITY	STOP BIT

3: 8,N,2 RTU :11 bits(1 start bit +8 data bits +2 stop bit)

START BIT	0	1	2	3	4	5	6	7	STOP BIT	STOP BIT

◎ Data structure (data content is in 16-bit unsigned format)

RTU mode：

START	Static period longer than 10 ms
ADR	Communication address: 8-bit address
CMD	Function code: 8-bit command
DATA (n-1)	Data content：nx8-bit data， n<=25
…….	
DATA 0	
CRC CHK Low	CRC error detection value：
CRC CHK High	The 16-bit error detection value consists of two 8-bit characters.
END	Static period longer than 10 ms

◎ Function code

(1) 03H : Read inverter setting parameters and display parameters.

(2) 06H : Write inverter operating parameters and setting parameters.

(3) 08H : Communication loop test.

(1) Function code【03H】: Read the inverter setting parameters	
A. PC call :	**B. Inverter response :**
D1. Communication address (0~FFh)	D1. Communication address (0~FEh)
D2. Function code (03h)	D2. Function code (03h)
D3. #Th setting parameter (H) (0xh)/(21h)	D3. Data BYTE number (00~80h)
D4. #Th setting parameter (L) (00~xxh)	D4. Set parameter content 1(H) (0~FFh)
D5. Number of data (H) (00h)	D5. Set parameter content 1(L) (0~FFh)
D6. Number of data (L) (00~06h)	………………
D7. CRCL (0~FFh)	Dm-3. Set parameter content n(H) (0~FFh)
D8. CRCH (0~FFh)	Dm-2. Set parameter content n(L) (0~FFh)
	Dm-1. CRCL (0~FFh)
※ $n \leq 64$	Dm. CRCH (0~FFh)
	※ m = 5 + 2*n

◎ There are 2 formats for【03H】read the inverter setting parameters：

1. P-001/001 **[NO./Hex]**
2. 2100 Fault record ~ 2113 Software version,please refer to pp. 7-1–7-3.

◆ Example 1 : The computer queried the inverter: parameter P-030 (30 = 01Eh) a piece of data.

◎ Inverter response：

P30 = 10.0 Sec，10.0 Sec=100=64(h) (Inverter response)

n=1

m=5+2*1=7, the data length responsed by the inverter reaches D7.

Communication format		PC call RTU	Communication format		Inverter response RTU
Communication address	D1	01h	Communication address	D1	01h
Function code	D2	03h	Function code	D2	03h
#Th setting parameter (H)	D3	00h	Data BYTE number	D3	02h
#Th setting parameter (L)	D4	1Eh	Set parameter content 1(H)	D4	00h
Number of data (H)	D5	00h	Set parameter content 1(L)	D5	64h
Number of data (L)	D6	01h	CRCL	D6	B9h
CRCL	D7	E4h	CRCH	D7	AFh
CRCH	D8	0Ch			

Communication monitoring content selection list			
HEX	**content**	**HEX**	**content**
2100	Fault record	210a	Ai1 Analog input signal (V)
2101	Frequency setting (0.1Hz)	210b	Ai1 (0~10V/4~20mA/0~20mA) (%)
2102	Display operating frequency (0.1Hz)	210c	Ai1 (frequency command) (%)
2103	Display output voltage (0.1V)	210d	Ai2 Analog input signal (V)
2104	Display operating torque current (0.1A)	210e	Ai2 (0~10V/4~20mA/0~20mA) (%)
2105	DC-BUS voltage (V)	210f	Ai2 (frequency command) (%)
2106	Output Power (%)	2110	Ao output calculation result (0.01%)
2107	Number of digital terminal input segments	2111	Temperature display (℃)
2108	Number of digital terminal output segments	2112	Estimated speed (rpm)
2109	The knob on the AV digital operator (V.R)	2113	Software version

◆ Example 2：Inverter response，3parameters displayed：2101～ 2103

◎ Inverter response：

2101：Frequency setting（60.0Hz）= 60.0Hz = 600 = 0258(h)

2102：operating frequency（60.0Hz）= 60.0Hz = 600 = 0258(h)

2103：output voltage（228V）= 228V = 228 = 08E9(h)

n=3

m=5+2*3=11, the data length responsed by the inverter reaches D11.

Communication format		PC call	Communication format		Inverter response
		RTU			RTU
Communication address	D1	01h	Communication address	D1	01h
Function code	D2	03h	Function code	D2	03h
#Th setting parameter (H)	D3	21h	Data BYTE number	D3	06h
#Th setting parameter (L)	D4	01h	Set parameter content 1(H)	D4	02h
Number of data (H)	D5	00h	Set parameter content 1(L)	D5	58h
Number of data (L)	D6	03h	Set parameter content 2(H)	D6	02h
CRCL	D7	5Eh	Set parameter content 2(L)	D7	58h
CRCH	D8	37h	Set parameter content 3(H)	D8	08h
			Set parameter content 3(L)	D9	E9h
			CRCL	D10	47h
			CRCH	D11	7Fh

(2) Function code 【06H】: Write the inverter operating parameters

A. PC call :

D1. Communication address	(00~FFh)
D2. Function code	(06h)
D3. #Th operating parameter (H)	(20h)
D4. #Th operating parameter (L)	(00h)
D5. Write parameter content (H)	
D6. Write parameter content (L)	
D7. CRCL	(0~FFh)
D8. CRCH	(0~FFh)

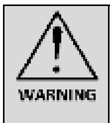
B. Inverter response :

D1. Communication address	(0~FFh)
D2. Function code	(06h)
D3. #Th operating parameter (H)	(20h)
D4. #Th operating parameter (L)	(00h)
D5. Write parameter content (H)	
D6. Write parameter content (L)	
D7. CRCL	(0~FFh)
D8. CRCH	(0~FFh)

2000h Operating parameter setting ::

Bit	Content				
Bit 15	EEPROM Store				Note : Refer to P-122
Bit 14	EEPROM Read				
Bit 13	Reserved				
Bit 12	Reserved				
Bit 11	Reserved				
Bit 10	Muti-stage speed selection 3				
Bit 09	Muti-stage speed selection 2				
Bit 08	Muti-stage speed selection 1				
Bit 07	External fault input				
Bit 06	Fault reset				
Bit 05	Running direction	0	0	1	1
Bit 04	Running direction	0	1	0	1
—		No action	FWD	REV	Change direction
Bit 03	Reserved				
Bit 02	Reserved				
Bit 01	Running command	0	0	1	1
Bit 00	Running command	0	1	0	1
		No action	FWD	REV	Jog running

※ The inverter provides 2 pages of EEPROM storage space for users to store or read parameter settings. Through parameter P-122 (storing/reading EEPROM page number) selection, setting parameter code 0x8000h (Bit15=1) can store all current parameters to EEPROM. Setting the parameter code 0x4000h (Bit14=1) will read back the parameter’s values which are stored in the EEPROM page number.



To frequently write parameter which will shorten the life of EEPROM.

Example: The computer commands the inverter to make aJogging forward rotation.

0000 0000 0001 0011(b) = 0013(h) Jogging forward rotation

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1

Communication format		PC call	Communication format		Inverter response
		RTU			RTU
Communication address	D1	01h	Communication address	D1	01h
Function code	D2	06h	Function code	D2	06h
#Th setting parameter (H)	D3	20h	#Th setting parameter (H)	D3	02h
#Th setting parameter (L)	D4	00h	#Th setting parameter (L)	D4	20h
Number of data (H)	D5	00h	Number of data (H)	D5	00h
Number of data (L)	D6	13h	Number of data (L)	D6	13h
CRCL	D7	C3h	CRCL	D7	C3h
CRCH	D8	C7h	CRCH		C7h

(2) Function code 【06H】: Write the inverter operating parameters			
A. PC call :		**B. Inverter response :**	
D1. Communication address	(00~FFh)	D1. Communication address	(0~FFh)
D2. Function code	(06h)	D2. Function code	(06h)
D3. #Th operating parameter (H)	(20h)	D3. #Th operating parameter (H)	(20h)
D4. #Th operating parameter (L)	(00h)	D4. #Th operating parameter (L)	(00h)
D5. Write parameter content (H)		D5. Write parameter content (H)	
D6. Write parameter content (L)		D6. Write parameter content (L)	
D7. CRCL	(0~FFh)	D7. CRCL	(0~FFh)
D8. CRCH	(0~FFh)	D8. CRCH	(0~FFh)

Example: By the computer modifies that the inverter setting parameter P-021 (main speed): 50.0Hz.

Parameter P-021 (Main speed) , 21 = 15h (hexadecimal)

Communication format		PC call	Communication format		Inverter response
		RTU			RTU
Communication address	D1	01h	Communication address	D1	01h
Function code	D2	06h	Function code	D2	06h
#Th setting parameter (H)	D3	00h	#Th setting parameter (H)	D3	00h
#Th setting parameter (L)	D4	15h	#Th setting parameter (L)	D4	15h
Number of data (H)	D5	01h	Number of data (H)	D5	01h
Number of data (L)	D6	F4h	Number of data (L)	D6	F4h
CRCL	D7	98h	CRCL	D7	98h
CRCH	D8	19h	CRCH		19h

(3) Function code 【08H】: Loop detection	
A. PC call :	**B. Inverter response :**
D1. Communication address (00~FFh)	D1.Communication address (00~FFh)
D2. Function code (08h)	D2. Function code (08h)
D3. Test data content (1) (0~FFh)	D3. Test data content (1) (00~FFh)
D4. Test data content (2) (0~FFh)	D4. Test data content (2) (00~FFh)
D5. Test data content (3) (0~FFh)	D5. Test data content (3) (00~FFh)
D6. Test data content (4) (0~FFh)	D6. Test data content (4) (00~FFh)
D7.CRCL (0~FFh)	D7. CRCL (0~FFh)
D8.CRCH (0~FFh)	D8. CRCH (0~FFh)

◆ **Example: Loop testing commands**

Communication format		PC call	Communication format		Inverter response
		RTU			RTU
Communication address	D1	01h	Communication address	D1	01h
Function code	D2	08h	Function code	D2	06h
Test data content (1)	D3	01h	Test data content (1)	D3	01h
Test data content (2)	D4	02h	Test data content (2)	D4	02h
Test data content (3)	D5	03h	Test data content (3)	D5	03h
Test data content (4)	D6	04h	Test data content (4)	D6	04h
CRCL	D7	41h	CRCL	D7	41h
CRCH	D8	04h	CRCH		04h

CHK（check sum：error detection value）

RTU mode uses CRC (Cyclical Redundancy Check) error detection value, and the CRC error detection value is calculated in the following steps:

1.CRC = 0FFFFH

2.CRC = (CRC)XOR (D1)

3.Determine if CRC's bit0 is 1.

Yes : CRC = (CRC >>1)✕OR (0A001H)

No : CRC = CRC>>1

Note : >> Means shift to the right by 1 bit , and add 0 to the high bit

4. Repeat step 3 again for seven times (that is, perform step 3 a total of eight times)

5. Load the next data D2

6. Repeat steps 2 ~ 4

7. Repeat steps 5 ~ 6 until all data have been executed

7.16 RECALLING PARAMETERS

NO./Hex	Description	Range	Default
P-122 07A (h)	EEPROM page for Store/Read parameter	1～2	1

◆ **1～2**.

◎ To Provide the user's EEPROM page number, Page 1 to 2 which can be saved/read the parameter value.

◎ When the user operates the inverter, parameter setting values are stored in the temporary memory RAM. Parameters will be quickly stored in the EEPROM memory immediately before a complete power shutdown, and after the inverter powers up again, parameters of the inverter will be read back from the default EEPROM addresses to RAM. And clear simultaneously data in the default EEPROM.

If inverter need to store different parameter setting. please use the function of P-122 (save/read EEPROM page number) to follow the operation steps below. Commonly used situations, such as: different parameter settings of rolling doors and elevator doors are saved in the same inverter simultaneously.

◆ **The operation steps :**

Step 1. Select the EEPROM page number for storing parameters (P-122)：**Set Page 1 or Page 2.**

Step 2. Press the digital manipulator simultaneously : a single action of storing (STOP + UP) or reading (STOP + Down).

Store (STOP + UP)：

Simultaneously press the digital operator buttons 『STOP RESET』+『∧』 to start writing to EEPROM which store automatically all current parameter values on the selected page.The digital operator will display "P1.SAVE" and "P2.SAVE".

Read (STOP + Down)：

Simultaneously press the digital operator buttons 『STOP RESET』+『∨』 to start reading EEPROM which recall all the stored parameters from the selected page .The digital operator will display "P1.READ" and "P2.READ".

