DIRISE
Electric

ES300 series current vectorial inverter

User Manual

SHENZHEN DIRISE ELECTRIC TECHNOLOGY CO.,LTD
DONGGUAN DIRISE ELECTRIC EQUIPMENT MANUFACTURING CO.,LTD

Introduction

Thank you for choosing DIRISE ES300 series current vectorial inverter !

ES300 series current vectorial inverter employs modular functional design concept. With high-performance vectorial control technology, the product is featured by low-speed high-torque output, excellent dynamic properties and powerful overload capacity, and can provide high-performance motor drive solution for industrial demands.

Please read ES300 series manual carefully before use ensure correct operation. This manual includes operating instructions of inverter and precautions for use. Incorrect use may cause unexpected accidents. This manual is attached to machine upon delivery and must be stored properly for troubleshooting and maintenance in the future.

Though we have examined the consistency of contents with the software and hardware, still, there may be contradictions and mistakes which will be revised in future versions. We will periodically update the contents without notice. We are open to any suggestions for improvement.

Must-Know In Use

The safe operation of product is dependent to correct installation, operation, transportation and maintenance. Please must read carefully and pay special attentions to the information about safety included in this manual.

- Make sure to have sufficient understanding about inverter, safety information and all precautions before use.
- This manual should be held by actual users.
- This manual has defined safety level as “Danger” and “Warning” which is indicated by following signs:

危 险 DANGER ： risk of heavy casualties due to false operation.

注 意 WARNING ： risk of medium harm or injury, or property loss due to false operation.

Make sure to obey by the contents marked with safety label. “Warning” items may also cause serious result in specific situations. Please' with the contents of 2 safety levels.

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Contents

Out of Box Audit (OOBA)

The product and package have passed serious QC inspection before manufacture and package. If any miss is found, please make a contact with us, branch office or distributor as soon as possible. We will devote to constanting optimization and improvement of product. If it is necessary to make a required modification, we will update the manual or provide corrigenda without further notice.

Please check the following items upon arrival:

- ◆ Whether the product package is damaged.
- ◆ Read the data on nameplate to confirm the type and specification of product are in accordance with your order.
- ◆ Check the period of inventory

Chapter 1 Safety Precautions

You must carefully read the following contents before installation, wiring, operation and maintenance of the product, and operate strictly according to notes.

1.1 Installation

危 险
DANGER

- Please install the inverter on a nonflammable object like metal, lest there may be a risk of fire.
- Must not install the inverter in the environment containing combustibles or explosive gases. otherwise, there may be a risk of explosion.

注 意
WARNING

- Install the inverter on a strong and reliable object which can stand the weight of inverter. otherwise, there may be a risk of fall or damage.
- Prevent any metal object from falling inside the inverter, otherwise, there may be a risk of accident.
- Do not try to install or run a damaged inverter, otherwise, there may be a risk of accident.

1.2 Wiring

危 险
DANGER

- Must connect a proper circuit-breaker which matches capacity of the inverter on the input power side of the inverter. Otherwise, human injoury, equipment damage or other accident may occur.
- Must ground PE terminal of inverter reliably, otherwise, it may cause electric shock or fire.
- Power source input terminal and motor output terminal must be tightened by bolts, otherwise, it may cause a fire.
- Wiring must be charged by professional.
- The wiring must be done after the power is cut off and the high-voltage indicator extinguishes.

注 意
WARNING

- The input power must conform to the specifications on the nameplate. Otherwise, the inverter may be damaged.
- Never connect the output terminals (U, V, W) to the input power. Otherwise it may destroy the inverter.

1.3 Operation

危 险
DANGER

- Only when the cover board has been attached, the power can be switched on. Otherwise, there may be a risk of electric shock.
- Do not touch main circuit terminal of the inverter when inverter is powered even if the inverter is in stop state. Otherwise, there may be a risk of electric shock.

注 意
WARNING

- Use the “STOP” key on operation panel or external control terminal to stop the inverter, but not to switch off the main power supply directly. Otherwise, the inverter may be damaged.

1.4 Maintenance

危 险
DANGER

- Must not carry out troubleshooting or maintenance until internal charge lamp is off or 10 minutes after power cut. Otherwise, there may be a risk of electric shock or injury.
- Maintenance of machine is for professional only, otherwise, it may cause electric shock or casualties.

注 意
WARNING

- Make sure not to leave any electric conductor inside machine after maintenance, otherwise, it may cause damage.
- For the inverter left unused for a long time, internal capacity must be charged before use. Input voltage must be raised slowly by a voltage regulator (must not exceed rated input voltage of inverter). Otherwise, there may be risk of accident.

1.5 Disposal

注 意
WARNING

- When the product is discarded, dispose it as an industrial waste. Otherwise, accident may occur.

1.6 Applicable scope of product

注 意
WARNING

- Not applicable to the machine or system which may cause life danger of human.
- If a serious accident or loss can be predicted due to abnormality of product, please be sure to install additional safety devices.

Chapter 2 Product Information

2.1 Check upon delivery

Please check the following items when the inverter is firstly packed:

- ◆ Whether the product is damaged during shipping.
- ◆ Read data on the nameplate to conform whether type and specification of the product is in accordance with your order.
- ◆ Check whether the accessories shipped together with the inverter are complete.

The product is developed and manufactured in strict accordance with ISO9001. If any abnormality is found, please contact our agent or distributor as soon as possible.

2.2 Model Description

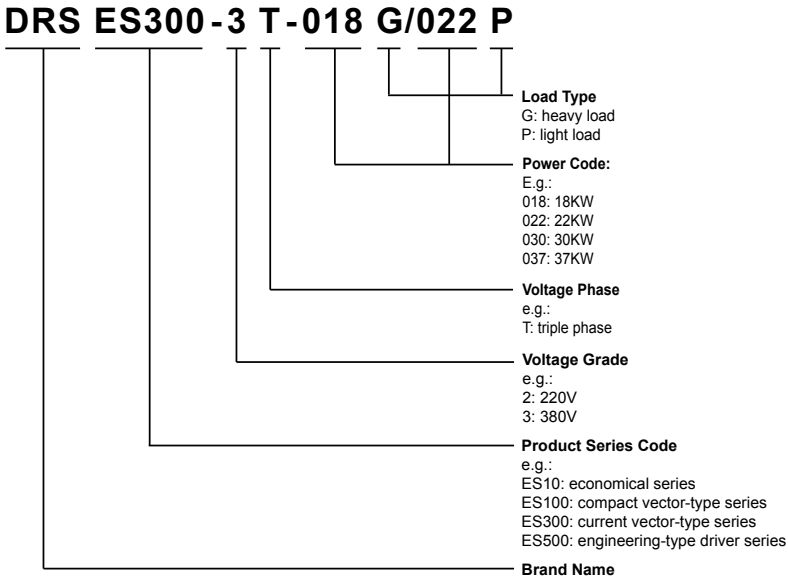


Fig 2-1 Model Description

2.3 Nameplate description

There is a nameplate indicating machine model and rated value at the bottom of right-side plate of inverter housing. Information of nameplate is shown as follow:

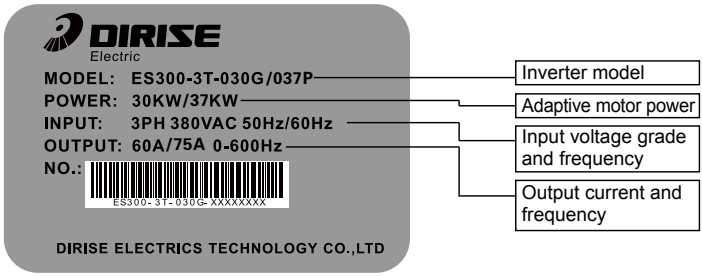


Fig 2-2 inverter nameplate

2.4 ES300 inverter series

Model description of ES300 current vectorial inverter is shown in table 2-1.

Voltage grade	Product model	Adaptive motor (KW)	Rate output current (A)
Triple phase 220V	DRS ES300-2T-011G/015P	11	45
	DRS ES300-2T-015G/018P	15	60
	DRS ES300-2T-018G/022P	18	75
	DRS ES300-2T-022G/030P	22	90
	DRS ES300-2T-030G/037P	30	110
	DRS ES300-2T-037G/045P	37	150
	DRS ES300-2T-045G/055P	45	180
	DRS ES300-2T-055G/075P	55	220
	DRS ES300-2T-075G/090P	75	260
	DRS ES300-2T-090G/110P	90	310
	DRS ES300-2T-110G/132P	110	340
	DRS ES300-2T-132G/160P	132	415
	DRS ES300-2T-160G/185P	160	600
Triple phase 380V	DRS ES300-3T-0R7G/1R5P	0.75	2.1
	DRS ES300-3T-1R5G/2R2P	1.5	3.8
	DRS ES300-3T-2R2G/4R0P	2.2	5.1
	DRS ES300-3T-4R0G/5R5P	3.7	9
	DRS ES300-3T-5R5G/7R5P	5.5	13
	DRS ES300-3T-7R5G/011P	7.5	17
	DRS ES300-3T-011G/015P	11	25
	DRS ES300-3T-015G/018P	15	32
	DRS ES300-3T-018G/022P	18.5	37
	DRS ES300-3T-022G/030P	22	45
	DRS ES300-3T-030G/037P	30	60
	DRS ES300-3T-037G/045P	37	75
	DRS ES300-3T-045G/055P	45	90
	DRS ES300-3T-055G/075P	55	110
	DRS ES300-3T-075G/090P	75	150

Triple phase 380V	DRS ES300-3T-090G/110P	90	180
	DRS ES300-3T-110G/132P	110	220
	DRS ES300-3T-132G/160P	132	260
	DRS ES300-3T-160G/185P	160	310
	DRS ES300-3T-185G/200P	185	340
	DRS ES300-3T-200G/220P	200	380
	DRS ES300-3T-220G/250P	220	415
	DRS ES300-3T-250G/280P	250	470
	DRS ES300-3T-280G/315P	280	510
	DRS ES300-3T-315G/355P	315	600
	DRS ES300-3T-355G/400P	355	670
	DRS ES300-3T-400G/450P	400	750
	DRS ES300-3T-450G/500P	450	810
	DRS ES300-3T-500G/560P	500	860
	DRS ES300-3T-560G/630P	560	990
	DRS ES300-3T-630G/710P	630	1100

Table 2-1 ES300 inverter series models

2.5 Contour dimension

Housing appearance of ES300 current vectorial inverter 18.5KW ~ 630KW is shown in Fig 2-3.

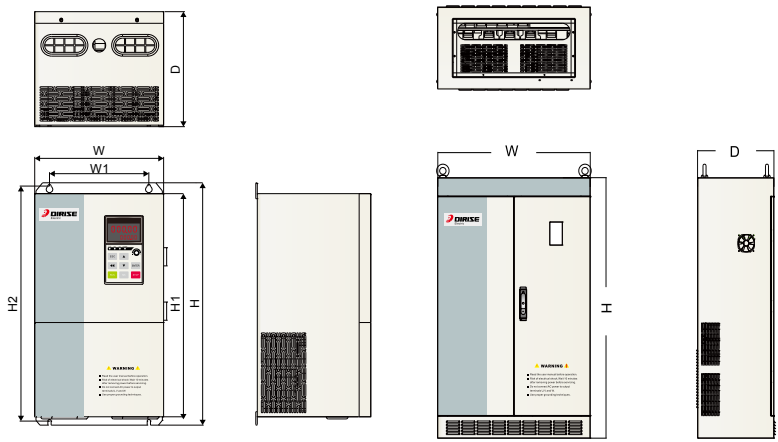


Figure 2-3 housing appearance and installation size of inverter 18.5KW ~ 630KW

Dimension of each power model of ES300 current vectorial inverter is shown in table 2-2.

Voltage grade	Product model	**W** (mm)	**W1** (mm)	**H** (mm)	**H1** (mm)	**H2** (mm)	**D** (mm)	Installation hole (mm)
Triple phase 220V	DRS ES300-2T-011G/015P	235	197	415	380	405	208	6.5
	DRS ES300-2T-015G/018P	255	197	475	440	465	225	6.5
	DRS ES300-2T-018G/022P							
	DRS ES300-2T-022G/030P	320	250	605	550	590	270	9.0
	DRS ES300-2T-030G/037P							
	DRS ES300-2T-037G/045P	380	280	725	670	710	297	11
	DRS ES300-2T-045G/055P							
	DRS ES300-2T-055G/075P							
	DRS ES300-2T-075G/090P	515	440	1050	980	1030	340	13
	DRS ES300-2T-090G/110P							
	DRS ES300-2T-110G/132P							
	DRS ES300-2T-132G/160P	650	440	1055	980	1030	390	13
	DRS ES300-2T-160G/185P	810	600	1295	1200	1260	405	18
Triple phase 380V	DRS ES300-3T-0R7G/1R5P	Developing						
	DRS ES300-3T-1R5G/2R2P							
	DRS ES300-3T-2R2G/4R0P							
	DRS ES300-3T-4R0G/5R5P							
	DRS ES300-3T-5R5G/7R5P							
	DRS ES300-3T-7R5G/011P							
	DRS ES300-3T-011G/015P							
	DRS ES300-3T-015G/018P							
	DRS ES300-3T-018G/022P	235	197	415	380	405	208	6.5
	DRS ES300-3T-022G/030P							
	DRS ES300-3T-030G/037P	255	197	475	440	465	225	6.5
	DRS ES300-3T-037G/045P							
	DRS ES300-3T-045G/055P	320	250	605	550	590	270	9.0
	DRS ES300-3T-055G/075P							
	DRS ES300-3T-075G/090P	383	280	725	670	710	303	11
	DRS ES300-3T-090G/110P							
	DRS ES300-3T-110G/132P							
	DRS ES300-3T-132G/160P	515	440	1050	980	1030	345	13
	DRS ES300-3T-160G/185P							
	DRS ES300-3T-185G/200P							
	DRS ES300-3T-200G/220P	650	440	1055	980	1030	390	13
	DRS ES300-3T-220G/250P							
	DRS ES300-3T-250G/280P							

Voltage grade	Product model	**W** (mm)	**W1** (mm)	**H** (mm)	**H1** (mm)	**H2** (mm)	**D** (mm)	Installation hole (mm)
Triple phase 380V	DRS ES300-3T-280G/315P	810	600	1295	1200	1260	405	18
	DRS ES300-3T-315G/355P							
	DRS ES300-3T-355G/400P							
	DRS ES300-3T-400G/450P							
	DRS ES300-3T-450G/500P	1100	--	1750	--	--	545	--
	DRS ES300-3T-500G/560P							
	DRS ES300-3T-560G/630P							
	DRS ES300-3T-630G/710P							

2-2 Dimension diagram

This table provides standard product dimensions and some products may be different. If dimension changes with product upgrade, no further notice will be issued. Please contact us for details.

2.6 Product features

1. Capable to provide industry professional solutions about motor drive and make secondary development as required;
2. Application of special control chip in motor and advanced optimized magnetic flux vector control algorithm make higher output precision and better operation performance;
3. Standard DC reactor of 18KW and above improves integral efficiency, heat stability and anti-interference capacity;
4. Stable moment output and low-frequency large moment can embody low-speed steady operation with 0.1Hz rated load;
5. Standard LED nixie tube keyboard and flexible multi-channel monitoring parameters;
6. Optional OLED keypad; all display dot matrixes are self-luminous and provide wider visual angle and higher luminance; parameter monitoring and setting is more visualized and convenient.
7. 8-CH can programme multifunctional input terminals. 2-CH can programme multifunctional open collector output. 2-CH can programme relay output;
8. 3-CH analog signal (0 ~ +10V,0 ~ 20mA, AI3 voltage -10V~10V) input channel, 2-CH voltage analog signal output channel;
9. Optional 15 period of speed and programmable multi-rates are provided for external terminals;
10. Standard configuration enhanced PID adjustor facilitates user's closed-loop control on temperature, pressure and flux.
11. Standard built-in braking unit below 22KW, rate of dynamic braking initial voltage and braking action can be flexibly adjusted as requirement;
12. With optional RS485 interface, PLC, IPC and other devices can be easily connected to inverter And also can achieve multi-inverter's linkage operation.
13. Provide V/F individual control way. Voltage and frequency can be controlled separately;
14. Over 20 protective functions are provided, including phase loss, output phase loss, overcurrent, overload, overvoltage, and output short circuit protection, to provide quick and effective protection to inverter and motor.

2.7 Technical specification

Function Description		Specification Indicators
Power Input	Rated input voltage	Triple phase 380V±20%, voltage imbalance ＜ 3%
	Rated input frequency	50 ~ 60Hz（±5%）
Power output	Rated output voltage	≤ input voltage
	Rated output current	Continuous output of rated output current
	Overload capacity	150% of rated current for 1 minute; 180% of rated current for 10 seconds
Control function	Control way	V/F control, without PG vector control
	Maximum Frequency	600.00Hz
	Signal feeding way	Communication, analog voltage, analog current, multi-segment velocity, simple PLC and various combinations.
	Frequency resolution	Digital feeding: 0.01Hz; Analog feeding: maximum×0.1%
	Adjustable velocity range	1: 50 (V/F control) 1: 100 (vector control)
	Steady velocity precision	±0.2% rated synchronous speed
	Torque boost	Automatic torque boost, fixed torque boost, random torque boost
	Acceleration and deceleration curve	Straight line
	Acceleration and deceleration time	0.01S ~ 600.00S
Control Function	Automatic voltage adjustment	When network voltage varies, it can automatically maintain constant output voltage.
	Overcurrent and overvoltage stall	Current and voltage is automatically limited during operation, so that frequent overcurrent or overvoltage trip can be prevented.
	DC braking	DC braking frequency: 0.10Hz ~ 60.00Hz Braking time: 0.00S ~ 30.00S Braking action current value: 0.00% ~ 150.00%
Special Function	Parameter self-adjusting	Capable to learn motor parameter automatically and maintain optimized motor efficiency.
	Random carrier	Effectively improve spectral distribution of PWM square wave, reduce working noise of motor, and more effectively inhibit electromagnetic interference。
	Configured reactor	Standard DC reactor can effectively inhibit higher harmonic, reduce current distortion rate and interference to maximum degree, and make current more like sine wave (above 18KW).
Peripheral interface	External power source	10V/20mA, 24V/150mA
	Digital input	8-CH digital can programme input terminals.X8 is a high-speed impulse input channel with, input frequency 0 ~ 100KHz.
	Digital output	2-CH can programme and open set output. 2-CH can programme relay output. Y2 may provide high-speed impulse output with, frequency 0~100KHz.
	Analog quantity input	AI1: input 0 ~ 10V/0 ~ 20mA AI2: input 0 ~ 10V/0 ~ 20mA AI3: voltage input -10V ~ +10V/PT100 temperature sensor
	Analog quantity output	AO1: output 0 ~ 10V/0 ~ 20mA AO2: output 0 ~ 10V/0 ~ 20mA
	485 communication	Support standard Modbus communication protocol

Keypad	LED display	5-digit nixie tube display
	OLED liquid crystal display	Optional liquid crystal display supports Chinese-English language.
	Keys	8 operation keys
	Parameter copy	Capable to upload and download parameter information of inverter to embody quick parameter copy.
Protection	Fault protection function	Input/output phase loss, overcurrent, overvoltage, undervoltage, overheat, overload protection and so on.
Environment	Installation site	Indoor environment free from direct exposure to sunlight, dust, corrosive gases, combustible gases, oil mist, vapour, water drop or salt.
	Altitude	Lower than 1000m
	Ambient temperature	-10℃ ~ +40℃
Protection grade		IP20
Cooling way		Forced air cooling

Table 2-3 technical specification table

2.8 Installation dimension of operation keypad

Label	**W** (mm)	**H** (mm)	**W1** (mm)	**H1** (mm)	**W2** (mm)	**H2** (mm)	**D** (mm)	Installation hole (mm)
Size	77	136	36.5	114	72.3	131	17	M3

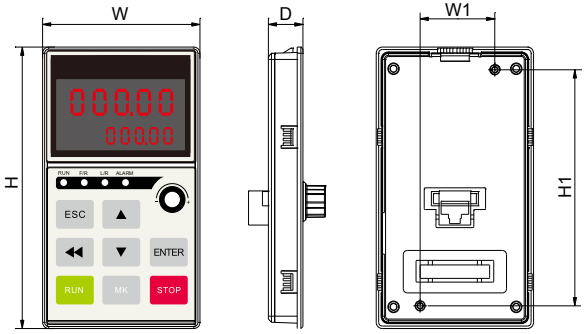


fig 2-4 keypad installation dimension diagram (unit: mm)

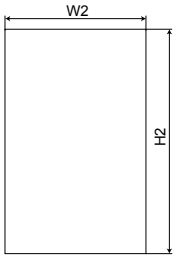


fig 2-5 keypad hole size diagram (unit: mm)

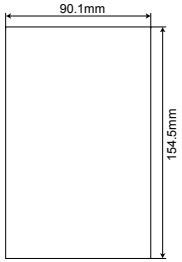


fig 2-6 keypad holeder size diagram (unit: mm)

Chapter 3 Mechanical and Electric Installation

3.1 Mechanical installation

3.1.1 Ambient condition

Environment temperature range of using inverter: -10℃ ~ 50 ℃ . When the ambient temperature is higher than 50℃ , please choose a well ventilated place and derate the output of inverter by 10% for every 5℃ increment.

3.1.2 Installation site

- ◆ No corrosive, flammable or explosive gases or liquids.
- ◆ Humidity: less than 90% RH, no condensation.
- ◆ Vibration: less than 5.9m/ (0.6g)
- ◆ Avoid installing it at a place with much dust and metal powder

If users have special installation requirements, please consult and confirm with manufacturer in advance.

3.1.3 Installation Precautions

During installation, please take effective precautions to keep metal scraps, dusts or powders from falling into inverter. After installation, please take protective tools away.

3.1.4 Installation interval and heat dissipation

Wall-mounted type is recommended for installation. Installation interval and required distance of single inverter is shown in Fig 3-1. If two inverters are installed above and below, they should be installed with spacer in the middle, as shown in Fig 3-2.

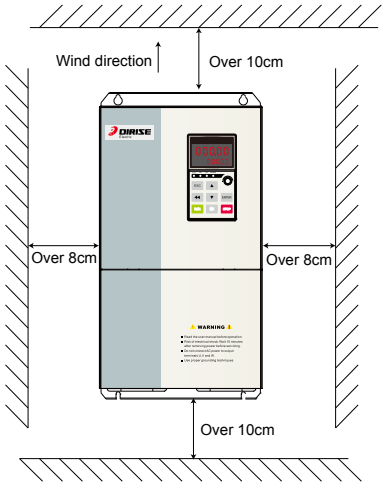


Fig 3-1 installation interval and distance diagram

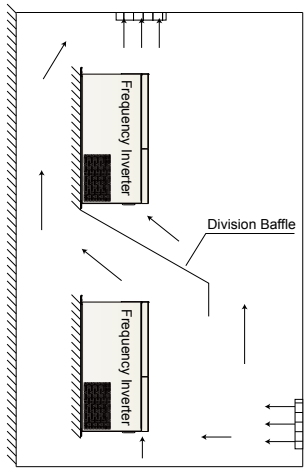


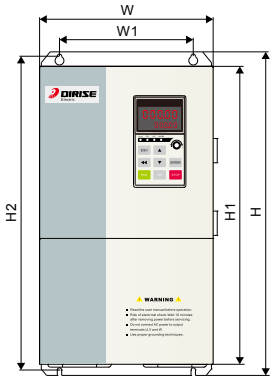
Fig 3-2 installation diagram of multiple inverters

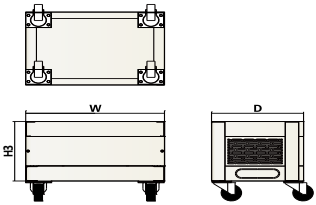
注 意
WARNING

◆ High temperature may shorten the service life of inverter.
◆ If there is heating device near inverter, please keep it as far as possible. When inverter is fixed inside a cabinet, sufficient consideration should be given to the perpendicularity and space size in order to help with heat dissipation.

3.1.5 Screw fixation and installation method

The product is installed by two holes in opposite corners. Size of installation hole should be subjected to housing dimension and installation dimension. Make 2 holes on installation surface, align inverter with the holes, insert bolts and tighten the bolts. Bolt option should be subjected to the note of inverter dimension diagram, as shown in Fig 3-3.





Product type	W (mm)	H3 (mm)	D (mm)
DRS ES300–3T–075G/090P~110G/132P	383	160	303
DRS ES300–3T–132G/160P~185G/200P	515	280	345
DRS ES300–3T–200G/220P~250G/280P	650	300	390
DRS ES300–3T–280G/315P~355G/400P	810	350	413

Fig 3-3 Screw fixation and installation method

3.1.6 Disassembly and installation of terminal cover

A. Terminal cover disassembly: as shown by following diagram, screw off the bolt in direction 1 and remove terminal cover in arrow direction 2.

B. Terminal cover installation: insert terminal cover into the slot shown by arrow direction 1, press down terminal cover in the direction of arrow 2, and then screw up bolts in the direction of arrow 3.

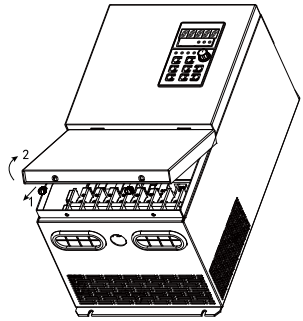


Fig 3-4 terminal cover disassembly

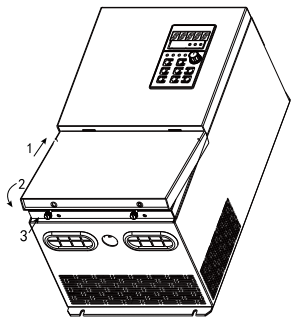


Fig 3-5 terminal cover installation

3.2 Electric connection

After opening terminal cover, a terminal strip is revealed. Check if terminals of main circuit and control circui tare clear. Pay attention to the following instructions in wiring:

1. Power supply terminals of main circuit R, S and T are input power terminals. If power supply were mistakenly connected to other terminals, the inverter would be burnt out. Make sure power supply is within rated voltage/current labeled on nameplate.
2. Grounding terminals must be well connected. Reliable connection may prevent electric shock or fire accident, and reduce noise.
3. Please make sure connection terminals and leads are reliably locked lest sparks would be caused due to loose connection.
4. Electriferous operation is forbidden for control terminals.

危 险 DANGER	1. Before connection, please make sure input power source is cut off, otherwise, there is risk of electric shock and fire. 2. Connection operation should be for electric engineering technicians only, otherwise, there is risk of electric shock and fire. 3. Grounding terminals must be reliably grounded, otherwise, there is risk of electric shock and fire. 4. After emergency stop button is connected, must check if action is effective, otherwise, there is risk of injury (connection liability should be undertaken by user). 5. Must not directly contact the terminals. Inverter terminals must not be connected to housing and short circuit between terminals is forbidden, otherwise, there is risk of electric shock and short circuit.
注 意 WARNING	1. Please confirm if voltage of AC power is consistent with rated voltage of inverter, otherwise, there is risk of injury and fire. 2. Voltage proof test is forbidden for inverter, otherwise, it would damage semiconductor components inside inverter. 3. Please connect braking resistor or braking unit according to connection diagram, otherwise, there is risk of fire. 4. Please use specified torque to screw up terminals with screw driver, otherwise, there is risk of . 5. Do not connect power cord to terminal U, V and W. When voltage is imposed on output terminals, inverter will be damaged from inside. 6. Must not connect phase-shifting capacitor and LC/RC noise filter to output circuit, otherwise, inverter would be damaged from inside. 7. Must not connect any switch or contactor to output circuit. When inverter runs with load, switch and contactor action will create surge current and surge voltage resulting in damage of inverter. 8. Must not disassemble connection cables inside inverter, otherwise, there is risk of damaging inverter.

