Goodrive5000 Series Medium Voltage Variable-frequency Speed Regulation System

User Manual

SHENZHEN INVT ELECTRIC CO., LTD.

No.	Change description	Version	Release date
1	First release.	V1.0	April 2023
2	● Moved the original section 2.4.4 Product outline to section 2.4.3, and updated the data in Table 2-3. ● Updated the direction description of user power supply in Table 3-3. ● Updated the UI images in section 3.3. ● Added function code group P25 and updated some function codes. ● Updated the description in section 10.4.2.	V1.1	April 2024
3	● Modified section 3.1.3 Control system. ● Modified the caption of Table 3-4. ● Modified the fastening torque requirements in section 4.3.2.3. ● Modified section 4.3.3 Secondary wiring. ● Modified the function codes for P06 group. ● Modified Appendix B Communication expansion card.	V1.2	February 2025

Preface

Thank you for purchasing INVT Goodrive5000 medium voltage variable-frequency speed regulation system.

For ease of use, read the manual carefully before using Goodrive5000 product.

As an upgrade product of GD5000 series medium voltage VFD, Goodrive5000 medium voltage variable-frequency speed regulation system inherits the high reliability feature of Goodrive5000 platform but optimizes the software, structure, and components, achieving more compact structure, easier installation and maintenance, and optimum protection.

- With mature power unit series technology, high power factor and high fault tolerance rate.
- With the DSP+FPGA+ARM tripe-core technology, advanced control algorithm, high control accuracy, fast dynamic response and large low frequency output torque.
- With optimized structure layout + distributed cables, smaller size and better heat dissipation.
- With Upgrade touch screen program, configuration programming and more convenient maintenance.

Goodrive5000 medium voltage variable-frequency speed regulation system can be widely applied in the following industries.

Thermal power generation: Induced-draft fan, FD (forced draught) fans, primary air fans, secondary air fans, feed pumps, circulating pumps, condensate pumps, mortar pumps, etc.

Cement: High temperature fans, kiln head exhaust fans, kiln end exhaust fans, coal mill circulating fans, raw material mill circulating fans, cement mill circulating fans, ball mills, etc.

Metallurgy: Blast furnace blowers, main sintering fans, coke-oven blowers, dust removal fans, ring cooling fans, combustion fans, circulating water pumps, slag pumps, rolling mills, etc.

Chemical industry: Desulfurization fans, nitrogen compressors, CO_2 compressors, ammonia compressors, other medium compressors, gas fans, circulating water pumps, etc.

Mining: Main ventilators, gas pumps, pressure fans, exhaust fans, air compressors, drainage pumps, medium pumps, belt conveyors, etc.

Petrochemical industry: Main pipeline pumps, oil-well pumps, medium pumps, circulation pumps, booster pumps, compressors, etc.

Water industry: Submersible pumps, clear water pumps, sewage pumps, oxygen delivery blowers, etc.

Others: Fans, pumps of pharmaceutical, paper making and other industries, and other loads such as wind turbines and dynamometers.

This manual is Goodrive5000 medium voltage variable-frequency speed regulation system manual, presenting safety precautions, product information, mechanical and electrical installation, device commissioning, and precautions related to daily maintenance. Read through this manual carefully before installation to ensure the product is installed and operated in a proper manner to give full play to its excellent performance and powerful functions. If you have any question about the function and performance of the product, please consult our technical support.

If the product is ultimately used for military affairs or weapon manufacture, comply with the export control regulations in the Foreign Trade Law of the People's Republic of China and complete related formalities.

To continuously improve the performance of the product to meet higher application requirements, we reserve the right to continuously improve the product and accordingly the product manual, which may be made without prior notice. We have the final interpretation of the manual content.

Contents

1 Precautions

This chapter describes safety precautions that are very important for safety and must be compliant.

Marking conventions

Safety precautions and warning labels are posted on the outside of each cabinet, on the inner side of power unit cabinet door, and on the front of the power unit.

	Danger	Personal injury or even death will be caused by incorrect operations or mishandling.
	Note	Ignoring dangerous situations may lead to personal injury or serious equipment damage.
	Electrostatic sensitive	The PCBA may be damaged if related requirements are not followed.
	Medium voltage danger!	Do not open the door in power-on state. You can open the cabinet door for maintenance and other actions only after all power has been disconnected at least 15 minutes.
	Electric shock danger!	Non-professionals cannot perform the work.
	Warning	This equipment has more than two power supplies. To avoid electric shock, disconnect all power supplies before maintenance.

Before maintenance, the main circuit breaker must be disconnected and the main circuit must be in discharge state. Grounding and other related measures must be taken.

About application

Attention
● Before installation, wiring, running or maintenance, please read this manual carefully to ensure proper use. You must also be familiar with the driven load and all relevant safety precautions when using it. ● Disconnect the equipment before performing the insulation test. The product has been tested for voltage resistance at the factory, so there is no need to perform the voltage resistance test again, and it should be noted that ambient temperature and humidity can affect the insulation resistance. ● When the product runs under the grid where phase lines are grounded or runs under the IT grid and a grounding fault occurs, excessive voltage to ground may cause damage to the insulation of the motor.

Danger
● The medium voltage variable-frequency speed regulation system is only applicable to three-phase medium voltage asynchronous and synchronous motors, disallowing other purposes of use; otherwise, danger may result. ● In applications where the failure of this product could cause accidents or losses, appropriate safety measures must be in place.

- Do not touch the machine after power-on, otherwise, electric shock may occur.
- Anyone wearing or implanted with electronic medical devices should stay away from the variable-frequency speed regulation system, motors, and power cables during system operation, because the presence of electromagnetic field may interfere with the proper operation of medical devices.

Electrostatic sensitive

- Strong electric fields or electrostatic discharges may damage individual components, integrated circuits, modules or devices, resulting in functional failure.
- Electronic components, modules or equipment shall be placed on conductive matting (workbenches with anti-static matting, conductive anti-static foam materials, anti-static packing bags, etc.).

About delivery

Attention

- When moving, transporting and placing equipment, the equipment placement position should be kept level and flat.
- When lifting equipment, ensure that the power of lifting equipment is sufficient and that the lifting and lowering process is smooth.
- Do not drop (or leave) foreign objects such as wires, paper, metal shavings, and tools in the variable-frequency speed regulation system.

About installation

Danger

- The grounding wire must be configured in strict accordance with the technical requirements of the manual and national standards.
- Only trained and qualified professionals can perform the wiring.
- Ensure there is no voltage input to the control circuit and the main circuit before you can operate.
- Input and output cables must be wired according to the instructions and cannot be connected incorrectly; otherwise, equipment may be damaged.
- Ensure that the input power supply meets the requirements of the product specifications.
- The variable-frequency speed regulation system shall be installed on fire-retardant materials, such as metal bracket.
- Do not place flammable objects including drawings and manual in or near the cabinet of the variable frequency speed regulation system.
- Do not install or run a variable-frequency speed regulation system whose components are damaged.

About wiring

Danger
● A medium voltage circuit breaker for circuit protection must be configured on the power side of the medium voltage variable-frequency speed regulation system. ● The grounding wire must be reliably connected. ● Wiring operations must be carried out under the guidance of our professional staff and in accordance with the relevant electrical safety operation standards. ● Wiring operations can be performed only after the equipment has been installed properly. ● The input power phases and rated input voltage of the power supply must be consistent with the rated values of the variable-frequency speed regulation system. ● The output terminals (U, V, and W) cannot be connected to an AC power supply. ● The input and output cables must meet the insulation and capacity requirements in the relevant national or industry standards.

About operating and running

Danger
● The medium voltage variable-frequency speed regulation system can be connected to the power only after each electrical cabinet door is closed , and the cabinet doors cannot be opened any more upon the power-on. ● Operate in accordance with medium voltage operation specifications. Do not touch a switch with wet hands. ● In the event of a trip restart, the designed peripheral system must be able to protect the safety of people and equipment. ● Do not touch the terminals of the medium voltage variable-frequency speed regulation system that is connected to the power because the terminals may be live even if they are in the stop state. ● Do not start or stop the medium voltage variable-frequency speed regulation system by connecting or disconnecting the main circuit. ● Do not disconnect the fan power while it is running; otherwise, overheating may result, which causes equipment damage. ● Ensure that the room for hosting the system is well ventilated so that the ambient temperature is within the range of -5°C–+40°C. ● The operations on transformer cabinets, power unit cabinets or bypass cabinets must comply with medium voltage operating procedures. ● The transformer cabinet, power unit cabinet, and bypass cabinet of the product are medium voltage danger areas, and the cabinet doors cannot be opened upon power-on (the system has been configured with locking devices). ● Guardrails (marked with medium voltage danger signs) must be installed at the necessary locations and they cannot be removed while the equipment is running.

About maintenance and component replacement

Danger
● Only qualified personnel can perform maintenance and component replacement in accordance with the relevant operating procedures.
● Do not touch any cabinet part if you are not sure whether there is voltage in the cabinet or whether the temperature is high.
● The grounding resistance should be checked frequently to check whether it meets the requirements of equipment operation and national standards. Non-compliance may cause danger.

About disposal

Attention
● Dispose of scrap components or parts as industrial waste.

2 Product overview

2.1 Product overview

As the medium voltage variable-frequency speed regulation system that INVT develops, designs and produces, Goodrive5000 product adopts advanced high performance vector control mode and simultaneously it is compatible with V/F control vectorization. The product features high-quality input, high power factor and excellent power output, and it also has the advantages of high control precision, quick dynamic torque response and large low-frequency output torque. The product can meet the application requirements of modern industry for energy saving and process speed regulation of large and medium-sized fans and general machinery such as pumps, and is widely used in electric power, metallurgy, mining, building materials, petrochemical, municipal engineering and other industries.

2.2 Product features

Goodrive5000 medium voltage variable-frequency speed regulation system is a medium voltage driving device that INVT develops, designs and produces to control three-phase AC (synchronous/asynchronous) motor speed, featuring:

- Independently-developed high-performance vector control technology (for asynchronous/synchronous motors), high-precision, and fast dynamic response.
- Embedded PID regulator, implementing closed-loop run.
- Compatible with V/F control vectorization. Optimized V/F control technology, making V/F control dynamic response performance close to that of vector control. Automatic torque boost at low frequency helps to obtain good low-frequency torque characteristics.
- Excellent low-frequency compensation performance. Outstanding output performance obtained in vector control or V/F control by using advanced dead-zone compensation and low-frequency oscillation suppression algorithm.
- Retention at transient voltage drop. The system does not stop if the main circuit encounters a power failure. This eliminates the device stop due to a sudden power failure.
- Optimized overvoltage stall protection. It is a control technique that uses closed-loop bus voltage to decelerate quickly without reporting an overvoltage fault.
- Master-slave control. It implements power balancing of multiple motors.
- Statistics on variable-frequency electricity consumption.
- V/F separation (suitable for power industry)
- One-driving-more bypass cabinet control.
- Braking energy equalization balances the braking energy absorbed by each power unit to lower the overvoltage point.
- Automatic voltage regulation (AVR) on output voltage. It accurately controls the output voltage and improves the motor control characteristics.
- Strong voltage adaptability. The system adapts to a wide range of input voltage, applicable to domestic and international grid voltage conditions.
- Speed-tracking restart for all frequency bands. This allows a running motor to restart, meeting production continuity requirements.
- Synchronous switchover. This implements the no-disturbance switchover between the power

frequency and variable frequency, reducing the impact on mechanical equipment and grid.

- Multiple communication modes. Modbus-RTU, PROFIBUS-DP (optional), PROFINET (optional), and Ethernet UDP (optional).
- Modular structure design, facilitating maintenance.
- The detachable ventilating window mounted externally is convenient for dedusting and maintenance.
- Touch screen display in Chinese, graded menu is easy to operate.
- Dual redundancy of control power, interlock protection against faults.

In addition to the preceding advantages, Goodrive5000 medium voltage variable-frequency speed regulation system has the following protection functions and features:

- Real-time monitoring on run parameters, real-time recording of run data, alarm and fault protection, and fault querying.
- Overload and overcurrent protection.
- Protection against input phase loss.
- Protection against overvoltage, undervoltage, overtemperature, and overspeed.
- High reliability for using optic-fiber isolation communication.

2.3 Technical parameters

See technical parameters of Goodrive5000 medium voltage variable-frequency speed regulation system in the following table.

Item		6kV	10kV
Input	Rated input voltage	AC 3PH 6kV	AC 3PH 10kV
	Voltage fluctuation range	-10%–+10%	
	Input frequency	50/60Hz; ±5%	
	Input power factor	⩾ 0.96 (load of 20%–100%)	
	Input current harmonic	Meets IEEE519-2014 and GB/T14549-93 standards	
Output	Output voltage range	0–6kV	0–10kV
	Output current range	See section 2.4.4 Product specifications and dimensions.	
	Output capacity range	0–5600kVA	0–10000kVA
	Output power range	0–4500kW	0–8000kW
	Output frequency range	0–120Hz (The product needs to be customized when the frequency exceeds 120Hz)	
	Output current harmonic	⩽2%	
Control performance	Control mode	V/F control, open-loop vector control, and closed-loop vector control.	
	Control system	DSP, FPGA, ARM	
	HMI	Touch screen	
	Adjustable-speed ratio	1:50 (V/F); 1:100 (open-loop vector control); 1:200 (closed-loop vector control)	
	Speed control accuracy	±1% of max. speed (V/F); ±0.4% of max. speed (open-loop vector control); ±0.2% of max. speed (closed-loop vector control)	
	Torque response time	< 200ms (open-loop vector control); < 100ms (closed-loop vector control)	

Item		6kV	10kV
	Overload protection	120%: 60s (every 10 minutes) 180%: immediate protection is carried out.	
	ACC/DEC time	0–3600s, customized	
Signal I/O	Digital input	12 digital inputs	
	Digital output	10 relay outputs (5 NO, 5 NO/NC). It can be extended to 12 outputs.	
	Analog input	Four inputs: AI1, AI2, AI3 (0–10V/4–20mA); AI4 (-10V–10V)	
	Analog output	Three outputs: AO1, AO2, AO3 (0–10V/4–20mA); three outputs: AO4, AO5, AO6* (0–20mA)	
Communication mode		Supports the Modbus protocol, provides the standard RS485 interface, PROFIBUS, PROFINET and Ethernet.	
Protection function	System protection	Including protection against overcurrent, overvoltage, undervoltage, motor overload, variable-frequency speed regulation system overload, and phase loss.	
		Including protection against overheat, temperature controller fault, communication fault, and access fault.	
	Unit protection	Including protection against communication fault, undervoltage, overvoltage, overtemperature, input phase loss, VCE fault, and bypass fault.	
Others	Mounting method	Installed in cabinet	
	Ingress protection (IP) rating	IP30 (The product needs to be customizable for other IP rating)	
	Noise level	≤80dB	
	Incoming/outgoing method	Bottom in and bottom out (The product needs to be customizable for other wiring methods)	
	Cooling method	Forced air cooling	
	Control power	AC 380V±10%	
	MTBF	50000h	
	Temperature of running environment	-10°C–+40°C. Derating is needed when the temperature exceeds 40°C. The max. running temperature is 50°C. **Note:** Preheating is needed before starting when the temperature is below 0°C.	
	Altitude	Below 1000m. Derating is needed when the altitude exceeds 1000m. Derate by 1% for every increase of 100m.	
	Environment	Free of dust, direct sunshine, flammable or corrosive gas, oil pollution, steam and vibration.	
	Vibration amplitude	≤0.59g	

Note: * indicates that AO6 is a dedicated channel for excitation.

2.4 Product model and model selection description

When selecting the models, refer to the rated voltage, current and power of the motors.

Note: Make sure the system capacity is not smaller than the motor capacity.

2.4.1 Product model instruction

The product model definitions of Goodrive5000 series products are shown in Figure 2-1.

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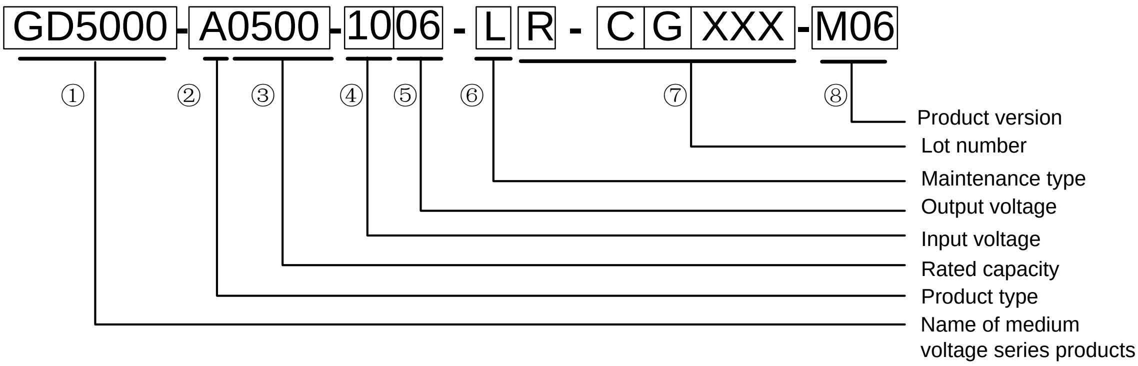
Figure 2-1 Product model definitions of Goodrive5000 series products



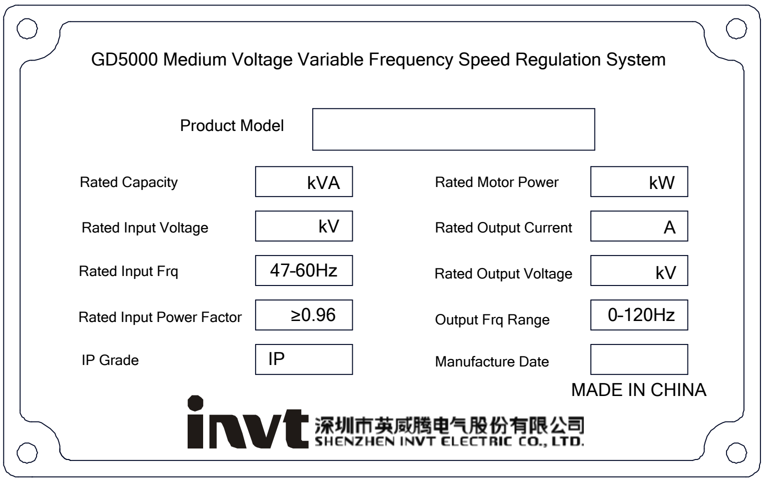
The product model definitions are shown in Table 2-1.

Table 2-1 Model definition description

Symbol	Field description	Definition
①	Product series	GD5000: GD5000 series vector medium voltage VFD
②	Product category	A: Asynchronous vector product (AM) B: Synchronous vector product (SM)
③	Rated capacity	050: 500kVA 10000: 10000kVA
④	Input voltage	03: voltage degree 3kV 66: voltage degree 6.6kV 33: voltage degree 3.3kV 10: voltage degree 10kV 04: voltage degree 4.16kV 11: voltage degree 11kV 06: voltage degree 6 kV When the input voltage is the same as the output voltage, reserve a single voltage value. When the input voltage is different from the output voltage, reserve both voltage values.
⑤	Output voltage	
⑥	Maintenance type	S: Front maintenance D: Dual-side maintenance L: Integrated machine
⑦	Lot number	R: Energy feedback system Default: No energy feedback
		C: Bypass system with unit contactor. Default: Bypass system without unit contactor.
		G: Plateau type Default: Plain type
		F: Film capacitor type Default: Electrolytic capacitor
⑧	Product version	Switching cabinet type 0: No switching cabinet A: Automatic switching cabinet M: Manual switching cabinet — Version 6: 06 7: 07 …
		Note: When the product needs to select the switching cabinet, use one digit to indicate the version, such as GD5000-A0500-10-L-M7. When the product does not select the switching cabinet, use two digits to indicate the version, such as GD5000-A0560-10-L-07.

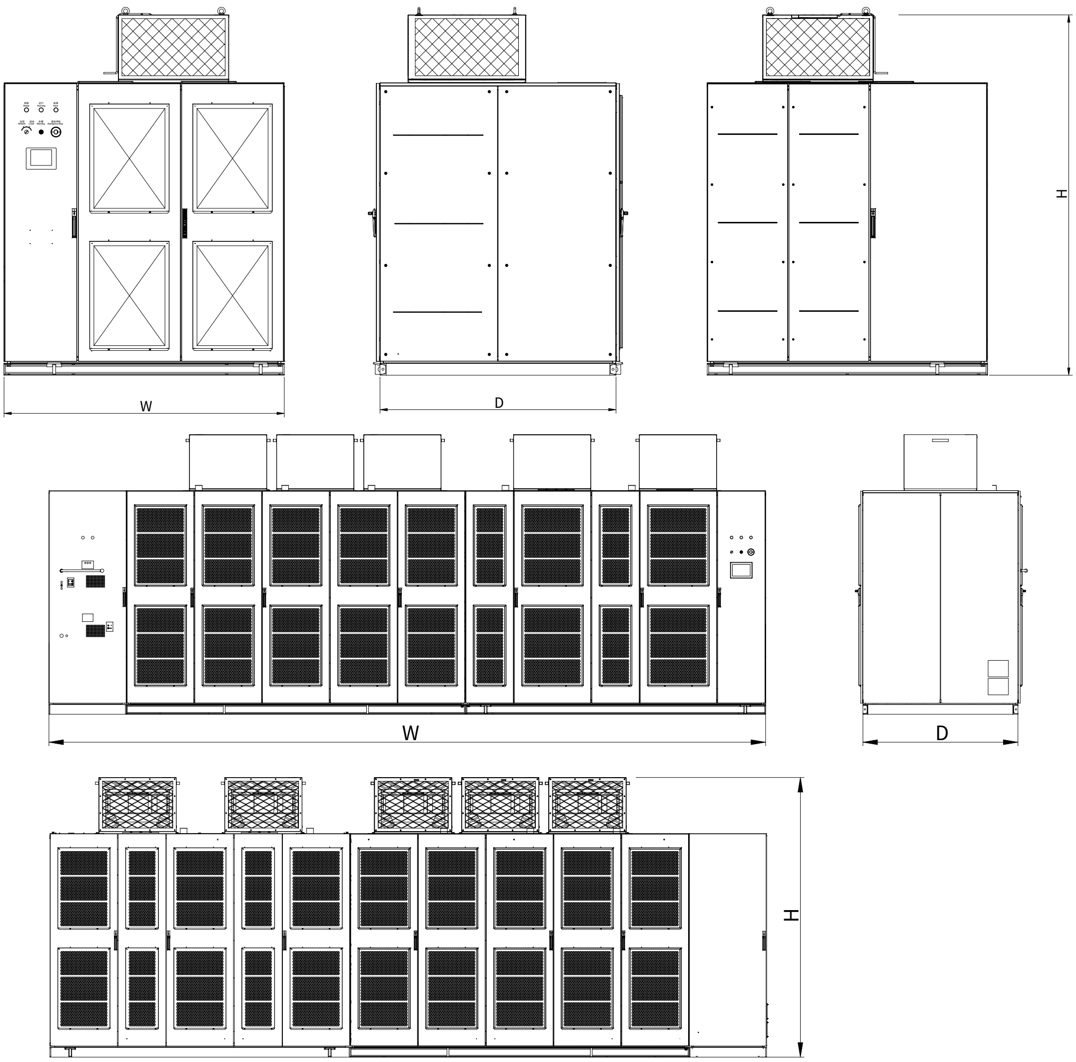
2.4.2 Nameplate model instruction

Figure 2-2 Nameplate of the system



2.4.3 Product outline

Figure 2-3 Outline structure of the system



Note: The outline structure diagram is for reference only.

2.4.4 Product specifications and dimensions

Table 2-2 Specifications of Goodrive5000 integrated machine products (6kV)

Product model	Rated power (kW)	Rated output current (A)	Outline dimensions W×D×H (mm)	Standard weight (kg)
GD5000-A0250-06-L-07	200	24	1900×1600×2422	1513
GD5000-A0315-06-L-07	250	30	1900×1600×2422	1563
GD5000-A0355-06-L-07	280	34	1900×1600×2422	1563
GD5000-A0400-06-L-07	315	38	1900×1600×2422	1578
GD5000-A0500-06-L-07	400	48	1900×1600×2422	1718
GD5000-A0560-06-L-07	450	54	1900×1600×2422	1768
GD5000-A0630-06-L-07	500	61	1900×1600×2445	1845
GD5000-A0710-06-L-07	560	68	1900×1600×2445	1895
GD5000-A0800-06-L-07	630	77	1900×1600×2445	1975
GD5000-A0900-06-L-07	710	87	1900×1600×2445	2055
GD5000-A1000-06-L-07	800	96	1900×1600×2445	2126
GD5000-A1120-06-L-07	900	108	2600×1600×2744	3527
GD5000-A1250-06-L-07	1000	120	2600×1600×2744	3687
GD5000-A1400-06-L-07	1120	135	2600×1600×2744	3987
GD5000-A1600-06-L-07	1250	154	3200×1600×2744	4407
GD5000-A1800-06-L-07	1400	173	3200×1600×2744	4557
GD5000-A2000-06-L-07	1600	192	3200×1600×2744	4797
GD5000-A2240-06-L-07	1800	216	3200×1600×2744	5232
GD5000-A2500-06-L-07	2000	241	3500X1600X2861	4779
GD5000-A0250-06-L-A7	200	24	2600x1600x2422	2063
GD5000-A0315-06-L-A7	250	30	2600x1600x2422	2113
GD5000-A0355-06-L-A7	280	34	2600x1600x2422	2113
GD5000-A0400-06-L-A7	315	38	2600×1600×2422	2128
GD5000-A0500-06-L-A7	400	48	2600×1600×2422	2268
GD5000-A0560-06-L-A7	450	54	2600×1600×2422	2318
GD5000-A0630-06-L-A7	500	61	2600×1600×2445	2395
GD5000-A0710-06-L-A7	560	68	2600×1600×2445	2445
GD5000-A0800-06-L-A7	630	77	2600×1600×2445	2525
GD5000-A0900-06-L-A7	710	87	2600×1600×2445	2605
GD5000-A1000-06-L-A7	800	96	2600×1600×2445	2676
GD5000-A1120-06-L-A7	900	108	3300×1600×2744	4077
GD5000-A1250-06-L-A7	1000	120	3300×1600×2744	4237
GD5000-A1400-06-L-A7	1120	135	3300×1600×2744	4537
GD5000-A1600-06-L-A7	1250	154	3900×1600×2744	4957
GD5000-A1800-06-L-A7	1400	173	3900×1600×2744	5107
GD5000-A2000-06-L-A7	1600	192	3900×1600×2744	5347
GD5000-A2240-06-L-A7	1800	216	3900×1600×2744	5782
GD5000-A2500-06-L-A7	2000	241	4200X1600X2861	5329
GD5000-A0250-06-L-M7	200	24	2600x1600x2422	1893
GD5000-A0315-06-L-M7	250	30	2600x1600x2422	1943
GD5000-A0355-06-L-M7	280	34	2600x1600x2422	1943
GD5000-A0400-06-L-M7	315	38	2600×1600×2422	1958
GD5000-A0500-06-L-M7	400	48	2600×1600×2422	2098

Product model	Rated power (kW)	Rated output current (A)	Outline dimensions W×D×H (mm)	Standard weight (kg)
GD5000-A0560-06-L-M7	450	54	2600×1600×2422	2148
GD5000-A0630-06-L-M7	500	61	2600×1600×2445	2225
GD5000-A0710-06-L-M7	560	68	2600×1600×2445	2275
GD5000-A0800-06-L-M7	630	77	2600×1600×2445	2355
GD5000-A0900-06-L-M7	710	87	2600×1600×2445	2435
GD5000-A1000-06-L-M7	800	96	2600×1600×2445	2506
GD5000-A1120-06-L-M7	900	108	3300×1600×2744	3907
GD5000-A1250-06-L-M7	1000	120	3300×1600×2744	4067
GD5000-A1400-06-L-M7	1120	135	3300×1600×2744	4367
GD5000-A1600-06-L-M7	1250	154	3900×1600×2744	4787
GD5000-A1800-06-L-M7	1400	173	3900×1600×2744	4937
GD5000-A2000-06-L-M7	1600	192	3900×1600×2744	5177
GD5000-A2240-06-L-M7	1800	216	3900×1600×2744	5612
GD5000-A2500-06-L-M7	2000	241	4200X1600X2861	5159

Table 2-3 Specifications of Goodrive5000 separate machine products (6kV)

Product model	Rated power (kW)	Rated output current (A)	Outline dimensions W×D×H (mm)	Standard weight (kg)
GD5000-A2800-06-D-07	2240	270	3800×1600×2862	6328
GD5000-A3150-06-D-07	2500	303	3800×1600×2862	6893
GD5000-A3550-06-D-07	2800	342	4500×1600×2882	7992
GD5000-A4000-06-D-07	3150	385	4500×1600×2882	8817
GD5000-A4500-06-D-07	3550	433	4900×1600×2882	9710
GD5000-A5000-06-D-07	4000	481	4900×1600×2882	10095
GD5000-A5600-06-D-07	4500	539	4900×1600×2882	10400
GD5000-A2800-06-D-A7	2240	270	4500×1600×2862	6878
GD5000-A3150-06-D-A7	2500	303	4500×1600×2862	7443
GD5000-A3550-06-D-A7	2800	342	5300×1600×2882	8732
GD5000-A4000-06-D-A7	3150	385	5300×1600×2882	9557
GD5000-A4500-06-D-A7	3550	433	5700×1600×2882	10450
GD5000-A5000-06-D-A7	4000	481	5700×1600×2882	10835
GD5000-A5600-06-D-A7	4500	539	5700×1600×2882	11140
GD5000-A2800-06-D-M7	2240	270	4500×1600×2862	6708
GD5000-A3150-06-D-M7	2500	303	4500×1600×2862	7273
GD5000-A3550-06-D-M7	2800	342	5300×1600×2882	8622
GD5000-A4000-06-D-M7	3150	385	5300×1600×2882	9447
GD5000-A4500-06-D-M7	3550	433	5700×1600×2882	10340
GD5000-A5000-06-D-M7	4000	481	5700×1600×2882	10725
GD5000-A5600-06-D-M7	4500	539	5700×1600×2882	11030

Table 2-4 Parameters of Goodrive5000 integrated machine products (10kV)

Product model	Rated power (kW)	Rated output current (A)	Outline dimensions W×D×H (mm)	Standard weight (kg)
GD5000-A0250-10-L-07	200	14	1900×1600×2422	1780
GD5000-A0315-10-L-07	250	18	1900×1600×2422	1830
GD5000-A0355-10-L-07	280	20	1900×1600×2422	1830
GD5000-A0400-10-L-07	315	23	1900×1600×2422	1830
GD5000-A0450-10-L-07	355	26	1900×1600×2422	1880
GD5000-A0500-10-L-07	400	29	1900×1600×2422	1915
GD5000-A0560-10-L-07	450	32	1900×1600×2422	1985
GD5000-A0710-10-L-07	560	41	1900×1600×2422	2105
GD5000-A0800-10-L-07	630	46	1900×1600×2422	2135
GD5000-A0900-10-L-07	710	52	1900×1600×2422	2215
GD5000-A1000-10-L-07	800	58	1900×1600×2445	2272
GD5000-A1120-10-L-07	900	65	1900×1600×2445	2312
GD5000-A1250-10-L-07	1000	72	1900×1600×2445	2562
GD5000-A1400-10-L-07	1120	81	1900×1600×2445	2612
GD5000-A1600-10-L-07	1250	92	1900×1600×2445	2743
GD5000-A1700-10-L-07	1400	98	1900×1600×2445	2823
GD5000-A2000-10-L-07	1600	115	2600×1600×2744	4759
GD5000-A2240-10-L-07	1800	129	2600×1600×2744	4964
GD5000-A2500-10-L-07	2000	144	2600×1600×2744	5219
GD5000-A2800-10-L-07	2240	162	3500×1600×2861	5136
GD5000-A3150-10-L-07	2500	182	3500×1600×2861	5586
GD5000-A3550-10-L-07	2800	205	3500×1600×2861	5986
GD5000-A4000-10-L-07	3150	231	3500X1600X2861	6186
GD5000-A0250-10-L-A7	200	14	2600x1600x2422	2330
GD5000-A0315-10-L-A7	250	18	2600x1600x2422	2380
GD5000-A0355-10-L-A7	280	20	2600x1600x2422	2380
GD5000-A0400-10-L-A7	315	23	2600x1600x2422	2380
GD5000-A0450-10-L-A7	355	26	2600x1600x2422	2430
GD5000-A0500-10-L-A7	400	29	2600×1600×2422	2465
GD5000-A0560-10-L-A7	450	32	2600×1600×2422	2535
GD5000-A0710-10-L-A7	560	41	2600×1600×2422	2655
GD5000-A0800-10-L-A7	630	46	2600×1600×2422	2685
GD5000-A0900-10-L-A7	710	52	2600×1600×2422	2765
GD5000-A1000-10-L-A7	800	58	2600×1600×2445	2822
GD5000-A1120-10-L-A7	900	65	2600×1600×2445	2862
GD5000-A1250-10-L-A7	1000	72	2600×1600×2445	3112
GD5000-A1400-10-L-A7	1120	81	2600×1600×2445	3162
GD5000-A1600-10-L-A7	1250	92	2600×1600×2445	3293
GD5000-A1700-10-L-A7	1400	98	2600×1600×2445	3373
GD5000-A2000-10-L-A7	1600	115	3300×1600×2744	5309
GD5000-A2240-10-L-A7	1800	129	3300×1600×2744	5514
GD5000-A2500-10-L-A7	2000	144	3300×1600×2744	5769
GD5000-A2800-10-L-A7	2240	162	4200×1600×2861	5686
GD5000-A3150-10-L-A7	2500	182	4200×1600×2861	6136
GD5000-A3550-10-L-A7	2800	205	4200×1600×2861	6536
GD5000-A4000-10-L-A7	3150	231	4200X1600X2861	6736

Product model	Rated power (kW)	Rated output current (A)	Outline dimensions W×D×H (mm)	Standard weight (kg)
GD5000-A0250-10-L-M7	200	14	2600×1600×2422	2160
GD5000-A0315-10-L-M7	250	18	2600×1600×2422	2210
GD5000-A0355-10-L-M7	280	20	2600×1600×2422	2210
GD5000-A0400-10-L-M7	315	23	2600×1600×2422	2210
GD5000-A0450-10-L-M7	355	26	2600×1600×2422	2260
GD5000-A0500-10-L-M7	400	29	2600×1600×2422	2295
GD5000-A0560-10-L-M7	450	32	2600×1600×2422	2365
GD5000-A0710-10-L-M7	560	41	2600×1600×2422	2485
GD5000-A0800-10-L-M7	630	46	2600×1600×2422	2515
GD5000-A0900-10-L-M7	710	52	2600×1600×2422	2595
GD5000-A1000-10-L-M7	800	58	2600×1600×2445	2652
GD5000-A1120-10-L-M7	900	65	2600×1600×2445	2692
GD5000-A1250-10-L-M7	1000	72	2600×1600×2445	2942
GD5000-A1400-10-L-M7	1120	81	2600×1600×2445	2992
GD5000-A1600-10-L-M7	1250	92	2600×1600×2445	3123
GD5000-A1700-10-L-M7	1400	98	2600×1600×2445	3203
GD5000-A2000-10-L-M7	1600	115	3300×1600×2744	5139
GD5000-A2240-10-L-M7	1800	129	3300×1600×2744	5344
GD5000-A2500-10-L-M7	2000	144	3300×1600×2744	5599
GD5000-A2800-10-L-M7	2240	162	4200×1600×2861	5516
GD5000-A3150-10-L-M7	2500	182	4200×1600×2861	5966
GD5000-A3550-10-L-M7	2800	205	4200×1600×2861	6366
GD5000-A4000-10-L-M7	3150	231	4200X1600X2861	6566

Table 2-5 Specifications of Goodrive5000 separate machine products (10kV)

Product model	Rated power (kW)	Rated output current (A)	Outline dimensions W×D×H (mm)	Standard weight (kg)
GD5000-A4500-10-D-07	3550	260	4700×1600×2745	9376
GD5000-A5000-10-D-07	4000	289	4700×1600×2745	10241
GD5000-A5600-10-D-07	4500	323	4700×1600×2745	10536
GD5000-A6300-10-D-07	5000	364	5600×1600×2882	11112
GD5000-A7100-10-D-07	5600	410	5600×1600×2882	11467
GD5000-A7500-10-D-07	6000	433	6600×1600×2882	14200
GD5000-A8000-10-D-07	6300	462	6600×1600×2882	14430
GD5000-A9000-10-D-07	7100	520	6600×1600×2882	16235
GD5000-A10000-10-D-07	8000	577	6600×1600×2882	16350
GD5000-A4500-10-D-A7	3550	260	5400×1600×2745	9926
GD5000-A5000-10-D-A7	4000	289	5400×1600×2745	10791
GD5000-A5600-10-D-A7	4500	323	5400×1600×2745	11086
GD5000-A6300-10-D-A7	5000	364	6400×1600×2882	11852
GD5000-A7100-10-D-A7	5600	410	6400×1600×2882	12207
GD5000-A7500-10-D-A7	6000	433	7400×1600×2882	14940
GD5000-A8000-10-D-A7	6300	462	7400×1600×2882	15170
GD5000-A9000-10-D-A7	7100	520	7400×1600×2882	16975
GD5000-A10000-10-D-A7	8000	577	7400×1600×2882	17090

Product model	Rated power (kW)	Rated output current (A)	Outline dimensions W×D×H (mm)	Standard weight (kg)
GD5000-A4500-10-D-M7	3550	260	5400×1600×2745	9756
GD5000-A5000-10-D-M7	4000	289	5400×1600×2745	10621
GD5000-A5600-10-D-M7	4500	323	5400×1600×2745	10916
GD5000-A6300-10-D-M7	5000	364	6400×1600×2882	11742
GD5000-A7100-10-D-M7	5600	410	6400×1600×2882	12097
GD5000-A7500-10-D-M7	6000	433	7400×1600×2882	14830
GD5000-A8000-10-D-M7	6300	462	7400×1600×2882	15060
GD5000-A9000-10-D-M7	7100	520	7400×1600×2882	16865
GD5000-A10000-10-D-M7	8000	577	7400×1600×2882	16980

Note:

- The outline dimensions of medium voltage variable-frequency speed regulation system listed in the tables above are standard.
- The outline dimensions of the system can be customized based on user requirements. Dimensions may vary among customized products listed in the catalog.
- If the value exceeds the rated data, please contact us.
- The dimensions may be subject to the technical agreement without notice during improving.

2.5 Product application

Widely used in various industries, Goodrive5000 series products provide perfect medium voltage AC motor (AM/SM) soft-start, speed regulation, energy saving and smart control solutions. The detailed applications are as follows:

Steel/Metallurgy	Air blowers, dusting blowers, ID (induced draft) fans, compression fans, descaling pumps, mud pumps, feed pumps, slag washing pumps, phosphorus removal pumps, rolling mills, etc.
Cement/Building material	High temperature fans, furnace head fans, furnace end fans, dusting blowers, raw meal rolling machine, clinker rolling machine, ore rolling machine, roller press, ball mill, etc.
Thermal power/Hydropower/Garbage power	Boiler induced-draft fans, FD (forced draught) fans, primary air fans, secondary air fans, desulphurization fans, air compressors, boiler feed pumps, condensate pumps, circulating pumps, ash pumps, ozone generator, etc.
Oil/Chemical industry/Natural gas	Water flooding pumps, circulating pumps, oil pipe pumps, submersible pumps, electric submersible pumps, brine pumps, descaling pumps, mud pumps, compressors, etc.
Paper making/Pharmacy	Beating pumps, cleaning pumps, etc.
Coal/mining	Belt conveyors, air exhausters, dusting blower, gas pumps, medium pumps, etc.
Municipal engineering	Domestic water pumps, industrial water pumps, sewage pumps, clean water pumps, purifying pumps, etc.
Others	Power station pumps, wind tunnel test fans, etc.

2.6 Product reference standards

Goodrive5000 integrated machine medium voltage variable-frequency speed regulation system is designed and manufactured with reference to the latest version of national standards (GB or GB/T), International

Electrotechnical Commission (IEC) standards, and International System of Units (SI) as the minimum design specifications, and some of its relevant technical parameters can meet the requirements of GB or GB/T and IEC standards.

Some technical standards for design reference:

IEC 61800-5-1:2007	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
IEC 61800-3-2017	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
IEC 61800-4-2012	Adjustable speed electrical power drive systems. Part 4. General requirements. Rating specifications for a.c power drive systems above 1000 V a.c. and exceeding 35 kV
IEC 60204-1-2016	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 60204-11:2018	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV
IEC 60721-3-1-2018	Classification of environmental conditions - Part 3-1: Classification of groups of environmental parameters and their severities - Storage
IEC 60721-3-2-2018	Classification of environmental conditions - Part 3-2: Classification of groups of environmental parameters and their severities - Transportation and Handling
IEC 60721-3-3-2019	Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weatherprotected locations
IEEE 519-2014	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
IEC 61800-5-1:2007	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
IEC 61800-3-2017	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
IEC 61800-4-2012	Adjustable speed electrical power drive systems. Part 4. General requirements. Rating specifications for a.c power drive systems above 1000 V a.c. and exceeding 35 kV
IEC 60204-1-2016	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 60204-11:2018	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV
IEC 60721-3-1-2018	Classification of environmental conditions - Part 3-1: Classification of groups of environmental parameters and their severities - Storage
IEC 60721-3-2-2018	Classification of environmental conditions - Part 3-2: Classification of groups of environmental parameters and their severities - Transportation and Handling
IEC 60721-3-3-2019	Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weatherprotected locations

IEEE 519-2014	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
GB/T 12668.501-2013	Adjustable speed electrical power drive systems Part 5-1: Safety requirements—Electrical, thermal and energy
GB/T 12668.3-2012	Adjustable speed electrical power drive systems Part 3: EMC requirements and specific test methods
GB/T 1094.1-2013	Power transformers-Part 1: General
GB/T 1094.3-2017	Power transformers-Part 3: Insulation levels, dielectric tests and
GB/T 1094.11-2007	Power transformers-Part 11: Dry-type transformers
GB/T 14549-1993	Quality of electric energy supply harmonics in public supply network
GB/T 3956-2008	Conductors of insulated cables
GB/T 10233-2016	Basic testing method for low-voltage switchgear and controlgear
GB/T 11022-2020	Common specifications for medium voltage switchgear and controlgear standards
GB/T 4208-2017	Degree of protection provided by enclosure (IP code)
GB/T 2423	Environmental testing Part 2: Test methods (series standard)
GB/T 30843.1-2014	Variable-frequency drive above 1 kV and not exceeding 35 kV Part 1: Technical conditions
GB/T 30843.2-2014	Variable-frequency drive above 1 kV and not exceeding 35 kV Part 2: Test methods
GB/T 30843.3-2017	Variable-frequency drive above 1 kV and not exceeding 35 kV Part 3: Safety requirements
GB/T 12668.902-2021	Adjustable speed electrical power drive systems Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications—Energy efficiency indicators for power drive systems and motor starters

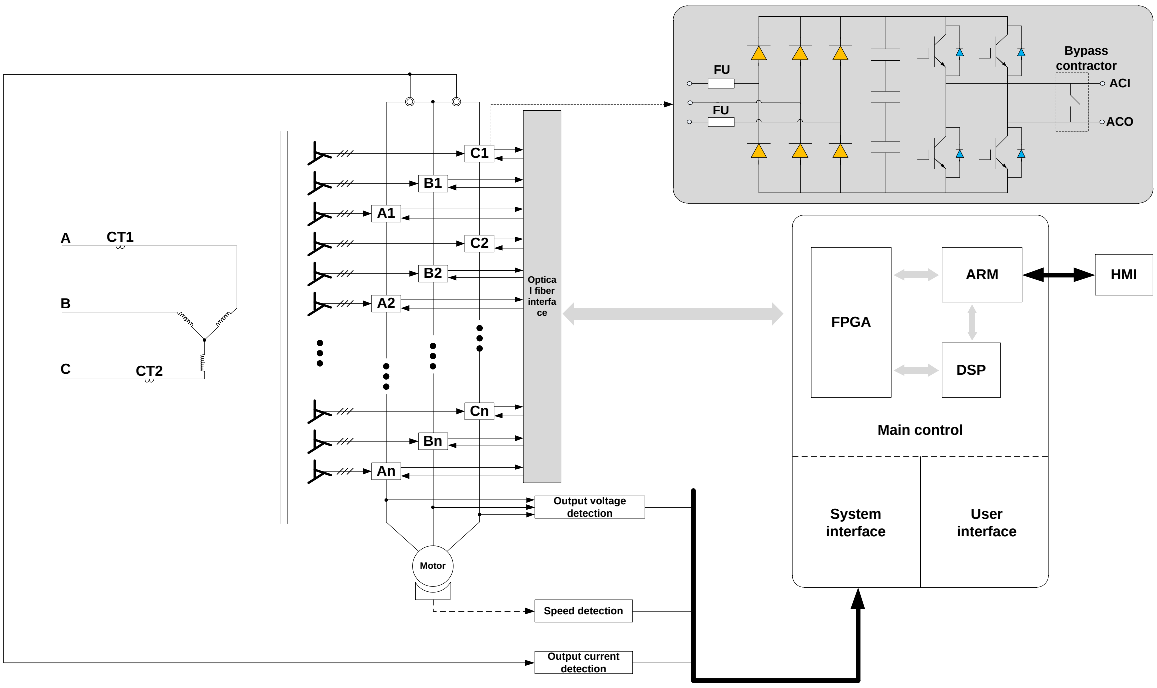
3 Principle and composition

3.1 Product principle

Goodrive5000 integrated machine medium voltage variable-frequency speed regulation system adopts the technology of multi-unit series PWM wave superposition. By power units in series, the input voltage of the grid runs through phase-shifting transformer, becomes 3*N channels 3-phase 690V voltage (N: the number of power units in each phase), and then supplies power to each power unit. The system consists of the main circuit, power units and control system. Each unit uses H-bridge whose PWM output is controlled by the main control system. Connect the unit outputs of the same phase in series, connect the first unit of each phase in "Y", and combine the last units of three phases into medium voltage output. The schematic diagram is shown in Figure 3-1.

3.1.1 Main circuit

Figure 3-1 Topological diagram of the system



The isolation transformer is dry-type phase shifting transformer using forced air cooling, the original side is in "Y" connection directly connected to medium voltage incoming line, and the secondary side winding is in prolonged delta connection with a certain phase difference.

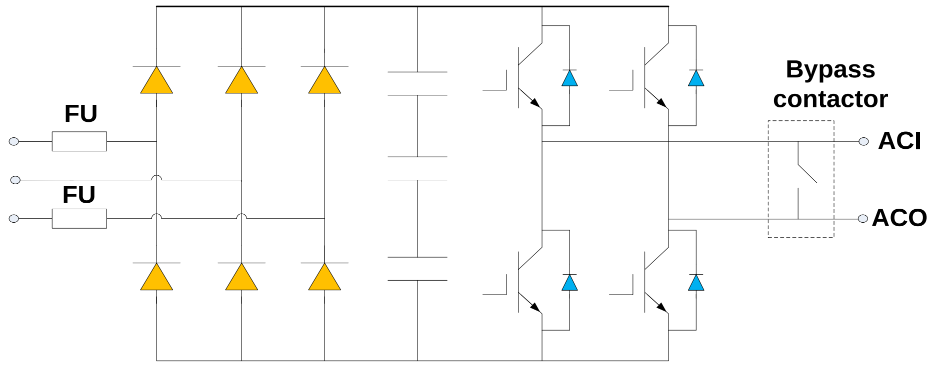
$$\text{Phase} - \text{shifting angle} = \frac{60^{\circ}}{\text{the number of power units in each phase}}$$

The secondary side winding supplies power to the power units and the phase difference is determined by the number of power units and the voltage degree of the variable-frequency speed regulation system.

3.1.2 Power unit

The power units mainly consist of main circuit and control circuit. The main circuit includes protection, rectification, filtering, converting and bypass (optional). Its schematic diagram is shown in Figure 3-2.

Figure 3-2 Schematic diagram of power units



The input terminals R/S/T are connected to 3-phase low voltage output of the secondary coil of the transformer, electrify DC bus after 3-phase full-bridge rectification, and then convert into AC output by H-bridge converting. The output terminal of power units in single phase is ACI/ACO.

The unit control circuit controls the power units by receiving the signals from the main control system, and simultaneously it monitors the power units by sending its own information including voltage, faults and states back to the main control system via optical fiber.

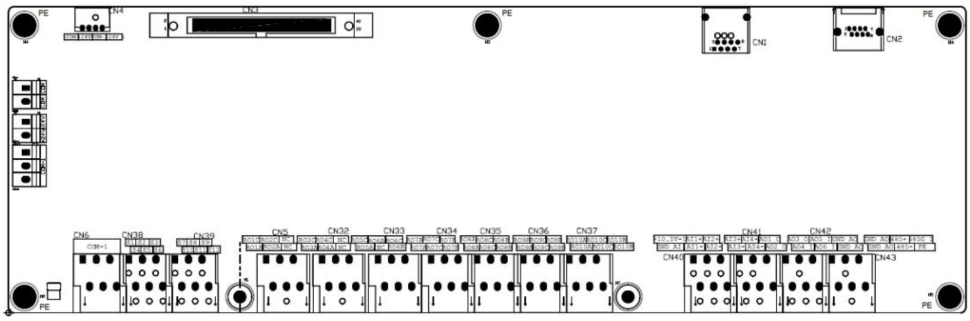
The power units have the function of unit bypasses, one is IGBT bypass and the other is contactor bypass (optional). When a unit has a fault, the unit will achieve automatic bypass to ensure the system continues working normally.

3.1.3 Control system

The main control system of Goodrive5000 medium voltage variable-frequency speed regulation system consists of modules such as the main control board, power supply module, temperature controller, system I/O, user I/O, terminal control board, and expansion I/O board (optional). The modular design is adopted, and single boards are connected via connectors. In this way, each single board has clear functions for the convenience of signal identification and maintenance. The control system and the power unit are isolated by optical fiber for signal transmission, ensuring stability and reliability. The internal resistance of the current analog input is 500Ω, and the max. load resistance of the current analog output is 500Ω.

The terminal control board provides interfaces of multi-functional user IO terminals, supporting 12 digital inputs, five relay NO outputs (220VAC, 6A), five relay NO/NC outputs (NO contact : 220VAC, 5A; NC contact: 220VAC, 3A), four analog inputs, and six analog outputs. The interface profile is shown in Figure 3-3.

Figure 3-3 Terminal control board interface outline diagram



The user interface definitions of the terminal control board are as follows.

Table 3-1 Digital input port descriptions of the terminal control board

No.	Name		Direction	Type	Remarks
1	Digital input	S1	User→Terminal	Digital	CN38
2	Digital input	S2	User→Terminal	Digital	
3	Digital input	S3	User→Terminal	Digital	
4	Digital input	S4	User→Terminal	Digital	
5	Digital input	S5	User→Terminal	Digital	
6	Digital input	S6	User→Terminal	Digital	
7	Digital input	S7	User→Terminal	Digital	CN39
8	Digital input	S8	User→Terminal	Digital	
9	Digital input	S9	User→Terminal	Digital	
10	Digital input	S10	User→Terminal	Digital	
11	Digital input	S11	User→Terminal	Digital	
12	Digital input	S12	User→Terminal	Digital	
13	Digital input	COM-1	User→Terminal	Digital	CN6
14	Digital input		User→Terminal	Digital	
15	Digital input		User→Terminal	Digital	

Table 3-2 Relay output port descriptions of the terminal control board

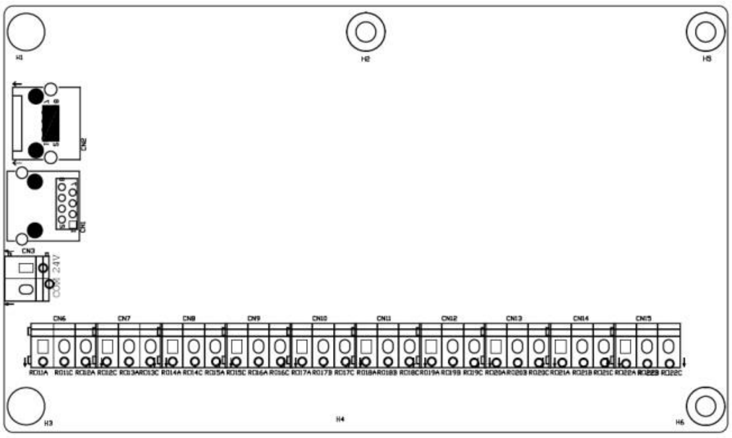
No.	Name		Direction	Type	Remarks
1	Relay output	RO1A	Terminal→User	Digital	CN5
2		RO1C	Terminal→User	Digital	
3	Relay output	RO2A	Terminal→User	Digital	
4		RO2C	Terminal→User	Digital	
5	Relay output	RO3A	Terminal→User	Digital	CN32
6		RO3C	Terminal→User	Digital	
7	Relay output	RO4A	Terminal→User	Digital	
8		RO4C	Terminal→User	Digital	
9	Relay output	RO5A	Terminal→User	Digital	CN33
10		RO5C	Terminal→User	Digital	
11	Relay output	RO6A	Terminal→User	Digital	
12		RO6B	Terminal→User	Digital	
13		RO6C	Terminal→User	Digital	
14	Relay output	RO7A	Terminal→User	Digital	CN34
15		RO7B	Terminal→User	Digital	
16		RO7C	Terminal→User	Digital	
17	Relay output	RO8A	Terminal→User	Digital	CN35
18		RO8B	Terminal→User	Digital	
19		RO8C	Terminal→User	Digital	
20	Relay output	RO9A	Terminal→User	Digital	CN36
21		RO9B	Terminal→User	Digital	
22		RO9C	Terminal→User	Digital	
23	Relay output	RO10A	Terminal→User	Digital	CN37
24		RO10B	Terminal→User	Digital	
25		RO10C	Terminal→User	Digital	

Table 3-3 Analog input & output terminal and 485 terminal descriptions of the terminal control board

No.	Name		Direction	Type	Remarks
1	User power supply	+10.5V-1	Terminal→User		CN40
2		GND_AI	Terminal→User		
3	Analog input	AI1+	User→Terminal	Analog	
4		AI1-	User→Terminal	Analog	
5	Analog input	AI2+	User→Terminal	Analog	
6		AI2-	User→Terminal	Analog	
7	Analog input	AI3+	User→Terminal	Analog	CN41
8		AI3-	User→Terminal	Analog	
9	Analog input	AI4+	User→Terminal	Analog	
10		AI4-	User→Terminal	Analog	
11	Analog output	AO1_0	Terminal→User	Analog	
12	Analog output	AO2_0	Terminal→User	Analog	
13	Analog output	AO3_0	Terminal→User	Analog	CN42
14	Analog output	AO4_I	Terminal→User	Analog	
15	Analog output	AO5_I	Terminal→User	Analog	
16	Analog output	AO6_I	Terminal→User	Analog	
17	AO reference ground	GND_AO	Terminal→User	Analog	
18	AO reference ground		Terminal→User	Analog	
19	AO reference ground		Terminal→User	Analog	CN43
20	AO reference ground		Terminal→User	Analog	
21	User 485	485+	User→Terminal	Digital	
22		485-	User→Terminal	Digital	
23	User 485 reference ground	485G_I	Terminal→User		
24	Ground	PE	User→Terminal		

The expansion I/O board (optional) includes 6 NO relay outputs (multiplexed with DC relay terminal board, 220VAC, 5A). 6 sets of NO and NC relay outputs (NO contact: 220VAC, 5A; NC contact: 220VAC, 3A). The interface outline diagram is shown in Figure 3-4.

Figure 3-4 Expansion I/O board interface outline diagram



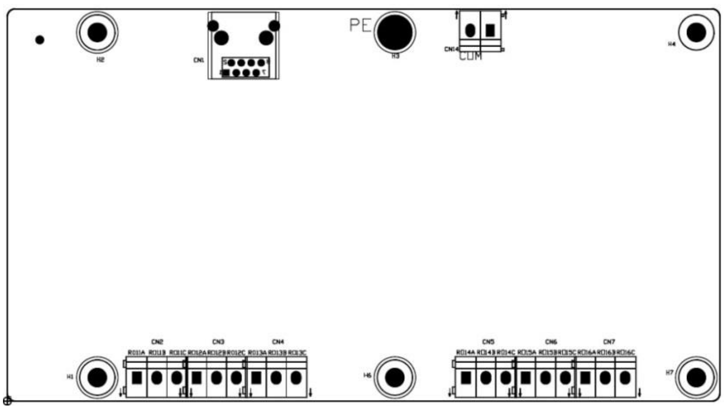
The user interface definitions of the expansion I/O board are as follows.

Table 3-4 Interface signal description of the AC relay terminal board

No.	Name		Direction	Type	Remarks
1	Relay output	RO11A	Terminal→User	Digital	CN6
2		RO11C	Terminal→User	Digital	
3	Relay output	RO12A	Terminal→User	Digital	
4		RO12C	Terminal→User	Digital	CN7
5	Relay output	RO13A	Terminal→User	Digital	
6		RO13C	Terminal→User	Digital	
7	Relay output	RO14A	Terminal→User	Digital	CN8
8		RO14C	Terminal→User	Digital	
9	Relay output	RO15A	Terminal→User	Digital	
10		RO15C	Terminal→User	Digital	CN9
11	Relay output	RO16A	Terminal→User	Digital	
12		RO16C	Terminal→User	Digital	
13	Relay output	RO17A	Terminal→User	Digital	CN10
14		RO17B	Terminal→User	Digital	
15		RO17C	Terminal→User	Digital	
16	Relay output	RO18A	Terminal→User	Digital	CN11
17		RO18B	Terminal→User	Digital	
18		RO18C	Terminal→User	Digital	
19	Relay output	RO19A	Terminal→User	Digital	CN12
20		RO19B	Terminal→User	Digital	
21		RO19C	Terminal→User	Digital	
22	Relay output	RO20A	Terminal→User	Digital	CN13
23		RO20B	Terminal→User	Digital	
24		RO20C	Terminal→User	Digital	
25	Relay output	RO21A	Terminal→User	Digital	CN14
26		RO21B	Terminal→User	Digital	
27		RO21C	Terminal→User	Digital	
28	Relay output	RO22A	Terminal→User	Digital	CN15
29		RO22B	Terminal→User	Digital	
30		RO22C	Terminal→User	Digital	

The DC relay terminal control board (optional) includes 6 relay NO and NC outputs (220VDC, 5A). The interface outline diagram is shown in Figure 3-5.

Figure 3-5 DC relay board interface outline diagram



The user interface definitions of the DC relay board are as follows.

No.	Name		Direction	Type	Remarks
1	Relay output	RO11A	Terminal→User	Digital	CN2
2		RO11B	Terminal→User	Digital	
3		RO11C	Terminal→User	Digital	
4	Relay output	RO12A	Terminal→User	Digital	CN3
5		RO12B	Terminal→User	Digital	
6		RO12C	Terminal→User	Digital	
7	Relay output	RO13A	Terminal→User	Digital	CN4
8		RO13B	Terminal→User	Digital	
9		RO13C	Terminal→User	Digital	
10	Relay output	RO14A	Terminal→User	Digital	CN5
11		RO14B	Terminal→User	Digital	
12		RO14C	Terminal→User	Digital	
13	Relay output	RO15A	Terminal→User	Digital	CN6
14		RO15B	Terminal→User	Digital	
15		RO15C	Terminal→User	Digital	
16	Relay output	RO16A	Terminal→User	Digital	CN7
17		RO16B	User→Terminal	Digital	
18		RO16C	User→Terminal	Digital	

3.1.4 Board jumper and selector switch

Voltage and current switching on terminal control board: The analog output signals can be voltage or current signals which are switched by the DIP switch. SW1 corresponds to AO1, SW2 corresponds to AO2, and SW3 corresponds to AO3 on the terminal control board. According to instructions on I/O board, connect the mini jumper to select the corresponding voltage or current signal. If the DIP switch is set to ON, it is output voltage analog. If the switch is set to OFF, it is output current analog.

User 485 setting: The RS485 interface supports Modbus communication protocol, and you can choose whether to connect the terminal resistor through the SW4 switch of the user I/O board. The system connects the 120Ω terminal resistor when SW4 is set to OFF.

Figure 3-6 Switch of the terminal control board

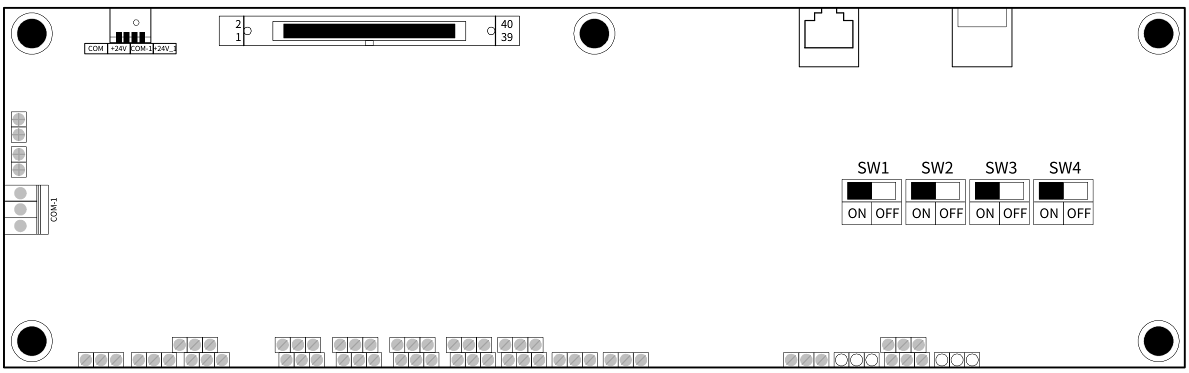
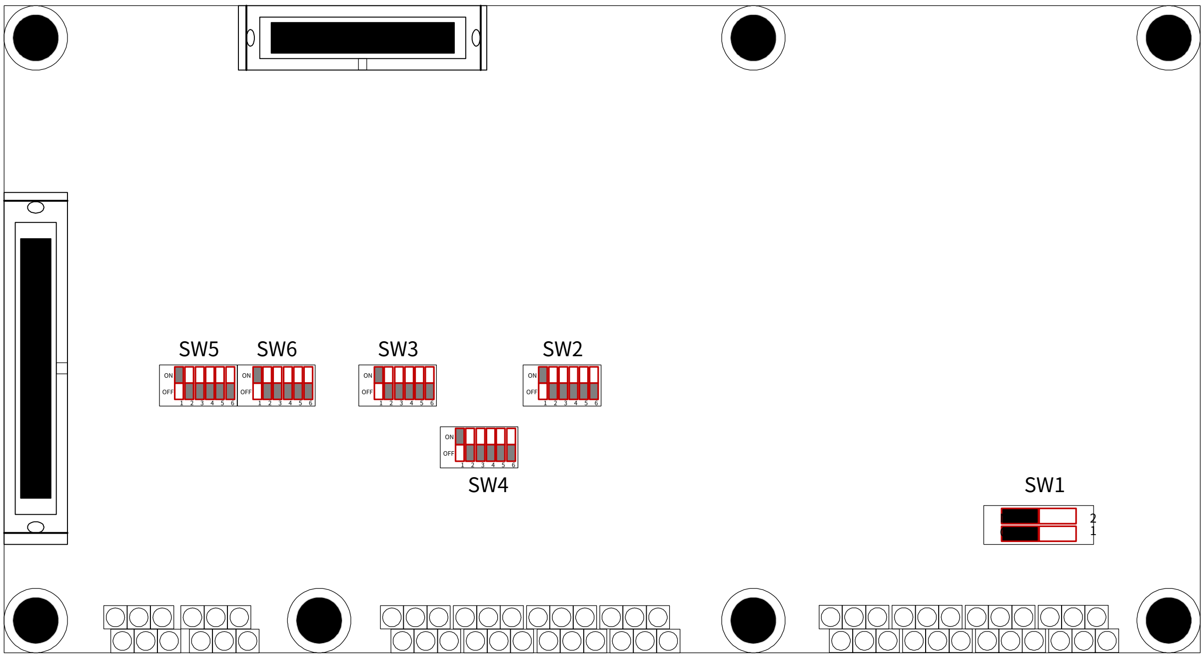


Figure 3-7 Switch of the system I/O board



The system I/O board includes input and output current detection, input and output voltage detection, and dial-up selection of different voltage and current levels as shown in Figure 3-8 and Figure 3-9.

Figure 3-8 Dial-up configuration of the system I/O board (output voltage)

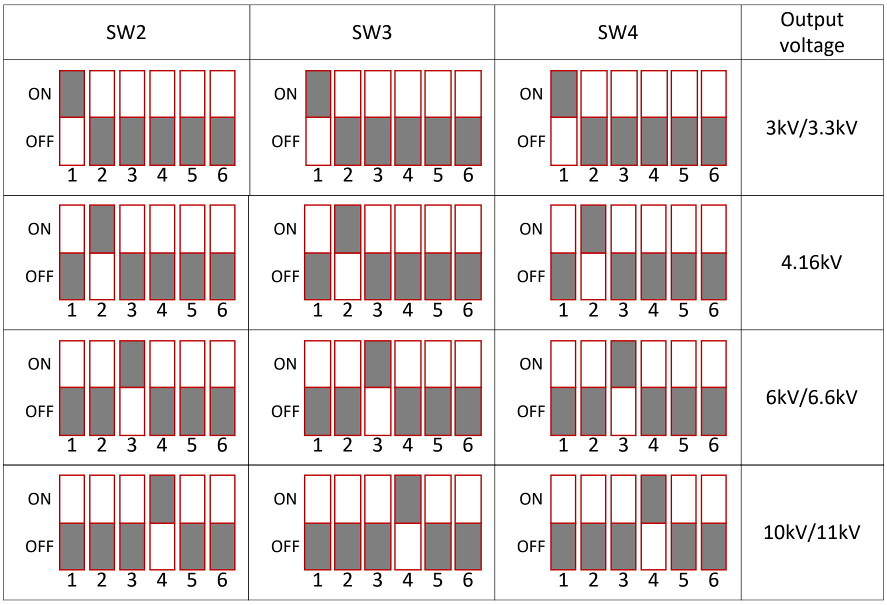
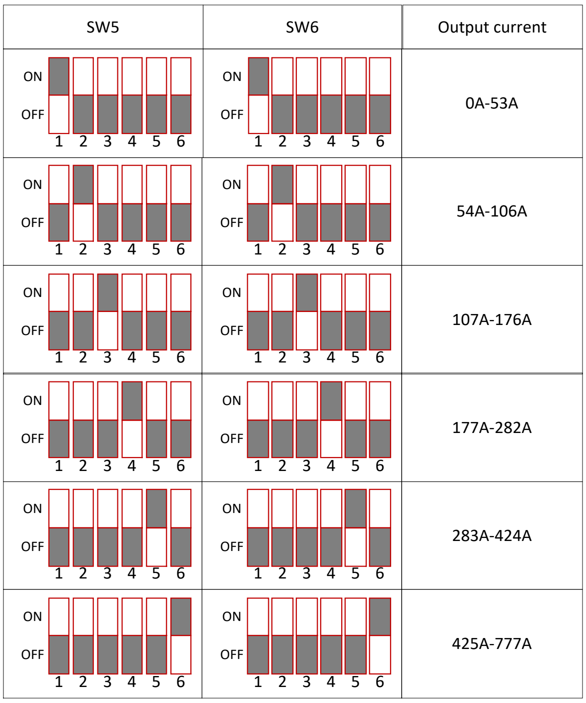


Figure 3-9 Dial-up configuration of the system I/O board (output current)



Note: The grey color in the above figure represents the strikers of the switch.

DIP switch functions of the main control board

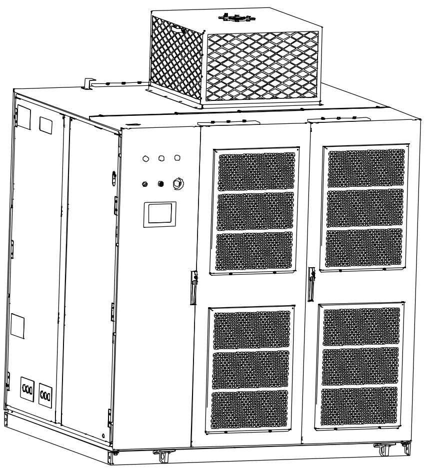
Table 3-5 SW1, SW2 function and position

Switch	ON	OFF
SW1	ARM flash loading mode	ARM serial programming mode enable
SW2	DSP flash loading mode	DSP serial programming mode enable

3.2 Product composition

Goodrive5000 medium voltage variable-frequency speed regulation system is mainly composed of the transformer cabinet, power unit cabinet, control cabinet, power units and HMI; in actual use, bypass cabinet can be fitted as optional according to requirements of users. The outline diagram of Goodrive5000 medium voltage variable-frequency speed regulation system is shown in Figure 3-10.

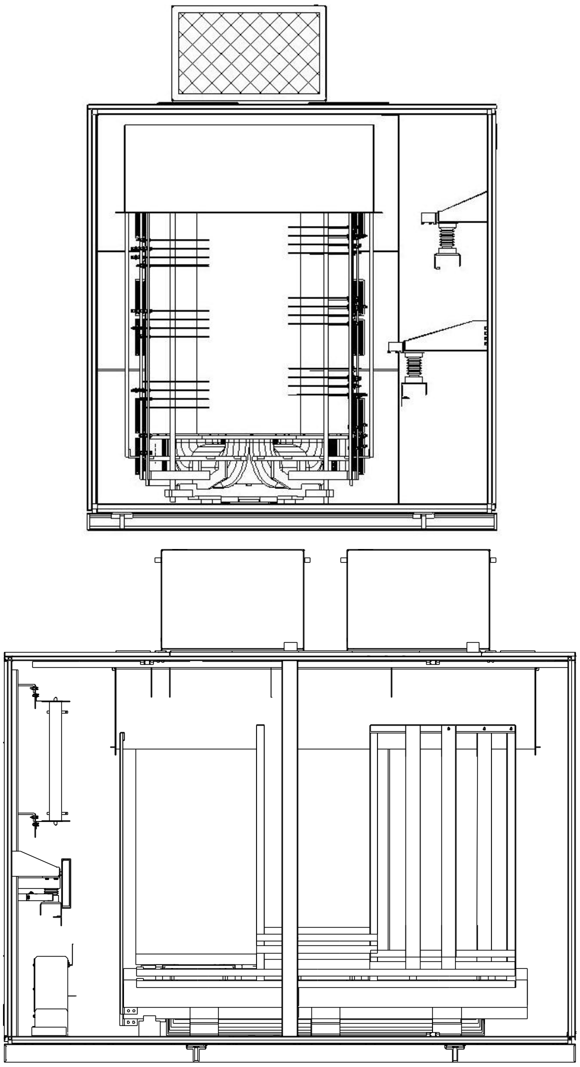
Figure 3-10 Outline diagram of the system



3.2.1 Transformer cabinet

The transformer cabinet is used to install phase shifting transformer and accessories. The internal layout of the transformer cabinet is shown in Figure 3-11.

Figure 3-11 Layout in the transformer cabinet



The phase shifting isolation transformer installed in the transformer cabinet provides 3-phase power supply for power units to achieve high/low voltage shifting and isolation. The phase shifting transformer adopts dry-type structure, isolation degree at H and secondary side in prolonged delta connection, effectively reducing harmonics at the grid side.

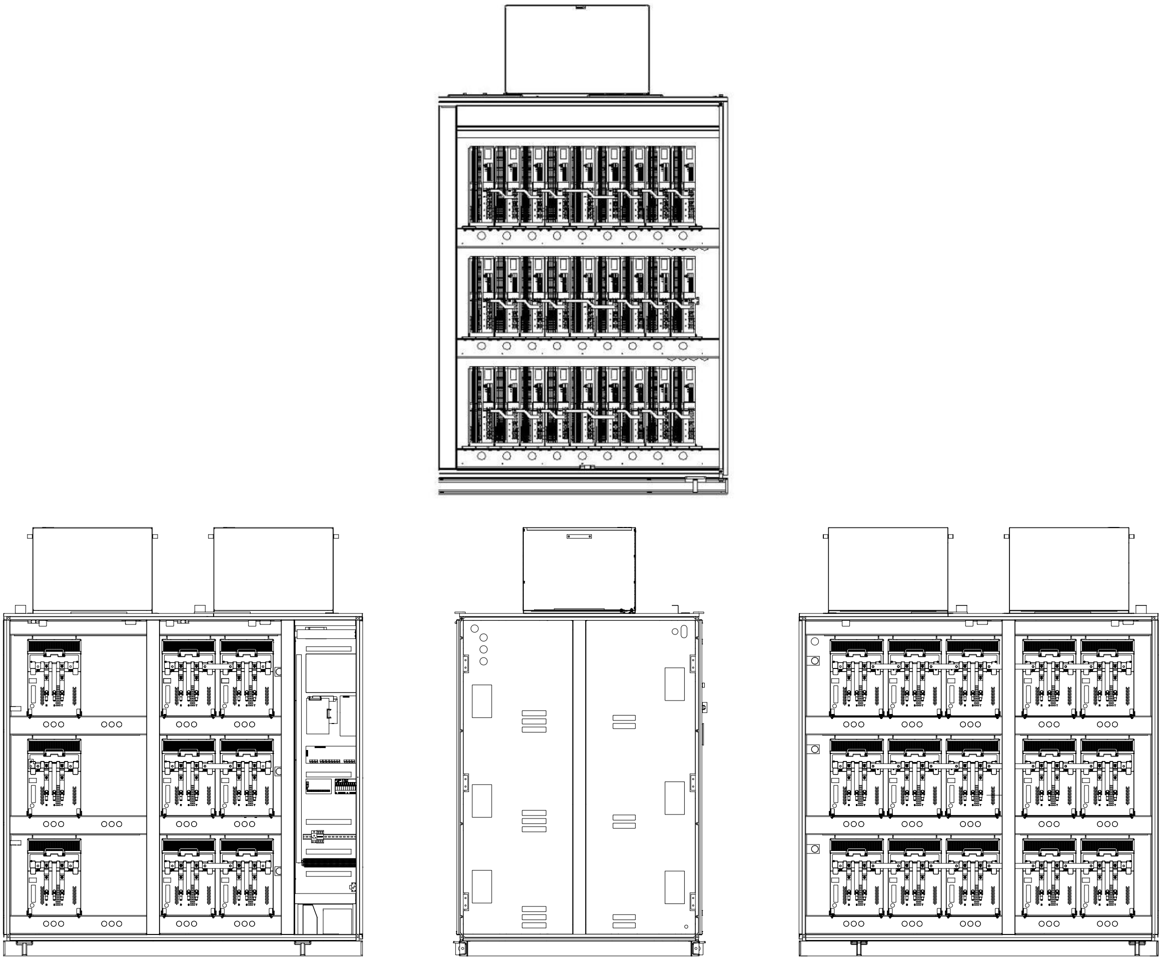
The temperature control system inside the transformer monitors the temperature of each phase in real-time, and provides over-temperature protection and alarms. The default setting is: when the temperature of the phase shifting transformer exceeds 90°C, the system will alarm but not stop automatically; when the temperature exceeds 110°C, the system will conduct temperature protection and stop automatically.

A special grounding copper bar at the bottom of the transformer cabinet is used for reliable medium voltage grounding. The system shall be grounded together with the medium voltage grounding system during construction.

3.2.2 Power unit cabinet

The power unit cabinet is the converter of the system and the actuator for AC-DC-AC conversion. It is used to install power units and accessories. The internal layout of the power unit cabinet is shown in Figure 3-12.

Figure 3-12 Layout in the power unit cabinet



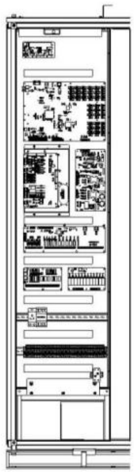
The power unit cabinet is used for installing power units; by the connection of medium voltage cable and secondary side winding of phase-shifting isolation transformer, the transformer can supply power to power units. The power units are placed in three lines in the cabinet, with the units of the same line in series connection forming A/B/C 3-phase. A1/B1/C1 power units are connected in "Y" shape, and the power unit at the end of the cascade connection is the medium voltage point of A, B and C phases. At this medium voltage point, connect to the output terminal copper bar of the transformer cabinet through the medium voltage cables for external medium voltage output.

By the connection of the optical fiber and main control system, the main control system realizes control and protection on power units.

3.2.3 Control cabinet

As the brain of the system, the control cabinet has the functions of command, control and self-protection. It is used to install the main control system, secondary control circuit system, and so on. The internal layout of the control cabinet is shown in Figure 3-13.

Figure 3-13 Layout in the control cabinet

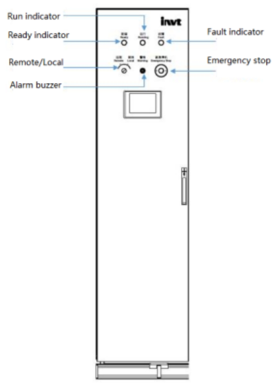


Goodrive5000 variable-frequency speed regulation system use independent control cabinets which are isolated from the medium voltage section of transformer cabinet, power unit cabinet by optical fiber, isolation transformer and special grounding.

There are 3 power supplies for the control system: main power supply, backup power supply and UPS power supply (optional). When the main supply fails, the system will switch into backup power supply automatically; when both the main and backup power supplies fail, the system will switch to the UPS power supply. When a power supply encounters a fault, the system will report an alarm to ensure stable operation in bad power conditions.

Goodrive5000 variable-frequency speed regulation system provides with indicators, buttons, alarm and HMI installed on the door of the control cabinet for convenient operation and monitoring. Its layout is shown in Figure 3-14.

Figure 3-14 Layout of control cabinet door



Fault indicator: It indicates whether the system is in fault or alarm state. If a fault occurred, the fault indicator is on.

Running indicator: It indicates whether the system is in running state. If the system is in running state, the indicator is on.

Ready indicator: It indicates whether the system is in standby or ready state. If the system does not run and no fault is in detection after power-on, the indicator is on.

Emergency stop button: If the main control board is damaged or cannot be controlled normally, users can push the emergency stop button; by the physical circuit disconnection, damage will be minimized.

Danger

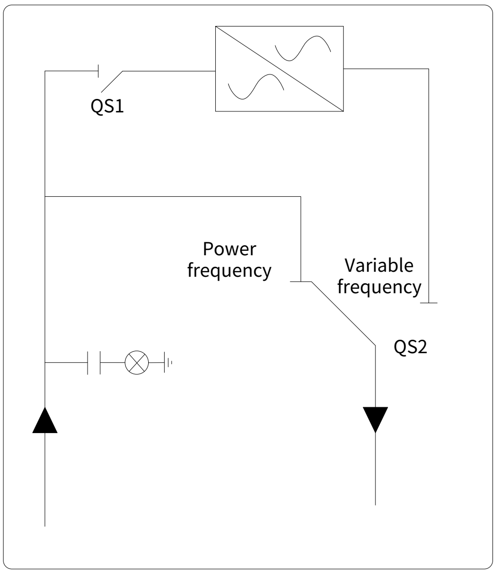
- Power on only after disconnecting medium voltage by loosening the emergency stop button with rotation.
- When the switching cabinet is under power frequency, the emergency stop button is invalid. Disconnect medium voltage by directly powering off the higher level or sending the command of disconnecting medium voltage to the system.
- When under manual switching, the emergency stop button can only control higher level medium voltage breaker or contactor. Connect the knife switch in series in the switching cabinet to higher level control circuit.

3.2.4 Bypass cabinet

In industrial applications, it is necessary to configure the switching cabinet with the medium voltage variable-frequency speed regulation system. Goodrive5000 medium voltage variable-frequency speed regulation system provides standard manual bypass cabinets and automatic bypass cabinets with isolation for choice. The system provides different combinations of bypass cabinets to meet different application requirements.

The bypass cabinets are used to make the equipment run at power frequency if the system has a fault, thereby ensuring the continuity of the production and improving the reliability of the system. According to production process requirements of users, the manual bypass cabinet or automatic bypass cabinet can be selected. When the system stops for a short time according to production process requirements, operators can switch between the variable frequency and the power frequency under power failure by using the manual bypass cabinet. The main circuit diagram of the manual bypass cabinet is shown in Figure 3-15.

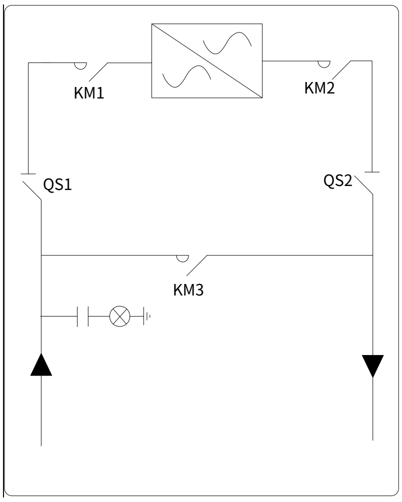
Figure 3-15 Main circuit diagram of the manual bypass cabinet



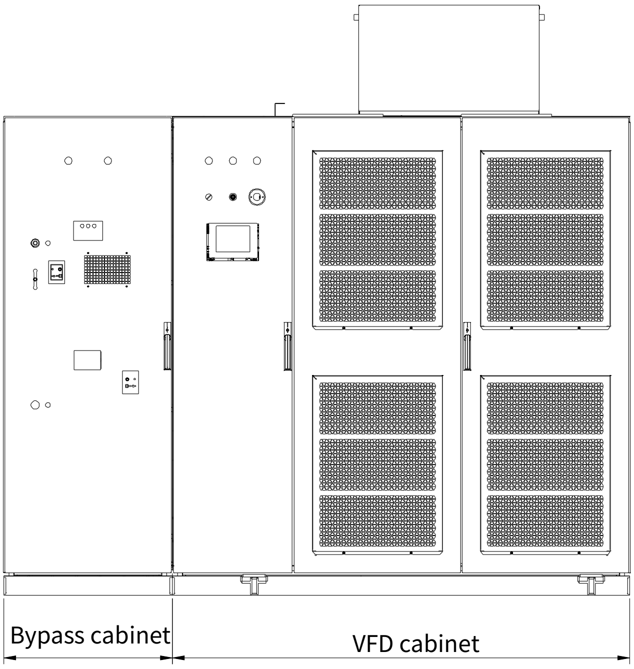
When the system is not allowed to stop, the automatic bypass cabinet will switch automatically. The cabinet has three medium voltage vacuum contactors KM1, KM2 and KM3, among which KM2 and KM3 realize electric interlock to ensure the power frequency supply will not be directly connected to the output terminal of the variable-frequency speed regulation system.

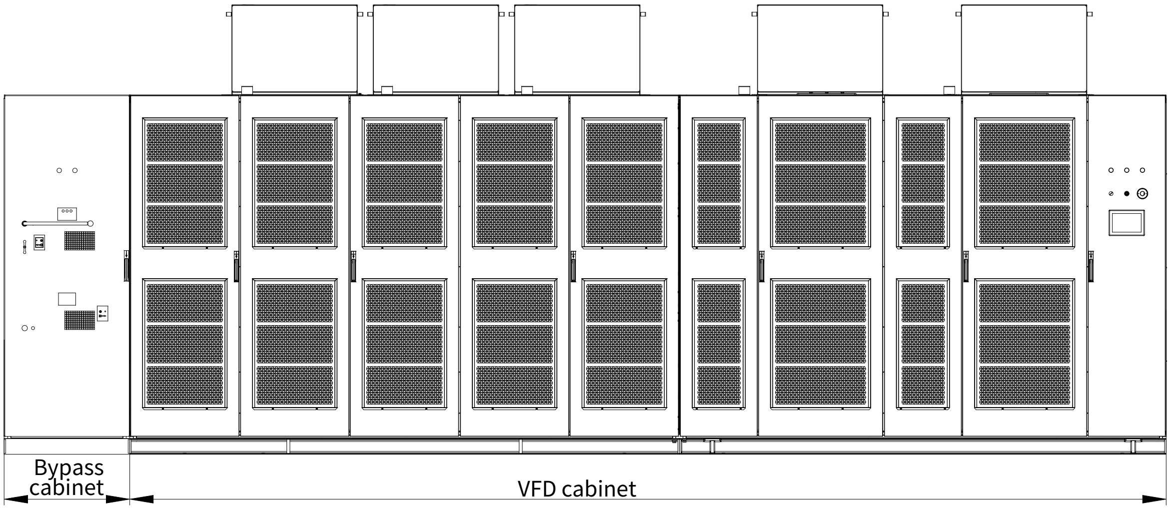
The automatic bypass cabinet with isolation also has two isolation knife switches QS1 and QS2 to isolate the variable-frequency speed regulation system from medium voltage power supply when the motor runs at power frequency, convenient for maintenance and inspection. The main circuit diagram of automatic bypass cabinet with isolation is shown in Figure 3-16.

Figure 3-16 Main circuit diagram of the automatic bypass cabinet



With bypass cabinets, users’ power cables (power incoming cable and motor outgoing cable) usually feed in at the bottom of the cabinets; while the power cable, between the bypass cabinet and the variable-frequency speed regulation system, adopts special medium voltage cable and lays out in the cabinet.





3.2.5 Power unit

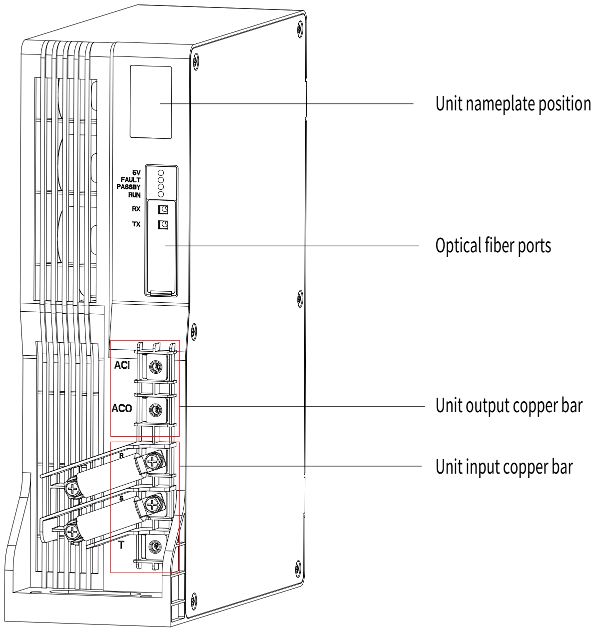
The power units, the converting part of the medium voltage variable-frequency speed regulation system, achieve medium-low-medium voltage shifting of the system by connection in series.

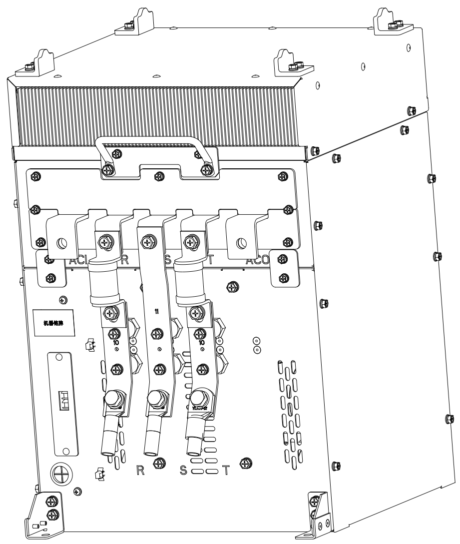
When installing the power units, put them on the brackets, next push the units inside till close to the air duct baffle, then fix them with screws. Connect corresponding input cables and series copper bars, and finally plug corresponding optical fiber cables in.

When removing the power units, follow the requirements and procedures of relevant medium voltage maintenance. First, unplug the optical fiber cables, then remove input cables and series copper bars. Next, twist off the screws on the power units, and finally remove the power units from the brackets. The appearance of the power unit is shown in Figure 3-17.

Figure 3-17Figure 3-17.

Figure 3-17 Appearance of power units





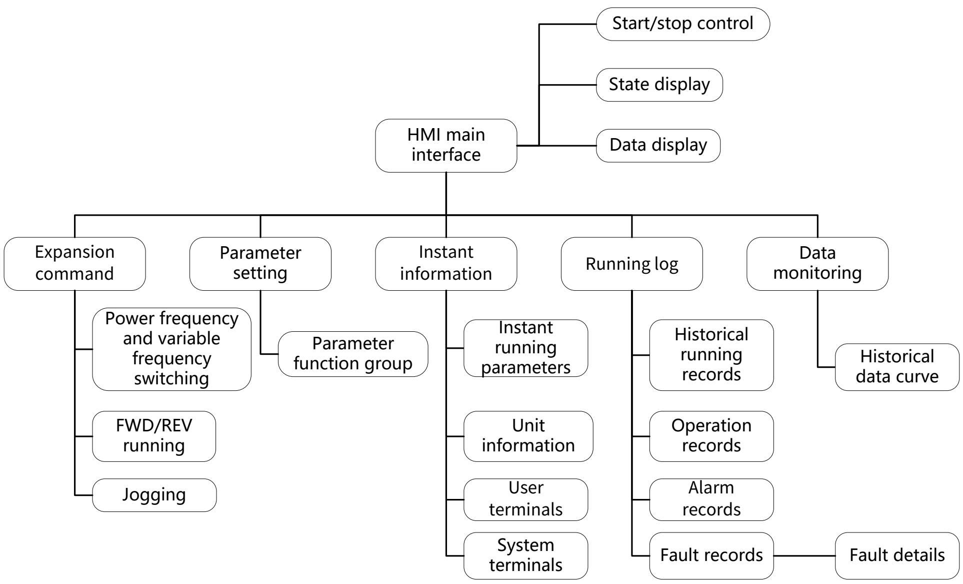
3.3 HMI

3.3.1 Interface introduction

The product is equipped with a 7-inch touch screen, which can be used to set the system functions, monitor the working status information, and view the running logs.

The specific functional block diagram is shown as Figure 3-18.

Figure 3-18 System block diagram of the touch screen



The touch screen operation interface is designed with corresponding operation windows, and the corresponding sub-interface pops up after clicking the operation window. The sub-interface is also designed with operation buttons (level-2 interface) that allow users to set or read parameters in the corresponding interface according to their usage needs.

3.3.2 Login interface

After the control system powers on or users exit the main interface, the login interface will be displayed on the touch screen as shown in Figure 3-19. Users can choose to log in based on permissions.

Figure 3-19 Login interface of the touch screen

We have three categories of login permissions based on application requirements.

Operator: for who will not configure the system and only start or stop the variable-frequency speed regulation system.

Administrator: for technical leaders who can configure and operate the system.

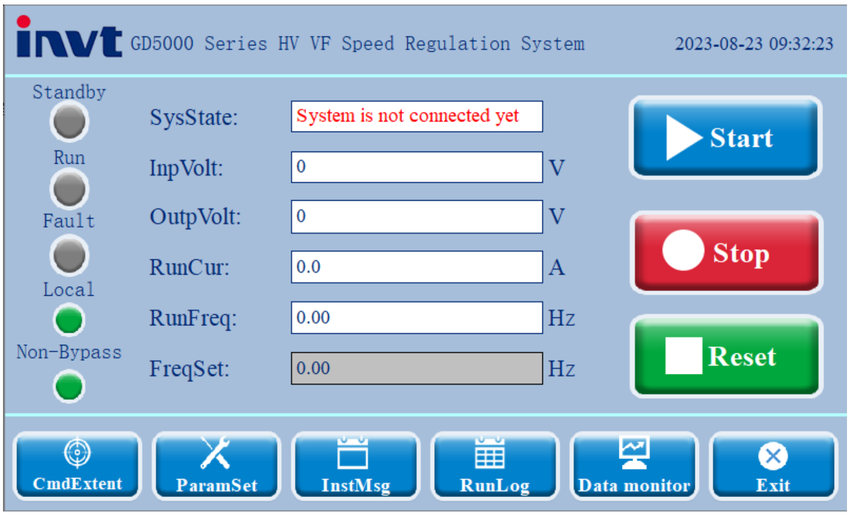
Manufacturer: for personnel who manufacture the system.

Table 3-6 Limited rights in different regions for different operators

Area	Operator	Administrator	Manufacturer
Data display	Allow view	Allow view	Allow view
State display	Allow view	Allow view	Allow view
Start/stop control	Allow operation	Allow operation	Allow operation
Expansion command	Allow operation	Allow operation	Allow operation
Parameter setting	Prohibit viewing	Allow operation	Allow operation
Instant information	Allow view	Allow view	Allow view
Running log	Allow view	Allow view	Allow view
Data monitoring	Allow view	Allow view	Allow view

3.3.3 Main interface

Figure 3-20 Touch screen main interface diagram



The above diagram shows the main interface of the touch screen, whose main interface is divided into the following areas.