NO./Hex	Description	Range	Default
P-123 07B (h)	Recall parameters	0～5	0

◆ **0：Not Recalled**

◆ **1：220V / 440V, 60HZ Ex-factory settings** — Recall the original 220V/440V, 60HZ factory settings.

◆ **2：220V / 400V, 50HZ factory settings** — Recall the original 220V/440V, 50HZ factory settings.

◆ **3：200V / 380V, 60HZ factory settings** — Recall the original 200V/380V, 60HZ factory setting.

◆ 4：**<u>200V / 380V, 50HZ factory settings</u>** — Recall the original 200V/380V, 50HZ factory setting.

<u>※ The parameters P109、P110、P126～P129 are not in this recall function.</u>

◆ 5：**<u>Clear the fault record</u>**

When the inverter is running, the failure phenomenon will be recorded in parameters P-126～P-129.

The fault record can be cleared by P123:5, and the fault content value stored in the memory can be cleared.

7.17 FAULT RECORDS

NO./Hex	Description	Range	Default
P-124 07C(h)	Number of auto-reset	0～10	0

◎ In the event of an abnormal fault during operation, automatic failure recovery and restart can be appropriately allowed, considering the operation of the system. This parameter sets the number of fault restart permissions.

WARNING	The auto-reset function will automatically restart in the event of an abnormal fault during operation. This function may cause danger to the user. Please conduct a functional safety risk assessment.

NO./Hex	Description	Range	Default
P-125 07D(h)	Waiting time of auto-reset	0.0～60.0 Sec	5.0

◎ The malfunciton of inverter will restart after waiting time of auto-reset(P-124).

◎ When fault occur in the inverter, P-124~P-125 will automatically clear the fault (P-124,P-125 = 0,disable automatic reset). If there is safety consideration, please cancel the automatic reset function of P-124~P-125.

◎ The fault auto-reset time is the default time of 5 seconds. **In case of large mechanical inertia equipment**, please refer to the function of parameters P-016～P-017 to **delay** the start-up operation.

NO./Hex	Description	Range	Default
P-126 07E (h)	Latest fault record	0～255	-
P-127 07F (h)	Last 1 fault record	0～255	-
P-128 080 (h)	Last 2 fault record	0～255	-
P-129 081 (h)	Last 3 fault record	0～255	-

◎ Fault record format 1：XXa._ _ _ 。

◎ Format explanation :

XX : OC (overcurrent)、OL (overload)、OV (overvoltage)、LV (low voltage)、
OH (overheating).

a(state) :

0: Static / DC-break.

1: Accelerating.

2: Constant velocity.

3: Decelerating.

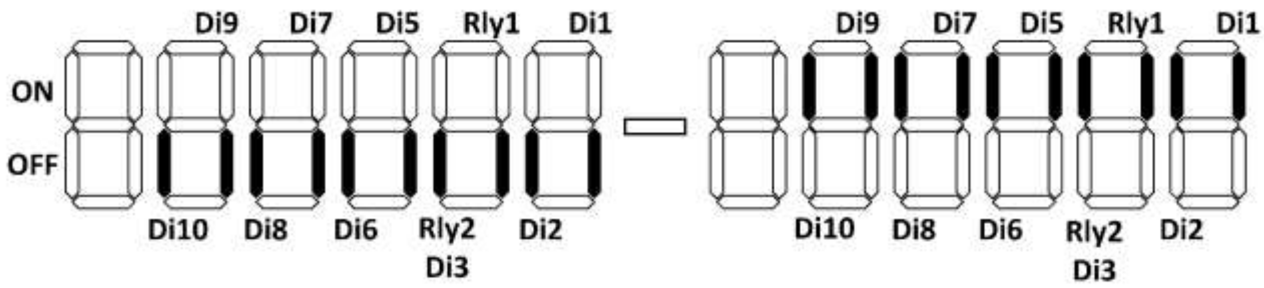
_ _ _: The number of error occurences, the maximum is 255.

◎ Format 2: Er 1~7 other error codes.

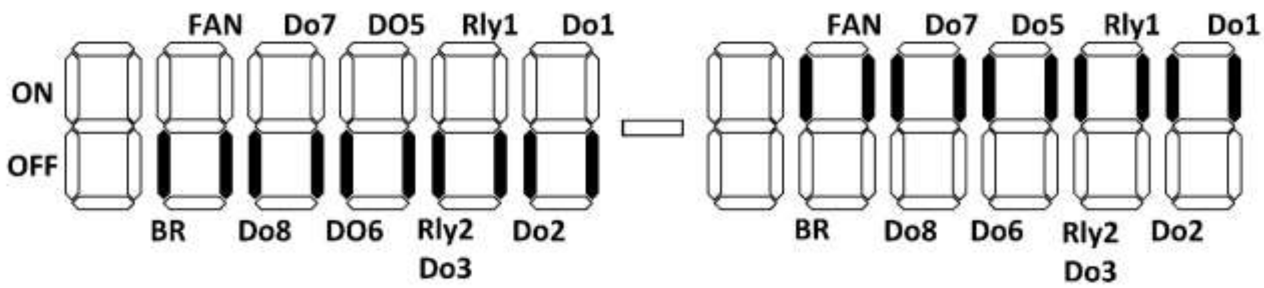
● Users can check the parameters P-130~P-141 in this section to know the latest fault records currently occurring, as well as the corresponding status information such as frequency, current, voltage, etc., and analyze the failure conditions of the inverter.

NO./Hex	Description	Range	Default
P-130 082 (h)	Speed command in the event of a fault	0～480.0 HZ	0.0
P-131 083 (h)	Output frequency in the event of a fault	0～480.0 HZ	0.0
P-132 084 (h)	Motor speed in the event of a fault	0～18000	0
P-133 085 (h)	Output voltage in the event of a fault	0～1000 V	0
P-134 086 (h)	Output torque current in the event of a fault	0～3000.0 A	0.0

NO./Hex	Description	Range	Default
P-135 087 (h)	DC voltage in the event of a fault	0～1000 V	0
P-136 088 (h)	DC current in the event of a fault	0～3000.0 A	0.0
P-137 089 (h)	Input terminal status in the event of a fault	0～1023	0



NO./Hex	Description	Range	Default
P-138 08A (h)	Output terminal status in the event of a fault	0～1023	0



NO./Hex	Description	Range	Default
P-139 08B (h)	Inverter temperature in the event of a fault	-63.0～150.0 ℃	0.0
P-140 08C (h)	AD value of OC when the fault occurs	0～4096	0
P-141 08D (h)	AD value of VDC when the fault occurs	0～4096	0

Chapter 8 Faults protection and troubleshooting

8.1 Introduction

This chapter introduces the relevant diagnosis and treatment measures for inverter faults,as well as the relevant problems and solutions for analyzing motor fault phenomena.

8.2 Faults information & Troubleshooting chart

◎ When the error code of the inverter is displayed on the digital operator, the error contact output will cut off the inverter output and the motor will stop to free run.

◎ When a fault occurs, data will be stored in the fault record (parameters P-126～P-129), and various failed status of the inverter (parameters P-130～P-141). The same fault code can be accumulated repeatedly.

◎ Remedys and possible causes can refer to the table and adopt coping measures.

◎ When the drive restart,it can reset abnormally using any of the following methods :

1. Press the Reset button of the digital operator.
2. Turn on the RESET of the digital input terminal mode
3. Input the RESET code of RS-485 mode.
4. After cutting off the main circuit power supply, LEDs of the digital operator extinguish before turning on the power again.

< Table > Fault indication and remedy

Display	Description	Cause	Remedy
OU0 OC0	Over-voltage or over-current during standby state	● Excessively high voltage at input (R.S.T) source resulting in that the voltage on the DC side is over the voltage detected level. ● Phase-Phase short-circuits or grounding short-circuit take place to output wire.	● Drop the voltage to fall within the range of power source specification. ● Check the output wire to remove any short-circuited phenomena.
OU1 OC1	Over-voltage or over-current during acceleration	● The output terminal of theinverter is short-circuit, loosen or ground. ● Whether the activation is done while the motor is idling (it is easy to cause over-voltage or over-current). ● Acceleration time too short (easy to cause over-current). ● Poor insulation of the motor causes over-voltage due to any leakage.	● Check whether the output of terminal wiring is correct. ● Please set P14 ,P15 for DC braking time and DC braking current. ● Extend the acceleration time appropriately. ● Check motor isolation or change new one.
OU2 OC2	Over-voltage or over-current during speed regulation	● The power changes instantaneously. ● Whether the motor is dragged by external force. ● Whether the load undergoes drastic change.	● Install a reactor on the power input side. ● Improve the system to eliminate external sources. ● Reduce the load or increase the inverter capacity.

Display	Description	Cause	Coping Measures
OU3 **OC3**	Over-voltage or over-current during deceleration	● The deceleration is too short to the motor's regenerative energy is too large(it's easy to cause over-voltage or over-current). (input 200V：O.V 410Vdc, 400V：O.V 820Vdc)	● Extend the deceleration time or connect a brake resistor(or brake controller)
LU0	DC low voltage (L.V) during standby state	● The DC voltage is too low when the operation command is put into operation.	● Please check whether the input voltage is normal.
LU1 **LU2** **LU3**	DC low voltage (L.V) during speed regulation	● Instantaneous power failure, resulting in lower than the DC protection level (200V：L.V 200Vdc/400V：L.V 400Vdc). ● The Voltage of the input power supply is too low. ● Whether the internal high-power fuse is blown. ● Check whether the load suddenly increases.	● Please check the orign and improve the quality of the power supply. ● Check whether the power supply capacity is too small.
OL1 **OL2**	Motor overload	● The over torque of the mechanical load is abnormal. ● The motor rated current is set incorrectly. ● The motor has been over loaded for a long time.	● Check whether the mechanical action of the load is normal. ● Please check whether it exceeds the rated value of parameter P-097. ● Reduce the motor load or increase the capacity of the motor and inverter.
OH	Heat sink overheating	● Check whether the cooling fan is normal. ● Ambient temperature is too high.	● Change the cooling fan. ● Increase the air-changing volume of environment.
Stx	Press and hold the "STOP+FWD" button for more than 5 seconds (Stx)	● When the virtual Di and virtual Do functions are not set properly, so that the control of the inverter becomes invalid, press and hold the STOP button for more than 5 seconds to make it invalid, and then reset the appropriate virtual Di and virtual Do functions.	● Press and hold the STOP and FWD key for more than 5 seconds to display the abnormal fault. ● To tap FUN button to reset vitrtual Di/Do parameters.
Er1	Inverter overload (150 %,60 sec)	● The motor capacity is greater than the inverter capacity. ● Ac drive is loaded a current over the rated current by 150% for 60 seconds.	● Increase the capacity of the inverter. ● Reduce the motor load.
Er2	External fault input	● External faliure signals are inputted from the multi-function input terminal (Di1~Di6) or Virtaul Digital input (Di7~Di10)	● Remove the cause of the external fault and press the reset button. If it is invalid,send back the factory for repair.

Display	Description	Cause	Coping Measures
Er3	Parameter setting error (Di repeated setting)	● Multi-function input terminals Di1~Di6 or Virtaul Digital input (Di7~Di10) set the same function repeatedly (with the exception of 0: no action).	● Check the settings of Parameters P-059~P-068.
Er4	EEPROM Parameter read back failure (Default1)	● Failure in EEPROM,no data available,storage incomplete,or parameter setting out of range.	● Use the function of Parameter P-123；Recall Ex-factory setting before setting up the motor nameplate parameter group,or check one by one the parameter setting for any challenge of the range. ● If the above step is fail,return it to genuine maker for service.
Er5	Memory recalling failure	● Factory parameter read failure from EEPROM memory data.	● Use the function of Parameter P-122；Save/Read parameter page before recalling.If Er4 still appears after recalling,please proceed to the next step. ● Use the function of Parameter P-123；Recall parameters before motor parameter group setting,or check whether the parameter setting value exceeds the one by one. ● If the above step is fail,return it to genuine maker for service.
Er6	RS485 transmission faliure.	● The inverter receives a communication transmission timeout from the master device (Master).	● Please check whether the Master side continues to read back parameters.
Er7	(Ai1/Ai2 : 4~20mA mode) disconnected.	● Is the (Ai1or Ai2 : 4~20mA) line in bad contact?	● Please check whether the Ai1/Ai2 and terminals are properly connected.

8.3 Most Frequently Used Troubleshooting

INHIBIT	Troubleshooting listed below can only be done by qualified technician or Dedicated keeper of this machine.The manufacturer of this machine will not be liable for any failure of this machine due to failure to observe this statement.