3.2.1 Connection configuration of peripheral equipment

Connection diagram of peripheral equipment is shown in Fig 3-6:

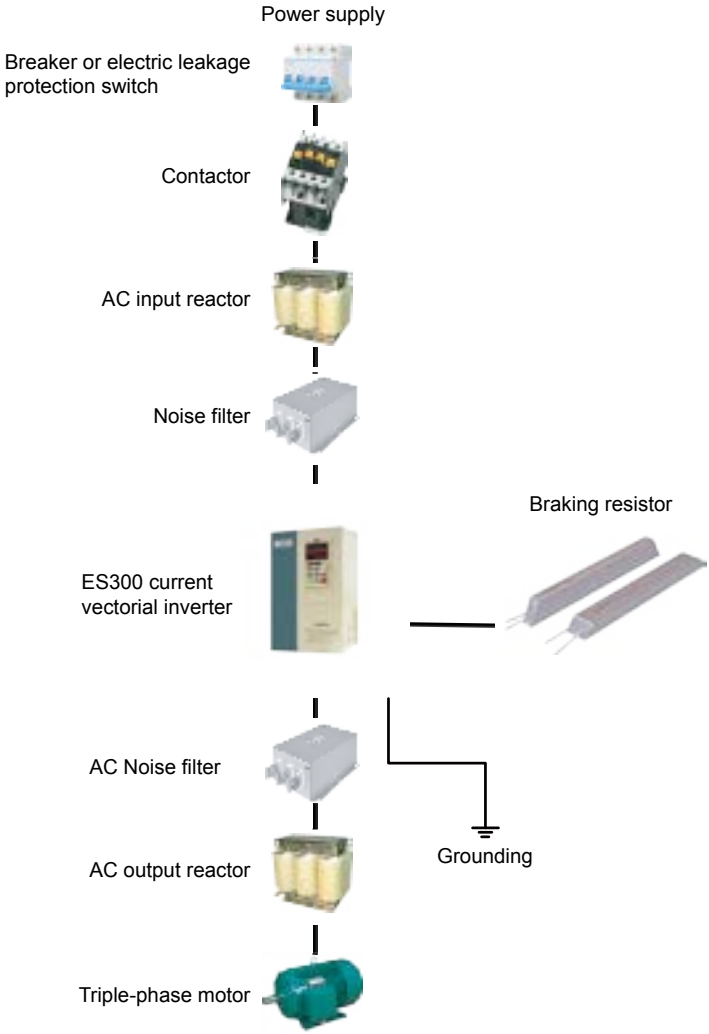


Fig 3-6 wiring diagram of inverter and peripheral equipment

3.2.2 Wiring diagram of main circuit terminals and control circuit terminals

Standard wiring of main circuit terminals and control circuit terminals of inverter is shown in Fig 3-7:

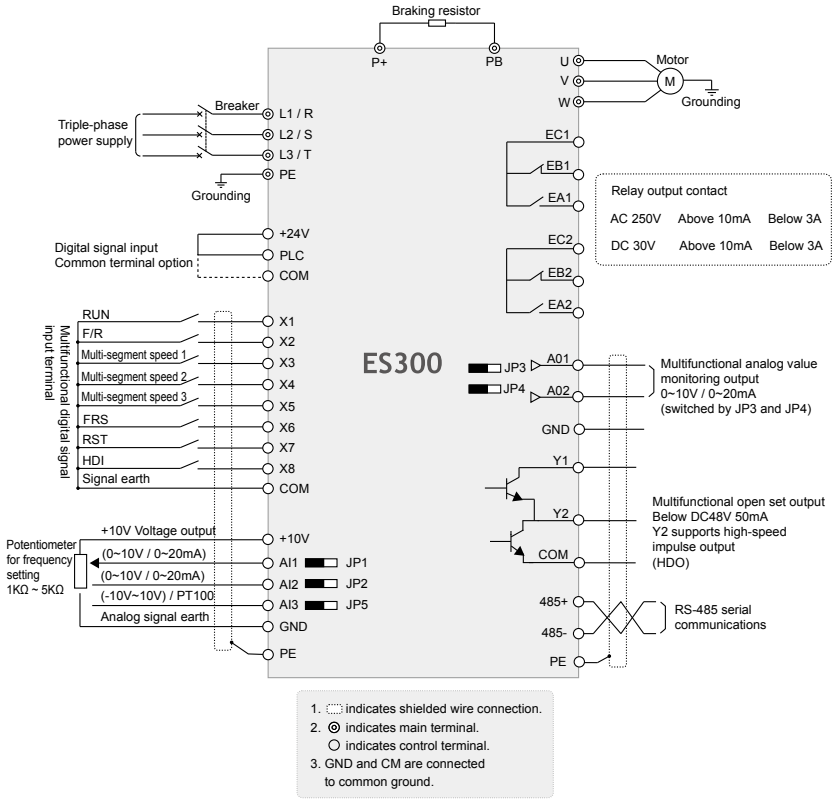


Fig 3-7 standard connection of main circuit and control circuit

- When multifunctional output terminals are connected to inductive load (e.g. relay coil), make sure to connect freewheel diodes to both ends of load in parallel.
- The distance from inverter or control wire in cabinet to power cable should be 100mm at least. Being in the same wiring trough is forbidden; if signal wire must go through power cable, both should maintain orthogonal position (90o angle). Control wire should be shielded twisted pair and shielded layer be connected to GND of terminal. Power cable should be sheathing and shielding cable for better.
- As strong electromagnetic jamming is unavoidable to inverter, it will cause bad influence on various electric devices and instruments in the same environment. To restrain the interference, output cable of inverter can be fitted into a grounded metal pipe or sheathing and shielding cable should be used and grounded. Besides, addition of magnet ring to output cable can also effectively restrain the interference.

3.2.3 Functions of main circuit terminals

Terminal Label	Function Description
R、S、T	AC power input terminals, triple phase R / S / T
U、V、W	Inverter output terminals are connected to triple phase AC asynchronous motor.
P+、P-	Positive and negative terminals of DC busbar
PB	External braking resistor connection terminals, one end connecting to P+ and the other end connecting to PB (Above 45KW of ES300 has no PB terminal)
PE	Connect to ground (PE terminal of ES300 30 ~ 37KW, 75 ~ 110KW power segment is set on the housing)

Note: main circuit connection terminals of ES300 each power segement has different marshalling sequence at present. Fig 3-8 to Fig 3-12 shows sequence of main circuit connection terminals in different power segments.

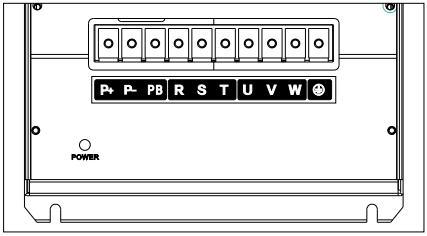


Fig 3-8 main circuit terminals diagram of ES300 18KW ~ 22KW
(Built-in braking unit)

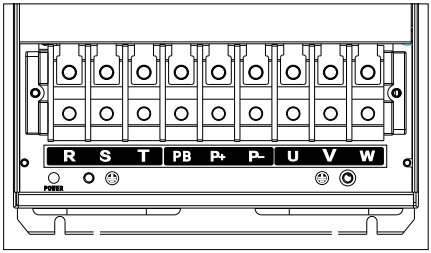


Fig 3-9 main circuit terminals diagram of ES300 30KW ~ 37KW
(Braking unit is selective)

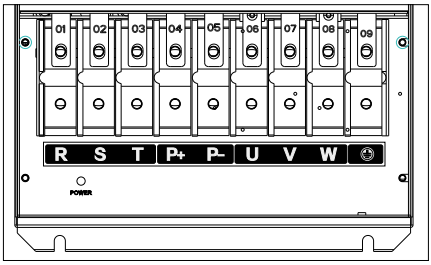


Fig 3-10 main circuit terminals diagram of ES300 45KW ~ 55KW

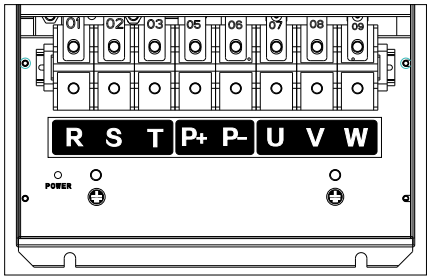


Fig 3-11 main circuit terminals diagram of ES300 75KW ~ 110KW

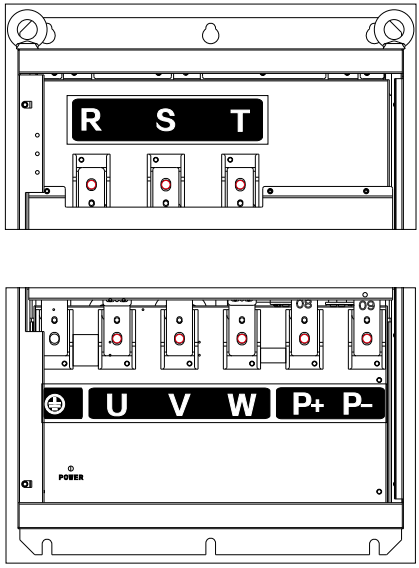


Fig 3-9 main circuit terminals diagram of ES300 132KW ~ 160KW

- Must not connect any terminal beyond R/S/T to AC 220V power source, otherwise, there is risk of damage in inverter.
- Check if rated input voltage of inverter is consistent with the voltage of AC power supply. If not, there is risk of damage.
- Make sure to connect grounding terminal of inverter and motor housing to ground lead. Ground lead should be copper wire and sectional area should be above 4cm², and ground resistance must be lower than 10Ω.
- Must connect a non-fuse breaker between power supply and inverter lest the accident caused by inverter fault becomes serious, damages power distribution unit or results in a fire.

3.2.4 Main circuit wiring

Main circuit wiring diagram of ES300 current vectorial inverter is shown in Fig 3-13.

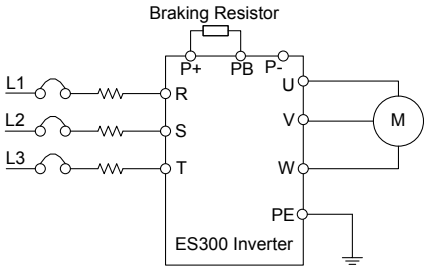


Fig 3-13 standard wiring diagram of main circuit

3.2.5 Main circuit input side wiring

● Breaker installation

Make sure to install an appropirate air circuit breaker (MCCB) for inverter between power supply and input terminals.

MCCB capacity should be 1.5 ~ 2 times of rated current of inverter.

Time characteristic of MCCB should meet the requirement of that of overheat protection (150% of rated current /1min).

When MCCB is shared with multiple inverters or other devices , please connect inverter fault output relay contact to power contactor coil in series connection, as shown in Fig 3-14. Fault signal may cut off power supply.

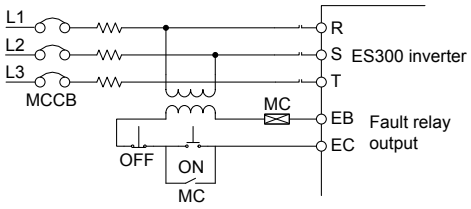


Fig 3-1 main circuit breaker wiring diagram

● Leakage protection switch installation

As inverter output is high-frequency PWM signal, it will produce high-frequency leakage current. Please choose special leakage breaker for inverter of current sensitivity above 30mA; if a common leakage breaker should be chosen, please choose the model of current sensitivity above 200mA and action time above 0.1sec.

● Electromagnetic contactor installation

Connect an electromagnetic contactor which matches the power of inverter as shown in Fig 3-10. Do not frequently use incoming-line side electromagnetic contactor to control and stop inverter as this is an important cause to the damage of inverter. If it is a must to control with incoming-line side electromagnetic contactor, frequency of operation and stop should be no lower than 30 min/time. After recovery from power-cut, inverter will not automatically run.

● Installation of AC electric reactor

When capacitive load is present in input power supply, it will create very great surge current which may damage inverter. In this case, please connect a triple-phase/single phase AC reactor (optional) to input side of inverter. In this way, it can not only inhibit peak current and voltage, but also can improve power factor of system.

● Noise filter installation

To keep the noise from inverter and prevent the influence of the noise of inverter on power grid, a special noise filter is required for inverter. As the performance of common noise filter is not good, it is not applicable. Correct and wrong installation way of noise filter is shown in Fig 3-15 and 3-16.

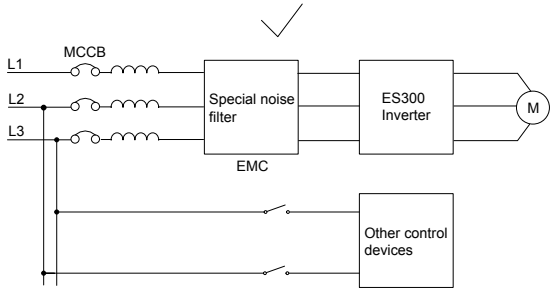


Fig 3-15 correct wiring of noise filter

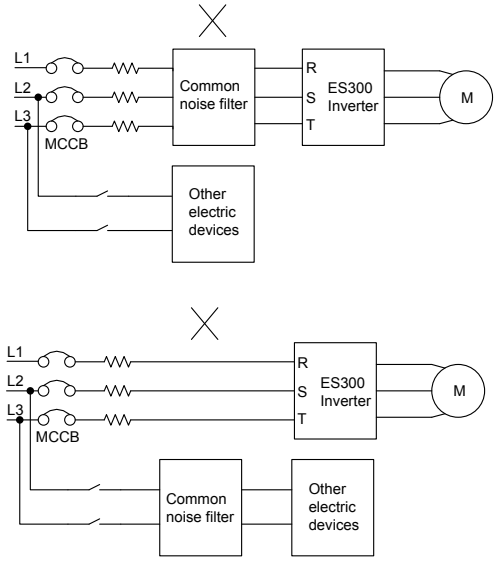


Fig 3-16 false wiring of noise filter

3.2.6 Output side wiring of main circuit

● Motor wiring and installation

Connect the output terminals U, V and W of inverter to input terminals of motor, U, V and W. Please confirm if motor makes forward rotation when forward rotation command is applied. To change rotation direction of motor, we just need to change any two wires of output terminal U, V and W.

● Must not connect power input to output terminals

Must not connect power wire to U, V and W terminal, after U, V and W terminal is imposed with voltage, components of inverter will be damaged.

● Must not short out output terminals or ground them

Must not directly touch terminals or short out output wire and inverter housing; otherwise, there would be risk of electric shock and short-circuit. Besides, must not short out output wires.

● Must not apply phase-shifting capacity

Must not connect a phase-shifting capacity or LC/RC filter to output circuit; otherwise, it would damage inverter.

● Must not apply electromagnetic switch

Must not connect an electromagnetic switch or electromagnetic contactor in output circuit; otherwise, when this type of components acts, overcurrent and overvoltage protection action would be activated. In a serious case, internal components of inverter would be damaged.

● Noise filter installation

The connection of noise filter to output side of inverter may reduce inductive interference and radio interference. Inductive interference: electromagnetic induction creates noise in signal line resulting in false action of control devices. Radio interference: inverter itself and high-frequency electromagnetic wave will disturb radio equipment nearby and produce noise during signal reception. Installation of noise filter on output side is shown in Fig 3-17.

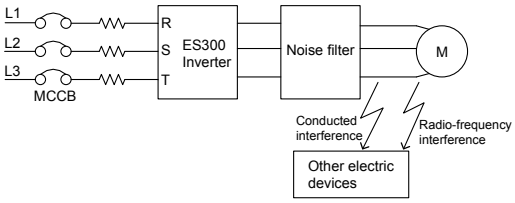


Fig 3-17 installation and wiring of noise filter on output side

● Anti-interference installation example

To inhibit the inductive interference of output side, besides installation of noise filter mentioned before, we can also put all output wires into grounded metal tube. When interval between output wire and signal wire is larger than 30cm, influence of inductive interference will be significantly reduced. Input wire, output wire and inverter itself will produce radio-frequency interference, noise filters on both output sides and screening inverter with iron box can also reduce radio-frequency interference. As shown in Fig 3-18, when multiple inverters work together, it is recommended to use the connection way in Fig 3-19.

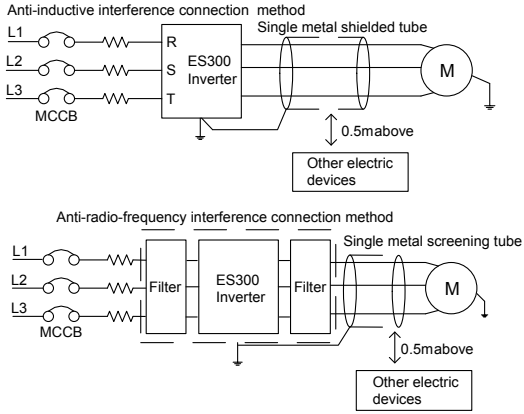


Fig 3-18 anti-interference installation wiring

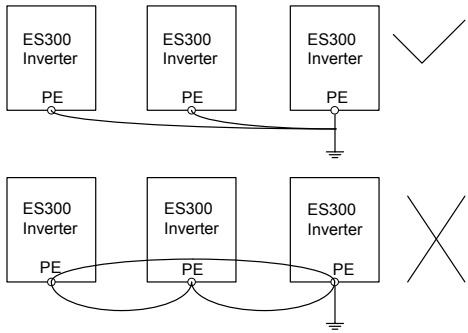


Fig 3-19 recommended grounding way

3.2.6 Functions of control circuit terminals

Control circuit terminals of ES300 current vectorial inverter are shown in Fig 3-10.

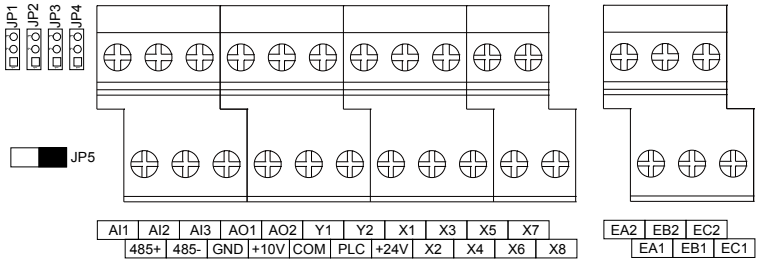
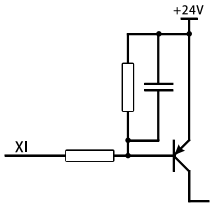
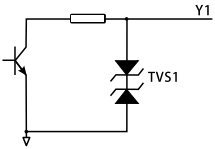
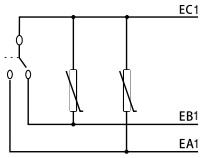
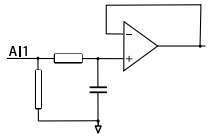
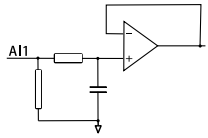
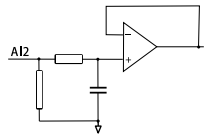
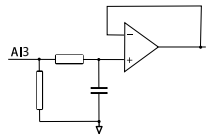
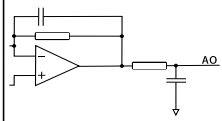


Fig 3-20 control circuit terminals

Control circuit terminal functions

Type	Terminal Label	Functions	Specification	Internal Circuit
Digital Functional Terminals	X1	By function code programming, user can embody the start, stop, forward and reverse rotation of inverter. X8 terminal possesses high-speed impulse input function which maximum frequency can reach to 100KHz.	Input impedance: 27KΩ; Input voltage: 0-24V; Input frequency: <1KHz; Low level effective	
	X2			
	X3			
	X4			
	X5			
	X6			
	X7			
	X8			
Switch quantity terinmal output	Y1	By function code programming,outward output to reflect frequency inverter's forward/reverse rotation, and frequency arrival status. Y2 can be set as high-speed impulse output mode which maximum frequency is 100KHZ.	Open set output: Load capacity: 50mA/24V; Output frequency: <1KHz;	
	Y2			
Switch terminal output	EA1	Relay output can be programmed by function code. EA1/ EA2, EB1/EB2 and EC1/EC2 separately indicates Constant-On, Constant-Off and common terminal.	Electric contact capacity: 3A/250VAC Output frequency: <50Hz	
	EB1			
	EC1			
	EA2			
	EB2			
	EC2			

Type	Terminal Label	description	Electrical specifications	Internal Circuit
Analog input/output terminal	AI1	AI1/AI2 analog voltage/current input (voltage input by default) can be set as current input by toggle switch JP1 and JP2.	Voltage source: input voltage: 0 ~ 10V; Input impedance: 1 MΩ; Current source: (optional) Input current: 0~20mA; Input impedance: 250Ω; Resolution: 0.2%;	
	AI2			 Switched by JP1 
	AI3	AI3 analog voltage input	Voltage source: Input voltage: -10 ~ 10V Input impedance: 1 MΩ	
	AO1	AO output can be programmed by function code to output and reflect frequency inverter's operation frequency , set frequency and other status.	Output voltage: 0 ~ 10V Load capacity: <4mA Resolution: 0.1V;	
	AO2			

Chapter 4 Keypad Operation

4.1 Keypad Introduction

Nixie tube keypad of ES300 series current vectorial inverter is composed by 5-bit 8-segment nixie tube, 3 unit indicator lamps, 4 status indicator lamps, 8 keys and 1 rotational potentiometer. By the keypad, user can complete start, stop, status monitoring, fault inquiry, parameter modification, speed regulation and so on functions. Appearance of keypad is shown in Fig 4-1.

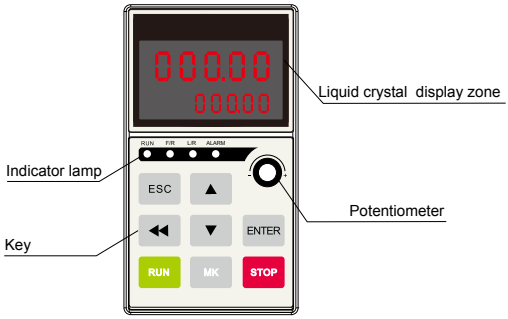


Fig 4-1 keypad introduction

OLED liquid crystal display of ES300 series current vectorial inverter is composed by a 2.42-inch OLED liquid crystal display screen, 3 LED indicator lamps, 8 keys and 1 potentiometer. We will choose fittings for user at the factory. OLED liquid crystal display dot matrixes are self-luminous and provide wider visual angle and higher luminance; parameter monitoring, start/stop and parameter setting are more convenient.

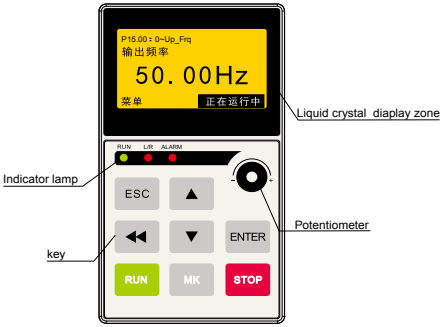


Fig 4-2 OLED keypad introduction

Function introduction of LED keypad

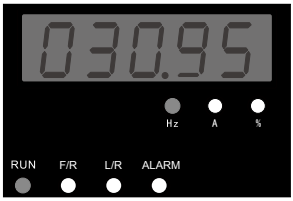
Figure	Name	Description
	5-bit Nixie tube	Display parameter code, parameter value, monitoring status and so on
	7 LED indicator lamps	RUN: this figure is constantly on in operation and off at stop. Blinking indicates deceleration; F/R: off in forward rotation, constant on in reverse rotation; L/R: when controlled by local keypad, this indicator lamp is off; when controlled by terminal, this indicator lamp is constantly on; when controlled by 485, this indicator lamp is blinking (time interval 1sec). ALARM: constant On indicates inverter is in fault alarming status. Hz: constant On indicates the unit of parameter is Hz. A: constant On indicates the unit of parameter is ampere. %: constant On indicates the unit of parameter is percentage.
	1 potentiometer	Change the feeding of frequency source and achieve frequency interver's speed governing.
	ESC key	Return to previous status or cancel current parameter modification.
	UP key	Increase parameter code, parameter value or parameter group.
	Shift key	Shifting of operation status monitoring data and parameter digit.
	Down key	Decrease parameter code, parameter value or parameter group.
	Enter key	Enter into parameter menu or confirm current modified value.
	RUN key	The key to run a command from keypad.
	MK key	Multifunctional key, can be set as invalid, inching or F/R function.
	STOP key	The key to stop or fault reset.

4.2 Keypad display

ES300 current vectorial inverter's all statuses are shown as follow.

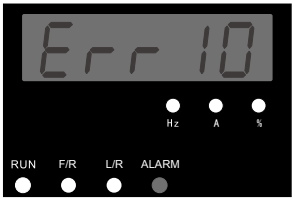
Stop status: given frequency 30.95Hz.

Operation status: running in forward rotation, frequency 30.95Hz.



Parameter edition status: secondary menu.

Abnormal status: fault code 10.



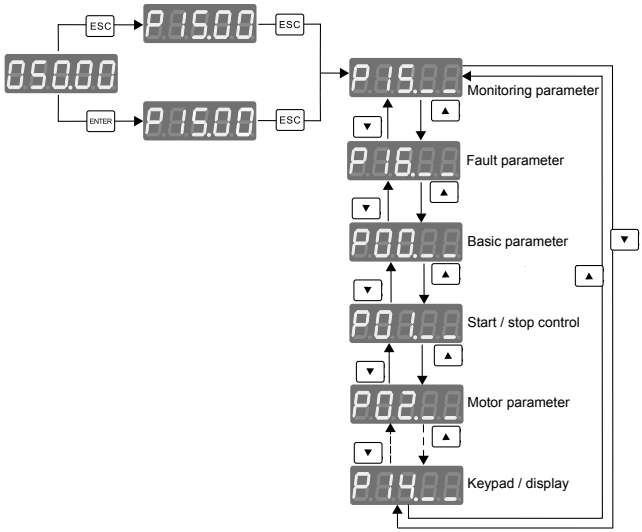
4.3 Keypad operation

The keypad of ES300 series vectorial inverter embodies parameter setting, status monitoring and other operations by 3-level menus, including parameter group (level 1 menu), function code (level 2 menu) and parameter value (level 3 menu).

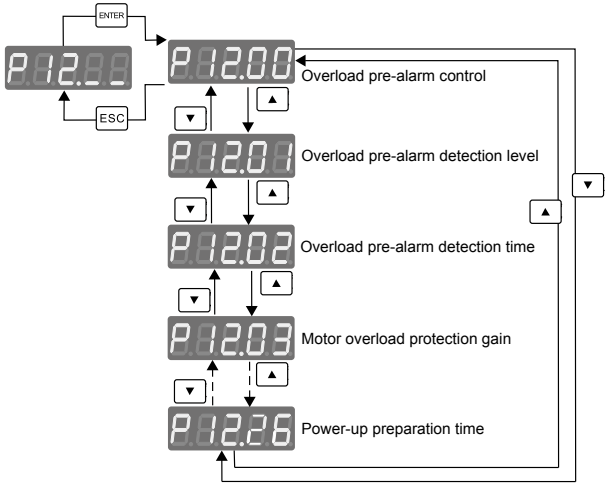
4.3.1 Parameter setting

To perform ES300 inverter parameter setting, we can carry out parameter group switching, function code switching and parameter value modification.