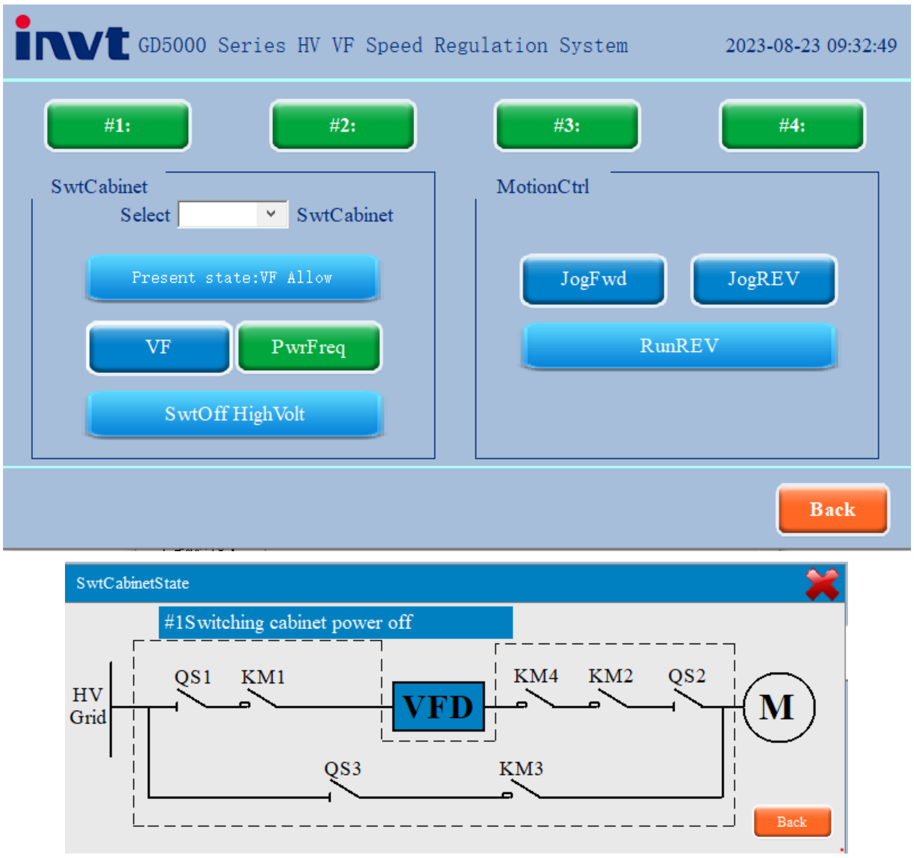
No.	Area	Keys and contents		Definition
1	State display	System state		The system is in the working state. Control command channel The unit is in the bypass state.
2	Data display	Frequency setting		Set frequency of the variable-frequency speed regulation system.
		Running frequency		Actual running frequency of the variable-frequency speed regulation system.
		Input voltage		Input voltage of the variable-frequency speed regulation system.
		Output voltage		Output voltage of the variable-frequency speed regulation system.
		Running current		Output current of the variable-frequency speed regulation system.
3	Start/stop control	Startup		Under the local command channel, push the button to send forward running command to the system.
		Stop	Coast to stop	Under any command channel, push the button to coast to stop.
			Decelerate to stop	Under any command channel, push the button to decelerate to stop.
		Reset		Fault reset by manual
4	Function buttons	Command expansion		Level-2 interface—Switching cabinet operation page of the system
		Parameter setting		Level-2 interface—Function code interface of the system
		Instant information		Level-2 interface—It displays running parameters, unit information, user terminals, and system terminal status of the system.
		Running log		Level-2 interface—It displays running records, operation records, alarm records, and fault record data of the system.
		Data monitoring		Level-2 interface—Data monitoring interface, displayed in the form of waveform curves.
		Exit		Return to the login page.

3.3.4 Level-2 interface

3.3.4.1 Command expansion level-2 interface

The interface mainly shows the switching cabinet operations of the system. The diagram is shown as Figure 3-21.

Figure 3-21 Expansion command level-2 interface diagram

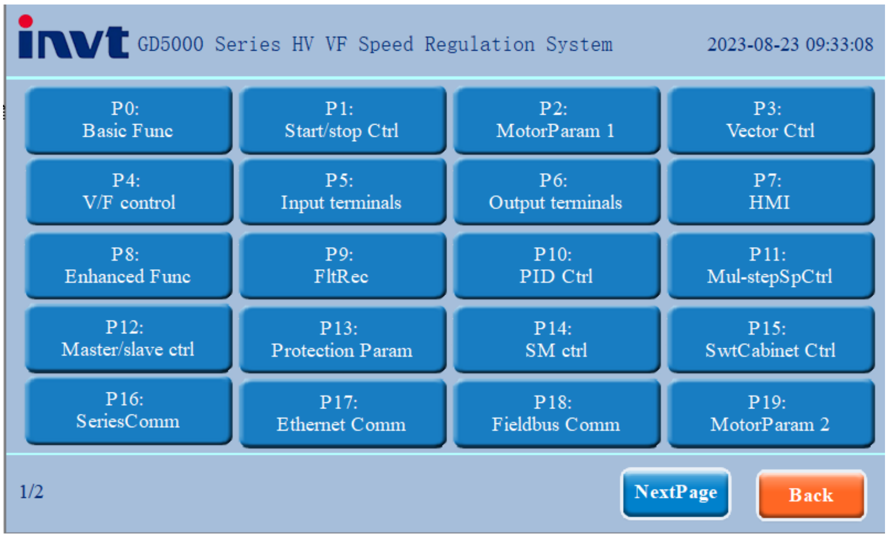


No.	Area	Keys and contents	Definition
1	Running control (Expansion)	Forward jogging	Under the local command channel, push the button to send forward jogging command to the system.
		Reverse jogging	Under the local command channel, push the button to send reverse jogging command to the system.
		Reverse running	Under the local command channel, push the button to send reverse running command to the system.
2	Switching cabinet 1	Variable frequency	The motor is in variable-frequency run mode.
		Power frequency	The motor is in power-frequency run mode.
		Cut off medium voltage	Cuts off the input medium voltage power of the specified motor, and the running mode of other motors is not affected.
3	State display of switching cabinet	Switch state	Displays the status of isolation knife switches and vacuum contactors in the switching cabinet.
		Present state	Used to display working state of present switching cabinet.

3.3.4.2 Parameter setting level-2 interface

The function groups in the following figure need to be set. You can press the corresponding buttons to pop up the function code group setting interfaces for the corresponding functions, and you can press the back button to return to the previous interface.

Figure 3-22 Parameter setting level-2 interface diagram



You can press the instant information button to pop up the level-2 interface. The level-2 interface mainly displays the running parameters, unit information, user terminals, and system terminals of the system.

Figure 3-23 Running parameters

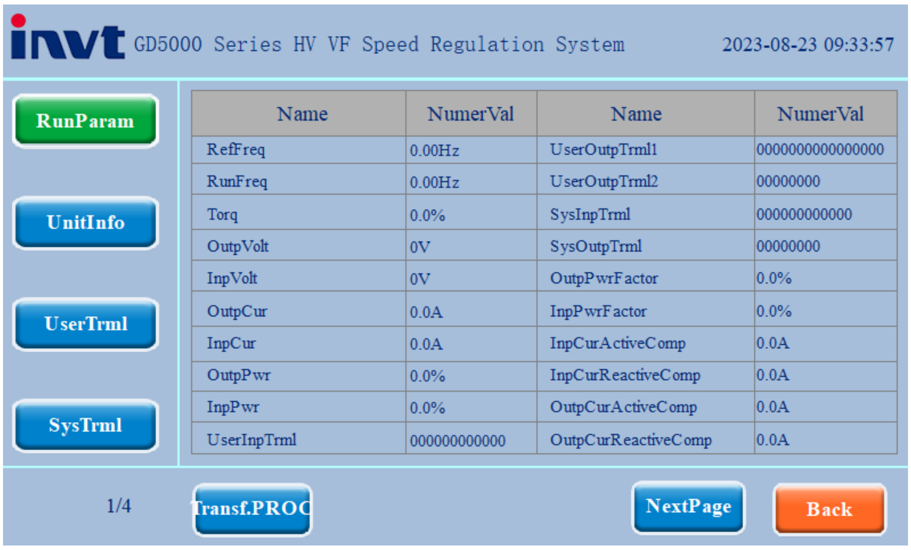


Figure 3-24 Unit information

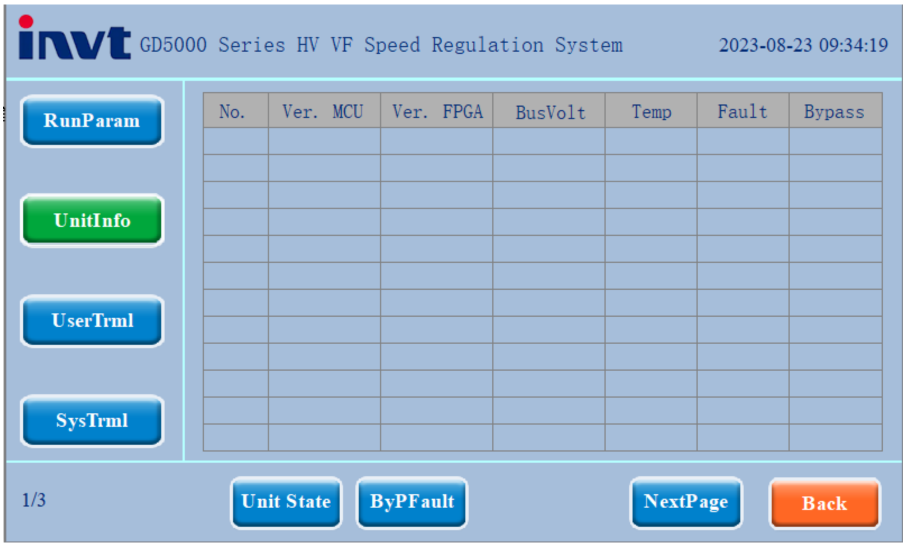


Figure 3-25 User terminals

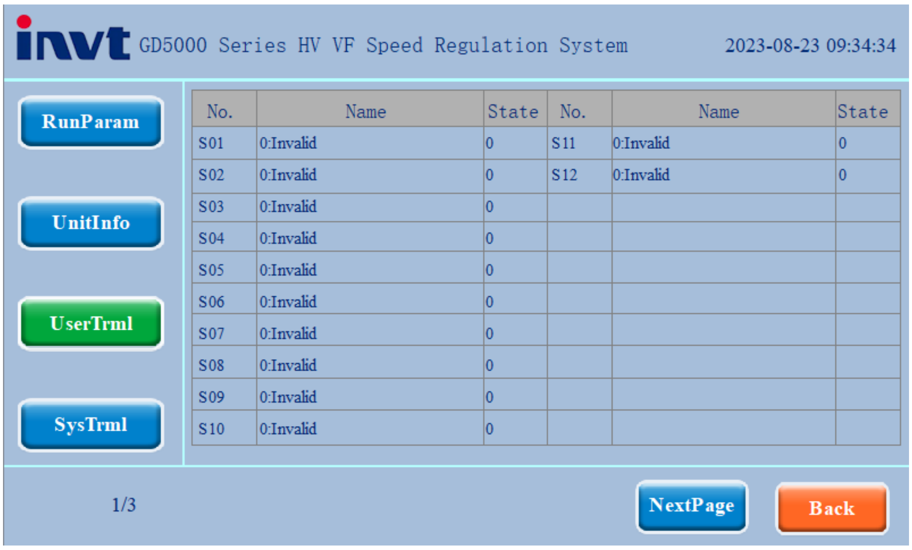
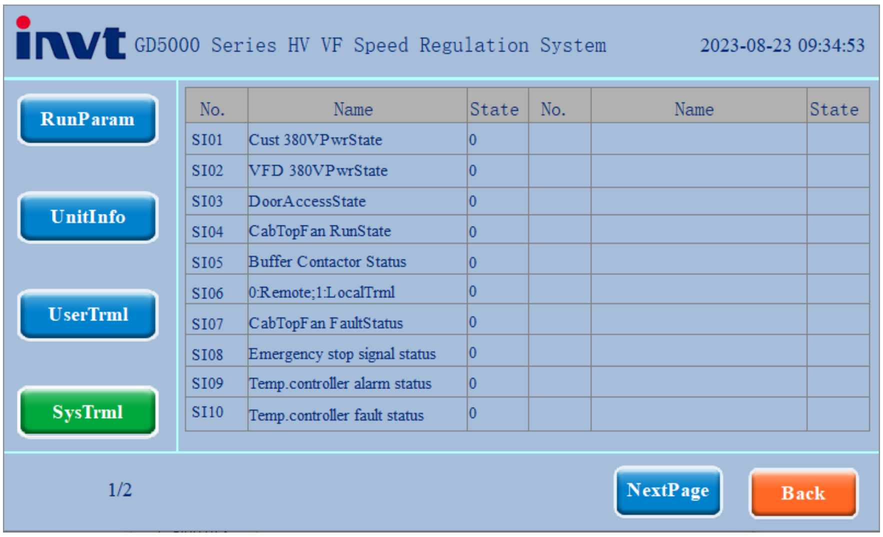


Figure 3-26 System terminals



No.	Area	Keys and contents	Definition
1	Running parameters	Reference frequency	Set frequency of the system.
		Running frequency	Actual running frequency of the system.
		Torque	Displays the ratio of the system output torque to the rated torque.
		Output voltage	Output voltage of the system.
		Input voltage	Input voltage of the system.
		Output current	Output current of the system.
		Input current	Input current of the system.
		Output power	Displays the ratio of the output motor power to the rated motor power.
		Input power	Displays the ratio of the input motor power to the rated motor power.
		User input terminal	0/1 corresponds to the user input terminal in the open/closed state

No.	Area	Keys and contents	Definition
		User output terminal 1	0/1 corresponds to user output terminal 1 in the open/closed state.
		User output terminal 2	0/1 corresponds to user output terminal 2 in the open/closed state.
		System input terminal	0/1 corresponds to system input terminal in the open/closed state.
		System output terminal	0/1 corresponds to system output terminal in the open/closed state.
		Output power factor	Size of output power factor
		Input power factor	Size of input power factor
		Input current active component	Magnitude of input current active current
		Input current reactive components	Magnitude of input current reactive current
		Output current active component	Magnitude of output current active current
		Output current reactive component	Magnitude of output current reactive current
		U-phase bus voltage	Magnitude of U-phase DC bus voltage
		V-phase bus voltage	Magnitude of V-phase DC bus voltage
		W-phase bus voltage	Magnitude of W-phase DC bus voltage
		Cabinet temperature	The temperature value in the control cabinet
		Transformer A-phase temperature	Primary-side A-phase temperature value of the transformer
		Transformer B-phase temperature	Primary-side B-phase temperature value of the transformer
		Transformer C-phase temperature	Primary-side C-phase temperature value of the transformer
		Transformer a-phase temperature	Secondary-side a-phase temperature value of the transformer
		Transformer b-phase temperature	Secondary-side b-phase temperature value of the transformer
		Transformer c-phase temperature	Secondary-side c-phase temperature value of the transformer
		Corresponding value of AI1	Corresponding input voltage or current percentage of AI1
		Corresponding value of AI2	Corresponding input voltage or current percentage of AI2
		Corresponding value of AI3	Corresponding input voltage or current percentage of AI3
		Corresponding value of AI4	Corresponding input voltage percentage of AI4
		Corresponding value of AO1	Corresponding output function percentage of AO1
		Corresponding value of AO2	Corresponding output function percentage of AO2
		Corresponding value of AO3	Corresponding output function percentage of AO3
		Corresponding value of AO4	Corresponding output function percentage of AO4
		Corresponding value of AO5	Corresponding output function percentage of AO5
		PID reference	Percentage of PID reference
		PID feedback	Percentage of PID feedback
		Motor temperature 1	Displays the temperature of motor channel 1

No.	Area	Keys and contents	Definition
		Motor temperature 2	Displays the temperature of motor channel 2
		Motor temperature 3	Displays the temperature of motor channel 3
		Motor temperature 4	Displays the temperature of motor channel 4
		Motor temperature 5	Displays the temperature of motor channel 5
		Motor vibration 1	Displays the vibration amplitude of motor channel 1
		Motor vibration 2	Displays the vibration amplitude of motor channel 2
		Motor vibration 3	Displays the vibration amplitude of motor channel 3
		Motor vibration 4	Displays the vibration amplitude of motor channel 4
		Motor vibration 5	Displays the vibration amplitude of motor channel 5
		Power consumption per second	Power consumption per second
		Total power consumption	Total power consumption
2	Unit parameters	This interface mainly displays the information of each unit of the system.	
3	User terminals	No.	Displays the number of the user terminal
		Terminal function	Displays the terminal functions set by function codes, which can be changed.
		Status	Displays corresponding state of user terminal: 0 or 1
4	System terminal	No.	Displays the number of input and output terminals
		Terminal function	Displays corresponding function setting of each terminal, which cannot be changed.
		Status	Displays corresponding state of system terminal: 0 or 1

3.3.4.3 Running log level-2 interface

You can press the Run button to pop up the interface. It mainly displays running records, operation records, alarm records, and fault records of the system.

Figure 3-27 Running records

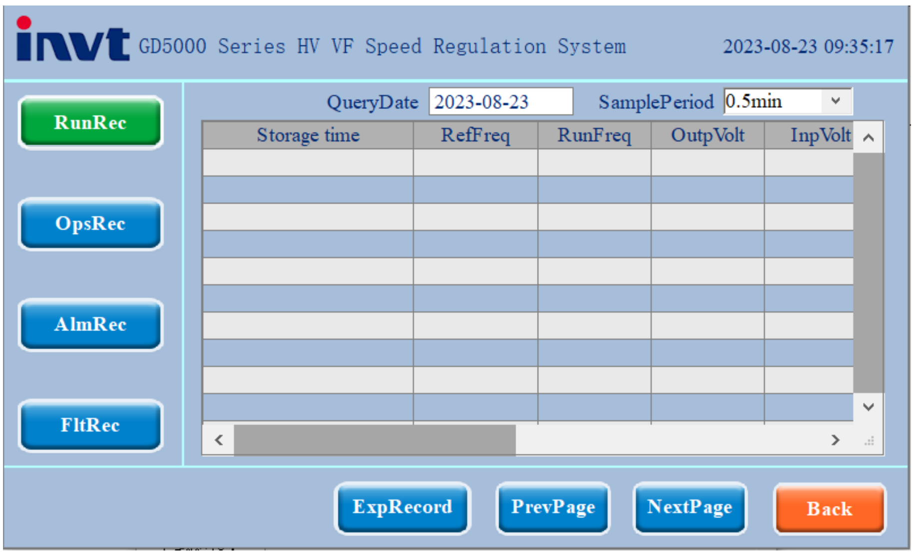


Figure 3-28 Running records

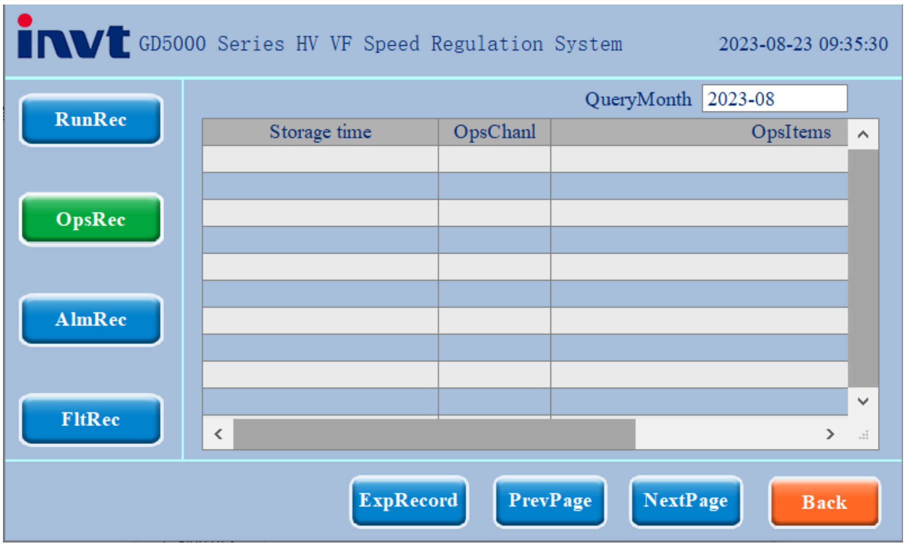


Figure 3-29 Alarm records

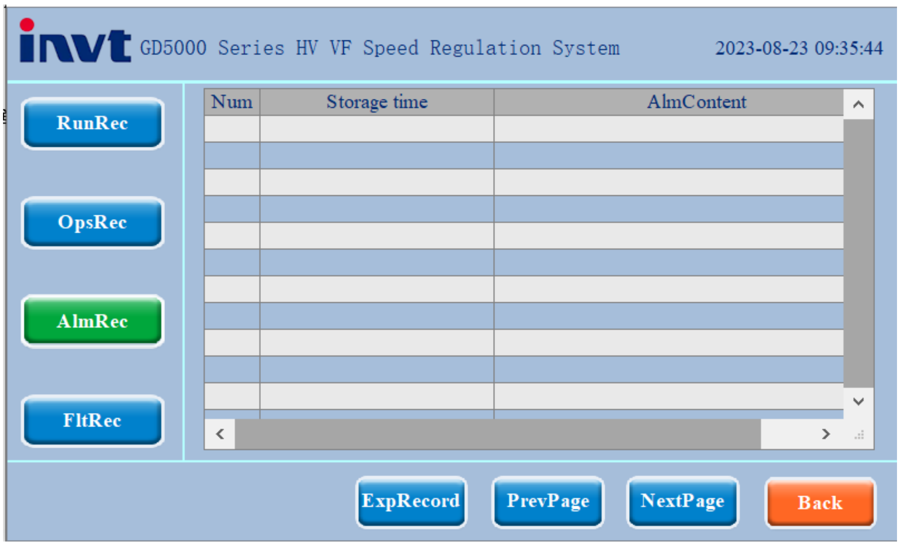
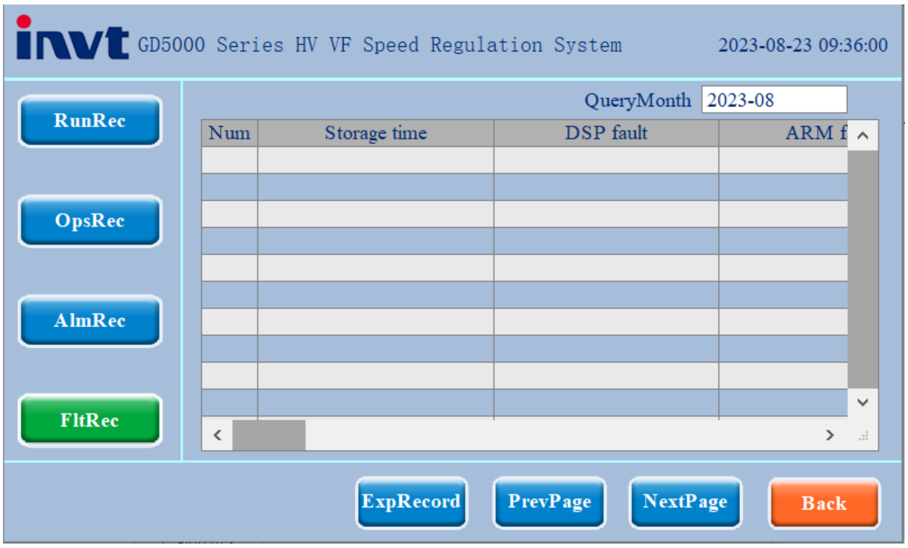


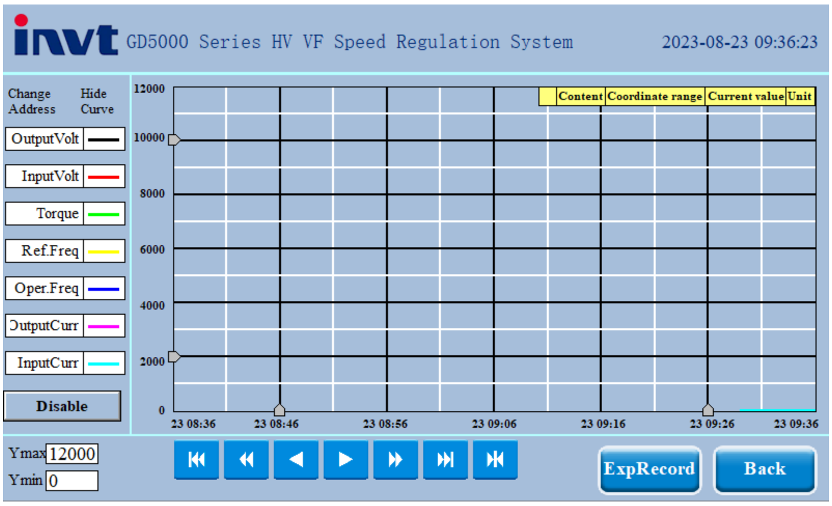
Figure 3-30 Fault records



3.3.4.4 Data monitoring level-2 interface

The data monitoring interface mainly records the data status when the system is running, and plotting it as a graph to to be displayed on the oscilloscope. The default monitoring parameters are input voltage, output voltage, input current, output current, reference frequency and running frequency. You can click the parameter name at the left column to change the parameters to be monitored, and click the curve column to hide the parameter curve. You can choose whether to use this function or not by using the "Disable" button. Ymax and Ymin in the bottom left corner can be used to set the curve coordinates, and the "ExpRecord" buttoncan be used to export parameters records for 5 days.

Figure 3-31 Data monitoring interface



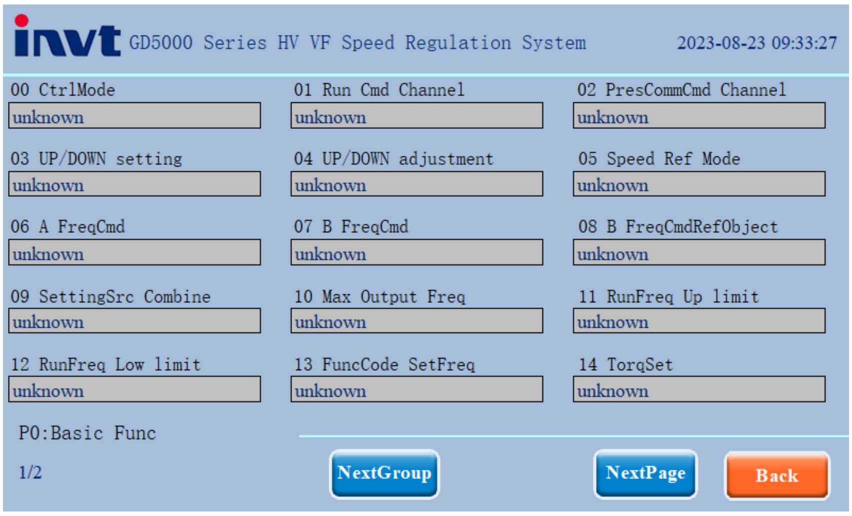
3.3.5 Level-3 interface

The level-2 interface function code group popped up by pressing the parameter setting button can generate level-3 interfaces, and the following briefly introduces the content of the level-3 interface.

3.3.5.1 Function code group level-3 interface

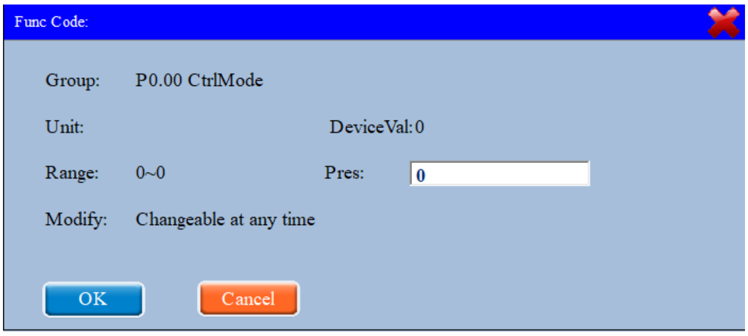
The main interface displays the value and state of each function code which can be modified or set by users. The white edit box indicates the item is modifiable while the grey box indicates the item is read-only.

Figure 3-32 Level 3 interface for setting parameters



3.3.5.2 Editing bar level-3 interface

Figure 3-33 Editing bar setting interface diagram

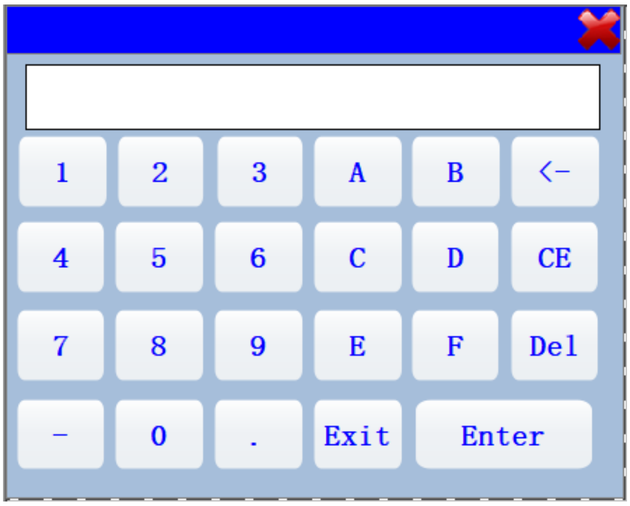


3.3.6 Other interfaces

3.3.6.1 Soft keypad

The input of the touch screen software depends on the soft keypad. After clicking the keypad, the following interface will pop up. Users can click the corresponding value to complete the setting.

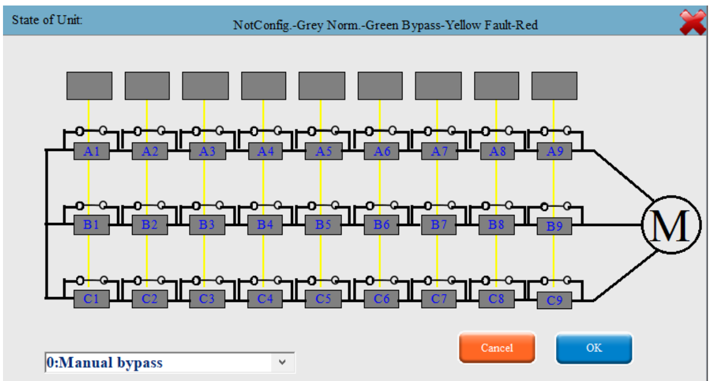
Figure 3-34 Soft keypad



3.3.6.2 Unit bypass state display

The bypass state interface can be accessed from the unit information interface of **Instant information**, which allows you to view the states of all units. Determine whether the units are in bypass state, and configure the bypass state of the units in this interface.

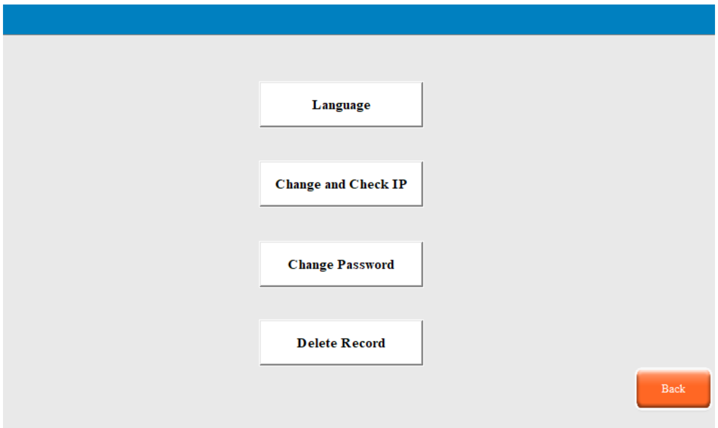
Figure 3-35 Unit bypass state



3.3.6.3 Extras menu on main interface

Note: On login interface, clicking on the hidden buttons in the top left and top right corners in sequence three times will pop up extras menu options.

Figure 3-36 Extras menu on login interface



1. Language and logo

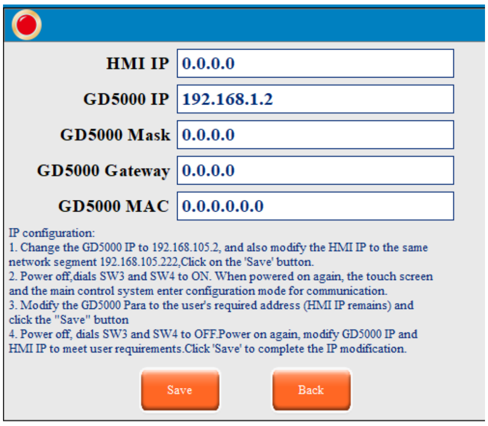
Click the button to pop up a options menu, you can choose language type and logo of the touch screen according to the application needs. Restart the touch screen after the selection is complete, and the system automatically changes the language environment to the set language type.

2. IP view and change

You can view and modify the IP of the touch screen, IP of the system, subnet mask, gateway, MAC. The communication between the touch screen and the system is completed through the configuration mode. When the system is connected to multiple touch screens, it is necessary to modify the IP data of the touch screen, and ensure that the IP value of the touch screen and the IP value of the system are in the same network segment. Generally, the IP value of the touch screen and the system is set to be in 192.168.1.* network segment.

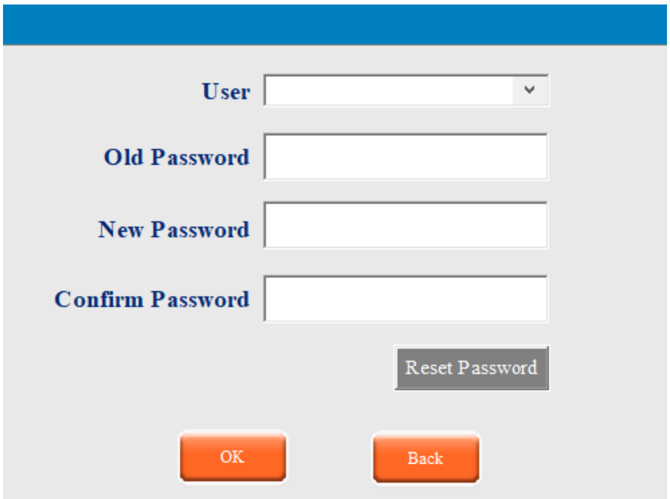
Note: Turn the DIP switch of the control board to the configuration mode state before viewing the configuration mode, and view the valid information after setting the DIP switch information correctly.

Figure 3-37 Interface of configuration mode



3. Modify password

Click the button to pop up a options menu, you can change login password of the operator or administrator according to the application needs.



4. Delete records

Click the button to enter the interface to delete the relevant content recorded in the touch screen system. This function will clear the recorded data and information. Exercise caution when using this function.

Figure 3-38 Delete records interface diagram

4 Installation and wiring

GD5000 series medium voltage variable-frequency speed regulation system needs to be installed in a suitable location and space for different working conditions. You must conduct plant layout and construction according to the foundation drawings and installation requirements provided by the manufacturer.

4.1 Installation conditions

4.1.1 Environment requirement

1. Regarding the installation environment of the equipment, you shall observe the requirements in the following table.

Table 4-1 Installation environment of the equipment

Item	Content	
Ambient temperature	Within the range of -10°C–40°C. Preheating is needed when the temperature is below 0°C. Derating is needed when the temperature is above 40°C. The average value of 24 hours shall be in the range of 5°C–35°C.	
Relative humidity	The relative humidity shall be less than 50% when the max. temperature is 40°C. The relative humidity cannot exceed 80% at low temperature. No condensation occurs.	
Altitude	Below 1000m. Derating is needed when the altitude is higher than 1000m. (When the altitude exceeds 1000m, please inform the manufacturer in advance before ordering.)	
Air pressure	Within the range of 860–1060kpa.	
Air quality	The dusts in the electrical room shall be roughly equal to atmospheric dusts, especially not containing iron powder, silicone particles, etc.	
Corrosion factors	Corrosive gas	Concentration
	Hydrogen sulfide (H_2S)	⩽0.001ppm
	Sulfur dioxide (SO_2)	⩽0.05ppm
	Chlorine (Cl_2)	⩽0.1ppm
	Ammonia (NH_3)	⩽0.1ppm
	Nitrogen oxide (NO_X)	⩽0.02ppm
	Ozone (O_3)	⩽0.002ppm
	hydrogen chloride (HCl)	⩽ 0.1mg/m^3

2. Regarding the storage environment of the equipment, you shall observe the requirements in the following table.

Item	Content	
Relative temperature	-40–+70°C, with the air temperature change rate less than 1°C/min.	Do not put it in the place with condensation or freeze caused by rapid changes of temperature.
Relative humidity	Less than 95%	
Storage environment	Without direct sunlight, dust, corrosive gas, combustible gas, oil mist, steam, and dripping water.	

Note: Improper storage of power electronic equipment can affect the service life of the equipment or even cause the equipment to be inoperable. Reference standards for storage environment conditions: IEC61800-4 (GB12668.4-2006), UDC 621.3:658.78, GB4798.1-88.

General requirements:

A. Do not place it directly on the ground; place it on appropriate supporting objects.

B. If there is any impact of humidity, appropriate desiccating agent shall be provided: each unit of desiccating agent (30g) absorbs 6g water content. According to the packaging materials in use, you will need the desiccating agent of the following amounts: Polyethylene metal film: 10 units per square meter; aluminum metal film: 8 units per square meter.

C. Taking polyethylene materials or aluminum metal film as the protective packaging can prevent the water content from infiltrating.

D. Regular inspection: During the whole storage period, inspect the storage state and packaging state of the equipment every month. If the equipment has been damaged, you need to check the damage immediately and find out the reason. After repairing the damaged equipment, store the system according to the requirements mentioned above.

3. To ensure the spare parts are not damaged, you shall observe the following matters during the storage of spare parts.

After receiving Goodrive5000 series medium voltage variable-frequency speed regulation system, check immediately whether there is any damage to the spare parts, and if any damage to the spare parts is found, please report it to us. We will not undertake any product quality guarantee responsibility for the damage caused by external shock or external environment within the product quality guarantee period. Within the quality guarantee period, to prevent the equipment spare parts from damage, please pay attention to following items.

Precautions
● There must be no vibration or impact at the storage place, and it is necessary to avoid damage caused by moisture, frost, temperature, dust and gravels. ● The environment conditions shall meet the requirements of temperature and humidity: The spare parts must be stored in a dry original packaging box without flying insects, and kept away from corrosive gas. ● The relative humidity shall be less than 95%, and the storage temperature for the spare parts shall be -5°C –+55°C. ● The circuit boards must be stored in anti-static packing bags without leakage of desiccant agent, and kept away from corrosive gas that may cause damage to the circuit boards or gases containing alkali-saline or other impurities, and they must not be frozen. ● The power unit is equipped with electrolytic capacitors inside, long-term power off of electrolytic capacitors will lead to the deterioration of their electrical characteristics; therefore, store them in the method of electrifying once every year. ● If you find that the humidity has surpassed the maximum allowable extent in the air, environmental protection measures such as cooling, heating, dehumidifying and other methods shall be taken to guarantee the environment conditions for storing the spare parts.

4.1.2 Installation dimension requirements

Please refer to the relevant drawings in the engineering technical data for the cabinet size, outline dimensions and base plate installation diagrams of the variable-frequency speed regulation system. All cabinets need to be installed according to the drawings. Sufficient clearances need to be reserved to ensure the space for air flow, max. door swing, and maintenance. Please provide access to the installation base (such as aisle spacing) and ensure that space is reserved for auxiliary equipment for transporting the variable-frequency speed regulation system.

Figure 4-1 Schematic diagram 1 of installation requirements (front view, unit: mm)

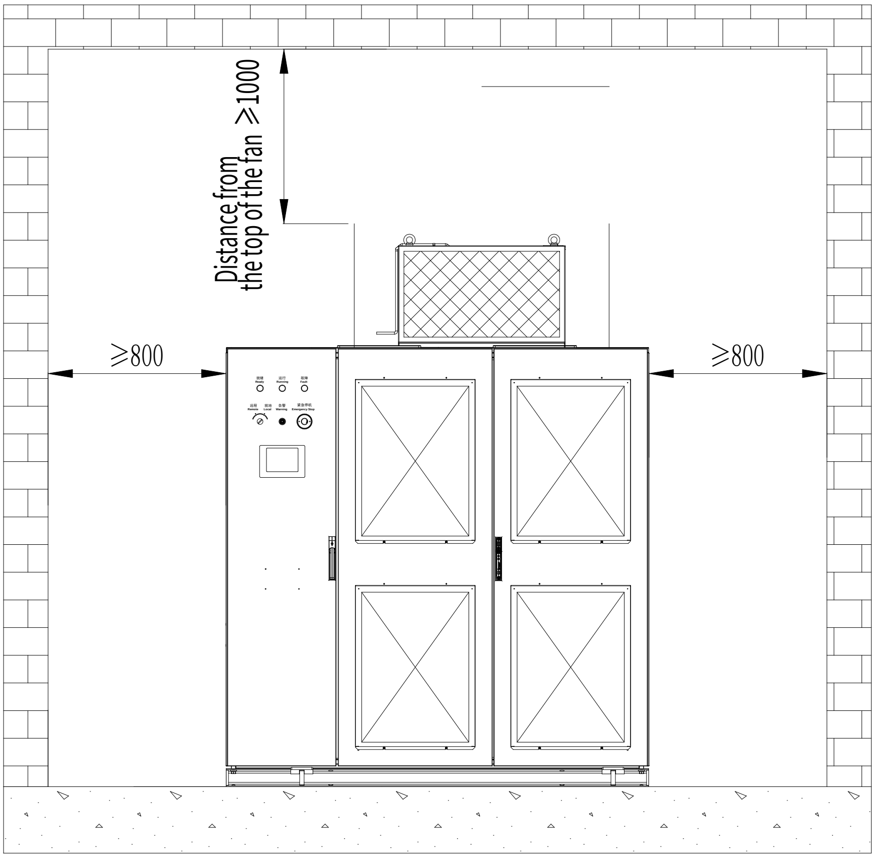


Figure 4-2 Schematic diagram 2 of installation requirements (side view, unit: mm)

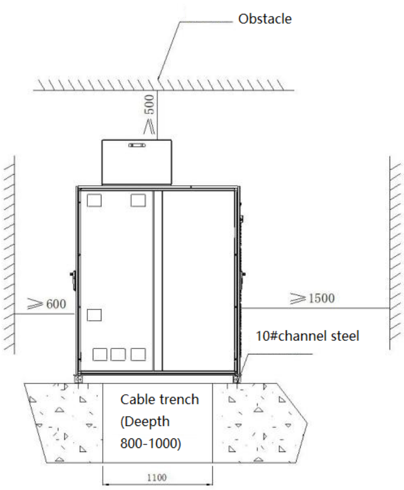


Figure 4-3 Schematic diagram 3 of double-row installation requirements (side view, unit: mm)

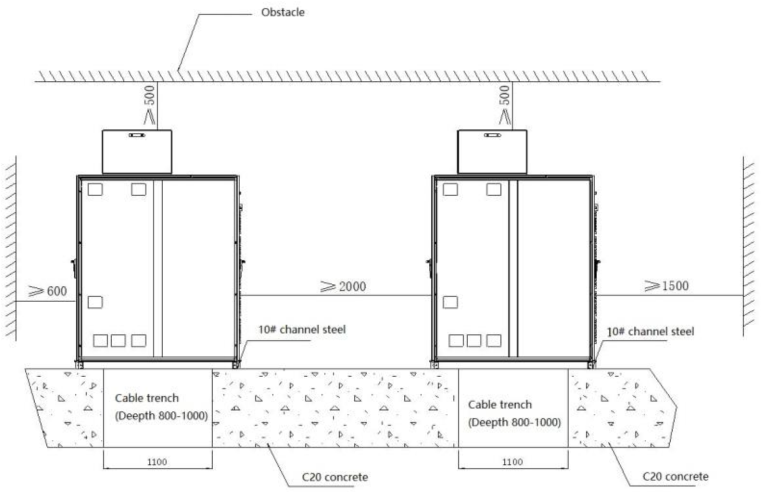


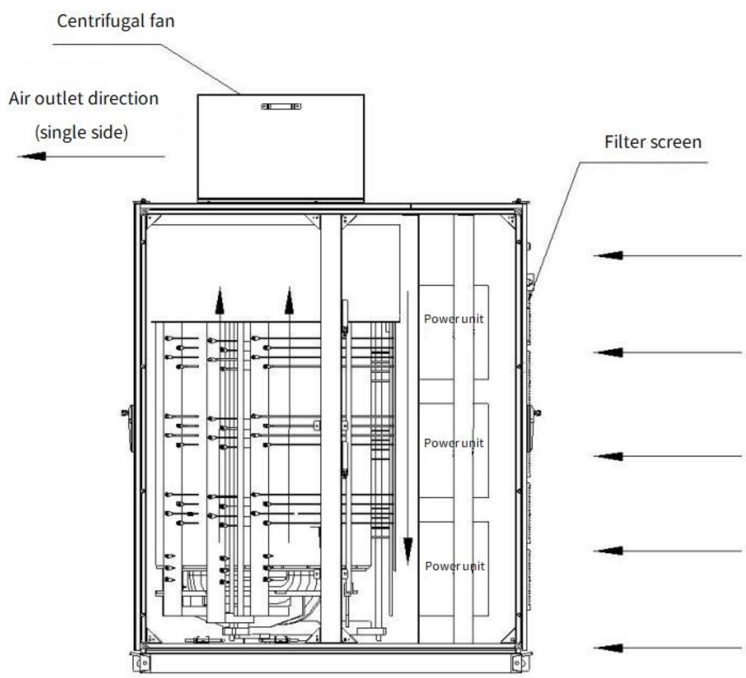
Table 4-2 Installation space dimensions

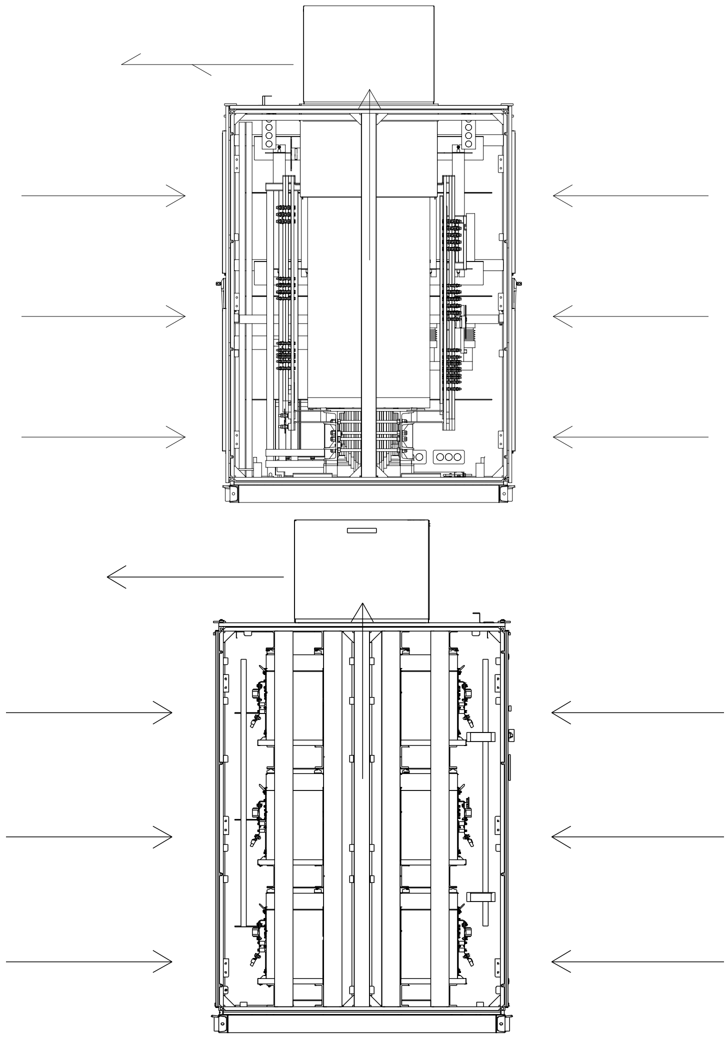
Min. width of surrounding passage of the medium voltage variable-frequency speed regulation system		
Layout manner	Maintenance channel	Operation channel
Dual-line layout	0.6m	2.0m/1.5m
Single-line layout	0.6m	1.5m

4.1.3 Dissipation guidance

The cooling air duct of the variable-frequency speed regulation system is shown in Figure 4-4. To guarantee sufficient cooling, the distance between the top of the system and the roof must comply with the requirements of relevant national regulations. To reduce ambient temperature further, you can install centralized ventilation air ducts for transmitting the hot air through centrifugal blower and directly to the outside by the air ducts.

Figure 4-4 Schematic diagram of cooling path

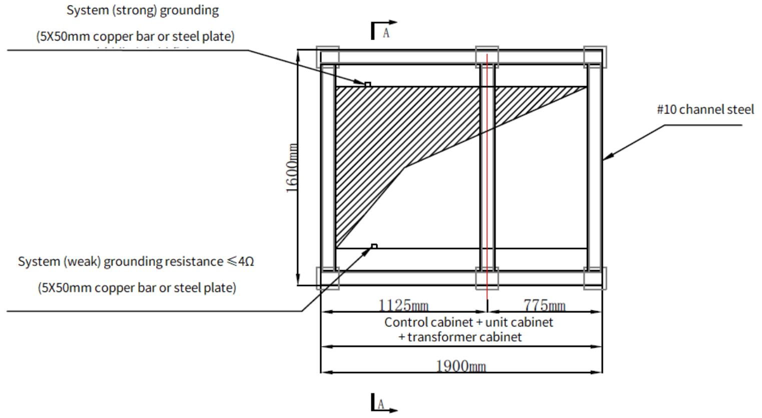


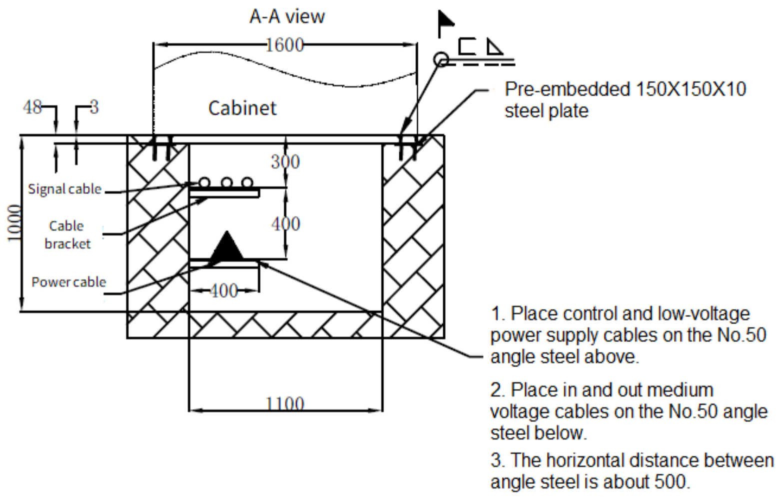


4.1.4 Foundation and channel design

The cabinets of Goodrive5000 medium voltage variable-frequency speed regulation system must be vertically installed onto the concrete casting foundation framework made of flat steel channels, with the overall roughness of the surface below 5mm. The foundation must be made of non-combustible materials and have smooth and abrasion-free surface, and shall be moisture-proof and able to bear the weight of the system. The cable ducts must be made of non-combustible materials and have smooth and abrasion-free surface, and shall be moisture-proof and dust-proof, with measures preventing animals from entering.

Figure 4-5 Schematic diagram of foundation installation





4.1.5 Cabinet installation

The system is directly welded onto foundation steel channels, and the wiring inside the cabinets shall be performed under the guidance of our professionals.

⚠ Warning
● Ensure that various kinds of fibers, paper scraps, sawdust, metal fragments and other foreign materials do not enter into the cabinets or adhere to the radiators; otherwise, it may cause accidents or fire. ● Install onto the non-combustible structure made of basic steel channels; otherwise, it may cause fire.

The following installation guidelines are applicable to the general installation in industrial environment. In special environment, please make inquiry to us for detailed installation procedures.

1. Before mechanical installation, please be sure to meet all environment conditions described above.
2. Examine the basic level with level instruments. The allowable maximum overall roughness is less than 5mm. If the ground surface is not flat, it may cause cabinet distortion and cabinet doors cannot be opened or closed smoothly.
3. Move to the installation position. Please refer to the requirements of moving.
4. Open all cabinet doors, and carefully inspect possible transportation damage to the system and the attached devices. If any part is damaged or missing, please immediately contact the technical service department of our company and the logistics company. Please note the opening methods of cabinet doors.
5. Check whether the cabinet doors can be fully opened or closed; if not, the cabinet need to be adjusted. Examine the position-restraint locks on the doors: after power on, aside from the doors of the main control cabinets, no other front doors and back doors can be opened. The illegal opening of cabinet doors will trigger the alarm.
6. Perform the wiring inside the cabinet under the guidance of our professionals.

Note: Please pay attention to the opening methods of cabinet doors. Forced opening of cabinet doors is forbidden; otherwise, the equipment will be damaged.

4.2 Mechanical wiring

4.2.1 Transportation and moving

The outer packaging of Goodrive5000 medium voltage variable-frequency speed regulation system can endure the external impact from the sea, land or air transportation, but appropriate protection measures must be taken to avoid the pollution of water immersion and dust. Besides, during the process of transportation, it is necessary to avoid the impact caused by mechanical shocks, damage and rough handling.

To move, disassemble and store properly, please pay attention to all relevant precautions and indication and instruction tags on the packaging boxes. We recommend entrusting logistic companies with a good reputation and credit to lift and transport the medium voltage variable-frequency speed regulation system.

4.2.1.1 Transportation

Goodrive5000 medium voltage variable-frequency speed regulation system can be transported by any vehicles such as trucks, trains, airplanes and ships. During transportation, the products must be handled with care. Exposure to rain and sunlight are both strictly forbidden. No severe vibration, impact, inclination or upend is allowed.

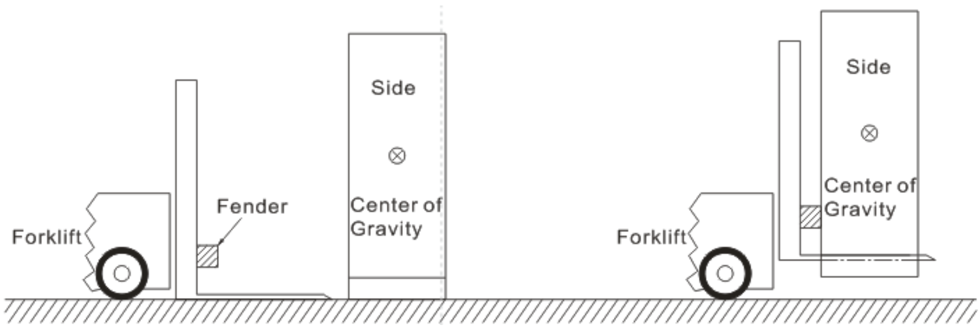
4.2.1.2 Moving

The variable-frequency speed regulation equipment can be transported in two ways after packing, namely forklifts and cranes.

Method 1: Forklifts

When using a forklift, you need to confirm that the bearing weight of the forklift must be more than 10 tons, the relieved tooth shall be at least 2.0m long and its thickness shall not be larger than 90mm. The relieved tooth must be adjustable from 600mm to 1200mm.

Figure 4-6 Moving with forklifts



Note:

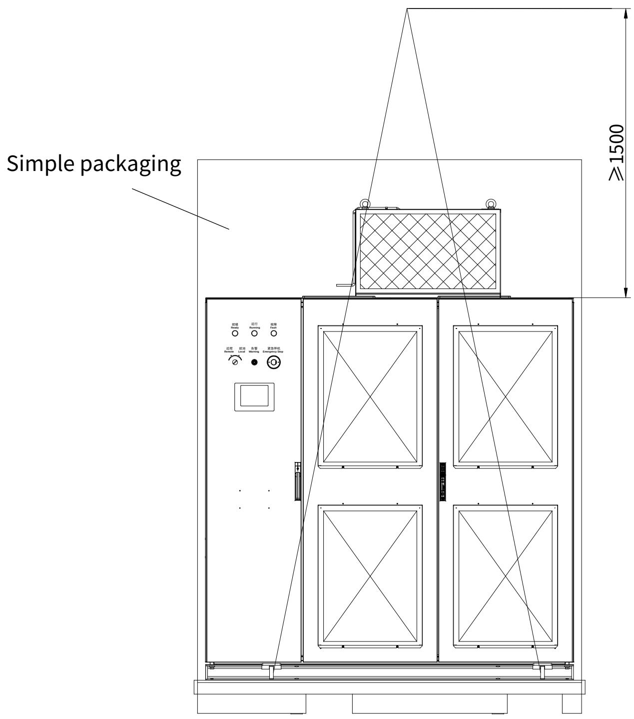
- Do not pick up the cargo with the forklift at high speed.
- When picking up the cargo with the forklift, it is necessary to adjust the fork tine spacing (the center of gravity is between fork tines) as needed to make the load of two fork tines balanced.
- The entry depth of the fork tines shall touch all the sleepers at the bottom of the box, first tilt the gantry back to make the cargo close to the fork arms, then lift it up.
- During the process of cargo lifting or landing, the forklift shall keep the horizontal direction and unmoved.
- The bottom end of fork tines shall be kept at a distance of 15-40cm from the ground or car surface before moving horizontally.
- When the forklift is operating, people are forbidden to stand here to avoid accidental injury.

- When there are people around, it is necessary to whistle to notify them before leaving the ground or the car surface slowly.

Method 2: Cranes

During hoisting, use lifting slings instead of wire ropes. The hooks of the lifting slings must be hooked to the lifting position on the steel channels, and the distance between the top hook position and the cabinet must meet the minimum distance specified, as shown in Figure 4-7.

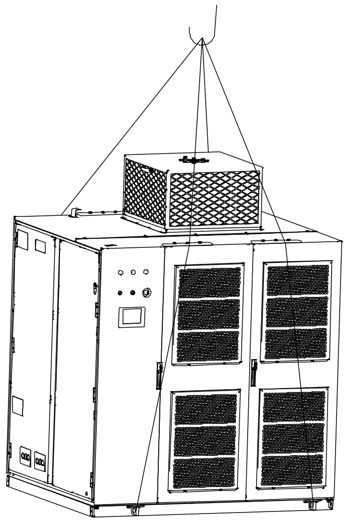
Figure 4-7 Hoisting of system components with packages (unit: mm)



The system can also be transported in two ways after removal from the wooden box, cranes or chain hoisting and rolling bars.

Method 1: Cranes or chain hoisting

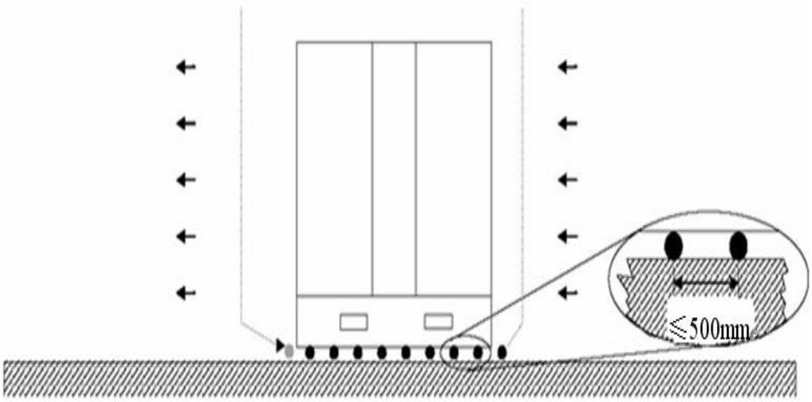
Figure 4-8 Cabinet hoisting



Method 2: Rolling bars

It is the simplest method. Put parallel rolling bars on the floor to move the cabinet and move the rolling bars in cycle. (The length of the rolling bar shall exceed the thickness of the cabinet, the diameter shall not be smaller than 50mm and the space between the rolling bars shall not be larger than 500mm.)

Figure 4-9 Moving with rolling bars



4.2.2 Unpacking inspection

After receiving the medium voltage variable-frequency speed regulation system that you ordered, please conduct unpacking check according to the following requirement. if there is anything wrong with the products you ordered or they do not comply with the specifications that you ordered, please contact the agent from whom you order the equipment or contact the nearest office of our company.

1. Check the nameplate of the medium voltage variable-frequency speed regulation system and confirm the models and specifications of the equipment you ordered.
2. Check whether any damage has occurred on the appearance during handling and transportation, such as damage to the cabinet appearance, any distortion to the door and sideboards and inner devices falling off, etc.
3. Open the cabinet door and check whether the control cables are loose and there is water immersion, missing or damaged parts.
4. By contrast of the supply list, check whether the equipment that you ordered is complete.

4.2.3 Positioning and fixing

Warning
● Ensure that various kinds of fibers, paper scraps, sawdust, metal fragments and other foreign materials do not enter into the cabinets or adhere to the radiators; otherwise, it may cause accidents or fire. ● Install onto the non-combustible structure made of basic steel channels; otherwise, it may cause fire.

The medium voltage variable-frequency speed regulation system is composed of one or more than three cabinets (depending on power size, layout mode and optional parts). According to the requirements, a single cabinet or multiple cabinets can be placed upon the foundation steel channels vertically using traveling cranes or forklifts. The cabinet bodies shall be assembled, connected, positioned and aligned, then shall be directly welded onto foundation steel channels, the wiring inside the cabinets and between the cabinets shall be installed under the guidance of the professionals from our company. In some cases, the power units shall be separately packaged for transportation, and they are installed into the power unit cabinets under the guidance of the professionals from our company after arriving.

The following installation guidelines are applicable to the general installation in industrial environment. In special environment, please make inquiry to us for detailed installation procedures.

1. Before mechanical installation, please be sure to meet all environment conditions described above.
2. Examine the basic level with level instruments. The allowable maximum overall roughness is less than 5mm. If the ground surface is not flat, it may cause cabinet distortion and cabinet doors cannot be opened or closed normally.
3. Move to the installation position. Please refer to the requirements of moving.
4. Open all cabinet doors, and carefully inspect possible transportation damage to the system and the attached devices. If any part is damaged or missing, please immediately contact our technical service department and the logistics company. Please note the opening methods of cabinet doors.
5. Check whether the cabinet doors can be fully opened or closed; if not, the cabinet bodies need to be adjusted. Examine the position-restraint locks on the doors: after power on, aside from the doors of the main control cabinets, no other front doors and back doors can be opened. The illegal opening of cabinet doors will trigger the alarm.
6. Perform the fine adjustment of the cabinets, and fix the adjacent cabinets tightly with binding bolts.
7. Connect the wiring inside the cabinets, install and fix the power units under the guidance of the professionals of our company.

Note: The phase-shifting transformer cabinet must be installed separately. Please pay attention to the opening methods of cabinet doors. Forced opening of cabinet doors is forbidden; otherwise, the equipment will be damaged.

4.2.4 What to do after scrapping

Warning
● When the package or product is scrapped, deal with it as industrial effluent; otherwise, injuries or environment pollution may occur.

The package of Goodrive5000 integrated machine medium voltage variable-frequency speed regulation system shall be designed with the minimum usage of the packing materials that have adverse effects on the environment; some of the packing materials can be recycled and reused. The handling of the packing materials shall comply with the nation

nal standards related to environment protection.

While scrapping the devices inside the medium voltage variable-frequency speed regulation system, the electrolytic capacitors, PCBs, electronic components and other parts need to be dealt with correct methods so that any part may not cause harm to the surroundings. These handling methods can refer to the national laws and regulations on environment protection.

4.3 Electrical installation

4.3.1 Precautions

Danger
● All connectors must receive insulation treatment to ensure good insulation. The connecting positions must be kept clean and meet the requirement of corresponding cleanliness.
● Medium voltage electrical insulation distance must meet the requirements of electrical safety distance in order to avoid short circuit.

1. Ensure that the medium voltage incoming and outgoing cables match the control cable insulation and the voltage class of the variable-frequency equipment. Ensure that the medium voltage incoming and outgoing cables and the diameter of the control cables meet the load power requirements.
2. Ensure that the medium voltage incoming circuit breaker is in the switch-off state, and hang the work sign.
3. Ensure that the medium voltage incoming and outgoing cables must be wired separately to prevent mixed lines.
4. Ensure that the protective steel armor of medium voltage incoming and outgoing cables shall be reliably grounded, and the cables and the cabinets are reliably fixed.
5. Route the control signal cables separately from the electrical cables, and the analog signal cables must use shielded twisted pairs and one end of the shielded wires shall be reliably grounded.
6. Ensure that the system cabinets are reliably grounded.

4.3.2 Primary wiring

4.3.2.1 Incoming/outgoing and grounding method

Attention
● Do not exchange the wiring of I/O terminals; otherwise, the system and other devices may be damaged.

The primary wiring feeds in R, S, T terminals and feeds out U, V, W terminals in transformer cabinet. The copper bar at the bottom of the transformer cabinet will be connected to the grounding of transformer, unit cabinet and control cabinet, and user grounding grid after the system is installed.

Note: The terminals of control circuit in control cabinet shall be grounded seperately.

4.3.2.2 Standard requirements of medium voltage power distribution

Danger
● Connect I/O terminals properly; otherwise, the system may be damaged.

- Before the power is connected to Goodrive5000 integrated machine medium voltage variable-frequency speed regulation system, it needs to pass through the main circuit breaker which is allowed to close only after receiving the medium voltage closing allowing signal from the system.
- The power of main circuit breaker is directly connected to the input terminals of the variable-frequency speed regulation system in no need of passing through the input reactor.
- The variable-frequency output of the system is connected to the motor by the output terminals of switching cabinets.

4.3.2.3 The wiring of the system and switching cabinets

Terminal		Name	Description	Fastening torque requirements
Input	R	Main circuit power input, the 1st phase sequence	Connect to 3PH medium voltage AC power, the 1st phase sequence	M10：25N.m M12：45N.m M16：100N.m
	S	Main circuit power input, the 2nd phase sequence	Connect to 3PH medium voltage AC power, the 2nd phase sequence	

Terminal		Name	Description	Fastening torque requirements
	T	Main circuit power input, the 3rd phase sequence	Connect to 3PH medium voltage AC power, the 3rd phase sequence	
Output	U	Output of the medium voltage variable-frequency speed regulation system, the 1st phase sequence	Connect to 3PH AC medium voltage motor, the 1st phase sequence	
	V	Output of the medium voltage variable-frequency speed regulation system, the 2nd phase sequence	Connect to 3PH AC medium voltage motor, the 2nd phase sequence	
	W	Output of the medium voltage variable-frequency speed regulation system, the 3rd phase sequence	Connect to 3PH AC medium voltage motor, the 3rd phase sequence	

Note: The output phase sequence of U, V and W terminals may be different from that of R, S and T. When power frequency power bypass is a necessity, make sure input phase sequence is consistent with output phase sequence; otherwise, the system cannot work properly.

4.3.2.4 Layout of medium voltage cables

The layout of main power supply and motor cables must comply with national standards. Please refer to the instructions and suggestions of the manufacturer.

1. It is recommended to use 3PH armoring steel cables shielded individually. If 1PH cable is used, 3PH cables shall be combined with each other to ensure EMC.
2. According to requirements of the manufacturer, install collectors at the cable terminations.
3. Corresponding ground wire shall be grounded in compliance with national electrical standards.

4.3.2.5 Grounding

Ensure the ground wire with less than 4Ω ground resistance, use wires between the cabinet and door of the system, channel in base among cabinets, copper conductor cable with no less than 50mm^2 sectional area for the ground connection between the whole-set equipment and the grid. To guarantee equipment and personal safety, check the grounding before using.

Danger

- Before wiring, please confirm that the input power supply has been cut off. There is the risk of electric shock and fire.
- Electric engineering professionals are allowed to perform the wiring. There is the risk of electric shock and fire.
- Be sure to make reliable grounding of the cabinet. There is the risk of electric shock and fire.
- Please check whether the AC main circuit power supply is consistent with the rated voltage of the variable-frequency speed regulation system; otherwise, there will be risk of injury and fire hazard.
- Please use the screwdriver of designated torque to tighten the terminals; otherwise, there will be the risk of fire.

- Do not connect the input power supply to the output terminals U, V and W; otherwise, internal damage may occur to the variable-frequency speed regulation system.

4.3.3 Secondary wiring

Recommended cross section and specification of control power supply, signal and communication cables:

1. Control power input cable: Use multi-core flexible copper wires with a cross-sectional area of 0.5–4 mm^2 (depending on load, up to two wires per phase can be connected).
2. Analog input/output cables: Whole shielded twisted pair, cross section 0.5–1.5 mm^2;
3. Digital input/output cables: Whole shielded twisted pair, cross section 0.5–1.5 mm^2;
4. Communication cables: Select specialized communication according to relevant requirements, or whole shielded twisted pair, cross section 0.5–1.5 mm^2;

4.3.4 User-provided accessories and wiring

1. Main circuit breaker

The main circuit breaker can be vacuum breaker or air isolation circuit breaker which will meet not only the requirements of voltage and current of power supply, but also the requirements of primary side voltage and current of phase shifting transformer. Furthermore, it shall be capable of bearing current surge caused by switching on the transformer, and it will not trip after fault current caused by secondary side short circuit in 100ms.

2. Input cable

There are no special requirements for the cables from the circuit breaker to the primary side of transformer. The rated voltage of the cables shall keep consistent with the voltage of the primary side circuit. The rated current shall satisfy the transformer and the set requirements for protection. On basis of the maximum ambient temperature, set the decreased capacity of the cables according to the cooling factors and local electrical regulations, and install it in accordance with the standards for medium voltage equipment.

3. Output cable

There are no special requirements for the cables from Goodrive5000 series medium voltage variable frequency speed regulation system to the motor. It is recommended that the cable length to be no longer than 1000m, the case that the field cable length is longer than 1000m shall be indicated in the order.

The rated voltage of the cables shall keep consistent with the motor model, and the rated current shall comply with the motor model as well as allowable overload current requirements for motor protection. The decreased capacity of the cables shall refer to the maximum ambient temperature, cooling factors, and national electrical standards. The installation shall be in accordance with the standards for medium voltage equipment.

4. Control power cables

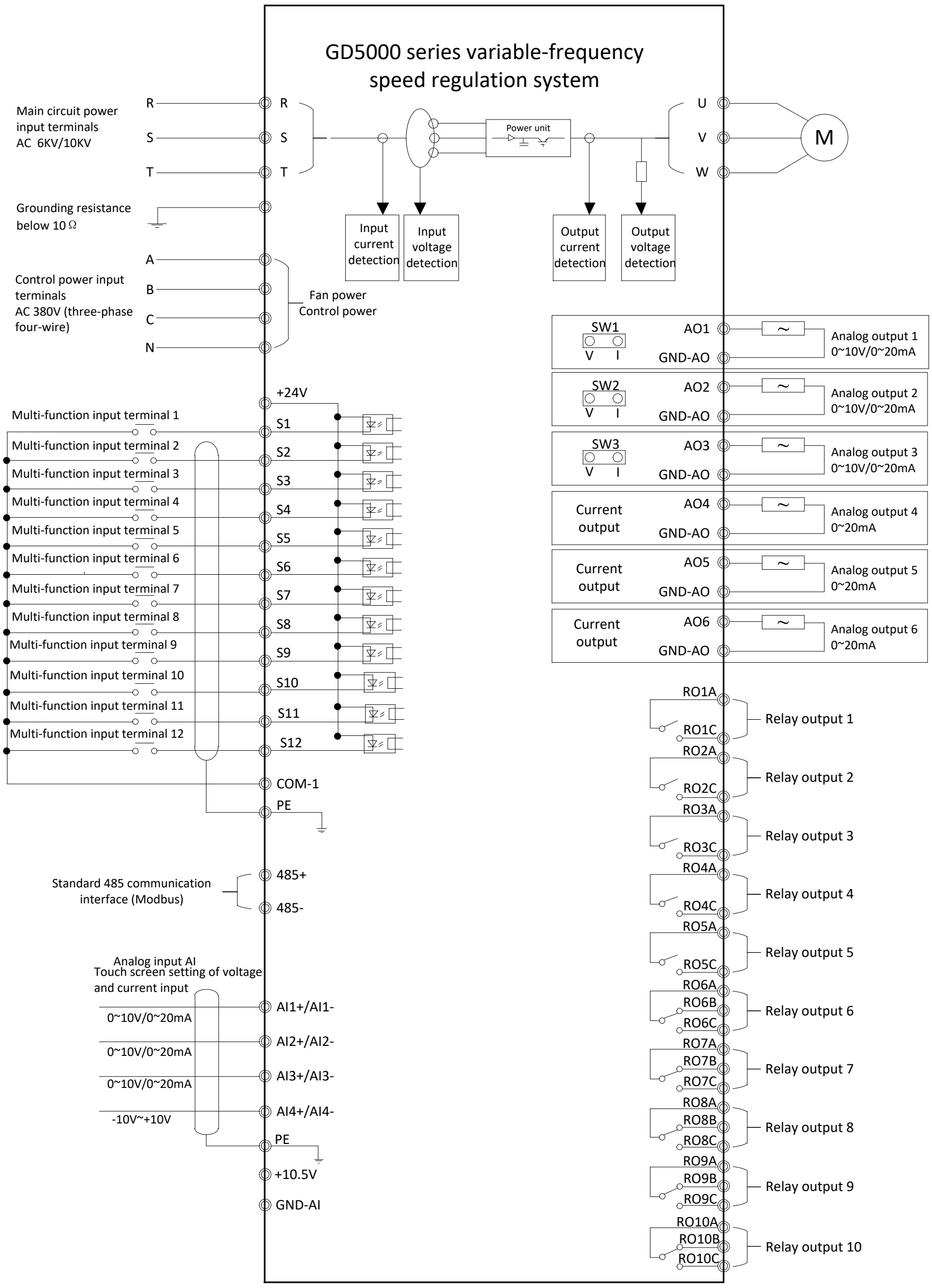
The external redundant power supply of the system is AC 380V, it is recommended to use a multi-core soft copper wire higher than this voltage, according to the corresponding load current, transmitting the wires to the corresponding terminals of the control panel, and tighten the wires up.

4.3.5 General introduction to user terminals

Goodrive5000 medium voltage variable-frequency speed regulation system provides standard 12-channel digital inputs, 10-channel relay outputs, 4-channel analog inputs, and 6-channel analog outputs. All user terminals are programmable and they can be set by function codes. Simultaneously, the control terminals can be extended as required.

All user terminals are connected to the terminal blocks, so pay attention to connecting from the terminal blocks before using. The secondary wiring for users shall be conducted in the control cabinet. The wiring diagram of user terminals is shown as Figure 4-10.

Figure 4-10 Wiring diagram of user terminals



The descriptions of user terminals are as follows.

Category	Terminal	Function	Technical specifications
Digital input	S1	Multi-function input 1	1. Forming the optical coupler isolation input with COM-1.
	S2	Multi-function input 2	
	S3	Multi-function input 3	2. The input voltage can only be 24V provided by the system.
	S4	Multi-function input 4	
	S5	Multi-function input 5	3. The suspension of terminals will be regarded as disconnected.
	S6	Multi-function input 6	
	S7	Multi-function input 7	4. Input impedance: 1kΩ

Category	Terminal	Function	Technical specifications
	S8	Multi-function input 8	
	S9	Multi-function input 9	
	S10	Multi-function input 10	
	S11	Multi-function input 11	
	S12	Multi-function input 12	
24V power supply	+24V	24V power supply provided by the system, which is only used for internal circuits and not connected to the outside.	
	COM-1	24V power GND	
10V power supply	+10.5V	+10.5V power supply provided by the system.	
	GND-AI	+10.5V power supply ground	
Analog input	AI1+/AI1-	Analog input terminal 1	1. Differential input 2. For voltage input, voltage range 0–+10V; for current input, current range 4–20mA, 20mA current corresponding to +10V. 3. Input impedance: 20kΩ (voltage)/500Ω (current)
	AI2+/AI2-	Analog input terminal 2	
	AI3+/AI3-	Analog input terminal 3	
	AI4+/AI4-	Analog input terminal 4	1. Differential input 2. Voltage input range: -10V–+10V 3. Voltage input resistance: 20kΩ
Analog output	AO1	Analog output terminal 1	1. Outputting the voltage and current corresponding to GND-AO terminals. 2. Output voltage range: 4–+10V, output current range: 0–20mA 3. For voltage output, allowable output impedance is ⩾5kΩ. For current output, allowable output impedance is 100–500Ω.
	AO2	Analog output terminal 2	
	AO3	Analog output terminal 3	
	AO4	Analog output terminal 4	1. Outputting the current corresponding to GND-AO terminals. 2. Output current range: 4–20mA, allowable output impedance: 100–500Ω
	AO5	Analog output terminal 5	
	AO6	Analog output terminal 6	
Relay output	RO1	Relay output terminal 1	1. RO1–RO5: NO; RO6–RO10: NO/NC 2. The current withstand capacity of RO1–RO5 relays is 6A (resistive load) and that of RO6–RO10 relays is 3A (resistive load).
	RO2	Relay output terminal 2	
	RO3	Relay output terminal 3	
	RO4	Relay output terminal 4	
	RO5	Relay output terminal 5	
	RO6	Relay output terminal 6	
	RO7	Relay output terminal 7	
	RO8	Relay output terminal 8	

Category	Terminal	Function	Technical specifications
	RO9	Relay output terminal 9	
	RO10	Relay output terminal 10	

Note:

1. Do not route the analog cables and input power cables in parallel.
2. Do not use the same line for the signal cables and input power cables.

Danger

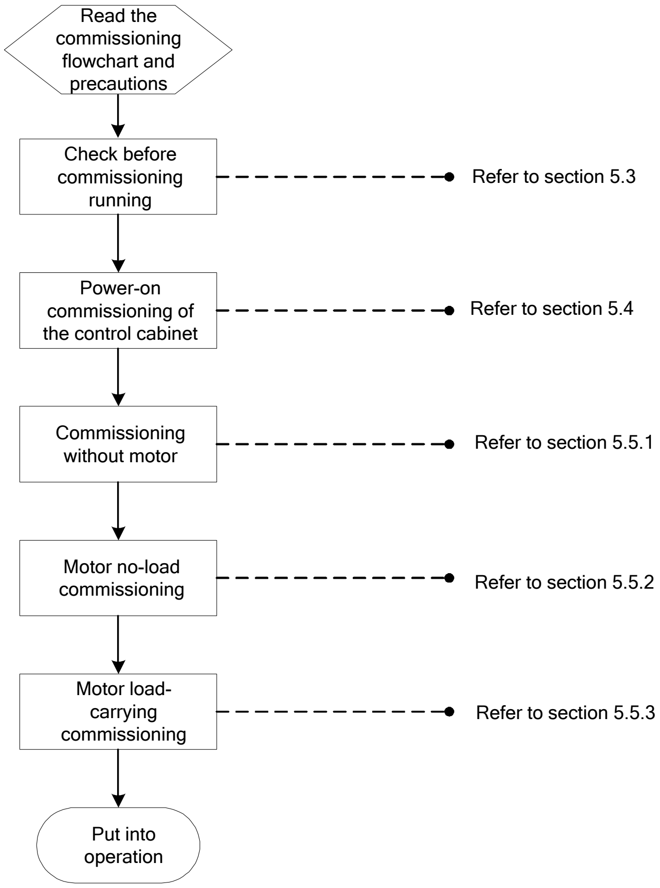
- Installation of large current positions: to enable the variable-frequency speed regulation system to meet the technical properties, pay close attention to large current installation (All I/O terminals with more than 10A current flow shall be considered large current terminals). The key points are:
- Terminals shall use the materials with excellent conductive property, such as oxygen-free copper terminals, silver-plating or tin-plating fasteners and other connecting materials.
- All terminals shall be carefully cleaned with ethanol before connecting.
- Connections of all connectors shall be very reliable, the fasteners shall be tightened with wrenches, the important connectors shall be wrenched tight reliably with torque wrenches to ensure the contact resistance is less than 2mΩ.
- The fasteners of all large current connecting positions shall include spring washers which will be pressed flat after fastening.
- The current density of large current wires shall be appropriate to avoid heating and thus influence the device.

5 System commissioning and running

5.1 Commissioning flowchart

This chapter mainly introduces the steps and contents required for commissioning the GD5000 series medium voltage variable-frequency speed regulation system, including the initial power-on inspection to the operation of the medium voltage motor, each step of which needs to be operated under the guidance of our professionals or after users have received relevant professional training. The function performance commissioning and parameter setting must be carried out in strict accordance with the relevant regulations and our operation manual. The commissioning process shall be carried out in accordance with Figure 5-1.

Figure 5-1 Schematic diagram of system commissioning procedures



5.2 Commissioning precautions

Danger
● The variable-frequency speed regulation system can be connected to the power only after each electrical cabinet door is closed, and the cabinet doors cannot be opened any more upon the power-on. ● Do not touch a switch with wet hands. It is prohibited to completely disconnect the control power supply during running.

● Do not touch the terminals of the variable-frequency speed regulation system that is connected to the power because the terminals may be live even if they are in the stop state. ● Only trained and authorized personnel can operate the control cabinet although it has no medium voltage. ● The transformer cabinet, power unit cabinet, and bypass cabinet of the product are medium voltage danger areas, and the cabinet doors cannot be opened upon power-on.

Users must provide at least two professional electrical technicians as our on-site cooperation personnel during commissioning, who must meet the following conditions.

1. They are familiar with medium voltage electrical equipment and the corresponding safety norms.
2. They are familiar with the user's load transmission process and the control logic involved with our equipment.
3. They are authorized to operate the medium voltage equipment and transmission equipment involved in the user's side.

5.3 Check before commissioning running

No.	Check item	Check
1	Ensure that there are no foreign objects inside the bypass cabinet, transformer cabinet, unit cabinet, or control cabinet.	☐
2	Ensure that all electrical connections are tight and that there is no cabinet damage; if so, the integrity of components, cables, or other materials around the damage must be checked to ensure that there are no safety hazards.	☐
3	Check all parallel cabinet lines, overcoils, and other cables in easy-to-cut places to ensure that no conductors are exposed.	☐
4	The grounding bar of the system cabinet must be reliably connected to the earth, and the ground wire at the door panel inside the cabinet is reliably connected to ensure personnel safety.	☐
5	Check the grounding wire connected to the grounding bar in each cabinet of the system is firmly connected without breakage.	☐
6	Ensure that the power cable of the cooling fan is reliably connected, the fan is firmly installed and rotates without abnormal friction sound.	☐
7	Ensure that the cable wiring between phase shifting transformer and unit, unit and unit is normal.	☐
8	Ensure that the optical fiber of each power unit is properly connected to the main control board.	☐
9	Ensure that each single board and its external wiring is proper and solid.	☐
10	The power cables and signal cables connected by users are correctly connected; and wired separately.	☐
11	Ensure that each cabinet door is free of abnormalities and locked before powering on.	☐

5.4 Power-on commissioning of the control cabinet

⚠ Attention
The following steps must be performed in order, make sure each step is performed and confirmed correctly before proceeding to the next step.

Step	Commissioning contents	Check
1	The control power supply is three-phase four-wire power supply, to ensure that the voltage in the required range.	☐
2	Close the power switch in the control cabinet, observe whether the single boards in the control cabinet are normal and whether there are abnormal phenomena such as abnormal noise and odor in the cabinet.	☐
3	Close the fan switch in the control cabinet and check whether the fan is turning and rotating smoothly without abnormalities.	☐
4	Log in the touch screen to enter the main interface, and enter the parameter setting interface. ● Setting P00.21 to 1 to restore default values (required for the first power-on commissioning, no operation required later). ● Ensure that parameters such as system power, voltage and current levels, and number of units are correct according to the model. ● Set function codes relating to the buffer, UPS, switching cabinet, fan start/stop and unit bypass according to the actual configuration of the model. ● Set motor parameters according to the actual load type. ● Select the appropriate control mode and start-up method, and set the relevant control parameters. ● Set the parameters of the user port according to the actual user application function.	☐
5	Perform the switching cabinet logic control test for the device in commissioning mode (can be ignored without switching cabinet)	☐
6	Start and stop, simulate faults and other operation s are conducted to ensure that the system is equipped with the self-protection function.	☐
7	Ensure that the opening and closing signals of the system are correct, valid and reliable to verify the interlock function of the medium voltage switchgears.	☐
8	Cancel the commissioning mode and related parameters, and put the system in POFF state.	☐
9	Prepare for medium voltage power-on commissioning.	☐

5.5 Medium voltage power-on commissioning

⚠ Warning
The medium voltage power-on commissioning shall be conducted after the operations of sections 5.1 Commissioning flowchart–5.4 Power-on commissioning of the control cabinet are done.

5.5.1 Commissioning without motor

⚠ Attention		
The following steps must be performed in order, making sure that each step is performed and confirmed correctly before proceeding to the next step.		
Step	**Commissioning contents**	**Check**
1	Ensure that the system is in the power-off state, system input terminals R, S and T are connected reliably to the medium voltage incoming cables. Ensure that the output terminals U, V and W are disconnected from the motor, close all cabinets and lock them.	☐
2	After the control power supply is connected, when the system is in POFF state, a switch-on permission signal is issued, notifying that the medium voltage power supply shall be connected.	☐
3	Connect the medium voltage power supply according to the medium voltage safety operation procedures, if any equipment abnormality occurs in the middle of the process, you can disconnect the medium voltage input power supply immediately by pressing the emergency stop button or notifying the superiorofficer.	☐
4	Ensure there is no abnormality during the power-on of the medium voltage power supply, and verify again whether the medium voltage switch-off logic is normal.	☐
5	Connect the medium voltage power supply again, and observe whether the input voltage, unit bus voltage, and U, V and W phase bus voltage are normal.	☐
6	Observe whether there are alarms or faults in the system and whether the information displayed on each interface of the touch screen is normal.	☐
7	Locally verify the correctness of basic functions such as start/stop operation and ACC/DEC operation, and ensure the data states of each module detection and feedback are correct.	☐
8	Verify whether some of the alarms and faults can be reported normally and the protection actions are normal.	☐
9	Manually disconnect the user power supply and verify the dual power switching function. You shall observe the rotation direction of the fans.	☐
10	After confirming that there is no abnormality in different working states of the no-load equipment, stop the machine and cut off the medium voltage power supply.	☐
11	Prepare to perform commissioning with the motor.	☐

5.5.2 Motor no-load commissioning

⚠ Attention		
The following steps must be performed in order, making sure that each step is performed and confirmed correctly before proceeding to the next step.		
Step	**Commissioning contents**	**Check**
1	Ensure that the motor is disconnected from the load.	☐
2	Disconnect the medium voltage power and control power supplies, and reliably connect the motor cables to output terminals U, V and W of the system in phase sequence.	☐
3	Connect the medium voltage power supply according to the steps, put the system in the standby or stopped state, and confirm that there is no abnormality in the system.	☐
4	Ensure that the function parameters are set correctly, and perform jogging in the expansion command interface to see whether the motor rotation direction is correct (change the rotation direction by changing the wiring or modifying the parameters if the direction is opposite), and confirm that there is no abnormality.	☐

5	Set the target frequency, conduct several speed boost and droop tests on the system in steps of 5Hz, and observe whether there is any abnormality in the motor and system during the process.	□
6	If there is no abnormality in the commissioning, stop and disconnect the medium voltage power supply.	□
7	Prepare the motor load-carrying commissioning.	□

5.5.3 Motor load-carrying commissioning

Attention		
The following steps must be performed in order, making sure that each step is performed and confirmed correctly before proceeding to the next step.		
Step	**Commissioning contents**	**Check**
1	Connect the motor to the load, switch on the control power supply after all checks are completed, and connect the medium voltage power supply according to the steps.	□
2	When the system is in the standby or stopped state and the motor load is light, start the system, observe the change of the output voltage and current of the system as the frequency increases, and add loads to meet the user's production process requirements.	□
3	If any alarm or fault occurs during the start-up or running process, stop immediately and handle the situation according to chapter 8 Alarm and fault solution.	□
4	After trial running, conduct 24-hour on-site inspection, and record data such as the running frequency, input and output voltage, and input and output current.	□
5	Ensure that the equipment operates normally and meets user requirements until the end of trial running.	□
6	Conduct the training and work handover to operators.	□

6 Function description

P00 group Basic functions

Function code	Name	Description	Setting range	Default
P00.00	Control mode selection	0: Space voltage vector control mode 1: Asynchronous sensorless vector control 2: Synchronous sensorless vector control 3: Vector control	0–3	0

Select speed control mode of the variable-frequency speed regulation system.

0: Space voltage vector control

Space voltage vector control mode supports both AMs and SMs and is applicable to cases where speed control precision is not required high for general load, such as fans and pumps, and where a variable-frequency speed regulation system drives multiple motors.

1: Asynchronous sensorless vector control

Asynchronous sensorless vector control also called open loop vector supports asynchronous motors and applies to the cases requiring high performance without pulse encoders, low-frequency large-torque and high speed control precision. One variable-frequency speed regulation system drives only one motor such as conveyors and large-power drive equipment.

2: Synchronous sensorless vector control

Synchronous sensorless vector control only supports synchronous motors and the system shall carry out high precision adjustment on output current by close loop control algorithm to make torque and speed output more stable and accurate.

3: Vector control

Vector control supports synchronous and asynchronous motors, uses encoders as speed detection sensor for higher precision and wider range, and applies to the cases requiring high rotating speed control precision and low-frequency large-torque.

Note: Precise motor parameters are the necessity for vector control with high performance. Therefore, input the nameplate parameters of the motor correctly before running and finish motor parameters autotuning. Adjusting P3 group vector control can optimize vector control performance.

Function code	Name	Description	Setting range	Default
P00.01	Channel of running commands	0: Local 1: Terminal 2: Communication 3: Master	0–3	0

The function code can be used to select the command channel of the system control commands (such as start, stop, forward, reverse, jog, fault reset, etc.) in the remote-local state (remote-local terminal points to remote). In the local state (remote-local terminal points to local), the operation is only controlled by the touch screen. When the terminal R_N of the control cabinet is valid, that is, in the local state, it has nothing to do with P00.01, and the operation is only controlled by the touch screen.

0: Local

Some functions are available by setting the function codes. (The touch screen supports our Ethernet protocol and IP protocol).

1: Terminal

The control commands including forward running, reverse running, forward jogging, reverse jogging, stop, and fault reset are controlled by input signals of multifunctional input terminals. Please refer to detailed settings in P05.

2: Communication

For details about communication modes, refer to chapter 10 Modbus communication protocol.

3: Master

The channel is mainly used to set the running command of the slave under master-slave control. If the function code is set to 3, the slave is controlled by the start/stop command of the master.

Note: The touch screen of the system applies Ethernet channel.

Function code	Name	Description	Setting range	Default
P00.02	Current communication command channel	0: Modbus 1: Fieldbus 2: Ethernet	0–2	0

When P00.01=2, P00.01 is used to select the communication method of frequency setting command channel.

Function code	Name	Description	Setting range	Default
P00.03	UP/DOWN setting	0: Valid, save the setting at power-off. 1: Valid, do not save the setting at power-off. 2: Invalid 3: Valid during running, clear at stop	0–3	0
P00.04	UP/DOWN adjustment	-120.00–120.00Hz	-120.00–120.00	0.00Hz

The function code of UP/DOWN setting (frequency setting increasing/decreasing) can modify the set frequency of the system, adjust any frequency setting except multi-step speed setting and achieve fine adjustment on the set frequency of the system. Actual set frequency of the system=set frequency of channels + adjusted frequency, as shown in Figure 6-1.

0: Valid, save the setting at power-off. You can set a fine-tuning value, save the value after the system control power is powered off, and the value is automatically combined with the current set frequency after next power on.

1: Valid, do not save the setting at power-off. You can set a fine-tuning value, but the value is not saved after the system control power is powered off.

2: Invalid. The terminal UP/DOWN function is invalid, and the set fine-tuning value is automatically cleared.

3: Valid during running, clear at stop. The terminal UP/DOWN function is valid during running, and the set fine-tuning value is automatically cleared at stop.

Note: When the parameters of the system restore to default values, the value of UP/DOWN will be cleared automatically.

After the UP/DOWN setting is valid, P00.03 will display the UP/DOWN adjusted value with the range of -120.00–120.00Hz.