✘ The motor just won’t run

Symptom：the motor fails to operate.

✓ **Check to see whether source has been delivered to the R.S.T source terminals ?**

- Turn on the power source.
- Cut off the power supply before turning it on.

- ✓ **Check to see whether there is voltage output terminals U.V.W ?**
  - ☞ Confirm the power source.
  - ☞ Follow the operation procedure to operate.
- ✓ **Is there any error in the wiring ?**
  - ☞ Check and repair for any error in wiring loops.
- ✓ **Check to see whether the motor shaft is deadlocked ?**
  - ☞ Reduce motor load.
  - ☞ Check the mechanical structure.
  - ☞ Replace new motor.

- ✓ **If the protection mechanism works ?**
  - ☞ Confirm the display.
- ✓ **If the operation keypad properly set up?**
  - ☞ Reconfirm the operation procedure.

✘ The ac drive trips when the motor is activated ?

Symptom：the message of OC1 dispalys when the motor activated or in course of acceleration(possible a transient output exceeds 200％ of the rated current when the over current protection function operates,or the IGBT module is damaged).

- ✓ **If the torque is insufficient upon activation of heavy load ?**
  - ☞ Change the setting of torque compensation.
- ✓ **If the acceleration time is too short to match the of GD^2 the load ?**
  - ☞ Extend the acceleration time.
- ✓ **If the activation frequency is too low ?**
  - ☞ Increase the activation frequency.
- ✓ **Protection function enabled ?**
  - ☞ Confirm the diplay in the monitor.
- ✓ **Ac drive staeted when motor is idling ?**
  - ☞ Set up the function：dc brake and start from zero frequency.
- ✓ **If the operation keyboard properly set up?Any leakage due to poor insulation of the motor ?**
  - ☞ Reconfirm.
  - ☞ Replace with a good motor,or remove the output wires before feeding to activate; if trip insists OC1,it indicates failure of the ac drive;if not,the failure of the motor.

✘ AC drive trips when motor is decelerating？

Symptom：OU3 appears when decelerating the motor (Protective funciotn of over-voltage enabled.)

✓ **The integral brake loop inside the ac drive failed to absorb the regenerative energy from motor during a sharp deceleration when the GD2 of motor-driven load is too big?**

＊Over-voltage protection function will be enabled immediately when regenerative energy exceeds 414V(200~240V series) or 827V(380~460V series).

- ☞ Extend the deceleration time.
- ☞ Install a DC brake resistance(optional) of a grade not greater than 15HP exclusively for external use.
- ☞ If the DC brake resistance is of a grade of 20HP or larger,an external brake unit and resistance must be provided.

✘ Trip during static operation ?

◆ **LU1 appears during operation.**

✓ **Voltage of power supply Low?**

Review the capacity of power supply equipment and find out the cause to the short voltage; such as, check if the contacts of no-fuse-breaker of magnetic switch are in good condition.

◆ **LU2 appears during operation.**

✓ **Caused by load and motor or power supply voltage?**

✓ **If any poor motor insulation leading or leakage?**

- ☞ Install external dedicated DC braking resistor(optional).
- ☞ Remove the output wires, re-supply the power and start it; if it still trips at OV, then the ac drive malfunctioned, if it does not trip at OV, then the motor is troubled with electric leakage and shall be replaced with new one

Chapter 9 Test,Inspection & Maintenance

9.1 Safety precautions

WARNING	
	☑ A maintenance professional shall confirm the current status of power supply switch in person.In order to ensure the safety of operation,stricktly keep the power switch from the reach of irrelevant personnel with an identification label hung on the switch. ☑ Within a short period of time right after disconnecting the power supply,there will be DC high voltage remained at the electrolytic capacitor of large capacity in the internal rectification loop of the ac drive.For this reason,please make sure to see if the [CHARGE] light is off before performing the substrate inspection.

Daily inspection, regular inspection:

◎ Electronic equipment cannot be used permanently. Even under normal working conditions, if it exceeds the service life, it will produce characteristic changes or malfunction. In order to prevent malfunctions, preventive maintenance such as daily inspections, regular inspections, and replacement of parts must be carried out.

◎ Inverter is composed of IGBT (power transistor), semiconductor parts such as IC, electronic parts such as capacitors and resistors, and many parts such as fans and relays. If all these parts can't operate normally, they can't perform the functions that the product should have.

◎ Please perform regular inspections in accordance with the checklist in this chapter.

◎ When the inverter was installed in the following environment, please shorten the period of regular inspection compared with the normal situation.

- ⦿ High temperature environment.
- ⦿ Frequently start and stop.
- ⦿ Environment with AC power supply or load fluctuation
- ⦿ There is an environment with excessive vibration or shock.
- ⦿ Environment with dust, metal dust, salt, sulfuric acid, and chlorine.
- ⦿ Storage in a bad environment.
- ⦿ It is recommended to check the equipment every 1 to 2 years after installation.

◆ **Daily Inspection Items**

The daily inspection of our company's inverter is shown in the table below. In order to avoid deterioration of the inverter function and product damage, please check the following items daily.

Inspection Items	Checkout content	Coping Measures
Motor	Whether the motor has abnormal vibration and abnormal sound.	◊ Confirm the connection with the machine. ◊ Measure the vibration of the motor. ◊ Tighten the screws of the connection part.

Inspection Items	Checkout content	Coping Measures
Cooling system	Whether the inverter and motor have abnormal heating and discoloration.	◊ Confirm whether it is overloaded. ◊ Lock screw. ◊ Check whether the heat sink and motor of the inverter are dirty. ◊ Confirm the ambient temperature.
	Confirm the cooling fan and cooling fan circuit board.	◊ Confirm the dirtiness of the cooling fan and internal air agitation fan. ◊ Use parameters to confirm the operating time of the cooling fan and internal air agitation fan.
Environment	Whether the installation environment corresponds to the standard.	◊ Eliminate pollution sources or improve the installation environment.
Loading	Whether the output current of the inverter is higher than the rated motor or rated inverter for a certain period of time.	◊ Confirm whether it is overload. ◊ Confirm the setting of motor parameters.
Power ,voltage	Whether the main circuit voltage and control voltage are normal.	◊ Adjust the voltage and current values to be within the value on the nameplate. ◊ Confirm each phase of the main circuit voltage.

◆ Regular inspection

The regular inspection of our company's inverter is shown in the table below. In general, it is recommended to conduct regular inspections every 1 to 2 years, but please determine the actual frequency of inspections based on the actual usage and working environment of each inverter. Regular inspections help prevent functional deterioration and product damage.

Check item	Check out content	Coping Measures
	Main circuit	
Overall	◊ Whether the parts are discolored due to overheating or aging. ◊ Whether each part is damaged or deformed.	◊ Replace damaged parts. ◊ If there are damaged bits that cannot be repaired or replaced, replace the entire inverter.
	◊ Whether it is stained with dirt, garbage, dust.	◊ Check whether the door of the control panel equipped with the inverter is tightly closed. ◊ Clear with dry air. ◊ If it cannot be removed, replace the heavily soiled part.
Wire	◊ Whether the wires and connections are discolored, damaged, or aging due to overheating. ◊ Whether the wire coating is damaged, cracked, or discolored	◊ Repair or replace damaged wires.
Terminals	◊ Whether the connecting terminal is worn, damaged or loose.	◊ If the screws or terminals are damaged after tightening, they should be replaced.
Electromagnetic contactor,relay	◊ Whether it makes an abnormal sound during the action. ◊ Whether the coil has the phenomenon of aging or cracking of the wire coating due to overheating.	◊ When the voltage exceeds the reference value and does not exceed the reference value, confirm the voltage of the coil respectively ◊ Replace damaged electromagnetic contactors, relays, and circuit boards.

Check item	Checkout content	Coping Measures
Main circuit		
Brake resistor option	◊ Whether the insulator is discolored due to overheating.	◊ The slight discoloration is not abnormal. ◊ When discoloration occurs, please confirm whether the wiring is defective.
Electrolytic capacitor	◊ Whether it is leaking, discolored, or cracked. ◊ Whether the safety valve is exposed, expanded or leaked.	◊ If there are damaged parts that cannot be repaired or replaced, replace the entire inverter.
Motor		
Action check	◊ Whether the vibration and running noise are abnormally aggravated.	◊ Stop the motor and contact professional maintenance personnel.
Control circuit		
Overall	◊ Whether the terminals are worn, damaged, or improperly connected. ◊ Whether the screws are loose.	◊ If the screws or terminals are damaged after tightening, they should be replaced. ◊ If the terminals of the printed circuit board cannot be repaired or replaced, change the entire inverter.
Printed circuit board	◊ Whether there is abnormal smell, discoloration, severe rust, whether the connector is installed correctly, whether it is stained with dust and oil mist.	◊ Reinstall the connector class. ◊ If it cannot be cleaned clearly with an electric cloth or vacuum cleaner, replace the printed circuit board. ◊ Don't use solvents on printed circuit boards. ◊ Use dry air to remove trash and dust. ◊ If there are damaged parts that cannot be repaired or replaced, change the entire inverter.
Cooling system		
Cooling fan	◊ Whether the motor has abnormal sound and vibration ◊ Whether there are damaged or missing blades.	◊ Clean or replace the fan.
Heat sink Vents	◊ Whether it is blocked or stained with foreign matter.	◊ Please use dry air to remove obstacles and dust.

※ Please truly follow the check items listed in this manual to conduct them item by item to ensure this product is always maintained at a normal state for a long time.

The AC drive is comprised of variety of components and takes the advantage of these parts & components to maintain and develop its expected functions.Because of it is an electronic part that will be worn somewhat by the working environment and operator's habit of using it,therefore,in order to obtain a normal operation for a long time,a regular check and replacement of parts & components is strongly recommended.

Chapter 10 Selection of brake unit

10.1 Safety precautions

DANGER	Avoid electric shock! The internal DC capacitor of the inverter will not be discharged until 5 minutes after the power is removed. Please disassemble or inspect it 5 minutes after the power is removed. Wait 15 minutes for 15Hp or more.

WARNING	◊ Do not operate with the inverter cover removed, otherwise there will be a risk of electric shock. ◊ In order to illustrate the details of the product, the illustrations in this manual sometimes show the state of removing the outer cover or safety cover. ◊ Be sure to follow the instruction manual to operate the inverter with the specified cover or cover installed. ◊ Do not remove the cover of the inverter or touch the printed circuit board when the power is on, otherwise there is a danger of electric shock. ◊ Only electric professionals are allowed to perform maintenance, inspection or component replacement, otherwise there is a danger of electric shock. ◊ Installation, wiring, repair, inspection and replacement of parts should be carried out by a person who is familiar with the installation, adjustment and repair of the inverter. ◊ Do not perform work related to the inverter when you are wearing loose clothes or accessories, and when you are not using goggles to protect your eyes. Otherwise, there is a danger of electric shock or injury. ◊ Be sure to ground the ground terminal on the motor side, otherwise it may cause electric shock or fire due to contact with the motor casing. ◊ Please tighten the terminal screws according to the specified torque. If the connection of the main circuit wire is loose, it may cause a fire due to the overheating.

Important	**When operating the inverter, please follow the steps specified in ESD prevention measures.** Otherwise, the internal circuit of the inverter will be damaged due to static electricity. **Do not unplug the wiring of the motor while the inverter is outputting voltage.** Otherwise, the inverter will be damaged.

10.2 Selection of brake unit

WARNING	The temperature surrounding of the brake resistance will rise after the continuous discharging by brake resistance to expose the objects in the vicinity.Therefore,always keep those objects at 2M away from the brake resistance.Sufficient ventilation or additional fans shall be provided at where the brake resistance is installed.