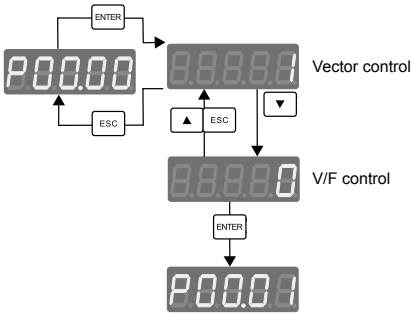
Parameter group switching



Function code switching



Parameter value modification



In level 3 menu, if a parameter has no blinking digit, it indicates current function code cannot be modified. Possible reasons include:

- Current function code is read-only;
- Current function code is non-modifiable in running status and becomes modifiable after stop.

4.3.2 Status monitoring

When inverter is in running status, press ◀◀ key to have Nixie tube display current output frequency (P15.00), output current (P15.04), output voltage (P15.06) and busbar voltage (P15.08) in cycle.

When inverter is in running or stop status, user can monitor the work status of inverter of monitoring parameter (P15.XX), such as input frequency, output frequency, output voltage, radiator temperature and so on.

4.3.3 Potentiometer operation

When keypad potentiometer is selected as frequency source of inverter, output frequency can be adjusted by keypad potentiometer.

4.3.4 Start/stop control

If command source is selected as current keypad, namely P00.01=0, inverter output can be controlled by RUN and STOP key.

4.3.5 MK multifunctional pragramming key

If P14.03=0, user can have inverter run by set jog frequency by MK key.

If P14.03=1, user can control inverter output by MK key to embody forward/reverse rotation switching of output frequency.

4.3.5 Fault reset/inquiry

When inverter meets fault, exclude the cause to fault first and then press STOP key to reset; otherwise, the inverter will remain current fault status. Press ESC key to perform parameter setting.

Chapter 5 Function Parameter Table

" ● " : A code parameter is modifiable when inverter is in running status.
" ○ " : A code parameter is non-modifiable when inverter is in running status.
" × " : A code parameter is read-only and non-modifiable.

Group P00 basic parameters

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P00.00	Control way	0: V/F control 1: vector control		1	○
P00.01	Command source options	0: local keypad 1: external terminal 2: computer communication		0	○
P00.02	Main frequency source option	0: main digital frequency 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI		1	○
P00.03	Auxiliary frequency source options	0: auxiliary digital frequency 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI 6: PLC 7: PID		0	○
P00.04	Output frequency source options	0: main frequency source 1: auxiliary frequency source 2: main + auxiliary 3: main - auxiliary 4: MAX (main, auxiliary) 5: MIN (main, auxiliary)		0	○
P00.05	Auxiliary frequency source range in stacking	0: relative to maximum frequency 1: relative to main frequency		0	○
P00.06	Main frequency source proportion	0.00 ~ 300.00	%	100.00	●
P00.07	Auxiliary frequency source proportion	0.00 ~ 300.00	%	100.00	●
P00.08	Output frequency source control	0: digital proportion 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI		0	○
P00.09	Output frequency source proportion	0.00 ~ 300.00	%	100.00	●
P00.10	Main digital frequency	0.00 ~ maximum frequency	Hz	0.00	●
P00.11	Auxiliary digital frequency	0.00 ~ maximum frequency	Hz	0.00	●
P00.12	Rotation direction setting	0: forward 1: reverse		0	●
P00.13	Acceleration time 1	0.00 ~ 600.00	S	10.00	●
P00.14	Deceleration time 1	0.00 ~ 600.00	S	10.00	●
P00.15	Carrier frequency	1.000 ~ 16.000	kHz	4.000	●

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P00.16	Maximum frequency	20.00 ~ 600.00	Hz	50.00	○
P00.17	Upper-limit frequency	Lower-limit frequency ~ maximum frequency	Hz	50.00	○
P00.18	Lower-limit frequency	0.00 ~ upper-limit frequency	Hz	0.00	○
P00.19	Lower-limit frequency control	0: run at lower-limit frequency 1: when lower-limit frequency running times up, running at zero rate.		0	○
P00.20	Lower-limit frequency running time	0.00 ~ 600.00	S	60.00	○
P00.21	Anti-reverse-rotation control	0: forward/reverse rotation enabled 1: reverse rotation disabled		0	○
P00.22	Forward/reverse rotation dead time	0.00 ~ 600.00	S	0.00	○
P00.23	Load velocity coefficient	0.00 ~ 300.00		30.00	●
P00.24	Parameter reset	0: invalid 1: reset to Factory Default		0	○

Group P01 start/stop control

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P01.00	Start way	0: direct start 1: start rotation speed tracking		0	○
P01.01	Start DC braking current	0.00 ~ 150.00	%	0.00	○
P01.02	Time of start DC braking	0.00 ~ 30.00	S	0.00	○
P01.03	Stop way	0: stop in deceleration 1: free stop		0	○
P01.04	DC braking starting frequency at stop	0.00 ~ maximum frequency	Hz	0.00	○
P01.05	DC braking current at stop	0.00 ~ 150.00	%	0.00	○
P01.06	DC braking wait time at stop	0.00 ~ 30.00	S	0.00	○
P01.07	DC braking time at stop	0.00 ~ 30.00	S	0.00	○
P01.08	Terminal start protection option	0: invalid 1: valid		0	○
P01.09	Terminal JOG preferential option	0: invalid 1: valid		0	○

Group P02 motor parameters

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P02.00	Motor type	0: common asynchronous motor 1: variable frequency induction motor 2: permanent magnet synchronous motor		0	○
P02.01	Rated motor power	0.10 ~ 600.00	kW	XXXX	○
P02.02	Rated motor voltage	0 ~ 660	V	XXX	○
P02.03	Rated motor current	0.1 ~ 1500.0	A	XXXX	○
P02.04	Rated motor frequency	20.00 ~ 600.00	Hz	XXXX	○
P02.05	Rated motor rotation speed	1 ~ 60000	rpm	XXXX	○

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P02.06	stator resistance of asynchronous motor	0.01 ~ 300.00	Ω	XXXX	○
P02.07	rotor resistance of asynchronous motor	0.01 ~ 300.00	Ω	XXXX	○
P02.08	leakage inductive reactance of asynchronous motor	0.1 ~ 3000.0	mH	XXXX	○
P02.09	interaction inductive reactance of asynchronous motor	0.1 ~ 3000.0	mH	XXXX	○
P02.10	No-load current of asynchronous motor	0.1 ~ 1500.0	A	XXXX	○
P02.11	Motor tuning	0: no identification 1: self-identification at stop 2: self-identification in rotation		0	○

Group P03 V/F Control Parameters

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P03.00	V/F curve options	0: linear V/F curve 1: multi-point V/F curve 2: motor curve 1 3: motor curve 2 4: motor curve 3 5: motor curve 4 6: V/F separation		0	○
P03.01	Torque boost	0.00 ~ 30.00	%	1.00	●
P03.02	Cut-off frequency of torque boost	0.01 ~ P03.03	Hz	50.00	○
P03.03	Basic frequency	20.00 ~ 600.00	Hz	50.00	○
P03.04	V/F frequency value F0	0.00 ~ frequency value F1	%	1.00	●
P03.05	V/F frequency value F1	Frequency value F0 ~ frequency value F2	%	4.00	●
P03.06	V/F frequency value F2	Frequency value F1 ~ frequency value F3	%	10.00	●
P03.07	V/F frequency value F3	frequency value F2 ~ 100.00	%	16.00	●
P03.08	V/F voltage value V0	0.00 ~ 100.00	%	1.00	●
P03.09	V/F voltage value V1	0.00 ~ 100.00	%	4.00	●
P03.10	V/F voltage value V2	0.00 ~ 100.00	%	10.00	●
P03.11	V/F voltage value V3	0.00 ~ 100.00	%	16.00	●
P03.12	V/F separation voltage control	0: digital setting 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI 6: PID		2	○
P03.13	VF separation digital voltage setting	0.00 ~ 100.00	%	0.00	●
P03.14	VF separation voltage acceleration time	0.00 ~ 60.00	S	2.00	●
P03.15	VF separation voltage deceleration time	0.00 ~ 60.00	S	2.00	●
P03.16	VF separation stop way option	0: frequency/voltage decreases to 0 alone 1: frequency decreases after voltage decreases to 0		0	○

Group P04 vector control

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P04.00	speed ring proportional gain 1	0.00 ~ 100.00	%	30.00	●
P04.01	speed ring integral time 1	0.000 ~ 30.000 0.000: no integral	SEC	0.500	●
P04.02	switching frequency 1	0.00 ~ switching frequency 2	Hz	5.00	○
P04.03	speed ring proportional gain 2	0.00~100.00	%	15.00	●
P04.04	speed ring integral time 2	0.000 ~ 30.000 0.000: no integral	SEC	1.000	●
P04.05	switching frequency 2	Switching frequency 1 ~ Fmax	Hz	10.00	○
P04.06	driving torque limit	80.00 ~ 180.00	%	165.00	○
P04.07	Braking torque limit	80.00 ~ 180.00	%	165.00	○
P04.08	Torque acceleration time	0.000 ~ 30.000	SEC	0.040	●
P04.09	Torque deceleration time	0.000 ~ 30.000	SEC	0.040	●
P04.10	Current ring proportional coefficient	0.00 ~ 10.00	%	0.60	●
P04.11	Current ring integral coefficient	0.000 ~ 30.000	SEC	0.020	●
P04.12	Closed-loop slip compensation gain (electric)	0.00 ~ 200.00	%	100.00	●
P04.13	Closed-loop slip compensation gain (braking)	0.00 ~ 200.00	%	100.00	●

Group P05 input terminal control

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P05.00	DI terminal filter	0 ~ 1000		10	○
P05.01	DI input logic option 1	0: valid when closed 1: valid when broken off Unit: X1 Tens: X2 Hundred: X3 Thousands: X4 Ten thousands: X5		00000	○
P05.02	DI input logic option 2	0: valid when closed 1: valid when broken off Unit: X6 Tens: X7 Hundred: X8 Thousands: reserved Ten thousands: reserved		00000	○
P05.03	Valid delay time of terminal X1	0.00 ~ 300.00	S	0.00	○
P05.04	Invalid delay time of terminal X1	0.00 ~ 300.00	S	0.00	○
P05.05	Valid delay time of terminal X2	0.00 ~ 300.00	S	0.00	○
P05.06	Invalid delay time of terminal X2	0.00 ~ 300.00	S	0.00	○
P05.07	Valid delay time of terminal X3	0.00 ~ 300.00	S	0.00	○
P05.08	Invalid delay time of terminal X3	0.00 ~ 300.00	S	0.00	○
P05.09	Valid delay time of terminal X4	0.00 ~ 300.00	S	0.00	○

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P05.10	Invalid delay time of terminal X4	0.00 ~ 300.00	S	0.00	○
P05.11	Functional input X1 - RUN	0: no function 1: run RUN 2: forward/reverse rotation F/R 3: 3-thread operation stop control 4: forward rotation jog FJOG 5: reverse rotation jog RJOG 6: terminal UP 7: terminal DOWN 8: UP / DOWN reset 9: free stop FRS 10: fault reset RST 11: external fault EXT 12: operation pause 13: acceleration/deceleration forbidden 14: multi-segment frequency terminal 1 15: multi-segment frequency terminal 2 16: multi-segment frequency terminal 3 17: multi-segment frequency terminal 4 18: acceleration / deceleration time option 1 19: acceleration / deceleration time option 2 20: PID forward / reverse function 21: PID parameter switching 22: PID pause 23: PLC reset 24: command is switched to terminal 25: command is switched to communication 26: frequency is switched to auxiliary speed 27: main speed is switched to digital setting 28: auxiliary speed is switched to digital setting 29: reserved 30: HDI impulse input (valid for X8 only)		1	○
P05.12	Functional input X2 – F/R			2	○
P05.13	Functional input X3 – F1			14	○
P05.14	Functional input X4 – F2			15	○
P05.15	Functional input X5 – F3			16	○
P05.16	Functional input X6 – FRS			9	○
P05.17	Functional input X7 – RST			10	○
P05.18	Functional input X8 – HDI			30	○
P05.19	Terminal command way	0: 2-thread control 1 1: 2-thread control 2 2: 3-thread control 1 3: 3-thread control 2		0	○
P05.20	Terminal UP / DOWN digital frequency adjustment control	**Unit: action when power down** 0: save upon power down 1: not save upon power down **Tens: action when stop** 0: maintain upon stop 1: reset upon stop **Hundred: UP/DOWN adjustment control** 0:Valid when given digital frequency only 1:adjustment is always valid 2:adjustment is always invalid **Thousands: integral control** 0: integral function available 1: integral function unavailable		0000	○

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P05.21	Terminal UP/DOWN change rate	0.01Hz/S ~ 100.00Hz/S	Hz/S	1.00	○
P05.22	HDI minimum input	0.00 ~ P05.24	kHz	0.00	●
P05.23	HDI minimum input related setting	-100.0 ~ +100.0	%	0.0	●
P05.24	HDI maximum input	P05.22 ~ 100.00	kHz	50.00	●
P05.25	HDI maximum input related setting	-100.0 ~ +100.0	%	100.0	●
P05.26	HDI filtering time	0.00 ~ 60.00	S	0.10	●

Group P06 AI curve function

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P06.00	AI curve option	Unit: keypad potentiometer curve option 0: curve 1 (2 dots) 1: curve 2 (2 dots) 2: curve 3 (2dots) 3: curve 4 (4dots) 4: curve 5 (4dots) Tens: AI1 curve option, same as above Hundreds: AI2 curve option, same as above Thousands: AI3 curve option, same as above		2110	○
P06.01	Curve 1 minimum input	0.00 ~ curve 1 maximum input	V	0.00	●
P06.02	Related setting of Curve 1 minimum input	-100.0 ~ +100.0	%	0.0	●
P06.03	Curve 1 maximum input	Curve 1 minimum input ~ 10.00	V	10.00	●
P06.04	Related setting of curve 1 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.05	Curve 2 minimum input	0.00 ~ curve 2 maximum input	V	0.00	●
P06.06	Related setting of Curve 2 minimum input	-100.0 ~ +100.0	%	0.0	●
P06.07	Curve 2 maximum input	Curve 2 minimum input ~ 10.00	V	10.00	●
P06.08	Related setting of curve 2 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.09	Curve 3 minimum input	-10.00 ~ curve 3 maximum input	V	-10.00	●
P06.10	Related setting of Curve 3 minimum input	-100.0 ~ +100.0	%	-100.0	●
P06.11	Curve 3 maximum input	Curve 3 minimum input ~ 10.00	V	10.00	●
P06.12	Related setting of curve 3 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.13	Curve 4 minimum input	0.00 ~ curve 4 inflection point 1 input	V	0.00	●
P06.14	Related setting of Curve 4 minimum input	-100.0 ~ +100.0	%	0.0	●
P06.15	curve 4 inflection point 1 input	Curve 4 minimum input ~ curve 4 inflection point 2 input	V	3.00	●
P06.16	Related setting of curve 4 inflection point 1 input	-100.0 ~ +100.0	%	30.0	●
P06.17	curve 4 inflection point 2 input	curve 4 inflection point 1 input ~ curve 4 maximum input	V	6.00	●

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P06.18	Related setting of curve 4 inflection point 2 input	-100.0 ~ +100.0	%	60.0	●
P06.19	Curve 4 maximum input	curve 4 inflection point 2 input ~ 10.00	V	10.00	●
P06.20	Related setting of curve 4 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.21	Curve 5 minimum input	-10.00 ~ curve 5 inflection point 1 input	V	-10.00	●
P06.22	Related setting of Curve 5 minimum input	-100.0 ~ +100.0	%	-100.0	●
P06.23	Curve 5 inflection point 1 input	Curve 5 minimum input ~ curve 5 inflection point 2 input	V	-5.00	●
P06.24	Related setting of curve 5 inflection point 1 input	-100.0 ~ +100.0	%	-50.0	●
P06.25	Curve 5 inflection point 2 input	curve 5 inflection point 1 input ~ curve 5 maximum input	V	5.00	●
P06.26	Related setting of curve 5 inflection point 2 input	-100.0 ~ +100.0	%	50.0	●
P06.27	Curve 5 maximum input	curve 5 inflection point 2 input ~ 10.00	V	10.00	●
P06.28	Related setting of curve 5 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.29	Filtering time of keypad potentiometer	0.00 ~ 60.00	S	0.10	●
P06.30	AI1 filtering time	0.00 ~ 60.00	S	0.10	●
P06.31	AI2 filtering time	0.00 ~ 60.00	S	0.10	●
P06.32	AI3 filtering time	0.00 ~ 60.00	S	0.10	●
P06.33	AI sampling hysteresis	0 ~ 100		2	●

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Group P07 output terminal control

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P07.00	Multifunctional output Y1	0: no output 1: inverter operation 2: run in forward rotation 3: run in reverse rotation 4: Jog operation 5: inverter fault 6: frequency reaches to FAR 7: frequency level detection FDT1 8: frequency level detection FDT2 9: analog value level detection ADT1 10: analog value level detecti-on ADT2 11: zero speed operation 12: upper-limit frequency arrival 13: lower-limit frequency arrival 14: ready for operation 15: overload pre-alarm 16: motor overheat pre-alarm 17: set time arrival 18: PID feedback upper-limit 19: PID feedback lower-limit 20: reserved		1	○
P07.01	Multifunctional output Y2			7	○
P07.02	Relay output R1			5	○
P07.03	Relay output R2			14	○

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P07.04	AO output type	0: level 1: single impulse Unit: Y1 output type Tens: Y2 output type Hundreds: R1 output type Thousands: R2 output type Ten thousands: reserved		00000	○
P07.05	AO output logic	0: positive logic 1: reverse logic Unit: Y1 output logic Tens: Y2 output logic Hundreds: R1 output logic Thousands: R2 output logic Ten thousands: reserved		00000	○
P07.06	Y2 output type	0: switching value output 1: HDO impulse output		0	○
P07.07	Y1 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.08	Y1 invalid delay time	0.00 ~ 300.00	S	0.00	○
P07.09	Y2 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.10	Y2 invalid delay time	0.00 ~ 300.00	S	0.00	○
P07.11	R1 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.12	R1 invalid delay time	0.00 ~ 300.00	S	0.00	○
P07.13	R2 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.14	R2 invalid delay time	0.00 ~ 300.00	S	0.00	○
P07.15	Y1 single impulse valid time	0.00 ~ 300.00	S	0.00	○
P07.16	Y2 single impulse valid time	0.00 ~ 300.00	S	0.00	○
P07.17	R1 single impulse valid time	0.00 ~ 300.00	S	0.00	○
P07.18	R2 single impulse valid time	0.00 ~ 300.00	S	0.00	○
P07.19	Analog value output AO1	0: operation frequency 1: set frequency 2: evaluated frequency 3: output current 4: output voltage 5: busbar voltage 6: keypad potentiometer 7: AI1 8: AI2 9: AI3 10: HDI 11: +10V 12: PID given 13: PID feedback 14: PID output 15: reserved	%	0	○
P07.20	Analog value output AO2		%	1	○
F07.21	HDO impulse output		%	0	○
P07.22	AO1 minimum output	0.00 ~ 100.00	%	0.00	●
P07.23	AO1 maximum output	0.00 ~ 100.00	%	100.00	●
P07.24	AO1 output gain	0.00 ~ 200.00	%	100.00	●
P07.25	AO2 minimum output	0.00 ~ 100.00	%	0.00	●

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P07.26	AO2 maximum output	0.00 ~ 100.00	%	100.00	●
P07.27	AO2 output gain	0.00 ~ 200.00	%	100.00	●
P07.28	HDO minimum output frequency	0.00 ~ P07.29	kHz	0.00	●
P07.29	HDO maximum output frequency	P07.28 ~ 100.00	kHz	50.00	●
P07.30	HDO output filtering time	0.00 ~ 60.00	S	0.10	●
P07.31	Reservation				

Group P08 auxiliary parameters

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P08.00	Jog frequency	0.00 ~ maximum frequency	Hz	5.00	●
P08.01	Jog acceleration time	0.00 ~ 600.00	S	10.00	●
P08.02	Jog deceleration time	0.00 ~ 600.00	S	10.00	●
P08.03	Acceleration/deceleration time dimension	0: S (sec) 1: M (min)		0	○
P08.04	Acceleration time 2	0.00 ~ 600.00	S	10.00	●
P08.05	Deceleration time 2	0.00 ~ 600.00	S	10.00	●
P08.06	Acceleration time 3	0.00 ~ 600.00	S	10.00	●
P08.07	Deceleration time 3	0.00 ~ 600.00	S	10.00	●
P08.08	Acceleration time 4	0.00 ~ 600.00	S	10.00	●
P08.09	Deceleration time 4	0.00 ~ 600.00	S	10.00	●
P08.10	Acceleration/deceleration time switching control	0: no switching 1: switching		0	○
P08.11	Acceleration time 1/2 switching frequency	0.00 ~ maximum frequency	Hz	0.00	●
P08.12	Deceleration time 1/2 switching frequency	0.00 ~ maximum frequency	Hz	0.00	●
P08.13	FAR frequency arrival	0.00 ~ 600.00	Hz	2.50	○
P08.14	Upper limit of FDT1 level	0.00 ~ maximum frequency	Hz	30.00	○
P08.15	Lower limit of FDI1 level	0.00 ~ maximum frequency	Hz	30.00	○
P08.16	Upper limit of FDT2 level	0.00 ~ maximum frequency	Hz	30.00	○
P08.17	Lower limit of FDI2 level	0.00 ~ maximum frequency	Hz	30.00	○
P08.18	Analog value level detection option	0: keypad potentiometer 1: AI1 2: AI2 3: AI3		1	○
P08.19	Analog value level ADT1	0.00 ~ 100.00	%	20.00	○
P08.20	Analog value level ADT1 lag	0.00 ~ 100.00 (single-phase valid downward)	%	5.00	○
P08.21	Analog value level ADT2	0.00 ~ 100.00	%	50.00	○
P08.22	Analog value level ADT2 lag	0.00 ~ 100.00 (single-phase valid downward)	%	5.00	○
P08.23	Hopping frequency point 1	0.00 ~ 600.00	Hz	600.00	○
P08.24	Hopping range 1	0.00 ~ 20.00 0.00: invalid	Hz	0.00	○
P08.25	Hopping frequency point 2	0.00 ~ 600.00	Hz	600.00	○

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P08.26	Hopping range 2	0.00 ~ 20.00 0.00: invalid	Hz	0.00	○
P08.27	Hopping frequency point 3	0.00 ~ 600.00	Hz	600.00	○
P08.28	Hopping range 3	0.00 ~ 20.00 0.00: invalid	Hz	0.00	○
P08.29	Set operation time	0 ~ 60000	Hour	0	○
P08.30	Action option when action times up	0: continue to run 1: stop		0	○
P08.31	Operation time control locking password	0 ~ 65535		XXXXX	○
P08.32	Output power correction coefficient	0.00 ~ 200.00	%	100.00	●

Group P09 communication function

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P09.00	Local address	0: broadcasting address 1 ~ 247		1	○
P09.01	Communication Baud rate	0: 4800 1: 9600 2: 19200 3: 38400	bps	1	○
P09.02	Communication format	0: no parity 1+8+1 for RTL 1: even parity check 1+8+1+1 For RTU 2: odd parity check 1+8+1+1 For RTU		0	○
P9.03	Communication overtime time	0.0 ~ 60.0 0.0: communication overtime invalid	S	0.0	○
P09.04	Master-slave communication way	0: current machine is slave. 1: current machine is master.		0	○
P09.05	Sending interval of master	0 ~ 1000	mS	10	○
P09.06	Sending data of master	0 ~ 20		0	○
P09.07	Slave receives address.	0: main digital frequency 1: auxiliary digital frequency		0	○
P09.08	Slave receives proportion coefficient	0.00 ~ 600.00	%	100.00	●

Group P10 PID control function

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P10.00	PID given source	0: digital given 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI		0	○
P10.01	PID digital given	0.00 ~ 100.00	%	50.00	●

Function code	Function codes' names	Range set	Unit	Factory Default	Property
P10.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: HDI		0	○
P10.03	PID maximum range	0 ~ 60000		10000	○
P10.04	PID function direction	0: positive function 1: negative function		0	○
P10.05	PID output gain	0.00 ~ 100.00	%	100.00	●
P10.06	Proportional gain P	0.00 ~ 100.00		0.50	●
P10.07	Integral time I	0.000 ~ 30.000 0.000: no integral	S	2.000	●
P10.08	Derivative time D	0.000 ~ 10.000	S	0.000	●
P10.09	PID deviation limit	0.00 ~ 100.00	%	0.00	●
P10.10	PID derivative amplitude limiting	0.00 ~ 100.00	%	1.00	●
P10.11	PID positive limit	0.00 ~ 100.00	%	100.00	●
P10.12	PID negative limit	0.00 ~ 100.00	%	100.00	●
P10.13	PID given variation time	0.000 ~ 10.000	S	0.000	●
P10.14	PID output filtering time	0.000 ~ 10.000	S	0.000	●
P10.15	Proportional gain Kp2	0.00 ~ 100.00		0.50	●
P10.16	Integral time Ti2	0.000 ~ 30.000	S	2.000	●
P10.17	Derivative time Td2	0.000 ~ 10.000	S	0.000	●
P10.18	PID parameter switching conditions	0: no switching 1: switching through DI terminal 2: switching by deviation		0	○
P10.19	PID parameter switching deviation 1	0.0 ~ PID parameter switching deviation 2	%	20.00	●
P10.20	PID parameter switching deviation 2	PID parameter switching deviation 1 ~ 100.00	%	80.00	●
P10.21	PID initial value	0.00 ~ 100.00	%	0.00	●
P10.22	PID initial value retention time	0.00 ~ 300.00	S	0.00	●
P10.23	PID integral separation deviation	0.00 ~ 100.00	%	100.00	●
P10.24	PID feedback loss upper limit	0.00 ~ 100.00	%	100.00	●
P10.25	PID feedback loss lower limit	0.00 ~ 100.00	%	0.00	●
P10.26	PID feedback loss detection time	0.00 ~ 30.00 0.00S: no detection	S	0.00	●
P10.27	PID dormancy control	0: invalid 1: valid		0	○
P10.28	PID awakening threshold	0.00 ~ dormancy threshold	%	0.00	●
P10.29	PID awakening delay time	0.0 ~ 30.0	S	0.0	●
P10.30	PID dormancy threshold	Awakening threshold ~ 100.00	%	100.00	●
P10.31	PID dormancy delay time	0.0 ~ 30.0	S	0.0	●