Function code	Name	Description	Setting range	Default
P00.05	Speed reference mode	0: Speed mode 1: Torque mode 2: Slave speed mode 3: Slave torque mode	0–3	0

0: Speed mode. The system will output frequency at the set speed command and the motor will automatically adjust the output torque to keep the speed. But the output torque is limited by P03.12. If the load torque is greater than the upper limit, the output torque of the system is limited and the motor speed will change.

1: Torque mode. The system will output torque at the set torque command and the output frequency is limited by the upper and lower limits. When the set torque is greater than the load torque, the output frequency will increase to the upper limit and when the set torque is lower than the load torque, the output frequency will decrease to the lower limit. If the output frequency of the system is limited, the output torque is different from the set torque.

2–3: Slave speed and torque mode. The two modes have no difference and they are mainly used in the master-slave mode.

Note:

- During decelerating to stop, the system will switch from torque control mode to speed control mode.
- When P12.29=3 (slave) and P00.01=3, the local is the slave. The torque control mode and speed control mode can also be switched via multifunction input terminals. The torque control mode is only for vector control.

Function code	Name	Description	Setting range	Default
P00.06	Setting channel of frequency A command	0: Function code 1: AI1 2: AI2 3: AI3 4: AI4 5: Multi-step speed running 6: PID control 7: Modbus 8: Fieldbus	0–8	0

Goodrive5000 medium voltage variable-frequency speed regulation system supports two command sources A and B, A command source is the general channel, B command source is the auxiliary channel. The combination of P00.06 and P00.07 determines the value of frequency setting. Refer to P00.09 for the way of combination.

0: Function code, frequency A setting is the value of P00.13.

1–4: AI, AI1, AI2, AI3, and AI4 are programmable analog input terminals. Refer to P5 group for the functions. Whether AI1, AI2, and AI3 are current or voltage inputs can be selected by the function code.

5: Multi-step speed running, the system runs at multi-step speed and P11.00 will select multi-step speed. P11.00=0, the multi-step speed terminal in P5 will select current step; P11.00=1, P11.18–P11.33 is the current step and P11.01–P11.16 is current frequency (multi-step n frequency=maximum frequency P00.10 * speed n percentage)

6: PID control, the result of built-in PID module adjustment is the set frequency of the system. See PID source, setting, feedback and parameters in P10 group.

7: Modbus, set the frequency of frequency A source.

8: Profibus, set the frequency of frequency A source.

Note: The fieldbus card of the system is optional.

Function code	Name	Description	Setting range	Default
P00.07	Setting channel of frequency B command	0: AI1 1: AI2 2: AI3 3: AI4	0–3	0
P00.08	Reference object of frequency B command	0: Max. output frequency 1: Frequency A command	0–1	0

P00.07 and P00.08 determine the value of frequency B setting. Frequency B =Reference of frequency B (P00.08)* Frequency B command source (P00.07).

If P00.07=0, P00.08=0, AI1 input percentage is 50%, max frequency setting is 50Hz, then frequency B = 50Hz×50%=25Hz; P00.07=0, P00.08=1, AI1 input percentage is 50%, frequency A command source is 40Hz, then frequency B =40Hz×50%=20Hz.

Function code	Name	Description	Setting range	Default
P00.09	Combination mode of setting source	0: A 1: B 2: A+B 3: Max(A, B)	0–3	0

P00.09 is used to set the combination of frequency sources, and it can be also switched by P5 group, as shown in Figure 6-1.

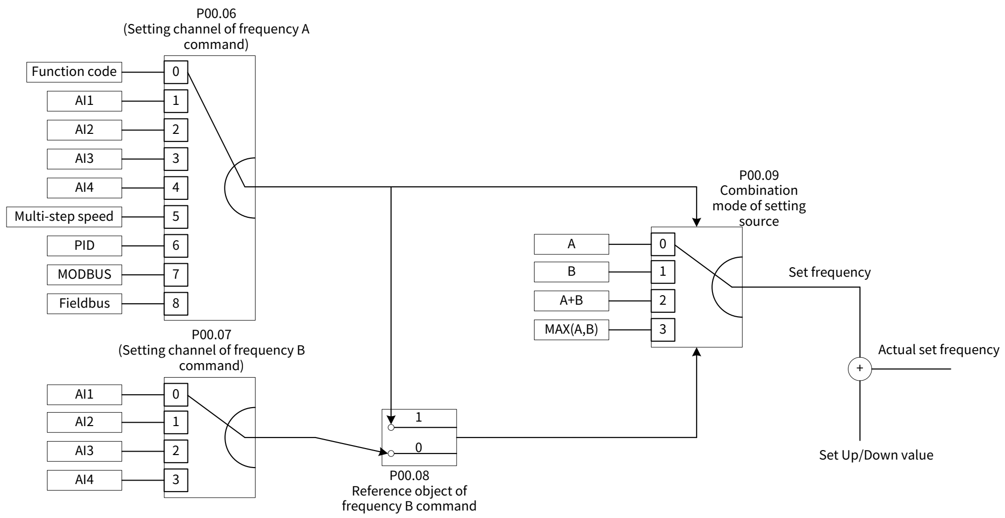
P00.09=0: Current frequency is frequency A command.

P00.09=1: Current frequency is frequency B command.

P00.09=2: Current frequency is frequency A command + B command.

P00.09=3: Current frequency is the greater value between frequency A and B command.

Figure 6-1 Combination of frequency sources



Function code	Name	Description	Setting range	Default
P00.10	Max. output frequency	P00.11–200.00Hz	P00.11–200.00	50.00Hz

Set the max. frequency of the variable-frequency speed regulation system.

Function code	Name	Description	Setting range	Default
P00.11	Upper limit of running frequency	P00.12–P00.10 (Max. frequency)	P00.12–P00.10	50.00Hz
P00.12	Lower limit of running frequency	0.00Hz–P00.11 (Upper limit of running frequency)	0.00–P00.11	0.00Hz

P00.11 and P00.12 are used to set output frequency upper and lower limits of the system. Pay attention to distinguish upper limit of running frequency from maximum output frequency, the former for actual maximum frequency and the latter for set maximum frequency.

Restrictions on the relationship between frequencies: Max. output frequency ⩾ upper limit frequency ⩾ set frequency ⩾ lower limit frequency.

Function code	Name	Description	Setting range	Default
P00.13	Function code setting frequency	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	50.00Hz

When frequency A command select "P00.06=0", the value of the function code is the original setting one of the variable-frequency speed regulation system.

Function code	Name	Description	Setting range	Default
P00.14	Torque setting	0: Function code 1: AI1 2: AI2 3: AI3 4: AI4 5: Reserved 6: Multi-step speed running 7: Modbus 8: Fieldbus	0–8	0

In the vector control mode, P00.05=1, torque reference channel can be selected by P00.14. If the torque is set as negative, the torque output direction is reverse to the set running direction.

Note: The set running direction is determined by the reference direction and P00.18.

Function code	Name	Description	Setting range	Default
P00.15	Function code setting torque	-200.0%–200.0%	-200.0%–200.0%	30.0%

When P00.14=0, P00.15 is used to set the set torque of the system, among which 100.0% corresponds to the rated output current of the system.

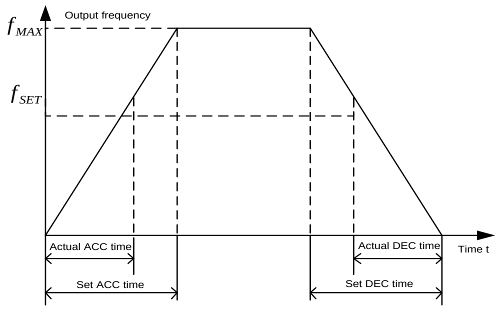
Function code	Name	Description	Setting range	Default
P00.16	ACC time 1	0.1–3600.0s	0.1–3600.0	Model depended

Function code	Name	Description	Setting range	Default
P00.17	DEC time 1	0.1–3600.0s	0.1–3600.0	Model depended

ACC time means the time needed if the variable-frequency speed regulation system speeds up from 0Hz to the max. output frequency (P00.10).

DEC time means the time needed if the variable-frequency speed regulation system speeds down from the max. output frequency (P00.10) to 0Hz.

Figure 6-2 ACC/DEC time diagram



When the set frequency (f_{SET}) equals to the maximum frequency (f_{MAX}), the actual acceleration and deceleration time will be in accordance with the set time.

When the set frequency is less than the maximum frequency, the actual acceleration and deceleration time will be less than the set time.

Actual acceleration and deceleration time = set time * (set frequency ÷ maximum frequency)

The system has 4 groups of ACC and DEC time.

Group 1: P00.16, P00.17;

Group 2: P08.00, P08.01;

Group 3: P08.02, P08.03;

Group 4: P08.04, P08.05.

Select different ACC/DEC time groups via state combinations of these two multi-function digital input terminals which must be set to the function 14 and function 15. For details, refer to terminal functions of P05 group. The first group of ACC and DEC time is by default.

Function code	Name	Description	Setting range	Default
P00.18	Running direction	0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running	0–2	0

0: Run at the default direction. The motor runs in accordance with the actual direction.

1: Run at the opposite direction. The motor runs at the opposite direction, which is equivalent to changing the direction of motor by changing any two-phase sequence.

Note: After initialization of parameters, the direction of the motor will restore to the original state. Be cautious to use when the motor direction is forbidden to change after commissioning.

2: Disable reverse running. Disable reverse running. It can be used in some special scenarios where reverse running is disabled, such as in situations which need to switch between power frequency and variable frequency. When reverse running is disabled, the system will enter into the standby state after receiving the reverse running command.

Function code	Name	Description	Setting range	Default
P00.19	Carrier frequency	0.5–2.0kHz	0.5–2.0	0.7kHz

The carrier frequency has been properly set in the factory before the variable-frequency speed regulation system is delivered, you do not need to modify it. When the frequency used exceeds the default carrier frequency, the variable-frequency speed regulation system needs to derate.

Function code	Name	Description	Setting range	Default
P00.20	Motor parameter autotuning	0: No operation 1: Rotary autotuning 2: Encoder autotuning 3: Motor frequency drop rate autotuning 4: Power frequency and variable frequency switching time autotuning 5: Static autotuning (Reserved)	0–5	0

In vector control, more accurate motor parameters are needed, and users can select whether to perform parameter autotuning based on application scenarios.

0: No operation. Motor parameter autotuning is not performed.

1: Rotary autotuning. Comprehensive motor parameter autotuning is performed. It is recommended to use rotating autotuning when high control accuracy is required.

2: Encoder autotuning, set a proper value of P00.23, and ensure that the motor runs stably in V/F before performing the autotuning.

3: Motor frequency drop rate autotuning, select synchronous switching without reactors. It is recommended to perform autotuning with the load. After setting P00.20=3, click the Run button, the system automatically runs to the rated frequency of the motor, and coasts to stop. After the end of the autotuning, you can view the autotuning results through P15.09–P15.12.

4: Power frequency and variable frequency switching time autotuning, select the synchronous switching without reactors. It is necessary to perform action time autotuning for contactors. In the low-voltage commissioning mode, after setting P00.20=4, click the variable frequency button, then click the power frequency button to complete the autotuning process. After the end of the autotuning, you can view the autotuning results through P15.17–P15.20.

5: Static autotuning. Partial motor parameter autotuning is performed.

Function code	Name	Description	Setting range	Default
P00.21	Function parameter restore	0: No operation 1: Restore to default values 2: Clear fault files 3: Clear ammeter records	0–3	0

The function code can restore the parameters to default values, and clear all fault records and ammeter records of the system.

Note: After the selected operation of P00.21 is performed, the function code is automatically restored to 0. Restoring to default values will not restore parameters of P02 group.

Function code	Name	Description	Setting range	Default
P00.22	AVR function selection	0: Disable 1: Enable all the time 2: Disable during DEC	0–2	1

Note: When AVR (Auto Voltage Regulation) function is disabled, the output voltage of the system will change along with the input voltage (or DC bus voltage). When the function is enabled, the output voltage will keep stable in a certain range. When DEC time is too long to meet field requirements, cancel the AVR function to shorten the DEC time.

Function code	Name	Description	Setting range	Default
P00.23	Encoder autotuning frequency	0.00Hz–P00.10	0.00–P00.10	10.00Hz
P00.24	Forward rotation upper-limit frequency in torque control	0.00Hz–P00.10	0.00–P00.10	50.00Hz
P00.25	Reverse rotation upper-limit frequency in torque control	0.00Hz–P00.10	0.00–P00.10	50.00Hz
P00.26	Electromotive torque upper limit	0.0–200.0%	0.0–200.0	100.0%
P00.27	Power generation torque upper limit	0.0–200.0%	0.0–200.0	100.0%

P01 group Start and stop control

Function code	Name	Description	Setting range	Default
P01.00	Braking mode	0: DC braking 1: Dual-frequency braking	0–1	0

P01.00 is used to set braking modes.

0: DC braking. When the output frequency of the system reaches the starting frequency of DC braking, DC current will run through the stator winding, and the braking torque will generate because the rotor cuts the static magnetic field.

1: Dual-frequency braking. It can produce a strong braking torque and significantly reduce the stopping time, applicable to scenarios with high requirements for braking time.

Function code	Name	Description	Setting range	Default
P01.01	Start mode	0: Direct start 1: Start after DC braking 2: Start after rotating speed tracking	0–2	0

0: Direct start. Start from the starting frequency.

1: Start after DC braking. Start the motor from the starting frequency after DC braking (Set the parameters P01.05 and P01.05). It is suitable in cases where reverse rotation may occur to the small inertia load during starting (such as pump load).

2: Start after rotating speed tracking. The system calculates the speed and direction of the motor, and starts running from the current speed, which can implement impact-free smooth startup for rotating motors.

Function code	Name	Description	Setting range	Default
P01.02	Starting frequency of direct start	0.00–10.00Hz	0.00–10.00	0.10Hz
P01.03	Starting frequency hold time	0.0–50.0s	0.0–50.0	0.0s

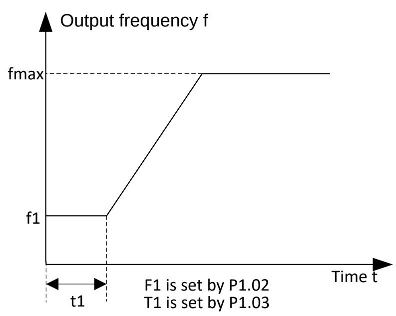
The system starts from the starting frequency (P01.02), then accelerates to the target frequency on basis of the set ACC time after hold time of starting frequency (P01.03). The starting frequency could not be limited by the frequency lower limit.

Setting a proper starting frequency and starting frequency hold time can increase the torque during starting, which can avoid the situation that the motor cannot start at 0 frequency in some occasions.

Note:

- If the target frequency is lower than starting frequency, the system will be in the running state with no output.
- The starting frequency shall not be greater than the frequency upper limit; otherwise, the system will be in the running state with no output and cannot respond to the running commands. When the starting frequency is greater than starting frequency of DC braking at stop, the system stops and DC braking is invalid. When the running frequency is lower than the starting frequency, the system coasts to stop.
- Running state with no output: When the PID is dormant, negative frequency or negative torque is given when reverse running is disabled, the target frequency is less than the starting frequency, and the set frequency is less than the frequency lower limit, the system will be in the running state, but there is no output frequency and output voltage. When the conditions for restoring the state without output are met, the system outputs, and the speed tracking starts.

Figure 6-3 Direct start



Function code	Name	Description	Setting range	Default
P01.04	DC braking current before start	0.0–120.0% (of the system rated current)	0.0–120.0	0.0%
P01.05	Braking time before start	0.0–50.0s	0.0–50.0	0.0s

P01.04: It indicates the applied DC current value during DC braking before start. It is the percentage of rated current of the system.

P01.05: It is duration of DC braking before start. If P01.05 is set to be 0, DC braking is invalid.

Note:

- DC braking before start is valid only when P01.04 and P01.05 are non-zero.
- The higher the DC braking current, the greater the braking torque, but the more serious the motor heating. Please set the function code properly according to actual conditions on site.

Function code	Name	Description	Setting range	Default
P01.06	ACC/DEC mode	0: Linear type 1: S curve	0–1	0

0: Linear type

The output speed increases or decreases as a straight line, and the acceleration = maximum frequency÷ ACC (DEC) time.

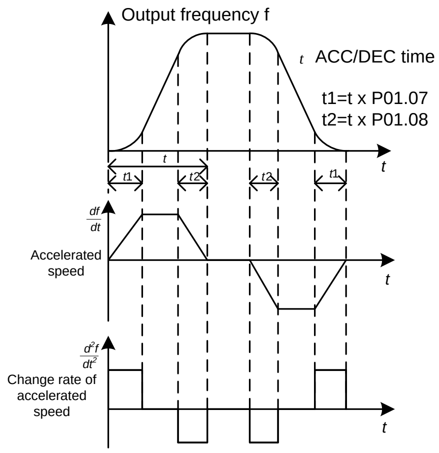
1: S curve

Output speed changes as S curve. The S curve is generally applied to hoists, conveyor belts, and other application scenarios where smoother start or stop is required.

Function code	Name	Description	Setting range	Default
P01.07	S curve starting segment proportion	1.0–40.0% (ACC/DEC time)	1.0–40.0	30.0%
P01.08	S curve ending segment proportion	1.0–40.0% (ACC/DEC time)	1.0–40.0	30.0%

S curve can directly influence whether the system starts and stops at load smoothly. The parameters of S curve are divided into ACC segment and DEC segment parameters, and the correspondence between these parameters and S-curve is shown as Figure 6-4. In the following figure, t1 (t1=t*P01.07) is the DEC/ACC time defined by P01.07, and the slope of output frequency change gradually increases during the period. t2 (t2=t*P01.08) is the DEC/ACC time defined by P01.08, during which the slope of the output frequency change gradually decreases. The slope of the output frequency change is constant during the time between t1 and t2. The shape of S curve is determined by ACC/DEC frequency range, ACC/DEC time, starting-segment time, and ending-segment time.

Figure 6-4 ACC/DEC of S curve



Function code	Name	Description	Setting range	Default
P01.09	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1	0

0: Decelerate to stop

When the stop command is valid, the system decreases the output frequency according to the defined DEC curve. If there is no DC braking at stop, the system will coast to stop when the frequency decelerates to the starting frequency; otherwise, it will coast to stop after DC braking.

1: Coast to stop

When the stop command is valid, the system immediately blocks the output and the motor coasts to stop according to the mechanical inertia.

Function code	Name	Description	Setting range	Default
P01.10	Starting frequency of DC braking at stop	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz
P01.11	Wait time before DC braking at stop	0.0–50.0s	0.0–50.0	0.0s
P01.12	DC braking current at stop	0.0–120.0% (of the system rated current)	0.0–120.0	0.0%
P01.13	DC braking time at stop	0.0–50.0s	0.0–50.0	0.0s

Starting frequency of DC braking at stop: During the deceleration to stop, the VFD starts DC braking at stop when running frequency reaches the starting frequency determined by P01.10. When the starting frequency of DC braking at stop is 0 or lower than the start frequency (P01.02), DC braking is invalid, and the system coasts to stop when the frequency decelerates to the starting frequency.

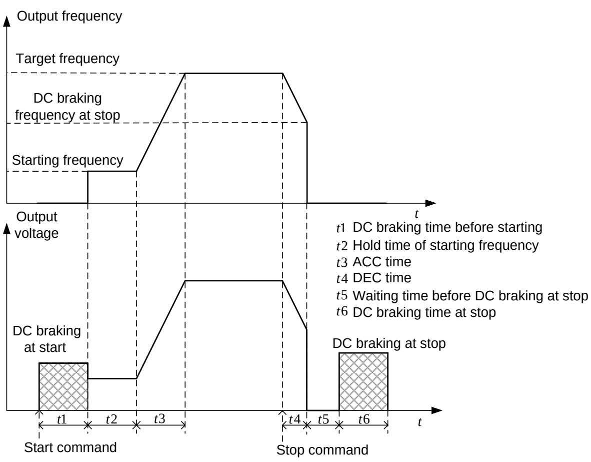
Wait time before DC braking at stop: The system blocks output when the starting frequency of DC braking at stop is reached during DEC. After this wait time, DC braking is started so as to prevent overcurrent caused by DC braking at high speed.

DC braking current at stop: It indicates the applied DC current value during DC braking at stop. Stronger braking current indicates larger braking torque.

DC braking time at stop: It indicates the hold time of DC braking.

Note: DC braking at stop is valid only when P01.12 and P01.13 are non-zero.

Figure 6-5 DC braking at stop



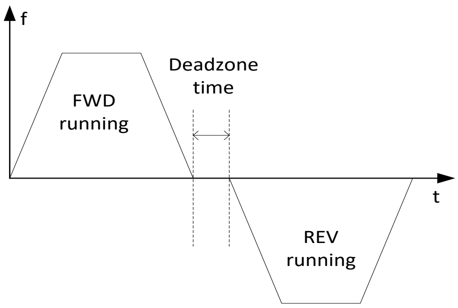
Function code	Name	Description	Setting range	Default
P01.14	Torque of frequency superposition braking	0.0%–50.0%	0.0–50.0	30.0%
P01.15	Enabling voltage of frequency superposition braking	1000–1500V	1000–1500	1130V
P01.16	Dual-frequency frequency of frequency superposition braking	200.0–500.0Hz	200.0–500.0	300.0Hz
P01.17	Dual-frequency current-limit point of frequency superposition braking	0.0%–100.0%	0.0–100.0	0.0%
P01.18	Dual-frequency voltage-limit point of frequency superposition braking	50.0%–80.0%	50.0–80.0	80.0%
P01.19	Proportional coefficient of frequency superposition braking	0–65535	0–65535	5
P01.20	Integral coefficient of frequency superposition braking	0–65535	0–65535	2
P01.21	Adjusting multiple of frequency superposition braking	0–65535	0–65535	2
P01.22	Reserved	0–65535	0–65535	0
P01.23	Reserved	0–65535	0–65535	0

When the frequency superposition braking is valid and the bus voltage exceeds P01.15, the system starts outputting frequency superposition frequency to reduce bus voltage. At the time, frequency superposition voltage amplitude output shall not exceed P01.18 (relative to motor rated voltage) and frequency superposition frequency output is P01.16. In vector mode, a greater value of P01.14 indicates a faster frequency superposition braking deceleration. In V/F mode, the function code is invalid.

Function code	Name	Description	Setting range	Default
P01.24	FWD/REV running deadzone time	0.0–3600.0s	0.0–3600.0	1.0s

Set the hold time at zero frequency in the transition between forward and reverse running. It is shown as Figure 6-6.

Figure 6-6 FWD/REV running deadzone time



Function code	Name	Description	Setting range	Default
P01.25	Action selected when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0)	0: Run at the frequency lower limit 1: Stop 2: Sleep	0–2	0

The function code determines the running state of the variable-frequency speed regulation system when absolute value of the set frequency is lower than the lower-limit one.

0: Run at the frequency lower limit. The target frequency is equal to the frequency lower limit.

1: Stop. The system will coast to stop when it decelerates to the lower frequency limit.

2: Sleep. The system decelerates to the frequency lower limit and enters into the running state with no output when the set frequency is lower than the frequency lower limit (refer to Note 3 in P01.03). When the set frequency is higher than or equal to the frequency lower limit again, the system will start to run automatically.

Function code	Name	Description	Setting range	Default
P01.26	Power-off restart selection	0: Disable 1: Enable	0–1	0
P01.27	Sudden power-off time	0.00–50.00s	0.00–50.00	1.00s
P01.28	Wait time for restart after power-off	0.0–3600.0s (valid when P01.26=1)	0.0–3600.0	1.0s

Note: If the main circuit of the system powers off during running, the steps for processing are as follows:

Figure 6-7 Processing after power off

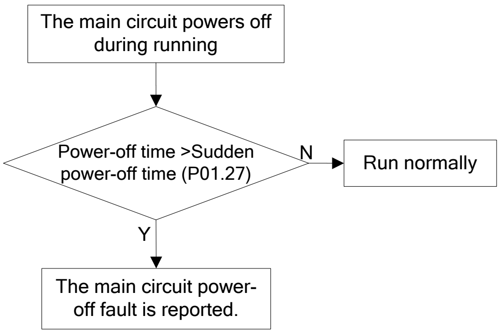
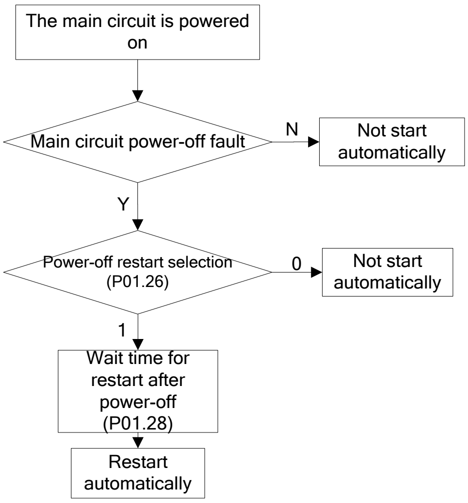


Figure 6-8 Restart after power off



P01.26 is the action when the system powers off and on again during running.

0: Disable. The system will not automatically restart when the main circuit is powered on again.

1: Enable. The system will be automatically restored to the previous running state after re-power on. That is, if the system is in the running state before power off, it will automatically restart after the delay of (P01.28) upon re-power on (when the system is controlled by terminals, ensure that the running command of the terminal is not withdrawn). If the system is in the stopped state before power-off, the system will not restart automatically after re-power on.

Note: This function may cause serious consequences, please use it with cautions.

P01.27 indicates the sudden power-off time, namely the maximum electric dazzling time that the system can bear during the normal running. When the power-off interval of the grid does not exceed the set time, the system can work normally without reporting a fault of power off in running.

Function code	Name	Description	Setting range	Default
P01.29	Medium voltage switch action at stop	0: Cut off medium voltage during stop 1: Not cut off medium voltage during stop	0–1	1

P01.29 decides whether to cut off medium voltage at stop.

Function code	Name	Description	Setting range	Default
P01.30	Waiting time of switching-on allowing	0.0–3600.0s	0.0–3600.0	10.0s

P01.30 refers to the waiting time from responding to power frequency into variable frequency properly to sending the switching-on allowing signal. It is used to protect the units from impact caused by a short time in switching on twice continuously.

Function code	Name	Description	Setting range	Default
P01.31	Running ready waiting time	0.0–3600.0s	0.0–3600.0	10.0s

P01.31 refers to the waiting time from finishing bus charging to sending the running ready signal to the higher level control system after the higher level medium voltage switch is connected to the medium voltage power supply.

The time is used to make sure DC bus charging completely so as to reduce voltage surge of the grid.

Function code	Name	Description	Setting range	Default
P01.32	Pull-in current at zero frequency start	0.0–100.0%	0.0–100.0	20.0%
P01.33	Cut-off frequency at zero frequency start	P01.02–P14.17	P01.02–P14.17	0.00Hz
P01.34	Exit time of pull-in current at zero frequency start	0.00–40.00s	0.00–40.00	1.00s
P01.35	Command source of coast to stop	0: None 1: UDP 2: Internally command 3: Terminal 4: Modbus 5: PROFIBUS	0–5	0
P01.36	Command source of decelerate to stop	0: None 1: UDP 2: Terminal 3: Modbus 4: PROFIBUS	0–4	0

P01.35 and P01.36 are used to check the current command sources of coast to stop and decelerate to stop and cleared in next start.

P02 group Motor parameter 1

Function code	Name	Description	Setting range	Default
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0

Note: The motor parameters are particularly important in motor protection and the voltage output, so be sure to set the parameters in accordance with the motor nameplate. When P02.00 is AM, the parameters of SM cannot be modified. When P02.00 is SM, the parameters of AM cannot be modified.

Function code	Name	Description	Setting range	Default
P02.01	Rated power of AM 1	4–50000kW	4–50000kW	Model depended
P02.02	Rated frequency of AM 1	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P02.03	Rated speed of AM 1	1–36000rpm	1–36000	Model depended
P02.04	Rated voltage of AM 1	0–20000V	0–20000	Model depended
P02.05	Rated current of AM 1	0.1–1000.0A	0.1–1000.0	Model depended

In order to achieve control performance, the system needs to match with the motor power. If the bias is too great, the control and protection performance of the system will degrade significantly.

Note: Resetting the rated power of the motor (P02.01) can initialize the parameters P02.06–P02.10.

Function code	Name	Description	Setting range	Default
P02.06	Stator resistance of AM 1	0.001–65.535Ω	0.001–65.535	Model depended
P02.07	Rotor resistance of AM 1	0.001–65.535Ω	0.001–65.535	Model depended
P02.08	Stator and rotor inductance of AM 1	0.1–6553.5mH	0.1–6553.5	Model depended
P02.09	Stator and rotor mutual inductance of AM 1	0.1–6553.5mH	0.1–6553.5	Model depended
P02.10	No-load current of AM 1	0.01–655.35A	0.01–655.35A	Model depended

The parameters from P02.06–P02.10 have a great impact on control performance in vector control. During the initialization, the system will determine a group of initial parameters according to the system power. After motor autotuning is performed, the parameters will be updated and saved automatically and users should not modify them at will. Be sure not to change P02.06–P02.10 in V/F control.

Function code	Name	Description	Setting range	Default
P02.11	Rated power of SM 1	4–50000kW	4–50000kW	Model depended
P02.12	Rated frequency of SM 1	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P02.13	Rated speed of SM 1	0–36000rpm	0–36000	1500rpm
P02.14	Number of pole pairs of SM 1	1–50	1–50	2

Function code	Name	Description	Setting range	Default
P02.15	Rated voltage of SM 1	0–20000V	0–20000	Model depended
P02.16	Rated current of SM 1	0.1–1000.0A	0.1–1000.0	Model depended

Note:

1. The motor parameters are particularly important in motor protection and voltage output, so be sure to set the parameters in accordance with the information on the nameplate of SM.
2. In order to achieve control performance, the system needs to match with the motor power. If the bias is too great, the control and protection performance of the system will degrade significantly.
3. Resetting the rated power of the SM (P02.11) can initialize the parameters P02.17–P02.20.

Function code	Name	Description	Setting range	Default
P02.17	Stator resistance of SM 1	0.001–65.535Ω	0.001–65.535	Model depended
P02.18	Direct-axis inductance of SM 1	0.1–655.35mH	0.1–655.35	Model depended
P02.19	Quadrature-axis inductance of SM 1	0.1–655.35mH	0.1–655.35	Model depended
P02.20	Counter-emf constant of SM 1	0–20000	0–20000	9700

The parameters from P02.17–P02.20 are reserved in V/F control.

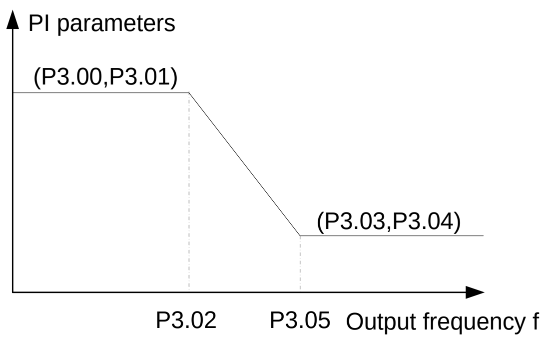
P03 group Vector control

Parameters of P03 group are valid only in vector control (P00.00 = 1, 2, 3).

Function code	Name	Description	Setting range	Default
P03.00	Speed-loop proportional gain 1	0–100	0–100	5
P03.01	Speed-loop integral time 1	0.01–10.00s	0.01–10.00	0.10s
P03.02	Low-point frequency for switching	0.00Hz–P03.05	0.00–P03.05	5.00Hz
P03.03	Speed-loop proportional gain 2	0–100	0–100	5
P03.04	Speed-loop integral time 2	0.01–10.00s	0.01–10.00	0.10s
P03.05	High-point frequency for switching	P03.02–P00.10 (Max. ouput frequency)	P03.02–P00.10	10.00Hz

Below the switching frequency 1 (P03.02), the speed-loop PI parameters are: P03.00 and P03.01. Above the switching frequency 2 (P03.05), the speed-loop PI parameters are: P03.03 and P03.04. PI parameters are obtained according to the linear change of two groups of parameters. See Figure 6-9.

Figure 6-9 PI parameters



The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increasing proportional gain or reducing integral time can accelerate dynamic response of speed loop; however, if the proportional gain is too large or integral time is too small, system oscillation and overshoot may occur. If Integral time is too small, stable oscillation or speed offset may occur.

PI parameters have a close relationship with the inertia of the system. Adjust PI parameters depending on different loads to meet various demands.

Function code	Name	Description	Setting range	Default
P03.06	Current-loop proportional coefficient P	0–65535	0–65535	500
P03.07	Current-loop integral coefficient I	0–65535	0–65535	500

Note: The preceding two parameters adjust the PI adjustment parameters of the current loop, affecting the dynamic response speed and control accuracy directly. Generally, you do not need to change the default values.

Function code	Name	Description	Setting range	Default
P03.08	Speed loop filter time	0.000–1.000s	0.000–1.000	0.002s

This function code is the filter time for motor speed detection, which can be set appropriately in the cases where speed fluctuates violently in vector control.

Function code	Name	Description	Setting range	Default
P03.09	VC slip compensation coefficient	50.0%–200.0%	50.0–200.0	100.0%

Slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the speed control accuracy of the system. Adjusting the parameter properly can control the speed steady-state error.

Function code	Name	Description	Setting range	Default
P03.10	Reserved	0–65535	0–65535	0
P03.11	Reserved	0–65535	0–65535	0
P03.12	Torque upper limit setting	0.0–200.0% (of the system rated current)	0.0–200.0	150.0%

P03.12 is used to set the torque upper limit, and 100% corresponds to rated output current of the system.

Note:

- A greater value of P03.12 indicates a better speed tracking performance. But too large torque upper limit will easily cause overcurrent.
- P03.12 is valid in the vector control speed mode. In the torque mode, the percentage of actual output torque=percentage of set torque (P00.15) × P03.12 = active component of output current/rated motor current.

P04 group V/F control

Parameters of P04 group are valid only in V/F control (P00.00＝0).

Function code	Name	Description	Setting range	Default
P04.00	V/F curve setting	0: Straight-line V/F curve 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) 5: Customized V/F (V/F separation)	0–5	0

0: Straight-line V/F curve. It is applicable to constant torque loads.

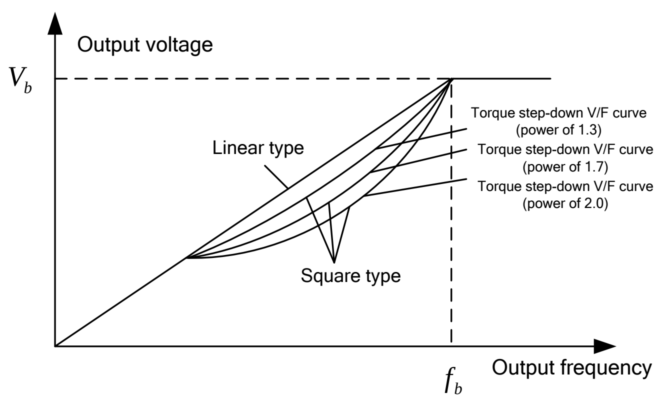
1: Multi-point V/F curve. It can be defined by setting P04.05–P04.10.

2–4: Multi-power V/F curve. It is applicable to variable torque loads, such as fans, pumps and so on. The curves for each power are shown in the following figure.

5: Customized V/F (V/F separation)

Note: In the following figure, V_b is the motor rated voltage and f_b is the motor rated frequency.

Figure 6-10 V/F curves

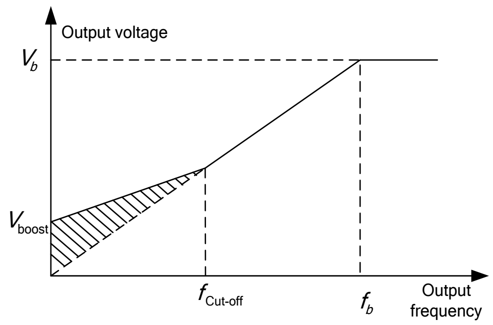


Function code	Name	Description	Setting range	Default
P04.01	Torque boost	0.0%–10.0%	0.0–10.0	0.1%
P04.02	Torque boost cut-off	0.0%–50.0% (of the motor rated frequency)	0.0–50.0	20.0%

In order to compensate for low-frequency torque characteristics, you need to make some boost compensation for the output voltage.

When P04.01 is non-zero, the system is manual torque boost. The V/F curve after boost is shown as follows (less than P04.02, the value of torque boost is determined by P04.01 and current frequency.). Torque boost can improve the low-frequency torque V/F performance.

Figure 6-11 Manual torque boost



You need to select torque boost based on the load. For example, larger load requires larger torque boost, however, if the torque boost is too large, the motor will run at over-excitation, which may cause increased output current and motor overheating, thus decreasing the efficiency.

Note: When torque boost is set to 0.0%, the system is automatic torque boost and it is valid in the whole frequency range.

Function code	Name	Description	Setting range	Default
P04.03	V/F slip compensation	0.0–200.0%	0.0–200.0	0.0%

The parameter is set to compensate for the motor rotating speed change caused by load change in V/F control mode, and thus improve the rigidity of the mechanical characteristics of the motor. The value is set to motor rated slip, which can be calculated as below:

P04.03= (fb-n*p/60)/fb*100%

Of which, f_b is the rated frequency of the motor, corresponding to function code P02.02, n is the rated rotating speed of the motor, corresponding to function code P02.03, p is the number of pole pairs of the motor.

Function code	Name	Description	Setting range	Default
P04.04	Energy-saving operation	0: Energy-saving operation is invalid 1: Energy-saving operation is valid	0–1	0

Energy-saving operation: When the motor is running with light load or without load, output voltage will be reduced appropriately to save energy.

Note: The function is especially effective for fan and pump loads.

Function code	Name	Description	Setting range	Default
P04.05	V/F frequency point 1	0.00Hz–P04.07	0.00–P04.07	0.00Hz

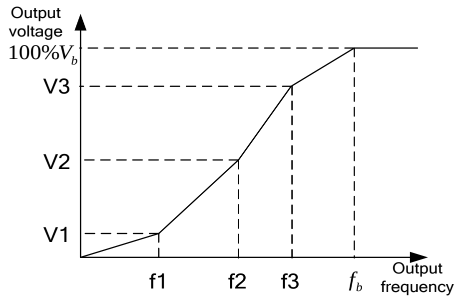
Function code	Name	Description	Setting range	Default
P04.06	V/F voltage point 1	0.0%–P04.08	0.0–P04.08	0.0%
P04.07	V/F frequency point 2	P04.05–P04.09	P04.05–P04.09	0.00Hz
P04.08	V/F voltage point 2	P04.06–P04.10	P04.06–P04.10	0.0%
P04.09	V/F frequency point 3	P04.07–P00.10 (max. frequency)	P04.07–P00.10	0.00Hz
P04.10	V/F voltage point 3	P04.08–100.0% (of the motor rated voltage)	P04.08–100.0	0.0%

P04.05–P04.10 are used to set the user-defined multi-point V/F curve. The value of the V/F curve needs to be set according to the load characteristics of the motor.

Note:

- V1<V2<V3, f1<f2<f3. Setting high voltage for low frequency may cause motor overheat or damage, and cause system overcurrent stall or trigger overcurrent protection.
- Set (P04.09, P04.10) at first, then (P04.07, P04.08), and finally (P04.05, P04.06).

Figure 6-12 V/F curve setting



Note: V/F voltage is relative to the percentage of motor rated voltage (P02.04).

Function code	Name	Description	Setting range	Default
P04.11	PWM method	0: PWM method 1 1: PWM method 2	0–1	0

Select the modulating wave method of the variable-frequency speed regulation system.

0: SPWM 1, sine waves with triple-harmonics.

1: SPWM 2, standard sine waves.

Function code	Name	Description	Setting range	Default
P04.12	Voltage setting channel	0: Voltage 1: AI1 2: AI2 3: AI3 4: AI4 5: Multi-step running 6: PID 7: Modbus communication 8: PROFIBUS/PROFINET communication	0–8	0

The function code (P04.00= 5) is used to select the output voltage setting channel at V/F curve separation.

Function code	Name	Description	Setting range	Default
P04.13	Set voltage	0.0%–100.0% (of the motor rated voltage)	0.0–100.0	20.0%
P04.14	Voltage increase time	0.0s–3600.0s	0.0–3600.0	100.0s
P04.15	Voltage decrease time	0.0s–3600.0s	0.0–3600.0	100.0s

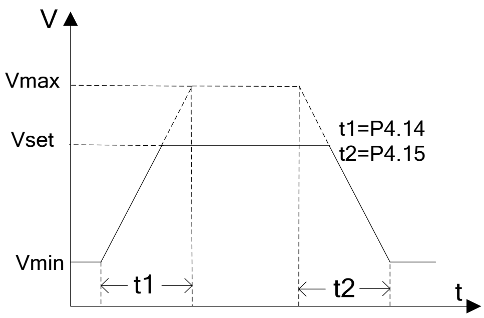
Voltage increase time means the time needed for the system to accelerate from 0V to the motor rated voltage.

Voltage decrease time means the time needed for the system to decelerate from the motor rated voltage to 0V.

Function code	Name	Description	Setting range	Default
P04.16	Min. output voltage	0.0%–P04.17	0.0–P04.17	5.0%
P04.17	Max. output voltage	P04.16–100.0%	P04.16–100.0	100.0%

The function codes are used to set the upper and lower limits of output voltage.

Figure 6-13 Upper and lower limits of output voltage



Function code	Name	Description	Setting range	Default
P04.18	Low-frequency oscillation control factor	0–100	0–100	10
P04.19	High-frequency oscillation control factor	0–100	0–100	0
P04.20	Oscillation control frequency threshold	0.00–120.00Hz	0.00–120.00	15.00Hz

In V/F control, motors, especially the large-power motors, may experience current oscillation at certain frequencies, which may cause unstable motor running, or even system overcurrent. Therefore, you need to adjust the size of the oscillation control factor in real time through P04.18 and P04.19 to adjust the intensity of oscillation control according to application situations on site.

The oscillation control frequency threshold specifies the action range of the low-frequency oscillation control factor and the high-frequency oscillation control factor. When the running frequency is lower than P04.20, the control intensity specified in P04.18 is used. When the running frequency is higher than P04.20, the control intensity specified in P04.19 is used.

Note: The higher the low frequency and high frequency oscillation control factors are not better. When there is a serious mismatch between the oscillation control factors and the motor characteristics, it will aggravate the current oscillation of the motor.

P05 group Input terminal functions

Goodrive5000 medium voltage variable-frequency speed regulation system provides 12 multi-function digital input terminals (S1–S12) and 4 analog input terminals as standard configuration, and the functions of these terminals are configurable.

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>P05.00</td><td>Function of S1</td><td rowspan="12">0: No function
1: Run forward
2: Run reversely
3: Enable three-wire running
4: Forward jogging
5: Reverse jogging
6: Coast to stop (emergency stop)
7: Fault reset
8: External fault NO input
9: External fault NC input
10: Increase frequency setting (UP)
11: Decrease frequency setting (DOWN)
12: Clear the frequency increase/decrease setting
13: Clear the frequency increase/decrease setting temporarily
14: ACC/DEC time selection 1
15: ACC/DEC time selection 2
16: Multi-step speed terminal 1
17: Multi-step speed terminal 2
18: Multi-step speed terminal 3
19: Multi-step speed terminal 4
20: Pause multi-step speed running
21: Switch between A setting and B setting
22: Switch between (A+B) setting and A setting
23: Switch between (A+B) setting and B setting
24: Variable-frequency running (pulse signal↑)
25: Power-frequency running (pulse</td><td>0–71</td><td>1</td></tr>
<tr><td>P05.01</td><td>Function of S2</td><td>0–71</td><td>2</td></tr>
<tr><td>P05.02</td><td>Function of S3</td><td>0–71</td><td>3</td></tr>
<tr><td>P05.03</td><td>Function of S4</td><td>0–71</td><td>6</td></tr>
<tr><td>P05.04</td><td>Function of S5</td><td>0–71</td><td>7</td></tr>
<tr><td>P05.05</td><td>Function of S6</td><td>0–71</td><td>0</td></tr>
<tr><td>P05.06</td><td>Function of S7</td><td>0–71</td><td>0</td></tr>
<tr><td>P05.07</td><td>Function of S8</td><td>0–71</td><td>0</td></tr>
<tr><td>P05.08</td><td>Function of S9</td><td>0–71</td><td>0</td></tr>
<tr><td>P05.09</td><td>Function of S10</td><td>0–71</td><td>0</td></tr>
<tr><td>P05.10</td><td>Function of S11</td><td>0–71</td><td>0</td></tr>
<tr><td>P05.11</td><td>Function of S12</td><td>0–71</td><td>0</td></tr>
</table>

Function code	Name	Description	Setting range	Default
		signal↑) 26: Switching from variable frequency to power frequency (pulse signal ↑) 27: Switching from power frequency to variable frequency (pulse signal ↑) 28: Medium voltage disconnection input 29: Pause PID control 30: UPS feedback 31: Reserved 32: Switching cabinet address 0 33: Switching cabinet address 1 34: Switching cabinet address 2 35: Switch the running command to local 36: Switch the running command to terminal 37: Switch the running command to communication 38: DCS start 39: DCS stop 40: Disable torque control 41: Enable master/slave control 42: Master-slave speed synchronization counting reset terminal 43: Disable ACC/DEC 44: Precharge cabinet vacuum contactor KM2 feedback 45: Commissioning signal input 46: Start on-site operation box 47: Stop on-site operation box 48: Medium voltage switch QF1M1 feedback 49: Medium voltage switch QF1M2 feedback 50: Medium voltage switch QF1M3 feedback 51: Medium voltage switch QF1M4 feedback 52: Medium voltage switch QF1M5 feedback 53: Medium voltage switch QF1M6 feedback 54: Medium voltage switch QF1M7 feedback 55: Medium voltage switch QF1M8		

Function code	Name	Description	Setting range	Default
		feedback 56: Medium voltage switch QF2M1 feedback 57: Medium voltage switch QF2M2 feedback 58: Medium voltage switch QF2M3 feedback 59: Medium voltage switch QF2M4 feedback 60: Medium voltage switch QF2M5 feedback 61: Medium voltage switch QF2M6 feedback 62: Medium voltage switch QF2M7 feedback 63: Medium voltage switch QF2M8 feedback 64: Switching cabinet 1 remote on-site state 65: Switching cabinet 2 remote on-site state 66: Switching cabinet 3 remote on-site state 67: Switching cabinet 4 remote on-site state 68: Switching cabinet 5 remote on-site state 69: Switching cabinet 6 remote on-site state 70: Switching cabinet 7 remote on-site state 71: Switching cabinet 8 remote on-site state		

This parameter is used to set the corresponding function of digital multi-function input terminals.

0: No function

1: Run forward (FWD)

2: Run reversely (REV)

3: 3-wire control S_{In}

Functions 1–3 are only valid when the running command channel is configured as terminal, in which function 3 is valid only when it is configured as 3-wire control. For details, see the description of terminal control running mode (P05.14).

4: Forward jogging

5: Reverse jogging

The terminals are used to select the states of jogging, which can control the motor for forward jogging and reverse jogging. For details about jogging frequency and ACC/DEC time, see the descriptions of P08.06–

P08.08.

6: Coast to stop

When the command takes effect, the system will block output immediately. For large inertia loads and without limit to stop time, it is advised to apply the method. It has the same meaning as P01.09. If the terminal command is not cancelled, the system cannot start.

7: Fault reset

It is used for long distance fault reset. If the terminal acts, the system will perform fault reset. The function is pulse triggering, a pulse rising edge for reset once.

8: External fault NO input

9: External fault NC input

The above two functions are mainly used to receive external faults. If the external faults are reported, the system will generate external fault signals and act according to P09.02. As for external fault NC input, the terminal switch-on indicates no fault while the terminal switch-off indicates external faults. External fault NO input is opposite.

10: Increase frequency setting (UP)

11: Decrease frequency setting (DOWN)

12: Clear the frequency increase/decrease setting

13: Clear the frequency increase/decrease setting temporarily

The above four functions are used to perform frequency fine-tuning by external terminals (Refer to the descriptions of P00.02 and P00.03). UP is frequency increase command while DOWN is frequency decrease command (Refer to the descriptions of P05.19 and P05.20). Terminal 12 is used to clear the frequency value set by UP/DOWN. Terminal 13 is used to clear the frequency value set by UP/DOWN temporarily. The frequency value goes back to normal when the terminal is invalid.

14, 15: ACC/DEC time selection terminal 1, 2

The status of the two terminals can be combined to select four groups of ACC/DEC time.

Terminal 2	Terminal 1	ACC/DEC time	Parameter
OFF	OFF	ACC/DEC time 1	P00.11, P00.12
OFF	ON	ACC/DEC time 2	P08.00, P08.01
ON	OFF	ACC/DEC time 3	P08.02, P08.03
ON	ON	ACC/DEC time 4	P08.04, P08.05

16–19: Multi-step speed terminal 1–4

16-step speeds can be set by combining states of these four terminals. See detailed instructions of multi-step speed control parameters in group P0 and P11.

Note: Multi-step speed terminal 1 is the low-order bit, and multi-step speed terminal 4 is the high-order bit.

Multi-step speed terminal 4	Multi-step speed terminal 3	Multi-step speed terminal 2	Multi-step speed terminal 1
Bit3	Bit2	Bit1	Bit0

20: Pause multi-step speed running

Once the terminal is enabled, whatever multi-step speed terminals or analog terminals change, the set frequency keeps in current step.

21: Switch between A setting and B setting

22: Switch between (A+B) setting and A setting

23: Switch between (A+B) setting and B setting

The above three functions are used to switch the frequency setting channels.

When the system frequency is set by A-channel and the terminal 21 acts, the channel of frequency setting will switch to B-channel. After the terminal 21 returns, the channel of frequency setting will switch to A-channel. The terminals 22 and 23 are invalid.

Similarly, when the system frequency is set by B-channel and the terminal 21 acts, the channel of frequency setting will switch to A-channel. After the terminal 21 returns, the channel of frequency setting will switch to B-channel.

The functions of terminals 22 and 23 are similar to the function of 21.

24: Variable-frequency running

When the terminal is valid, the system switches from the power-off state to the variable-frequency state by pulse signal of the terminal, that is to say, KM1, KM2, KM3 and KM4 are off at first, then KM1, KM2 and KM3 are on (KM4 is still off). If the system is in other states, the terminal input is invalid.

25: Power-frequency running

When the terminal is valid, the system switches from the power-off state to the power frequency bypass state by pulse signal of the terminal, that is to say, KM1, KM2, KM3 and KM4 are off at first, then KM4 is on. If the system is in other states, the terminal input is invalid.

26: Switch from variable frequency to power frequency

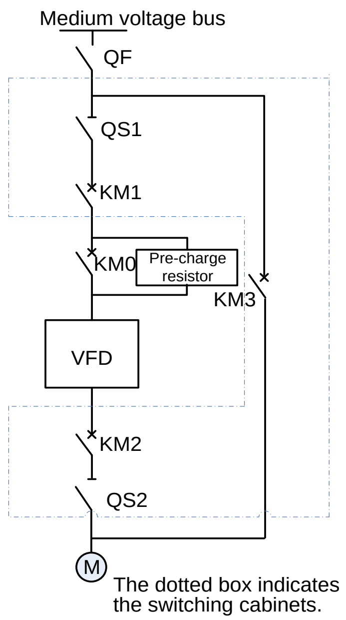
When the terminal is valid, the system switches from the variable-frequency state to the power frequency bypass state by pulse signal of the terminal, that is to say, KM1, KM2, and KM3 are on and KM4 is off at first, then KM4 is on and KM1, KM2 and KM3 are off. If the system is in other states, the terminal input is invalid.

27: Switch from power frequency to variable frequency

When the terminal is valid, the system changes from the power frequency bypass state to the variable-frequency state by pulse signal of the terminal, that is to say, KM4 is on and KM1, KM2, and KM3 are off at first, then KM1, KM2 and KM3 are on and KM4 is off. If the system is in other states, the terminal input is invalid.

Note: Functions 24–27 are valid only for the system with isolated automatic switching cabinet. If there is no isolated automatic switching cabinet, they are invalid.

Figure 6-14 Switching diagram



Note: 150A and lower system models are not equipped with the pre-charge resistor as standard configuration.

28: Medium voltage disconnection input

If the terminal is valid, the system will automatically cut off the medium voltage.

29: Pause PID control

PID is ineffective temporarily, and the system maintains the present frequency output.

30: UPS feedback signal

31: Reserved

32: Switching cabinet address 0

33: Switching cabinet address 1

34: Switching cabinet address 2

Take the combinations of 0 and 1 of 3 switching cabinet addresses (000–111, 8 combinations in total) as the number of 1–8 switching cabinets, in which 000–111 corresponds to the switching cabinets 1–8 respectively.

35: Switch the running command to local

When the terminal is valid, the running command channel of the system will be forced to switch into UDP.

36: Switch the running command to terminal

When the terminal is valid, the running command channel of the system will be forced to switch into terminal.

37: Switch the running command to communication

When the terminal is valid, the running command channel of the system will be forced to switch into communication specified in P00.02.

Note: Above channel switching is valid only when the remote-local switch is at remote.

38: DCS start, forward running

39: DCS stop

40: Disable torque control

The control mode will switch from torque control to speed control if the terminal is valid. In actual application, the terminal can be used to switch between speed control and torque control.

41: Enable master/slave control

42: Master-slave speed synchronization counting reset terminal

Pulse encoder count reset signal input terminal for the speed synchronization method in master-slave control (this terminal is reserved).

43: Disable ACC/DEC

When this function is valid, ensure that the system is not affected by the fluctuation of the external frequency reference sources and the current output frequency remains. The function is invalid in the torque mode.

44: Precharge cabinet vacuum contactor KM2 feedback

45: Commissioning signal input

When this function is valid, the system can simulate the states of ready, power frequency, and variable frequency without connecting to the medium voltage power supply.

46: Start on-site operation box

47: Stop on-site operation box

48: Medium voltage switch QF1M1 feedback

49: Medium voltage switch QF1M2 feedback

50: Medium voltage switch QF1M3 feedback

51: Medium voltage switch QF1M4 feedback

52: Medium voltage switch QF1M5 feedback

53: Medium voltage switch QF1M6 feedback

54: Medium voltage switch QF1M7 feedback

55: Medium voltage switch QF1M8 feedback

56: Medium voltage switch QF2M1 feedback

57: Medium voltage switch QF2M2 feedback

58: Medium voltage switch QF2M3 feedback

59: Medium voltage switch QF2M4 feedback

60: Medium voltage switch QF2M5 feedback

61: Medium voltage switch QF2M6 feedback

62: Medium voltage switch QF2M7 feedback

63: Medium voltage switch QF2M8 feedback

48 and 56 are vacuum breaker feedback of QF1M1 at the variable-frequency side and QF2M1 at the power frequency side of the switching cabinet 1 (main switching cabinet). When P15.01 is 1, variable frequency and power frequency share the power. As long as either QF1M1 or QF2M1 feedback switches on, the common vacuum breaker will switch off. As long as both QF1M1 and QF2M1 feedback switch off, the common vacuum breaker will switch off. When P15.01 is 0, variable frequency and power frequency do not share the power. QF1M1 and QF2M1 feedback indicates the states of vacuum breakers respectively, high electrical level standing for switching on and low electrical level for switching off.

49–55: Feedback of medium voltage switch QF1M2–QF1M8 indicates the state feedback of the higher level vacuum breaker at the variable frequency end of switching cabinet 2–8 respectively.

57–63: Feedback of medium voltage switch QF2M2–QF2M8 indicates the state feedback of the higher level vacuum breaker at the power frequency end of switching cabinet 2–8 respectively.

Note: If the system is configured with the higher level vacuum breaker, you must set the terminal used for vacuum contactor feedback to the corresponding vacuum breaker feedback function according to the on-site wiring.

64: Switching cabinet 1 remote on-site state

65: Switching cabinet 2 remote on-site state

66: Switching cabinet 3 remote on-site state

66: Switching cabinet 4 remote on-site state

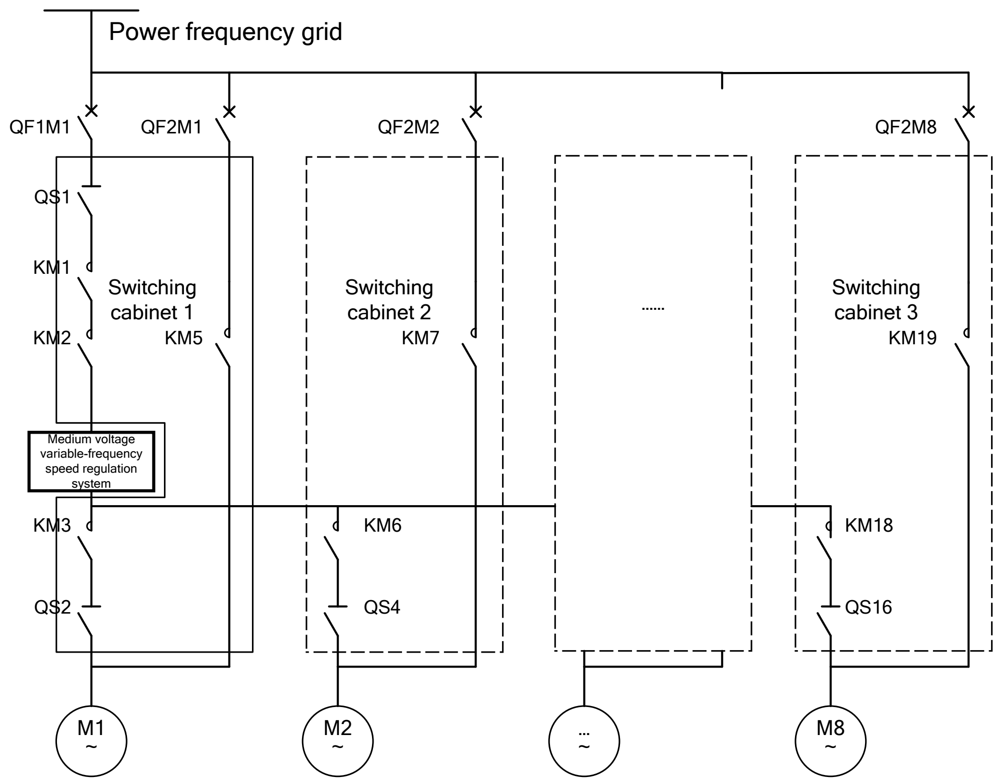
66: Switching cabinet 5 remote on-site state

66: Switching cabinet 6 remote on-site state

66: Switching cabinet 7 remote on-site state

66: Switching cabinet 8 remote on-site state

Figure 6-15 One-driving-more diagram



Function code	Name	Description	Setting range	Default
P05.12	Input terminal polarity setup	0x0000–0xFFFF	0x0000–0xFFFF	0x0000

The function code is used to set the polarity of the digital input terminals, i.e. whether the terminal contact is NO or NC. Each input terminal corresponds to a bit, and 0 indicates NO contact, and 1 indicates NC contact.

-	-	-	-	S12	S11	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1
Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0

Function code	Name	Description	Setting range	Default
P05.13	Digital filter times	1–500	1–500	20

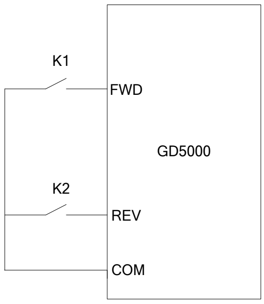
P05.17 is used to set the filter time of sampling of S1–S12 terminals. In strong interference cases, increase the value to avoid maloperation.

Function code	Name	Description	Setting range	Default
P05.14	Terminal control running mode	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2	0–3	0

This parameter defines four different control modes that control the system through external terminals.

0: Two-wire control 1, the enabling consistent with the direction. This mode is widely used. The defined FWD/REV terminal command determines the motor rotation direction.

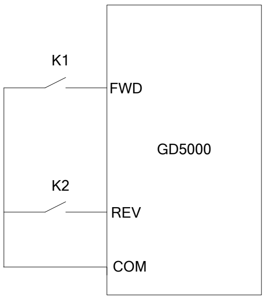
Figure 6-16 Two-wire control (the enabling consistent with the direction)



K1	K2	Running command
OFF	OFF	Stop
OFF	ON	REV running
ON	OFF	FWD running
ON	ON	Stop

1: Two-wire control 2, the enabling separated from the direction. In this mode, FWD is the enabling terminal. The direction depends on the defined REV state.

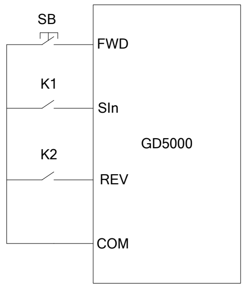
Figure 6-17 Two-wire control (the enabling separated from the direction)



K1	K2	Running command
OFF	OFF	Stop
OFF	ON	Stop
ON	OFF	FWD running
ON	ON	REV running

2: Three-wire control mode 1. If S_{In} (In=1-12) is 3 (three-wire control enabled), when S_{In} switches on, the running command will be generated by FWD (terminal rising edge is valid) and the direction will be controlled by REV (REV off indicates forward running; REV on indicates reverse running.). When S_{In} switches off, the system will stop.

Figure 6-18 Three-wire control 1

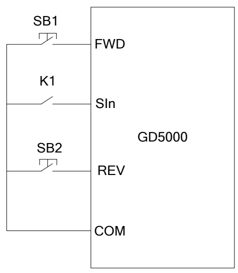


K1	K2	SB	Running command
ON	OFF	Action	FWD running
	ON		REV running
OFF	OFF		Stop
	ON		

Note: K1: Enabling switch; SB1: Running button; K2: Running direction switch.

3: Three-wire control mode 2. If S_{In} (In=1-12) is 3 (three-wire control enabled), when S_{In} switches on, the running command will be generated by FWD or REV and the direction will be controlled by both of them. When S_{In} switches off, FWD and REV are invalid. FWD and REV (both rising edges are valid) refer to inputs of forward and reverse running commands respectively.

Figure 6-19 Three-wire control 2



K1	SB1	SB2	Running command
ON	Action	No action	FWD running
	No action	Action	REV running
OFF			Stop

Note: SB1: Forward running; K1: Enabling switch; SB2: Reverse running.

Note:

- The system will not respond to the running commands given before two-wire control is ready. Only after the ready of two-wire control will the system respond to re-given running commands.
- For two-wire control running mode, when the FWD/REV terminal is valid, if the system stops due to a stop command given by another source, the system does not run again after the stop command disappears even if the control terminal FWD/REV is still valid. To make the system run, you need to trigger FWD/REV again.

Function code	Name	Description	Setting range	Default
P05.15	Frequency increment change rate of the terminal UP	0.01–50.00Hz/s	0.01–50.00	0.50Hz/s
P05.16	Frequency increment change rate of the terminal DOWN	0.01–50.00Hz/s	0.01–50.00	0.50Hz/s

When UP/DOWN terminal functions are used to adjust the set frequency, P05.15 and P05.16 are used to set the UP/DOWN change rate.

Function code	Name	Description	Setting range	Default
P05.17	AI1 lower limit	0.00V–P05.19	0.00–P05.19	0.00V
P05.18	Corresponding setting of AI1 lower limit	-100.0%–P05.20	-100.0–P05.20	0.0%
P05.19	AI1 upper limit	P05.17–10.00V	P05.17–10.00	10.00V
P05.20	Corresponding setting of AI1 upper limit	P05.18–100.0%	P05.18–100.0	100.0%
P05.21	AI1 input filter time	0.00s–10.00s	0.00–10.00	2.00s

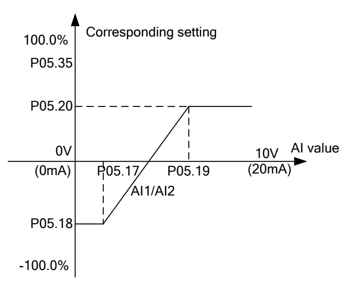
The preceding function codes define the relationship between the input voltage or input current of analog inputs AI1 and its corresponding setting. When the analog input voltage or current exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used.

When the analog input is current input, 0mA–20mA current corresponds to 0V–10V voltage.

In different applications, 100.0% of the analog setting corresponds to different nominal values. See the descriptions of each application section for details.

The following figure shows the relationship between AI1/AI2 and corresponding setting.

Figure 6-20 Relationship between AI1/AI2 and corresponding setting



AI1 input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input.

Function code	Name	Description	Setting range	Default
P05.22	AI2 lower limit	0.00V–P05.24	0.00–P05.24	0.00V
P05.23	Corresponding setting of AI2 lower limit	-100.0%–P05.25	-100.0–P05.25	0.0%
P05.24	AI2 upper limit	P05.22–10.00V	P05.22–10.00	10.00V
P05.25	Corresponding setting of AI2 upper limit	P05.23–100.0%	P05.23–100.0	100.0%
P05.26	AI2 input filter time	0.00s–10.00s	0.00–10.00	2.00s
P05.27	AI3 lower limit	0.00V–P05.29	-1000–P05.29	0.00V
P05.28	Corresponding setting of AI3 lower limit	-100.0%–P05.30	-100.0–P05.30	0.0%
P05.29	AI3 upper limit	P05.27–10.00V	P05.27–10.00	10.00V
P05.30	Corresponding setting of AI3 upper limit	P05.28–100.0%	P05.28–100.0	100.0%
P05.31	AI3 input filter time	0.00s–10.00s	0.00–10.00	2.00s
P05.32	AI4 lower limit	-10.00V–P05.34	-10.00–P05.34	0.00V
P05.33	Corresponding setting of AI4 lower limit	-100.0%–P05.35	-100.0–P05.35	0.0%
P05.34	AI4 upper limit	P05.32–10.00V	P05.32–10.00	10V
P05.35	Corresponding setting of AI4 upper limit	P05.33–100.0%	P05.33–100.0	100.0%
P05.36	AI4 input filter time	0.00s–10.00s	0.00–10.00	2.00s

The setting of AI2, AI3 and AI4 is the same as that of AI1. AI4 is only -10V–+10V voltage type.

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>P05.37</td><td>AI1 mode switchover</td><td rowspan="3">0: Current
1: Voltage</td><td>0–1</td><td>0</td></tr>
<tr><td>P05.38</td><td>AI12 mode switchover</td><td>0–1</td><td>0</td></tr>
<tr><td>P05.39</td><td>AI3 mode switchover</td><td>0–1</td><td>0</td></tr>
<tr><td>P05.40</td><td>AI1 calibration configuration</td><td rowspan="2">0–2
0: Disable
1: Calibrate AI lower limit
2: Calibrate AI upper limit</td><td>0–2</td><td>0</td></tr>
<tr><td>P05.41</td><td>AI2 calibration configuration</td><td>0–2</td><td>0</td></tr>
</table>

Function code	Name	Description	Setting range	Default
P05.42	AI3 calibration configuration		0–2	0
P05.43	AI4 zero calibration coefficient	-10.00%–10.00%	-10.00–10.00	0.00

The calibration method of P05.40–P05.42 is as follows: Take the calibration of AI1 as an example, when input 4mA–20mA corresponds to 0–10V, first calibrate AI lower limit, input 4mA, set P05.40=1, and wait for AI1 input value in the instant message to be 0%. Then calibrate AI upper limit, set P05.40=2, input 20mA, wait for AI1 input value in the instant message to be 100%, set P05.40=0, AI1 calibration is completed.

Function code	Name	Description	Setting range	Default
P05.44	Communication analog lower limit	0.000V–P05.46	0.000–P05.46	0.000V
P05.45	Corresponding setting of communication analog lower limit	-100.0%–P05.47	-100.0–P05.47	0.0%
P05.46	Communication analog upper limit	P05.44–10.000V	P05.44–10.000	10.000V
P05.47	Corresponding setting of communication analog upper limit	P05.45–100.0%	P05.45–100.0	100.0%
P05.48	Communication setting range	0.00–100.00mm	0.00–100.00	0.00mm
P05.49	S1 switch-on delay	0.00–50.00s	0.00–50.00s	1.50s
P05.50	S1 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.51	S2 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.52	S2 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.53	S3 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.54	S3 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.55	S4 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.56	S4 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.57	S5 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.58	S5 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.59	S6 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.60	S6 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.61	S7 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.62	S7 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.63	S8 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.64	S8 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.65	S9 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.66	S9 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.67	S10 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.68	S10 switch-off delay	0.00–50.00s	0.00–50.00	1.50s

Function code	Name	Description	Setting range	Default
P05.69	S11 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.70	S11 switch-off delay	0.00–50.00s	0.00–50.00	1.50s
P05.71	S12 switch-on delay	0.00–50.00s	0.00–50.00	1.50s
P05.72	S12 switch-off delay	0.00–50.00s	0.00–50.00	1.50s

P06 group Output terminal functions

Goodrive5000 medium voltage variable-frequency speed regulation system provides 10 multi-function relay output terminals (RO1–RO10, a maximum of 22 multi-function relay outputs are supported) and 5 multi-function analog output terminals (AO1–AO5) as standard configuration.

Function code	Name	Description	Setting range	Default
P06.00	RO1 output	0: No output 1: In system running 2: Fault output 3: Frequency level detection FDT output 4: Frequency reached 5: Zero speed running 6: Variable-frequency working state 7: Power frequency bypass working state 8: Running time reached 9: Running forward 10: Running reversely 11: Ready for running (running request) 12: Alarm output Variable-frequency: 13: Permission of medium voltage switch QF1M1 switching on 14: Permission of medium voltage switch QF1M2 switching on 15: Permission of medium voltage switch QF1M3 switching on 16: Permission of medium voltage switch QF1M4 switching on 17: Permission of medium voltage switch QF1M5 switching on 18: Permission of medium voltage switch QF1M6 switching on 19: Permission of medium voltage switch QF1M7 switching on 20: Permission of medium voltage switch QF1M8 switching on power frequency Power frequency: 21: Permission of medium voltage	0–91	1
P06.01	RO2 output			2
P06.02	RO3 output			11
P06.03	RO4 output			12
P06.04	RO5 output			0
P06.05	RO6 output			0
P06.06	RO7 output			0
P06.07	RO8 output			0
P06.08	RO9 output			0
P06.09	RO10 output			0
P06.10	RO11 output			0
P06.11	RO12 output			0
P06.12	RO13 output			0
P06.13	RO14 output			0
P06.14	RO15 output			0
P06.15	RO16 output			0
P06.16	RO17 output			0
P06.17	RO18 output			0
P06.18	RO19 output			0
P06.19	RO20 output			0
P06.20	RO21 output			0
P06.21	RO22 output			0

Function code	Name	Description	Setting range	Default
		switch QF2M1 switching on 22: Permission of medium voltage switch QF2M2 switching on 23: Permission of medium voltage switch QF2M3 switching on 24: Permission of medium voltage switch QF2M4 switching on 25: Permission of medium voltage switch QF2M5 switching on 26: Permission of medium voltage switch QF2M6 switching on 27: Permission of medium voltage switch QF2M7 switching on 28: Permission of medium voltage switch QF2M8 switching on 29: Permission of medium voltage switch QF1M1 switching off 30: Permission of medium voltage switch QF1M2 switching off 31: Permission of medium voltage switch QF1M3 switching off 32: Permission of medium voltage switch QF1M4 switching off 33: Permission of medium voltage switch QF1M5 switching off 34: Permission of medium voltage switch QF1M6 switching off 35: Permission of medium voltage switch QF1M7 switching off 36: Permission of medium voltage switch QF1M8 switching off 37: Permission of medium voltage switch QF2M1 switching off 38: Permission of medium voltage switch QF2M2 switching off 39: Permission of medium voltage switch QF2M3 switching off 40: Permission of medium voltage switch QF2M4 switching off 41: Permission of medium voltage switch QF2M5 switching off 42: Permission of medium voltage switch QF2M6 switching off 43: Permission of medium voltage switch QF2M7 switching off 44: Permission of medium voltage switch QF2M8 switching off 45: Variable-frequency working state of switching cabinet 1 46: Power-frequency working state of switching cabinet 1		

Function code	Name	Description	Setting range	Default
		47: Variable-frequency working state of switching cabinet 2 48: Power-frequency working state of switching cabinet 2 49: Variable-frequency working state of switching cabinet 3 50: Power-frequency working state of switching cabinet 3 51: Variable-frequency working state of switching cabinet 4 52: Power-frequency working state of switching cabinet 4 53: Variable-frequency working state of switching cabinet 5 54: Power-frequency working state of switching cabinet 5 55: Variable-frequency working state of switching cabinet 6 56: Power-frequency working state of switching cabinet 6 57: Variable-frequency working state of switching cabinet 7 58: Power-frequency working state of switching cabinet 7 59: Variable-frequency working state of switching cabinet 8 60: Power-frequency working state of switching cabinet 8 (45–60: Both power frequency and variable frequency valid at the same time indicates fault.) 61: Unit bypass state 62: Remote-local state 63–64: Reserved 65: Low-voltage commissioning vacuum contactor KM1 control 66: Low-voltage commissioning vacuum contactor KM2 control 67: Switching cabinet 1# KM1 feedback signal 68: Switching cabinet 1# KM2 feedback signal 69: Switching cabinet 1# KM3 feedback signal 70: Switching cabinet 2# KM1 feedback signal 71: Switching cabinet 2# KM2 feedback signal 72: Switching cabinet 2# KM3 feedback signal 73: Switching cabinet 3# KM1		

Function code	Name	Description	Setting range	Default
		feedback signal 74: Switching cabinet 3# KM2 feedback signal 75: Switching cabinet 3# KM3 feedback signal 76: Switching cabinet 4# KM1 feedback signal 77: Switching cabinet 4# KM2 feedback signal 78: Switching cabinet 4# KM3 feedback signal 79: Switching cabinet KM4 feedback signal 80: Switching cabinet 1 QS1 feedback signal 81: Switching cabinet 1 QS2 feedback signal 82: Switching cabinet 1 QS3 feedback signal 83: Switching cabinet 2 QS1 feedback signal 84: Switching cabinet 2 QS2 feedback signal 85: Switching cabinet 2 QS3 feedback signal 86: Switching cabinet 3 QS1 feedback signal 87: Switching cabinet 3 QS2 feedback signal 88: Switching cabinet 3 QS3 feedback signal 89: Switching cabinet 4 QS1 feedback signal 90: Switching cabinet 4 QS2 feedback signal 91: Switching cabinet 4 QS3 feedback signal		

0: No output.

1: In running: When the system is running, ON signal will be output.

2: Fault output: When any fault occurs to the system, ON signal will be output.

3: Frequency level detection signal FDT. Refer to the descriptions for P08.15–P08.16.

4: The frequency reached. Refer to the description of P08.17.

5: In zero-speed running. When the system is running and the output frequency is zero, ON signal will be output.

6: Variable-frequency working state. When the system is in the variable-frequency state, ON signal will be output.

7: Power frequency bypass working state. When the system is in the power frequency bypass state, ON signal will be output.

8: Running time reached. When the local accumulative running time reaches the set time in P07.11, ON signal will be output.

9: Running forward

10: Running reversely

11: Ready for running. When main circuit and control circuit powers are established, the protection functions do not act. When the system is ready to run, ON signal will be output.

12: Alarm output: When the system alarms (not to cause fault abnormality), ON signal will be output.

13: Permission of medium voltage switch QF1M1 switching on

14: Permission of medium voltage switch QF1M2 switching on

15: Permission of medium voltage switch QF1M3 switching on

16: Permission of medium voltage switch QF1M4 switching on

17: Permission of medium voltage switch QF1M5 switching on

18: Permission of medium voltage switch QF1M6 switching on

19: Permission of medium voltage switch QF1M7 switching on

20: Permission of medium voltage switch QF1M8 switching on

21: Permission of medium voltage switch QF2M1 switching on

22: Permission of medium voltage switch QF2M2 switching on

23: Permission of medium voltage switch QF2M3 switching on

24: Permission of medium voltage switch QF2M4 switching on

25: Permission of medium voltage switch QF2M5 switching on

26: Permission of medium voltage switch QF2M6 switching on

27: Permission of medium voltage switch QF2M7 switching on

28: Permission of medium voltage switch QF2M8 switching on

13–28: Permissions of medium voltage switch switching on. After the system receives the variable-frequency running signals, it needs to pass self-testing and waiting time set in P01.30, and then send signals to the higher level (console or medium voltage switch). The higher level will switch on the higher level medium voltage switch after receiving the signal.

29: Permission of medium voltage switch QF1M1 switching off

30: Permission of medium voltage switch QF1M2 switching off

31: Permission of medium voltage switch QF1M3 switching off

32: Permission of medium voltage switch QF1M4 switching off

33: Permission of medium voltage switch QF1M5 switching off

34: Permission of medium voltage switch QF1M6 switching off

35: Permission of medium voltage switch QF1M7 switching off

36: Permission of medium voltage switch QF1M8 switching off

37: Permission of medium voltage switch QF2M1 switching off

38: Permission of medium voltage switch QF2M2 switching off

39: Permission of medium voltage switch QF2M3 switching off

40: Permission of medium voltage switch QF2M4 switching off

41: Permission of medium voltage switch QF2M5 switching off

42: Permission of medium voltage switch QF2M6 switching off

43: Permission of medium voltage switch QF2M7 switching off

44: Permission of medium voltage switch QF2M8 switching off

29–44: Permissions of medium voltage switch switching off. When the system needs to switch off the higher level medium voltage switch, it is necessary to send signals to the higher level (console or medium voltage vacuum breaker) which will have to switch off the higher level medium voltage switch to protect the system.

45: Variable-frequency working state of switching cabinet 1

46: Power-frequency working state of switching cabinet 1

47: Variable-frequency working state of switching cabinet 2

48: Power-frequency working state of switching cabinet 2

49: Variable-frequency working state of switching cabinet 3

50: Power-frequency working state of switching cabinet 3

51: Variable-frequency working state of switching cabinet 4

52: Power-frequency working state of switching cabinet 4

53: Variable-frequency working state of switching cabinet 5

54: Power-frequency working state of switching cabinet 5

55: Variable-frequency working state of switching cabinet 6

56: Power-frequency working state of switching cabinet 6

57: Variable-frequency working state of switching cabinet 7

58: Power-frequency working state of switching cabinet 7

59: Variable-frequency working state of switching cabinet 8

60: Power-frequency working state of switching cabinet 8 (45–60: Both power frequency and variable frequency valid at the same time indicates fault.)

45–60: The working states of switching cabinets 1–8.

When the corresponding motor of the switching cabinet is in the variable-frequency state, ON signal will be output in the variable-frequency working state. When the corresponding motor of the switching cabinet is in the power frequency state, ON signal will be output in the power frequency working state.

61: Unit bypass state

When the system has unit bypass, ON signal will be output.

62: Remote-local state

When the switch is at the local state, the system can only control through the local command channel and output OFF signal; and at the remote state, the system can control through terminals, Modbus and fieldbus, and output ON signal.

63–64: Reserved

65: Low-voltage commissioning vacuum contactor KM1 control

66: Low-voltage commissioning vacuum contactor KM2 control

65–66: Low-voltage commissioning vacuum contactor control (mainly used for low-voltage power-on commissioning of the factory)

67: Switching cabinet 1# KM1 feedback signal

68: Switching cabinet 1# KM2 feedback signal

69: Switching cabinet 1# KM3 feedback signal

70: Switching cabinet 2# KM1 feedback signal

71: Switching cabinet 2# KM2 feedback signal

72: Switching cabinet 2# KM3 feedback signal

73: Switching cabinet 3# KM1 feedback signal
74: Switching cabinet 3# KM2 feedback signal
75: Switching cabinet 3# KM3 feedback signal
76: Switching cabinet 4# KM1 feedback signal
77: Switching cabinet 4# KM2 feedback signal
78: Switching cabinet 4# KM3 feedback signal
79: Switching cabinet KM4 feedback signal

Note: ON signals refer to the signals of the relay NO contact on and NC contact off.

80: Switching cabinet 1 QS1 feedback signal
81: Switching cabinet 1 QS2 feedback signal
82: Switching cabinet 1 QS3 feedback signal
83: Switching cabinet 2 QS1 feedback signal
84: Switching cabinet 2 QS2 feedback signal
85: Switching cabinet 2 QS3 feedback signal
86: Switching cabinet 3 QS1 feedback signal
87: Switching cabinet 3 QS2 feedback signal
88: Switching cabinet 3 QS3 feedback signal
89: Switching cabinet 4 QS1 feedback signal
90: Switching cabinet 4 QS2 feedback signal
91: Switching cabinet 4 QS3 feedback signal

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>P06.22</td><td>AO1 output</td><td rowspan="5">0: Running frequency (100% corresponds to the max. frequency)
1: Set frequency (100% corresponds to the max. frequency)
2: Output current valid value (100% corresponds to twice the system rated current)
3: Output current valid value (100% corresponds to twice the motor rated current)
4: Output voltage (100% corresponds to 1.2 times the system rated voltage)
5: Output power (100% corresponds to twice the motor rated power)
6: Output torque (100% corresponds to twice the motor rated torque)
7: AI1 input value (100% corresponds to 10V)
8: AI2 input value (100% corresponds to 10V)
9: AI3 input value (100% corresponds to 10V)
10: AI4 input value (100% corresponds to 10V)</td><td>0–10</td><td>0</td></tr>
<tr><td>P06.23</td><td>AO2 output</td><td>0–10</td><td>0</td></tr>
<tr><td>P06.24</td><td>AO3 output</td><td>0–10</td><td>0</td></tr>
<tr><td>P06.25</td><td>AO4 output</td><td>0–10</td><td>0</td></tr>
<tr><td>P06.26</td><td>AO5 output</td><td>0–10</td><td>0</td></tr>
</table>

AO1, AO2, and AO3 provide 0–10V voltage output or 4–20mA current output which can be selected by the jumpers SW1 (AO1), SW2 (AO2), and SW3 (AO3) on the I/O board. AO4 and AO5 only provide current output.

The corresponding ranges are shown in the following table.

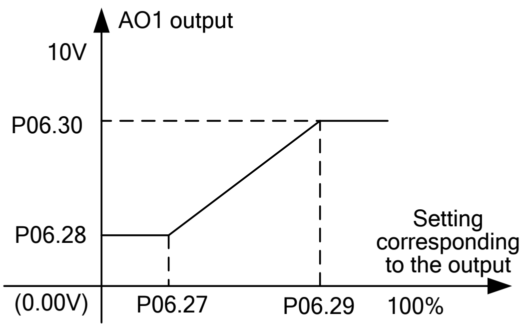
Set value	Function	Range
0	Running frequency	100% corresponds to the max. output frequency
1	Set frequency	100% corresponds to the max. output frequency
2	Output current valid value	100% corresponds to twice the rated current of variable-frequency speed regulation system
3	Output current valid value	100% corresponds to twice the motor rated current
4	Output voltage	100% corresponds to 1.2 times the rated voltage of variable-frequency speed regulation system
5	Output power	100% corresponds to twice the motor rated power
6	Output torque	100% corresponds to twice the motor rated torque
7	AI1 input	100% corresponds to 10V
8	AI2 input	100% corresponds to 10V
9	AI3 input	100% corresponds to 10V
10	AI4 input	100% corresponds to 10V

Function code	Name	Description	Setting range	Default
P06.27	AO1 output lower limit	0.00%–P06.29	0.00%–P06.29	0.00%
P06.28	AO1 output corresponding to lower limit	0.00V–P06.30	0.00V–P06.30	0.00V
P06.29	AO1 output upper limit	P06.27–100.0%	P06.27–100.0	100.0%
P06.30	AO1 output corresponding to upper limit	P06.28–10.00V	P06.28–10.00	10.00V
P06.31	AO2 output lower limit	0.00%–P06.33	0.00%–P06.33	0.00%
P06.32	AO2 output corresponding to lower limit	0.00V–P06.34	0.00V–P06.34	0.00V
P06.33	AO2 output upper limit	P06.31–100.0%	P06.31–100.0	100.0%
P06.34	AO2 output corresponding to upper limit	P06.32–10.00V	P06.32–10.00	10.00V
P06.35	AO3 output lower limit	0.00%–P06.37	0.00%–P06.37	0.00%
P06.36	AO3 output corresponding to lower limit	0.00V–P06.38	0.00V–P06.38	0.00V
P06.37	AO3 output upper limit	P06.35–100.0%	P06.35–100.0	100.0%
P06.38	AO3 output corresponding to	P06.36–10.00V	P06.36–10.00	10.00V

Function code	Name	Description	Setting range	Default
	upper limit			
P06.39	AO4 output lower limit	0.00%–P06.41	0.00%–P06.41	0.0%
P06.40	AO4 output corresponding to lower limit	0.00V–P06.42	0.00V–P06.42	0.00V
P06.41	AO4 output upper limit	P06.39–100.0%	P06.39–100.0	100.0%
P06.42	AO4 output corresponding to upper limit	P06.40–10.00V	P06.40–10.00	10.00V
P06.43	AO5 output lower limit	0.00%–P06.45	0.00%–P06.45	0.0%
P06.44	AO5 output corresponding to lower limit	0.00V–P06.46	0.00V–P06.46	0.00V
P06.45	AO5 output upper limit	P06.43–100.0%	P06.43–100.0	100.0%
P06.46	AO5 output corresponding to upper limit	P06.44–10.00V	P06.44–10.00	10.00V

Analog output is shown in the following figure.

Figure 6-21 Relationship between the reference value and analog output



Note: When current output is selected for AO1, AO2 and AO3, 1mA corresponds to 0.5V.

Function code	Name	Description	Setting range	Default
P06.47	RO1 switch-on delay	0.00–50.00s	0.00–50.00	0.00s
P06.48	RO1 switch-off delay	0.00–50.00s	0.00–50.00	0.00s
P06.49	RO2 switch-on delay	0.00–50.00s	0.00–50.00	0.00s
P06.50	RO2 switch-off delay	0.00–50.00s	0.00–50.00	0.00s
P06.51	RO3 switch-on delay	0.00–50.00s	0.00–50.00	0.00s

Function code	Name	Description	Setting range	Default
P06.52	RO3 switch-off delay	0.00–50.00s	0.00–50.00	0.00s
P06.53	RO4 switch-on delay	0.00–50.00s	0.00–50.00	0.00s
P06.54	RO4 switch-off delay	0.00–50.00s	0.00–50.00	0.00s
P06.55	RO5 switch-on delay	0.00–50.00s	0.00–50.00	0.00s
P06.56	RO5 switch-off delay	0.00–50.00s	0.00–50.00	0.00s
P06.57	RO6 switch-on delay	0.00–50.00s	0.00–50.00	0.00s
P06.58	RO6 switch-off delay	0.00–50.00s	0.00–50.00	0.00s
P06.59	RO7 switch-on delay	0.00–50.00s	0.00–50.00	0.00s
P06.60	RO7 switch-off delay	0.00–50.00s	0.00–50.00	0.00s
P06.61	RO8 switch-on delay	0.00–50.00s	0.00–50.00	0.00s
P06.62	RO8 switch-off delay	0.00–50.00s	0.00–50.00	0.00s

P07 group Human-machine interface

Function code	Name	Description	Setting range	Default
P07.00	Touch screen version	0.00–655.35	0.00–655.35	Default setting
P07.01	Standard I/O board software version	0.00–655.35	0.00–655.35	Default setting
P07.02	Software version (FPGA)	0.00–655.35	0.00–655.35	Default setting
P07.03	Software version (DSP)	0.00–655.35	0.00–655.35	Default setting
P07.04	Software version (ARM)	0.00–655.35	0.00–655.35	Default setting
P07.05	Unit MCU version	0.00–655.35	0.00–655.35	Default setting

The touch screen version is read-only.

The standard I/O board software version is read-only.

The software version (FPGA) is read-only.

The software version (DSP) is read-only.

The software version (ARM) is read-only.

The unit MCU version is read-only.

Function code	Name	Description	Setting range	Default
P07.06	Max. number of available units	1–12	1–12	Default setting

The system supports up to 12 units per phase in series, and the max. number of units available to users is 12 at the factory according to the users' purchase needs.

Function code	Name	Description	Setting range	Default
P07.07	Supported motor type	0: Only AM 1: Only SM 2: SM and AM	0–2	Default setting

According to the users' purchase needs, set the supported motor types at the factory. 0 indicates that only AMs are supported, 1 indicates that only SMs are supported, and 2 indicates that both SMs and AMs are supported.

Function code	Name	Description	Setting range	Default
P07.08	Unit FPGA version	0–655.35	0–655.35	Default setting

The unit FPGA version is read-only.

Function code	Name	Description	Setting range	Default
P07.09	Two-quadrant and four-quadrant selection	0: Two-quadrant 1: Four-quadrant	0–1	Default setting

P07.09 is used to set whether a two-quadrant or four-quadrant VFD is supported.

0: The two-quadrant VFD is supported.

1: The four-quadrant VFD is supported.

Function code	Name	Description	Setting range	Default
P07.10	Max. number of switching cabinets	0–4	0–4	Default setting

It is applied in the cases where one VFD drives multiple motors, supporting a maximum of 4 switching cabinets. Set the parameters at the factory according to the users' purchase needs.

Function code	Name	Description	Setting range	Default
P07.11	Local accumulative running time	0–65535h	0–65535	0h

The function code is used to record the accumulative running time of the system by hours. It is read-only.

Function code	Name	Description	Setting range	Default
P07.12	Local running time	0–65535min	0–65535	0min

The function code is used to set the current running time of the system by minutes. If the running time is reached, users can operate after the system outputs the signal of running time reached.

Function code	Name	Description	Setting range	Default
P07.13	Factory bar code 1	0–65535	0–65535	0
P07.14	Factory bar code 2	0–65535	0–65535	0
P07.15	Factory bar code 3	0–65535	0–65535	0
P07.16	Factory bar code 4	0–65535	0–65535	0
P07.17	Factory bar code 5	0–65535	0–65535	0
P07.18	Factory bar code 6	0–65535	0–65535	0

P08 group Enhanced functions

Function code	Name	Description	Setting range	Default
P08.00	ACC time 2	0.1–3600.0s	0.1–3600.0	Model depended
P08.01	DEC time 2	0.1–3600.0s	0.1–3600.0	Model depended
P08.02	ACC time 3	0.1–3600.0s	0.1–3600.0	Model depended
P08.03	DEC time 3	0.1–3600.0s	0.1–3600.0	Model depended
P08.04	ACC time 4	0.1–3600.0s	0.1–3600.0	Model depended
P08.05	DEC time 4	0.1–3600.0s	0.1–3600.0	Model depended

The function codes P08.00–P08.05 can be switched by the combinations of multi-function input terminals (see the description of P05). The definitions of different ACC/DEC time are the same, as described in P00.16 and P00.17.

Function code	Name	Description	Setting range	Default
P08.06	Running frequency of jogging	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	5.00Hz
P08.07	ACC time of jogging	0.1–3600.0s	0.1–3600.0	Model depended
P08.08	DEC time of jogging	0.1–3600.0s	0.1–3600.0	Model depended

Jogging start/stop mode: Direct start and decelerate to stop.

ACC time for jogging means the time needed for the variable-frequency speed regulation system speeds up from 0Hz to the max. output frequency (P00.10) during jogging.

DEC time for jogging means the time needed for the variable-frequency speed regulation system speeds down from the max. output frequency (P00.10) to 0Hz during jogging.

Note:

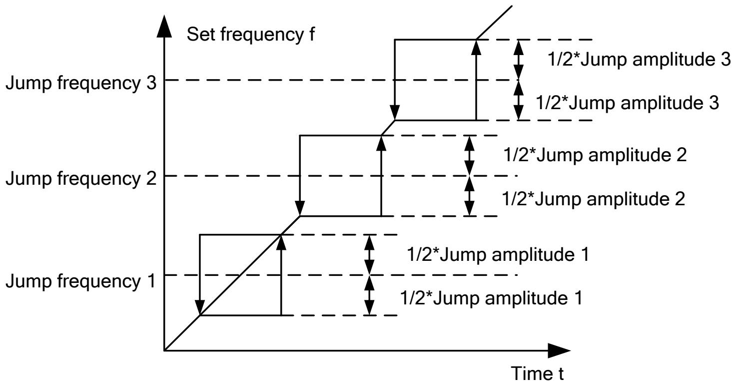
- Jogging enjoys the top priority. Even in the torque mode, if the jogging command is valid, it is necessary to switch into speed mode to respond to the jogging command.
- When the jogging command is valid, run in linear ACC/DEC according to jogging ACC/DEC time. If there is no running command after jogging is cancelled, stop according to the jogging DEC curve, otherwise, switch into the ACC/DEC curve of normal running.