Specification Table：200V series

Ac drive						Specifications			
Voltage	Applicable motor capacity		Equivalent resistance specification W / Ω	Brake torque (10%ED) %	Equivalent Min resistance value (Ω)	Brake resistor (Module)	Brake resistor /SET	Specifications of externally mounted brake unit	SET
	HP	KW							
200V	0.5	0.4	150W/150Ω	225	75Ω			Included	
	1	0.75	150W/150Ω	150	75Ω				
	2	1.5	300W/100Ω	125	39Ω				
	3	2.2	500W/60Ω	140	30Ω				
	5	3.7	800W/40Ω	125	27Ω				
	7.5	5.5	1200W/25Ω	135	18Ω	DR1K5W-24	1		
	10	7.5	1500W/20Ω	125	10Ω	DR1K5W-20	1		
	15	11	2200W/13.6Ω	125	10Ω	DR3K1W-12	1		
	20 △	15	3000W/10Ω	125	6.6Ω	DR3K1W-10	1	LSBR-2015B	1
	25 △	18.5	3700W/8Ω	125	6.6Ω	DR4K6W-8	1	LSBR-2022B	1
	30 △	22	4400W/6.8Ω	125	3.3Ω	DR4K6W-6.6	1	LSBR-2022B	1
	40 △	30	6000W/5Ω	125	3.3Ω	DR6K2W-5	1	LSBR-2015B	2
	50 △	37	7400W/4Ω	125	3.3Ω	DR4K6W-8	2	LSBR-2022B	2
	60 △	45	9000W/3.3Ω	125	2.5Ω	DR4K6W-6.6	2	LSBR-2022B	2
	75 △	55	11000W/2.7Ω	125	2.5Ω	DR6K2W-5	2	LSBR-2022B	3
	100	75	15000W/2Ω	125		DR6K2W-6	3	LSBR-2022B	4
	125	90	18000W/1.6Ω	125		DR6K2W-5	3	LSBR-2022B	4 / 5
	150	110	22000W/1.3Ω	125		DR6K2W-5	4	LSBR-2022B	5

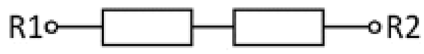
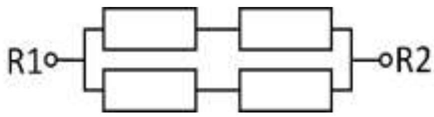
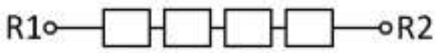
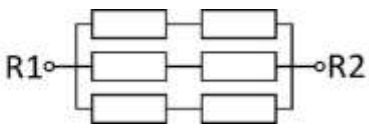
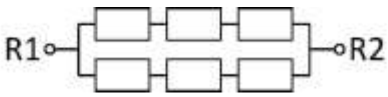
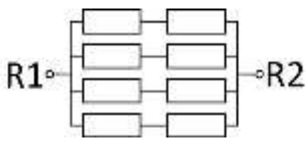
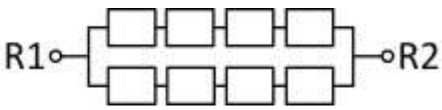
△：An additional brake circuit can be fitted into the ac drive when placing the purchase order.

Specification Table：400V series

Ac drive						Specifications			
Voltage	Applicable motor capacity HP	Applicable motor capacity KW	Equivalent resistance specification W / Ω	Brake torque (10%ED) %	Equivalent Min resistance value (Ω)	Brake resistor (Module)	Brake resistor/ SET	Specifications of externally mounted brake unit	SET
400V	1	0.75	150W/300Ω	200	150Ω			Included	
	2	1.5	300W/300Ω	155	150Ω				
	3	2.2	500W/150Ω	175	72Ω				
	5	3.7	800W/100Ω	170	72Ω				
	7.5	5.5	1200W/80Ω	155	40Ω	DR1K5W-80	1		
	10	7.5	1500W/60Ω	155	40Ω	DR1K5W-60	1		
	15	11	2200W/50Ω	135	40Ω	DR3K1W-48	1		
	20 △	15	3000W/40Ω	125	20Ω	DR3K1W-40	1	LSBR-4015B	1
	25 △	18.5	3700W/32Ω	125	20Ω	DR4K6W-30	1	LSBR-4030B	1
	30 △	22	4400W/27.2Ω	125	20Ω	DR4K6W-30	1	LSBR-4030B	1
	40 △	30	6000W/20Ω	125	14.3Ω	DR6K2W-20	1	LSBR-4030B	1
	50 △	37	7400W/16Ω	125	14.3Ω	DR4K6W-30	2	LSBR-4030B	2
	60 △	45	9000W/13.3Ω	125	10Ω	DR4K6W-6.6	2	LSBR-4030B	2
	75 △	55	11000W/10Ω	125	6.6Ω	DR6K2W-20	2	LSBR-4030B	2
	100	75	15000W/8Ω	125	6.6Ω	DR6K2W-24	3	LSBR-4030B	3
	125	90	18000W/6.6Ω	125		DR6K2W-20	3	LSBR-4030B	3
	150	110	22000W/5.4Ω	125		DR6K2W-20	4	LSBR-4030B	4
	175	132	26400W/4.5Ω	125		DR6K2W-20	4	LSBR-4030B	5
	200	160	32000W/3.7Ω	125		DR6K2W-20	5	LSBR-4030B	6
	250	185	37000W/3.2Ω	125		DR6K2W-20	6	LSBR-4030B	7
	300	220	44000W/2.7Ω	125		DR6K2W-20	8	LSBR-4030B	8
	400	300	60000W/2Ω	125		DR6K2W-20	10	LSBR-4030B	10
	500	375	75000W/1.6Ω	125		DR6K2W-24	13	LSBR-4030B	13

△：An additional brake circuit can be fitted into the ac drive when placing the purchase order.

Selection of brake resistance(DR brake resistance specifications)

Model NO.		Connection（Internal configuration）	
DR1K5W-R		R1. R2 wire diameter above 3.5 mm	
R	16Ω	Configuration	
	20Ω		
	24Ω		
	40Ω		
DR3K1W-R		R1. R2 wire diameter above 5.5 mm	
R	8Ω	Configuration 1	
	10Ω		
	12Ω		
	20Ω		
	32Ω	Configuration 2	
	40Ω		
	48Ω		
	60Ω		
DR4K6W-R		R1. R2 wire diameter above 3.5 mm	
R	5.3Ω	Configuration 1	
	6.6Ω		
	8Ω		
	13.3Ω		
	12Ω	Configuration 2	
	15Ω		
	18Ω		
	30Ω		
DR6K2W-R		R1. R2 wire diameter above 8.0 mm R1. R2	
R	4Ω	Configuration 1	
	5Ω		
	6Ω		
	10Ω		
	16Ω	Configuration 2	
	20Ω		
	24Ω		
	40Ω		

Braking resistor (module) model description

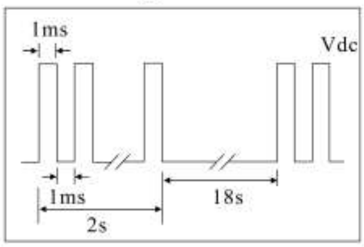
DR 3K1W - 10

Brake resistance Module

Rated power(W)

Resistance(Ω)

Brake cyclic curve



Brake power conditions :

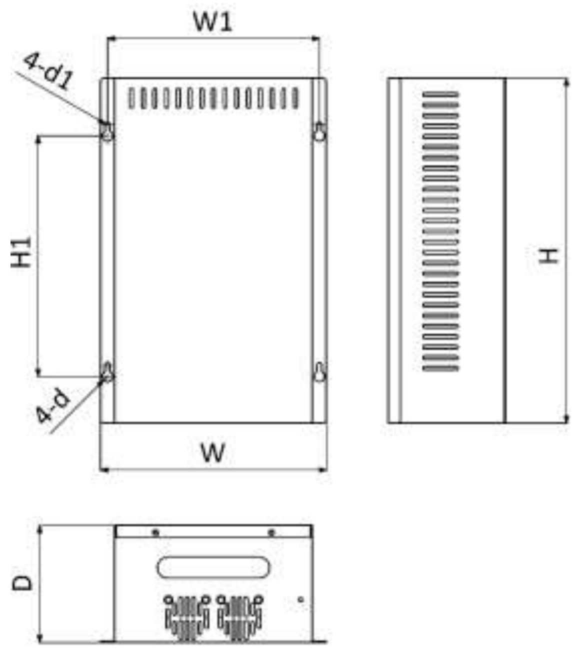
1. Duty/Cycle :1ma/2ms
2. Brake time：2s
3. Rest time：18s

Work frequency (ED%) :

$ED\% = \frac{2s}{20s} \times 100\% = 10\%$

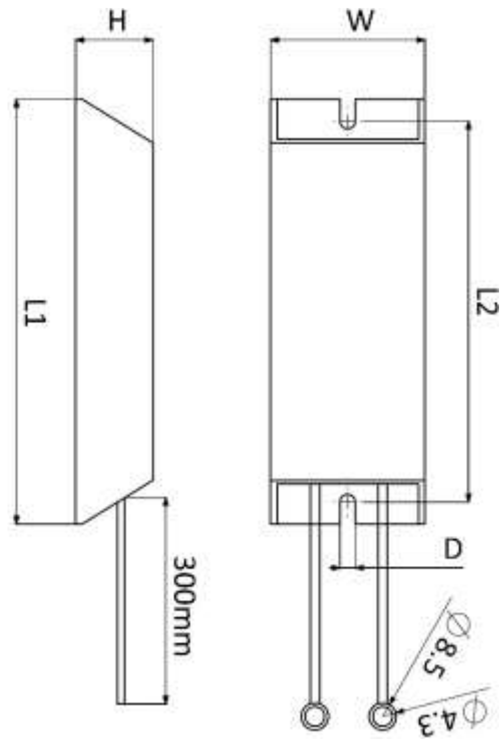
Brake resistance(module),Dimension(mm)

Model NO.	Dimensions			Constant dimensions		ø	
	W	H	D	W1	H1	d	d1
DR1K5W-R	140	184	110	128	135	9	4.5
DR3K1W-R DR4K6W-R	193	295	100	181	206	9	4.5
DR6K2W-R	193	314	120	181	206	9	4.5



Brake resistance Dimension(mm)

Model No.	Dimensions (mm) ±3%					Resistance range(Ω)
	L1	L2	H	D	W	
SDR080W	140	125	20	5.2	40	0.1～10K
SDR100W	165	150	20	5.2	40	0.1～10K
SDR120W	190	175	20	5.2	40	0.15～15K
SDR150W	215	200	20	5.2	40	0.15～15K
SDR200W	165	150	30	5.2	60	0.3～20K
SDR300W	215	200	30	5.2	60	0.5～30K
SDR400W	265	250	30	5.2	60	0.5～30K
SDR500W	335	320	30	5.2	60	0.5～30K
SDR600W	335	320	30	5.2	60	1～50K
SDR800W	400	385	40	5.2	80	1～50K



NOTE

◎ Please select the resistance (ohms), watts and the frequency of application (ED %) specified by the Company.

◎ A precaution toward the safety and inflammability around the peripheral environment shall be made when installing the brake resistance.

◎ For an application with more than two sets of brake unit, please pay attention to the equivalent resistance after installing these brake units in parallel connection that shall not be lower than the equivalent minimum resistance of each ac drive. When using the brake unit is desired, please peruse the operation instruction of brake unit and connect the wirings accordingly.

Chapter 11 Dimensions and Specifications

11.1 Specifications

A : Output rated current ; KHz : Upper limit of carrier frequency

200V-series specification

Model number：ES600-2□□□	0K4	0K7	1K1	1K5	2K2	3K0	5K5	7K5	011	015	018	022	030	037	045
Applicable motor power (KW)	0.4	0.75	1.1	1.5	2.2	3.0	5.5	7.5	11	15	18.5	22	30	37	45
Applicable motor power (HP)	0.5	1	1.5	2	3	4	7.5	10	15	20	25	30	40	50	60
Rated output capacity (KVA)	1.4	1.9	2.4	2.8	3.8	5.7	9.5	13	19	26	31	38	50	63	72
A	3.7	5	6.2	7.5	10	15	25	34	50	68	82	100	130	165	190
KHz	15										12		10		
Over current capability(V)	OL：150% /60 sec，OC：200%														
Model number：ES600-2□□□	055	075	090	110											
Applicable motor power (KW)	55	75	90	110											
Applicable motor power (HP)	75	100	125	150											
Rated output capacity (KVA)	88	114	133	173											
A	230	300	350	455											
KHz	8			6											
Over current capability(V)	OL：150% /60 sec，OC：200%														
Output frequency range	0.0 ～ 480.0HZ														
Input voltage, frequency	Three-phase power 200V～240V，50/60Hz														
Allowable voltage variation range	±10%（180V～264V）														
Allowable frequency range	±5%（47Hz～63Hz）														