Group P11 simple PLC function

Function code	Function codes' names	Range set	Unit	Factory Default	Property
P11.00	Multi-segment frequency 1	0.00 ~ maximum frequency	Hz	0.00	●
P11.01	Multi-segment frequency 2	0.00 ~ maximum frequency	Hz	5.00	●
P11.02	Multi-segment frequency 3	0.00 ~ maximum frequency	Hz	10.00	●
P11.03	Multi-segment frequency 4	0.00 ~ maximum frequency	Hz	15.00	●
P11.04	Multi-segment frequency 5	0.00 ~ maximum frequency	Hz	20.00	●
P11.05	Multi-segment frequency 6	0.00 ~ maximum frequency	Hz	25.00	●
P11.06	Multi-segment frequency 7	0.00 ~ maximum frequency	Hz	30.00	●
P11.07	Multi-segment frequency 8	0.00 ~ maximum frequency	Hz	35.00	●
P11.08	Multi-segment frequency 9	0.00 ~ maximum frequency	Hz	40.00	●
P11.09	Multi-segment frequency 10	0.00 ~ maximum frequency	Hz	45.00	●
P11.10	Multi-segment frequency 11	0.00 ~ maximum frequency	Hz	50.00	●
P11.11	Multi-segment frequency 12	0.00 ~ maximum frequency	Hz	50.00	●
P11.12	Multi-segment frequency 13	0.00 ~ maximum frequency	Hz	50.00	●
P11.13	Multi-segment frequency 14	0.00 ~ maximum frequency	Hz	50.00	●
P11.14	Multi-segment frequency 15	0.00 ~ maximum frequency	Hz	50.00	●
P11.15	PLC operation way	0: stop after single operation 1: stop after limited cycles 2: keep final value after singe operation 3: cycle operation		0	○
P11.16	Limited cycle times	1 ~ 30000		1	○
P11.17	PLC saving options	Unit: save options after power down 0: not save 1: save Tens: save options at stop 0: not save 1: save		00	○
P11.18	1st segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.19	1st segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.20	2nd segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.21	2nd segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.22	3rd segment operation time	0.0 ~ 6000.0	S/H	5.0	●

Function code	Function codes' names	Range set	Unit	Factory Default	Property
P11.23	3rd segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.24	4th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.25	4th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.26	5th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.27	5th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.28	6th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.29	6th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.30	7th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.31	7th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.32	8th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.33	8th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.34	9th segment operation time	0.0 ~ 6000.0	S/H	5.0	●

Function code	Function codes' names	Range set	Unit	Factory Default	Property
P11.35	9th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.36	10th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.37	10th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.38	11th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.39	11th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.40	12th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.41	12th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.42	13th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.43	13th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.44	14th segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.45	14th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.46	15th segment operation time	0.0 ~ 6000.0	S/H	5.0	●

Function code	Function codes' names	Range set	Unit	Factory Default	Property
P11.47	15th segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration/deceleration time 0: acceleration/deceleration time 1 1: acceleration/deceleration time 2 2: acceleration/deceleration time 3 3: acceleration/deceleration time 4		00	●
P11.48	Simple PLC operation time unit	0: S (sec) 1: M (minute)		0	●

Group P12 fault and protection

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P12.00	Overload pre-alarm control	Unit: overload pre-alarm detection option 0: always detect 1: only detect in constant speed Tens: overload pre-alarm option 0: continue to operate without alarm 1: fault stop		00	○
P12.01	Overload pre-alarm detection level	0.00 ~ 200.00	%	200.00	○
P12.02	Overload pre-alarm detection time	0.00 ~ 60.00	S	5.00	○
P12.03	Motor overload protection gain	5.00 ~ 100.00	%	100.00	○
P12.04	Offload protection option	0: invalid 1: valid		0	○
P12.05	Offload detection level	0.00 ~ 100.00	%	30.00	●
P12.06	Offload detection time	0.00 ~ 60.00	S	1.00	●
P12.07	Motor temperature sensor type	0: no temperature sensor 1: PT100		0	○
P12.08	Motor overheat protection threshold	0 ~ 200	℃	110	○
P12.09	Motor overheat pre-alarm threshold	0 ~ 200	℃	90	○
P12.10	Overcurrent stall protection	0: invalid 1: valid		1	○
P12.11	Current limiting level	50.00 ~ 180.00	%	165.00	○
P12.12	Overspeed current-limiting coefficient	0.00 ~ 200.00	%	50.00	○
P12.13	Quick current-limiting function	0: invalid 1: valid		0	○
P12.14	Overvoltage stall protection	0: invalid 1: valid 2: invalid in acceleration/ constant speed, valid in deceleration		1	○

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P12.15	Overvoltage stall action point	120.00% ~ 135.00%	%	128.00	○
P12.16	Undervoltage detection level	0.00 ~ 100.00 (UDC_e)	%	65.18	○
P12.17	Undervoltage detection time	0.00 ~ 30.00	SEC	0.50	○
P12.18	Fault protection and control 1	Unit: overload fault Tens: software overcurrent Hundreds: software overvoltage Thousands: undervoltage fault Ten thousands: input phase-loss fault 0: fault is not screened and machine stops in fault 1: fault screening		00000	○
P12.19	Fault protection and control 2	Unit: output phase loss fault Tens: none Hundreds: none Thousands: none Ten thousands: none 0: fault is not screened and machine stops in fault 1: fault screening		00000	○
P12.20	Fault retrial control 1	Unit: overload Tens: software overcurrent Hundreds: software overvoltage Thousands: hardware overcurrent Ten thousands: hardware overvoltage 0: fault is not screened and machine stops in fault 1: fault screening		00000	○
P12.21	Fault retrial control 2	Unit: undervoltage Tens: input phase loss Hundreds: none Thousands: none Ten thousands: none 0: fault is not screened and machine stops in fault 1: fault screening		00000	○
P12.22	Automatic reset times of fault	0 ~ 100		0	○
P12.23	Automatic reset interval of fault	0.01 ~ 30.00	SEC	0.50	○
P12.24	Automatic reset times clearance interval	0.01 ~ 30.00	SEC	10.00	○
P12.25	Fault output option during automatic resetting	0: inaction 1: action		0	○
P12.26	Power-up preparation time	0.00 ~ 30.00	S	1.00	○

Group P13 control parameters

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P13.00	Fan control	0: run at power-on 1: run at start		1	○
P13.01	Carrier frequency control	0: fixed carrier 1: random carrier way 1 2: random carrier way 2		0	○
P13.02	Carrier upper-limit frequency	1.000 ~ 16.000	KHz	6.000	○
P13.03	Carrier lower-limit frequency	1.000 ~ 16.000	KHz	2.000	○
P13.04	AVR automatic voltage regulation	0: invalid 1: valid 2: invalid when exceeding rated voltage		0	○
P13.05	Dynamic braking option	0: valid at power-on 1: valid in operation 2: valid in deceleration		0	○
P13.06	Dynamic braking usage rate	5.00 ~ 100.00	%	80.00	○
P13.07	Dynamic braking voltage	120.00 ~ 140.00	%	128.00	○
P13.08	Braking voltage hysteresis	0.00 ~ 30.00 (single-phase valid downward)	%	6.00	○
P13.09	Output voltage	5.00 ~ 100.00	%	100.00	●
P13.10	Overmodulation function	0: invalid 1: valid		0	○
P13.11	Oscillation suppression gain	0 ~ 100		10	●
P13.12	Excitation compensation coefficient	0.00 ~ 300.00	%	100.00	●
P13.13	Slip compensation coefficient	0.00 ~ 200.00	%	0.00	●
P13.14	Slip compensation filtering time	0.00 ~ 10.00	SEC	0.50	●
P13.15	Voltage compensation coefficient	0.00 ~ 200.00	%	80.00	●
P13.16	Voltage compensation filtering time	0.00 ~ 10.00	SEC	0.50	●
P13.17	Magnetic flux braking strength	100.00 ~ 300.00 (100.00: invalid)	%	100.00	●
P13.18	PWM compensation coefficient	0.00 ~ 100.00	%	100.00	●
P13.19	Instantaneous-stop, non-stop function	0: invalid 1: valid		0	○
P13.20	Instantaneous-stop, non-stop deceleration time	0.00 ~ 10.00	SEC	1.50	○
P13.21	Restart after power cut	0: inaction 1: action		0	○
P13.22	Waiting time of restart	0.0 ~ 20.0	S	0.5	○
P13.23	Overcurrent deceleration time	0.01 ~ 300.00	S	2.00	●

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P13.24	Overcurrent stall proportional gain	0.00 ~ 10.00	%	0.40	●
P13.25	Overcurrent stall integral time	0.000 ~ 30.000	SEC	0.020	●
P13.26	Overvoltage stall proportional gain	0.00 ~ 10.00	%	0.40	●
P13.27	Overvoltage stall integral time	0.00 ~ 30.000 0.000: no integral	SEC	0.200	●

Group P14 keypad and display

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P14.00	LCD language option	0: Chinese 1: English		0	○
P14.01	User password	0 ~ 65535		XXXXX	○
P14.02	Parameter protection	0: parameter setting enabled 1: parameter lock 0 2: parameter lock 1		0	○
P14.03	Multifunctional key definition	0: jog operation 1: positive / negative input switching 2: no function		0	○
P14.04	Parameter copy	0: no operation 1: parameter upload (from inverter to keypad) 2: parameter download (from keypad to inverter)		0	○
P14.05	Operation display parameter	0.00 ~ XX.XX		P15.00~P15.25	●
P14.06	Stop display parameter	0.00 ~ XX.XX		P15.00~P15.25	●
P14.07	Standby display parameter	0.00 ~ XX.XX		P15.00~P15.25	●
P14.08	Accumulated operation time	XXXX		H	×
P14.09	Accumulated power-up time	XXXX		H	×
P14.10	Model display	0: model G 1: model P		X	×
P14.11	Rated power	0.10 ~ 650.00	Kw	XXXX	×
P14.12	Rated voltage	60 ~ 690	V	XXX	×
P14.13	Rated current	0.1 ~ 1500.0	A	XXXX	×
P14.14	Keypad software version	xx.xxx		xx.xxx	×
P14.15	Software version 1	xx.xxx		xx.xxx	×
P14.16	Software version 2	xx.xxx		xx.xxx	×
P14.17	Manufacturer password	0 ~ 65535		XXXXX	○

Group P15 monitoring parameters

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P15.00	Output frequency	0.00 ~ upper-limit frequency	Hz	-	×
P15.01	Estimated frequency	0.00 ~ upper-limit frequency	Hz	-	×
P15.02	Set frequency	0.00 ~ maximum frequency	Hz	-	×
P15.03	Load speed	0 ~ 60000	rpm	-	×
P15.04	Output current	0.0 ~ 3000.0	A	-	×
P15.05	Output current percentage	0.00 ~ 100.00	%	-	×
P15.06	Output voltage	0 ~ 690	V	-	×
P15.07	Busbar voltage	0 ~ 1200	V	-	×
P15.08	Output power	-800.0 ~ +800.0	kW	-	×
P15.09	Output torque	-300.0 ~ +300.0	%	-	×
P15.10	PID feedback	0 ~ full scale		-	×
P15.11	PID given	0 ~ full scale		-	×
P15.12	Program operation segments	1 ~ 15	SECT	-	×
P15.13	Program operation time	0.0 ~ 6000.0	S/min	-	×
P15.14	Motor temperature	0 ~ 200	℃	-	×
P15.15	DI terminal status	X8 X7 X6 X5 X4 X3 X2 X1 0 0 0 0 0 0 0 0		-	×
P15.16	DO terminal status	* * * * R2 R1 Y2 Y1 0 0 0 0 0 0 0 0		-	×
P15.17	Keypad potentiometer	0.00 ~ 100.00	%	-	×
P15.18	AI1	0.00 ~ 100.00	%	-	×
P15.19	AI2	0.00 ~ 100.00	%	-	×
P15.20	AI3	-100.00 ~ +100.00	%	-	×
P15.21	AO1	0.00 ~ 100.00	%	-	×
P15.22	AO2	0.00 ~ 100.00	%	-	×
P15.23	HDI input impulse frequency	0.00 ~ 100.00	kHz	-	×
P15.24	HDI input impulse frequency	0 ~ 65535	Hz	-	×
P15.25	HDO output impulse frequency	0.00 ~ 100.00	kHz	-	×

Group P16 fault parameters

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P16.00	Current fault type	ERR00: no fault ERR01: inverter unit fault ERR02: hardware overcurrent ERR03: hardware overvoltage ERR04: software overcurrent ERR05: software overvoltage ERR06: undervoltage fault ERR07: input phase loss ERR08: output phase loss ERR09: overload fault ERR10: offload fault ERR11: inverter overheat ERR12: motor overheat ERR13: external fault ERR14: communication fault ERR15: I2C fault ERR16: motor tuning fault ERR17: timing stop fault ERR18: PID feedback offline		XXXX	×

Function code	Function codes' names	Range set	Unit	Factory defaults	Property
P16.01	During current fault output frequency	XX.XX	Hz	XXXX	×
P16.02	During current fault current	XXX.X	A	XXXX	×
P16.03	Current busbar voltageduring fault	XXXX	V	XXXX	×
P16.04	operation status during current fault	0: standby 1: forward rotation acceleration 2: forward rotation constant speed 3: forward rotation deceleration 4: reverse rotation acceleration 5: reverse rotation constant speed 6: reverse rotation deceleration		X	×
P16.05	During current fault operation time	XXXX	H	XXXX	×
P16.06	DI terminal status in current fault	XXXXXXX		XXXX	×
P16.07	DO terminal status in current fault	XXXXXXX		XXXX	×
P16.08	Last fault type	ERR00 ~ ERR20		XXXX	×
P16.09	Output frequency in last fault	XX.XX	Hz	XXXX	×
P16.10	Current in last fault	XXX.X	A	XXXX	×
P16.11	Busbar voltage in last fault	XXXX	V	XXXX	×
P16.12	Operation status in last fault	X		X	×
P16.13	Operation time in last fault	XXXX	H	XXXX	×
P16.14	DI terminal status in last fault	XXXXXXX		XXXX	×
P16.15	DO terminal status in last fault	XXXXXXX		XXXX	×
P16.16	Fault type of last 2 times	ERR00 ~ ERR20		XXXX	×
P16.17	Output frequency in the fault of last 2 times	XX.XX	Hz	XXXX	×
P16.18	Current in the fault of last 2 times	XXX.X	A	XXXX	×
P16.19	Busbar voltage in the fault of last 2 times	XXXX	V	XXXX	×
P16.20	Operation status in the fault of last 2 times	X		X	×
P16.21	Operation time in the fault of last 2 times	XXXX	H	XXXX	×
P16.22	DI terminal status in the fault of last 2 times	XXXXXXX		XXXX	×
P16.23	DO terminal status in the fault of last 2 times	XXXXXXX		XXXX	×

Chapter 6 Parameter Description

Group P00 basic parameters

Function Code	Name	Description	Unit	Factory Default	Property
P00.00	Control way	0: V/F open-loop control 1: vector control		1	○

0: V/F open-loop control

Applicable to variable frequency control occasion which does not have much demand for load, for example, the load of fan and pump.

1: vector control

Applicable to general high-performance control occasion.

Function Code	Name	Description	Unit	Factory Default	Property
P00.01	Command source option	0: local keypad 1: external terminal 2: PC communication		0	○

0: local keypad

Control the start and stop of inverter from the RUN and STOP key on keypad.

1: external terminal

Perform command control by multifunctional input terminals, RUN, F/R, FJOG, RJOG and so on.

2: pc communication

Run command is provided by host computer by communication. Please refer to “ES300 MODBUS Communication Protocol”.

In computer communication, computer serial port and communication port 485 of inverter needs to be connected by RS232-RS485 adaptor.

Function Code	Name	Description	Unit	Factory Default	Property
P00.02	Main frequency source option	0: main digital frequency given 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI		1	○

0: main digital frequency is set by function code P00.10.

1: main frequency is given by keypad potentiometer.

2: main frequency is given by terminal AI1.

3: main frequency is given by terminal AI2.

4: main frequency is given by terminal AI3.

5: main frequency is given by impulse frequency inputted by high-speed impulse terminal HDI (X8).

Function Code	Name	Description	Unit	Factory Default	Property
P00.03	Auxiliary frequency source option	0: auxiliary digital frequency 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI 6: PLC 7: PID		0	○

0: auxiliary digital frequency is set by function codeP00.11.
1: auxiliary frequency is given by keypad potentiometer.
2: auxiliary frequency is given by terminal AI1.
3: auxiliary frequency is given by terminal AI2.
4: auxiliary frequency is given by terminal AI3.
5: auxiliary frequency is given by impulse frequency inputted by high-speed impulse terminal HDI (X8).
6: auxiliary frequency of PLC program operation is given by PLC program operation function and frequency of each segmental speed of PLC function is set in group P11.
7: PID auxiliary frequency is given by PID function during PID process and related parameters of PID function are set in group P10.

Function Code	Name	Description	Unit	Factory Default	Property
P00.04	Output frequency source option	0: main frequency source 1: auxiliary frequency source 2: main + auxiliary 3: main - auxiliary 4: MAX (main, auxiliary) 5: MIN (main, auxiliary)		0	○

0: main frequency source
Main frequency source is valid as output frequency.
1: auxiliary frequency source
Auxiliary frequency source is valid as output frequency.
2: main + auxiliary
Combination of main and auxiliary frequency source is valid as output frequency source and combined frequency is no higher than upper-limit frequency.
3: main – auxiliary
Difference of main frequency source and auxiliary frequency source is valid as output frequency. The combined frequency is no higher than upper-limit frequency.
4: MAX (main, auxiliary)
Output frequency is the maximum value of main and auxiliary frequency.
5: MIN (main, auxiliary)
Output frequency is the minimum value of main and auxiliary frequency.

Function Code	Name	Description	Unit	Factory Default	Property
P00.05	Auxiliary frequency source range in stacking	0: relative to maximum frequency 1: relative to main frequency		0	○

P00.05=0: relative to maximum frequency
When output frequency source is main + auxiliary or main – auxiliary, the control range of auxiliary frequency is relative to maximum frequency.
P00.05=1: relative to main frequency
When output frequency source is main + auxiliary or main – auxiliary, the control range of auxiliary frequency is relative to main frequency.

Function Code	Name	Description	Unit	Factory Default	Property
P00.06	Main frequency source proportion	0.00 ~ 300.00	%	100.00	●
P00.07	Auxiliary frequency source proportion	0.00 ~ 300.00	%	100.00	●

P00.06: main frequency output = main frequency source * main frequency source proportion, factory default value 100%
P00.07: auxiliary frequency output = auxiliary frequency source * auxiliary frequency source proportion,factory default value 100.00%

Function Code	Name	Description	Unit	Factory Default	Property
P00.08	Output frequency source control	0: digital proportion 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI		0	○

0: digital proportion
Output frequency source proportion can be set in P00.09 in the range 0.00 ~ 300.00 .
1: Keypad potentiometer
Output frequency source proportion is dependent to keypad potentiometer.
2: AI1
Output frequency source proportion is dependent to AI1 input.
3: AI2
Output frequency source proportion is dependent to AI2 input.
4: AI3
Output frequency source proportion is dependent to AI3 input.
5: HDI
Output frequency source proportion is dependent to the impulse frequency inputted by impulse terminal HDI (X8).

Function Code	Name	Description	Unit	Default Value	Property
P00.09	Output frequency source proportion	0.00 ~ 300.00	%	100.00	●

P00.09: output frequency = output frequency source * output frequency source proportion

Function Code	Name	Description	Unit	Default Value	Property
P00.10	Main digital frequency	0.00 ~ maximum frequency	Hz	0.00	●
P00.11	Auxiliary digital frequency	0.00 ~ maximum frequency	Hz	0.00	●

P00.10: given value of main digital frequency.
P00.11: given value of auxiliary digital frequency.

Function Code	Name	Description	Unit	Default Value	Property
P00.12	Rotation direction setting	0: forward rotation 1: reverse rotation		0	●

0: forward rotation
1: reverse rotation
Motor rotation direction setting.

Function Code	Name	Description	Unit	Default Value	Property
P00.13	Acceleration time 1	0.00 ~ 600.00	S	10.00	●
P00.14	Deceleration time 1	0.00 ~ 600.00	S	10.00	●

Acceleration time is the time inverter takes to rise to maximum frequency from 0Hz.
Deceleration time is the time inverter takes to decline to 0Hz from maximum frequency.

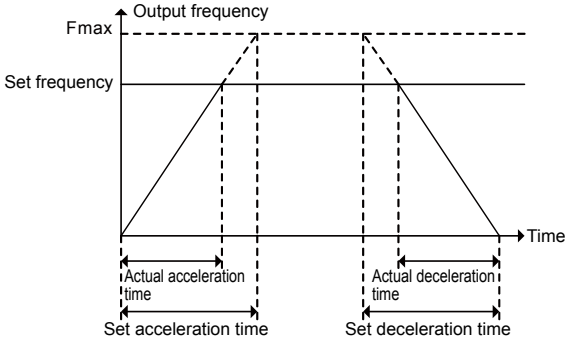

Fig 6-1 acceleration/deceleration time

Function Code	Name	Description	Unit	Default Value	Property
P00.15	Carrier frequency	1.000 ~ 16.000	KHz	4.000	●

By this function, we can adjust the PWM carrier frequency of inverter. High carrier frequency can properly reduce motor noise. But, when carrier frequency reaches to a high level, temperature rising of motor decreases and wear of inverter increases; when carrier frequency is at a low level, high-order harmonic component of output current enlarge and motor temperature rising increases. Therefore, please properly set carrier frequency according to practical situations.

Function Code	Name	Description	Unit	Default Value	Property
P00.16	Maximum frequency	20.00 ~ 300.00	Hz	50.00	○
P00.17	Upper-limit frequency	Lower-limit frequency ~ upper-limit frequency	Hz	50.00	○
P00.18	Lower-limit frequency	0.00 ~ upper-limit frequency	Hz	0.00	○
P00.19	Lower-limit frequency control	0: run at lower-limit frequency 1: when lower-limit frequency operation times up, run at zero speed.		0	○
P00.20	Lower-limit frequency operation time	0.00 ~ 600.00	S	60.00	○

Maximum frequency:
The maximum frequency supported by inverter.
Upper-limit frequency:
The maximum frequency of motor allowed during usage according to production technology.
Lower-limit frequency:
Minimum frequency of motor allowed during usage according to production technology;
If P00.19 set as 1 is valid and working frequency of inverter is lower than upper-limit frequency, the inverter will work at lower-limit frequency; when accumulated running time exceeds P00.20, inverter runs at 0 Hz; when operation frequency of inverter exceeds lower-limit frequency again and remains for the time set in P00.20, the inverter will operate by set frequency again.

Function Code	Name	Description	Unit	Default Value	Property
P00.21	Anti-reverse rotation control	0: forward/reverse rotation allowed 1: reverse rotation forbidden		0	○
P00.22	Forward/reverse rotation dead time	0.00 ~ 600.00	S	0.00	○

Reverse rotation of some devices may result in the damage of equipment. P00.21 can be used to prohibit reverse rotation of motor.
0: forward / reverse rotation enabled
Enable inverter to output positive / negative frequency.
1: reverse rotation disabled
When inverter outputs negative frequency, operates by 0Hz.
P00.22 forward / reverse rotation dead-time
The time inverter stays in 0Hz when operation frequency of inverter changes from positive to negative, or from negative to positive.

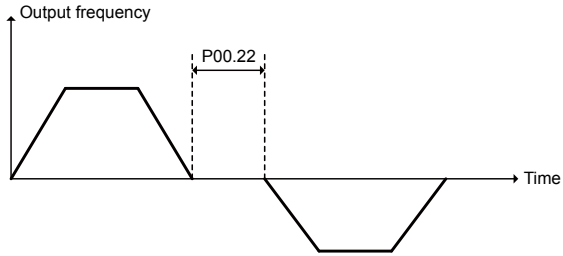

Fig 6-2 diagram of forward/reverse rotation dead-time

Function Code	Name	Description	Unit	Default Value	Property
P00.23	Load speed coefficient	0.00 ~ 300.00		30.00	●

Load speed coefficient is in proportional relation with output frequency and used to indicate load running speed.
Load running speed = output frequency * load speed coefficient

Function Code	Name	Description	Unit	Default Value	Property
P00.24	Parameter recovery	0: invalid 1: reset to default value		0	○

Reset to factory default value of inverter and motor parameter remains the same.

Group P01 start / stop control

Function Code	Name	Description	Unit	Default Value	Property
P01.00	Start way	0: direct start 1: rotation speed tracking start		0	○

0: direct start
If P01.02: the time to start DC braking is set as 0, inverter is started by built-in 0Hz. It is applicable to the situation that motor is in stop status when start-up. If the time to start DC braking is not 0, DC braking first and then start with starting frequency; it is applicable to the situation that motor is under a small inertia load when start-up. Direct start way is shown in Fig 6-3. Left diagram is the case that the time to start DC braking is not 0; the right diagram is the case that the time to start DC braking is 0.

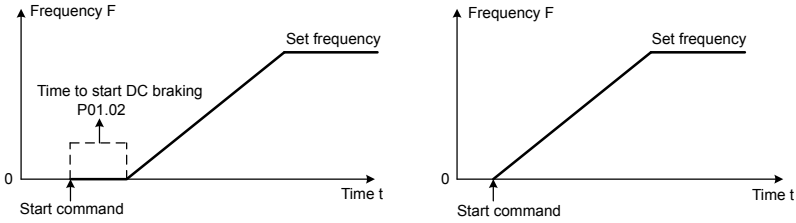

Fig 6-3 direct start diagram

1: rotation speed tracking start
When inverter is set as direct start and drives great inertia mechanical load, if instant power-cut occurs and inverter restarts, the load motor still continues running due to inertia and creates great energy feedback. In this case, inverter is likely to skip over overcurrent fault. Therefore, for this great inertia load drive, it is possible to set the inverter as rotation speed tracking start. It means when inverter starts up, it will automatically track the rotation speed and direction of motor, and then start up with motor frequency tracked. This way can embody smooth and shock-free start and avoid overcurrent at start. Diagram of this type of start is shown in Fig 6-4. Left diagram is the rotation speed tracking start diagram after load motor stops; right diagram is the rotation speed tracking start diagram in stop status.

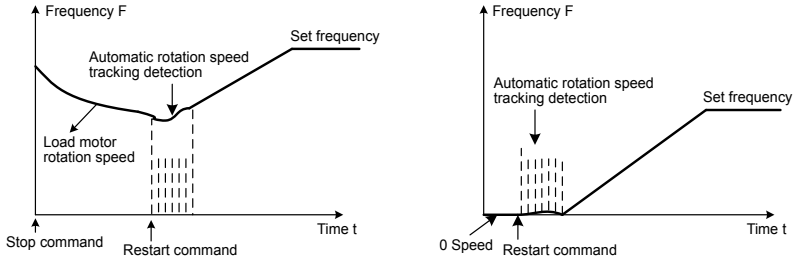

Fig 6-4 rotation speed tracking start diagram

Function Code	Name	Description	Unit	Default Value	Property
P01.01	Current of start DC braking	0.00 ~ 150.00	%	0.00	○
P01.02	Time to start DC braking	0.00 ~ 30.00	S	0.00	○

P01.01 current of start DC braking:
Set the size of current of start DC braking, which is relative to certain percentage of rated current of inverter.
P01.02 time to start DC braking:
Set the functioning period of DC braking current at the start of inverter.