Function code	Name	Description	Setting range	Default
P08.09	Jump frequency 1	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz
P08.10	Jump frequency amplitude 1	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz
P08.11	Jump frequency 2	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz
P08.12	Jump frequency amplitude 2	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz
P08.13	Jump frequency 3	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz
P08.14	Jump frequency amplitude 3	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz

The variable-frequency speed regulation system can avoid mechanical resonance points by setting jump frequencies. Goodrive5000 integrated machine medium voltage variable-frequency speed regulation system supports the setting of three jump frequencies. If three jump frequency points are set to 0, this function is invalid.

Note: The qualified object of the jump frequency is the set frequency. For example, f_0=initial set frequency, f_j=jump frequency, Δf=jump amplitude, f=actual running frequency. If $(f_j-\triangle f/2) < f_0 \leqslant f_j$, thus $f=f_j-\triangle f/2$. If $f_j < f_0 \leqslant (f_j+\triangle f/2)$, thus $f=f_j+\triangle f/2$.

Figure 6-22 Jump frequency diagram



Function code	Name	Description	Setting range	Default
P08.15	Auto fault reset count	0–3	0–3	0

Function code	Name	Description	Setting range	Default
P08.16	Auto fault reset interval	0.1–100.0s	0.1–100.0	1.0s

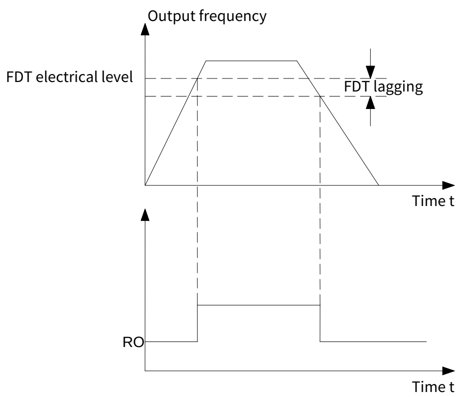
Auto fault reset count: When the system uses automatic fault reset, it is used to set the number of automatic fault reset times. The system will automatically reset and start speed tracking when light faults occurs. If the continuous reset times exceed the set value during the period set in P08.32, the system stops and manual intervention is needed.

Auto fault reset interval: Time interval from when a fault occurred to when automatic fault reset takes effect.

Function code	Name	Description	Setting range	Default
P08.17	FDT electrical level detection value	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	50.00Hz
P08.18	FDT lagging detection value	0.0–100.0% (FDT electrical level)	0.0–100.0	5.0%

When the output frequency exceeds the corresponding frequency FDT electrical level, output the signal until the output frequency decreases to a value lower than the corresponding frequency (FDT retention detection value). The specific waveform is shown in Figure 6-23.

Figure 6-23 Diagram of FDT electrical level

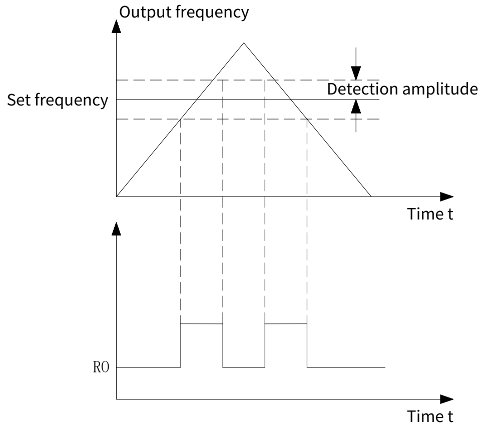


Note: FDT electrical level retention value is the percentage corresponding to FDT electrical level.

Function code	Name	Description	Setting range	Default
P08.19	Detection amplitude for frequency being reached	0.0–100.0% (of the max. frequency)	0.0–100.0	0.0%

The output frequency of the system outputs pulse signals within the detection range of the set frequency, as shown in Figure 6-24.

Figure 6-24 Detection amplitude value for frequency being reached



Note: The detection amplitude value for frequency being reached is the percentage corresponding to the maximum frequency (P00.10).

Function code	Name	Description	Setting range	Default
P08.20	Overmodulation	0: Overmodulation is invalid 1: Overmodulation is valid	0–1	0

Under the conditions of low voltage (below 85% of rated voltage) or heavy loads for a long time, the system can improve utilization of bus voltage and thus raise output voltage by overmodulation.

Function code	Name	Description	Setting range	Default
P08.21	Running mode of cooling fan	0: Normal mode 1: The fan keeps running after power-on.	0–1	0

0: During normal running mode, the fan starts running under the following conditions.

1) The temperature of the transformer is higher than the value set in P23.20 or the temperature of the unit is higher than the value set in P23.22.
2) The system is running.
3) Conditions for the fan stops running: The system does not run, and the temperature of the transformer is lower than the value set in P23.21 and the temperature of the unit is lower than the value set in P23.23.

1: The fan keeps running after power-on. The fan keeps running after the system is powered on.

Function code	Name	Description	Setting range	Default
P08.22	Alarm reset interval	0.0s (The alarm function is invalid) 0.1–3600.0s	0.0–3600.0	1.0s

Note: Alarm means when the system works abnormally, if users do not pay attention to it, the abnormity will cause faults. Users can select whether it is necessary for the system to report alarms and the interval of automatic alarm reset.

Function code	Name	Description	Setting range	Default
P08.23	Reference frequency disconnection	0.0–100.0%	0.0–100.0	0.0%

Function code	Name	Description	Setting range	Default
	threshold			
P08.24	Reference frequency disconnection time	0.0–360.0s	0.0–360.0	0.0s

Set the frequency disconnection threshold: 100% of the threshold corresponds to the upper limit of running frequency (P00.11), when the system detects the set frequency less than or equal to the set frequency threshold, it will start timing. If the timing exceeds the disconnection time, the system will reports the frequency setting disconnection fault.

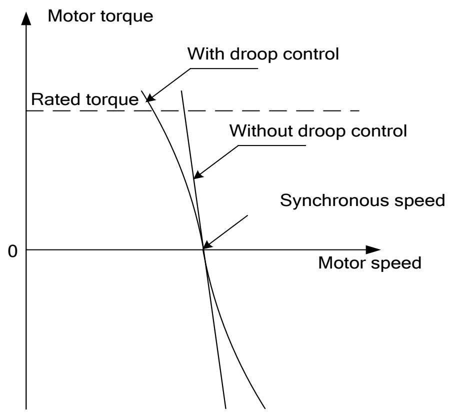
Function code	Name	Description	Setting range	Default
P08.25	Drop control	0.00–10.00Hz	0.00–10.00	0.00Hz
P08.26	Reserved	0–65535	0–65535	0
P08.27	Unit alarm temperature setting	60.0–100.0°C	60.0–100.0	75°C

When the unit temperature exceeds the temperature set in P08.27, too high unit temperature is reported.

Function code	Name	Description	Setting range	Default
P08.28	Droop control mode	0: Droop control mode 1 1: Droop control mode 2	0–1	0
P08.29	Droop control mode 1 droop frequency	-10.00–10.00Hz	-10.00–10.00	0.00Hz
P08.30	Droop control mode 2 droop frequency	-10.00–10.00Hz	-10.00–10.00	0.00Hz

When several variable-frequency speed regulation systems drive one load, due to different speeds, unbalanced load distribution will make the system at the highest speed bear heavy load. The droop control is featuring speed changing along with loads and balanced distribution. Adjust the parameter from the smallest one to the largest one. The relationship between the load and output frequency is shown as Figure 6-25.

Figure 6-25 Motor characteristics in droop control



The parameter is used to adjust the frequency change rate of droop control for the system.

Function code	Name	Description	Setting range	Default
P08.31	Ambient temperature alarm detection value	0–100°C	0–100	60°C
P08.32	Initialization time of fault reset count	0: The fault reset count will not be automatically reset. 1–65535min: The auto fault reset count is cleared after the time is set.	0–65535	60min
P08.33	Allowed time of undervoltage fault reset	0–100s	0–100	10s
P08.34–P08.39	Reserved	0–65535	0–65535	0

Ambient temperature alarm detection value: When the ambient temperature detection value exceeds the alarm value, the system will reports ambient temperature too high.

Initialization time of fault reset count: See the description of P08.15.

Allowed time of undervoltage fault reset: After the continuous undervoltage time exceeds the set value, the fault will not be automatically reset even if the input voltage is restored.

P09 group Fault record parameters

Function code	Name	Description	Setting range	Default
P09.00	Action selection 1 of DSP fault	0xAAAA–0xFFFF Two bits stand for a fault. 00: No processing 01: Alarm 10: Light fault, stop but not cut off medium voltage power. 11: Serious fault, stop and cut off medium voltage power. Automatic reset is disabled.	0xAAAA–0xFFFF	0xEABA
P09.01	Action selection 2 of DSP fault	0x8AAA–0xFFFF	0x8AAA–0xFFFF	0x8EAA
P09.02	Action selection 3 of DSP fault	0xAA82–0xFFFF	0xAA82–0xFFFF	0xAA82
P09.03	Action selection 4 of DSP fault	0x0000–0xFFFF	0x0000–0xFFFF	0x07FC
P09.04	Action selection 1 of ARM fault	0x0000–0xFFFF	0x0000–0xFFFF	0x555D
P09.05	Action selection 2 of ARM fault	0x0000–0xFFFF	0x0000–0xFFFF	0x6555
P09.06	Action selection 3 of ARM fault	0x0000–0xFFFF	0x0000–0xFFFF	0x1555
P09.07	Action selection 4	0x0000–0xFFFF	0x0000–0xFFFF	0x1555

Function code	Name	Description	Setting range	Default
	of ARM fault			
P09.08	Action selection 1 of unit fault	0x2AEA–0xFFFF	0x2AEA–0xFFFF	0xAAEA
P09.09	Action selection 2 of unit fault	0x0AAA–0xFFFF	0x0AAA–0xFFFF	0xAAAA
P09.10	Action selection 3 of unit fault	0xAABF–0XFFFF	0xAABF–0xFFFF	0xAABF
P09.11	Action selection 4 of unit fault	0x000B–0xFFFF	0x000B–0xFFFF	0x000B

The fault action includes 4 types: no processing, alarm, light fault (stop but not cut off medium voltage power), and serious fault (stop and cut off medium voltage power). Each two bits in the fault action selection word are combined to set the action selection when a certain fault occurs.

00: No processing.

01: Alarm.

10: Light fault, stop but not cut off medium voltage power. Automatic fault reset is enabled.

11: Serious fault, stop and cut off medium voltage power. Automatic fault reset is disabled.

Function code	Name	Description	Setting range	Default
P09.12	2th-last DSP fault 1	Each bit stands for 1 fault type. 0: No fault; 1: Fault Bit0: Software overcurrent Bit1: Hardware overcurrent Bit2: Grid overvoltage Bit3: Grid undervoltage Bit4: Motor overload Bit5: VFD overload Bit6: Phase loss on output side Bit7: Input phase loss detection fault Bit8: Current detection fault Bit9: Parameter autotuning fault Bit10: Encoder disconnection fault Bit11: Encoder reversal fault Bit12: Handshake fault Bit13: Input overcurrent Bit14: Voltage detection transmission board fault Bit15: Phase sequence inconsistency	0x0000–0xFFFF	0x0000
P09.13	2th-last DSP fault 2	Each bit stands for 1 fault type. 0: No fault; 1: Fault Bit16: Magnetic pole position detection Bit17: Speed out-of-tolerance-range fault Bit18: VFD overspeed fault Bit19: Resolver position reading error	0x0000–0xFFFF	0x0000

Function code	Name	Description	Setting range	Default
		Bit20: The resolver can't track the motor rotation Bit21: Resolver signal distortion fault Bit22: UVW encoder connection fault Bit23: UVW encoder zero position fault Bit24: Encoder parameter autotuning fault Bit25: Transformer loss is too large Bit26: Reactive current is too large Bit27: Transformer overload Bit28: Input voltage imbalance Bit29: Input current imbalance Bit3031: Reserved		

P09.12 and P09.13 includes 32 DSP fault types, each bit stands for 1 fault type, bitn=1 means some fault occur, bitn=0 means the fault does not occur.

Similarly, P09.14 and P09.15 includes 32 ARM fault types, and P09.16 and P09.17 includes 26 unit fault types.

The relationship between fault word and fault type as follows:

For example, if a DSP hardware overcurrent fault occurs in P09.12, bit1 of P09.12 (bit15–bit0) is 1. If P09.00 is set to 0XEABA, bit3–bit2 of P09.00 is 10, indicating that the hardware overcurrent fault is configured as a light fault, and the system stops but does not cut off the medium voltage power supply.

Function code	Name	Description	Setting range	Default
P09.14	2th-last ARM fault type 1	Each bit stands for 1 fault type. 0: No fault; 1: Fault Bit0: VFD overheating Bit1: VFD tripping Bit2: External fault Bit3: Modbus communication fault Bit4: Buffer cabinet fault Bit5: PID disconnection fault Bit6: Door access fault Bit7: Synchronous switchover timeout Bit8: Synchronous switchover serious fault Bit9: Factory time reached Bit10: Ambient temperature too high Bit11: Switching cabinet communication fault Bit12: Insufficient SD card capacity Bit13: QF feedback fault Bit14: DSP and ARM handshake fault Bit15: Power off in running	0x0000–0xFFFF	0x0000
P09.15	2th-last ARM fault type 2	Bit16: PROFIBUS communication fault Bit17: Reference frequency disconnection detection fault	0x0000–0xFFFF	0x0000

Function code	Name	Description	Setting range	Default
		Bit18: Switching cabinet 1 action fault Bit19: Switching cabinet 2 action fault Bit20: Switching cabinet 3 action fault Bit21: Switching cabinet 4 action fault Bit22: Version not match Bit23: Reserved Bit24: Ambient temperature too high Bit25: Unit optical-fiber communication fault Bit26: Fan overheating fault Bit27: Master/slave optical-fiber communication fault Bit28–bit29: Reserved Bit30: Temperature controller communication fault Bit31: Reserved		
P09.16	2th-last unit fault 1	Each bit stands for 1 fault type. 0: No fault; 1: Fault Bit0: Unit optical-fiber uplink communication fault Bit1: Unit optical-fiber downlink communication fault Bit2: The unit is not ready Bit3: Unit overvoltage Bit4: Unit undervoltage Bit5: Unit power fault Bit6: Unit overheating Bit7: Unit input phase loss protection Bit8: Unit input power loss protection Bit9: ACI fault Bit10: ACO fault Bit11: Unit hardware overvoltage Bit12: The unit does not match Bit13: Unit bypass failure Bit14: Reserved Bit15: Reserved Bit16: Rectifier unit R-phase VCE Bit17: Rectifier unit S-phase VCE Bit18: Rectifier unit T-phase VCE Bit19: Grid-side current detection fault Bit20: Phase lock failure	0x0000–0xFFFF	0x0000
P09.17	2th-last unit fault 2		0x0000–0xFFFF	0x0000

Function code	Name	Description	Setting range	Default
		Bit21: Rectifier side overheating Bit22: Reserved Bit23: Reserved Bit24: Zero calculation fault Bit25: Hardware overcurrent		
P09.18	2nd-last fault unit number	If the number is 0, there is no unit fault. If it is not 0, then A1–A12: 1–12 B1–B12: 13–24 C1–C12: 25–36	0–36	0

Displays the 2nd-last fault unit number. If the fault unit number is 0, it means no fault. If it is non-zero, 1–12 represent the faults of A1–A12 units in phase A, 13–24 represent the faults of B1–B12 units in phase B, and 25–36 represent the faults of C1–C12 units in phase C, respectively.

Function code	Name	Description	Setting range	Default
P09.19	ACC/DEC state at 2nd-last fault	0: Constant speed 1: ACC 2: DEC	0–2	0

Displays the ACC/DEC state at 2nd-last fault when the system runs. 0 indicates constant speed, 1 indicates ACC, and 2 indicates DEC.

Function code	Name	Description	Setting range	Default
P09.20	Running frequency at 2nd-last fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz
P09.21	Set frequency at 2nd-last fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz
P09.22	Output current at 2nd-last fault	0.0–6553.5A	0.0–6553.5	0.0A
P09.23	Output voltage at 2nd-last fault	0–65535V	0–65535	0V
P09.24	Input current at 2nd-last fault	0.0–6553.5A	0.0–6553.5	0.0A
P09.25	Input voltage at 2nd-last fault	0–65535V	0–65535	0V
P09.26	Unit bus voltage at 2nd-last fault	0–65535V	0–65535	0V
P09.27	Unit temperature at 2nd-last fault	0.0–6553.5°C	0.0–6553.5	0.0°C

P09.20–P09.27 displays the frequency, voltage, current, and unit temperature at 2nd-last fault for the users to check.

Function code	Name	Description	Setting range	Default
P09.28	System input terminal state at	0x0000–0xFFFF	0x0000–0xFFFF	0x0000

Function code	Name	Description	Setting range	Default
	2nd-last fault			
P09.29	User input terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000

P09.28 is system input terminal states at 2nd-last fault, which are hexadecimal digits to display the states of 10 system input terminals at 2nd-last fault. If the input terminal is ON, the corresponding bit is 1. If it is OFF, the corresponding bit is 0. You can know the state of the system digital input signals at the fault through this value. The sequence is as follows.

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	S10	S9
Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
S8	S7	S6	S5	S4	S3	S2	S1

P09.29 is user input terminal states at 2nd-last fault, which are hexadecimal digits to display the states of 12 user input terminals at 2nd-last fault. If the input terminal is ON, the corresponding bit is 1. If it is OFF, the corresponding bit is 0. You can know the state of the digital input signals at the fault through this value. The sequence is as follows.

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	S12	S11	S10	S9
Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
S8	S7	S6	S5	S4	S3	S2	S1

Function code	Name	Description	Setting range	Default
P09.30	System output terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.31	User output terminal state 1 at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.32	User output terminal state 2 at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000

P09.30 is system output terminal states at 2nd-last fault, which are hexadecimal digits to display the states of 8 system output terminals at 2nd-last fault. If the output terminal is ON, the corresponding bit is 1. If it is OFF, the corresponding bit is 0. You can know the state of the digital output signals at the fault through this value. The sequence is as follows.

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
RO8	RO7	RO6	RO5	RO4	RO3	RO2	RO1

P09.31 and P09.32 are user output terminal states at 2nd-last fault, which are hexadecimal digits to display the states of 20 user output terminals at 2nd-last fault. If the output terminal is ON, the corresponding bit is 1. If it is OFF, the corresponding bit is 0. You can know the state of the digital output signals at the fault through this value. The sequence is as follows.

P09.31 indicates:

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
RO16	RO15	RO14	RO13	RO12	RO11	RO10	RO9
Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
RO8	RO7	RO6	RO5	RO4	RO3	RO2	RO1

P09.32 indicates:

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
Bit7	**Bit6**	**Bit5**	**Bit4**	**Bit3**	**Bit2**	**Bit1**	**Bit0**
Reserved	Reserved	RO22	RO21	RO20	RO19	RO18	RO17

Function code	Name	Description	Setting range	Default
P09.33	Last DSP fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.34	Last DSP fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.35	Last ARM fault type 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.36	Last ARM fault type 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.37	Last unit fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.38	Last unit fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.39	Last fault unit number	If the number is 0, there is no unit fault. If it is not 0, then A1–A12: 1–12 B1–B12: 13–24 C1–C12: 25–36	0–36	0
P09.40	ACC/DEC state at last fault	0: Constant speed 1: ACC 2: DEC	0–2	0
P09.41	Running frequency at last fault	0.00Hz–P00.10	0.00Hz–P00.10	0.00Hz
P09.42	Set frequency at last fault	0.00Hz–P00.10	0.00Hz–P00.10	0.00Hz
P09.43	Output current at last fault	0.0–6553.5A	0.0–6553.5	0.0A
P09.44	Output voltage at last fault	0–65535V	0–65535	0V
P09.45	Input current at last fault	0.0–6553.5A	0.0–6553.5	0.0A
P09.46	Input voltage at last fault	0–65535V	0–65535	0V
P09.47	Unit bus voltage at last fault	0–65535V	0–65535	0V
P09.48	Unit temperature at last fault	0.0–6553.5°C	0.0–6553.5	0.0°C
P09.49	System input terminal state at	0x0000–0xFFFF	0x0000–0xFFFF	0x0000

Function code	Name	Description	Setting range	Default
	last fault			
P09.50	User input terminal state at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.51	System output terminal state at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.52	User output terminal state 1 at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.53	User output terminal state 2 at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000

Same as the descriptions of 2nd-last fault.

Function code	Name	Description	Setting range	Default
P09.54	Present DSP fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.55	Present DSP fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.56	Present ARM fault type 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.57	Present ARM fault type 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.58	Present unit fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.59	Present unit fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.60	Unit number at present fault	If the number is 0, there is no unit fault. If it is not 0, then A1–A12: 1–12 B1–B12: 13–24 C1–C12: 25–36	0–36	0
P09.61	ACC/DEC state at present fault	0: Constant speed 1: ACC 2: DEC	0–2	0
P09.62	Running frequency at present fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz
P09.63	Set frequency at present fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz
P09.64	Output current at present fault	0.0–6553.5A	0.0–6553.5	0.0A
P09.65	Output current at present fault	0–65535V	0–65535	0V
P09.66	Input current at present fault	0.0–6553.5A	0.0–6553.5	0.0A
P09.67	Input voltage at present fault	0–65535V	0–65535	0V
P09.68	Unit bus voltage at present fault	0–65535V	0–65535	0V

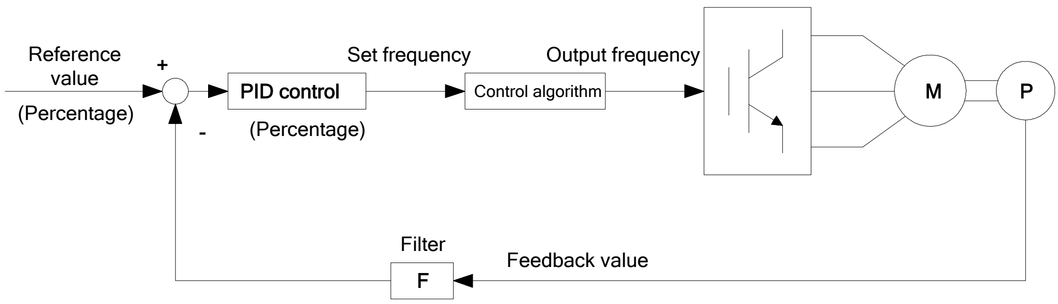
Function code	Name	Description	Setting range	Default
P09.69	Unit temperature at present fault	0.0–6553.5°C	0.0–6553.5	0.0°C
P09.70	System input terminal state at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.71	User input terminal state at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.72	System output terminal state at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.73	User output terminal state 1 at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.74	User output terminal state 2 at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P09.75	Reserved	0–65535	0–65535	0

Same as the descriptions of 2nd-last fault.

P10 group PID control

PID control, a common mode for process control, is mainly used to adjust output frequency of the system by performing scale-division, integral and differential operations on the deviation between feedback signal of controlled variables and signal of the target, thus forming a feedback system to keep the controlled variables above the target. It is applicable to flow control, pressure control, temperature control, and so on. The basic principle diagram of control is as follows.

Figure 6-26 Process PID principle diagram



Function code	Name	Description	Setting range	Default
P10.00	PID reference source	0: Function code (P10.01) 1: AI1 2: AI2 3: AI3 4: AI1+ AI1 5: AI2+ AI3 6: AI3+ AI1 7: Reserved	0–10	0

Function code	Name	Description	Setting range	Default
		8: Multi-step running 9: Modbus 10: PROFIBUS/PROFINET		

When the frequency source selects PID, that is, P00.06=6, the group function is enabled. The function code determines the target reference channel during the PID process. The reference target of process PID is a relative value, for which 100% equals 100% of the feedback signal of the controlled system. The system operates in relative value (0–100%), by default, 100% of PID reference and feedback values correspond to 10V.

Note: After setting the parameters of P11 group, multi-step speed reference can be realized by current step selection via terminals.

Function code	Name	Description	Setting range	Default
P10.01	Local preset PID reference	0.0%–100.0%	0.0–100.0	0.0%

Set P10.00 to 0, namely the target source is set by function code, and the parameter needs to be set. The base value of the function code is the feedback of the system.

Function code	Name	Description	Setting range	Default
P10.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: AI1+ AI2 4: AI2+ AI3 5: AI3+ AI1 6: Reserved 7: Modbus 8: PROFIBUS/PROFINET	0–8	0

It is used to select the PID feedback channel.

Note: The reference channel and feedback channel cannot be duplicate. Otherwise, effective PID control cannot be achieved.

Function code	Name	Description	Setting range	Default
P10.03	PID output characteristics selection	0: PID output is positive. 1: PID output is negative.	0–1	0

0: PID output is positive. When the feedback signal is greater than the PID reference value, the output frequency of the system will decrease to balance the PID.

1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the system will increase to balance the PID.

Function code	Name	Description	Setting range	Default
P10.04	Proportional gain (Kp)	0.00–100.00	0.00–100.00	1.00
P10.05	Integral time (Ti)	0.01–10.00s	0.01–10.00	0. 50s

Function code	Name	Description	Setting range	Default
P10.06	Differential time (Td)	0.00–10.00s	0.00–10.00	0.00s

PID is the most commonly used control method in process control, each part of which plays a different role. The following is a brief description of the working principle and regulation methods.

Proportional control (P): When the feedback is different from the reference, the output will be proportional to the difference. If such a difference is constant, the regulating variable will also be constant. Proportional control can respond to feedback changes rapidly, however, it cannot eliminate the difference by itself. A larger proportional gain indicates a faster regulating speed, but a too large gain will result in oscillation. To solve this problem, set the integral time to a large value and the differential time to 0, run the system only with proportional control, and then change the reference to observe the difference (that is, static difference) between the feedback signal and reference. If the static difference occurs in the direction of reference change (such as reference increase, where the feedback is always less than the reference after system stabilizes), continue increasing the proportional gain; otherwise, decrease the proportional gain. Repeat this process until the static difference becomes small.

Integral time (I): When feedback is different from reference, the output regulating variable accumulates continuously, if the difference persists, the regulating variable will increase continuously until difference disappears. The integral regulator can be used to effectively eliminate static difference. A smaller integral time indicates a stronger effect. However, too strong regulation may lead to repetitive overshoot, which will cause system instability and oscillation. The feature of oscillation caused by strong integral effect is that the feedback signal fluctuates up and down based on the reference variable, and fluctuation range increases gradually until oscillation occurs. The integral time parameter is generally regulated gradually from large to small until the stabilized system speed fulfills the requirement.

Differential time (D): When the difference between feedback and reference changes, there is output of the regulating variable that is proportional to the difference variation rate, and this regulating variable is only related to the direction and magnitude of the difference change rather than the direction and magnitude of the difference itself. Differential control is used to control the feedback signal variation based on the change trend. A larger differential time indicates a stronger effect. Exercise caution before using the differential regulator since it may enlarge the system interferences, especially those with high change frequency.

PID parameter setting:

There are multiple methods of PID parameter setting, among which the steps of the experience try and error method that is most widely used are as follows.

(1) Determine proportional gain P

When determining proportional gain P, remove the integral term and differential term first, i.e. Ti=0 and Td=0, thus turning the system into pure proportional control. Set input to 60%–70% of the maximum value allowed by the system, increase Kp from 0 gradually till system oscillation appears; decrease Kp till the oscillation disappears, record Kp at this time. The set proportional gain is 60%–70% of current proportional gain. Proportional gain setting finishes.

(2) Determine integral time Ti

After above setting, set Td to 0, proportional gain to the value in first step and integral time Ti to a larger value, then decrease Ti till system oscillation appears, increase Ti till the oscillation disappears, and finally record Ti at this time. The set integral coefficient is 150%–180% of current integral coefficient. Integral time setting finishes.

(3) Determine differential coefficient Td

Generally, Td=0, if differential effect is necessary, the setting is the same as Kp and Ti setting, 30% of critical oscillation.

(4) System fine-tuning

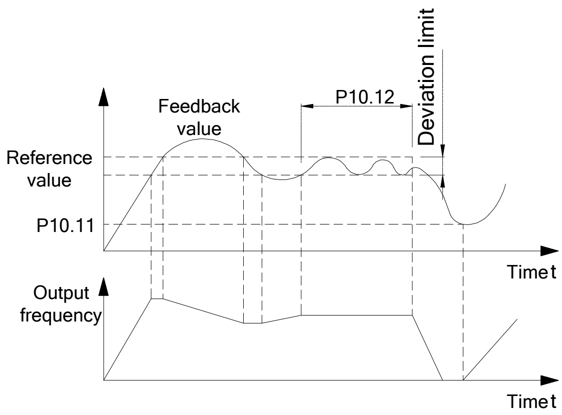
After all settings, the system runs with load. Adjust the values under different conditions to achieve satisfying control effects. As for experienced engineers, they can skip over above three steps and adjust PID factors directly.

Function code	Name	Description	Setting range	Default
P10.07	Sampling cycle (T)	0.01–100.00s	0.01–100.00	0.10s
P10.08	PID control deviation limit	0.0–100.0% (Reference source)	0.0–100.0	0.0%

Sampling cycle (T): Used to indicate the sampling cycle of feedback. The regulator calculates once in each sampling cycle. A longer sampling cycle indicates slower response.

PID control deviation limit: The output of the PID system is relative to the max. deviation of the closed loop reference. As shown in the following figure, the PID regulator stops regulating in the range of deviation limit and restores working out of the deviation limit. Set the function parameter properly to adjust the accuracy and stability of the PID system.

Figure 6-27 Relationship between PID deviation limit and system output frequency



Function code	Name	Description	Setting range	Default
P10.09	Feedback offline detection value	0.0–100.0% (Reference source)	0.0–100.0	0.0%
P10.10	Feedback offline detection time	0.0–3600.0s (Reference source)	0.0–3600.0	1.0s

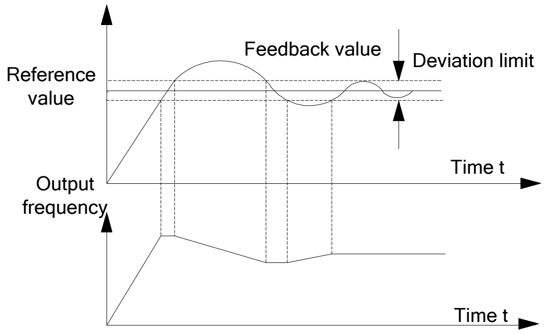
Feedback offline detection value: The set value is relative to full range (100%) of PID feedback value. The system will be detecting PID feedback when PID reference is valid. When the feedback value is less than or equal to feedback offline detection value, the system begins timing for detection. If the detection time exceeds feedback offline detection time, the system will report the PID feedback offline.

Function code	Name	Description	Setting range	Default
P10.11	PID wake-up-from-sleep value	0.0–100.0% (Reference source)	0.0–100.0	0.0
P10.12	PID sleep delay	0.0–360.0s	0.0–360.0	1.0s

PID wake-up-from-sleep value: If the system is in sleep, when PID feedback value is higher than PID sleep value (negative) or PID feedback value is lower than PID sleep value (positive), PID will be waked up. Then system output frequency increases from 0 until PID feedback reaches PID reference again.

PID sleep delay: If the time is not 0, PID sleep will be valid. After PID feedback reaches PID reference and work steadily, the system will keep current output frequency for PID sleep delay, then reduce the output frequency to 0 and enter into the sleep state until PID is waked up again.

Figure 6-28 Diagram for PID sleep and wake-up-from-sleep



As shown above, the positive characteristics of the PID feedback are analyzed as an example. After the system starts running, output frequency increases, so does PID feedback. When the feedback value reaches the reference value within the deviation limit, the system remains current output frequency for PID sleep delay set in P10.12, and the output frequency is reduced to 0. Because of system inertia, PID feedback reduces slowly. When the feedback value reaches the PID wake-up-from-sleep value set in P10.11, the system will be waked up from sleep, and the output frequency increases, so does PID feedback.

P11 group Multi-step speed control

In non-jogging mode, multi-step speed control has the highest priority. If the speed step is not 0, that is to say, the frequency setting or PID setting source is other modes, the system will run at multi-step speed mode.

Note: Only when the frequency setting or PID setting source is multi-step speed mode is step 0 valid.

When PID setting source is multi-step speed, the setting of multi-step speed is the percentage of PID reference rather than frequency.

Function code	Name	Description	Setting range	Default
P11.00	Multi-step speed reference	0: Terminal 1: Analog	0–1	0

Select a multi-step speed setting method.

0: Terminal. Refer to the description of group P05.

1: Analog. Refer to the description of P11.17.

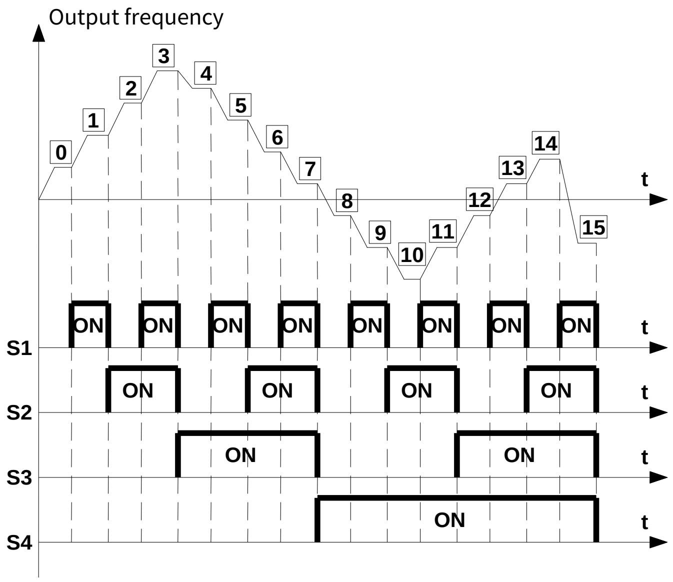
Function code	Name	Description	Setting range	Default
P11.01	Multi-step speed 0	-100.0–100.0%	-100.0–100.0	0.0%
P11.02	Multi-step speed 1	-100.0–100.0%	-100.0–100.0	0.0%
P11.03	Multi-step speed 2	-100.0–100.0%	-100.0–100.0	0.0%
P11.04	Multi-step speed 3	-100.0–100.0%	-100.0–100.0	0.0%
P11.05	Multi-step speed 4	-100.0–100.0%	-100.0–100.0	0.0%
P11.06	Multi-step speed 5	-100.0–100.0%	-100.0–100.0	0.0%
P11.07	Multi-step speed 6	-100.0–100.0%	-100.0–100.0	0.0%
P11.08	Multi-step speed 7	-100.0–100.0%	-100.0–100.0	0.0%

Function code	Name	Description	Setting range	Default
P11.09	Multi-step speed 8	-100.0–100.0%	-100.0–100.0	0.0%
P11.10	Multi-step speed 9	-100.0–100.0%	-100.0–100.0	0.0%
P11.11	Multi-step speed 10	-100.0–100.0%	-100.0–100.0	0.0%
P11.12	Multi-step speed 11	-100.0–100.0%	-100.0–100.0	0.0%
P11.13	Multi-step speed 12	-100.0–100.0%	-100.0–100.0	0.0%
P11.14	Multi-step speed 13	-100.0–100.0%	-100.0–100.0	0.0%
P11.15	Multi-step speed 14	-100.0–100.0%	-100.0–100.0	0.0%
P11.16	Multi-step speed 15	-100.0–100.0%	-100.0–100.0	0.0%

P11.01–P11.16 are used to set the value of each step speed.

If the frequency setting source is multi-step speed, 100.0% corresponds to the maximum frequency P00.10. The sign of multi-step speed determines the running direction. Negative value means reverse running. Multi-step speed can be set continuously in the range of -fmax–fmax. Goodrive5000 medium voltage variable-frequency speed regulation system supports the setting of 16-step speeds.

Figure 6-29 Multi-step speed running logic diagram



As for multi-step speed terminal setting mode, the step speed can be set by the combinations of input terminals.

Set S1–S4 to multi-step speed input terminals. The following table shows the relationship between the terminals and steps. The multi-step speed control process is shown in Figure 6-29.

S1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
S2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
S3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
S4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON
Step	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

As for analog mode (P11.17), select analog input source at first, and set the step speed (P11.18–P11.33) according to the input analog values.

Function code	Name	Description	Setting range	Default
P11.17	Multi-step speed analog input	0: AI1 1: AI2	0–3	0

Function code	Name	Description	Setting range	Default
	source	2: AI3 3: AI4		

When P11.00=1, P11.17 is used to set the multi-step speed analog input source, namely AI1–AI4.

Function code	Name	Description	Setting range	Default
P11.18	Corresponding analog of step 0	-100.0–100.0%	-100.0–100.0	0.0%
P11.19	Corresponding analog of step 1	-100.0–100.0%	-100.0–100.0	0.0%
P11.20	Corresponding analog of step 2	-100.0–100.0%	-100.0–100.0	0.0%
P11.21	Corresponding analog of step 3	-100.0–100.0%	-100.0–100.0	0.0%
P11.22	Corresponding analog of step 4	-100.0–100.0%	-100.0–100.0	0.0%
P11.23	Corresponding analog of step 5	-100.0–100.0%	-100.0–100.0	0.0%
P11.24	Corresponding analog of step 6	-100.0–100.0%	-100.0–100.0	0.0%
P11.25	Corresponding analog of step 7	-100.0–100.0%	-100.0–100.0	0.0%
P11.26	Corresponding analog of step 8	-100.0–100.0%	-100.0–100.0	0.0%
P11.27	Corresponding analog of step 9	-100.0–100.0%	-100.0–100.0	0.0%
P11.28	Corresponding analog of step 10	-100.0–100.0%	-100.0–100.0	0.0%
P11.29	Corresponding analog of step 11	-100.0–100.0%	-100.0–100.0	0.0%
P11.30	Corresponding analog of step 12	-100.0–100.0%	-100.0–100.0	0.0%
P11.31	Corresponding analog of step 13	-100.0–100.0%	-100.0–100.0	0.0%
P11.32	Corresponding analog of step 14	-100.0–100.0%	-100.0–100.0	0.0%
P11.33	Corresponding analog of step 15	-100.0–100.0%	-100.0–100.0	0.0%

P11.18–P11.33 are used to set corresponding steps of analog. Take AIn for example, P11.29<AIn≤P11.30, corresponding multi-step speed 12, corresponding multi-step speed frequency setting is P11.13*P00.10.

During step setting by analog, the step will be 15 if not satisfying the conditions of step 0–14.

P12 group Master/slave control

Function code	Name	Description	Setting range	Default
P12.00	Master-slave mode selection	0: Power-balancing mode 1: Reserved	0–1	0

The power-balancing mode is a load distribution application for applications where two motor axes runs in way of gearboxes, guide rails or shafts coupling. The power balancing application controls the load distribution between the drives. The master controls the operation of the slaves by sending command signals and setting values (speed and torque settings) to the slaves.

Speed synchronization mode is used for multiple drives in synchronous running, where multiple independent cranes are connected to one load. The speed synchronization function requires the system shall have pulse encoder feedback and communication connection.

Function code	Name	Description	Setting range	Default
P12.01	Reference signal sources sent by the master to the slave	0: The master outputs torque signal 1: The master outputs current signal 2: The master outputs PG signal (reserved)	0–2	0

In master-slave control mode, the signals sent by the master to the slave include the command signals, the master running frequency signals (reference signal 1), and the signal source selected by P12.01 (reference signal 2).

0: The master outputs a torque signal, indicating that the master sends the current output torque to the slave.

1: The master outputs a current signal, indicating that the master sends the current output current to the slave.

2: The master outputs a PG signal (this function is reserved).

Function code	Name	Description	Setting range	Default
P12.02	Filter time of slave reference signal	0.00s–655.35s	0.00–655.35	0.00s

P12.02 is used to set the filter time of slave reference signal to eliminate influence caused by interferences.

Function code	Name	Description	Setting range	Default
P12.03	PID adjustment limit	0.0–100.0%	0.0–100.0	100.0%

The integral result limit range limits the PID adjustment result (-P12.03 ⩽ PID output ⩽ P12.03). When the PID output is less than -P12.03, PID output = -P12.03; when the PID output is greater than P12.03, PID output = P12.03. The PID adjustment limit value cannot be 0.

Function code	Name	Description	Setting range	Default
P12.04	PID mode selection	0: Proportion plus integration as synchronous coefficient 1: Proportion plus integration as error correction	0–1	0

PID mode selection: Keep the default value and do not change it.

Function code	Name	Description	Setting range	Default
P12.05	Slave reference frequency source gain	0.01–100.00	0.01–100.00	1.00
P12.06	Slave reference signal source gain	0.01–100.00	0.01–100.00	1.00

In master-slave control, the product of the reference frequency source (reference signal 1) received by the slave and the gain set in P12.05 is used as the internal operational frequency data of the slave. It is more convenient for users to adjust the speed relationship between the master and the slave flexibly.

Similarly, in master-slave control, the product of the reference signal source (reference signal 2) received by the slave and the gain set in P12.06 is used as the internal operational signal data of the slave. It is more convenient for users to adjust the speed relationship between the master and the slave flexibly.

Function code	Name	Description	Setting range	Default
P12.07	Master-slave proportional coefficient P1	0.0000–6.5535	0.0000–6.5535	0.1000
P12.08	Master-slave integral coefficient I1	0.00s–655.35s	0.00–655.35	1.00s
P12.09	Low-point frequency for switching master-slave PI	0.00Hz–P12.12	0.00–P12.12	5.00Hz
P12.10	Master-slave proportional coefficient P2	0.000–6.5535	0.000–6.5535	10.0000
P12.11	Master-slave integral coefficient I2	0.00s–655.35s	0.00s–655.35	6.00s
P12.12	High-point frequency for switching master-slave PI	P12.09–P00.10	P12.09–P00.10	10.00Hz

P12.07–P12.12 are used to set proportional coefficient and integral coefficient of slave PI adjustment. The control diagram of master-slave power-balancing mode is shown as Figure 6-30 and Figure 6-31.

Figure 6-30 Master-slave flexible connection, the slave adopts speed control mode

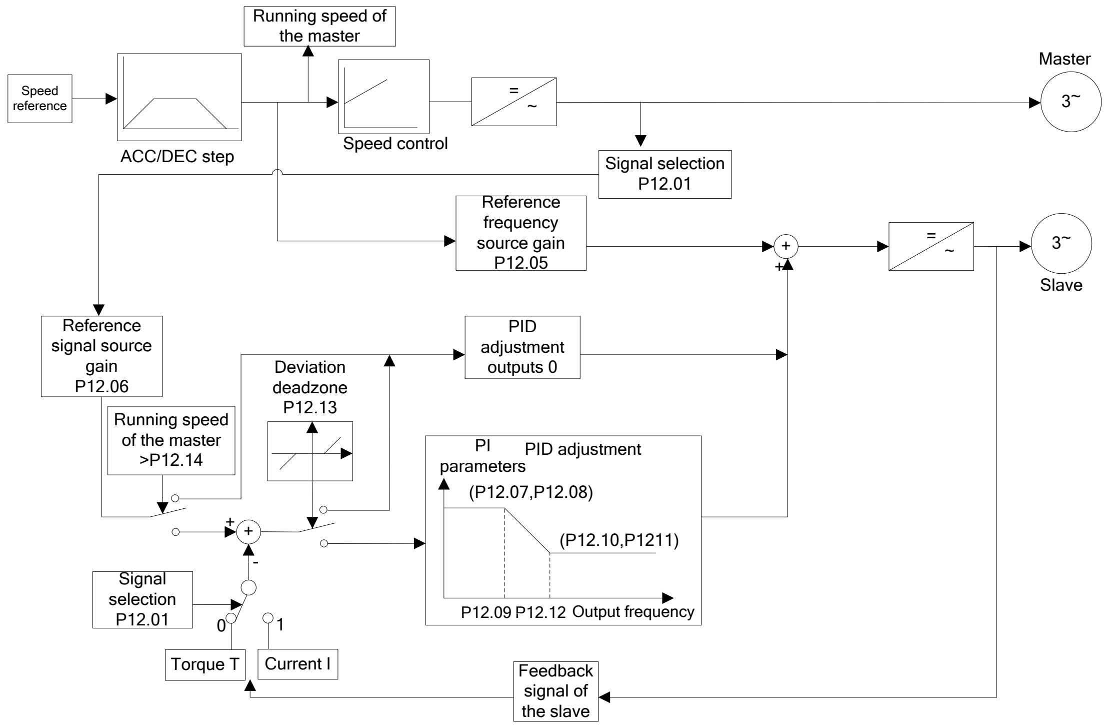
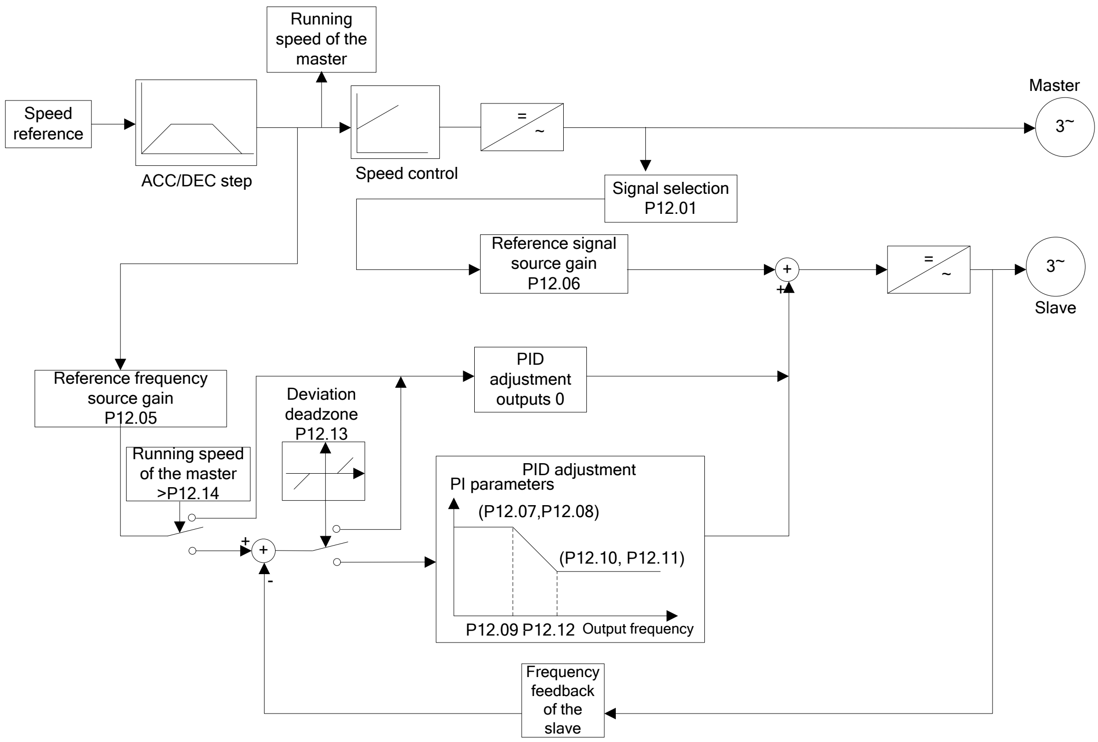


Figure 6-31 Master-slave rigid connection, the slave adopts torque control mode

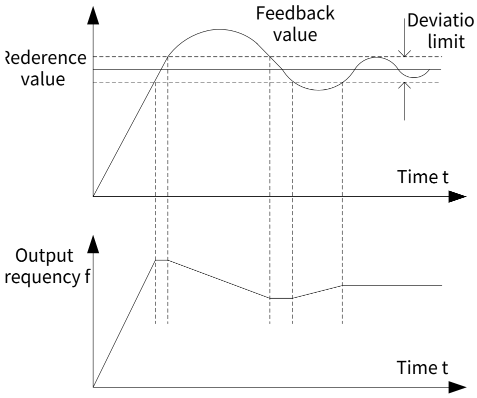


High and low switching frequency of PI and corresponding PI coefficients are in the same switching way as speed loop PI parameters in P3 group. Refer to the description of speed loop parameters in P3 group. Because PID adjustment is only used as the fine-tuning on slave control signals, proportional and integral adjusting effect cannot be too strong. That is to say, set smaller proportional coefficient and larger integral coefficient.

Function code	Name	Description	Setting range	Default
P12.13	PI control deviation limit	0.0–80.0%	0.0–80.0	0.0%

Master-slave PI control deviation limit: The output of the PI system is relative to the max. deviation of the closed loop reference. As shown in Figure 6-32, the PI regulator stops regulating in the range of deviation limit. Set the function parameter properly to adjust the accuracy and stability of the PI system.

Figure 6-32 Relationship between the deviation limit and corresponding output frequency



Function code	Name	Description	Setting range	Default
P12.14	Lower limit of PI integral enabling deviation	0.0–100.0%	0.0–100.0	0.0%
P12.15	Master-slave control differential coefficient	0.00s–655.35s	0.00–655.35	0.00s

P12.14 is defined when slave PI calculation begins running under master-slave control. Only when the running speed of the master exceeds the lower limit of synchronous speed will the slave begin PI calculation. The function code can perform PI adjustment after the slave starts running.

Function code	Name	Description	Setting range	Default
P12.16–P12.23	Reserved	0–65535	0–65535	0
P12.24	Master-slave control ID code	0–15	0–15	0
P12.25	Master-slave character	0–1	0–1	0
P12.26	Master-slave node state 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000
P12.27	Master-slave node state 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000

P12.24–P12.27 are mainly used for inquiry under master-slave control.

P12.24 indicates the code of the local in the master-slave control system. There is a maximum of 16 machines in a master-slave control system, numbered 0–15, among which 0 represents the master and following codes represent the slaves in sequence.

P12.25 is the symbol of substituted master. If any fault occurs to the master during running, a substituted master will be selected from the slaves to control other slaves. At this time, P12.25=1.

P12.26 and P12.27 indicate the states of the master and the slaves in the master-slave control system. Each two bits of the parameter indicates a state for 16 machines at most.

00: Power off

01: Ready

10: Running

11: Fault

Function code	Name	Description	Setting range	Default
P12.28	Bit27: Master/slave optical-fiber communication fault shield	0: Enable 1: Disable	0–1	0

P12.28 is used to select whether to shield master-slave optical fiber communication fault. For one machine, set P12.28 to 0 to shield master-slave optical fiber communication fault.

Function code	Name	Description	Setting range	Default
P12.29	Master-slave type setting	0: Single master 1: Spare machine 2: Master 3: Slave	0–3	0
P12.30	Enabling spare machine KM1 closing	0: Disable 1: Enable	0–1	0
P12.31–P12.32	Reserved	0–65535	0–65535	0

P12.29 is used to set the master-slave type. When P12.29=0, the VFD will run independently; when P12.29=1, multiple for operation and one for spare, the VFD will be the spare machine; when P12.29=2, the VFD will be the master; when P12.29=3 (P00.01=3), the VFD will be the slave.

P12.30 is used in the application of multiple for operation and one for spare. When P12.30=1, by clicking the variable frequency 1 on the touch screen, the contactor KM1 closes; when P12.30=0, cope it with normal mode.

P13 group Protection parameters

Function code	Name	Description	Setting range	Default
P13.00	Protection against output phase loss	0: Disable 1: Enable	0–1	1

The function code is used to select whether the system performs output phase loss protection.

Function code	Name	Description	Setting range	Default
P13.01	Motor overload protection selection	0: No protection 1: Common motor (with low-speed compensation) 2: Frequency-variable motor (without low-speed compensation)	0–2	2

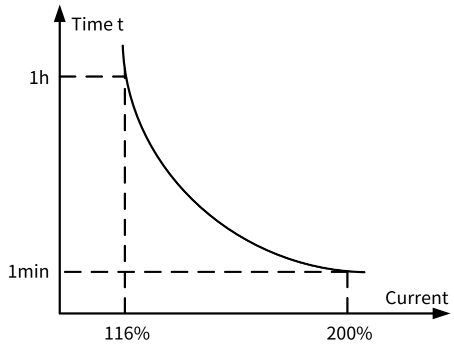
0: No protection. The system has no motor overload protection. Exercise caution when using this function.

1: Common motor (with low-speed compensation). As the cooling effect of a common motor is degraded at low speed running, the corresponding current thermal protection value needs to be adjusted properly, the low compensation indicates lowering the overload protection threshold of the motor whose running frequency is lower than 30Hz.

2: Frequency-variable motor (without low-speed compensation). Because the heat dissipation function for a variable-frequency motor is not impacted by the rotation speed, it is not necessary to adjust the protection value at low speed running.

Function code	Name	Description	Setting range	Default
P13.02	Motor overload protection coefficient	20.0%–120.0% (of the motor rated current)	20.0–120.0	100.0%

Figure 6-33 Motor overload protection coefficient setting



Motor overload multiples M=Iout/(In*K)

"In" is rated motor current, "Iout" is VFD output current, and "K" is motor overload protection coefficient.

A smaller value of "K" indicates a bigger value of "M".

When M=116%, protection is performed after motor overload lasts for 1 hour; when M=200%, protection is performed after motor overload lasts for 60 seconds; and when M≥400%, protection is performed immediately.

Function code	Name	Description	Setting range	Default
P13.03	Frequency decreasing point at sudden power failure	600–900V	600–900	650V
P13.04	Frequency drop rate at transient power-off	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	3.00Hz

When the frequency drop rate at transient power-off is set to 0, the frequency drop at transient power-off is invalid.

Frequency decreasing point at sudden power failure: If the bus voltage drops to the sudden frequency decreasing point due to the power loss of the grid, the variable-frequency speed regulation system begins to decrease the running frequency according to P13.04 to make the motor in the power generation state. The regenerative power can maintain the bus voltage to ensure normal running of the system until the recovery of power.

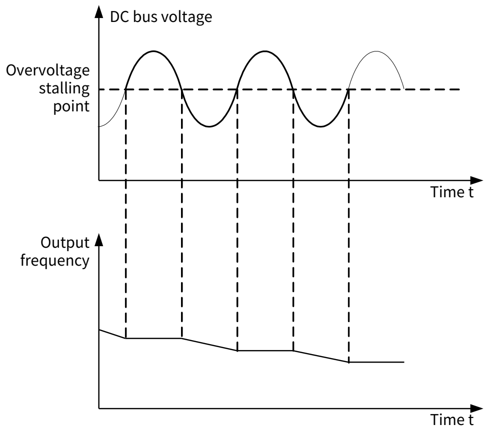
Note: Adjusting these two parameters properly to avoid the stopping caused by the grid voltage drop during heavy load start-up.

Function code	Name	Description	Setting range	Default
P13.05	Overvoltage stalling protection	0: Disable 1: Enable	0–1	1
P13.06	Overvoltage stalling protection voltage	300–1280V	300–1280	1100V

During DEC running of the system, due to load inertia, the actual decreasing ratio of the motor speed is lower than the decreasing ratio of the output frequency. At this time, the motor will feedback the electric energy to the system, which will make the bus voltage increase. If no measures are taken, the system will be report an overvoltage fault caused by the rise in bus voltage.

During the running of the system, overvoltage stall protection will detect the unit bus voltage and compare it with overvoltage stalling point defined in P13.06. If the overvoltage stalling point is exceeded, the output frequency of the system will stop decreasing. If the unit bus voltage is lower than the overvoltage stalling point, the system will continue DEC running. It is shown as Figure 6-34.

Figure 6-34 Overvoltage stalling function diagram

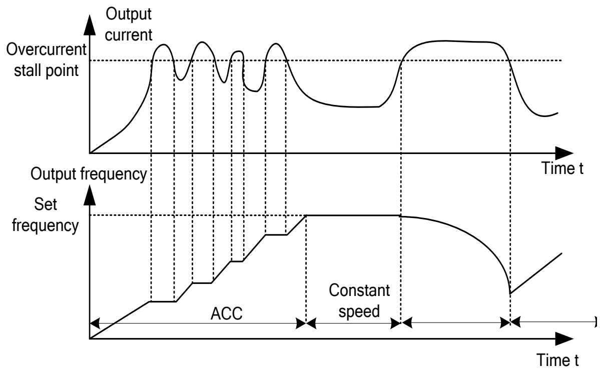


Function code	Name	Description	Setting range	Default
P13.07	Automatic current limit threshold	50–180%	50–180	125%
P13.08	Frequency drop rate during current limit	0.00–10.00Hz (0.00 indicates overcurrent stalling is invalid.)	0.00–10.00	10.00Hz

During accelerated running, as the load is too large, the actual acceleration rate of motor is lower than that of output frequency, if no measures are taken, overcurrent during acceleration may occur.

During the running of the system, this function will detect the output current and compare it with the automatic current limit threshold defined in P13.07 (P13.07 * rated current of the system). If it exceeds the threshold, the system will run at stable frequency during ACC running, while the system will run in decreased frequency during constant running according to the value set in P13.08. If it exceeds the threshold continuously, the output frequency of the system will continue to decrease until 0. When the output current is detected to be lower than the automatic current limit threshold again, it will continue accelerated running, as shown in Figure 6-35.

Figure 6-35 Automatic current limit threshold



Function code	Name	Description	Setting range	Default
P13.09	Input overvoltage prealarm threshold	105–120%	105–120	110%

P13.09 is used to set the prealarm threshold for input voltage detection. When the actual input voltage exceeds the prealarm threshold, the system will report an alarm. The value corresponds to the percentage of rated input voltage.

Function code	Name	Description	Setting range	Default
P13.10	Unit bypass function	0: Manual bypass 1: Common automatic bypass 2: Neutral point drifting automatic bypass	0–2	0
P13.11	Unit manual bypass setting	0x000–0x1FF	0x000–0x1FF	VFD voltage depended

P13.10 is used to set bypasses of the system.

0: Manual bypass. The unit is not automatically bypassed in the event of a unit failure. If users want to bypass a unit, it is necessary to set P13.11 to perform a manual bypass setting. When a unit in one phase is bypassed, the units in the corresponding position in the other two phases are also bypassed.

1: Common automatic bypass. The system does not report a fault in the event of a unit failure and automatically bypasses the faulty unit directly. At this time, P13.11 is invalid. When a unit in one phase is bypassed, the units in the corresponding position in the other two phases are also bypassed.

2: Neutral point drifting automatic bypass. The system does not report a fault in the event of a unit failure and automatically bypasses the faulty unit directly. The difference with function 1 lies in: It only bypasses the faulty unit.

Goodrive5000 medium voltage variable-frequency speed regulation system support 12 units in series at most. P13.11 adopts hex, with each bit corresponding to one unit. When corresponding bit is 1, do not bypass the unit; when corresponding bit is 0, bypass the unit.

Number of bypass units:

For 10kV asynchronous motors, a maximum of 2 units can be bypassed, and the minimum number of effective units must not be less than 6. For 6kV asynchronous motors, a maximum of 2 units can be bypassed, with a minimum number of 3 effective units. For 3kV asynchronous motors, a maximum of 2 units can be bypassed, with a minimum of 2 effective units.

For synchronous motors, a maximum of 2 units can be bypassed, and the voltage levels corresponding to the minimum number of effective units are as follows: 10kV: 7 units, 6kV: 4 units, 3kV: 3 units.

Note: The output capacity of the system is reduced after bypassing and derating is required.

Function code	Name	Description	Setting range	Default
P13.12	Hardware overcurrent point	50–185% (of the VFD rated current)	50–185	180%
P13.13	Hardware current-limit point	50–185% (of the VFD rated current)	50–185	180%

P13.12 is used to set the hardware overcurrent point of the system. When output current of the system exceeds the hardware overcurrent point, the system reports the hardware overcurrent fault.

P13.13 is used to set the hardware current limit point. When output current of the system exceeds the hardware current limit point, the system begins hardware current limit.

Function code	Name	Description	Setting range	Default
P13.14	Optical-fiber communication alarm triggering value	0–50	0–50	5

P13.14: 10s is one detection cycle.

The optical-fiber communication alarm will be reset if the number of fiber communication abnormalities detected in one cycle is less than (2xP13.14). ;

If the number of communication abnormalities exceeds the triggering value (P13.14-2xP13.14) within one cycle, the alarm value will be cumulative plus one, and the optical-fiber communication alarm will be triggered when the cumulative value exceeds the value set in P13.14.

Fault reset can clear accumulated values and optical-fiber communication alarms.

Function code	Name	Description	Setting range	Default
P13.15	Enable VFD overload integral	0–1 0: Disable 1: Enable	0–1	0
P13.16	Overload integral value	0–65535 Accumulated overload integral value	0–65535	0

P13.15: When this parameter is set to 0, the overload timing value is reset after the VFD is stopped. In this case, the determination of VFD overload takes more time, and therefore the effective protection over the VFD is weakened. When this parameter is set to 1, the overload timing value is not reset, and the overload timing value is accumulative. In this case, the determination of VFD overload takes less time, and therefore the protection over the VFD can be performed more quickly.

P13.16: Overload integral value.

Function code	Name	Description	Setting range	Default
P13.17	Underload prealarm detection value	0.0–200.0%	0.0–200.0	0.0%
P13.18	Underload prealarm detection time	0.0–3600.0s	0.0–3600.0	1.0s

Function code	Name	Description	Setting range	Default
P13.19	Speed deviation detection value	0.0–50.0%	0.0–50.0	10.0%
P13.20	Speed deviation detection time	0.0–10.0s	0.0–10.0s	1.0s
P13.21–P13.23	Reserved	0–65535	0–65535	0

P13.17: The underload prealarm detection value is the threshold to determine whether to enter the underload state.

P13.18: The underload fault is triggered after keeping the underload state for the detection time.

In the constant speed state, the output current ⩽ (underload percentage (function code adjustable (0.1%)) * motor rated current), continuous state time ⩾ underload setting time (function code setting (0.1s)), report an alarm. No fault is reported in the non-running state, commissioning mode, or non-constant speed state.

P13.19: The speed deviation detection value is the threshold to determine whether to enter the speed deviation state.

P13.20: The speed deviation fault is triggered after keeping the speed deviation state for the detection time.

In the constant speed state, the difference between the reference frequency and the running frequency ⩾ or ⩽ [deviation percentage (function code adjustable) * motor rated frequency], duration ⩾ deviation setting time (function code setting (0.1s)), report an alarm. No fault is reported in the non-running state or commissioning mode.

P14 group SM control parameters

Function code	Name	Description	Setting range	Default
P14.00	SM reference sources	0: D-axis current reference (flux-weakening 0) 1: Max. torque current ratio (flux-weakening 0) 2: Unit power factor (flux-weakening 0) 3: D-axis current reference (flux-weakening 1) 4: Max. torque current ratio (flux-weakening 1) 5: Unit power factor control(flux-weakening 1)	0–5	0
P14.01	SM excitation mode	0: Manual 1: Automatic	0–1	1

When the system controls synchronous motors, P14.00 is used to set the reference source of synchronous motors.

For the vector control of permanent magnet synchronous motors (electrically excited synchronous motor is invalid), GD5000 series medium voltage VFD provides three current control algorithms.

1. D-axis current reference: Control according to Id=0. For surface-mounted permanent magnet synchronous motors, the electromagnetic torque generated by the VFD output current is maximum at this time, and for inserted permanent magnet synchronous motors, the reluctance torque of the motor

is not fully utilized at this time.

2. Max. torque-current ratio: For inserted permanent magnet synchronous motors, the reluctance torque of the motor can be fully utilized at this time, and the torque generated by the output current is optimal.
3. Unit power factor: At this time, the output efficiency is high, the copper loss of the motor rotor is low, but the torque is not optimal. When the SMs work above the rated frequency, the flux-weakening control algorithm is required to prevent the current regulator from saturation due to the limitation of the max. voltage output capacity of the VFD, and GD5000 provides two flux-weakening control algorithms.

- Flux-weakening 0: Using voltage regulator control method, which does not depend on motor parameters, with easy parameter adjustment but poor dynamic response.
- Flux-weakening 1: Using motor model calculation method, this method depends on motor parameters. When the motor parameters are accurate , dynamic response is fast. The robustness of the system is poor because motors Ld and Lq are easily affected by motor current, temperature and other factors.

Users shall choose the appropriate control method according to the actual working conditions.

P14.01 is used to set the excitation mode of synchronous motors (permanent magnet synchronous motors are invalid)

0: Manual, the system does not adjust exciting current.

1: Automatic, the system automatically adjusts the exciting current according to power factors.

Function code	Name	Description	Setting range	Default
P14.02	Initial value percentage of SM automatic excitation	0.0%–100.0%	0.0–100.0	0.0%
P14.03	Starting frequency of automatic excitation	0.00Hz–50.00Hz	0.00–50.00	0.00Hz

When P14.01 is set to 1, P14.02 is used to set the initial value of SM automatic excitation, which is relative to the percentage of rated exciting current. When the output frequency of the system reaches the frequency set in P14.03, automatic excitation starts running.

Function code	Name	Description	Setting range	Default
P14.04	Output power factor setting of SM	0.0%–200.0%	0.0–200.0	0.0%

P14.03 is used to set the output power factor of the SM. 0.0%–100.0% indicates that the load characteristic of the motor is inductive. 0.0% corresponds to power factor 0 and 100.0% corresponds to power factor 1. 100.0%–200.0% indicates that the load characteristic of the motor is capacitive. 200.0% corresponds to power factor 0 and 100.0% corresponds to power factor 1.

Function code	Name	Description	Setting range	Default
P14.05	Corresponding voltage of SM exciting analog 0%	0.00V–P14.06	0.00–P14.06	0.00V
P14.06	Corresponding voltage of SM	P14.05–10.00V	P14.05–10.00	10.00V

Function code	Name	Description	Setting range	Default
	excitation analog 100%			

P14.04 and P14.05 correspond to the max. and mini. values of the SM excitation analog voltage respectively. 100% corresponds to the max. value of the excitation analog adjustment and 0% corresponds to the mini. value of the excitation analog adjustment.

Function code	Name	Description	Setting range	Default
P14.07	Low-frequency oscillation control factor of SM	0–100	0–100	10
P14.08	High-frequency oscillation control factor of SM	0–100	0–100	0
P14.09	Oscillation control frequency threshold of SM	0.00–120.00Hz	0.00–120.00	15.00Hz
P14.10	Oscillation control frequency switch of SM	0.00–120.00Hz	0.00–120.00	0.00Hz

P14.06–P14.09 are mainly used for V/F control of SMs with alternating loads, such as air compressors. When the output frequency of the system reaches the set frequency of P14.09, the SM oscillation control function is valid. At this time, if the frequency is higher than P14.08, P14.07 is used, and if the frequency is lower than P14.08, P14.06 is used.

Function code	Name	Description	Setting range	Default
P14.11	Power-frequency exciting current reference	0.0%–100.0%	0.0–100.0	0.0%

P14.11 is used to set the control signal of the excitation current output by the VFD during manual excitation or power frequency bypass running.

Function code	Name	Description	Setting range	Default
P14.12	Flux-weakening protection coefficient of SM	0–3000	0–3000	1000
P14.13	Identification current of SM	0.0%–100.0%	0.0–100.0	20.0%
P14.14	SM autotuning command	0: Low-frequency autotuning 1: High-frequency autotuning	0–1	0
P14.15	D-axis pull-in current 1	0.0%–100.0%	0.0–100.0	20.0%
P14.16	D-axis pull-in current 2	0.0%–100.0%	0.0–100.0	10.0%
P14.17	Pull-in current switchover	0.00–P00.10 (two decimal places)	0.00–P00.10	10.00

Function code	Name	Description	Setting range	Default
	frequency point			
P14.18	Reference frequency as zero action	0: Suspend disabled 1: Suspend enabled	0–1	0
P14.19	Pull-in current in hovering state	0.0%–100.0%	0.0–100.0	50.0%
P14.20	Starting time of hovering	0.00–10.00s	0.00–10.00	1.00
P14.21	Exit time of hovering	0.00–10.00s	0.00–10.00	1.00

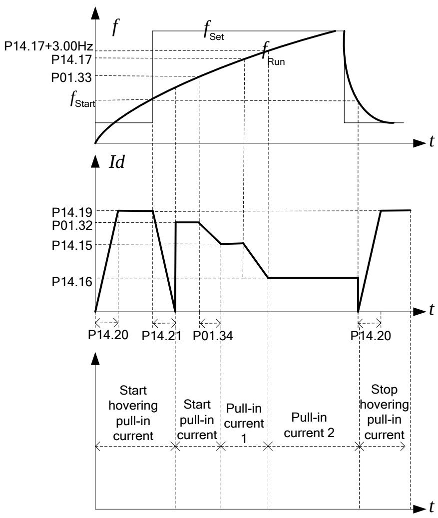
For SMs with PG vector control (no PG vector is invalid), in applications such as up and down belt conveyors or hoists, the VFD is required to use the hover function to ensure that loads such as belt conveyors or hoists do not slide under zero frequency running. A greater value of P14.19 indicates a higher value of the max. hovering torque, but it will increase the copper loss of motor stator resistor. In practice, set a proper value according to the load conditions.

When the hover function is enabled:

When the set frequency < the starting frequency and the running frequency < the starting frequency, enter into the hovering state, at this time, inject pull-in current to SM D-axis. The current increases from 0 to the value set in P14.19 after the time set in P14.20 is reached.

When the set frequency > the starting frequency and the running frequency > the starting frequency, exit the hovering state, at this time, inject the current to SM D-axis. The current is decreased to 0 after the time set in P14.21 is reached.

Figure 6-36 Hover function enabling status description



Function code	Name	Description	Setting range	Default
P14.22	Reactive current closed-loop control enable	0–1	0–1	0
P14.23	Starting frequency of reactive current closed-loop	0.00Hz–P00.10	0.00–P00.10	0.00Hz

Function code	Name	Description	Setting range	Default
P14.24	Proportional coefficient of reactive current regulation	0–1000	0–1000	50
P14.25	Integral coefficient of reactive current regulation	0–1000	0–1000	50

The reactive current closed-loop synchronous motors are valid in V/F control. P14.15, P14.16, and P14.17 are used to set the reactive current reference values.

P15 group Switching cabinet control functions

Function code	Name	Description	Setting range	Default
P15.00	Delay for switching from variable frequency to power frequency	0.0–60.0s	0.0–60.0	2.0s

When the motor switches from variable frequency to power frequency, the switch will act after delay time set by P15.00.

Function code	Name	Description	Setting range	Default
P15.01	Switching cabinet QF configuration mode	0: Independent mode 1: Two-in-One mode	0–1	0

P15.01 is used to set QF configuration modes at power frequency and variable frequency.

0: Power frequency and variable frequency has independent QF.

1: Power frequency and variable frequency share one QF.

Function code	Name	Description	Setting range	Default
P15.02	Switching cabinet command channel	0: Locally controlled 1: Master controlled	0–1	0

P15.02 is used to set the command channel of the slave.

0: The commands are given by the local. That is to say, the switching of power frequency and variable frequency is controlled by the local.

1: The commands are given by the master. That is to say, the switching of power frequency and variable frequency is controlled by the master.

Function code	Name	Description	Setting range	Default
P15.03	Synchronous switching enabling	0: Disable 1: Synchronous switching with reactors 2: Synchronous switching without reactors	0–2	0

The synchronous switching function can achieve bumpless synchronous switching between power frequency and variable frequency. P15.03=1 is used to set whether to perform synchronous switching during switching from the variable-frequency to the power frequency.

0: Disable. The inrush current is large during the switching process.

1: Synchronous switching with reactors

2: Synchronous switching without reactors

Note: When the system reports a synchronous switching fault, it indicates failure of KM4 switching off or incorrect switching off feedback. It is necessary to check whether the contact of KM4 is damaged or feedback is incorrect. After KM4 acts and feedbacks properly, restart the system to continue synchronous switching.

Function code	Name	Description	Setting range	Default
P15.04	QF1 configuration information 1	Set the configuration information of switching cabinets 1–4, QF1 configuration information is set independently by 4 bits, and 0000–0100 are valid. 0000: No common use 0001: Group 1 QF1 in common use 0010: Group 2 QF1 in common use 0011: Group 3 QF1 in common use 0100: Group 4 QF1 in common use	0x0000–0xFFFF	0x0000
P15.05	QF1 configuration information 2	Set the configuration information of switching cabinets 5–8, QF1 configuration information is set independently by 4 bits, and 0000–0100 are valid. 0000: No common use 0001: Group 1 QF1 in common use 0010: Group 2 QF1 in common use 0011: Group 3 QF1 in common use 0100: Group 4 QF1 in common use	0x0000–0xFFFF	0x0000

P15.04 and P15.05 are used for configuration information of the switching cabinets in common use when two or above inputs share one group of QF1. For example, when P15.04=0x0011, the switching cabinets 1 and 2 share the 1st group of QF1. When P15.05=0x3033, the switching cabinet 5, 6 and 8 share the 3rd group of QF1.

Function code	Name	Description	Setting range	Default
P15.06	Synchronous switching reactor voltage drop	0–1000V	0–1000	50V

The function is used to compensate voltage drop of the reactor and the parameter is set according to the reactance and current.

Function code	Name	Description	Setting range	Default
P15.07	KM1 configuration information 1	Set the configuration information of switching cabinets 1–4, QS1/KM1 configuration information is set	0x0000–0xFFFF	0x0000

Function code	Name	Description	Setting range	Default
		independently by 4 bits, and 0000–0100 are valid. 0000: No common use 0001: Group 1 QS1/KM1 in common use 0010: Group 2 QS1/KM1 in common use 0011: Group 3 QS1/KM1 in common use 0100: Group 4 QS1/KM1 in common use		
P15.08	KM1 configuration information 2	Set the configuration information of switching cabinets 5–8, QS1/KM1 configuration information is set independently by 4 bits, and 0000–0100 are valid. 0000: No common use 0001: Group 1 QS1/KM1 in common use 0010: Group 2 QS1/KM1 in common use 0011: Group 3 QS1/KM1 in common use 0100: Group 4 QS1/KM1 in common use	0x0000–0xFFFF	0x0000

P15.07 and P15.08 are used for configuration information of the switching cabinets in common use when two or above inputs share one group of QS1/KM1. For example, when P15.07=0x0011, the switching cabinets 1 and 2 share the 1st group of QS1/KM1. When P15.08=0x3033, the switching cabinet 5, 6 and 8 share the 3rd group of QS1/KM1.

For each switch position of the switching cabinets in P15.04, P15.05, P15.07 and P15.08, refer to Figure 6-5 One-driving-more diagram in P5 group.

Function code	Name	Description	Setting range	Default
P15.09	Motor frequency drop rate of switching cabinet 1	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.10	Motor frequency drop rate of switching cabinet 2	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.11	Motor frequency drop rate of switching cabinet 3	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.12	Motor frequency drop rate of switching cabinet 4	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.13	Action time of switching cabinet 1	0–300ms	0–300	90ms
P15.14	Action time of	0–300ms	0–300	90ms

Function code	Name	Description	Setting range	Default
	switching cabinet 2			
P15.15	Action time of switching cabinet 3	0–300ms	0–300	90ms
P15.16	Action time of switching cabinet 4	0–300ms	0–300	90ms
P15.17	Torque current of switching cabinet 1	0.0–6553.5A	0.0–6553.5	0.0A
P15.18	Torque current of switching cabinet 2	0.0–6553.5A	0.0–6553.5	0.0A
P15.19	Torque current of switching cabinet 3	0.0–6553.5A	0.0–6553.5	0.0A
P15.20	Torque current of switching cabinet 4	0.0–6553.5A	0.0–6553.5	0.0A
P15.21	Synchronous switchover phase lock delay	0–120min	0–120	2min
P15.22	Synchronous switchover angle compensation of switching cabinet 1	-200.0–200.0°	-200.0–200.0	12.0°
P15.23	Synchronous switchover angle compensation of switching cabinet 2	-200.0–200.0°	-200.0–200.0	12.0°
P15.24	Synchronous switchover angle compensation of switching cabinet 3	-200.0–200.0°	-200.0–200.0	12.0°
P15.25	Synchronous switchover angle compensation of switching cabinet 4	-200.0–200.0°	-200.0–200.0	12.0°
P15.26	Synchronous switchover actual deviation angle of switching cabinet 1	0–65535°	0–65535	0°
P15.27	Synchronous switchover actual deviation angle of switching cabinet 2	0–65535°	0–65535	0°
P15.28	Synchronous switchover actual deviation angle of switching cabinet 3	0–65535°	0–65535	0°
P15.29	Synchronous switchover actual deviation angle of	0–65535°	0–65535	0°

Function code	Name	Description	Setting range	Default
	switching cabinet 4			
P15.30	Voltage detection board enabling	0: Disable (Power frequency and variable frequency share the voltage detection board) 1: Enable (The detection boards of power frequency and variable frequency are separate)	0–1	0
P15.31	Reserved	0–65535	0–65535	0
P15.32	Filter coefficient for synchronous switchover	1–20	1–20	4
P15.33	Phase locking stability accuracy for synchronous switchover	1–500	1–500	200
P15.34	Stability holding time for synchronous switchover	0.1–100.0s	0.1–100.0	4.0s
P15.35	Fault power-frequency bypass action selection	0: Manual power-frequency bypass 1: Automatic power-frequency bypass	0–1	0
P15.36	KM1 configuration	0: KM1 is configured 1: KM1 is not configured	0–1	1
P15.37	Switching cabinet type	0: Manual 1: Automatic	0–1	0

P16 group Serial communication

Function code	Name	Description	Setting range	Default
P16.00	Local Modbus address	1–247; 0 indicates a broadcast address	1–247	1

The function code is used to set Modbus communication node address. When slave communication address is set to 0 (broadcast address), the slaves only accept the communication frame without response. In the same Modbus network, the local communication addresses on the communication network are unique and slave address cannot be repeated. It is the basis of the point-to-point communication between the upper computer and the system.

Function code	Name	Description	Setting range	Default
P16.01	Modbus baud rate	0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps	0–5	4

The function code is used to set the baud rate of the system. If the baud rate is different from the primary node, communication will fail. (**Note:** BPS, abbreviation of bit per second, means how many bits in every second.)

Function code	Name	Description	Setting range	Default
P16.02	Modbus data bit check	0: No check (N, 8, 2) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 1) for RTU	0–3	1

The function code is used to set Modbus communication format.

0: Communication mode (RTU), byte length of 8 bits, no parity, stop bit of 2 bits

1: Communication mode (RTU), byte length of 8 bits, even check of 1bit, stop bit of 1 bit

2: Communication mode (RTU), byte length of 8 bits, odd check of 1bit, stop bit of 1 bit

3: Communication mode (RTU), byte length of 8 bits, no parity, stop bit of 1 bit

Function code	Name	Description	Setting range	Default
P16.03	Modbus communication response delay	0–200ms	0–200	5ms

P16.03 is used to set the interval from when the VFD completes receiving data from upper computer to when it sends response data to the upper computer. If the response delay is shorter than the system processing time, the parameter may be subject to system processing time. If the delay is longer than the system processing time, the system needs to delay after data processing and sends data to upper computer after delay time is reached.

Function code	Name	Description	Setting range	Default
P16.04	Modbus communication timeout time	0.0 (invalid); 0.1–100.0s	0.0–100.0	0.0s
P16.05	Remote upgrade enabling	0–1 0: Disable 1: Enable When remote upgrade is enabled, the serial baud rate is automatically configured to 115200, and it can realize the remote upgrade of the main control ARM program with the 4G IoT module.	0–65535	0

When the function code is set to 0.0s, the communication timeout time is invalid.

When the function code is set to a valid value, the system reports the Modbus communication fault if the interval between current and next communication exceeds communication timeout time.

In general, the function code is set to 0.0. When continuous communication is required, you can set the function code to monitor communication status.

P17 group Ethernet communication

Function code	Name	Description	Setting range	Default
P17.00	High-order bit of local IP address	0x0000–0xFFFF (high-oder bit)	0x0000–0xFFFF	0xC0A8
P17.01	Low-order bit of Local IP address	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0x0102
P17.02	High-order bit of local subnet mask	0x0000–0xFFFF (high-oder bit)	0x0000–0xFFFF	0xFFFF
P17.03	Low-order bit of local subnet mask	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0xFF00
P17.04	High-order bit of local gateway	0x0000–0xFFFF (high-oder bit)	0x0000–0xFFFF	0xC0A8
P17.05	Low-order bit of local gateway	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0x0101
P17.06	High-order bit of local MAC	0x0000–0xFFFF (high-oder bit)	0x0000–0xFFFF	0x5254
P17.07	Middle-order bit of local MAC	0x0000–0xFFFF (middle-order bit)	0x0000–0xFFFF	0x4C19
P17.08	Low-order bit of local MAC	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0xF742

P17.00–P17.08 are used to set IP addresses, subnet masks, and MAC addresses for Ethernet communication. The parameters can be modified in setting mode; they will be read-only but unmodifiable in common mode.

IP address format: P17.00–P17.01

Example: IP address is C0.A8.01.02 (hexadecimal), namely 192.168.1.2 (decimal).

IP subnet mask format: P17.02–P17.03

Example: Subnet mask is FF.FF.FF.00 (hexadecimal), namely 255.255.255.0 (decimal).

Gateway format: P17.04.P17.05

Example: Subnet mask is C0.A8.01.01 (hexadecimal), namely 192.168.1.1 (decimal).

MAC address format: P17.06.P17.07. P17.08

Example: Subnet mask is 52.54.4C.19.F7.42 (hexadecimal).

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Setting range</th><th>Default</th></tr>
<tr><td>P17.09</td><td>Log level of DSP command control module</td><td rowspan="4">Bit0: No log
Bit1: Fatal
Bit2: Error
Bit4: Key information
Bit8: Prompt message
Combination of above levels</td><td>0x0–0xF</td><td>0x0</td></tr>
<tr><td>P17.10</td><td>Log level of DSP speed control module</td><td>0x0–0xF</td><td>0x0</td></tr>
<tr><td>P17.11</td><td>Log level of DSP torque calculation module</td><td>0x0–0xF</td><td>0x0</td></tr>
<tr><td>P17.12</td><td>Log level of DSP current loop</td><td>0x0–0xF</td><td>0x0</td></tr>
</table>

Function code	Name	Description	Setting range	Default
P17.13	Log level of DSP oscillograph calculation module		0x0–0xF	0x0
P17.14	Log level of DSP fault management module		0x0–0xF	0x0
P17.15	Log level of DSP parameter inquiry module		0x0–0xF	0x0

The system has the function of log recording. P17.09–P17.15 are used to set the log levels of each function module, which have 4 levels (bit3–bit0) marking the log level of current module. When the log level is 1, the log of current module is recorded.

Function code	Name	Description	Setting range	Default
P17.16	Log level of ARM start/stop control module	Bit0: No log Bit1: Fatal Bit2: Error Bit4: Key information Bit8: Prompt message Combination of above levels	0x0–0xF	0x0
P17.17	Log level of ARM frequency reference module		0x0–0xF	0x0
P17.18	Log level of ARM fault handling module		0x0–0xF	0x0
P17.19	Log level of ARM frequency calculation module		0x0–0xF	0x0
P17.20	Log level of ARM switching cabinet module		0x0–0xF	0x0
P17.21	Log level of ARM function code module		0x0–0xF	0x0
P17.22	Log level of ARM terminal function module		0x0–0xF	0x0
P17.23	Log level of ARM UDP/IP module		0x0–0xF	0x0
P17.24	Log level of ARM Modbus module		0x0–0xF	0x0
P17.25	Log level of ARM PROFIBUS module		0x0–0xF	0x0
P17.26	Log level of ARM master-slave module		0x0–0xF	0x0

Log levels of P17.16–P17.26 ARM are the same as those of P17.09–P17.15 DSP.

Function code	Name	Description	Setting range	Default
P17.27	High-order bit of log receiving IP	0x0000–0XFFFF (high-order bit)	0x0000–0XFFFF	0x0000
P17.28	Low-order bit of log receiving IP	0x0000–0XFFFF (low-order bit)	0x0000–0XFFFF	0x0000

The function codes are used to set the IP address of the host controller that receives logs.

P18 group Communication card functions

Function code	Name	Description	Setting range	Default
P18.00	Module type	0: The module is not connected 1: PROFIBUS 2: PROFINET	0–2	0

P18.00 is used to set the type of fieldbus communication and users cannot adjust the parameter.

0: It indicates that the fieldbus communication card is not connected.

1: PROFIBUS card

2: PROFINET card

Function code	Name	Description	Setting range	Default
P18.01	Module address	0–99	0–99	2

In PROFIBUS, each device corresponds to a unique node address. If the selection switch of the node address (on DP expansion card) is set to 0, the parameter can be used to define the node address.

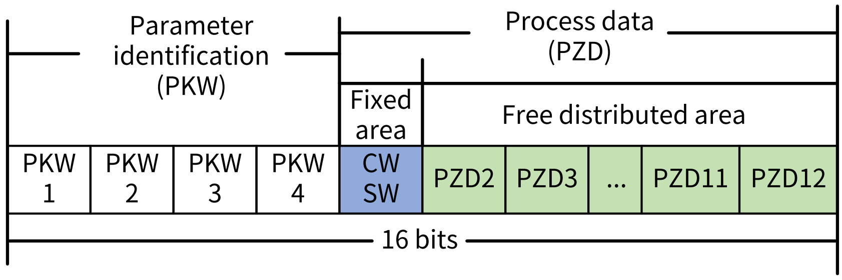
If the selection switch of the node address (on DP expansion card) is used to define the node address when the switch is not at 0, the parameter will be only used to display the node address.

After resetting the node address, it is necessary to restart the system to initialize PROFIBUS communication module.

Function code	Name	Description	Setting range	Default
P18.02	Received PZD2	0: Invalid 1: Frequency reference value 2: Torque reference value 3: Reserved 4: PID control setting value reference 5: PID control feedback value reference 6: V/F separation voltage reference 7: Power frequency and variable frequency control command 8–20: Reserved	0–20	0
P18.03	Received PZD3		0–20	0
P18.04	Received PZD4		0–20	0
P18.05	Received PZD5		0–20	0
P18.06	Received PZD6		0–20	0
P18.07	Received PZD7		0–20	0
P18.08	Received PZD8		0–20	0
P18.09	Received PZD9		0–20	0
P18.10	Received PZD10		0–20	0
P18.11	Received PZD11		0–20	0
P18.12	Received PZD12		0–20	0

The master and the system exchange data quickly by PROFIBUS-DP protocol and the data frame is 16 bits, the structure is as shown in Figure 6-37.

Figure 6-37 Structure of PROFIBUS-DP data frame



P18.02–P18.12 are used to set PZD2–PZD12 receiving data of master communication in PROFIBUS-DP, as described below.

Set value	Function	Description
0	Invalid	No meaning
1	Frequency reference	The master sends speed reference to the inverter. Data type: integer, -10000–+10000, with 2 decimal places, unit: Hz; for example, 5000 is 50.00Hz.
2	Torque reference	The master sends torque reference to the inverter. Data type: percentage, integer, -1000–+1000, with 2 decimal places, unit: %; for example, 500 is 50.00%.
3	Reserved	-
4	PID control setting value reference	Under PID mode, the master can set PID reference. Data type: percentage, integer, -10000–+10000, with 2 decimal places, unit: %; for example, 5000 is 50.00%.
5	PID feedback value reference	Under PID mode, the master can set PID feedback. Data type: percentage, integer, -10000–+10000, with 2 decimal places, unit: %; for example, 5000 is 50.00%.
6	V/F separation voltage reference	When V/F separation function is valid, set voltage reference through the master with one decimal place. For example, 100 indicates 10.0%, with the range of 0%–100.0%.
7	Power frequency and variable frequency control command	Switching cabinet control command
8–20	Reserved	-

P18.02–P18.12 can be modified in any state.

Function code	Name	Description	Setting range	Default
P18.13	Sent PZD2	0: Invalid	0–31	9
P18.14	Sent PZD3	1: Running frequency	0–31	2
P18.15	Sent PZD4	2: Reserved	0–31	11
P18.16	Sent PZD5	3: Input voltage	0–31	6
P18.17	Sent PZD6	4: Output voltage	0–31	1
P18.18	Sent PZD7	5: Input current	0–31	5
P18.19	Sent PZD8	6: Output current	0–31	4
P18.20	Sent PZD9	7: Actual output torque	0–31	0
P18.21	Sent PZD10	8: Output power percentage	0–31	0
P18.22	Sent PZD11	9: Set frequency absolute value	0–31	0
P18.23	Sent PZD12	10: Present DSP fault 1 11: Present DSP fault 2	0–31	0

Function code	Name	Description	Setting range	Default
		12: Present ARM fault type 1 13: Present ARM fault type 2 14: Present unit fault 1 15: Present unit fault 2 16: Unit number at present fault 17: User input terminal 1 18: User input terminal 2 19: User output terminal 1 20: User output terminal 2 21: System input terminal 22: System output terminal 23: Reserved 24: State of switching cabinet 1 25: State of switching cabinet 2 26: State of switching cabinet 3 27: State of switching cabinet 4 28–31: Reserved		

P18.13–P18.23 are used to set PZD2–PZD12 sending data of master communication in PROFIBUS-DP, as described below.

Set value	Function	Description
0	Invalid	No meaning
1	Running frequency	The VFD sends data (running frequency, actual value, integer, two decimal places, unit: Hz) to the upper master through PZD in DP communication.
2	Reserved	-
3	Input voltage	The VFD sends data (input voltage, actual value, integer, unit: V) to the upper master through PZD in DP communication.
4	Output voltage	The VFD sends data (output voltage, actual value, integer, unit: V) to the upper master through PZD in DP communication.
5	Input current	The VFD sends data (input current, actual value, integer, one decimal place, unit: A) to the upper master through PZD in DP communication.
6	Output current	The VFD sends data (output current, actual value, integer, one decimal place, unit: A) to the upper master through PZD in DP communication.
7	Actual output torque	The VFD sends data (output torque, percentage, integer, one decimal place, unit: %) to the upper master through PZD in DP communication.
8	Output power percentage	The VFD sends data (output power, the percentage relative to motor rated power, integer, one decimal place, unit: %) to the upper master through PZD in DP communication.
9	Set frequency absolute value	The VFD sends data (set frequency, actual value, integer, two decimal places, unit: Hz) to the upper master through PZD in DP communication.
10	Present DSP fault 1	Same as the description of P09.12.
11	Present DSP fault 2	Same as the description of P09.13.

Set value	Function	Description
12	Present ARM fault type 1	Same as the description of P09.14.
13	Present ARM fault type 2	Same as the description of P09.15.
14	Present unit fault 1	Same as the description of P09.16.
15	Present unit fault 2	Same as the description of P09.17.
16	Unit number at present fault	Same as the description of P09.18.
17	User terminal input state 1	User input terminal state 1
18	User terminal input state 2	User input terminal state 2
19	User terminal output state 1	User output terminal state 1
20	User terminal output state 2	User output terminal state 2
21	System terminal input state 1	System terminal input state 1
22	System terminal output state 2	System terminal output state 2
23	Reserved	-
24	State of switching cabinet 1	State of switching cabinet 1
25	State of switching cabinet 2	State of switching cabinet 2
26	State of switching cabinet 3	State of switching cabinet 3
27	State of switching cabinet 4	State of switching cabinet 4
28–31	Reserved	-

P18.13–P18.23 can be modified in any state.

Function code	Name	Description	Setting range	Default
P18.24	Temporary variable for PZD sending	0–65535	0–65535	0

The function code is used as a temporary variable for PZD sending.

P18.24 can be modified in any state.

Function code	Name	Description	Setting range	Default
P18.25	DP communication timeout time	0.0 (invalid); 0.1–100.0s	0.0–100.0	0.0s

When P18.25 is set to 0.0s, PROFIBUS-DP communication timeout is invalid. When P18.25 is set to a non-zero value (actual value, unit: second) and the interval between the present and next communication exceeds the communication timeout time, the system will report DP communication fault (PCF).

P18.25 can be modified in any state.