400V-series specification

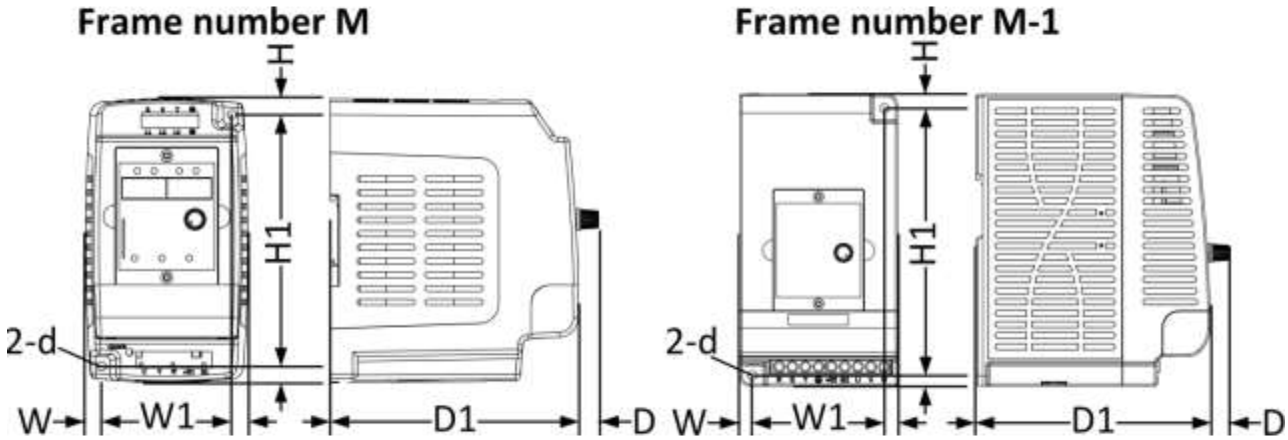
Model number：ES600-4□□□	0K4	0K7	1K5	2K2	4K0	5K5	7K5	011	015	018	022	030	037	045	055
Applicable motor power (KW)	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55
Applicable motor power (HP)	0.5	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75
Rated output capacity (KVA)	1.9	2.8	3.8	5.7	7.6	11.4	13.3	19	29	33	38	52	62	76	99
A	2.5	3.7	5	7.5	10	15	17.5	25	38	43	50	68	82	100	130
KHz	15									12		10			8
Over current capability(V)	OL：150% /60 sec，OC：200%														
Model number：ES600-4□□□	075	090	110	132	162	185	220	280	315						
Applicable motor power (KW)	75	90	110	132	162	185	220	280	315						
Applicable motor power (HP)	100	125	150	175	215	250	300	375	420						
Rated output capacity (KVA)	126	152	175	209	229	267	347	419	472						
A	165	200	230	275	300	350	455	550	620						
KHz	8		6			5			4						
Over current capability(V)	OL：150% /60 sec，OC：200%														
Output frequency range	0.0 ～ 480.0HZ														
Input voltage, frequency	Three-phase power 380V～480V，50/60Hz														
Allowable voltage variation range	±10%（342V～528V）														
Allowable frequency range	±5%（47Hz～63Hz）														

Common characteristics

Control Characteristics	
Operation method	6-digit number of LED digit display operation.32- bit DSP-MCU Special PWM control mode.Using high-performance low-noise IGBT.
System control mode	Special sine wave PWM 2-phase modulation, V/F voltage vector control
Max.frequency	0.1～480.0Hz
Frequency accuracy (temoerature change)	Digital instruction：±0.1%(-10℃～+40℃) Analog instruction：±0.1%(25℃±10℃)
Frequency command resolution	Digital command：0.1Hz， Analog command：0.1Hz
Frequency output resolution	Digital instruction ：± 0.1Hz； Analog instruction：± 0.5 %
Acceleration/ deceleration time	0.01～3000.0(Seconds), 8 groups of acceleration and deceleration times
Main control function	
. 5 mode cycle operator’s display . N-square V/F curve . Editable digital input/output function terminals . Stall prevention control . Modbus RS-485 communication . Modbus RS-485 time-out handle . Parameter Store/Read memory control . 4 groups fault record . 16 terms fault state records	. 2 pages Parameter Store/Read memory control . Three-wire control . Start/stop DC braking . Compensable torque current of low frequency . Carrier frequency 2～16 KHz can be set . Digital output positive/opposite logic control . Inching frequency setting . DC braking time after inverter stopping . Editable virtual digital function terminal
Frequency setting signal	4 groups of analog commands：DC 0～5V，0～10V，4～20mA，0～20mA
Brake torque	20%approximately, 125% with brake controllermounted
Control functions	Digital operation panel,MODBUS RS-485,stage speed control,etc

Protection functions	
Motor overload(OL)	Electronic overload curve protection (motor rated current)
Inverter overload (Er1)	Inverter rated current - heavy duty (HD): 150 % / 1 minute
Instantaneous overcurrent(OC)	Inverter rated current - heavy load type (HD): 200 %/ < 1 second
Automatic restart after instantaneous power failure	Power off for more than 15 ms.
Overvoltage protection (OU)	Overvoltage level (OU)： Vdc > 414V(200V~240V class) /Vdc > 827V(380V~460V class)
Low voltage protection (LU)	Low voltage level (LU)： Vdc < 200V(200V~240V class) / Vdc < 400V(380V~460V class)
Over temperature rotection (OH)	Built-in temperature detector or thermistor detection (inverter overheating protection)
Stall prevention	To protect the device from stall during acceleration/deceleration operation.
Grounding protection	To protect electronic circuit.
Charging indication	Charging indicator will be tuned 〝ON〞 when the DC voltage of main circuitis over 50V.
Environment specifications	
Refer to section 3.1 Environment	

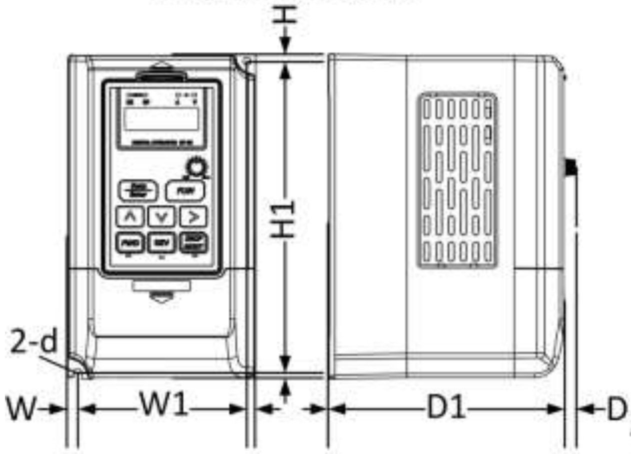
11.2 Dimensions



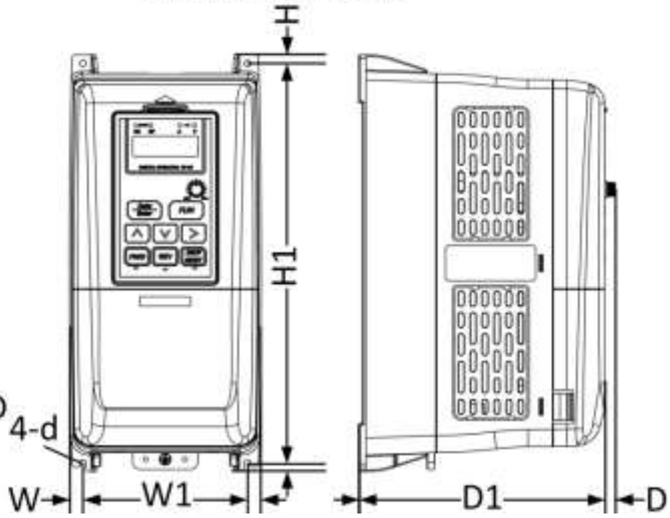
Voltage	Applicable motor capacity		Model number	Dimensions (mm)								Frame no.
	HP	KW		W	H	D	W1	W2	H1	D1	d	
200V	0.5	0.4	20K4	83	145	138	67	—	129	128	4.6	M
	1	0.75	20K7									
	2	1.5	21K5									
	3	2.2	22K2									
220V	5	4.0	24K0	92	169	147	77	—	155	136	5.2	M-1
400V	1	0.75	40K7									
	2	1.5	41K5									
	3	2.2	42K2									
	5	4.0	44K0									

11.3 Dimensions

Frame number A

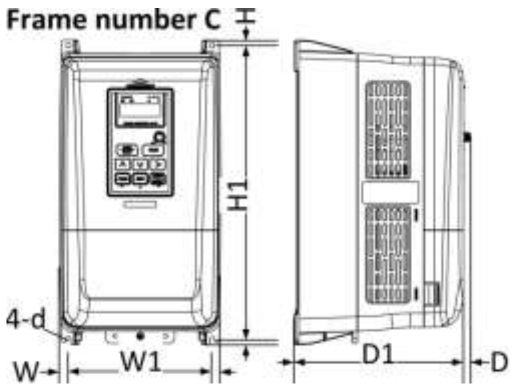


Frame number B



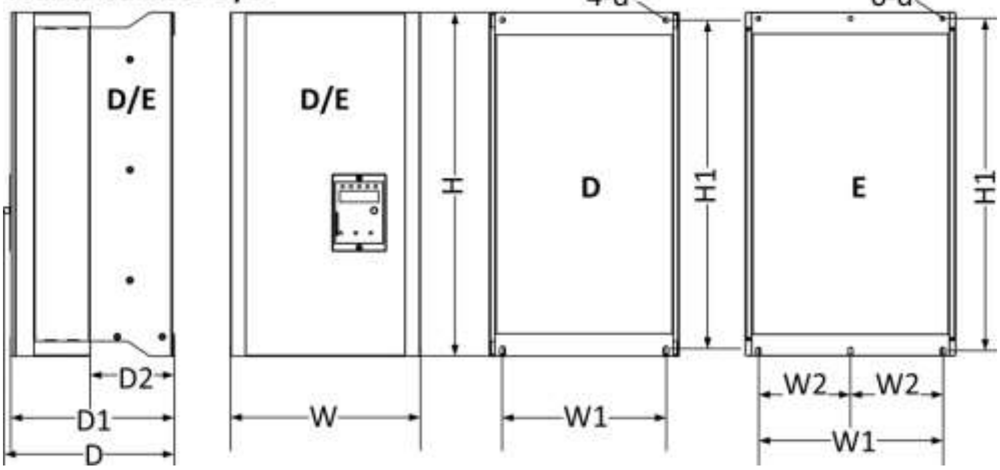
Voltage	Applicable motor capacity		Model number	Dimensions (mm)								Frame no.
	HP	KW		W	H	D	W1	W2	H1	D1	d	
200V	0.5	0.4	20K4	115	199	151	103	—	190	144	4.8	A
	1	0.75	20K7									
	2	1.5	21K5									
	3	2.2	22K2									
	5	4.0	24K0									
400V	0.5	0.4	40K4									
	1	0.75	40K7									
	2	1.5	41K5									
	3	2.2	42K2									
	5	4.0	44K0									

Voltage	Applicable motor capacity		Model number	Dimensions (mm)								Frame no.
	HP	KW		W	H	D	W1	W2	H1	D1	d	
200V	5	4.0	24K0	129	286	176	113	—	274	169	4.5	B
	7.5	5.5	25K5									
400V	5	4.0	44K0									
	7.5	5.5	45K5									
	10	7.5	47K5									



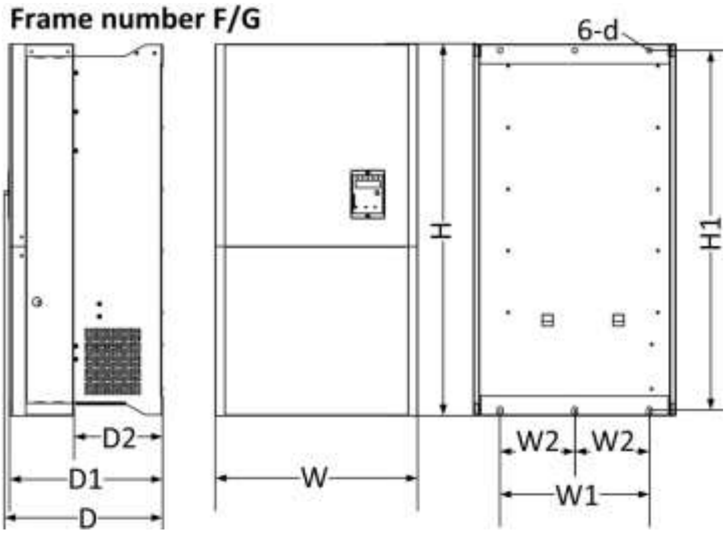
Voltage	Applicable motor capacity		Model number	Dimensions (mm)								Frame no.
	HP	KW		W	H	D	W1	W2	H1	D1	d	
200V	10	7.5	27K5	175	335	193	158	—	323	186	5.5	C
	15	11	2011									
	20	15	2015									
400V	15	11	4011									
	20	15	4015									
	25	18.5	4018									