6

Function Code	Name	Description	Unit	Default Value	Property
P01.03	Stop way option	0: stop in deceleration 1: free stop		0	○

0: stop in deceleration
Inverter stops in deceleration according to set deceleration time.
1: free stop
After receiving stop command, inverter blocks output immediately and load motor stop freely under the function of inertia.

Function Code	Name	Description	Unit	Default Value	Property
P01.04	DC braking starting frequency in stop	0.00 ~ maximum frequency	Hz	0.00	○
P01.05	DC braking current in stop	0.00 ~ 150.00	%	0.00	○
P01.06	DC braking waiting time in stop	0.00 ~ 30.00	S	0.00	○
P01.07	DC braking time in stop	0.00 ~ 30.00	S	0.00	○

P01.04: DC braking starting frequency in stop
During stop, start inputting starting frequency of braking current.
P01.05: DC braking current in stop
Set braking current which is relative to certain percentage of rated current of inverter.
P01.06: DC braking waiting time in stop
The tube sealing time before inputting DC braking current.

P01.07: DC braking time in stop
Set the functioning time of DC braking current.

Function Code	Name	Description	Unit	Default Value	Property
P01.08	Terminal start protection options	0: invalid 1: valid		0	○
P01.09	Terminal JOG priority options	0: invalid 1: valid		0	○

Inverter command source option is set as external terminal start. When powered up or fault reset, initial connection status of periphery devices may affect the safety of devices. By setting this parameter, protective measure is provided according to terminal startup.
P01.08=0: invalid
When powered up, terminal start control can directly turn on the machine.
P01.08=1: valid
When powered up, terminal start control needs to relieve valid signal of terminal start before starting up terminal.
Case 1: if terminal start command becomes valid when inverter is powered up (for example, it is closed state before powered up), inverter will not respond to operation command. It is a must to cancel operation command once and after terminal start command becomes valid again, inverter will respond to the operation command.
Case 2: when inverter is reset because of fault and terminal start command becomes valid, inverter will not respond to start operation command. It is a must to cancel operation command first to clear operation protection status.

When terminal is set as JOG, check whether the setting of terminal JOG command is given top priority.
P01.09=0: invalid
Terminal JOG priority option is invalid.
P01.09=1: valid
Terminal JOG priority option is valid.

Group P02 motor parameters

Function Code	Name	Description	Unit	Default Value	Property
P02.00	Motor type	0: common asynchronous motor 1: permanent magnet asynchronous motor 2: permanent magnet synchronous motor		0	○
P02.01	Rated power	0.10 ~ 600.00	KW	XX.XX	○
P02.02	Rated voltage	0 ~ 660	V	XXX	○
P02.03	Rated current	0.1 ~ 1500.0	A	XX.X	○
P02.04	Rated frequency	20.00 ~ 600.00	Hz	XX.XX	○
P02.05	Rated rotation speed	1 ~ 60000	rpm	XXXX	○

Group P02.00 ~ 02.05 is used to set the parameters of driven motor. Set according to motor nameplate before use.

Function Code	Name	Description	Unit	Default Value	Property
P02.06	Stator resistance of asynchronous motor	0.01 ~ 300.00	Ω	XX.X	○
P02.07	Rotor resistance of asynchronous motor	0.01 ~ 300.00	Ω	XX.X	○
P02.08	Leak inductance of asynchronous motor	0.1 ~ 3000.0		X.XXX	○
P02.09	Interaction inductive reactance of asynchronous motor	0.1 ~ 3000.0	mH	XXX.X	○
P02.10	No-load current of asynchronous motor	0.1 ~ 1500.0	A	XX.X	○
P02.05	Rated rotation speed of motor	1 ~ 60000	rpm	XXXX	○

P02.06 ~ P02.10 is the calculation result after motor coordination.

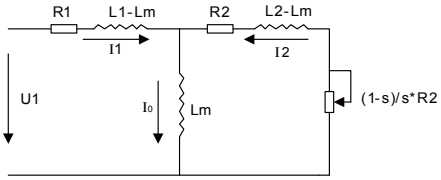

Fig 6-5 equivalent model of asynchronous motor in steady state

Function Code	Name	Description	Unit	Default Value	Property
P02.11	Motor coordination	0: no identification 1: self-identification in static state 2: self-identification in rotation state		0	○

After motor tuning, P02.11 will automatically become 0.

Group P03 V/F control parameter group

Function Code	Name	Description	Unit	Default Value	Property
P03.00	V/F curve setting	0: linear V/F curve 1: multipoint V/F curve 2: fan curve 1 3: fan curve 2 4: fan curve 3 5: fan curve 4 6: V/F separation		0	○

0: linear V/F curve
Applicable to constant torque load
1: multipoint V/F curve
Customized curve
2~ 5: fan curve
Applicable to variable load of fan and pump

6: V/F separation

Output frequency and voltage of inverter is separately independent. Output frequency is determined by frequency source and output voltage source is set by P03.12. V/F separation mode is usually applied to induction heating, inverter power supply, torque motor control and so on.

Function Code	Name	Description	Unit	Default Value	Property
P03.01	Torque boost	0.00 ~ 30.00	%	1.00	●
P03.02	Torque boost cut-off frequency	0.01 ~ P03.03	Hz	50.00	○
P03.03	Reference frequency	20.00 ~ 300.00	Hz	50.00	○

P03.01: torque boost

Torque boost is mainly to improve low-frequency torque properties under V/F control.

When output torque of inverter cannot meet the demand of current load, set this parameter is to increase additional DC component in order to improve motor torque,raise output voltage of inverter, and increase load capacity. When this parameter setting is too low, motor will run at low speed. When the setting is too high, over-current fault is likely to happen.

P03.02: Torque boost cut-off frequency

Below torque boost cut-off frequency, torque boost is valid; if exceed the set frequency, torque boost is invalid, as shown in Fig 6-6:

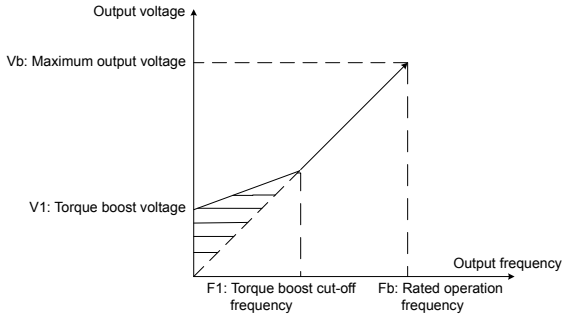

Fig 6-6 torque boost diagram

P03.03: benchmark frequency

With the setting basic on rated motor frequency, motor can run in basic working status.

Function Code	Name	Description	Unit	Default Value	Property
P03.04	V/F frequency value F0	0.00 ~ frequency value F1	%	1.00	●
P03.05	V/F frequency value F1	Frequency value F0 ~ frequency value F2	%	4.00	●
P03.06	V/F frequency value F2	Frequency value F1 ~ frequency value F3	%	10.00	●
P03.07	V/F frequency value F3	Frequency value F2 ~ 100.00	%	16.00	●
P03.08	V/F voltage value V0	0.00 ~ 100.00	%	1.00	●
P03.09	V/F voltage value V1	0.00 ~ 100.00	%	4.00	●
P03.10	V/F voltage value V2	0.00 ~ 100.00	%	10.00	●
P03.11	V/F voltage value V3	0.00 ~ 100.00	%	16.00	●

When F03.00=1, V/F curve can be adjusted by multi-points.

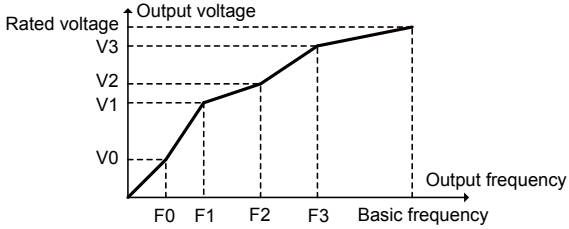

Fig 6-7 multi-points V/F curve diagram

Function Code	Name	Description	Unit	Factory Default	Property
P03.12	V/F separation voltage control	0: digital setting 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI 6: PID		2	○
P03.13	VF separation digital voltage setting	0 ~ 100.00	%	0.00	●

P03.12=0: digital setting
V/F separation voltage control is provided by P03.13 and setting range 0 ~ 100.00
P03.12=1: keypad potentiometer
V/F separation voltage control is given by keypad potentiometer.
P03.12=2: AI1
V/F separation voltage control is given by AI1.
P03.12=3: AI2
V/F separation voltage control is given by AI2.
P03.12=4: AI3
V/F separation voltage control is given by AI3.
P03.12=5: HDI
V/F separation voltage control is given by high-speed impulse inputted by high-speed digital impulse input terminal HDI (X8).
P03.12=6: PID
V/F separation voltage control is provided by PID.
P03.13: VF separation digital voltage setting
When P03.12=0, V/F separation digital voltage is set by P03.13

Function Code	Name	Description	Unit	Factory Default	Property
P03.14	VF separation voltage acceleration time	0.00 ~ 60.00	S	2.00	●
P03.15	VF separation voltage deceleration time	0.00 ~ 60.00	S	2.00	●

P03.14: VF separation voltage acceleration time
The time of VF separation voltage accelerating from 0 to 100%.

P03.15: VF separation voltage deceleration time
The time of VF separation voltage decelerating from 100%0 to 0.

Function Code	Name	Description	Unit	Factory Default	Property
P03.16	VF separation stop way options	0: frequency/voltage decreases to 0 alone 1: after voltage decreases to 0, frequency starts to decrease.		0	○

0: when VF separation stops, frequency and voltage decreases to 0 alone.
1: when VF separation stops, voltage decreases to 0 and then frequency starts to decrease.

Group P04 vector control

Function Code	Name	Description	Unit	Factory Default	Property
P04.00	Speed ring proportional gain 1	0.00 ~ 100.00	%	30.00	●
P04.01	Speed ring integral time 1	0.000~30.000 0.000: no integral	SEC	0.500	●
P04.02	Switching frequency 1	0.00 ~ switching frequency 2	Hz	5.00	○
P04.03	Speed ring proportional gain2	0.00 ~ 100.00	%	15.00	●
P04.04	Speed ring integral time 2	0.000 ~ 30.000 0.000: no integral	SEC	1.000	●
P04.05	Switching frequency 2	Switching frequency 1 ~ Fmax	Hz	10.00	○

When ES300 inverter runs in different frequencies, user can choose different speed ring PI parameters. When output frequency is lower than P04.02 switching frequency 1, speed ring PI adjusting parameter should be chosen from group 1 parameters (P04.00 ~ P04.01); when output frequency is higher than P04.05 switching frequency 2, speed ring PI adjusting parameter should be chosen from group 2 parameters (P04.03 ~ P04.04); when output frequency is higher than switching frequency 1 and lower than switching frequency 2, speed ring PI parameter should be the proportional transition of two groups of PI parameters, as shown in Fig 6-8:

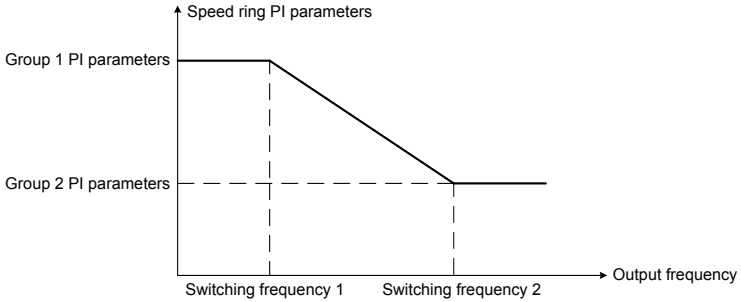

Fig 6-8 speed ring PI parameter switching diagram

P04.00: speed ring proportional gain 1 P04.03: speed ring proportional gain 2
Increasing speed ring proportional gain can speed up dynamic response of system, but excessive proportional gain is likely to cause vibration to system.
P04.01: speed ring integral time 1 P04.04: speed ring integral time 2
Decreasing integral time may speed up dynamic response of system, but when integral time is too short, overshooting is great and likely to cause vibration.
Generally, when system runs under low frequency, we can comparatively increase proportional gain and decrease integral time to make sure the system is vibration-free and has good dynamic response properties.
P04.02: switching frequency 1
When system needs to run under low frequency, choose proper switching frequency 1 first; when output frequency is lower than switching frequency 1, group 1 speed-ring parameter is valid.
P04.05: switching frequency 2
When system needs to run under high frequency, choose proper switching frequency 2 first; when output frequency is higher than switching frequency 2, group 2 speed-ring parameter is valid.

Function Code	Name	Description	Unit	Factory Default	Property
P04.06	Driving torque limit	80.00 ~ 180.00	%	165.00	○
P04.07	Braking torque limit	80.00 ~ 180.00	%	165.00	○

P04.06: drive torque limit
Set the drive torque limit value of motor. When load torque increases suddenly, it is possible to restrict the drive torque limit into set value.
P04.07: braking torque limit
Set the limit value of braking torque. When this value is smaller, braking force is greater, which is applicable to the occasions where sharp acceleration and deceleration is required.

6

Function Code	Name	Description	Unit	Default Value	Property
P04.08	Torque acceleration time	0.000 ~ 30.000	SEC	0.040	●
P04.09	Torque deceleration time	0.000 ~ 30.000	SEC	0.040	●

The difference value of motor output torque and load torque determines the speed change rate of motor and load. Therefore, motor rotation speed may changes rapidly resulting in excessive noise or mechanical stress. Controlling acceleration/deceleration time by setting torque can make motor rotation speed change smoothly. But, in some occasions where quick response is required, it is necessary to set torque accelatation and deceleration time as 0.00s.

Function Code	Name	Description	Unit	Factory Default	Property
P04.10	Current ring proportional coefficient	0.00 ~ 10.00	%	0.60	●
P04.11	Current ring integral coefficient	0.000 ~ 30.000	SEC	0.020	●

P04.10: current ring proportional coefficient
It may speed up dynamic response of system, but the system is likely to have vibration when proportional gain is too much.
P04.11: current ring integral coefficient

Shortening integral time may speed up dynamic response of system, but when integral time is too short, overshooting is great and the system is likely to have vibration.

Function Code	Name	Description	Unit	Factory Default	Property
P04.12	Closed-loop slip compensation gain (electric)	0.00 ~ 200.00	%	100.00	●
P04.13	Closed-loop slip compensation gain (braking)	0.00 ~ 200.00	%	100.00	●

P04.12: Closed-loop slip compensation gain (electric)
This parameter is used to adjust electric slip frequency compensation in vector control. In the occasions where quick response, high-speed and high-precision are required, properly adjusting this parameter may improve dynamic response rate of system and can make motor reach to set frequency in a short time, and decrease the error of steady state speed.
P04.13: Closed-loop slip compensation gain (braking)
This parameter is used to adjust braking slip frequency compensation in vector control.
In the occasions where quick response, high-speed and high-precision are required, properly adjusting this parameter may decelerate the motor to zero in a short time and improve response rate of system.

Group P05 input terminal control

Function Code	Name	Description	Unit	Factory Default	Property
P05.00	DI terminal filter	0 ~ 1000		10	○

Set the sensitivity of DI terminal. Bigger value tells greater anti-jamming capability and lower sensitivity.

Function Code	Name	Description	Unit	Factory Default	Property
P05.01	DI input logic option 1	0: valid when closed 1: valid when disconnected Unit: X1 Tens: X2 Hundreds: X3 Thousands: X4 Ten thousands: X5		00000	○
P05.02	DI input logic option 2	0: valid when closed 1: valid when disconnected Unit: X6 Tens: X7 Hundreds: X8 Thousands: reserved Ten thousands: reserved		00000	○

0: valid when closed
Input terminal is valid when closed and invalid when disconnected.
1: valid when disconnected
Input terminal is valid when disconnected and invalid when closed.

Function Code	Name	Description	Unit	Factory Default	Property
P05.03	X1 terminal valid delay time	0.00 ~ 300.00	S	0.00	○
P05.04	X1 terminal invalid delay time	0.00 ~ 300.00	S	0.00	○
P05.05	X2 terminal valid delay time	0.00 ~ 300.00	S	0.00	○
P05.06	X2 terminal invalid delay time	0.00 ~ 300.00	S	0.00	○
P05.07	X3 terminal valid delay time	0.00 ~ 300.00	S	0.00	○
P05.08	X3 terminal invalid delay time	0.00 ~ 300.00	S	0.00	○
P05.09	X4 terminal valid delay time	0.00 ~ 300.00	S	0.00	○
P05.10	X4 terminal invalid delay time	0.00 ~ 300.00	S	0.00	○

Input response valid/invalid delay time of terminal X1, X2, X3 and X4.

Function Code	Name	Description	Unit	Factory Default	Property
P05.11	Multifunctional input X1-RUN	0: no function 1: run RUN 2: forward/reverse rotation F/R 3: 3-thread operation stop control 4: forward rotation jog FJOG 5: reverse rotation jog RJOG 6: terminal UP 7: terminal DOWN 8: UP / DOWN reset 9: free stop FRS 10: fault reset RST 11: external fault EXT 12: operation pause 13: acceleration/deceleration forbidden 14: multi-segment frequency terminal 1 15: multi-segment frequency terminal 2 16: multi-segment frequency terminal 3 17: multi-segment frequency terminal 4 18: acceleration / deceleration time option 1 19: acceleration / deceleration time option 2 20: PID positive / negative function 21: PID parameter switching 22: PID pause 23: PLC reset 24: command is switched to terminal 25: command is switched to communication 26: frequency is switched to auxiliary speed 27: main speed is switched to digital given 28: auxiliary speed is switched to digital given 29: reserved 30: HDI impulse input (valid for X8 only)		1	○
P05.12	Multifunctional input X2-F/R			2	○
P05.13	Multifunctional input X3-F1			14	○
P05.14	Multifunctional input X4-F2			15	○
P05.15	Multifunctional input X5-F3			16	○
P05.16	Multifunctional input X6-FRS			9	○
P05.17	Multifunctional input X7-RST			10	○
P05.18	Multifunctional input X8-HDI			30	○

Table 6-1multifunctional input terminal function codes table

ET Value	Function	Description
0	No function	No response to external terminal signal.
1	Run RUN	Control operation and stop by external terminals.
2	Forward/reverse rotation F/R	Control forward/reverse rotation by external terminals.
3	3-thread operation stop control	Operation way is valid in 3-thread control.
4	Forward rotation jog FJOG	External terminal forward / reverse jog function.
5	Reverse rotation jog RJOG	
6	Terminal UP	Adjust setting frequency by external terminals.
7	Terminal DOWN	
8	UP/DOWN reset	Clear the frequency value modified by UP/DOWN.

ET Value	Function	Description
9	Free stop FRS	Inverter locks the output.
10	Fault reset RST	For fault reset when inverter comes into fault.
11	External fault EXT	When external fault signal becomes valid, inverter has fault.
12	Operation pause	When operation pause signal is valid, inverter output is 0.00Hz, When signal is invalid,continue to run by the state before pause.
13	Acceleration/deceleration forbidden	Inverter maintains current output frequency.
14	Multi-segment frequency terminal 1	Embody 15-segments speeds setting through combination of 4 terminals.
15	Multi-segment frequency terminal 2	
16	Multi-segment frequency terminal 3	
17	Multi-segment frequency terminal 4	
18	Acceleration/deceleration time option 1	Acceleration/deceleration time option command input terminal and code combination embodies 4-segments acceleration/deceleration option. Before setting the parameter and terminal becomes valid, acceleration/deceleration time 1 is valid by default.
19	Acceleration/deceleration time option 2	
20	PID positive/negative action	When terminal signal is valid, PID is negative action; when terminal signal is invalid, PID is positive action.
21	PID parameter switching	Switch between two groups of PID parameters.
22	PID pause	PID control becomes invalid temporarily and inverter maintains current output frequency, and no longer performs PID adjustment to frequency source.
23	PLC reset	During execution of PLC function, inverter can return to initial state of simple PLC by setting the terminal of this function.
24	Command is switched to terminal	When terminal function is valid, operation command is switched to terminal control.
25	Command is switched to communication	When terminal function is valid, operation command is switched to communication.
26	Frequency is switched to auxiliary speed	When terminal function is valid, frequency output is switched to auxiliary speed valid.
27	Main speed is switched to digital given	When terminal function is valid, main speed is switched to digital given.
28	Auxiliary speed is switched to digital given	When terminl function is valid, auxiliary speed is switched to digital given.
29	Reservation	
30	HDI impulse input	Set input terminals of high-speed impulse.

Multi segment speed terminal definition table

Function Code	Name	X6	X5	X4	X3
P11.00	Multiple sections of speed1	0	0	0	1
P11.01	Multiple sections of speed2	0	0	1	0
P11.02	Multiple sections of speed3	0	0	1	1
P11.03	Multiple sections of speed4	0	1	0	0
P11.04	Multiple sections of speed5	0	1	0	1
P11.05	Multiple sections of speed6	0	1	1	0
P11.06	Multiple sections of speed7	0	1	1	1
P11.07	Multiple sections of speed8	1	0	0	0
P11.08	Multiple sections of speed9	1	0	0	1
P11.09	Multiple sections of speed10	1	0	1	0
P11.10	Multiple sections of speed11	1	0	1	1
P11.11	Multiple sections of speed12	1	1	0	0
P11.12	Multiple sections of speed13	1	1	0	1
P11.13	Multiple sections of speed14	1	1	1	0
P11.14	Multiple sections of speed15	1	1	1	1

Function Code	Name	Description	Unit	Factory Default	Property
P05.19	Terminal command way	0: 2-thread control 1 1: 2-thread control 2 2: 3-thread control 1 3: 3-thread control 2		0	●

When terminal start/stop control mode is valid, control the start/stop way of inverter through terminal.

2-thread control 1 :

K1	K2	Command
0	0	Stop
1	0	Operate in forward rotation
0	1	Stop
1	1	Operate in reverse rotation

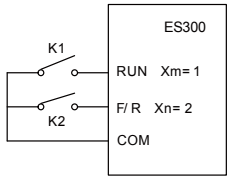

Fig 6-9: 2-thread control 1

2-thread control 2 :

K1	K2	Command
0	0	Stop
1	0	Operate in forward rotation
0	1	Operate in reverse rotation
1	1	Reservation

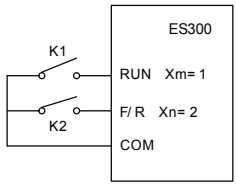

Fig 6-10: 2-thread control 2

3-thread control 1 :

SB1	Forward rotation operation control
SB2	Stop control
SB3	Reverse rotation operation control

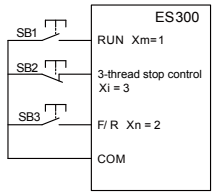

Fig 6-11: 3-thread control 11

3-thread control 2 :

SB1	Operation control
K1	stop control
K2	Operation direction control

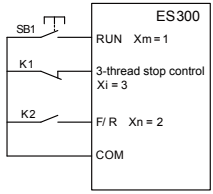

Fig 6-12 3-thread control 2

Function Code	Name	Description	Unit	Factory Default	Property
P05.20	Terminal UP / DOWN digital adjusting frequency control	Unit: action when power down 0: save upon power down 1: not save when power down Tens: action when stop 0: reserved when stop 1: reset when stop Hundreds: UP/DOWN adjusting control 0: only valid for digital frequency given 1: adjustment always valid 2: adjustment always invalid Thousands: integral control 0: with integral function 1: without integral function		0000	○

P05.20: Terminal UP/DOWN digital frequency adjustment control

Unit: action when power down. 0 indicates saving the frequency value adjusted by terminal UP/DOWN when power down; 1 indicates not saving.

Tens: action when stop. 0 indicates keeping the frequency value adjusted by terminal UP/DOWN whrn stop; 1 indicates resetting the value when stop.

Hundreds: UP/DOWN adjustment control. 0 indicates terminal UP/DOWN digital adjustment is valid only when adjusting digital frequency; 1 indicates UP/DOWN digital adjustment is always valid and can be used in setting state of any parameter which can be increased or decreased; 2 indicates adjustment is always invalid, namely terminal UP/DOWN digital adjustment is invalid.

Thousands: integral control; 0 indicates that addition of integral function to UP/DOWN digital adjustment frequency can make adjustment more precise. 1 indicates no integral function is added.

Function Code	Name	Description	Unit	Factory Default	Property
P05.21	Terminal UP / DOWN change rate	0.01Hz/S ~ 100.00Hz/S	Hz/S	1.00	○

When external terminals are used to set frequency by UP/DOWN, it is the increment or decrement of set frequency per second.

Function Code	Name	Description	Unit	Factory Default	Property
P05.22	HDI minimum input	0.00 ~ P05.24	kHz	0.00	●
P05.23	Related setting of HDI minimum input	-100.0 ~ +100.0	%	0.0	●
P05.24	HDI maximum input	P05.22 ~ 100.00	kHz	50.00	●
P05.25	Related setting of HDI maximum input	-100.0 ~ +100.0	%	100.0	●
P05.26	HDI filtering time	0.00 ~ 60.00	S	0.10	●

P05.22: HDI minimum input

When input impulse frequency is smaller than HDI minimum input, input high-speed impulse is calculated by minimum input.

P05.25: HDI maximum input

When input impulse frequency is greater than HDI maximum input, input high-speed impulse is calculated by maximum input.

P05.23, P05.24: related setting of HDI minimum / maximum input
It is used to set the relation of HDI high-speed impulse frequency and related given value as linear relation.
P05.26: HDI filtering time
It is used to set the software filtering time of HDI impulse frequency input. When impulse in the scene is likely to be disturbed, filtering time can be lengthened to stabilize detected impulse frequency. However, The longer filtering time is the slower response speed of impulse frequency detection. Therefore, it is a must to set according to practical state.

Group P06 AI curve function

Function Code	Name	Description	Unit	Factory Default	Property
P06.00	AI curve option	Unit: keypad potentiometer curve option. 0: curve 1 (2 points) 1: curve 2 (2 points) 2: curve 3 (2 points) 3: curve 4 (4 points) 4: curve 5 (4 points) Tens: AI1 curve option, the same as above. Hundreds: AI2 curve option, the same as above. Thousands: AI3 curve option, the same as above.		2110	○

6

Keypad potentiometer and AI terminal has 5 groups of AI curves for option. The unit value of parameter P06.00 corresponds to the curve optioning by keypad potentiometer; the value of tens corresponds to the curve optioning by AI1; the value of hundreds corresponds AI2 corresponding curve; thousands correspond to AI3 corresponding curve. Related parameters of curve 1 can be set in P06.01~P06.04; related parameters of curve 2 can be set in P06.05~P06.08; related parameters of curve 3 can be set in P06.09~P06.12; related parameters of curve 4 can be set in P06.13~P06.20; related parameters of curve 5 can be set in P06.21~P06.28.