Function code	Name	Description	Setting range	Default
P18.26	PROFINET input length	0–32	0–32	24
P18.27	PROFINET output length	0–32	0–32	24
P18.28	PROFINET communication speed	0–65535	0–65535	0
P18.29	PROFINET IP address 1	0–65535	0–65535	192
P18.30	PROFINET IP address 2	0–65535	0–65535	168
P18.31	PROFINET IP address 3	0–65535	0–65535	0
P18.32	PROFINET IP address 4	0–65535	0–65535	4
P18.33	PROFINET subnet mask 1	0–65535	0–65535	255
P18.34	PROFINET subnet mask 2	0–65535	0–65535	255
P18.35	PROFINET subnet mask 3	0–65535	0–65535	255
P18.36	PROFINET subnet mask 4	0–65535	0–65535	0
P18.37	PROFINET gateway 1	0–65535	0–65535	192
P18.38	PROFINET gateway 2	0–65535	0–65535	168
P18.39	PROFINET gateway 3	0–65535	0–65535	0
P18.40	PROFINET gateway 4	0–65535	0–65535	2
P18.41	Reserved	0–65535	0–65535	0
P18.42	Reserved	0–65535	0–65535	0

P19 group Motor parameter 2

Function code	Name	Description	Setting range	Default
P19.00	Type of motor 2	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0

Function code	Name	Description	Setting range	Default
P19.01	Rated power of AM 2	4–50000kW	4–50000	Model depended
P19.02	Rated frequency of AM 2	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.03	Rated speed of AM 2	1–36000rpm	1–36000	Model depended
P19.04	Rated voltage of AM 2	0–20000V	0–20000	Model depended
P19.05	Rated current of AM 2	0.1–1000.0A	0.1–1000.0	Model depended
P19.06	Stator resistance of AM 2	0.001–65.535Ω	0.001–65.535	Model depended
P19.07	Rotor resistance of AM 2	0.001–65.535Ω	0.001–65.535	Model depended
P19.08	Stator and rotor inductance of AM 2	0.1–6553.5mH	0.1–6553.5	Model depended
P19.09	Stator and rotor mutual inductance of AM 2	0.1–6553.5mH	0.1–6553.5	Model depended
P19.10	No-load current of AM 2	0.01–655.35A	0.01–655.35	Model depended
P19.11	Rated power of SM 2	4–50000kW	4–50000	Model depended
P19.12	Rated frequency of SM 2	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.13	Rated speed of SM 2	0–36000rpm	0–36000	1500rpm
P19.14	Number of pole pairs of SM 2	1–50	1–50	2
P19.15	Rated voltage of SM 2	0–20000V	0–20000	Model depended
P19.16	Rated current of SM 2	0.1–1000.0A	0.1–1000.0	Model depended
P19.17	Stator resistance of SM 2	0.001–65.535Ω	0.001–65.535	Model depended
P19.18	Direct-axis inductance of SM 2	0.1–6553.5mH	0.1–6553.5	Model depended
P19.19	Quadrature-axis inductance of SM 2	0.1–6553.5mH	0.1–6553.5	Model depended
P19.20	Counter-emf constant of SM 2	0–20000	0–20000	9700

For the parameter setting of motor 2, see the parameter descriptions of P02 group for details.

Function code	Name	Description	Setting range	Default
P19.21	Type of motor 3	0: Asynchronous motor (AM) 1: Electrically excited synchronous	0–3	0

Function code	Name	Description	Setting range	Default
		motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor		
P19.22	Rated power of AM 3	4–50000kW	4–50000	Model depended
P19.23	Rated frequency of AM 3	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.24	Rated speed of AM 3	1–36000rpm	1–36000	Model depended
P19.25	Rated voltage of AM 3	0–20000V	0–20000	Model depended
P19.26	Rated current of AM 3	0.1–1000.0A	0.1–1000.0	Model depended
P19.27	Stator resistance of AM 3	0.001–65.535Ω	0.001–65.535	Model depended
P19.28	Rotor resistance of AM 3	0.001–65.535Ω	0.001–65.535	Model depended
P19.29	Stator and rotor inductance of AM 3	0.1–6553.5mH	0.1–6553.5	Model depended
P19.30	Stator and rotor mutual inductance of AM 3	0.1–6553.5mH	0.1–6553.5	Model depended
P19.31	No-load current of AM 3	0.01–655.35A	0.01–655.35	Model depended
P19.32	Rated power of SM 3	4–50000kW	4–50000	Model depended
P19.33	Rated frequency of SM 3	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.34	Rated speed of SM 3	0–36000rpm	0–36000	1500rpm
P19.35	Number of pole pairs of SM 3	1–50	1–50	2
P19.36	Rated voltage of SM 3	0–20000V	0–20000	Model depended
P19.37	Rated current of SM 3	0.1–1000.0A	0.1–1000.0	Model depended
P19.38	Stator resistance of SM 3	0.001–65.535Ω	0.001–65.535	Model depended
P19.39	Direct-axis inductance of SM 3	0.1–6553.5mH	0.1–6553.5	Model depended
P19.40	Quadrature-axis inductance of SM 3	0.1–6553.5mH	0.1–6553.5	Model depended
P19.41	Counter-emf constant of SM 3	0–20000	0–20000	9700

For the parameter setting of motor 3, see the parameter descriptions of P02 group for details.

Function code	Name	Description	Setting range	Default
P19.42	Type of motor 4	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0
P19.43	Rated power of AM 4	4–50000kW	4–50000	Model depended
P19.44	Rated frequency of AM 4	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.45	Rated speed of AM 4	1–36000rpm	1–36000	Model depended
P19.46	Rated voltage of AM 4	0–20000V	0–20000	Model depended
P18.47	Rated current of AM 4	0.1–1000.0A	0.1–1000.0	Model depended
P19.48	Stator resistance of AM 4	0.001–65.535Ω	0.001–65.535	Model depended
P19.49	Rotor resistance of AM 4	0.001–65.535Ω	0.001–65.535	Model depended
P19.50	Stator and rotor inductance of AM 4	0.1–6553.5mH	0.1–6553.5	Model depended
P19.51	Stator and rotor mutual inductance of AM 4	0.1–6553.5mH	0.1–6553.5	Model depended
P19.52	No-load current of AM 4	0.01–655.35A	0.01–655.35	Model depended
P19.53	Rated power of SM 4	4–50000kW	4–50000	Model depended
P19.54	Rated frequency of SM 4	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.55	Rated speed of SM 4	0–36000rpm	0–36000	1500rpm
P19.56	Number of pole pairs of SM 4	1–50	1–50	2
P19.57	Rated voltage of SM 4	0–20000V	0–20000	Model depended
P19.58	Rated current of SM 4	0.1–1000.0A	0.1–1000.0	Model depended
P19.59	Stator resistance of SM 4	0.001–65.535Ω	0.001–65.535	Model depended
P19.60	Direct-axis inductance of SM 4	0.1–6553.5mH	0.1–6553.5	Model depended
P19.61	Quadrature-axis inductance of SM 4	0.1–6553.5mH	0.1–6553.5	Model depended

Function code	Name	Description	Setting range	Default
P19.62	Counter-emf constant of SM 4	0–20000	0–20000	9700

For the parameter setting of motor 4, see the parameter descriptions of P02 group for details.

Function code	Name	Description	Setting range	Default
P19.63	Type of motor 5	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0
P19.64	Rated power of AM 5	4–50000kW	4–50000	Model depended
P19.65	Rated frequency of AM 5	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.66	Rated speed of AM 5	1–36000rpm	1–36000	Model depended
P19.67	Rated voltage of AM 5	0–20000V	0–20000	Model depended
P19.68	Rated current of AM 5	0.1–1000.0A	0.1–1000.0	Model depended
P19.69	Stator resistance of AM 5	0.001–65.535Ω	0.001–65.535	Model depended
P19.70	Rotor resistance of AM 5	0.001–65.535Ω	0.001–65.535	Model depended
P19.71	Stator and rotor inductance of AM 5	0.1–6553.5mH	0.1–6553.5	Model depended
P19.72	Stator and rotor mutual inductance of AM 5	0.1–6553.5mH	0.1–6553.5	Model depended
P19.73	No-load current of AM 5	0.01–655.35A	0.01–655.35	Model depended
P19.74	Rated power of SM 5	4–50000kW	4–50000	Model depended
P19.75	Rated frequency of SM 5	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P19.76	Rated speed of SM 5	0–36000rpm	0–36000	1500rpm
P19.77	Number of pole pairs of SM 5	1–50	1–50	2
P19.78	Rated voltage of SM 5	0–20000V	0–20000	Model depended
P19.79	Rated current of SM 5	0.1–1000.0A	0.1–1000.0	Model depended
P19.80	Stator resistance of SM 5	0.001–65.535Ω	0.001–65.535	Model depended

Function code	Name	Description	Setting range	Default
P19.81	Direct-axis inductance of SM 5	0.1–6553.5mH	0.1–6553.5	Model depended
P19.82	Quadrature-axis inductance of SM 5	0.1–6553.5mH	0.1–6553.5	Model depended
P19.83	Counter-emf constant of SM 5	0–20000	0–20000	9700

For the parameter setting of motor 5, see the parameter descriptions of P02 group for details.

P20 group Motor parameter 3

Function code	Name	Description	Setting range	Default
P20.00	Type of motor 6	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0
P20.01	Rated power of AM 6	4–50000kW	4–50000	Model depended
P20.02	Rated frequency of AM 6	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P20.03	Rated speed of AM 6	1–36000rpm	1–36000	Model depended
P20.04	Rated voltage of AM 6	0–20000V	0–20000	Model depended
P20.05	Rated current of AM 6	0.1–1000.0A	0.1–1000.0	Model depended
P20.06	Stator resistance of AM 6	0.001–65.535Ω	0.001–65.535	Model depended
P20.07	Rotor resistance of AM 6	0.001–65.535Ω	0.001–65.535	Model depended
P20.08	Stator and rotor inductance of AM 6	0.1–6553.5mH	0.1–6553.5	Model depended
P20.09	Stator and rotor mutual inductance of AM 6	0.1–6553.5mH	0.1–6553.5	Model depended
P20.10	No-load current of AM 6	0.01–655.35A	0.01–655.35	Model depended
P20.11	Rated power of SM 6	4–50000kW	4–50000	Model depended
P20.12	Rated frequency of SM 6	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P20.13	Rated speed of SM 6	0–36000rpm	0–36000	1500rpm

Function code	Name	Description	Setting range	Default
P20.14	Number of pole pairs of SM 6	1–50	1–50	2
P20.15	Rated voltage of SM 6	0–20000V	0–20000	Model depended
P20.16	Rated current of SM 6	0.1–1000.0A	0.1–1000.0	Model depended
P20.17	Stator resistance of SM 6	0.001–65.535Ω	0.001–65.535	Model depended
P20.18	Direct-axis inductance of SM 6	0.1–6553.5mH	0.1–6553.5	Model depended
P20.19	Quadrature-axis inductance of SM 6	0.1–6553.5mH	0.1–6553.5	Model depended
P20.20	Counter-emf constant of SM 6	0–20000	0–20000	9700

For the parameter setting of motor 6, see the parameter descriptions of P02 group for details.

Function code	Name	Description	Setting range	Default
P20.21	Type of motor 7	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0
P20.22	Rated power of AM 7	4–50000kW	4–50000	Model depended
P20.23	Rated frequency of AM 7	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P20.24	Rated speed of AM 7	1–36000rpm	1–36000	Model depended
P20.25	Rated voltage of AM 7	0–20000V	0–20000	Model depended
P20.26	Rated current of AM 7	0.1–1000.0A	0.1–1000.0	Model depended
P20.27	Stator resistance of AM 7	0.001–65.535Ω	0.001–65.535	Model depended
P20.28	Rotor resistance of AM 7	0.001–65.535Ω	0.001–65.535	Model depended
P20.29	Stator and rotor inductance of AM 7	0.1–6553.5mH	0.1–6553.5	Model depended
P2030	Stator and rotor mutual inductance of AM 7	0.1–6553.5mH	0.1–6553.5	Model depended
P20.31	No-load current of AM 7	0.01–655.35A	0.01–655.35	Model depended
P20.32	Rated power of SM 7	4–50000kW	4–50000	Model depended

Function code	Name	Description	Setting range	Default
P20.33	Rated frequency of SM 7	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P20.34	Rated speed of SM 7	0–36000rpm	0–36000	1500rpm
P20.35	Number of pole pairs of SM 7	1–50	1–50	2
P20.36	Rated voltage of SM 7	0–20000V	0–20000	Model depended
P20.37	Rated current of SM 7	0.1–1000.0A	0.1–1000.0	Model depended
P20.38	Stator resistance of SM 7	0.001–65.535Ω	0.001–65.535	Model depended
P20.39	Direct-axis inductance of SM 7	0.1–6553.5mH	0.1–6553.5	Model depended
P20.40	Quadrature-axis inductance of SM 7	0.1–6553.5mH	0.1–6553.5	Model depended
P20.41	Counter-emf constant of SM 7	0–20000	0–20000	9700

For the parameter setting of motor 7, see the parameter descriptions of P02 group for details.

Function code	Name	Description	Setting range	Default
P20.42	Type of motor 8	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0
P20.43	Rated power of AM 8	4–50000kW	4–50000	Model depended
P20.44	Rated frequency of AM 8	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P20.45	Rated speed of AM 8	1–36000rpm	1–36000	Model depended
P20.46	Rated voltage of AM 8	0–20000V	0–20000	Model depended
P20.47	Rated current of AM 8	0.1–1000.0A	0.1–1000.0	Model depended
P20.48	Stator resistance of AM 8	0.001–65.535Ω	0.001–65.535	Model depended
P20.49	Rotor resistance of AM 8	0.001–65.535Ω	0.001–65.535	Model depended
P20.50	Stator and rotor inductance of AM 8	0.1–6553.5mH	0.1–6553.5	Model depended
P20.51	Stator and rotor mutual inductance of AM 8	0.1–6553.5mH	0.1–6553.5	Model depended

Function code	Name	Description	Setting range	Default
P20.52	No-load current of AM 8	0.01–655.35A	0.01–655.35	Model depended
P20.53	Rated power of SM 8	4–50000kW	4–50000	Model depended
P20.54	Rated frequency of SM 8	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz
P20.55	Rated speed of SM 8	0–36000rpm	0–36000	1500rpm
P20.56	Number of pole pairs of SM 8	1–50	1–50	2
P20.57	Rated voltage of SM 8	0–20000V	0–20000	Model depended
P20.58	Rated current of SM 8	0.1–1000.0A	0.1–1000.0	Model depended
P20.59	Stator resistance of SM 8	0.001–65.535Ω	0.001–65.535	Model depended
P20.60	Direct-axis inductance of SM 8	0.1–6553.5mH	0.1–6553.5	Model depended
P20.61	Quadrature-axis inductance of SM 8	0.1–6553.5mH	0.1–6553.5	Model depended
P20.62	Counter-emf constant of SM 8	0–20000	0–20000	9700

For the parameter setting of motor 8, see the parameter descriptions of P02 group for details.

When configuring multiple bypass cabinets in one-driving-more control, set the motor parameters corresponding to the motor numbers in P02 and P19.

P21 Encoder state viewing

Function code	Name	Description	Setting range	Default
P21.00	Actual frequency of encoder	-327.68–327.67Hz	-327.68–327.67	0.00Hz
P21.01	High-order bit of PG1 pulse count	0–65535	0–65535	0
P21.02	Low-order bit of PG1 pulse count	0–65535	0–65535	0
P21.03	Resolver counting	0–65535	0–65535	0
P21.04	Resolver angle	0.00–359.99	0.00–359.99	0.00
P21.05	Magnetic pole angle	0.00–359.99	0.00–359.99	0.00
P21.06	High bit of PG2 pulse count	0–65535	0–65535	0
P21.07	Low-order bit of PG2 pulse count	0–65535	0–65535	0
P21.08	QEP pulse counting	0–65535	0–65535	0

Function code	Name	Description	Setting range	Default
P21.09	Magnetic pole position	0–65535	0–65535	0
P21.10	Reserved	0–65535	0–65535	0
P21.11	Reserved	0–65535	0–65535	0
P21.12	Reserved	0–65535	0–65535	0

P22 group Encoders

Function code	Name	Description	Setting range	Default
P22.00	Encoder type	0: Incremental encoder 1: UVW encoder 2: Resolver-type encoder 3: Sin/Cos encoder with CD 4: Sin/Cos encoder without CD	0–4	0
P22.01	Encoder pulse count	0–65535	0–65535	1000
P22.02	Encoder direction	0: Forward input 1: Reverse input	0–1	0
P22.03	Detection time of encoder offline fault	0.0–10.0s	0.0–10.0	1.0s
P22.04	Detection time of encoder reversal fault	0.0–10.0s	0.0–10.0	1.0s
P22.05	Filter times of encoder detection	0–10	0–10	1
P22.06	Speed ratio between motor and encoder	0.000–65.535	0.000–65.535	1.000
P22.07	Control parameters of SM	0x0000–0xFFFF Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Rotary transformer speed detection mode Bit4: Z-pulse capture mode	0x0000–0xFFFF	0x0003
P22.08	Enable Z pulse offline detection	0: Disable 1: Enable	0–1	0
P22.09	Initial angle of Z pulse	0.00–359.99°	0.00–359.99	0.00°
P22.10	Pole initial angle	0.00–359.99°	0.00–359.99	0.00°
P22.11	Vector control frequency deviation value	0.0%–100.0% (of the max. frequency)	0.0–100.0	5.0%

Function code	Name	Description	Setting range	Default
P22.12	Deviation count time	0.0–6553.5s	0.0–6553.5	1.0s
P22.13	Encoder filter time	0.00–10.00s	0.00–10.00s	0.10s
P22.14–P22.17	Reserved	0–65535	0–65535	0

P23 group Temperature controller communication

Function code	Name	Description	Setting range	Default
P23.00	Modbus baud rate setting of temperature controller	0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps	0–5	4
P23.01	Data bit check setting of temperature controller	0: No check (N, 8, 2) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 1) for RTU	0–3	1
P23.02	Modbus communication timeout time of temperature controller	0.0–100.0s	0.0–100.0	10.0s
P23.03	Overtemperature alarm temperature of transformer	0–135°C	0–135	90°C
P23.04	Overtemperature tripping temperature of transformer	0–135°C	0–135	110°C
P23.05	Calibration coefficient of temperature control detection 1	-100.00%–100.00%	-100.00–100.00	0.00
P23.06	Calibration coefficient of temperature control detection 2	-100.00%–100.00%	-100.00–100.00	0.00
P23.07	Calibration coefficient of temperature control detection 3	-100.00%–100.00%	-100.00–100.00	0.00
P23.08	Calibration coefficient of temperature control detection 4	-100.00%–100.00%	-100.00–100.00	0.00

Function code	Name	Description	Setting range	Default
P23.09	Calibration coefficient of temperature control detection 5	-100.00%–100.00%	-100.00–100.00	0.00
P23.10	Calibration coefficient of temperature control detection 6	-100.00%–100.00%	-100.00–100.00	0.00
P23.11	Number of configured temperature controllers	1–4	1–4	1
P23.12	Transmission fault code of temperature controller 1	0–65535	0–65535	0
P23.13	Transmission slave address of temperature controller 1	0–65535	0–65535	0
P23.14	Transmission fault code of temperature controller 2	0–65535	0–65535	0
P23.15	Transmission slave address of temperature controller 2	0–65535	0–65535	0
P23.16	Transmission fault code of temperature controller 3	0–65535	0–65535	0
P23.17	Transmission slave address of temperature controller 3	0–65535	0–65535	0
P23.18	Transmission fault code of temperature controller 4	0–65535	0–65535	0
P23.19	Transmission slave address of temperature controller 4	0–65535	0–65535	0
P23.20	Fan turn-on temperature 1 (transformer)	P23.21–70.0°C When the temperature of the transformer is higher than the value set in P23.20, the fan turns on.	P23.21–75.0	50.0°C

Function code	Name	Description	Setting range	Default
P23.21	Fan turn-off temperature 1	0.0–P23.20 When the temperature of the transformer is lower than the value set in P23.21, the fan turns off.	0.0–P23.20	40.0°C
P23.22	Fan turn-on temperature 2 (unit)	P23.23–70.0°C When the temperature of the unit is higher than the value set in P23.22, the fan turns on.	P23.21–75.0	50.0°C
P23.23	Fan turn-off temperature 2	0.0–P23.22 When the temperature of the unit is lower than the value set in P23.23, the fan turns off.	0.0–P23.22	40.0°C

P24 group Reserved functions

Function code	Name	Description	Setting range	Default
P24.00	Reserved	0–65535	0–65535	0
P24.01	Reserved	0–65535	0–65535	0
P24.02	Reserved	0–65535	0–65535	0
P24.03	Reserved	0–65535	0–65535	0
P24.04	Reserved	0–65535	0–65535	0
P24.05	Reserved	0–65535	0–65535	0
P24.06	Reserved	0–65535	0–65535	0
P24.07	Reserved	0–65535	0–65535	0
P24.08	Reserved	0–65535	0–65535	0
P24.09	Reserved	0–65535	0–65535	0
P24.10	Reserved	0–65535	0–65535	0
P24.11	Reserved	0–65535	0–65535	0
P24.12	Reserved	0–65535	0–65535	0
P24.13	Reserved	0–65535	0–65535	0
P24.14	Reserved	0–65535	0–65535	0
P24.15	Reserved	0–65535	0–65535	0
P24.16	Reserved	0–65535	0–65535	0
P24.17	Reserved	0–65535	0–65535	0
P24.18	Reserved	0–65535	0–65535	0
P24.19	Reserved	0–65535	0–65535	0
P24.20	Reserved	0–65535	0–65535	0
P24.21	Reserved	0–65535	0–65535	0
P24.22	Reserved	0–65535	0–65535	0
P24.23	Reserved	0–65535	0–65535	0
P24.24–P24.52	Reserved	0–65535	0–65535	0

P25 group Transformer protefction

Function code	Name	Description	Setting range	Default
P25.00	Max. input voltage imbalance	0.0–6553.5%	0.0–6553.5	0.0
P25.01	Max. input current imbalance	0.0–6553.5%	0.0–6553.5	0.0
P25.02	Input voltage R	0–65535V	0–65535	0
P25.03	Input voltage S	0–65535V	0–65535	0
P25.04	Input voltage T	0–65535V	0–65535	0
P25.05	Input current R	0.0–6553.5A	0.0–6553.5	0.0
P25.06	Input current S	0.0–6553.5A	0.0–6553.5	0.0
P25.07	Input current T	0.0–6553.5A	0.0–6553.5	0.0
P25.08	Filter value of input voltage R imbalance	0–65535V	0–65535	0
P25.09	Filter value of input voltage S imbalance	0–65535V	0–65535	0
P25.10	Filter value of input voltage T imbalance	0–65535V	0–65535	0
P25.11	Filter value of input current R imbalance	0.0–6553.5A	0.0–6553.5	0.0
P25.12	Filter value of input current S imbalance	0.0–6553.5A	0.0–6553.5	0.0
P25.13	Filter value of input current T imbalance	0.0–6553.5A	0.0–6553.5	0.0
P25.14	Fault word of transformer protection	0–65535	0–65535	0
P25.15–P25.56	Reserved	0–65535	0–65535	0
P25.57	Transformer protection constant 1	0.0–6553.5%	0.0–6553.5	5.0
P25.58	Transformer protection constant 2	0.0–6553.5	0.0–6553.5	0.5
P25.59	Transformer protection constant 3	0.00–655.35	0.00–655.35	1.00
P25.60	Transformer protection constant 4	0.0–6553.5%	0.0–6553.5	25.0
P25.61	Transformer protection	0.0–100.0%	0.0–100.0	30.0

Function code	Name	Description	Setting range	Default
	constant 5			
P25.62	Transformer protection constant 6	0.0–100.0%	0.0–100.0	40.0
P25.63	Transformer protection constant 7	0.0–100.0%	0.0–100.0	40.0
P25.64	Transformer protection constant 8	0.0–50.0A	0.0–50.0	5.0
P25.65	Transformer protection constant 9	0–5000ms	0–5000	2000
P25.66–P25.71	Reserved	0–65535	0–65535	0

P28 group SD card functions

Function code	Name	Description	Setting range	Default
P28.00	Number of files to be reserved	3–10 (The maximum number of files that can be saved for each type of file, such as alarm records, operation records, waveform files saved after fault triggering, etc.)	3–10	5
P28.01	File size	0.1–10.0M	0.1–10.0	1.0M
P28.02	Retention cycle of running records	0.5–30.0min	0.0–30.0	0.5min
P28.03	Year setting	When P28.07 is 0, the real time of ARM is displayed, and P28.03–P28.06 update the time in real time. The RTC time can be modified by modifying P28.07. Operation steps for configuring time: Step 1 Input 2 to P28.07, the time stops updating at this time. Step 2 Change the date and time. Step 3 Input 1 to P28.07, when P28.07 is 0, it indicates that the configuration is complete.	0–9999	Year
P28.04	Month and day setting		1.01–12.31	Mon Day
P28.05	Hour and minute setting		0.0–23.59	Hour Min
P28.06	Seconds setting		0–59	Sec
P28.07	Setting mode enabling		0–2	0
P28.08	Reserved	0–65535	0–65535	0
P28.09	Reserved	0–65535	0–65535	0
P28.10	Fault storage mode	0: Disable 1: Trigger the storage mode 2: Reserved	0–2	1
P28.11	SD card state feedback	SD card state feedback (feedback whether the previous operation is	0–6	0

Function code	Name	Description	Setting range	Default
		successful): 0: System power-on, if no SD card is inserted or SD card is invalid, the value is 0. 1: The initialization of the SD card is successful, waiting for SD card operation. 2: SD card reading failure 3: SD card writing failure 4: File opening failure 5: File creation failure 6: The operation is successful		
P28.12	Save function code configuration files (Number of function code groups, number of function codes and VFD model information)	0: Initial value, no operation 1: Save the function codes, and copy the configuration files to the SD card 2: The execution succeeds 3: The execution fails.	0–3	0
P28.13	Save function codes	0: Save function codes to the file 0 1: Save function codes to the file 1 2: Save function codes to the file 2	0–2	0
P28.14	Restore function codes	0: Restore function codes from the function code parameter file 0 1: Restore function codes from the function code parameter file 1 2: Restore function codes from the function code parameter file 2	0–2	0
P28.15	Save function codes to the SD card	0: Disable 1: Generate parameter files (unreadable) 2: Generate reports (.csv) 3: The execution succeeds 4: The execution fails.	0–4	0
P28.16	Restore function code settings from the SD card	0: Disable 1: Full recovery (including motor parameter groups) 2: Filter recovery (excluding motor parameter groups) 3: The execution succeeds 4: The execution fails.	0–4	0
P28.17	Sampling channel 1	0: No function 1: Running frequency 2: Output voltage 3: Input voltage	0–20	1
P28.18	Sampling channel 2		0–20	2

Function code	Name	Description	Setting range	Default
P28.19	Sampling channel 3	4: Output U-phase current 5: Output V-phase current 6: Output W-phase current 7: Q-axis angle 8: T-axis angle 9: Output current M-axis component 10: Output current T-axis component 11–20: Reserved	0–20	3
P28.20	Sampling channel 4		0–20	4
P28.21	Sampling channel 5		0–20	5
P28.22	Sampling channel 6		0–20	6
P28.23	Sampling channel 7		0–20	7
P28.24	Sampling channel 8		0–20	8
P28.25	Sampling channel 9		0–20	9
P28.26	Sampling channel 10		0–20	10

7 Function introduction and application

This chapter is a brief introduction to the functions of the Goodrive5000 medium voltage variable-frequency speed regulation system, with all the necessary operation steps numbered, which must be followed strictly and accurately.

Danger
● Strictly follow the instructions in chapter 1 Precautions and only trained personnel with the permission of the user unit are allowed to operate the system. ● The system is medium voltage danger equipment, any operator must be familiar with the following precautions before operation, otherwise physical injury or death, or property damage may be caused.

7.1 Frequency setting

The system has two frequency command channels followed by multiple choices for users to set the frequency. Channel A and channel B support simple arithmetical operation between each other and they can switch into each other by setting multi-function input terminals. The final set frequency is calculated by the set values of frequency A and B sources according to P00.09.

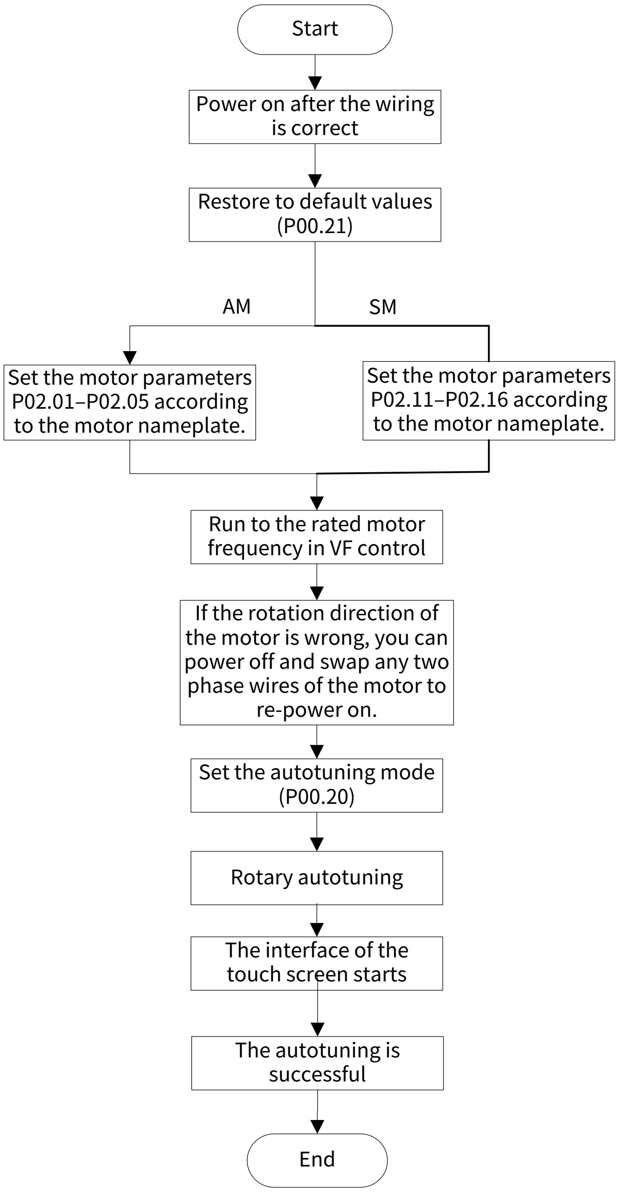
Function code	Name	Description	Setting range
P00.06	Setting channel of frequency A command	0: Function code 1: AI1 2: AI2 3: AI3 4: AI4 5: Multi-step speed running 6: PID control 7: Modbus 8: Fieldbus	0–8
P00.07	Setting channel of frequency B command	0: AI1 1: AI2 2: AI3 3: AI4	0–3
P00.08	Reference object of frequency B command	0: Max. output frequency 1: Frequency A command	0–1
P00.09	Combination mode of setting source	0: A 1: B 2: A+B 3: Max(A, B)	0–3
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3
P02.01	Rated power of AM 1	4–50000kW	4–50000kW

Function code	Name	Description	Setting range
P02.02	Rated frequency of AM 1	0.01Hz–P00.10 (Max. output frequency)	0.01 – P00.10
P02.03	Rated speed of AM 1	1–36000rpm	1–36000
P02.04	Rated voltage of AM 1	0–20000V	0–20000
P02.05	Rated current of AM 1	0.1–1000.0A	0.1–1000.0
P02.06	Stator resistance of AM 1	0.001–65.535Ω	0.001–65.535
P02.07	Rotor resistance of AM 1	0.001–65.535Ω	0.001–65.535
P02.08	Stator and rotor leakage inductance of AM 1	0.1–6553.5mH	0.1–6553.5
P02.09	Stator and rotor mutual inductance of AM 1	0.1–6553.5mH	0.1–6553.5
P02.10	No-load current of AM 1	0.01–655.35A	0.01–655.35
P02.11	Rated power of SM 1	4–50000kW	4–50000kW
P02.12	Rated frequency of SM 1	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10
P02.13	Rated speed of SM 1	0–36000rpm	0–36000
P02.14	Number of pole pairs of SM 1	1–50	1–50
P02.15	Rated voltage of SM 1	0–20000V	0–20000
P02.16	Rated current of SM 1	0.1–1000.0A	0.1–1000.0
P02.17	Stator resistance of SM 1	0.001–65.535Ω	0.001–65.535
P02.18	Direct-axis inductance of SM 1	0.01–655.35mH	0.01–655.35
P02.19	Quadrature-axis inductance of SM 1	0.01–655.35mH	0.01–655.35
P02.20	Counter-emf constant of SM 1	0–20000	0–20000

7.2 Parameter autotuning

After installing the system on site, confirm the wiring, carry out commissioning in operation procedures after power-on according to the operation manual, and select the motor type (P02.00). On basis of motor type selection and nameplate parameters setting (P02.01–P02.05 or P02.11–P02.16), press and hold the jogging forward button on the touch screen, and check the rotating direction of the motor. If the motor rotates in the reverse direction, you can power off and change any two phase wires of the motor to achieve positive rotation. The running direction of the motor can also be changed through setting P00.18 if cables cannot be changed.

Perform motor parameter autotuning (P00.20=1), press the forward running button on the touch screen to start parameter autotuning. The motor will automatically stop after the autotuning is complete.

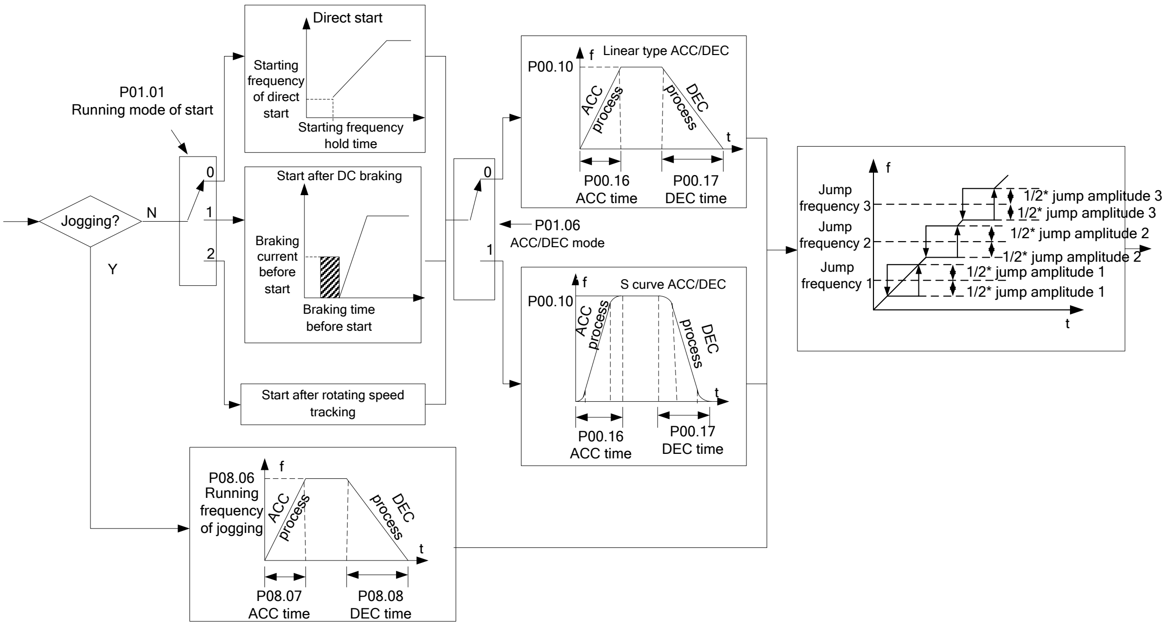


After the autotuning is complete, ensure the motor parameters (P02 group) are correct. Set the control methods and running command channels (P00.00 and P00.01), running frequency, and start/stop mode and ACC/DEC time in P01 group. After that, send the running and stop commands to the system, the system will run according to the set mode and frequency, and stop after receiving the stop command. As a result, the system works normally.

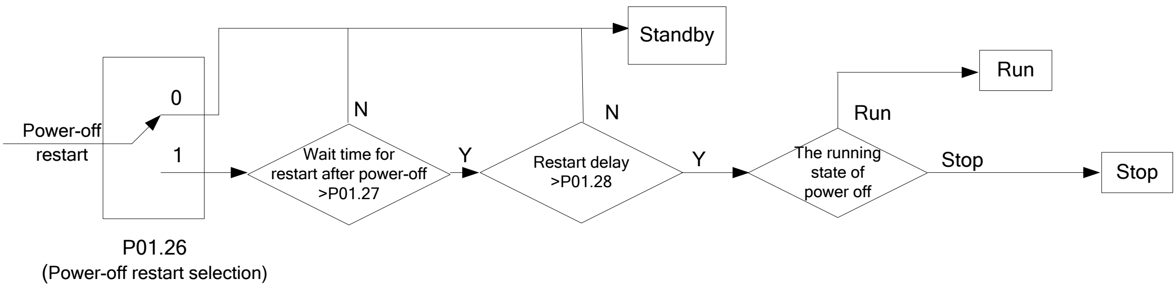
7.3 Start/stop control

The start commands of the system include power-on start, power-off restart and start after fault reset. The start modes include start at the starting frequency, start after DC braking, and start after speed tracking. Users can select a proper start mode based on actual conditions. The stop modes include decelerate to stop and coast to stop. During coasting to stop, it is to block the medium voltage output of the system and the load stops according to its mechanical inertia. During decelerating to stop, the system gradually reduces the output voltage until there is no output, then stop. The DEC time and the parameters related to DC braking during deceleration are settable. Start after speed tracking can be used in cases where the system is started frequently. Direct start is recommended for SMs.

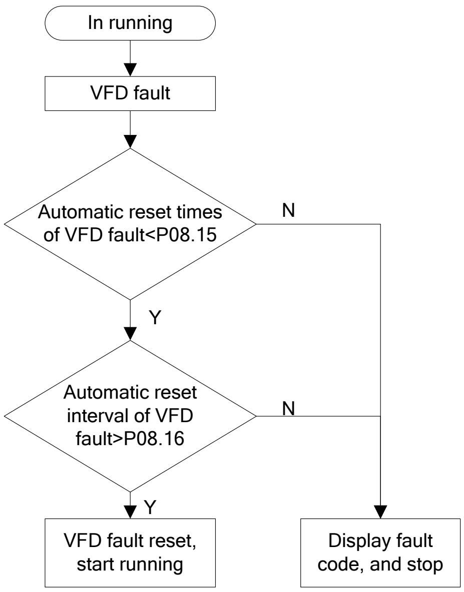
1. Logic diagram for start after a running command is given at power-on



2. Logic diagram for start after power-off restart is effective



3. Logic diagram for start after automatic fault reset



Function code	Name	Description	Setting range
P01.00	Braking mode	0: DC braking 1: Dual-frequency braking	0–1
P01.01	Start mode	0: Direct start	0–2

Function code	Name	Description	Setting range
		1: Start after DC braking 2: Start after rotating speed tracking	
P01.02	Starting frequency of direct start	0.00–10.00Hz	0.00–10.00
P01.03	Starting frequency hold time	0.0–50.0s	0.0–50.0
P01.04	Braking current before start	0.0–120.0% (of the VFD rated current)	0.0–120.0
P01.05	Braking time before start	0.0–50.0s	0.0–50.0
P01.06	ACC and DEC mode	0: Linear type 1: S curve	0–1
P01.07	S curve starting segment proportion	1.0–40.0% (ACC/DEC time)	1.0–40.0
P01.08	S curve ending segment proportion	1.0–40.0% (ACC/DEC time)	1.0–40.0
P01.09	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1
P01.10	Starting frequency of DC braking at stop	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10
P01.11	Wait time before DC braking at stop	0.0–50.0s	0.0–50.0
P01.26	Power-off restart selection	0: Disable 1: Enable	0–1
P01.27	Sudden power-off time	0.00–50.00s	0.00–50.00
P01.28	Wait time for restart after power-off	0.0–3600.0s (valid when P01.17=1)	0.0–3600.0
P01.29	Medium voltage switch action at stop	0: Cut off medium voltage during stop 1: Not cut off medium voltage during stop	0–1
P08.15	Auto fault reset count	0–3	0–3
P08.16	Auto fault reset interval	0.1–100.0s	0.1–100.0

7.4 V/F control

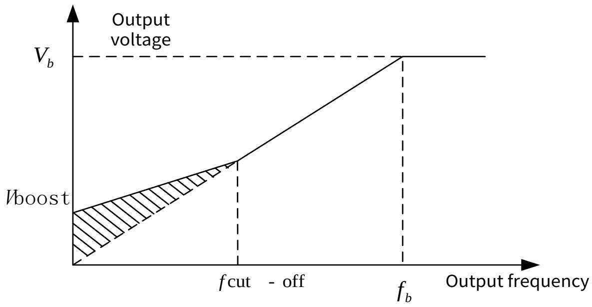
The system has built-in V/F control, which can be applied in most cases of the non-closed loop applications, including one-driving-more applications. V/F control provides multiple V/F curves for users to select the corresponding V/F curve flexibly according to on-site conditions and set multi-point V/F curves by themselves.

For loads featuring constant torque, such as conveyor belts, as the running process requires constant torque, it is recommended to adopt the straight line V/F curve. For loads featuring decreasing torque, such as fans and pumps, as there is a power (square or cube) relation between its actual torque and speed, it is recommended to adopt the V/F curve corresponding to the power of 1.3, 1.7 or 2.0. The system also provides multi-point V/F curves. Users can form a curve with 5 reference points through three customized frequency and voltage points, zero point, and rated frequency and voltage points.

Low frequency torque boost (P04.01) can effectively compensate for the low-speed torque performance in

V/F control. When it is set to 0, the system will automatically adjust the boost value according to loads. However, the boost value shall not be too large; otherwise, the motor may encounter low-frequency oscillation or overcurrent. If such a situation occurs, reduce the torque boost value.

Figure 7-1 Torque boost



Motor oscillation often occurs in V/F control in large-power driving applications. To solve this problem, the system provides two oscillation control factor function codes (P04.18 and P04.19) to adjust. Generally, they are set to default values. Users can adjust the parameters based on oscillation occurrence frequency. Use the low-frequency oscillation control factor when the frequency is below P04.20 and high-frequency oscillation control factor when the frequency is above P04.20. A larger factor value indicates better control effect. However, if the value is too large, output current may be too large. Users cannot set it too large during adjustment.

Customized V/F function, namely V/F separation, indicates there is no corresponding relationship between voltage and frequency, and the voltage and frequency change according to their set values and ACC/DEC time, respectively.

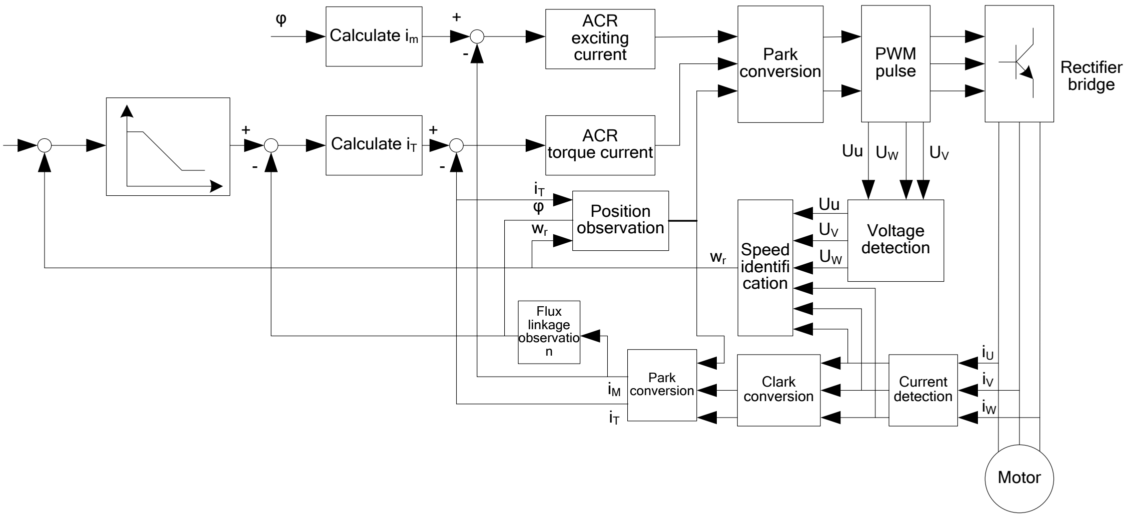
Function code	Name	Description	Setting range
P00.00	Control mode selection	0: Space voltage vector control 1: Asynchronous sensorless vector control 2: Synchronous sensorless vector control 3: Vector control	0–3
P00.16	ACC time 1	0.1–3600.0s	0.1–3600.0
P00.17	DEC time 1	0.1–3600.0s	0.1–3600.0
P00.18	Running direction	0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running	0–2
P00.20	Motor parameter autotuning	0: No operation 1: Parameter autotuning	0–1
P01.01	Start mode	0: Direct start 1: Start after DC braking 2: Start after rotating speed tracking	0–2
P01.02	Starting frequency of direct start	0.00–10.00Hz	0.00–10.00
P01.03	Starting frequency hold time	0.0–50.0s	0.0–50.0
P01.09	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0–1
P02.01	Rated power of AM 1	4–50000kW	4–50000kW

Function code	Name	Description	Setting range
P02.02	Rated frequency of AM 1	0.01Hz–P00.10 (Max. output frequency)	0.01Hz – P00.10
P02.04	Rated voltage of AM 1	0–20000V	0–20000
P02.05	Rated current of AM 1	0.1–1000.0A	0.1–1000.0
P04.01	Torque boost	0.0%–10.0%	0.0–10.0
P08.23	Drop control	0.00–10.00Hz	0.00–10.00
P12.29	Master-slave type setting	0: Single master 1: Spare machine 2: Master 3: Slave	0–3
P04.18	Low-frequency oscillation control factor	0–100	0–100
P04.19	High-frequency oscillation control factor	0–100	0–100
P04.20	Vibration control frequency threshold	0.00–120.00Hz	0.00–120.00

7.5 Vector control

AMs feature high order, nonlinearity, strong coupling and multi-variables, which increase difficulty to precisely control AMs. Vector control is a method for precise control over the motor, by measuring the stator current of the motor, and then decomposes the stator current into exciting current and torque current based on field orientation principle, and therefore controls the amplitude values and phase positions of the two components to realize decoupled control on exciting current and torque current, thus achieving high-performance speed regulation of the motor.

The system uses the sensor-less vector control algorithm, which is based on accurate motor parameters, the accuracy of motor parameters affects vector control performance. It is recommended to enter motor nameplate parameters first and autotune motor parameters before executing vector control.



Function code	Name	Description	Setting range
P00.00	Control mode selection	0: Space voltage vector control 1: Asynchronous sensorless vector control 2: Synchronous sensorless vector control 3: Vector control	0–3
P00.20	Motor parameter autotuning	0: No operation 1: Rotary autotuning 2: Encoder autotuning 3: Motor frequency drop rate autotuning 4: Power frequency and variable frequency switching time autotuning 5: Static autotuning (reserved)	0–5
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3
P02.01	Rated power of AM 1	4–50000kW	4–50000
P02.02	Rated frequency of AM 1	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10
P02.03	Rated speed of AM 1	1–36000rpm	1–36000
P02.04	Rated voltage of AM 1	0–20000V	0–20000
P02.05	Rated current of AM 1	0.1–1000.0A	0.1–1000.0
P03.00	Speed-loop proportional gain 1	0–100	0–100
P03.01	Speed-loop integral time 1	0.01–10.00s	0.01–10.00
P03.02	Low-point frequency for switching	0.00Hz–P03.05	0.00–P03.05
P03.03	Speed-loop proportional gain 2	0–100	0–100
P03.04	Speed-loop integral time 2	0.01–10.00s	0.01–10.00
P03.05	High-point frequency for switching	P03.02–P00.10 (Max. ouput frequency)	P03.02–P00.10
P03.06	Current-loop proportional coefficient P	0–65535	0–65535
P03.07	Current-loop integral coefficient I	0–65535	0–65535
P03.08	Speed loop filter time	0.000–1.000s	0.000–1.000
P03.09	VC slip compensation coefficient	50.0%–200.0%	50.0%–200.0%
P03.10	Encoder pulse count setting	1–65535	1–65535
P03.12	Torque upper limit setting	0.0–200.0% (of the VFD rated current)	0.0–200.0%

Vector control includes speed mode and torque mode. Speed control aims to stabilize the speed. The output torque of the system automatically changes according to different loads, to ensure that the running speed is consistent with the set speed. If the output torque is greater than the torque upper limit, the motor will no longer run at a set speed and its speed will automatically change. The system outputs torque at the set torque command in torque mode, and the output frequency is limited by the frequency upper and lower limits. When the set torque is greater than the load torque, the output frequency will increase to the upper limit and when the set torque is lower than the load torque, the output frequency will decrease to the lower limit. If the output frequency of the system is limited, the output torque is different from the set torque.

During the adjustment of vector control parameters, users need to have a better understanding of vector control algorithm, so parameters of P3 group are generally set to default values. Exercise caution when modifying these parameters.

7.6 PID control

PID control can be used in the closed-loop application of constant pressure water supply, and its flexible PID parameters setting can meet the user requirements in different control scenarios.

Function code	Name	Description	Setting range
P10.00	PID reference source	0: Function code (P10.01) 1: AI1 2: AI2 3: AI3 4: AI1+ AI2 5: AI2+ AI3 6: AI3+ AI1 7: Reserved 8: Multi-step running 9: Modbus 10: PROFIBUS/PROFINET	0–10
P10.01	Local preset PID reference	0.0%–100.0%	0.0–100.0
P10.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: AI1+ AI2 4: AI2+ AI3 5: AI3+ AI1 6: Reserved 7: Modbus 8: PROFIBUS/PROFINET	0–8
P10.03	PID output characteristics selection	0: PID output is positive. 1: PID output is negative.	0–1
P10.04	Proportional gain (Kp)	0.00–100.00	0.00–100.00
P10.05	Integral time (Ti)	0.01–10.00s	0.01–10.00
P10.06	Differential time (Td)	0.00–10.00s	0.00–10.00
P10.07	Sampling cycle (T)	0.01–100.00s	0.01–00.00
P10.08	PID control deviation limit	0.0–100.0% (Reference source)	0.0–100.0

Function code	Name	Description	Setting range
P10.09	Feedback offline detection value	0.0–100.0% (Reference source)	0.0–100.0
P10.10	Feedback offline detection time	0.0–3600.0s (Reference source)	0.0–3600.0
P10.11	PID wake-up-from-sleep value	0.0–100.0% (Reference source)	0.0–100.0
P10.12	PID sleep delay	0.0–360.0s	0.0–360.0

In PID closed-loop application, first set PID reference and PID feedback sources, adjust proportional, integral, differential initial parameters of PID control, and run the system. Adjust PID parameters again according to the commissioning method provided by group P10 to achieve satisfying control effects.

7.7 Analog/Digital input/output

The system features a wide range of terminal control options. In applications, P05.37, P05.38 and P05.39 can be used to set voltage type or current type. Each analog input or output has upper & lower limits and corresponding maximum and minimum parameters which can be modified by users to adjust corresponding curves.

Figure 7-2 AI1 setting relationship

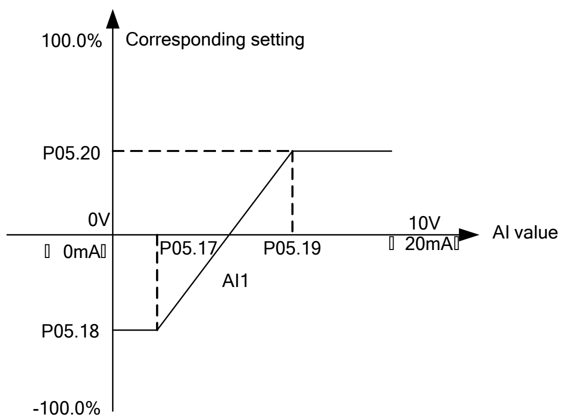
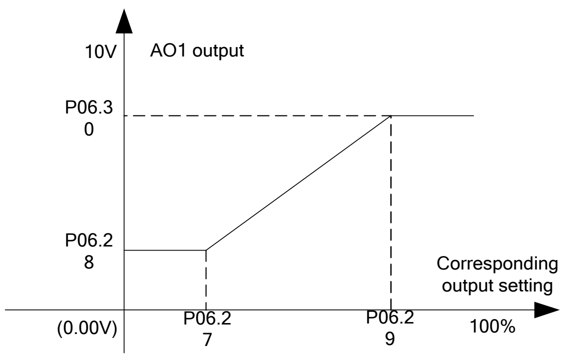


Figure 7-3 AO1 setting relationship



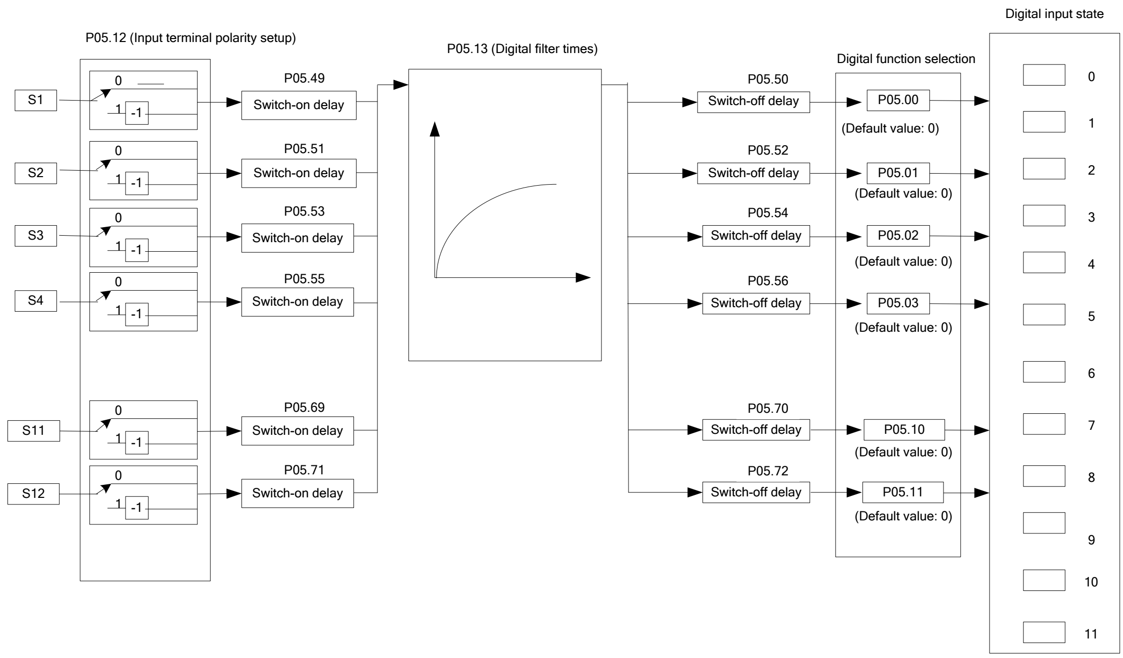
When AI1–AI3 deviates, they can be calibrated by function codes. The calibration method is as follows.

Take the calibration of AI1 as an example, when input 4mA–20mA corresponds to 0–10V, first calibrate AI lower limit, input 4mA, set P05.40=1, and wait for AI1 input value in the instant message to be 0%. Then calibrate AI upper limit, set P05.40=2, input 20mA, wait for AI1 input value in the instant message to be 100%, set P05.40=0, AI1 calibration is completed.

AI4 can only be calibrated to zero by P05.43.

Function code	Name	Description	Setting range
P05.17	AI1 lower limit	0.00V–P05.19	0.00V–P05.19
P05.18	Corresponding setting of AI1 lower limit	-100.0%–P05.20	-100.0%–P05.20
P05.19	AI1 upper limit	P05.17–10.00V	P05.17–10.00
P05.20	Corresponding setting of AI1 upper limit	P05.18–100.0%	P05.18–100.0
P05.21	AI1 input filter time	0.00s–10.00s	0.00–10.00
P05.22	AI2 lower limit	0.00V–P05.24	0.00–P05.24
P05.23	Corresponding setting of AI2 lower limit	-100.0%–P05.25	-100.0–P05.25
P05.24	AI2 upper limit	P05.22–10.00V	P05.22–10.00
P05.25	Corresponding setting of AI2 upper limit	P05.23–100.0%	P05.23–100.0
P05.26	AI2 input filter time	0.00s–10.00s	0.00–10.00
P05.27	AI3 lower limit	-10.00V–P05.29	-10.00–P05.29
P05.28	Corresponding setting of AI3 lower limit	-100.0%–P05.30	-100.0–P05.30
P05.29	AI3 upper limit	P05.27–10.00V	P05.27–10.00
P05.30	Corresponding setting of AI3 upper limit	P05.28–100.0%	P05.28–100.0
P05.31	AI3 input filter time	0.00s–10.00s	0.00–10.00
P05.32	AI4 lower limit	-10.00V–P05.34	-10.00–P05.34
P05.33	Corresponding setting of AI4 lower limit	-100.0%–P05.35	-100.0–P05.35
P05.34	AI4 upper limit	P05.32–10.00V	P05.32–10.00
P05.35	Corresponding setting of AI4 upper limit	P05.33–100.0%	-100.0–100.0
P05.36	AI4 input filter time	0.00s–10.00s	0.00–10.00
P05.37	AI1 mode switchover	0: Current 1: Voltage	0–1
P05.38	AI2 mode switchover		0–1
P05.39	AI3 mode switchover		0–1
P05.40	AI1 calibration configuration	0–2 0: Disable 1: Calibrate AI lower limit 2: Calibrate AI upper limit	0–2
P05.41	AI2 calibration configuration		0–2
P05.42	AI3 calibration configuration		0–2
P05.43	AI4 zero calibration coefficient	-10%–10%	-10%–10%

The system provides multiple I/O terminals as standard configuration. All are programmable terminals, thus ensuring the flexibility and expansibility of the system. There are 12 digital input terminals and 10 relay output terminals (can be extended to 12) as standard configuration. There are multiple function selections for user input terminals. When the user configures the function of one input terminal, the corresponding signal can be connected to that terminal.



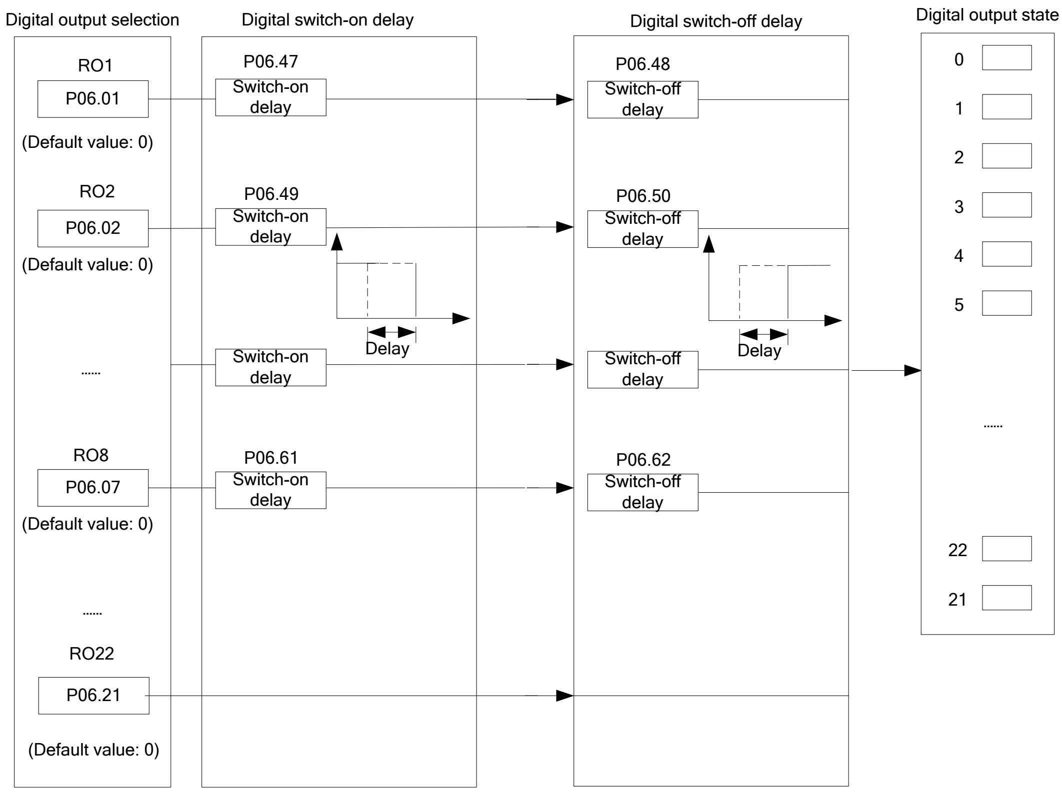
<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Setting range</th></tr>
<tr><td>P05.00</td><td>Function of S1</td><td rowspan="12">0: No function
1: Run forward
2: Run reversely
3: Enable three-wire running
4: Forward jogging
5: Reverse jogging
6: Coast to stop (emergency stop)
7: Fault reset
8: External fault NO input
9: External fault NC input
10: Increase frequency setting (UP)
11: Decrease frequency setting (DOWN)
12: Clear the frequency increase/decrease setting
13: Clear the frequency increase/decrease setting temporarily
14: ACC/DEC time selection 1
15: ACC/DEC time selection 2
16: Multi-step speed terminal 1
17: Multi-step speed terminal 2
18: Multi-step speed terminal 3
19: Multi-step speed terminal 4
20: Pause multi-step speed running
21: Switch between A setting and B setting
22: Switch between (A+B) setting and A setting
23: Switch between (A+B) setting and B setting</td><td>0–71</td></tr>
<tr><td>P05.01</td><td>Function of S2</td><td>0–71</td></tr>
<tr><td>P05.02</td><td>Function of S3</td><td>0–71</td></tr>
<tr><td>P05.03</td><td>Function of S4</td><td>0–71</td></tr>
<tr><td>P05.04</td><td>Function of S5</td><td>0–71</td></tr>
<tr><td>P05.05</td><td>Function of S6</td><td>0–71</td></tr>
<tr><td>P05.06</td><td>Function of S7</td><td>0–71</td></tr>
<tr><td>P05.07</td><td>Function of S8</td><td>0–71</td></tr>
<tr><td>P05.08</td><td>Function of S9</td><td>0–71</td></tr>
<tr><td>P05.09</td><td>Function of S10</td><td>0–71</td></tr>
<tr><td>P05.10</td><td>Function of S11</td><td>0–71</td></tr>
<tr><td>P05.11</td><td>Function of S12</td><td>0–71</td></tr>
</table>

Function code	Name	Description	Setting range
		24: Variable-frequency running (pulse signal↑) 25: Power-frequency running (pulse signal↑) 26: Switching from variable frequency to power frequency (pulse signal ↑) 27: Switching from power frequency to variable frequency (pulse signal ↑) 28: Medium voltage disconnection input 29: Pause PID control 30: UPS feedback 31: Reserved 32: Switching cabinet address 0 33: Switching cabinet address 1 34: Switching cabinet address 2 35: Switch the running command to local 36: Switch the running command to terminal 37: Switch the running command to communication 38: DCS start 39: DCS stop 40: Disable torque control 41: Enable master/slave control 42: Master-slave speed synchronization counting reset terminal 43: Disable ACC/DEC 44: Precharge cabinet vacuum contactor KM2 feedback 45: Commissioning signal input 46: Start on-site operation box 47: Stop on-site operation box 48: Medium voltage switch QF1M1 feedback 49: Medium voltage switch QF1M2 feedback 50: Medium voltage switch QF1M3 feedback 51: Medium voltage switch QF1M4 feedback 52: Medium voltage switch QF1M5 feedback 53: Medium voltage switch QF1M6 feedback 54: Medium voltage switch QF1M7 feedback 55: Medium voltage switch QF1M8	

Function code	Name	Description	Setting range
		feedback 56: Medium voltage switch QF2M1 feedback 57: Medium voltage switch QF2M2 feedback 58: Medium voltage switch QF2M3 feedback 59: Medium voltage switch QF2M4 feedback 60: Medium voltage switch QF2M5 feedback 61: Medium voltage switch QF2M6 feedback 62: Medium voltage switch QF2M7 feedback 63: Medium voltage switch QF2M8 feedback 64: Switching cabinet 1 remote on-site state 65: Switching cabinet 2 remote on-site state 66: Switching cabinet 3 remote on-site state 67: Switching cabinet 4 remote on-site state 68: Switching cabinet 5 remote on-site state 69: Switching cabinet 6 remote on-site state 70: Switching cabinet 7 remote on-site state 71: Switching cabinet 8 remote on-site state	
P05.12	Input terminal polarity setup	0x0000–0xFFFF	0x0000–0xFFFF
P05.13	Digital filter times	1–500	1–500
P05.49	S1 switch-on delay	0.00–50.00s	0.00–50.00
P05.50	S1 switch-off delay	0.00–50.00s	0.00–50.00
P05.51	S2 switch-on delay	0.00–50.00s	0.00–50.00
P05.52	S2 switch-off delay	0.00–50.00s	0.00–50.00
P05.53	S3 switch-on delay	0.00–50.00s	0.00–50.00
P05.54	S3 switch-off delay	0.00–50.00s	0.00–50.00
P05.55	S4 switch-on delay	0.00–50.00s	0.00–50.00
P05.56	S4 switch-off delay	0.00–50.00s	0.00–50.00
P05.57	S5 switch-on delay	0.00–50.00s	0.00–50.00
P05.58	S5 switch-off delay	0.00–50.00s	0.00–50.00
P05.59	S6 switch-on delay	0.00–50.00s	0.00–50.00

Function code	Name	Description	Setting range
P05.60	S6 switch-off delay	0.00–50.00s	0.00–50.00
P05.61	S7 switch-on delay	0.00–50.00s	0.00–50.00
P05.62	S7 switch-off delay	0.00–50.00s	0.00–50.00
P05.63	S8 switch-on delay	0.00–50.00s	0.00–50.00
P05.64	S8 switch-off delay	0.00–50.00s	0.00–50.00
P05.65	S9 switch-on delay	0.00–50.00s	0.00–50.00
P05.66	S9 switch-off delay	0.00–50.00s	0.00–50.00
P05.67	S10 switch-on delay	0.00–50.00s	0.00–50.00
P05.68	S10 switch-off delay	0.00–50.00s	0.00–50.00
P05.69	S11 switch-on delay	0.00–50.00s	0.00–50.00
P05.70	S11 switch-off delay	0.00–50.00s	0.00–50.00
P05.71	S12 switch-on delay	0.00–50.00s	0.00–50.00
P05.72	S12 switch-off delay	0.00–50.00s	0.00–50.00

Similarly, after the user output terminal is configured with one output signal, a low level signal will be output when conditions are met. Only RO1–RO8 have the input and output delay function. You can select and set the corresponding delay for delayed applications.



Function code	Name	Description	Setting range
P06.00	RO1 output	0: No output 1: In VFD running 2: Fault output 3: Frequency level detection FDT output 4: Frequency reached 5: Zero speed running	0–91

Function code	Name	Description	Setting range
		6: Variable-frequency working state 7: Power frequency bypass working state 8: Running time reached 9: Running forward 10: Running reversely 11: Ready for running (running request) 12: Alarm output Variable-frequency: 13: Permission of medium voltage switch QF1M1 switching on 14: Permission of medium voltage switch QF1M2 switching on 15: Permission of medium voltage switch QF1M3 switching on 16: Permission of medium voltage switch QF1M4 switching on 17: Permission of medium voltage switch QF1M5 switching on 18: Permission of medium voltage switch QF1M6 switching on 19: Permission of medium voltage switch QF1M7 switching on 20: Permission of medium voltage switch QF1M8 switching on power frequency Power frequency: 21: Permission of medium voltage switch QF2M1 switching on 22: Permission of medium voltage switch QF2M2 switching on 23: Permission of medium voltage switch QF2M3 switching on 24: Permission of medium voltage switch QF2M4 switching on 25: Permission of medium voltage switch QF2M5 switching on 26: Permission of medium voltage switch QF2M6 switching on 27: Permission of medium voltage switch QF2M7 switching on 28: Permission of medium voltage switch QF2M8 switching on 29: Permission of medium voltage switch QF1M1 switching off 30: Permission of medium voltage switch QF1M2 switching off 31: Permission of medium voltage switch QF1M3 switching off	

Function code	Name	Description	Setting range
		32: Permission of medium voltage switch QF1M4 switching off 33: Permission of medium voltage switch QF1M5 switching off 34: Permission of medium voltage switch QF1M6 switching off 35: Permission of medium voltage switch QF1M7 switching off 36: Permission of medium voltage switch QF1M8 switching off 37: Permission of medium voltage switch QF2M1 switching off 38: Permission of medium voltage switch QF2M2 switching off 39: Permission of medium voltage switch QF2M3 switching off 40: Permission of medium voltage switch QF2M4 switching off 41: Permission of medium voltage switch QF2M5 switching off 42: Permission of medium voltage switch QF2M6 switching off 43: Permission of medium voltage switch QF2M7 switching off 44: Permission of medium voltage switch QF2M8 switching off 45: Variable-frequency working state of switching cabinet 1 46: Power-frequency working state of switching cabinet 1 47: Variable-frequency working state of switching cabinet 2 48: Power-frequency working state of switching cabinet 2 49: Variable-frequency working state of switching cabinet 3 50: Power-frequency working state of switching cabinet 3 51: Variable-frequency working state of switching cabinet 4 52: Power-frequency working state of switching cabinet 4 53: Variable-frequency working state of switching cabinet 5 54: Power-frequency working state of switching cabinet 5 55: Variable-frequency working state of	

Function code	Name	Description	Setting range
		switching cabinet 6 56: Power-frequency working state of switching cabinet 6 57: Variable-frequency working state of switching cabinet 7 58: Power-frequency working state of switching cabinet 7 59: Variable-frequency working state of switching cabinet 8 60: Power-frequency working state of switching cabinet 8 (45–60: Both power frequency and variable frequency valid at the same time indicates fault.) 61: Unit bypass state 62: Remote-local state 63–64: Reserved 65: Low-voltage commissioning vacuum contactor KM1 control 66: Low-voltage commissioning vacuum contactor KM2 control 67: Switching cabinet 1# KM1 feedback signal 68: Switching cabinet 1# KM2 feedback signal 69: Switching cabinet 1# KM3 feedback signal 70: Switching cabinet 2# KM1 feedback signal 71: Switching cabinet 2# KM2 feedback signal 72: Switching cabinet 2# KM3 feedback signal 73: Switching cabinet 3# KM1 feedback signal 74: Switching cabinet 3# KM2 feedback signal 75: Switching cabinet 3# KM3 feedback signal 76: Switching cabinet 4# KM1 feedback signal 77: Switching cabinet 4# KM2 feedback signal 78: Switching cabinet 4# KM3 feedback signal 79: Switching cabinet KM4 feedback signal	

Function code	Name	Description	Setting range
		80: Switching cabinet 1 QS1 feedback signal 81: Switching cabinet 1 QS2 feedback signal 82: Switching cabinet 1 QS3 feedback signal 83: Switching cabinet 2 QS1 feedback signal 84: Switching cabinet 2 QS2 feedback signal 85: Switching cabinet 2 QS3 feedback signal 86: Switching cabinet 3 QS1 feedback signal 87: Switching cabinet 3 QS2 feedback signal 88: Switching cabinet 3 QS3 feedback signal 89: Switching cabinet 4 QS1 feedback signal 90: Switching cabinet 4 QS2 feedback signal 91: Switching cabinet 4 QS3 feedback signal	
P06.47	RO1 switch-on delay	0.00–50.00s	0.00–50.00
P06.48	RO1 switch-off delay	0.00–50.00s	0.00–50.00
P06.49	RO2 switch-on delay	0.00–50.00s	0.00–50.00
P06.50	RO2 switch-off delay	0.00–50.00s	0.00–50.00
P06.51	RO3 switch-on delay	0.00–50.00s	0.00–50.00
P06.52	RO3 switch-off delay	0.00–50.00s	0.00–50.00
P06.53	RO4 switch-on delay	0.00–50.00s	0.00–50.00
P06.54	RO4 switch-off delay	0.00–50.00s	0.00–50.00
P06.55	RO5 switch-on delay	0.00–50.00s	0.00–50.00
P06.56	RO5 switch-off delay	0.00–50.00s	0.00–50.00
P06.57	RO6 switch-on delay	0.00–50.00s	0.00–50.00
P06.58	RO6 switch-off delay	0.00–50.00s	0.00–50.00
P06.59	RO7 switch-on delay	0.00–50.00s	0.00–50.00
P06.60	RO7 switch-off delay	0.00–50.00s	0.00–50.00
P06.61	RO8 switch-on delay	0.00–50.00s	0.00–50.00
P06.62	RO8 switch-off delay	0.00–50.00s	0.00–50.00

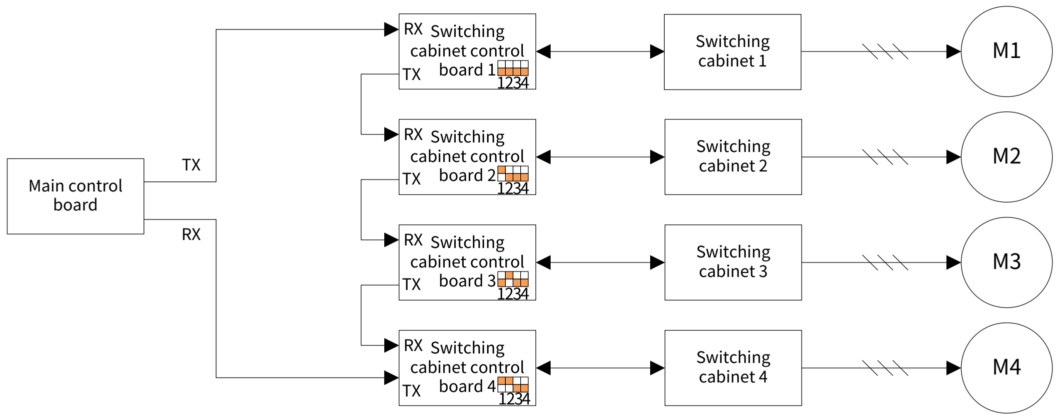
7.8 Bypass switching function

INVT bypass cabinets are divided into manual bypass cabinets, automatic bypass cabinets and one-driving-more bypass cabinet.

7.8.1 Switching cabinet function setting

The system supports one-drive-multiple switching cabinet control. A maximum of 8 control boards can be used to control 8 switching cabinets. The address codes are selected by the DIP switches on the boards. The control scheme configuration of the one-drive-multiple switching cabinet is as follows.

Figure 7-4 Configuration of the one-driving-more switching cabinet



The DIP switch 1, 2 and 3 on the control board can combine into 4 states corresponding to 4 switching cabinet addresses. As shown in the following table, the main control board will send a command to the switching cabinet along with corresponding switching cabinet address, only when the switching cabinet address is the same as the command address, the switching cabinet will act.

DIP switch 1	DIP switch 2	DIP switch 3	Switching cabinet address
OFF	OFF	OFF	Switching cabinet 1
ON	OFF	OFF	Switching cabinet 2
OFF	ON	OFF	Switching cabinet 3
ON	ON	OFF	Switching cabinet 4

DIP switch 4 is the voltage detection function enabling. When the DIP switch is tuned to ON, the voltage detection function of the switching cabinet control board is enabled. When the DIP switch is tuned to OFF, the voltage detection function of the switching cabinet control board is disabled.

The switches and jumpers in the control system shall be set well in factory. It is not recommended to modify; otherwise, damage may occur. If necessary, please read the instructions carefully before proper operating.

Related function codes:

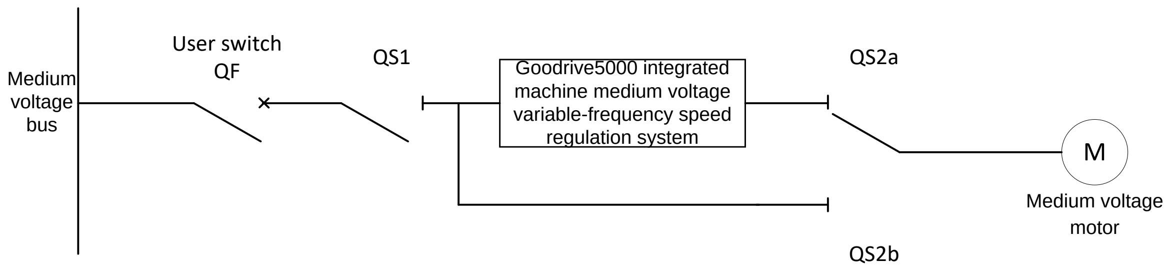
Function code	Name	Description	Setting range
P07.10	Max. number of switching cabinets	0–4	0–4
P15.01	Switching cabinet QF configuration mode	0: Independent mode 1: Two-in-One mode	0–1
P15.35	Fault power-frequency bypass action selection	0: Manual power-frequency bypass 1: Automatic power-frequency bypass	0–1
P15.36	KM1 configuration	0: KM1 is configured 1: KM1 is not configured	0–1
P15.37	Switching cabinet type	0: Manual 1: Automatic	0–1

For different types of switching cabinets, function codes need to be set according to the actual situation, such as the number of bypass cabinets, manual or automatic, whether KM1 is configured or not, etc.

7.8.2 Manual bypass

The following describes the function of configuring only one manual bypass cabinet. When the system stops for a short time according to production process requirements, operators can switch variable frequency to power frequency by using the manual bypass cabinet. Figure 7-5 is main circuit diagram of the manual bypass cabinet. QF refers to the higher level customer breaker of the system, the higher level breaker QF and the system shall be interlocked, that is, QF can only be switched on when the system is in the switch-on allowing state. QF switch-on of the higher level switchgear is invalid in the system fault state, QF is automatically switched off when a fault occurs to the system after switch-on.

Figure 7-5 Main circuit diagram of the manual bypass cabinet



Parameter setting: P07.10=1; P15.36=1; P15.37=0

The procedure of switching between variable frequency and power frequency is as follows.

Note: The switching operations of the knife switches QS1, QS2 are conducted in the switch-off state of QF.

Variable-frequency running

Step 1 Press the unlock key of the electromagnetic lock, and pull the electromagnetic lock rightwards to the unlock position.

Step 2 Pull out the baffle pin, and move it from the position of baffle closing to the position of power frequency and variable frequency switching. At this time, the operation hole of the power frequency and variable frequency switching isolation switch is open, insert the operation handle to rotate clockwise, so that the isolation switch QS2 is the switch-on (variable frequency) position, and pull out the operation handle.

Step 3 Pull out the baffle pin, and move it from the position of power frequency and variable frequency switching to the position of the upper isolation switch-on/switch-off. At this time, the operation hole of the upper isolation switch is open, insert the operation handle to rotate counterclockwise, so that the upper isolation switch QS1 is switched on, and pull out the operation handle.

Step 4 After the conversion is complete, pull out the baffle pin, put it down to the position of baffle closing, pull the electromagnetic lock leftwards, make the electromagnetic lock reset to the locking position, and the system is in the running state.

Step 5 Send a switch-on permission signal, the GD5000 VFD is connected to the medium voltage power supply, the motor is connected to the VFD, and the VFD can be used normally.

Switch from variable frequency to power frequency

Step 1 Press the unlock key of the electromagnetic lock, and pull the electromagnetic lock rightwards to the unlock position.

Step 2 Pull out the baffle pin, and move it from the position of baffle closing to the position of the upper isolation switch-on/switch-off. At this time, the operation hole of the upper isolation switch is open, insert the operation handle to rotate clockwise, so that the upper isolation switch QS1 is switched on, and pull out the operation handle.

Step 3 Pull out the baffle pin, and move it from the position of the upper isolation switch-on/switch-off to the position of power frequency and variable frequency switching. At this time, the operation hole of the power frequency and variable frequency switching isolation switch is open, insert the operation handle to rotate counterclockwise, so that the isolation switch QS2 is the switch-off (power frequency) position, and pull out the operation handle.

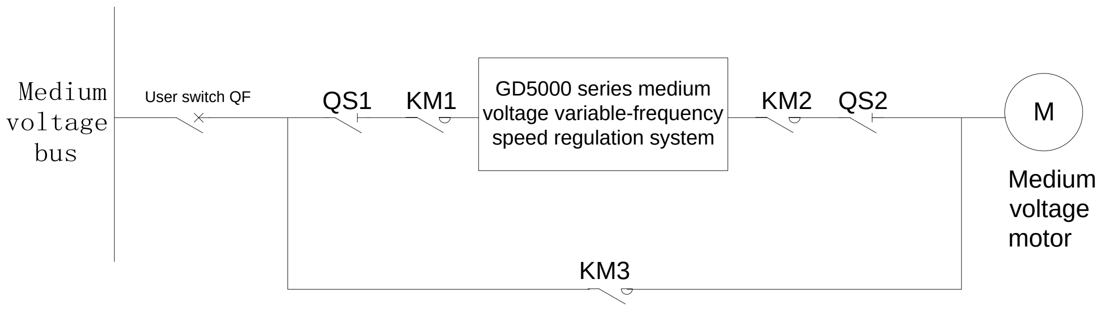
Step 4 After the conversion is complete, pull out the baffle pin, put it down to the position of baffle closing, pull the electromagnetic lock leftwards, make the electromagnetic lock reset to the locking position, and the system is in the running state.

Step 5 After a variable frequency permission signal is sent, QF is allowed to switch on, and the motor is connected to the power frequency power supply.

7.8.3 Automatic bypass

The following describes the function of configuring only one automatic bypass cabinet. When the system is not allowed to stop, the automatic bypass cabinet will switch automatically. The cabinet has three medium voltage vacuum contactors KM1, KM2 and KM3, among which KM2 and KM3 realize electric interlock to ensure the power frequency supply will not be directly sent to the output terminal of the variable-frequency speed regulation system. The automatic bypass cabinet with isolation also has two isolation knife switches QS1 and QS2 to isolate the variable-frequency speed regulation system from medium voltage power supply when the motor runs at power frequency, convenient for maintenance and inspection. The main circuit diagram of automatic bypass cabinet is shown in Figure 7-6.

Figure 7-6 Main circuit diagram of the automatic bypass cabinet



Relevant parameter setting: P07.10=1, P15.36=0, P15.37=1. P15.35 needs to be configured according to whether a power frequency bypass is required after a fault occurs.

Note: The switching operations of the knife switches QS1, QS2 are conducted in the switch-off state of QF.

Power-on operations:

Step 1 Close the cabinet door, and observe whether QS1 and QS2 are in the switch-off state.

Step 2 Press the unlock key of the electromagnetic lock, and pull the electromagnetic lock rightwards to the unlock position.

Step 3 Pull out the baffle pin, and move it from the position of baffle closing to the position of power frequency and variable frequency switching. At this time, the operation hole of the power frequency and variable frequency switching isolation switch is open, insert the operation handle to rotate counterclockwise, so that the isolation switch QS2 is the switch-on position, and pull out the operation handle.

Step 4 Pull out the baffle pin, and move it from the position of power frequency and variable frequency switching to the position of the upper isolation switch-on/switch-off. At this time, the operation hole of the upper isolation switch is open, insert the operation handle to rotate counterclockwise, so that the upper isolation switch QS1 is switched on, and pull out the operation handle.

Step 5 After the conversion is complete, pull out the baffle pin, put it down to the position of baffle closing, pull the electromagnetic lock leftwards, make the electromagnetic lock reset to the locking position.

Step 6 The system sends a command, KM1 and KM2 are switched on (KM3 is switched off).

Step 7 Check whether the feedback signal of the vacuum contactor is consistent with the working state, and the system is in the variable-frequency running state.

Mode for switching from variable frequency to power frequency:

Step 1 Close the cabinet door, and observe whether QS1 and QS2 are switched on.

Step 2 The system sends a command, KM1 and KM2 are switched off, KM3 is switched on, and the system is in the power frequency running state.

Step 3 Check whether the feedback signal of the vacuum contactor is consistent with the working state, and the system is in the power frequency running state.

Maintenance mode:

Step 1 Close the cabinet door, and observe whether QS1 and QS2 are switched on.

Step 2 The system sends a command, KM1, KM2 and KM3 are switched off.

Step 3 Check whether the feedback signal of the vacuum contactor is consistent with the working state,

Step 4 Ensure that the front-end circuit breaker QF is switched off, the vacuum circuit breaker is moved out of the state, and the maintenance sign is hung.

Step 5 Press the unlock key of the electromagnetic lock, and pull the electromagnetic lock rightwards to the unlock position.

Step 6 Pull out the baffle pin, and move it from the position of baffle closing to the position of the upper isolation switch-on/switch-off. At this time, the operation hole of the upper isolation switch is open, insert the operation handle to rotate clockwise, so that the upper isolation switch QS1 is switched on, and pull out the operation handle.

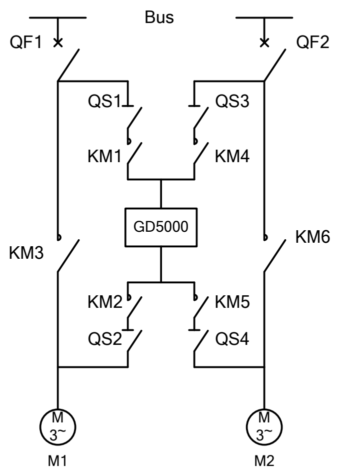
Step 7 Pull out the baffle pin, and move it from the position of the upper isolation switch-on/switch-off to the position of power frequency and variable frequency switching. At this time, the operation hole of the power frequency and variable frequency switching isolation switch is open, insert the operation handle to rotate clockwise, so that the isolation switch QS2 is the switch-off position, and pull out the operation handle.

Step 8 After the conversion is complete, pull out the baffle pin, put it down to the position of baffle closing, pull the electromagnetic lock leftwards, make the electromagnetic lock reset to the locking position, and the system is in the maintenance state.

7.8.4 One-driving-more application

The system supports one-drive-four switching cabinet control, that is to say, 4 switching cabinets are controlled by corresponding 4 control boards. The address codes are selected by the DIP switches on the control boards. The following only introduces the application of 2 switching cabinets, and other switching cabinets are similar to it.

Figure 7-7 One-driving-two diagram



Relevant parameter settings: take automatic bypass cabinets with one-driving-two for example, P07.10=2; P15.01=1; P15.36=0; P15.37=1.

After the parameters are set as above, it will be configured to the automatic bypass cabinet state in independent mode as shown in Figure 7-7. (P15.01 is configured to independent mode when the bus of frequency input and frequency input are independent).

In the application, QS1, QS2, QS3 and QS4 need to be switched on manually when the medium voltage power is not connected.

M1 variable-frequency mode: When the medium voltage switch QF1 is in the switch-off state, a switch-on permission signal is issued, and user QF1 is switched on. When a variable frequency command is issued, KM1 is switched on, and the GD5000 VFD is connected to the medium voltage power supply. After the VFD completes the self-check items without fault, KM2 is switched on, the motor M1 is connected to the VFD, and the VFD can be used normally.

M1 power frequency mode: When users need power frequency running, a switch-on permission signal is issued, and user QF1 is switched on. After a power frequency command is issued, KM3 is switched on, and the motor M1 will be directly connected to the power frequency power supply.

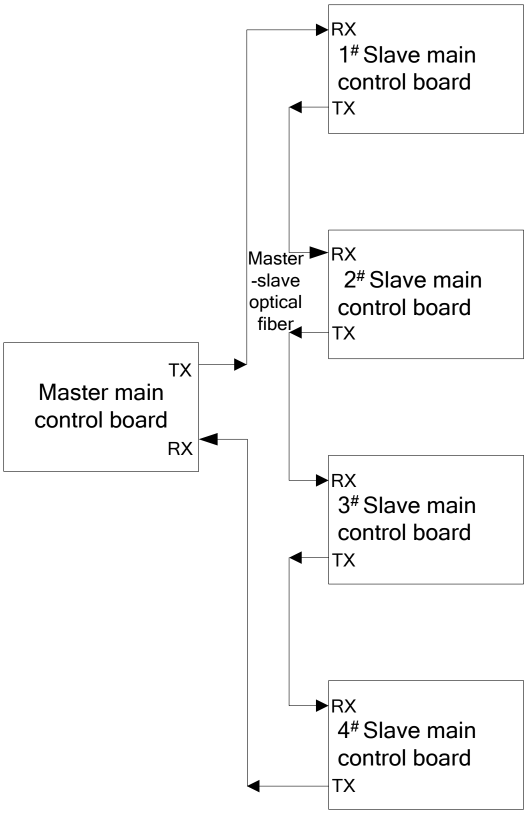
Note:

- When M1 is in the variable-frequency mode, M2 can only be in static or power frequency mode, and vice versa.
- KM1 and KM4, KM2 and KM5 are locked and they cannot be switched on simultaneously.
- During maintenance, disconnect QS1, QS2, QS3 and QS4 to form an obvious breakpoint, which can extend the one-driving-four applications. It is not described in detail here.

7.9 Master-slave control

Master-slave control is that two or above motors work in cooperation to drive the load, including master-slave power-balancing mode and master-slave speed synchronous mode. The first mode is the control mode that the motors are connected to work together in way of gearboxes, guide rails, chains, belts or shafts coupling and the powers among the motors are distributed properly to reach corresponding control precision. External control signals are connected to the master and the slaves are controlled by the master via communication. Master-slave power-balancing mode is the main mode of master-slave control.

As for rigid connection via gearboxes or shafts coupling, the master runs under speed mode while the slaves run under torque mode; as for flexible connection via belts, both the master and the slaves are under speed mode.



As shown in the above figure, the master-slave control adopts a ring connection method, where TX is the optical fiber transmitting port and RX is the optical fiber receiving port, which can support the control of one master and four slaves.

As for a master-slave control system, carry out parameters autotuning respectively at first, then select the speed mode for the master, next set the command channel and reference of the master and finally set master output signal source (P12.01). As for the slaves, set P00.01 to master, then select the speed mode or torque mode for the slaves, next set master output signal source in consistent with the master and finally adjust PID control parameters of the slaves.

No matter speed mode or torque mode for the slaves, the effect of PID adjusting is fine adjustment, so the effect should not be too strong; otherwise, the slaves may run unstably. Set P15.02 to 1 in the cases where the master and slaves need to power on and off at the same time and the switching cabinets are installed.

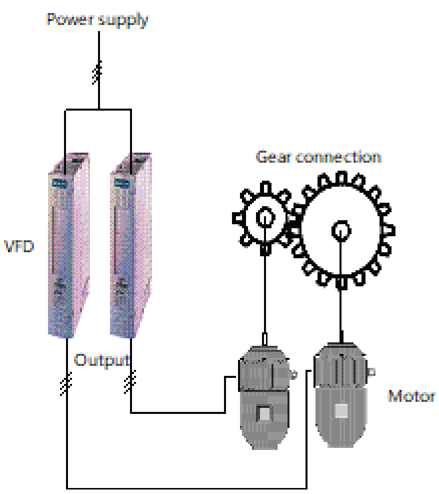


Figure 1

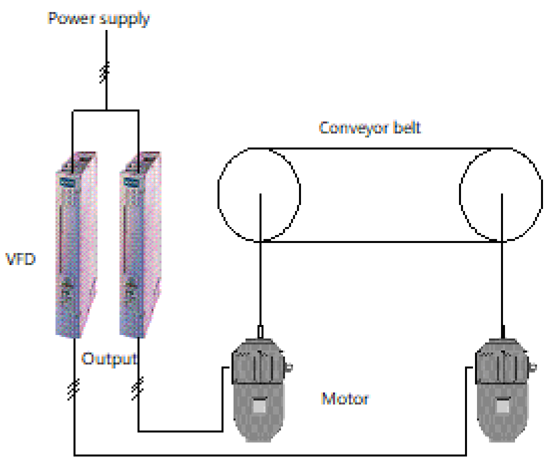


Figure 2

Rigid connection: Rigid connection modes such as gears, chains, rollers or shaft coupling, with no deviation in linear speed between the master and the slaves.

Flexible connection: Connection mode such as conveyor belts, with slight deviations in linear speed between the master and the slaves.

Connection mode of loads in coal industry: Rigid connection indicates the master and slaves drive a roller (Figure 1). There is belt connection (Figure 2) between the master and the slaves , which shall be flexible connection in theory, but is considered rigid connection in actual application. When the belt between the master and the slaves is not tight, it can be considered as a flexible connection. The master-slave connection usually involved in the practical applications is flexible connection or rigid connection, and the control method will usually be matched, as shown in the following table.

Control mode	Master running mode	Slave running mode	Master/slave connection mode
V/F control	Master speed mode	Slave speed mode	Flexible/rigid connection
Vector control	Master speed mode	Slave speed mode	Flexible connection
	Master speed mode	Slave torque mode	Rigid connection

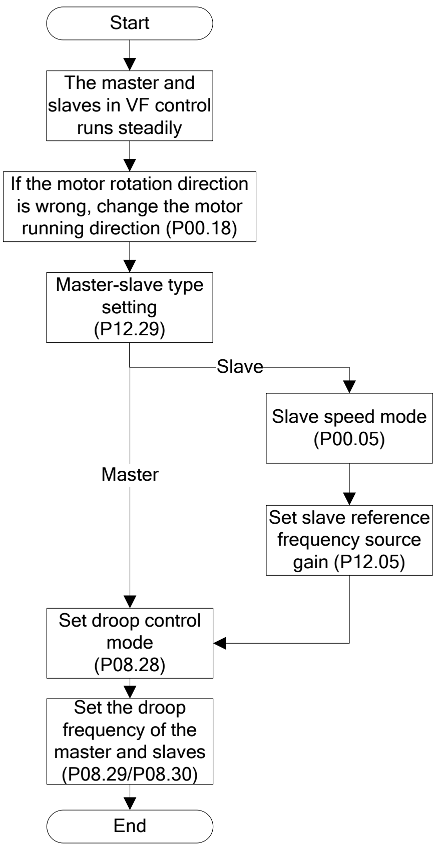
Note:

- Select a proper control method according to the type of master-slave load connection, V/F control is used in priority.
- For unstable situations of V/F control, vector control can be considered.