Frame number D/E



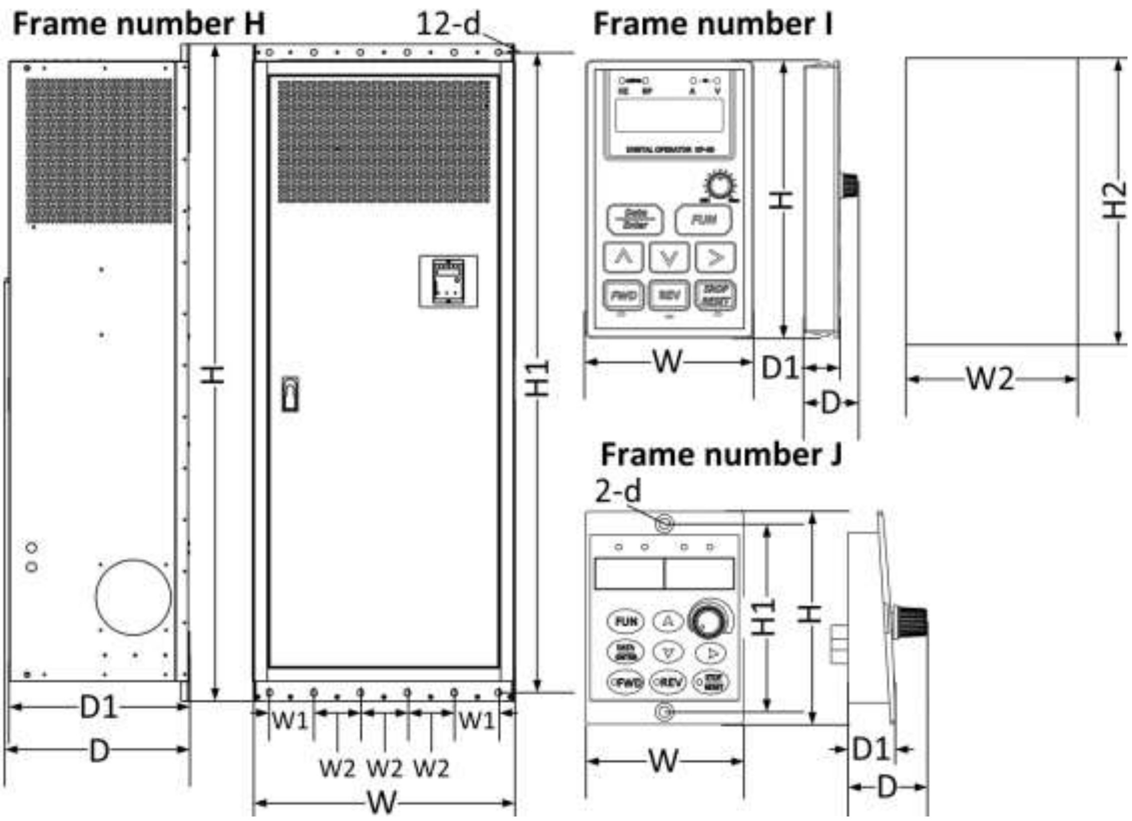
Voltage	Applicable motor capacity HP	Applicable motor capacity KW	Model numbe	Dimensions (mm) W	H	D	W1	W2	H1	D1	D2	d	Frame no.
200V	25	18.5	2018	253	458	227	218	—	438	217	112	7	D
	30	22	2022										
	40	30	2030										
400V	30	22	4022										
	40	30	4030										
	50	37	4037										

Voltage	Applicable motor capacity HP	Applicable motor capacity KW	Model number	Dimensions (mm) W	H	D	W1	W2	H1	D1	D2	d	Frame no.
200V	50	37	2037	345	563	276	303	151	543	266	139	7	E
	60	45	2045										
	75	55	2055										
400V	60	45	4045										
	75	55	4055										
	100	75	4075										



Voltage	Applicable motor capacity		Model number	Dimensions (mm)									Frame no.
	HP	KW		W	H	D	W1	W2	H1	D1	D2	d	
200V	100	75	2075	430	790	336	317	158	763	326	189	11	F
400V	125	90	4090										
	150	110	4110										
	175	132	4132										

Voltage	Applicable motor capacity		Model number	Dimensions (mm)									Frame no.
	HP	KW		W	H	D	W1	W2	H1	D1	D2	d	
200V	125	90	2090	604	770	322	525	262	750	312	158	11	G
	150	110	2110										
400V	200	160	4160										
	250	185	4185										
	300	220	4220										



Voltage	Applicable motor capacity		Model number	Dimensions (mm)									Frame no.
	HP	KW		W	H	D	W1	W2	H1	D1	D2	d	
400V	350	260	4260	612	1532	428	104	109	1493	421	—	14	H
	375	280	4280										
	425	315	4315										

Digital Operator	Dimensions (mm)						Digging hole size (mm)		Frame no.
	W	H	D	D1	d	H1	W2	H2	
H1000-A1	70.7	116.7	22.5	15	—	—	67	113	I
H1000M-A1	52	70	27	14	3.5	62	51	57	J

Chapter 12 Summary of Parameter settings

Hex : MODBUS communication code / **★:** Read/write allowed during operation

1	Hex	NO.	Description	Range	Default
OPERATION DISPLAY SETUP（PP.7-1~7-4）	－	P-001	Reserved	-32767～32767	0
	－	P-002	Reserved	-32767～32767	0
	003 (h)	P-003	Lock the functional parameters ★	-32767～32767	99
	004 (h)	P-004	Boot display screen selection ★	0～5	0
			0：Enter frequency setting (F) 1：Enter the parameter setting mode (P) 2：Display operating frequency (H) 3：Display output voltage (E) 4：Display operating torque current (A) 5：Display monitoring content (P-005) 6：Reserved		
	005 (h)	P-005	Monitoring operation content selection ★	0～15	0
	006 (h)	P-006	Unitless display ★	0.01～300.00	30.00

P-005	Hex	Content
14	2100	Fault record
－	2101	Frequency setting (F)
－	2102	Display operating frequency (H)
－	2103	Display output voltage (E)
－	2104	Display operating torque current (A)
0	2105	DC-BUS voltage (V)
1	2106	Output Power (%)
2	2107	Number of digital terminal input segments
3	2108	Number of digital terminal output segments
4	2109	The knob on the AV digital operator (V.R) (%)
5	210A	Ai1 Analog input signal (V)
6	210B	Ai1 Analog input instructions (%)
7	210C	Ai1 (Frequency command) (%)
8	210D	Ai2 Analog input signal (V)
9	210E	Ai2 Analog input instructions (%)
10	210F	Ai2 (Frequency command) (%)
11	2110	Ao output calculation result (%)
12	2111	Temperature display (℃)
13	2112	Estimated speed (rpm)
15	2113	Software version

Hex : MODBUS communication code / ★**:** Read/write allowed during operation

<table>
<tr><th>2</th><th>Hex</th><th>NO.</th><th>Description</th><th>Range</th><th>Default</th></tr>
<tr><td rowspan="25">OPERATION CONTROL PARAMETER (PP.7-4~7-6)</td><td>007 (h)</td><td>P-007</td><td>Keypad operator STOP button election</td><td>0~1</td><td>1</td></tr>
<tr><td colspan="5">0：The keyboard STOP key is invalid 1：The keyboard STOP key is valid
When the operational control command input by terminal or RS485,P13 can enable or disable the keypad's STOP button.</td></tr>
<tr><td>008 (h)</td><td>P-008</td><td>Stop mode</td><td>0~2</td><td>1</td></tr>
<tr><td colspan="5">0：Free running stop 1：Dynamic stop 2：Dynamic + DC braking</td></tr>
<tr><td>009 (h)</td><td>P-009</td><td>Operational control source 1</td><td rowspan="2">0~2</td><td>0</td></tr>
<tr><td>00A(h)</td><td>P-010</td><td>Operational control source 2</td><td>1</td></tr>
<tr><td colspan="5">0：Digital Operator (keypad operator) 1：External control terminal (Di) 2：RS-485 communication</td></tr>
<tr><td>00B(h)</td><td>P-011</td><td>Frequency command source 1</td><td rowspan="2">0～3</td><td>0</td></tr>
<tr><td>00C(h)</td><td>P-012</td><td>Frequency command source 2</td><td>1</td></tr>
<tr><td colspan="5">0：Main speed 1：Keypad operator Ai input (5V) 2：Ai1 (0~10V/4~20mA)
3：Ai2 (0~10V/4~20mA)</td></tr>
<tr><td>00D(h)</td><td>P-013</td><td>Multi-speed control is specified by RS485 communication</td><td>0～1</td><td>0</td></tr>
<tr><td colspan="5">0：Disable 1：Enable</td></tr>
<tr><td colspan="5">Note : When the multi-speed control is specified as 1 by RS485 communication, the multi-speed command can only be controlled from RS485 and cannot be started from the terminal.</td></tr>
<tr><td>00E(h)</td><td>P-014</td><td>DC braking time before starting</td><td>0.0～60.0 Sec</td><td>0.0</td></tr>
<tr><td colspan="5">0：Disabled The braking time before starting is set to 0, and DC dynamic braking is not started.</td></tr>
<tr><td>00F(h)</td><td>P-015</td><td>Target value of braking current before start up / Compensable torque current of low frequency</td><td>0～100 %</td><td>20</td></tr>
<tr><td colspan="5">● 1. P15 enhances the torque current to smoothly start up when frequency is low on heavy loading.Please refer to P.7-23-24.
2. P14= 0,no compensation.
The output is 50% of the set value of P15 when P14 is above 0.1 sec.
The output is 100% of the set value of P15 when P14 is above 0.2 sec.
3. P111 is the reference voltage of braking current before start up (P15).</td></tr>
<tr><td>010(h)</td><td>P-016</td><td>DC braking time after inverter stopping</td><td>0.0～60.0 Sec</td><td>2.5</td></tr>
<tr><td colspan="5">0：Disabled (P-016 = 0)</td></tr>
<tr><td>011(h)</td><td>P-017</td><td>Stop braking current target value</td><td>0～100 %</td><td>20</td></tr>
<tr><td colspan="5">● This percentage of braking current, and the rated current of the (P109) inverter, as a benchmark.
● P111 is the reference voltage of P17.When the Stop braking current was triggered,P111 is also the reference voltage.</td></tr>
</table>

Hex : MODBUS communication code / **★:** Read/write allowed during operation

3	Hex	NO.	Description	Range	Default	
SPEED LIMIT	012(h)	**P-018**	Restriction of rotating direction	0～3	0	
	0：Either Forward or Reversed 1：Forward only 2：Reversed only 3：Backward rotation available for negative bias					
	013(h)	**P-019**	Lower limit of frequency	0～480.0 Hz	0.0	
	014(h)	**P-020**	Upper limit of frequency	0～480.0 Hz	60.0	50.0
MULTI-STAGE SPEED (PP.7-8)	015(h)	**P-021**	Main speed ★	0.0～480.0 Hz	25.0	
	016(h)	**P-022**	Stage 1 speed ★	0.0～480.0 Hz	10.0	
	017(h)	**P-023**	Stage 2 speed ★	0.0～480.0 Hz	15.0	
	018(h)	**P-024**	Stage 3 speed ★	0.0～480.0 Hz	20.0	
	019(h)	**P-025**	Stage 4 speed ★	0.0～480.0 Hz	30.0	
	01A(h)	**P-026**	Stage 5 speed ★	0.0～480.0 Hz	40.0	
	01B(h)	**P-027**	Stage 6 speed ★	0.0～480.0 Hz	60.0	
	01C(h)	**P-028**	Stage 7 speed/Jog frequency command ★	0.0～480.0 Hz	5.0	
	P-028: To set any terminal Di1~Di6 as "multi-stage speed command" is closed (conducted) to com, that is to execute jogging (7th speed) control, the target speed will be base on P-028.					
ACCELERATION/DECELERATION TIME (PP.7-9~7-10)	01D(h)	**P-029**	Acceleration and deceleration time unit	0～1	1	
	0：0.01 Sec(Acceleration/Decceleration time range : 0.01-300.00) 1： 0.1 Sec (0.1-3000.0)					
	01E(h)	**P-030**	Main speed acceleration time ★	0.01～300.00 Sec	10.0	
	01F(h)	**P-031**	Main speed deceleration time ★	0.01～300.00 Sec	10.0	
	020(h)	**P-032**	Acceleration time of stage 1 speed ★	0.01～300.00 Sec	10.0	
	021(h)	**P-033**	Deceleration time of stage 1 speed ★	0.01～300.00 Sec	10.0	
	022(h)	**P-034**	Acceleration time of stage 2 speed ★	0.01～300.00 Sec	10.0	
	023(h)	**P-035**	Deceleration time of stage 2 speed ★	0.01～300.00 Sec	10.0	
	024(h)	**P-036**	Acceleration time of stage 3 speed ★	0.01～300.00 Sec	10.0	
	025(h)	**P-037**	Deceleration time of stage 3 speed ★	0.01～300.00 Sec	10.0	
	026(h)	**P-038**	Acceleration time of stage 4 speed ★	0.01～300.00 Sec	10.0	
	027(h)	**P-039**	Deceleration time of stage 4 speed ★	0.01～300.00 Sec	10.0	
	028(h)	**P-040**	Acceleration time of stage 5 speed ★	0.01～300.00 Sec	10.0	
	029(h)	**P-041**	Deceleration time of stage 5 speed ★	0.01～300.00 Sec	10.0	
	02A(h)	**P-042**	Acceleration time of stage 6 speed ★	0.01～300.00 Sec	10.0	
	02B(h)	**P-043**	Deceleration time of stage 6 speed ★	0.01～300.00 Sec	10.0	
	02C(h)	**P-044**	Acceleration time of stage 7 speed(Jogging)★	0.01～300.00 Sec	10.0	
	02D(h)	**P-045**	Deceleration time of stage 7 speed(Jogging)★	0.01～300.00 Sec	10.0	
	◎Acceleration and deceleration are based on the set upper limit frequency(P-020) and acceleration time as the conversion basis. ◎Acceleration and deceleration of Inching, FWD inching, REV inching are base on P44,P45.					