Function Code	Name	Description	Unit	Factory Default	Property
P06.01	Curve 1 minimum input	0.00 ~ curve 1 maximum input	V	0.00	●
P06.02	Related setting of curve 1 minimum input	-100.0 ~ +100.0	%	0.0	●
P06.03	Maximum input of curve 1	Curve 1 minimum input ~ 10.00	V	10.00	●
P06.04	Related setting of curve 1 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.05	Minimum input of curve 2	0.00 ~ curve 2 maximum input	V	0.00	●
P06.06	Related setting of curve 2minimum input	-100.0 ~ +100.0	%	0.0	●
P06.07	Maximum input of curve 2	Curve 2 minimum ~ 10.00	V	10.00	●
P06.08	Related setting of curve 2 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.09	Curve 3 minimum input	-10.00 ~ curve 3 maximum input	V	0.00	●

P06.10	Related setting of curve 3 minimum input	-100.0 ~ +100.0	%	0.0	●
P06.11	Curve 3 maximum input	Curve minimum input ~ 10.00	V	10.00	●
P06.12	Related setting of curve 3 maximum input	-100.0 ~ +100.0	%	100.0	●

Parameter P06.01~P06.12 is used to set the input voltage of analog input curve 1-3 and the property parameter of its set value.

Curve 1~3 is two-point curve, namely minimum and maximum value. When analog input voltage is lower than minimum input of curve, analog will calculate according to minimum input set by curve; when analog input voltage is higher than maximum input of curve, analog will calculate according to maximum input set by curve.

When analog input terminal AI is switched to current input, 1mA current is equivalent to input voltage 0.5V. Meaning of 100% varies with different application occasions. Fig 6-13 ~ Fig 6-15 respectively indicates 3 kinds of typical settings, as shown in the following figures:

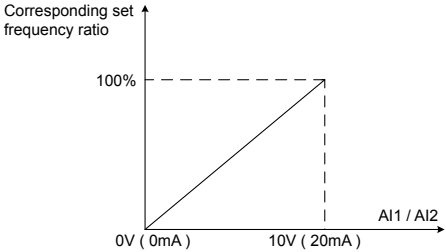

Fig 6-13 typical application 1 of AI curve (2-point) setting

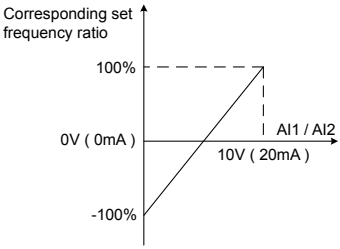

Fig 6-14 typical application 2 of AI curve (2-point) setting

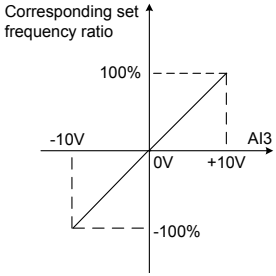

Fig 6-15 typical application 3 of AI curve (2-point) setting

Function Code	Name	Description	Unit	Default Value	Property
P06.13	Curve 4 minimum input	0.00 ~ curve 4 inflection point 1 input	V	0.00	●
P06.14	Related setting of curve 4 minimum input	-100.0 ~ 100.0	%	0.0	●
P06.15	Curve 4 inflection point 1 input	Curve 4 minimum input ~ Curve 4 inflection point 2 input	V	3.00	●
P06.16	Related setting of curve 4 inflection point 1 input	-100.0 ~ +100.0	%	30.0	●
P06.17	Curve 4 inflection point 2 input	Curve 4 inflection point 1 input ~ curve 4 maximum input	V	6.00	●
P06.18	Related setting of curve 4 inflection point 2 input	-100.0 ~ +100.0	%	60.0	●
P06.19	Curve 4 maximum input	Curve 4 inflection point 2 input ~ 10.00	V	10.00	●
P06.20	Related setting of curve 4 maximum input	-100.0 ~ +100.0	%	100.0	●
P06.21	Curve 5 minimum input	-10.00 ~ curve 5 inflection point 1 input	V	-10.00	●
P06.22	Related setting of curve 5 minimum input	-100.0 ~ +100.0	%	-100.0	●
P06.23	Curve 5 inflection point 1 input	Curve 5 minimum input ~ curve 5 inflection point2 input	V	-5.00	●
P06.24	Related setting of curve 5 inflection point 1 input	-100.0 ~ +100.0	%	-50.0	●
P06.25	curve 5 inflection point 2 input	Curve 5 inflection point1 input ~ curve 5 maximum input	V	5.00	●
P06.26	Related setting of curve 5 inflection point 2 input	-100.0 ~ +100.0	%	50.0	●
P06.27	Curve 5 maximum input	Curve 5 inflection point2 input ~ 10.00	V	10.00	●
P06.28	Related setting of curve 5 maximum input	-100.0 ~ +100.0	%	100.0	●

Analog input curve 4 and curve 5 is 4-point curve. Corresponding property parameters are set by P06.13~P06.28 and applicable to multi-segment frequency.

When analog input AI is smaller than minimum input value in curve setting, minimum value prevails; when larger than maximum value, maximum value prevails. Fig 6-16 ~ Fig 6-18 lists several typical application cases.

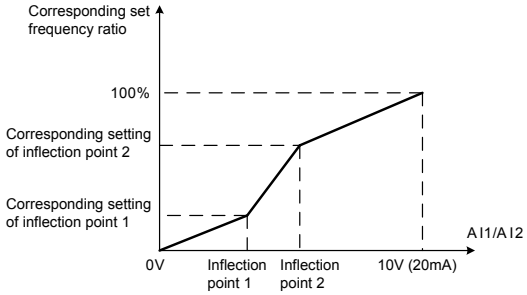

Fig 6-16 typical application case 1 of AI curve (4-points)

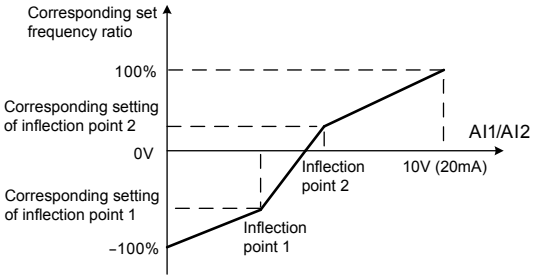

Fig 6-17 typical application case 2 of AI curve (4-points)

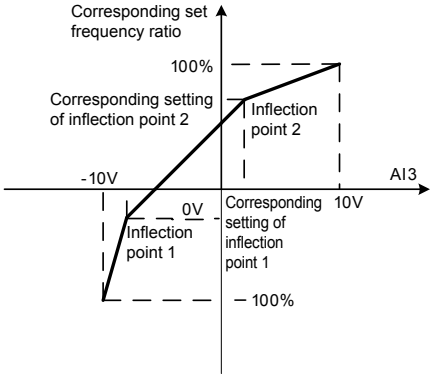

Fig 6-18 typical application case 3 of AI curve (4-points)

Function Code	Name	Description	Unit	Default Value	Property
P06.29	Keypad potentiometer filtering time	0.00 ~ 60.00	S	0.10	●
P06.30	AI1 filtering time	0.00 ~ 60.00	S	0.10	●
P06.31	AI2 filtering time	0.00 ~ 60.00	S	0.10	●
P06.32	AI3 filtering time	0.00 ~ 60.00	S	0.10	●

It is used to set the filtering time of keypad potentiometer and analog input signal AI. When there is a large interference, we can set corresponding filtering time to obtain higher sampling precision. Longer filtering time provides more stable sampling result, but longer sampling time is required.

Function Code	Name	Description	Unit	Default Value	Property
P06.33	AI sampling hysteresis	0~100		2	●

Larger parameter value is relative to great stability of sampling and anti-interference capacity, but related sampling sensitivity will be reduced.

Group P07 output terminal control

Function Code	Name	Description	Unit	Default Value	Property
P07.00	Multifunctional output Y1	0: no output 1: inverter operation 2: forward rotation 3: reverse rotation 4: jog operation 5: inverter fault 6: frequency reaches to FAR 7: frequency level detection FDT1 8: frequency level detection FDT2 9: analog level detection ADT1 10: analog level detection ADT2 11: zero-speed operation 12: upper-limit frequency arrival 13: lower-limit frequency arrival 14: operation ready 15: overload pre-alarm 16: motor overheat pre-alarm 17: set time arrival 18: PID feedback upper limit 19: PID feedback lower limit 20: reserved		1	○
P07.01	Multifunctional output Y2			7	○
P07.02	Relay output R1			5	○
P07.03	Relay output R2			14	○

Table 6-2 function code list of multifunctional output terminals

Set value	Function	Description
0	No output	Indicate the terminal is invalid. If a terminal is left unused, it is suggested to set it as “0” lest malfunction might occur.
1	Inverter operation	When inverter is in operation status, terminal outputs valid signal.
2	Forward rotation	When inverter runs in forward rotation, terminal outputs valid signal.
3	Reverse rotation	When inverter runs in reverse rotation, terminal outputs valid signal.
4	Jog operation	When inverter jogs, terminal outputs valid signal.
5	Inverter fault	When inverter has a fault, terminal outputs valid signal.
6	Frequency reaches to FAR	When frequency output range is valid, terminal outputs valid signal.
7	Frequency level detection FDT 1	When frequency output level is valid, terminal outputs valid signal.
8	Frequency level detection FDT 2	
9	Analog level detection ADT1	When analog level output is valid, terminal outputs valid signal.
10	Analog level detection ADT2	
11	Zero-speed operation	When inverter is in operation status and outputs 0.00Hz, terminal outputs valid signal.
12	Upper-limit frequency arrival	When operation frequency reaches to upper-limit, it outputs valid signal.
13	Lower-limit frequency arrival	When operation frequency reaches to lower-limit, it outputs valid signal.

14	Operation ready	Inverter power-up preparation is completed.
15	Overload pre-alarm	When overload pre-alarm is valid, terminal outputs valid signal.
16	Motor overheat pre-alarm	When motor overload pre-alarm is valid, terminal outputs valid signal.
17	Set time arrival	When set time arrives, terminal outputs valid signal.
18	PID feedback upper-limit	When PID feedback is higher than upper-limit, terminal outputs valid signal.
19	PID feedback lower-limit	When PID feedback is lower than lower-limit, terminal outputs valid signal.
20	Reserved	

Function Code	Name	Description	Unit	Default Value	Property
P07.04	AO output type	0: level 1: single impulse Unit: Y1 output type Tens: Y2 output type Hundreds: R1 output type Thousands: R2 output type Ten thousands: reserved		00000	○

Set the output type of terminal AO, Y1 in unit, Y2 in tens, R1 in hundreds and R2 in thousands.

Function Code	Name	Description	Unit	Default Value	Property
P07.05	AO output logic	0: positive logic 1: negative logic Unit: Y1 output logic Tens: Y2 output logic Hundreds: R1 output logic Thousands: R2 output logic Ten thousands: reserved		00000	○

Set the output logic of terminal AO, Y1 in unit, Y2 in tens, R1 in hundreds and R2 in thousands.

Function Code	Name	Description	Unit	Default Value	Property
P07.06	Y2 output type	0: switch output 1: HDO impulse output		0	○

Set the output type of Y2. 0 is switch output and 1 is high-speed impulse output.

Function Code	Name	Description	Unit	Default Value	Property
P07.07	Y1 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.08	Y1 invalid delay time	0.00 ~ 300.00	S	0.00	○
P07.09	Y2 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.10	Y2 invalid delay time	0.00 ~ 300.00	S	0.00	○

Function Code	Name	Description	Unit	Default Value	Property
P07.11	R1 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.12	R1 invalid delay time	0.00 ~ 300.00	S	0.00	○
P07.13	R2 valid delay time	0.00 ~ 300.00	S	0.00	○
P07.14	R2 invalid delay time	0.00 ~ 300.00	S	0.00	○

Set the valid delay time and invalid delay time of DO terminal.

Function Code	Name	Description	Unit	Default Value	Property
P07.15	Y1 single impulse valid time	0.00 ~ 300.00	S	0.00	○
P07.16	Y2 single impulse valid time	0.00 ~ 300.00	S	0.00	○
P07.17	R1 single impulse valid time	0.00 ~ 300.00	S	0.00	○
P07.18	R2 single impulse valid time	0.00 ~ 300.00	S	0.00	○

Set the single impulse valid time of DO terminal.

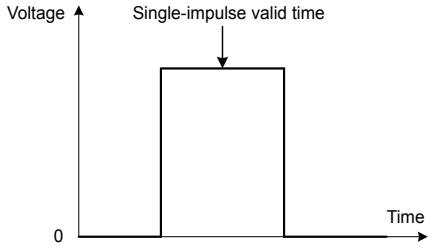

Fig 6-19 diagram of single impulse valid time

Function Code	Name	Description	Unit	Default Value	Property
P07.19	Analog output AO1	0: operation frequency 1: set frequency 2: estimated frequency 3: output current 4: output voltage 5: busbar voltage 6: keypad potentiometer 7: AI1 8: AI2 9: AI3 10: HDI 11: +10V 12: PID given 13: PID feedback 14: PID output 15: reserved	%	0	○
P07.20	Analog output AO2		%	1	○
P07.21	HDO impulse output		%	0	○

Table 6-3 multifunctional analog output function code list

Set value	Function	Description
0	Operation frequency	0 ~ maximum frequency
1	Set frequency	0 ~ maximum frequency
2	Estimated frequency	0 ~ maximum frequency
3	Output current	0 ~ rated current x 2
4	Output voltage	0 ~ rated voltage x 1.5
5	Busbar voltage	0 ~ rated busbar voltage x 1.5
6	Keypad Potentiometer	0.00~5.00V
7	AI1	0.00~10.00V/0.00~20mA
8	AI2	0.00~10.00V/0.00~20mA
9	AI3	-10.00~10.00V
10	HDI	0.01KHz~100KHz
11	+10V	+10V
12	PID given	0.00~10.00V
13	PID feedback	0.00~10.00V
14	PID output	0.00~10.00V
15	Reserved	

Function Code	Name	Description	Unit	Default Value	Property
P07.22	AO1 minimum output	0.00 ~ 100.00	%	0.00	●
P07.23	AO1 maximum output	0.00 ~ 100.00	%	100.00	●
P07.24	AO1 output gain	0.00 ~ 200.00	%	100.00	●
P07.25	AO2 minimum output	0.00 ~ 100.00	%	0.00	●
P07.26	AO2 maximum output	0.00 ~ 100.00	%	100.00	●
P07.27	AO2 output gain	0.00 ~ 200.00	%	100.00	●

The 0 ~ 10V of analog output AO1 and AO2 is relative to 0%~100%. When P07.19 analog output AO1 is set as output function 1(set frequency), if set frequency of inverter is 50% of maximum frequency, output voltage of AO1 is 10V×50%=5V.

Function Code	Name	Description	Unit	Default Value	Property
P07.28	HDO minimum output frequency	0.00 ~ P07.29	kHz	0.00	●
P07.29	HDO maximum output frequency	P07.28 ~ 100.00	kHz	50.00	●
P07.30	HDO output filtering time	0.00 ~ 60.00	S	0.10	●

Set related parameter values of high-speed impulse output HDO.

P07.28: HDO minimum output frequency

When output impulse frequency is lower than minimum output frequency, minimum output frequency will prevail.

P07.29: HDO maximum output frequency
When output impulse frequency is higher than maximum output frequency, maximum output frequency will prevail.
P07.30: HDO output filtering time
When there is large external interference, HDO output filtering time can be increased to obtain higher precision high-speed impulse.

Group P08 auxiliary parameters

Function Code	Name	Description	Unit	Default Value	Property
P08.00	JOG digital frequency	0.00 ~ maximum frequency	Hz	5.00	○
P08.01	JOG acceleration time	0.01 ~ 600.00	S	10.00	○
P08.02	JOG deceleration time	0.01 ~ 600.00	S	10.00	○
P08.03	Acceleration/deceleration time dimension	0: S (sec) 1: M (min)		0	○

P08.00 JOG digital frequency:
Reference frequency given in JOG control.
P08.01 JOG acceleration time:
The time frequency takes to rise to maximum value from 0Hz in JOG control.
P08.02 JOG deceleration time:
The time frequency takes to decline to 0Hz from maximum value in JOG control.
P08.03 acceleration / deceleration time dimension:
Set the acceleration / deceleration time dimension of inverter.

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Function Code	Name	Description	Unit	Default Value	Property
P08.04	Acceleration time 2	0.00 ~ 600.00	S	10.00	○
P08.05	Deceleration time 2	0.00 ~ 600.00	S	10.00	○
P08.06	Acceleration time 3	0.00 ~ 600.00	S	10.00	●
P08.07	Deceleration time 3	0.00 ~ 600.00	S	10.00	●
P08.08	Acceleration time 4	0.00 ~ 600.00	S	10.00	●
P08.09	Deceleration time 4	0.00 ~ 600.00	S	10.00	●

The acceleration / deceleration time of group 2-4 and the ones of P00.13 and P00.14 makes up 4 groups of acceleration / deceleration time. These 4 groups of acceleration / deceleration time can be selected by different combinations of multifunctional input terminal DI.

Function Code	Name	Description	Unit	Default Value	Property
P08.10	Acceleration/deceleration time switching control	0: no switching 1: switching		0	○
P08.11	Acceleration time 1 and 2 switching frequency	0.00 ~ maximum frequency	Hz	0.00	●
P08.12	Deceleration time 1 and 2 switching frequency	0.00 ~ maximum frequency	Hz	0.00	●

Set the switching frequency of acceleration/deceleration time 1 and 2, namely, acceleration/deceleration time is switched by operation frequency. It can be set as valid and invalid. When this function is valid and operation frequency is lower than P08.11 during acceleration process, acceleration time 1 prevails; when operation frequency is higher than P08.11, acceleration time 2 prevails. During deceleration process, when operation frequency is higher than P08.12, deceleration time 2 prevails; when operation frequency is lower than P08.12, deceleration time 1 prevails, as shown in Fig 6-20：

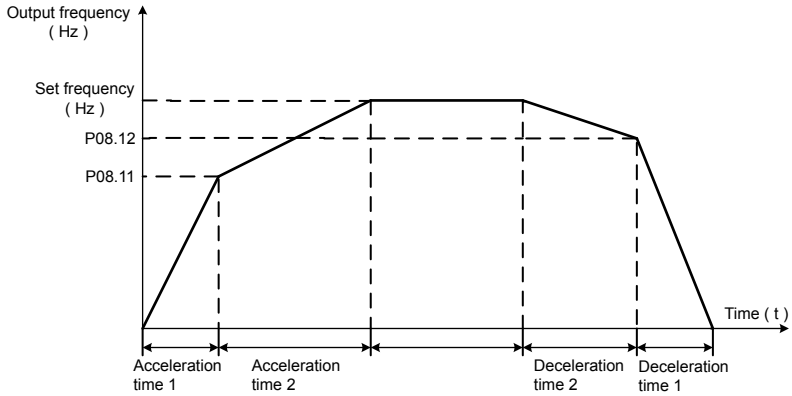

Fig 6-20 acceleration/deceleration time switching diagram

Function Code	Name	Description	Unit	Default Value	Property
P08.13	FAR frequency arrival	0.00 ~ 600.00	Hz	2.50	○

Set FAR frequency arrival value. When output frequency of inverter is within ±FAR range of set value, DO terminal will output high level to indicate that output frequency of inverter will reach to set value.

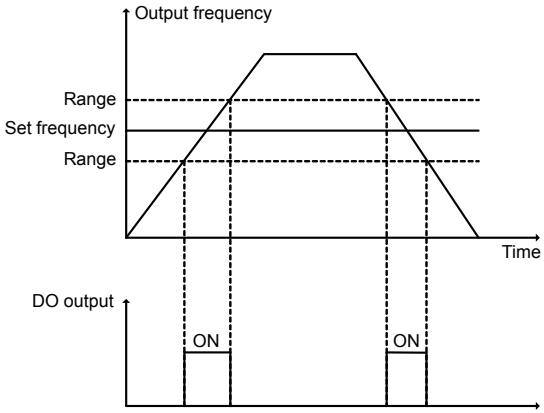

Fig 6-21 frequency arrival

Function Code	Name	Description	Unit	Default Value	Property
P08.14	FDT1 level upper-limit	0.00 ~ maximum frequency	Hz	30.00	○
P08.15	FDT1 level lower-limit	0.00 ~ maximum frequency	Hz	30.00	○
P08.16	FDT2 level upper-limit	0.00 ~ maximum frequency	Hz	30.00	○
P08.17	FDT2 level lower-limit	0.00 ~ maximum frequency	Hz	30.00	○

Set the upper and lower level limit of FDT1 and FDT2. When inverter output frequency is higher than FDT, DO terminal outputs high level to indicate that output frequency has reached to FDT upper limit, when output frequency is lower than FDT lower limit, DO terminal stops outputting high level and starts to output lower level.

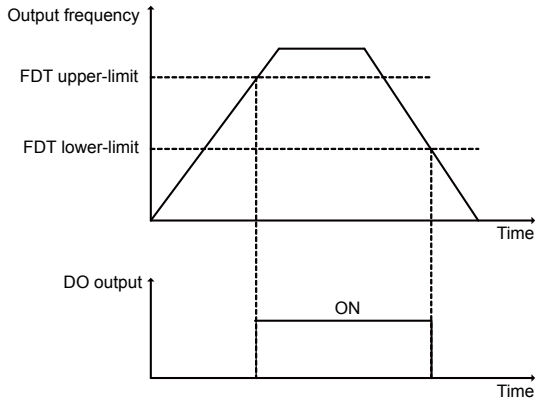

Fig 6-22 FDT frequency output level

Function Code	Name	Description	Unit	Default Value	Property
P08.18	Analog level detection options	0: keypad potentiometer 1: AI1 2: AI2 3: AI3		1	○
P08.19	Analog level ADT1	0.00 ~ 100.00	%	20.00	○
P08.20	Analog level ADT1 hysteresis	0.00 ~ 100.00 (single-phase valid downward)	%	5.00	○
P08.21	Analog level ADT2	0.00 ~ 100.00	%	50.00	○
P08.22	Analog level ADT2 hysteresis	0.00 ~ 100.00 (single-phase valid downward)	%	5.00	○

P08.18: analog level detection options

Set the analog parameters for analog level detection. They can be set as keypad potentiometer, AI1/2/3.

P08.19 ~ P08.22 is used to set the trigger value and lagged value of analog level detection ADT1/2. When analog level is higher than ADT trigger value, DO terminal will output high level; when analog level is lower than lagged value, DO terminal stops outputting high level and starts to output low level.

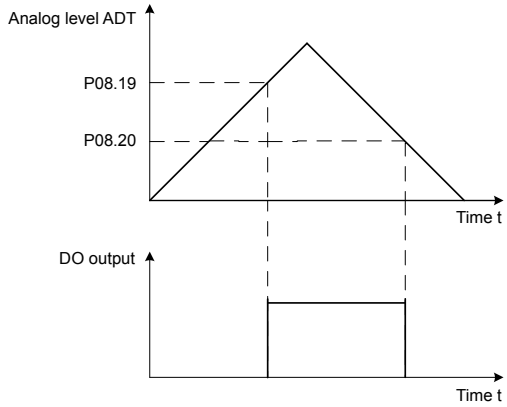

Fig 6-23 analog level ADT

Function Code	Name	Description	Unit	Default Value	Property
P08.23	Hopping frequency point 1	0.00 ~ 600.00	Hz	600.00	○
P08.24	Hopping range 1	0.00 ~ 20.00 0.00: invalid	Hz	0.00	○
P08.25	hopping frequency point 2	0.00 ~ 600.00	Hz	600.00	○
P08.26	Hopping range 2	0.00 ~ 20.00 0.00: invalid	Hz	0.00	○
P08.27	hopping frequency point 3	0.00 ~ 600.00	Hz	600.00	○
P08.28	Hopping range 3	0.00 ~ 20.00 0.00: invalid	Hz	0.00	○

Hopping frequency is set to make inverter operation frequency avoid load resonance band of drive system.

ES300 series inverter can set 3 hopping frequency points and their hopping range. After setting, even if given frequency is within load resonance band, inverter will automatically adjust output frequency to avoid the load resonance band, as shown in Fig 6-24:

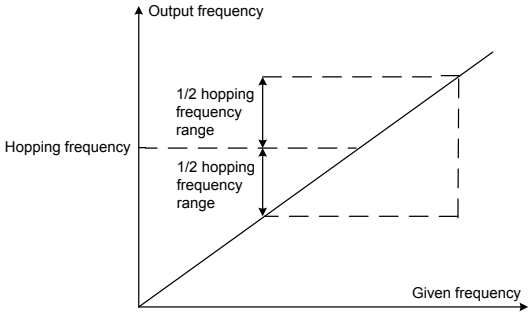

Fig 6-24 hopping frequency points

Function Code	Name	Description	Unit	Default Value	Property
P08.29	Set operation time	0 ~ 60000	Hour	0	○
P08.30	Action option upon arrival of operation time	0: continue to run 1: stop		0	○
P08.31	Locking password for operation time control	0 ~ 65535		XXXXX	○

P08.29: set operation time
Set required operation time of inverter.
P08.30: action option upon operation time arrival
Set operation action after operation time arrival. Operation action can be set as “keep running” and stop.
P08.31: locking password for operation time control
Set locking password for operation time control. When password is correctly inputted, operation time can be modified.

Function Code	Name	Description	Unit	Default Value	Property
P08.32	Output power correction coefficient	0.00 ~ 200.00	%	100.00	●

When output power is not consistent with expectation value, output power can be linearly corrected through this value.

6

Group P09 communication function

Function Code	Name	Description	Unit	Default Value	Property
P09.00	Local address	0: broadcasting address 1 ~ 247		1	○

0 is broadcasting address. 1 ~ 247 is available local communication address.

Function Code	Name	Description	Unit	Default Value	Property
P09.01	Communication Baud rate	0: 4800 1: 9600 2: 19200 3: 38400	bps	1	○
P09.02	Communication format	0: no parity 1+8+1 1: even parity check 1+8+1+1 2: odd parity check 1+8+1+1		0	○

Baud rate supports 4800 ~ 38400bps.
Data format supports 3 types, 0 ~ 2.

Function Code	Name	Description	Unit	Default Value	Property
P09.03	Communication overtime	0.0 ~ 60.0 0.0 communication overtime invalid	S	0.0	○

Communication overtime.

Function Code	Name	Description	Unit	Default Value	Property
P09.04	Master-salve communication way	0: local machine is slave 1: local machine is master		0	○
P09.05	Sending interval of master	0 ~ 1000	mS	10	○
P09.06	Sending address of master	0 ~ 20		0	○
P09.07	Receiving address of slave	0: main digital frequency 1: auxiliary digital frequency		0	○
P09.08	Receiving proportion coefficient of slave	0.00 ~ 600.00	%	100.00	●

Choose to set current inverter as a host or slave. When the inverter is set as a host, user can set sending data and interval.
When set as a slave, user can set the address for received data and proportionality coefficient.

Group P10 PID control function

Function Code	Name	Description	Unit	Default Value	Property
P10.00	PID given source	0: digital given 1: keypad potentiometer 2: AI1 3: AI2 4: AI3 5: HDI		0	○
P10.01	PID digital given	0.00 ~ 100.00	%	50.00	●
P10.02	PID feedback option	0: AI1		0	○
P10.03	PID full scale	0 ~ 60000		10000	○

PID control function given and feedback signal source.

Function Code	Name	Description	Unit	Default Value	Property
P10.04	PID action direction	0: positive action 1: negative action		0	○

0: positive action
When feedback signal is greater than PID given, inverter output frequency should be reduced to make PID reach to balance.
1: negative action
When feedback signal is greater than PID given, inverter output frequency should be increased to make PID reach to balance.

Function Code	Name	Description	Unit	Default Value	Property
P10.05	PID output gain	0.00 ~ 100.00	%	100.00	●

PID output proportional coefficient, PID output = PID operation result x PID output gain.