7.9.1 Flexible connection

7.9.1.1 V/F control

When the master and the slaves use V/F control, the commissioning step flowchart is shown in the following figure.



First, the master and the slaves need to be in single-node mode, each frequency band in V/F control runs steadily. Observe the running direction of the motor to ensure the consistency of the running direction. Set the slave reference frequency gain = R master/R slave according to the master-slave roller diameter. Set the master-slave droop frequency to 1Hz, when the master-slave current fluctuates, the value can be fine-tuned.

Function code	Name	Description	Setting range	Master	Slave
P00.00	Control mode selection	0: Space voltage vector control 1: Asynchronous sensorless vector control 2: Synchronous sensorless vector control 3: Vector control	0–3	0	Same as the master
P00.16	ACC time 1	0.1–3600.0s	0.1–3600.0	100.0s	Same as the master
P00.17	DEC time 1	0.1–3600.0s	0.1–3600.0	100.0s	Same as the master
P00.18	Running direction	0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running	0–2	V/F control diagram in section 7.9.1.1	V/F control diagram in section 7.9.1.1
P01.01	Start mode	0: Direct start 1: Start after DC braking 2: Start after rotating speed tracking	0–2	0	Same as the master
P01.02	Starting frequency of direct start	0.00–10.00Hz	0.00–10.00	0.5Hz	Same as the master
P01.03	Starting frequency hold time	0.0–50.0s	0.0–50.0	1s	Same as the master
P01.09	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1	1	Same as the master
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0–1	Set according to the nameplate	Set according to the nameplate
P02.01	Rated power of AM 1	4–50000kW	4–50000kW	Set according to the nameplate	Set according to the nameplate
P02.02	Rated frequency of AM 1	0.01Hz–P00.10 (Max. output frequency)	0.01Hz – P00.10	Set according to the nameplate	Set according to the nameplate
P02.04	Rated voltage of AM 1	0–20000V	0–20000	Set according to the nameplate	Set according to the nameplate
P02.05	Rated current	0.1–1000.0A	0.1–1000.0	Set according	Set according

Function code	Name	Description	Setting range	Master	Slave
	of AM 1			to the nameplate	to the nameplate
P02.03	Rated speed of AM 1	0.1–1000.0A	0.1–1000.0	Set according to the nameplate, if there is no rated speed on the nameplate, consult the motor manufacturer.	Set according to the nameplate, if there is no rated speed on the nameplate, consult the motor manufacturer.
P04.01	Torque boost	0.0%–10.0%	0.0–10.0	0.1%	Same as the master
P08.23	Drop control	0.00–10.00Hz	0.00–10.00	1Hz	Same as the master
P04.18	Low-frequency oscillation control factor	0–100	0–100	V/F control diagram in section 7.9.1.1	V/F control diagram in section 7.9.1.1
P04.19	High-frequency oscillation control factor	0–100	0–100	V/F control diagram in section 7.9.1.1	V/F control diagram in section 7.9.1.1
P04.20	Vibration control frequency threshold	0.00–120.00Hz	0.00–120.00	15.00Hz	Same as the master
P12.29	Master-slave type setting	0: Single master 1: Spare machine 2: Master 3: Slave	0–3	2	3
P12.05	Slave reference frequency source gain	0.01–100.00	0.001–100.000	The function code of the master is invalid.	The formula is as follows.

P12.05 is used to ensure that the master and the slaves drive the rollers at the same linear speed, which depends on the reduction ratio of the reducer and the radius of the roller. The master does not need to be set, but the slaves need to be set.

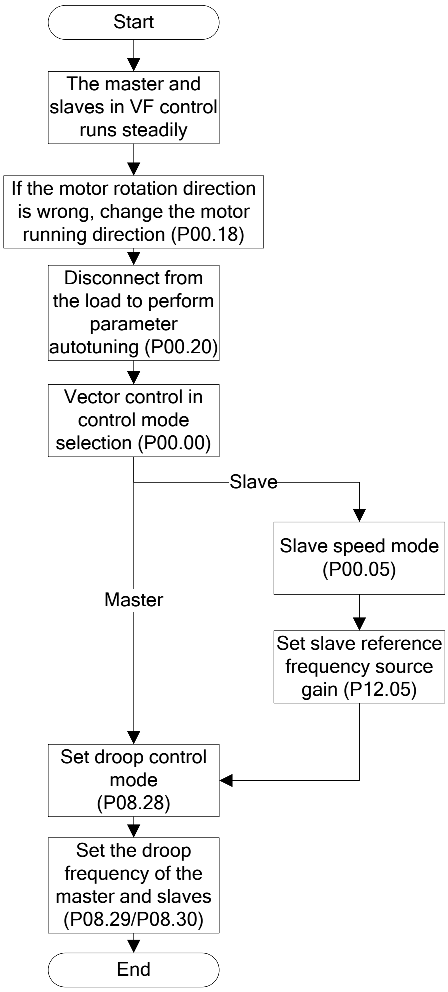
$$\text{Slave P12.05}=\frac{\text{Roller radius of the master}}{\text{Roller radius of the slaves}}*\frac{\text{Reducer reduction ratio of the master}}{\text{Reducer reduction ratio of the slaves}}*1.00$$

1. If overcurrent is reported during the start-up process, the starting frequency can be increased appropriately.
2. If the output current of the master and the slaves fluctuates greatly during running, you can fine-tune P08.23 and adjust the step length ±0.1Hz.
3. If the output current of the master and the slaves deviates greatly during running, you can fine-tune P12.05 and adjust the step length ± 0.001. If the output current of the slaves is lower than the master, you can increase P12.05, and vice versa. Balance the output current through no-load adjustment, and try not to adjust the droop value.

4. Calculate the slip frequency, and obtain the starting frequency.

7.9.1.2 Vector control

When the master and the slaves use vector control, the commissioning step flowchart is shown in the following figure.



First, the master and the slaves need to be in single-node mode, each frequency band in V/F control runs steadily. Observe the running direction of the motor to ensure the consistency of the running direction. The parameter autotuning is needed before running in vector mode. Set the slave reference frequency gain = R master/R slave according to the master-slave roller diameter. Set the master-slave droop frequency to 1Hz, when the master-slave current fluctuates, the value can be fine-tuned.

Function code	Name	Description	Setting range	Master	Slave
P00.00	Control mode selection	0: Space voltage vector control 1: Asynchronous sensorless vector control 2: Synchronous sensorless vector control 3: Vector control	0–3	2	Same as the master
P00.05	Speed reference mode	0: Speed mode 1: Torque mode	0–3	0	2

Function code	Name	Description	Setting range	Master	Slave
		2: Slave speed mode 3: Slave torque mode			
P00.16	ACC time 1	0.1–3600.0s	0.1–3600.0	100.0s	Same as the master
P00.17	DEC time 1	0.1–3600.0s	0.1–3600.0	100.0s	Same as the master
P00.18	Running direction	0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running	0–2	V/F control diagram in section 7.9.1.1	V/F control diagram in section 7.9.1.1
P01.01	Start mode	0: Direct start 1: Start after DC braking 2: Start after rotating speed tracking	0–2	0	Same as the master
P01.02	Starting frequency of direct start	0.00–10.00Hz	0.00–10.00	0.5Hz	Same as the master
P01.03	Starting frequency hold time	0.0–50.0s	0.0–50.0	4.0s	Same as the master
P01.09	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1	1	Same as the master
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0–1	Set according to the nameplate	Set according to the nameplate
P02.01	Rated power of AM 1	4–50000kW	4–50000	Set according to the nameplate	Set according to the nameplate
P02.02	Rated frequency of AM 1	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	Set according to the nameplate	Set according to the nameplate
P02.04	Rated voltage of AM 1	0–20000V	0–20000	Set according to the nameplate	Set according to the nameplate
P02.05	Rated current of AM 1	0.1–1000.0A	0.1–1000.0	Set according to the nameplate	Set according to the nameplate
P02.03	Rated speed of AM 1	0.1–1000.0A	0.1–1000.0	Set according to the nameplate, if there is no rated speed on the nameplate, consult the motor manufacturer.	Set according to the nameplate, if there is no rated speed on the nameplate, consult the motor manufacturer.
P04.01	Torque boost	0.0%–10.0%	0.0–10.0	0.1%	Same as the master
P08.23	Drop control	0.00–10.00Hz	0.00–10.00	1Hz	Same as the master

Function code	Name	Description	Setting range	Master	Slave
P04.18	Low-frequency oscillation control factor	0–100	0–100	V/F control diagram in section 7.9.1.1	V/F control diagram in section 7.9.1.1
P04.19	High-frequency oscillation control factor	0–100	0–100	V/F control diagram in section 7.9.1.1	V/F control diagram in section 7.9.1.1
P04.20	Vibration control frequency threshold	0.00–120.00Hz	0.00–120.00	15.00Hz	Same as the master
P12.29	Master-slave type setting	0: Single master 1: Spare machine 2: Master 3: Slave	0–3	2	3
P12.02	Filter time of slave reference signal	0.00s–655.35s	0.00–655.35	The function code of the master is invalid.	0.2s
P12.05	Slave reference frequency source gain	0.01–100.00	0.001–100.000	The function code of the master is invalid.	The formula is as follows.

P12.05 is used to ensure that the master and the slaves drive the rollers at the same linear speed, which depends on the reduction ratio of the reducer and the radius of the roller. The master does not need to be set, but the slaves need to be set.

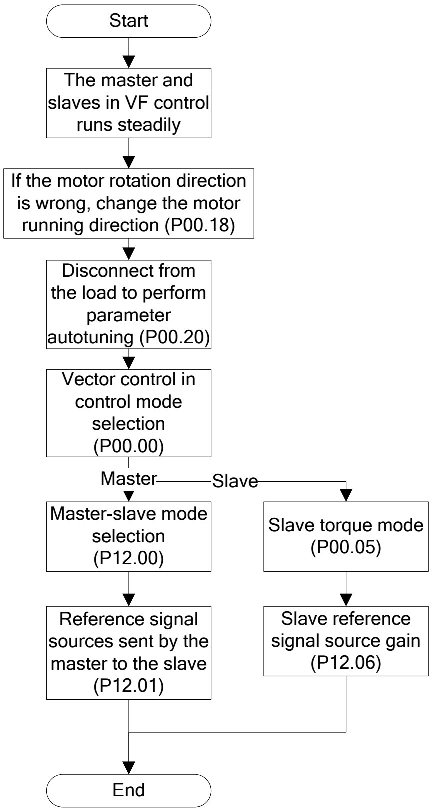
$$\text{Slave P12.05}=\frac{\text{Roller radius of the master}}{\text{Roller radius of the slaves}}*\frac{\text{Reducer reduction ratio of the master}}{\text{Reducer reduction ratio of the slaves}}*1.00$$

If overcurrent is reported during the start-up process, the starting frequency can be increased appropriately. For rollers with greater inertia, you can decrease the speed loop proportional gain 1 and increase the speed loop integral time 1 appropriately. Both the master and the slaves need to be modified to keep consistent.

Function code	Name	Description	Setting range	Default
P03.00	Speed-loop proportional gain 1	0–100	0–100	5
P03.01	Speed-loop integral time 1	0.01–10.00s	0.01–10.00	0.10s

7.9.2 Rigid connection

When the master uses vector speed control and the slaves use the vector torque control, the commissioning step flowchart is shown in the following figure.



The master uses vector speed mode, the slaves use the vector torque mode, in single-node mode, each frequency band in V/F control runs steadily. Observe the running direction of the motor to ensure the consistency of the running direction. Disconnect from the load to perform parameter autotuning, set the slave reference torque gain = P slave/P master according to the master-slave VFD power. Adjust the master speed loop PI parameters when the master-slave current fluctuates.

Function code	Name	Description	Setting range	Master	Slave
P00.05	Speed reference mode	0: Speed mode 1: Torque mode 2: Slave speed mode 3: Slave torque mode	0–3	0	3
P08.23	Drop control	0.00–10.00Hz	0.00–10.00	0.0Hz	Same as the master

7.10 Synchronous switching

7.10.1 Synchronous switching with reactors

Goodrive5000 medium voltage variable-frequency speed regulation system can achieve bumpless synchronous switching between power frequency and variable frequency. When variable frequency switches into power frequency, the system will adjust the phase, frequency and range of output voltage, and then switch into power frequency when in consistent with power supply at power frequency, with small surge. When power frequency switches into variable frequency, the system will automatically track current motor speed, and then switch into variable frequency. Achieved by the switching cabinet, synchronous switching makes the system run reliably with small surge to the motor and it is applicable in one-drive-more control such as constant pressure water supply.

Since there is an inherent angle deviation between the detection loop and the actual grid waveform, it is necessary to perform the compensation angle autotuning. The commissioning steps are as follows (taking switching cabinet 1 as an example).

1. Set P15.03=1: Synchronous switching with reactors.
2. Set P15.21=0min, after setting P15.21 to 0min, only phase locking will be performed during synchronous switching, and the power frequency switching-on will not be executed.
3. When the VFD is running, it will execute "switch from variable frequency to power frequency" to lock the phases, if the running frequency of the VFD is lower than 35Hz, it will not respond to the command of "switch from variable frequency to power frequency". Open INVT Workshop and monitor the waveforms of input voltage and output voltage .
4. After locking phases for a period of time, view P15.26 to obtain the actual deviation angle.
5. Coast to stop, then set P15.22 = current value + P15.26, the current value is 4° by default.
6. Restore the default value of P15.21, and the value can also be adjusted appropriately according to the site.

Function code	Name	Description	Setting range	Default
P15.03	Synchronous switching enabling	0: Disable 1: Synchronous switching with reactors 2: Synchronous switching without reactors	0–2	0
P15.21	Synchronous switchover phase lock delay	0–120min	0–120	2min
P15.22	Synchronous switchover angle compensation of switching cabinet 1	-200.0–200.0°	-200.0–200.0	12.0°
P15.23	Synchronous switchover angle compensation of switching cabinet 2	-200.0–200.0°	-200.0–200.0	12.0°
P15.24	Synchronous switchover angle compensation of switching cabinet 3	-200.0–200.0°	-200.0–200.0	12.0°
P15.25	Synchronous switchover angle compensation of switching cabinet 4	-200.0–200.0°	-200.0–200.0	12.0°
P15.26	Synchronous switchover actual deviation angle of switching cabinet 1	0–65535	0–65535	0
P15.27	Synchronous switchover actual deviation angle of switching cabinet 2	0–65535	0–65535	0

Function code	Name	Description	Setting range	Default
P15.28	Synchronous switchover actual deviation angle of switching cabinet 3	0–65535	0–65535	0
P15.29	Synchronous switchover actual deviation angle of switching cabinet 4	0–65535	0–65535	0

If overcurrent or unit overvoltage is reported during the process of switching from variable frequency to power frequency, you can try to adjust P15.22, according to the 0.2 ° step length (increasing the compensation angle is in priority), and ensure the current peak is below 1.5 times the VFD current peak. If the switching fails, you can adjust P15.21, P15.33 and P15.34 appropriately. The smaller the stability accuracy indicates the longer the stability holding time, and the higher the phase locking accuracy indicates the smaller the shock. However, if there are fluctuations in the grid, phase locking failure may be caused.

Figure 7-8 Synchronous switching wiring diagram

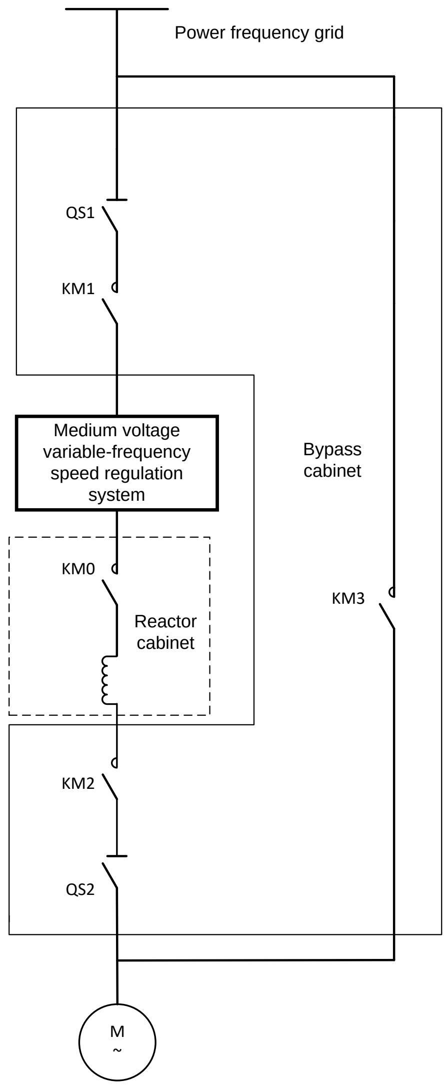
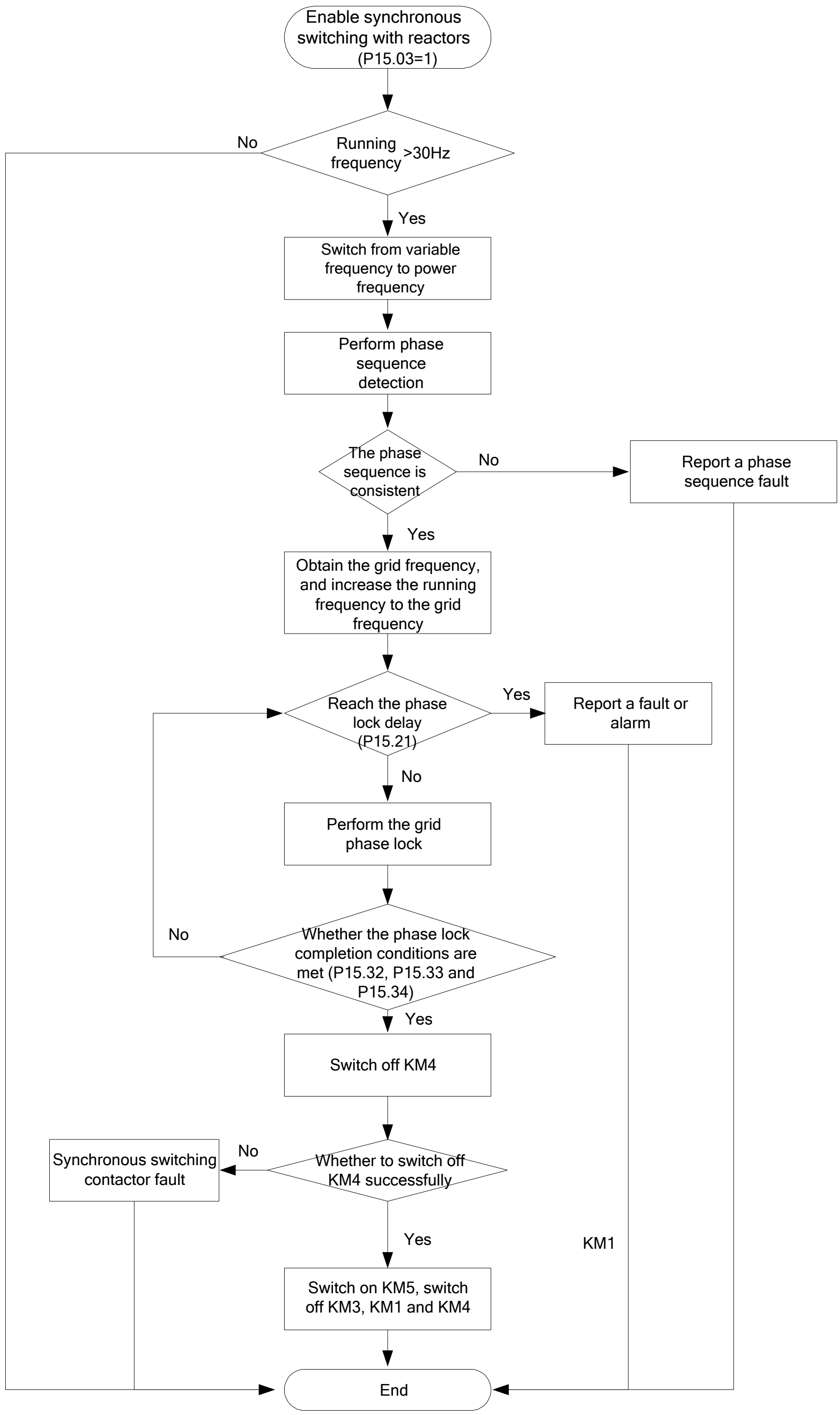


Figure 7-9 Flowchart of switching from variable frequency to power frequency



Function code	Name	Description	Setting range	Default
P15.03	Synchronous switching enabling	0: Disable 1: Synchronous switching with reactors 2: Synchronous switching without reactors	0–2	0

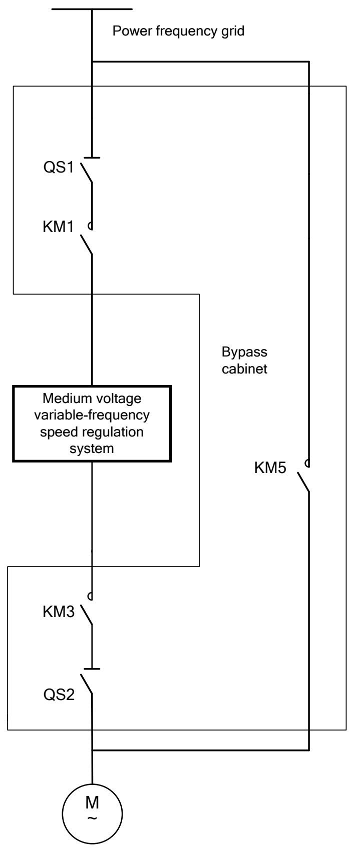
Function code	Name	Description	Setting range	Default
P15.21	Synchronous switchover phase lock delay	0–120min	0–120	2min
P15.32	Filter coefficient for synchronous switchover	1–20	1–20	4
P15.33	Phase locking stability accuracy for synchronous switchover	1–500	1–500	200
P15.34	Stability holding time for synchronous switchover	0.1–100.0s	0.1–100.0	4.0s

7.10.2 Synchronous switching without reactors

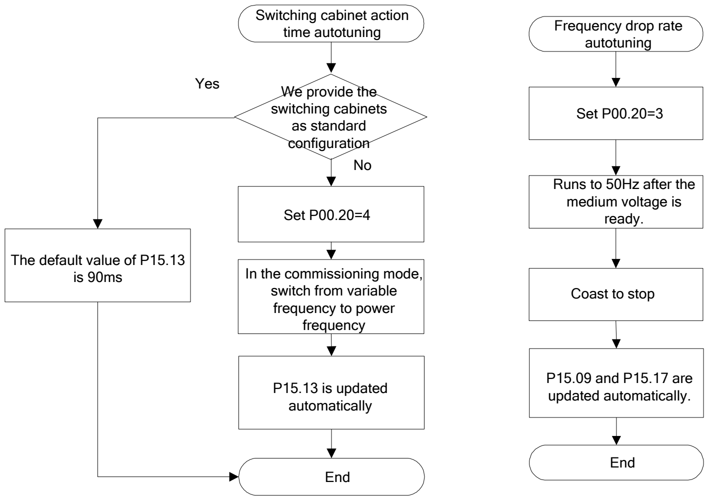
The electrical block diagram of the standard one-driving-one synchronous switching without reactor is shown in Figure 7-10.

During the whole switching process, the input voltage of medium voltage bus 2, the contactor switching control signal, the feedback signal of the contactors and knife switches are completed by the switching cabinet control board. This switching method is mainly applicable to large inertia loads such as fans.

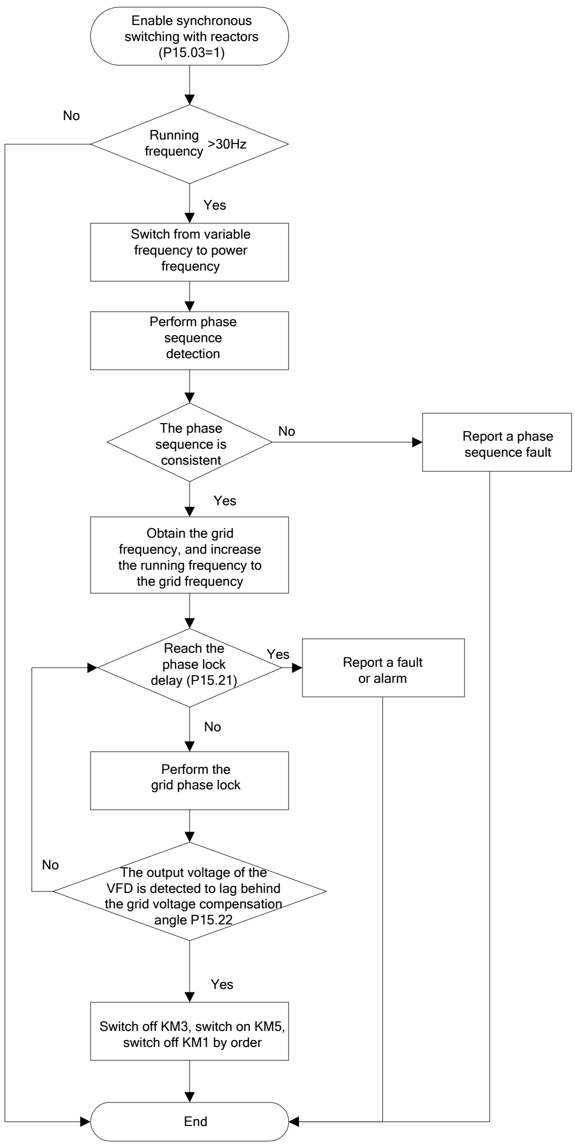
Figure 7-10 Electrical diagram of one-driving-one without reactor for switching from variable frequency to power frequency



It is necessary to perform the autotuning for the switching cabinet action time and the motor frequency drop rate first. Take the switching cabinet 1 as an example, the process is as follows.



The operation process of synchronous switching without reactors is as follows. If the inrush current is large during the switching process, you can increase P15.22 appropriately and increase the step length by about 1°.



Function code	Name	Description	Setting range	Default
P15.03	Synchronous switching enabling	0: Disable 1: Synchronous switching with reactors 2: Synchronous switching without reactors	0–2	0
P15.09	Motor frequency drop rate of switching cabinet 1	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.10	Motor frequency drop rate of switching cabinet 2	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.11	Motor frequency drop rate of switching cabinet 3	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.12	Motor frequency drop rate of switching cabinet 4	0.00–50.00Hz	0.00–50.00	0.00Hz
P15.13	Action time of switching cabinet 1	0–300ms	0–300	90ms
P15.14	Action time of switching cabinet 2	0–300ms	0–300	90ms
P15.15	Action time of switching cabinet 3	0–300ms	0–300	90ms
P15.16	Action time of switching cabinet 4	0–300ms	0–300	90ms
P15.17	Torque current of switching cabinet 1	0.0–6553.5A	0.0–6553.5	0.0A
P15.18	Torque current of switching cabinet 2	0.0–6553.5A	0.0–6553.5	0.0A
P15.19	Torque current of switching cabinet 3	0.0–6553.5A	0.0–6553.5	0.0A
P15.20	Torque current of switching cabinet 4	0.0–6553.5A	0.0–6553.5	0.0A
P15.21	Synchronous switchover phase lock delay	0–120min	0–120	2min
P15.22	Synchronous switchover angle compensation of switching cabinet 1	-200.0–200.0°	-200.0–200.0	12.0°
P15.23	Synchronous switchover angle compensation of switching cabinet 2	-200.0–200.0°	-200.0–200.0	12.0°
P15.24	Synchronous switchover angle compensation of switching cabinet 3	-200.0–200.0°	-200.0–200.0	12.0°

Function code	Name	Description	Setting range	Default
P15.25	Synchronous switchover angle compensation of switching cabinet 4	-200.0–200.0°	-200.0–200.0	12.0°

7.11 Unit bypass function

The power units of the medium voltage VFD have the function of unit bypasses, one is IGBT bypass and the other is contactor bypass (optional). When a unit has a fault, the unit will achieve automatic bypass to ensure the system continues working normally.

Note:

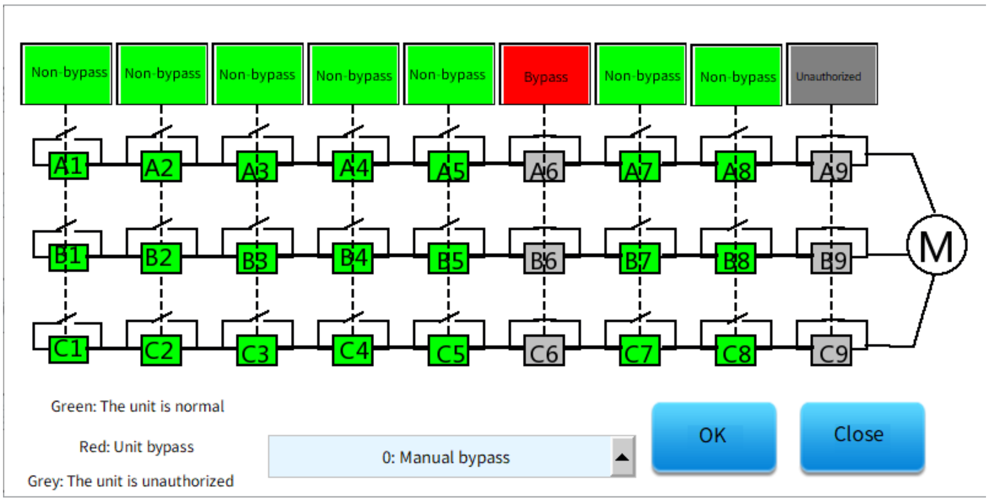
1. Unit bypass can only be completed when the unit optical-fiber communication is normal.
2. The unit bypass can bypass up to two groups of units for 10kV system and up to one group of units for 6kV system.

Unit bypass includes three types: manual bypass, common automatic bypass, and neutral point drifting automatic bypass. For details, you can set the bypass mode through P13.10, and see whether each unit is in bypass state through P13.11.

Function code	Name	Description	Setting range	Default
P13.10	Unit bypass function	0: Manual bypass 1: Common automatic bypass 2: Neutral point drifting automatic bypass	0–2	0
P13.11	Unit manual bypass setting	0x000–0x1FF	0x000–0x1FF	VFD voltage depended

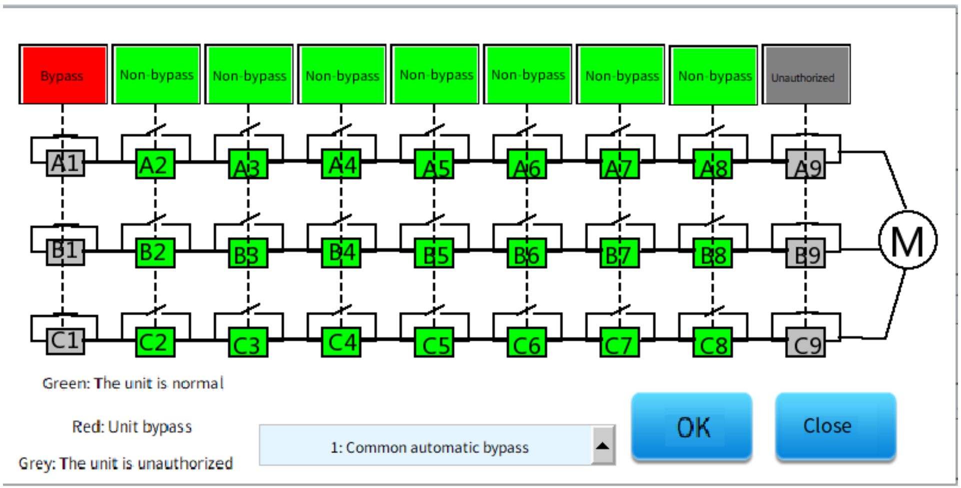
Manual bypass: The units can be bypassed during running or standby. In the application, select the units to be bypassed according to the actual situation, and bypasses three units in a group simultaneously. For example, manually bypass three units (A6-B6-C6), as shown in Figure 7-11.

Figure 7-11 Manual bypass



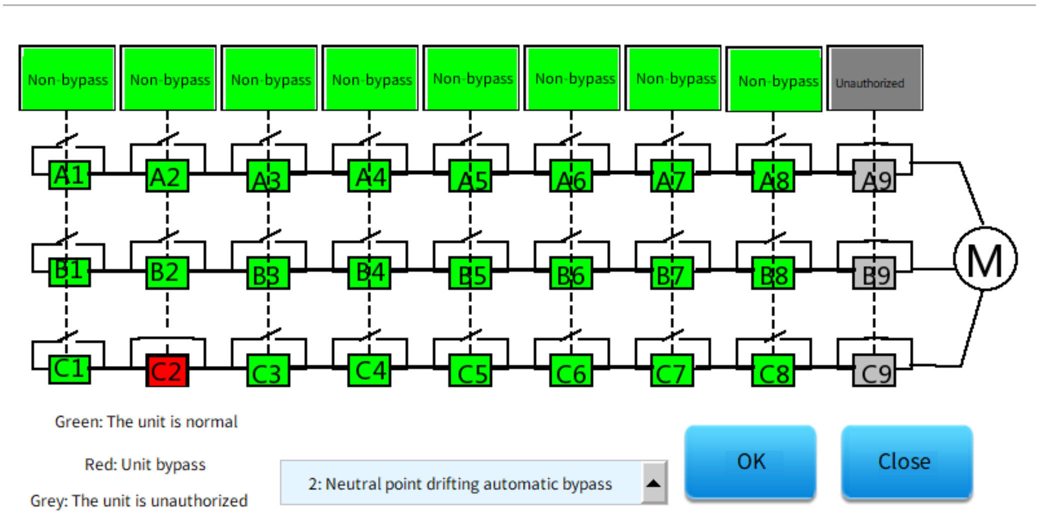
Common automatic bypass: When one fault occurs to a unit, the system can automatically bypass the faulty unit, but it will bypass the non-faulty units in the same group simultaneously. If a unit fault occurs to A1 unit during running, which is not caused by communication, the VFD will automatically bypass three units A1-B1-C1, and the system still runs normally, as shown in Figure 7-12.

Figure 7-12 Common automatic bypass



Neutral point drifting automatic bypass: When some faults occurs to a unit, the system can automatically bypass the faulty unit. If a unit fault occurs to C2 unit during running, which is not caused by communication, the VFD will automatically bypass C2 unit, and the system still runs normally, as shown in Figure 7-13.

Figure 7-13 Neutral point drifting automatic bypass



Bypass unit recovery: When a unit of the VFD system is in the unit bypass state described in the above three cases, the unit can be restored to its normal state after the unit is repaired and tested to be fault-free. The recovery method is to first modify the bypass mode to manual bypass (when the modification is finished, three units in a group will be bypassed, and the state is similar to Figure 7-11), and click the bypass and non-bypass button to switch. Three units in the corresponding group can be automatically restored to the normal state. The intermediate operations will not affect the running of the VFD.

8 Alarm and fault solution

Goodrive5000 medium voltage variable-frequency speed regulation system provides various functions of fault protection and alarm. If any fault occurs to the system, it can indicate fault state and implement stop protection, power unit bypass, alarm, cutting off medium voltage input automatically according to alarm levels. Due to fault instructions on the touch screen and general fault solutions, in the guidance of alarm interface, users can make a quick judgment and work out appropriate solutions.

Goodrive5000 medium voltage variable-frequency speed regulation system has two types of faults, unit fault and system fault. The system faults are ARM fault and DSP fault. Users can view fault type and fault location on fault history sub-interface of the main interface on the touch screen.

For fault unit Xn, X (A/B/C) indicates the phase of fault unit and n (1–12) indicates the location of fault unit.

Goodrive5000 medium voltage variable-frequency speed regulation system also provides alarm functions. If the fault is not serious enough to cause destructive damage, the system will alarm without stop. During alarm, the system will reset automatically or manually.

Two types of alarms: System alarm and unit alarm. Users can view the types on alarm information menu of the main interface on the touch screen.

Three types of faults:

Serious fault: The fault causes alarm, stop and medium voltage power supply disconnection. The system cannot reset automatically and manual intervention is necessary.

Light fault: The fault causes alarm and stop, but no medium voltage power supply disconnection occurs. Refer to other faults except serious fault.

Alarm: Only alarm without stop. Refer to system alarm and unit alarm.

8.1 System fault

8.1.1 DSP fault

Fault name	Possible cause	Detection method	Solution
Software/Hardware overcurrent	ACC is too fast.	If the fault disappears by increasing the ACC time, it indicates the ACC time is too short.	Increase ACC time.
	The voltage of the grid is too low.	Check whether input grid voltage is within the input voltage range.	Check the input power.
	The system power is too small.	Check whether the motor power is greater than the rated power of the VFD.	Select the system with larger power.
	Load transient or exception occurred.	Check the load running process data (whether the speed is smooth and the motor vibration exceeds the standard).	Check the load or reduce the sudden change of load.
	The hall sensor is damaged or the	Check whether the wiring of the hall sensor is loose.	Perform the wiring properly.

Fault name	Possible cause	Detection method	Solution
	wiring is abnormal.	The hall sensor is damaged. Check whether the grounding is normal. Check whether the direction of the hall sensor is consistent with the current direction.	Replace the hall. Connect the ground wire as required. Adjust the direction of the hall sensors to be consistent.
	Interference false alarm	Check whether there are obvious interference sources around the VFD, and use the black box of the upper computer to view the fault data. If there is no abnormality, it can be considered as interference false alarm. Check whether an overcurrent fault is reported occasionally and runs normally again after reset.	Ensure that the VFD is properly grounded and that the current detection cables are configured with magnetic rings. Eliminate other interference sources.
	Parameter setting problem	Check whether current oscillation occurs.	Set the torque boost and oscillation control factor in V/F control. Ensure that parameter autotuning is performed in vector control.
Grid overvoltage	DEC is too fast.	Increase the DEC time and observe whether overvoltage occurs.	Increase the DEC time if allowed.
	The load inertia torque is too large.	Check whether the motor stops for too long after coasting to stop of the VFD.	Select a VFD with larger power.
	The system power is too low.	Check whether the motor power is greater than the rated power of the VFD.	Select a VFD with larger power.
	Exception occurred to input voltage	Check whether other devices on the same line are normal and whether there are transient surges in the grid voltage.	Troubleshoot grid problems.
	Reset the rotating motor after a momentary power failure.	Check whether the motor is not stopped steadily or dragged by external forces to rotate when the VFD starts. Stop the motor steadily or disconnect from the load to test whether overvoltage occurs.	Set the speed tracking start method.

Fault name	Possible cause	Detection method	Solution
Grid undervoltage	The voltage of the grid is too low.	Check the actual grid voltage. Check whether there is a display exception of the actually normal VFD. Check whether the power-on buffer of the configuration buffer resistor is closed.	Adjust transformer connectors to meet the input range of the VFD. Adjust voltage calibration coefficient or replace the voltage detection board. Troubleshoot and resolve buffering abnormalities.
Motor overload	Grid voltage is too low.	Check whether input grid voltage is within the range of -10%–+15% (rated value).	Check the grid voltage.
	The motor rated current is set incorrectly.	Check whether the motor parameters are consistent with the nameplate parameters. Check whether the actual output current of motor is consistent with the displayed current.	Reset the rated current of the motor according to actual parameters of the motor. Adjust the current calibration coefficient or replace the current detection board.
	Motor stall or load jumps violently.	Check whether the running direction of the motor is correct. Check whether the motor braking system is open.	Eliminate the stalling. Release the hand brake.
	The motor power is too large.	Check whether the motor power deviates sharply from the rated power of the VFD.	Select a proper motor.
	Torque boost is too large	Check whether the torque boost is set too large in V/F control.	Decrease the torque boost.
	SM demagnetization	If the current was normal before but suddenly becomes larger now, it may be caused by SM demagnetization, and the counter-emf constant needs to be estimated.	Repair the motor.
System overload	ACC is too fast.	If the overload disappears by reducing the ACC time, it indicates that ACC is too fast.	Decrease the ACC time.
	The motor in rotating is restarted.	Check whether the motor is not stopped steadily or dragged by external forces to rotate when the VFD starts. Stop the motor steadily or disconnect from the load to test whether overvoltage occurs.	Set the speed tracking start method.
	Grid voltage is too	Check whether input grid	Check the grid voltage.

Fault name	Possible cause	Detection method	Solution
	low.	voltage is within the range of 10%–+15% (rated value).	
	Load is too large.	If current is too large in V/F or vector control, it indicates that the load is too heavy.	Select a VFD with larger power.
Phase loss on output side	Phase loss occurred to U, V, W output (or the three phases of motor is asymmetrical).	Check whether the wiring of output terminals is tightened.	Check the output wiring. Check the motor and cables.
	Hall or current detection exception	Check the hall U/V/W phase sequence and check whether the hall wiring is tightened. Check whether the current detection board is abnormal.	The hall cable phase sequence corresponds to the drive.
Input phase loss	Phase loss occurred on R, S, and T inputs.	Check the wiring terminals are tightened.	Check the input power and wiring.
	Input power fluctuates violently	Detect whether unbalance or violent fluctuation occurred to inputs R, S, and T through the upper computer.	Check the input power and wiring.
Current detection fault	The signal collection board connector is in poor contact.	Check whether the wiring of the signal detection board is tightened. Check whether the grounding is normal.	Check the connector and re-plug.
	Auxiliary power supply is damaged. Exception occurred to amplification circuit.	Initially check the signal detection board circuit.	Replace the signal detection board.
	Hall components are broken	Check whether the direction of the hall sensor is consistent with the current direction. Check whether the hall sensor is damaged.	Adjust the hall direction. Replace the hall component.
Motor autotuning fault	The motor capacity does not match the system capacity	Check whether the motor power matches the VFD power. Check whether the motor parameters are consistent with the nameplate parameters.	Select the VFD with proper power.
	Motor parameter is set improperly	Check whether the stator resistance, rated voltage and current settings are equivalent to the actual ones.	Adjust the motor parameter settings, and perform the autotuning again. If a fault is reported during autotuning, adjust

Fault name	Possible cause	Detection method	Solution
			the stator resistance appropriately.
	Autotuning timeout.	Check whether the current detection is normal.	Run the VFD at no load and monitor whether the running current is normal.
Handshake fault	ARM does not work for a short time	Check whether the fault occurs during the program writing, if so, try to reset. If the fault can be reset, it will be normal, otherwise, it is necessary to rewrite the program. If a fault is reported during running, you may need to replace the main board.	Replace the control board.
Input overcurrent	The system capacity is too small.	Check whether the motor power is consistent the VFD power.	Replace with a system of a larger capacity.
	The input current detection cable suffers from interferences	Check whether to re-run without fault, if the fault does not appear during running, it can be considered as the interference.	Update the input current detection cables, and conduct a proper grounding of the shield layer.
	Medium voltage winding short circuit in the system	Stop the machine, and check whether there is a short circuit in the transformer winding.	Repair the transformer.
Voltage detection transmission fault	The power cables of the voltage detection transmission board are not connected properly.	Check the wiring of the transmission board.	Re-plug.
	The uplink and downlink optical fibers of the voltage detection transmission board are not connected properly/The optical fiber bending angle of the voltage detection transmission board fiber is too large.	Check whether the voltage detection optical fiber is intact.	Replace the optical fiber.

8.1.2 ARM fault

Fault name	Possible cause	Detection method	Solution
The phase shifting transformer trips.	The load of the transformer is too high.	Detect the ambient temperature. Check whether the temperature data in the instant information interface is displayed correctly. Check whether the fan operates normally. Check whether the shield of the control cable is grounded properly.	Check whether the external signal circuit and its cable shield are properly grounded. Check the load of transformer and ambient temperature, and compare them with rated values (make records). Check whether installation conditions meet requirements (whether it is exposed to sunlight and whether air circulation is good) Check whether the shield of the control cable is grounded properly. Check the temperature controller and its circuits.
	Ambient temperature is too high.		
	Temperature controller fault		
	Transformer cooling circuit fault		
	The protection circuit suffers from interferences		
Phase-shifting transformer overheating	The shield of the control cable is grounded improperly.		
External fault	External fault input terminal action	View the fault records to compare the user input terminal configuration with the user fault input terminal state at the fault moment.	Check input signals of external device. Check P05 group Input terminal functions.
Modbus communication fault	Incorrect baud rate	Check the wiring and serial communication settings, read and write any function code to see whether any data is returned. Check whether the data on the bus are correct through the serial port monitoring assistant.	Set a proper baud rate.
	Serial communication error		Reset.
	Long period of communication interruption		Check the wiring of communication interfaces.
Buffer cabinet fault	The contactor feedback is incorrect.	The feedback signal of the buffer cabinet is "0" after the medium voltage power off, and the feedback signal of the buffer cabinet is "1" after the medium voltage power on. A fault is reported when the feedback signal does not match.	Check the contactor feedback.
	The vacuum contactor or contact is damaged.	Check whether the contactor can be closed / disconnected properly.	Repair the contactor.

Fault name	Possible cause	Detection method	Solution
PID feedback offline fault	PID feedback disconnection	Check PID reference source and feedback source.	Check PID feedback signal wires.
	PID feedback source disappears.		Check PID feedback source.
Door access fault	The cabinet door is not properly closed	Check whether each cabinet door (control cabinet door is not affected) is in the closed state.	Check the cabinet door closing state - Check the cabinet door travel switch and its contacts.
	Cabinet door travel switch fault	In the door opening state, press the travel switch to see whether the fault is eliminated.	Check the cabinet door closing state - Check the cabinet door travel switch and its contacts.
	The shield of the control cable is grounded improperly.	/	Check the cabinet door closing state - Check the cabinet door travel switch and its contacts.
Synchronous switchover timeout	During synchronous switching, the system and the grid is not synchronous at running frequency, or the system output voltage deviates sharply from grid input voltage , or the phase locking parameters are set improperly.	Monitor whether the input voltage fluctuates, causing phase locking failure, and monitor whether the phases of input and output voltages are consistent.	Ensure that the system runs to the synchronous frequency of the grid before synchronous switching. Adjust the phase locking parameter setting.
Synchronous switchover serious fault	During the synchronous switching process, the contactor corresponding to the reactor does not execute the corresponding action correctly	User output terminals are configured with 79: Switching cabinet KM4 feedback signal. Monitor whether KM4 acts correctly during the synchronous switching process.	Check the contactor feedback.
Factory time reached	Reach the running time set by the manufacturer	/	Ask for manufacturer support.
Motor temperature is too high	Ambient temperature is too high.	Check the motor state and ambient temperature.	Lower the ambient temperature.
	Motor overload for a long time		Check the load or replace with a motor with greater power.
Switching cabinet communication	The optical fiber connector is loosened.	Detect the optical path.	Re-connect the connector.

Fault name	Possible cause	Detection method	Solution
fault	The optical fiber is damaged.		Replace the optical fiber.
	Switching cabinet control board fault	Check whether there is light emitted normally from both ends TX of the optical fiber, if not, the hardware needs to be replaced.	Replace the control board.
The capacity of the SD card is insufficient.	The SD card saves too much data.	Take out of the SD card to check the remaining capacity.	Format the SD card after backing up its data.
DSP and ARM handshake fault	DSP does not work in a short time, and the software version does not match	Check whether the DSP and ARM software versions are matched (The matching principle is V.X.YY.ZZ, where ARM and DSP software YY must be consistent).	Replace the control board.
Power off in running	The transient electric dazzling time of the grid during running is too long	Check whether there is electric dazzling through the fault black box.	Check the grid power distribution.
	The transient power-off time of the system is set too small.		Increase the transient power-off time properly.
PROFIBUS communication fault (fieldbus fault)	The PROFIBUS communication card is connected improperly.	Check whether the communication card is connected properly. Check the VFD communication parameter setting. Check the working state of the communication card, and ensure the PLC configuration is correct.	Re-connect the PROFIBUS communication card.
	The PROFIBUS communication card is damaged		Replace the PROFIBUS communication card.
	Communication address setting error		Reset the parameters.
	The interference is too large.		Remove the interference.
Reference frequency disconnection detection fault	The wiring of the reference frequency sources is loosened.	Check whether the reference frequency sources are set correctly. Check whether the reference frequency sources disappear.	Check the wiring.
	Reference frequency sources disappear		Check the reference frequency sources.
	The vacuum contactor or contact is damaged.		Replace the contactor.
Switching cabinet action fault	The state feedback of the vacuum contactor or isolation switch is incorrect.	Observe whether the switching cabinet action corresponds correctly to the feedback signal in commissioning mode.	Check whether the wiring of the switch state feedback is correct and whether the contacts are in poor contact.
	The vacuum	Check the contactor.	Change the wiring to a spare

Fault name	Possible cause	Detection method	Solution
	contactor or isolation switch is damaged.		contact that is not damaged, or replace the contactor or isolation switch.
The software version does not match	The program of the three chips of the main control board does not match	Check the software version of each chip in P07 group. Check whether the DSP and ARM software versions are matched (The matching principle is V.X.YY.ZZ, where ARM and DSP software X.YY must be consistent).	Replace the main control board.
Fan overheating	Ambient temperature is too high.	Check the ambient temperature.	Lower the ambient temperature.
	The fan temperature sensor at the top of the cabinet is damaged.	Check the fan temperature sensor.	Check whether the fan temperature sensor is damaged.
Master/slave optical-fiber communication fault	The optical fiber connector is loosened	For one machine, screen out this fault through the function codes.	Re-connect the connector.
	The optical fiber is damaged.		Replace the optical fiber.
Underload fault	The load drops during constant speed running	Check the load conditions. Check the unit state.	Check the load conditions. Check the unit state.
Speed deviation fault	The reference frequency is inconsistent with the running frequency.	Check the actual running frequency.	Check whether current-limit frequency drop or overvoltage stall occurs.
Temperature controller communication fault	The wiring of 485 communication interface is wrong. Suffer from interferences.	Connect the serial tooling to the RS485 bus interface to judge whether there is normal data.	Correct the wiring of communication interfaces. Remove the interference.

8.2 Unit fault

Fault name	Possible cause	Detection method	Solution
Unit optical-fiber uplink communication fault	The optical fiber connector is loosened.	Stop and power off to check whether the optical fiber connector is loosened.	Re-connect the connector.
	The optical fiber is damaged.	Check whether the optical fiber connector shows light and whether the brightness is abnormal.	Replace the optical fiber.
	Unit fault	Disassemble the unit and test whether the power supply of	Check the unit.

Fault name	Possible cause	Detection method	Solution
		the unit control board is normal.	
Unit optical-fiber downlink communication fault	The optical fiber connector is loosened.	Stop and power off to check whether the optical fiber connector is loosened.	Re-connect the connector.
	The optical fiber is damaged.	Check whether the optical fiber connector shows light and whether the brightness is abnormal.	Replace the optical fiber.
Unit not ready	Unit control board fault	The fault cannot be reset, and the fault is reported frequently.	Repair the unit, and replace the unit control board.
Unit overvoltage	The load inertia is large, and DEC is fast	Check whether the DEC time is too short. If the fault disappears by reducing the DEC time, it indicates that the DEC time is too short.	Increase the DEC time.
	Current oscillation	Observe whether oscillation occurs to output UVW current through workshop.	Adjust the oscillation factor In V/F control. Check whether the motor parameters are correct, and perform parameter autotuning.
	The grid voltage is too high	Observe whether the grid voltage is too high through the touch screen or workshop, and check whether there is a grid overvoltage alarm.	Check whether the unit bus voltage is too high through the unit information. Check whether the ACC/DEC time is too short, causing the rising of unit voltage. Adjust the output of the phase-shifting transformer.
	Unit fault	The fault cannot be reset, and the fault is reported frequently.。 Disassemble the unit and test whether the circuit and the IGBT module are abnormal.	Repair the unit.
Unit undervoltage	The grid input voltage is too low	Observe whether input voltage is low through the touch screen, or observe the real-time voltage value through the upper computer.	Check the grid voltage.
	Unit input exception	Check the input of the faulty unit, and check the rectifier bridge and fuse.	Detect the unit input.
Unit overheating	Ambient temperature is too high.	Measure the actual temperature through the temperature tester.	Lower the ambient temperature.
	The cooling duct of	Check whether there is dust	Optimize the air duct.

Fault name	Possible cause	Detection method	Solution
	the unit is blocked	accumulation in the air duct.	
	Poor cabinet tightness and cooling condition	Visually inspect the dust condition of the dust filter.	Clean the dust filter.
Unit input phase loss	The wiring of unit input terminals is wrong	Check the wiring of input terminals according to the electrical diagram.	Perform the correct wiring.
	The shifting-transformer is faulty.	Check whether there are obvious damage signs of the transformer through visual inspection, and check the transformer impedance with a megameter.	Check the phase-shifting transformer
	Unit fuse burn-out	Stop and power off, and check whether the unit fuse is burned out through visual inspection or a multimeter.	Repair the unit.
Unit input power off	The wiring of unit input terminals is wrong	Check the wiring of input terminals according to the electrical diagram.	Check the wiring and perform the input wiring properly.
	Unit fault	The fault cannot be reset, and the fault is reported frequently.	Ask for technical support.
ACI fault	Unit output short circuit	Check whether there is short circuit in output cables.	Ask for technical support.
	H bridge direct connection	The fault cannot be reset, and the fault is reported frequently.	Ask for technical support.
	Unit drive fault	The fault cannot be reset, and the fault is reported frequently.	Ask for technical support.
ACO fault	Unit output short circuit	Check whether there is short circuit on output end of the VFD.	Check whether there is short circuit on output end of the VFD.
	H bridge direct connection	The fault cannot be reset, and the fault is reported frequently.	Ask for technical support.
	Unit drive fault	The fault cannot be reset, and the fault is reported frequently.	Ask for technical support.
Hardware overvoltage	The load inertia is large, and DEC is fast	Check whether the motor DEC time is too short.	Change the motor DEC time.
	Current oscillation	Observe whether output current fluctuates greatly.	Adjust the oscillation factor In V/F control. Check whether the motor parameters are correct, and perform parameter autotuning in vector control.
	The grid voltage is too high	Observe whether the grid voltage is too high through the touch screen or workshop.	Adjust the output of the secondary side of the transformer.
	Unit fault	Check whether the fault cannot be reset, and the fault is	Repair the unit.

Fault name	Possible cause	Detection method	Solution
		reported frequently.	
The unit does not match	The valid units configured by the manufacturer are not consistent with the actual valid units	Check whether the factory parameter unit configuration corresponds to the actual unit fiber connection.	Check the unit configuration.
Unit bypass failure	Bypass relay fault	Check the bypass relay.	Replace the bypass relay.
	The wiring of the bypass relay is wrong	Check the wiring of the bypass relay.	Check the wiring of the bypass relay.
	A VCE fault occurs to the unit	Check whether the unit fault code for the bypass failure unit is VCE.	Repair the unit.
Rectifier unit R/S/ T-phase VCE	The internal IGBT is damaged	Check whether the unit IGBT is damaged.	Replace the IGBT module.
	Strong interference	Check whether the fault can be reset and whether it is an accidental fault.	Check the surroundings to rule out interference source.
	External short circuit	Check whether short circuit occurs.	Check the external circuit and eliminate the load fault.
Hardware overcurrent	The unit IGBT is damaged	Check whether the unit IGBT is damaged.	
	ACC time of the inverter is short	If the fault disappears by reducing the ACC time, it indicates that the ACC time is too short.	Increase the ACC/DEC time.
	Short circuit occurs on the output side of the unit	Detect whether short circuit occurs on the output side of the unit	Check the external circuit of the unit, and eliminate the short circuit fault.
Grid-side current detection fault	The unit current detection components are damaged	Check whether the unit current detection circuit is abnormal. Check whether the current detection wiring is abnormal.	Check the wiring and the circuit boards.
	Interference	Check whether there is interference.	Check the surroundings to rule out interference source.
Zero calculation fault	The unit input voltage detection components are damaged	Check whether the voltage detection is abnormal.	Replace the hardware.
	Interference	Check whether there is interference.	Check the surroundings to rule out interference source.

8.3 Action after fault

After a fault occurs to the system, it will latch and display fault information. At the same time, alarm begins.

For system fault, the system will coast to stop immediately. For serious system fault, such as the temperature of phase-shifting transformer over 110°C, the system will cut off medium voltage along with coast to stop.

For unit fault, use bypass fault unit according to requirements for derating without processing unit fault. If you check fault unit, stop the system and cut off medium voltage. Bypass fault unit is only used to deal with one fault unit. If several units encounter a fault and fault units are not in bypass, the system reports the fault and cuts off medium voltage.

The system will latch fault all the time and it will not restore to the normal state until users removes the fault and push the fault reset button.

Warning

- ✧ Do not reset and re-run the system if the fault reason is uncertain. Deal with the fault after confirming its level and reason.
- ✧ The system is complicated electronics converter equipment. Inspection or repair must be carried out under the instruction of manufacture engineers.
- ✧ Make sure the power supply is disconnected and the filter capacitor of the main circuit discharges completely before conducting system maintenance.

8.4 Action after alarm

8.4.1 Introduction of system alarm

Alarm code	Name	Possible cause	Solution
1	Grid overvoltage	The grid voltage is too high.	Make sure the grid voltage within -15%–+10% of rated voltage.
2	Transformer overheating	The load of the transformer is too high. Ambient temperature is too high; Temperature controller fault. Transformer cooling circuit fault. The protection circuit line suffers from interferences. The shield of the control cable is grounded improperly.	Check whether the external signal circuit and its cable shield are properly grounded. Check the load of transformer and ambient temperature, and compare them with rated values (make records). Check whether installation conditions meet requirements (whether it is exposed to sunlight and whether air circulation is good) Check whether the shield of the control cable is grounded properly. Check the temperature controller and its circuits.
3	Control power 1 off	The main control power supply is off or connected improperly. The main control power switch of the control cabinet is not turned on. A fault occurred to the feedback relay of the control cabinet main control power supply.	Check the main control power supply system to ensure that it is powered and the wiring is proper. Check and ensure that the main control power switch is turned on. Check whether the feedback relay works properly, if not, replace it. Ask for technical support.

Alarm code	Name	Possible cause	Solution
4	Control power 2 off	The backup control power supply is off or connected improperly. The backup control power switch of the control cabinet is not turned on. A fault occurred to the feedback relay of the control cabinet backup control power supply.	Check the backup control power supply system to ensure that it is powered and the wiring is proper. Check and ensure that the backup control power switch is turned on. Check whether the feedback relay works properly, if not, replace it. Ask for technical support.
5	Fan power off	The power supply for fan is off. The fan power switch of the control cabinet is not turned on. A fault occurred to the feedback of the control cabinet fan power supply.	Check whether the 380V fan power is turned on. Check and ensure that the fan power switch is turned on. Check whether the fan feedback works properly, if not, replace the fan running contactor.
6	UPS off	The UPS is not connected or has been damaged.	Check whether UPS can work properly.

8.4.2 Introduction of unit alarm

Unit	Name	Possible cause	Solution
1–36	Unit overheating	Fan fault. Poor cabinet tightness and cooling condition. Heavy load and large current.	Ask for technical support. Clean the dust filter. Select the system with larger power.
1–36	Optical-fiber communication alarm	The optical-fiber communication alarm triggering value is set improperly.	Set P13.14 properly.

1–36 indicates the number of alarm units. 1–12 is the number of A-phase units, 13–24 is the number of B-phase units and 25–36 is the number of C-phase units. After the system alarms, it will prompt and not affect working. However, users should pay attention to the alarm; otherwise, long time alarm may change into fault and result in system stop.

8.5 Common faults and solutions

The system may encounter the following faults during running. Please refer to the following solutions:

Ready indicator is not on:

1. Check whether input voltage exists through the touch screen. The ready indicator is on only when there is medium voltage.
2. Check whether the corresponding unit has voltage through the unit interface on the touch screen, if not, check the wiring between the phase-shifting transformer and the unit after power-off.

3. If the unit has voltage, but the ready indicator is still not on, please check whether the effective unit of the system is consistent with the unit which has voltage.

The system reports the overvoltage fault during decelerating:

1. Check whether the input voltage is too high.
2. Increase DEC time.

9 Routine maintenance

To ensure the system operates continuously and reliably for a long period of time, the system should be inspected daily and periodically. This chapter introduces the precautions of inspecting or maintaining the system.

9.1 Routine inspection

1. Check the room temperature and ventilation, and note that the room temperature should not exceed 40 °C.
2. Keep the room for the system clean.
3. Check whether the cooling fan is running normally (use an A4 paper placed in the cabinet air inlet, and the A4 paper shall be firmly absorbed by the filter screen).
4. Check whether the variable-frequency speed regulation system has abnormal sound and odor, whether the cabinet is hot, and whether the dry-type transformer three-phase temperature display is normal.
5. Check whether the variable-frequency speed regulation system control power supply and fan power supply air switches are closed and whether the UPS power switch at the bottom is turned on.
6. Record the variable-frequency speed regulation system running status (such as run mode, voltage, current, speed, and power) regularly, and record fault information upon a tripping fault and then identify the fault cause before re-power on.
7. Check whether the unit status, displayed temperature, and bus voltage are normal.
8. Check whether the bypass cabinet knife switch is in place and whether there is any abnormal vibration and sound in the medium voltage contactor.

9.2 Routine maintenance procedure

Step 1 After the shutdown of the system, cut off the main power supply of the medium voltage switching cabinet and close the grounding knife switch.

Step 2 Cut off the control power and UPS of the system.

Step 3 Wait at least 15 minutes before opening the cabinet door, and ensure the discharge status of the power unit before starting to work; otherwise, there is a risk of electric shock.

Step 4 If there is a lot of dust, dust filters should be cleaned once a week and the cabinet inside should be vacuumed.

Step 5 Within the first month of putting the variable-frequency speed regulation system into operation, fasten all incoming and outgoing cables, all connection cables and the terminal blocks of control part. In the future, fasten them (including the control cables) once every six months.

Step 6 Check whether the optical fiber plug of each power unit is loose.

Step 7 Ensure that no tools or foreign objects are left in the cabinets and every electrical cabinet door is closed.

Step 8 Perform the power-on running on the spare units periodically (typically 6 months) to ensure that the optical fiber holder plugs of the spare units are inserted properly to prevent the pollution.

Step 9 Re-power on and record the maintenance records of the variable-frequency speed regulation system.

Attachment:

Table 9-1 Routine check items

Item	Content	Method/Criterion
Ambient environment	Check the temperature, and humidity, and whether there is vibration, dust, gas, oil spray, and water droplets in the environment. Check whether there are foreign matters, such as tools, or dangerous substances placed nearby.	Visual inspection or instruments, or appearance observation Compliant with technical specifications No such placing
Touch screen	Check whether the touch screen display is clear.	Visual inspection: The display is clear.
Structure	Check for abnormal vibration or sound. Check for loose fasteners such as screws. Check for deformation damage or collision marks. Check for dust, stains, or rust.	Visual inspection. No exception occurs.
Cooling fan	Check for abnormal vibration or sound.	Visual and auditory inspection. No exception occurs.
Ventilation duct	Check whether there are blockages or foreign objects attached. Observe whether the temperature displayed by the unit varies greatly with the previous temperature.	Visual inspection. No exception occurs.
Phase shifting transformer	Check whether there is abnormal temperature rise. Check whether there is abnormal sound.	Visual and auditory inspection, or appearance observation
Medium-voltage contactor	Check for abnormal vibration or sound.	Visual and auditory inspection. No exception occurs.

Table 9-2 System maintenance list

No.	Check scope	Check category	Check item	Cycle				Method	Criterion	Used instrument	Remarks
				Daily	Periodically						
					1 year	2 years	3 years				
1	All	Ambient environment	Ambient temperature, humidity, and dust	✓				Observation	Ambient temperature: -5–40°C, no freezing. RH: Below 90%, no condensation	Thermometer and hygrometer	
2		Entire system	Check for abnormal vibration or sound.	✓				Visual and auditory inspection	No exception		
3		Main power voltage	Check whether the voltage is normal.	✓				Check the input voltage displayed on the interface.	-15%–+10% of the rated voltage		

No.	Check scope	Check category	Check item	Cycle: Daily	Cycle: Periodically 1 year	Cycle: Periodically 2 years	Cycle: Periodically 3 years	Method	Criterion	Used instrument	Remarks
4		Control power voltage	Check whether the voltage is normal.	√				Check the input voltage of the control part.	AC380V ± 10%	Multimeter	
5		HMI	Check whether display is normal and operations are correct.	√				Observation	Displayed data is in the normal range and operations are performed properly.		
6		Dust filter	Check for blockages and check whether there is much dust.	√				Observation	Check the airflow of each air inlet with a piece of A4 size paper. The paper should be able to be firmly absorbed by the filter screeen, and there should be no obvious dust from the appearance.		
7	Main circuit	All	1. Insulation resistance check (phase shifting transformer insulation)		√			1. The resistance of the phase shifting transformer coil insulation to ground should be within the normal range. 2. Check and fasten. 3. Observe.	1. Greater than 20MΩ 2–3. No exception.	DC 2500V insulation resistance meter	
			2. Check fastened parts for any loose phenomenon.		√	√	√				
			3. Check components or parts for overheating.		√	√	√				
			4. Clean		√	√	√				
8		Connection conductors and wires	1. Check whether conductors are tilted.		√	√	√	Observation	No exception occurs.		
			2. Check whether the lead wire insulation layers are broken or aged.		√	√	√				

<table>
<tr><th rowspan="3">No.</th><th rowspan="3">Check scope</th><th rowspan="3">Check category</th><th rowspan="3">Check item</th><th colspan="4">Cycle</th><th rowspan="3">Method</th><th rowspan="3">Criterion</th><th rowspan="3">Used instrument</th><th rowspan="3">Remarks</th></tr>
<tr><th rowspan="2">Daily</th><th colspan="3">Periodically</th></tr>
<tr><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>9</td><td rowspan="6"></td><td>Terminal block</td><td>Check whether terminal blocks are broken.</td><td></td><td>√</td><td>√</td><td>√</td><td>Observation</td><td>No exception occurs.</td><td></td><td></td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Filter capacitor</td><td>1. Check the filter capacitors for liquid leakage.</td><td>√</td><td>√</td><td>√</td><td>√</td><td rowspan="3">1–2. Observe.
3. Use a capacitance meter for measurement.</td><td rowspan="3">1–2. No exception.
3. More than 85% of the rated capacity.</td><td rowspan="3">Capacitance meter</td><td rowspan="3"></td></tr>
<tr><td>2. Check for swelling.</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Check static capacitance.</td><td></td><td></td><td></td><td>√</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Relay</td><td>1. Check whether abnormal sounds such as "Boing, boing...".</td><td></td><td>√</td><td>√</td><td>√</td><td rowspan="2">1. Listen.
2. Observe.</td><td rowspan="2">No exception occurs.</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>2. Check whether contacts are rough or broken.</td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">Control circuit Protection circuit</td><td rowspan="2">Action check</td><td>1. Check whether the output voltage between each phase is balanced during running of the variable-frequency speed regulation system.</td><td></td><td>√</td><td></td><td></td><td rowspan="2">1. Measure the phase-to-phase voltages of the U, V and W output terminals of the variable-frequency speed regulation system.
2. Turn the higher level medium voltage switch of the system to the simulated running position for the relevant test.</td><td rowspan="2">1. The phase-to-phase voltage error should be within 10V.
2. The medium voltage switch can be closed only after the signal of allowing closing is given from the variable-frequency speed regulation system; after the emergency button is pressed, the medium voltage switch should be opened at once.</td><td rowspan="2">Multimeter</td><td rowspan="2"></td></tr>
<tr><td>2. Check whether the interlock between the system and its higher level medium voltage switch is normal and whether the protection circuit is normal.</td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>13</td><td>Cooling system</td><td>Cooling air fan</td><td>1. Check for abnormal vibration or sound.</td><td>√</td><td></td><td></td><td></td><td>1. Rotate by hand at power off.
2. Check and</td><td>1. Perform smooth rotation.
2. No exception</td><td></td><td></td></tr>
</table>

No.	Check scope	Check category	Check item	Cycle				Method	Criterion	Used instrument	Remarks
				Daily	Periodically						
					1 year	2 years	3 years				
			2. Check connection parts for any loose phenomenon.		√	√	√	fasten.			
14	Display	Display	1. Check whether the HMI display is normal.	√				1. None 2. Clean with shredded cotton yarn but not organic solvents.			Ensure normal display.
			2. Clean		√						
15		Indication	Check whether indicators are properly on.	√				Check whether indicator turning-on meets requirements.	Design requirements are met.		
16		Instrument	Check whether the indication value is normal.	√				Check the indication value of the instrument.	The rating is met.		
17	Motor	All	1. Check for abnormal vibration or sound.	√				1. Visual and auditory inspection, and feel. 2. Odor caused due to overheating or damage.	No exception occurs.		
			2. Check for odors.	√							
18		Insulation resistance	Check (all terminals and grounding terminals) with an insulation resistance meter.		√			Remove the U, V, and W connection cables and motor cables.	Above 5MΩ	DC 2500V insulation resistance meter	

10 Modbus communication protocol

The VFD provides RS485 communication interfaces and adopts the master-slave communication based on the international standard Modbus communication protocol. You can implement centralized control (setting commands for controlling the VFD, modifying the running frequency and related function code parameters, and monitoring the working state and fault information of the VFD) through PC/PLC, upper control computer, or other devices to meet specific application requirements.

10.1 Modbus protocol introduction

Modbus is a communication protocol for use with electronic controllers. By using this protocol, a controller can communicate with other devices through transmission lines. It is a general industrial standard. With this standard, control devices produced by different manufacturers can be connected to form an industrial network and be monitored in a centralized way.

The Modbus protocol provides two transmission modes, namely American Standard Code for Information Interchange (ASCII) and remote terminal units (RTU). On one Modbus network, all the device transmission modes, baud rates, data bits, check bits, end bits, and other basic parameters must be set consistently.

A Modbus network is a control network with one master and multiple slaves, that is, on one Modbus network, there is only one device serving as the master, and other devices are the slaves. The master can communicate with any single slave or with all slaves. For separate access commands, a slave needs to return a response. For broadcasted information, slaves do not need to return responses.

10.2 Application of Modbus

The VFD uses the Modbus RTU mode and communicates through RS485 interfaces.

10.2.1 RS485

RS485 interfaces work in half-duplex mode and transmit data signals in the differential transmission way, which is also referred to as balanced transmission. An RS485 interface uses a twisted pair, where one wire is defined as A (+), and the other B (-). Generally, if the positive electrical level between the transmission drives A and B ranges from +2V to +6V, the logic is "1"; and if it ranges from -2V to -6V, the logic is "0".

The 485+ terminal on the terminal block of the VFD corresponds to A, and 485- corresponds to B.

The communication baud rate (P16.01) indicates the number of bits sent in a second, and the unit is bit/s (bps). A higher baud rate indicates faster transmission and poorer anti-interference capability. When a twisted pair of 0.56mm (24 AWG) is used, the maximum transmission distance varies according to the baud rate, as described in the following table.

Baud rate	Max. transmission distance	Baud rate	Max. transmission distance
2400bps	1800m	9600bps	800m
4800bps	1200m	19200bps	600m

In long-distance RS485 communication, it is recommended that you use shielded cables, and use the shielding layer as the ground wire.

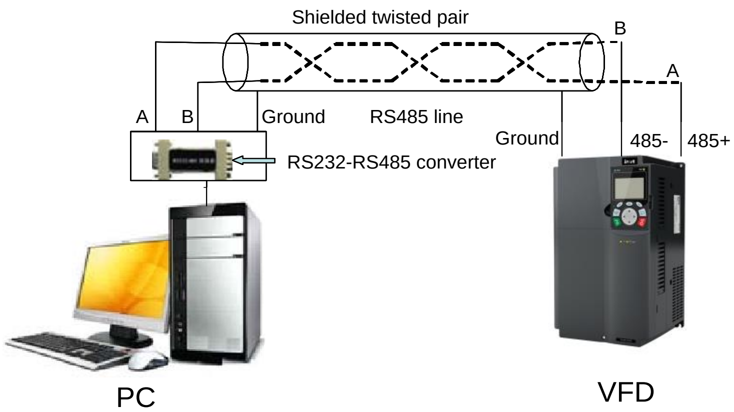
When there are fewer devices and the transmission distance is short, the whole network works well without terminal load resistors. The performance, however, degrades as the distance increases. Therefore, it is recommended that you use a 120 Ω terminal resistor when the transmission distance is long.

10.2.1.1 Application to one VFD

Figure 10-1 Modbus on-site wiring diagram for the network with one VFD and PC. Generally, PCs do not provide RS485 interfaces, so you need to convert an RS232 or USB interface of a PC to an RS485 interface through an adapter. Connect end A of the RS485 interface to the 485+ port on the terminal block of the VFD, and connect end B to the 485- port. It is recommended that you use shielded twisted pairs. When an RS232-RS485 converter is used, the cable used to connect the RS232 interface of the PC and the converter cannot be longer than 15 m. Use a short cable when possible. It is recommended that you insert the converter directly into the PC. Similarly, when a USB-RS485 converter is used, use a short cable when possible.

After wiring, select the correct port (such as COM1 to connect the RS232-RS485 converter) on the upper computer, and set the basic parameters such as baud rate and data bit check consistent with those of the VFD.

Figure 10-1 Wiring of one RS485 VFD application



10.2.1.2 Application to multiple VFDs

In practical application to multiple VFDs, chrysanthemum connection and star connection are commonly used.

According to the requirements of the RS485 industrial bus standards, all the devices need to be connected in chrysanthemum mode with one 120 Ω terminal resistor on each end, as shown in Figure 10-2. Figure 10-3 is simplified connection diagram, and Figure 10-4 is the practical application diagram.

Figure 10-2 Onsite chrysanthemum connection diagram

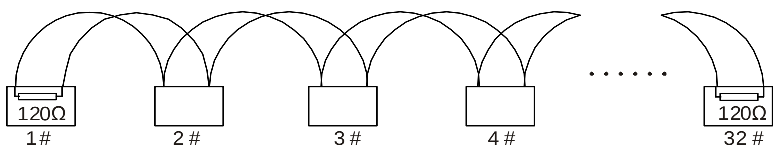


Figure 10-3 Simplified chrysanthemum connection diagram

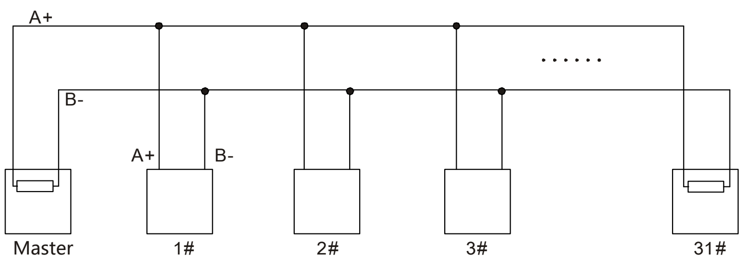


Figure 10-4 Practical application diagram of chrysanthemum connection

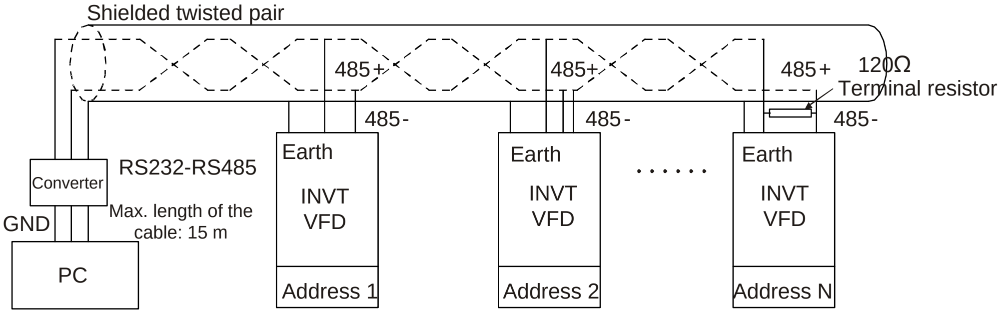
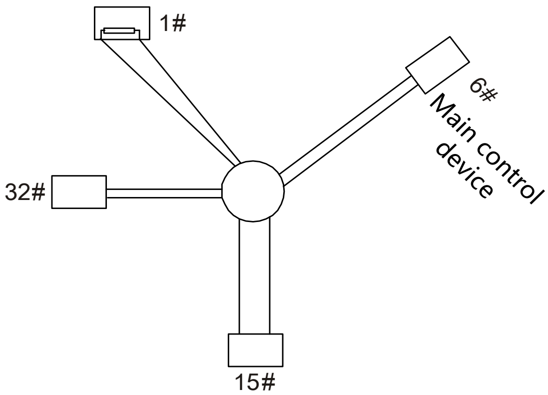


Figure 10-5 shows the star connection diagram. When this connection mode is adopted, the two devices that are farthest away from each other on the line must be connected with a terminal resistor (the two devices are devices #1 and #15).

Figure 10-5 Star connection



Use shielded cables, if possible, in multi-device connection. The baud rates, data bit check settings, and other basic parameters of all the devices on the RS485 line must be set consistently, and addresses cannot be repeated.

10.2.2 RTU mode

10.2.2.1 RTU communication frame structure

When a controller is set to use the RTU communication mode on a Modbus network, every byte (8 bits) in the message includes 2 hexadecimal characters (each includes 4 bits). Compared with the ASCII mode, the RTU mode can transmit more data with the same baud rate.

Code system

- 1 start bit.
- 7 or 8 data bits; the minimum valid bit is transmitted first. Each frame domain of 8 bits includes 2 hexadecimal characters (0–9, A–F).
- 1 odd/even check bit; this bit is not provided if no check is needed.
- 1 stop bit (with check performed), 2 bits (without check).

Error detection domain

- Cyclic redundancy check (CRC)

The following table describes the data format.

11-bit character frame (Bits 1 to 8 are data bits)

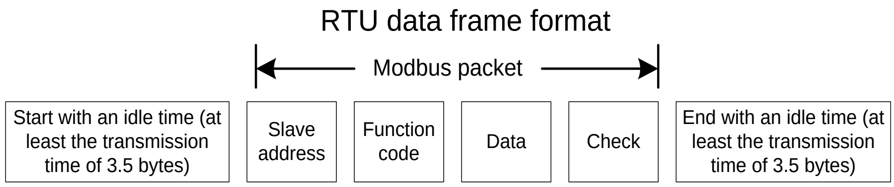
Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	Check bit	Stop bit

10-bit character frame (Bits 1 to 7 are data bits)

Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Check bit	Stop bit

In a character frame, only the data bits carry information. The start bit, check bit, and stop bit are used to facilitate the transmission of the data bits to the destination device. In practical applications, you must set the data bits, parity check bits, and stop bits consistently.

In RTU mode, the transmission of a new frame always starts from an idle time (the transmission time of 3.5 bytes). On a network where the transmission rate is calculated based on the baud rate, the transmission time of 3.5 bytes can be easily obtained. After the idle time ends, the data domains are transmitted in the following sequence: slave address, operation command code, data, and CRC check character. Each byte transmitted in each domain includes 2 hexadecimal characters (0–9, A–F). The network devices always monitor the communication bus. After receiving the first domain (address information), each network device identifies the byte. After the last byte is transmitted, a similar transmission interval (the transmission time of 3.5 bytes) is used to indicate that the transmission of the frame ends. Then, the transmission of a new frame starts.



The information of a frame must be transmitted in a continuous data flow. If there is an interval greater than the transmission time of 1.5 bytes before the transmission of the entire frame is complete, the receiving device deletes the incomplete information, and mistakes the subsequent byte for the address domain of a new frame. Similarly, if the transmission interval between two frames is shorter than the transmission time of 3.5 bytes, the receiving device mistakes it for the data of the last frame. The CRC check value is incorrect due to the disorder of the frames, and thus a communication fault occurs.

Standard structure of an RTU frame:

START (frame header)	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR (slave address domain)	Communication address: 0–247 (decimal system) (0 is the broadcast address)
CMD (function domain)	03H: read slave parameters 06H: write slave parameters
Data domain DATA (N-1) ... DATA (0)	Data of 2×N bytes, main content of the communication as well as the core of data exchanging.
CRC CHK LSB	Detection value: CRC (16 bits)
CRC CHK MSB	
END (frame tail)	T1-T2-T3-T4 (time gap with a min. length of 3.5 bytes)

10.2.2.2 RTU communication frame error check modes

During the transmission of data, errors may occur due to various factors. Without check, the data receiving device cannot identify data errors and may make an incorrect response. The incorrect response may cause severe problems. Therefore, the data must be checked.

The check is implemented as follows: The transmitter calculates the to-be-transmitted data based on a specific algorithm to obtain a result, adds the result to the rear of the message, and transmits them together. After receiving the message, the receiver calculates the data based on the same algorithm to obtain a result, and compares the result with that transmitted by the transmitter. If the results are the same, the message is correct. Otherwise, the message is considered incorrect.

The error check of a frame includes two parts, namely, bit check on individual bytes (that is, odd/even check using the check bit in the character frame), and whole data check (CRC check).

Bit check on individual bytes (odd/even check)

You can select the bit check mode as required, or you can choose not to perform the check, which will affect the check bit setting of each byte.

Definition of even check: Before the data is transmitted, an even check bit is added to indicate whether the number of "1" in the to-be-transmitted data is odd or even. If it is even, the check bit is set to "0"; and if it is odd, the check bit is set to "1".

Definition of odd check: Before the data is transmitted, an odd check bit is added to indicate whether the number of "1" in the to-be-transmitted data is odd or even. If it is odd, the check bit is set to "0"; and if it is even, the check bit is set to "1".

For example, the data bits to be sent are "11001110", including five "1". If the even check is applied, the even check bit is set to "1"; and if the odd check is applied, the odd check bit is set to "0". During the transmission of the data, the odd/even check bit is calculated and placed in the check bit of the frame. The receiving device performs the odd/even check after receiving the data. If it finds that the odd/even parity of the data is inconsistent with the preset information, it determines that a communication error occurs.

CRC check mode

A frame in the RTU format includes an error detection domain based on the CRC calculation. The CRC domain checks all the content of the frame. The CRC domain consists of two bytes, including 16 binary bits. It is calculated by the transmitter and added to the frame. The receiver calculates the CRC of the received frame, and compares the result with the value in the received CRC domain. If the two CRC values are not equal to each other, errors occur in the transmission.

During CRC, 0xFFFF is stored first, and then a process is invoked to process a minimum of 6 contiguous bytes in the frame based on the content in the current register. CRC is valid only for the 8-bit data in each character. It is invalid for the start, end, and check bits.

During the generation of the CRC values, the "exclusive or" (XOR) operation is performed on the each 8-bit character and the content in the register. The result is placed in the bits from the least significant bit (LSB) to the most significant bit (MSB), and 0 is placed in the MSB. Then, LSB is detected. If LSB is 1, the XOR operation is performed on the current value in the register and the preset value. If LSB is 0, no operation is performed. This process is repeated for 8 times. After the last bit (8th bit) is detected and processed, the XOR operation is performed on the next 8-bit byte and the current content in the register. The final values in the register are the CRC values obtained after operations are performed on all the bytes in the frame.

The calculation adopts the international standard CRC check rule. You can refer to the related standard CRC algorithm to compile the CRC calculation program as required.

The following example is a simple CRC calculation function for your reference (using the C programming language):

```
unsigned int crc_cal_value(unsigned char*data_value,unsigned char data_length)
{
   int i;
   unsigned int crc_value=0xffff;
   while(data_length--)
```

```
    {
        crc_value^=*data_value++;
        for(i=0;i<8;i++)
        {
            if(crc_value&0x0001)
                crc_value=(crc_value>>1)^0xa001;
            else
                crc_value=crc_value>>1;
        }
    }
    return(crc_value);
}
```

In the ladder logic, CKSM uses the table look-up method to calculate the CRC value according to the content in the frame. The program of this method is simple, and the calculation is fast, but the ROM space occupied is large. Use this program with caution in scenarios where there are space occupation requirements on programs.

10.3 RTU command code and communication data

10.3.1 Command code 03H, reading N words (continuously up to 16 words)

The command code 03H is used by the master to read data from the VFD. The count of data to be read depends on the "data count" in the command. A maximum of 16 pieces of data can be read. The addresses of the read parameters must be contiguous. Each piece of data occupies 2 bytes, that is, one word. The command format is presented using the hexadecimal system (a number followed by "H" indicates a hexadecimal value). One hexadecimal value occupies one byte.

The 03H command is used to read information including the parameters and running status of the VFD.

For example, to read two contiguous data content pieces from 0004H from the VFD with the address of 01H (that is, to read content from data addresses 0004H and 0005H), the frame structure is as follows:

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR (address)	01H
CMD (command code)	03H
Start address MSB	00H
Start address LSB	04H
Data count MSB	00H
Data count LSB	02H
CRC LSB	85H
CRC MSB	CAH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The value in START and END is "T1-T2-T3-T4 (transmission time of 3.5 bytes)", indicating that the RS485 needs to stay idle for at least the transmission time of 3.5 bytes. An idle time is required to distinguish on message from another to ensure that the two messages are not regarded as one.

ADDR=01H means the command message is sent to the VFD with the address of 01H and ADDR occupies one byte.

CMD=03H means the command message is sent to read data from the VFD and CMD occupies one byte.

"Start address" means reading data from the address and it occupies two bytes with the MSB on the left and LSB on the right.

"Data count" indicates the count of data to be read (unit: word). "Start address" is "0004H" and "Data count" is 0002H, indicating that data is to be read from the data addresses of 0004H and 0005H.

CRC check occupies two bytes, with the LSB on the left, and MSB on the right.

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	03H
Number of bytes	04H
MSB of data in 0004H	13H
LSB of data in 0004H	88H
MSB of data in 0005H	00H
LSB of data in 0005H	00H
CRC LSB	7EH
CRC MSB	9DH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

The definition of the response information is described as follows:

"ADDR" is "01H", indicating that the message is sent by the VFD whose address is 01H. The ADDR information occupies one byte.

"CMD" is "03H", indicating that the message is a response of the VFD to the 03H command of the master for reading data. The CMD information occupies one byte.

"Number of bytes" indicates the number of bytes between a byte (not included) and the CRC byte (not included). The value "04" indicates that there are four bytes of data between "Number of bytes" and "CRC LSB", that is, "MSB of data in 0004H", "LSB of data in 0004H", "MSB of data in 0005H", and "LSB of data in 0005H".

A piece of data contains two bytes, with the MSB on the left and LSB on the right. From the response, the data in 0004H is 1388H, and that in 0005H is 0000H.

CRC check occupies two bytes, with the LSB on the left, and MSB on the right.

10.3.2 Command code 06H, writing a word

This command is used by the master to write data to the VFD. One command can be used to write only one piece of data. It is used to modify the parameters and running mode of the VFD.

For example, if the master writes 5000 (1388H) to 0004H of the VFD whose address is 02H, the frame structure is as follows.

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of to-be-written data	13H
LSB of to-be-written data	88H
CRC LSB	C5H

CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	02H
CMD	06H
MSB of data writing address	00H
LSB of data writing address	04H
MSB of to-be-written data	13H
LSB of to-be-written data	88H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

Note: The sections 10.3.1 and 10.3.2 mainly describe the command formats. For the detailed application, see the examples in section 10.4.5.

10.3.3 Command code 08H, diagnosis

Sub-function code description:

Sub-function code	Description
0000	Returned data based on query information

For example, to query about the circuit detection information about the VFD whose address is 01H, the query and return strings are the same, and the format is described as follows.

RTU master command:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code MSB	00H
Sub-function code LSB	00H
MSB of to-be-written data	12H
LSB of to-be-written data	ABH
CRC CHK LSB	ADH
CRC CHK MSB	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

RTU slave response:

START	T1-T2-T3-T4 (transmission time of 3.5 bytes)
ADDR	01H
CMD	08H
Sub-function code MSB	00H
Sub-function code LSB	00H
MSB of to-be-written data	12H
LSB of to-be-written data	ABH
CRC CHK LSB	ADH
CRC CHK MSB	14H
END	T1-T2-T3-T4 (transmission time of 3.5 bytes)

10.4 Data address definition

This section describes the address definition of communication data. The addresses are used for controlling the running, obtaining the state information, and setting related function parameters of the VFD.

10.4.1 Function code address format rules

The address of a function code consists of two bytes, with the high-order byte on the left and low-order byte on the right. The function code serial number is used as the register address corresponding to the parameter, which needs to be converted into a hexadecimal number. Take P05.06 as an example: The group number is 05, and the number behind the dot mark is 06, that is, the parameter address is 506. Therefore, the function code address is 01FAH in the hexadecimal form. For P10.01, the parameter address is 03E9H.

Function code	Name	Description	Setting range	Default	Modify
P10.01	Local preset PID reference	0: Function code (P10.01) 1: AI1 2: AI2 3: AI3 4: AI1+ AI2 5: AI2+ AI3 6: AI3+ AI1 7: Reserved 8: Multi-step running 9: Modbus 10: PROFIBUS/PROFINET	0.0–10.0	0.0	○

Note:

- The parameters in the P29 group are set by the manufacturer and cannot be read or modified. Some parameters cannot be modified when the VFD is running; some cannot be modified regardless of the VFD status. Pay attention to the setting range, unit, and description of a parameter when modifying it.
- The service life of the Electrically Erasable Programmable Read-Only Memory (EEPROM) may be reduced if it is frequently used for storage. Some function codes do not need to be stored during communication. The application requirements can be met by modifying the value of the on-chip RAM, that is, modifying the MSB of the corresponding function code address from 0 to 1. For example, if P00.07 is not to be stored in the EEPROM, you need only to modify the value in the RAM, that is, set the address to 8007H. The address can be used only for writing data to the on-chip RAM, and it is invalid when used for reading data.

10.4.2 Addresses of other Modbus functions

In addition to modifying the parameters of the VFD, the master can also control the VFD, such as starting and stopping the VFD, and monitoring the running status of the VFD. The following table lists other function parameters.