Hex : MODBUS communication code / ★**:** Read/write allowed during operation

4	Hex	NO.	Description	Range	Default
ANALOG (AI) INPUT(PP7-11 ~7-18)	02E(h)	**P-046**	Ai1：Input signal mode	0~3	1
	0：Disable 1：0~10V 2：4~20mA 3：0~20mA				
	02F(h)	**P-047**	Ai1：0V/4mA Input bias voltage	-100.0～100.0 ％	0.0
	030(h)	**P-048**	Ai1：10V/20mA Input gain	-400.0～400.0 ％	100.0
	031(h)	**P-049**	Ai1：Input dead band	0.0～85.0 ％	1.0
	032(h)	**P-050**	Ai1：Input signal mode	0～3	1
	0：Disable 1：0~10V 2：4~20mA 3：0~20mA				
	033(h)	**P-051**	Ai2：0V/4mA Input bias voltage	-100.0～100.0 ％	0.0
	034(h)	**P-052**	Ai2：10V/20mA Input gain	-400.0～400.0 ％	100.0
	035(h)	**P-053**	Ai2：Input dead band	0.0～85.0 ％	1.0
	036(h)	**P-054**	(Ai1/ Ai2：4~20mA mode) disconnection detection	0～4	0
	0：Disable 1：Free running stop 2：Dynamic stop 3：Keep running at the frequency before disconnection				
ANALOG (AO) OUTPUT(P7-19)	037(h)	**P-055**	AO：Analog output function ★	0～4	0
	0：Disable 1：Output frequency 2：Output voltage 3：Output current 4：Output power				
	038(h)	**P-056**	AO：Output Offset ★	0～100 ％	0
	039 (h)	**P-057**	AO：Output Gain ★	0～400 ％	100
DIGITAL INPUT(P7-20)	03A (h)	**P-058**	Di1,Di2 settings	0～4	0
	0：Di1(FWD/STOP)、Di2(REV/STOP) 1：Di1(RUN/STOP)，Di2(FWD/REV) 2：Three-wire stop:Di1(RUN)，Di2(STOP)，Di3(FWD/REV) (Note:any input terminal Di3~Di6 can define this function.) 3：Di1(FWD/STOP) , Di2 (according to P60) 4：Di1 (according to P59) , Di2 (according to P60)				

Hex : MODBUS communication code / **★:** Read/write allowed during operation

5	Hex	NO.	Description	Range	Default
DIGITAL (DI) INPUT（ PP.7-22~7-24 ）	03B (h)	**P-059**	Di1 settings	0～14	0
	03C (h)	**P-060**	Di2 settings	0～14	0
	03D (h)	**P-061**	Di3 settings	0～14	2
	03E (h)	**P-062**	Di4 settings	0～14	3
	03F (h)	**P-063**	Di5 settings	0～14	6
	040 (h)	**P-064**	Di6 settings	0～14	8
	041 (h)	**P-065**	Virtual Di7 settings(driven by virtual DO5) ★	0～14	0
	042 (h)	**P-066**	Virtual Di8 settings(driven by virtual DO6) ★	0～14	0
	043 (h)	**P-067**	Virtual Di9 settings(driven by virtual DO7) ★	0～14	0
	044 (h)	**P-068**	Virtual Di10 settings(driven by virtual DO8) ★	0～14	0
	045 (h)	**P-069**	Main speed increasing frequency	0.0～60.0 Hz	1.0
	046 (h)	**P-070**	Main speed decreasing frequency	0.0～60.0 Hz	1.0

0	Disabled	8	Inching(Jogging) operation
1	Three-wire control	9	Forward Inching(Jogging) operation
2	External fault input	10	Reverse Inching(Jogging) operation
3	RESET	11	Main speed increment
4	Free run to stop	12	Main speed decrement
5	Multi-stage speed command 1	13	Turn on operation command source 2 (P11) and frequency command source 2 (P12)
6	Multi-stage speed command 2		
7	Multi-stage speed command 3	14	Turn on frequency command source 2 (P12)

● Forward Inching, Reverse Inching contain function of Running direction command + inching frequency

Note : Digital input (The following must be set P9 or P10 = 0 Main speed.)

11/12：Main speed increment/decrement : The signal of main speed frequency was activated by Digital input.As soon as "Main speed increment/decrement " is activated by a trigger,the main speed will increase once according to the P69/ P70 frequency.

13：Turn on operation command source 2 (P11) and frequency command source 2 (P12)－

Di switch	Content	
On(OFF)	(P9) Operational control source 1	(P11) Operational control source 2
Close(ON)	(P10) Frequency command source 1	(P12) Frequency command source 2

14 : Turn on frequency command source 2 (P12)－

Di switch	Frequency command source
ON(OFF)	(P11) Frequency command source 1
Close(ON)	(P12) Frequency command source 2

● Inching(Jogging) operation command priority over other frequency command.

Hex : MODBUS communication code / **★:** Read/write allowed during operation

6	Hex	NO.	Description	Range	Default
DIGITAL (DO) OUTPUT (PP.7-23~7-30)	047 (h)	**P-071**	DO1 settings	0～45	6
	048 (h)	**P-072**	Upper limit 1(frequency/current/Ai1/Ai2) ★	0～100%	0
	049 (h)	**P-073**	Lower limit 1(frequency/current/Ai1/Ai2) ★	0～100%	0
	04A (h)	**P-074**	DO2 settings	0～45	16
	04B (h)	**P-075**	Upper limit 2(frequency/current/Ai1/Ai2) ★	0～100%	0
	04C (h)	**P-076**	Lower limit 2(frequency/current/Ai1/Ai2) ★	0～100%	0

Do(P71 、P74)： Movement according to functional content Do will be switched to **" On output " / Closed**		Do(P71 、P74)： Movement according to functional content Do will be switched to **“ No on output”/ Open**	
0	Disabled	1	Disabled
2	Fault output	3	Fault output
4	In operation	5	In operation
6	In zero speed	7	In zero speed
8	Forward rotaion	9	Forward rotaion
10	Reverse rotaion	11	Reverse rotaion
12	Accelerating	13	Accelerating
14	Decelerating	15	Decelerating
16	Consistent frequency (in constant speed)	17	Consistent frequency (in constant speed)
18	Inverter overload (Er1)	19	Inverter overload (Er1)
20	Heat sink temperature is too high (OHx)	21	Heat sink temperature is too high (OHx)
22	Motor overload (OLx)	23	Motor overload (OLx)
24	RS-485 communiction is faliure	25	RS-485 communiction is faliure
26-36	Digital input Dix (H/L) signal (x=1-6)	27-37	Digital input Dix (H/L) signal (x=1-6)
38	Frequency comparison upper and lower limit	39	Frequency comparison upper and lower limit
40	Torque current comparison upper and lower limit	41	Torque current comparison upper and lower limit
42	Ai1 compare upper and lower limits	43	Ai1 compare upper and lower limits
44	Ai2 compare upper and lower limits	45	Ai2 compare upper and lower limits

Note :

1. If Digital output is 0, COM(Digital Ground) is enable.
2. If P71, P74 is Even function to call 'Positive logic' ,Odd function is ' Opposite logic'.
3. When modulating P73,P76 the maximum value will be automatically limited below the upper limit (P72<= P71 、 P76<= P75).

Hex : MODBUS communication code / ★**:** Read/write allowed during operation

7	Hex	NO.	Description	Range	Default
DIGITAL (DO) OUTPUT (Relay) (PP.7-26~7-30)	047 (h)	**P-077**	Relay1 settings	0～45	2
	048 (h)	**P-078**	Upper limit 3(frequency/current/Ai1/Ai2) ★	0～100%	0
	049 (h)	**P-079**	Lower limit 3(frequency/current/Ai1/Ai2) ★	0～100%	0
	04A (h)	**P-080**	Relay2 settings/DO3 setting(M type)	0～45	4
	04B (h)	**P-081**	Upper limit 4(frequency/current/Ai1/Ai2) ★	0～100%	0
	04C (h)	**P-082**	Lower limit 4(frequency/current/Ai1/Ai2) ★	0～100%	0

P-080 : Standardization type (ES600) terminals have hardware of Do1,Do2,Relay 1 and Relay 2 .

Miniaturiztion type (ES600M) terminals have hardware of Do1,Do2,Relay 1,Do3 .

Relay(P77 、P80)： Movement according to functional content Relay will be switched to "**Action state"**		Relay(P77 、P80)： Movement according to functional content Relay will be switched to "**No action state"**	
0	Disabled	1	Disabled
2	External fault output	3	External fault output
4	In operation	5	In operation
6	In zero speed	7	In zero speed
8	Forward rotaion	9	Forward rotaion
10	Reverse rotaion	11	Reverse rotaion
12	Accelerating	13	Accelerating
14	Decelerating	15	Decelerating
16	Consistent frequency (in constant speed)	17	Consistent frequency (in constant speed)
18	Inverter overload (Er1)	19	Inverter overload (Er1)
20	Heat sink temperature is too high (OHx)	21	Heat sink temperature is too high (OHx)
22	Motor overload (OLx)	23	Motor overload (OLx)
24	RS-485 communiction is faliure	25	RS-485 communiction is failure
26-36	Digital input Dix (H/L) signal (x=1-6)	27-37	Digital input Dix (H/L) signal (x=1-6)
38	Frequency comparison upper and lower limit	39	Frequency comparison upper and lower limit
40	Torque current comparison upper and lower limit	41	Torque current comparison upper and lower limit
42	Ai1 compare upper and lower limits	43	Ai1 compare upper and lower limits
44	Ai2 compare upper and lower limits	45	Ai2 compare upper and lower limits

Note :

1. If Digital output is 0, COM(Digital Ground) is enable.
2. If P77, P80 is Even function to call 'Positive logic' ,Odd function is 'Opposite logic'.
3. When modulating P79,P82 the maximum value will be automatically limited below the upper limit (P79<= P80 、 P82<= P81).