Function Code	Name	Description	Unit	Default Value	Property
P10.06	Proportional gain P	0.00 ~ 100.00		0.50	●
P10.07	Integral time 1	0.000 ~ 30.000 0.000: no integral	S	2.000	●
P10.08	Derivative time	0.000 ~ 10.000	S	0.000	●

Proportion, integral and differential parameter of PID function.
With greater proportional gain P value, regulating variable will be greater and response will be faster, but excessive value will create system oscillation; with smaller P value, system will be more stable and response will be slower.
With greater integral time I value, response will be slower, output will be more stable and fluctuation control capacity of feedback will be poorer; on the contrary, with smaller I value, response will be faster and output fluctuation will be greater. Excessive value will create oscillation.
Derivative time D can provide limit for gain given of differentiator to make sure differentiator will obtain a pure differential gain in low frequency and a constant differential gain in high frequency. Longer derivative time is relative to regulating strength.

Function Code	Name	Description	Unit	Default Value	Property
P10.09	PID deviation limit	0.0 ~ 100.0	%	0.0	●

Helpful for output precision and stability.

Function Code	Name	Description	Unit	Default Value	Property
P10.10	PID differential amplitude limit	0.00 ~ 100.00	%	1.00	●

In PID regulator, differential is likely to cause system oscillation. Therefore, PID differential is usually limited to a very small range.

Function Code	Name	Description	Unit	Default Value	Property
P10.11	PID positive limit	0.00 ~ 100.00	%	100.00	●
P10.12	PID negative limit	0.00 ~ 100.00	%	100.00	●

The positive and negative limit of PID restricts PID output within a set value.

Function Code	Name	Description	Unit	Default Value	Property
P10.13	PID given change time	0.000 ~ 10.000	S	0.000	●
P10.14	PID output filtering time	0.000 ~ 10.000	S	0.000	●

P10.13: PID given change time
When PID given changes, set the required time of change.
P10.14: PID output filtering time
When there is a large interference in PID output, PID output frequency should be filtered. This parameter is used to set the output filtering time of PID. The filtering will reduce the mutation of output frequency, but will lower down the response performance of closed-loop system.

Function Code	Name	Description	Unit	Default Value	Property
P10.15	Proportional gain Kp2	0.00 ~ 100.00		0.50	●
P10.16	Integral time Ti2	0.000 ~ 30.000	S	2.000	●
P10.17	Differential time Td2	0.000 ~ 10.000	S	0.000	●

Set the group 2 PID control parameters and parameter functions are the same with group 1 PID parameters.

Function Code	Name	Description	Unit	Default Value	Property
P10.18	PID parameter switching conditions	0: no switching 1: switch by terminal DI 2: automatically switch by deviation		0	○
P10.19	PID parameter switching deviation 1	0.0 ~ PID parameter switching deviation 2	%	20.00	●
P10.20	PID parameter switching deviation 2	PID parameter switching deviation 1 ~ 100	%	80.00	●

P10.18 = 0 PID parameter is not switched.
P10.18 = 1 two groups of PID parameters are switched by DI terminal.
P10.18 = 2 automatically switched by given and feedback deviation.
P10.19: PID parameter switching deviation 1
Set PID parameter switching deviation 1. When the absolute value of given and feedback deviation is smaller than PID parameter switching deviation 1, the first group PID parameter prevails (P10.06~P10.08).
P10.20: PID parameter switching deviation 2
Set PID parameter switching deviation 2. When the absolute value of given and feedback deviation is larger than PID parameter switching deviation 2, the second group PID parameter prevails (P10.15~P10.17). When the deviation of given value and feedback is between PID parameter switching deviation 1 and 2, PID parameter is the linear interpolation value of two groups of PID parameters, as shown in Fig 6-25.

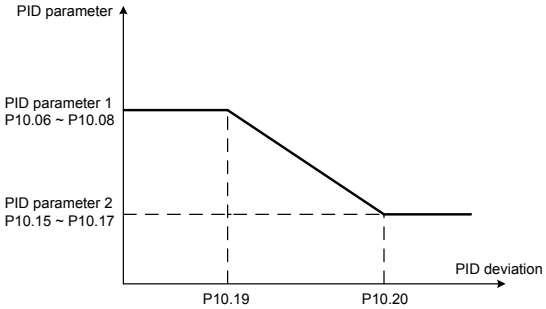

Fig 6-25 PID parameter switching

Function Code	Name	Description	Unit	Default Value	Property
P10.21	PID initial value	0.00 ~ 100.00	%	0.00	●
P10.22	PID initial value retention time	0.00 ~ 300.00	S	0.00	●

When inverter starts, it is accelerated to initial value of PID by normal acceleration time, and then keeps operating in initial value status for the retention time of P10.22: PID initial value. After that, it adjusts PID. PID initial value is relative to the percentage of maximum frequency, as shown in Fig 6-26.

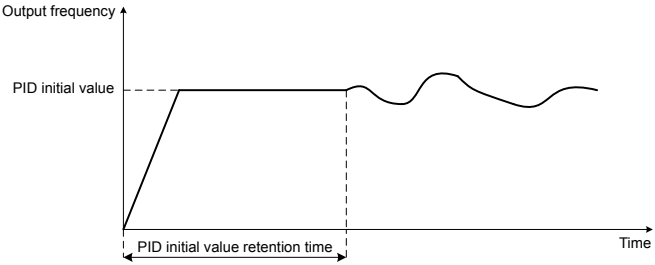

Fig 6-26 PID initial value retention time

Function Code	Name	Description	Unit	Default Value	Property
P10.23	PID integral separation deviation	0.00 ~ 100.00	%	100.00	●

P10.23: PID integral separation deviation

In PID control, large interference or variation of given value will cause great deviation of system. Under the function of integral items, there will be great overshoot and long-time fluctuation. When deviation is large, perform integral separation, namely cancelling integral function; when deviation is small, add integral function. This deviation is just PID integral separation deviation.

Function Code	Name	Description	Unit	Default Value	Property
P10.24	Upper-limit of PID feedback loss	0.00 ~ 100.00	%	100.00	●
P10.25	Lower-limit of PID feedback loss	0.00 ~ 100.00	%	0.00	●
P10.26	Detection time of PID feedback loss	0.0 ~ 30.00 0.00S: no detection	S	0.00	●

P10.24: PID feedback loss upper-limit

When actual PID feedback is larger than PID feedback loss upper-limit and sustains the status for the set value of P10.26: PID feedback loss detection time, inverter skips to EER18: PID feedback loss fault.

P10.25: PID feedback loss lower-limit

When actual PID feedback is smaller than PID feedback loss lower-limit and sustains the status for the set value of P10.26: PID feedback loss detection time, inverter skips to EER18: PID feedback loss fault.

Function Code	Name	Description	Unit	Default Value	Property
P10.27	PID dormancy control	0: invalid 1: valid		0	○
P10.28	PID wake-up threshold	0.00 ~ dormancy threshold	%	0.00	●
P10.29	PID wake-up delay time	0.0 ~ 30.0	S	0.0	●
P10.30	PID dormancy threshold	wake-up threshold ~ 100.00	%	100.00	●
P10.31	PID dormancy delay time	0.0 ~ 30.0	S	0.0	●

When feedback is smaller than wake-up threshold and sustains the status for the time longer than or equal to wake-up delay time, PID adjuster enters into work status from dormancy status; when feedback is larger than dormancy threshold and sustains for the time longer than or equal to dormancy delay time, PID adjuster enters into dormancy status from normal work status.

Group P11 simple PLC function

Function Code	Name	Description	Unit	Default Value	Property
P11.00	Multi-segment frequency 1	0.00 ~ maximum frequency	Hz	0.00	●
P11.01	Multi-segment frequency 2	0.00 ~ maximum frequency	Hz	5.00	●
P11.02	Multi-segment frequency 3	0.00 ~ maximum frequency	Hz	10.00	●
P11.03	Multi-segment frequency 4	0.00 ~ maximum frequency	Hz	15.00	●
P11.04	Multi-segment frequency 5	0.00 ~ maximum frequency	Hz	20.00	●
P11.05	Multi-segment frequency 6	0.00 ~ maximum frequency	Hz	25.00	●
P11.06	Multi-segment frequency 7	0.00 ~ maximum frequency	Hz	30.00	●
P11.07	Multi-segment frequency 8	0.00 ~ maximum frequency	Hz	35.00	●
P11.08	Multi-segment frequency 9	0.00 ~ maximum frequency	Hz	40.00	●
P11.09	Multi-segment frequency 10	0.00 ~ maximum frequency	Hz	45.00	●
P11.10	Multi-segment frequency 11	0.00 ~ maximum frequency	Hz	50.00	●
P11.11	Multi-segment frequency 12	0.00 ~ maximum frequency	Hz	50.00	●
P11.12	Multi-segment frequency 13	0.00 ~ maximum frequency	Hz	50.00	●
P11.13	Multi-segment frequency 14	0.00 ~ maximum frequency	Hz	50.00	●
P11.14	Multi-segment frequency 15	0.00 ~ maximum frequency	Hz	50.00	●

PLC program runs set value of multi-segment frequency. There are 15 segment speeds in all, as shown in Fig 6-27.

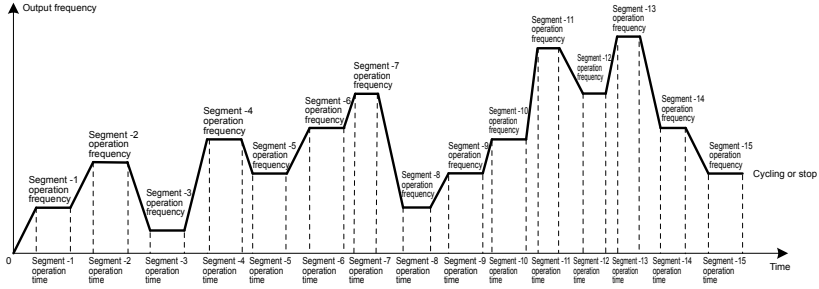

Fig 6-27 PLC multi-segment frequency operation

Function Code	Name	Description	Unit	Default Value	Property
P11.15	PLC operation way	0: stop after single operation 1: stop after limited cycles 2: hold final value after single operation 3: cycled operation		0	○

0: stop after single operation
Automatically stop after operating for the set time at set segment speed.
1: stop after limited cycle
Automatically stop after cycles of P11.16.
2: operate by final value after single operation
Operate by final value after operating for the set time at set segment speed.
3: cycle operation
Restart cycle operation after operating for the set time at set segment speed.

Function Code	Name	Description	Unit	Default Value	Property
P11.16	Limited cycle times	1 ~ 30000		1	○

Set the number of cycles of PLC program.

Function Code	Name	Description	Unit	Default Value	Property
P11.17	PLC saving options	Unit: power-down save option 0: not save 1: save Tens: stop save option 0: not save 1: save		00	○

Set the PLC parameter saving upon power down or stop. Unit is relative to power down saving and decade to stop saving.

Function Code	Name	Description	Unit	Default Value	Property
P11.18	1st segment operation time	0.0 ~ 6000.0	S/H	5.0	●
P11.19	1st segment operation control	Unit: operation direction 0: forward rotation 1: reverse rotation Tens: acceleration / deceleration time 0: acceleration / deceleration time 1 1: acceleration / deceleration time 2 2: acceleration / deceleration time 3 3: acceleration / deceleration time 4		00	●

P11.18: set the operation time of PLC segment 1 speed.
P11.19: set the operation control way of PLC segment 1 speed. Set operation direction in unit. acceleration / deceleration time in tens.
Operation time and control way of speed segment 2 ~ 15 can be set by parameter P11.20 ~ P11.47.

Function Code	Name	Description	Unit	Default Value	Property
P11.48	Simple PLC operation time unit	0: S (second) 1: M (minute)		0	●

Set the time unit of PLC operation segment speed.

Group P12 fault and protection

Function Code	Name	Description	Unit	Default Value	Property
P12.00	Overload pre-alarm control	Unit: overload pre-alarm detection option 0: always detect 1: detect at constant speed Tens: overload pre-alarm option 0: continue to run without alarm 1: stop with fault		00	○
P12.01	Overload pre-alarm detection level	0.00 ~ 200.00	%	200.00	○
P12.02	Overload pre-alarm detection time	0.00 ~ 60.00	S	5.00	○
P12.03	Motor overload protection gain	5.00 ~ 100.00	%	100.00	○

P12.00: overload pre-alarm control
The setting in unit detects overload pre-alarm way. Setting in tens detects the action after overload pre-alarm. Overload pre-alarm is applied before inverter skips to ERR09: before overload fault. It sends a pre-alarm signal to control terminal by DO terminal.
P12.01: overload pre-alarm detection level
Set the detection level of current overload pre-alarm. It is mainly used to set the degree of pre-alarm before overload protection. When this value is greater, advance will be smaller.
P12.02: overload pre-alarm detection time
Set the time value of pre-alarm detection. When output current is larger than overload pre-alarm detection level x rated current, and lasting time exceeds overload pre-alarm detection time, motor overload pre-alarm is valid.
P12.03: motor overload protection gain
When overload fault is not screened, inverter will judge if motor is overloaded according to inverse time limit curve of overload protection. Inverse time limit curve is 150% × motor overload protection gain × rated current. When the status lasts for 1 minute, motor will report EER09: overload fault; 180% × motor overload protection gain × rated current. When the status lasts for 10 seconds, motor will report motor overload fault.

Function Code	Name	Description	Unit	Default Value	Property
P12.04	Off-load protection option	0: invalid 1: valid		0	○
P12.05	Off-load detection level	0.00 ~ 100.00	%	30.00	●
P12.06	Off-load detection time	0.00 ~ 60.00	S	1.00	●

P12.04: offload protection option
Set protection option when motor is offload.
P12.05: offload detection level
When P12.04 offload protection setting becomes valid, and output current is smaller than the current value stated in offload detection level P12.05, and lasting time exceeds offload detection time P12.06, inverter reports EER10: offload fault.
P12.06: offload detection time
Detect the lasting time of motor offload.

Function Code	Name	Description	Unit	Default Value	Property
P12.07	Motor temperature sensor type	0: no temperature sensor 1: PT100		0	○
P12.08	Motor overheat protection threshold	0 ~ 200	℃	110	○
P12.09	Motor overheat pre-alarm threshold	0 ~ 200	℃	90	○

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P12.07: motor temperature sensor type
Set the temperature sensor type of motor. PT100 is a common temperature sensor.
P12.08: motor overheat protection threshold
Set motor overheat protection threshold. When motor temperature exceeds this protection threshold, inverter reports overheat alarm fault.
P12.09: motor overheat pre-alarm threshold
Set motor overheat pre-alarm threshold. When motor temperature exceeds this protection threshold, inverter reports overheat pre-alarm fault.

Function Code	Name	Description	Unit	Default Value	Property
P12.10	Overcurrent stall protection	0: invalid 1: mode 1 2: mode 2		2	○

Taking acceleration process of inverter as an example, when overcurrent stall protection becomes valid and if inverter output current exceeds the value stated in P12.11 current-limiting level setting, overcurrent stall will action. At this time, output frequency starts to decline until output current is smaller than limit; and then output frequency continues to increase until it reaches to set frequency. This function will lead to the result that actual acceleration time is longer than set acceleration time. For the occasions which have higher requirement for time efficiency, P12.11 can be properly increased.
P12.10=0: overcurrent stall protection invalid
P12.10=1: overcurrent stall protection mode 1
P12.10=2: overcurrent stall protection mode 2

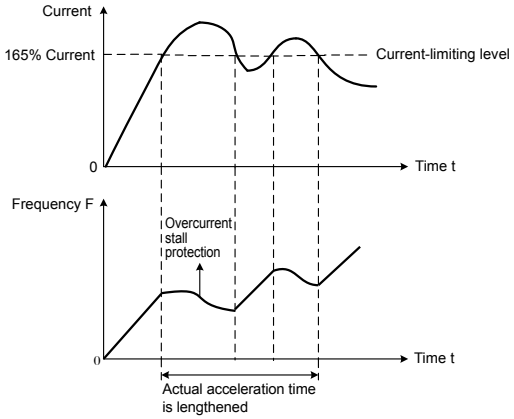


Fig 6-28 overcurrent stall protection

Function Code	Name	Description	Unit	Default Value	Property
P12.11	Current-limiting level	50.00 ~ 180.00	%	165.00	○
P12.12	Overspeed current-limiting coefficient	0.00 ~ 200.00	%	50.00	○
P12.13	High-speed current-limiting	0: invalid 1: valid		0	○

P12.11: current-limiting level

Current amplitude limiting function can prevent output current from exceeding amplitude limiting level.

P12.12: overspeed current-limiting coefficient

When motor runs in overspeed status, for example, operation frequency is twice of rated frequency, the drive current is smaller than the one in rated frequency operation. Therefore, for the same current-limiting level, the decline of motor speed will be much larger. For this situation, when operation frequency of motor exceeds rated frequency, we can decrease the value of P12.11 current-limiting level to improve the acceleration performance of motor in overspeed operation and prevent motor stall. Current-limiting level in overspeed = (operation frequency/rated frequency) X overspeed current-limiting coefficient X P12.11.

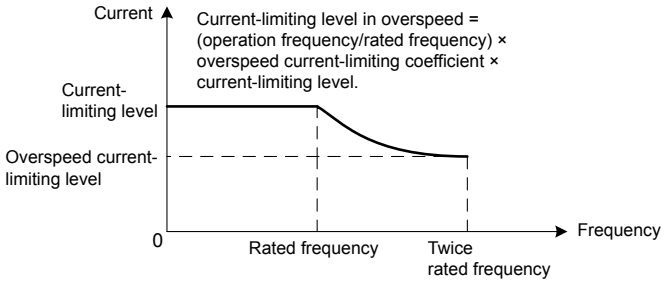


Fig 6-29 overspeed current-limiting level

P12.13: high-speed current-limiting function
High-speed current-limiting function can effectively reduce overcurrent fault and lessen the influence of overcurrent stall protection on lengthened actual acceleration time.

Function Code	Name	Description	Unit	Default Value	Property
P12.14	Overvoltage stall protection	0: invalid 1: valid 2: invalid in acceleration / constant speed, valid in deceleration		1	○
P12.15	Overvoltage stall action point	120.00% ~ 135.00%	%	128.00	○

P12.14 = 0: overvoltage stall protection invalid
P12.14 = 1: overvoltage stall protection valid
P12.14 = 2: overvoltage stall protection is invalid in acceleration / constant speed status and valid in deceleration.
During deceleration of inverter, after busbar voltage exceeds stall protection voltage, inverter stops deceleration and maintain current operation frequency. After busbar voltage declines, it continues to decelerate.
P12.15: overvoltage stall action point
This is to adjust the capacity to control overvoltage during deceleration process. Larger value is relative to greater control on overvoltage. When overvoltage does not occur, it is better to keep this gain setting as small as possible.

6

Function Code	Name	Description	Unit	Default Value	Property
P12.16	Undervoltage detection level	0.00 ~ 100.00 (UDC_e)	%	65.18	○
P12.17	Undervoltage detection time	0.00 ~ 30.00	SEC	0.50	○

P12.16: undervoltage detection level
When busbar voltage is lower than the voltage stated in undervoltage detection level setting and lasting time exceeds undervoltage detection time (P12.17), inverter reports undervoltage fault.
P12.17: undervoltage detection time
Detect the lasting time of busbar undervoltage.

Function Code	Name	Description	Unit	Default Value	Property
P12.18	Fault protection and control 1	Unit: overload fault Tens: software overcurrent Hundreds: software overvoltage Thousands: undervoltage fault Ten thousands: input phase loss fault 0: fault is not screened. Stop when fault happens. 1: fault is screened.		00000	○

P12.19	Fault protection and control 2	Unit: output phase loss fault Tens: none Hundreds: none Thousands: none Ten thousands: none 0: fault is not screened. Stop when fault happens. 1: fault is screened.		00000	○

There are 2 groups of parameters for fault protection and control of inverter. Each digit of parameter is relative to corresponding fault code. Each digit provides 2 control ways. 0 indicates fault is not screened and inverter stops in fault. 1 indicates fault is screened.

Function Code	Name	Description	Unit	Default Value	Property
P12.20	Fault retry control 1	Unit: overload Tens: software overcurrent Hundreds: software overvoltage Thousands: hardware overcurrent Ten thousands: hardware overvoltage 0: fault is not screened. Stop when fault happens. 1: fault is screened.		00000	○
P12.21	Fault retry control 2	Unit: undervoltage Tens: input phase loss Hundreds: none Thousands: none Ten thousands: none 0: fault is not screened. Stop when fault happens. 1: fault is screened.		00000	○

There are 2 groups of parameters for fault retry and control of inverter. Each digit of parameter is relative to corresponding fault code. Each digit provides 2 control ways. 0 indicates fault is not screened and inverter stops in fault. 1 indicates fault is screened.

Function Code	Name	Description	Unit	Default Value	Property
P12.22	Automatic fault reset times	0 ~ 100		0	○
P12.23	Automatic fault reset interval	0.01 ~ 30.00	SEC	0.50	○
P12.24	Reset times clearance interval	0.01 ~ 30.00	SEC	10.00	○
P12.25	Fault output option during automatic fault reset	0: no action 1: action		0	○

P12.22: automatic fault reset times

Set automatic reset times when inverter has a fault. When the value is larger than 0, automatic reset is valid.

P12.23: Automatic fault reset interval
Set automatic fault reset interval. When automatic reset is valid and larger than 1 times, set the interval between 2 automatic resets.
P12.24: reset times clearance interval
Set automatic reset time clearance interval. When automatic fault reset times reach to a set value, set the interval of automatic reset time clearance.
P12.25: fault output option during automatic fault reset
Set the fault output option during automatic fault reset.

Function Code	Name	Description	Unit	Default Value	Property
P12.26	Power-up preparation time	0.00 ~ 30.00	S	1.00	○

Set power-up preparation time of inverter. When a set value is reached, inverter responses to external control command.

Group P13 control parameters

Function Code	Name	Description	Unit	Default Value	Property
P13.00	Fan control	0: run at power-up 1: run at start		1	○

0: run at power-up
After inverter is powered, fan starts to run immediately.
1: run at start
When inverter is in output valid status, fan starts to run.

6

Function Code	Name	Description	Unit	Default Value	Property
P13.01	Carrier frequency control	0: fixed carrier 1: random carrier way 1 2: random carrier way 2		0	○
P13.02	Carrier upper-limit frequency	1.000 ~ 16.000	KHz	6.000	○
P13.03	Carrier lower-limit frequency	1.000 ~ 16.000	KHz	2.000	○

P13.01: carrier frequency control
PWM carrier frequency control can be set as fixed carrier, random carrier way 1 and random carrier way 2, When random carrier way is set, it can effectively reduce the noise of motor during operation.

Function Code	Name	Description	Unit	Default Value	Property
P13.04	Automatic voltage regulation	0: invalid 1: valid 2: invalid when exceeding rated voltage		0	○

0: invalid
Automatic voltage regulation is invalid.
1: valid
Automatic voltage regulation is valid.
2: invalid when exceeding rated voltage
When input voltage exceeds rated voltage, automatic voltage regulation is invalid.

Function Code	Name	Description	Unit	Default Value	Property
P13.05	Dynamic braking option	0: valid upon power-up 1: valid during operation 2: valid during deceleration		0	○
P13.06	Dynamic braking usage rate	5.00 ~ 100.00	%	80.00	○
P13.07	Dynamic braking voltage	120.00 ~ 140.00	%	128.00	○
P13.08	Dynamic braking hysteresis	0.00 ~ 30.00 (single phase valid downward)	%	6.00	○

Inverter dynamic braking control parameters.

Function Code	Name	Description	Unit	Default Value	Property
P13.09	Output voltage	5.00 ~ 100.00	%	100.00	●

Control the output voltage proportion of inverter.

Function Code	Name	Description	Unit	Default Value	Property
P13.10	Overmodulation	0: invalid 1: valid		0	○

PWM overmodulation control.

Function Code	Name	Description	Unit	Default Value	Property
P13.11	Oscillation inhibition gain	0.00 ~ 100.00	%	10.00	●

This parameter is mainly used to control motor oscillation. When there is no motor oscillation, try not to adjust this parameter. When there is motor oscillation, properly increase the value of this parameter.

Function Code	Name	Description	Unit	Default Value	Property
P13.12	Magnetizing component compensation coefficient	0.00 ~ 300.00	%	100.00	●

It is applied to magnetizing component compensation in vector control.

Function Code	Name	Description	Unit	Default Value	Property
P13.13	Slip compensation coefficient	0.00 ~ 200.00	%	0.00	●
P13.14	Slip compensation filtering time	0.00 ~ 10.00	SEC	0.50	●

When gradually increasing motor load, the greater load motor is under, the lower rotation speed motor rotor will be. To guarantee rotation speed of rotor is close to synchronous speed under rated load, we can increase P13.13: slip compensation parameter to compensate the rotation speed of motor rotor.
When this parameter is set as 0, slip compensation is invalid.

Function Code	Name	Description	Unit	Default Value	Property
P13.15	Voltage compensation coefficient	0.00 ~ 200.00	%	80.00	●
P13.16	Voltage compensation filtering time	0.00 ~ 10.00	SEC	0.50	●

It is the output voltage when dynamically compensating low frequency, which can improve dynamic loading capacity.

Function Code	Name	Description	Unit	Default Value	Property
P13.17	Flux braking intensity	100.00 ~ 300.00 (100.00: invalid)	%	100.00	●

When the set value of flux braking intensity is greater than 100.00, flux braking is valid.
When inverter stops, inverter will rapidly brake and stop motor by increasing motor flux. During this process, the electric energy of motor is transformed to thermal energy which is consumed. Therefore, motor tends to be heated during this process. Though motor can be decelerated rapidly during this process, output current will be larger, so this parameter should be set properly lest motor would be damaged.

Function Code	Name	Description	Unit	Default Value	Property
P13.18	PWM compensation coefficient	0.00 ~ 100.00	%	100.00	●

It is used to compensate PWM output consumption.

Function Code	Name	Description	Unit	Default Value	Property
P13.19	Non-stop in instant power-cut or power fault	0: invalid 1: valid		0	○
P13.20	Instant non-stop deceleration time	0.00 ~ 10.00	SEC	1.50	○

Non-stop in instant power-cut or power fault: when instant power-cut or power fault occurs, inverter will reduce output frequency first, namely deceleration, and enable motor to generate power.

By load feedback energy, it compensates the reduction of busbar voltage to maintain temporary operation of inverter. Deceleration degree can be set by P13.20: instant non-stop deceleration time.

Function Code	Name	Description	Unit	Default Value	Property
P13.21	Restart after power cut	0: no action 1: action		0	○
P13.22	Waiting time before restart	0.0 ~ 20.0	S	0.5	○

Restart control after power cut: when control becomes valid, inverter will start after a while. The time length is determined by P13.22.

Function Code	Name	Description	Unit	Default Value	Property
P13.23	Overcurrent deceleration time	0.01 ~ 300.00	S	2.00	●
P13.24	Overcurrent stall proportional gain	0.00 ~ 10.00	%	0.40	●
P13.25	Overcurrent stall integral time	0.000 ~ 30.000	SEC	0.020	●

Overcurrent protection control parameters.