Address	Function	Data description	R/W
1000H	VFD status	0001H: Forward running 0002H: Reverse running 0003H: Stopped 0004H: Faulty 0005H: POFF state For UDP/IP protocols, these information are	R

Address	Function	Data description	R/W
		given in the handshake information. For the UDP/IP protocols of the non-master node, or other protocols, it is necessary to query the address.	
1001H	Motor 1 state	Bit0–bit1, logic state of the motor 0: Power-off state 1: Variable-frequency state 2: Power-frequency state Bit2–bit8, results related to the VFD switching cabinet 1 Bit2: QS1 state Bit3: QS2 state Bit4: QS3 state Bit5: KM1 state Bit6: KM3 state Bit7: KM4 state Bit8: KM5 state Bit9–bit14: Reserved Bit15: Control state of the switching cabinet 1 0: Remote 1: Local	R
1002H	Motor 2 state	Bit0–bit1, logic state of the motor 0: Power-off state 1: Variable-frequency state 2: Power-frequency state Bit2–bit8, results related to the VFD switching cabinet 2 Bit2: QS1 state Bit3: QS2 state Bit4: QS3 state Bit5: KM1 state Bit6: KM3 state Bit7: KM4 state Bit8: KM5 state Bit9–bit14: Reserved Bit15: Control state of the switching cabinet 2 0: Remote 1: Local	R
1003H	Motor 3 state	Bit0–bit1, logic state of the motor 0: Power-off state 1: Variable-frequency state 2: Power-frequency state Bit2–bit8, results related to the VFD switching cabinet 3 Bit2: QS1 state Bit3: QS2 state Bit4: QS3 state Bit5: KM1 state	R

Address	Function	Data description	R/W
		Bit6: KM3 state Bit7: KM4 state Bit8: KM5 state Bit9–bit14: Reserved Bit15: Control state of the switching cabinet 3 0: Remote 1: Local	
1004H	Motor 4 state	Bit0–bit1, logic state of the motor 0: Power-off state 1: Variable-frequency state 2: Power-frequency state Bit2–bit8, results related to the VFD switching cabinet 4 Bit2: QS1 state Bit3: QS2 state Bit4: QS3 state Bit5: KM1 state Bit6: KM3 state Bit7: KM4 state Bit8: KM5 state Bit9–bit14: Reserved Bit15: Control state of the switching cabinet 4 0: Remote 1: Local	R
1005H	Motor 5 state	Bit0–bit1, logic state of the motor 0: Power-off state 1: Variable-frequency state 2: Power-frequency state Bit2–bit8, results related to the VFD switching cabinet 5 Bit2: QS1 state Bit3: QS2 state Bit4: QS3 state Bit5: KM1 state Bit6: KM3 state Bit7: KM4 state Bit8: KM5 state Bit9–bit14: Reserved Bit15: Control state of the switching cabinet 5 0: Remote 1: Local	R
1006H	Device code	200	R
1007H	VFD control state	0: Local state 1: Remote state	R
1008H	VFD ready state	0: Invalid 1: Ready to run 2: Power-on fault state 3: Power off	R

Address	Function	Data description	R/W
		4: Power-off fault state	
1009H	Unit bypass state	0: Without bypass unit 1: With bypass unit	R
100AH	U-phase bypass unit	Each bit indicates the unit number of the bypass. There are two types of bypasses: symmetrical bypass and asymmetrical bypass.	R
100BH	V-phase bypass unit		R
100CH	W-phase bypass unit		R
100DH	U-phase bypass fault	Indicates the fault of the current bypass unit, similar to the unit fault format, with each bit indicating a fault.	R
100EH	V-phase bypass fault		R
100FH	W-phase bypass fault		R
1010H	A1 unit version	See the formats of unit versions.	R
1011H	A2 unit version	See the formats of unit versions.	R
1012H	A3 unit version	See the formats of unit versions.	R
1013H	A4 unit version	See the formats of unit versions.	R
1014H	A5 unit version	See the formats of unit versions.	R
1015H	A6 unit version	See the formats of unit versions.	R
1016H	A7 unit version	See the formats of unit versions.	R
1017H	A8 unit version	See the formats of unit versions.	R
1018H	A9 unit version	See the formats of unit versions.	R
1019H	A10 unit version	See the formats of unit versions.	R
101AH	A11 unit version	See the formats of unit versions.	R
101BH	A12 unit version	See the formats of unit versions.	R
101CH	B1 unit version	See the formats of unit versions.	R
101DH	B2 unit version	See the formats of unit versions.	R
101EH	B3 unit version	See the formats of unit versions.	R
101FH	B4 unit version	See the formats of unit versions.	R
1020H	B5 unit version	See the formats of unit versions.	R
1021H	B6 unit version	See the formats of unit versions.	R
1022H	B7 unit version	See the formats of unit versions.	R
1023H	B8 unit version	See the formats of unit versions.	R
1024H	B9 unit version	See the formats of unit versions.	R
1025H	B10 unit version	See the formats of unit versions.	R
1026H	B11 unit version	See the formats of unit versions.	R
1027H	B12 unit version	See the formats of unit versions.	R
1028H	C1 unit version	See the formats of unit versions.	R
1029H	C2 unit version	See the formats of unit versions.	R
102AH	C3 unit version	See the formats of unit versions.	R
102BH	C4 unit version	See the formats of unit versions.	R
102CH	C5 unit version	See the formats of unit versions.	R
102DH	C6 unit version	See the formats of unit versions.	R
1102EH	C7 unit version	See the formats of unit versions.	R
102FH	C8 unit version	See the formats of unit versions.	R
1030H	C9 unit version	See the formats of unit versions.	R
1031H	C10 unit version	See the formats of unit versions.	R
1032H	C11 unit version	See the formats of unit versions.	R
1033H	C12 unit version	See the formats of unit versions.	R
1034H–	High-order bit of A1–	0000H–FFFFH	R

Address	Function	Data description	R/W
103FH	A12 unit faults		
1040H	A1 unit temperature	0.0–100.0°c	R
1041H	A2 unit temperature	0.0–100.0°c	R
1042H	A3 unit temperature	0.0–100.0°c	R
1043H	A4 unit temperature	0.0–100.0°c	R
1044H	A5 unit temperature	0.0–100.0°c	R
1045H	A6 unit temperature	0.0–100.0°c	R
1046H	A7 unit temperature	0.0–100.0°c	R
1047H	A8 unit temperature	0.0–100.0°c	R
1048H	A9 unit temperature	0.0–100.0°c	R
1049H	A10 unit temperature	0.0–100.0°c	R
104AH	A11 unit temperature	0.0–100.0°c	R
104BH	A12 unit temperature	0.0–100.0°c	R
104CH	B1 unit temperature	0.0–100.0°c	R
104DH	B2 unit temperature	0.0–100.0°c	R
104EH	B3 unit temperature	0.0–100.0°c	R
104FH	B4 unit temperature	0.0–100.0°c	R
1050H	B5 unit temperature	0.0–100.0°c	R
1051H	B6 unit temperature	0.0–100.0°c	R
1052H	B7 unit temperature	0.0–100.0°c	R
1053H	B8 unit temperature	0.0–100.0°c	R
1054H	B9 unit temperature	0.0–100.0°c	R
1055H	B10 unit temperature	0.0–100.0°c	R
1056H	B11 unit temperature	0.0–100.0°c	R
1057H	B12 unit temperature	0.0–100.0°c	R
1058H	C1 unit temperature	0.0–100.0°c	R
1059H	C2 unit temperature	0.0–100.0°c	R
105AH	C3 unit temperature	0.0–100.0°c	R
105BH	C4 unit temperature	0.0–100.0°c	R
105CH	C5 unit temperature	0.0–100.0°c	R
105DH	C6 unit temperature	0.0–100.0°c	R
105EH	C7 unit temperature	0.0–100.0°c	R
105FH	C8 unit temperature	0.0–100.0°c	R
1060H	C9 unit temperature	0.0–100.0°c	R
1061H	C10 unit temperature	0.0–100.0°c	R
1062H	C11 unit temperature	0.0–100.0°c	R
1063H	C12 unit temperature	0.0–100.0°c	R
1064H–106FH	High-order bit of B1–B12 unit faults	0000H–FFFFH	R
1070H	A1 unit bus	0–1400V	R
1071H	A2 unit bus	0–1400V	R
1072H	A3 unit bus	0–1400V	R
1073H	A4 unit bus	0–1400V	R
1074H	A5 unit bus	0–1400V	R
1075H	A6 unit bus	0–1400V	R
1076H	A7 unit bus	0–1400V	R
1077H	A8 unit bus	0–1400V	R

Address	Function	Data description	R/W
1078H	A9 unit bus	0–1400V	R
1079H	A10 unit bus	0–1400V	R
107AH	A11 unit bus	0–1400V	R
107BH	A12 unit bus	0–1400V	R
107CH	B1 unit bus	0–1400V	R
107DH	B2 unit bus	0–1400V	R
107EH	B3 unit bus	0–1400V	R
107FH	B4 unit bus	0–1400V	R
1080H	B5 unit bus	0–1400V	R
1081H	B6 unit bus	0–1400V	R
1082H	B7 unit bus	0–1400V	R
1083H	B8 unit bus	0–1400V	R
1084H	B9 unit bus	0–1400V	R
1085H	B10 unit bus	0–1400V	R
1086H	B11 unit bus	0–1400V	R
1087H	B12 unit bus	0–1400V	R
1088H	C1 unit bus	0–1400V	R
1089H	C2 unit bus	0–1400V	R
108AH	C3 unit bus	0–1400V	R
108BH	C4 unit bus	0–1400V	R
108CH	C5 unit bus	0–1400V	R
108DH	C6 unit bus	0–1400V	R
108EH	C7 unit bus	0–1400V	R
108FH	C8 unit bus	0–1400V	R
1090H	C9 unit bus	0–1400V	R
1091H	C10 unit bus	0–1400V	R
1092H	C11 unit bus	0–1400V	R
1093H	C12 unit bus	0–1400V	R
1094H–109FH	High-order bit of C1–C12 unit faults	0000H–FFFFH	R
10A0H	Low-order bit of A1 unit fault	0000H–FFFFH	R
10A1H	Low-order bit of A2 unit fault	0000H–FFFFH	R
10A2H	Low-order bit of A3 unit fault	0000H–FFFFH	R
10A3H	Low-order bit of A4 unit fault	0000H–FFFFH	R
10A4H	Low-order bit of A5 unit fault	0000H–FFFFH	R
10A5H	Low-order bit of A6 unit fault	0000H–FFFFH	R
10A6H	Low-order bit of A7 unit fault	0000H–FFFFH	R
10A7H	Low-order bit of A8 unit fault	0000H–FFFFH	R
10A8H	Low-order bit of A9	0000H–FFFFH	R

Address	Function	Data description	R/W
	unit fault		
10A9H	Low-order bit of A10 unit fault	0000H–FFFFH	R
10AAH	Low-order bit of A11 unit fault	0000H–FFFFH	R
10ABH	Low-order bit of A12 unit fault	0000H–FFFFH	R
10ACH	Low-order bit of B1 unit fault	0000H–FFFFH	R
10ADH	Low-order bit of B2 unit fault	0000H–FFFFH	R
10AEH	Low-order bit of B3 unit fault	0000H–FFFFH	R
10AFH	Low-order bit of B4 unit fault	0000H–FFFFH	R
10B0H	Low-order bit of B5 unit fault	0000H–FFFFH	R
10B1H	Low-order bit of B6 unit fault	0000H–FFFFH	R
10B2H	Low-order bit of B7 unit fault	0000H–FFFFH	R
10B3H	Low-order bit of B8 unit fault	0000H–FFFFH	R
10B4H	Low-order bit of B9 unit fault	0000H–FFFFH	R
10B5H	Low-order bit of B10 unit fault	0000H–FFFFH	R
10B6H	Low-order bit of B11 unit fault	0000H–FFFFH	R
10B7H	Low-order bit of B12 unit fault	0000H–FFFFH	R
10B8H	Low-order bit of C1 unit fault	0000H–FFFFH	R
10B9H	Low-order bit of C2 unit fault	0000H–FFFFH	R
10BAH	Low-order bit of C3 unit fault	0000H–FFFFH	R
10BBH	Low-order bit of C4 unit fault	0000H–FFFFH	R
10BCH	Low-order bit of C5 unit fault	0000H–FFFFH	R
10BDH	Low-order bit of C6 unit fault	0000H–FFFFH	R
10BEH	Low-order bit of C7 unit fault	0000H–FFFFH	R
10BFH	Low-order bit of C8 unit fault	0000H–FFFFH	R

Address	Function	Data description	R/W
10C0H	Low-order bit of C9 unit fault	0000H–FFFFH	R
10C1H	Low-order bit of C10 unit fault	0000H–FFFFH	R
10C2H	Low-order bit of C11 unit fault	0000H–FFFFH	R
10C3H	Low-order bit of C12 unit fault	0000H–FFFFH	R
10C4H	A-phase unit fault	-	R
10C5H	B-phase unit fault	-	R
10C6H	C-phase unit fault	-	R
10C7H–10CFH	Reserved	Reserved	R
10D0H	Actual step of multi-step speed	0–15	R
10D1H	Present ACC/DEC time group	1–5	R
10D2H	Valid unit count	0–12, same as P07.06	R
10D3H	Present DSP1 fault	See group P09: Fault record parameters	R
10D4H	Present DSP2 fault	See group P09: Fault record parameters	R
10D5H	Present ARM fault type 1	See group P09: Fault record parameters	R
10D6H	Present ARM fault type 2	See group P09: Fault record parameters	R
10D7H	Present unit fault 1	See group P09: Fault record parameters	R
10D8H	Present unit fault 2	See group P09: Fault record parameters	R
10D9H	Unit number at present fault	-	R
10DAH	ACC/DEC state at present fault	-	R
10DBH	Running frequency at present fault	-	R
10DCH	Set frequency at present fault	-	R
10DDH	Output current at present fault	-	R
10DEH	Output current at present fault	-	R
10DFH	Input current at present fault	-	R
10E0H	Input voltage at present fault	-	R
10E1H	Unit bus voltage at present fault	-	R
10E2H	Unit temperature at present fault	-	R
10E3H	System input terminal	-	R

Address	Function	Data description	R/W
	state at present fault		
10E4H	User input terminal state at present fault	-	R
10E5H	System output terminal state at present fault	-	R
10E6H	User output terminal state 1 at present fault	-	R
10E7H	User output terminal state 2 at present fault	-	R
10E8H	Present fault time	-	R
10E9H	Present control command channel	P00.01	-
10EAH	Alarm output flag	-	-
10EBH	System/DSP/ARM alarm code	0: System alarm 1–36: Unit alarm 98: DSP alarm 99: ARM alarm	-
10ECH	High-order bit of alarm code	-	R
10EDH	Low-order bit of alarm code	-	R
10EEH	Parameter autotuning auxiliary bit	Used as the parameter autotuning auxiliary state of the upper computer display.	R
10EFH	Commissioning auxiliary bit	Commissioning state flag	R
10F0H	Switch action faults of the switching cabinets 1–2	8 low-order bits correspond to switch action faults of the switching cabinet 1 8 high-order bits correspond to switch action faults of the switching cabinet 2 Bit0: KM1 Bit1: KM2 Bit2: KM3 Bit3: KM4 Bit4: QS1 Bit5: QS2 Bit6: QS3 Bit7: Reserved Bit8: KM1 Bit9: KM2 Bit10: KM3 Bit11: KM4 Bit12: QS1 Bit13: QS2 Bit14: QS3 Bit15: Reserved	R
10F1H	Switch action faults of the switching cabinets	Same as the above	R

Address	Function	Data description	R/W
	2–3		
10F2H–10FFH	Reserved	-	R
1100H–11FFH	Property of each display value (bits by bits)	Bit0–bit2: Multiplication rate It indicates the number behind the dot mark. 0=6: Two decimal places. Bit3: Reserved It indicates restoring factory values is allowed to override the characteristics. Bit4: Sign characteristics 1= signed 0= unsigned Bit5–bit6: Write level 0 = Can be changed at any time 1 = Cannot be changed in running 2 = Cannot be changed Bit7: Read level 0= readable 1= unreadable Bit8–bit10: Max. and Min value type 0 = The whole byte is used as a criterion (common) 1 = 8bit a group, as a criterion 2 = 4bit a group, as a criterion 3 = 2bit a group, as a criterion 4 = 1bit a group, as a criterion 5 = Cannot be repeated Bit11–bit15: Enumeration of the units 0= no unit 1 = hexadecimal (XXXXH) 2 = Enumeration type 3 =Pulse frequency (Hz) 4 = High-speed frequency (kHz) 5 = Frequency change rate (Hz/s) 6 = rpm 7 = Millisecond (ms) 8 = Second (s) 9 = Minute (m) 10 = Hour (h) 11 = Baud rate (bps) 12 = Percentage (%) 13 = Voltage (V) 14 = Current (A) 15 = Resistance (Ω) 16 = Inductance (mH) 17 = Power (kW) 18 = PU (this is a per-unit value, and the unit is the associated data) 19 = ℃	R

Address	Function	Data description	R/W
		20 = * (asterisk) 21 =μs 22 = KVA 23 = kWh 24 = MPa 25 =μm 26 = angle 27 = mm	
2000H	Communication-based control command	0001H: Run forward 0002H: Run reversely 0003H: Jog forward 0004H: Jog reversely 0005H: Stop 0006H: Coast to stop (in emergency) 0007H: Fault reset 0008H: Stop jogging	W
2001H		8 high-order bits indicate the switching cabinets that require power frequency and variable frequency switching 00H: Main switching cabinet 1 01H: Switching cabinet 2 02H: Switching cabinet 3 03H: Switching cabinet 4 04H: Main switching cabinet 5 05H: Switching cabinet 6 06H: Switching cabinet 7 07H: Switching cabinet 8 8 low-order bits indicate the commands. 00H: No action 01H: Variable frequency 1 02H: Power frequency 03H: Switch from variable frequency to power frequency 04H: Switch from power frequency to variable frequency 1 05H: Cut of medium voltage 06H: Variable frequency 2 07H: Switch from power frequency to variable frequency 2 Variable frequency 1: If there are other variable-frequency motors before, the original variable-frequency motor runs at power frequency after the switching cabinet is switched to variable frequency. Variable frequency 2: If there are other variable-frequency motors before, the original variable-frequency motor stops after the switching cabinet is switched to variable	W

Address	Function	Data description	R/W
		frequency. Switch from power frequency to variable frequency 1: If there are other variable-frequency motors before, the original variable-frequency motor runs at power frequency after the switching cabinet is switched to variable frequency. Variable frequency 2: If there are other variable-frequency motors before, the original variable-frequency motor stops after the switching cabinet is switched to variable frequency.	
2004H		Read the fault records saved in the fault black box.	
2200H		-Fmax–Fmax, Hz, 2 decimal places after the decimal point	W
2005H		8 high-order bits indicate the switching cabinets that require power frequency and variable frequency switching 00H: Main switching cabinet 1 01H: Switching cabinet 2 02H: Switching cabinet 3 03H: Switching cabinet 4 04H: Main switching cabinet 5 05H: Switching cabinet 6 06H: Switching cabinet 7 07H: Switching cabinet 8 8 low-order bits indicate the commands. 00H: Allow variable frequency 01H: Allow power frequency 02H: Allow power frequency and variable frequency	2005H
2201H		It can be PID reference or PID feedback according to the configuration. 0–1000, 1000 corresponds to 100.0%	W
2202H		Configure the sampling frequency of the oscilloscope. 0: 2K, 0.5ms once 1: 1K, 1ms once 2: 0.5K, 2ms once 3: 0.25K, 4ms once 4: 0.125K, 8ms once After the sampling times of ARM reaches 64, all channels are uploaded uniformly	W
2203H		-100.0%–100.0%	W
2204H		0.0%–100.0%	W
4000H	Reference frequency	0.00–120.00Hz (Actual value)	R
4001H	Running frequency	0.00–120.00Hz (Actual value)	R

Address	Function	Data description	R/W
4002H	Torque	0–100.0%	R
4003H	Output voltage	0–20000V (No decimal place)	R
4004H	Input voltage	0–20000V (No decimal place)	R
4005H	Output current	0.0–1000.0	R
4006H	Input current	0.0–1000.0	R
4007H	Output power	Percentage, one decimal place, signed	R
4008H	Input power	Percentage, one decimal place, unsigned	R
4009H	Output power factor	Percentage, one decimal place, unsigned	R
400AH	Input power factor	Percentage, one decimal place, unsigned	R
400BH	Input current active component	Percentage, (4096 per unit, P02.05)	R
400CH	Input current reactive components	Percentage, (4096 per unit, P02.05)	R
400DH	Output current active component	Percentage, (4096 per unit, P02.05)	R
400EH	Output current reactive component	Percentage, (4096 per unit, P02.05)	R
400FH	Input voltage L1L2 waveform	Actual value, (1.875 times the rated peak voltage corresponds to 2048, P02.04)	R
4010H	Input voltage L2L3 waveform	Actual value, (1.875 times the rated peak voltage corresponds to 2048, P02.04)	R
4011H	Input voltage L3L1 waveform	Actual value, (1.875 times the rated peak voltage corresponds to 2048, P02.04)	R
4012H	Input current L1 waveform	Actual*10 value, (twice the rated peak current corresponds to 2048, P02.05)	R
4013H	Input current L2 waveform	Actual*10 value, (twice the rated peak current corresponds to 2048, P02.05)	R
4014H	Input current L3 waveform	Actual*10 value, (twice the rated peak current corresponds to 2048, P02.05)	R
4015H	Output voltage UV waveform	Actual value, (1.875 times the rated peak voltage corresponds to 2048, P02.04)	R
4016H	Output voltage VW waveform	Actual value, (1.875 times the rated peak voltage corresponds to 2048, P02.04)	R
4017H	Output voltage WU waveform	Actual value, (1.875 times the rated peak voltage corresponds to 2048, P02.04)	R
4018H	Output U-phase current waveform	Actual*10 value, (twice the rated peak current corresponds to 32767, P02.05)	R
4019H	Output V-phase current waveform	Actual*10 value, (twice the rated peak current corresponds to 32767, P02.05)	R
401AH	Output W-phase current waveform	Actual*10 value, (twice the rated peak current corresponds to 32767, P02.05)	R
401BH	U-phase modulating waveform	Waveform, no unit	R
401CH	V-phase modulating waveform	Waveform, no unit	R
401DH	W-phase modulating waveform	Waveform, no unit	R

Address	Function	Data description	R/W
401EH	Q-axis angle	0–65536	R
401FH	T-axis angle	0–65536	R
4020H	Output current M-axis component	-32768–32767 (4096 per unit)	R
4021H	Output current T-axis component	-32768–32767 (4096 per unit)	R
4022H	Output voltage phase	0–65536	R
4023H	Output current phase	0–65536	R
4024H	U-phase bus voltage	No decimal place (unit: V)	R
4025H	V-phase bus voltage	No decimal place (unit: V)	R
4026H	W-phase bus voltage	No decimal place (unit: V)	R
4027H	Temperature in VFD cabinet	°C	R
4028H	Phase shifting transformer A1 temperature	°C	R
4029H	Phase shifting transformer B1 temperature	°C	R
402AH	Phase shifting transformer C1 temperature	°C	R
402BH	Phase shifting transformer A2 temperature	°C	R
402CH	Phase shifting transformer B2 temperature	°C	R
402DH	Phase shifting transformer C2 temperature	°C	R
402EH	Bumpless switching flag bit	0–1	R
402FH	Motor temperature 1	°C	R
4030H	Motor temperature 2	°C	R
4031H	Motor temperature 3	°C	R
4032H	Motor temperature 4	°C	R
4033H	Motor temperature 5	°C	R
4034H	Motor vibration 1	0–65536	R
4035H	Motor vibration 2	0–65536	R
4036H	Motor vibration 3	0–65536	R
4037H	Motor vibration 4	0–65536	R
4038H–403FH	Reserved	Reserved	
4040H	User input terminal	Each bit indicates the corresponding terminal state.	R
4041H	User output terminal 1	Each bit on the user I/O board indicates the	R

Address	Function	Data description	R/W
		corresponding terminal state.	
4042H	User output terminal 2	Each bit on the I/O expansion board indicates the corresponding terminal state.	R
4043H	System input terminal	Each bit indicates the corresponding terminal state.	R
4044H	System output terminal	Each bit indicates the corresponding terminal state.	R
4045H	AI1 display	0–100.0%	R
4046H	AI2 display	0–100.0%	R
4047H	AI3 display	0–100.0%	R
4048H	AI4 display	0–100.0%	R
4049H	AO1	0–100.0%	R
404AH	AO2	0–100.0%	R
404BH	AO3	0–100.0%	R
404CH	AO4	0–100.0%	R
404DH	AO5	0–65536	R
404EH	Reserved	0–50.000kHz	R
404FH	PID reference	0–100.0%	R
404FH	PID feedback	0–100.0%	R
4050H	Power consumption per second	-	R
4051H	16 low-order bits of total power consumption	The final result needs to be calculated by the upper computer before display.	R
4052H	16 high-order bits of total power consumption		R
4053H	Reserved	Reserved, used for power saving display	R
4054H	Reserved		
4055H	Operation commands of the touch screen display	00H: No action 01H: Switch from power frequency to variable frequency 2 02H: Switch from power frequency to variable frequency 1 03H: Variable frequency 1 04H: Variable frequency 2 05H: Switch from variable frequency to power frequency 06H: Power frequency 07H: Cut of medium voltage	R
4056H	Operation command: count value	Counting overflow	R
4057H	Operation command: Motor number	Motor number	R
4058H	Operation command: power frequency and variable frequency	1: Local 2: Modbus 3: PROFIBUS	R

Address	Function	Data description	R/W
	commands	4: Terminal 5: Master 6: Terminal 1 7: Terminal 2	
4059H	Feedback state of switching cabinet 0	KM5: 1 KM4: 1 KM3: 1 KM1: 1 QS1: 1 QS2: 1 QS3: 1 Reserved: 9	R
405AH	Feedback state of switching cabinet 1	Same as the above	R
405BH	Feedback state of switching cabinet 2	Same as the above	R
405CH	Feedback state of switching cabinet 3	Same as the above	R
405DH	Feedback variable frequency allowing state of the switching cabinet 1	00H: Allow variable frequency 01H: Allow power frequency 02H: Allow power frequency/variable frequency	R
405EH	Feedback variable frequency allowing state of the switching cabinet 2	Same as the above	R
405FH	Feedback variable frequency allowing state of the switching cabinet 3	Same as the above	R
4060H	Feedback variable frequency allowing state of the switching cabinet 4	Same as the above	R
4061H–4064H	Reserved	-	R
4065H	Modify function code address	-	R
4066H	Modify function code backup value	-	R
4067H	Modify function code modified value	-	R
4068H	Modify function code counting	-	R
4069H	Modify function code channel	-	R
406AH–4074H	Reserved	-	R

Address	Function	Data description	R/W
4075H	Running command	0: Decelerate to stop 1: Forward 2: Reverse 3: Coast to stop 4: Speed tracking	R
4076H	Jog running command	0: Forward jogging 1: Reverse jogging 2: Cancel jogging 3: Jogging and coast to stop	R
4077H	Modify the count value	Start/stop delay counting	R
4078H	Command channel	-	R
4079H	Run/jog flag	1: Run 2: Jogging	R
407AH–407FH	Reserved	-	
4080H–40FFH	Property of each oscilloscope unit (bits by bits)	Same as 3100H–31FFH	R
4100H–417FH	Waveform start/stop of each oscilloscope channel	An address corresponds to an oscilloscope channel. Write the specific channel number to the corresponding address. If 0 is written, it indicates that the variable cannot perform oscillography.	R
4180H–41FFH	Setting range of each oscilloscope channel	An address corresponds to an oscilloscope channel. The setting range of a signed value is –Max–+Max, and the setting range of an unsigned value is 0–Max.	R

The Read/Write (R/W) characteristics indicate whether a function parameter can be read and written. For example, "Communication-based control command" can be written, and therefore the command code 06H is used to control the VFD. The R characteristic indicates that a function parameter can only be read, and W indicates that a function parameter can only be written.

Note: Some parameters in the preceding table are valid only after they are enabled. Take the running and stop operations as examples, you need to set "Running command channel" (P00.01) to "Communication", and set "Communication mode of running commands" (P00.02) to Modbus. For another example, when modifying "PID reference", you need to set "PID reference source" (P10.00) to Modbus communication.

10.4.3 Fieldbus scale

In practical applications, communication data is represented in the hexadecimal form, but hexadecimal values cannot represent decimals. For example, 50.12 Hz cannot be represented in the hexadecimal form. In such cases, multiply 50.12 by 100 to obtain an integer 5012, and then 50.12 can be represented as 1394H in the hexadecimal form (5012 in the decimal form).

In the process of multiplying a non-integer by a multiple to obtain an integer, the multiple is referred to as a fieldbus scale.

The fieldbus scale depends on the number of decimal places in the value specified in "Setting range" or "Default". If there are n (for example, 1) decimal places in the value, the fieldbus scale m (then m=10) is the result of 10 to the power of n. Take the following table as an example.

Function code	Name	Description	Setting range	Default	Modify
P01.28	Wait time for restart after power-off	0.0–3600.0s (valid when P01.17=1)	0.0–3600.0	1.0s	○

If "Setting range" or "Default value" contains one decimal, the fieldbus scale is 10. If the value received by the upper computer is 50, "Wait time for restart after power-off" of the VFD is 5.0 (5.0=50/ 10).

To set "Wait time for restart after power-off" to 5.0s through Modbus communication, you need first to multiply 5.0 by 10 according to the scale to obtain an integer 50, that is, 32H in the hexadecimal form, and then send the following write command:

01	06	00 80	00 32	09 F7
VFD address	Write command	Parameter address	Parameter data	CRC

After receiving the command, the VFD converts 50 into 5.0 based on the fieldbus scale, and then sets "Wake-up-from-sleep delay" to 5.0s.

For another example, after the upper computer sends the "Wait time for restart after power-off" parameter read command, the master receives the following response from the VFD:

01	03	02	00 32	39 91
VFD address	Read command	2-byte data	Parameter data	CRC

The parameter data is 0032H, that is, 50, so 5.0 is obtained based on the fieldbus scale (50/10=5.0). In this case, the master identifies that "Wait time for restart after power-off" is 5.0s.

10.4.4 Error message response

Operation errors may occur in communication-based control. For example, some parameters can only be read, but a write command is sent. In this case, the VFD returns an error message response.

Error message responses are sent from the VFD to the master. The following table lists the codes and definitions of the error message responses.

Modbus exception code		
Code	**Name**	**Definition**
01H	Invalid function	The function code received by the upper computer is not allowed to be executed. The possible causes are as follows: • The function code is applicable only on new devices and is not implemented on this device. • The slave is in faulty state when processing this request.
02H	Invalid data address	For the system, the data address in the request of the upper computer is not allowed. In particular, the combination of the register address and the number of the to-be-sent bytes is invalid.
03H	Invalid data value	The received data domain contains a value that is not allowed. The value indicates the error of the remaining structure in the combined request. **Note:** It does not mean that the data item submitted for storage in the register includes a value unexpected by the program.
06H	The slave device is	The system is busy (EPPROM is saving).

Modbus exception code		
Code	**Name**	**Definition**
	busy	
10H	Password error	The password entered in the password verification address is different from that set in P07.00.
11H	Check error	The data frame sent from the upper computer is incorrect in the length, or in the ASCII format, the value of the LRC check bit is inconsistent with the CRC value calculated by the lower computer.
12H	Parameter modification is invalid	In the parameter write command sent by the upper computer, the data sent is outside the range of the parameter, or the write address is currently in a non-rewritable state, or the written input terminal selection function has been already occupied by other terminals.
13H	The system is locked	If the upper computer does not provide the correct password to unlock the system to perform a read or write operation, the error of "system being locked" is reported.

When returning a response, the slave uses a function code domain and fault address to indicate whether it is a normal response (no error) or exception response (an error occurs). In a normal response, the slave returns the corresponding function code and data address or sub-function code. In an exception response, the slave returns a code that is equal to a normal code, but the first bit is logic 1.

For example, if the master sends a request message to a slave for reading a group of function code address data, the following code is generated:

0 0 0 0 0 0 1 1 (03H in the hexadecimal form)

In a normal response, the slave returns the same function code. In an exception response, the slave returns the following code.

1 0 0 0 0 0 1 1 (83H in the hexadecimal form)

In addition to the modification of the code, the slave returns a byte of exception code that describes the cause of the exception. After receiving the exception response, the typical processing of the master is to send the request message again or modify the command based on the fault information.

For example, to set the "Channel of running commands" (P00.01, the parameter address is 0000H) to 04 for the VFD whose address is 01H, the command is as follows:

01	**06**	**00 01**	**00 04**	**D9 C9**
VFD address	Write command	Parameter address	Parameter data	CRC

However, "Running command channel" ranges from 0 to 3. The value 4 is out of the setting range. In this case, the VFD returns an error message response as shown in the following:

01	**86**	**03**	**02 61**
VFD address	Exception response code	Error code	CRC

The exception response code 86H (generated based on the MSB "1" of the write command 06H) indicates that it is an exception response to the write command (06H). The error code is 03H that indicates the error "Invalid data value", which means "The received data domain contains a value that is not allowed". The value indicates the error of the remaining structure in the combined request.

10.4.5 Read/Write operation examples

For the formats of the read and write commands, see sections 10.3.1 and 10.3.2.

10.4.5.1 Read command 03H examples

Example 1: Read state word of the VFD whose address is 01H. According to the table of other Modbus function addresses in section 10.4.2 Addresses of other Modbus functions, the parameter address of state word of the VFD is 1000H.

The read command transmitted to the VFD is as follows:

01	03	10 00	00 01	80 CA
VFD address	Read command	Parameter address	Data count	CRC

Assume that the following response is returned:

01	03	02	00 03	F8 45
VFD address	Read command	Number of bytes	Data content	CRC

The data content returned by the VFD is 0003H, which indicates that the VFD is in the stopped state.

10.4.5.2 Write command 06H examples

Example 1: Set the VFD whose address is 03H to be forward running. Refer to the table of other function parameters, the address of "Communication-based control command" is 2000H, and 0001H indicates forward running. See the following figure.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Run forward	W
		0002H: Run reversely	
		0003H: Jog forward	
		0004H: Jog reversely	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Stop jogging	

The command transmitted from the master is as follows:

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

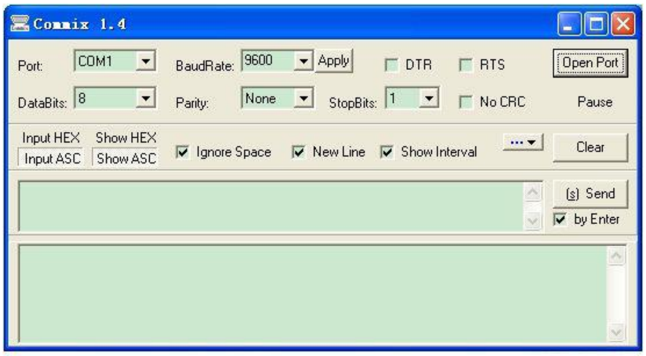
If the operation is successful, the following response is returned (same as the command sent from the master):

03	06	20 00	00 01	42 28
VFD address	Write command	Parameter address	Forward running	CRC

Note: In the preceding command description, spaces are added to a command just for explanatory purposes. In practical applications, no space is required in the commands.

10.4.5.3 Example of Modbus communication commissioning

A PC is used as the host, an RS232-RS485 converter is used for signal conversion, and the PC serial port used by the converter is COM1 (an RS232 port). The upper computer commissioning software is the serial port commissioning assistant Commix, which can be downloaded from the Internet. Download a version that can automatically execute the CRC check function. The following figure shows the interface of Commix.



First, set the serial port to **COM1**. Then, set the baud rate consistently with P16.01. The data bits, check bits, and end bits must be set consistently with P16.02. If the RTU mode is selected, you need to select the hexadecimal form **Input HEX**. To set the software to automatically execute the CRC function, you need to select **ModbusRTU** ModbusRTU, select **CRC16 (MODBU SRTU)**, and set the start byte to **1**. After the auto CRC check function is enabled, do not enter CRC information in commands. Otherwise, command errors may occur due to repeated CRC check.

The commissioning command to set the VFD whose address is 03H to be forward running is as follows:

03	**06**	**20 00**	**00 01**	**42 28**
VFD address	Write command	Parameter address	Forward running	CRC

Note:

- Set the address (P16.00) of the VFD to 03.
- Set "Channel of running commands" (P00.01) to "Communication", and set "Communication channel of running commands" (P00.02) to the Modbus communication channel.
- Click Send. If the line configuration and settings are correct, a response transmitted by the VFD is received.

10.5 Common communication faults

Common communication faults include the following:

- No response is returned.
- The VFD returns an exception response.

Possible causes of no response include the following:

- The serial port is set incorrectly. For example, the adapter uses the serial port COM1, but COM2 is selected for the communication.
- The settings of the baud rates, data bits, end bits, and check bits are inconsistent with those set on the VFD.
- The positive pole (+) and negative pole (-) of the RS485 bus are connected reversely.
- The resistor connected to 485 terminals on the terminal block of the VFD is set incorrectly.

Appendix A EMC

EMC is short for electromagnetic compatibility, which refers to the ability of a device or system to function properly in its electromagnetic environment and not constitute an unbearable electromagnetic disturbance to anything in that environment. EMC includes two aspects: electromagnetic interference and electromagnetic immunity.

Electromagnetic interference can be divided into two categories according to the transmission paths: conducted interference and radiation interference.

Conducted interference propagates along any conductor. Therefore, any conductor, such as wire, transmission line, inductor, and capacitor, is a transmission channel for conducted interference.

Radiated interference is in the form of electromagnetic waves that propagate with energy that is inversely proportional to the square of the distance.

Electromagnetic interference must have three conditions or three elements at the same time: interference source, transmission channel, and sensitive receiver, each of which is indispensable. The solution of EMC problem mainly focuses the three elements. For users, the solution of EMC problem is mainly in transmission channels because the equipment as interference source or receiver cannot be changed.

Different electric and electronic devices have different EMC capacities because of adopting different EMC standards or classes.

A.1 EMC features of the system

Like other electric or electronic devices, the system is not only an electromagnetic interference source but also an electromagnetic receiver. The operating principle of the system determines that it can produce certain electromagnetic interference noise. At the same time the system needs to be designed with certain anti-jamming ability to ensure the smooth working in certain electromagnetic environment. Its EMC features are shown in the following aspects:

1. The input current waveform is close to perfect sine waves, but the current still contains high-order harmonics that can form electromagnetic interferences, causing some impacts on the surrounding electronic equipment.
2. The output voltage is high-frequency PWM wave, which can form the common-mode voltage and differential mode voltage in phase-to-phase or phase-to-ground. And the leakage current will increase, which generates strong electromagnetic interferences, affecting the reliability of other electric equipment in the system.
3. As the electromagnetic radiation receiver, too strong external interference will lead to system malfunction or even damage, affecting the normal use of users.
4. In the system wiring, external interferences and system anti-interference capacity complement each other. During the process of reducing external interferences, the system anti-interference capacity is also improved.

A.2 General EMC guidelines on the wiring of the system

The following introduces general EMC guidelines on medium voltage VFDs in several aspects including noise control, site wiring and grounding for reference in site installation, with consideration of ECM characteristics of the system where the input current and output voltage harmonics are relatively small but the voltage is high and the current is large.

Noise control:

All the connections to the system control terminals must use shielded wires. The shield layer of wire must be grounded near the system entrance. The ground mode is 360° loop connection formed by cable clips. It is not allowed to connect the twisted shield layer to the ground of the VFD, which greatly decreases or loses the shield effect.

Site wiring

Power supply wiring: The shield layer of medium voltage power supply incoming cables of the system shall be grounded reliably. It is not allowed to route the power cables and control cables in parallel.

Device categorization: There are different electric devices in the same distribution system, which have different ability of emitting and withstanding electromagnetic noise. Therefore, it needs to categorize these devices into strong noise device and noise sensitive device. The same kind of devices needs to be placed in the same area, and the distance between devices in different categories needs to be more than 20cm.

Wiring in the control cabinet: During wiring, signal cables and power cables need to be arranged in different areas. It is not allowed to arrange them in parallel or in interlaced state at a close distance (less than 20cm) or tie them together. If the signal cables have to cross the power cables, they need to be arranged in 90 degree angle.

Grounding

The VFD must be grounded safely and reliably in operation. Grounding has the priority in all EMC methods because it does not only ensure the safety of equipment and persons, but also it is the simplest, most effective and lowest-cost solution for EMC problems.

Three categories of grounding: special pole grounding, common pole grounding and series-wound grounding. Different control system needs to use special pole grounding, different devices in the same control system needs to use common pole grounding, and different devices connected by the same power cables needs to use series-wound grounding.

Appendix B Communication expansion card

B.1 Model definition and function description

B.1.1 Function description

This VFD features independent slots for installing closed-loop encoder cards and communication cards. The VFD can be equipped with various expansion cards to extend its application functions. The PG card supports applications of incremental, resolver, Sin/Cos, and UVW encoders. The communication card supports two communication modes: PROFIBUS-DP and PROFINET.

Figure B-1 Expansion card installation position

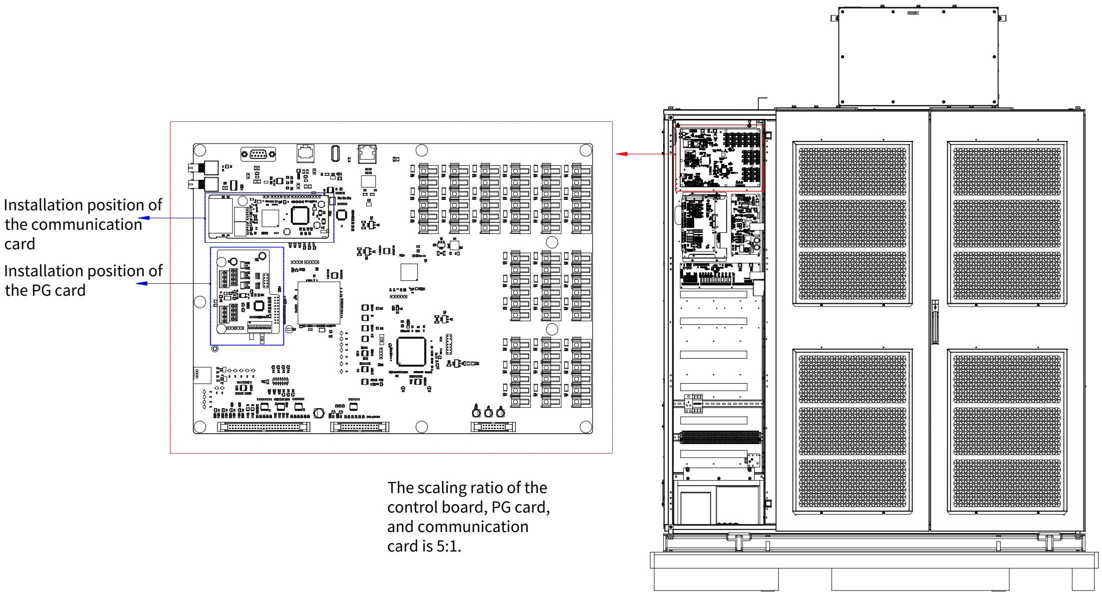


Figure B-2 Expansion card model definition

EC-XX 1 01 -00

Product category
EC: Expansion card

Board card category
TX: communication expansion card
PG: PG card

Technical version
Indicates the generation of a technical version by using odd numbers, for example, 1, 3, 5, and 7 indicate the 1st, 2nd, 3rd and 4th generations of the technical version.

Code distinction
For the TX card:
01: Bluetooth communication card
02: WI-FI communication card
03: PROFIBUS communication card
04: Ethernet communication card
05: CAN multi-protocol communication card
06: DeviceNet communication card
07: BACnet communication card
08: EtherCAT communication card
09: PROFINET communication card
10: Ethernet/IP communication card
11: CAN master-slave control communication card
15: Modbus TCP communication card

For the PG card:
02: Sin/Cos PG card + pulse direction reference + frequency-division output
03: UVW PG interface + pulse direction reference + frequency-division output
04: Resolver PG interface + pulse direction reference + frequency-division output
05: Incremental PG card + pulse direction reference + frequency-division output
06: Absolute PG interface + pulse direction reference + frequency-division output
07: Simple incremental PG card

For the TX card: Expansion card version
Empty: Version A
B: Version B
C: Version C

For the PG card: Working power + Expansion card version
00: Passive
05: 5V
12: 12-15V
24: 24V
Empty: Version A
B: Version B
C: Version C

Table B-1 Expansion card function description

Expansion card type	Model	Description	Ordering information
PROFIBUS-DP communication card	EC-TX503D	● Supports PROFIBUS-DP protocol	11023-00151
PROFINET communication card	EC-TX509C	● Supports PROFINET protocol	11023-00149
5V incremental PG card	EC-PG101-05	● 5V incremental ABZ encoder ● Supports differential input, up to 200kHz	11023-00014
12V incremental PG card	EC-PG101-12	● 12V incremental ABZ encoder ● Supports differential, OC, and push-pull inputs, up to 100kHz	11023-00003
24V incremental PG card	EC-PG101-24	● 24V incremental ABZ encoder ● Supports differential, OC, and push-pull inputs, up to 100kHz	11023-00004
Resolver PG card	EC-PG104-00	● Resolver encoder ● Supports pulse/direction differential input, up to 500kHz ● Supports 5V differential frequency-divided output	-
Sin/Cos PG card	EC-PG102-05	● 5V Sin/Cos encoder ● Supports pulse train reference input ● Supports the frequency-divided output of A, B, and Z	11023-00005
UVW incremental PG card	EC-PG103-05	● 5V UVW incremental encoder ● Supports the orthogonal input of A, B, and Z ● Supports the pulse input of phases U, V, and W	11023-00006

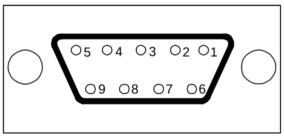
B.2 Communication card

B.2.1 PROFIBUS-DP communication card (EC-TX503D)

B.2.1.1 Terminal description

Figure B-3 EC-TX503D appearance

Table B-2 CN1 description

<table>
<tr><th>CN1</th><th colspan="2">Connector pin</th><th>Description</th></tr>
<tr><td rowspan="10">9-pin D-type connector</td><td>1</td><td>-</td><td>Unused</td></tr>
<tr><td>2</td><td>-</td><td>Unused</td></tr>
<tr><td>3</td><td>B-Line</td><td>Data+ (twisted pair 1)</td></tr>
<tr><td>4</td><td>RTS</td><td>Request transmission</td></tr>
<tr><td>5</td><td>GND_BUS</td><td>Isolation ground</td></tr>
<tr><td>6</td><td>+5V BUS</td><td>Isolated power supply of 5 V DC</td></tr>
<tr><td>7</td><td>-</td><td>Unused</td></tr>
<tr><td>8</td><td>A-Line</td><td>Data- (twisted pair 2)</td></tr>
<tr><td>9</td><td>-</td><td>Unused</td></tr>
<tr><td>Housing</td><td>SHLD</td><td>PROFIBUS cable shielding line</td></tr>
</table>

Note:

- +5V BUS and GND_BUS are bus terminators. Some devices, such as the optical transceiver (RS485), may need to obtain power through these pins.
- On some devices, the transmission and receiving directions are determined by RTS. In normal applications, only A-Line, B-Line, and the shield layer need to be used.

B.2.1.2 Indicator description

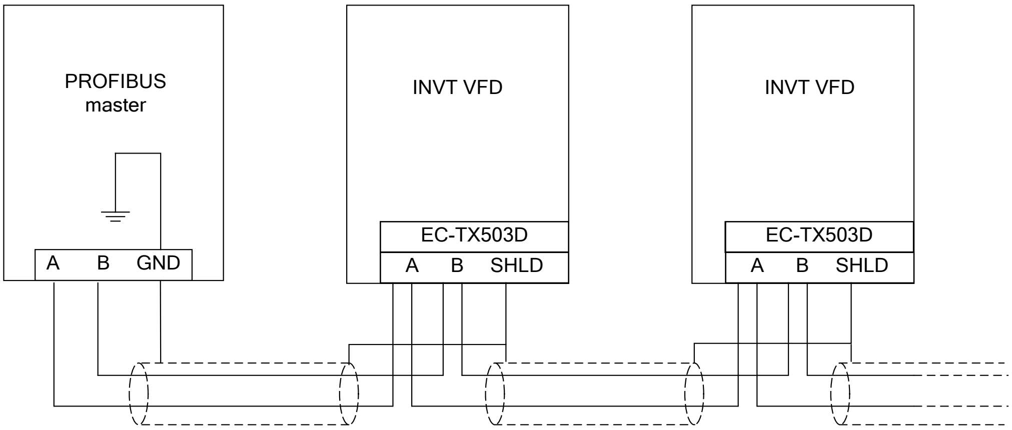
Table B-3 LED function description

Symbol	Name	Description
LED1	State indicator	On: The expansion card is connecting with the control board. Blinking (On: 500ms; Off: 500ms): The expansion card is connected to the control board properly. Off: The expansion card is disconnected from the control board.
LED2	Communication indicator	On: The expansion card is connected with the master device and data exchange can be performed. Off: The expansion card is disconnected from the master device.
LED3	Fault indicator	On: The expansion card is offline and data exchange cannot be performed. Blinking (On: 500ms; Off: 500ms): A configuration error occurs. The length of the user parameter data set during the initialization of the communication card is different from that during the network configuration. Blinking (On: 250ms; Off: 250ms): User parameter data is incorrect. The length or content of the user parameter data set during the initialization of the communication card is different from that during the network configuration. Blinking (On: 125ms; Off: 125ms): An error occurs in the ASIC initialization of PROFIBUS-DP communication. Off: No fault
LED4	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.

Note: For details about the operation, see the *Communication Card Operation Manual*.

B.2.1.3 Wiring description

Figure B-4 PROFIBUS bus connection



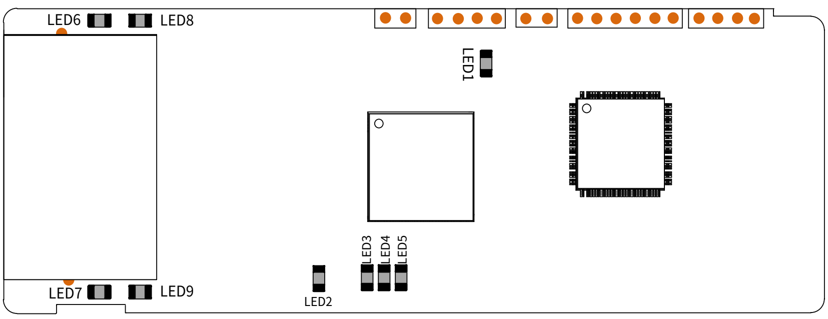
Note:

1. Figure B-4 shows the terminal wiring diagram. The cables are standard PROFIBUS cables, each consisting of a twisted pair and shielding layer. The shielding layers of PROFIBUS cables are directly grounded on all nodes. You can select a proper grounding mode based on the actual situation on site.
2. When connecting the stations, ensure that the data cables are not twisted. For systems to be used in environments with strong electromagnetic radiation, you need to use cables with shielding layers. The shielding layers can improve electromagnetic compatibility (EMC).
3. If shielding braid or shielding foil is used, connect the two ends of it to the protective ground and cover an area as large as possible to ensure high conductivity. In addition, data cables need to be separated from high-voltage cables.
4. When the data transmission rate is higher than 500kbit/s, do not use short stub. Use the plugs available in the market. You can directly connect the data input and output cables to those plugs, and the plug of the bus can be connected or disconnected at any time without interrupting data communication of other stations.

B.2.2 PROFINET communication card (EC-TX509C)

B.2.2.1 Terminal description

Figure B-5 EC-TX509C appearance



B.2.2.2 Indicator description

Table B-4 LED function description

Symbol	Name	Description
LED1	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED2	State indicator	Bus state indicator On: No network connection Blinking (On: 500ms; Off: 500ms): Network connection with the PROFINET controller is normal, but the communication is not established. Off: The communication with the PROFINET controller has been established.
LED3	Fault indicator	On: PROFINET diagnosis exists. Off: No PROFINET diagnosis.
LED4	State indicator	Slave ready indicator On: TPS-1 protocol stack has started. Blinking (On: 500ms; Off: 500ms): TPS-1 waits for MCU initialization. Off: TPS-1 protocol stack does not start.
LED5	Maintenance status indicator	Reserved
LED6/7	State indicator	Network port status indicator On: The expansion card has been connected with the PC/PLC by using a network cable. Off: The expansion card has not been connected with the PC/PLC.
LED8/9	Communication indicator	Network port communication indicator On: The expansion card and the PC/PLC are communicating. Off: The expansion card and the PC/PLC have no communication yet.

B.2.2.3 Wiring description

The PROFINET communication card can be used in a linear network topology and a star network topology.

Figure B-6 Linear network topology electrical connection

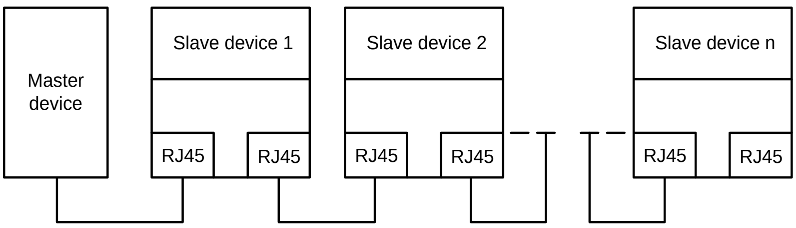
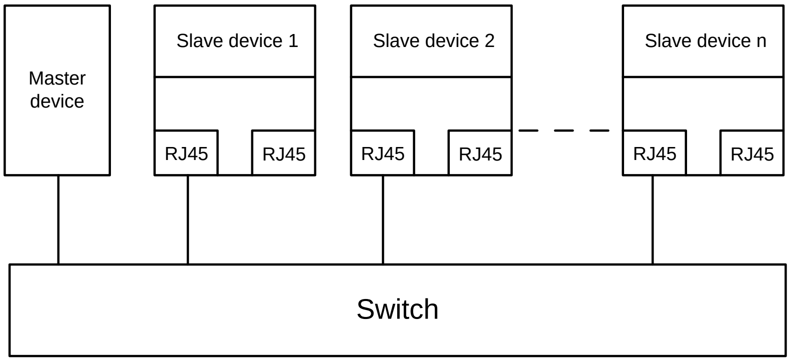


Figure B-7 Star network topology electrical connection



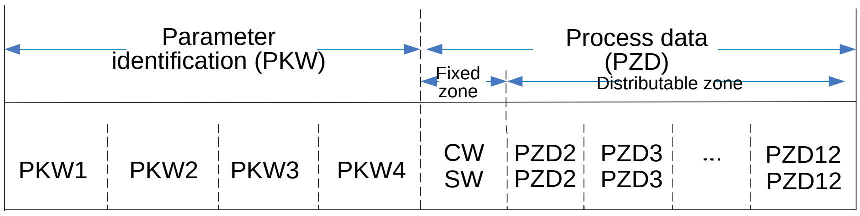
Note: For the star network topology, you need to prepare PROFINET switches.

B.2.3 PROFIBUS-DP/PROFINET communication protocol

PROFIBUS-DP/PROFINET information frame data structure

The PROFIBUS-DP/PROFINET system allows fast data exchange between the master and system devices. For system devices, data is always read and written in the master/slave mode. The system always functions as slave stations, and one address is clearly defined for each slave station. PROFIBUS transmits 16-bit packets periodically. Figure 3.1 shows the structure of the packet.

Figure B-8 Structure of PROFIBUS-DP packets



Parameter zone:

PKW1––Parameter identification

PKW2––Array index number

PKW3––Parameter value 1

PKW4––Parameter value 2

Process data:

CW––Control word (transmitted from the master to a slave. For description, see Table B-5)

SW––State word (transmitted from a slave to the master. For description, see Table B-7)

PZD––Process data (defined by users)

(When the process data is output by the master to a slave, it is a reference value; and when the process data is input by a slave to the master, it is an actual value.)

PZD zone (process data zone)

The PZD zone in a communication packet is designed for controlling and monitoring the system. The master and slave stations always process the received PZD with the highest priority. The processing of PZD takes priority over that of PKW, and the master and slave stations always transmit the latest valid data on the interfaces.

CWs and SWs

Using CWs is the basic method of the fieldbus system to control the variable-frequency speed regulation system devices. A CW is transmitted by the fieldbus master station to a system device. In this case, the adapter module functions as a gateway. The system device responds to the bit code information of the CW and feeds state information back to the master through an SW.

CWs and SWs are shown in Table B-5 and Table B-7, respectively. For the bit code information related to the system equipment, refer to the operation manual.

Reference value

A system device may receive control information in multiple channels, including analog and digital input terminals, system control panel, and communication modules (such as RS485 and EC-TX503 adapter modules). To enable the control over system devices through PROFIBUS, you need to set the communication module as the controller of the system device.

The set values are shown in Table B-6.

Actual value

An actual value is a 16-bit word that includes information about system device operation. The monitoring function is defined through system parameters. The conversion scale of an integer transmitted as an actual value from the system device to the master depends on the set function. For more description, see the related system operation manual.

The set values are shown in Table B-8.

Note: A system device always checks the bytes of a CW and reference value.

Task packet (master station→variable-frequency speed regulation system)

CW:

The first word in a PZD task packet is a system CW. Table B-5 describes all bits of CWs.

Table B-5 CWs

Bit	Name	Value	State to be entered/description
00	Heartbeat	1	Enable heartbeat
		0	No function
01	Forward running	1	Enable forward running
		0	No function
02	Reverse running	1	Enable reverse running
		0	No function
03	Forward jogging	1	Enable forward jogging
		0	No function
04	Reverse jogging	1	Enable reverse jogging
		0	No function
05	Coast to stop	1	Enable coast to stop
		0	No function
06	Stop	1	Enable stop
		0	No function
07	Fault reset	1	Enable fault reset
		0	No function
08	Jog stop	1	Enable jog stop
		0	No function
09	Enable torque	1	Reserved
		0	Reserved
10–14	Reserved	1	Reserved
		0	Reserved
15	Enable write	1	Reserved
		0	Reserved

Reference value (REF):

The second to twelfth words in a PZD task packet are the main settings. The main frequency settings are provided by the main setting signal source.

Table B-6 Set value

Word	Name	Value
PZD2–PZD12	Invalid	00
	Frequency reference	01
	Torque reference	02
	Reserved	03
	PID reference	04
	PID feedback	05

Response packet (variable-frequency speed regulation system→master station)

SW:

The first word in a PZD response packet is a system SW. Table B-3 describes all bits of SWs.

Table B-7 SWs

Bit	Name	Value	State to be entered/description
00	Invalid	1	Heartbeat feedback
		0	No heartbeat feedback
01	Fault	1	Fault
		0	No fault
02	Ready to run	1	Ready to run
		0	Not ready
03	Local/remote state	1	Remote control state
		0	Local control state
04	Control mode	1	Torque control mode
		0	Speed control mode
05	Forward running	1	In forward running
		0	Not in forward running
06	Reverse running	1	In reverse running
		0	Not in reverse running
07	Master/slave mode	1	Reserved
		0	Reserved
08	Frequency level detection FDT output	1	FDT output
		0	No FDT output
09	Frequency reached	1	Set frequency is reached
		0	Set frequency is not reached
10–15	Reserved	-	-

Actual value (ACT):

The second to twelfth words in a PZD task packet are the main actual values. The main actual frequency values are provided by the main actual value signal source.

Table B-8 Actual values

Word	Name	Value
PZD2–PZD12	Invalid	00
	Running frequency	01
	Output rotating speed (rpm)	02

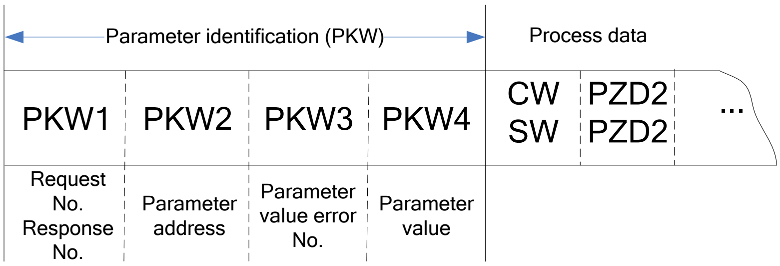
Word	Name	Value
	Input voltage	03
	Output voltage	04
	Output current	05
	Actual output torque	06
	Output power percentage	07
	Set frequency absolute value	08
	Present DSP fault	09
	Present ARM fault type 1	10
	Present ARM fault type 2	11
	Present unit fault	12
	Unit number at present fault	13
	User input terminal 1	14
	User input terminal 2	15
	User output terminal 1	16
	User output terminal 2	17
	Reserved	

PKW zone (parameter identification flag PKW1––numerical zone)

The PKW zone describes the processing mode of the parameter identification interface. A PKW interface is not a physical interface but a mechanism that defines the transmission mode (such reading and writing a parameter value) of a parameter between two communication ends.

Structure of the PKW zone

Figure B-9 Parameter identification zone



In the periodic PROFIBUS-DP communication, the PKW zone consists of four 16-bit words. The following table describes each word in the PKW zone.

First word

First word PKW 1 (16 bits)		
Bits 15–00	Task or response identification flag	0–7

Second word

Second word PKW2 (16 bits)		
Bits 15–00	Basic parameter address	0–247

Third word

Third word PKW3 (16 bits)		
Bits 15–00	Value (most significant word) of a parameter	00

Fourth word

Fourth word PKW4 (16 bits)		
Bits 15–00	Value (least significant word) of a parameter	0–65535

Note: If the master station requests the value of a parameter, the values in PKW3 and PKW4 of the packet that the master station transmits to the system are no longer valid.

Task request and response

When transmitting data to a slave, the master uses a request number, and the slave uses a response number to accept or reject the request. Table B-5 and Table B-6 describes the request and response functions.

Definitions of the task identification flag PKW1 are shown in Table B-9.

Table B-9 Definitions of the task identification flag PKW1

Request No. (from the master to a slave)		Response signal	
Request No.	**Function**	**Acceptance**	**Rejection**
0	No task.	0	—
1	Read	1, 2	3
2	Write	1	3 or 4
3	Reserved	2	3 or 4
4	Write RAM and FLASH	1	3 or 4

Definitions of the response identification flag PKW1 are shown in Table B-10.

Table B-10 Definitions of the response identification flag PKW1

Response No. (from a slave to the master)	
Response No.	**Function**
0	Invalid parameter number
1	The parameter value cannot be modified
2	Exceeds the setting range.
3	The task cannot be executed and one of the following error number is returned: 0: Invalid parameter number 1: The parameter value cannot be modified (read-only parameter) 2: Exceeds the setting range 3: Incorrect sub-index number 4: The setting is disallowed (only reset). 5: Invalid data type 6: The task cannot be executed due to operation state 7: Non-supported request 8: The request cannot be completed due to a communication error 9: A fault occurred to the writing operation in permanent storage area 10: The request failed due to timeout 11: The parameter cannot be assigned to PZD 12: Cannot allocate the bits of the control word 13: Other errors
4	No permission to modify parameters

PKW examples:

Example 1: Reading the value of a parameter

You can set PKW1 to 1 and PKW2 to 0x0200 to read a value of motor type (the address of the motor type is 0x0200), and the value is returned in PKW4.

Request (master station→variable-frequency speed regulation system):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Request	00	01	02	00	00	00	00	00	xx	xx	xx	xx	xx	xx	...	xx	xx

0200: Parameter address

0001: Request for reading parameter values

Response (variable-frequency speed regulation system→master station):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Response	00	01	02	00	00	00	00	01	xx	xx	xx	xx	xx	xx	...	xx	xx

0001: Parameter value in address 200

0001: Response (parameter value updated)

Example 2: Modifying a parameter value (modifying the value only on RAM)

You can set PKW1 to 0x0002 and PKW2 to 0x0200 to modify a value of motor type (the address of the motor type is 0x0200), and the value of motor type to be modified (SM: 1, AM: 0) is in PKW4.

Request (master station→variable-frequency speed regulation system):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Request	00	02	02	00	00	00	00	01	xx	xx	xx	xx	xx	xx	...	xx	xx

0200: Parameter value in address 200

0001: Modify a parameter value

Response (variable-frequency speed regulation system→master station):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Response	00	02	02	00	00	00	00	01	xx	xx	xx	xx	xx	xx	...	xx	xx

0001: Response (parameter value updated)

Example 3: Modifying a parameter value (modifying the value only on both RAM and EEPROM)

You can set PKW1 to 0x0004 and PKW2 to 0x0200 to modify a value of motor type (the address of the motor type is 0x0200), and the value of motor type to be modified (SM: 1, AM: 0) is in PKW4.

Request (master station→variable-frequency speed regulation system):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Request	00	04	02	00	00	00	00	01	xx	xx	xx	xx	xx	xx	...	xx	xx

0200: Parameter value in address 200

0004: Modify a parameter value

Response (variable-frequency speed regulation system→master station):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Response	00	04	02	00	00	00	00	01	xx	xx	xx	xx	xx	xx	...	xx	xx

0001: Response (parameter value updated)

PZD examples:

The transmission of the PZD zone is implemented through system function code settings. For the function codes, see the related operation manual of INVT variable-frequency speed regulation system.

Example 1: Reading the process data of the system

In the example, select "01: Running frequency" in the actual value array as PZD3 to transmit, which can be achieved by setting P18.14 to 1. This operation is mandatory until the parameter is replaced by another option.

Request (master station→variable-frequency speed regulation system):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		…	PZD12	
Request	xx	Xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	00	01	...	xx	xx

Example 2: Writing process data to a system device

In the example, the value of "01: Frequency reference" in the reference array is taken out from PZD3, which can be achieved by setting P18.03 to 1. The parameters are updated with the contents of PZD3 in each request frame until another parameter is selected.

Request (master station→variable-frequency speed regulation system):

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		…	PZD12	
Request	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	00	01	...	xx	xx

Subsequently, the information contained in PZD3 is used as frequency reference in each request frame until another parameter is specified.

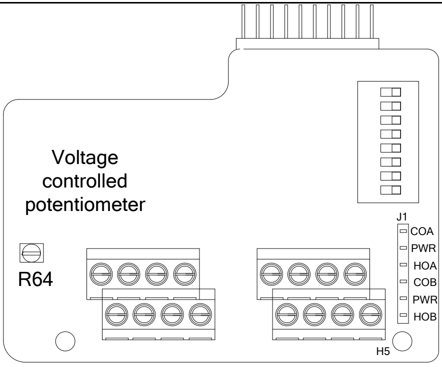
B.3 PG expansion card

B.3.1 Incremental encoder PG card (EC-PG101-05, EC-PG101-12, EC-PG101-24)

B.3.1.1 Product specifications

Specification	Incremental encoder		
	EC-PG101-05	EC-PG101-12	EC-PG101-24
Output power supply	Voltage output: 4.75V–7V; default: 5V±5%; Max. output current: 300mA	Voltage output: 11.75V–16V; default: 12V±5%; Max. output current: 350mA	Voltage output: 24 V ±5%☒ Max. output current: 300mA
Input signal	Supports the A, B, and Z signal inputs of differential, open collector, and push-pull encoders. Response speed: 0–100kHz		
Output signal	Output frequency: 0–80kHz Output type: Differential output, push-pull output, open collector output, and frequency-divided output. Range: 1–256 Output impedance: 70Ω		

B.3.1.2 Terminal description

Figure B-10 Appearance of the incremental encoder card	Figure B-11 Terminals of the incremental encoder card
	

Note: You must choose a PG card when using PG vector control product. The function of the PG card includes processing two channels of quadrature encoder signals and supporting the Z signal input for spindle positioning. It can receive encoder signals with differential, open collector, and push-pull outputs. Additionally, the PG card is capable of frequency division output for the input encoder signals, providing two channels of differential signals as output. You can choose to output push-pull signals or open collector signals through jumper J1 or J2 according to your actual use.

The incremental encoder PG card has two 2*4P user wiring terminals. The terminals are arranged as follows:

IA+	IA-	IB+	IB-
PWR	COM1	IZ+	IZ-

OA+	OA-	OB+	OB-
OA	OB	COM1	

Table B-11 Terminal function description

Symbol	Name	Description
PWR	Encoder working power output	EC-PG101-05: Voltage output: 4.75V–7V; default: 5V/±5%; Max. output current: 300mA EC-PG101-12: Voltage output: 11.75V–16V; default: 12V±5%; Max. output current: 350mA EC-PG101-24: Voltage output: 24V±5%; Max. output current: 300mA
COM1		
IA+	Encoder signal input terminal	Supports the A, B, and Z signal inputs of differential, open collector, and push-pull encoders. Response speed: 0–100kHz
IA-		
IB+		
IB-		
IZ+		
IZ-		
OA+	Differential frequency-divided signal output terminal	Output frequency: 0–80kHz Output type: Differential output, push-pull output, open collector output, and frequency-divided output. Range: 1–256 Output impedance: 70Ω
OA-		
OB+		
OB-		
OA	Frequency-divided push-pull signal and open collector signal output terminal	The output signal type is selected by the jumper J1 or J2.
OB		
COM1		

Note: The PG card does not connect PE to the earth internally, you can ground it during use.

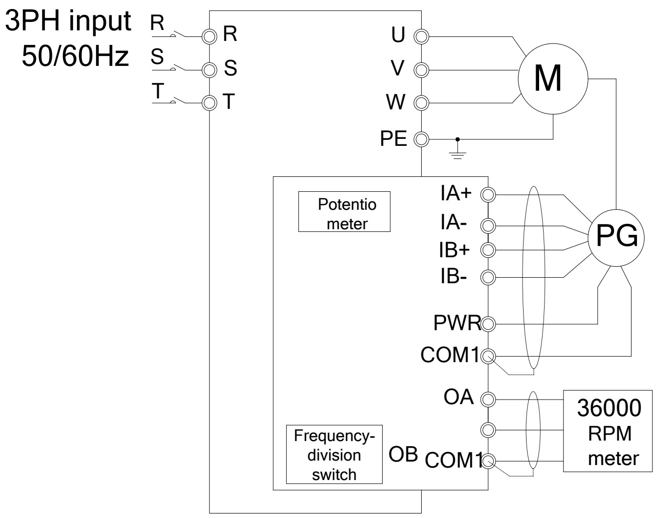
The frequency division coefficient of the incremental encoder PG card is determined by the DIP switch on the card. The DIP switch consists of 8 bits. The frequency division coefficient is determined by adding 1 to the binary number represented by the switch settings. The switch marked "1" represents the least significant bit (LSB), while the switch marked "8" represents the most significant bit (MSB). When the switch is toggled to the ON position, the corresponding bit is valid and represents "1"; otherwise, it represents "0."

Table B-12 Frequency division coefficients

Decimal	Binary	Frequency division coefficient
0	00000000	1
1	00000001	2
2	00000010	3
...	...	...
m	...	m+1
255	11111111	256

B.3.1.3 Wiring description

Figure B-12 Wiring of incremental encoder PG card



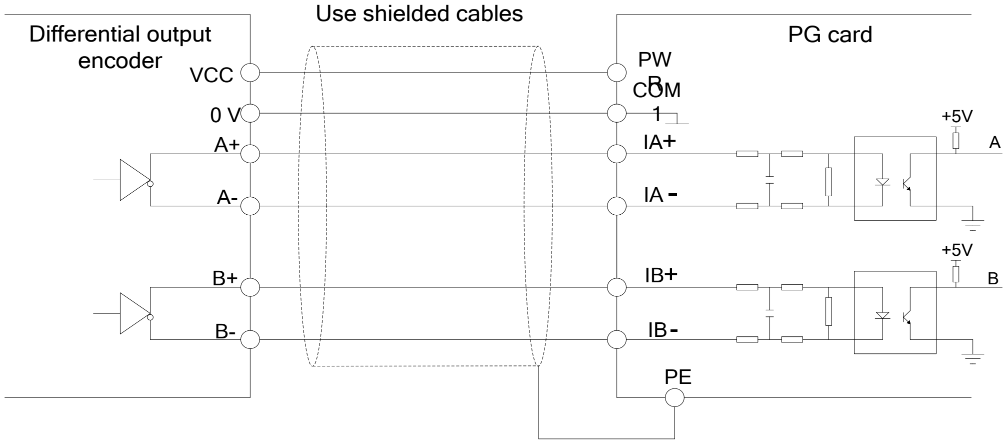
Note:

- A PG card signal cable and a power cable must be routed separately and disallow parallel routing.
- To avoid interference from encoder signals, use a shielded cable for the PG card signal.
- The shield layer of the encoder shield cable should be connected to the earth (such as the PE of VFD), and it must be connected to earth only at one end to avoid signal interference.
- If the PG card uses frequency-divided output when externally connecting to a user power supply, the voltage should be less than 24V; otherwise the PG card will be damaged.
- You can set the output voltage by adjusting the 12–15V incremental encoder PG card potentiometer (clockwise for voltage increases) according to actual needs, and the force should not be too great when rotating the potentiometer.

B.3.1.4 Input application connection

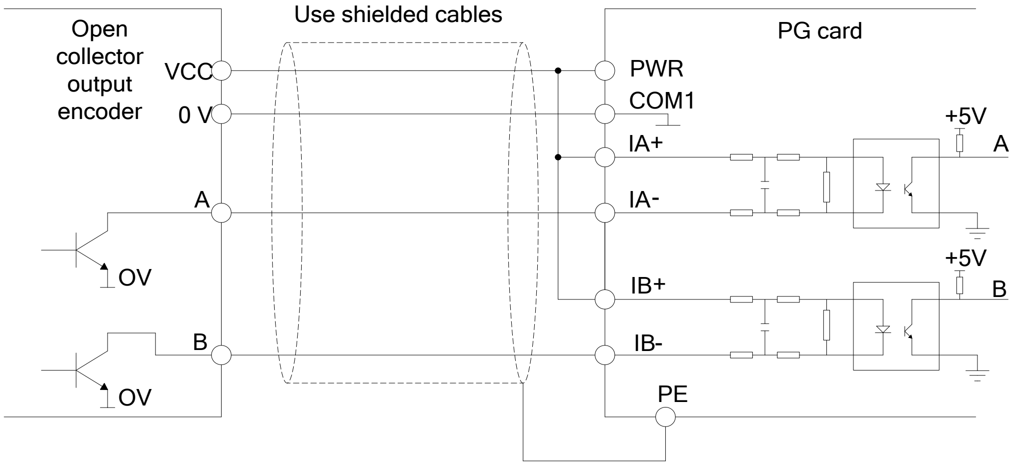
The wiring for the differential output encoder is as follows:

Figure B-13 Wiring for differential output encoder



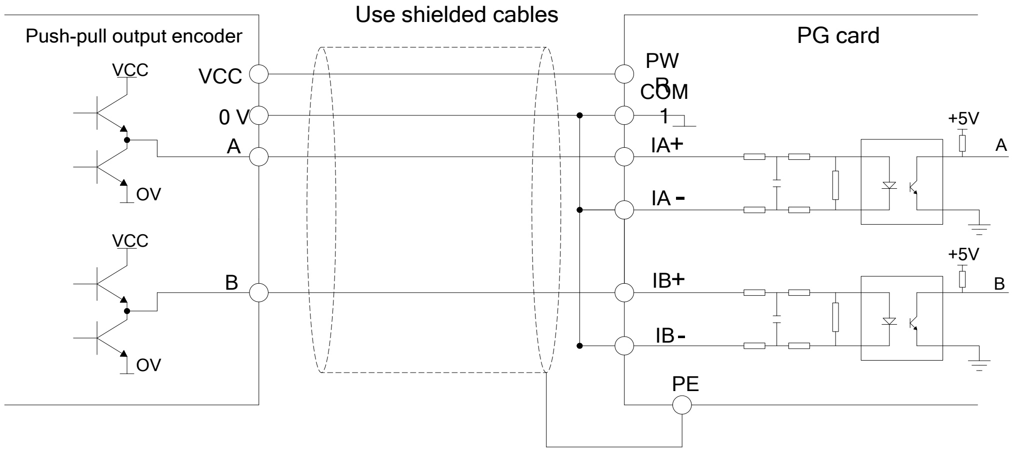
The wiring for the open collector output encoder is as follows:

Figure B-14 Wiring for open collector output encoder



The wiring for the push-pull output encoder is as follows:

Figure B-15 Wiring for push-pull output encoder

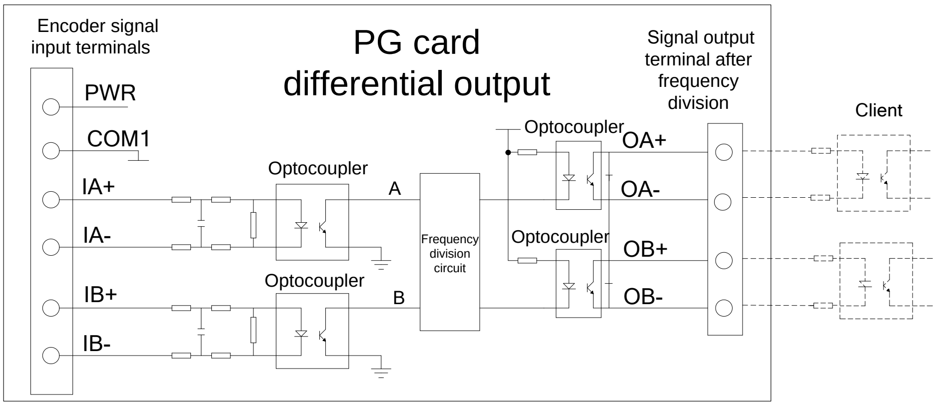


Note: When used with the spindle positioning VFD, the Z signal must be connected, and the wiring method is the same as that for the A and B signals.

B.3.1.5 Output application connection

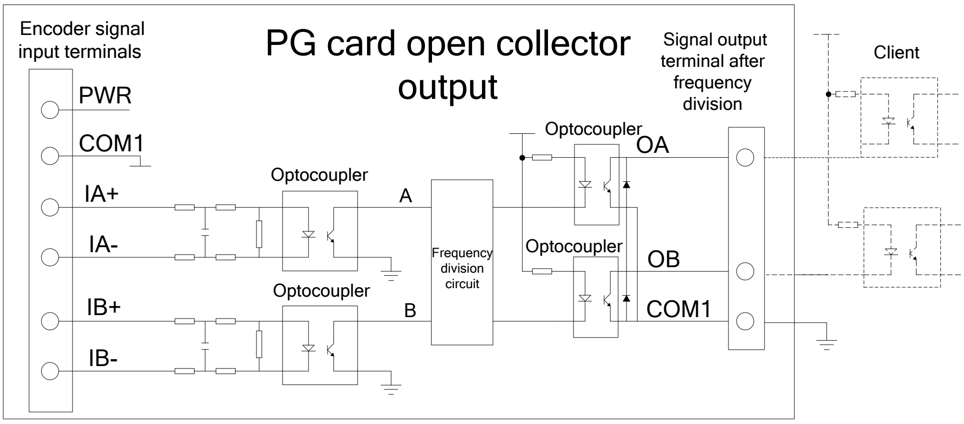
The wiring for PG card frequency-divided differential output is as follows:

B-16 Wiring for PG card frequency-divided differential output



The wiring for PG card frequency-divided open collector output is as follows:

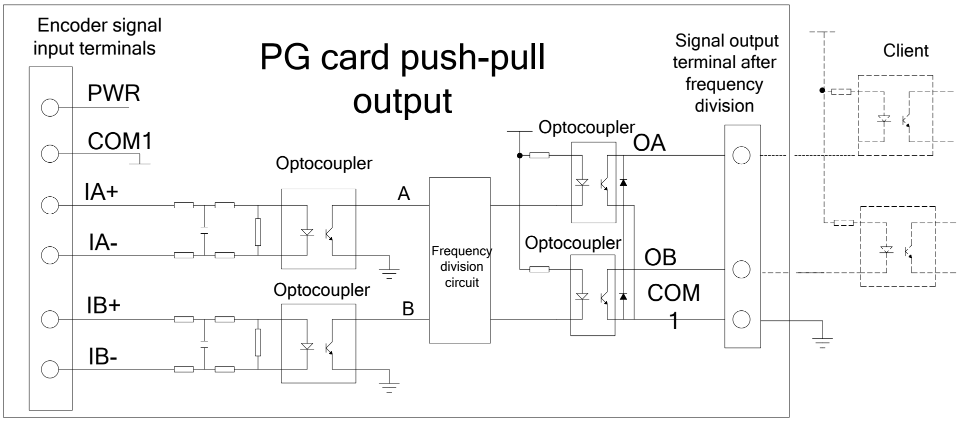
Figure B-17 Wiring for PG card frequency-divided open collector output



Note: During open collector output, PWR at J1 and that at J2 are short connected to COA and COB.

The wiring for PG card frequency-divided push-pull output is as follows:

Figure B-18 Wiring for PG card frequency-divided push-pull output



Note:

- Note: During push-pull output, PWR at J1 and that at J2 are short connected to HOA and HOB.
- Incremental encoder PG cards are mainly used to closed-loop vector control on asynchronous motors.

B.3.2 Resolver PG card (EC-PG104-00)

B.3.2.1 Terminal description

EC-PG104-00 appearance

The resolver encoder card has one signal cable interface and three user wiring terminals, as shown in the following figure.

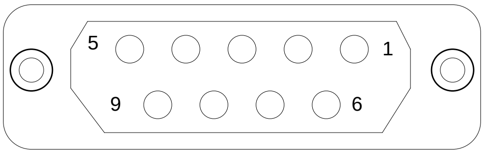


Table B-13 Input signal terminal function description

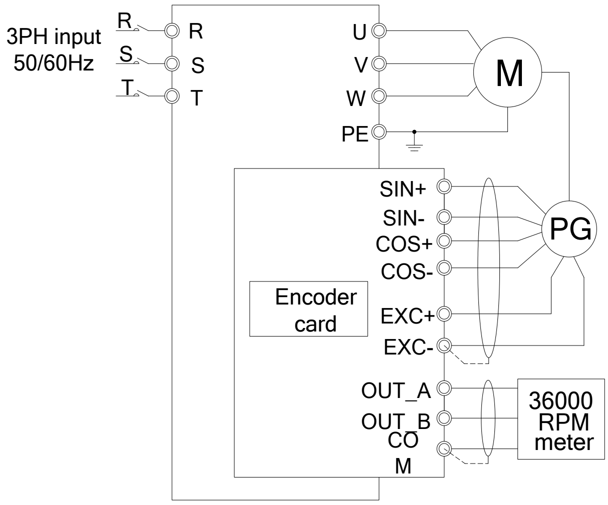
PIN	Symbol	Name	Description
1	SIN+	Encoder signal input	Recommended resolver transformation ratio: 0.5
2	SIN-		
3	COS+		
8	COS-		
4	**GND**	-	-
5	Empty	-	-
6	EXC+	Encoder excitation signal	Supports resolvers with a frequency range of 10–20 kHz and an excitation voltage of 7Vrms.
7	EXC-		
9	Empty	-	-

Table B-14 Output signal terminal function description

Symbol	Name	Description
OUT_A	Encoder signal frequency-divided output	
OUT_B		

B.3.2.1 Wiring description

Figure B-19 Wiring for resolver encoder card



Note:

- The encoder cable must use shielded twisted-pair cables, with shielding effectiveness of over 90%, or a braid density of the shielding layer not less than 80%.
- Encoder signals are weak electrical signals and must be routed separately from power cables, without any overlap.
- It is recommended to connect the encoder cable on the VFD side directly to the PG card terminal, with the shielding layer connected nearby to the housing, and wrapped with a ferrite core to enhance anti-interference capability.
- The shielding layer of the encoder cable on the motor side should be left floating and must not come into contact with the metal housing of the motor.
- If the encoder cable needs to be connected through a terminal block, a separate terminal box should be provided for the encoder cable only, and it should not be shared with other signal cables.

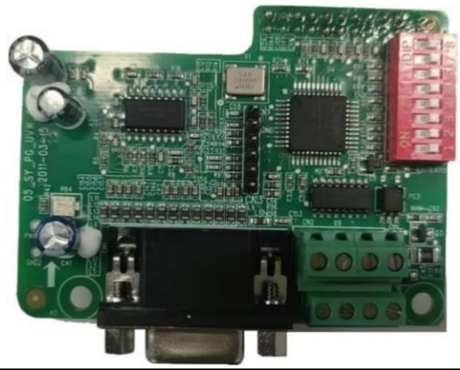
B.3.3 Sin/Cos encoder PG card (EC-PG102-05) and UVW encoder PG card (EC-PG103-05)

B.3.3.1 Product features

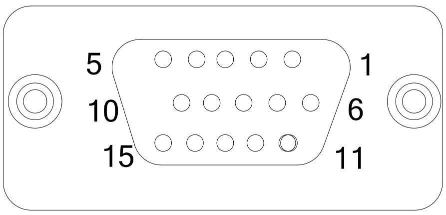
Specification	Sin/Cos encoder PG card EC-PG102-05	UVW encoder PG card EC-PG103-05
Frequency division coefficient	1 (Without a frequency-division switch)	1–256 (With a frequency-division switch)
Output power supply	● Adjustable voltage range: 4.75V–7V ● Default setting: 5V/±5% ● Max. output current: 300mA	● Adjustable voltage range: 4.75V–7V ● Default setting: 5V/±5% ● Max. output current: 300mA
Output signal	● Output form: Two quadrature frequency division differential outputs, and open collector output ● Open collector output resistance: 70Ω	● Output form: Two quadrature differential outputs, and open collector output ● Open collector output resistance: 70Ω

Note: You can choose the output voltage according to your actual use. When transmitting encoder signals over long distances, the output supply voltage can be adjusted using a potentiometer (the voltage adjustment method is the same as that for the incremental encoder card) to extend the wiring distance.

B.3.3.2 Terminal and dial switch description

EC-PG102-05 appearance	EC-PG103-05 appearance
	

The UVW encoder PG card, like the Sin/Cos encoder PG card, has one signal cable interface and seven user terminals, as shown in the following figure.



DB15

OA+	OA-	OB+	OB-
OA	OB	COM1	

Frequency-divided output interface

Note:

- OA+, OA-, OB+, and OB- are differential output signal terminals, while OA, OB, and COM1 are open collector signal output terminals.
- The PG card does not connect PE to the earth internally, you can ground it during use.
- The Sin/Cos encoder and UVW encoder PG cards have the similar output signal wiring method as the incremental encoder PG card, but they do not support push-pull output.

The DB15 three-row female interface is the encoder signal input interface. The following table shows the PG card interface signal arrangement sequence.

VFD interface	SIN/COS	UVW
5	A+	A+
6	A-	A-
8	B+	B+
1	B-	B-
3	R+	Z+
4	R-	Z-
11	C+	U+
10	C-	U-
12	D+	V+
13	D-	V-

VFD interface	SIN/COS	UVW
9	PWR	PWR
7	GND	GND
14	Empty	W
15	Empty	W-
2	Empty	Empty

Note:

- When using the above two PG cards, the signal arrangement of the Sin/Cos or UVW encoder must correspond to the respective signal arrangement of the PG card before inserting the DB15 male connector into the DB15 female connector on the PG card.
- The frequency division coefficient setting for the UVW encoder PG card is the same as that for the incremental encoder.
- The Sin/Cos encoder PG card and the UVW encoder PG card are primarily used for closed-loop vector control of synchronous motors.
- The UVW encoder PG card supports 5V incremental encoder signal processing, and the input wiring method is the same as that for the incremental encoder PG card. It is mainly used for the A, B, Z, PWR, and GND ports on the DB15 connector.

Appendix C Function parameter list

C.1 Introduction to function code setting

The function parameters are divided into 21 groups (P00–P20) by function, and each group includes several function codes. A three-level menu style is applied to the function codes. For example, "P08.08" indicates the 8th function code in the P00.08 group. P29 group consists of factory function parameters, which are user inaccessible.

The function group numbers correspond to the level-1 menus, the function codes correspond to the level-2 menus, and the function parameters correspond to the level-3 menus.

1. The content of the function code table is as follows:

Column 1 "Function code ": Code of the function group and parameter.

Column 2 "Name": Full name of the function parameter.

Column 3 "Description": Detailed description of the function parameter.

Column 4 "Setting range": The valid setting value range of the function parameters, displayed on the touch screen.

Column 5 "Default": Initial value set in factory.

Column 6 "Modify": Whether the parameter can be modified, and conditions for the modification.

"○" indicates that the value of the parameter can be modified when the VFD is in stopped or running state.

"◎" indicates that the value of the parameter cannot be modified when the VFD is in running state.

"●" indicates that the value of the parameter is detected and recorded, and cannot be modified.

(The VFD automatically checks and constrains the modification of parameters, which helps prevent incorrect modifications.)

2. The parameters adopt the decimal system (DEC). If the hexadecimal system is adopted, all bits are mutually independent on data during parameter editing, and the setting ranges at some bits can be hexadecimal (0–F).

3. "Default" indicates the factory setting of the function parameter. If the value of the parameter is detected or recorded, the value cannot be restored to the factory setting.

4. To better protect parameters, the VFD provides the password protection function. After setting the user password, the system will enter into the user password authentication state before the touch screen enters into the user interface. You need to enter the correct user password to enter the interface. For the factory parameters, you need to enter the correct factory password to enter the interface. (You are not advised to modify the factory parameters. Incorrect parameter setting may cause operation exceptions or even damage to the VFD.) If password protection is not in locked state, you can change the password any time.

5. When you modify function parameters through serial communication, the user password protection function is also applicable and compliant with the same rule.