Hex : MODBUS communication code / ★**:** Read/write allowed during operation

8	Hex	NO.	Description	Range	Default
VIRTUAL DIGITAL (DO) OUTPUT （ P.7-30 ）	053 (h)	**P-083**	Virtual DO5 settings (drive the virtual Di7 setting function) ★	0～45	0
	054 (h)	**P-084**	Virtual Upper limit 5(frequency/current/Ai1/Ai2) ★	0～100 %	0
	055 (h)	**P-085**	Virtual Lower limit 5(frequency/current/Ai1/Ai2) ★	0～100 %	0
	056 (h)	**P-086**	Virtual DO6 settings (drive the virtual Di8 setting function) ★	0～45	0
	057 (h)	**P-087**	Virtual Upper limit 6(frequency/current/Ai1/Ai2) ★	0～100 %	0
	058 (h)	**P-088**	Virtual Lower limit 6(frequency/current/Ai1/Ai2) ★	0～100 %	0
	059 (h)	**P-089**	Virtual DO7 settings (drive the virtual Di9 setting function) ★	0～45	0
	05A (h)	**P-090**	Virtual Upper limit 7(frequency/current/Ai1/Ai2) ★	0～100 %	0
	05B (h)	**P-091**	Virtual Lower limit 7(frequency/current/Ai1/Ai2) ★	0～100 %	0
	05C (h)	**P-092**	Virtual DO8 settings (drive the virtual Di10 setting function) ★	0～45	0
	05D (h)	**P-093**	Virtual Upper limit 8(frequency/current/Ai1/Ai2) ★	0～100 %	0
	05E (h)	**P-094**	Virtual Lower limit 8(frequency/current/Ai1/Ai2) ★	0～100 %	0
	Note : Virtual DOx(P83,P86,P89,P92) **settings same as Do1,Do2.** **Standardization type (ES600) terminals have hardware of Do1,Do2,Relay 1 and Relay 2 .** **Miniaturiztion type (ES600M) terminals have hardware of Do1,Do2,Relay 1,Do3 .** **The combination of virtual Dix and DOx is not properly parameter setting,causing the inverter to fail to work normally.The solution refer to P7-30.**				

Hex : MODBUS communication code / ★**:** Read/write allowed during operation

9	Hex	NO.	Description	Range	Default
MOTOR PROTECTION SETTING (PP.7-33~7-34)	05F (h)	**P-095**	Stall current protection switch during running	0～1	0
	0：Disable 1：Protection start				
	060 (h)	**P-096**	Fan start mode	0～1	1
	0：Fan constantly rotate 1：The fan is started by temperature(P100 setting)				
	061 (h)	**P-097**	Motor overload protection switch	0～1	0
	0：Disable 1：Enable the mortor overload (OL) protection.				
	062 (h)	**P-098**	Stall prevention voltage switch during deceleration	0～1	1
	0：Disable 1：Enalbe Stall prevention voltage during deceleration protection.				
	063 (h)	**P-099**	Output current limit ★	0～220	185
	Note: The rated current of the inverter is set at 100%, and the overcurrent is OC.200%.				
	064 (h)	**P-100**	Fan start temperature setting	40.0～60.0	45.0
	065 (h)	**P-101**	Over temperature protection setting	60.0～90.0	88.0
	066 (h)	**P-102**	Decelerating-Stall prevention voltage level	220V : 330～400	370
				440V : 660～800	740
	067 (h)	**P-103**	Regenerative braking voltage level	220V: 350～400	365
				440V: 300～510	730
MOTOR AND INVERTER PARAMETER SETTING(PP.7-35~7-36)	068 (h)	**P-104**	RST input voltage (rms)	220V: 150～255	220 / 200
				440V: 300～510	440 / 380
	069 (h)	**P-105**	Motor rated current	0.0~1400.0 A	P-105
	06A (h)	**P-106**	PWM carrier frequency	2～16KHZ	8
	P-106 = 2~16 (2K~16KHZ), the carrier frequency is updated after stopping and restarting. 0.5HP ~ 30HP：8K / 40HP ~ 60HP：6K 75HP ~ 125HP：5K / 150HP ~ 300HP：3K				
	06B(h)	**P-107**	UVW output phase sequence setting	0～1	0
	0：UVW 1：UWV				
	06C (h)	**P-108**	Vdc gain (read only)	1～900 Times	347
	06D (h)	**P-109**	Inverter rated current (read only)	0.0~1400.0 A	3.7
	06E (h)	**P-110**	Inverter rated power (read only)	0.0～500.0 HP	3.0

Hex : MODBUS communication code / **★:** Read/write allowed during operation

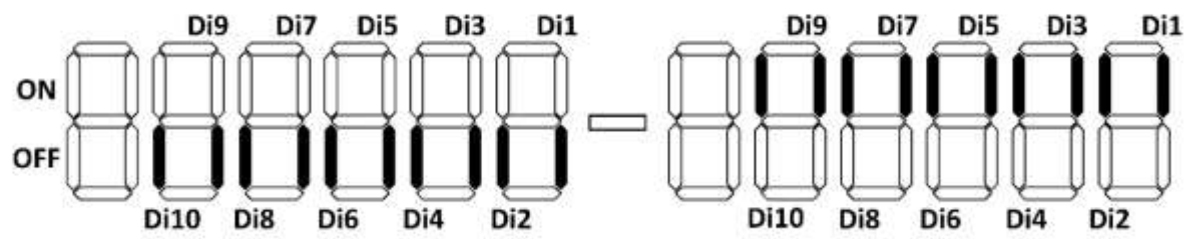
A	Hex	NO.	Description	Range	Default	
V/F CURVE（P7-36）	06F (h)	**P-111**	V/F minimum voltage display	0.0～10.0%	0.0	
	070 (h)	**P-112**	V/F maximum output voltage setting	V：0～255	220	200
				V：0～510	440	380
	071 (h)	**P-113**	V/F maximum voltage's frequency setting	V：25.0～480.0	60.0	50.0
	072 (h)	**P-114**	N-square curve gain	V：0.0～100.0	0.0	
			P7-35 F-N square curve (the values in the figure are for reference)			
COMMUNICATION SETTING(RS485)（PP.7-38~7-46）	073 (h)	**P-115**	Inverter communication address	1～254	1	
	074 (h)	**P-116**	PC transfer rate	0～6	2	
			0：2400 1：4800 2：9600 3：19200 4：38400 5：57600 6：115200			
	075 (h)	**P-117**	Inverter communication data format	0～3	0	
			0：8,N,1 RTU (1 start bit + 8 data bits + 1 stop bit) 1：8,E,1 RTU (1 start bit + 8 data bits + 1 Even bit + 1 stop bit) 2：8,O,1 RTU (1 start bit + 8 data bits + 1 Odd bit + 1 stop bit) 3：8,N,2 RTU (1 start bit + 8 data bits 1 + 2 stop bit)			
	076 (h)	**P-118**	Inverter communication response delay time	3～50 ms	5	
	077 (h)	**P-119**	Detected transmission timeout	0.0～120.0 Sec	0.0	
			0：No detection of communication timeout, continue to run.			
	078 (h)	**P-120**	Time-out detection processing method	0～2	2	
			0：Free to stop. 1：Decelerate to stop. 2：Continue to run (only display Er7).			
	079 (h)	**P-121**	Receive failure response code	0～7	0	

0	Normal receiving	4	Packet receiving time exceeds P-119 seconds
1	Function code error	5	Write non-modifiable parameters
2	CRCL error	6	Parameter address error
3	CRCH error	7	The setting parameter value is out of range

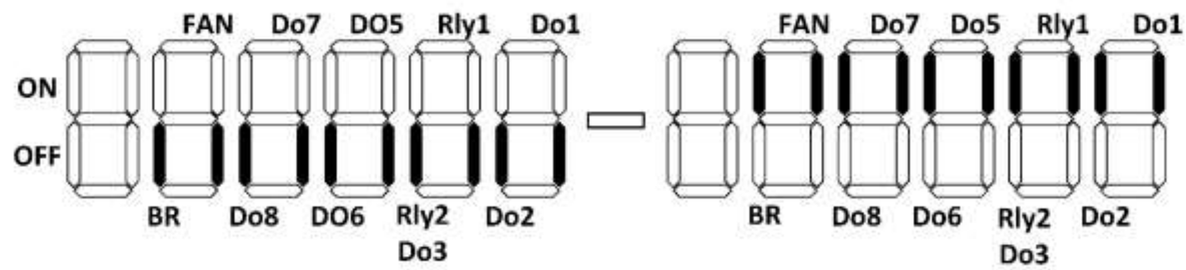
A	Hex	NO.	Description	Range	Default
RECALLING PARAMETERS（P7-47）	07A (h)	**P122**	Store/Read parameter page ★	1~3	1
			Page 1 and 2 provide users with the ability to store and read the set parameter values. Page 3 is only for reading and recalling the factory settings.Data will not be erased upon reboot in the page's EEPROM.		
	07B (h)	**P123**	Recall parameters	0~5	0
			0：Not Recalled 1：220V/440V, 60HZ Ex-factory settings 2：220V/400V, 50HZ factory settings 3：2200V/380V, 60HZ factory settings 4：2200V / 380V, 50HZ factory settings 5：Clear the fault record		

Hex : MODBUS communication code / **★:** Read/write allowed during operation

B	Hex	NO.	Description	Range	Default
FAULT RECORDS（PP.7-48~7-50）	07C (h)	**P-124**	Number of auto-reset	0～10	0
	07D (h)	**P-125**	Waiting time of auto-reset	0～60.0 Sec	5.0
	When an fault trip occurs in the inverter, P-124~P-125 will automatically clear the fault's state (P-124,P-125 = 0,disable automatic reset). If there is safety consideration, please cancel the automatic reset function of P-124~P-125.				
	07E (h)	**P-126**	Latest fault record	0～255	-
	07F (h)	**P-127**	Last 1 fault record	0～255	-
	080 (h)	**P-128**	Last 2 fault record	0～255	-
	081 (h)	**P-129**	Last 3 fault record	0～255	-
	082 (h)	**P-130**	Speed command in the event of a fault	0～480.0 HZ	0.0
	083 (h)	**P-131**	Output frequency in the event of a fault	0～480.0 HZ	0.0
	084 (h)	**P-132**	Motor speed in the event of a fault	0～18000	0
	085 (h)	**P-133**	Output voltage in the event of a fault	0～1000 V	0
	086 (h)	**P-134**	Output torque current in the event of a fault	0～3000.0 A	0.0
	087 (h)	**P-135**	DC voltage in the event of a fault	0～1000 V	0
	088 (h)	**P-136**	DC current in the event of a fault	0～3000.0 A	0.0
	089 (h)	**P-137**	Input terminal status in the event of a fault	0～1023	0



B	Hex	NO.	Description	Range	Default
	08A (h)	**P-138**	Output terminal status in the event of a fault	0～1023	0



B	Hex	NO.	Description	Range	Default
	08B (h)	**P-139**	Inverter temperature in the event of a fault	-63.0～150.0 ℃	0
	08C (h)	**P-140**	AD value of OC when the fault occurs	0～4096	0
	08D (h)	**P-141**	AD value of VDC when the fault occurs	0～4096	0

Chapter 13 Appendix

13.1 Summary of fault codes & diagnostic descriptions

P5=12	Fault code	Description
0	**-**	Normal status
1	**OC0**	Overcurrent during static state
2	**OC1**	Overcurrent during acceleration (200% of rated current) (hardware detection protection)
3	**OC2**	Overcurrent at constant speed (200% of rated current) (hardware detection protection)
4	**OC3**	Overcurrent during deceleration (200% of rated current) (hardware detection protection)
5	**OL1**	Motor overload during acceleration
6	**OL2**	Motor overload at constant speed
7	**OU0**	The DC voltage was too high when the operation command was activated. The DC voltage exceeds 400V during the static state (AC220V specification) Or DC800V (AC380V specification) (OV)
8	**OU1**	Overvoltage during acceleration (OV)
9	**OU2**	During constant speed, the DC voltage exceeds 400V (AC220V specification) Or DC800V (AC380V specification)
10	**OU3**	Overvoltage during deceleration/input voltage is too high DC voltage exceeds 400V (AC220V specification) or DC800V (AC380V specification)
11	**LU0**	The DC voltage is too low when the operation command is activated. The low voltage DC voltage is lower than 180V (AC220V specification) or the DC voltage is lower than 380V (AC380V specification).
12	**LU1**	During acceleration, the voltage is too low. DC voltage is lower than 180V (AC220V specification) or DC voltage is lower than 380V (AC380V specification)
13	**LU2**	Constant speed, low voltage. The DC voltage is lower than 180V (AC220V specification) or the DC voltage is lower than 380V (AC380V specification).
14	**LU3**	Low voltage during deceleration. The DC voltage is lower than 180V (AC220V specification) or the DC voltage is lower than 380V (AC380V specification).
15	**OHx**	Heat sink temperature is too high
16	**Stx**	Press and hold the STOP+DATA key for more than 5 seconds to display the fault. To solve virtual Do/Di improperly match.
	Other error codes are reserved for fault signals.	

P5=12	Fault code	Description of Error
17	**Er1**	Inverter overload (current >150% , time >60sec)
18	**Er2**	External fault input action
19	**Er3**	Parameter setting error 1 (Di repeat setting)
20	**Er4**	EEPROM read back parameters out of range
21	**Er5**	Call back parameter exception
22	**Er6**	RS-485 transmission failure.
23	**Er7**	(Ai1/Ai2 : 4～20 mA mode) disconnected
	Err 8～Err 20 are reserved for faults signals.	

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