Function Code	Name	Description	Unit	Default Value	Property
P13.26	Overvoltage stall proportional gain	0.00 ~ 10.00	%	0.40	●
P13.27	Overvoltage stall integral time	0.000 ~ 30.000 0.000: no integral	SEC	0.200	●

Overvoltage protection control parameters.

Group P14 keypad and display

Function Code	Name	Description	Unit	Default Value	Property
P14.00	LCD language option	0: Chinese 1: English		0	○

When LCD keypad is applied, language can be set as Chinese or English.

Function Code	Name	Description	Unit	Default Value	Property
P14.01	User password	0 ~ 65535		XXXXX	○

User password is required to modify inverter parameters.

Function Code	Name	Description	Unit	Default Value	Property
P14.02	Parameter protection function	0: parameter setting enabled 1: parameter lock 0 2: parameter lock 1		0	○

0: parameter setting enabled
All parameters can be modified.
1: parameter lock 0
Only enable the modification of main digital frequency.
2: parameter lock 1
All parameters must not be modified.

Function Code	Name	Description	Unit	Default Value	Property
P14.03	Definition of multifunctional key	0: jog operation 1: positive / negative input switching 2: no function		0	○

0: jog operation
Multifunctional key is set for jog operation.
1: positive / negative input switching
Multifunctional key is set for switching of positive and negative operation.
2: no function
Multifunctional key is invalid.

Function Code	Name	Description	Unit	Default Value	Property
P14.04	Parameter copy	0: no operation 1: parameter upload (from inverter to keypad) 2: parameter download (from keypad to inverter)		0	○

Inverter parameter copy function
0: no operation
1: parameter upload
Copy the parameters of inverter and save into keypad.
2: parameter download
Copy the saved parameters in keypad and download them into inverter.

Function Code	Name	Description	Unit	Default Value	Property
P14.05	Operation display parameters	P15.00 ~ P15.25		XX.XX	●
P14.06	Stop display parameters	P15.00 ~ P15.25		XX.XX	●
P14.07	Standby display parameters	P15.00 ~ P15.25		XX.XX	●

The monitoring parameters of inverter in operation and standby status.

Function Code	Name	Description	Unit	Default Value	Property
P14.08	Accumulated operation time	XXXX		H	×
P14.09	Accumulated power-up time	XXXX		H	×

Record the accumulated operation time of inverter.

Function Code	Name	Description	Unit	Default Value	Property
P14.10	Model display	0: G type 1: P type		X	×

Display machine model.

Function Code	Name	Description	Unit	Default Value	Property
P14.11	Inverter rated power	0.10 ~ 650.00	kW	XXXX	×
P14.12	Inverter rated voltage	60 ~ 690	V	XXX	×
P14.13	Inverter rated current	0.1 ~ 1500.0	A	XXXXX	×

Parameters in inverter nameplate.

Function Code	Name	Description	Unit	Default Value	Property
P14.14	Keypad software version	XX.XXX		XX.XXX	×
P14.15	Software version 1	XX.XXX		XX.XXX	×
P14.16	Software version 2	XX.XXX		XX.XXX	×

Keypad software version and inverter software version.

Function Code	Name	Description	Unit	Default Value	Property
P14.17	Manufacturer password	0 ~ 65535		XXXXX	○

Internal password of manufacturer.

Chapter 7 fault diagnosis and elimination

7.1 Alarm and solution

ES300 series current vectorial inverter provides 18 alarm messages and protection functions. Once a fault occurs, protection function acts, inverter stops output, inverter fault relay R1 acts and shows fault code on the display of inverter. When a fault occurs during usage, user can refer to list 7-1, analyze the cause of fault and find out solution in a short time. If a fault remains, please contact your distributor or us.

Note: when a fault occurs during operation of motor, free stop will be enabled until motor stops.

List 7-1 fault alarm and solution list

Fault code	Explanation	Possible Causes	Solutions
ERR00	No fault	/	/
ERR01	Inverter unit fault	1. Short circuit between output side phases or to the ground. 2. Connection between motor and inverter is too long. 3. Inverter module is damaged.	1. Eliminate the fault in peripheral short circuit. 2. Shorten connection and install an electric reactor or output filter. 3. Seek for technical support and replace module.
ERR02/ ERR04	Hardware overcurrent/ software overcurrent	**Hardware overcurrent** 1. Short circuit between output side phases or to the ground. 2. Load is increased suddenly during operation or acceleration/ deceleration time is too short. 3. V/F torque boost setting is excessive. 4. Motor is in rotation state upon start-up. 5. Motor capacity is higher than inverter's.	1. Eliminate peripheral short-circuit fault. 2. Remove sudden load or reset acceleration/deceleration time. 3. Reset V/F torque boost value. 4. Start rotation speed tracking function. 5. Replace motor or inverter.
ERR03	Hardware overvoltage	1. Deceleration time is too short and recovered energy of motor is too large. 2. Voltage of power source is too high.	1. Increase deceleration time. 2. Install a proper braking unit/ braking resistance. 3. Reduce power source voltage to regulated range.
ERR05	Software overvoltage	1. Input voltage is too high. 2. Motor is driven by external forces. 3. Deceleration time is too short.	1. Reduce input voltage to normal range. 2. Eliminate external drive or install a braking unit. 3. Reset deceleration time.
ERR06	Undervoltage fault	1. Instant power-down exists in input voltage. 2. Phase loss of input power source. 3. Loose input terminals or bad contact.	1. Reset fault 2. Check input power source. 3. Reconnect input wire and guarantee sufficient contact.
ERR07	Input phase loss fault	1. Input power source phase loss. 2. Rectifier bridge or charging resistance is damaged.	1. Check input power source and connection. 2. Seek for technical support.

ERR08	Output phase loss fault	1. Loose connection between inverter and motor. 2. Motor is damaged.	1. Check the connection between inverter and motor. 2. Observe if inverter output is in balance without motor. If output is in balance, we can confirm motor is damaged.
ERR09	Overload fault	1. Acceleration/deceleration time is too short. 2. V/F torque boost setting is too large. 3. Load is too large.	1. Reset acceleration/deceleration time. 2. Reset torque boost value. 3. Reduce load or replace a matching inverter.
ERR10	Offload fault	Operation current of inverter is smaller than related current of offload detection level set by P12.05, and lasting time exceeds offload detection time (P12.06).	Confirm if load is separated or if parameter setting of P12.05 and P12.06 meets actual operation conditions.
ERR11	Inverter overheat	1. Ambient temperature is too high. 2. Poor ventilation in inverter. 3. Damaged fan. 4. Damaged temperature sensor.	1. Check if ambient temperature meets requirements. 2. Improve ventilation of inverter. 3. Replace a fan. 4. Replace a temperature sensor.
ERR12	Motor overheat	1. Temperature sensor connection is loose. 2. Motor overheat.	1. Check temperature sensor connection and eliminate a fault. 2. Reduce carrier frequency or perform other cooling measures.
ERR13	External fault	1. External fault terminal acts.	1. Check external devices.
ERR14	Communication fault	1. Improper communication parameter setting 2. Communication circuit has a fault.	1. Reset communication parameter P07.XX 2. Examine communication circuit.
ERR15	I2C fault	EEPROM chip is broken.	Replace main control panel or EEPROM chip.
ERR16	Motor tuning cancelation	1. Press STOP button during parameter self-identification process.	1. Retry after fault reset.
ERR17	Timing stop fault		
ERR18	PID feedback disconnection	1. Improper PID parameter setting 2. PID feedback circuit has a fault.	1. Reset PID parameters, P10.XX 2. Examine PID feedback loop.

7.2 Fault record inquiry

ES300 series current vectorial inverter provides 3 fault information records. User can inquire 3 recent fault codes, output frequency, current and busbar voltage of last fault by referring to group P16. xxparameters. They are helpful for user to judge and eliminate a fault.

7.3 Fault reset

When ES300 series current vectorial inverter has a fault, in order to quit fault alarm status, press STOP key to reset the fault after eliminating the cause to fault; if the fault is not cleared, inverter will stay in fault state and keypad display continues to show fault code.

Chapter 8 electromagnetic compatibility guidance

8.1 Definition

Electromagnetic compatibility means that electric devices may coexist in limited time, space and spectrum resources without degrading performance. Devices, branch systems and systems must not produce the electromagnetic emission which goes beyond criterions or standards, and meet the requirement of noise immunity.

8.2 EMC standard introduction

According to national standard GB/T12668.3, inverter needs to meet the requirements of electromagnetic interference and anti-electromagnetic interference.

Our products conform to the latest international standards: IEC/EN61800-3: 2004 (Adjustable speed electrical power drive systems part 3: EMC requirements and specific test methods) and national standard GB/T12668.3.

IEC/EN61800-3is composed to investigate the electromagnetic interference and anti-electromagnetic interference of an inverter. The content of electromagnetic interference is mainly to test the radiated interference, conducted interference and harmonic interference (inverter for civil purposes should meet this requirement). The content of anti-electromagnetic interference is mainly to test the interference immunity to conduction, radiation, surge, quick mutation pulse packet, ESD and power source low-frequency terminal (specific test items include: 1. anti-interference tests of input voltage dip, interruption and variation; 2. anti-interference test of commutation notch; 3. anti-interference test of harmonic input; 4. input frequency variation test; 5. Input voltage unbalance test; 6. input voltage fluctuation test). Tests have been strictly implemented according to above IEC/EN61800-3. Our products are installed according to the section 8.3 ad have excellent electromagnetic compatibility in common industrial environment.

8.3 EMC guidance

8.3.1 Harmonic influence

Higher harmonic of power supply may damage inverter and surrounding electric devices. In the areas of poor power quality, it is suggested to install an AC input electric reactor or current harmonic filter. Due to the influence of harmonic, option of input leakage breaker should refer to related description of main loop input side wires.
As current in motor power cable contains higher harmonic, it is likely to result in misoperation of relay due to resonance. It is necessary to reduce carrier frequency or install an output reactor. It is suggested not to install a thermal relay before motor but apply overcurrent protection function of inverter instead.

8.3.2 Electromagnetic Interference and Installation Notes

1. Inverter and other electric products should be reliably grounded. When EMC filter is applied, it is a must to apply permanent fixed ground joint which is not connected by connector.
2. Input and power cable of inverter should be separated from weak current signal line (e.g. control signal cable). If possible, weak current signal line should be wired alone in metal wiring duct.
3. It is suggested to apply shielded cable or sheathed cable as input and motor power cable of inverter. Shielding layer or sheath of cable should be reliably grounded. For interference-vulnerable weak power signal wire, it is suggested to apply shielded twisted-pair and shielding

layer should be reliably grounded.

4. For the length of motor cable longer than 50m, output filter or electric reactor is required.

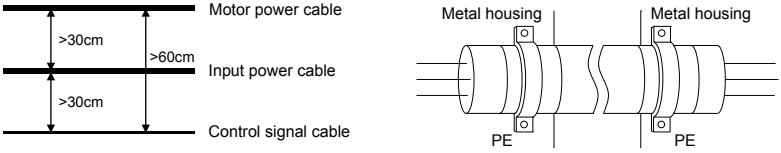
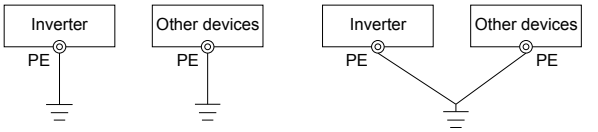


Fig 8-1 wiring requirement and shielded grounding way

8.3.3 Grounding

1. It is suggested that inverter and other devices should be grounded, if a common grounding point is required, single-point grounding should be applied. Common grounding wire is not recommended.
2. Try to select large-section grounding cable to make sure grounding impedance is small as possible. As flat conductor has smaller high frequency impedance than round conductor even though both have the same section, flat conductor is recommended. Grounding cable should be as short as possible and grounding point should be close to inverter as much as possible.
3. If 4-core cable is applied as motor power cable, the ground wire of 4-core cable must be grounded at inverter side and the other end is connected to grounding terminal of motor; if motor and inverter has exclusive grounding point separately, the best grounding effect can be achieved.
4. If the grounding terminals of all parts are connected together, the noise source caused by grounding leakage current will affect other peripheral devices in control system. Therefore, in the same control system, the grounding of inverter and weak-current devices, such as computer, sensor or audio equipment, must be separated.
5. To obtain lower high-frequency impedance, fixed bolts of each device can be treated as the high-frequency terminals connecting to the rear of cabinet. Must eliminate the insulation varnish on fixed points in installation.
6. Grounding cable should be kept away from the wires of noise-sensitive devices and grounding wire should be kept as short as possible.



Correct grounding way of inverter and other devices

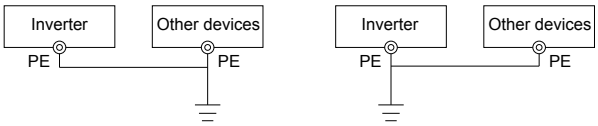


Fig 8-2 incorrect grounding way of inverter and other devices

8.3.4 Solutions of electromagnetic interference from surrounding electric equipment

Relay, contactor and electromagnetic brake in the surrounding of inverter may cause electromagnetic interference. When inverter performs faulty action due to electromagnetic interference, it is suggested to apply the following methods:

1. Install a surge suppressor to the components which may cause interference.
2. Install an EMC filter to the output power cable. Detailed operation will be introduced later.
3. Control signal and detection circuits should be connected by shielded wire or twisted-pair. Shielding layer of shielded wire should be reliably grounded (360oarticulated).

8.3.5 Solutions to electromagnetic interference from surrounding devices

The electromagnetic interference from surrounding devices can be divided into two types: conducted interference and radiated interference. Solutions are provided basic on different situations.

1. Signal from measuring instrument, appliance, receiver and sensor is usually weak current signal. If this type of signal is too close to inverter or exists in the same control cabinet, it is likely to be disturbed and performs false operation. It is suggested to keep weak-current signal away from interference sources as much as possible; do not bind weak-current signal wire and power cable together; signal wire should be shielded wire or twisted-pair, and shielded layer of shielded wire should be reliably grounded (360oarticulated); power cable should be twined by ferrite cores (Ni-Zn magnet ring, blanketing frequency above 30MHz). To obtain better effect, EMC filter will do.
2. When disturbed equipment and inverter is supplied by the same power source, it is likely to cause conducted interference. It is suggested to install an EMC filter to output terminal. Detailed operation will be introduced in the last section of this chapter.
3. Peripheral equipment is grounded alone to reduce common-mode interference caused by common ground impedance.

8.3.6 Leakage current and solution

There is distributed capacitance between power cable and ground. The longer power cable is, the larger capacitance between power cable and ground will be; the higher carrier frequency, the greater leak current will be. Leakage current can be reduced by shortening power cable and reducing carrier frequency. But, reducing carrier frequency may increase motor noise. A balance should be achieved between both.

8.3.7 Notes of installing EMC filter to power input terminal

1. Strictly conform to rated value of filter; as filter is one of type I electric appliances, metal housing should have good contact with grounding end of cabinet with good grounding continuity; otherwise, there is risk of electric shock and EMC effect would be seriously affected.
2. Filter grounding and inverter PE terminal must be connected to a common ground; otherwise, EMC effect would be seriously affected.
3. In the cabinet, installation position of filter should be close to input power cable entry and power input wire of filter should be kept as short as possible inside cabinet.
4. If input and output wire of filter is too close, high-frequency interference will bypass filter; input and output wire of filter will be directly coupled and power filter will be out of action.
5. The housing of filter is usually equipped with an exclusive grounding terminal. But, if filter is connected to control cabinet housing by a lead, it is useless for high-frequency interference because a long lead has very large high-frequency impedance and cannot play the role of bypass. The correct installation is attaching filter housing in large area to conductive surface of metal housing. Please eliminate insulation varnish in installation to ensure reliable connection.

Chapter 9 optional accessories

ES300 series current vectorial inverter (Below 22KW) provides built-in braking unit and user can choose the brake resistor of different resistance values and powers. But, resistance value must be no smaller than the recommended value of table 9-1 and power of brake resistor can be larger. Option of brake resistor should be basic on motor generation power in actual application system, and is related with system inertia, deceleration time, load energy and so on.
User should make option by practical situation. The greater system inertia is, the shorter deceleration time will be and more frequent braking will be, and the greater power and smaller resistance value brake resistor should have.

Table 9-1 brake resistor model options of ES300 series current vectorial inverter

Inverter model	Recommended power for brake resistor	Recommend resistance for brake resistor
DRS ES300-2T-011G/015P	2,000W	32Ω
DRS ES300-2T-015G/018P	2,200W	28Ω
DRS ES300-2T-018G/022P	3,000W	24Ω
DRS ES300-2T-022G/030P	4,500W	16Ω
DRS ES300-2T-030G/037P	5,500W	13Ω
DRS ES300-2T-037G/045P	1,500W	9Ω
DRS ES300-2T-045G/055P	9,300W	6.8Ω
DRS ES300-2T-055G/075P	11,000W	6.2Ω
DRS ES300-2T-075G/090P	13,000W	4.7Ω
DRS ES300-2T-090G/110P	15,000W	3.9Ω
DRS ES300-2T-110G/132P	18,500W	3.Ω
DRS ES300-2T-132G/160P	22,500W	2.4Ω
DRS ES300-2T-160G/185P	30,000W	2Ω
DRS ES300-3T-0R7G/1R5P	150W	750Ω
DRS ES300-3T-1R5G/2R2P	300W	400Ω
DRS ES300-3T-2R2G/4R0P	400W	250Ω
DRS ES300-3T-4R0G/5R5P	500W	150Ω
DRS ES300-3T-5R5G/7R5P	600W	100Ω
DRS ES300-3T-7R5G/011P	780W	75Ω
DRS ES300-3T-011G/015P	1,200W	50Ω
DRS ES300-3T-015G/018P	1,500W	40Ω
DRS ES300-3T-018G/022P	2,000W	32Ω
DRS ES300-3T-022G/030P	2,200W	28Ω
DRS ES300-3T-030G/037P	3,000W	24Ω
DRS ES300-3T-037G/045P	3,700W	20Ω
DRS ES300-3T-045G/055P	4,500W	16Ω
DRS ES300-3T-055G/075P	5,500W	13Ω
DRS ES300-3T-075G/090P	7,500W	9Ω

Inverter model	Recommended power for brake resistor	Recommend resistance for brake resistor
DRS ES300-3T-090G/110P	9,300W	6.8Ω
DRS ES300-3T-110G/132P	11,000W	6.2Ω
DRS ES300-3T-132G/160P	13,000W	4.7Ω
DRS ES300-3T-160G/185P	15,000W	3.9Ω
DRS ES300-3T-185G/200P	15,000W	3.9Ω
DRS ES300-3T-200G/220P	18,500W	3Ω
DRS ES300-3T-220G/250P	20,000W	2.7Ω
DRS ES300-3T-250G/280P	22,500W	2.4Ω
DRS ES300-3T-280G/315P	25,500W	2Ω
DRS ES300-3T-315G/355P	30,000W	1.8Ω
DRS ES300-3T-355G/400P	33,000W	1.5Ω
DRS ES300-3T-400G/450P	42,000W	1.2Ω
DRS ES300-3T-450G/500P	42,000W	1.2Ω
DRS ES300-3T-500G/560P	42,000W	1.2Ω
DRS ES300-3T-560G/630P	50,000W	1Ω
DRS ES300-3T-630G/710P	50,000W	1Ω

Note: the lead connecting brake resistors is required to stand voltage above AC450V and temperature 105℃ .

Appendix A ModBus Communication Protocol

1. Introduction

ES300 series current vectorial inverter provides RS485 serial port communication interface which obeys byMODBUS communication protocol. User can embody centralized control by computer or PLC by setting operation command, modifying or reading function code parameters, reading work status and fault information of inverter. The ES300 series current vectorial inverter can work as the host and facilitates synchronous operation of multiple inverters.

2. Serial port data format

User can set related communication parameters by parameter setting of P09.XX communication function group.
Local address: supports 1 ~ 247 (cannot conflict other devices in the network). When the value is set as 0, it is broadcasting address.
Communication Baud rate: 4800, 9600, 19200 or 38400bps.
Communication format: no parity: 1+8+1
Even parity check: 1+8+1+1
Odd parity check: 1+8+1+1
Master-slave communication way: can work as master or slave.

3. Protocol frame format

Frame start ≥ 3.5 character interval	Salve address (1byte)	Function code (1byte)	Data (Nbyte)	CRC16 (2byte)	Frame end ≥ 3.5 character interval

4. Supported function codes

ES300 series current vectorial inverter supports 4 types of MODBUS-RTU function codes.
Function code: 0x03registermulti-read operation, 8 continuous function codes at most.
Case 1 master sends frame: read the set frequency and load speed of inverter from No.10 (0AH), namely reading the content of first 2 bytes from register address 0F02H.

Byte order	Data meaning	Data value
1	Slave address	0AH
2	MODBUS function code	03H
3	Visiting address (high bytes)	0FH
4	Visiting address (low bytes)	02H
5	Reading bytes (high bytes)	00H
6	Reading bytes (low bytes)	02H
7	CRC (low bytes)	67H
8	CRC (high bytes)	A4H

Slave return frame: No.10 inverter operates successfully. Return set frequency 50.00Hz and load speed 1500RPM.

Byte order	Data meaning	Data value
1	Slave address	0AH
2	MODBUS function number	03H
3	Return to number of bytes	04H
4	0D00 high bytes	13H
5	0D00 low bytes	88H
6	0D01 high bytes	05H
7	0D01 low bytes	DCH
8	CRC (low bytes)	C6H
9	CRC (high bytes)	94H

Function code: 0x06 single register write operation, only writing 1 function code at a time.
Case 2: master sends frame: set the acceleration time 1 (P00.13) of No.10 (0AH) inverter as 15.00S, namely writing in 05DCH in address 000DH.

Byte order	Data meaning	Data value
1	Slave address	0AH
2	MODBUS function number	06H
3	Visiting address (high bytes)	00H
4	Visiting address (low bytes)	0DH
5	Write-in data (high bytes)	05H
6	Write-in data (low bytes)	DCH
7	CRC (low bytes)	1BH
8	CRC (high bytes)	BBH

Slave returns frame: No.10 inverter operates successfully. Return acceleration time 1 (P00.13) is 15.00S.

Byte order	Data meaning	Data value
1	Slave address	0AH
2	MODBUS function number	06H
3	Visiting address (high bytes)	00H
4	Visiting address (low bytes)	0DH
5	Write-in data (high bytes)	05H
6	Write-in data (low bytes)	DCH
7	CRC (low bytes)	1BH
8	CRC (high bytes)	BBH

Function code: 0x010registermulti-read operation, 8 continuous function codes at most.
Case 2 master sends frame: set the acceleration time 2 (P08.04) and deceleration time 2 (P08.05) of No.10 (0AH) register as 15.0S, namely write in the first 2 registers starting from0804H with O5DCH.

Byte order	Data meaning	Data value
1	Slave address	0AH
2	MODBUS function number	10H
3	Visiting address (high bytes)	08H
4	Visiting address (low bytes)	04H
5	Register number (high bytes)	00H
6	Register number (low bytes)	02H
7	Write-in data byte number	04H
8	First data (high bytes)	05H
9	First data (low bytes)	DCH
10	Second data (high bytes)	05H
11	Second data (low bytes)	DCH
12	CRC (high bytes)	E2H
13	CRC (high bytes)	C2H

Slave returns frame: No.10 inverter operates successfully. Return to operate starting address of register and the number of registers.

Byte order	Data meaning	Data value
1	Slave address	0AH
2	MODBUS function number	10H
3	Visiting address (high bytes)	08H
4	Visiting address (low bytes)	04H
5	Register number (high bytes)	00H
6	Register number (low bytes)	02H
7	CRC (low bytes)	03H
8	CRC (high bytes)	12H

Function code: 0x08 loop diagnosis test is applied to detect the fault of serial communication. Frame is required to return in original state. Sent frame from master and returned frame from slave is shown as follow (No.10 inverter for example)

Byte order	Data meaning	Data value
1	Slave address	0AH
2	MODBUS function number	08H
3	Test code (high bytes)	00H
4	Test code (low bytes)	00H
5	Test data (high bytes)	22H
6	Test data (low bytes)	02H
7	CRC (low bytes)	78H
8	CRC (high bytes)	11H

5. Mapping range of communication register

To avoid frequent read and write in EEPROM and improve its service life and reliability, inverter provides 2 storage spaces for all parameter codes and 2 additional special registers.

Register	Mapping address	Description
Parameter code (EEPROM)	0000H ~ 0E05H	The mapping of related parameter codes opened in EEPROM; High byte is relative to parameter function group and low byte is relative to parameter function code. For example: Communication address of P00.05 consists of high digit 00H and low digit 05H, namely, mapping address is 0005H. Communication address of P13.17 consists of high digit 0DH and low digit 11H, namely, mapping address is 0D11H.
Parameter code (RAM)	2000H ~ 2E05H	The mapping of related parameter codes opened in RAM; High byte is relative to parameter function group and low byte is relative to parameter function code. For example: Communication address of P00.05 consists of high digit 20H and low digit 05H, namely, mapping address is 2005H. Communication address of P13.17 consists of high digit 2DH and low digit 11H, namely, mapping address is 2D11H.
Exclusive control register	4000H	User can write in following data to exclusive control register to implement related functions: 0000H: invalid command 0001H: forward rotation operation 0002H: reverse rotation operation 0003H: forward rotation jog 0004H: reverse rotation jog 0005H: slave stop 0006H: stop in deceleration 0007H: free stop 0008H: fault reset 0009H: positive/negative input switching 000AH: reserved 000BH: reserved
Exclusive state register	4100H	User can get to know work status of inverter by reading the data of exclusive state register through 0x03: 0000H: parameter setting 0001H: slave operation 0002H: jog operation 0003H: self-identification operation 0004H: slave stop 0005H: jog stop 0006H: fault status 0007H: inverter self-inspection

6. Communication error

When slave inverter cannot respond to the command sent by master, return to abnormal response frame. The format is as follow (assume that slave is No.10 inverter):

Byte order	Data meaning	Data value
1	Slave address	0AH
2	Response code	MODBUS function code + 80H
3	False code	01H: illegal function number 02H: illegal data address 03H: illegal data 04H: slave operation fails 05H: command is valid and being processed 06H: slave busy 10H: frame fault 11H: parameter read-only 12H: unchangeable in parameter operation 13H: parameter is protected by password
4	CRC (low bytes)	--H
5	CRC (high bytes)	--H

C language code of CRC16:

```
unsigned short GetCRC ( unsigned char *data,unsigned short length )
{
unsigned short j;
unsigned short crc = 0xFFFF;
while( length --)
{
crc ^= *data ++;
for( j = 0; j < 8; j ++ )
{
if( crc & 0x01 )
{
        crc = ( crc >> 1 ) ^ 0xa0001;
}
else
{
crc = crc >> 1;
}
}

}
return ( crc );
}
```

DIRISE
Electric

SHENZHEN DIRISE ELECTRIC TECHNOLOGY CO., LTD
R &D Center:Room 0411, Building 6, Skyworth Innovation Valley, Baoan District, Shenzhen.
Shenzhen switchboard：0755-2605 2805
Http：http://www.dirise.cn

DONGGUAN DIRISE ELECTRIC EQUIPMENT MANUFACTURING CO.,LTD
production base:No.11 SangYuan Road,ChenWu Village,HouJie Town,DongGuan City
Dongguan switchboard：0769-8588 7800
Http：http://www.dirise.cn