C.2 Function parameter list

Function code	Name	Description	Setting range	Default	Modify
P00 group Basic functions					
P00.00	Control mode selection	0: Space voltage vector control 1: Asynchronous sensorless vector control 2: Synchronous sensorless vector control 3: Vector control	0–3	0	◎
P00.01	Channel of running commands	0: Local 1: Terminal 2: Communication 3: Master	0–3	0	○
P00.02	Current communication command channel	0: Modbus 1: Fieldbus 2: Ethernet	0–2	0	○
P00.03	UP/DOWN setting	0: Valid, save the setting at power-off. 1: Valid, do not save the setting at power-off. 2: Invalid 3: Valid during running, clear at stop	0–3	0	○
P00.04	UP/DOWN adjustment	-120.00–120.00Hz	-120.00–120.0	0.00Hz	●
P00.05	Speed reference mode	0: Speed mode 1: Torque mode 2: Slave speed mode 3: Slave torque mode	0–3	0	◎
P00.06	Setting channel of frequency A command	0: Function code 1: AI1 2: AI2 3: AI3 4: AI4 5: Multi-step speed running 6: PID control 7: Modbus 8: Fieldbus	0–8	0	○
P00.07	Setting channel of frequency B command	0: AI1 1: AI2 2: AI3 3: AI4	0–3	0	○
P00.08	Reference object of frequency B command	0: Max. output frequency 1: Frequency A command	0–1	0	○

Function code	Name	Description	Setting range	Default	Modify
P00.09	Combination mode of setting source	0: A 1: B 2: A+B 3: Max(A, B)	0–3	0	○
P00.10	Max. output frequency	P00.11–200.00Hz	P00.11–200.00	50.00Hz	◎
P00.11	Upper limit of running frequency	P00.12–P00.10 (Max. ouput frequency)	P00.12–P00.10	50.00Hz	◎
P00.12	Lower limit of running frequency	0.00Hz–P00.11 (Upper limit of running frequency)	0.00–P00.10	0.00Hz	◎
P00.13	Function code setting frequency	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	50.00Hz	○
P00.14	Torque setting	0: Function code 1: AI1 2: AI2 3: AI3 4: AI4 5: Reserved 6: Multi-step speed running 7: Modbus 8: Fieldbus	0–8	0	○
P00.15	Function code setting torque	-200.0%–200.0%	-200.0–200.0	30.0%	○
P00.16	ACC time 1	0.1–3600.0s	0.1–3600.0	Model depended	○
P00.17	DEC time 1	0.1–3600.0s	0.1–3600.0	Model depended	○
P00.18	Running direction	0: Run at the default direction. 1: Run at the opposite direction. 2: Disable reverse running	0–2	0	○
P00.19	Carrier frequency	0.5–2.0kHz	0.5–2.0	0.7kHz	◎
P00.20	Motor parameter autotuning	0: No operation 1: Rotary autotuning 2: Encoder autotuning 3: Motor frequency drop rate autotuning 4: Power frequency and variable frequency switching time autotuning 5: Static autotuning (reserved)	0–5	0	◎
P00.21	Function parameter restore	0: No operation 1: Restore to default values 2: Clear fault files 3: Clear ammeter records	0–3	0	◎
P00.22	AVR function selection	0: Invalid 1: Valid during the whole procedure 2: Disable during DEC	0–2	1	◎

Function code	Name	Description	Setting range	Default	Modify
P00.23	Encoder autotuning frequency	0.00Hz–P00.10	0.00–P00.10	10.00Hz	●
P00.24	Forward rotation upper-limit frequency in torque control	0.00Hz–P00.10	0.00–P00.10	50.00Hz	○
P00.25	Reverse rotation upper-limit frequency in torque control	0.00Hz–P00.10	0.00–P00.10	50.00Hz	○
P00.26	Electromotive torque upper limit	0.0–200.0%	0.0–200.0	100.0%	○
P00.27	Power generation torque upper limit	0.0–200.0%	0.0–200.0	100.0%	○
P01 group Start and stop control					
P01.00	Braking mode	0: DC braking 1: Dual-frequency braking	0–1	0	◎
P01.01	Start mode	0: Direct start 1: Start after DC braking 2: Start after rotating speed tracking	0–2	0	◎
P01.02	Starting frequency of direct start	0.00–10.00Hz	0.00–10.00	0.10Hz	◎
P01.03	Starting frequency hold time	0.0–50.0s	0.0–50.0	0.0s	◎
P01.04	Braking current before start	0.0–120.0% (of the VFD rated current)	0.0–120.0	0.0%	◎
P01.05	Braking time before start	0.0–50.0s	0.0–50.0	0.0s	◎
P01.06	ACC and DEC mode	0: Linear type 1: S curve	0–1	0	◎
P01.07	S curve starting segment proportion	1.0–40.0% (ACC/DEC time)	1.0–40.0	30.0%	◎
P01.08	S curve ending segment proportion	1.0–40.0% (ACC/DEC time)	1.0–40.0	30.0%	◎
P01.09	Stop mode	0: Decelerate to stop 1: Coast to stop	0–1	0	○
P01.10	Starting frequency of DC braking at stop	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz	○
P01.11	Wait time before DC braking at stop	0.0–50.0s	0.0–50.0	0.0s	○
P01.12	DC braking current at stop	0.0–120.0% (of the VFD rated current)	0.0–120.0	0.0%	○
P01.13	DC braking time at stop	0.0–50.0s	0.0–50.0	0.0s	○
P01.14	Torque of frequency superposition braking	0.0%–50.0%	0.0–50.0	30.0%	○

Function code	Name	Description	Setting range	Default	Modify
P01.15	Enabling voltage of frequency superposition braking	1000–1500V	1000–1500	1130V	○
P01.16	Dual-frequency frequency of frequency superposition braking	200.0–500.0Hz	200.0–500.0	300.0Hz	○
P01.17	Dual-frequency current-limit point of frequency superposition braking	0.0–100.0%	0.0–100.0	0.0%	○
P01.18	Dual-frequency voltage-limit point of frequency superposition braking	50.0%–80.0%	50.0–80.0	80.0%	○
P01.19	Proportional coefficient of frequency superposition braking	0–65535	0–65535	5	◎
P01.20	Integral coefficient of frequency superposition braking	0–65535	0–65535	2	◎
P01.21	Adjusting multiple of frequency superposition braking	0–65535	0–65535	2	◎
P01.22	Reserved	0–65535	0–65535	0	●
P01.23	Reserved	0–65535	0–65535	0	●
P01.24	FWD/REV running deadzone time	0.0–3600.0s	0.0–3600.0	1.0s	○
P01.25	Action selected when running frequency less than frequency lower limit (valid when frequency lower limit greater than 0)	0: Run at the frequency lower limit 1: Stop 2: Sleep	0–2	0	◎
P01.26	Power-off restart selection	0: Disable 1: Enable	0–1	0	○
P01.27	Sudden power-off time	0.00–50.00s	0.00–50.00	1.00s	◎
P01.28	Wait time for restart after power-off	0.0–3600.0s (valid when P01.17=1)	0.0–3600.0	1.0s	○
P01.29	Medium voltage switch action at stop	0: Cut off medium voltage during stop 1: Not cut off medium voltage during stop	0–1	1	○
P01.30	Waiting time of switching-on allowing	0.0–3600.0s	0.0–3600.0	10.0s	○

Function code	Name	Description	Setting range	Default	Modify
P01.31	Running ready waiting time	0.0–3600.0s	0.0–3600.0	10.0s	○
P01.32	Pull-in current at zero frequency start	0.0–100.0%	0.0–100.0	20.0%	○
P01.33	Cut-off frequency at zero frequency start	P01.02–P14.17	P01.02–P14.17	0.00Hz	○
P01.34	Exit time of pull-in current at zero frequency start	0.00–40.00s	0.00–40.00	1.00s	○
P01.35	Command source of coast to stop	0: None 1: UDP 2: Internally command 3: Terminal 4: Modbus 5: PROFIBUS	0–5	0	●
P01.36	Command source of decelerate to stop	0: None 1: UDP 2: Terminal 3: Modbus 4: PROFIBUS	0–4	0	●
P02 group Motor parameter 1					
P02.00	Type of motor 1	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P02.01	Rated power of AM 1	4–50000kW	4–50000	Model depended	◎
P02.02	Rated frequency of AM 1	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P02.03	Rated speed of AM 1	1–36000rpm	1–36000	Model depended	◎
P02.04	Rated voltage of AM 1	0–20000V	0–20000	Model depended	◎
P02.05	Rated current of AM 1	0.1–1000.0A	0.1–1000.0	Model depended	◎
P02.06	Stator resistance of AM 1	0.001–65.535Ω	0.001–65.535	Model depended	○
P02.07	Rotor resistance of AM 1	0.001–65.535Ω	0.001–65.535	Model depended	○
P02.08	Stator and rotor leakage inductance of AM 1	0.1–6553.5mH	0.1–6553.5	Model depended	○
P02.09	Stator and rotor mutual inductance of AM 1	0.1–6553.5mH	0.1–6553.5	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
P02.10	No-load current of AM 1	0.01–655.35A	0.01–655.35	Model depended	○
P02.11	Rated power of SM 1	4–50000kW	4–50000	Model depended	◎
P02.12	Rated frequency of SM 1	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P02.13	Rated speed of SM 1	0–36000rpm	0–36000	1500rpm	◎
P02.14	Number of pole pairs of SM 1	1–50	1–50	2	◎
P02.15	Rated voltage of SM 1	0–20000V	0–20000	Model depended	◎
P02.16	Rated current of SM 1	0.1–1000.0A	0.1–1000.0	Model depended	◎
P02.17	Stator resistance of SM 1	0.001–65.535Ω	0.001–65.535	Model depended	○
P02.18	Direct-axis inductance of SM 1	0.01–655.35mH	0.01–655.35	Model depended	○
P02.19	Quadrature-axis inductance of SM 1	0.01–655.35mH	0.01–655.35	Model depended	○
P02.20	Counter-emf constant of SM 1	0–20000	0–20000	9700	○
P03 group Vector control					
P03.00	Speed-loop proportional gain 1	0–100	0–100	5	○
P03.01	Speed-loop integral time 1	0.01–10.00s	0.01–10.00	0.10s	○
P03.02	Low-point frequency for switching	0.00Hz–P03.05	0.00–P03.05	5.00Hz	○
P03.03	Speed-loop proportional gain 2	0–100	0–100	5	○
P03.04	Speed-loop integral time 2	0.01–10.00s	0.01–10.00	0.10s	○
P03.05	High-point frequency for switching	P03.02–P00.10 (Max. ouput frequency)	P03.02–P00.10	10.00Hz	○
P03.06	Current-loop proportional coefficient P	0–65535	0–65535	500	○
P03.07	Current-loop integral coefficient I	0–65535	0–65535	500	○
P03.08	Speed loop filter time	0.000–1.000s	0.000–1.000	0.002s	○
P03.09	VC slip compensation coefficient	50.0%–200.0%	50.0–200.0	100.0%	○
P03.10	Reserved	0–65535	0–65535	0	○
P03.11	Reserved	0–65535	0–65535	0	○
P03.12	Torque upper limit setting	0.0–200.0% (of the VFD rated current)	0.0–200.0	150.0%	○

Function code	Name	Description	Setting range	Default	Modify
P04 group Space voltage vector control					
P04.00	V/F curve setting	0: Straight-line V/F curve 1: Multi-point V/F curve 2: Torque-down V/F curve (power of 1.3) 3: Torque-down V/F curve (power of 1.7) 4: Torque-down V/F curve (power of 2.0) 5: Customized V/F (V/F separation)	0–5	0	◎
P04.01	Torque boost	0.0%–10.0%	0.0–10.0	0.1%	○
P04.02	Torque boost cut-off	0.0%–50.0% (of the motor rated frequency)	0.0–50.0	20.0%	◎
P04.03	V/F slip compensation	0.0%–200.0%	0.0–200.0	0.0%	○
P04.04	Energy-saving operation	0: Energy-saving operation is invalid 1: Energy-saving operation is valid	0–1	0	◎
P04.05	V/F frequency point 1	0.00Hz–P04.07	0.00–P04.07	0.00Hz	○
P04.06	V/F voltage point 1	0.0%–P04.08	0.0–P04.08	0.0%	○
P04.07	V/F frequency point 2	P04.05–P04.09	P04.05–P04.09	0.00Hz	○
P04.08	V/F voltage point 2	P04.06–P04.10	P04.06–P04.10	0.0%	○
P04.09	V/F frequency point 3	P04.07–P00.10 (max. frequency)	P04.07–P00.10	0.00Hz	○
P04.10	V/F voltage point 3	P04.08–100.0% (of the motor rated voltage)	P04.08–100.0	0.0%	○
P04.11	PWM method	0: PWM method 1 1: PWM method 2	0–1	0	◎
P04.12	Voltage setting channel	The function code is used to select the output voltage setting channel at V/F curve separation. 0: Voltage 1: AI1 2: AI2 3: AI3 4: AI4 5: Multi-step running 6: PID 7: Modbus communication 8: PROFIBUS/PROFINET communication	0–8	0	○
P04.13	Voltage set through keypad	0.0%–100.0% (of the motor rated voltage)	0.0–100.0	20.0%	○
P04.14	Voltage increase time	0.0s–3600.0s	0.0–3600.0	100.0s	○
P04.15	Voltage decrease time	0.0s–3600.0s	0.0–3600.0	100.0s	○

Function code	Name	Description	Setting range	Default	Modify
P04.16	Min. output voltage	0.0%–P04.17	0.0–P04.17	5.0%	○
P04.17	Max. output voltage	P04.16–100.0%	P04.16–100.0	100.0%	○
P04.18	Low-frequency oscillation control factor	0–100	0–100	10	○
P04.19	High-frequency oscillation control factor	0–100	0–100	0	○
P04.20	Vibration control frequency threshold	0.00–120.00Hz	0.00–120.00	15.00Hz	○
P05 group Input terminal functions					
P05.00	Function of S1	0: No function 1: Run forward 2: Run reversely 3: Enable three-wire running 4: Forward jogging 5: Reverse jogging 6: Coast to stop (emergency stop) 7: Fault reset 8: External fault NO input 9: External fault NC input 10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Clear the frequency increase/decrease setting temporarily 14: ACC/DEC time selection 1 15: ACC/DEC time selection 2 16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Pause multi-step speed running 21: Switch between A setting and B setting 22: Switch between (A+B) setting and A setting 23: Switch between (A+B) setting and B setting 24: Variable-frequency running (pulse signal↑) 25: Power-frequency running	0–71	1	◎
P05.01	Function of S2		0–71	2	◎
P05.02	Function of S3		0–71	3	◎
P05.03	Function of S4		0–71	6	◎
P05.04	Function of S5		0–71	7	◎
P05.05	Function of S6		0–71	0	◎
P05.06	Function of S7		0–71	0	◎
P05.07	Function of S8		0–71	0	◎
P05.08	Function of S9		0–71	0	◎
P05.09	Function of S10		0–71	0	◎
P05.10	Function of S11		0–71	0	◎
P05.11	Function of S12		0–71	0	◎

Function code	Name	Description	Setting range	Default	Modify
		(pulse signal↑) 26: Switching from variable frequency to power frequency (pulse signal ↑) 27: Switching from power frequency to variable frequency (pulse signal ↑) 28: Medium voltage disconnection input 29: Pause PID control 30: UPS feedback 31: Reserved 32: Switching cabinet address 0 33: Switching cabinet address 1 34: Switching cabinet address 2 35: Switch the running command to local 36: Switch the running command to terminal 37: Switch the running command to communication 38: DCS start 39: DCS stop 40: Disable torque control 41: Enable master/slave control 42: Master-slave speed synchronization counting reset terminal 43: Disable ACC/DEC 44: Precharge cabinet vacuum contactor KM2 feedback 45: Commissioning signal input 46: Start on-site operation box 47: Stop on-site operation box 48: Medium voltage switch QF1M1 feedback 49: Medium voltage switch QF1M2 feedback 50: Medium voltage switch QF1M3 feedback 51: Medium voltage switch QF1M4 feedback 52: Medium voltage switch QF1M5 feedback 53: Medium voltage switch QF1M6 feedback 54: Medium voltage switch QF1M7			

Function code	Name	Description	Setting range	Default	Modify
		feedback 55: Medium voltage switch QF1M8 feedback 56: Medium voltage switch QF2M1 feedback 57: Medium voltage switch QF2M2 feedback 58: Medium voltage switch QF2M3 feedback 59: Medium voltage switch QF2M4 feedback 60: Medium voltage switch QF2M5 feedback 61: Medium voltage switch QF2M6 feedback 62: Medium voltage switch QF2M7 feedback 63: Medium voltage switch QF2M8 feedback 64: Switching cabinet 1 remote on-site state 65: Switching cabinet 2 remote on-site state 66: Switching cabinet 3 remote on-site state 67: Switching cabinet 4 remote on-site state 68: Switching cabinet 5 remote on-site state 69: Switching cabinet 6 remote on-site state 70: Switching cabinet 7 remote on-site state 71: Switching cabinet 8 remote on-site state			
P05.12	Input terminal polarity setup	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	○
P05.13	Digital filter times	1–500	1–500	20	○
P05.14	Terminal control running mode	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2	0–3	0	◎
P05.15	Frequency increment change rate of the terminal UP	0.01–50.00Hz/s	0.01–50.00	0.50Hz/s	○
P05.16	Frequency increment change rate of the terminal DOWN	0.01–50.00Hz/s	0.01–50.00	0.50Hz/s	○

Function code	Name	Description	Setting range	Default	Modify
P05.17	AI1 lower limit	0.00V–P05.19	0.00–P05.19	0.00V	○
P05.18	Corresponding setting of AI1 lower limit	-100.0%–P05.20	-100.0–P05.20	0.0%	○
P05.19	AI1 upper limit	P05.17–10.00V	P05.17–10.00	10.00V	○
P05.20	Corresponding setting of AI1 upper limit	P05.18–100.0%	P05.18–100.0	100.0%	○
P05.21	AI1 input filter time	0.00–10.00s	0.00–10.00	2.00s	○
P05.22	AI2 lower limit	0.00–P05.24	0.00–P05.24	0.00V	○
P05.23	Corresponding setting of AI2 lower limit	-100.0%–P05.25	-100.0–P05.25	0.0%	○
P05.24	AI2 upper limit	P05.22–10.00V	P05.22–10.00	10.00V	○
P05.25	Corresponding setting of AI2 upper limit	P05.23–100.0%	P05.23–100.0	100.0%	○
P05.26	AI2 input filter time	0.00–10.00s	0.00–10.00	2.00s	○
P05.27	AI3 lower limit	-10.00V–P05.29	-10.00–P05.29	0.00V	○
P05.28	Corresponding setting of AI3 lower limit	-100.0%–P05.30	-100.0–P05.30	0.0%	○
P05.29	AI3 upper limit	P05.27–10.00V	P05.27–10.00	10.00V	○
P05.30	Corresponding setting of AI3 upper limit	P05.28–100.0%	P05.28–100.0	100.0%	○
P05.31	AI3 input filter time	0.00–10.00s	0.00–10.00	2.00s	○
P05.32	AI4 lower limit	-10.00V–P05.34	-10.00–P05.34	0.00V	○
P05.33	Corresponding setting of AI4 lower limit	-100.0%–P05.35	-100.0–P05.35	0.0%	○
P05.34	AI4 upper limit	P05.32–10.00V	P05.32–10.00	10.00V	○
P05.35	Corresponding setting of AI4 upper limit	P05.33–100.0%	P05.33–100.0	100.0%	○
P05.36	AI4 input filter time	0.00–10.00s	0.00–10.00	2.00s	○
P05.37	AI1 mode switchover	0: Current 1: Voltage	0–1	0	○
P05.38	AI2 mode switchover		0–1	0	○
P05.39	AI3 mode switchover		0–1	0	○
P05.40	AI1 calibration configuration	0–2 0: Disable	0–2	0	○

Function code	Name	Description	Setting range	Default	Modify
P05.41	AI2 calibration configuration	1: Calibrate AI lower limit 2: Calibrate AI upper limit **Note:** When input 4mA–20mA corresponds to 0–10V, first calibrate AI lower limit, input 4mA, and wait for 20s to complete the calibration. Calibrate AI upper limit, input 20mA, and wait for 20s to complete the calibration. Then set the function code to 0.	0–2	0	○
P05.42	AI3 calibration configuration		0–2	0	○
P05.43	AI4 zero calibration coefficient	-10.00%–10.00%	-10.00–10.00	0.00%	○
P05.44	Communication analog lower limit	0.000V–P05.46	0.000–P05.46	0.000V	○
P05.45	Corresponding setting of communication analog lower limit	-100.0%–P05.47	-100.0–P05.47	0.0%	○
P05.46	Communication analog upper limit	P05.44–10.000V	P05.44–10.000	10.000V	○
P05.47	Corresponding setting of communication analog upper limit	P05.45–100.0%	P05.45–100.0	100.0%	○
P05.48	Communication setting range	0.00–100.00mm	0.00–100.00	0.00mm	○
P05.49	S1 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.50	S1 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.51	S2 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.52	S2 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.53	S3 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.54	S3 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.55	S4 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.56	S4 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.57	S5 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.58	S5 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.59	S6 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.60	S6 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.61	S7 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.62	S7 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.63	S8 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.64	S8 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.65	S9 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.66	S9 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.67	S10 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.68	S10 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○

Function code	Name	Description	Setting range	Default	Modify
P05.69	S11 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.70	S11 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.71	S12 switch-on delay	0.00–50.00s	0.00–50.00	1.50s	○
P05.72	S12 switch-off delay	0.00–50.00s	0.00–50.00	1.50s	○
P06 group Output terminal functions					
P06.00	RO1 output	0: No output 1: In VFD running 2: Fault output 3: Frequency level detection FDT output 4: Frequency reached 5: Zero speed running 6: Variable-frequency working state 7: Power frequency working state 8: Running time reached 9: Running forward 10: Running reversely 11: Ready for running (running request) 12: Alarm output Variable-frequency: 13: Permission of medium voltage switch QF1M1 switching on 14: Permission of medium voltage switch QF1M2 switching on 15: Permission of medium voltage switch QF1M3 switching on 16: Permission of medium voltage switch QF1M4 switching on 17: Permission of medium voltage switch QF1M5 switching on 18: Permission of medium voltage switch QF1M6 switching on 19: Permission of medium voltage switch QF1M7 switching on 20: Permission of medium voltage switch QF1M8 switching on power frequency Power frequency: 21: Permission of medium voltage switch QF2M1 switching on 22: Permission of medium voltage switch QF2M2 switching on 23: Permission of medium voltage switch QF2M3 switching on 24: Permission of medium voltage	0–91	1	○
P06.01	RO2 output		0–91	2	○
P06.02	RO3 output		0–91	11	○
P06.03	RO4 output		0–91	12	○
P06.04	RO5 output		0–91	0	○
P06.05	RO6 output		0–91	0	○
P06.06	RO7 output		0–91	0	○
P06.07	RO8 output		0–91	0	○
P06.08	RO9 output		0–91	0	○
P06.09	RO10 output		0–91	0	○
P06.10	RO11 output		0–91	0	○
P06.11	RO12 output		0–91	0	○
P06.12	RO13 output		0–91	0	○
P06.13	RO14 output		0–91	0	○
P06.14	RO15 output		0–91	0	○
P06.15	RO16 output		0–91	0	○
P06.16	RO17 output		0–91	0	○
P06.17	RO18 output		0–91	0	○
P06.18	RO19 output		0–91	0	○
P06.19	RO20 output		0–91	0	○
P06.20	RO21 output		0–91	0	○
P06.21	RO22 output		0–91	0	○

Function code	Name	Description	Setting range	Default	Modify
		switch QF2M4 switching on 25: Permission of medium voltage switch QF2M5 switching on 26: Permission of medium voltage switch QF2M6 switching on 27: Permission of medium voltage switch QF2M7 switching on 28: Permission of medium voltage switch QF2M8 switching on 29: Permission of medium voltage switch QF1M1 switching off 30: Permission of medium voltage switch QF1M2 switching off 31: Permission of medium voltage switch QF1M3 switching off 32: Permission of medium voltage switch QF1M4 switching off 33: Permission of medium voltage switch QF1M5 switching off 34: Permission of medium voltage switch QF1M6 switching off 35: Permission of medium voltage switch QF1M7 switching off 36: Permission of medium voltage switch QF1M8 switching off 37: Permission of medium voltage switch QF2M1 switching off 38: Permission of medium voltage switch QF2M2 switching off 39: Permission of medium voltage switch QF2M3 switching off 40: Permission of medium voltage switch QF2M4 switching off 41: Permission of medium voltage switch QF2M5 switching off 42: Permission of medium voltage switch QF2M6 switching off 43: Permission of medium voltage switch QF2M7 switching off 44: Permission of medium voltage switch QF2M8 switching off 45: Variable-frequency working state of switching cabinet 1 46: Power-frequency working state of switching cabinet 1 47: Variable-frequency working state of switching cabinet 2			

Function code	Name	Description	Setting range	Default	Modify
		48: Power-frequency working state of switching cabinet 2 49: Variable-frequency working state of switching cabinet 3 50: Power-frequency working state of switching cabinet 3 51: Variable-frequency working state of switching cabinet 4 52: Power-frequency working state of switching cabinet 4 53: Variable-frequency working state of switching cabinet 5 54: Power-frequency working state of switching cabinet 5 55: Variable-frequency working state of switching cabinet 6 56: Power-frequency working state of switching cabinet 6 57: Variable-frequency working state of switching cabinet 7 58: Power-frequency working state of switching cabinet 7 59: Variable-frequency working state of switching cabinet 8 60: Power-frequency working state of switching cabinet 8 (45–60: Both power frequency and variable frequency valid at the same time indicates fault.) 61: Unit bypass state 62: Remote-local state 63–64: Reserved 65: Low-voltage commissioning vacuum contactor KM1 control 66: Low-voltage commissioning vacuum contactor KM2 control 67: Switching cabinet 1# KM1 feedback signal 68: Switching cabinet 1# KM2 feedback signal 69: Switching cabinet 1# KM3 feedback signal 70: Switching cabinet 2# KM1 feedback signal 71: Switching cabinet 2# KM2 feedback signal 72: Switching cabinet 2# KM3			

Function code	Name	Description	Setting range	Default	Modify
		feedback signal 73: Switching cabinet 3# KM1 feedback signal 74: Switching cabinet 3# KM2 feedback signal 75: Switching cabinet 3# KM3 feedback signal 76: Switching cabinet 4# KM1 feedback signal 77: Switching cabinet 4# KM2 feedback signal 78: Switching cabinet 4# KM3 feedback signal 79: Switching cabinet KM4 feedback signal 80: Switching cabinet 1 QS1 feedback signal 81: Switching cabinet 1 QS2 feedback signal 82: Switching cabinet 1 QS3 feedback signal 83: Switching cabinet 2 QS1 feedback signal 84: Switching cabinet 2 QS2 feedback signal 85: Switching cabinet 2 QS3 feedback signal 86: Switching cabinet 3 QS1 feedback signal 87: Switching cabinet 3 QS2 feedback signal 88: Switching cabinet 3 QS3 feedback signal 89: Switching cabinet 4 QS1 feedback signal 90: Switching cabinet 4 QS2 feedback signal 91: Switching cabinet 4 QS3 feedback signal			
P06.22	AO1 output	0: Running frequency (100% corresponds to the max. frequency) 1: Set frequency (100% corresponds to the max. frequency) 2: Output current valid value (100% corresponds to twice the	0–10	0	○
P06.23	AO2 output		0–10	0	○
P06.24	AO3 output		0–10	0	○
P06.25	AO4 output		0–10	0	○
P06.26	AO5 output		0–10	0	○

Function code	Name	Description	Setting range	Default	Modify
		VFD rated current) 3: Output current valid value (100% corresponds to twice the motor rated current) 4: Output voltage (100% corresponds to 1.2 times the VFD rated voltage) 5: Output power (100% corresponds to twice the motor rated power) 6: Output torque (100% corresponds to twice the motor rated torque) 7: AI1 input value (100% corresponds to 10V) 8: AI2 input value (100% corresponds to 10V) 9: AI3 input value (100% corresponds to 10V) 10: AI4 input value (100% corresponds to 10V)			
P06.27	AO1 output lower limit	0.00%–P06.29	0.00–P06.29	0.00%	○
P06.28	AO1 output corresponding to lower limit	0.00V–P06.30	0.00–P06.30	0.00V	○
P06.29	AO1 output upper limit	P06.27–100.0%	P06.27–100.0	100.0%	○
P06.30	AO1 output corresponding to upper limit	P06.28–10.00V	P06.28–10.00	10.00V	○
P06.31	AO2 output lower limit	0.00%–P06.33	0.00–P06.33	0.0%	○
P06.32	AO2 output corresponding to lower limit	0.00V–P06.34	0.00–P06.34	0.00V	○
P06.33	AO2 output upper limit	P06.31–100.0%	P06.31–100.0	100.0%	○
P06.34	AO2 output corresponding to upper limit	P06.32–10.00V	P06.32–10.00	10.00V	○
P06.35	AO3 output lower limit	0.00%–P06.37	0.00–P06.37	0.0%	○
P06.36	AO3 output corresponding to lower limit	0.00V–P06.38	0.00–P06.38	0.00V	○
P06.37	AO3 output upper	P06.35–100.0%	P06.35–	100.0%	○

Function code	Name	Description	Setting range	Default	Modify
	limit		100.0		
P06.38	AO3 output corresponding to upper limit	P06.36–10.00V	P06.36–10.00	10.00V	○
P06.39	AO4 output lower limit	0.00%–P06.41	0.00–P06.41	0.0%	○
P06.40	AO4 output corresponding to lower limit	0.00V–P06.42	0.00–P06.42	0.00V	○
P06.41	AO4 output upper limit	P06.39–100.0%	P06.39–100.0	100.0%	○
P06.42	AO4 output corresponding to upper limit	P06.40–10.00V	P06.40–10.00	10.00V	○
P06.43	AO5 output lower limit	0.00%–P06.45	0.00–P06.45	0.0%	○
P06.44	AO5 output corresponding to lower limit	0.00V–P06.46	0.00–P06.46	0.00V	○
P06.45	AO5 output upper limit	P06.43–100.0%	P06.43–100.0	100.0%	○
P06.46	AO5 output corresponding to upper limit	P06.44–10.00V	P06.44–10.00	10.00V	○
P06.47	RO1 switch-on delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.48	RO1 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.49	RO2 switch-on delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.50	RO2 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.51	RO3 switch-on delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.52	RO3 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.53	RO4 switch-on delay	0.000–50.00s	0.00–50.00	0.00s	○
P06.54	RO4 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.55	RO5 switch-on delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.56	RO5 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.57	RO6 switch-on delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.58	RO6 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.59	RO7 switch-on delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.60	RO7 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.61	RO8 switch-on delay	0.00–50.00s	0.00–50.00	0.00s	○
P06.62	RO8 switch-off delay	0.00–50.00s	0.00–50.00	0.00s	○
P07 group Human-machine interface					
P07.00	Touch screen version	0.00–655.35	0.00–655.35	Default setting	●
P07.01	Standard I/O board software version	0.00–655.35	0.00–655.35	Default setting	●

Function code	Name	Description	Setting range	Default	Modify
P07.02	Software version (FPGA)	0.00–655.35	0.00–655.35	Default setting	●
P07.03	Software version (DSP)	0.00–655.35	0.00–655.35	Default setting	●
P07.04	Software version (ARM)	0.00–655.35	0.00–655.35	Default setting	●
P07.05	Unit MCU version	0.00–655.35	0.00–655.35	Default setting	●
P07.06	Max. number of available units	1–12	1–12	Default setting	●
P07.07	Supported motor type	0: Only AM 1: Only SM 2: SM and AM	0–2	Default setting	●
P07.08	Unit FPGA version	0.00–655.35	0.00–655.35	Default setting	●
P07.09	Two-quadrant and four-quadrant selection	0: Two-quadrant 1: Four-quadrant	0–1	Default setting	●
P07.10	Max. number of switching cabinets	0–4	0–4	Default setting	●
P07.11	Local accumulative running time	0–65535h	0–65535	0h	●
P07.12	Local running time	0–65535min	0–65535	0min	○
P07.13	Factory bar code 1	0–65535	0–65535	0	●
P07.14	Factory bar code 2	0–65535	0–65535	0	●
P07.15	Factory bar code 3	0–65535	0–65535	0	●
P07.16	Factory bar code 4	0–65535	0–65535	0	●
P07.17	Factory bar code 5	0–65535	0–65535	0	●
P07.18	Factory bar code 6	0–65535	0–65535	0	●
P08 group Enhanced functions					
P08.00	ACC time 2	0.1–3600.0s	0.1–3600.0	Model depended	○
P08.01	DEC time 2	0.1–3600.0s	0.1–3600.0	Model depended	○
P08.02	ACC time 3	0.1–3600.0s	0.1–3600.0	Model depended	○
P08.03	DEC time 3	0.1–3600.0s	0.1–3600.0	Model depended	○
P08.04	ACC time 4	0.1–3600.0s	0.1–3600.0	Model depended	○
P08.05	DEC time 4	0.1–3600.0s	0.1–3600.0	Model depended	○
P08.06	Running frequency of jogging	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	5.00Hz	○
P08.07	ACC time of jogging	0.1–3600.0s	0.1–3600.0	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
P08.08	DEC time of jogging	0.1–3600.0s	0.1–3600.0	Model depended	○
P08.09	Jump frequency 1	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz	○
P08.10	Jump frequency amplitude 1	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz	○
P08.11	Jump frequency 2	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz	○
P08.12	Jump frequency amplitude 2	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz	○
P08.13	Jump frequency 3	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz	○
P08.14	Jump frequency amplitude 3	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	0.00Hz	○
P08.15	Auto fault reset count	0–3	0–3	0	○
P08.16	Auto fault reset interval	0.1–100.0s	0.1–100.0	1.0s	○
P08.17	FDT electrical level detection value	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	50.00Hz	○
P08.18	FDT lagging detection value	0.0–100.0% (FDT electrical level)	0.0–100.0	5.0%	○
P08.19	Detection amplitude for frequency being reached	0.0–100.0% (of the max. frequency)	0.0–100.0	0.0%	○
P08.20	Overmodulation	0: Overmodulation is invalid 1: Overmodulation is valid	0–1	0	◎
P08.21	Cooling-fan running mode	0: Normal mode 1: The fan keeps running after power up.	0–1	1	○
P08.22	Alarm reset interval	0.0s (The alarm function is invalid) 0.1–3600.0s	0.0–3600.0	1.0s	○
P08.23	Reference frequency disconnection threshold	0.0–100.0%	0.0–100.0	0.0%	◎
P08.24	Reference frequency disconnection time	0.0–360.0s	0.0–360.0	0.0s	◎
P08.25	Drop control	0.00–10.00Hz	0.00–10.00	0.00Hz	○
P08.26	Reserved	0–65535	0–65535	0	○
P08.27	Unit alarm temperature setting	60.0–100.0°C	60.0–100.0	75.0°C	○
P08.28	Droop control mode	0: Droop control mode 1 1: Droop control mode 2	0–1	0	◎
P08.29	Droop control mode 1 droop frequency	-10.00–10.00Hz	-10.00–10.00	0.00Hz	●
P08.30	Droop control mode 2 droop frequency	-10.00–10.00Hz	-10.00–10.00	0.00Hz	●

Function code	Name	Description	Setting range	Default	Modify
P08.31	Ambient temperature alarm detection value	0–100°C	0–100	60°C	○
P08.32	Initialization time of fault reset count	0–65535min	0–65535	60min	○
P08.33	Allowed time of undervoltage fault reset	0–100s	0–100	10s	○
P08.34–P08.39	Reserved	0–65535	0–65535	0	○
P09 group Fault record parameters					
P09.00	Action selection 1 of DSP fault	Two bits stand for a fault. 0: No processing 1: Alarm 2: Light fault, stop but not cut off medium voltage power. 3: Serious fault, stop and cut off medium voltage power. Automatic reset is disabled.	0xAAAA–0xFFFF	0xEABA	○
P09.01	Action selection 2 of DSP fault	0x8AAA–0xFFFF	0x8AAA–0xFFFF	0x8EAA	○
P09.02	Action selection 3 of DSP fault	0xAA82–0xFFFF	0xAA82–0xFFFF	0xAA82	○
P09.03	Action selection 4 of DSP fault	0xAAAA–0xFFFF	0xAAAA–0xFFFF	0x0x07FC	○
P09.04	Action selection 1 of ARM fault	0x0000–0xFFFF	0x0000–0xFFFF	0x555D	○
P09.05	Action selection 2 of ARM fault	0x0000–0xFFFF	0x0000–0xFFFF	0x6555	○
P09.06	Action selection 3 of ARM fault	0x0000–0xFFFF	0x0000–0xFFFF	0x1555	○
P09.07	Action selection 4 of ARM fault	0x0000–0xFFFF	0x0000–0xFFFF	0x1555	○
P09.08	Action selection 1 of unit fault	0x2AEA–0xFFFF	0x2AEA–0xFFFF	0xAAEA	○
P09.09	Action selection 2 of unit fault	0x0AAA–0xFFFF	0x0AAA–0xFFFF	0xAAAA	○
P09.10	Action selection 3 of unit fault	0xAABF–0xFFFF	0xAABF–0xFFFF	0xAABF	○
P09.11	Action selection 4 of unit fault	0x000B–0xFFFF	0x000B–0xFFFF	0x000B	○
P09.12	2th-last DSP fault 1	bitN=0: No fault bitN=1: Fault Bit0: Software overcurrent Bit1: Hardware overcurrent Bit2: Grid overvoltage Bit3: Grid undervoltage	0x0000–0xFFFF	0x0000	●

Function code	Name	Description	Setting range	Default	Modify
		bit4: Motor overload Bit5: VFD overload Bit6: Phase loss on output side Bit7: Input phase loss detection fault Bit8: Current detection fault Bit9: Parameter autotuning fault Bit10: Encoder disconnection fault Bit11: Encoder reversal fault Bit12: Handshake fault Bit13: Input overcurrent Bit14: Voltage detection transmission board fault Bit15: Phase sequence inconsistency			
P09.13	2th-last DSP fault 2	BitN=0: No fault BitN=1: Fault Bit16: Magnetic pole position detection Bit17: Speed out-of-tolerance-range fault Bit18: VFD overspeed fault Bit19: Resolver position reading error Bit20: The resolver can't track the motor rotation bit21: Resolver signal distortion fault Bit22: UVW encoder connection fault Bit23: UVW encoder zero position fault Bit24: Encoder parameter autotuning fault Bit25: Transformer loss is too large Bit26: Reactive current is too large Bit27: Transformer overload Bit28: Input voltage imbalance Bit29: Input current imbalance Bit30–31: Reserved	0x0000–0xFFFF	0x0000	●
P09.14	2th-last ARM fault type 1	bitN=0: No fault bitN=1: Fault Bit0: Transformer overheating Bit1: Transformer tripping Bit2: External fault Bit3: Modbus communication fault Bit4: Buffer cabinet fault	0x0000–0xFFFF	0x0000	●

Function code	Name	Description	Setting range	Default	Modify
		Bit5: PID disconnection fault Bit6: Door access alarm Bit7: Synchronous switchover timeout Bit8: Synchronous switchover serious fault Bit9: Factory time reached Bit10: Motor temperature too high Bit11: Switching cabinet communication fault Bit12: Insufficient SD card capacity Bit13: QF feedback fault Bit14: DSP and ARM handshake fault bit15: Power off during running			
P09.15	2th-last ARM fault type 2	bitN=0: No fault bitN=1: Fault Bit16: PROFIBUS communication fault Bit17: Reference frequency disconnection detection fault Bit18: Switching cabinet 1 action fault Bit19: Switching cabinet 2 action fault Bit20: Switching cabinet 3 action fault Bit21: Switching cabinet 4 action fault Bit22: Version not match bit23: Reserved bit24: Ambient temperature too high Bit25: Unit optical-fiber communication fault Bit26: Fan overheating fault Bit27: Master/slave optical-fiber communication fault Bit28–bit29: Reserved Bit30: Temperature controller communication fault bit31: Reserved	0x0000–0xFFFF	0x0000	●
P09.16	2th-last unit fault 1	bitN=0: No fault bitN=1: Fault Bit0: Unit optical-fiber uplink communication fault Bit1: Unit optical-fiber downlink	0x0000–0xFFFF	0x0000	●

Function code	Name	Description	Setting range	Default	Modify
		communication fault Bit2: The unit is not ready Bit3: Unit overvoltage Bit4: Unit undervoltage Bit5: Unit power fault Bit6: Unit overheating Bit7: Unit input phase loss protection Bit8: Unit input power loss protection Bit9: Upper bridge VCE fault Bit10: Lower bridge VCE fault Bit11: Hardware overvoltage Bit12: The unit does not match Bit13: Unit bypass failure bit14: Reserved bit15: Reserved			
P09.17	2th-last unit fault 2	bitN=0: No fault bitN=1: Fault Bit16: Rectifier unit R-phase VCE Bit17: Rectifier unit S-phase VCE Bit18: Rectifier unit T-phase VCE Bit19: Grid current detection fault Bit20: Phase lock failure Bit21: Rectifier side overheating bit22: Reserved bit23: Reserved Bit24: Zero calculation fault Bit25: Hardware overcurrent Bit26–31: Reserved	0x0000–0xFFFF	0x0000	●
P09.18	2nd-last fault unit number	If the number is 0, there is no unit fault. If it is not 0, then A1–A12: 1–12 B1–B12: 13–24 C1–C12: 25–36	0–65535	0	●
P09.19	ACC/DEC state at 2nd-last fault	0: Constant speed 1: ACC 2: DEC	0–2	0	●
P09.20	Running frequency at 2nd-last fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz	●
P09.21	Set frequency at 2nd-last fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz	●
P09.22	Output current at 2nd-last fault	0.0–6553.5A	0.0–6553.5	0.0A	●
P09.23	Output voltage at 2nd-last fault	0–65535V	0–65535	0V	●

Function code	Name	Description	Setting range	Default	Modify
P09.24	Input current at 2nd-last fault	0.0–6553.5A	0.0–6553.5	0.0A	●
P09.25	Input voltage at 2nd-last fault	0–65535V	0–65535	0V	●
P09.26	Unit bus voltage at 2nd-last fault	0–65535V	0–65535	0V	●
P09.27	Unit temperature at 2nd-last fault	0.0–6553.5°C	0.0–6553.5	0.0°C	●
P09.28	System input terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.29	User input terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.30	System output terminal state at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.31	User output terminal state 1 at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.32	User output terminal state 2 at 2nd-last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.33	Last DSP fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.34	Last DSP fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.35	Last ARM fault type 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.36	Last ARM fault type 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.37	Last unit fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.38	Last unit fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.39	Last fault unit number	Same as the description of P09.18.	0–36	0	●
P09.40	ACC/DEC state at last fault	0: Constant speed 1: ACC 2: DEC	0–2	0	●
P09.41	Running frequency at last fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz	●
P09.42	Set frequency at last fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz	●
P09.43	Output current at last fault	0.0–6553.5A	0.0–6553.5	0.0A	●
P09.44	Output voltage at last fault	0–65535V	0–65535	0V	●

Function code	Name	Description	Setting range	Default	Modify
P09.45	Input current at last fault	0.0–6553.5A	0.0–6553.5	0.0A	●
P09.46	Input voltage at last fault	0–65535V	0–65535	0V	●
P09.47	Unit bus voltage at last fault	0–65535V	0–65535	0V	●
P09.48	Unit temperature at last fault	0.0–6553.5°C	0.0–6553.5	0.0°C	●
P09.49	System input terminal state at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.50	User input terminal state at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.51	System output terminal state at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.52	User output terminal state 1 at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.53	User output terminal state 2 at last fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.54	Present DSP fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.55	Present DSP fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.56	Present ARM fault type 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.57	Present ARM fault type 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.58	Present unit fault 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.59	Present unit fault 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.60	Unit number at present fault	If the number is 0, there is no unit fault. If it is not 0, then A1–A12: 1–12 B1–B12: 13–24 C1–C12: 25–36	0–36	0x0000	●
P09.61	ACC/DEC state at present fault	0: Constant speed 1: ACC 2: DEC	0–2	0	●
P09.62	Running frequency at present fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz	●
P09.63	Set frequency at present fault	0.00Hz–P00.10	0.00–P00.10	0.00Hz	●
P09.64	Output current at present fault	0.0–6553.5A	0.0–6553.5	0.0A	●

Function code	Name	Description	Setting range	Default	Modify
P09.65	Output current at present fault	0–65535V	0–65535	0V	●
P09.66	Input current at present fault	0.0–6553.5A	0.0–6553.5	0.0A	●
P09.67	Input voltage at present fault	0–65535V	0–65535	0V	●
P09.68	Unit bus voltage at present fault	0–65535V	0–65535	0V	●
P09.69	Unit temperature at present fault	0.0–6553.5°C	0.0–6553.5	0.0°C	●
P09.70	System input terminal state at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.71	User input terminal state at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.72	System output terminal state at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.73	User output terminal state 1 at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.74	User output terminal state 2 at present fault	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P09.75	Present fault time	0–65535	0–65535	0	●
P10 group PID control					
P10.00	PID reference source	0: Function code (P10.01) 1: AI1 2: AI2 3: AI3 4: AI1+ AI2 5: AI2+ AI3 6: AI3+ AI1 7: Reserved 8: Multi-step running 9: Modbus 10: PROFIBUS/PROFINET	0–10	0	○
P10.01	Local preset PID reference	0.0%–100.0%	0.0–100.0	0.0%	○
P10.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: AI1+ AI2 4: AI2+ AI3 5: AI3+ AI1 6: Reserved 7: Modbus	0–8	0	○

Function code	Name	Description	Setting range	Default	Modify
		8: PROFIBUS/PROFINET feedback			
P10.03	PID output characteristics selection	0: PID output is positive. 1: PID output is negative.	0–1	0	○
P10.04	Proportional gain (Kp)	0.00–100.00	0.00–100.00	1.00	○
P10.05	Integral time (Ti)	0.01–10.00s	0.01–10.00	0. 50s	○
P10.06	Differential time (Td)	0.00–10.00s	0.00–10.00	0.00s	○
P10.07	Sampling cycle (T)	0.01–100.00s	0.01–00.00	0.10s	○
P10.08	PID control deviation limit	0.0–100.0% (Reference source)	0.0–100.0	0.0%	○
P10.09	Feedback offline detection value	0.0–100.0% (Reference source)	0.0–100.0	0.0%	○
P10.10	Feedback offline detection time	0.0–3600.0s (Reference source)	0.0–3600.0	1.0s	○
P10.11	PID wake-up-from-sleep value	0.0–100.0% (Reference source)	0.0–100.0	0.0%	○
P10.12	PID sleep delay	0.0–360.0s	0.0–360.0	1.0s	○
P11 group Multi-step speed control					
P11.00	Multi-step speed reference	0: Terminal 1: Analog	0–1	0	○
P11.01	Multi-step speed 0	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.02	Multi-step speed 1	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.03	Multi-step speed 2	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.04	Multi-step speed 3	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.05	Multi-step speed 4	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.06	Multi-step speed 5	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.07	Multi-step speed 6	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.08	Multi-step speed 7	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.09	Multi-step speed 8	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.10	Multi-step speed 9	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.11	Multi-step speed 10	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.12	Multi-step speed 11	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.13	Multi-step speed 12	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.14	Multi-step speed 13	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.15	Multi-step speed 14	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.16	Multi-step speed 15	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.17	Multi-step speed analog input source	0: AI1 1: AI2 2: AI3 3: AI4	0–3	0	○
P11.18	Corresponding analog of step 0	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.19	Corresponding analog of step 1	-100.0–100.0%	-100.0–100.0	0.0%	○

Function code	Name	Description	Setting range	Default	Modify
P11.20	Corresponding analog of step 2	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.21	Corresponding analog of step 3	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.22	Corresponding analog of step 4	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.23	Corresponding analog of step 5	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.24	Corresponding analog of step 6	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.25	Corresponding analog of step 7	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.26	Corresponding analog of step 8	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.27	Corresponding analog of step 9	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.28	Corresponding analog of step 10	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.29	Corresponding analog of step 11	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.30	Corresponding analog of step 12	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.31	Corresponding analog of step 13	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.32	Corresponding analog of step 14	-100.0–100.0%	-100.0–100.0	0.0%	○
P11.33	Corresponding analog of step 15	-100.0–100.0%	-100.0–100.0	0.0%	○
P12 group Master/slave control					
P12.00	Master-slave mode selection	0: Power-balancing mode 1: Reserved	0–1	0	◎
P12.01	Reference signal sources sent by the master to the slave	0: The master outputs torque signal 1: The master outputs current signal 2: The master outputs PG signal	0–2	0	◎
P12.02	Filter time of slave reference signal	0.00s–655.35s	0.00–655.35	0.00s	○
P12.03	PID adjustment limit	0.0–100.0%	0.0–100.0	100.0%	○
P12.04	PID mode selection	0: Proportion plus integration as synchronous coefficient 1: Proportion plus integration as error correction	0–1	0	○
P12.05	Slave reference frequency source gain	0.01–100.00	0.01–100.00	1.00	○

Function code	Name	Description	Setting range	Default	Modify
P12.06	Slave reference signal source gain	0.01–100.00	0.01–100.00	1.00	○
P12.07	Master-slave proportional coefficient P1	0.0000–6.5535	0.0000–6.5535	0.1000	○
P12.08	Master-slave integral coefficient I1	0.00s–655.35	0.00–655.35	5.00	○
P12.09	Low-point frequency for switching master-slave PI	0.00Hz–P12.12	0.00–P12.12	5.00Hz	○
P12.10	Master-slave proportional coefficient P2	0.0000–6.5535	0.0000–6.5535	0.1000	○
P12.11	Master-slave integral coefficient I2	0.00s–655.35	0.00–655.35	5.00	○
P12.12	High-point frequency for switching master-slave PI	P12.09–P00.10	P12.09–P00.10	10.00Hz	○
P12.13	PI control deviation limit	0.0–80.0%	0.0–80.0	0.0%	○
P12.14	Lower limit of PI integral enabling deviation	0.0–100.0%	0.0–100.0	0.0%	○
P12.15	Master-slave control differential coefficient	0.00s–655.35s	0.00–655.35	0.00	○
P12.16–P12.23	Reserved	0–65535	0–65535	0	●
P12.24	Master-slave control ID code	0–15	0–15	0	●
P12.25	Master-slave character	0–1	0–1	0	●
P12.26	Master-slave node state 1	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P12.27	Master-slave node state 2	0x0000–0xFFFF	0x0000–0xFFFF	0x0000	●
P12.28	Bit27: Master/slave optical-fiber communication fault shield	0: Enable 1: Disable	0–1	0	○
P12.29	Master-slave type setting	0: Single master 1: Spare machine 2: Master 3: Slave	0–3	0	●
P12.30	Enabling spare machine KM1 closing	0: Disable 1: Enable	0–1	0	●
P12.31	Reserved	0–65535	0–65535	0	●
P12.32	Reserved	0–65535	0–65535	0	●

Function code	Name	Description	Setting range	Default	Modify
P13 group Protection parameters					
P13.00	Protection against output phrase loss	0: Disable 1: Enable	0–1	1	○
P13.01	Motor overload protection selection	0: No protection 1: Common motor (with low-speed compensation) 2: Variable-frequency motor (without low-speed compensation)	0–2	2	◎
P13.02	Motor overload protection coefficient	20.0%–120.0% (of the motor rated current)	20.0–120.0	100.0%	○
P13.03	Frequency decreasing point at sudden power failure	600–900V	600–900	650V	○
P13.04	Frequency drop rate at transient power-off	0.00Hz–P00.10 (Max. output frequency)	0.00–P00.10	3.00Hz	○
P13.05	Overvoltage stalling protection	0: Disable 1: Enable	0–1	1	○
P13.06	Overvoltage stalling protection voltage	300–1280V	300–1280	1100V	○
P13.07	Automatic current limit threshold	5–180%	5–180	120%	○
P13.08	Frequency drop rate during current limit	0.00–10.00Hz (0.00 indicates overcurrent stalling is invalid.)	0.00–10.00	10.00Hz	○
P13.09	Input overvoltage prealarm threshold	105–120%	105–120	110%	○
P13.10	Unit bypass function	0: Manual bypass 1: Common automatic bypass 2: Neutral point drifting automatic bypass	0–2	0	○
P13.11	Unit manual bypass setting	0x000–0x1FF	0x000–0x1FF	VFD voltage depended	○
P13.12	Hardware overcurrent point	50–200% (of the VFD rated current)	50–200	180%	◎
P13.13	Hardware current-limit point	50–200% (of the VFD rated current)	50–200	180%	◎
P13.14	Optical-fiber communication alarm triggering value	0–20	0–20	5	○
P13.15	Enable VFD overload integral	0: Disable 1: Enable	0–1	0	○
P13.16	Overload integral value	Accumulated overload integral value	0–65535	0	○
P13.17	Underload prealarm detection value	0.0–200.0%	0.0–200.0	0.0%	○

Function code	Name	Description	Setting range	Default	Modify
P13.18	Underload prealarm detection time	0.0–3600.0s	0.0–3600.0	1.0s	○
P13.19	Speed deviation detection value	0.0–50.0%	0.0–50.0	10.0%	○
P13.20	Speed deviation detection time	0.0–10.0s	0.0–10.0	1.0s	○
P13.21–P13.23	Reserved	0–65535	0–65535	0	○
P14 group SM control					
P14.00	SM reference sources	0: D-axis current reference (flux-weakening 0) 1: Max. torque current ratio (flux-weakening 0) 2: Unit power factor (flux-weakening 0) 3: D-axis current reference (flux-weakening 1) 4: Max. torque current ratio (flux-weakening 1) 5: Unit power factor control(flux-weakening 1)	0–5	0	◎
P14.01	SM excitation mode	0: Manual 1: Automatic	0–1	1	
P14.02	Initial value percentage of SM automatic excitation	0.0%–100.0%	0.0–100.0	0.0%	◎
P14.03	Starting frequency of automatic excitation	0.00Hz–50.00Hz	0.00–50.00	0.00Hz	◎
P14.04	Output power factor setting of SM	0.0%–200.0%	0.0–200.0	0.0%	○
P14.05	Corresponding voltage of SM excitation analog 0%	0.00V–P14.06	0.00–P14.06	0.00V	◎
P14.06	Corresponding voltage of SM excitation analog 100%	P14.05–10.00V	P14.05–10.00	10.00V	◎
P14.07	Low-frequency oscillation control factor of SM	0–100	0–100	10	○
P14.08	High-frequency oscillation control factor of SM	0–100	0–100	0	○
P14.09	Oscillation control frequency threshold of SM	0.00–120.00Hz	0.00–120.00	15.00Hz	○
P14.10	Oscillation control	0.00–120.00Hz	0.00–120.00	0.00Hz	○

Function code	Name	Description	Setting range	Default	Modify
	frequency switch of SM				
P14.11	Power-frequency exciting current reference	0.0%–100.0%	0.0–100.0	0%	○
P14.12	Weakening protection coefficient of SM	0–3000	0–3000	1000	○
P14.13	Identification current of SM	0.0–100.0%	0.0–100.0	20.0%	◎
P14.14	SM autotuning command	0: Low-frequency autotuning 1: High-frequency autotuning	0–1	0	◎
P14.15	D-axis pull-in current 1	0.00–100.0%	0.00–100.0	20.0%	◎
P14.16	D-axis pull-in current 2	0.00–100.0%	0.00–100.0	10.0%	●
P14.17	Pull-in current switchover frequency point	0.00Hz–P00.10 (two decimal places)	0.00–P00.10	10.00Hz	○
P14.18	Reference frequency as zero action	0: Suspend disabled 1: Suspend enabled	0–1	0	○
P14.19	Pull-in current in hovering state	0.0–100.0%	0.0–100.0	50.0%	○
P14.20	Starting time of hovering	0.00–10.00s	0.00–10.00	1.00s	○
P14.21	Exit time of hovering	0.00–10.00s	0.00–10.00	1.00s	○
P14.22	Reactive current closed-loop control enable	0–1	0–1	0	○
P14.23	Reactive current closed-loop starting frequency	0.00Hz–P00.10	0.00–P00.10	0.00Hz	○
P14.24	Proportional coefficient of reactive current regulation	0–1000	0–1000	50	
P14.25	Integral coefficient of reactive current regulation	0–1000	0–1000	50	
P15 group Switching cabinet control function					
P15.00	Delay for switching from variable frequency to power frequency	0.0–60.0s	0.0–60.0	2.0s	◎
P15.01	Switching cabinet QF configuration mode	0: Independent mode 1: Two-in-One mode	0–1	0	◎
P15.02	Switching cabinet command channel	0: Locally controlled 1: Master controlled	0–1	0	◎

Function code	Name	Description	Setting range	Default	Modify
P15.03	Synchronous switching enabling	0: Disable 1: Synchronous switching with reactors 2: Synchronous switching without reactors	0–2	0	◎
P15.04	Switching cabinet QF1 configuration information 1	0: No common use 1: Group 1 in common use 2: Group 2 in common use 3: Group 3 in common use 4: Group 4 in common use	0x0000–0xFFFF	0x0000	◎
P15.05	Switching cabinet QF1 configuration information 2	0: No common use 1: Group 1 in common use 2: Group 2 in common use 3: Group 3 in common use 4: Group 4 in common use	0x0000–0xFFFF	0x0000	◎
P15.06	Synchronous switching reactor voltage drop	0–1000V (line voltage)	0–1000	50V	◎
P15.07	Switching cabinet KM1 configuration information 1	Set the common information of a switching cabinet every 4 bits. 0: No common use 1: Group 1 in common use 2: Group 2 in common use 3: Group 3 in common use 4: Group 4 in common use	0x0000–0xFFFF	0x0000	◎
P15.08	Switching cabinet KM1 configuration information 2	0: No common use 1: Group 1 in common use 2: Group 2 in common use 3: Group 3 in common use 4: Group 4 in common use	0x0000–0xFFFF	0x0000	◎
P15.09	Motor frequency drop rate of switching cabinet 1	0.00–50.00Hz	0.00–50.00	0.00Hz	◎
P15.10	Motor frequency drop rate of switching cabinet2	0.00–50.00Hz	0.00–50.00	0.00Hz	◎
P15.11	Motor frequency drop rate of switching cabinet 3	0.00–50.00Hz	0.00–50.00	0.00Hz	◎
P15.12	Motor frequency drop rate of switching cabinet 4	0.00–50.00Hz	0.00–50.00	0.00Hz	◎
P15.13	Action time of switching cabinet 1	0–300ms	0–300	90ms	◎
P15.14	Action time of switching cabinet 2	0–300ms	0–300	90ms	◎

Function code	Name	Description	Setting range	Default	Modify
P15.15	Action time of switching cabinet 3	0–300ms	0–300	90ms	◎
P15.16	Action time of switching cabinet 4	0–300ms	0–300	90ms	◎
P15.17	Torque current of switching cabinet 1	0.0–6553.5A	0.0–6553.5	0.0	◎
P15.18	Torque current of switching cabinet 2	0.0–6553.5A	0.0–6553.5	0.0	◎
P15.19	Torque current of switching cabinet 3	0.0–6553.5A	0.0–6553.5	0.0	◎
P15.20	Torque current of switching cabinet 4	0.0–6553.5A	0.0–6553.5	0.0	◎
P15.21	Synchronous switchover phase lock delay	0–120min	0–120	2min	◎
P15.22	Synchronous switchover angle compensation of switching cabinet 1	-200.0–200.0°	-200.0–200.0	12.0°	◎
P15.23	Synchronous switchover angle compensation of switching cabinet 2	-200.0–200.0°	-200.0–200.0	12.0°	◎
P15.24	Synchronous switchover angle compensation of switching cabinet 3	-200.0–200.0°	-200.0–200.0	12.0°	◎
P15.25	Synchronous switchover angle compensation of switching cabinet 4	-200.0–200.0°	-200.0–200.0	12.0°	◎
P15.26	Synchronous switchover actual deviation angle of switching cabinet 1	0.0–6553.5°	0.0–6553.5	0.0°	●
P15.27	Synchronous switchover actual deviation angle of switching cabinet 2	0.0–6553.5°	0.0–6553.5	0.0°	●
P15.28	Synchronous switchover actual deviation angle of switching cabinet 3	0.0–6553.5°	0.0–6553.5	0.0°	●
P15.29	Synchronous switchover actual deviation angle of switching cabinet 4	0.0–6553.5°	0.0–6553.5	0.0°	●

Function code	Name	Description	Setting range	Default	Modify
P15.30	Voltage detection board enabling	0: Disable (Power frequency and variable frequency share the voltage detection board) 1: Enable (The detection boards of power frequency and variable frequency are separate)	0–1	0	◎
P15.31	Reserved	0–65535	0–65535	0	◎
P15.32	Filter coefficient for synchronous switchover	1–20	1–20	4	◎
P15.33	Phase locking stability accuracy for synchronous switchover	1–500	1–500	200	◎
P15.34	Stability holding time for synchronous switchover	0.1–100.0s	0.1–100.0	4.0s	◎
P15.35	Fault power-frequency bypass action selection	0: Manual power-frequency bypass 1: Automatic power-frequency bypass	0–1	0	◎
P15.36	KM1 configuration	0: KM1 is configured 1: KM1 is not configured	0–1	1	◎
P15.37	Switching cabinet type	0: Manual 1: Automatic	0–1	0	◎
P16 group Serial communication					
P16.00	Local Modbus address	1–247; 0 indicates a broadcast address	1–247	1	○
P16.01	Modbus baud rate	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS	0–5	4	○
P16.02	Modbus data bit check	0: No check (N, 8, 2) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 1) for RTU	0–3	1	○
P16.03	Modbus communication response delay	0–200ms	0–200	5ms	○
P16.04	Modbus communication timeout time	0.0 (invalid); 0.1–100.0s	0.0–100.0	0.0s	○
P16.05	Remote upgrade enabling	0: Disable 1: Enable When remote upgrade is enabled,	0–1	0	◎

Function code	Name	Description	Setting range	Default	Modify
		the serial baud rate is automatically configured to 115200, and it can realize the remote upgrade of the main control ARM program with the 4G IoT module.			
P17 group Ethernet communication					
P17.00	MSB of Local IP address	0x0000–0xFFFF (high-order bit)	0x0000–0xFFFF	0xC0A8	●
P17.01	LSB of Local IP address	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0x0102	●
P17.02	MSB of local subnet mask	0x0000–0xFFFF (high-order bit)	0x0000–0xFFFF	0xFFFF	●
P17.03	LSB of local subnet mask	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0xFF00	●
P17.04	MSB of local gateway	0x0000–0xFFFF (high-order bit)	0x0000–0xFFFF	0xC0A8	●
P17.05	LSB of local gateway	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0x0101	●
P17.06	MSB of local MAC	0x0000–0xFFFF (high-order bit)	0x0000–0xFFFF	0x5254	●
P17.07	Middle-order bit of local MAC	0x0000–0xFFFF (middle-order bit)	0x0000–0xFFFF	0x4C19	●
P17.08	LSB of local MAC	0x0000–0xFFFF (low-order bit)	0x0000–0xFFFF	0xF742	●
P17.09	Log level of DSP command control module	Bit0: No log Bit1: Fatal Bit2: Error Bit4: Key information Bit8: Prompt message Combination of above levels	0–0xF	0	○
P17.10	Log level of DSP speed control module		0x0–0xF	0x0	○
P17.11	Log level of DSP torque calculation module		0x0–0xF	0x0	○
P17.12	Log level of DSP current loop		0x0–0xF	0x0	○
P17.13	Log level of DSP oscillograph calculation module		0x0–0xF	0x0	○
P17.14	Log level of DSP fault management module		0x0–0xF	0x0	○
P17.15	Log level of DSP parameter inquiry module		0x0–0xF	0x0	○
P17.16	Log level of ARM start/stop control module	Bit0: No log Bit1: Fatal Bit2: Error	0x0–0xF	0x0	○

Function code	Name	Description	Setting range	Default	Modify
P17.17	Log level of ARM frequency reference module	Bit4: Key information Bit8: Prompt message Combination of above levels	0x0–0xF	0x0	○
P17.18	Log level of ARM fault handling module		0x0–0xF	0x0	○
P17.19	Log level of ARM frequency calculation module		0x0–0xF	0x0	○
P17.20	Log level of ARM switching cabinet module		0x0–0xF	0x0	○
P17.21	Log level of ARM function code module		0x0–0xF	0x0	○
P17.22	Log level of ARM terminal function module		0x0–0xF	0x0	○
P17.23	Log level of ARM UDP/IP module		0x0–0xF	0x0	○
P17.24	Log level of ARM Modbus module		0x0–0xF	0x0	○
P17.25	Log level of ARM PROFIBUS module		0x0–0xF	0x0	○
P17.26	Log level of ARM master-slave module		0x0–0xF	0x0	○
P17.27	High-order bit of log receiving IP	0x0000–0XFFFF (high-order bit)	0x0000–0XFFFF	0x0000	○
P17.28	Low-order bit of log receiving IP	0x0000–0XFFFF (low-oder bit)	0x0000–0XFFFF	0x0000	○
P18 group PROFIBUS communication					
P18.00	Module type	0: The module is not connected 1: PROFIBUS 2: PROFINET	0–2	0	●
P18.01	Module address	0–99	0–99	2	◎
P18.02	Received PZD2	0: Disable 1: Frequency reference value (actual value: -MaxFrq–MaxFrq, two decimal places) 2: Torque reference value (percentage, two decimal places) 3: Reserved 4: PID control setting value reference 5: PID control feedback value reference 6: V/F separation reference (percentage, two decimal places) 7: Power frequency and variable	0–20	0	○
P18.03	Received PZD3		0–20	0	○
P18.04	Received PZD4		0–20	0	○
P18.05	Received PZD5		0–20	0	○
P18.06	Received PZD6		0–20	0	○
P18.07	Received PZD7		0–20	0	○
P18.08	Received PZD8		0–20	0	○
P18.09	Received PZD9		0–20	0	○
P18.10	Received PZD10		0–20	0	○
P18.11	Received PZD11		0–20	0	○
P18.12	Received PZD12		0–20	0	○

<table>
<tr><th>Function code</th><th>Name</th><th>Description</th><th>Setting range</th><th>Default</th><th>Modify</th></tr>
<tr><td></td><td></td><td>frequency control command
8–20: Reserved</td><td></td><td></td><td></td></tr>
<tr><td>P18.13</td><td>Sent PZD2</td><td rowspan="11">0: Invalid
1: Running frequency
2: Reserved
3: Input voltage
4: Output voltage
5: Input current
6: Output current
7: Actual output torque
8: Output power percentage
9: Set frequency absolute value
10: Present DSP fault 1
11: Present DSP fault 2
12: Present ARM fault 1
13: Present ARM fault 2
14: Present unit fault 1
15: Present unit fault 2
16: Unit number at present fault
17: User input terminal 1
18: User input terminal 2
19: User output terminal 1
20: User output terminal 2
21: System input terminal
22: System output terminal
23: Reserved
24: State of switching cabinet 1
25: State of switching cabinet 2
26: State of switching cabinet 3
27: State of switching cabinet 4
28–31: Reserved</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.14</td><td>Sent PZD3</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.15</td><td>Sent PZD4</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.16</td><td>Sent PZD5</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.17</td><td>Sent PZD6</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.18</td><td>Sent PZD7</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.19</td><td>Sent PZD8</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.20</td><td>Sent PZD9</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.21</td><td>Sent PZD10</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.22</td><td>Sent PZD11</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.23</td><td>Sent PZD12</td><td>0–31</td><td>0</td><td>○</td></tr>
<tr><td>P18.24</td><td>Temporary variable for PZD sending</td><td>0–65535</td><td>0–65535</td><td>0</td><td>○</td></tr>
<tr><td>P18.25</td><td>DP communication timeout time</td><td>0.0 (invalid); 0.1–100.0s</td><td>0.0–100.0</td><td>0.0s</td><td>○</td></tr>
<tr><td>P18.26</td><td>PROFINET input length</td><td>0–32</td><td>0–32</td><td>24</td><td>●</td></tr>
<tr><td>P18.27</td><td>PROFINET output length</td><td>0–32</td><td>0–32</td><td>24</td><td>●</td></tr>
<tr><td>P18.28</td><td>PROFINET communication speed</td><td>0–65535</td><td>0–65535</td><td>0</td><td>●</td></tr>
<tr><td>P18.29</td><td>PROFINET IP address 1</td><td>0–65535</td><td>0–65535</td><td>192</td><td>●</td></tr>
<tr><td>P18.30</td><td>PROFINET IP address 2</td><td>0–65535</td><td>0–65535</td><td>168</td><td>●</td></tr>
</table>

Function code	Name	Description	Setting range	Default	Modify
P18.31	PROFINET IP address 3	0–65535	0–65535	1	●
P18.32	PROFINET IP address 4	0–65535	0–65535	4	●
P18.33	PROFINET subnet mask 1	0–65535	0–65535	255	●
P18.34	PROFINET subnet mask 2	0–65535	0–65535	255	●
P18.35	PROFINET subnet mask 3	0–65535	0–65535	255	●
P18.36	PROFINET subnet mask 4	0–65535	0–65535	0	●
P18.37	PROFINET gateway 1	0–65535	0–65535	192	●
P18.38	PROFINET gateway 2	0–65535	0–65535	168	●
P18.39	PROFINET gateway 3	0–65535	0–65535	1	●
P18.40	PROFINET gateway 4	0–65535	0–65535	2	●
P18.41	Reserved	0–65535	0–65535	0	○
P18.42	Reserved	0–65535	0–65535	0	○
P19 group Motor parameter 2					
P19.00	Type of motor 2	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P19.01	Rated power of AM 2	4–50000kW	4–50000	Model depended	◎
P19.02	Rated frequency of AM 2	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.03	Rated speed of AM 2	1–36000rpm	1–36000	Model depended	◎
P19.04	Rated voltage of AM 2	0–20000V	0–20000	Model depended	◎
P19.05	Rated current of AM 2	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.06	Stator resistance of AM 2	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.07	Rotor resistance of AM 2	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.08	Stator and rotor leakage inductance of AM 2	0.1–6553.5mH	0.1–6553.5	Model depended	○
P19.09	Stator and rotor mutual inductance of AM 2	0.1–6553.5mH	0.1–6553.5	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
P19.10	No-load current of AM 2	0.01–655.35A	0.01–655.35	Model depended	○
P19.11	Rated power of SM 2	4–50000kW	4–50000	Model depended	◎
P19.12	Rated frequency of SM 2	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.13	Rated speed of SM 2	0–36000rpm	0–36000	1500rpm	◎
P19.14	Number of pole pairs of SM 2	1–50	1–50	2	◎
P19.15	Rated voltage of SM 2	0–20000V	0–20000	Model depended	◎
P19.16	Rated current of SM 2	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.17	Stator resistance of SM 2	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.18	Direct-axis inductance of SM 2	0.01–655.35mH	0.01–655.35	Model depended	○
P19.19	Quadrature-axis inductance of SM 2	0.01–655.35mH	0.01–655.35	Model depended	○
P19.20	Counter-emf constant of SM 2	0–20000	0–20000	9700	○
P19.21	Type of motor 3	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P19.22	Rated power of AM 3	4–50000kW	4–50000	Model depended	◎
P19.23	Rated frequency of AM 3	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.24	Rated speed of AM 3	1–36000rpm	1–36000	Model depended	◎
P19.25	Rated voltage of AM 3	0–20000V	0–20000	Model depended	◎
P19.26	Rated current of AM 3	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.27	Stator resistance of AM 3	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.28	Rotor resistance of AM 3	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.29	Stator and rotor leakage inductance of AM 3	0.1–6553.5mH	0.1–6553.5	Model depended	○
P19.30	Stator and rotor mutual inductance of	0.1–6553.5mH	0.1–6553.5	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
	AM 3				
P19.31	No-load current of AM 3	0.01–655.35A	0.01–655.35	Model depended	○
P19.32	Rated power of SM 3	4–50000kW	4–50000	Model depended	◎
P19.33	Rated frequency of SM 3	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.34	Rated speed of SM 3	0–36000rpm	0–36000	1500rpm	◎
P19.35	Number of pole pairs of SM 3	1–50	1–50	2	◎
P19.36	Rated voltage of SM 3	0–20000V	0–20000	Model depended	◎
P19.37	Rated current of SM 3	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.38	Stator resistance of SM 3	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.39	Direct-axis inductance of SM 3	0.01–655.35mH	0.01–655.35	Model depended	○
P19.40	Quadrature-axis inductance of SM 3	0.01–655.35mH	0.01–655.35	Model depended	○
P19.41	Counter-emf constant of SM 3	0–20000	0–20000	9700	○
P19.42	Type of motor 4	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P19.43	Rated power of AM 4	4–50000kW	4–50000	Model depended	◎
P19.44	Rated frequency of AM 4	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.45	Rated speed of AM 4	1–36000rpm	1–36000	Model depended	◎
P19.46	Rated voltage of AM 4	0–20000V	0–20000	Model depended	◎
P18.47	Rated current of AM 4	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.48	Stator resistance of AM 4	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.49	Rotor resistance of AM 4	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.50	Stator and rotor leakage inductance of AM 4	0.1–6553.5mH	0.1–6553.5	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
P19.51	Stator and rotor mutual inductance of AM 4	0.1–6553.5mH	0.1–6553.5	Model depended	○
P19.52	No-load current of AM 4	0.01–655.35A	0.01–655.35	Model depended	○
P19.53	Rated power of SM 4	4–50000kW	4–50000	Model depended	◎
P19.54	Rated frequency of SM 4	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.55	Rated speed of SM 4	0–36000rpm	0–36000	1500rpm	◎
P19.56	Number of pole pairs of SM 4	1–50	1–50	2	◎
P19.57	Rated voltage of SM 4	0–20000V	0–20000	Model depended	◎
P19.58	Rated current of SM 4	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.59	Stator resistance of SM 4	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.60	Direct-axis inductance of SM 4	0.01–655.35mH	0.01–655.35	Model depended	○
P19.61	Quadrature-axis inductance of SM 4	0.01–655.35mH	0.01–655.35	Model depended	○
P19.62	Counter-emf constant of SM 4	0–20000	0–20000	9700	○
P19.63	Type of motor 5	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P19.64	Rated power of AM 5	4–50000kW	4–50000	Model depended	◎
P19.65	Rated frequency of AM 5	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.66	Rated speed of AM 5	1–36000rpm	1–36000	Model depended	◎
P19.67	Rated voltage of AM 5	0–20000V	0–20000	Model depended	◎
P19.68	Rated current of AM 5	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.69	Stator resistance of AM 5	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.70	Rotor resistance of AM 5	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.71	Stator and rotor leakage inductance of	0.1–6553.5mH	0.1–6553.5	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
	AM 5				
P19.72	Stator and rotor mutual inductance of AM 5	0.1–6553.5mH	0.1–6553.5	Model depended	○
P19.73	No-load current of AM 5	0.01–655.35A	0.01–655.35	Model depended	○
P19.74	Rated power of SM 5	4–50000kW	4–50000	Model depended	◎
P19.75	Rated frequency of SM 5	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P19.76	Rated speed of SM 5	0–36000rpm	0–36000	1500rpm	◎
P19.77	Number of pole pairs of SM 5	1–50	1–50	2	◎
P19.78	Rated voltage of SM 5	0–20000V	0–20000	Model depended	◎
P19.79	Rated current of SM 5	0.1–1000.0A	0.1–1000.0	Model depended	◎
P19.80	Stator resistance of SM 5	0.001–65.535Ω	0.001–65.535	Model depended	○
P19.81	Direct-axis inductance of SM 5	0.01–655.35mH	0.01–655.35	Model depended	○
P19.82	Quadrature-axis inductance of SM 5	0.01–655.35mH	0.01–655.35	Model depended	○
P19.83	Counter-emf constant of SM 5	0–20000	0–20000	9700	○
P20 group Motor parameter 3					
P20.00	Type of motor 6	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P20.01	Rated power of AM 6	4–50000kW	4–50000	Model depended	◎
P20.02	Rated frequency of AM 6	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P20.03	Rated speed of AM 6	1–36000rpm	1–36000	Model depended	◎
P20.04	Rated voltage of AM 6	0–20000V	0–20000	Model depended	◎
P20.05	Rated current of AM 6	0.1–1000.0A	0.1–1000.0	Model depended	◎
P20.06	Stator resistance of AM 6	0.001–65.535Ω	0.001–65.535	Model depended	○

Function code	Name	Description	Setting range	Default	Modify
P20.07	Rotor resistance of AM 6	0.001–65.535Ω	0.001–65.535	Model depended	○
P20.08	Stator and rotor leakage inductance of AM 6	0.1–6553.5mH	0.1–6553.5	Model depended	○
P20.09	Stator and rotor mutual inductance of AM 6	0.1–6553.5mH	0.1–6553.5	Model depended	○
P20.10	No-load current of AM 6	0.01–655.35A	0.01–655.35	Model depended	○
P20.11	Rated power of SM 6	4–50000kW	4–50000	Model depended	◎
P20.12	Rated frequency of SM 6	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P20.13	Rated speed of SM 6	0–36000rpm	0–36000	1500rpm	◎
P20.14	Number of pole pairs of SM 6	1–50	1–50	2	◎
P20.15	Rated voltage of SM 6	0–20000V	0–20000	Model depended	◎
P20.16	Rated current of SM 6	0.1–1000.0A	0.1–1000.0	Model depended	◎
P20.17	Stator resistance of SM 6	0.001–65.535Ω	0.001–65.535	Model depended	○
P20.18	Direct-axis inductance of SM 6	0.01–655.35mH	0.01–655.35	Model depended	○
P20.19	Quadrature-axis inductance of SM 6	0.01–655.35mH	0.01–655.35	Model depended	○
P20.20	Counter-emf constant of SM 6	0–20000	0–20000	9700	○
P20.21	Type of motor 7	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P20.22	Rated power of AM 7	4–50000kW	4–50000	Model depended	◎
P20.23	Rated frequency of AM 7	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P20.24	Rated speed of AM 7	1–36000rpm	1–36000	Model depended	◎
P20.25	Rated voltage of AM 7	0–20000V	0–20000	Model depended	◎
P20.26	Rated current of AM 7	0.1–1000.0A	0.1–1000.0	Model depended	◎
P20.27	Stator resistance of	0.001–65.535Ω	0.001–	Model	○

Function code	Name	Description	Setting range	Default	Modify
	AM 7		65.535	depended	
P20.28	Rotor resistance of AM 7	0.001–65.535Ω	0.001–65.535	Model depended	○
P20.29	Stator and rotor leakage inductance of AM 7	0.1–6553.5mH	0.1–6553.5	Model depended	○
P20.30	Stator and rotor mutual inductance of AM 7	0.1–6553.5mH	0.1–6553.5	Model depended	○
P20.31	No-load current of AM 7	0.01–655.35A	0.01–655.35	Model depended	○
P20.32	Rated power of SM 7	4–50000kW	4–50000	Model depended	◎
P20.33	Rated frequency of SM 7	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P20.34	Rated speed of SM 7	0–36000rpm	0–36000	1500rpm	◎
P20.35	Number of pole pairs of SM 7	1–50	1–50	2	◎
P20.36	Rated voltage of SM 7	0–20000V	0–20000	Model depended	◎
P20.37	Rated current of SM 7	0.1–1000.0A	0.1–1000.0	Model depended	◎
P20.38	Stator resistance of SM 7	0.001–65.535Ω	0.001–65.535Ω	Model depended	○
P20.39	Direct-axis inductance of SM 7	0.01–655.35mH	0.01–655.35	Model depended	○
P20.40	Quadrature-axis inductance of SM 7	0.01–655.35mH	0.01–655.35	Model depended	○
P20.41	Counter-emf constant of SM 7	0–20000	0–20000	9700	○
P20.42	Type of motor 8	0: Asynchronous motor (AM) 1: Electrically excited synchronous motor 2: Synchronous motor with damping winding 3: Permanent-magnet synchronous motor	0–3	0	○
P20.43	Rated power of AM 8	4–50000kW	4–50000	Model depended	◎
P20.44	Rated frequency of AM 8	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P20.45	Rated speed of AM 8	1–36000rpm	1–36000	Model depended	◎
P20.46	Rated voltage of AM 8	0–20000V	0–20000	Model depended	◎
P20.47	Rated current of AM 8	0.1–1000.0A	0.1–1000.0	Model depended	◎

Function code	Name	Description	Setting range	Default	Modify
P20.48	Stator resistance of AM 8	0.001–65.535Ω	0.001–65.535	Model depended	○
P20.49	Rotor resistance of AM 8	0.001–65.535Ω	0.001–65.535	Model depended	○
P20.50	Stator and rotor leakage inductance of AM 8	0.1–6553.5mH	0.1–6553.5	Model depended	○
P20.51	Stator and rotor mutual inductance of AM 8	0.1–6553.5mH	0.1–6553.5	Model depended	○
P20.52	No-load current of AM 8	0.01–655.35A	0.01–655.35	Model depended	○
P20.53	Rated power of SM 8	4–50000kW	4–50000	Model depended	◎
P20.54	Rated frequency of SM 8	0.01Hz–P00.10 (Max. output frequency)	0.01–P00.10	50.00Hz	◎
P20.55	Rated speed of SM 8	0–36000rpm	0–36000	1500rpm	◎
P20.56	Number of pole pairs of SM 8	1–50	1–50	2	◎
P20.57	Rated voltage of SM 8	0–20000V	0–20000	Model depended	◎
P20.58	Rated current of SM 8	0.1–1000.0A	0.1–1000.0	Model depended	◎
P20.59	Stator resistance of SM 8	0.001–65.535Ω	0.001–65.535	Model depended	○
P20.60	Direct-axis inductance of SM 8	0.01–655.35mH	0.01–655.35	Model depended	○
P20.61	Quadrature-axis inductance of SM 8	0.01–655.35mH	0.01–655.35	Model depended	○
P20.62	Counter-emf constant of SM 8	0–20000	0–20000	9700	○
P21 Encoder state viewing					
P21.00	Actual frequency of encoder	-327.68–327.67Hz	-327.68–327.67	0.00Hz	●
P21.01	High-order bit of PG1 pulse count	0–65535	0–65535	0	●
P21.02	Low-order bit of PG1 pulse count	0–65535	0–65535	0	●
P21.03	Resolver counting	0–65535	0–65535	0	●
P21.04	Resolver angle	0.00–359.99	0.00–359.99	0.00	●
P21.05	Magnetic pole angle	0.00–359.99	0.00–359.99	0.00	●
P21.06	High-order bit of PG2 pulse count	0–65535	0–65535	0	●
P21.07	Low-order bit of PG2 pulse count	0–65535	0–65535	0	●
P21.08	QEP pulse counting	0–65535	0–65535	0	●

Function code	Name	Description	Setting range	Default	Modify
P21.09	Magnetic pole position	0–65535	0–65535	0	●
P21.10–P21.12	Reserved	0–65535	0–65535	0	●
P22 group Encoders					
P22.00	Encoder type	0: Incremental encoder 1: UVW encoder 2: Resolver-type encoder 3: Sin/Cos encoder with CD 4: Sin/Cos encoder without CD	0–4	0	◎
P22.01	Encoder pulse count	0–65535	0–65535	1000	◎
P22.02	Encoder direction	0: Forward input 1: Reverse input	0–1	0	◎
P22.03	Detection time of encoder offline fault	0.0–10.0s	0.0–10.0	1.0s	◎
P22.04	Detection time of encoder reversal fault	0.0–10.0s	0.0–10.0	1.0s	◎
P22.05	Filter times of encoder detection	0–10	0–10	1	◎
P22.06	Speed ratio between motor and encoder	0.000–65.535	0.000–65.535	1.000	◎
P22.07	Control parameters of SM	0x0000–0xFFFF Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3: Rotary transformer speed detection mode Bit4: Z-pulse capture mode	0x0000–0xFFFF	0x0003	◎
P22.08	Enable Z pulse offline detection	0: Disable 1: Enable	0–1	0	◎
P22.09	Initial angle of Z pulse	0.00–359.99°	0.00–359.99	0.00°	◎
P22.10	Pole initial angle	0.00–359.99°	0.00–359.99	0.00°	◎
P22.11	Vector control frequency deviation value	0.0%–100.0% (of the max. frequency)	0.0–100.0	5.0%	○
P22.12	Deviation count time	0.0–6553.5s	0.0–6553.5	1.0s	○
P22.13	Encoder filter time	0.00–10.00s	0.00–10.00	0.10s	○
P22.14–P22.17	Reserved	0–65535	0–65535	0	●
Group 23 Temperature controller communication					
P23.00	Modbus baud rate setting of temperature controller	0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS	0–5	4	●

Function code	Name	Description	Setting range	Default	Modify
		4: 19200BPS 5: 38400BPS			
P23.01	Data bit check setting of temperature controller	0: No check (N, 8, 2) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 1) for RTU	0–3	1	●
P23.02	Modbus communication timeout time of temperature controller	0.0–100.0s	0.0–100.0	10.0s	◎
P23.03	Overtemperature alarm temperature of transformer	0–135°C	0–135	90°C	◎
P23.04	Overtemperature tripping temperature of transformer	0–135°C	0–135	110°C	◎
P23.05	Calibration coefficient of temperature control detection 1	-100.00%–100.00%	-100.00–100.00	0.00%	◎
P23.06	Calibration coefficient of temperature control detection 2	-100.00%–100.00%	-100.00–100.00	0.00%	◎
P23.07	Calibration coefficient of temperature control detection 3	-100.00%–100.00%	-100.00–100.00	0.00%	◎
P23.08	Calibration coefficient of temperature control detection 4	-100.00%–100.00%	-100.00–100.00	0.00%	◎
P23.09	Calibration coefficient of temperature control detection 5	-100.00%–100.00%	-100.00–100.00	0.00%	◎
P23.10	Calibration coefficient of temperature control detection 6	-100.00%–100.00%	-100.00–100.00	0.00%	◎
P23.11	Number of configured temperature controllers	1–4	1–4	1	◎
P23.12	Transmission fault code of temperature controller 1	0–65535	0–65535	0	●
P23.13	Transmission slave address of temperature controller 1	0–65535	0–65535	0	●
P23.14	Transmission fault code of temperature	0–65535	0–65535	0	●

Function code	Name	Description	Setting range	Default	Modify
	controller 2				
P23.15	Transmission slave address of temperature controller 2	0–65535	0–65535	0	●
P23.16	Transmission fault code of temperature controller 3	0–65535	0–65535	0	●
P23.17	Transmission slave address of temperature controller 3	0–65535	0–65535	0	●
P23.18	Transmission fault code of temperature controller 4	0–65535	0–65535	0	●
P23.19	Transmission slave address of temperature controller 4	0–65535	0–65535	0	●
P23.20	Fan turn-on temperature 1 (transformer)	P23.21–70.0°C When the temperature of the transformer is higher than the value set in P23.20, the fan turns on.	P23.21–75.0	50.0°C	○
P23.21	Fan turn-off temperature 1	0.0–P23.20 When the temperature of the transformer is lower than the value set in P23.21, the fan turns off.	0.0–P23.20	40.0°C	○
P23.22	Fan turn-on temperature 2 (unit)	P23.23–70.0°C When the temperature of the unit is higher than the value set in P23.22, the fan turns on.	P23.22–75.0	50.0°C	○
P23.23	Fan turn-off temperature 2	0.0–P23.22 When the temperature of the unit is lower than the value set in P23.23, the fan turns off.	0.0–P23.22	40.0°C	○
P24 group Reserved functions					
P24.00	Reserved	0–65535	0–65535	0	●
P24.01	Reserved	0–65535	0–65535	0	●
P24.02	Reserved	0–65535	0–65535	0	●
P24.03	Reserved	0–65535	0–65535	0	●
P24.04	Reserved	0–65535	0–65535	0	●
P24.05	Reserved	0–65535	0–65535	0	●
P24.06	Reserved	0–65535	0–65535	0	●
P24.07	Reserved	0–65535	0–65535	0	●

Function code	Name	Description	Setting range	Default	Modify
P24.08	Reserved	0–65535	0–65535	0	●
P24.09	Reserved	0–65535	0–65535	0	●
P24.10	Reserved	0–65535	0–65535	0	●
P24.11	Reserved	0–65535	0–65535	0	●
P24.12	Reserved	0–65535	0–65535	0	●
P24.13	Reserved	0–65535	0–65535	0	●
P24.14	Reserved	0–65535	0–65535	0	●
P24.15	Reserved	0–65535	0–65535	0	●
P24.16	Reserved	0–65535	0–65535	0	●
P24.17	Reserved	0–65535	0–65535	0	●
P24.18	Reserved	0–65535	0–65535	0	●
P24.19	Reserved	0–65535	0–65535	0	●
P24.20	Reserved	0–65535	0–65535	0	●
P24.20	Reserved	0–65535	0–65535	0	●
P24.22	Reserved	0–65535	0–65535	0	●
P24.23	Reserved	0–65535	0–65535	0	●
P24.24–P24.52	Reserved	0–65535	0–65535	0	●
P25 group Transformer protection					
P25.00	Max. input voltage imbalance	0.0–6553.5%	0.0–6553.5	0.0	○
P25.01	Max. input current imbalance	0.0–6553.5%	0.0–6553.5	0.0	○
P25.02	Input voltage R	0–65535V	0–65535	0	○
P25.03	Input voltage S	0–65535V	0–65535	0	○
P25.04	Input voltage T	0–65535V	0–65535	0	○
P25.05	Input current R	0.0–6553.5A	0.0–6553.5	0.0	○
P25.06	Input current S	0.0–6553.5A	0.0–6553.5	0.0	○
P25.07	Input current T	0.0–6553.5A	0.0–6553.5	0.0	○
P25.08	Filter value of input voltage R imbalance	0–65535V	0–65535	0	○
P25.09	Filter value of input voltage S imbalance	0–65535V	0–65535	0	○
P25.10	Filter value of input voltage T imbalance	0–65535V	0–65535	0	○
P25.11	Filter value of input current R imbalance	0.0–6553.5A	0.0–6553.5	0.0	○
P25.12	Filter value of input current S imbalance	0.0–6553.5A	0.0–6553.5	0.0	○
P25.13	Filter value of input current T imbalance	0.0–6553.5A	0.0–6553.5	0.0	○
P25.14	Fault word of transformer protection	0–65535	0–65535	0	○
P25.15–P25.56	Reserved	0–65535	0–65535	0	○

Function code	Name	Description	Setting range	Default	Modify
P25.57	Transformer protection constant 1	0.0–6553.5%	0.0–6553.5	5.0	○
P25.58	Transformer protection constant 2	0.0–6553.5	0.0–6553.5	0.5	○
P25.59	Transformer protection constant 3	0.00–655.35	0.00–655.35	1.00	○
P25.60	Transformer protection constant 4	0.0–6553.5%	0.0–6553.5	25.0	○
P25.61	Transformer protection constant 5	0.0–100.0%	0.0–100.0	30.0	○
P25.62	Transformer protection constant 6	0.0–100.0%	0.0–100.0	40.0	○
P25.63	Transformer protection constant 7	0.0–100.0%	0.0–100.0	40.0	○
P25.64	Transformer protection constant 8	0.0–50.0A	0.0–50.0	5.0	○
P25.65	Transformer protection constant 9	0–5000ms	0–5000	2000	○
P25.66–P25.71	Reserved	0–65535	0–65535	0	○
P28 group SD card functions					
P28.00	Number of files to be reserved	3–10 (The maximum number of files that can be saved for each type of file, such as alarm records, operation records, waveform files saved after fault triggering, etc.)	3–10	5	◎
P28.01	File size	0.1–10.0M	0.1–10.0	1.0M	◎
P28.02	Retention cycle of running records	0.5–30.0Min	0.0–30.0	0.5Min	◎
P28.03	Year setting	When P28.07 is 0, the real time of ARM is displayed, and P28.03–P28.06 update the time in real time. The RTC time can be modified by modifying P28.07. Operation steps for configuring time: 1. Input 2 to P28.07, the time stops updating at this time. 2. Change the date and time. 3. Input 1 to P28.07, when P28.07 is 0, it indicates that the configuration is complete.	0–9999	Year	○
P28.04	Month and day setting		1.01–12.31	Mon Day	○
P28.05	Hour and minute setting		0.0–23.59	Hour Min	○
P28.06	Seconds setting		0–59	Sec	○
P28.07	Setting mode enabling		0–2	0	○
P28.08	Reserved	0–65535	0–65535	0	○
P28.09	Reserved	0–65535	0–65535	0	○

Function code	Name	Description	Setting range	Default	Modify
P28.10	Fault storage mode	0–2 0: Disable 1: Trigger the storage mode 2: Reserved	0–2	1	◎
P28.11	SD card state feedback	SD card state feedback (feedback whether the previous operation is successful): 0: System power-on, if no SD card is inserted or SD card is invalid, the value is 0. 1: The initialization of the SD card is successful, waiting for SD card operation. 2: SD card reading failure 3: SD card writing failure 4: File opening failure 5: File creation failure 6: The operation is successful	0–6	0	◎
P28.12	Save function code configuration files (Number of function code groups, number of function codes and VFD model information)	0: Initial value, no operation 1: Save the function codes, and copy the configuration files to the SD card 2: The execution succeeds 3: The execution fails.	0–3	0	◎
P28.13	Save function codes	0: Save function codes to the file 0 1: Save function codes to the file 1 2: Save function codes to the file 2	0–2	0	◎
P28.14	Restore function codes	0: Restore function codes from the function code parameter file 0 1: Restore function codes from the function code parameter file 1 2: Restore function codes from the function code parameter file 2	0–2	0	◎
P28.15	Save function codes to the SD card	0: Disable 1: Generate parameter files (unreadable) 2: Generate reports (.csv) 3: The execution succeeds 4: The execution fails.	0–4	0	◎
P28.16	Restore function code settings from the SD card	0: Disable 1: Full recovery (including motor parameter groups) 2: Filter recovery (excluding motor parameter groups) 3: The execution succeeds 4: The execution fails.	0–4	0	◎

Function code	Name	Description	Setting range	Default	Modify
P28.17	Sampling channel 1	0: No function 1: Running frequency 2: Output voltage 3: Input voltage 4: Output U-phase current 5: Output V-phase current 6: Output W-phase current 7: Q-axis angle 8: T-axis angle 9: Output current M-axis component 10: Output current T-axis component 11–20: Reserved	0–20	1	●
P28.18	Sampling channel 2		0–20	2	●
P28.19	Sampling channel 3		0–20	3	●
P28.20	Sampling channel 4		0–20	4	●
P28.21	Sampling channel 5		0–20	5	●
P28.22	Sampling channel 6		0–20	6	●
P28.23	Sampling channel 7		0–20	7	●
P28.24	Sampling channel 8		0–20	8	●
P28.25	Sampling channel 9		0–20	9	●
P28.26	Sampling channel 10		0–20	10	●
P29 group Factory parameters					
P29.00	Factory password	0–65535	0–65535	***	●
P29.01	VFD model	0–20	0–20	Model depended	◎
P29.02	VFD rated power	4–50000kW	4–50000	Model depended	◎
P29.03	VFD rated voltage	10–20000V	10–20000	Model depended	◎
P29.04	Actual grid voltage	10–20000V	10–20000	Model depended	◎
P29.05	VFD rated current	0.0–1000.0A	0.0–1000.0	Model depended	○
P29.06	Unit output selection	0x000–0xFFF	0x000–0xFFF	Voltage depended	◎
P29.07	Deadzone time	0.0μs–10.0μs	0.0–10.0	Model depended	◎
P29.08	A-phase unit fault shield	0x000–0xFFF	0x000–0xFFF	Voltage depended	◎
P29.09	B-phase unit fault shield	0x000–0xFFF	0x000–0xFFF	Voltage depended	◎
P29.10	C-phase unit fault shield	0x000–0xFFF	0x000–0xFFF	Voltage depended	◎
P29.11	Unit software overvoltage point	0–1500V	0–1500	Model depended	◎
P29.12	Unit ready voltage	0–1000V	0–1000	Model depended	◎
P29.13	Software overcurrent point	50.0%–200.0%	50.0–200.0	190.0%	○
P29.14	U-phase bus voltage calibration coefficient	50.0%–150.0%	50.0–150.0	100.0%	◎
P29.15	V-phase bus voltage calibration coefficient	50.0%–150.0%	50.0–150.0	100.0%	◎
P29.16	W-phase bus voltage	50.0%–150.0%	50.0–150.0	100.0%	◎

Function code	Name	Description	Setting range	Default	Modify
	calibration coefficient				
P29.17	Input voltage calibration coefficient	30.0%–200.0%	30.0–200.0	100.0%	○
P29.18	Input current calibration coefficient	50.0%–150.0%	50.0–150.0	100.0%	○
P29.19	Output voltage calibration coefficient	30.0%–200.0%	30.0–200.0	100.0%	○
P29.20	Output current calibration coefficient	50.0%–150.0%	50.0–150.0	100.0%	○
P29.21	Bypass mode	0: IGBT bypass 1: Contactor bypass	0–1	0	◎
P29.22	Reserved	0–65535	0–65535	0	◎
P29.23	Factory time setting	0–65535	0–65535	0h	◎
P29.24	Reserved	0–65535	0–65535	0	◎
P29.25	Factory bar code 1	500–2000	500–2000	1500	○
P29.26	Factory bar code 2	500–2000	500–2000	1500	○
P29.27	Running mode	0: User mode 1: Low voltage commissioning mode	0–1	0	●
P29.28	Precharge configuration	0: Not configured 1: The precharge resistor is configured.	0–1	0	●
P29.29	UPS configuration	0: UPS is not configured 1: UPS is configured	0–1	0	●

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